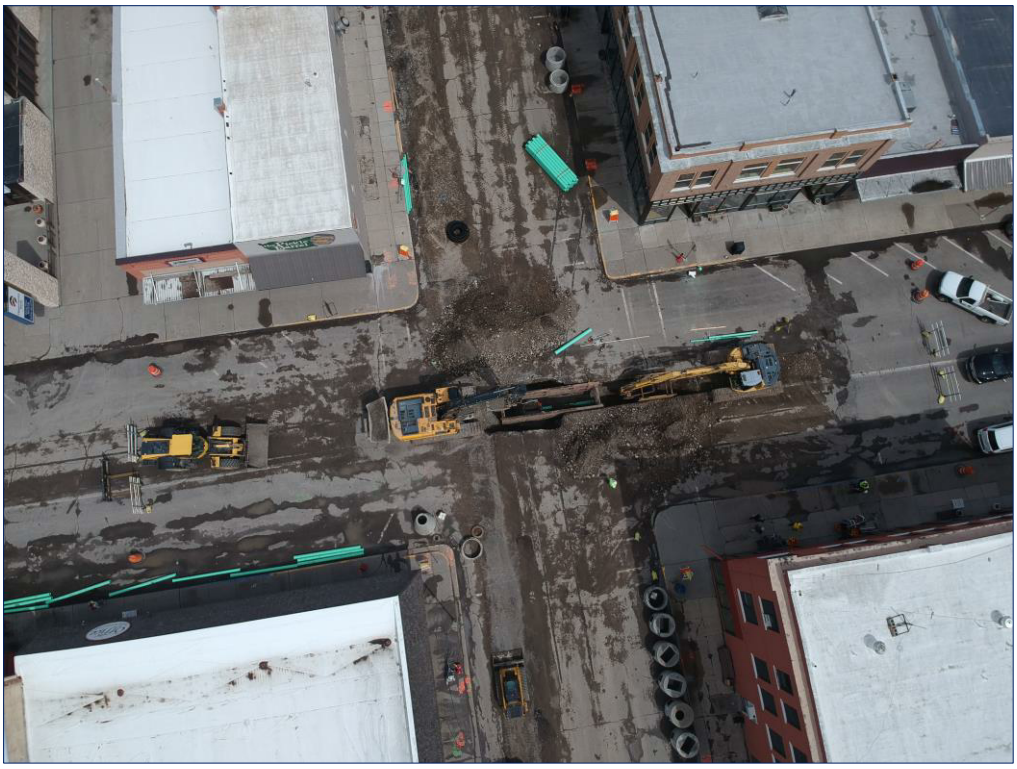
234 East Babcock Street
Suite 3
Bozeman, MT 59715

406.586.0277
tdhengineering.com



PRELIMINARY ENGINEERING REPORT

WASTEWATER COLLECTION SYSTEM

CLIENT

City of Livingston
414 E. Callender Street
Livingston, MT 59047

ENGINEER

TD&H Engineering
Engineer: Keith Waring, PE

JOB NO. B15-081-044

SEPTEMBER 2019

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APPENDICES

0.0 EXECUTIVE SUMMARY

A. SUMMARY

The purpose of this Preliminary Engineering Report (PER) is to provide a review of the existing gravity collection system in Livingston, Montana and develop possible solutions to any identified problems. This study will:

- Evaluate the conveyance capacity of the current system with existing and projected 20-year design flows
- Catalog gravity collection with respect to pipe age, material, size and known defects
- Identify high-risk mains, expected to be contributing to the City's high inflow and infiltration
- Develop possible collection system alternatives, including preliminary cost estimates
- Evaluate alternatives with respect to cost, feasibility, required operations and maintenance (O&M), and impacts the human health and the environment
- Prioritize potential improvements.

The wastewater collection system is owned and operated by:

The City of Livingston
330 N. Bennett Street
Livingston, Montana 59047

This report evaluates the collection system to determine immediate needs for reliability, safety and public health. The City of Livingston has experienced consistent annual growth are 0.25% in recent years. Given the population boom happening in the neighboring Gallatin Valley, the local population growth is expected to increase to 2.6% annually.

B. ALTERNATIVES CONSIDERED

Nine alternatives were considered. These alternatives included:

- Alternative 1-No Action
- Alternative 2-N. 5th Street Capacity Increase
- Alternative 3-Northern Trunk Main Capacity Increase
- Alternative 4-Park Street Capacity Increase
- Alternative 5-W. Geyser Street Capacity Increase
- Alternative 6-E. Lewis Street Replacement
- Alternative 7-Green Acres Subdivision
- Alternative 8- Civic Center
- Alternative 9-Centennial Lift Station

C. SUMMARY OF RECOMMENDED IMPROVEMENTS

Throughout the evaluation presented in this PER, Alternatives 2, 3, 4, 5, 6, 7,8, and 9 were deemed feasible and beneficial to the City of Livingston. As such, each of these eight

alternatives are recommended. The recommended improvements have been prioritized based on estimated construction cost, impacts to human health and the environment, logistical feasibility, and required O&M procedures.

The prioritized list and associated costs are summarized in Table 0-1.

Table 0-1
Project Cost Estimate Summary

Priority	Project Name	Total Estimated Construction Cost
1	Northern Trunk Main Capacity Increase	$1,291,000
2	W Geyser Street Capacity Increase	$1,992,000
3	N 5th Street Capacity Increase	$3,116,000
4	Centennial Lift Station	$474,000
5	Park Street Capacity Increase	$4,332,000
6	E. Lewis Street Replacement	$2,709,000
7 (tie)	Greens Acres Subdivision	$2,260,000
7 (tie)	Civic Center	$616,000

Conversations with City staff regarding financial planning are necessary at this time. It is believed that the City's need for the existing aging and undersized mains to be replaced and upsized could result in a competitive application for grant and low interest loans.

D. ACKNOWLEDGEMENTS

City of Livingston personnel, including Mr. Shannon Holmes - Public Works Director, Mr. Matt Whitman - Project Manager, and Mr. Tom Schweigert - Water/Sewer Foreman were helpful in providing data and other historic information on the system. Their direction guided the recommendations in this report. The community has shown concern for the potential problems with the aging wastewater systems included in this report and has a strong desire to address the problem in the way that allows for future growth and reduces risk to public health and the environment.

1.0 PROJECT PLANNING

The City of Livingston's wastewater system contain a network of sanitary sewer mains and lift stations located throughout the City. The collection system conveys raw wastewater to the Water Reclamation Facility (WRF) located on the banks of the Yellowstone River. The following sections describe the service area in detail.

A. LOCATION

The City of Livingston is the county seat of Park County, Montana, located along I-90 and the Yellowstone River, approximately 25 miles east of Bozeman and 115 miles west of Billings. Refer to Figure 1-1 for a vicinity map. Livingston was established in 1882 when construction of the Northern Pacific Railway (NPR) reached the area and developed a railroad depot and railroad shops. With the expansion of the rail line, visitors to Yellowstone National Park passed through Livingston regularly and it became known as the Gateway to Yellowstone National Park. Although the population and economy experienced a decline when the railroad moved its rail shops out of Livingston in the mid 1980's, the City has rebounded and expanded its industries and businesses to include general service, manufacturing, health, and online/digital service providers as well as agriculture, ranching, logging, and mining. In addition, Livingston continues to capitalize on the tourism industry as the only year-round access into Yellowstone National Park and has significant tourist volumes from April through September with a high percentage being international travelers. Livingston provides opportunity for many recreational activities including fishing, hunting, hiking, rafting, hot springs, and entertainment.

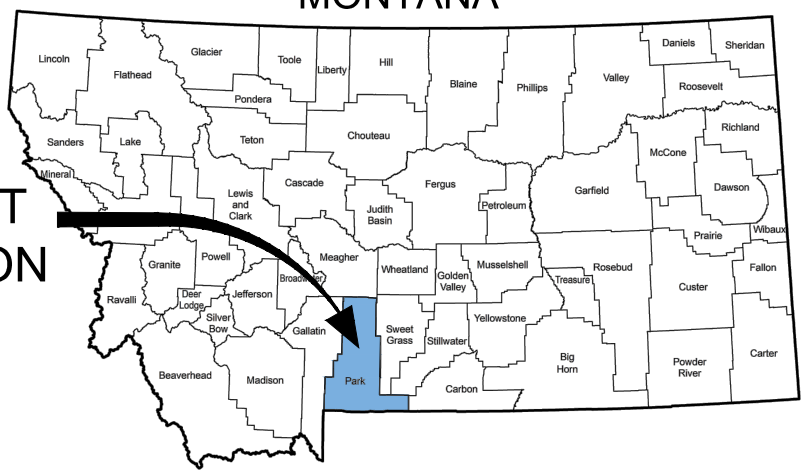
The City of Livingston is located along the Yellowstone River in a valley between four mountain ranges: the Bangtail Hills to the northwest, the Crazy Mountains to the northeast, the Gallatin Range to the southwest, and the Absaroka – Beartooth Mountains to the southeast. In addition to the Yellowstone River, there are several other year-round streams that flow in and around Livingston including Fleshman Creek, Billman Creek, Livingston Ditch and other minor tributaries. A USGS quad map of the area is shown in Figure 1-2.

Livingston encompasses an area of approximately six square miles including developed areas outside the City limits as shown in Figure 1-3. A hydrogeologic assessment for this area was not completed as part of this PER, however, information on the hydrogeologic conditions have been provided within the City of Livingston's 2001 Source Water Delineation and Assessment Report. According to this report, "*The ancestral Yellowstone River cut a 25 to 80 ft deep and roughly one-mile wide trough into bedrock beneath present day Livingston. The river later filled this trough with course sand and gravel layers that comprise the Livingston Aquifer, the source of the City of Livingston public water system wells. Fine-grained sandy clay layers are encountered when drilling the Livingston Aquifer…".*

Livingston is at an elevation of approximately 4,500 feet above sea level. The average daily low and high temperatures are 17° F and 37° F in January and 49° F and 85° F in July. Precipitation ranges from approximately 0.5 inches per month during the dry season (December through February) to approximately 2.5 inches per month during the wet season (May and June). Livingston receives on average 14.8 inches of precipitation annually and an average of 46.8 inches of snowfall annually. (www.weatherbase.com).

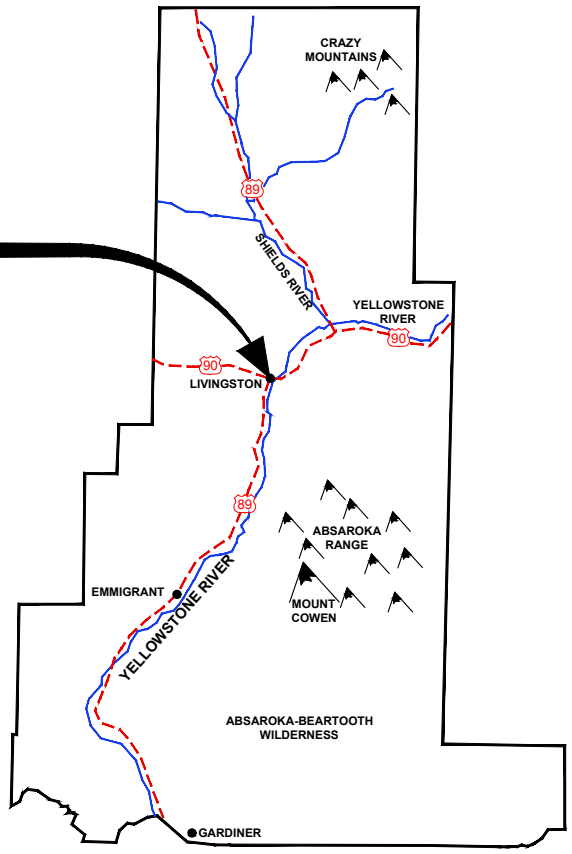
The City of Livingston provides wastewater service to residents within and outside the City Limits. The service area is shown in Figure 1-4. The City's WRF discharges to the Yellowstone River. Figure 1-5 shows the project planning area as adopted in Livingston's 2017 Growth Policy.

MONTANA



PROJECT LOCATION

PROJECT LOCATION



PARK COUNTY

N

NOT TO SCALE

NOT FOR CONSTRUCTION

LIVINGSTON WATER MASTER PLAN
LIVINGSTON, MONTANA

VICINITY MAP

TD&H Engineering
406.586.0277 • tdhengineering.com
234 E. BABCOCK ST., SUITE 3 • BOZEMAN, MONTANA 59715

DRAWN BY:	JLB
DESIGNED BY:	KW
QUALITY CHECK:	MM
DATE:	APRIL 2018
JOB NO.	B15-081
CAD NO.	LIVINGSTON VIC MAP

1-1

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

LIVINGSTON QUADRANGLE
MONTANA—PARK CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

Mapped, edited, and published by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and NOS/NOAA

Topography from aerial photographs by multiplex methods
Aerial photographs taken 1948. Field check 1951

Polyconic projection. **1927 North American Datum**
10,000-foot grid based on Montana coordinate system, south zone

Red tint indicates area in which only landmark buildings are shown

Dashed land lines indicate approximate locations

Unchecked elevations are shown in brown

1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

UTM GRID AND 1981 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

Revisions shown in purple compiled from aerial photographs taken 1977 and other source data. This information not field checked. Map edited 1981

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, P.O. BOX 25286, DENVER, COLORADO 80225
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION
Heavy-duty — 4 LANE | 6 LANE — Light-duty
Medium-duty — 4 LANE | 6 LANE — Unimproved dirt
U. S. Route — State Route
Interstate Route

MONTANA
QUADRANGLE LOCATION

To place on the predicted North American Datum 1983 move the projection lines 10 meters north and 60 meters east as shown by dashed corner ticks

Purple tint indicates extension of urban areas

LIVINGSTON, MONT.
45110—F5—TF—024

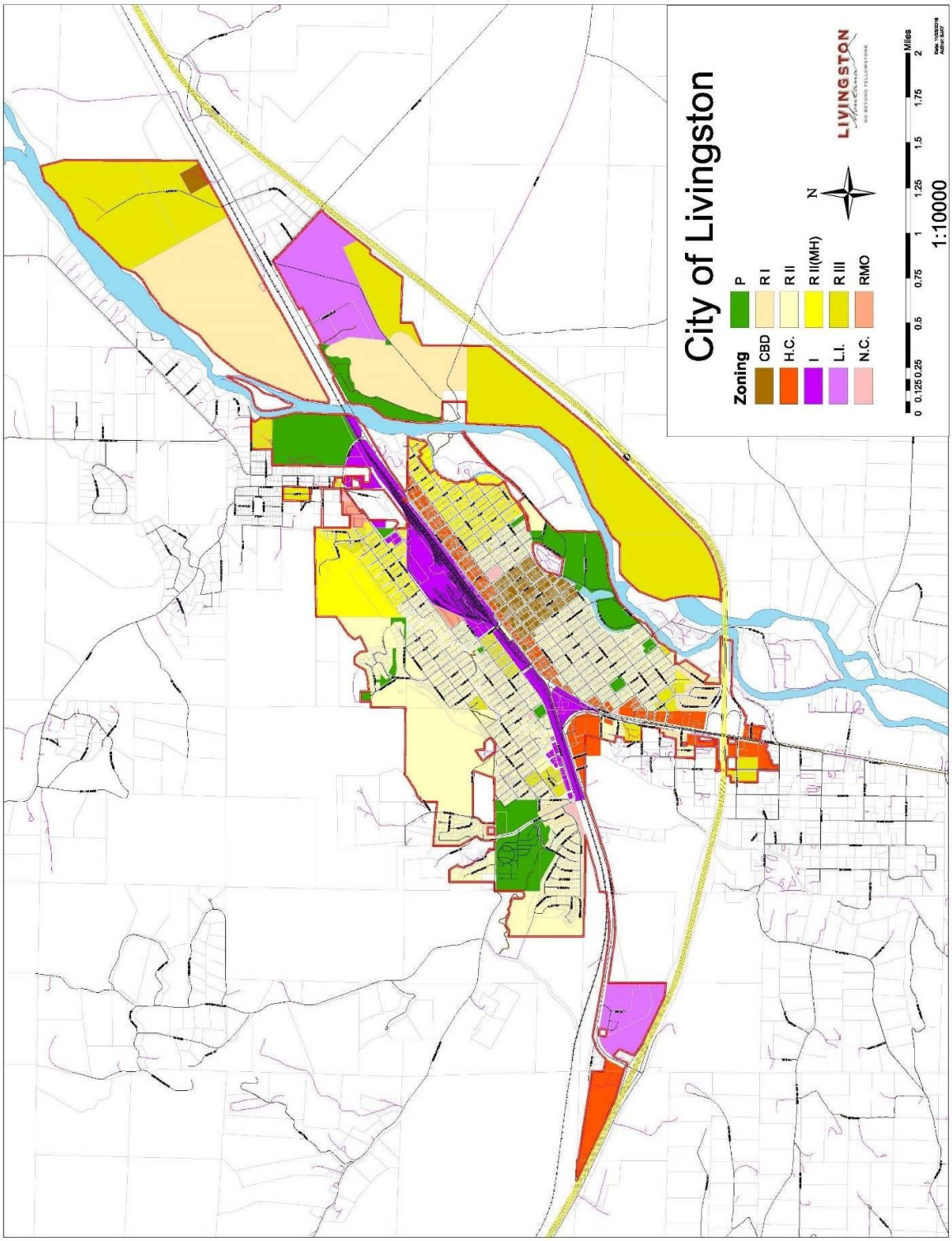
1951
PHOTOREVISED 1981
DMA 3875 II NE—SERIES V894

ISBN 0-607-30765-X
9 780607 307658

20% TOTAL RECOVERED FIBER

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1986

Figure 1-3: City Limits



J:\2015\B15-081 City of Livingston\CADD\CIVIL\WW PER\B15-081 SANITARY SEWER MAP.dwg, 3/13/2019 5:06:29 PM, NMR

N

LEGEND

2 INCH FORCE MAIN	12 INCH GRAVITY SEWER
3 INCH FORCE MAIN	15 INCH GRAVITY SEWER
4 INCH FORCE MAIN	16 INCH GRAVITY SEWER
4 INCH GRAVITY SEWER	18 INCH GRAVITY SEWER
6 INCH GRAVITY SEWER	21 INCH GRAVITY SEWER
8 INCH GRAVITY SEWER	24 INCH GRAVITY SEWER
10 INCH GRAVITY SEWER	

LIFT STATION
TREATMENT PLANT
LIVINGSTON HEALTH CENTER
E GALLATIN STREET
LIFT STATION
NORTHTOWN
YELLOWSTONE STREET
MAIN STREET
PARK STREET
STAR ROAD
W MONTANA STREET
FRONT STREET
LIFT STATION
PARK COUNTY FARIGROUNDS
FLESHMAN CREEK EXTENSION
VISTA VIEW DRIVE
GEYSER STREET
HWY 10 W
DISCOVERY VISTA
SUN AVENUE
9TH STREET
LIFT STATION
LIFT STATION
LIFT STATION
PARK STREET
LIFT STATION
INTERSTATE-15
MURDOCHS
MURDOCHS SEPTIC TANKS

NOT FOR CONSTRUCTION

REV	DATE	REVISION

TD&H Engineering
tdhengineering.com

DRAWN BY:	NMR
DESIGNED BY:	
QUALITY CHECK:	
DATE:	03-04-2019
JOB NO.	B15-081
FIELDBOOK	

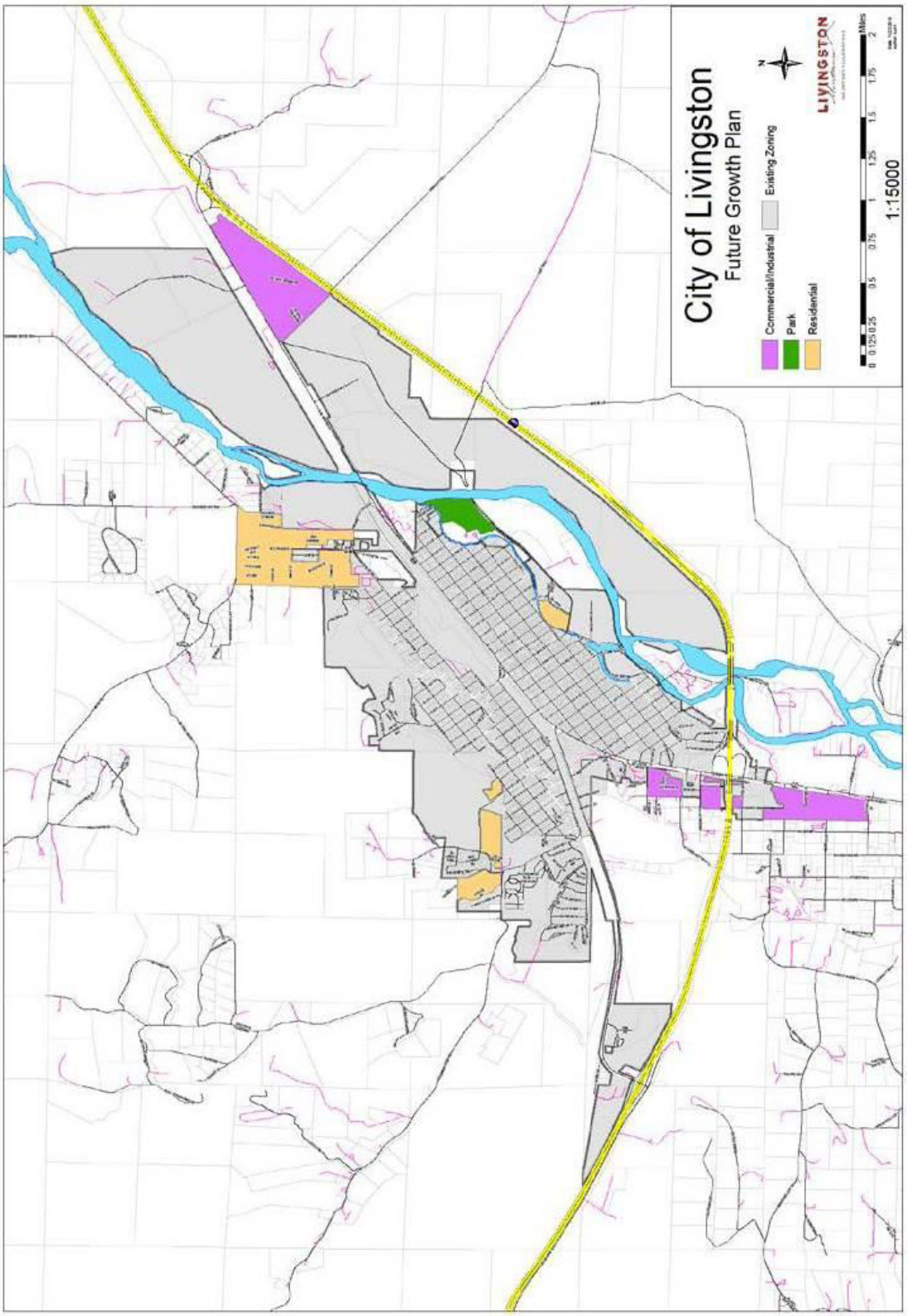
LIVINGSTON COLLECTION SYSTEM PER
LIVINGSTON, MONTANAN

SANITARY SEWER MAP

B15-081 SANITARY SEWER MAP.DWG

FIGURE 1-4

Figure 1-5: Planning Area



B. ENVIRONMENTAL RESOURCES PRESENT

Environmental resources present in the project area are discussed below. In March 2019, The Montana Natural Heritage Program (MTNHP) provided a Custom Environmental Summary for the City of Livingston plus a one mile buffer surrounding the City, encompassing the City's service area. The full Environmental Summary is provided in Appendix 1 and its findings are included below.

a. Floodplains

The City of Livingston is located along the Yellowstone River with additional creeks and minor tributaries running in and around the City. FEMA maps of the City of Livingston and surrounding area are provided in Figure 1-6 A-F. A portion of the proposed improvements in this PER are located within the 500-year floodplain. There are no critical facilities included in this project and no floodplain permit requirements are anticipated.

On May 21, 2019 a scoping letter and map were provided to the Montana DNRC Floodplain Management Program for review and comment on the proposed improvements within the designated floodplains. No response received to date. All agency correspondence can be found in Appendix 1.

b. Wetlands

There are several designated wetland areas within the planning boundary, such as Freshwater Emergent Wetlands, Freshwater Forested/Shrub Wetlands, Freshwater Ponds, and a Riverine as shown in Figure 1-7. Should collection system improvements impact wetland or riverine drainage or fill, or occur within a floodplain, further environmental investigation and reporting will be conducted as necessary. Appropriate mitigation measures and permitting will be pursued.

Comments on the proposed improvements were requested from the U.S. Army Corps of Engineers (Corps) regarding wetlands. In their June 10, 2019 response letter (see Appendix 1), the Corps noted that jurisdictional waters of the U.S. may be present within the project area and may be impacted by the proposed work. A DA permit may be required, an aquatic resources delineation is recommended, and mitigation requirements will be determined. A Montana Joint Permit Application is to be submitted to the Corps to determine permitting requirements.

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures.** Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 12. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum.** For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC- 3, #9202
1315 East- West Highway
Silver Spring, MD 20910- 3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242,** or visit its website at http://www.ngs.noaa.gov/.

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This map reflects more detailed and up- to- date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables *in the Flood Insurance Study report (which contains authoritative hydraulic data*) may reflect stream channel distances that differ from what is shown on this map.

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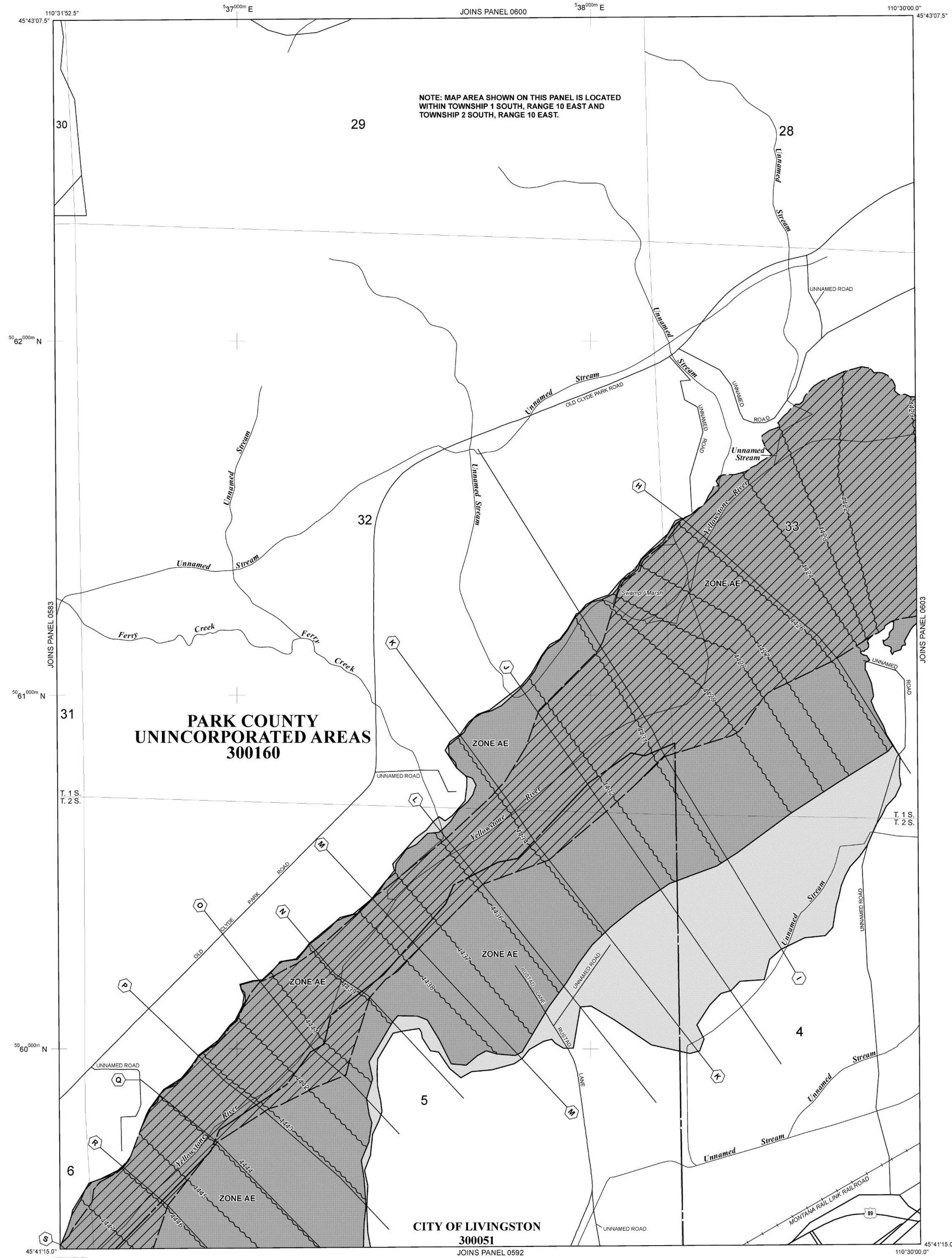
Contact the **FEMA Map Service Center** at 1- 800- 358- 9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, *a Flood Insurance Study report*, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1- 800- 358- 9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1- 877- FEMA MAP** (1- 877- 336- 2627) or visit the FEMA website at http://www.fema.gov/.

Figure 1-6A



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

Floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

513 — Base Flood Elevation line and value; elevation in feet*

(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A—A — Cross section line

23- - - -23 — Transect line

97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)

$^{42}75^{000m}$N — 1000-meter Universal Transverse Mercator grid ticks, zone 12

6000000 M — 5000-foot grid ticks: Alabama State Plane coordinate system, east zone (FIPSZONE 0101), Transverse Mercator

DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)

• M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
October 18, 2011
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1- 800- 638- 6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0584C

FIRM
FLOOD INSURANCE RATE MAP
PARK COUNTY, MONTANA
AND INCORPORATED AREAS

PANEL 584 OF 1925
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
PARK COUNTY	300160	0584	C
LIVINGSTON, CITY OF	300051	0584	C

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
30067C0584C

EFFECTIVE DATE
OCTOBER 18, 2011

Federal Emergency Management Agency

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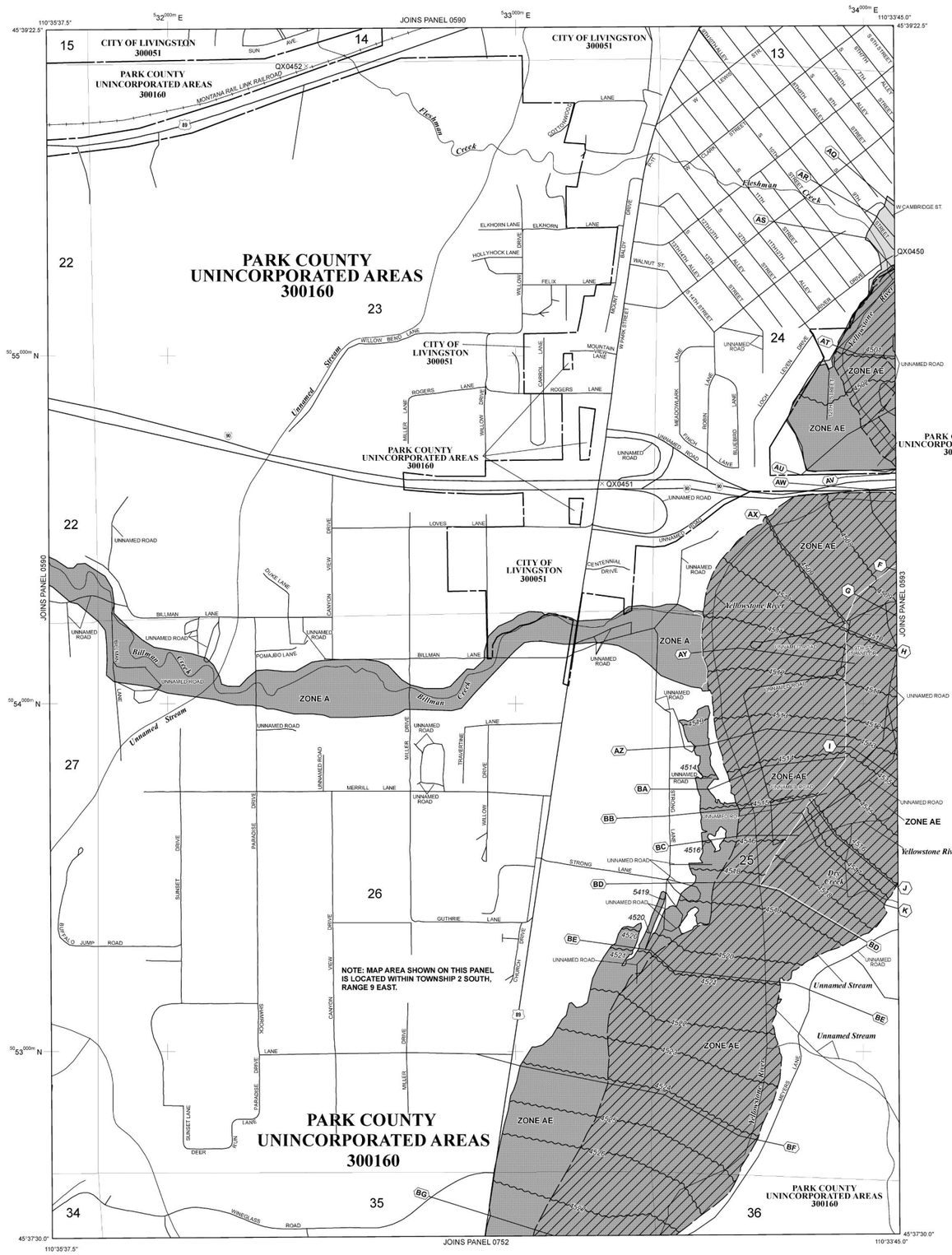
Figure 1-6B



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	Floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A — A	Cross section line
23 — 23	Transect line
97°07'30", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000mN	1000-meter Universal Transverse Mercator grid ticks, zone 12
6000000 M	5000-foot grid ticks: Alabama State Plane coordinate system, east zone (FIPSZONE 0101), Transverse Mercator
DX5510	Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
October 18, 2011
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1- 800- 638- 6620.

MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0589C

FIRM
FLOOD INSURANCE RATE MAP

PARK COUNTY, MONTANA
AND INCORPORATED AREAS

PANEL 589 OF 1925
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
PARK COUNTY	300160	0589	C
LIVINGSTON, CITY OF	300051	0589	C

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
30067C0589C
EFFECTIVE DATE
OCTOBER 18, 2011

Federal Emergency Management Agency

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures.** Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 12. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum.** For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC- 3, #9202
1315 East- West Highway
Silver Spring, MD 20910- 3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242,** or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on this FIRM was provided by the U.S. Census Bureau, Geography Division, 2009 TIGER/Line files. The coordinate system used for production of the digital FIRM is the Universal Transverse Mercator Zone 12 North, reference to North American Datum of 1983 and GRS spheroid, Western Hemisphere.
This map reflects more detailed and up- to- date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables *in the Flood Insurance Study report (which contains authoritative hydraulic data)* may reflect stream channel distances that differ from what is shown on this map.

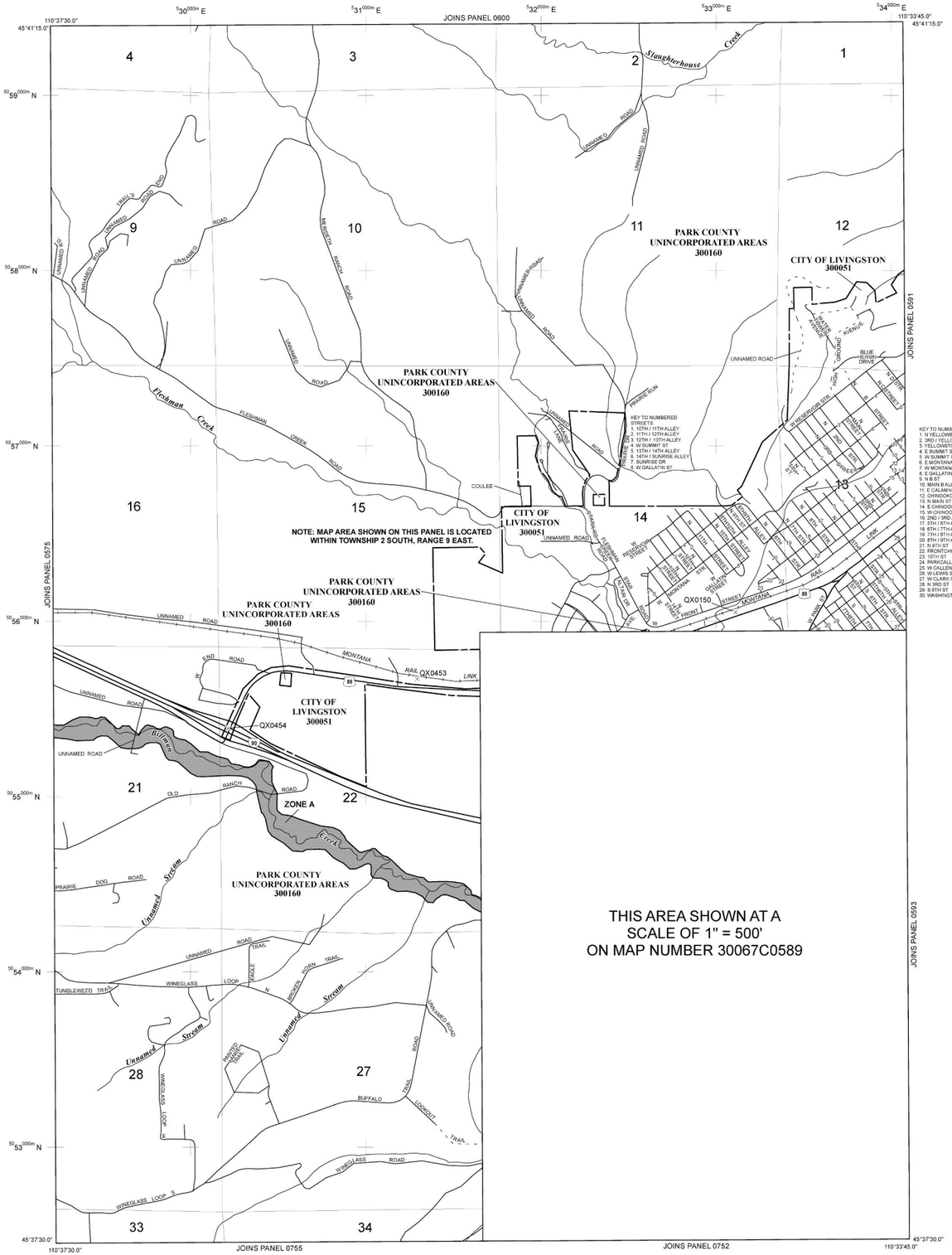
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de- annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1- 800- 358- 9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, *a Flood Insurance Study report,* and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1- 800- 358- 9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1- 877- FEMA MAP** (1- 877- 336- 2627) or visit the FEMA website at http://www.fema.gov/.

Figure 1-6C



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
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ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
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COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- Floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

- A — A: Cross section line
- 23 — 23: Transect line
- 97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4275000mN — 1000-meter Universal Transverse Mercator grid ticks, zone 12
- 6000000 M — 5000-foot grid ticks: Alabama State Plane coordinate system, east zone (FIPSZONE 0101), Transverse Mercator
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
October 18, 2011
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

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MAP SCALE 1" = 1000'
500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0590C

FIRM
FLOOD INSURANCE RATE MAP
PARK COUNTY, MONTANA AND INCORPORATED AREAS

PANEL 590 OF 1925
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
PARK COUNTY	300160	0590	C
LIVINGSTON, CITY OF	300051	0590	C

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
30067C0590C

MAP REVISED
OCTOBER 18, 2011

Federal Emergency Management Agency

NOTES TO USERS

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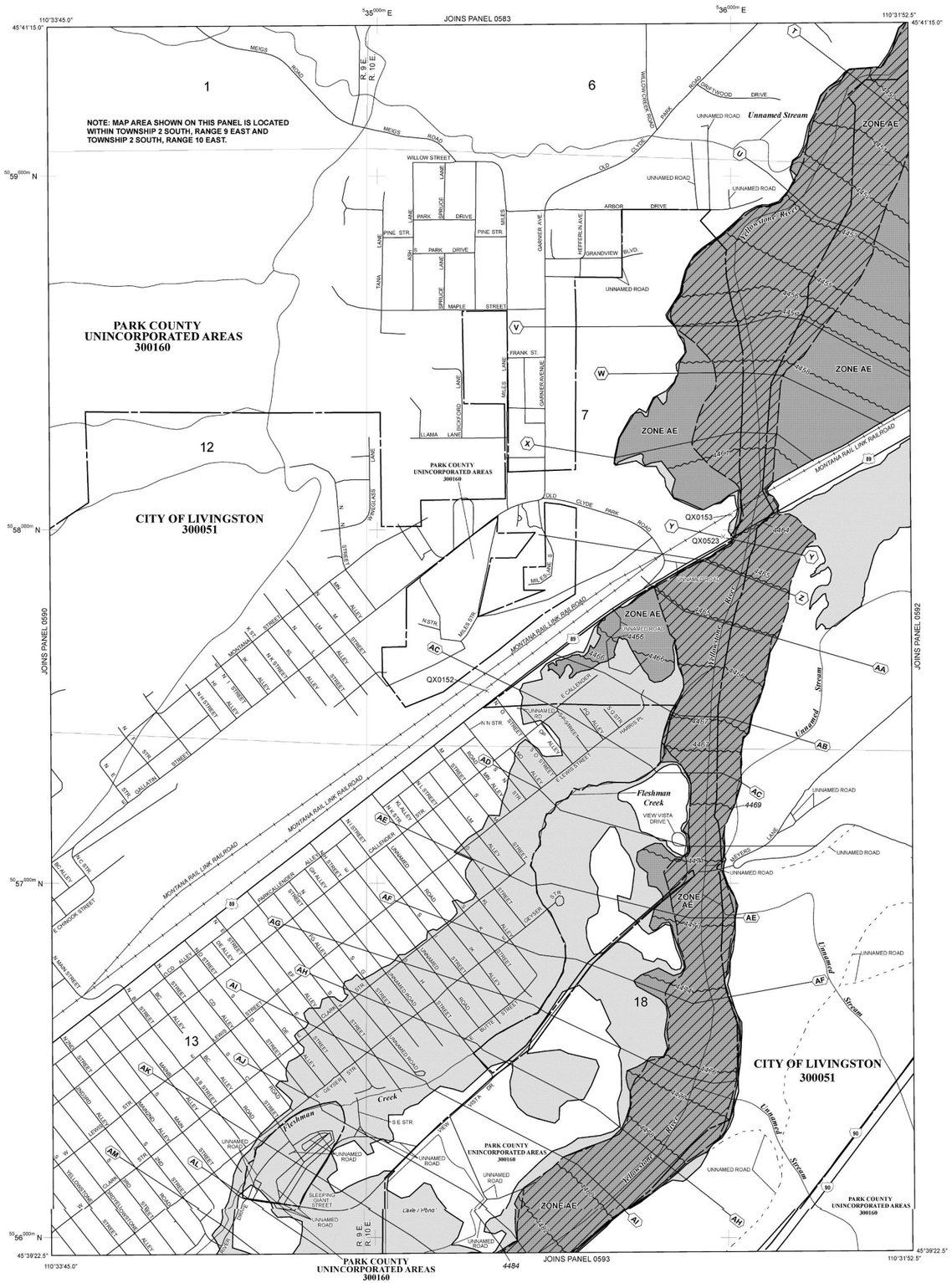

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

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ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	Floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A — A	Cross section line
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97°07'30", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
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M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
October 18, 2011
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

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MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0591C

FIRM
FLOOD INSURANCE RATE MAP
PARK COUNTY, MONTANA
AND INCORPORATED AREAS

PANEL 591 OF 1925
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
PARK COUNTY	300160	0591	C
LIVINGSTON, CITY OF	300051	0591	C

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
30067C0591C
EFFECTIVE DATE
OCTOBER 18, 2011

Federal Emergency Management Agency

Figure 1-6D

NOTES TO USERS

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SSMC- 3, #9202
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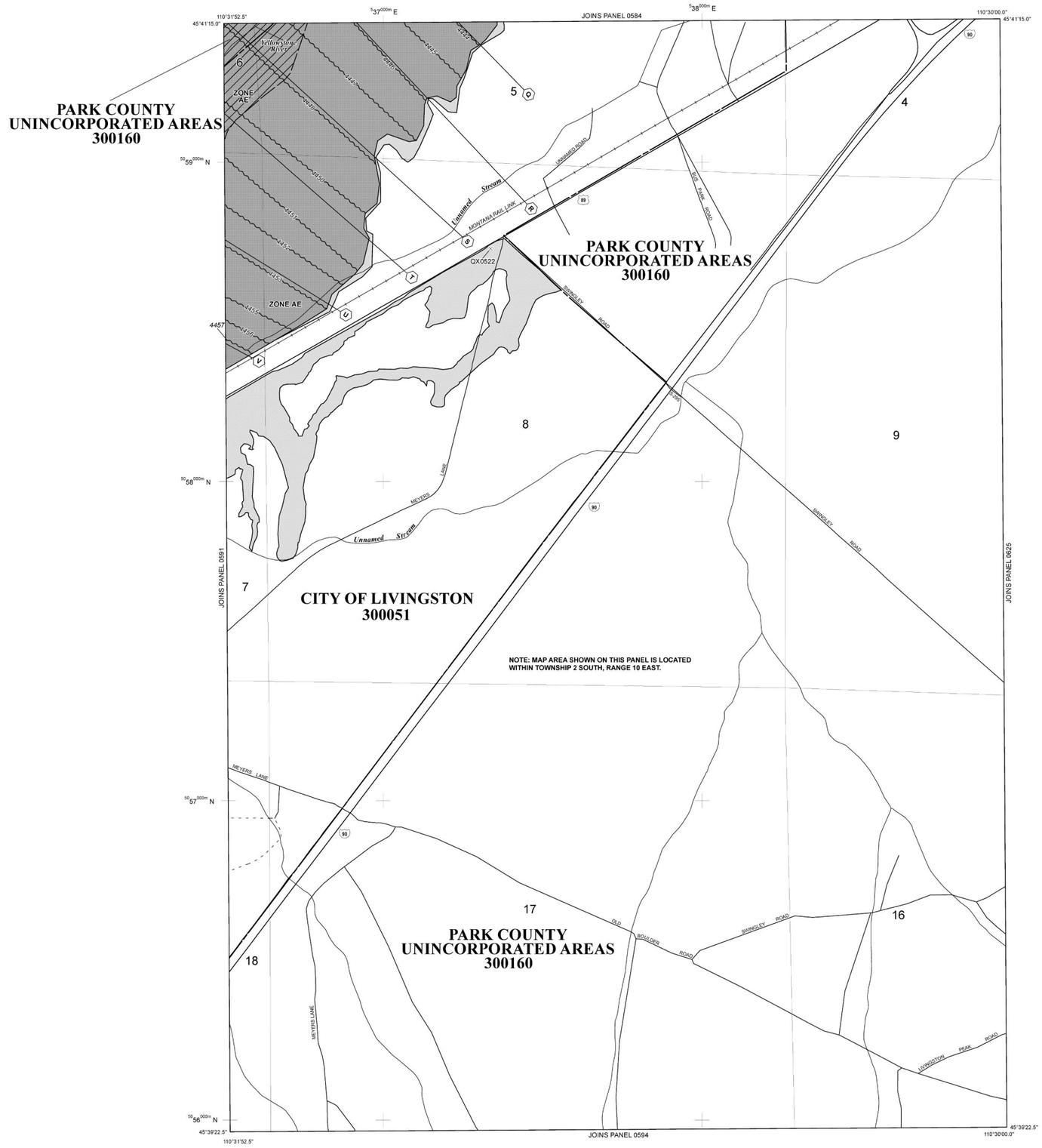
Figure 1-6E



LEGEND

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ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- Floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

- A — A — Cross section line
- 23 — 23 — Transect line
- 97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4275 000mN — 1000-meter Universal Transverse Mercator grid ticks, zone 12
- 6000000 M — 5000-foot grid ticks: Alabama State Plane coordinate system, east zone (FIPSZONE 0101), Transverse Mercator
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
October 18, 2011
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1- 800- 638- 6620.

MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0592C

FIRM
FLOOD INSURANCE RATE MAP
PARK COUNTY, MONTANA
AND INCORPORATED AREAS

PANEL 592 OF 1925
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
PARK COUNTY	300160	0592	C
LIVINGSTON, CITY OF	300051	0592	C

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
30067C0592C

EFFECTIVE DATE
OCTOBER 18, 2011

Federal Emergency Management Agency

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures.** Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 12. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum.** For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC- 3, #9202
1315 East- West Highway
Silver Spring, MD 20910- 3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242,** or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on this FIRM was provided by the U.S.Census Bureau, Geographic Division, 2009 TIGER/Line files.The coordinate system used for production of the digital FIRM is the Universal Transverse Mercator Zone 12 North, reference to the North American Datum of 1983 and GRS spheroid, Western Hemisphere.
This map reflects more detailed and up- to- date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables *in the Flood Insurance Study report (which contains authoritative hydraulic data)* may reflect stream channel distances that differ from what is shown on this map.

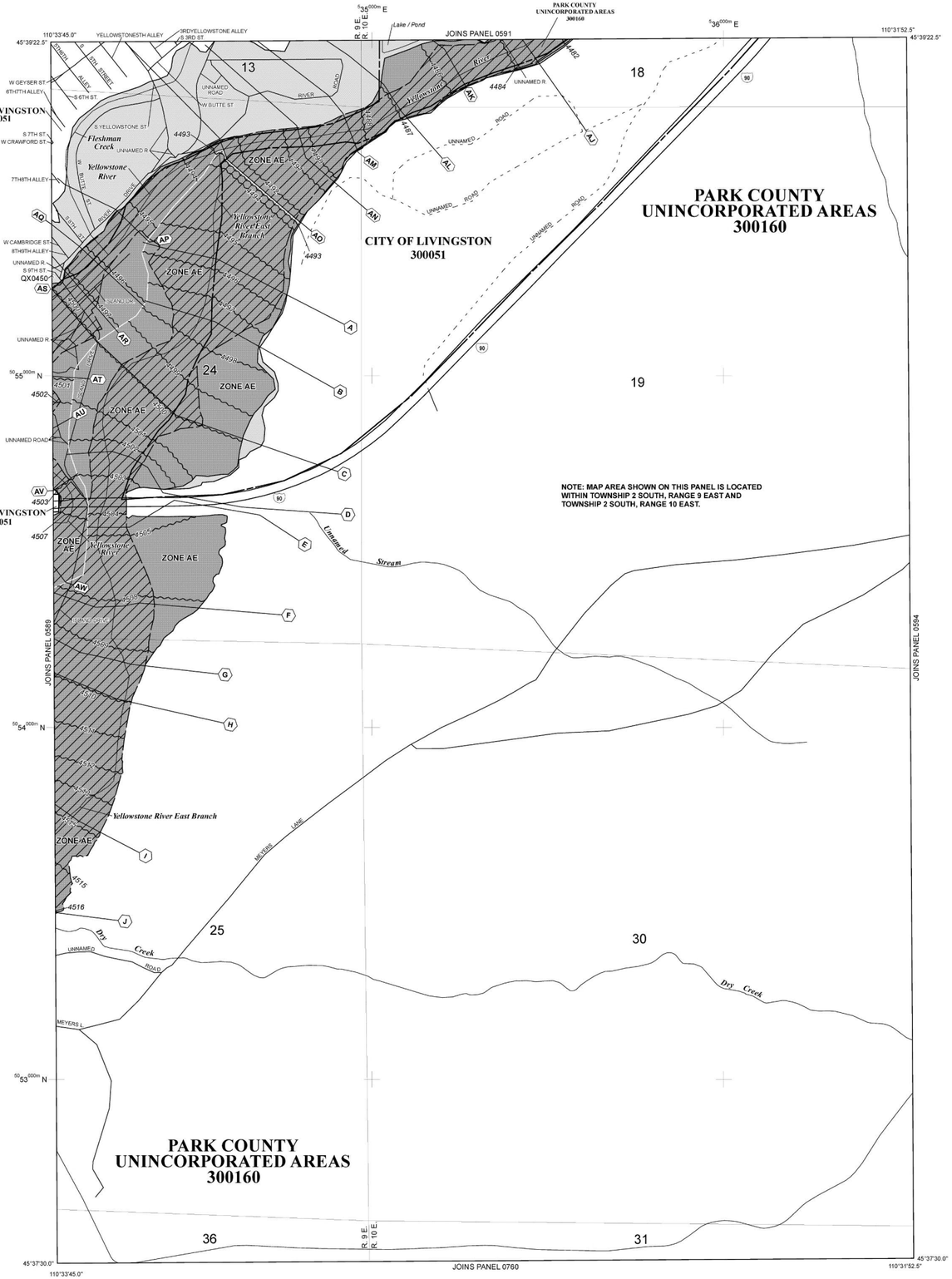
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de- annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1- 800- 358- 9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, *a Flood Insurance Study report*, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1- 800- 358- 9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1- 877- FEMA MAP** (1- 877- 336- 2627) or visit the FEMA website at http://www.fema.gov/.

Figure 1-6F



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0593C

FIRM
FLOOD INSURANCE RATE MAP
PARK COUNTY, MONTANA
AND INCORPORATED AREAS

PANEL 593 OF 1925
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

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LIVINGSTON, CITY OF	300051	0593	C

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
30067C0593C

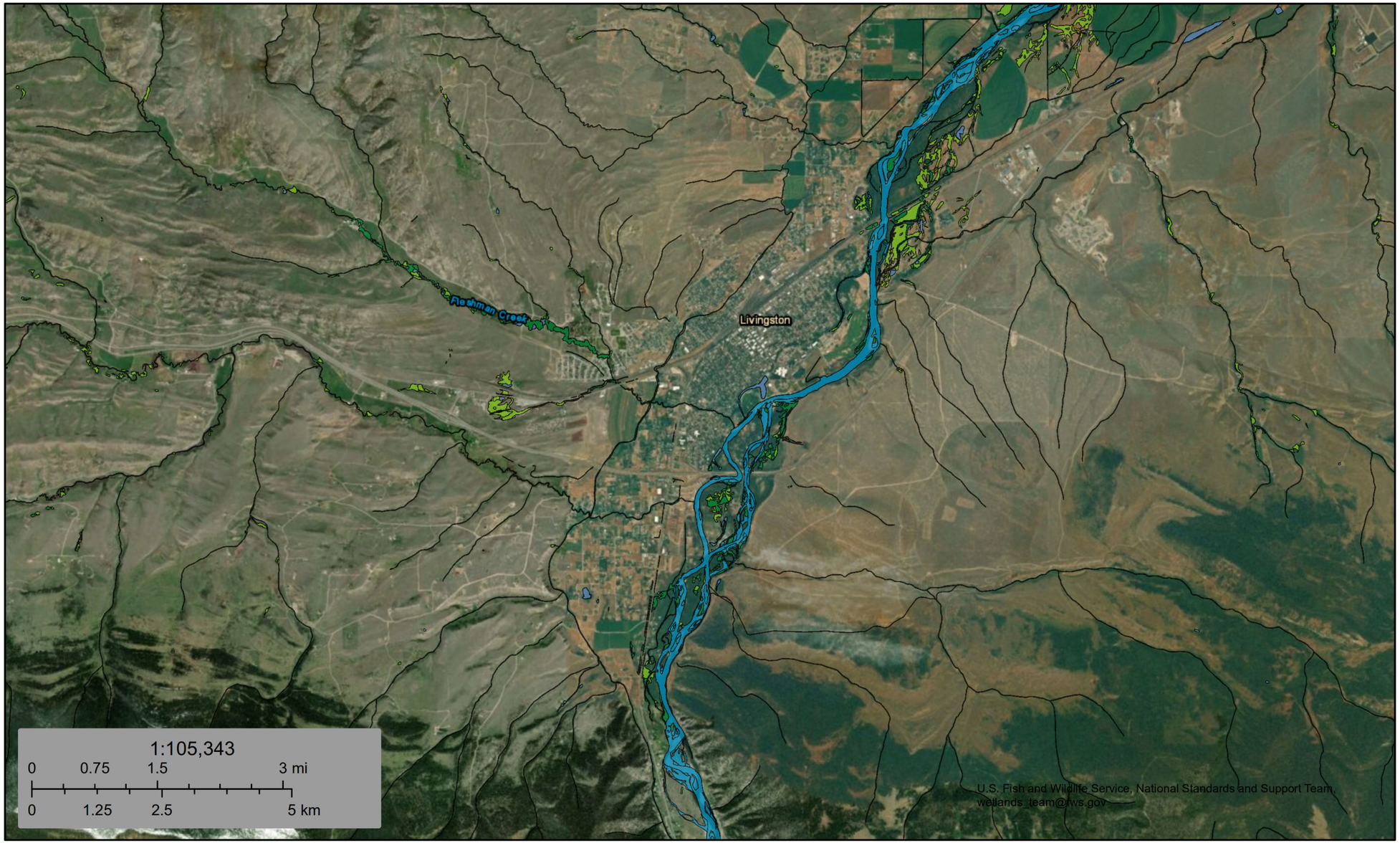
EFFECTIVE DATE
OCTOBER 18, 2011

Federal Emergency Management Agency

U.S. Fish and Wildlife Service

National Wetlands Inventory

City of Livingston Wetlands Map



April 2, 2019

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

National Wetlands Inventory (NWI)
This page was produced by the NWI mapper

Farmland Classification—Park County Area, Montana

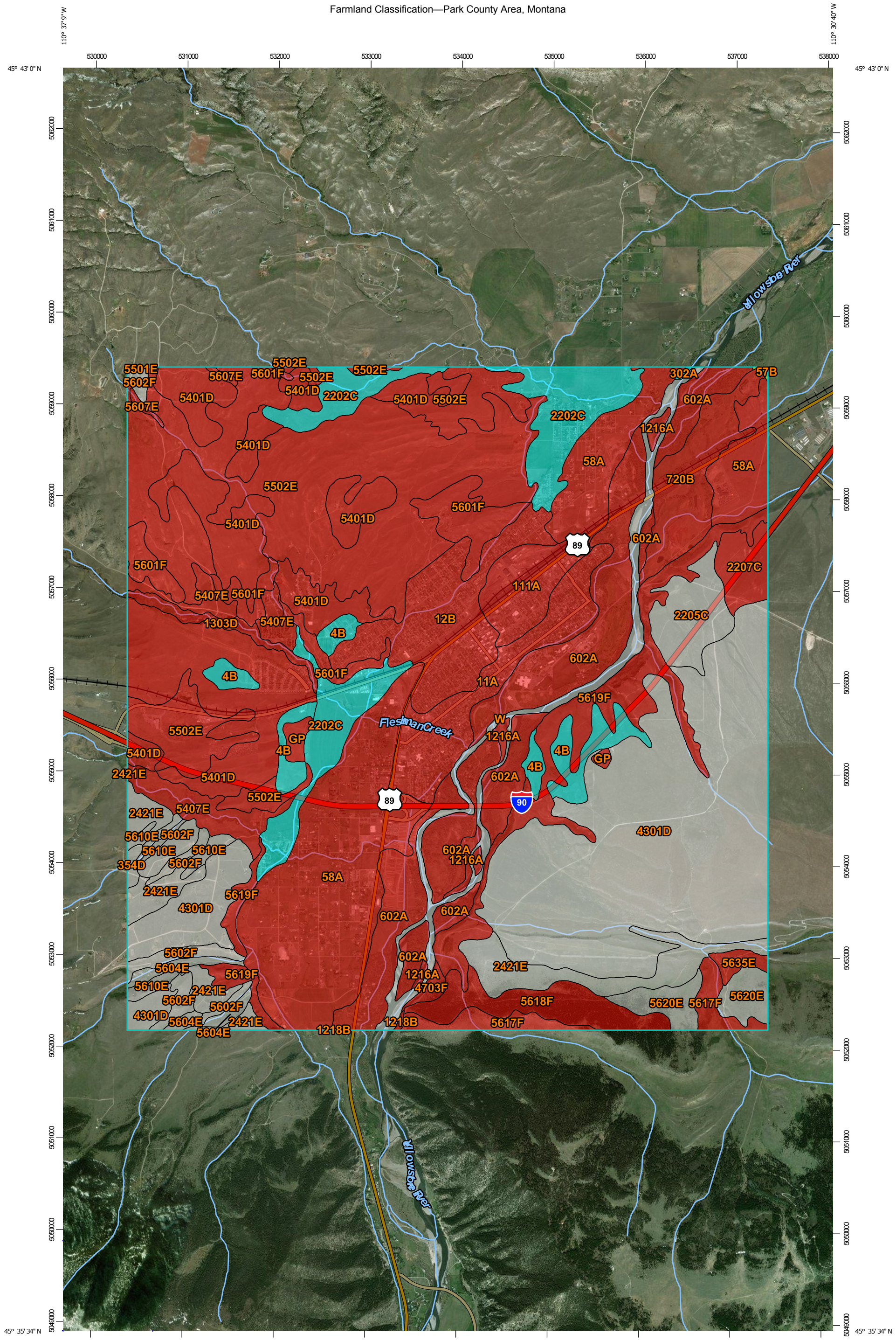


FIGURE 1-8

USDA **Natural Resources Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

c. Agricultural Lands

The City of Livingston and surrounding area has considerable amounts of agricultural lands, as seen in Figure 1-8. The Farmland Protection Policy Act (FPPA) of 1981 was passed to minimize the impact of Federal programs and projects on the conversion of farmland to nonagricultural uses. The project as proposed occurs within city limits where FPPA does not apply. Furthermore, the planning area is currently developed area, which contains no areas of prime or unique farmland. No conversion of any farmland would be included in the project scope, as proposed, thus no impacts to important farmland would occur (AE2S, 2016).

d. Hazardous Waste Sites

A query was run on the www.DEQDataSearch.mt.gov website for all hazardous waste handlers within the City of Livingston. The search returned eight active facilities that handle hazardous waste. The results are listed below in Table 1-1. For all alternatives, regulations must be met that ensure minimum separation requirements and prevention of contamination to the wastewater system.

Table 1-1: Hazardous Waste Handlers

Facility Name	Generator Classification	Last Reporting Year	Waste Generated (Tons)
BNSF Mission Wye	Small Quantity Generator	2001	0
BNSF Railway Company	Large Quantity Generator	2018	1.2
Livingston Readiness Center	Small Quantity Generator	2018	0
Park High School	Small Quantity Generator	1990	0.27
Parker Repair	Conditionally Exempt Small Quantity Generator	1992	0
Printing for Less	Small Quantity Generator	2018	1
Strong & Bradley Inc	Small Quantity Generator	1997	0.26
US Postal Service	Small Quantity Generator	1999	0.95

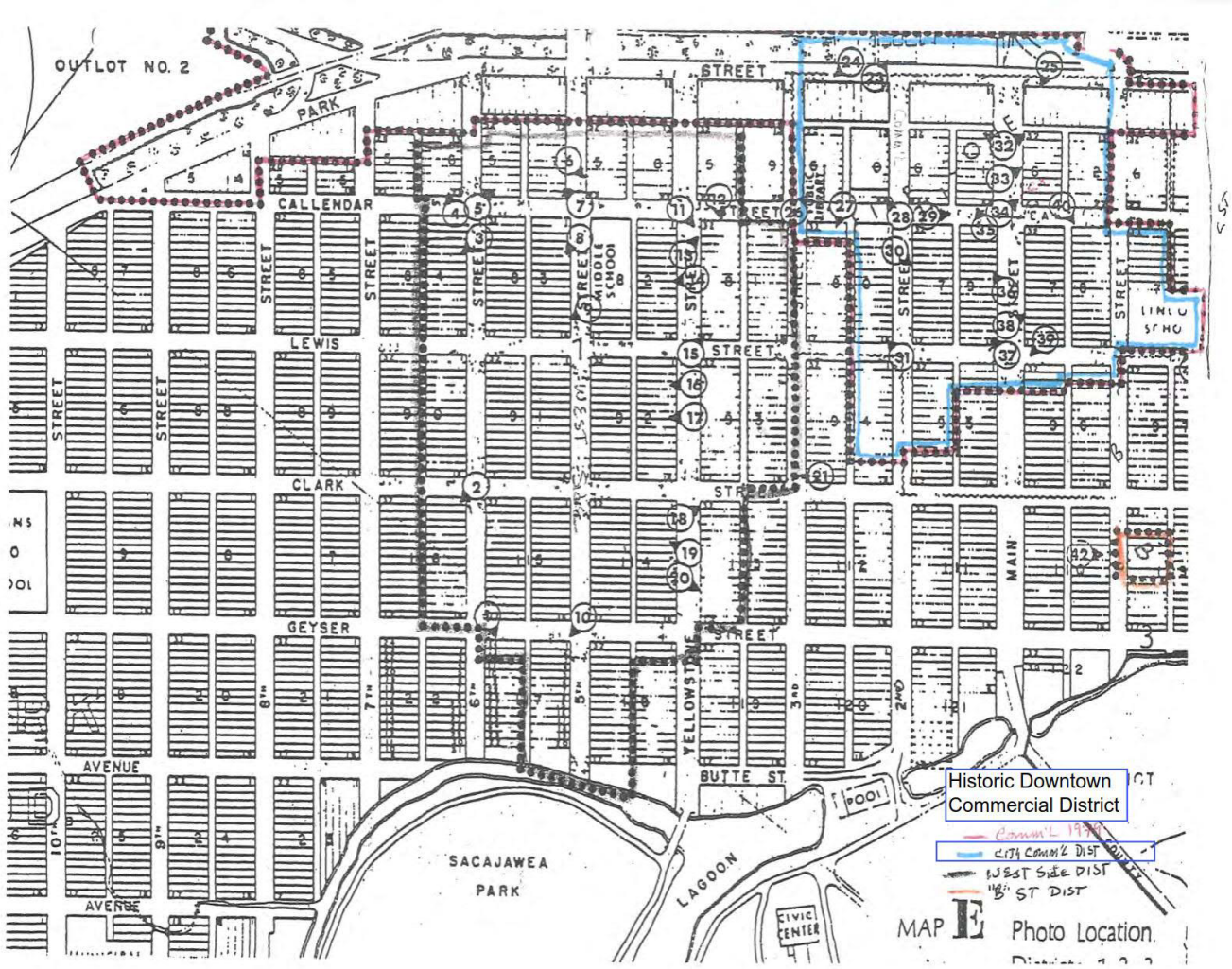
e. Historic Sites

The City of Livingston has four districts that are recognized by the National Register of Historic Places, as shown in Figure 1-9 below:

- Westside Residential,
- Eastside Residential,
- B Street, and
- Downtown (business)

A scoping letter and map were sent to the State Historical Preservation Office (SHPO) regarding the recommended improvements for their review and comment. No response was received to date.

Figure 1-9: Livingston Historic Districts



f. Biological Species Occurrences

The Montana Ecological Services Field Office of the U.S. Fish & Wildlife Service lists four species within Park County that are a candidate, proposed, or protected under the Endangered Species Act as a threatened species. There are no endangered species listed in Park County. Table 1-2 below displays those species and their status. The full list for Montana can be found in Appendix 1.

Table 1-2
U.S. FWS Listed Species of Park County

Scientific Name	Common Name	Status	Status Description
Lynx Canadensis	Canada Lynx	Candidate, Listed Threatened	C- FWS or NOAA Fisheries has on file sufficient information on biological vulnerability and threats to support a proposal to list as endangered or threatened. LT- Likely to become endangered within the foreseeable future throughout all or a significant portion of its range
Gulo Gulo Luscus	Wolverine	Proposed	Proposed in the Federal Register to be listed under section 4 of the Endangered Species Act
Pinus Albicaulis	Whitebark Pine	Candidate	FWS or NOAA Fisheries has on file sufficient information on biological vulnerability and threats to support a proposal to list as endangered or threatened
Ursus arctos horribilis	Grizzly Bear	Listed Threatened	Likely to become endangered within the foreseeable future throughout all or a significant portion of its range

A query of the MTNHP Environmental Report (March 2019) provided a list of plant and animal "Species of Concern," "Potential Species of Concern," and "Special Status Species" within the queried area. The species of concern and potential species of concern are plants or animals that are native to Montana and are currently, or potentially, at risk for extirpation or local extinction. The special status species are species that have some legal protection in place but are no longer recognized as federally listed under the Endangered Species Act. Table 1-3 provides species occurrences. The Report noted the occurrence of 18 species of concern, one special status species, and 19 invasive species potentially present within the planning boundary. The full list of species can be found in Appendix 1.

Table 1-3 Montana Natural Heritage Program Species Occurrences		
Species Group and Status	**Common Name**	**Scientific Name**
Plant- Species of Concern	Scribner's Ragwort Scarlet Ammannia Sitka Columbine Slim-pod Venus'-looking-glass	Senecio integerrimus var. scribneri Ammannia robusta Aquilegia formosa Triodanis leptocarpa
Bird- Species of Concern	Golden Eagle Clark's Nutcracker Peregrine Falcon Long-billed Curlew Great Blue Heron Trumpeter Swan Sagebrush Sparrow	Aquila chrysaetos Nucifraga Columbiana Falco peregrinus Numenius americanus Ardea Herodias Cygnus buccinators Artemisiospiza nevadensis
Fish- Species of Concern	Yellowstone Cutthroat Trout	Oncorhynchus clarkii bouvieri
Mammals- Species of Concern	Hoary Bat Little Brown Myotis Townsend's Big-eared Bat Grizzly Bear Canada Lynx Wolverine	Lasiurus cinereus Myotis lucifugus Corynorhinus townsendii Ursus arctos Lynx Canadensis Gulo gulo
All Groups- Special Status Species	Bald Eagle	Haliaeetus leucocephalus*
*Protected under the Bald and Golden Eagle Protection Act of 1940.		

As part of this planning document, a consultation letter was provided to the U.S. Fish and Wildlife Service for their review and comments on any potential environmental impacts. On June 28, 2019 the agency responded that they have no comments or concerns (see Appendix 1).

The Montana Fish, Wildlife & Parks Department was also provided a letter and map for their comment on the recommended project improvements and any environmental impacts. On June 20, 2019 the agency recommended that wastewater meets DEQ standards before being discharged to the Yellowstone River and that any necessary additional improvements are completed for the project (see Appendix 1).

C. POPULATION TRENDS

A detailed analysis of population trends is critical to correctly assess the existing system's available capacity as well as provide accurate design conditions for future upgrades. Historic population trends and future projections for the City of Livingston are detailed in the following sections.

a. Historic Population and Analysis

Population trends for the area were reviewed to gain a better understanding of past growth in the area. Population information published by the United States Census Bureau and the American Communities Survey (ACS) is summarized in Table 1-4 along with calculated annual growth rates. This information is graphically displayed in Figure 1-10.

The City of Livingston and Park County have experienced rapid population shifts at times as a result of the railroad industry boom and decline. The City has experienced consistent annual growth around 0.25% since 1990. Park County saw rapid population growth from 1970 to 1990; the County's growth has decreased in recent years with the US Census data reporting a negative growth rate in the early 2000.

Table 1-4
Historic Population Trends

Year	City of Livingston		Livingston CCD		Park County	
	Population	% Annual Growth	Population	% Annual Growth	Population	% Annual Growth
1970					11,197	
1980					12,869	1.40%
1990	6,701		11,132		14,484	1.19%
2000	6,854	0.23%	12,016	0.77%	15,694	0.81%
2010	7,044	0.27%	12,325	0.25%	15,636	-0.04%
2015 (1)	7,136	0.26%			15,708	0.09%

(1) American Communities Survey Data

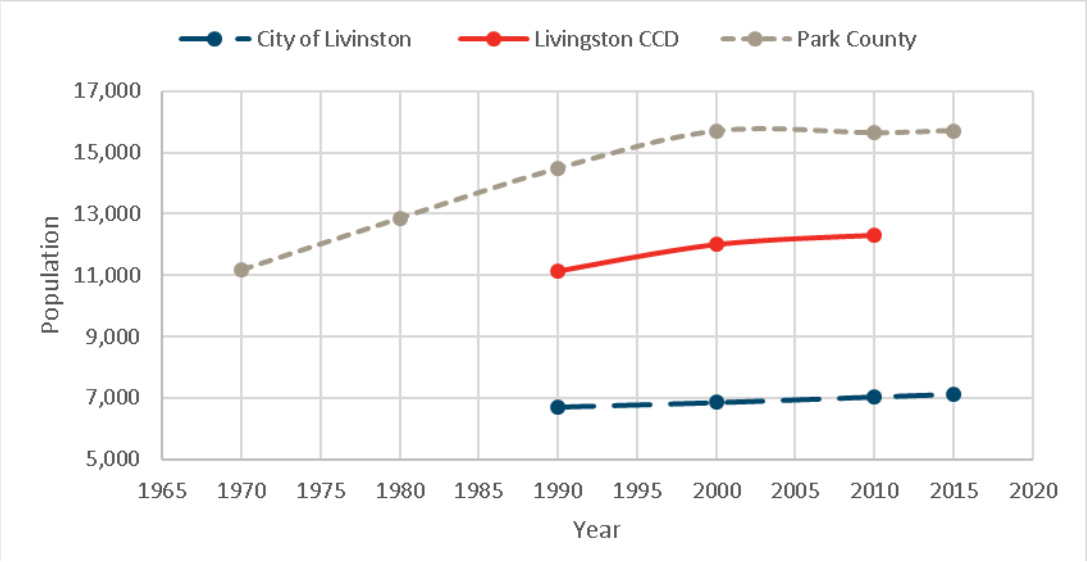


Figure 1-10: Historic Population Data

Due to the recent population boom in the neighboring Gallatin Valley, an annual growth rate of 0.25% is not considered reasonable for projecting the City of Livingston's 20- year design population and average day flow rates. It is considered likely the Park County and the City of Livingston will

expectance growth similar to the nearby Gallatin County. Table 1-5 presents historic growth for the City of Bozeman, the City of Belgrade and Gallatin County.

Table 1-5
Gallatin County Historic Population Trends

	City of Belgrade		City of Bozeman		Gallatin County	
Year	Population	% Annual Growth	Population	% Annual Growth	Population	% Annual Growth
1970					32,505	
1980					42,865	2.81%
1990	3,422		22,660		50,463	1.65%
2000	5,728	5.29%	27,509	1.96%	67,831	3.00%
2010	7,389	2.58%	37,275	3.08%	89,513	2.81%
2015 (1)	7,738	0.93%	40319	1.58%	95,323	1.27%

(1) American Communities Survey Data

b. Population and Flow Projections

The recent wastewater treatment plant PER published by Stahly Engineering in 2014, reported a 2030 design population of 10,500 persons. That that will require a 2.6% annual growth rate within the City. Given the recorded growth in the neighboring Gallatin County, an annual growth rate of 2.6% is considered a reasonably conservative estimate. Population growth may be lower than projected if economic conditions decline or significantly higher for many unforeseeable and unpredictable reasons. Growth projections should be reviewed on an annual basis to determine when improvements recommended to serve population growth are required. Table 1-6 provides projected population and average day flow rates. The recent upgrades for the City's wastewater treatment facility (WWTF) included an average day design flow rate of 1.21 MGD in year 2035. The proposed 2.6% annual growth rate will result in an average day flow of 1.27 MGD in 2035. The proposed growth rate results in a slightly higher flow and more conservative design. **The recommended design average day flow rate for the 20-year design period is 1.44 MGD in year 2040.** The City approved the growth rate in a May 5, 2019 e-mail, available in Appendix 1.

Table 1-6
Population and Flow Projections

	Annual Growth Rate	Population	Average Day Flow (MGD)
2015	2.6%	7,136	
2016	2.6%	7,322	0.78
2020	2.6%	8,113	0.86
2030	2.6%	10,487	1.12
2035	2.6%	11,923	1.27
2040	**2.6%**	**13,556**	**1.44**

D. COMMUNITY ENGAGEMENT

The City of Livingston has presented the need for wastewater system upgrades at numerous City Commission meetings over the past eight years.

Advertised public hearings will be forthcoming as the City initiates the planning process with the community.

2.0 EXISTING FACILITIES

A. LOCATION MAP

The City of Livingston's jurisdictional zoning boundary encompasses roughly 6 square miles in central Park County. The City's sewer service area covers approximately 2.2 square miles within the jurisdictional boundary. Figure 2-1 presents boundary locations.

The collection system consists of gravity and force mains located throughout City with seven lift stations. Raw wastewater is ultimately conveyed to the water reclamation facility (WRF) located near the northeastern border of the City, on the banks of the Yellowstone River. Figure 2-2 presents the extent of the existing wastewater system, locations of the lift stations, and WRF.

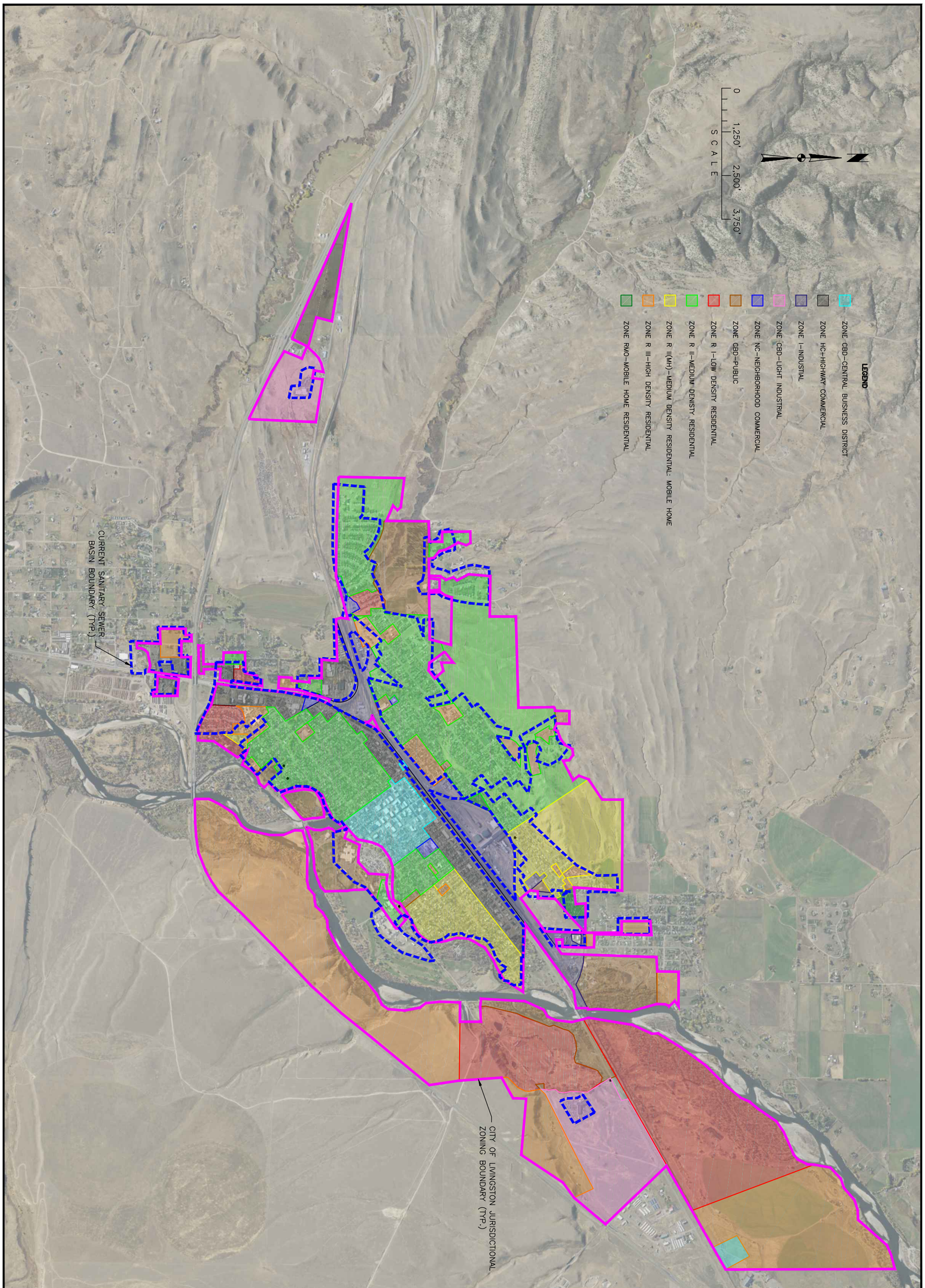
B. HISTORY

The collection system was originally installed in 1922. Over the past century, a number of extensions have been completed. Currently, the City's collection system consists of roughly 45 miles of gravity mains and seven lift stations with associated forcemains. The City has been working to replace aging and inadequate sanitary mains over the past decade. Recent capital improvement projects (CIP) regarding the City's sanitary system are summarized in Table 2-1. A number of similar projects have also been completed to repair sections of the municipal water system.

Table 2-1
Recent Capital Improvement Projects

Year	Description
2011	Sanitary Sewer Replacement • Callendar-Park Street Alley, 3rd Street to B Street • 3rd-2nd Street Alley, near Callendar Street • 2nd-Main Street Alley, near Callendar Street • Main-B Street Alley, near Callendar Street.
2014	Sanitary Sewer Replacement • 9th-10th Street Alley near Geyser Street • G-H Street Alley, near Park Street • M-N Street Alley, near Lewis Street • 2nd-3rd Street Alley, near Summit Street • 3rd-Yellowstone Street Alley, near Summit Street
2015	Sanitary Sewer Replacement • Main Street-B Street Alley, Callendar Street to Geyser Street
2018	Sanitary Sewer Replacement-Downtown CIP • Main Street, Callendar Street to Lewis Street
2019	Sanitary Sewer Replacement-Downtown CIP • Main Street, Lewis Street to Geyser Street • Clark Street, 2nd-Main Street Alley to B-C Street Alley • 5th Street to 8th Street Alley Sewer

J:\2015\B15-081 City of Livingston\CADD\CIVIL\WW PER\B15-081 BOUNDARY.dwg, 6/10/2019 4:54:42 PM, NMR



LIVINGSTON COLLECTION SYSTEM PER
LIVINGSTON, MONTANA

JURISDICTIONAL ZONING AND SEWER SYSTEM BOUNDARY

FIGURE 2-1

B15-081 BOUNDARY.DWG

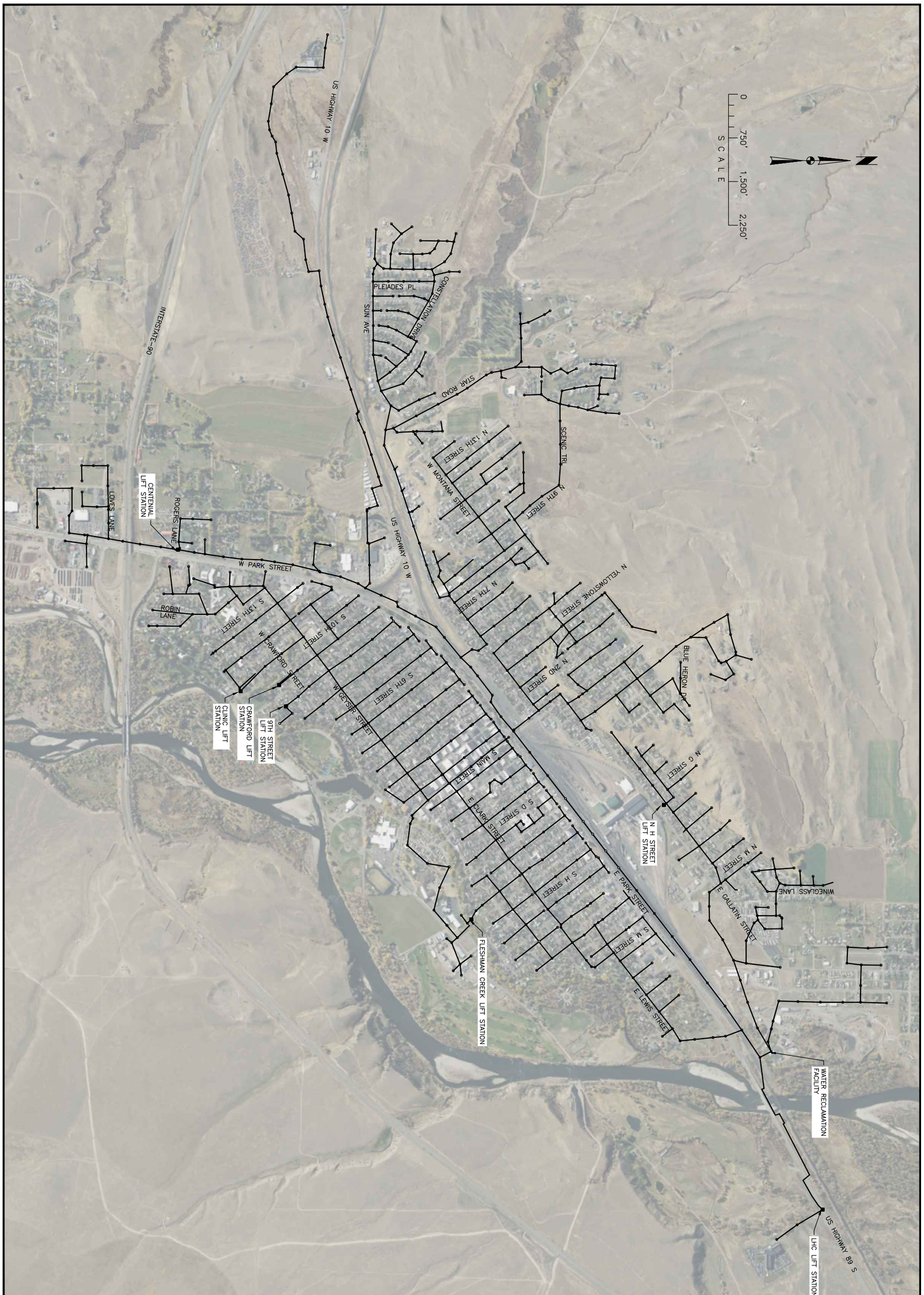
JOB NO: B15-081
FIELDBOOK:
DATE: 4-26-2019
QUALITY CHECK:
DESIGNED BY:
DRAWN BY: NMR

TD&H Engineering
406.586.0277 • tdhengineering.com
234 E. BABCOCK ST., SUITE 3 • BOZEMAN, MONTANA 59715

REV	DATE	REVISION

NOT FOR CONSTRUCTION

J:\2015\B15-081 City of Livingston\CADD\CIVIL\WW PER\B15-081OVERVIEW.dwg, 6/10/2019 4:56:57 PM, NMR



LIVINGSTON COLLECTION SYSTEM PER
LIVINGSTON, MONTANA

EXISTING WASTEWATER SYSTEM

FIGURE 2-2
B15-081OVERVIEW.DWG

DRAWN BY: NMR
DESIGNED BY:
QUALITY CHECK:
DATE: 03-04-2019
JOB NO. B15-081
FIELDBOOK

TD&H Engineering
406.586.0277 • tdhengineering.com
234 E. BABCOCK ST., SUITE 3 • BOZEMAN, MONTANA 59715

REV	DATE	REVISION

NOT FOR CONSTRUCTION

In 1960 the City constructed a mechanical WRF with an aerobic attached growth secondary treatment system that continuously discharges to the Yellowstone River. The WRF was upgraded in 1980 to include a chlorine contact basin, secondary clarifiers, rotating biological contactors, and a new influent pump station. In 2000 the City added a new headworks facility, replacement primary clarifiers, and ultraviolet (UV) disinfection. Most recently, the City completed a treatment plant PER in 2014 that resulted in significant upgrades to the treatment facility in 2018. Construction of the new sequencing batch reactor (SBR) was completed in 2019.

C. CONDITION OF EXISTING FACILITIES

The majority of the City of Livingston's collection system consists of gravity sewer mains ranging in size from 6- to 24-inches. Seven lift stations with associated forcemains are located throughout the City. The sanitary sewer mains transport raw wastewater to the WRF on the eastern edge of town. The WRF and disposal system were evaluated in detail in the 2014 Wastewater Treatment Facility PER, prepared by Stahly Engineering. Improvements to the WRF were completed in 2019. The updated WRF is in excellent condition with sufficient capacity to serve the City for the 20-year design life.

Additionally, this section will cover areas in and around the City that are not connected to the existing municipal system. Raw wastewater generated from these areas is treated in septic tanks and drainfields rather than the City's WRF. Drainfields are not designed to meet the same secondary treatment standards as public systems. Furthermore, these systems are not regulated to the same extent as publicly owned treatment works (POTWs) and tend to result in greater groundwater contamination.

a. Condition

The condition of the City's gravity sewer system was evaluated based on pipe age, material, size, and noted deficiencies. City staff has indicated that raw wastewater flow to the WRF can double or even triple during the spring and early summer months. This strongly suggests inflow and infiltration (I/I). Sanitary sewer mains of a certain age and/or material have proven to be prone to cracks, root intrusions and blockages. These deficiencies are likely to increase I/I flow rates, cause mains to leak raw wastewater, and/or decrease available capacity. The age and material of the City's sanitary sewer system are detailed below. Additionally, the condition of the City's seven lift station is discussed below. The lift stations' condition evaluation is largely based on input from City staff.

i. Pipe Material

The City of Livingston's Geographical Information System (GIS) was referenced for pipe material. The majority of the gravity collection system is comprised of either polyvinyl chloride (PVC) or clay tile pipe. Issues such as cracks, root intrusions and blockages are common occurrences in clay tile pipe. A small percentage of the system is vitrified clay pipe (VCP) and reinforced concrete pipe (RCP). Sections of clay tile pipe in the downtown area have been rehabbed through cured in place pipe (CIPP) or replaced with new PVC pipe in recent capital improvement projects (CIP). Figure 2-3 presents the City's collection system with defined pipe material. High Density Polyethylene (HDPE) forcemains are included with the existing lift stations. The length of each pipe material as a percentage of the gravity collection system is summarized in Chart 2-1. Nearly half of the gravity system is PVC. However, at least 35% of the system is clay tile pipe, putting the collection system at higher risk of defects.

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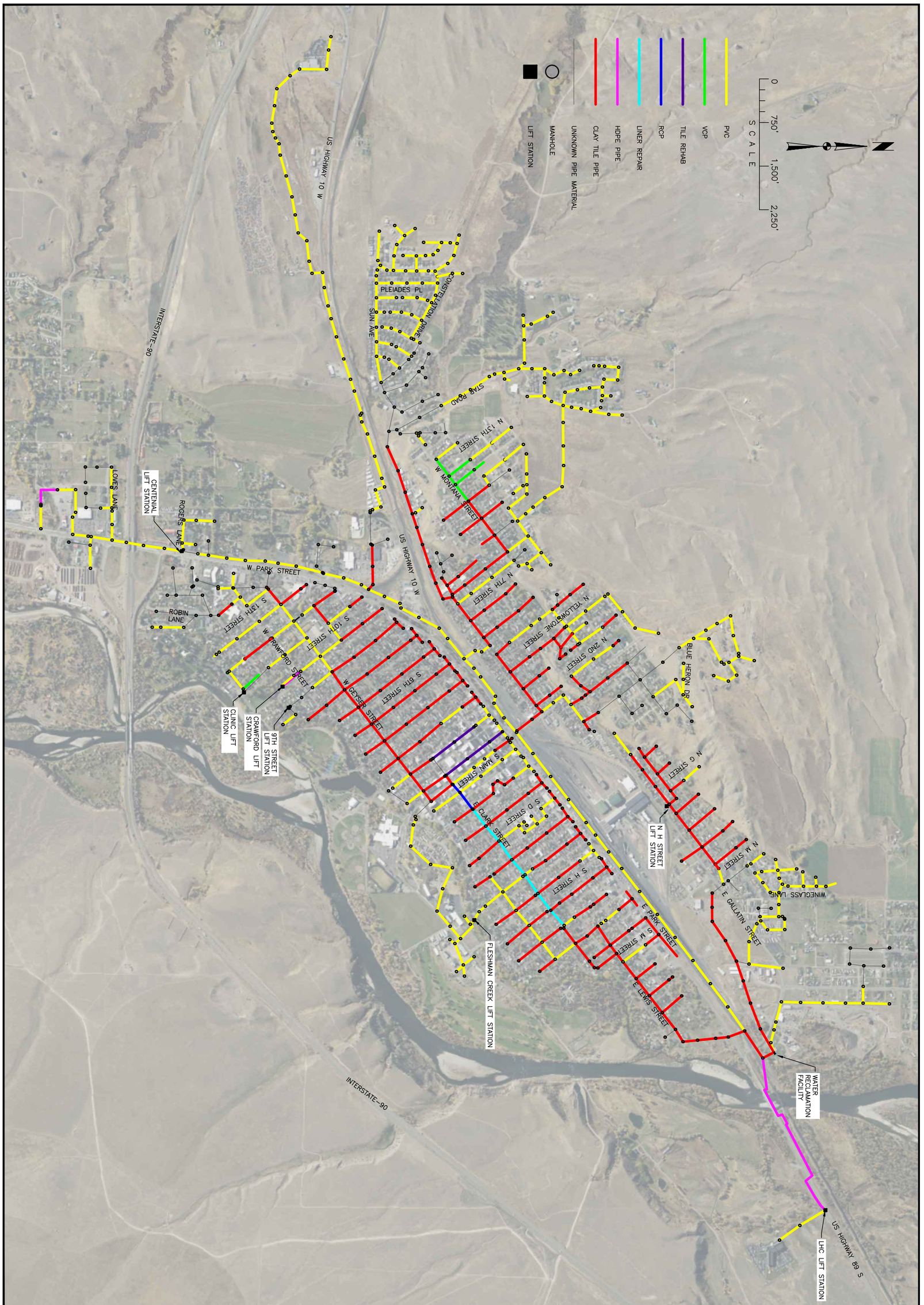

LIVINGSTON COLLECTION SYSTEM PER
LIVINGSTON, MONTANA

COLLECTION SYSTEM MAP

PIPE MATERIALS

FIGURE 2-3

B15-081 MATERIAL.DWG

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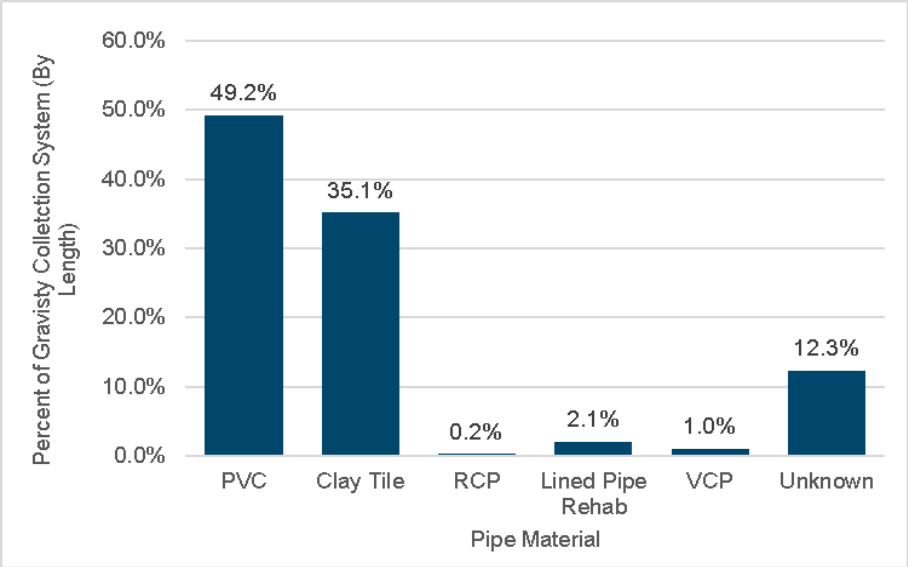

Chart 2-1: Gravity Collection System Pipe Material

ii. Pipe Age

The City's GIS was referenced for installation dates of the existing collection system. According to the available GIS, the oldest mains in the current system were installed in 1922; the newest mains were installed in the last decade. Plastic pipes, such as PVC, can have a life expectancy as high as 100 years. However, plastic pipes did not become popular until the 1970s and 1980s, the oldest PVC pipe in the City's existing system is 40 to 50 years old. Pipes segments installed prior to 1970 are predominately clay tile pipe and have a life expectancy of 50 to 60 years. Chart 2-2 summarizes the quantity of the collection system in each age group as a percentage of pipe length. As indicated in Chart 2-2, at least 31.5% of the City's collection system is over 70 years old, with a large portion of those mains installed in 1922, nearing 100 years old. The City's collection system with defined pipe age is presented in Figure 2-4.

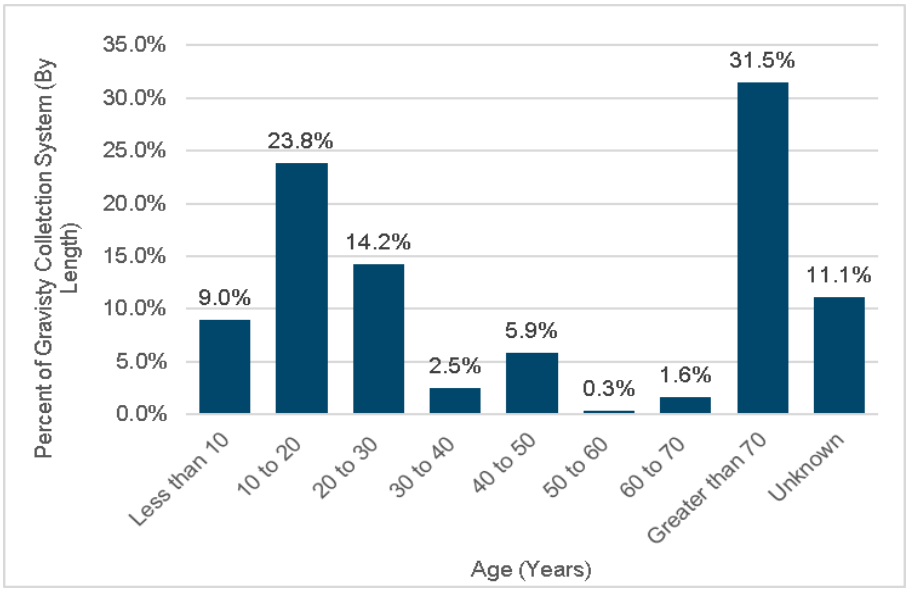

Chart 2-2: Gravity Collection System Pipe Age

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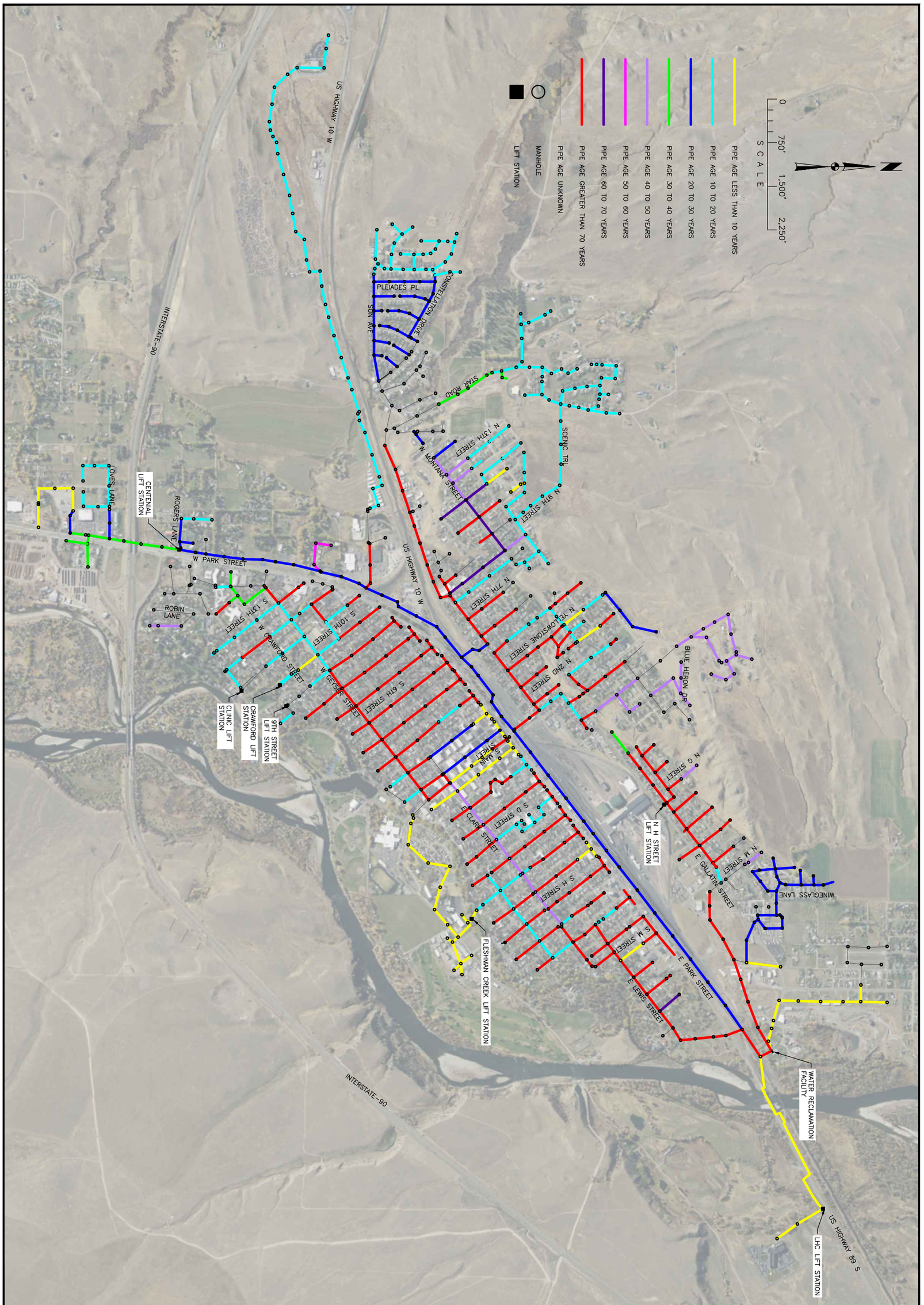

LIVINGSTON COLLECTION SYSTEM PER
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COLLECTION SYSTEM MAP

PIPE AGE

FIGURE 2-4
B15-081 PIPE AGE MAP.DWG

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iii. Pipe Size

The gravity collection system consists of pipe ranging from 6- to 24-inches. Figure 2-5 presents the collection system with defined pipe sizing. Chart 2-3 summarizes the quantity of each pipe size as a percentage of total pipe length. The majority of the gravity system is 8-inch, with the trunk mains increasing in size. Roughly a quarter of the gravity system is undersized. The Montana Department of Environmental Quality (DEQ) defines the minimum acceptable size for gravity sewer mains as 8-inches, 24% of the City's gravity system is 6-inch.

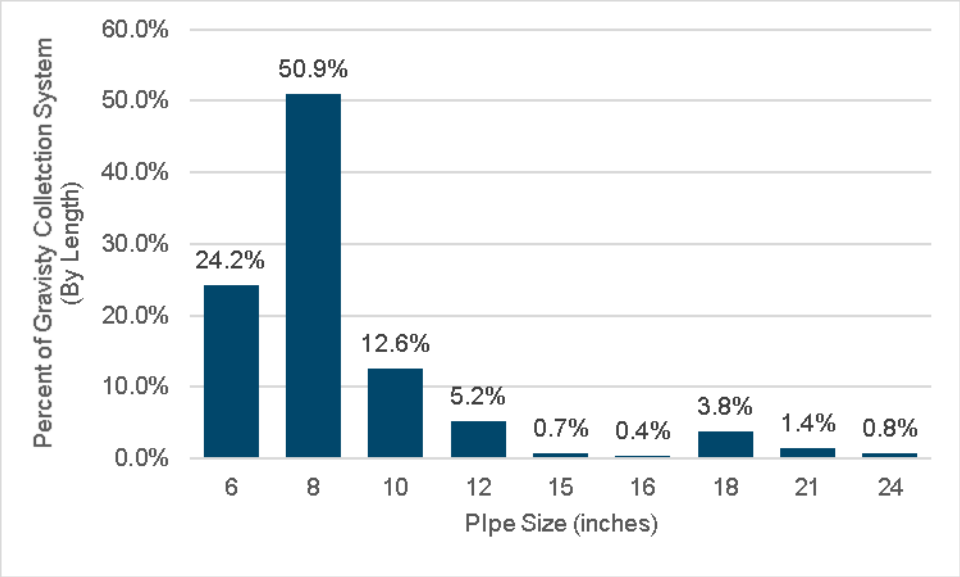

Chart 2-3: Gravity Collection System Pipe Size

iv. Noted Deficiencies

The City's GIS database details known deficiencies within the collection system. These deficiencies include, but are not limited to, root intrusions, blockages, sags, and general poor conditions. Table 2-2 summarizes the noted defects; additional deficiencies are likely present in the older, clay tile pipe.

Table 2-2
Gravity Collection Not Deficiencies

Location	Notes
Meadowlark Lane	Blockage
N 9th Street, south of W Chinook Street	Sags
Between N 7th Street & N 8th Street and W Front Street & W Chinook Street	Root Intrusion and Blockages
S D and E Alley, South of E Clark Street	Root Intrusion
S L and M Alley, north of E Lewis Street	Poor Condition
S M and N Alley, north of E Lewis Street	Root Intrusion

6-INCH GRAVITY MAIN
8-INCH GRAVITY MAIN
10-INCH GRAVITY MAIN
12-INCH GRAVITY MAIN
15-INCH GRAVITY MAIN
16-INCH GRAVITY MAIN
18-INCH GRAVITY MAIN
21-INCH GRAVITY MAIN
24-INCH GRAVITY MAIN

2-INCH FORCE MAIN
3-INCH FORCE MAIN
4-INCH FORCE MAIN
6-INCH FORCE MAIN
MANHOLE
LIFT STATION

0 750' 1,500' 2,250'
SCALE

WINEGLASS LANE
US HIGHWAY 89 S
WATER RECLAMATION FACILITY
LHC LIFT STATION
N M STREET
E GALLATIN STREET
BLUE HERON DR
N G STREET
N H STREET LIFT STATION
E PARK STREET
S W STREET
E LEWIS STREET
N YELLOWSTONE STREET
N 2ND STREET
SCENIC TRL
N 9TH STREET
N 7TH STREET
S H STREET
S D STREET
S MAIN STREET
E CLARK STREET
N 13TH STREET
W MONTANA STREET
STAR ROAD
CONSTELLATION DRIVE
PLEIADES PL
SUN AVE
US HIGHWAY 10 W
S 6TH STREET
W GEYSER STREET
S 10TH STREET
W CRAWFORD STREET
W PARK STREET
S 13TH STREET
CRAWFORD LIFT STATION
CLINIC LIFT STATION
ROGERS LANE
ROBIN LANE
CENTENIAL LIFT STATION
LOVES LANE
INTERSTATE-90

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LIVINGSTON COLLECTION SYSTEM PER
LIVINGSTON, MONTANA

COLLECTION SYSTEM MAP
PIPE SIZE

B15-081 SIZING MAP.DWG
FIGURE 2-5

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v. Lift Stations

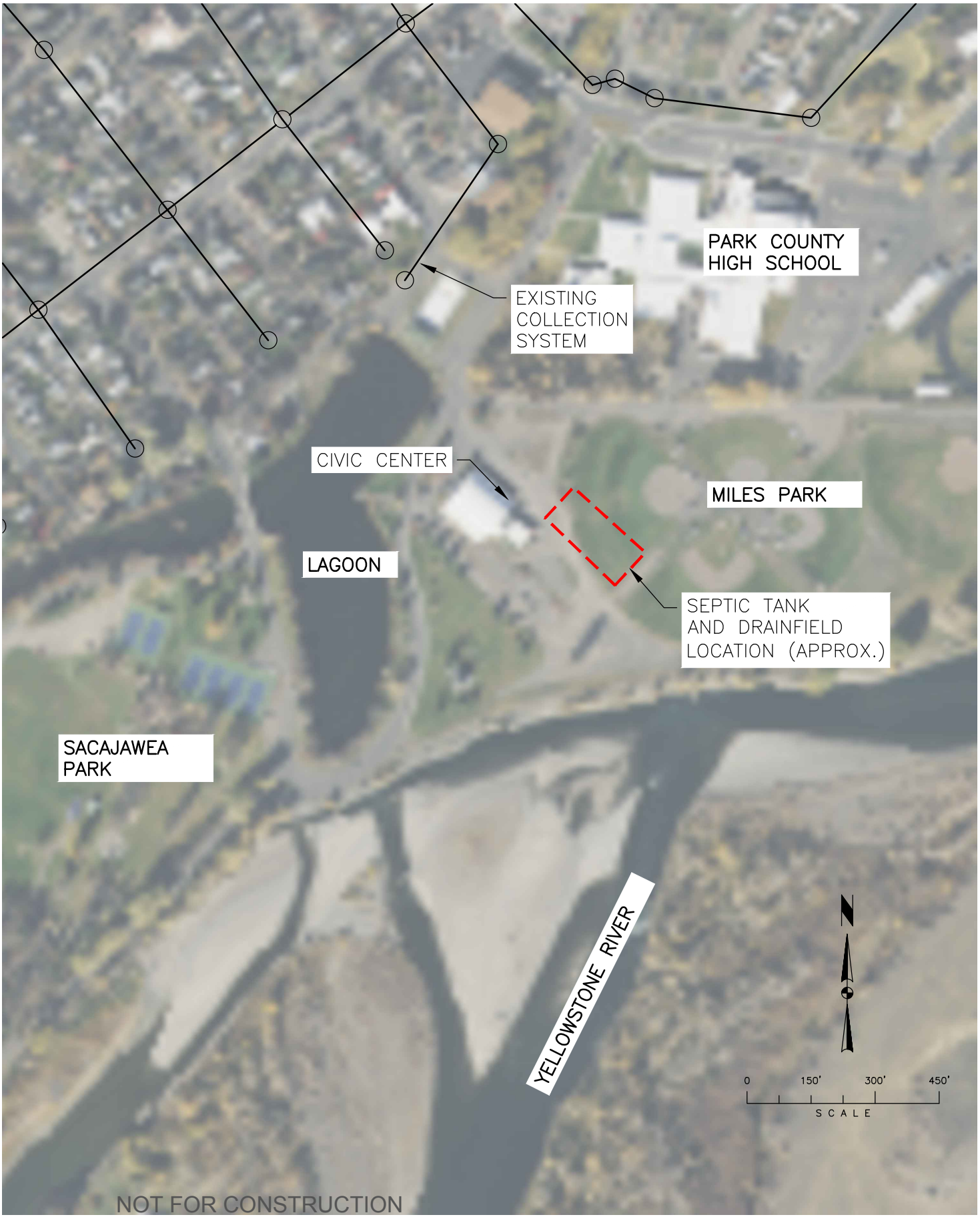
Seven lift stations are present throughout the City's collections system; lift station locations have been presented previously in Figure 2-2. Two of the existing lift stations were construction in the past decade; the Livingston Health Center (LHC) lift station was constructed in 2015 and the Fleshman Creek lift station was constructed in 2014. Both of the newer lift stations contain a typical wet well with a separate valve vault. According to City personnel both these lift stations include a backup generator and are connected to the City's Supervisory Control and Data Acquisition (SCADA) system. Due to the age of these stations, they are believed to be in good condition

As-Built drawings indicate the Centennial lift station was constructed in 1989. The exact age of the other four lift stations are unknown at this time. According to City staff, the Crawford and Clinic lift stations are not connected to the City SCADA system; the Centennial and 9th Street stations are. Furthermore, the Crawford, Clinic, and 9th street stations are not equipped with a permanent backup generator; however, the City is able to connect each station to a portable generator in the event of power loss. The Centennial station is equipped with a permanent backup generator. The condition of the N. H Street station is unknown at this time. City staff has not indicated sever deficiencies or elevated operations and maintenance (O&M) requirements with regard to any of the seven lift stations.

vi. Nearby Drainfields

Currently, the City of Livingston's Recreation and Civic Center is not connected to the City collection system. Instead raw wastewater is treated in a 2,000-gallon concrete septic tanks and drainfield. The size of the drainfield and laterals is unknown at this time. This drainfield serves not only the Civic Center but the Miles Park and Sacagawea Park bathrooms as well. The drainfield is located roughly 300 feet from the Lagoon at Sacagawea Park and directly upstream from the Yellowstone River. Because septic systems are not regulated as Publicly Owned Treatment Works (POTWs) and do not have the same effluent limitations, this drainfield increases the likely hood of surface water contamination and the general public coming into contact with raw wastewater. A PER regarding the Civic Center drainfield and possible solutions was completed by TD&H Engineering in March 2019. Figure 2-6 presents the location of the Civic Center and it's drainfield.

The Green Acres Subdivision, north of the City, also treats its generated wastewater with drainfields. According to the City's GIS database and a memorandum of understanding between the City of Livingston and the Green Acres Owners Association, Green Acres is connected to the City's water distribution system. Extending sewer service to the subdivision would eliminate the drainfields. This will decrease the likelihood of groundwater and surface water contamination. The Subdivision is located near the Yellowstone River, a popular fishing and recreation destination. The location of the Green Acres Subdivision is shown in Figure 2-7.



LIVINGSTON COLLECTION SYSTEM PER
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CIVIC CENTER DRAINFIELD

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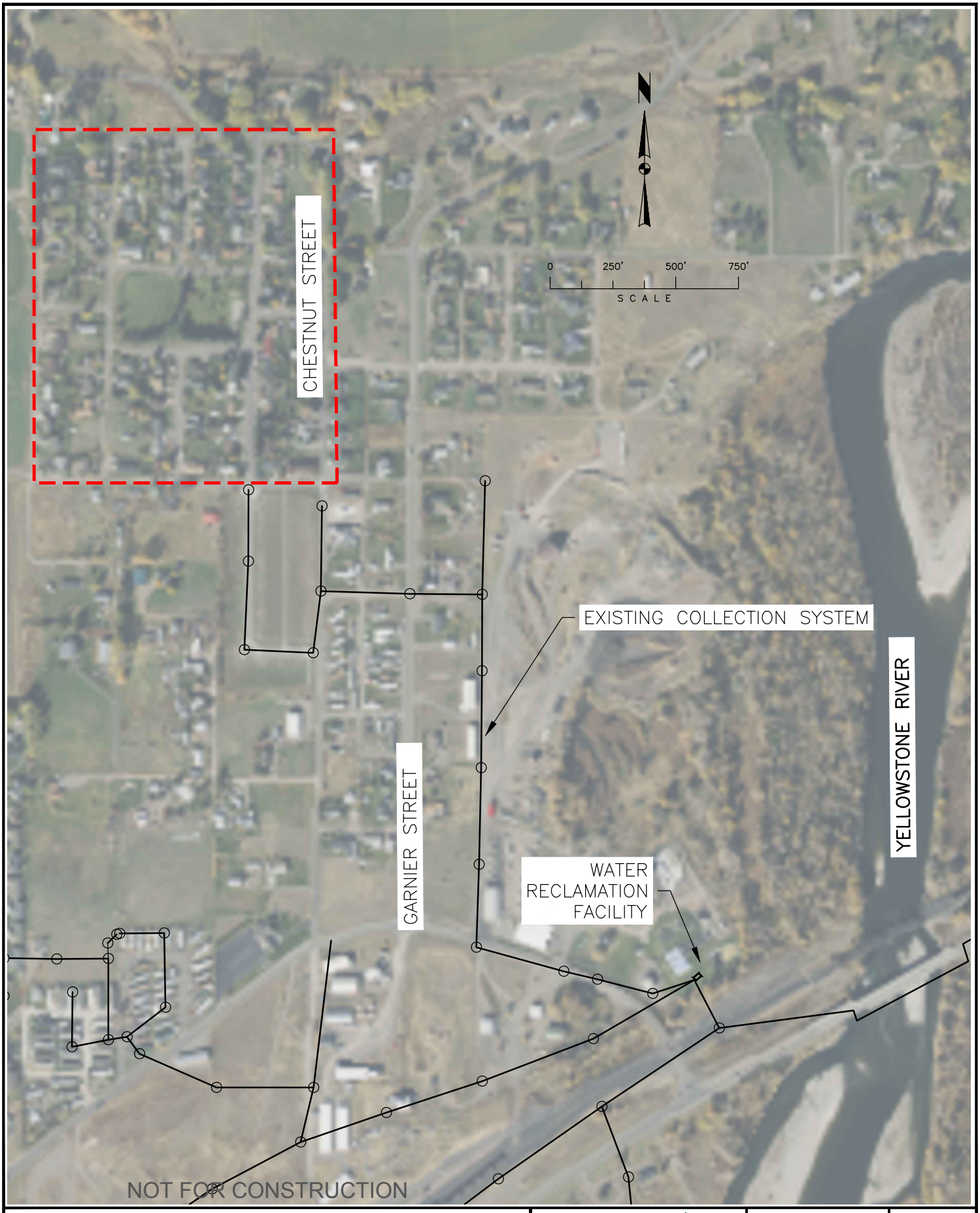
CAD NO.	B15-081CIVIC CENTER

FIGURE

2-6



LIVINGSTON COLLECTION SYSTEM PER
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GREEN ACRES SUBDIVISION

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FIGURE

2-7

b. Capacity

The capacity of the City's collection system is discussed below. The capacity evaluation includes discussion of the existing sanitary main with respect to existing and projected design flows. Computer models were used to analyze the existing and future flows. The models were completed in AutoDesk's Storm and Sanitary Analysis (SSA) 2016. Using SSA, hydrodynamic models were created to predict flow rates, pipe depth, and fluid velocities within the collection system. The following sections detail the components and results of the two SSA models. Additionally, the capacity of the seven lift stations is discussed below, separate from the hydraulic model evaluation.

i. Pipes and Manholes

A previous sanitary sewer model was completed for the City. Model information regarding pipe size, pipe slope and manhole elevations were imported directly from the previous model. Component details were verified and updated using the City's online GIS database, discussions with City staff, and Record Drawings from the recent CIP projects.

SSA includes typical Manning's n for closed conduit pipes based on pipe material and references the American Society of Civil Engineers (ASCE) manual *Gravity Sanitary Sewer Design and Construction* and *Open Channel Hydraulics* by V.T. Chow. As presented previously, the City's collection system is predominately PVC or clay tile pipe. A fraction of the system is either RCP, VCP, or lined pipe rehab. Typical Manning's n values are reported as follows:

- Smooth Plastic Pipe: 0.011 to 0.015
- Concrete Sewer with Manholes: 0.013 to 0.017
- Clay, common drainage tile: 0.011 to 0.017
- Clay, vitrified sewer with manholes: 0.013 to 0.017

For modeling purposes, a Manning's n of 0.013 was applied to all gravity pipes in the City's collections system.

ii. Modeled Lift Stations

The seven lift stations throughout the City have varying force main lengths. Because the North H. Street and Crawford lift stations have minimal gravity main upstream, they were not modeled similar to other lift stations; flows from these lift stations were simply assigned directly to the node as a point source. The other 5 lift station were modeled with a pump and a node acting as a wet well. Record drawings of a few of the lift stations were provided and wet wells were modeled to reflect them. When the Record Drawings were not available, wet wells were conservatively assumed to have 10 feet total depth and 6 feet in diameter. Each lift station included one pump with capacity to handle the predicted peak hour flow rate.

iii. Flow Rates

a. Jurisdictional Zoning

Existing flows were modeled based on the City of Livingston's jurisdictional zoning. The City's 2017 Growth Policy was referenced for zoning classifications and locations. The neighboring City of Bozeman defines design wastewater flows for various land use designations in Table V-2 of its Design Standards; these values were referenced for Livingston's sanitary flows. The zoning

classification was paired with the appropriate design flow to estimate wastewater flows throughout the collection system. The zoning and associated flows are summarized in Table 2-3. The City's zoning map is included in Appendix 2 and shown in Figures 2-6 and 2-7, presented later in this Section.

Table 2-3
Wastewater Flows by Jurisdictional Zoning

Zone	Flow Rate per area (gpd/acre)
Residential	1,030
Commercial	1,200
Industrial	960
Public	1,030

b. Subbasins

Subbasins were delineated to distribute sanitary flows appropriately throughout the collection system. The following discusses the process in which the existing and future subbasins were defined.

i. Existing

Existing subbasins were delineated based on flow directions throughout the existing collection system and the City's jurisdictional zoning. The goal of the existing subbasin delineation was to define areas with a single zoning designation where wastewater is ultimately conveyed to a single point. Figure 2-8 illustrates the delineated existing subbasins.

ii. Future

Future subbasins were delineated based on the City's current limits and zoning boundaries. Additionally, conversations with City personnel regarding likely future development locations were considered. Correspondence with City staff are included in Appendix 2. Figure 2-9 presents the predicted future sanitary subbasins, in relation to the existing sanitary system and subbasins.

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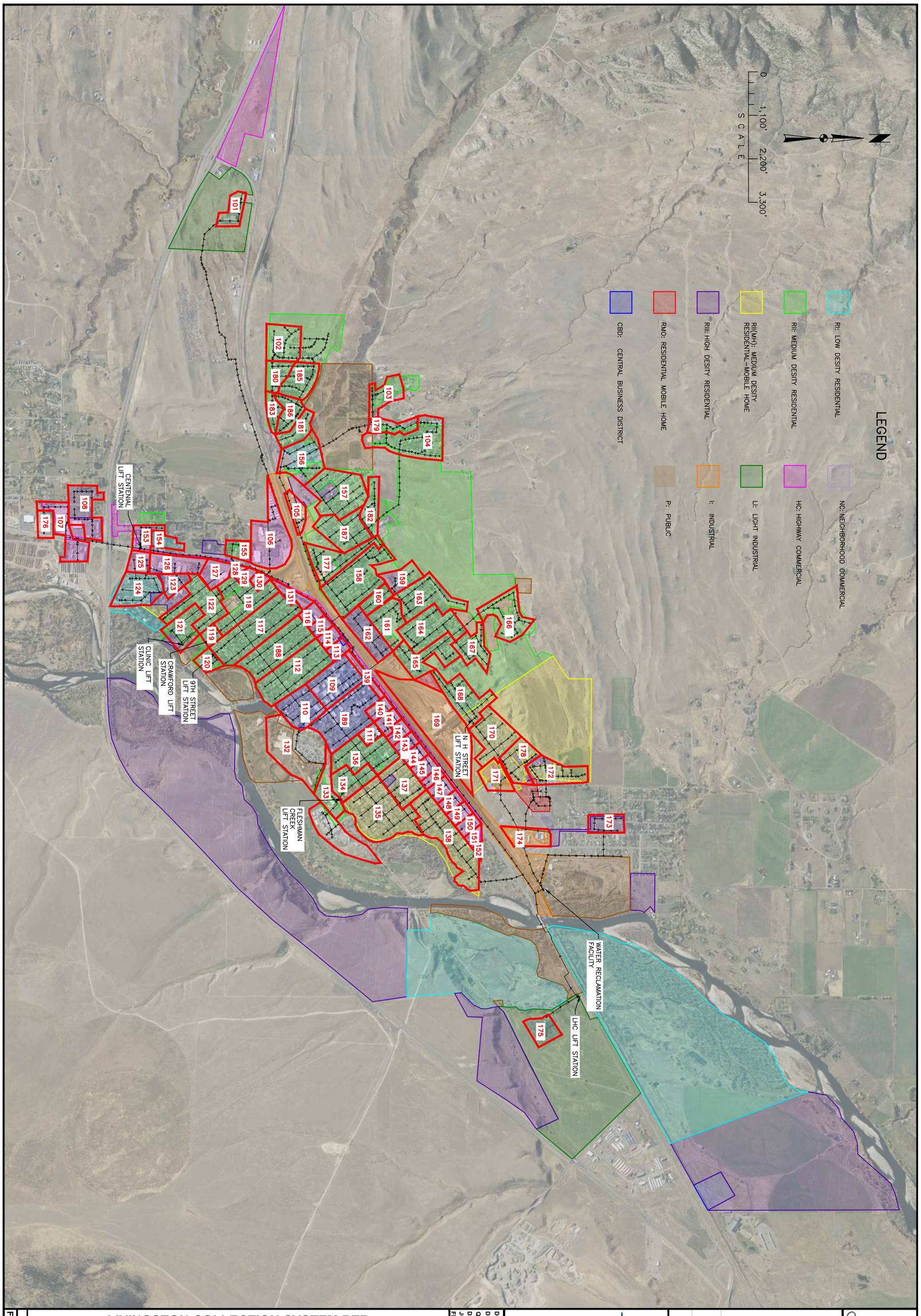

LIVINGSTON COLLECTION SYSTEM PER
LIVINGSTON, MONTANA

EXISTING SANITARY SEWER SUBBASINS

FIGURE 2-8

B15-081 SUBBASINS.DWG

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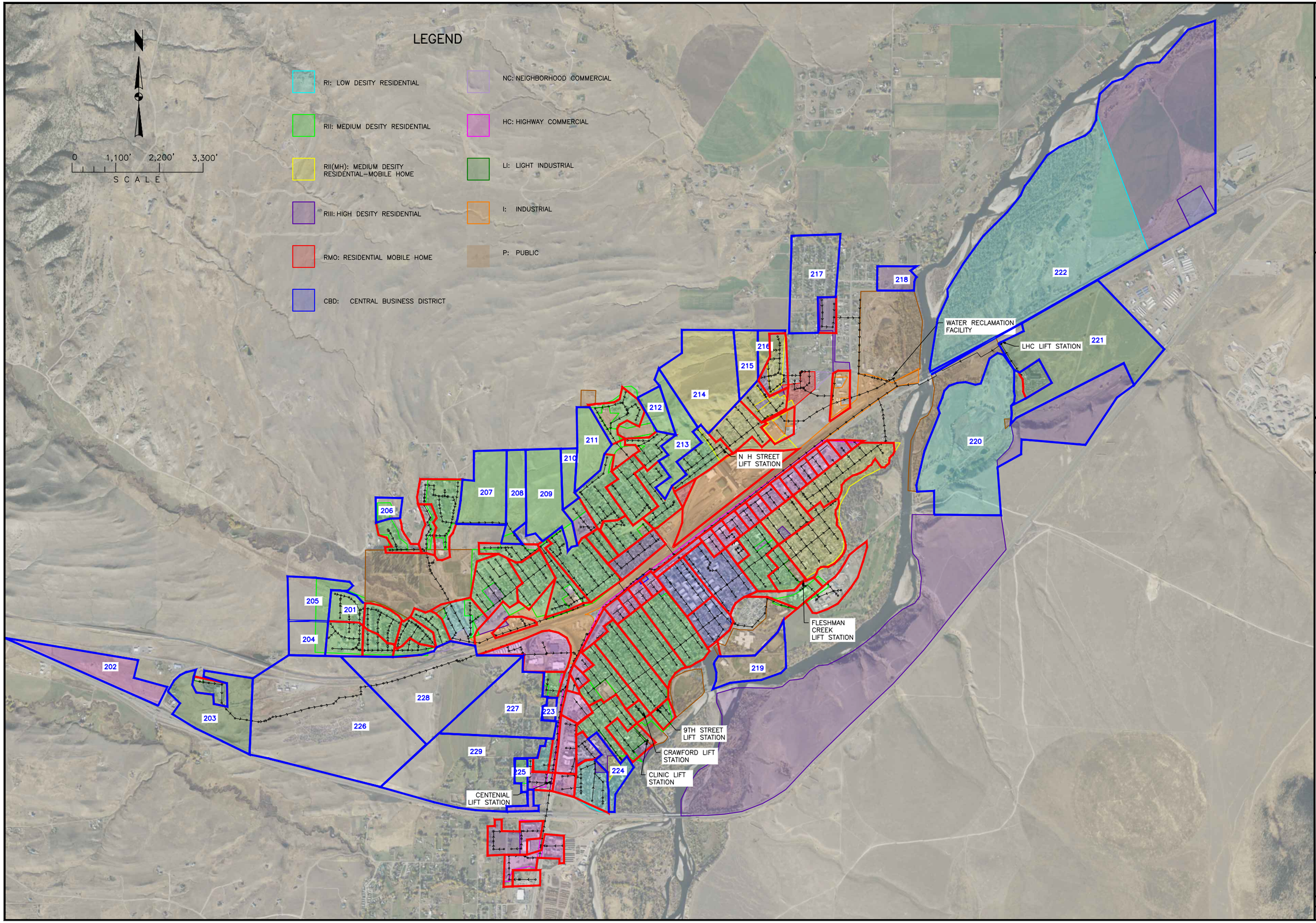

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LIVINGSTON COLLECTION SYSTEM PER LIVINGSTON, MONTANA

FUTURE SANITARY SEWER SUBBASINS

B15-081 SUBBASINS.DWG

FIGURE 2-9

c. Average Day Flow Calculations

Average day flow rates were calculated based on subbasin area and wastewater flows presented previously, in Table 2-3. Flow rates were input into the SSA model as point sources directly into the furthest downstream manhole for each subbasin. The appropriate diurnal curve was assigned to each point source. Detailed flow rate calculations are available for review in Appendix 2. Modeled flows were crossed checked against measured flows at the WRF; model calibration and verification are detailed later in this Section.

d. Diurnal Curves

Diurnal curves were prepared for both residential and non-residential subbasins to predict typical flow rates throughout the day. Both curves were created based on hourly unit multipliers. SSA multiplies the average day flow from each subbasin by the defined unit multiplier for each time step. The residential and non-residential diurnal curves are presented in Charts 2-4 and 2-5, respectively. As illustrated below, residential wastewater flows are expected to vary more significantly throughout the day when compared to non-residential flows. Residential unit multipliers vary from 0.1 to 4.0; non-residential unit multipliers vary from 0.6 to 1.25. Both residential and non-residential unit multipliers average 1.0.

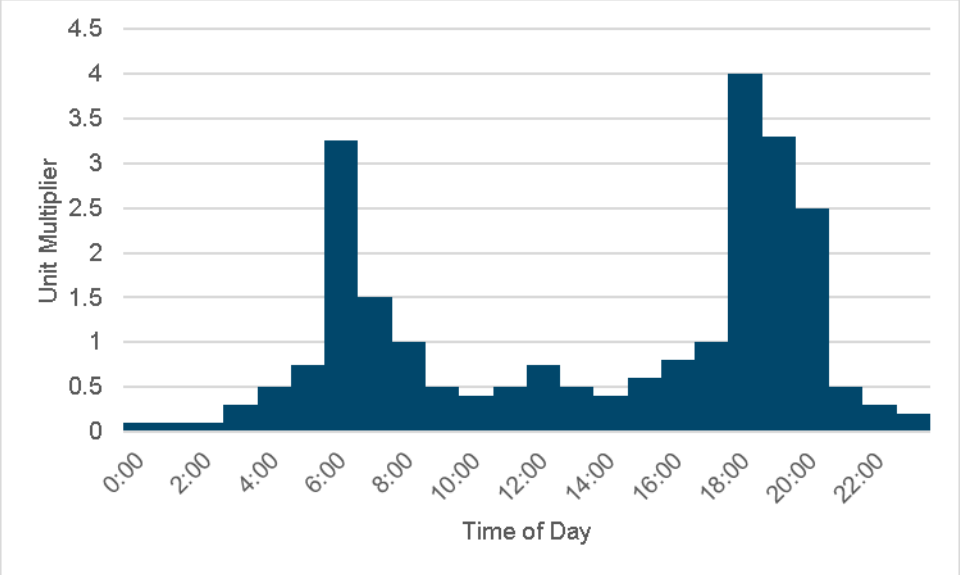

Chart 2-4: Residential Diurnal Design Curve

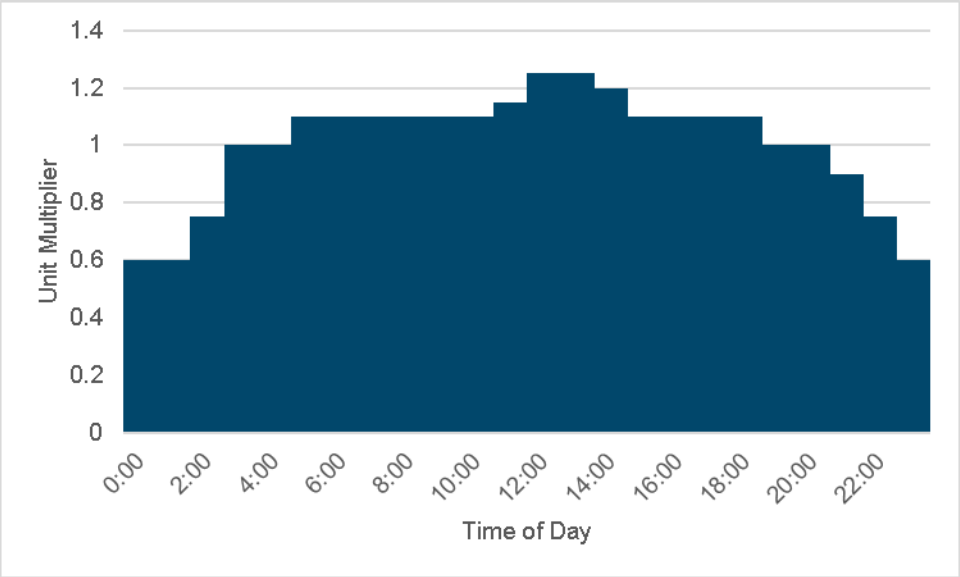

Chart 2-5: Non-Residential Diurnal Design Curve

e. Calibration and Verification

As previously discussed, average day flow rates were calculated based on area and zoning, then input into the SSA model as point sources. City staff was contacted regarding areas of the City that are less developed and not likely contributing wastewater flows to the same extent. Scaling factors were applied to these subbasins, presented in Table 2-4.

Table 2-4
Less Developed Subbasin

Subbasin	Scaling Factor
101	0.75
102	0.50
103	0.75
104	0.75
105	0.75
106	0.50
107	0.75
108	0.75
132	0.75
169	0.75
174	0.50
175	0.50
176	0.75
179	0.75

Next, an overall factor was applied to all subbasins. This was done to both existing and future subbasins to generate wastewater flows into the WRF that closely match the measured and predicted flows. Seasonal flows associated with I/I are not included in these models.

f. Existing Flows

City staff and the recent WRF upgrade design team were contacted regarding existing flows into the WRF; correspondences are available for review in Appendix 2. Additionally, the historic average day flows presented in the 2014 treatment PER, published by Stahy Engineering, were referenced. Table 2-5 presents historic flows and suggests a relatively constant wastewater flow rate since the year 2000.

Table 2-5
Historic Flow Data

Year	Average Day Flow (MGD)
2000	0.80
2005	0.74
2010	0.81
2012	0.78
2016	0.78

As discussed in Chapter 1, the American Communities Survey (ACS) reported the population for the City of Livingston at 7,136 persons. Assuming the approved annual growth rate of 2.6%, an estimated 7,322 persons were residing in the City of Livingston in 2016. According to the following equation, presented in Circular DEQ-2, *Design Standards for Public Sewage Systems*, the City of Livingston's peak hour peaking factor (PF) should be roughly 3.09

$$PF=(18+P1/2)/(4+P1/2)= (18+7.31/2)/(4+7.31/2)=3.09$$

The SSA model of the existing collection system predicts an average influent flow to the WRF of 0.789MGD (1.22 cfs); assuming an actual average day flow of 0.78, the percent difference is 1%. A peak flow of 2.20 MGD (3.41 cfs) was modeled, resulting in a peaking factor of 2.8. This is considered reasonably accurate for this planning document. The time series plot of influent flow to the WRF is presented in Chart 2-6. This plot is generated by SSA from a 48-hour simulation. Detailed SSA results are available in the attached CD.

g. Future Flows

As previously mentioned, the approved annual growth rate is 2.6%. This growth rate results in a projected average day flow of 1.44 MGD in 2040. The future conditions SSA model predicts an average day flow rate of into the WRF of 1.33 MGD (2.06 cfs), resulting in a percent difference of 8 % from the approved projected flow rate. The modeled peak flow is equal to 4.02 MGD (6.22 cfs), resulting in a peaking factor of 3.02. This is considered reasonably accurate given the inherit uncertainty that is associated with flow projections. The time series plot of future influent flow to the WRF is presented in Chart 2-7. This plot is generated by SSA from a 48-hour simulation. Detailed SSA results are available in the attached CD.

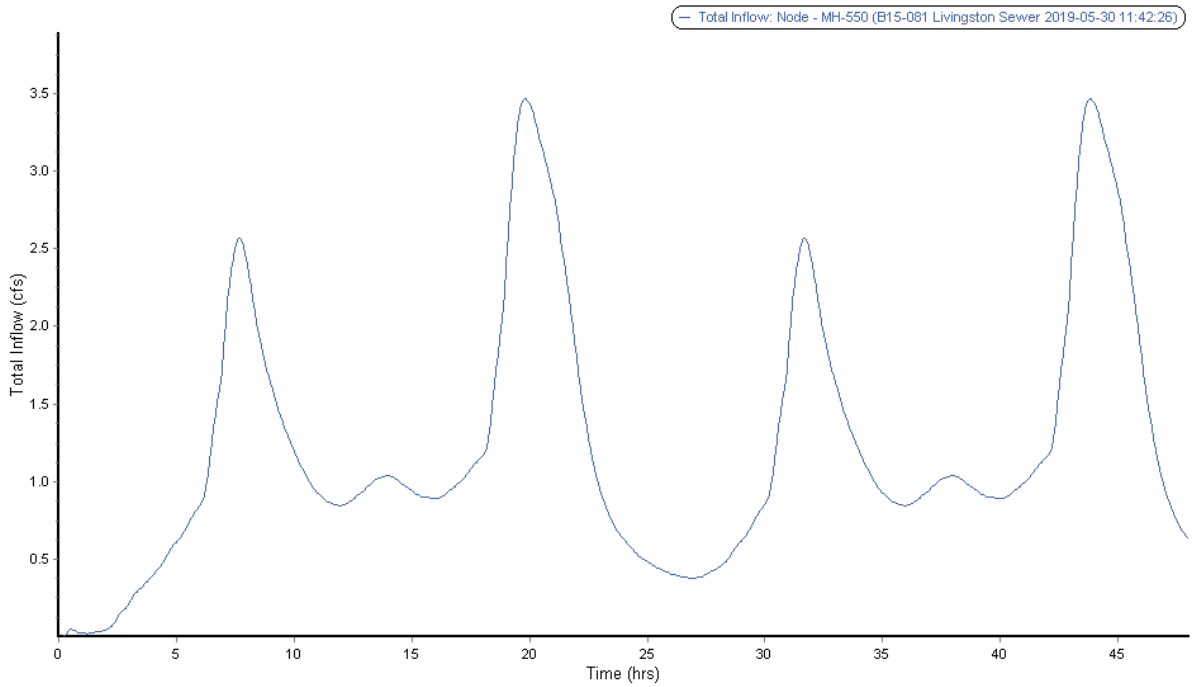

Chart 2-6 Modeled Existing WRF Influent Flow Rate

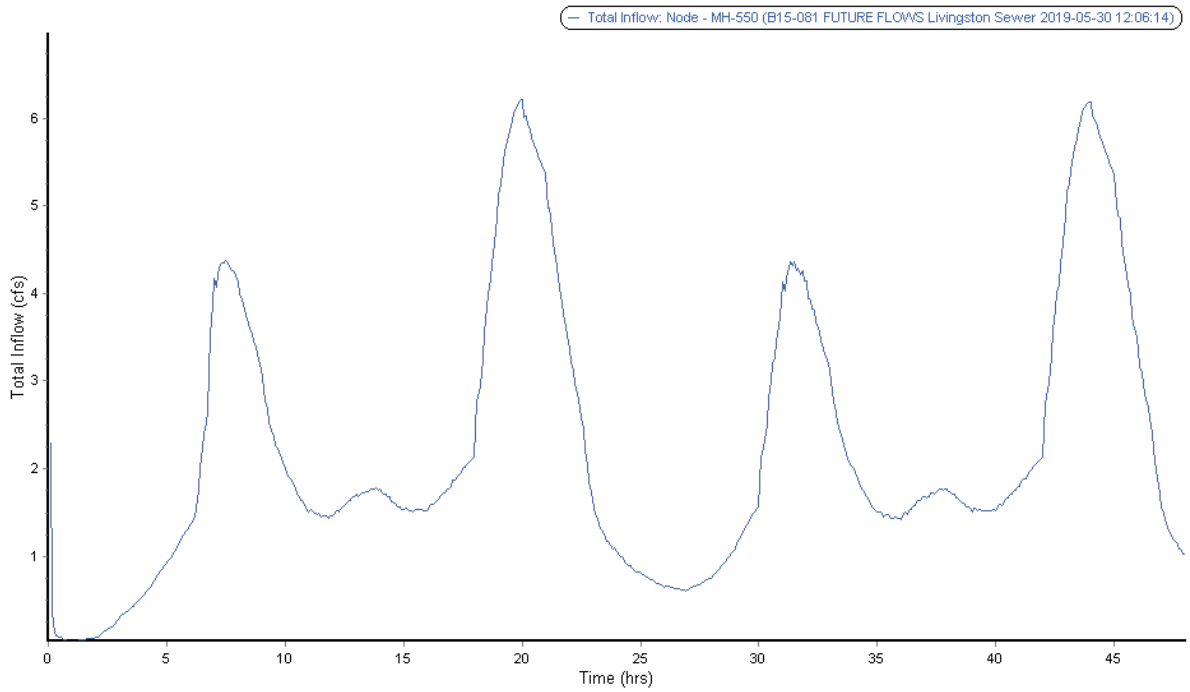

Chart 2-7 Modeled Future WRF Influent Flow Rate

h. Hydraulic Model Results

Both the existing and future SSA models were used to analyze the capacity of the current gravity collection system. The City of Livingston defines gravity mains capacity at 75% pipe depth. Detailed SSA results are provided in the attached CD; these results do not take into account seasonal flows associated with I/I.

The existing flow model indicates areas of the collection system are nearing capacity. Pipe depths along the W. Geyser Street trunk main and surrounding mains were predicted between 50% and 70%. Peak flow pipe depths between 50% and 60% were also modeled along both E. Park Street and E. Gallatin Street. Pressing capacity issues were indicated in and upstream of the N. 5th Street railroad crossing, with some main segments reporting pipe depths greater than 75% during peak flows. The modeled pipe depths associated with existing flows are presented in Figure 2-10.

SSA was also utilized to predict pipe depth during projected future flows. The future flows model indicates the trunk main including and upstream of the N. 5th Street railroad crossing will become grossly undersized and unable to safely convey future flows.. The hydraulic model predicts surcharged mains and flooded manholes during peak flows. Insufficient capacity is indicated from the N. 5th Street railroad crossing to Constellation Drive. Conversations with City staff indicate a portion of the trunk is scheduled to be upsized in the summer on 2019. The Park Street trunk main will also become exceeding inly undersized with the anticipated growth west of the City Additional capacity deficiencies were also noted along E. Park Street, W. Geyser Street, and from E. Gallatin Street to the WRF. Figure 2-11 maps modeled pipe depths within the gravity collection system associated with the 20-year projected flows.

iv. Gravity System Condition and Capacity Summary

The analysis of the gravity collection system, presented above, is summarized in Figures 2-12, 2-13, 2-14 and 2-15. Figures 2-12 and 2-13 provides a comprehensive look at the collection system's deficiencies assuming existing wastewater flows. Figure 2-14 and 2-15 illustrates the system's deficiencies with respect to projected design wastewater flow rates. High risk areas were defined by pipe segments that meet any or all of the following requirements:

- More than 50-years old
- Clay tile pipe
- Diameter less than or equal to 6-inches

The high groundwater area presented in the following maps was delineated based on the Montana Bureau of Mines and Geology's (MBMG) Groundwater Information Center (GWIC) recorded static water depths in the area. A map illustrating area static groundwater depths is available for review in Appendix 2.

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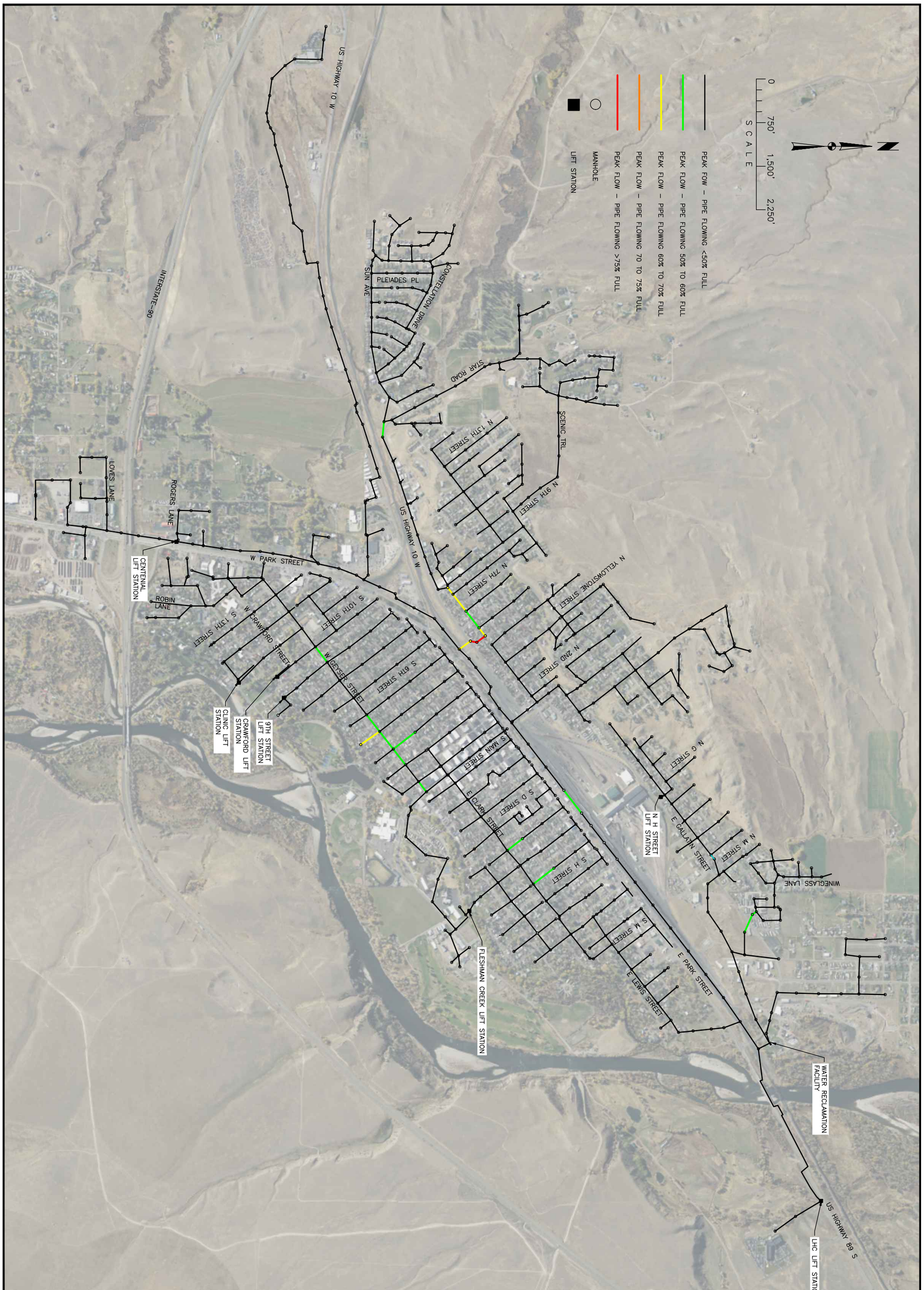

LIVINGSTON COLLECTION SYSTEM PER
LIVINGSTON, MONTANA

EXISTING FLOW CAPACITY MAP

FIGURE 2-10

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0 750' 1,500' 2,250'

SCALE

- PEAK FOW – PIPE FLOWING <50% FULL
- PEAK FLOW – PIPE FLOWING 50% TO 60% FULL
- PEAK FLOW – PIPE FLOWING 60% TO 70% FULL
- PEAK FLOW – PIPE FLOWING 70 TO 75% FULL
- PEAK FLOW – PIPE FLOWING >75% FULL
- MANHOLE
- FLOODED MANHOLE
- LIFT STATION

WINEGLASS LANE
US HIGHWAY 89 S
LHC LIFT STATION
WATER RECLAMATION FACILITY
N M STREET
N G STREET
E GALLATIN STREET
N H STREET LIFT STATION
E PARK STREET
S M STREET
E LEWIS STREET
SCENIC TRL
N 9TH STREET
N YELLOWSTONE STREET
N 2ND STREET
N 7TH STREET
N 13TH STREET
STAR ROAD
S H STREET
S D STREET
S MAIN STREET
S CLARK STREET
FLESHMAN CREEK LIFT STATION
CONSTELLATION DRIVE
PLEIADES PL
SUN AVE
US HIGHWAY 10 W
S 6TH STREET
S 10TH STREET
W GEYSER STREET
W PARK STREET
9TH STREET LIFT STATION
W CRAWFORD STREET
CRAWFORD LIFT STATION
CLINIC LIFT STATION
S 13TH STREET
ROGERS LANE
ROBIN LANE
CENTENIAL LIFT STATION
INTERSTATE–90
LOVES LANE

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LIVINGSTON COLLECTION SYSTEM PER
LIVINGSTON, MONTANA

FUTURE FLOW CAPACITY MAP

B15-081 COMBINED-FF.DWG

FIGURE 2-11

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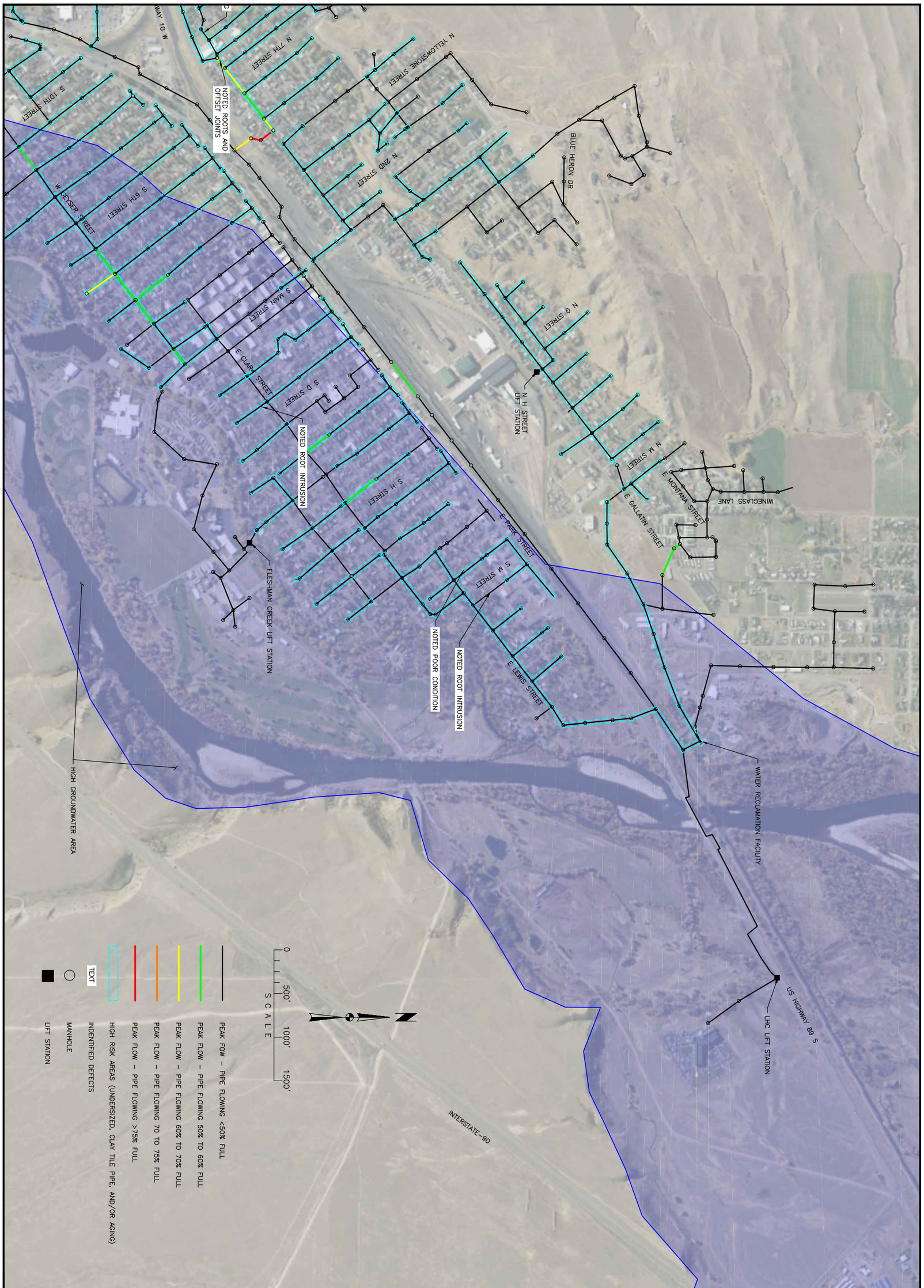

FIGURE 2-12

B15-081 COMBINED.DWG

LIVINGSTON COLLECTION SYSTEM PER
LIVINGSTON, MONTANA

EXISTING FLOW CONDITION AND CAPACITY MAP
EAST

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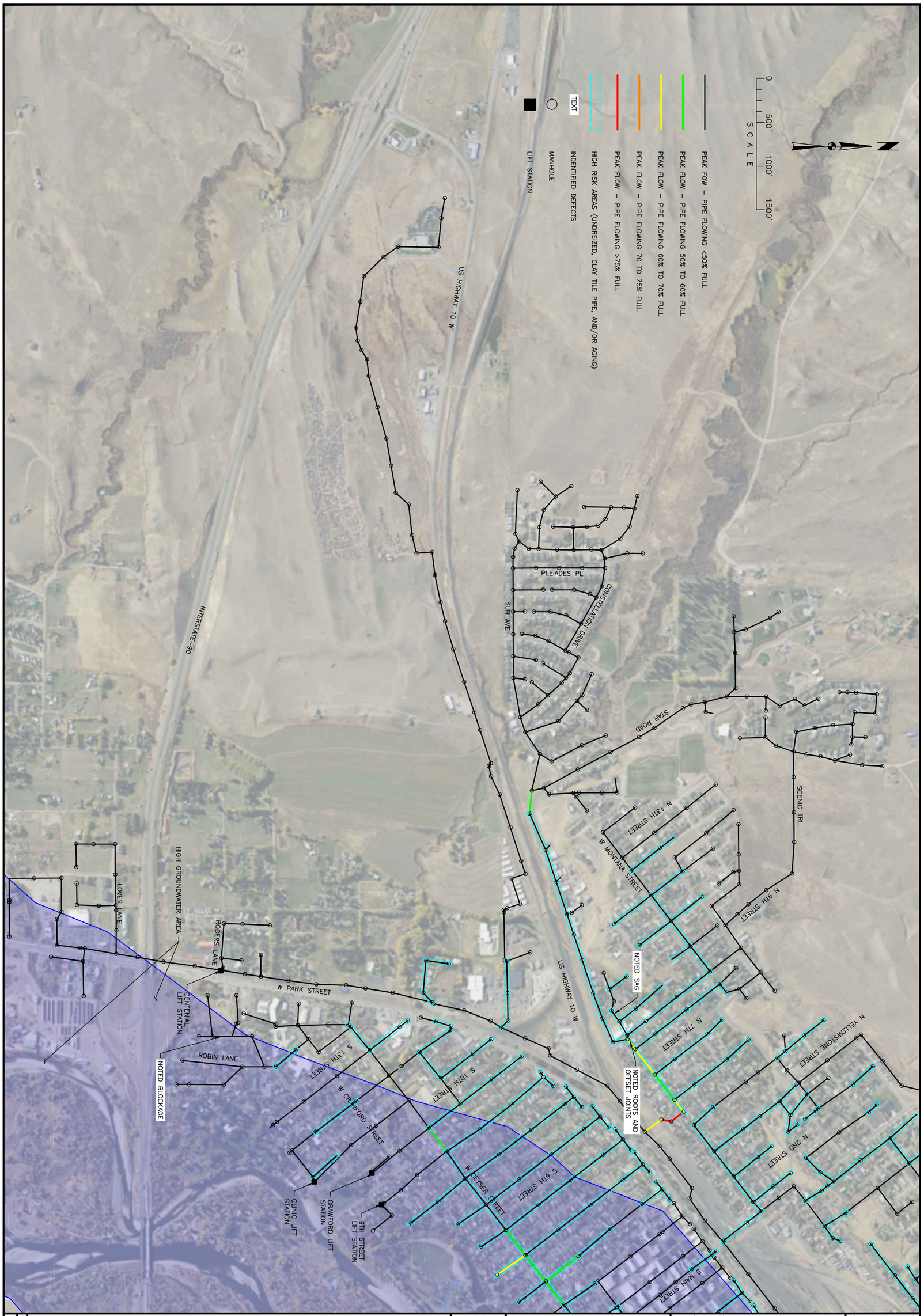

LIVINGSTON COLLECTION SYSTEM PER
LIVINGSTON, MONTANA

EXISTING FLOW CONDITION AND CAPACITY MAP

WEST

FIGURE 2-13

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LIVINGSTON COLLECTION SYSTEM PER LIVINGSTON, MONTANA

FUTURE FLOW CONDITION AND CAPACITY MAP EAST

B15-081 COMBINED-FF.DWG

FIGURE 2-14

WINEGLASS LANE
E MONTANA STREET
E GALLATIN STREET
N M STREET
BLUE HERON DR
N G STREET
N H STREET LIFT STATION
WATER RECLAMATION FACILITY
US HIGHWAY 89 S
LHC LIFT STATION
HIGH GROUNDWATER AREA
E PARK STREET
E LEWIS STREET
S M STREET
NOTED ROOT INTRUSION
NOTED POOR CONDITION
INTERSTATE-90
N 2ND STREET
N YELLOWSTONE STREET
W GALLATIN STREET
N 7TH STREET
S H STREET
S D STREET
S MAIN STREET
E CLARK STREET
NOTED ROOT INTRUSION
FLESHMAN CREEK LIFT STATION
NOTED SAG
NOTED ROOTS AND OFFSET JOINTS
US HIGHWAY 10 W
S 6TH STREET
W GEYSER STREET
S 10TH STREET

0 500' 1000' 1500'
SCALE

- PEAK FOW – PIPE FLOWING <50% FULL
- PEAK FLOW – PIPE FLOWING 50% TO 60% FULL
- PEAK FLOW – PIPE FLOWING 60% TO 70% FULL
- PEAK FLOW – PIPE FLOWING 70 TO 75% FULL
- PEAK FLOW – PIPE FLOWING >75% FULL
- HIGH RISK AREAS (UNDERSIZED, CLAY TILE PIPE, AND/OR AGING)
- TEXT — INDENTIFIED DEFECTS
- MANHOLE
- FLOODED MANHOLE
- LIFT STATION

NOT FOR CONSTRUCTION

0 500' 1000' 1500'
SCALE

PEAK FOW – PIPE FLOWING <50% FULL
PEAK FLOW – PIPE FLOWING 50% TO 60% FULL
PEAK FLOW – PIPE FLOWING 60% TO 70% FULL
PEAK FLOW – PIPE FLOWING 70 TO 75% FULL
PEAK FLOW – PIPE FLOWING >75% FULL
HIGH RISK AREAS (UNDRSIZED, CLAY TILE PIPE, AND/OR AGING)
TEXT INDENTIFIED DEFECTS
MANHOLE
FLOODED MANHOLE
LIFT STATION

SCENIC TRL
N 9TH STREET
STAR ROAD
N 13TH STREET
W MONTANA STREET
CONSTELLATION DRIVE
PLEIADES PL
SUN AVE
NOTED SAG
NOTED ROOTS AND OFFSET JOINTS
N 7TH STREET
W GALLATIN STREET
N YELLOWSTONE STREET
N 2ND STREET
S MAIN STREET
US HIGHWAY 10 W
S 6TH STREET
W GEYSER STREET
S 10TH STREET
9TH STREET LIFT STATION
CRAWFORD LIFT STATION
CLINIC LIFT STATION
W CRAWFORD STREET
S 15TH STREET
W PARK STREET
ROGERS LANE
CENTENIAL LIFT STATION
ROBIN LANE
NOTED BLOCKAGE
HIGH GROUNDWATER AREA
LOVES LANE
INTERSTATE-90

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LIVINGSTON COLLECTION SYSTEM PER
LIVINGSTON, MONTANA

FUTURE FLOW CONDITION AND CAPACITY MAP
WEST

B15-081 COMBINED-FF.DWG

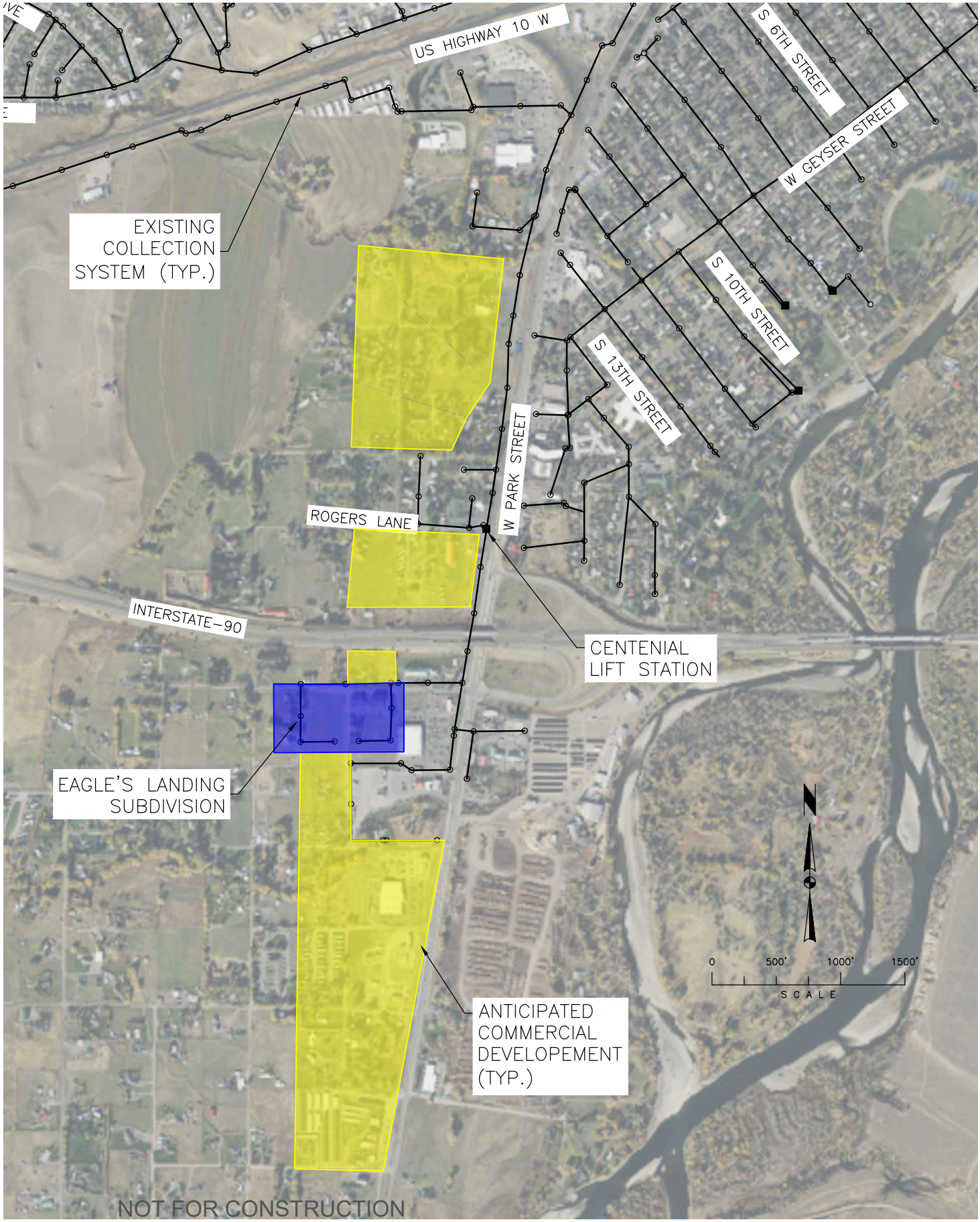
FIGURE **2-15**

v. Existing Lift Station Capacity

As discussed previously, seven lift stations are located throughout the City. The LHC and Fleshman Creek lift station were constructed recently. The Fleshman Creek lift station is located near the Park County Fairgrounds and the Yellowstone River; minimal development is anticipated upstream of this station. The LHC lift station is located at the eastern extent of the collection system. According to the Livingston Health Care Sewer Main Extension Report, prepared by CTA Architects in 2013, the lift station and force main have been sized to accommodate the current development, and can be easily upgraded to handle future flows. At the time of writing this report, no future development is planned.

Four of the older lift stations are located in areas when further upstream development is unlikely. The Crawford, Clinic and 9th Street stations are all located near the southern extents of the collection system, near the Yellowstone. There is minimal physical space to accommodate future development between the lift stations and the River. No capacity issues associated with these stations have been indicated by City staff, and additional sewer flows are unlikely to be connected to the stations in the future.

The Centennial lift station is located along W. Park Street with significant area upstream to accommodate future development. The recent *City of Livingston Growth Policy*, published in 2017, indicates the City is expecting significant commercial growth to contribute additional flows to the Centennial station in the foreseeable future. Additionally, the Growth Policy states that the Eagles Landing Subdivision has recently been annexed into the City. According to City Staff, at least 140 condos are expected to be constructed in the new subdivision. Figure 2-14 presents the location of Eagles Landing and anticipated commercial growth in relation to the Centennial lift station.



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LIVINGSTON COLLECTION SYSTEM PER
LIVINGSTON, MONTANA

CENTENIAL LIFT STATION
ANTICIPATED GROWTH

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CAD NO.	B15-081 CENTENIAL LIFT STATION

FIGURE
2-16

3.0 NEED FOR THE PROJECT

The City of Livingston's gravity collections system has a number of deficiencies. These deficiencies are primarily the result of an aging system. Although diligent operations and maintenance (O&M) practices have sustained the collection system, updated or advanced O&M procedures will not fix the problems. Some of the problems facing the City include insufficient conveyance capacity, aging and undersized mains, cracks, root intrusions, and offset joints. The previous chapter discussed these issues and the need for capital improvements. The problems facing the collections system are presented below with respect to health, sanitation & security, aging infrastructure, and reasonable growth.

A. HEALTH, SANITATION, AND SECURITY

a. Leaking Sanitary Mains

Leaking sanitary sewer mains allow untreated wastewater to enter the groundwater system and surrounding surface water. The City of Livingston obtains its drinking water from 6 groundwater wells located throughout the water distribution system. As such, the quality of the groundwater is of the utmost importance to the City and its residents. Additionally, the City is located on the banks of the Yellowstone River and is a popular recreation destination. Activities such as floating the Yellowstone and fishing are common. Leaking mains are likely to contaminate the Yellowstone River as the local aquifer recharges the River. To protect the health of local outdoor enthusiasts, the quality of the surrounding surface water must be maintained.

Water contaminated with raw wastewater may contain pathogens. There are disease-producing micro-organisms, which include bacteria (such as giardia lamblia), viruses, and parasites. These pathogens can cause gastroenteritis, salmonella infection, dysentery, shigellosis, hepatitis, and giardiasis, all of which can be dangerous to human health. Additionally, extended exposure to nitrogen in drinking water can be damaging or even fatal. Nitrates react directly with hemoglobin in humans and other warm-blooded animals to produce methemoglobin. Methemoglobin destroys the ability of red blood cells to transport oxygen. This condition is especially serious in babies. It caused a condition known as methemoglobinemia or "blue baby syndrome". Since the City obtains its drinking water exclusively from the local aquifer and many people recreate in and around the Yellowstone River near Livingston, groundwater and surface water contamination is a potentially serious health issue.

b. Insufficient Capacity

As presented in Chapter 2, the City of Livingston's gravity collection system contains sections with capacity issues. This is particularly true upstream of and including the N. 5th Street railroad crossing. Significant capacity issues were modeled with existing flows and are further exacerbated with the additional flows projected for the 20-year design life. Insufficient conveyance capacity was also indicated along E. Park Street, W. Geyser Street, and E. Gallatin Street. Without adequate capacity, sewers cannot safely transport raw wastewater to the WRF. Additionally, as the area along the western extent of the City's wastewater system grows, sanitary flows to the Centennial lift station are expected to exceed the station's design capacity. Insufficient capacity in the gravity collection system and lift stations can result in untreated sewage backing up within the collection system, flooding from manholes or into residential and high traffic building. This is not only unsafe due to the pathogens present in wastewater but can also result in sever property damage. Adequate conveyance capacity is imperative for any wastewater system and upsized mains are recommended.

c. Nearby Drainfields

Chapter 2 presented two areas in or around the City that are not connected to the municipal wastewater system. Both the Civic Center and the Green Acres Subdivision treat their generated wastewater in conventional septic tanks and drainfields. Drainfields are not designed to produce effluent that meets secondary standards; POTW are required to maintain secondary effluent standards, at a minimum. Additionally, typical septic systems are not regulated to same extent as municipal system. As a result, groundwater contamination is more likely with these systems. The Civic Center and the Green Acres Subdivision are both upstream of the Yellowstone River. As previously detailed, this section of the River is a popular destination for outdoor enthusiast. The quality of the River must be maintained to protect human heath and the local fish species.

B. AGING INFRASTRUCTURE

Aging infrastructure has negative implications for a community's sewer collection and treatment system. Inflow and Infiltration (I/I) can disrupt the WRF's ability to achieve proper treatment and require higher energy usage to treat the additional flow. Leaking pipes, joints, and manholes also allow untreated wastewater to contaminate the local aquifer and surface water. Additionally, aging sanitary mains are prone to root intrusions and blockages, which can cause sewage to backup in the collection system. This can destroy property and be extremely harmful to human health.

a. Collections System Deficiencies

The City's Geographical Information System (GIS) database identified mains with specific defects including, but not limited to, blockages, sags, and offset joints. Additional deficiencies are considered likely given that at least 30% of the system was installed more than 70 years ago. These issues are contributing to the City's elevated I/I flows during periods of high groundwater and may be contaminating the local aquifer and surface water during times of low groundwater elevation. Furthermore, higher levels of operations and maintenance (O&M) are required to keep the aging mains functional. The City of Livingston is a small community with limited manpower and resources. Replacing the defective mains would go a long way in assisting the City in future maintenance efforts.

b. Inflow and Infiltration

A large percentage of the mains in the City of Livingston's collection system are considered high-risk. High-risk mains are pipes that fit any or all of the following criteria:

- Greater than 50-years old
- Clay tile pipe
- Diameter less than or equal to 6-inches

These high-risk mains are likely contributing to the City's significant I/I flows. Inflow is direct storm water runoff that enters the system though manhole lids, storm sewer connection, and sump pumps. Infiltration is groundwater seepage into sewer pipes through defective pipes, joints, and manholes.

Well logs from the Montana Bureau of Mines and Geology (MBMG) indicate high static groundwater in and around the City of Livingston. Additionally, the City has mentioned that

sanitary flows have been known to double, or even triple during the spring and early summer. This strongly suggests the older clay tile mains are allowing groundwater to enter the collection system at unacceptable rates. Replacing deficient mains would likely decrease required energy consumption of the WRF and lift stations.

C. Reasonable Growth

As detailed in Chapter 2 and mentioned previously in this Chapter, sections of the City's existing collection system are at or near capacity, 75% pipe depth. As the community grows and sanitary flows continue to increase, issues associated with capacity will worsen. Although the City of Livingston and Park County have experienced minimal population growth in recent years, the neighboring Gallatin County has seen a drastic population boom. The increase in residents in the City of Bozeman is likely to occur similarly within the City of Livingston. As such, the City has approved an annual growth rate of 2.6%, resulting in a design average day flow of 1.44 MGD in 2040. This will nearly double the sanitary flows, not associated with I/I, over the next 20 years. Furthermore, the City is expecting large commercial growth along W. Park Street. The anticipated increased flows are expected to exceed the design capacity of the Centennial lift station.

To facilitate the expected population increase and continue to provide safe and clean wastewater management for the residents, the City of Livingston must upsize the deficient truck mains identified in Chapter 2.

4.0 ALTERNATIVES CONSIDERED

A. ALTERNATIVE 1- NO ACTION

This alternative entails allowing the City of Livingston's existing collection system to function as it currently does. As discussed in Chapters 2 and 3, several deficiencies are present in the existing system. Much of the gravity collection system is clay tile pipe, installed over 50 years ago. This is believed to be a large contributor to the significant inflow and infiltration (I/I) the City experiences. Additionally, the hydraulic model indicates areas of the collection system do not have sufficient capacity to safely convey the existing sanitary flows; this problem is further exacerbated by large I/I flow. As the City continues to grow, the capacity of the system will become increasingly inadequate. For these reasons, Alterative 1-No Action is not considered a viable alternative for the City of Livingston and will not be discussed further.

B. ALTERNATIVE 2- N. 5TH STREET CAPACITY INCREASE

a. Description

Alternative 2 entails upsizing the existing sanitary sewers upstream of and including the N. 5th Street railroad crossing. As previously discussed, the hydraulic model indicates the sanitary mains in this area are undersized and unable to safely handle the current flows. The model also predicts surcharged mains and flooded manholes with the projected 20-year peak hour flow rates. Alternative 2 include upsizing the 8-inch mains upstream of the N. 5th Street Railroad Crossing to Constellation Drive with new 12-inch PVC. This will result in mains capable of handling the projected 20-year flow rates. Additionally, the surrounding 6-inch clay tile mains will be replaced with 8-inch PVC pipes to comply with DEQ minimum sizing standards and eliminate a portion of the City's aging and high-risk infrastructure. Although this area is not located in high groundwater area presented in Chapter 2, replacing the aging mains will help with the City's I/I issues, protect the local aquifer, and remove any clogs or blockages.

Several construction techniques are available for gravity sanitary main replacement. Some construction options include open cut trench excavation, Cured in Place Pipe (CIPP), and Pipe Bursting:

- Open Cut

Open cut trench excavation is a traditional and popular construction technique used in sanitary sewer replacement and involves excavating a trench for manual demolition of the existing main and installation of the new main. Open cut trench excavation is effective for rehab of most sanitary sewer defects including, but not limited to, root intrusions, blockages, collapsed or broken pipes, sags, and negative slopes. Additionally, insufficient capacity can simply be remedied with a larger diameter replacement pipe. The main disadvantage to this method is the cost associated with surface restoration; compared to trenchless methods, open cut construction is more expensive.

- CIPP

CIPP involves installing a thermoplastic, seamless liner within the existing pipe. This provides a rigid conduit that is resistant to gasses, chemicals, and corrosion to rehabilitate the existing main. The cost of this method is slightly less then a complete replacement. The cost savings are associated with reducing restoration of roads, parking lots, and other developed surfaces.

However, CIPP is not practical when joint offsets are present in the existing pipe. Furthermore, CIPP does not increase the size or capacity of the pipe. In fact, the cross-sectional area is reduced, decreasing the conveyance capacity. As such, it is not used in pipelines with insufficient capacity.

- Pipe Bursting

Pipe bursting involves winching a bursting head through an existing pipe while pulling a new pipe of equal or larger diameter behind the bursting tool. “Launching and receiving pits” replace the trench required of conventional open cut installation. A smaller leading end is designed to guide the expander through the existing pipe. A machine is set in the receiving pit to pull the expander head and new pipe into the line with a heavy interlocking chain. The main advantages of pipe bursting are associated with cost savings. These savings result from eliminating extensive surface restoration. Limitations of this technology include expansive soils and potential conflicts with other buried utilities near the existing pipe. Thus, the technology should only be implemented at appropriate locations. Finally, this method is not effective where large sags or negative grades are present.

For planning purposes, open cut trench excavation is assumed. As mentioned above, CIPP does not increase the conveyance capacity of the pipe and is therefore not effective method of construction for Alternative 2. Pipe bursting would end in a larger diameter pipe, however, is not effective where large sags are present. This City has noted sags, roots and offset joints in the area; given the age and material of the sanitary sewers, additional defects are expected.

b. Design Criteria

Alternative 2 involves replacing roughly 11,000 linear feet (LF) of existing pipe. Nearly 6,400 LF of the new piping is 8-inch PVC to replace the existing 6-inch clay tile pipe, in accordance with DEQ minimum size requirements. This will also replace the aging and damaged pipe in the area, protecting the local aquifer and decreasing I/I. The remaining replacement pipe will be installed from Comet Boulevard to the railroad crossing at N. 5th Street. The upsized trunk main will include roughly 4,200 and 500 LF of 12-inch and 15-inch PVC, respectively. New 48-inch manholes are included throughout the project area. The age of surrounding pipe indicates the manholes are over 50 years and likely deteriorating. Pipe sizes were chosen based on the hydraulic model previously discussed. Pipe were upsized to ensure all area pipe segments are less than 65% full during peak flows. Given the future flows in the collection system are based on predicted development locations, there is an inherent uncertainty in the design flow rates. Maintaining maximum modeled depth near 65% provides flexibility in the preliminary design. Detailed results of Alternative 2’s SSA model are included in the attached CD. Figure 4-1 summarizes the post-construction SSA model results with assumed future flows.

The City of Livingston has indicated the existing 8-inch clay tile pipe along the Front Street-Chinook Street alley, between North 8th Street and North 5th Street is scheduled to be upsized to a 15-inch PVC pipe in the summer of 2019. This preliminary design assumes that projected is completed prior to final design and construction of Alternative 2.

Alternative 2 includes upsizing the existing 8-inch railroad crossing at N, 5th Street with a 15-inch main. City staff have indicated the existing crossing contains a 24-inch casing pipe, installed in the 1993. Given the age and size of the casing, it can likely be reused. A detailed analysis of the casing pipe, soil type, and life expectancy should be included in final design.

All sanitary main improvements will adhere to DEQ Guidelines as set forth in Circular DEQ-2, *Design Standards for Wastewater Facilities*. Final project design will also adhere to Montana Public Work Standard Specifications (MPWSS) and generally accepted engineering practices.

c. Map

Figure 4-2 presents the proposed improvement locations with respect to the City of Livingston and the existing collection system.

d. Environmental Impacts

Minor, short-term environmental impacts associated with dust and noise will occur during construction. Although the impacts will be unavoidable, they can be easily mitigated with carefully planned construction practices. Groundwater degradation associated with leaking pipes will be lessened as a result of Alternative 2.

e. Land Requirements

All proposed improvements will occur within the existing City of Livingston Right-of-Way or easements; no additional land acquisition will be required.

f. Potential Construction Problems

Main replacement will likely require groundwater dewatering and disposal due to shallow area groundwater. Although dewatering is not a complicated procedure, it will require additional manpower and resources. If possible, construction should be scheduled in late summer, when static groundwater elevations are expected to decrease.

Temporary service will be necessary at service connections throughout the project. Major construction delays are not anticipated as a result of the required temporary services. Careful coordination with residents and businesses will be crucial to avoid major concerns associated with service outages.

Some coordination with the Montana Rail Link (MRL) Railroad will be required. A permit to work within the MRL Right-of-Way will need to be secured. Additionally, careful consideration of MRL design standards will be required when evaluating the life expectancy of the existing casing pipe.

g. Sustainability Considerations

i. Water and Energy Efficiency

Replace aging infrastructure will eliminate raw sewage leaking from the pipe when the groundwater table is low. This will lessen any groundwater contamination in the area. During the spring and early summer, the new mains will prevent groundwater from entering the collection system. This will increase the energy efficiency of the WRF.

ii. Green Infrastructure

A Storm Water Pollution Prevention Plan (SWPPP) will be required prior to construction to mitigate storm water runoff from disturbed areas. After construction is complete, storm water mitigation will no longer be applicable.

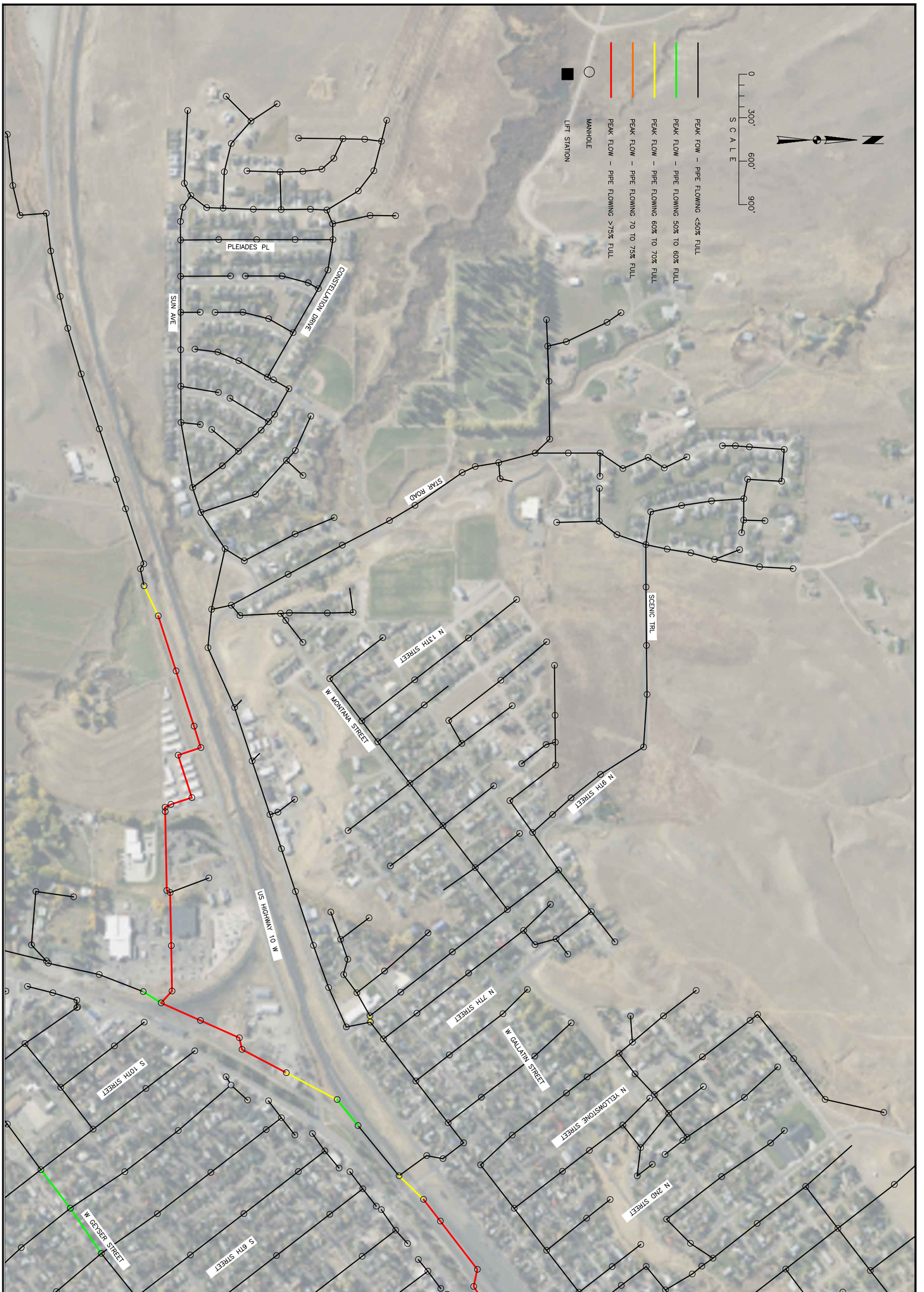

FIGURE 4-1

B15-081 FIG 4-1.DWG

LIVINGSTON COLLECTION SYSTEM PER
LIVINGSTON, MONTANA

ALTERNATIVE 2- N. 5TH STREET CAPACITY INCREASE
POST-CONSTRUCTION HYDRAULIC MODEL RESULTS

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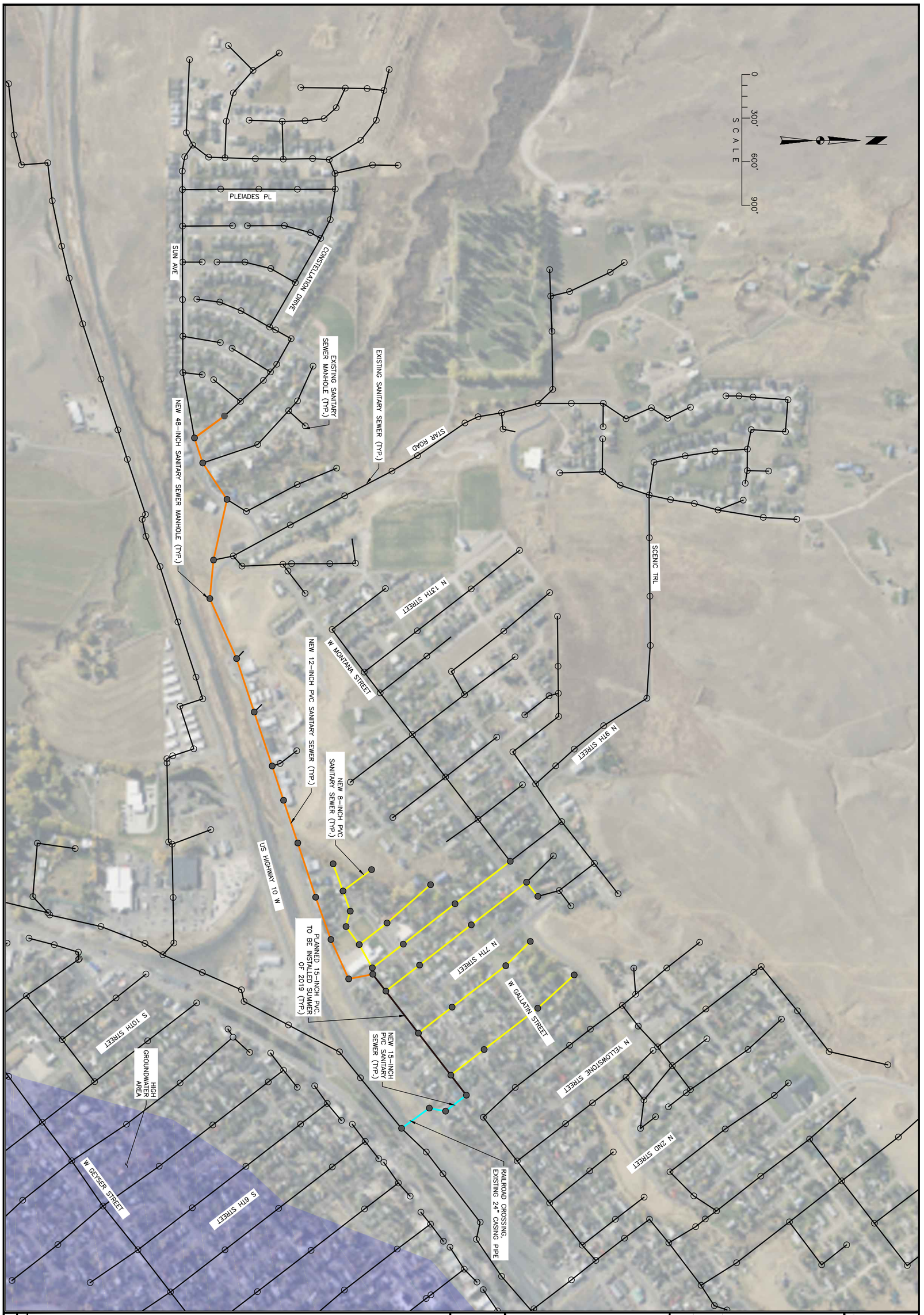
J:\2015\B15-081 City of Livingston\CADD\CIVIL\WW PER\B15-081 FIG 4-2.dwg, 6/11/2019 8:51:45 AM, NMR



LIVINGSTON COLLECTION SYSTEM PER
LIVINGSTON, MONTANA

ALTERNATIVE 2- N. 5TH STREET CAPACITY INCREASE MAP

FIGURE 4-2

B15-081 FIG 4-2.DWG

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iii. Other

Installation of new sewer mains will reduce the potential for plugging and frequency of cleaning, ultimately simplifying maintenance requirements.

h. Cost Estimates

Planning level capital costs for Alternative 2 are presented in Table 4-1. The conceptual level capital cost presented is a Class 4 cost estimate as defined by the Association for Advancement of Cost Engineering. Class 4 cost estimates as prepared based on limited information in which engineering is up to 5% complete. The accuracy of Class 4 cost estimates ranges from 15% to 50%. Given the high level of uncertainty at this stage, a contingency of 15% was applied. A 25% allowance for engineering design, legal, and construction administration was included to pay for non-construction related activities. Estimated construction costs are presented in Table 4-1 and total roughly $3.1 million.

No increase to Operations and Maintenance (O&M) costs are anticipated as a result of Alternative 2. O&M efforts are expected to decrease as a result of high-risk main replacement.

Table 4-1 Alternative 2- N. 5th Street Capacity Increase Construction Cost Estimate				
Description	**Quantity**	**Units**	**Unit Costs**	**Total Costs**
Mobilization (5%)				$103,237
Traffic Control	1	LS	$43,000	$43,000
Type II Pipe Bedding	165	CY	$35	$5,775
8-inch PVC	6,381	LF	$65	$414,765
12-inch PVC	4,190	LF	$85	$356,150
15-inch PVC	530	LF	$95	$50,350
Railroad Crossing	1	EA	$25,000	$25,000
New 48" Manholes	40	EA	$4,000	$160,000
Connect to Existing Sanitary Sewer	11	EA	$1,500	$16,500
Surface Restoration	9,900	SY	$95	$940,500
Utility Crossing	1	LS	$7,500	$7,500
Exploratory Excavation	8	HR	$150	$1,200
Layout and Construction Staking	1	LS	$7,500	$7,500
Special Trench Excavation	1	LS	$1,500	$1,500
Construction Dewatering	1,100	LF	$25	$27,500
Miscellaneous Fieldwork	7,500	UNITS	$1	$7,500
			Subtotal	**$2,167,977**
			Contingency (15%)	**$325,197**
			Engineering, Administrative, Legal (25%)	**$623,293**
Total Construction Cost (rounded to the nearest $1,000)				**$3,116,000**

C. Alternative 3- Northern Trunk Main Capacity Increase

a. Description

Alternative 3 involves upsizing the City's existing trunk main from E. Gallatin Street to the WRF. Sanitary mains in the area are 8-inch clay tile pipe, installed more than 50 years ago. No existing capacity issues are indicated in the hydraulic model. However, the predicted 20-year flow rates result in significant capacity issues, with much of the trunk main more than 75% full during peak flows. Additionally, a portion of this trunk main is within the high groundwater area. This is likely contributing to the City's elevated I/I. Replacing and upsizing the mains would decrease the I/I flow to the WRF, conserving both energy and resources.

Three construction methods, including open cut trench excavation, CIPP, and pipe bursting, are described in detail with Alternative 2. As discussed above, CIPP does not increase the size or conveyance capacity of the pipe and is therefore not an effective solution for Alternative 3. Pipe bursting is not the optimal method for issues associated with pipe grade include sags or negative slopes. Given the age of the existing pipe, sags are assumed. Trenchless construction

is often associated with cost savings from limited surface restoration. However, much of the construction for Alternative 3 would occur under gravel roads or undeveloped land. Because minimal asphalt or concrete replacement would be required, cost savings are expected be minimal. For these reasons, the preliminary design for Alternative 3 assumes open cut trench excavation.

b. Design Criteria

Alternative 3 involves replacing roughly 3,600 LF of 8-inch clay tile pipe with 10-inch PVC pipe. Although no capacity issues were modeled with existing flows, insufficient capacity was noted with future flows. Pipes were upsized to ensure all area pipe segments are less than 60% full during predicted peak flows. Given the future flows in the collection system are based on predicted development locations, there is an inherent uncertainty in the design flow rates. Maintaining maximum modeled depth below 60% provides flexibility in the preliminary design. Detailed results of Alternative 3's SSA model are included in the attached CD and are summarized in Figure 4-3.

Alternative 3 will replace nearly 1,200 LF of undersized and inadequate mains with 8-inch PVC to comply with DEQ's minimum size requirements. New 48-inch manholes are included throughout the project area. The age of surrounding pipe indicates the manholes are over 50 years and likely deteriorating.

All sanitary main improvements will adhere to DEQ Guidelines as set forth in Circular DEQ-2, *Design Standards for Wastewater Facilities*. Final project design will also adhere to MPWSS and generally accepted engineering practices.

c. Map

Figure 4-4 presents the proposed improvement locations with respect to the City of Livingston and the existing collection system.

d. Environmental Impacts

Minor, short-term environmental impacts associated with dust and noise will occur during construction. Although the impacts will be unavoidable, they can be easily mitigated with carefully planned construction practices. Groundwater degradation associated with leaking pipes will be lessened as a result of Alternative 3.

e. Land Requirements

All proposed improvements will occur within the existing City of Livingston Right-of-Way; no additional land acquisition will be required.

NOT FOR CONSTRUCTION

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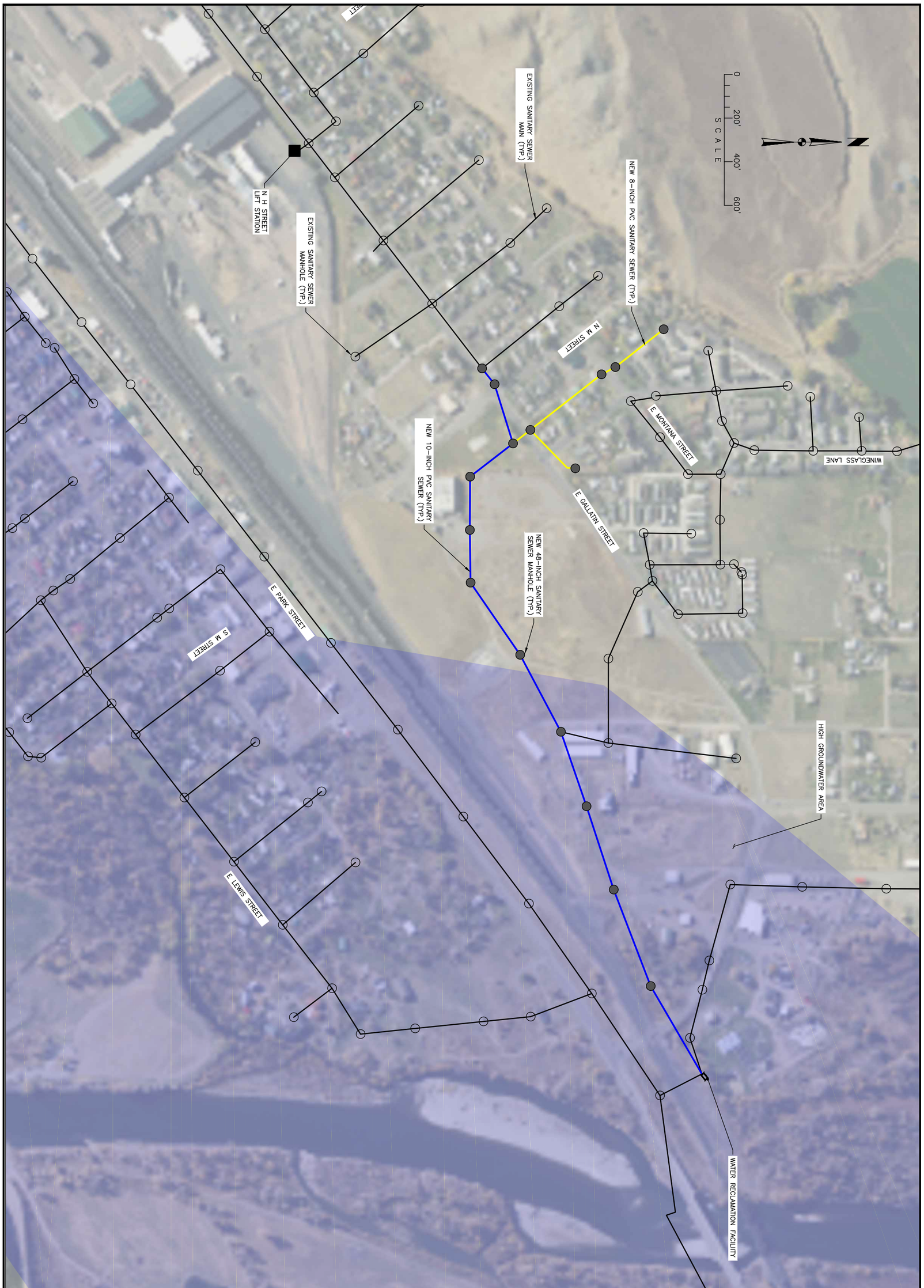
LIVINGSTON COLLECTION SYSTEM PER
LIVINGSTON, MONTANA

ALTERNATIVE 3-NORTHERN TRUNK MAIN CAPACITY INCREASE
POST-CONSTRUCTION HYDRAULIC MODEL RESULTS

B15-081 FIG 4-3.DWG

FIGURE 4-3

J:\2015\B15-081 City of Livingston\CADD\CIVIL\WW PER\B15-081 FIG 4-4.dwg, 6/11/2019 9:02:20 AM, NMR



LIVINGSTON COLLECTION SYSTEM PER
LIVINGSTON, MONTANA

ALTERNATIVE 3-NORTHERN TRUNK MAIN CAPACITY INCREASE MAP

FIGURE 4-4

B15-081 FIG 4-4.DWG

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f. Potential Construction Problems

Main replacement will likely require groundwater dewatering and disposal due to shallow area groundwater. Although dewatering is not a complicated procedure, it will require manpower and resources. If possible, construction should be scheduled in late summer, when static groundwater elevations are expected to decrease.

Temporary service will be necessary at service connections throughout the project. Major construction delays are not anticipated as a result of the required temporary services. Careful coordination with residents and businesses will be crucial to avoid major concerns associated with service outages.

g. Sustainability Considerations

i. Water and Energy Efficiency

Replace aging infrastructure will eliminate raw sewage leaking from the pipe when the groundwater table is low. This will result in a decrease in local groundwater contamination. During the spring and early summer, the new mains will prevent groundwater from entering the collection system. This will increase the energy efficiency of the WRF.

ii. Green Infrastructure

A SWPPP will be required prior to construction to mitigate storm water runoff from disturbed areas. After construction is complete, storm water mitigation will no longer be applicable.

iii. Other

Installation of new sewer mains will reduce the potential for plugging and frequency of cleaning, ultimately simplifying maintenance requirements.

h. Cost Estimates

Planning level capital costs for Alternative 3 are presented in Table 4-2. The conceptual level capital cost presented is a Class 4 cost estimate as defined by the Association for Advancement of Cost Engineering. Class 4 cost estimates are prepared based on limited information in which engineering is up to 5% complete. The accuracy of Class 4 cost estimates ranges from 15% to 50%. Given the high level of uncertainty at this stage, a contingency of 15% was applied. A 25% allowance for engineering design, legal, and construction administration was included to pay for non-construction related activities. Estimated construction costs are presented in Table 4-2 and total roughly $1.3 million.

No increase to O&M costs are anticipated as a result of Alternative 3. O&M efforts are expected to decrease as a result of high-risk main replacement.

Table 4-2 Alternative 3-Northern Trunk Main Capacity Increase Construction Cost Estimate				
Description	**Quantity**	**Units**	**Unit Costs**	**Total Costs**
Mobilization (5%)				$42,741
Traffic Control	1	LS	$18,500	$18,500
Type II Pipe Bedding	75	CY	$35	$2,625
8-inch PVC	1,150	LF	$65	$74,750
10-inch PVC	3,620	LF	$75	$271,500
New 48" Manholes	16	EA	$4,000	$64,000
Connect to Existing Sanitary Sewer	4	EA	$1,500	$6,000
Surface Restoration	4,250	SY	$70	$297,500
Utility Crossing	1	LS	$6,000	$6,000
Exploratory Excavation	8	HR	$150	$1,200
Layout and Construction Staking	1	LS	$7,500	$7,500
Special Trench Excavation	1	LS	$1,500	$1,500
Construction Dewatering	3,850	LF	$25	$96,250
Miscellaneous Fieldwork	7,500	UNITS	$1	$7,500
			Subtotal	**$897,566**
			Contingency (15%)	**$134,635**
			Engineering, Administrative, Legal (25%)	**$258,050**
Total Construction Cost (rounded to the nearest $1,000)				**$1,291,000**

D. ALTERNATIVE 4- PARK STREET CAPACITY INCREASE

a. Description

Alternative 4 includes upsizing the conveyance capacity along Park Street to facilitate future growth west of the City. The SSA models suggest that sections of the current Park Street trunk main are close to capacity with existing flows. Much of the line will be undersized with the 20-year peak flow rate projections. This section of the trunk main is PVC pipe and was constructed in the 1990s. There are currently no noted defects along the alignment. A portion of Alternative 4 is within the high groundwater area. However, given the age and material of the pipe, it is likely not a major contributor to the City's elevated flow rates associated with I/I. For these reasons, parallel 12- and 18-inch mains are proposed along Park Street. As the trunk main turns west near US Highway 10, a new 15-inch PVC main will replace the undersized aging mains.

The possible construction techniques are detailed in Alternative 2. Because a large portion of this alternative includes a new parallel main, trench excavation is the most feasible construction

technique and is assumed for preliminary design.

b. Design Criteria

Roughly 13,300 LF of new sanitary sewer mains will be installed as a result of Alternative 4. Approximately 3,000 LF of 15-inch PVC will be used to upsize the existing 10-inch main south of US Highway 10. Roughly 3,900 LF of 12-inch and 6,400 LF of 185-inch PVC will be installed parallel to the existing main along Park Street. The upsized main will discharge to an existing 24-inch trunk main on Park Street. Pipe sizes were chosen based on the hydraulic model previously discussed. Pipe were upsized to ensure all area pipe segments are less than 60% full during peak flows. Given the future flows in the collection system are based on predicted development locations, there is an inherent uncertainty in the design flow rates. Maintaining maximum modeled pipe depth below 60% provides flexibility in the preliminary design. Detailed results of Alternative 4's SSA model are included in the attached CD and are summarized in Figure 4-5.

New 48-inch manholes are included throughout the project area. The preliminary design for Alternative 4 includes replacement of 43 concrete manholes.

All sanitary main improvements will adhere to DEQ Guidelines as set forth in Circular DEQ-2, *Design Standards for Wastewater Facilities*. Final project design will also adhere to MPWSS and generally accepted engineering practices.

c. Map

Figure 4-6 presents the proposed improvement locations with respect to the City of Livingston and the existing collection system.

d. Environmental Impacts

Minor, short-term environmental impacts associated with dust and noise will occur during construction. Although the impacts will be unavoidable, they can be easily mitigated with carefully planned construction practices. Groundwater degradation associated with leaking pipes will be lessened as a result of Alternative 4.

NOT FOR CONSTRUCTION

0 750' 1,500' 2,250'

SCALE

PEAK FOW – PIPE FLOWING <50% FULL

PEAK FLOW – PIPE FLOWING 50% TO 60% FULL

PEAK FLOW – PIPE FLOWING 60% TO 70% FULL

PEAK FLOW – PIPE FLOWING 70 TO 75% FULL

PEAK FLOW – PIPE FLOWING >75% FULL

MANHOLE

FLOODED MANHOLE

LIFT STATION

WINEGLASS LANE

US HIGHWAY 89 S

LHC LIFT STATION

WATER RECLAMATION FACILITY

N M STREET

N G STREET

E GALLATIN STREET

N H STREET LIFT STATION

E PARK STREET

S M STREET

E LEWIS STREET

SCENIC TRL

N 9TH STREET

N YELLOWSTONE STREET

N 2ND STREET

N 7TH STREET

N 13TH STREET

STAR ROAD

CONSTELLATION DRIVE

PLEIADES PL

SUN AVE

US HIGHWAY 10 W

S H STREET

S D STREET

S MAIN STREET

S CLARK STREET

FLESHMAN CREEK LIFT STATION

S 6TH STREET

S 10TH STREET

W GEYSER STREET

W PARK STREET

W CRAWFORD STREET

S 13TH STREET

9TH STREET LIFT STATION

CRAWFORD LIFT STATION

CLINIC LIFT STATION

ROGERS LANE

CENTENIAL LIFT STATION

ROBIN LANE

LOVES LANE

INTERSTATE–90

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LIVINGSTON COLLECTION SYSTEM PER LIVINGSTON, MONTANA

ALTERNATIVE 4-PARK STREET CAPACITY INCREASE POST-CONSTRUCTION HYDRAULIC MODEL

B15-081 FIG 4-5.DWG

FIGURE 4-5

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LIVINGSTON COLLECTION SYSTEM PER LIVINGSTON, MONTANA

ALTERNATIVE 4-PARK STREET CAPACITY INCREASE MAP

B15-081 FIG 4-6.DWG

FIGURE 4-6

N

0 750' 1,500' 2,250'
SCALE

EXISTING SANITARY SEWER (TYP.)
EXISTING SEWER MANHOLE (TYP.)
HIGH GROUNDWATER AREA
WATER RECLAMATION FACILITY
US HIGHWAY 89 S
LHC LIFT STATION
E GALLATIN STREET
N G STREET
N H STREET LIFT STATION
NEW 48-INCH SEWER MANHOLE (TYP.)
E PARK STREET
E LEWIS STREET
S M STREET
S H STREET
NEW PARALLEL 18-INCH PVC SANITARY SEWER (TYP.)
FLESHMAN CREEK LIFT STATION
S D STREET
E CLARK STREET
S MAIN STREET
NEW PARALLEL 12-INCH PVC SANITARY SEWER (TYP.)
SCENIC TRL
N 9TH STREET
N 2ND STREET
W GALLATIN STREET
N 7TH STREET
STAR ROAD
US HIGHWAY 10 W
NEW 15-INCH PVC SANITARY SEWER (TYP.)
US HIGHWAY 10 W
S 6TH STREET
S 10TH STREET
W GEYSER STREET
W CRAWFORD STREET
9TH STREET LIFT STATION
CRAWFORD LIFT STATION
CLINIC LIFT STATION
W PARK STREET
S 13TH STREET
CENTENIAL LIFT STATION
ROGERS LANE
ROBIN LANE
INTERSTATE-90
HIGH GROUNDWATER AREA

e. Land Requirements

All proposed improvements will occur within the existing MDT Right-of-Way and City of Livingston easement; no additional land acquisition will be required. Coordination with MDT and MRL is anticipated with this alternative.

f. Potential Construction Problems

Main replacement will likely require groundwater dewatering and disposal due to shallow area groundwater. Although dewatering is not a complicated procedure, it will require manpower and resources. If possible, construction should be scheduled in late summer, when static groundwater elevations are expected to decrease.

Temporary service will be necessary at service connections throughout the project. Major construction delays are not anticipated as a result of the required temporary services. Careful coordination with residents and businesses will be crucial to avoid major concerns associated with service outages.

The alignment of Alternative 4 is entirely within the MDT's Right-of-Way. As such coordination with MDT and MRL will be required prior to construction, including acquisition of applicable permits and traffic control.

g. Sustainability Considerations

i. Water and Energy Efficiency

Replace aging infrastructure will eliminate raw sewage leaking from the pipe when the groundwater table is low. This will result in less groundwater contamination in the area. During the spring and early summer, the new mains will prevent groundwater from entering the collection system. This will increase the energy efficiency of the WRF.

ii. Green Infrastructure

A SWPPP will be required prior to construction to mitigate storm water runoff from disturbed areas. After construction is complete, storm water mitigation will no longer be applicable.

iii. Other

Installation of new sewer mains will reduce the potential for plugging and frequency of cleaning, ultimately simplifying maintenance requirements.

h. Cost Estimates

Planning level capital costs for Alternative 4 are presented in Table 4-3. The conceptual level capital cost presented is a Class 4 cost estimate as defined by the Association for Advancement of Cost Engineering. Class 4 cost estimates are prepared based on limited information in which engineering is up to 5% complete. The accuracy of Class 4 cost estimates ranges from 15% to 50%. Given the high level of uncertainty at this stage, a contingency of 15% was applied. A 25% allowance for engineering design, legal, and construction administration was included to pay for non-construction related activities. Estimated construction costs are presented in Table 4-3. and total roughly $4.3 million.

No increase to O&M costs are anticipated as a result of Alternative 4. O&M efforts are expected

to decrease as a result of high-risk mains replacement.

Table 4-3 Alternative 4-Park Street Capacity Increase Construction Cost Estimate				
Description	**Quantity**	**Units**	**Unit Costs**	**Total Costs**
Mobilization (5%)				$143,485
Traffic Control	1	LS	$45,000	$45,000
Type II Pipe Bedding	200	CY	$35	$7,000
12-inch PVC	3,900	LF	$85	$331,500
15-inch PVC	3,000	LF	$95	$285,000
18-inch PVC	6,400	LF	$120	$768,000
New 48" Manholes	43	EA	$4,000	$172,000
Connect to Existing Sanitary Sewer	5	EA	$1,500	$7,500
Surface Restoration	12,000	SY	$95	$1,140,000
Utility Crossing	1	LS	$9,000	$9,000
Exploratory Excavation	8	HR	$150	$1,200
Layout and Construction Staking	1	LS	$7,000	$7,000
Special Trench Excavation	1	LS	$1,500	$1,500
Construction Dewatering	3,500	LF	$25	$87,500
Miscellaneous Fieldwork	7,500	UNITS	$1	$7,500
			Subtotal	**$3,013,185**
			Contingency (15%)	**$451,978**
			Engineering, Administrative, Legal (25%)	**$866,291**
			Total Construction Cost (rounded to the nearest $1,000)	**$4,332,000**

E. ALTERNATIVE 5- W. GEYSER STREET CAPACITY INCREASE

a. Description

Alternative 5 involves upsizing a portion of the trunk main along W. Geyser Street. Currently, the 12-inch PVC main on the western edge of W. Geyser Street discharges to a 10-inch clay tile pipe. This is causing minor capacity issues with existing flows. Future flows are expected to exacerbate the problem further. Due to the age, material and location of the existing pipe, this trunk main is likely a major contributor to the City's high I/I flow rates. Additionally, 6-inch clay tile pipe is present around the trunk main. These mains do not meet DEQ's minimum size requirement and are included in Alternative 5 for replacement. Upsizing this trunk main and surrounding 6-inch pipe will increase the efficiency of the City's WRF by decreasing the amount of I/I. Additionally, the collection system will operate more effectively with the new upsized main replacing the existing aging mains.

Construction techniques were detailed in Alternative 2. Open cut trench excavation is

considered the best option for Alternative 5. CIPP will not increase the capacity of the trunk and is therefore not considered a reasonable technique for Alternative 5. Given the age and material of the trunk main, sags are likely present; pipe busting is not an effective method for replacing pipes with issues associated with slope, including sags. To ensure a conservative cost estimate for the most appropriate and effective solution to the W. Geyser Street replacement, open cut trench excavation is assumed in the preliminary design.

b. Design Criteria

Alternative 5 will replace approximately 2,800 LF of 10-inch clay tile pipe with 12-inch PVC. Roughly 3,500 LF of 6-inch clay tile pipe surrounding the trunk main will be upsized to meet DEQ minimum size requirements as well as eliminate the aging and inefficient pipe. The upsized main will discharge to an existing 12-inch pipe on S. Main Street. Pipe sizes were chosen based on the hydraulic model previously discussed. Pipe were upsized to ensure all area pipe segments are less than 60% full during peak flows. Given the future flows in the collection system are based on predicted development locations, there is an inherent uncertainty in the design flow rates. Maintaining maximum modeled depth below 60% provides flexibility in the preliminary design. Detailed results of Alternative 5's SSA model are included in the attached CD and are summarized in Figure 4-7.

New 48-inch manholes are included throughout the project area. The age of surrounding pipe indicates the manholes are over 50 years and likely deteriorating. The preliminary design for Alternative 5 includes replacement of 19 concrete manholes.

All sanitary main improvements will adhere to DEQ Guidelines as set forth in Circular DEQ-2, *Design Standards for Wastewater Facilities*. Final project design will also adhere to MPWSS and generally accepted engineering practices.

c. Map

Figure 4-8 presents the proposed improvement locations with respect to the City of Livingston and the existing collection system.

d. Environmental Impacts

Minor, short-term environmental impacts associated with dust and noise will occur during construction. Although the impacts will be unavoidable, they can be easily mitigated with carefully planned construction practices. Groundwater degradation associated with leaking pipes will be lessened as a result of Alternative 5.

e. Land Requirements

All proposed improvements will occur within the existing City of Livingston Right-of-Way; no additional land acquisition will be required.

N 7TH STREET

US HIGHWAY 10 W

S MAIN STREET

E CLARK STREET

S 6TH STREET

S 10TH STREET

W GEYSER STREET

W PARK STREET

S 13TH STREET

W CRAWFORD STREET

9TH STREET
LIFT STATION

CRAWFORD LIFT
STATION

0 200' 400' 600'
SCALE

PEAK FOW – PIPE FLOWING <50% FULL

PEAK FLOW – PIPE FLOWING 50% TO 60% FULL

PEAK FLOW – PIPE FLOWING 60% TO 70% FULL

PEAK FLOW – PIPE FLOWING 70 TO 75% FULL

PEAK FLOW – PIPE FLOWING >75% FULL

MANHOLE

LIFT STATION

NOT FOR CONSTRUCTION

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LIVINGSTON COLLECTION SYSTEM PER
LIVINGSTON, MONTANA

ALTERNATIVE 5-W. GEYSER STREET CAPACITY INCREASE
POST-CONSTRUCTION HYDRAULIC MODEL RESULTS

B15-081 FIG 4-7.DWG

FIGURE 4-7

J:\2015\B15-081 City of Livingston\CADD\CIVIL\WW PER\B15-081 FIG 4-8.dwg, 6/11/2019 9:19:06 AM, NMR

FIGURE 4-8

B15-081 FIG 4-8.DWG

LIVINGSTON COLLECTION SYSTEM PER
LIVINGSTON, MONTANA

ALTERNATIVE 5-W. GEYSER STREET CAPACITY INCREASE MAP

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f. Potential Construction Problems

Main replacement will likely require groundwater dewatering and disposal due to shallow area groundwater. Although dewatering is not a complicated procedure, it will require manpower and resources. If possible, construction should be scheduled in late summer, when static groundwater elevations are expected to decrease.

Temporary service connections will be necessary at service connections throughout the project. Major construction delays are not anticipated as a result of the temporary services. Careful coordination with residents and businesses will be crucial to avoid major concerns associated with service outages.

g. Sustainability Considerations

i. Water and Energy Efficiency

Replace aging infrastructure will eliminate raw sewage leaking from the pipe when the groundwater table is low. This will lessen groundwater contamination in the area. During the spring and early summer, the new mains will prevent groundwater from entering the collection system. This will increase the energy efficiency of the WRF.

ii. Green Infrastructure

A SWPPP will be required prior to construction to mitigate storm water runoff from disturbed areas. After construction is complete, storm water mitigation will no longer be applicable.

iii. Other

Installation of new sewer mains will reduce the potential for plugging and frequency of cleaning, ultimately simplifying maintenance requirements.

h. Cost Estimates

Planning level capital costs for Alternative 5 are presented in Table 4-4. The conceptual level capital cost presented is a Class 4 cost estimate as defined by the Association for Advancement of Cost Engineering. Class 4 cost estimates are prepared based on limited information in which engineering is up to 5% complete. The accuracy of Class 4 cost estimates ranges from 15% to 50%. Given the high level of uncertainty at this stage, a contingency of 15% was applied. A 25% allowance for engineering design, legal, and construction administration was included to pay for non-construction related activities. Estimated construction costs are presented in Table 4-4 and total roughly $2.0 million.

No increase to O&M costs are anticipated as a result of Alternative 5. O&M efforts are expected to decrease as a result of high-risk mains replacement.

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Table 4-4 Alternative 5-W. Geyser Street Capacity Increase Construction Cost Estimate				
Description	**Quantity**	**Units**	**Unit Costs**	**Total Costs**
Mobilization (5%)				$65,986
Traffic Control	1	LS	$28,000	$28,000
Type II Pipe Bedding	95	CY	$35	$3,325
8-inch PVC	3,550	LF	$65	$230,750
12-inch PVC	2,800	LF	$85	$238,000
New 48" Manholes	19	EA	$4,000	$76,000
Connect to Existing Sanitary Sewer	13	EA	$1,500	$19,500
Surface Restoration	5,700	SY	$95	$541,500
Utility Crossing	1	LS	$7,000	$7,000
Exploratory Excavation	6	HR	$150	$900
Layout and Construction Staking	1	LS	$7,000	$7,000
Special Trench Excavation	1	LS	$1,500	$1,500
Construction Dewatering	6,350	LF	$25	$158,750
Miscellaneous Fieldwork	7,500	UNITS	$1	$7,500
			Subtotal	**$1,385,711**
			Contingency (15%)	**$207,857**
			Engineering, Administrative, Legal (25%)	**$398,392**
Total Construction Cost (rounded to the nearest $1,000)				**$1,992,000**

F. ALTERNATIVE 6- E. LEWIS STREET REPLACEMENT

a. Description

Alternative 6 involves replacing the existing 21-inch and 24-inch trunk main along E. Lewis Street to the City's WRF. The surrounding 6-inch mains do not meet DEQ minimum size requirements and are to be upsized as a part of Alternative 6. Capacity issues were not noted in the SSA model. However, the included mains are clay tile pipe, constructed more than 50 years ago and located in the high groundwater area. As such, this area is likely to have defects including, but not limited to, cracks, offset joints and root intrusions, and are contributing to the City's I/I issue. The City has noted 2 mains with poor condition and root intrusions in the project limits. Additional defects are considered likely. Alternative 6 is designed to replace deficient mains and decrease the high I/I flow rates the City is experiencing. This will increase the effectiveness of the WRF.

Potential construction methods are detailed in Alternative 2. Open cut trench excavation is assumed for the preliminary design of Alternative 6. Although both CIPP and pipe bursting could be used to replace the E. Lewis Street trunk main, CIPP could not be utilizes to upsize the surrounding 6-inch pipe. A large portion of the trunk main is under undeveloped land. As such,

cost savings associated with trenchless installation would likely be minimal because concrete and asphalt replacement will not be required in that section. Finally, trenchless installation is not as effective at repairing pipes with problems associated with grade, such as large sags, and CIPP is not effective with offset joints. Given the age and material of the pipe in the project area, open cut trench excavation is believed to be the most effective method for Alternative 6.

b. Design Criteria

Alternative 6 entails replacing approximately 5,100 LF of 6-inch clay tile pipe with 8-inch PVC. This will be done to satisfy DEQ minimum pipe size requirement and decrease the likelihood of blockages within the pipe. Additionally, 3,200 LF of 21-inch PVC and 1,900 LF of 24-inch PVC will be replaced in-kind. The new PVC pipe will replace the high-risk mains in the high groundwater area. This is expected to drastically decrease the volume of I/I impacting the WRF. New 48-inch manholes are included throughout the project area. The age of surrounding pipe indicates the manholes are over 50 years and likely deteriorating. The preliminary design for Alternative 6 includes replacement of 30 concrete manholes.

All sanitary main improvements will adhere to DEQ Guidelines as set forth in Circular DEQ-2, *Design Standards for Wastewater Facilities*. Final project design will also adhere to MPWSS and generally accepted engineering practices.

c. Map

Figure 4-9 presents the proposed improvement locations with respect to the existing collection system.

d. Environmental Impacts

Minor, short-term environmental impacts associated with dust and noise will occur during construction. Although the impacts will be unavoidable, they can be easily mitigated with carefully planned construction practices. Groundwater degradation associated with leaking pipes will be lessened as a result of Alternative 5.

e. Land Requirements

All proposed improvements will occur within the existing City of Livingston Right-of-Way and easements; no additional land acquisition will be required.

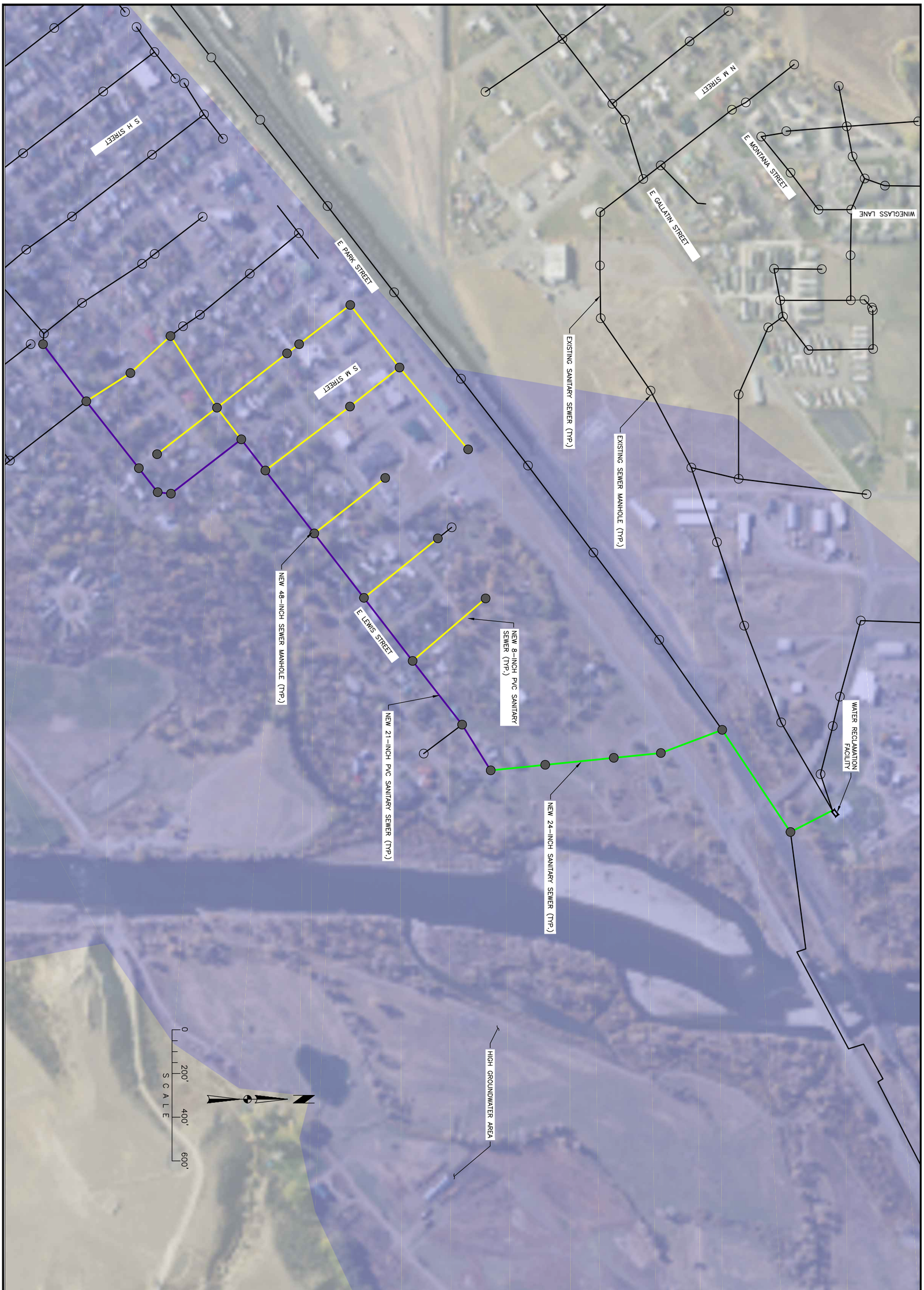
f. Potential Construction Problems

Main replacement will likely require groundwater dewatering and disposal due to shallow area groundwater. Although dewatering is not a complicated procedure, it will require manpower and resources. If possible, construction should be scheduled in late summer, when static groundwater elevations are expected to decrease.

Temporary service will be necessary at service connections throughout the project. Major construction delays are not anticipated as a result of the required temporary services. Careful coordination with residents and businesses will be crucial to avoid major concerns associated with service outages.

A small portion of Alternative 6 will occur within MDT Right-of-Way. As such, careful coordination with MDT will be required prior to construction, including acquisition of applicable permits and traffic control.

J:\2015\B15-081 City of Livingston\CADD\CIVIL\WW PER\B15-081 FIG 4-9.dwg, 6/11/2019 9:23:05 AM, NMR



LIVINGSTON COLLECTION SYSTEM PER
LIVINGSTON, MONTANA

ALTERNATIVE 6-E. LEWIS STREET REPLACEMENT

MAP

FIGURE 4-9

B15-081 FIG 4-9.DWG

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g. Sustainability Considerations

i. Water and Energy Efficiency

Replace aging infrastructure will eliminate raw sewage leaking from the pipe when the groundwater table is low. This will result in less groundwater contamination in the area. During the spring and early summer, the new mains will prevent groundwater from entering the collection system. This will increase the energy efficiency of the WRF.

ii. Green Infrastructure

A SWPPP will be required prior to construction to mitigate storm water runoff from disturbed areas. After construction is complete, storm water mitigation will no longer be applicable.

iii. Other

Installation of new sewer mains will reduce the potential for plugging and frequency of cleaning, ultimately simplifying maintenance requirements.

h. Cost Estimates

Planning level capital costs for Alternative 6 are presented in Table 4-5. The conceptual level capital cost presented is a Class 4 cost estimates as defined by the Association for Advancement of Cost Engineering. Class 4 cost estimates are prepared based on limited information in which engineering is up to 5% complete. The accuracy of Class 4 cost estimates ranges from 15% to 50%. Given the high level of uncertainty at this stage, a contingency of 15% was applied. A 25% allowance for engineering design, legal, and construction administration was included to pay for non-construction related activities. Estimated construction costs are presented in Table 4-5 and total roughly $2.7 million.

No increase to O&M costs are anticipated as a result of Alternative 6. O&M efforts are expected to decrease as a result of high-risk main replacement.

Table 4-5 Alternative 6-E. Lewis Street Replacement Construction Cost Estimate				
Description	**Quantity**	**Units**	**Unit Costs**	**Total Costs**
Mobilization (5%)				$89,713
Traffic Control	1	LS	$33,000	$33,000
Type II Pipe Bedding	75	CY	$35	$2,625
8-inch PVC	5,147	LF	$65	$334,580
21-inch PVC	3,222	LF	$135	$435,032
24-inch PVC	1,861	LF	$150	$279,119
New 48" Manholes	30	EA	$4,000	$120,000
Connect to Existing Sanitary Sewer	6	EA	$1,500	$9,000
Surface Restoration	4,518	SY	$95	$429,210
Utility Crossing	1	LS	$7,000	$7,000
Exploratory Excavation	8	HR	$150	$1,200
Layout and Construction Staking	1	LS	$7,000	$7,000
Special Trench Excavation	1	LS	$1,500	$1,500
Construction Dewatering	5,100	LF	$25	$127,500
Miscellaneous Fieldwork	7,500	UNITS	$1	$7,500
			Subtotal	**$1,883,979**
			Contingency (15%)	**$282,597**
			Engineering, Administrative, Legal (25%)	**$541,644**
			Total Construction Cost (rounded to the nearest $1,000)	**$2,709,000**

G. ALTERNATIVE 7-GREEN ACRES SUBDIVISION

a. Description

Alternative 7 entails connecting the Green Acres Subdivision to the City's existing wastewater collection system. The subdivision is located north of the City, directly west of the Yellowstone River. Approximately 1,900 LF of 12-inch PVC will be included to extend the existing trunk main near Granier Avenue to Green Acres. Roughly 7,000 LF of 8-inch main will be constructed throughout streets within the subdivision. Individual services will be extended to each of the 118 existing houses.

The purpose of this project is to eliminate the individual septic tanks and protect the local aquifer. The existing septic tanks and drainfields will be abandoned. To properly abandon the existing infrastructure, the tanks will be emptied completely and backfilled with the lines capped.

b. Design Criteria

Area topography will allow for gravity flow from the Green Acres Subdivision to the collection system. An estimated 8,900 lf of new sewer main and 18 new concrete manholes are included

in Alternative 7. Roughly 7,000 LF of new 8-inch PVC will serve the subdivision and comply with DEQ's minimum pipe size requirements. The remaining 1,900 LF will be an extension of an existing 12-inch trunk main.

Per Circular DEQ-2 regulations, the new mains will be sized to safely convey peak hour sanitary flows. For planning purposes, it is assumed that each of the 118 services are connected to a 3-bedroom home. Circular DEQ-4 *Montana Standards for Subsurface Wastewater Treatment Systems* recommends using 300 gpd to estimate average day flow from 3-bedroom residence. This equates to a total average day flow from Green Acres of 154,000 gpd (24.6 gpm). Conservatively assuming a peak hour peaking factor of 4.0, the peak hour flow rate is estimated to be 98.3 gpm. With DEQ required minimum slopes and 75% pipe depth, the design capacities of 8-inch and 12-inch PVC gravity mains are 370 gpm and 808 gpm, respectively. The 12-inch trunk main will be oversized to facilitate future development in the area.

The SSA model indicates the existing downstream trunk mains have capacity to handle the excess flows. The recently upgraded WRF was designed to for the projected 2035 sanitary flows and sufficient capacity to treat the flows expected from Green Acres Subdivision.

All improvements will adhere to DEQ Guidelines, presented in Circular DEQ-2. Final project design will adhere to MPWSS and generally accepted engineering practices.

c. Map

Figure 4-10 presents the proposed alignment for Alternative 7.

d. Environmental Impacts

Minor, short term environmental impacts association with dust and noise will occur during construction. Although these impacts are unavoidable, they can be easily mitigated with carefully planned construction practices. Groundwater and surface water degradation are expected to decrease as a result eliminating the area drainfields.

e. Land Requirements

The proposed improvements will occur within City Right-of-Way; no land acquisition will be required.

f. Potential Construction Problems

Temporary service may be necessary at service connections throughout the project. Major construction delays are not anticipated as a result of the required temporary services. Careful coordination with residents will be crucial to avoid major concerns associated with service outages.

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LIVINGSTON COLLECTION SYSTEM PER LIVINGSTON, MONTANA

ALTERNATIVE 7-GREEN ACRES SUBDIVISION

B15-081 FIG 4-10.DWG

FIGURE 4-10

g. Sustainability Considerations

i. Water and Energy Efficiency

There is no additional water use or energy requirements associated with Alternative 7.

ii. Green Infrastructure

A SWPP will be required prior to construction to mitigate storm water runoff from disturbed areas. After construction is complete, storm water mitigation will no longer be applicable.

iii. Other

The O&M requirements associated with the existing subsurface treatment system will be eliminated as a result of this project.

h. Cost Estimates

Planning level capital costs for Alternative 7 are presented in Table 4-6. The conceptual level capital cost presented is a Class 4 cost estimate as defined by the Association for Advancement of Cost Engineering. Class 4 cost estimates as prepared based on limited information in which engineering is up to 5% complete. The accuracy of Class 4 cost estimates ranges from 15% to 50%. Given the high level of uncertainty at this stage, a contingency of 15% was applied. A 25% allowance for engineering design, legal, and construction administration was included to pay for non-construction related activities. Estimated construction costs are presented in Table 4-5 and total roughly $2.3 million. A slight increase in O&M procedures is anticipated to maintain the additional infrastructure.

Table 4-6 Alternative 7-Green Acres Subdivision Construction Cost Estimate				
Description	**Quantity**	**Units**	**Unit Costs**	**Total Costs**
Mobilization (5%)				$74,835
Traffic Control	1	LS	$35,000	$35,000
Type II Pipe Bedding	100	CY	$35	$3,500
8-inch PVC	7,000	LF	$65	$455,000
12-inch PVC	1,900	LF	$85	$161,500
New 48" Manholes	18	EA	$4,000	$72,000
Connect to Existing Sanitary Sewer	1	EA	$1,500	$1,500
Surface Restoration	7,900	SY	$95	$750,500
Utility Crossing	1	LS	$5,000	$5,000
Exploratory Excavation	8	HR	$150	$1,200
Layout and Construction Staking	1	LS	$5,000	$5,000
Special Trench Excavation	1	LS	$1,500	$1,500
Miscellaneous Fieldwork	5,000	UNITS	$1	$5,000
			Subtotal	**$1,571,535**
			Contingency (15%)	**$235,730**
			Engineering, Administrative, Legal (25%)	**$451,816**
			Total Construction Cost (rounded to the nearest $1,000)	**$2,260,000**

H. ALTERNATIVE 8- CIVIC CENTER

a. Description

Alternative 8 involves abandoning the existing septic and drainfield near the City's Civic Center and connecting the affected areas to the existing municipal wastewater system. This alternative was originally presented in the 2019 Livingston Recreation and Civic Center PER, prepared by TD&H Engineering. The areas to be affect include the Civic Center, Miles Park bathroom, baseball park bathrooms, and Sacajawea Park bathrooms. The new main will connect to the existing collection system on View Vista, near Park County High School. The sanitary sewer will travel southwest, bisecting the baseball fields and terminating in Sacagawea Park. To properly abandon the existing septic tank and drainfield, the tank will be emptied completely with the lines capped.

b. Design Criteria

Alternative 8 involves an estimated 3,000 LF of 8-PVC gravity sewer main with 7 new 48-inch manholes. The 8-inch main will comply with DEQ's minimum pipe size requirements. Approximate manhole locations were surveyed for the Livingston Recreation and Civic Center Waster PER. Calculation, provided in Appendix 4, indicate acceptable cover can be maintained throughout the proposed alignment while adhering to DEQ required minimum slopes.

The recent PER presented the Civic Center's historic water demand. Water usage data is available for review in Appendix 4. The peak monthly water demand for 2017 and 2018 occurred in August 2017 and was 19,516 gpd. Conservatively assuming wastewater flows equal water demand and a peak hour peaking factor of 4.0, The average day and peak hour flow from the Civic Center be 13.5 gpm and 54 gpm respectively. Additional flows from the Miles Park and Sacajawea Park bathrooms and the baseball field concessions are expected to be periodic and minimal compared to the Civic Center. At minimum slope and 75% pipe depth, an 8-inch PVC gravity main has a design capacity of roughly 360 gpm. The SSA model previously discussed indicated the downstream mains have sufficient capacity to handle the increased flows.

All improvements will adhere to DEQ Guidelines, presented in Circular DEQ-2. Final project design will adhere to MPWSS and generally accepted engineering practices.

c. Map

Figure 4-11 presents the proposed alignment for Alternative 8.

d. Environmental Impacts

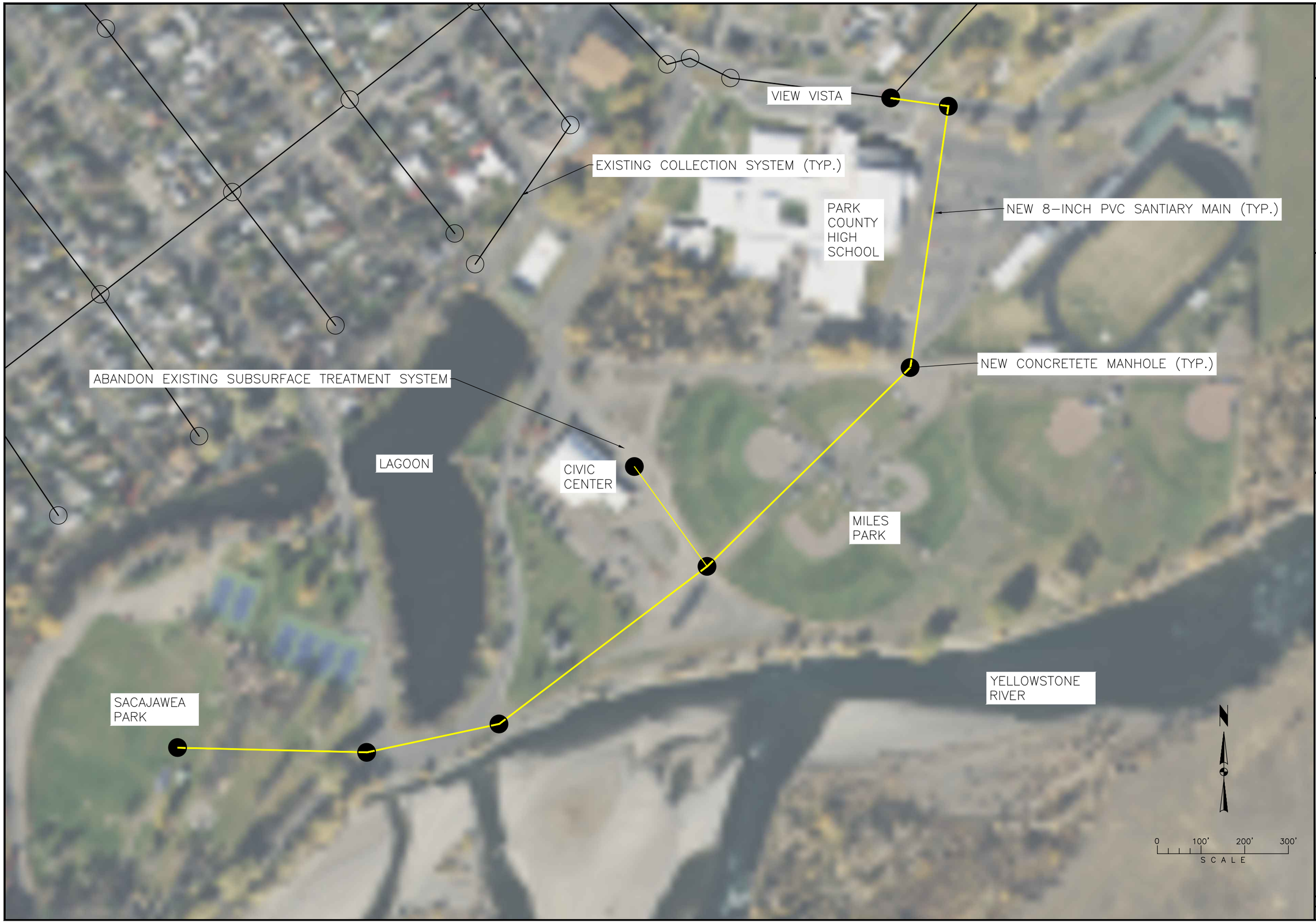
Minor, short term environmental impacts association with dust and noise will occur during construction. Although these impacts are unavoidable, they can be easily mitigated with carefully planned construction practices. Groundwater and surface water degradation is expected to decrease as a result eliminating the area drainfields.

e. Land Requirements

The proposed improvements will occur primarily within City Right-of-Way or City parks. An easement will be required for work within the Park County High School parking lot.

f. Potential Construction Problems

Main replacement will likely require groundwater dewatering and disposal due to shallow area groundwater. Although dewatering is not a complicated procedure, it will require manpower and resources. If possible, construction should be scheduled in late summer, when static groundwater elevations are expected to decrease. Additionally, temporary service will be required for the Civic Center and Park County High School, at a minimum. Coordination will be required to determine the most advantageous construction sequencing and scheduling.



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LIVINGSTON COLLECTION SYSTEM PER
LIVINGSTON, MONTANA

ALTERNATIVE 8-CIVIC CENTER

B15-081 FIG 4-11.DWG

FIGURE **4-11**

g. Sustainability Considerations

i. Water and Energy Efficiency

There is no additional water use or energy requirements associated with Alternative 8.

ii. Green Infrastructure

A SWPP will be required prior to construction to mitigate storm water runoff from disturbed areas. After construction is complete, storm water mitigation will no longer be applicable.

iii. Other

The O&M requirements associated with the existing septic system will be eliminated as a result of this project.

h. Cost Estimates

Planning level capital costs for Alternative 8 are presented in Table 4-7. The conceptual level capital cost presented is a Class 4 cost estimate as defined by the Association for Advancement of Cost Engineering. Class 4 cost estimates as prepared based on limited information in which engineering is up to 5% complete. The accuracy of Class 4 cost estimates ranges from 15% to 50%. Given the high level of uncertainty at this stage, a contingency of 15% was applied. A 25% allowance for engineering design, legal, and construction administration was included to pay for non-construction related activities. Estimated construction costs are presented in Table 4-7 and total roughly $616,000

Minor changes to the City's O&M procedures is expected do to the added infrastructure. O&M efforts associated with the subsurface treatment system will be eliminated.

Table 4-7 Alternative 8-Civic Center Construction Cost Estimate				
Description	**Quantity**	**Units**	**Unit Costs**	**Total Costs**
Mobilization (5%)				$20,380
Traffic Control	1	LS	$15,000	$15,000
Abandon Existing Drainfield	1	LS	$4,500	$4,500
8-inch PVC	3,000	LF	$65	$195,000
New 48" Manholes	7	EA	$4,000	$28,000
Connect to Existing Sanitary Sewer	1	EA	$1,500	$1,500
Surface Restoration	2,700	SY	$40	$108,000
Utility Crossing	1	LS	$12,000	$12,000
Exploratory Excavation	24	HR	$150	$3,600
Construction Dewatering	1,200	LF	$30	$36,000
Miscellaneous Fieldwork	4,000	UNITS	$1	$4,000
			Subtotal	**$427,980**
			Contingency (15%)	**$64,197**
			Engineering, Administrative, Legal (25%)	**$123,044**
			Total Construction Cost (rounded to the nearest $1,000)	**$616,000**

I. ALTERNATIVE 9-CENTENNIAL LIFT STATION

a. Description

Alternative 9 includes upgrades to the existing Centennial Lift Station. As discussed in Chapters 2 and 3, anticipated commercial development upstream of the existing lift station is expected to increase flow beyond the existing lift station capacity. The Centennial Lift Station alternative entails demolishing the existing 72-inch wet well and constructing a new 96-inch wet well and new submersible grinder pumps. The upgraded lift station will function similar to the existing lift station. Raw wastewater will enter the upsized wet well where the submersible pumps will be located. The control system, activated by wet well water depth, will start and stop the pumps. Flow will be discharged through the existing 6-inch forcemain and the existing valve vault.

b. Design Criteria

The existing SSA model, previously discussed, estimates the existing average day flow to the Centennial Lift Station at 0.08 cfs, or 51,705 gpd. According to the City of Livingston's Growth Policy, an estimated 75 acres of commercial property is expected to develop in the coming years. As presented in Table 2-3, commercial property has an average day flow of 1,200 gpd/acre. This equates to approximately 90,000 gpd of additional flows to the Centennial Lift Station, or a total projected flow of 141,700 gpd (98.3 gpm). For planning purposes, a conservative peaking factor of 4.0 was assumed to estimate a projected peak hour flow rate of 393.5 gpm.

Preliminary design of the Centennial Lift Station capacity increase was done in accordance with Circular DEQ-2. A 96-inch wet well with an effective depth of 7 feet will provide an effective wet well volume of 2,630 gallons. At the projected flow rates, the average fill time will be 26.75 min. This is less then DEQ's required maximum fill time of 30 min, but greater then most pump manufacture recommended minimum fill times of 15 min.

Two submersible pumps will be installed in the new wet well. Each pump will have a capacity equal to the projected peak hour flow rate, 395 gpm, to comply with DEQ-2. This flow rate will result in a fluid velocity of roughly 4.5 ft/sec within the existing 6-inch force main. DEQ-2 recommends fluid velocities within force mains to be between 3 ft/sec and 8 ft/sec. It is assumed that the current backup power is sufficient for the upsized pumps.

All improvements will adhere to DEQ Guidelines, presented in Circular DEQ-2. Final project design will adhere to MPWSS and generally accepted engineering practices.

c. Map

Figure 4-12 presents the location of the Centennial Lift Station along with proposed improvements.

d. Environmental Impacts

Minor, short term environmental impacts associated with dust and noise will be unavoidable during construction. However, these impacts cane be easily mitigated with carefully planned construction practices. After construction is complete, negative environmental impacts are not expected to result from this project. The upsized wet well and pump will be installed to prevent raw wastewater from backing up and contaminating the surrounding groundwater.

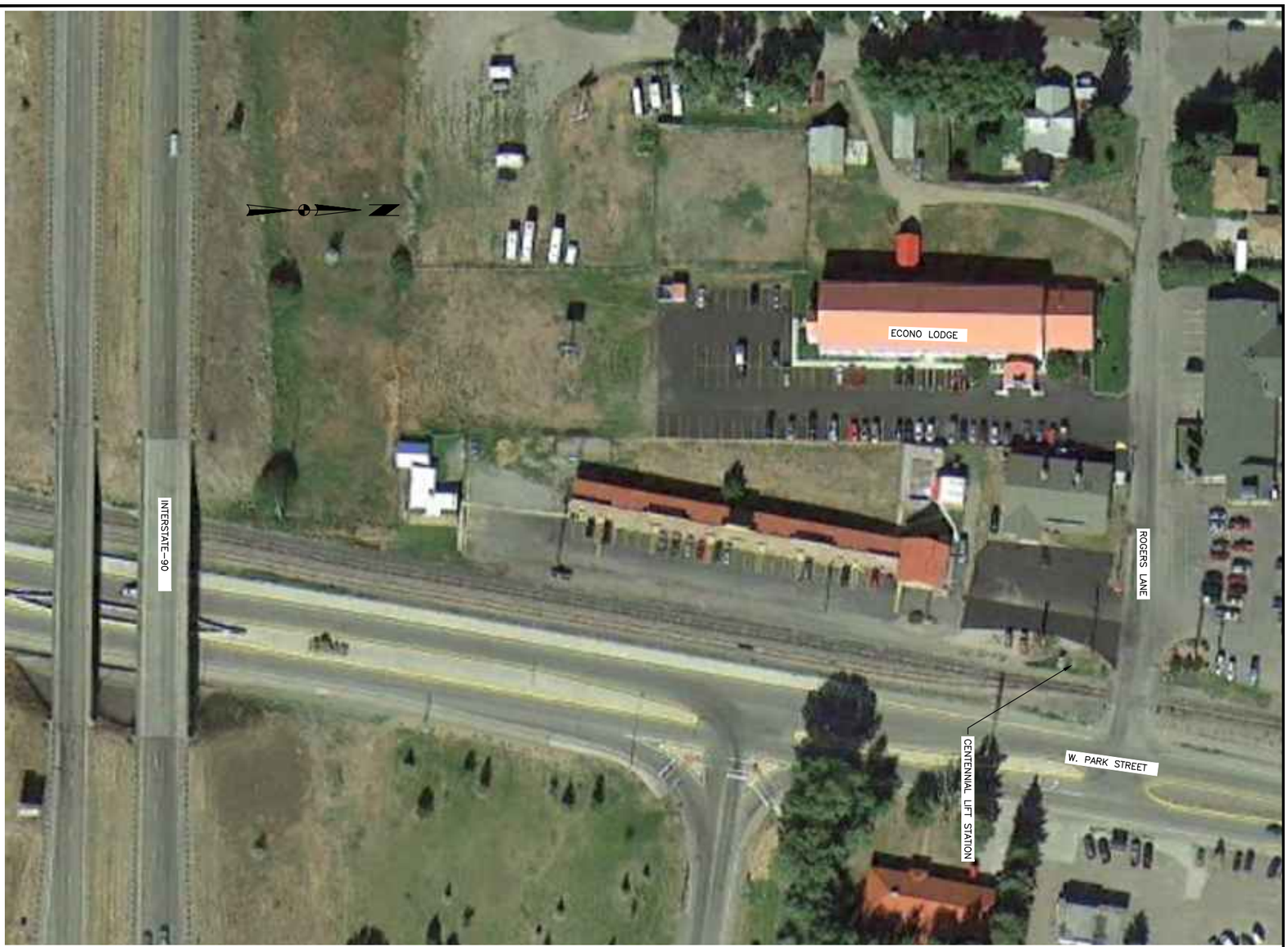
e. Land Requirements

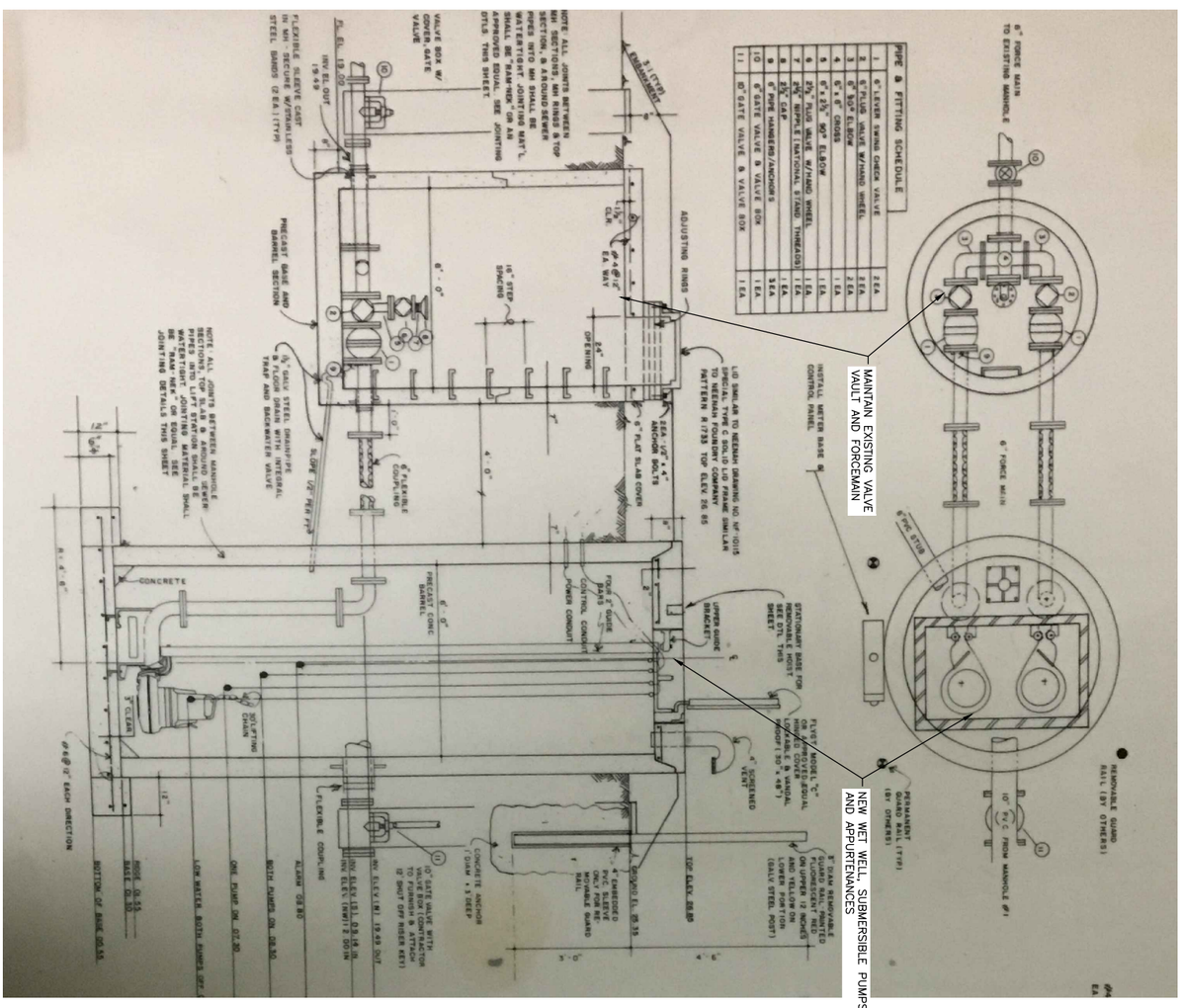
Proposed improvements will occur within the footprint of the existing lift station. Alternative 9 does not require the City to acquire more land through purchase, lease, or easement.

f. Potential Construction Problems

The proposed improvements will likely require groundwater dewatering and disposal due to shallow area groundwater. Although dewatering is not a complicated procedure, it will require manpower and resources. If possible, construction should be scheduled in late summer, when static groundwater elevations are expected to decrease. Bypassing pumping will be necessary for the duration of Alternative 9 construction. This is not expected to result in major construction delays as it is typical of many public utility projects.

Finally, Alternative 9 is entirely within the MRL's Right-of-Way. As such coordination with MRL will be required prior to construction, including acquisition of applicable permits and traffic control. Given the proximity to the Highway, it is likely that correlation with MDT will be required.





B15-081 CENTENNIAL LIFT STATION.DWG

FIGURE 4-12

LIVINGSTON COLLECTION SYSTEM PER
LIVINGSTON, MONTANA

ALTERNATIVE 9-CENTENNIAL LIFT STATION

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QUALITY CHECK:
DATE: 09-04-2019
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g. Sustainability Considerations

i. Water and Energy Efficiency

Water and energy efficiency of the lift station is not expected to be affected by the proposed improvements.

ii. Green Infrastructure

A SWPP will be required prior to construction to mitigate storm water runoff from disturbed areas. After construction is complete, storm water mitigation will no longer be applicable.

iii. Other

Lift station improvements are expected to decrease the likelihood of system failures; ultimately simplifying maintenance requirements.

h. Cost Estimates

Planning level capital costs for Alternative 9 are presented in Table 4-8. The conceptual level capital cost presented is a Class 4 cost estimate as defined by the Association for Advancement of Cost Engineering. Class 4 cost estimates as prepared based on limited information in which engineering is up to 5% complete. The accuracy of Class 4 cost estimates ranges from 15% to 50%. Given the high level of uncertainty at this stage, a contingency of 20% was applied. A 25% allowance for engineering design, legal, and construction administration was included to pay for non-construction related activities. Estimated construction costs are presented in Table 4-8 and total roughly $474,000. No increase to O&M costs are anticipated as a result of Alternative 9.

Table 4-8 Alternative 9-Centennial Lift Station Construction Cost Estimate				
Description	**Quantity**	**Units**	**Unit Costs**	**Total Costs**
Mobilization (5%)				$15,025
Traffic Control	1	LS	$25,000	$25,000
Bypass Pumping	1	LS	$50,000	$50,000
Demo Existing Wet Well	1	LS	$15,000	$15,000
Submersible Lift Station Equipment and Installation	1	LS	$46,000	$46,000
Precast Concrete Wet Well	1	EA	$37,000	$37,000
Site Electrical	1	LS	$50,000	$50,000
Aluminum Hatch	1	EA	$4,500	$4,500
Buried Pipe Connections and Couplings	1	LS	$3,500	$3,500
Layout and Construction Staking	1	LS	$4,500	$4,500
Surface Restoration	1	LS	$10,000	$10,000
Construction Dewatering	1	LS	$40,000	$40,000
Miscellaneous Fieldwork	15,000	UNITS	$1	$15,000
			Subtotal	**$315,525**
			Contingency (20%)	**$63,105**
			Engineering, Administrative, Legal (25%)	**$94,658**
			Total Construction Cost (rounded to the nearest $1,000)	**$474,000**

5.0 SELECTION OF ALTERNATIVES

Each feasible alternative presented in Chapter 4 is evaluated in the following Sections to prioritize the collection system improvements for the City of Livingston. The viable alternatives are evaluated below based on an organized and systematic approach. This methodology ensures a consistent and unbiased means of prioritizing the alternatives in a way that is most beneficial for the City. Each alternative was evaluated by applying consistent criteria. These criteria include cost, technical and logistical feasibility, operations and maintenance complexity, public health and safety, and environmental impacts. Each viable option was ranked within a decision matrix. The alternative selection process is presented in the following sections.

Nine collection system alternatives were presented previously in Chapter 4:

- Alternative 1- No Action
- Alternative 2- N. 5th Street Capacity Increase
- Alternative 3- Northern Trunk Main Capacity Increase
- Alternative 4- Park Street Capacity Increase
- Alternative 5- W. Geyser Street Capacity Increase
- Alternative 6- E. Lewis Street Replacement
- Alternative 7- Green Acres Subdivision
- Alternative 8- Civic Center
- Alternative 9- Centennial Lift Station

Alternative 1 was eliminated from further discussion as it does not provide a solution to any of the problems within the City's collection system. The following sections compare the remaining alternatives with respect to the above-mentioned criterion. The remaining alternatives have been scored for each criterion with higher scores indicating the more desirable alternatives. Scores within each criterion were summed together in a decision matrix, presented at the end of this Chapter; the highest total score suggests the most advantageous project.

A. COST ANALYSIS

Table 5-1 presents the estimated construction cost for each of the feasible alternatives. A low total construction cost is considered desirable. As such, Alternative 9 has received a score of 8 for cost analysis; Alternative 4 has been given a score of 1.

Table 5-1
Alternative Cost Comparison

Alternative	Construction Cost	Contingency	Engineering, Admin, & Legal	Total Construction Cost[(1)]
2-N 5th Street Capacity Increase	$2,167,977	$325,197	$623,293	**$3,116,000**
3-Northern Trunk Main Capacity Increase	$897,566	$134,635	$258,050	**$1,291,000**
4-Park Street	$3,013,185	$451,978	$866,291	**$4,332,000**

Capacity Increase				
5-W Geyser Street Capacity Increase	$1,385,711	$207,857	$398,392	**$1,992,000**
6- E Lewis Street Replacement	$1,883,979	$282,597	$541,644	**$2,709,000**
7-Green Acers Subdivision	$1,571,535	$235,730	$451,816	**$2,260,000**
8-Civic Center	$427,980	$64,197	$123,044	**$616,000**
9-Centennial Lift Station	$315,525	$63,105	$94,658	**$474,000**
(1) Rounded to the nearest $1,000				

B. NON-MONETARY FACTORS

The alternative analysis includes consideration of non-monetary factors such as technical and logistical feasibility, operations and maintenance complexity, public health and safety, and environmental impacts. The following discussion evaluates the viable alternatives with respect to these non-monetary factors.

a. Technical and Logistical Feasibility

Technical and logistical feasibility considers factors such as permitting requirements, land acquisition and technical practicality of each alternative. The eight remaining alternatives are all considered technically feasible. Preliminary design of each option considered typical industry standard and applicable design requirements. The proposed improvements are all designed with sufficient conveyance capacity to serve the City of Livingston during the 20-year planning period.

Additional land acquisition will not be required for Alternatives 2, 3, 4, 5, 6, 7, and 9. Each of these alternatives will occur within the City's existing Right-of-Way or easements. Alternative 4 and a portion of Alternative 6 will occur within the existing MDT Right-of-Way; a portion of Alternative 2 will take place in the MRL Right-of Way. The majority of Alternative 8 will take place within the City Right-of-Way or City owned parks. However, a small section will occur with the Park County High School property and easement acquisition will be necessary.

Permitting requirements will be slightly different for each Alternative. No unusual permits are anticipated for Alternatives 3, 5, 7 and 8. Alternatives 2 and 9 will require work within MRL's Right-of- Way. The casing pipe required in Alternative 2 for the existing railroad crossing is believed to be of sufficient size and condition. Reusing the casing pipe is expected to decrease the required efforts, however some coordination with MRL will be required prior to construction. Alternatives 4 and 6 include work within MDT's Right-of-Way, coordination and permitting with MDT will be required prior to any work within Park Street (US Highway-89). All of Alternative 9 will take place within the MDT Right-of-Way; a small portion of Alternative 6 is within US HWY 89. Coordination with MRL is also expected with Alternative 4.

For these reasons Alternatives 3, 5, and 7 each receive a score of 6, indicating the most advantageous options with regard to technical and logistical feasibility. This is due to the minimal permitting and agency coordination anticipated. Minimal agency coordination is also expected for Alternative 8, however, acquisition of an easement will be require prior to

construction in Park County High School property. Therefore, Alternative 8 has been given a score of 5. Alternatives 4 and 9 will both occur within MDT Right-of-Way and will likely required some coordination with MRL. Because Alternative 4 a significant portion of Park Street and will require more traffic control, it has been scored with a 1; Alternative 9 has been given a score of 2. Alternative 6 has been given a score of 3 given the small portion of the proposed work occurring within MDT's Right-of-Way. Preliminary design anticipates using the existing casing pipe in Alternative 2, the required coordination with MRL is expected to be minimal. As such, Alternative 2 receives a score of 4. Technical and logistical feasibility scores are summarized in Table 5-2.

Table 5-2
Technical and Logistical Feasibly Scoring

Alternative	Score
2-N. 5th Street Capacity Increase	4
3-Northern Trunk Main Capacity Increase	6
4-Park Street Capacity Increase	1
5-W. Geyser Street Capacity Increase	6
6- E. Lewis Street Replacement	3
7-Green Acers Subdivision	6
8-Civic Center	5
9-Centennial Lift Station	2

b. Operations and Maintenance Complexity

Six of the remaining alternatives are expected to reduce O&M efforts for the City. The frequency of which the City must deal with blockage and clogs is expected to decrease with Alternatives 2, 3, 4, 5, 6, and 9. Each of alternative receives an equal score of 4 for Operations and Maintenance Complexity. Alternatives 7 and 8 include extensions to the existing collection system. The added infrastructure is expected to slightly increase required O&M. An O&M score of 2 has been assigned to Alternatives 7 and 8.

c. Public Health and Safety

Public health and safety is of the utmost concern to the City of Livingston and one a primary reason for this PER. Each of the remaining alternatives has been designed to protect public health and safety. Each alternative will increase the capacity of the collection system, prevent te public from coming into contact with raw wastewater, or both.

Hydraulic modeling, discussed previously, indicates Alternative 2 is essential due to existing capacity restriction. Sections of the current trunk main are at or nearing its available capacity with existing flows. The City is anticipating significant growth upstream of the N. 5th Street railroad crossing and associated trunk main. The SSA model predicted surcharge mains and flooded manholes with the 20-year design peak hour flows. Increasing capacity in this area will allow the collection system to safely convey raw sewage to the treatment facility. Additionally, replacement of the aging clay tile pipe will eliminate raw sewage from contaminating the local aquifer. For these reason, Alternative 2 is scored 8 with respect to public health and safety.

Alternatives 3, 4, and 5 have been designed to replace trunk mains with insufficient capacity.

Alternative 3 and 5 will also replace aging clay tile pipe and eliminate groundwater contamination in the area. Alternative 4 will replace PVC pipe constructed in the 1990s and is therefore likely not leaking raw wastewater to the same rate as the clay tile pipe. The capacity issues associated with Alternative 3 are more pressing then those of 4 or 5. As such, Alternatives 3, 4, and 5 are scored 7, 5, and 6, respectively.

Alternative 9 has been included to increase the capacity of the Centennial Lift Station and accommodate flows from anticipated commercial developments. The increased capacity of the lift station will help prevent future failures of the lift station and wastewater backing up into the upstream collection system. Alternative 9 has been assigned a score of 4 for public health and safety.

Capacity issues were not indicated in the SSA model for Alternative 6. Alternative 6 has been designed to eliminated aging mains. This project will protect the local aquifer and eliminate I/I within the project limits. Alternatives 7 and 8 are also included to protect the local aquifer by eliminating area drainfields. Capacity issues are considered more detrimental to public health and safety, as the likelihood of raw sewage backing up into residential homes, high traffic buildings, or flooding from manholes is increased with insufficient conveyance capacity. Therefore, Alternatives 6, 7 and 8 each receive a score of 1 for public health and safety.

Table 5-3 summarizes public health and safety scores.

Table 5-3
Public Health and Safety Scoring

Alternative	Score
2-N. 5th Street Capacity Increase	8
3-Northern Trunk Main Capacity Increase	7
4-Park Street Capacity Increase	5
5-W. Geyser Street Capacity Increase	6
6- E. Lewis Street Replacement	1
7-Green Acers Subdivision	1
8-Civic Center	1
9-Centennial Lift Station	4

d. Environmental Impacts

Each alternative has been designed to protect the surrounding environment and prevent raw sewage from contaminating the surrounding area. Alternative 4 will replace PVC sanitary mains along Park Street. Due to the age and material of this trunk main, it is unlikely that it is leaking to the same extent as the older clay tile pipes. Alternative 9 proposes upsizing a current lift station to provide excess capacity for future growth. There has been to evidence of the existing station leaking or contaminating the surrounding area. For these reasons, Alternatives 4 and 9 are not expected to benefit the environment to the same extent as the other Alternatives and has received a score of 1 for environmental impacts. The other viable alternatives are all expected to drastically decrease the amount of raw wastewater leaking from the collection system during times of low groundwater depth and/or prevent I/I during periods of high groundwater.

Alternatives 5 and 6 are both located entirely within the high groundwater area. These alternatives are expected to decrease the City's large I/I flow, saving on energy required for treatment and result in less groundwater contamination. For these reasons, Alternatives 5 and 6 have received an equal score of 7 with respect to environmental impacts; Alternatives 2 and 3 do not include main replacement within the high groundwater area; Alternatives 7 and 8 include abandoning area drainfields and connecting the affected areas to the municipal system. These 4 alternatives are all expected to have similar environmental impacts and have been given a score of 3. Environmental impact scoring is summarized in Table 5-4.

Table 5-4
Environmental Impacts Scoring

Alternative	Score
2-N. 5th Street Capacity Increase	3
3-Northern Trunk Main Capacity Increase	3
4-Park Street Capacity Increase	1
5-W. Geyser Street Capacity Increase	7
6- E. Lewis Street Replacement	7
7-Green Acers Subdivision	3
8-Civic Center	3
9-Centennial Lift Station	1

C. ALTERNATIVE RANKING

Each of the above criterion were assigned a scaling factor (SF) based on the City of Livingston's current needs and the similarity of the 8 viable alternatives within each criterion. Scaling factors are detailed below:

- Cost Analysis: **SF=1**
  - Total construction cost estimates vary from $474,000 to $4.3 million. However, the larger proposed projects may be scaled down or phased to accommodate the City's financial needs.
- Technical and Logistical Feasibility: **SF=1**
  - Each alternative is considered technically feasible. The logistical aspects of each alternative vary slightly, however are all reasonable. None of the anticipated permitting requirements, agency coordination or land acquisition is expected to cause construction delays.
- Operations and Maintenance Complexity: **SF=3**
  - The City of Livingston, like many Montana cities, is a small community with limited manpower and resources. As such, simple O&M procedures are a priority.
- Public Health and Safety: **SF=4**
  - Public health and safety is of the utmost concern for any municipal wastewater system and one of the driving force behind this planning document.
- Environmental Impacts: **SF=3**
  - The City of Livingston is situated on the banks of the Yellowstone River and a popular recreational area. The quality of the local aquifer is a priority in the planning document and future improvement projects. Additionally, the large volume of I/I is affected the energy efficiency of the wastewater system. Alternatives that will decrease the City's required energy consumption should be

prioritized.

The alternative scores for each criterion were multiplied by the corresponding SF and then summed to calculate the total score for each remaining alternative. As previously mentioned, the highest score indicates the most desirable option. The detailed decision matrix is available in Appendix 5. Chart 5-1 summarizes the results.

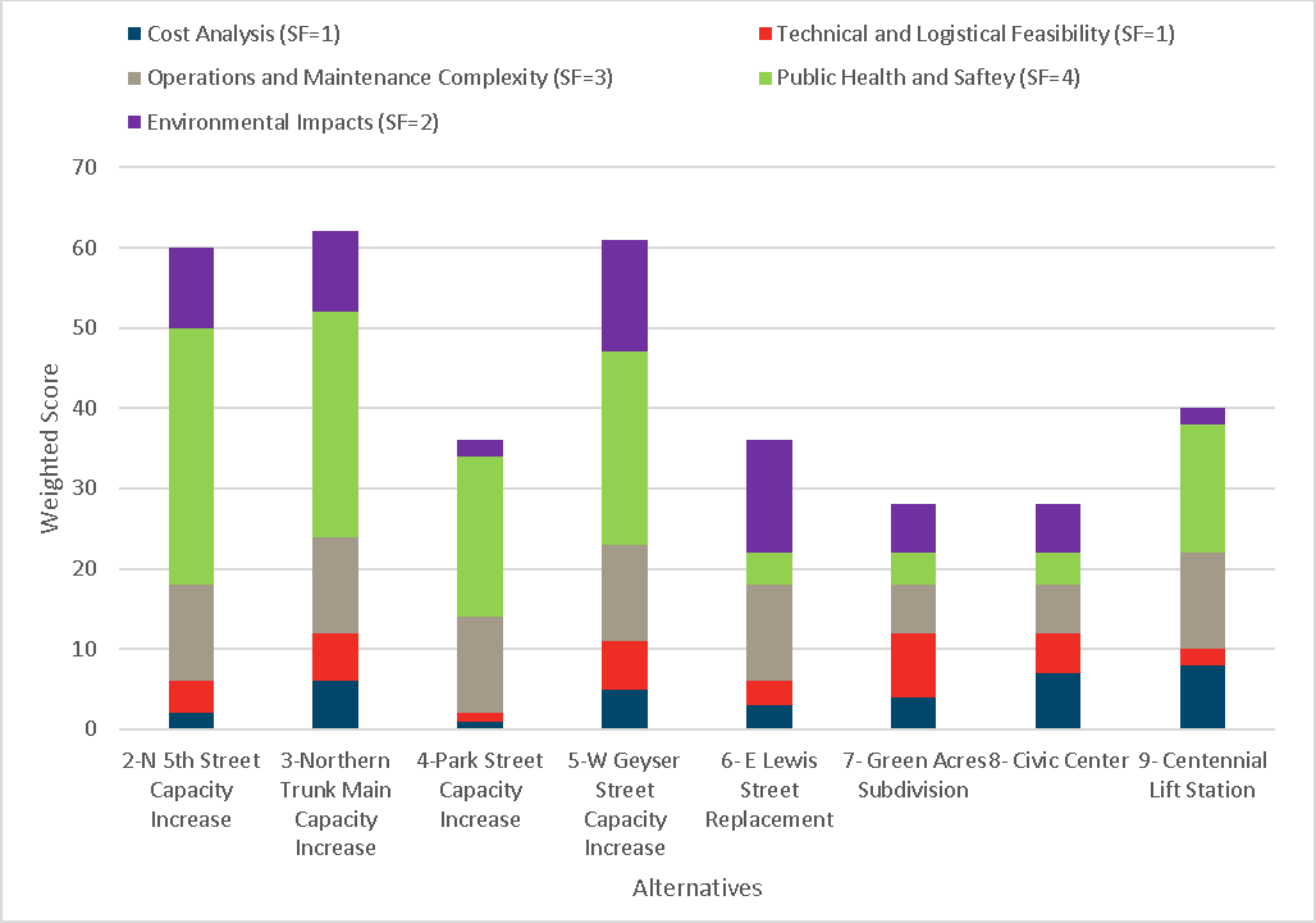

Chart 5-1: Alternative Scoring

Alternative 2, 3, and 5 receive similar scores with 60, 62, and 61 respectively. This suggest these Alternatives are the most beneficial to the City. Other alternatives scored between 28 and 40, indicating less advantageous projects.

6.0 PROPOSED PROJECT

A. PRELIMINARY PROJECT DESIGN

The evaluation presented in Chapters 4 and 5 resulted in a prioritized list of collection system improvements. The projects were prioritized based on cost, feasibility, required operations and maintenance (O&M), public health and safety, and environmental impacts. The projects are prioritized as follows:

- Priority 1: Northern Trunk Main Capacity Increase
- Priority 2: W. Geyser Street Capacity Increase
- Priority 3: N. 5th Street Capacity Increase
- Priority 4: Centennial Lift Station
- Priority 5: Park Street Capacity Increase
- Priority 6: E. Lewis Street Replacement
- Priority 7: Green Acres Subdivision (tie)
- Priority 7: Civic Center (tie)

Design of each project will be in accordance with DEQ Guidelines as set forth in Circular DEQ-2: *Design Standards for Wastewater Facilities*, Montana Public Works Standard Specifications and generally accepted engineering principles. New sewer mains will meet the following minimum standards:

- The minimum pipe size will be 8-inches
- Mains will not be buried less than 4 feet from to the top of the pipe without insulation
- Minimum slope requirements listed in Circular DEQ-2 will be maintained.
- The mains will be installed with straight alignment between manholes.

Upgrades to the Centennial lift station will be in accordance with all requirements detailed in Circular DEQ-2 including, but not limited to

- Redundant pumps, each capable of handling project peak hour flows
- Maximum fill time of 30 minutes
- Fluid velocity between 3 ft/sec and 8 ft/sec

Additional regulatory requirements will be addressed during final design and construction. Figure 6-1 summarizes the proposed improvement locations.

N

0 800' 1,600' 2,400'

SCALE

PRIORITY 7 (TYP.)

WINEGLASS LANE

WATER RECLAMATION FACILITY

US HIGHWAY 89 S

LHC LIFT STATION

INTERSTATE-90

N M STREET

E. GALLATIN STREET

PRIORITY 1 (TYP.)

BLUE HERON DR

N G STREET

N H STREET LIFT STATION

E. PARK STREET

S M STREET

E LEWIS STREET

PRIORITY 6 (TYP.)

PRIORITY 5 (TYP.)

SCENIC TRL

N 9TH STREET

N YELLOWSTONE STREET

N 2ND STREET

S H STREET

S D STREET

S MAIN STREET

E CLARK STREET

FLESHMAN CREEK LIFT STATION

N 7TH STREET

N 13TH STREET

W MONTANA STREET

STAR ROAD

CONSTELLATION DRIVE

PLEIADES PL

SUN AVE

PRIORITY 3 (TYP.)

US HIGHWAY 10 W

S 6TH STREET

W GEYSER STREET

PRIORITY 7 (TYP.)

PRIORITY 2 (TYP.)

S 10TH STREET

W CRAWFORD STREET

9TH STREET LIFT STATION

CRAWFORD LIFT STATION

CLINIC LIFT STATION

W PARK STREET

S 13TH STREET

ROGERS LANE

ROBIN LANE

CENTENIAL LIFT STATION

PRIORITY 4

INTERSTATE-90

LOVES LANE

NOT FOR CONSTRUCTION

REV	DATE	REVISION

TD&H Engineering
406.586.0277 • tdhengineering.com
234 E. BABCOCK ST., SUITE 3 • BOZEMAN, MONTANA 59715

DRAWN BY:	NMR
DESIGNED BY:	
QUALITY CHECK:	
DATE:	06-03-2019
JOB NO.	B15-081
FIELDBOOK	

LIVINGSTON COLLECTION SYSTEM PER
LIVINGSTON, MONTANA

PRIORITIZED IMPROVEMENTS

FIGURE 6-1.DWG

FIGURE 6-1

B. Permit Requirements and Environmental Impacts

Unusual or difficult permitting requirements are not anticipated for any of the proposed projects. A Storm Water Pollution Prevention Plan (SWPPP) and a Notice of Intent (NOI) must prepared and submitted to DEQ for approval prior to construction of all proposed projects. Additionally, the N. 5th Street Capacity Increase and Centennial Lift Station upgrades will require Montana Rail Link (MRL) permits to work within the Railroad's Right-of-Way. Permits through the Montana Department of Transportation (MDT) will be required for the E. Lewis Street Replacement project. Coordination with both MDT and MRL is anticipated for the Park Street Capacity Increase and Centennial Lift Station improvement project.

Letters regarding environmental issues were sent to the following agencies requesting comments on the proposed project:

- Department of Environmental Quality Permitting and Compliance Division
- Montana Department of Fish, Wildlife and Parks
- Department of Natural Resources and Conservation
- Montana DNRC
- State Historic Preservation Office
- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service
- Bureau of Indian Affairs
- Bureau of Land Management
- U.S. Environmental Protection Agency

A copy of these letters as well as any responses from the environmental agencies is included in Appendix 1.

C. SUSTAINABILITY CONCERNS

a. Water and Energy Efficiency

Replacing aging infrastructure will eliminate raw sewage leaking from the pipe when the groundwater table is low. This will lessen any groundwater contamination in the area. During the spring and early summer, the new mains will prevent groundwater from entering the collection system. This will increase the energy efficiency of the WRF.

Lift station improvements, along with abandonment of the Civic Center and Green Acres drainfields, are not expected to significantly affect the water and energy efficiency of the Town's wastewater system.

b. Green Infrastructure

A SWPPP will be required prior to construction to mitigate storm water runoff from disturbed areas. After construction is complete, storm water mitigation will no longer be applicable.

c. Other

There are not other sustainability concerns associated with the proposed projects.

D. TOTAL PROJECT COST ESTIMATES

Estimated project costs for each priority are presented in Table 6-1. Each of the total project costs include construction costs, a contingency and an additional 25% for engineering, administration, and legal. These costs estimates are based on limited design detail, given the inherent uncertainty associated with preliminary estimates such as these, a contingency is included. Non-construction costs including, but not limited to, engineer, survey, geotechnical evaluation, and project administration are accounted for in the additional 25%.

Table 6-1
Project Cost Estimate Summary

Priority	Project Name	Total Estimated Cost
1	Northern Trunk Main Capacity Increase	$1,291,000
2	W Geyser Street Capacity Increase	$1,992,000
3	N 5th Street Capacity Increase	$3,117,000
4	Centennial Lift Station	$474,000
5	Park Street Capacity Increase	$4,332,000
6	E. Lewis Street Replacement	$2,709,000
7 (tie)	Green Acres Subdivision	$2,260,000
7 (tie)	Civic Center	$616,000

E. ANNUAL OPERATING BUDGET

Annual operating costs are anticipated to decrease as a result of each of the projects prioritized 1 through 6. Replacement of undersized, aging, and defective mains will decrease the occurrence of pipe blockages. Additionally, replacing high risk mains, particularly in high groundwater areas, will decrease the flows associated with inflow and infiltration (I/I), ultimately decreasing energy consumption. Minor impacts to the Town's O&M procedures is expected to result from the added infrastructure associated with the Green Acres and Civic Center alternatives.

F. FUNDING STRATEGIES

The following provides a general discussion of the grant and loan funds available. The Montana Department of Commerce (MDOC), which encompasses the Treasure State Endowment Program (TSEP) and Community Development Block Grant (CDBG) Programs, require a community set their utility fees at or greater than published target rates in order to be eligible for grant funds. Target rates are based on the Median Household Income (MHI) for a community which is determined by the Census Bureau. In the case of the City of Livingston, the 2015 American Community Survey (ACS) data determined the MHI was $40,619. Target rates for systems that supply both water and sewer are established by dividing the MHI by twelve months of the year and multiplied by the MDOC factor of 0.023.

$$(\$40,619/12)*0.023=\$77.85$$

The above formula sets the target rates for water and sewer combined for the City of Livingston

at $77.85 per equivalent dwelling unit (EDU) per month. Single family homes and small commercial users generally equate to one EDU each

Details regarding possible funding sources follow:

a. Montana Renewable Resource Grant and Loan (RRGL)-Department of Natural Resource and Conservation (DNRC)

The Montana legislature established the RRGL Program to enhance Montana's renewable resources. The program is administered by the Resource Development Bureau of the DNRC. Funds are appropriated directly through the legislature based on recommendations from DNRC. The grant funding limits are $125,000 pre project. The loan amount limit is the maximum amount that can be borrowed by the local government and repaid by issuing bonds. The grant program is a viable option for the City of Livingston. Preliminary review of the PER indicates the proposed improvements in Livingston could result in a competitive RRGL application.

b. Treasure State Endowment Program (TSEP)

This State-funded program is administered by the MDOC. The funding is derived from a portion of the Coal Tax Trust Fund interest. The TSEP program provides matching grants for qualifying projects for up to $750,000. In order to qualify for the maximum grant of $750,000 the applicant's user rates must be 150% of the community's target rate upon completion of the proposed project. If the user rates are projected to be between 125% and 150% of the target rate the applicant may apply for a maximum grant of $625,000. Applicants with user rates under 125% of the target rate can apply for a maximum of $500,000.

Because the City of Livingston provides both water and sewer services, the target is to be compared to the water and sewer rates combined. Table 6-2 summarized the TSEP required combined water and sewer rates. A local match of 50% of the project is required. Cash, loans or other grants can qualify as matching funds.

Table 6-2
TSEP Required User Rates

User Rate[(1)] (per EDU)	Available TSEP Funds
$77.85	$500,000
$97.70	$625,000
$116.78	$750,000
(1) Target rates based on combined water and sewer	

Applications for the TSEP program are accepted every other year by the MDOC and submitted to the legislature for review and approval for funding. The applications are accepted in May of the year prior to the next legislative session (even numbered years). TSEP is a viable source of funding for the recommended improvements and therefore should be pursued.

c. Community Development Block Grant (CDBG)

Montana's CDBG program is a federally funded competitive grant program intended to assist

communities of less than 50,000 people with primary benefits to low and moderate income (LMI) persons. The funds are frequently pooled with other federal, state or local resources to improve infrastructure including water and wastewater facilities. The maximum grant awarded for a public facility project is $450,000.

In order to qualify for a CDGB grant, the community must have an LMI greater than 51%. According to the 2015 ACS, the City of Livingston has an LMI of 45.5% and therefore does not currently qualify for CDBG funding. Should the City decide to challenge their non-eligible status, an income survey can be completed to potentially verify a higher LMI.

d. State Revolving Fund Loan (SRF)

The SRF Program was initiated by the Montana legislature for water and wastewater projects using federal seed money. This program provides at or below market interest rates to qualifying entities. The loans are funded using capitalization grants from EPA and are matched with state issued general obligation bonds.

In order to be eligible for this type of funding, the project must be added to the SRF Project Priority List and Intended Use Plan. The annual process to identify projects eligible for SRF funds begins in July. Early notification by the applicant is important to be included on the priority list. A project remains on the list until it has been completed, regardless of the funding sources used to finance the project.

SRF loans terms are generally 3% for up to twenty years. A revenue bond requires debt service and coverage of 125%. Loan amounts are limited to the borrower's ability to pay and the amount of SRF funds available. If the user rates are higher than the TSEP target rates, the community is eligible for loan forgiveness.

e. US Department of Agriculture Rural Development (RD)

The U.S. Department of Agriculture Rural Development (RD) program provides grants and loans to communities of less than 10,000 people. These funds may be used to construct, repair, improve, expand, or modify rural water and sewer facilities. Priority is given to communities of less than 5,500 in population. Funds are available for up to 75% of the eligible facility costs. Eligible communities are those that are unable to obtain financing at reasonable rates and terms elsewhere. The maximum term of RD loans is 40 years or the useful life of the facility, whichever is less. All loans must be secured. Bonds or notes pledging taxes, assessments, or revenues may be accepted as security if they meet statutory requirements. Grants are only available if they are required to reduce the rates to a target level commensurate with the amounts residents in other similar communities pay. This rate is typically set at approximately one percent of the median income.

Rural Development operates an open application cycle and applications may be received and funded at any time during the year. Each project is given a priority score based on income, population, health and other considerations. The applicants with the highest score are selected to proceed with the application process.

7.0 CONCLUSIONS AND RECOMMENDATIONS

A large portion of the City of Livingston's existing gravity collection system is considered high-risk. High-risk mains are defined as any main that is 6-inches in diameter, over 50 years old, and/or clay tile pipe. These mains are more prone to defects such as root intrusions, blockages, cracks, and offset joints. Given the high groundwater in and around the City, the high-risk mains and suspected defects are likely contributing to City's elevated inflow and infiltration (I/I) rates. This is requiring additional energy consumption to transport and treat the I/I. During times of low groundwater these mains are likely leaking raw wastewater, contaminating the local aquifer. The City obtains its municipal drinking water from a series of 6 groundwater wells. As such, the quality of the local aquifer is of utmost importance to the City and its residents. Additionally, two nearby developments use septic tanks and drainfields to treat the generated wastewater. These system are not able to treat wastewater to the same extent as the City's municipal treatment facility. Additionally, individual drainfields are not monitored for compliance the way a municipal system is. This drainfields are introducing unnecessary levels of pollutants to the surrounding environment. Livingston is located on the banks of the Yellowstone River. This section of the River is a popular recreational area with many people spending time floating, fishing and swimming near the City. To protect the surrounding environment, the residents of Livingston and outdoor enthusiasts, the defective and leaking mains must be replaced and the surrounding drainfields need to be connected to the City's system.

Autodesk's Storm and Sanitary Analysis (SSA) software was used to evaluate the conveyance capacity of the existing gravity infrastructure. A wide range of capacity issues were observed with modeled existing flows. Minor capacity issues were noted along E. Park Street, W. Geyser Street, and E. Gallatin Street. Sever capacity inadequacies were noted upstream of and including the N. 5th Street railroad crossing. The noted insufficient capacities were made worse by the additional flows included in the projected 20-year model. Furthermore, rapid commercial development is expected downstream of the Centennial Lift Station. To serve the anticipated growth, the lift station must be upsized.

Eight improvements were recommended and prioritized as a result of this PER. The recommended improvements were selected to increase capacity in deficient areas, repair and replace high-risk mains, and eliminate area drainfields. Projects costs range from $474,000 to $4.3 million. The larger projects may be scaled down to fit the City's financial needs if necessary. These projects could result in competitive grant applications for a number of the funding options discussed in Chapter 6. It is recommended that the City pursue financial aid through grant and low interest loans.

8.0 REFERENCES

The following references were utilized in the preparation of the PER:

1. Department of Environmental Quality (DEQ) Circular 2, Design Standards for Wastewater Facilities
2. Department of Environmental Quality (DEQ) Circular 4, Montana Standards for Subsurface Wastewater Treatment Systems
3. USDA Natural Resources Conservation Service (NRCS) Web Soil Survey http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm
4. Montana Natural Heritage Program website, http://mtnhp.org, February 2019
5. Montana Natural Resource Information System (NRIS), http://nris.mt.gov/
6. Montana Department of Commerce, Census and Target Rate 2015 Info, American Communities Survey, http://comdev.mt.gov, February 2019
7. "QuickFacts." *U.S. Census Bureau QuickFacts: Livingston city, Montana*, www.census.gov/quickfacts/fact/table/livingstoncitymontana /PST045216
8. Livingston Water Preliminary Engineering Report, TD&H Engineering, July 2014
9. City of Livingston Water Master Plan (Draft), TD&H Engineering, 2019
10. Wastewater Facility Preliminary Engineering Report, Stahly Engineering, 2014
11. Civic Center Preliminary Engineering Report (Draft), TD&H Engineering, 2019
12. City of Livingston Growth Policy, 2017
13. City of Bozeman Design Standards
14. Autodesk's Storm and Sanitary Analysis, 2016
15. City of Livingston Geographical Information System
16. 2014 CIP Project, City of Livingston, Park County, Montana, Record Drawings Stahly Engineering 2014
17. 2012 B Street Project, City of Livingston, Park County, Montana, Record Drawings, Stahly Engineering, 2012
18. North Tenth Street Homes Utility Service Connection, City of Livingston, Montana, Octagon Consulting Engineering, LLC. Record Drawings, 2017
19. Sewer and Water Main Replacement, City of Livingston, Park County, Montana, Record Drawings, Stahly Engineering, 2011
20. Miles Street Sewer Extension, Livingston, Montana, Record Drawings, CTA, 2014
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Engineer, 2015

22. City of Livingston 2018 CIP, Record Drawings , TD&H Engineering, 2018
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24. Discovery Vista Subdivision Phase 1B Road, Sewer and Water Improvements, Livingston, Montana, Record Drawings, Madison Engineering, 2017
25. Brookstone Major Subdivision, PW & SS Utility Extensions, Record Drawings, Octagon Consulting Engineering, LLC, 2017
26. Livingston Commercial Site Infrastructure Improvements, Construction Plans, Hyalite Engineering, 2016
27. Fleshman Creek Restoration, Park County, Montana, Record Drawings, CTA, 2014
28. Park County Fairgrounds Sanitary Sewer Extension, Park County, Montana, 100% Review Plans, CTA 2014
29. Livingston Health W&S Extension Ph2, Livingston, Montana, Record Drawings, CTA, 2015
30. Livingston Health Center Sewer Main, Off-Site Utility Extensions, Livingston, Montana, Engineering Report, CTA, 2013
31. Northtown Subdivision, Phase 1, Livingston, Montana, Preliminary Plans, C&H Engineering and Survey, Inc. 2018
32. Acreville Commercial Site Infrastructure Improvements, Livingston, Montana, Construction Drawings, Hyalite Engineers, 2017
33. City of Livingston 2019 CIP, Livingston, MT, Construction Drawings, TD&H Engineering, 2019
34. Environmental Report Categorical Exclusion Prepared for USDA Rural Development, Livingston Water Reclamation Facility Upgrades, Livingston, MT, AE2S December 2016

APPENDICES

APPENDIX 1
Environmental Resources

Montana Natural Heritage Program Environmental Summary

U.S. FWS Listed Species of Park County

Agency Consultation

Population Data

Approved Growth Rate Correspondence

MONTANA
Natural Heritage
Program

P.O. Box 201800 • 1515 East Sixth Avenue • Helena, MT 59620-1800 • fax 406.444.0266 • tel 406.444.5354 • http://mtnhp.org

March 22, 2019

Crystal Kramer
TD & H Engineering
234 East Babcock
Bozeman, Montana 59715

Dear Crystal,

Thank you for your request for Natural Heritage information for the City of Livingston PER in Park County. Included with this letter is an Environmental Summary report PDF and a companion Excel workbook summarizing information managed in the Montana Natural Heritage Program's (MTNHP) databases for: (1) Species of Concern occurrences; (2) other observed species without Species Occurrences; (3) other species potentially present based on their range, presence of associated habitats, or predictive distribution model output if available; (4) structured surveys (organized efforts following a protocol capable of detecting one or more species); (5) land cover mapped as ecological systems; (6) wetland and riparian mapping; (7) land management categories; (8) biological reports associated with plant and animal observations; and (9) invasive and pest species documented in the area. The PDF report contains introductory materials and limitations associated with the use of each of these data types, a list of additional information resources, data use terms and conditions, and suggested contacts. The Excel workbook contains worksheets for each data type that can be easily sorted to summarize particular information needs. In addition to these materials, we have included a compilation of one-page snapshots containing general description, habitat, spatial and temporal distribution, and conservation status information for each species listed in the species occurrence, other observed species, and other potential species sections of the Environmental Summary report. These three field guide compilations are excerpted from the full accounts found on the Montana Field Guide http://fieldguide.mt.gov for general reference use and, if desired, as appendices to environmental review documents.

Please keep in mind the following when using and interpreting the enclosed information:

(1) This information is intended for distribution or use only within your department, agency, or business. Please see the Data Use Terms and Conditions in the Environmental Summary report PDF for additional guidelines.

(2) Our minimum search area for standard information requests consists of the requested area buffered by an additional mile in order to capture records that may be immediately adjacent to the requested area. Please let us know if a buffer greater than 1 mile would be of use to your efforts.

(3) Additional information on animal, plant, and lichen species and ecological systems in Montana is available on the Montana Field Guide at http://fieldguide.mt.gov/

(4) In addition to the information you receive from us, we encourage you to contact state, federal, and tribal resource management agencies in the area where your project is located (see Environmental Summary report PDF).

In order to help us improve our services to you, we invite you to take a simple survey. The survey is intended to gather some basic information on the value and quality of the information and services you recently received from the Montana Natural Heritage Program. The survey is short and should not take more than a few minutes to complete. All information will be kept confidential and will be used internally to improve the delivery of services and to help document the value of our services. Use this link to go to the survey: http://www.surveymonkey.com/s/RYN8Y8L.

I hope the enclosed information is helpful to you. Please feel free to contact me at the phone or email address below if you have any questions, require additional information, or have suggestions for how we could improve our information resources.

Sincerely,

Bryce A. Maxell
Montana Natural Heritage Program
(406) 444-3989
bmaxell@mt.gov

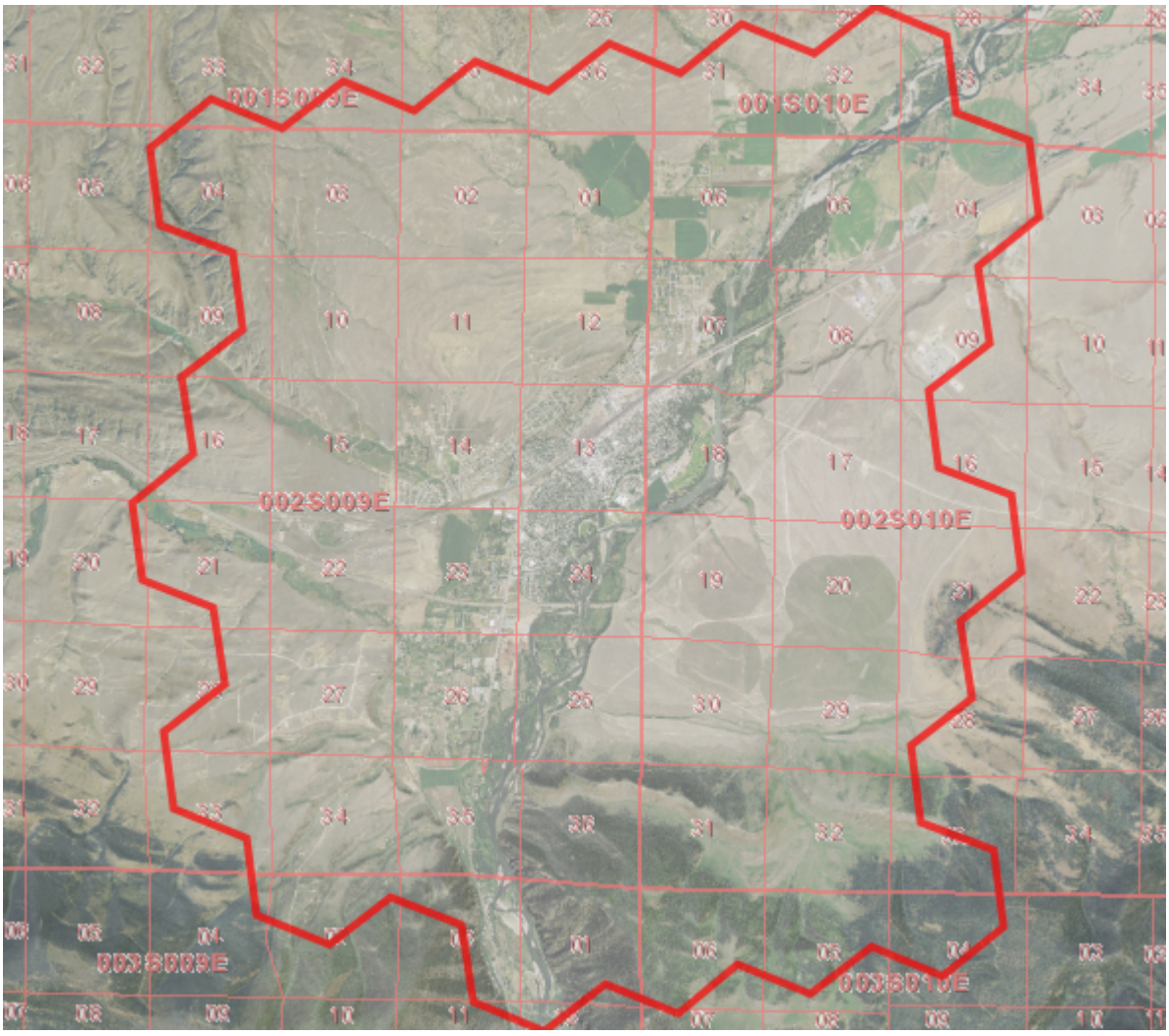
Environmental Summary

MONTANA
Natural Heritage Program

1515 East 6th Avenue
Helena, MT 59620
(406) 444-0241
mtnhp.org

Latitude	Longitude
45.59444	-110.48660
45.71469	-110.63445

Summarized by:
19mtsl0003 CityOfLivingstonPER
(Custom Area of Interest)



Suggested Citation
Montana Natural Heritage Program. Environmental Summary Report.
for Latitude 45.59444 to 45.71469 and Longitude -110.48660 to -110.63445. Retrieved on 3/22/2019.

The Montana Natural Heritage Program is a program of the Montana State Library's Natural Resource Information System. It is operated as a special program under the Office of the Vice President for Research and Creative Scholarship at the University of Montana, Missoula.

The Montana Natural Heritage Program is part of NatureServe – a network of over 80 similar programs in states, provinces and nations throughout the Western Hemisphere, working to provide comprehensive status and distribution information for species and ecosystems.

Montana Natural Heritage Program · Montana State Library · University of Montana · NatureServe

Table of Contents

Introduction to Environmental Summary Report

The Environmental Summary report for your area of interest consists of introductory and related materials in this PDF and an Excel workbook with worksheets summarizing information managed in the Montana Natural Heritage Program's (MTNHP) databases for: (1) species occurrences; (2) other observed species without Species Occurrences; (3) other species potentially present based on their range, presence of associated habitats, or predictive distribution model output if available; (4) structured surveys (organized efforts following a protocol capable of detecting one or more species); (5) land cover mapped as ecological systems; (6) wetland and riparian mapping; (7) land management categories; and (8) biological reports associated with plant and animal observations. In order to do this in a consistent manner across Montana and allow for rapid delivery of summaries, we have intersected this information with a uniform grid of hexagons that have been used for planning efforts across the western United States (e.g. Western Association of Fish and Wildlife Agencies - Crucial Habitat Assessment Tool). Each hexagon is one square mile in area and approximately one kilometer in length on each side. Summary information for each data layer is then stored with each hexagon and those summaries are added up to an overall summary for the report area you have requested. Users should be aware that summaries do not correspond to the exact boundaries of the polygon they have specified, but instead are a summary across all hexagons intersected by the polygon they specified.

In presenting this information, MTNHP is working towards assisting the user with rapidly assessing the known or potential species and biological communities, land management categories, and biological reports associated with the report area. We remind users that this information is likely incomplete and may be inaccurate as surveys to document species are lacking in many areas of the state, species' range polygons often include regions of unsuitable habitat, methods of predicting the presence of species or communities are constantly improving, and information is constantly being added and updated in our databases. **Field verification by professional biologists of the absence or presence of species and biological communities in a report area will always be an important obligation of users of our data. Users are encouraged to only use this environmental summary report as a starting point for more in depth analyses and are encouraged to contact state, federal, and tribal resource management agencies for additional data or management guidelines relevant to your efforts. Please see the Appendix for introductory materials to each section of the report, additional information resources, and a list of relevant agency contacts.**

MONTANA Natural Heritage Program

Aprogram of the **Montana State Library's Natural Resource Information System** operated by the **University of Montana**.

Legend

Model Icons	Habitat Icons	Range Icons	Num Obs
N Suitable (native range)	C Common	I Introduced	Count of obs with 'good precision' (<=1000m)
O Optimal Suitability	O Occasional	Y Year-round	+ indicates additional 'poor precision' obs (1001m-10,000m)
M Moderate Suitability		S Summer	
L Low Suitability		W Winter	
I Suitable (introduced range)		M Migratory	
		H Historic	

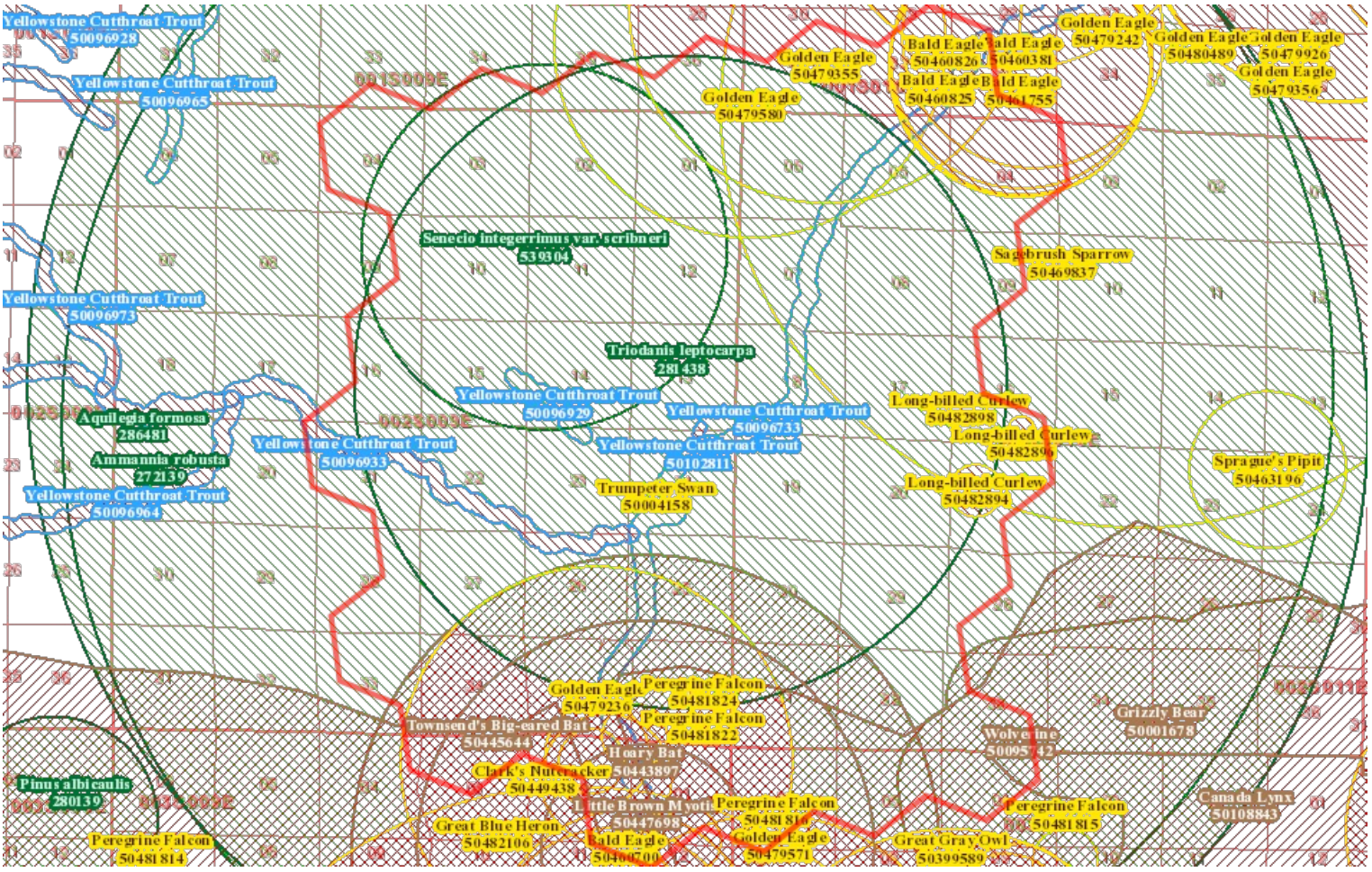
Latitude	Longitude
45.59444	-110.48660
45.71469	-110.63445

Native Species

Summarized by: **19mtsl0003 CityOfLivingstonPER** *(Custom Area of Interest)*

Filtered by:

MT_Status='Species of Concern', 'Special Status', 'Important Animal Habitat', 'Potential SOC'



Species Occurrences

	USFWS Sec7	# SO	# Obs	Predictive Model	Associated Habitat	Range
F - Yellowstone Cutthroat Trout *(Oncorhynchus clarkii bouvieri)* SOC		4	7 +		Not Assigned	Y H

View in Field Guide **View Predicted Models** **View Range Maps**

Species of Concern - Native Species Global: **G4T4** State: **S2** USFS: **Sensitive - Known on Forests (CG)** BLM: **SENSITIVE** FWP SWAP: **SGCN2**

Delineation Criteria Stream reaches and standing water bodies where the species presence has been confirmed through direct capture or where they are believed to be present based on the professional judgement of a fisheries biologist due to confirmed presence in adjacent areas. In order to reflect the importance of adjacent terrestrial habitats to survival, stream reaches are buffered 100 meters, standing water bodies greater than 1 acre are buffered 50 meters, and standing water bodies less than 1 acre are buffered 30 meters into the terrestrial habitat based on PACFISH/INFISH Riparian Conservation Area standards. (Last Updated: May 08, 2015)

Predictive Models: N 42% Suitable (native range) (deductive)

B - Bald Eagle *(Haliaeetus leucocephalus)* SSS		6	23 +			Y

View in Field Guide **View Predicted Models** **View Associated Habitat** **View Range Maps**

Special Status Species - Native Species Global: **G5** State: **S4** USFWS: **DM; BGEPA; MBTA; BCC10; BCC11; BCC17**
USFS: **Sensitive - Known on Forests (BD, BRT, CG, HLC, KOOT, LOLO)** BLM: **SENSITIVE** PIF: **2**

Delineation Criteria Confirmed nesting area buffered by a minimum distance of 2,000 meters in order to be conservative about encompassing the breeding territory and area commonly used for renesting and otherwise buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. (Last Updated: Oct 19, 2018)

Predictive Models: O 9% Optimal (inductive), M 27% Moderate (inductive), L 36% Low (inductive)
Associated Habitats: C 18% Common, O 42% Occasional

B - Golden Eagle *(Aquila chrysaetos)* SOC		5	9 +			Y

View in Field Guide View Predicted Models View Associated Habitat View Range Maps

Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **BGEPA; MBTA; BCC17** BLM: **SENSITIVE** FWP SWAP: **SGCN3**

Delineation Criteria Confirmed nesting area buffered by a minimum distance of 3,000 meters in order to be conservative about encompassing the entire breeding territory and area commonly used for renesting and otherwise buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. (Last Updated: Dec 20, 2018)

Predictive Models: O 2% Optimal (inductive), M 78% Moderate (inductive), L 20% Low (inductive)
Associated Habitats: C 58% Common, O 6% Occasional

B - Clark's Nutcracker *(Nucifraga columbiana)* SOC — 1 — 1 — Y

View in Field Guide View Predicted Models View Associated Habitat View Range Maps

Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA** USFS: **Species of Conservation Concern on Forests (FLAT)** FWP SWAP: **SGCN3** PIF: **3**

Delineation Criteria Observations with direct evidence of breeding activity or indirect evidence of breeding activity between early March and mid-July within forested habitats containing Whitebark Pine (Pinus albicaulis), Limber Pine (Pinus flexilis), or Ponderosa Pine (Pinus ponderosa). Observations are buffered by a minimum distance of 1,000 meters in order to encompass the spring/summer breeding territory size reported for the species or the locational uncertainy of the observation to a maximum distance of 10,000 meters. (Last Updated: Oct 19, 2018)

Predictive Models: O 2% Optimal (inductive), M 40% Moderate (inductive), L 56% Low (inductive) **Associated Habitats:** C 19% Common

B - Peregrine Falcon *(Falco peregrinus)* SOC — 4 — 31 + — Y

View in Field Guide View Predicted Models View Associated Habitat View Range Maps

Species of Concern - Native Species Global: **G4** State: **S3** USFWS: **DM; MBTA; BCC10; BCC11; BCC17** USFS: **Sensitive - Known on Forests (BD, BRT, CG, HLC, KOOT, LOLO)** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2**

Delineation Criteria Confirmed nesting area buffered by a minimum distance of 500 meters in order to encompass the area around the nest known to be defended by adults as well as the minimum distance reported between nests. Otherwise the nest area is buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. (Last Updated: Jan 14, 2019)

Predictive Models: O 2% Optimal (inductive), M 2% Moderate (inductive), L 36% Low (inductive) **Associated Habitats:** C 38% Common, O 7% Occasional

M - Hoary Bat *(Lasiurus cinereus)* SOC — 1 — 9 — S M

View in Field Guide View Predicted Models View Associated Habitat View Range Maps

Species of Concern - Native Species Global: **G3G4** State: **S3** FWP SWAP: **SGCN3**

Delineation Criteria Confirmed area of occupancy based on the documented presence (mistnet captures, definitively identified acoustic recordings, and definitively identified roosting individuals) of adults or juveniles during the active season. Point observation location is buffered by a minimum distance of 3,500 meters in order to be conservative about encompassing the maximum reported foraging distance for the congeneric Lasiurus borealis and otherwise buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. (Last Updated: Oct 18, 2018)

Predictive Models: M 67% Moderate (inductive), L 33% Low (inductive) **Associated Habitats:** C 77% Common, O 19% Occasional

M - Little Brown Myotis *(Myotis lucifugus)* SOC — 1 — 1 — Y

View in Field Guide View Predicted Models View Associated Habitat View Range Maps

Species of Concern - Native Species Global: **G3** State: **S3** FWP SWAP: **SGCN3**

Delineation Criteria Confirmed area of occupancy based on the documented presence (mistnet captures, definitively identified acoustic recordings, or definitively identified roosting individuals) of adults or juveniles. Point observation location is buffered by a distance of 1,600 meters in order to encompass the greater than 1,500 meters foraging distance reported for the species in New Brunswick, Canada and otherwise buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. When cave locations are involved, point observations are mapped in the center of a one-square mile hexagon to protect the exact location of the cave entrance as per the Federal Cave Resource Protection Act and associated regulations (U.S. Code Title 16 Chapter 63, Code of Federal Regulations Title 43 Subtitle A Part 37). The outer edges of the hexagon are then buffered by a distance of 1,600 meters and otherwise by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. All of the one-square mile hexagons intersecting this buffered area are presented as the Species Occurrence record. (Last Updated: Oct 19, 2018)

Predictive Models: M 62% Moderate (inductive), L 38% Low (inductive) **Associated Habitats:** C 83% Common, O 17% Occasional

M - Townsend's Big-eared Bat *(Corynorhinus townsendii)* SOC — 1 — 2 — Y

View in Field Guide View Predicted Models View Associated Habitat View Range Maps

Species of Concern - Native Species Global: **G4** State: **S3** USFS: **Sensitive - Known on Forests (BD, BRT, CG, HLC, KOOT, LOLO)** BLM: **SENSITIVE** FWP SWAP: **SGCN3**

Delineation Criteria Confirmed area of occupancy based on the documented presence (mistnet captures, definitively identified acoustic recordings, and definitively identified roosting individuals) of adults or juveniles. Point observation location is buffered by a distance of 4,500 meters in order to encompass the 95% confidence interval for nightly foraging distance reported for the species in California and otherwise by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. When cave locations are involved, point observations are mapped in the center of a one-square mile hexagon to protect the exact location of the cave entrance as per the Federal Cave Resource Protection Act and associated regulations (U.S. Code Title 16 Chapter 63, Code of Federal Regulations Title 43 Subtitle A Part 37). The outer edges of the hexagon are then buffered by a distance of 4,500 meters and otherwise by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. All of the one-square mile hexagons intersecting this buffered area are presented as the Species Occurrence record. (Last Updated: Oct 19, 2018)

Predictive Models: M 58% Moderate (inductive), L 36% Low (inductive) **Associated Habitats:** C 69% Common, O 14% Occasional

B - Long-billed Curlew *(Numenius americanus)* SOC — 4 — 11 + — S M

View in Field Guide View Predicted Models View Associated Habitat View Range Maps

Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA; BCC10; BCC11; BCC17** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2**

Delineation Criteria Confirmed breeding area based on the presence of a nest, chicks, or territorial adults during the breeding season. Point observation location is buffered by a minimum distance of 200 meters in order to approximate the breeding territory size reported for the species in Idaho and otherwise is buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. (Last Updated: Jan 25, 2019)

Predictive Models: M 36% Moderate (inductive), L 53% Low (inductive) **Associated Habitats:** C 39% Common, O 16% Occasional

B - Great Blue Heron *(Ardea herodias)* SOC — 1 — 3 — Y S M

View in Field Guide View Predicted Models View Associated Habitat View Range Maps

Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA** FWP SWAP: **SGCN3**

Delineation Criteria Confirmed nesting area buffered by a minimum distance of 6,500 meters in order to be conservative about encompassing the areas commonly used for foraging near the breeding colony and otherwise buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. (Last Updated: Jan 16, 2019)

Predictive Models: M 29% Moderate (inductive), L 42% Low (inductive) **Associated Habitats:** C 8% Common

B - Trumpeter Swan *(Cygnus buccinator)* SOC — 1 — 22 + — Y S W M

View in Field Guide View Predicted Models View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G4** State: **S3** USFWS: **MBTA** USFS: **Sensitive - Known on Forests (BD, CG)** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **1**

Delineation Criteria Standing water bodies with confirmed nesting areas buffered by 100 meters in order to reflect importance of adjacent terrestrial habitats to breeding success. (Last Updated: Sep 25, 2017)

Predictive Models: M 2% Moderate (inductive), L 78% Low (inductive) **Associated Habitats:** C 10% Common

M - Grizzly Bear *(Ursus arctos)* SOC 1 Y H

View in Field Guide View Predicted Models View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G4** State: **S2S3** USFWS: **PS: LT; XN; DM** USFS: **Threatened on Forests (BD, CG, HLC, KOOT, LOLO)** BLM: **THREATENED** FWP SWAP: **SGCN2-3**

Delineation Criteria Species Occurrence polygons represent the U.S. Fish and Wildlife Service recovery zone boundaries for the Northern Continental Divide and Cabinet-Yaak populations, which are listed as Threatened; the Greater Yellowstone Ecosystem distinct population segment, which has been delisted; and the Bitterroot recovery area, where animals would be listed as Threatened, but experimental nonessential if introduced. (Last Updated: Aug 28, 2014)

Predictive Models: L 47% Low (inductive) **Associated Habitats:** C 60% Common, O 15% Occasional

M - Canada Lynx *(Lynx canadensis)* SOC 7 1 + Y

View in Field Guide View Predicted Models View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **LT; CH** USFS: **Threatened on Forests (BD, BRT) Threatened, Critical Habitat on Forests (CG, HLC, KOOT, LOLO)** BLM: **THREATENED** FWP SWAP: **SGCN3**

Delineation Criteria Areas designated as Critical Habitat for the species by the U.S. Fish and Wildlife Service on September 12, 2014 because they currently contain physical and biological features (e.g. boreal forests with snowshoe hare) essential to the conservation of the species and state and other lands within the outer boundaries of USFWS Critical Habitat polygons. (Last Updated: Dec 15, 2014)

Predictive Models: L 27% Low (inductive) **Associated Habitats:** C 8% Common, O 5% Occasional

V - Senecio integerrimus var. scribneri *(Scribner's Ragwort)* SOC 1 Not Available

View in Field Guide View Associated Habitat
Species of Concern - Native Species Global: **G5T2T3** State: **S2S3**

Associated Habitats: C 13% Common

B - Sagebrush Sparrow *(Artemisiospiza nevadensis)* SOC 1 + Not Available S M

View in Field Guide View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA; BCC10; BCC17** BLM: **SENSITIVE** FWP SWAP: **SGCN3**

Delineation Criteria Confirmed breeding area based on the presence of a nest, chicks, or territorial adults during the breeding season. Point observation location is buffered by a minimum distance of 125 meters in order to encompass the majority of breeding territory sizes reported for the species and otherwise is buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. (Last Updated: Oct 19, 2018)

Associated Habitats: C 12% Common

M - Wolverine *(Gulo gulo)* SOC 7 1 + Not Available Y

View in Field Guide View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G4** State: **S3** USFWS: **P** USFS: **Proposed on Forests (BD, BRT, CG, HLC, KOOT, LOLO)** BLM: **SENSITIVE** FWP SWAP: **SGCN3**

Delineation Criteria Confirmed area of occupancy supported by recent (post-1980), nearby (within 10 kilometers) observations of adults or juveniles. Tracking regions were defined by areas of primary habitat and adjacent female dispersal habitat as modeled by Inman et al. (2013). These regions were buffered by 1 kilometer in order to link smaller areas and account for potential inaccuracies in independent variables used in the model. (Last Updated: Sep 03, 2014)

Associated Habitats: C 10% Common, O 11% Occasional

V - Aquilegia formosa *(Sitka Columbine)* SOC 1 Not Available

View in Field Guide View Associated Habitat
Species of Concern - Native Species Global: **G5** State: **S3**

Delineation Criteria Individual occurrences are generally based upon a discretely mapped area provided by an observer and are not separated by any pre-defined distance. Individual clusters of plants mapped at fine spatial scales (separated by less than approximately 25-50 meters) may be grouped together into one occurrence if they are not separated by distinct areas of habitat or terrain features. Point observations are buffered to encompass any locational uncertainty associated with the observation. (Last Updated: Feb 26, 2019)

Associated Habitats: C 2% Common

V - Ammannia robusta *(Scarlet Ammannia)* SOC 1 Not Available Y

View in Field Guide View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G5** State: **S2**

Delineation Criteria Individual occurrences are generally based upon a discretely mapped area provided by an observer and are not separated by any pre-defined distance. Individual clusters of plants mapped at fine spatial scales (separated by less than approximately 25-50 meters) may be grouped together into one occurrence if they are not separated by distinct areas of habitat or terrain features. Point observations are buffered to encompass any locational uncertainty associated with the observation. (Last Updated: Jan 04, 2018)

Associated Habitats: C 1% Common

V - Triodanis leptocarpa *(Slim-pod Venus'-looking-glass)* SOC 1 Not Available Not Assigned

View in Field Guide
Species of Concern - Native Species Global: **G5?** State: **S3**

MONTANA Natural Heritage Program

A program of the **Montana State Library's Natural Resource Information System** operated by the **University of Montana**.

Legend

Model Icons	Habitat Icons	Range Icons	Num Obs
N Suitable (native range)	C Common	I Introduced	Count of obs with 'good precision' (<=1000m)
O Optimal Suitability	O Occasional	Y Year-round	+ indicates additional 'poor precision' obs (1001m-10,000m)
M Moderate Suitability		S Summer	
L Low Suitability		W Winter	
I Suitable (introduced range)		M Migratory	
		H Historic	

Latitude	Longitude
45.59444	-110.48660
45.71469	-110.63445

Native Species

Summarized by: **19mtsl0003 CityOfLivingstonPER** *(Custom Area of Interest)*
Filtered by:
MT_Status='Species of Concern', 'Special Status', 'Important Animal Habitat', 'Potential SOC'

Other Observed Species

	USFWS Sec7	# Obs	Predictive Model	Associated Habitat	Range
B - Pinyon Jay *(Gymnorhinus cyanocephalus)* SOC		4			Y
View in Field Guide · View Predicted Models · View Associated Habitat · View Range Maps Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA; BCC17** FWP SWAP: **SGCN3** **Predictive Models:** O 20% Optimal (inductive), M 58% Moderate (inductive), L 18% Low (inductive) **Associated Habitats:** C 9% Common, O 6% Occasional					
B - Green-tailed Towhee *(Pipilo chlorurus)* SOC		1			S M
View in Field Guide · View Predicted Models · View Associated Habitat · View Range Maps Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **3** **Predictive Models:** M 62% Moderate (inductive), L 38% Low (inductive) **Associated Habitats:** C 71% Common, O 4% Occasional					
M - Silver-haired Bat *(Lasionycteris noctivagans)* PSOC		1			Y
View in Field Guide · View Predicted Models · View Associated Habitat · View Range Maps Potential Species of Concern - Native Species Global: **G3G4** State: **S4** **Predictive Models:** M 47% Moderate (inductive), L 53% Low (inductive) **Associated Habitats:** C 77% Common, O 14% Occasional					
B - Veery *(Catharus fuscescens)* SOC		3			S M
View in Field Guide · View Predicted Models · View Associated Habitat · View Range Maps Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2** **Predictive Models:** M 44% Moderate (inductive), L 49% Low (inductive) **Associated Habitats:** C 11% Common, O 8% Occasional					
B - Hooded Merganser *(Lophodytes cucullatus)* PSOC		1			Y M
View in Field Guide · View Predicted Models · View Associated Habitat · View Range Maps Potential Species of Concern - Native Species Global: **G5** State: **S4** USFWS: **MBTA** FWP SWAP: **SGIN** PIF: **2** **Predictive Models:** M 20% Moderate (inductive), L 18% Low (inductive) **Associated Habitats:** C 10% Common, O 1% Occasional					
B - Cassin's Finch *(Haemorhous cassinii)* SOC		11			Y
View in Field Guide · View Predicted Models · View Associated Habitat · View Range Maps Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA; BCC10** FWP SWAP: **SGCN3** PIF: **3** **Predictive Models:** M 18% Moderate (inductive), L 62% Low (inductive) **Associated Habitats:** C 11% Common					
B - Northern Goshawk *(Accipiter gentilis)* SOC		2 +			Y W M
View in Field Guide · View Predicted Models · View Associated Habitat · View Range Maps Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **2** **Predictive Models:** M 9% Moderate (inductive), L 18% Low (inductive) **Associated Habitats:** C 8% Common, O 3% Occasional					
B - Brewer's Sparrow *(Spizella breweri)* SOC		+			S M
View in Field Guide · View Predicted Models · View Associated Habitat · View Range Maps Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA; BCC10; BCC17** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2** **Predictive Models:** M 7% Moderate (inductive), L 93% Low (inductive) **Associated Habitats:** C 12% Common, O 1% Occasional					
B - Bobolink *(Dolichonyx oryzivorus)* SOC		1			S M
View in Field Guide · View Predicted Models · View Associated Habitat · View Range Maps Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **3** **Predictive Models:** M 4% Moderate (inductive), L 56% Low (inductive) **Associated Habitats:** C 52% Common, O 1% Occasional					
B - Barrow's Goldeneye *(Bucephala islandica)* PSOC		1 +			Y W M
View in Field Guide · View Predicted Models · View Associated Habitat · View Range Maps Potential Species of Concern - Native Species Global: **G5** State: **S4** USFWS: **MBTA** FWP SWAP: **SGIN** PIF: **2** **Predictive Models:** M 4% Moderate (inductive), L 49% Low (inductive) **Associated Habitats:** C 10% Common					
B - Great Gray Owl *(Strix nebulosa)* SOC		+			Y
View in Field Guide · View Predicted Models · View Associated Habitat · View Range Maps Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3, SGIN** PIF: **3** **Predictive Models:** M 4% Moderate (inductive), L 47% Low (inductive) **Associated Habitats:** C 20% Common, O 1% Occasional					

B - Brown Creeper *(Certhia americana)* SOC — 1 — Y

View in Field Guide | View Predicted Models | View Associated Habitat | View Range Maps

Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **1**

Predictive Models: M 4% Moderate (inductive), L 27% Low (inductive) **Associated Habitats:** C 8% Common, O 2% Occasional

B - Evening Grosbeak *(Coccothraustes vespertinus)* SOC — 4 — Y W

View in Field Guide | View Predicted Models | View Associated Habitat | View Range Maps

Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA** FWP SWAP: **SGCN3**

Predictive Models: M 2% Moderate (inductive), L 73% Low (inductive) **Associated Habitats:** C 26% Common, O 1% Occasional

B - McCown's Longspur *(Rhynchophanes mccownii)* SOC — 2 + — S M

View in Field Guide | View Predicted Models | View Associated Habitat | View Range Maps

Species of Concern - Native Species Global: **G4** State: **S3B** USFWS: **MBTA; BCC10; BCC11; BCC17** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2**

Predictive Models: L 18% Low (inductive) **Associated Habitats:** C 3% Common, O 48% Occasional

B - Mountain Plover *(Charadrius montanus)* SOC — 1 — Not Available — S M

View in Field Guide | View Associated Habitat | View Range Maps

Species of Concern - Native Species Global: **G3** State: **S2B** USFWS: **MBTA; BCC11; BCC17** BLM: **SENSITIVE** FWP SWAP: **SGCN2** PIF: **1**

Associated Habitats: C 13% Common, O 36% Occasional

B - Tennessee Warbler *(Oreothlypis peregrina)* PSOC — 1 — Not Available — M

View in Field Guide | View Associated Habitat | View Range Maps

Potential Species of Concern - Native Species Global: **G5** State: **S3S4B** USFWS: **MBTA**

Associated Habitats: C 11% Common

B - Franklin's Gull *(Leucophaeus pipixcan)* SOC — 1 — Not Available — M

View in Field Guide | View Associated Habitat | View Range Maps

Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2**

Associated Habitats: C 2% Common, O 9% Occasional

B - Horned Grebe *(Podiceps auritus)* SOC — 1 — Not Available — M

View in Field Guide | View Associated Habitat | View Range Maps

Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA; BCC11; BCC17** FWP SWAP: **SGCN3** PIF: **2**

Associated Habitats: C 2% Common, O 1% Occasional

B - American White Pelican *(Pelecanus erythrorhynchos)* SOC — 8 — Not Available — M

View in Field Guide | View Associated Habitat | View Range Maps

Species of Concern - Native Species Global: **G4** State: **S3B** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **3**

Associated Habitats: C 2% Common

B - Common Loon *(Gavia immer)* SOC — 4 — Not Available — M

View in Field Guide | View Associated Habitat | View Range Maps

Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** USFS: **Sensitive - Known on Forests (KOOT, LOLO)** FWP SWAP: **SGCN3** PIF: **1**

Associated Habitats: C 2% Common

B - Pacific Wren *(Troglodytes pacificus)* SOC — 1 — Not Available — Y

View in Field Guide | View Associated Habitat | View Range Maps

Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **2**

Associated Habitats: C 1% Common, O 8% Occasional

B - Gray-crowned Rosy-Finch *(Leucosticte tephrocotis)* SOC — 3 — Not Available — W M

View in Field Guide | View Associated Habitat | View Range Maps

Species of Concern - Native Species Global: **G5** State: **S2B,S5N** USFWS: **MBTA** FWP SWAP: **SGCN2, SGIN**

Associated Habitats: C 1% Common

F - Westslope Cutthroat Trout *(Oncorhynchus clarkii lewisi)* SOC — 1 + — Not Available — Not Assigned — I

View in Field Guide | View Range Maps

Species of Concern - Native Species Global: **G4T4** State: **S2** USFS: **Sensitive - Known on Forests (BD, BRT, CG, HLC, KOOT, LOLO)** BLM: **SENSITIVE** FWP SWAP: **SGCN2**

MONTANA Natural Heritage Program

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Legend

Model Icons	Habitat Icons	Range Icons	Num Obs
N Suitable (native range)	C Common	I Introduced	Count of obs with 'good precision' (<=1000m)
O Optimal Suitability	O Occasional	Y Year-round	+ indicates additional 'poor precision' obs (1001m-10,000m)
M Moderate Suitability		S Summer	
L Low Suitability		W Winter	
I Suitable (introduced range)		M Migratory	
		H Historic	

Latitude	Longitude
45.59444	-110.48660
45.71469	-110.63445

Native Species

Summarized by: **19mtsl0003 CityOfLivingstonPER** *(Custom Area of Interest)*
Filtered by:
MT_Status='Species of Concern', 'Special Status', 'Important Animal Habitat', 'Potential SOC'

Other Potential Species

	USFWS Sec7	Predictive Model	Associated Habitat	Range
M - Spotted Bat *(Euderma maculatum)* **SOC**				S M
M - Western Spotted Skunk *(Spilogale gracilis)* **PSOC**				Y
R - Western Milksnake *(Lampropeltis gentilis)* **SOC**				Y
M - Merriam's Shrew *(Sorex merriami)* **SOC**				Y
V - Eleocharis rostellata *(Beaked Spikerush)* **SOC**			Not Assigned	Y
M - Fringed Myotis *(Myotis thysanodes)* **SOC**				Y
M - Preble's Shrew *(Sorex preblei)* **SOC**				Y
M - Porcupine *(Erethizon dorsatum)* **PSOC**				Y
M - Uinta Ground Squirrel *(Urocitellus armatus)* **PSOC**				Y
B - Lewis's Woodpecker *(Melanerpes lewis)* **SOC**				S M
M - Dwarf Shrew *(Sorex nanus)* **SOC**				Y

M - Spotted Bat *(Euderma maculatum)* **SOC**

View in Field Guide | View Predicted Models | View Associated Habitat | View Range Maps

Species of Concern - Native Species Global: **G4** State: **S3** USFS: **Sensitive - Known on Forests (BD, CG)** BLM: **SENSITIVE** FWP SWAP: **SGCN3, SGIN**

Predictive Models: O 27% Optimal (inductive), M 40% Moderate (inductive), L 22% Low (inductive)
Associated Habitats: C 66% Common, O 17% Occasional

M - Western Spotted Skunk *(Spilogale gracilis)* **PSOC**

View in Field Guide | View Predicted Models | View Associated Habitat | View Range Maps

Potential Species of Concern - Native Species Global: **G5** State: **SU** FWP SWAP: **SGIN**

Predictive Models: O 18% Optimal (inductive), M 73% Moderate (inductive), L 9% Low (inductive)
Associated Habitats: C 64% Common, O 9% Occasional

R - Western Milksnake *(Lampropeltis gentilis)* **SOC**

View in Field Guide | View Predicted Models | View Associated Habitat | View Range Maps

Species of Concern - Native Species Global: **G5** State: **S2** USFS: **Sensitive - Known on Forests (CG)** BLM: **SENSITIVE** FWP SWAP: **SGCN2**

Predictive Models: O 2% Optimal (inductive), M 47% Moderate (inductive), L 44% Low (inductive)
Associated Habitats: C 49% Common, O 11% Occasional

M - Merriam's Shrew *(Sorex merriami)* **SOC**

View in Field Guide | View Predicted Models | View Associated Habitat | View Range Maps

Species of Concern - Native Species Global: **G4** State: **S3** FWP SWAP: **SGCN3**

Predictive Models: M 84% Moderate (inductive), L 16% Low (inductive) **Associated Habitats:** C 58% Common

V - Eleocharis rostellata *(Beaked Spikerush)* **SOC**

View in Field Guide | View Predicted Models | View Range Maps

USFS: **Sensitive - Known on Forests (BD, CG, HLC)**
Species of Concern - Native Species Global: **G5** State: **S3** **Species of Conservation Concern on Forests (FLAT)** MNPS: **3**

Predictive Models: M 73% Moderate (inductive), L 16% Low (inductive)

M - Fringed Myotis *(Myotis thysanodes)* **SOC**

View in Field Guide | View Predicted Models | View Associated Habitat | View Range Maps

Species of Concern - Native Species Global: **G4** State: **S3** BLM: **SENSITIVE** FWP SWAP: **SGCN3**

Predictive Models: M 44% Moderate (inductive), L 49% Low (inductive) **Associated Habitats:** C 69% Common, O 20% Occasional

M - Preble's Shrew *(Sorex preblei)* **SOC**

View in Field Guide | View Predicted Models | View Associated Habitat | View Range Maps

Species of Concern - Native Species Global: **G4** State: **S3** FWP SWAP: **SGCN3**

Predictive Models: M 42% Moderate (inductive), L 58% Low (inductive) **Associated Habitats:** C 60% Common, O 1% Occasional

M - Porcupine *(Erethizon dorsatum)* **PSOC**

View in Field Guide | View Predicted Models | View Associated Habitat | View Range Maps

Potential Species of Concern - Native Species Global: **G5** State: **S4** FWP SWAP: **SGIN**

Predictive Models: M 33% Moderate (inductive), L 67% Low (inductive) **Associated Habitats:** C 80% Common

M - Uinta Ground Squirrel *(Urocitellus armatus)* **PSOC**

View in Field Guide | View Predicted Models | View Associated Habitat | View Range Maps

Potential Species of Concern - Native Species Global: **G5** State: **S3S4** FWP SWAP: **SGIN**

Predictive Models: M 29% Moderate (inductive), L 31% Low (inductive) **Associated Habitats:** C 25% Common

B - Lewis's Woodpecker *(Melanerpes lewis)* **SOC**

View in Field Guide | View Predicted Models | View Associated Habitat | View Range Maps

Species of Concern - Native Species Global: **G4** State: **S2B** USFWS: **MBTA; BCC10; BCC17** BLM: **SENSITIVE** FWP SWAP: **SGCN2** PIF: **2**

Predictive Models: M 22% Moderate (inductive), L 78% Low (inductive) **Associated Habitats:** C 1% Common, O 17% Occasional

M - Dwarf Shrew *(Sorex nanus)* **SOC**

View in Field Guide View Predicted Models View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G4** State: **S2S3** FWP SWAP: **SGCN2-3**
Predictive Models: M 18% Moderate (inductive), L 71% Low (inductive) **Associated Habitats:** C 15% Common, O 44% Occasional

B - Yellow-billed Cuckoo *(Coccyzus americanus)* SOC S M

View in Field Guide View Predicted Models View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **PS: LT; MBTA; BCC10** USFS: **Threatened on Forests (BRT, LOLO)**
BLM: **SENSITIVE** FWP SWAP: **SGCN3, SGIN** PIF: **2**
Predictive Models: M 18% Moderate (inductive), L 42% Low (inductive) **Associated Habitats:** C 9% Common

B - Sage Thrasher *(Oreoscoptes montanus)* SOC S M

View in Field Guide View Predicted Models View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G4** State: **S3B** USFWS: **MBTA; BCC10; BCC17** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **3**
Predictive Models: M 13% Moderate (inductive), L 69% Low (inductive) **Associated Habitats:** C 12% Common, O 1% Occasional

B - Meesia triquetra *(Meesia Moss)* SOC Not Assigned Y

View in Field Guide View Predicted Models View Range Maps
USFS: **Sensitive - Known on Forests (BRT, CG, KOOT)**
Sensitive - Suspected on Forests (LOLO)
Species of Concern - Native Species Global: **G5** State: **S2** **Species of Conservation Concern on Forests (FLAT)**
Predictive Models: M 9% Moderate (inductive), L 49% Low (inductive)

V - Pyrrocoma carthamoides var. subsquarrosa *(Beartooth Large-flowered Goldenweed)* SOC Y

View in Field Guide View Predicted Models View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G4G5T3** State: **S3** USFS: **Sensitive - Known on Forests (CG)** BLM: **SENSITIVE** MNPS: **3**
Predictive Models: M 9% Moderate (inductive), L 27% Low (inductive) **Associated Habitats:** C 12% Common

B - Ovenbird *(Seiurus aurocapilla)* PSOC S M

View in Field Guide View Predicted Models View Associated Habitat View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S4B** USFWS: **MBTA** PIF: **3**
Predictive Models: M 9% Moderate (inductive), L 22% Low (inductive) **Associated Habitats:** C 4% Common, O 3% Occasional

V - Trichophorum cespitosum *(Tufted Club-rush)* SOC Y

View in Field Guide View Predicted Models View Associated Habitat View Range Maps
USFS: **Sensitive - Known on Forests (BD, HLC, KOOT)**
Species of Concern - Native Species Global: **G5** State: **S2** **Species of Conservation Concern on Forests (FLAT)** MNPS: **3**
Predictive Models: M 9% Moderate (inductive), L 22% Low (inductive) **Associated Habitats:** C 1% Common

V - Shoshonea pulvinata *(Shoshonea)* SOC Y

View in Field Guide View Predicted Models View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G3** State: **S2** USFS: **Sensitive - Known on Forests (CG)** BLM: **SENSITIVE** MNPS: **3**
Predictive Models: M 9% Moderate (inductive), L 11% Low (inductive) **Associated Habitats:** C 1% Common

M - Water Vole *(Microtus richardsoni)* PSOC Y

View in Field Guide View Predicted Models View Associated Habitat View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S4**
Predictive Models: M 9% Moderate (inductive), L 9% Low (inductive) **Associated Habitats:** C 11% Common, O 1% Occasional

B - Common Poorwill *(Phalaenoptilus nuttallii)* PSOC S M

View in Field Guide View Predicted Models View Associated Habitat View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S4B** USFWS: **MBTA** FWP SWAP: **SGIN** PIF: **3**
Predictive Models: M 7% Moderate (inductive), L 69% Low (inductive) **Associated Habitats:** C 54% Common, O 23% Occasional

A - Northern Leopard Frog *(Lithobates pipiens)* SOC Y

View in Field Guide View Predicted Models View Associated Habitat View Range Maps
USFS: **Sensitive - Known on Forests (CG, HLC, KOOT)**
Species of Concern - Native Species Global: **G5** State: **S1,S4** **Sensitive - Suspected on Forests (BRT, LOLO)** BLM: **SENSITIVE**
FWP SWAP: **SGCN1**
Predictive Models: M 7% Moderate (inductive), L 60% Low (inductive) **Associated Habitats:** C 2% Common, O 9% Occasional

B - Plumbeous Vireo *(Vireo plumbeus)* PSOC S M

View in Field Guide View Predicted Models View Associated Habitat View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S3S4B** USFWS: **MBTA** PIF: **3**
Predictive Models: M 7% Moderate (inductive), L 51% Low (inductive) **Associated Habitats:** C 16% Common, O 1% Occasional

B - Broad-tailed Hummingbird *(Selasphorus platycercus)* PSOC S M

View in Field Guide View Predicted Models View Associated Habitat View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S4B** USFWS: **MBTA** FWP SWAP: **SGIN**
Predictive Models: M 7% Moderate (inductive), L 20% Low (inductive) **Associated Habitats:** C 27% Common, O 49% Occasional

R - Greater Short-horned Lizard *(Phrynosoma hernandesi)* SOC Y

View in Field Guide View Predicted Models View Associated Habitat View Range Maps

USFS: **Sensitive - Known on Forests (CG)**

Species of Concern - Native Species Global: **G5** State: **S3** **Sensitive - Suspected on Forests (HLC)** BLM: **SENSITIVE**

FWP SWAP: **SGCN3, SGIN**

Predictive Models: M 2% Moderate (inductive), L 76% Low (inductive) **Associated Habitats:** C 49% Common, O 5% Occasional

B - Rufous Hummingbird *(Selasphorus rufus)* **PSOC** S M

View in Field Guide View Predicted Models View Associated Habitat View Range Maps

Potential Species of Concern - Native Species Global: **G5** State: **S4B** USFWS: **MBTA** PIF: **3**

Predictive Models: M 2% Moderate (inductive), L 69% Low (inductive) **Associated Habitats:** C 64% Common, O 2% Occasional

A - Western Toad *(Anaxyrus boreas)* **SOC** Y

View in Field Guide View Predicted Models View Associated Habitat View Range Maps

Species of Concern - Native Species Global: **G4** State: **S2** USFS: **Sensitive - Known on Forests (BD, BRT, CG, HLC, KOOT, LOLO)**

BLM: **SENSITIVE** FWP SWAP: **SGCN2**

Predictive Models: L 76% Low (inductive) **Associated Habitats:** C 25% Common, O 42% Occasional

M - Black-tailed Prairie Dog *(Cynomys ludovicianus)* **SOC** Y

View in Field Guide View Predicted Models View Associated Habitat View Range Maps

Species of Concern - Native Species Global: **G4** State: **S3** USFS: **Sensitive - Known on Forests (CG)** BLM: **SENSITIVE** FWP SWAP: **SGCN3**

Predictive Models: L 67% Low (inductive) **Associated Habitats:** C 13% Common, O 50% Occasional

M - Hayden's Shrew *(Sorex haydeni)* **PSOC** Y

View in Field Guide View Predicted Models View Associated Habitat View Range Maps

Potential Species of Concern - Native Species Global: **G5** State: **S3S4**

Predictive Models: L 64% Low (inductive) **Associated Habitats:** C 62% Common

B - Ferruginous Hawk *(Buteo regalis)* **SOC** S M

View in Field Guide View Predicted Models View Associated Habitat View Range Maps

Species of Concern - Native Species Global: **G4** State: **S3B** USFWS: **MBTA; BCC10; BCC17** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2**

Predictive Models: L 40% Low (inductive) **Associated Habitats:** C 54% Common, O 1% Occasional

B - Black-billed Cuckoo *(Coccyzus erythropthalmus)* **SOC** S M

View in Field Guide View Predicted Models View Associated Habitat View Range Maps

Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA; BCC11; BCC17** FWP SWAP: **SGCN3, SGIN** PIF: **2**

Predictive Models: L 27% Low (inductive) **Associated Habitats:** C 11% Common

B - Greater Sage-Grouse *(Centrocercus urophasianus)* **SOC** Y

View in Field Guide View Predicted Models View Associated Habitat View Range Maps

USFS: **Sensitive - Known on Forests (BD)**

Species of Concern - Native Species Global: **G3G4** State: **S2** **Sensitive - Suspected on Forests (CG, HLC)** BLM: **SENSITIVE**

FWP SWAP: **SGCN2** PIF: **1**

Predictive Models: L 24% Low (inductive) **Associated Habitats:** C 15% Common, O 1% Occasional

V - Adoxa moschatellina *(Musk-root)* **SOC** Not Assigned Y

View in Field Guide View Predicted Models View Range Maps

Species of Concern - Native Species Global: **G5** State: **S3** USFS: **Sensitive - Known on Forests (BD, CG, LOLO)**

Predictive Models: L 18% Low (inductive)

B - American Bittern *(Botaurus lentiginosus)* **SOC** S M

View in Field Guide View Predicted Models View Associated Habitat View Range Maps

Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA; BCC11; BCC17** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **3**

Predictive Models: L 13% Low (inductive) **Associated Habitats:** C 8% Common

B - Short-eared Owl *(Asio flammeus)* **PSOC** Y

View in Field Guide View Predicted Models View Associated Habitat View Range Maps

Potential Species of Concern - Native Species Global: **G5** State: **S4** USFWS: **MBTA; BCC11; BCC17** PIF: **3**

Predictive Models: L 9% Low (inductive) **Associated Habitats:** C 70% Common, O 4% Occasional

B - Black-backed Woodpecker *(Picoides arcticus)* **SOC** Y

View in Field Guide View Predicted Models View Associated Habitat View Range Maps

Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA**

USFS: **Sensitive - Known on Forests (BD, BRT, CG, HLC, KOOT, LOLO)** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **1**

Predictive Models: L 7% Low (inductive) **Associated Habitats:** C 8% Common

B - Sprague's Pipit *(Anthus spragueii)* **SOC** 7 S M

View in Field Guide View Predicted Models View Associated Habitat View Range Maps

Species of Concern - Native Species Global: **G3G4** State: **S3B** USFWS: **MBTA; BCC11; BCC17** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **1**

Predictive Models: L 7% Low (inductive) **Associated Habitats:** C 3% Common, O 36% Occasional

B - Flammulated Owl *(Psiloscops flammeolus)* **SOC** S M

View in Field Guide View Predicted Models View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G4** State: **S3B** USFWS: **MBTA; BCC10**
USFS: **Sensitive - Known on Forests (BD, BRT, HLC, KOOT, LOLO)**
Sensitive - Suspected on Forests (CG)
Species of Conservation Concern on Forests (FLAT) BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **1**
Predictive Models: L 4% Low (inductive) **Associated Habitats:** C 8% Common, O 3% Occasional

B - Burrowing Owl *(Athene cunicularia)* **SOC** S M

View in Field Guide View Predicted Models View Associated Habitat View Range Maps
USFS: **Sensitive - Known on Forests (CG)**
Species of Concern - Native Species Global: **G4** State: **S3B** USFWS: **MBTA; BCC17** **Sensitive - Suspected on Forests (HLC)** BLM: **SENSITIVE**
FWP SWAP: **SGCN3** PIF: **1**
Predictive Models: L 2% Low (inductive) **Associated Habitats:** C 15% Common, O 39% Occasional

B - Varied Thrush *(Ixoreus naevius)* **SOC** S M

View in Field Guide View Predicted Models View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **3**
Predictive Models: L 2% Low (inductive) **Associated Habitats:** C 2% Common, O 1% Occasional

B - Sharp-tailed Grouse *(Tympanuchus phasianellus)* **SOC** Not Available Y

View in Field Guide View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G5** State: **SX,S4** FWP SWAP: **SGCN1** PIF: **2**
Associated Habitats: C 62% Common, O 9% Occasional

B - Loggerhead Shrike *(Lanius ludovicianus)* **SOC** Not Available S M

View in Field Guide View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G4** State: **S3B** USFWS: **MBTA; BCC10; BCC17** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2**
Associated Habitats: C 60% Common, O 7% Occasional

M - Bison *(Bos bison)* **SOC** Not Available H

View in Field Guide View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G4** State: **S2** FWP SWAP: **SGCN2**
Associated Habitats: C 49% Common, O 1% Occasional

M - Black-footed Ferret *(Mustela nigripes)* **SOC** Not Available H

View in Field Guide View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G1** State: **S1** USFWS: **LE; XN** USFS: **Endangered, Experimental Nonessential on Forests (CG)**
BLM: **ENDANGERED** FWP SWAP: **SGCN1**
Associated Habitats: C 13% Common, O 1% Occasional

I - Polygonia progne *(Gray Comma)* **SOC** Not Available Y

View in Field Guide View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G5** State: **S2**
Associated Habitats: C 12% Common, O 1% Occasional

B - Boreal Owl *(Aegolius funereus)* **PSOC** Not Available Y

View in Field Guide View Associated Habitat View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S3S4** USFWS: **MBTA** FWP SWAP: **SGIN** PIF: **3**
Associated Habitats: C 10% Common, O 2% Occasional

I - Euphydryas gillettii *(Gillette's Checkerspot)* **SOC** Not Available Y

View in Field Guide View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G3** State: **S2**
Associated Habitats: C 9% Common, O 40% Occasional

I - Argia alberta *(Paiute Dancer)* **PSOC** Not Available Y

View in Field Guide View Associated Habitat View Range Maps
Potential Species of Concern - Native Species Global: **G4** State: **S2S3**
Associated Habitats: C 8% Common, O 2% Occasional

B - Harlequin Duck *(Histrionicus histrionicus)* **SOC** Not Available S M

View in Field Guide View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G4** State: **S2B** USFWS: **MBTA** USFS: **Sensitive - Known on Forests (BD, CG, HLC, KOOT, LOLO)**
FWP SWAP: **SGCN2** PIF: **1**
Associated Habitats: C 8% Common, O 2% Occasional

I - Boloria freija *(Freija Fritillary)* **PSOC** Not Available Y

View in Field Guide View Associated Habitat View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S3S5**
Associated Habitats: C 8% Common, O 1% Occasional

B - Northern Hawk Owl *(Surnia ulula)* **SOC** Not Available W M

View in Field Guide View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA** FWP SWAP: **SGCN3, SGIN**
Associated Habitats: C 5% Common, O 1% Occasional

M - Swift Fox *(Vulpes velox)* SOC — Not Available — Y

View in Field Guide | View Associated Habitat | View Range Maps

Species of Concern - Native Species Global: **G3** State: **S3** BLM: **SENSITIVE** FWP SWAP: **SGCN3**

Associated Habitats: C 3% Common, O 49% Occasional

I - Argia emma *(Emma's Dancer)* PSOC — Not Available — Y

View in Field Guide | View Associated Habitat | View Range Maps

Potential Species of Concern - Native Species Global: **G5** State: **S3S5**

Associated Habitats: C 2% Common, O 8% Occasional

I - Libellula saturata *(Flame Skimmer)* PSOC — Not Available — Y

View in Field Guide | View Associated Habitat | View Range Maps

Potential Species of Concern - Native Species Global: **G5** State: **S2S4**

Associated Habitats: C 2% Common, O 8% Occasional

I - Somatochlora minor *(Ocellated Emerald)* PSOC — Not Available — Y

View in Field Guide | View Associated Habitat | View Range Maps

Potential Species of Concern - Native Species Global: **G5** State: **S2S4**

Associated Habitats: C 2% Common, O 8% Occasional

I - Aeshna constricta *(Lance-tipped Darner)* PSOC — Not Available — Y

View in Field Guide | View Associated Habitat | View Range Maps

Potential Species of Concern - Native Species Global: **G5** State: **S1S3**

Associated Habitats: C 2% Common, O 1% Occasional

I - Enallagma civile *(Familiar Bluet)* PSOC — Not Available — Y

View in Field Guide | View Associated Habitat | View Range Maps

Potential Species of Concern - Native Species Global: **G5** State: **S2S4**

Associated Habitats: C 2% Common, O 1% Occasional

I - Rhionaeschna multicolor *(Blue-eyed Darner)* PSOC — Not Available — Y

View in Field Guide | View Associated Habitat | View Range Maps

Potential Species of Concern - Native Species Global: **G5** State: **S2S4**

Associated Habitats: C 2% Common, O 1% Occasional

B - Black Tern *(Chlidonias niger)* SOC — Not Available — S M

View in Field Guide | View Associated Habitat | View Range Maps

Species of Concern - Native Species Global: **G4G5** State: **S3B** USFWS: **MBTA; BCC11** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2**

Associated Habitats: C 2% Common, O 1% Occasional

B - Black-necked Stilt *(Himantopus mexicanus)* SOC — Not Available — M

View in Field Guide | View Associated Habitat | View Range Maps

Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **3**

Associated Habitats: C 2% Common, O 1% Occasional

B - Caspian Tern *(Hydroprogne caspia)* SOC — Not Available — M

View in Field Guide | View Associated Habitat | View Range Maps

Species of Concern - Native Species Global: **G5** State: **S2B** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN2** PIF: **2**

Associated Habitats: C 2% Common, O 1% Occasional

B - Clark's Grebe *(Aechmophorus clarkii)* SOC — Not Available — M

View in Field Guide | View Associated Habitat | View Range Maps

Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **3**

Associated Habitats: C 2% Common, O 1% Occasional

B - Forster's Tern *(Sterna forsteri)* SOC — Not Available — M

View in Field Guide | View Associated Habitat | View Range Maps

Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2**

Associated Habitats: C 2% Common, O 1% Occasional

I - Aeshna eremita *(Lake Darner)* PSOC — Not Available — Y S W

View in Field Guide | View Associated Habitat | View Range Maps

Potential Species of Concern - Native Species Global: **G5** State: **S3S4**

Associated Habitats: C 2% Common

I - Rhionaeschna californica *(California Darner)* PSOC — Not Available — Y

View in Field Guide | View Associated Habitat | View Range Maps

Potential Species of Concern - Native Species Global: **G5** State: **S3S5**

Associated Habitats: O 2% Occasional

I - Somatochlora hudsonica *(Hudsonian Emerald)* PSOC — Not Available — Y

View in Field Guide View Associated Habitat View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S2S4**
Associated Habitats: O 2% Occasional

B - White-faced Ibis *(Plegadis chihi)* **SOC** Not Available S M

View in Field Guide View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2**
Associated Habitats: C 2% Common

B - Black-crowned Night-Heron *(Nycticorax nycticorax)* **SOC** Not Available M

View in Field Guide View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **3**
Associated Habitats: C 2% Common

B - Common Tern *(Sterna hirundo)* **SOC** Not Available M

View in Field Guide View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2**
Associated Habitats: C 2% Common

B - Piping Plover *(Charadrius melodus)* **SOC** Not Available M

View in Field Guide View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G3** State: **S2B** USFWS: **LT; CH; MBTA** BLM: **THREATENED** FWP SWAP: **SGCN2** PIF: **1**
Associated Habitats: C 2% Common

I - Argia vivida *(Vivid Dancer)* **PSOC** Not Available Y

View in Field Guide View Associated Habitat View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S3S5**
Associated Habitats: C 1% Common, O 10% Occasional

I - Colias gigantea *(Giant Sulphur)* **PSOC** Not Available Y

View in Field Guide View Associated Habitat View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S3**
Associated Habitats: C 1% Common, O 8% Occasional

I - Aeshna juncea *(Sedge Darner)* **PSOC** Not Available Y

View in Field Guide View Associated Habitat View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S3S5**
Associated Habitats: C 1% Common, O 2% Occasional

I - Aeshna sitchensis *(Zigzag Darner)* **PSOC** Not Available Y

View in Field Guide View Associated Habitat View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S2S3**
Associated Habitats: C 1% Common, O 2% Occasional

I - Enallagma clausum *(Alkali Bluet)* **PSOC** Not Available Y

View in Field Guide View Associated Habitat View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S2S4**
Associated Habitats: C 1% Common, O 2% Occasional

I - Leucorrhinia borealis *(Boreal Whiteface)* **SOC** Not Available Y

View in Field Guide View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G5** State: **S1**
Associated Habitats: C 1% Common, O 2% Occasional

I - Sympetrum madidum *(Red-veined Meadowhawk)* **PSOC** Not Available Y

View in Field Guide View Associated Habitat View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S2S3**
Associated Habitats: C 1% Common, O 2% Occasional

I - Erebia callias *(Colorado Alpine)* **PSOC** Not Available Y

View in Field Guide View Associated Habitat View Range Maps
Potential Species of Concern - Native Species Global: **G4** State: **S2S3**
Associated Habitats: C 1% Common, O 1% Occasional

B - Black Rosy-Finch *(Leucosticte atrata)* **SOC** Not Available Y S M

View in Field Guide View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G4** State: **S2** USFWS: **MBTA; BCC10** FWP SWAP: **SGCN2, SGIN** PIF: **2**
Associated Habitats: C 1% Common

I - Boloria frigga *(Frigga Fritillary)* **SOC** Not Available Y

View in Field Guide View Associated Habitat View Range Maps
Species of Concern - Native Species Global: **G5** State: **S1S2**
Associated Habitats: C 1% Common

I - Oeneis bore *(White-veined Arctic)* **PSOC** Not Available

View in Field Guide **View Associated Habitat** **View Range Maps**

Potential Species of Concern - Native Species Global: **G5** State: **S2S3**

Associated Habitats: 1% Common

I - Oeneis melissa *(Melissa Arctic)* **PSOC** Not Available

View in Field Guide **View Associated Habitat** **View Range Maps**

Potential Species of Concern - Native Species Global: **G5** State: **S2S3**

Associated Habitats: 1% Common

I - Somatochlora semicircularis *(Mountain Emerald)* **PSOC** Not Available

View in Field Guide **View Associated Habitat** **View Range Maps**

Potential Species of Concern - Native Species Global: **G5** State: **S3S5**

Associated Habitats: 1% Common

V - Pinus albicaulis *(Whitebark Pine)* **SOC** Not Available

View in Field Guide **View Associated Habitat** **View Range Maps**

Species of Concern - Native Species Global: **G3G4** State: **S3** USFWS: **C** USFS: **Candidate on Forests (BD, BRT, CG, HLC, KOOT, LOLO)**
BLM: **SENSITIVE**

Associated Habitats: 1% Common

Latitude	Longitude
45.59444	-110.48660
45.71469	-110.63445

Structured Surveys

Summarized by: **19mtsl0003 CityOfLivingstonPER** *(Custom Area of Interest)*

The Montana Natural Heritage Program (MTNHP) records information on the locations where more than 80 different types of well-defined repeatable survey protocols capable of detecting an animal species or suite of animal species have been conducted by state, federal, tribal, university, or private consulting biologists. Examples of structured survey protocols tracked by MTNHP include: visual encounter and dip net surveys for pond breeding amphibians, point counts for birds, call playback surveys for selected bird species, visual surveys of migrating raptors, kick net stream reach surveys for macroinvertebrates, visual encounter cover object surveys for terrestrial mollusks, bat acoustic or mist net surveys, pitfall and/or snap trap surveys for small terrestrial mammals, track or camera trap surveys for large mammals, and trap surveys for turtles. Whenever possible, photographs of survey locations are stored in MTNHP databases.

MTNHP does not typically manage information on structured surveys for plants; surveys for invasive species may be a future exception.

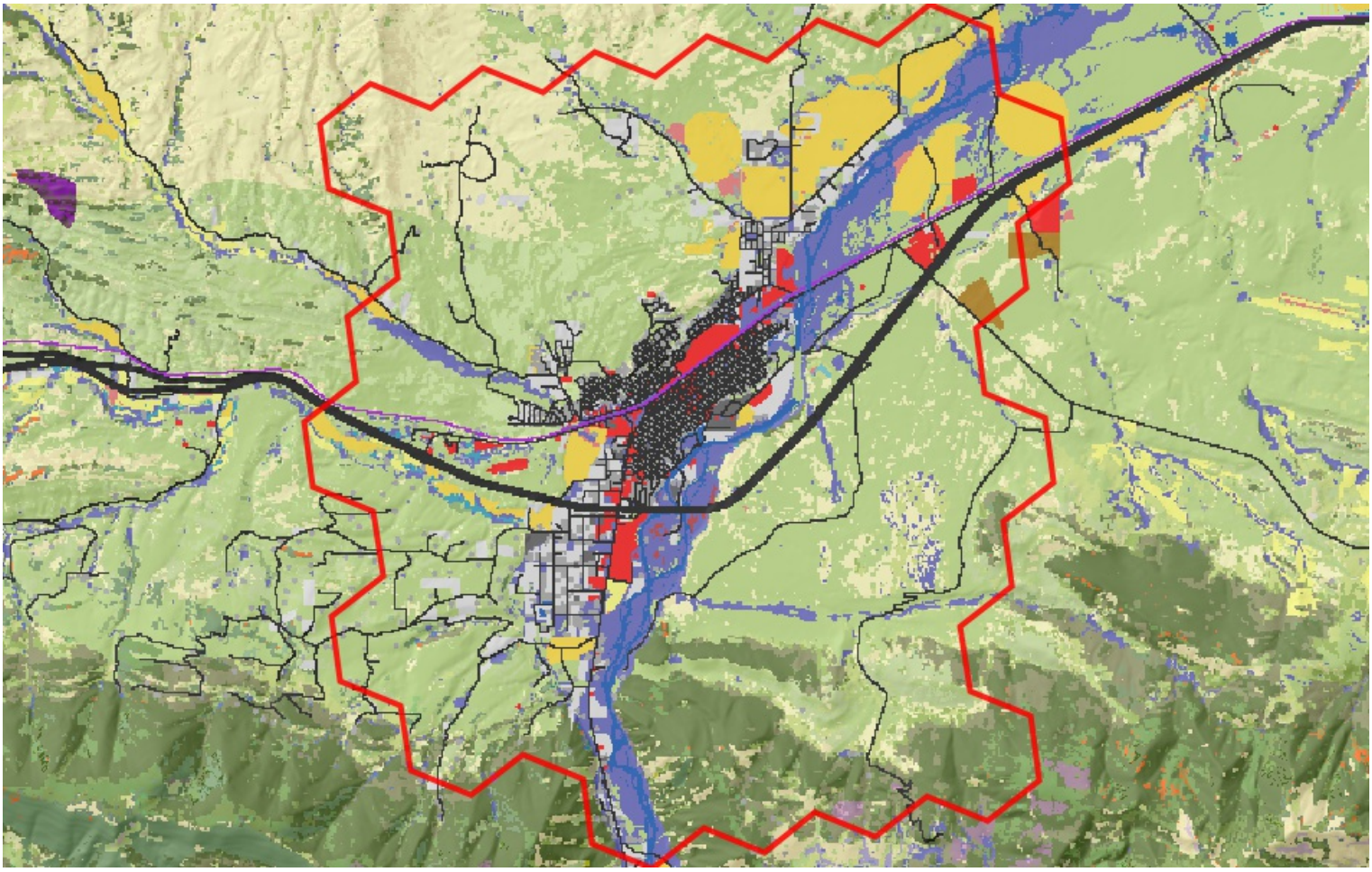
Within the report area you have requested, structured surveys are summarized by the number of each type of structured survey protocol that has been conducted, the number of species detections/observations resulting from these surveys, and the most recent year a survey has been conducted.

B-Long-billed Curlew *(Long-billed Curlew, Road-based, Point Count)*	**Survey Count**: 10	**Obs Count**: 4	**Recent Survey**: 2015
B-Raptor nest *(Raptor Nest Survey)*	**Survey Count**: 20	**Obs Count**: 20	**Recent Survey**: 2018
E-Eastern Heath Snail *(Eastern Heath Snail Survey)*	**Survey Count**: 3	**Obs Count**:	**Recent Survey**: 2012
E-Eurasian Water-milfoil Rake *(Rake tows/pulls for Eurasian Water-milfoil)*	**Survey Count**: 24	**Obs Count**:	**Recent Survey**: 2017
E-Invasive Mussel Plankton Tow *(Plankton tows for veligers of Invasive Mussels)*	**Survey Count**: 3	**Obs Count**:	**Recent Survey**: 2018
E-Kicknet *(Kicknet Collection Survey for Invasive Mussels and Snails)*	**Survey Count**: 7	**Obs Count**:	**Recent Survey**: 2018
E-Noxious Weed, Road-based *(Noxious Weed Road-based Visual Surveys)*	**Survey Count**: 35	**Obs Count**: 220	**Recent Survey**: 2003
E-Noxious Weed, Visual *(Noxious Weed Visual Surveys)*	**Survey Count**: 6	**Obs Count**: 141	**Recent Survey**: 2009
E-Visual Aquatic Invasives *(Visual Encounter Surveys for Aquatic Invasives on Shorelines or Underwater)*	**Survey Count**: 143	**Obs Count**: 196	**Recent Survey**: 2018
F-Fish Electrofishing *(Fish Electrofishing Surveys)*	**Survey Count**: 10	**Obs Count**: 33	**Recent Survey**: 2013
F-Fish Other Survey *(Fish Other Survey (FWP Survey Type))*	**Survey Count**: 15	**Obs Count**: 36	**Recent Survey**: 1986
I-Aquatic Invert Lotic Dipnet *(Invertebrate Lotic Site Dipnet and Visual Encounter Survey)*	**Survey Count**: 3	**Obs Count**: 16	**Recent Survey**: 2001
I-Mussel *(Stream Mussel Survey)*	**Survey Count**: 1	**Obs Count**:	**Recent Survey**: 2009
M-Bat Acoustic *(Bat Acoustic Survey)*	**Survey Count**: 29	**Obs Count**: 20	**Recent Survey**: 2015

Latitude	Longitude
45.59444	-110.48660
45.71469	-110.63445

Land Cover

Summarized by: **19mtsl0003 CityOfLivingstonPER** *(Custom Area of Interest)*



35% (*10,141 Acres*)

Grassland Systems
Montane Grassland

Rocky Mountain Lower Montane, Foothill, and Valley Grassland

This grassland system of the northern Rocky Mountains is found at lower montane to foothill elevations in mountains and valleys throughout Montana. These grasslands are floristically similar to Big Sagebrush Steppe but are defined by shorter summers, colder winters, and young soils derived from recent glacial and alluvial material. They are found at elevations from 548 - 1,650 meters (1,800-5,413 feet). In the lower montane zone, they range from small meadows to large open parks surrounded by conifers; below the lower treeline, they occur as extensive foothill and valley grasslands. Soils are relatively deep, fine-textured, often with coarse fragments, and non-saline. Microphytic crust may be present in high-quality occurrences. This system is typified by cool-season perennial bunch grasses and forbs (>25%) cover, with a sparse shrub cover (<10%). Rough fescue (*Festuca campestris*) is dominant in the northwestern portion of the state and Idaho fescue (*Festuca idahoensis*) is dominant or co-dominant throughout the range of the system. Bluebunch wheatgrass (*Pseudoroegneria spicata*) occurs as a co-dominant throughout the range as well, especially on xeric sites. Western wheatgrass (*Pascopyrum smithii*) is consistently present, often with appreciable coverage (>10%) in lower elevation occurrences in western Montana and virtually always present, with relatively high coverages (>25%), on the edge of the Northwestern Great Plains region. Species diversity ranges from a high of more than 50 per 400 square meter plot on mesic sites to 15 (or fewer) on xeric and disturbed sites. Most occurrences have at least 25 vascular species present. Farmland conversion, noxious species invasion, fire suppression, heavy grazing and oil and gas development are major threats to this system.

10% (*2,829 Acres*)

Shrubland, Steppe and Savanna Systems
Sagebrush Steppe
Big Sagebrush Steppe

This widespread ecological system occurs throughout much of central Montana, and north and east onto the western fringe of the Great Plains. In central Montana, where this system occurs on both glaciated and non-glaciated landscapes, it differs slightly, with more summer rain than winter precipitation and more precipitation annually. Throughout its distribution, soils are typically deep and non-saline, often with a microphytic crust. This shrub-steppe is dominated by perennial grasses and forbs with greater than 25% cover. Overall shrub cover is less than 10 percent. In Montana and Wyoming, stands are more mesic, with more biomass of grass, and have less shrub diversity than stands farther to the west, and 50 to 90% of the occurrences are dominated by Wyoming big sagebrush with western wheatgrass (*Pascopyrum smithii*). Japanese brome (*Bromus japonicus*) and cheatgrass (*Bromus tectorum*) are indicators of disturbance, but cheatgrassis typically not as abundant as in the Intermountain West, possibly due to a colder climate. The natural fire regime of this ecological system maintains a patchy distribution of shrubs, preserving the steppe character. Shrubs may increase following heavy grazing and/or with fire suppression. In central and eastern Montana, complexes of prairie dog towns are common in this ecological system.

8% (*2,228 Acres*)

Wetland and Riparian Systems
Floodplain and Riparian
Rocky Mountain Lower Montane-Foothill Riparian Woodland and Shrubland

This ecological system is found throughout the Rocky Mountain and Colorado Plateau regions. In Montana, it ranges from approximately 945 to 2,042 meters (3,100 to 6,700 feet), characterristically occuring as a mosaic of multiple communities that are tree-dominated with a diverse shrub component. It is dependent on a natural hydrologic regime, especially annual to episodic flooding. Occurrences are found within the flood zone of rivers, on islands, sand or cobble bars, and on immediate streambanks. It can form large, wide occurrences on mid-channel islands in larger rivers or narrow bands on small, rocky canyon tributaries and well-drained benches. It is also typically found in backwater channels and other perennially wet but less scoured sites, such as floodplains swales and irrigation ditches. In some locations, occurrences extend into moderately high intermountain basins where the adjacent vegetation is sage steppe. Dominant trees may include boxelder maple (*Acer negundo*), narrowleaf cottonwood (*Populus angustifolia*), Plains cottonwood (*Populus deltoides*), Douglas-fir (*Pseudotsuga menziesii*), peachleaf willow (*Salix amygdaloides*), or Rocky Mountain juniper (*Juniperus scopulorum*). Dominant shrubs include Rocky Mountain maple (*Acer glabrum*), thinleaf alder (*Alnus incana*), river birch (*Betula occidentalis*), redoiser dogwood (*Cornus sericea*), hawthorne (*Crataegus spp.*), chokecherry (*Prunus virginiana*), skunkbush sumac (*Rhus trilobata*), Drummondâ€™s willow (*Salix drummondiana*), sandbar willow (*Salix exigua*), Pacific willow (*Salix lucida*), rose (*Rosa* species), silver buffaloberry (*Shepherdia argentea*), or snowberry (*Symphoricarpos* species). Exotic trees of Russian olive (*Elaeagnus angustifolia*) and saltcedar (*Tamarix* species) may invade some stands in southeastern and south-central Montana.

7% (*2,151 Acres*)

Forest and Woodland Systems
Conifer-dominated forest and woodland (xeric-mesic)
Rocky Mountain Montane Douglas-fir Forest and Woodland

In Montana, this ecological system occurs on the east side of the Continental Divide, north to about the McDonald Pass area, and along the Rocky Mountain Front. This system is associated with a dry to submesic continental climate regime with annual precipitation ranging from 51 to 102 centimeters (20-40 inches), with a maximum in winter or late spring. Winter snowpacks typically melt off in early spring at lower elevations. Elevations range from valley bottoms to 1,980 meters (6500 feet) in northern Montana and up to 2,286 meters (7500 feet) on warm aspects in southern Montana. It occurs on north-facing aspects in most areas, and south-facing aspects at higher elevations. This is a Douglas-fir (*Pseudotsuga menziesii*) dominated system without any maritime floristic composition. Fire disturbance intervals are as infrequent as 500 years, and as a result, individual trees and forests can attain great age on some sites (500 to 1,500 years). In Montana, this system occurs from lower montane to lower subalpine environments and is prevalent on calcareous substrates. Common understory shrubs include common ninebark (*Physocarpus malvaceus*), common juniper (*Juniperus communis*), Rocky Mountain juniper (*Juniperus scopulorum*), birch-leaf spiraea (*Spiraea betulifolia*), snowberry (*Symphoricarpos* species), creeping Oregon grape (*Mahonia repens*) and Canadian buffaloberry (*Shepherdia canadensis*). The Douglas-fir/pinegrass (C*alamogrostis rubescens*) type is the most ubiquitous association found within this system in Montana.

No Image

6% (*1,759 Acres*)

Human Land Use
Developed
Other Roads

County, city and or rural roads generally open to motor vehicles.

6% (*1,644 Acres*)

Human Land Use
Agriculture
Cultivated Crops

These areas used for the production of crops, such as corn, soybeans, small grains, sunflowers, vegetables, and cotton, typically on an annual cycle. Agricultural plant cover is variable depending on season and type of farming. Other areas include more stable land cover of orchards and vineyards.

4% (*1,058 Acres*)

Human Land Use
Developed
Developed, Open Space

Vegetation (primarily grasses) planted in developed settings for recreation, erosion control, or aesthetic purposes. Impervious surfaces account for less than 20% of total cover. This category often includes highway and railway rights of way and graveled rural roads.

3% (*900 Acres*)

Human Land Use
Developed
Low Intensity Residential

Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-50% of total cover. These areas most commonly include single-family housing units in rural and suburban areas. Paved roadways may be classified into this category.

3% (*885 Acres*)

Grassland Systems
Lowland/Prairie Grassland
Great Plains Mixedgrass Prairie

The system covers much of the eastern two-thirds of Montana, occurring continuously for hundreds of square kilometers, interrupted only by wetland/riparian areas or sand prairies. Soils are primarily fine and medium-textured. The growing season averages 115 days, ranging from 100 days on the Canadian border to 130 days on the Wyoming border. Climate is typical of mid-continental regions with long severe winters and hot summers. Grasses typically comprise the greatest canopy cover, and western wheatgrass (*Pascopyrum smithii*) is usually dominant. Other species include thickspike wheatgrass (*Elymus lanceolatus*), green needlegrass (*Nassella viridula*), blue grama (*Bouteloua gracilis*), and needle and thread (*Hesperostipa comata*). Near the Canadian border in north-central Montana, this system grades into rough fescue (*Festuca campestris)* and Idaho fescue (*Festuca idahoensis*) grasslands. Remnants of shortbristle needle and thread *(Hesperostipa curtiseta)* dominated vegetation are found in northernmost Montana and North Dakota, and are associated with productive sites, now mostly converted to farmland. Forb diversity is typically high. In areas of southeastern and central Montana where sagebrush steppe borders the mixed grass prairie, common plant associations include Wyoming big sagebrush-western wheatgrass (*Artemisia tridentata* ssp. *wyomingensis/ Pascopyrum smithii*). Fire and grazing are the primary drivers of this system. Drought can also impact it, in general favoring the shortgrass component at the expense of the mid-height grasses. With intensive grazing, cool season exotics such as Kentucky bluegrass (*Poa pratensis*), smooth brome (*Bromus inermis*), and Japanese brome (*Bromus japonicus*) increase in dominance; both of these rhizomatous species have been shown to markedly decrease species diversity. Previously cultivated acres that have been re-vegetated with non-native plants have been transformed into associations such as Kentucky bluegrass (*Poa pratensis*)/western wheatgrass *(Pascopyrum smithii)* or into pure crested wheatgrass (*Agropyron cristatum)* stands.

3% (*802 Acres*)

Shrubland, Steppe and Savanna Systems
Deciduous Shrubland
Great Plains Shrubland

This ecological system is found from southern Alberta through northern Montanaâ€™s glaciated and unglaciated plains, typically at elevations ranging from 1,220 to 1,524 meters (4,000-5,000 feet). It can occur on all aspects but is more common on mesic sites with moderately shallow or deep, fine to sandy loam soils. Often it is located on slopes near breaklands and on the edge of coulees, or on upper terraces of rivers and streams. It differs from the Northwestern Great Plains Mixedgrass Prairie in that shrub cover is more than 10%, although the grass component is similar, and may occur where fire suppression in grasslands has allowed shrubs to establish. Dominant shrubs include serviceberry (*Amelanchier alnifolia*), skunkbush sumac (*Rhus trilobata*), snowberry (*Symphoricarpos* species), silver buffaloberry (Sheperdia argentea), shrubby cinquefoil (*Dasiphora fruticosa ssp. floribunda*), silverberry (*Elaeagnus commutata*) and horizontal rug juniper (*Juniperus horizontalis*). Silver sage (*Artemisia cana ssp. cana*) shrublands may occur on flat alluvial deposits on floodplains, terraces or benches, and alluvial fans.

2% (*658 Acres*)

Forest and Woodland Systems
Deciduous dominated forest and woodland
Aspen Forest and Woodland

This widespread ecological system is more common in the southern and central Rocky Mountains, but occurs in the montane and subalpine zones throughout much of Montana north into Canada. It is similar to the Inter-Mountain Basins Aspen Mixed Conifer Forest-Woodland found in the Big Snowy Mountains, but lacks the conifer component. Distribution of this system is primarily limited by adequate soil moisture required to meet its high evapotranspirative demand, length of growing season, and temperatures. Mean annual precipitation where these systems occur is generally greater than 38 centimeters (15 inches) and typically greater than 51 centimeters (20 inches), except in semi-arid environments where occurrences are restricted to mesic microsites such as seeps or areas below large snow drifts. Stands can occur on gentle to moderate slopes, in swales, or on level sites. At lower elevations, occurrences are found on cooler, north aspects and mesic sites. Soils are usually deep and well developed with rock often absent from the soil. Soil texture ranges from sandy loam to clay loams. This system describes mesic forests and woodlands dominated by quaking aspen (*Populus tremuloides*) without a significant conifer component (<25% relative tree cover). This aspen system can be stable and long-lived with little encroachment of coniferous species. The understory structure may be complex with multiple shrub and herbaceous layers, or simple, with just an herbaceous layer. The herbaceous layer may be dense or sparse, dominated by mesic grasses or forbs. Occurrences of this system often originate, and are likely maintained, by stand-replacing disturbances such as crown fire, disease, windthrow, elk and beaver activity.

2% (*507 Acres*)

Shrubland, Steppe and Savanna Systems
Sagebrush Steppe
Montane Sagebrush Steppe

This system dominates the montane and subalpine landscape of southwestern Montana from valley bottoms to subalpine ridges and is found as far north as Glacier National Park. It can also be seen in the island mountain ranges of the north-central and south-central portions of the state. It primarily occurs on deep-soiled to stony flats, ridges, nearly flat ridgetops, and mountain slopes. In general, this system occurs in areas of gentle topography, fine soils, subsurface moisture or mesic conditions, within zones of higher precipitation and areas of snow accumulation. It occurs on all slopes and aspects, variable substrates and all soil types. The shrub component of this system is generally dominated by mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*). Other co-dominant shrubs include silver sagebrush (*Artemisia cana ssp. viscidula)*, subalpine big sagebrush (*Artemisia tridentata ssp. spiciformis*), three tip sagebrush (*Artemisia tripartita* ssp. *tripartita*) and antelope bitterbrush (*Purshia tridentata*). Little sagebrush (*Artemisia arbuscula ssp. arbuscula*) shrublands are only found in southwestern Montana on sites with a perched water table. Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*) sites may be included within this system if occurrences are at montane elevations, and are associated with montane graminoids such as Idaho fescue (*Festuca idahoensis),* spike fescue (*Leucopoa kingii*), or poverty oatgrass (*Danthonia intermedia)*. In ares where sage has been eliminated by human activities like burning, disking or poisoning, other shrubs may be dominant, especially rubber rabbitbrush (*Ericameria nauseosa*), and green rabbitbrush (*Chrysothamnus viscidiflorus*). Because of the mesic site conditions, most occurrences support a diverse herbaceous undergrowth of grasses and forbs. Shrub canopy cover is extremely variable, ranging from 10 percent to as high as 40 or 50 percent.

No Image

2% (*494 Acres*)

Human Land Use
Developed
Interstate

National Highway System (NHS) limited access highways and their shoulders and rights of way.

2% (*484 Acres*)

Wetland and Riparian Systems
Open Water
Open Water

All areas of open water, generally with less than 25% cover of vegetation or soil

No Image

2% (*483 Acres*)

Human Land Use
Developed
Commercial / Industrial

Businesses, industrial parks, hospitals, airports; utilities in commercial/industrial areas.

Additional Limited Land Cover

1% (*397 Acres*) Rocky Mountain Subalpine-Montane Mesic Meadow
1% (*239 Acres*) Rocky Mountain Montane-Foothill Deciduous Shrubland
1% (*159 Acres*) Rocky Mountain Lodgepole Pine Forest
1% (*150 Acres*) Major Roads
<1% (*127 Acres*) Rocky Mountain Foothill Limber Pine - Juniper Woodland
<1% (*120 Acres*) Railroad
<1% (*117 Acres*) High Intensity Residential
<1% (*75 Acres*) Quarries, Strip Mines and Gravel Pits
<1% (*69 Acres*) Introduced Upland Vegetation - Annual and Biennial Forbland
<1% (*56 Acres*) Pasture/Hay
<1% (*50 Acres*) Great Plains Riparian
<1% (*42 Acres*) Great Plains Wooded Draw and Ravine
<1% (*26 Acres*) Harvested forest-tree regeneration
<1% (*23 Acres*) Rocky Mountain Cliff, Canyon and Massive Bedrock
<1% (*22 Acres*) Introduced Riparian and Wetland Vegetation
<1% (*19 Acres*) Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland
<1% (*9 Acres*) Mountain Mahogany Woodland and Shrubland
<1% (*8 Acres*) Insect-Killed Forest
<1% (*8 Acres*) Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland
<1% (*8 Acres*) Great Plains Cliff and Outcrop
<1% (*7 Acres*) Harvested forest-grass regeneration
<1% (*6 Acres*) Great Plains Saline Depression Wetland
<1% (*6 Acres*) Alpine-Montane Wet Meadow

<1% (*5 Acres*) Aspen and Mixed Conifer Forest

<1% (*5 Acres*) Great Plains Floodplain

<1% (*2 Acres*) Rocky Mountain Foothill Woodland-Steppe Transition

<1% (*2 Acres*) Harvested forest-shrub regeneration

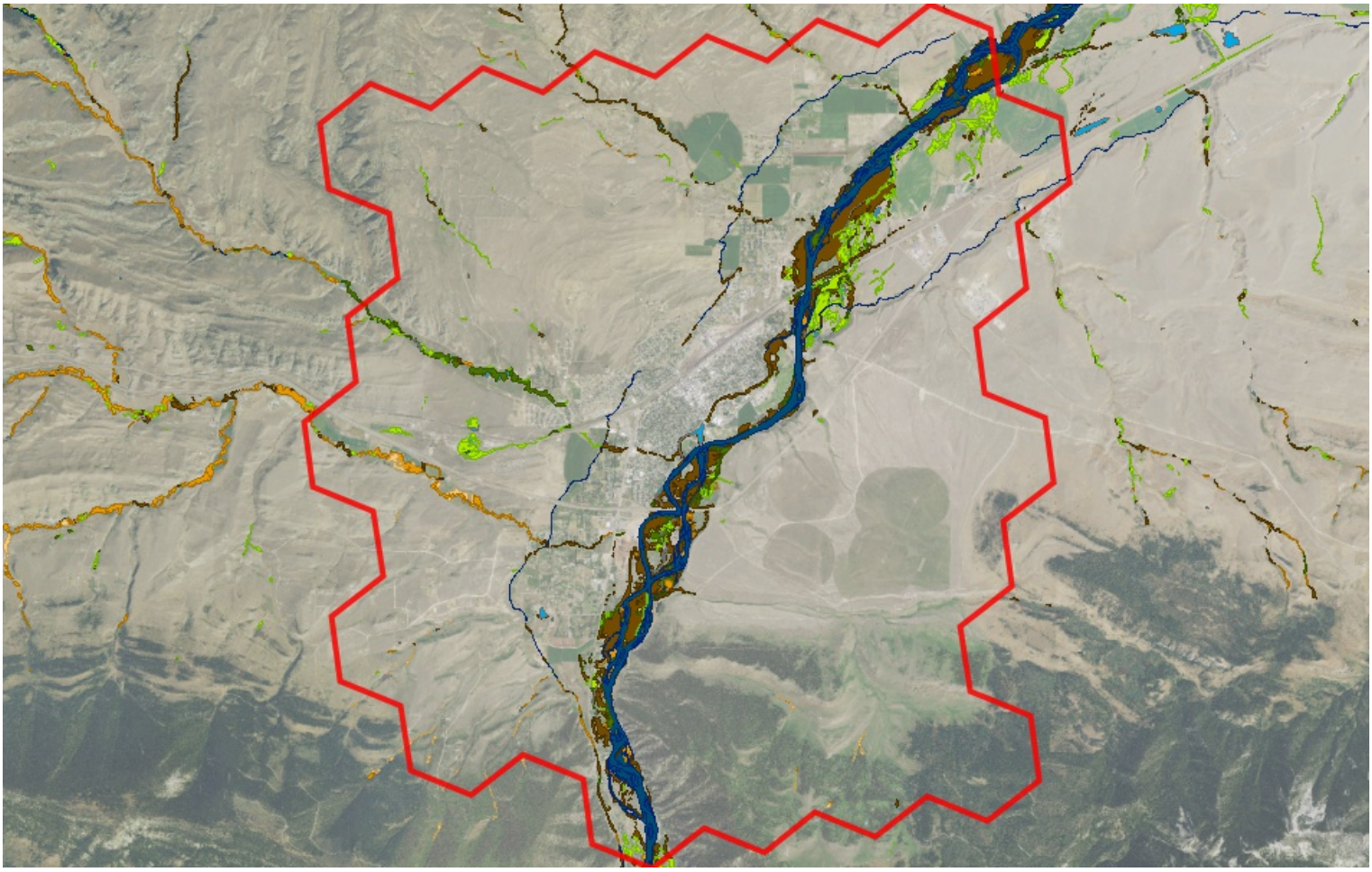
<1% (*2 Acres*) Rocky Mountain Lower Montane-Foothill Shrubland

<1% (*1 Acres*) Low Sagebrush Shrubland

Latitude	Longitude
45.59444	-110.48660
45.71469	-110.63445

Wetland and Riparian

Summarized by: **19mtsl0003 CityOfLivingstonPER** *(Custom Area of Interest)*



Wetland and Riparian Mapping

Explain

P - Palustrine

UB - Unconsolidated Bottom

F - Semipermanently Flooded	1 Acres	
(no modifier)	**1 Acres**	**PUBF**

P - Palustrine, UB - Unconsolidated Bottom
Wetlands where mud, silt or similar fine particles cover at least 25% of the bottom, and where vegetation cover is less than 30%.

AB - Aquatic Bed

F - Semipermanently Flooded	36 Acres	
(no modifier)	**13 Acres**	**PABF**
b - Beaver	**5 Acres**	**PABFb**
h - Diked/Impounded	**8 Acres**	**PABFh**
x - Excavated	**10 Acres**	**PABFx**
G - Intermittently Exposed	8 Acres	
h - Diked/Impounded	**8 Acres**	**PABGh**
K - Artificially Flooded	<1 Acres	
x - Excavated	**<1 Acres**	**PABKx**

P - Palustrine, AB - Aquatic Bed
Wetlands with vegetation growing on or below the water surface for most of the growing season.

US - Unconsolidated Shore

A - Temporarily Flooded	<1 Acres	
x - Excavated	**<1 Acres**	**PUSAx**
C - Seasonally Flooded	1 Acres	
h - Diked/Impounded	**1 Acres**	

P - Palustrine, US - Unconsolidated Shore
Wetlands with less than 75% areal cover of stones, boulders, or bedrock. AND with less than 30% vegetative cover AND the wetland is irregularly exposed due to seasonal or irregular flooding and subsequent drying.

PUSCh

EM - Emergent

P - Palustrine, EM - Emergent
Wetlands with erect, rooted herbaceous vegetation present during most of the growing season.

A - Temporarily Flooded	247 Acres	
(no modifier)	**246 Acres**	**PEMA**
h - Diked/Impounded	**1 Acres**	**PEMAh**
C - Seasonally Flooded	45 Acres	
(no modifier)	**40 Acres**	**PEMC**
b - Beaver	**2 Acres**	**PEMCb**
h - Diked/Impounded	**3 Acres**	**PEMCh**
F - Semipermanently Flooded	1 Acres	
h - Diked/Impounded	**1 Acres**	**PEMFh**
x - Excavated	**<1 Acres**	**PEMFx**

SS - Scrub-Shrub

P - Palustrine, SS - Scrub-Shrub
Wetlands dominated by woody vegetation less than 6 meters (20 feet) tall. Woody vegetation includes tree saplings and trees that are stunted due to environmental conditions.

A - Temporarily Flooded	127 Acres	
(no modifier)	**120 Acres**	**PSSA**
b - Beaver	**6 Acres**	**PSSAb**
x - Excavated	**1 Acres**	**PSSAx**
C - Seasonally Flooded	35 Acres	
(no modifier)	**7 Acres**	**PSSC**
b - Beaver	**28 Acres**	**PSSCb**

R - Riverine (Rivers)

3 - Upper Perennial

UB - Unconsolidated Bottom

R - Riverine (Rivers), 3 - Upper Perennial, UB - Unconsolidated Bottom
Stream channels where the substrate is at least 25% mud, silt or other fine particles.

H - Permanently Flooded	438 Acres	
(no modifier)	**438 Acres**	**R3UBH**

US - Unconsolidated Shore

R - Riverine (Rivers), 3 - Upper Perennial, US - Unconsolidated Shore
Shorelines with less than 75% areal cover of stones, boulders, or bedrock and less than 30% vegetation cover. The area is also irregularly exposed due to seasonal or irregular flooding and subsequent drying.

A - Temporarily Flooded	98 Acres	
(no modifier)	**98 Acres**	**R3USA**
C - Seasonally Flooded	83 Acres	
(no modifier)	**83 Acres**	**R3USC**

4 - Intermittent

SB - Stream Bed

R - Riverine (Rivers), 4 - Intermittent, SB - Stream Bed
Active channel that contains periodic water flow.

C - Seasonally Flooded	14 Acres	
(no modifier)	**<1 Acres**	**R4SBC**
x - Excavated	**14 Acres**	**R4SBCx**

Rp - Riparian

1 - Lotic

SS - Scrub-Shrub
(no modifier) **90 Acres** **Rp1SS**

Rp - Riparian, 1 - Lotic, SS - Scrub-Shrub
This type of riparian area is dominated by woody vegetation that is less than 6 meters (20 feet) tall. Woody vegetation includes tree saplings and trees that are stunted due to environmental conditions.

FO - Forested
(no modifier) **720 Acres** **Rp1FO**

Rp - Riparian, 1 - Lotic, FO - Forested
This riparian class has woody vegetation that is greater than 6 meters (20 feet) tall.

EM - Emergent
(no modifier) **34 Acres** **Rp1EM**

Rp - Riparian, 1 - Lotic, EM - Emergent
Riparian areas that have erect, rooted herbaceous vegetation during most of the growing season.

2 - Lentic

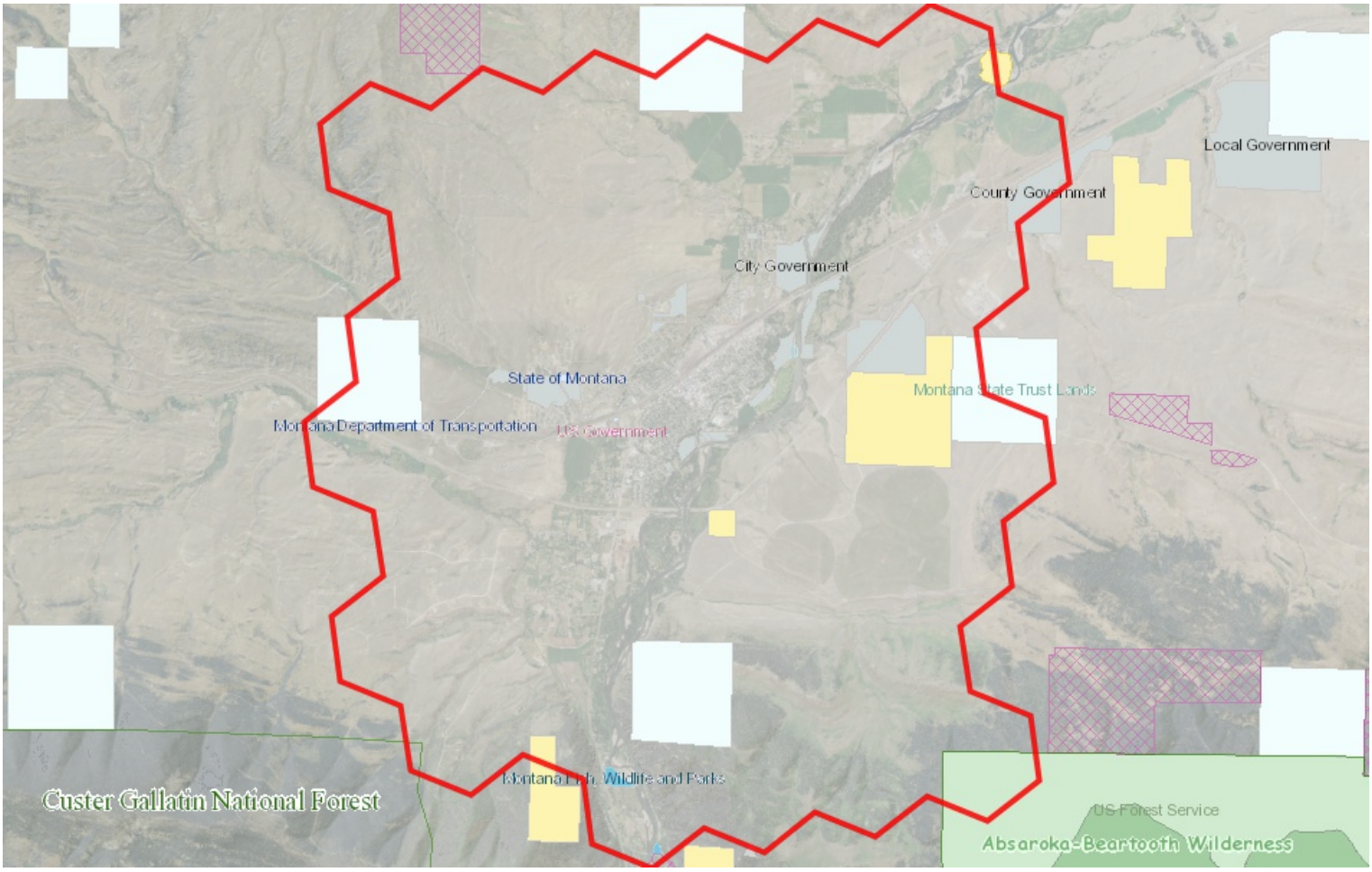
FO - Forested
(no modifier) **1 Acres** **Rp2FO**

Rp - Riparian, 2 - Lentic, FO - Forested
This riparian class has woody vegetation that is greater than 6 meters (20 feet) tall.

Latitude	Longitude
45.59444	-110.48660
45.71469	-110.63445

Land Management

Summarized by: **19mtsl0003 CityOfLivingstonPER** *(Custom Area of Interest)*



Land Management Summary

Explain

	Ownership	Tribal	Easements	Other Boundaries (possible overlap)
Public Lands	**3,541 Acres (12%)**			
Federal	**1,030 Acres (4%)**			
US Forest Service	**292 Acres (1%)**			
USFS Owned	**292 Acres (1%)**			
USFS Ranger Districts				**314 Acres**
Custer Gallatin National Forest, Yellowstone Ranger District				314 Acres
USFS National Forest Boundaries				**314 Acres**
Custer Gallatin National Forest				314 Acres
US Bureau of Land Management	**732 Acres (3%)**			
BLM Owned	**732 Acres (3%)**			
BLM Wilderness Study Areas				**25 Acres**
Yellowstone Island Wilderness Study Area				25 Acres
US Government	**6 Acres (<1%)**			
US Government Owned	**6 Acres (<1%)**			
State	**1,769 Acres (6%)**			
Montana State Trust Lands	**1,730 Acres (6%)**			
MT State Trust Owned	**1,730 Acres (6%)**			
Montana Fish, Wildlife and Parks	**20 Acres (<1%)**			
MTFWP Owned	**20 Acres (<1%)**			
MTFWP Fishing Access Sites				**23 Acres**

Land Management Summary

Explain

	Ownership	Tribal	Easements	Other Boundaries (possible overlap)
Carter's Bridge Fishing Access Site				4 Acres
Free River Fishing Access Site				16 Acres
Mayor's Landing Fishing Access Site				3 Acres
Montana Department of Transportation	13 Acres (<1%)			
MTDOT Owned	13 Acres (<1%)			
State of Montana	6 Acres (<1%)			
State of Montana Owned	6 Acres (<1%)			
Local	742 Acres (3%)			
Local Government	742 Acres (3%)			
Local Government Owned	742 Acres (3%)			
Conservation Easements			8 Acres (<1%)	
Private			8 Acres (<1%)	
Montana Land Reliance			7 Acres (<1%)	
Rocky Mountain Elk Foundation			1 Acres (<1%)	
Private Lands or Unknown Ownership	25,232 Acres (88%)			

Latitude	Longitude
45.59444	-110.48660
45.71469	-110.63445

Biological Reports

Summarized by: **19mtsl0003 CityOfLivingstonPER** *(Custom Area of Interest)*

Within the report area you have requested, citations for all reports and publications associated with plant or animal observations in Montana Natural Heritage Program (MTNHP) databases are listed and, where possible, links to the documents are included.

The MTNHP plans to include reports associated with terrestrial and aquatic communities in the future as allowed for by staff resources. If you know of reports or publications associated with species or biological communities within the report area that are not shown in this report, please let us know: mtnhp@mt.gov

- Dubovsky, James. 2004. Trumpeter Swan Survey of the Rocky Mountain Population, U.S. Breeding Segment Fall 2004. USFWS Migratory Birds and State Programs. Mountain-Prairie Region. Lakewood, CO.
- Dubovsky, James. 2005. Trumpeter Swan Survey of the Rocky Mountain Population, U.S. Breeding Segment Fall 2005. USFWS Migratory Birds and State Programs. Mountain-Prairie Region. Lakewood, CO.
- Dubovsky, Jim. 2002. Trumpeter Swan Survey of the Rocky Mountain Population Fall 2002. US Fish and Wildlife Service Mountain-Prairie Region. Lakewood, CO. 28 pages including appendices plus errata.
- Dubovsky, Jim. 2003. Trumpeter Swan Survey of the Rocky Mountain Population, US Breeding segment Fall 2003. US Fish and Wildlife Service, Mountain-Prairie Region. Lakewood CO. 28 pages including appendices.
- Fuller, Pam and A. Benson. U.S. Department of the Interior. USGS NAS: ***Nonindigenous Aquatic Species Database***. 2017. Accessed 10 October 2017. https://nas.er.usgs.gov/
- Gomez, Daniel. 1995. 1995 mid-winter survey Rocky Mountain population trumpeter swans. Red Rock Lakes National Wildlife Refuge. USFWS Lakeview, Montana. 10pp.
- Gomez, Daniel. 1996. 1996 mid-winter survey Rocky Mountain population trumpeter swans. Red Rock Lakes National Wildlife Refuge. US Fish and Wildlife Service Lakeview, Montana. 24 pp.
- Gomez, Daniel. 1997. Trumpeter swan survey of the Rocky Mountain population/U.S. flocks, Fall 1997. Unpublished report from the Red Rock Lakes NWR.
- Gomez, Daniel. 1998. Trumpeter swan survey of the Rocky Mountain population/U.S. flocks, fall 1998. Red Rock Lakes NWR.
- Gomez, Daniel. 1999. 1999 mid-winter survey Rocky Mountain population trumpeter swans. Red Rock Lakes National Wildlife Refuge USFWS Lakeview, MT.
- Gomez, Daniel. 1999. Trumpeter swan survey of the Rocky Mountain population/U.S. flocks, fall 1999. Red Rock Lakes NWR.
- Hinckley, Dan. 1985. ***Blackbook of Montana Peregrine Falcon Eyries***. BLM Spec. Rep.
- Olson, Dave. 2001. 2001 mid-winter survey Rocky Mountain population trumpeter swans. Red Rock Lakes National Wildlife Refuge USFWS Lakeview, MT.
- Olson, Dave. 2001. Trumpeter swan survey of the Rocky Mountain population Fall 2001. US Fish and Wildlife Service, Red Rock Lakes National Wildlife Refuge, Lakeview, MT. 7 pp. plus appendices.
- Olson, Dave. 2002. 2002 mid-winter survey Rocky Mountain population trumpeter swans. Red Rock Lakes National Wildlife Refuge USFWS Lakeview, MT.
- Reed, Tom and Daniel Gomez. 2000. 2000 mid-winter survey Rocky Mountain population trumpeter swans. Red Rock Lakes National Wildlife Refuge USFWS Lakeview, MT.
- Reed, Tom. 2000. Trumpeter Swan Survey ot the US sub-population of the Rocky Mountain population Fall 2000. US Fish and Wildlife Service. Red Rock Lakes NWR. Lakeview, MT. 15pp.
- Rogers, Ralph and Jay Sumner. 2004. Montana Peregrine Falcon Survey. Centmont Bioconsultants. Winifred, Montana. 32 pp plus appendix.
- Sumner, Jay and Ralph Rogers. 2006. Montana Peregrine Falcon Survey. Montana Peregrine Institute. Arlee, Montana. 36 pp plus appendix.

MONTANA Natural Heritage Program

A program of the **Montana State Library's Natural Resource Information System** operated by the **University of Montana**.

Legend

Model Icons
- N Suitable (native range)
- O Optimal Suitability
- M Moderate Suitability
- L Low Suitability
- I Suitable (introduced range)

Habitat Icons
- C Common
- O Occasional

Range Icons
- T Suspect (invasive / pest)
- D Documented (invasive / pest)
- R Released (biocontrol)
- E Established (biocontrol)

Num Obs
Count of obs with 'good precision' (<=1000m)

+ indicates additional 'poor precision' obs (1001m-10,000m)

Latitude	Longitude
45.59444	-110.48660
45.71469	-110.63445

Invasive and Pest Species

Summarized by: **19mtsl0003 CityOfLivingstonPER** *(Custom Area of Interest)*

	# Obs	Predictive Model	Associated Habitat	Range
Aquatic Invasive Species				
I - Potamopyrgus antipodarum *(New Zealand Mudsnail)* AIS	2	Not Available	Not Assigned	
View in Field Guide Aquatic Invasive Species - Non-native Species Global: **G5** State: **SNA**				
Noxious Weeds: Priority 1B				
V - Lythrum salicaria *(Purple Loosestrife)* N1B	1	Not Available	Not Assigned	
View in Field Guide Noxious Weed: Priority 1B - Non-native Species Global: **G5** State: **SNA**				
Noxious Weeds: Priority 2B				
V - Centaurea stoebe *(Spotted Knapweed)* N2B	70	Not Available	Not Assigned	D
View in Field Guide View Range Maps Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**				
V - Cirsium arvense *(Canada Thistle)* N2B	45	Not Available	Not Assigned	D
View in Field Guide View Range Maps Noxious Weed: Priority 2B - Non-native Species Global: **G5** State: **SNA**				
V - Convolvulus arvensis *(Field Bindweed)* N2B	41	Not Available	Not Assigned	D
View in Field Guide View Range Maps Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**				
V - Cynoglossum officinale *(Common Hound's-tongue)* N2B	40	Not Available	Not Assigned	D
View in Field Guide View Range Maps Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**				
V - Euphorbia virgata *(Leafy Spurge)* N2B	50	Not Available	Not Assigned	D
View in Field Guide View Range Maps Noxious Weed: Priority 2B - Non-native Species Global: **GNRTNR** State: **SNA**				
V - Lepidium draba *(Whitetop)* N2B	33	Not Available	Not Assigned	D
View in Field Guide View Range Maps Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**				
V - Linaria dalmatica *(Dalmatian Toadflax)* N2B	41	Not Available	Not Assigned	D
View in Field Guide View Range Maps Noxious Weed: Priority 2B - Non-native Species Global: **G5** State: **SNA**				
V - Berteroa incana *(Hoary False-alyssum)* N2B	14	Not Available	Not Assigned	
View in Field Guide Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**				
V - Potentilla recta *(Sulphur Cinquefoil)* N2B	11	Not Available	Not Assigned	
View in Field Guide Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**				
V - Tanacetum vulgare *(Common Tansy)* N2B	30	Not Available	Not Assigned	
View in Field Guide Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**				
Regulated Weeds: Priority 3				
V - Bromus tectorum *(Cheatgrass)* R3	2	Not Available	Not Assigned	D
View in Field Guide View Range Maps Regulated Weed: Priority 3 - Non-native Species Global: **GNR** State: **SNA**				
Biocontrol Species				
I - Oberea erythrocephala *(Red-headed Leafy Spurge Stem Borer)* BIOCNTRL			Not Assigned	R
View in Field Guide View Predicted Models View Range Maps Biocontrol Species - Non-native Species Global: **GNR** State: **SNA** **Predictive Models:** O 7% Optimal (inductive), M 67% Moderate (inductive), L 20% Low (inductive)				
I - Mecinus janthiniformis *(Dalmatian Toadflax Stem-boring Weevil)* BIOCNTRL			Not Assigned	R

View in Field Guide View Predicted Models View Range Maps
Biocontrol Species - Non-native Species Global: **GNR** State: **SNA**
Predictive Models: M 56% Moderate (inductive), L 44% Low (inductive)

I - Aphthona lacertosa *(Brown-legged Leafy Spurge Flea Beetle)* **BIOCNTRL** Not Assigned R

View in Field Guide View Predicted Models View Range Maps
Biocontrol Species - Non-native Species Global: **GNR** State: **SNA**
Predictive Models: M 53% Moderate (inductive), L 33% Low (inductive)

I - Cyphocleonus achates *(Knapweed Root Weevil)* **BIOCNTRL** Not Assigned R

View in Field Guide View Predicted Models View Range Maps
Biocontrol Species - Non-native Species Global: **GNR** State: **SNA**
Predictive Models: M 20% Moderate (inductive), L 76% Low (inductive)

I - Aphthona nigriscutis *(Black Dot Leafy Spurge Flea Beetle)* **BIOCNTRL** Not Assigned R

View in Field Guide View Predicted Models View Range Maps
Biocontrol Species - Non-native Species Global: **GNR** State: **SNA**
Predictive Models: M 16% Moderate (inductive), L 64% Low (inductive)

I - Mecinus janthinus *(Yellow Toadflax Stem-boring Weevil)* **BIOCNTRL** Not Assigned R

View in Field Guide View Predicted Models View Range Maps
Biocontrol Species - Non-native Species Global: **GNR** State: **SNA**
Predictive Models: L 49% Low (inductive)

Introduction to Montana Natural Heritage Program

P.O. Box 201800 • 1515 East Sixth Avenue • Helena, MT 59620-1800 • fax 406.444.0266 • tel 406.444.0241 • mtnhp.org

Introduction

The Montana Natural Heritage Program (MTNHP) is Montana's source for reliable and objective information on Montana's native species and habitats, emphasizing those of conservation concern. MTNHP was created by the Montana legislature in 1983 as part of the Natural Resource Information System (NRIS) at the Montana State Library (MSL). MTNHP is "a program of information acquisition, storage, and retrieval for data relating to the flora, fauna, and biological community types of Montana" (MCA 90-15-102). MTNHP's activities are guided by statute (MCA 90-15) as well as through ongoing interaction with, and feedback from, principal data source agencies such as Montana Fish, Wildlife, and Parks, the Montana Department of Environmental Quality, the Montana Department of Natural Resources and Conservation, the Montana University System, the US Forest Service, and the US Bureau of Land Management. The enabling legislation for MTNHP provides the State Library with the option to contract the operation of the Program. Since 2006, MTNHP has been operated as a program under the Office of the Vice President for Research and Creative Scholarship at the University of Montana (UM) through a renewable 2-year contract with the MSL. Since the first staff was hired in 1985, the Program has logged a long record of success, and developed into a highly respected, service-oriented program. MTNHP is widely recognized as one of the most advanced and effective of over 80 natural heritage programs throughout the Western Hemisphere.

Vision

Our vision is that public agencies, the private sector, the education sector, and the general public will trust and rely upon MTNHP as the source for information and expertise on Montana's species and habitats, especially those of conservation concern. We strive to provide easy access to our information in order for users to save time and money, speed environmental reviews, and inform decision making.

Core Values

- We endeavor to be a single statewide source of accurate and up-to-date information on Montana's plants, animals, and aquatic and terrestrial biological communities.
- We actively listen to our data users and work responsively to meet their information and training needs.
- We strive to provide neutral, trusted, timely, and equitable service to all of our information users.
- We make every effort to be transparent to our data users in setting work priorities and providing data products.

Confidentiality

All information requests made to the Montana Natural Heritage Program are considered library records and are protected from disclosure by the Montana Library Records Confidentiality Act (MCA 22-1-11).

Information Managed

Information managed at the Montana Natural Heritage Program includes: (1) lists of, and basic information on, plant and animal species and biological communities; (2) plant and animal surveys, observations, species occurrences, predictive distribution models, range polygons, and conservation status ranks; and (3) land cover and wetland and riparian mapping and the conservation status of these and other biological communities.

Data Use Terms and Conditions

- Montana Natural Heritage Program (MTNHP) products and services are based on biological data and the objective interpretation of those data by professional scientists. MTNHP does not advocate any particular philosophy of natural resource protection, management, development, or public policy.
- MTNHP has no natural resource management or regulatory authority. Products, statements, and services from MTNHP are intended to inform parties as to the state of scientific knowledge about certain natural resources, and to further develop that knowledge. The information is not intended as natural resource management guidelines or prescriptions or a determination of environmental impacts. MTNHP recommends consultation with appropriate state, federal, and tribal resource management agencies and authorities in the area where your project is located.
- Information on the status and spatial distribution of biological resources produced by MTNHP are intended to inform parties of the state-wide status, known occurrence, or the likelihood of the presence of those resources. **These products are not intended to substitute for field-collected data, nor are they intended to be the sole basis for natural resource management decisions.**
- MTNHP does not portray its data as exhaustive or comprehensive inventories of rare species or biological communities. **Field verification of the absence or presence of sensitive species and biological communities will always be an important obligation of users of our data.**
- MTNHP responds equally to all requests for products and services, regardless of the purpose or identity of the requester.
- Because MTNHP constantly updates and revises its databases with new data and information, products will become outdated over time. Interested parties are encouraged to obtain the most current information possible from MTNHP, rather than using older products. We add, review, update, and delete records on a daily basis. Consequently, we strongly advise that you update your MTNHP data sets at a minimum of every three months for most applications of our information.
- MTNHP data require a certain degree of biological expertise for proper analysis, interpretation, and application. Our staff is available to advise you on questions regarding the interpretation or appropriate use of the data that we provide. Contact information for MTNHP staff is posted at: http://mtnhp.org/contact.asp
- The information provided to you by MTNHP may include sensitive data that if publicly released might jeopardize the welfare of threatened, endangered, or sensitive species or biological communities. This information is intended for distribution or use only within your department, agency, or business. Subcontractors may have access to the data during the course of any given project, but should not be given a copy for their use on subsequent, unrelated work.
- MTNHP data are made freely available. Duplication of hard-copy or digital MTNHP products with the intent to sell is prohibited without written consent by MTNHP. Should you be asked by individuals outside your organization for the type of data that we provide, please refer them to MTNHP.
- MTNHP and appropriate staff members should be appropriately acknowledged as an information source in any third-party product involving MTNHP data, reports, papers, publications, or in maps that incorporate MTNHP graphic elements.
- Sources of our data include museum specimens, published and unpublished scientific literature, field surveys by state and federal agencies and private contractors, and reports from knowledgeable individuals. MTNHP actively solicits and encourages additions, corrections and updates, new observations or collections, and comments on any of the data we provide.
- MTNHP staff and contractors do not cross or survey privately-owned lands without express permission from the landowner. However, the program cannot guarantee that information provided to us by others was obtained under adherence to this policy.

Suggested Contacts for Natural Resource Agencies

As required by Montana statute (MCA 90-15), the Montana Natural Heritage Program works with state, federal, tribal, nongovernmental organizations, and private partners to ensure that the latest animal and plant distribution and status information is incorporated into our databases so that it can be used to inform a variety of planning processes and management decisions. In addition to the information you receive from us, we encourage you to contact state, federal, and tribal resource management agencies in the area where your project is located. They may have additional data or management guidelines relevant to your efforts. In particular, we encourage you to contact the Montana Department of Fish, Wildlife, and Parks for the latest data and management information regarding hunted and high-profile management species and to use the U.S. Fish and Wildlife Service's Information Planning and Conservation (IPAC) website http://ecos.fws.gov/ipac/ regarding U.S. Endangered Species Act listed Threatened, Endangered, or Candidate species.

For your convenience, we have compiled a list of relevant agency contacts and links below:

Montana Fish, Wildlife, and Parks

Fish Species	Zachary Shattuck zshattuck@mt.gov (406) 444-1231 or Lee Nelson leenelson@mt.gov (406) 444-2447
American Bison Black-footed Ferret Black-tailed Prairie Dog Bald Eagle Golden Eagle Common Loon Least Tern Piping Plover Whooping Crane	Lauri Hanauska-Brown LHanauska-Brown@mt.gov (406) 444-5209
Grizzly Bear Greater Sage Grouse Trumpeter Swan Big Game Upland Game Birds Furbearers	John Vore jvore@mt.gov (406) 444-5209
Managed Terrestrial Game and Nongame Animal Data	Smith Wells – MFWP Data Analyst smith.wells@mt.gov (406) 444-3759
Fisheries Data	Adam Petersen – MFWP Fish Data Manager apetersen@mt.gov (406) 444-1275
Wildlife and Fisheries Scientific Collector's Permits	http://fwp.mt.gov/doingBusiness/licenses/scientificWildlife/ Karen Speeg for Wildlife kspeeg@mt.gov (406) 444-2612 Kim Wedde for Fisheries kim.wedde@mt.gov (406) 444-5594
Fish and Wildlife Recommendations for Subdivision Development	Renee Lemon RLemon@mt.gov (406) 444-3738 and see http://fwp.mt.gov/fishAndWildlife/livingWithWildlife/buildingWithWildlife/subdivisionRecommendations/
Regional Contacts  	Region 1 (Kalispell) (406) 752-5501 Region 2 (Missoula) (406) 542-5500 Region 3 (Bozeman) (406) 994-4042 Region 4 (Great Falls) (406) 454-5840 Region 5 (Billings) (406) 247-2940 Region 6 (Glasgow) (406) 228-3700 Region 7 (Miles City) (406) 234-0900

United States Fish and Wildlife Service:

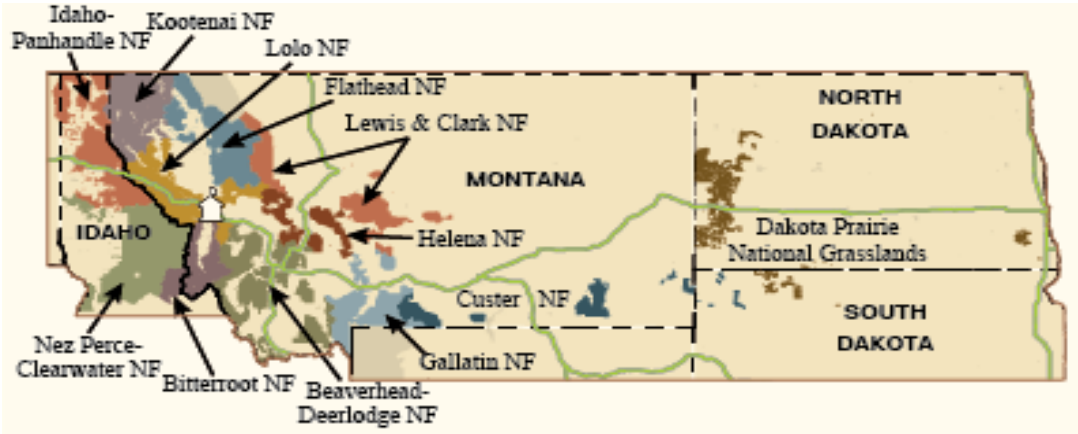
Information Planning and Conservation (IPAC) website: http://ecos.fws.gov/ipac/

Montana Ecological Services Field Office: http://www.fws.gov/montanafieldoffice/ (406) 449-5225

Bureau of Land Management

Montana Field Office Contacts:		
	Billings	(406) 896-5013
	Butte	(406) 533-7600
	Dillon	(406) 683-8000
	Glasgow	(406) 228-3750
	Havre	(406) 262-2820
	Lewistown	(406) 538-1900
	Malta	(406) 654-5100
	Miles City	(406) 233-2800
	Missoula	(406) 329-3914

United States Forest Service



Regional Office – Missoula, Montana Contacts

Wildlife Program Leader	Tammy Fletcher	tammyfletcher@fs.fed.us	(406) 329-3588
Wildlife Ecologist	Cara Staab	cstaab@fs.fed.us	(406) 329-3677
Fish Program Leader	Scott Spaulding	scottspaulding@fs.fed.us	(406) 329-3287
Fish Ecologist	Cameron Thomas	cathomas@fs.fed.us	(406) 329-3087
TES Program	Lydia Allen	lrallen@fs.fed.us	(406) 329-3558
Interagency Grizzly Bear Coordinator	Scott Jackson	sjackson03@fs.fed.us	(406) 329-3664
Regional Botanist	Steve Shelly	sshelly@fs.fed.us	(406) 329-3041

Tribal Nations

Assiniboine & Gros Ventre Tribes – Fort Belknap Reservation

Assiniboine & Sioux Tribes – Fort Peck Reservation

Blackfeet Tribe - Blackfeet Reservation

Chippewa Creek Tribe - Rocky Boy's Reservation

Crow Tribe – Crow Reservation

Little Shell Chippewa Tribe

Northern Cheyenne Tribe – Northern Cheyenne Reservation

Salish & Kootenai Tribes - Flathead Reservation

Introduction to Native Species

Within the report area you have requested, separate summaries are provided for: (1) Species Occurrences (SO) for plant and animal Species of Concern, Special Status Species (SSS), Important Animal Habitat (IAH) and some Potential Plant Species of Concern; (2) other observed non Species of Concern or Species of Concern without suitable documentation to create Species Occurrence polygons; and (3) other non-documented species that are potentially present based on their range, predicted suitable habitat model output, or presence of associated habitats. Each of these summaries provides the following information when present for a species: (1) the number of Species Occurrences and associated delineation criteria for construction of these polygons that have long been used for considerations of documented Species of Concern in environmental reviews; (2) the number of observations of each species; (3) the geographic range polygons for each species that the report area overlaps; (4) predicted relative habitat suitability classes that are present if a predicted suitable habitat model has been created; (5) the percent of the report area that is mapped as commonly associated or occasionally associated habitat as listed for each species in the Montana Field Guide; and (6) a variety of conservation status ranks and links to species accounts in the Montana Field Guide. Details on each of these information categories are included under relevant section headers below or are defined on our Species Status Codes page. In presenting this information, the Montana Natural Heritage Program (MTNHP) is working towards assisting the user with rapidly determining what species have been documented and what species are potentially present in the report area. We remind users that this information is likely incomplete as surveys to document native and introduced species are lacking in many areas of the state, information on introduced species has only been tracked relatively recently, the MTNHP's staff and resources are restricted by declining budgets, and information is constantly being added and updated in our databases. **Thus, field verification by professional biologists of the absence or presence of species and biological communities will always be an important obligation of users of our data.**

If you are aware of observation datasets that the MTNHP is missing, please report them to the Program Botanist apipp@mt.gov or Senior Zoologist dbachen@mt.gov. If you have observations that you would like to contribute, you can submit animal observations using our online data entry system at http://mtnhp.org/AddObs/, plant and animal observations via Excel spreadsheets posted at http://mtnhp.org/observations.asp , or to the Program Botanist or Senior Zoologist.

Observations

The MTNHP manages information on more than 1.8 million animal and plant observations that have been reported by professional biologists and private citizens from across Montana. The majority of these observations are submitted in digital format from standardized databases associated with research or monitoring efforts and spreadsheets of incidental observations submitted by professional biologists and amateur naturalists. At a minimum, accepted observation records must contain a credible species identification (i.e. appropriate geographic range, date, and habitat and, if species are difficult to identify, a photograph and notes on key identifying features), a date or date range, observer name, locational information (ideally with latitude and longitude in decimal degrees), notes on numbers observed, and species behavior or habitat use (e.g., is the observation likely associated with reproduction). Bird records are also required to have information associated with date-appropriate breeding or overwintering status of the species observed. MTNHP reviews observation records to ensure that they are mapped correctly, occur within date ranges when the species is known to be present or detectable, occur within the known seasonal geographic range of the species, and occur in appropriate habitats. MTNHP also assigns each record a locational uncertainty value in meters to indicate the spatial precision associated with the record's mapped coordinates. Only records with locational uncertainty values of 10,000 meters or less are included in environmental summary reports and number summaries are only provided for records with locational uncertainty values of 1,000 meters or less.

Species Occurrences

The MTNHP evaluates plant and animal observation records for species of higher conservation concern to determine whether they are worthy of inclusion in the Species Occurrence (SO) layer for use in environmental reviews; observations not worthy of inclusion in this layer include long distance dispersal events, migrants observed away from key migratory stopover habitats, and winter observations. An SO is a polygon depicting what is known about a species occupancy from direct observation with a defined level of locational uncertainty and any inference that can be made about adjacent habitat use from the latest peer-reviewed science. If an observation can be associated with a map feature that can be tracked (e.g., a wetland boundary for a wetland associated plant) then this polygon feature is used to represent the SO. Areas that can be inferred as probable occupied habitat based on direct observation of a species location and what is known about the foraging area or home range size of the species may be incorporated into the SO. Species Occurrences generally belong to one of the following categories:

Plant Species Occurrences

A documented location of a specimen collection or observed plant population. In some instances, adjacent, spatially separated clusters are considered subpopulations and are grouped as one occurrence (e.g., the subpopulations occur in ecologically similar habitats, and their spatial proximity likely allows them to interbreed). Tabular information for multiple observations at the same SO location is generally linked to a single polygon. Plant SO's are only created for Species of Concern and Potential Species of Concern.

Animal Species Occurrences

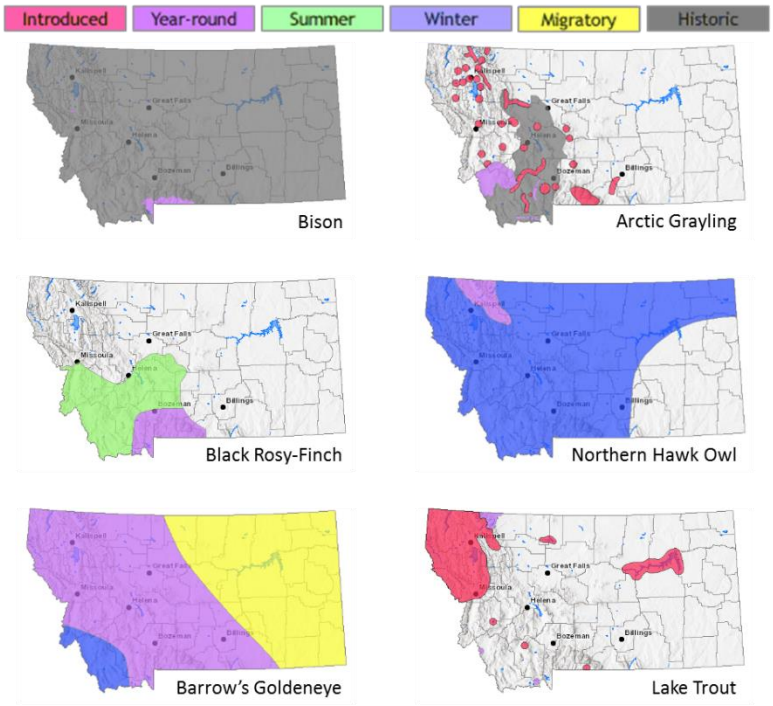
The location of a verified observation or specimen record typically known or assumed to represent a breeding population or a portion of a breeding population. Animal SO's are generally: (1) buffers of terrestrial point observations based on documented species' home range sizes; (2) buffers of stream segments to encompass occupied streams and immediate adjacent riparian habitats; (3) polygonal features encompassing known or likely breeding populations (e.g., a wetland for some amphibians or a forested portion of a mountain range for some wide ranging carnivores); or (4) combinations of the above. Tabular information for multiple observations at the same SO location is generally linked to a single polygon. Species Occurrence polygons may encompass some unsuitable habitat in some instances in order to avoid heavy data processing associated with clipping out habitats that are readily assessed as unsuitable by the data user (e.g., a point buffer of a terrestrial species may overlap into a portion of a lake that is obviously inappropriate habitat for the species). Animal SO's are only created for Species of Concern and Special Status Species (e.g., Bald Eagle).

Other Occurrence Polygons

These include significant biological features not included in the above categories, such as Important Animal Habitats like bird rookeries and bat roosts, and peatlands or other wetland and riparian communities that support diverse plant and animal communities.

Geographic Range Polygons

Geographic range polygons have not yet been defined for most plant species. Native year-round, summer, winter, migratory and historic geographic range polygons as well as polygons for introduced populations have been defined for most animal species for which there are enough observations, surveys, and knowledge of appropriate seasonal habitat use to define them (see examples to left). These native or introduced range polygons bound the extent of known or likely occupied habitats for non-migratory and relative sedentary species and the regular extent of known or likely occupied habitats for migratory and long-distance dispersing species; polygons may include unsuitable intervening habitats. For most species, a single polygon can represent the year-round or seasonal range, but breeding ranges of some colonial nesting water birds and some introduced species are represented more patchily when supported by data. Some ranges are mapped more broadly than actual distributions in order to be visible on statewide maps (e.g., fish).



Predicted Suitable Habitat Models

Recent predicted suitable habitat suitability models have not yet been created for most plant species. For animal species for which models have been completed, the environmental summary report includes simple, rule-based, associations with streams for fish and other aquatic species and mathematically complex Maximum Entropy models (Phillips et al. 2006, Ecological Modeling 190:231-259) constructed from a variety of statewide biotic and abiotic layers and presence only data for individual species contributed to Montana Natural Heritage Program databases for most terrestrial species. For the Maximum Entropy models, we reclassified 90 x 90-meter continuous model output into suitability classes (unsuitable, low, moderate, and optimal) then aggregated that into the one square mile hexagons used in the environmental summary report; this is the finest spatial scale we suggest using this information in management decisions and survey planning. Full model write ups for individual species that discuss model goals, inputs, outputs, and evaluation in much greater detail are posted on the MTNHP's Predicted Suitable Habitat Models page. Evaluations of predictive accuracy and specific limitations are included with the metadata for models of individual species. **Model outputs should not be used in place of on-the-ground surveys for species. Instead model outputs should be used in conjunction with habitat evaluations to determine the need for on-the-ground surveys for species.** We suggest that the percentage of predicted optimal and moderate suitable habitat within the report area be used in conjunction with geographic range polygons and the percentage of commonly associated habitats to generate lists of potential species that may occupy broader landscapes for the purposes of landscape-level planning.

Associated Habitats

Within the boundary of the intersected hexagons, we provide the approximate percentage of commonly or occasionally associated habitat for vertebrate animal species that regularly breed, overwinter, or migrate through the state; a detailed list of commonly and occasionally associated habitats is provided in individual species accounts in the Montana Field Guide. We assigned common or occasional use of each of the 82 ecological systems mapped in Montana by: (1) using personal knowledge and reviewing literature that

summarizes the breeding, overwintering, or migratory habitat requirements of each species; (2) evaluating structural characteristics and distribution of each ecological system relative to the species' range and habitat requirements; (3) examining the observation records for each species in the state-wide point observation database associated with each ecological system; and (4) calculating the percentage of observations associated with each ecological system relative to the percent of Montana covered by each ecological system to get a measure of numbers of observations versus availability of habitat. Species that breed in Montana were only evaluated for breeding habitat use, species that only overwinter in Montana were only evaluated for overwintering habitat use, and species that only migrate through Montana were only evaluated for migratory habitat use. In general, species were listed as associated with an ecological system if structural characteristics of used habitat documented in the literature were present in the ecological system or large numbers of point observations were associated with the ecological system. However, species were not listed as associated with an ecological system if there was no support in the literature for use of structural characteristics in an ecological system, even if point observations were associated with that system. Common versus occasional association with an ecological system was assigned based on the degree to which the structural characteristics of an ecological system matched the preferred structural habitat characteristics for each species as represented in the scientific literature. The percentage of observations associated with each ecological system relative to the percent of Montana covered by each ecological system was also used to guide assignment of common versus occasional association.

We suggest that the percentage of commonly associated habitat within the report area be used in conjunction with geographic range polygons and the percentage of predicted optimal and moderate suitable habitat from predictive models to generate lists of potential species that may occupy broader landscapes for the purposes of landscape-level planning. Users of this information should be aware that land cover mapping accuracy is particularly problematic when the systems occur as small patches or where the land cover types have been altered over the past decade. Thus, particular caution should be used when using the associations in assessments of smaller areas (e.g., evaluations of public land survey sections).

Introduction to Land Cover

Land Use/Land Cover is one of 15 Montana Spatial Data Infrastructure framework layers considered vital for making statewide maps of Montana and understanding its geography. The layer records all Montana natural vegetation, land cover and land use, classified from satellite and aerial imagery, mapped at a scale of 1:100000, and interpreted with supporting ground-level data. The baseline map is adapted from the Northwest ReGAP (NWGAP) project land cover classification, which used 30m resolution multi-spectral Landsat imagery acquired between 1999 and 2001. Vegetation classes were drawn from the Ecological System Classification developed by NatureServe (Comer et al. 2003). The land cover classes were developed by Anderson et al. (1976). The NWGAP effort encompasses 12 map zones. Montana overlaps seven of these zones. The two NWGAP teams responsible for the initial land cover mapping effort in Montana were Sanborn and NWGAP at the University of Idaho. Both Sanborn and NWGAP employed a similar modeling approach in which Classification and Regression Tree (CART) models were applied to Landsat ETM+ scenes. The Spatial Analysis Lab within the Montana Natural Heritage Program was responsible for developing a seamless Montana land cover map with a consistent statewide legend from these two separate products. Additionally, the Montana land cover layer incorporates several other land cover and land use products (e.g., MSDI Structures and Transportation themes and the Montana Department of Revenue Final Land Unit classification) and reclassifications based on plot-level data and the latest NAIP imagery to improve accuracy and enhance the usability of the theme. Updates are done as partner support and funding allow, or when other MSDI datasets can be incorporated. Recent updates include fire perimeters and agricultural land use (annually), energy developments such as wind, oil and gas installations (2014), roads, structures and other impervious surfaces (various years): and local updates/improvements to specific ecological systems (e.g., central Montana grassland and sagebrush ecosystems). Current and previous versions of the Land Use/Land Cover layer with full metadata are available for download at the Montana State Library's Geographic Information Clearinghouse.

Within the report area you have requested, land cover is summarized by acres of Level 1, Level 2, and Level 3 Ecological Systems.

Literature Cited

Anderson, J.R. E.E. Hardy, J.T. Roach, and R.E. Witmer. 1976. A land use and land cover classification system for use with remote sensor data. U.S. Geological Survey Professional Paper 964.

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. Ecological systems of the United States: A working classification of U.S. terrestrial systems. NatureServe, Arlington, VA.

Introduction to Wetland and Riparian

Within the report area you have requested, wetland and riparian mapping is summarized by acres of each classification present. Summaries are only provided for modern MTNHP wetland and riparian mapping and not for outdated (NWI Legacy) or incomplete (NWI Scalable) mapping efforts; described here. MTNHP has made all three of these datasets and associated metadata available for separate download on the Montana Wetland and Riparian Framework MSDI download page.

Wetland and Riparian mapping is one of 15 Montana Spatial Data Infrastructure framework layers considered vital for making statewide maps of Montana and understanding its geography. The wetland and riparian framework layer consists of spatial data representing the extent, type, and approximate location of wetlands, riparian areas, and deepwater habitats in Montana.

Wetland and riparian mapping is completed through photointerpretation of 1-m resolution color infrared aerial imagery acquired from 2005 or later. A coding convention using letters and numbers is assigned to each mapped wetland. These letters and numbers describe the broad landscape context of the wetland, its vegetation type, its water regime, and the kind of alterations that may have occurred. Ancillary data layers such as topographic maps, digital elevation models, soils data, and other aerial imagery sources are also used to improve mapping accuracy. Wetland mapping follows the federal Wetland Mapping Standard and classifies wetlands according to the Cowardin classification system of the National Wetlands Inventory (NWI) (Cowardin et al. 1979, FGDC Wetlands Subcommittee 2013). Federal, State, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands differently than the NWI. Similar coding, based on U.S. Fish and Wildlife Service conventions, is applied to riparian areas (U.S. Fish and Wildlife Service 2009). These are mapped areas where vegetation composition and growth is influenced by nearby water bodies, but where soils, plant communities, and hydrology do not display true wetland characteristics. **These data are intended for use in publications at a scale of 1:12,000 or smaller. Mapped wetland and riparian areas do not represent precise boundaries and digital wetland data cannot substitute for an on-site determination of jurisdictional wetlands.**

A detailed overview, with examples, of both wetland and riparian classification systems and associated codes can be found at: http://mtnhp.org/help/MapViewer/WetRip_Classification.asp

Literature Cited

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish and Wildlife Service, FWS/OBS-79/31. Washington, D.C. 103pp.

Federal Geographic Data Committee. 2013. Classification of wetlands and deepwater habitats of the United States. FGDC-STD-004-2013. Second Edition. Wetlands Subcommittee, Federal Geographic Data Committee and U.S. Fish and Wildlife Service, Washington, D.C.

U.S. Fish and Wildlife Services. 2009. A system for mapping riparian areas in the western United States. Division of Habitat and Resource Conservation, Branch of Resource and Mapping Support, Arlington, Virginia.

Introduction to Land Management

Within the report area you have requested, land management information is summarized by acres of federal, state, and local government lands, tribal reservation boundaries, private conservation lands, and federal, state, local, and private conservation easements. Acreage for "Owned", "Tribal", or "Easement" categories represents non-overlapping areas that may be totaled. However, "Other Boundaries" represents managed areas such as National Forest boundaries containing private inholdings and other mixed ownership which may cause boundaries to overlap (e.g. a wilderness area within a forest). Therefore, acreages may not total in a straight-forward manner.

Because information on land stewardship is critical to effective land management, the Montana Natural Heritage Program (MTNHP) began compiling ownership and management data in 1997. The goal of the Montana Land Management Database is to manage a single, statewide digital data set that incorporates information from both public and private entities. The database assembles information on public lands, private conservation lands, and conservation easements held by state and federal agencies and land trusts and is updated on a regular basis. Since 2011, the Information Management group in the Montana State Library's Digital Library Division has taken an increasingly active role in managing layers of the Montana Land Management Database in partnership with the MTNHP.

Public and private conservation land polygons are attributed with the name of the entity that owns it. The data are derived from the statewide Montana Cadastral Parcel layer. Conservation easement data shows land parcels on which a public agency or qualified land trust has placed a conservation easement in cooperation with the land owner. The dataset contains no information about ownership or status of the mineral estate. For questions about the dataset or to report errors, please contact the Montana Natural Heritage Program at (406) 444-5354 or mtnhp@mt.gov. You can download various components of the Land Management Database and view associated metadata at the Montana State Library's GIS Data List at the following links:

Public Lands
Conservation Easements
Private Conservation Lands
Managed Areas

Map features in the Montana Land Management Database or summaries provided in this report are not intended as a legal depiction of public or private surface land ownership boundaries and should not be used in place of a survey conducted by a licensed land surveyor. Similarly, map features do not imply public access to any lands. The Montana Natural Heritage Program makes no representations or warranties whatsoever with respect to the accuracy or completeness of this data and assumes no responsibility for the suitability of the data for a particular purpose. The Montana Natural Heritage Program will not be liable for any damages incurred as a result of errors displayed here. Consumers of this information should review or consult the primary data and information sources to ascertain the viability of the information for their purposes.

Introduction to Invasive and Pest Species

Within the report area you have requested, separate summaries are provided for: Aquatic Invasive Species, Noxious Weeds, Agricultural Pests, and Forest Pests that have been documented or potentially occur there based on their known distribution in the state. Definitions for each of these invasive and pest species categories can be found on our Species Status Codes page.

Each of these summaries provides the following information when present for a species: (1) the number of observations of each species; (2) the geographic range polygons for each species, if developed, that the report area overlaps; (3) predicted relative habitat suitability classes that are present if a predicted suitable habitat model has been created; (4) the percent of the report area that is mapped as commonly associated or occasionally associated habitat as listed for each species in the Montana Field Guide; and (5) and links to species accounts in the Montana Field Guide. Details on each of these information categories are included under relevant section headers under the Introduction to Native Species above or are defined on our Species Status Codes page. In presenting this information, the Montana Natural Heritage Program (MTNHP) is working towards assisting the user with rapidly determining what invasive and pest species have been documented and what species are potentially present in the report area. We remind users that this information is likely incomplete as surveys to document introduced species are lacking in many areas of the state, information on introduced species has only been tracked relatively recently, the MTNHP's staff and resources are restricted by declining budgets, and information is constantly being added and updated in our databases. **Thus, field verification by professional biologists of the absence or presence of species will always be an important obligation of users of our data.**

If you are aware of observation or survey datasets for invasive or pest species that the MTNHP is missing, please report them to the Program Coordinator bmaxell@mt.gov Program Botanist apipp@mt.gov or Senior Zoologist dbachen@mt.gov. If you have observations that you would like to contribute, you can submit animal observations using our online data entry system at http://mtnhp.org/AddObs/, plant and animal observations via Excel spreadsheets posted at http://mtnhp.org/observations.asp , or to the Program Botanist or Senior Zoologist.

Additional Information Resources

Home Page for Montana Natural Heritage Program (MTNHP)

MTNHP Staff Contact Information

Montana Field Guide

MTNHP Species of Concern Report - Animals and Plants

MTNHP Species Status Codes - Explanation

MTNHP Predicted Suitable Habitat Models (for select Animals and Plants)

MTNHP Request Information page

Montana Cadastral

Montana Code Annotated

Montana Department of Environmental Quality

Montana Fisheries Information System

Montana Fish, Wildlife, and Parks Subdivision Recommendations

Montana GIS Data Layers

Montana GIS Data Bundler

Montana Greater Sage-Grouse Project Submittal Site

Montana Ground Water Information Center

Montana Legislative Environmental Policy Office Publications
(Including Index of Environmental Permits required in Montana and Guide to the Montana Environmental Policy Act)

Montana Environmental Policy Act (MEPA)

MEPA Analysis Resource List

Laws, Treaties, Regulations, and Permits on Animals and Plants

Montana Spatial Data Infrastructure Layers

Montana State Historic Preservation Office Review and Compliance

Montana Water Information System

Montana Web Map Services

National Environmental Policy Act

U.S. Fish and Wildlife Service Information for Planning and Conservation (Section 7 Consultation)

Web Soil Survey Tool

United States Department of the Interior
Fish and Wildlife Service
Ecological Services
Montana Field Office
585 Shepard Way, Suite 1
Helena, Montana 59601-6287
Phone: (406) 449-5225, Fax: (406) 449-5339

ENDANGERED, THREATENED, PROPOSED AND CANDIDATE SPECIES
MONTANA COUNTIES*
Endangered Species Act

October 23, 2018

C = Candidate
LT = Listed Threatened
LE = Listed Endangered
P = Proposed
PCH = Proposed Critical Habitat
CH = Designated Critical Habitat
XN = Experimental non-essential population

*Note: Generally, this list identifies the counties where one would reasonably expect the species to occur, not necessarily every county where the species is listed

County/Scientific Name	Common Name	Status
BEAVERHEAD		
Spiranthes diluvialis	Ute Ladies' Tresses	LT
Ursus arctos horribilis	Grizzly Bear	LT
Lynx canadensis	Canada Lynx	LT
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C
BIG HORN		
Mustela nigripes	Black-footed Ferret	LE
BLAINE		
Scaphirhynchus albus	Pallid Sturgeon	LE
Mustela nigripes	Black-footed Ferret	LE
Charadrius melodus	Piping Plover	LT
BROADWATER		
Spiranthes diluvialis	Ute Ladies' Tresses	LT
Lynx canadensis	Canada Lynx	LT
Ursus arctos horribilis	Grizzly Bear	LT
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C
CARBON		
Lynx canadensis	Canada Lynx	LT, CH
Ursus arctos horribilis	Grizzly Bear	LT
Gulo gulo luscus	Wolverine	P
Zapada glacier	Western Glacier Stonefly	P
Pinus albicaulis	Whitebark Pine	C

County/Scientific Name	Common Name	Status
CARTER		
Grus americana	Whooping Crane	LE
Myotis septentrionalis	Northern Long-eared Bat	LT
CASCADE		
Scaphirhynchus albus	Pallid Sturgeon	LE
Lynx canadensis	Canada Lynx	LT
Calidris canutus rufa	Red Knot	LT
Charadrius melodus	Piping Plover	LT
Ursus arctos horribilis	Grizzly Bear	LT
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C
CHOUTEAU		
Scaphirhynchus albus	Pallid Sturgeon	LE
Lynx canadensis	Canada Lynx	LT
Charadrius melodus	Piping Plover	LT
Calidris canutus rufa	Red Knot	LT
Ursus arctos horribilis	Grizzly Bear	LT
CUSTER		
Scaphirhynchus albus	Pallid Sturgeon	LE
Sterna antillarum athalassos	Interior Least Tern	LE
Grus americana	Whooping Crane	LE
Myotis septentrionalis	Northern Long-eared Bat	LT
DANIELS		
Grus americana	Whooping Crane	LE
Charadrius melodus	Piping Plover	LT
DAWSON		
Scaphirhynchus albus	Pallid Sturgeon	LE
Sterna antillarum athalassos	Interior Least Tern	LE
Grus americana	Whooping Crane	LE
Charadrius melodus	Piping Plover	LT
Myotis septentrionalis	Northern Long-eared Bat	LT
DEER LODGE		
Salvelinus confluentus	Bull Trout	LT, CH
Ursus arctos horribilis	Grizzly Bear	LT
Lynx canadensis	Canada Lynx	LT
Calidris canutus rufa	Red Knot	LT
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C
FALLON		
Grus americana	Whooping Crane	LE
Myotis septentrionalis	Northern Long-eared Bat	LT
Charadrius melodus	Piping Plover	LT
FERGUS		
Scaphirhynchus albus	Pallid Sturgeon	LE
Lynx canadensis	Canada Lynx	LT
Pinus albicaulis	Whitebark Pine	C

County/Scientific Name	Common Name	Status
FLATHEAD		
Salvelinus confluentus	Bull Trout	LT, CH
Ursus arctos horribilis	Grizzly Bear	LT
Silene spaldingii	Spalding's Campion	LT
Lynx canadensis	Canada Lynx	LT, CH
Coccyzus americanus	Yellow-billed cuckoo (western pop.)	LT
Gulo gulo luscus	Wolverine	P
Lednia tumana	Meltwater Lednian Stonefly	P
Pinus albicaulis	Whitebark Pine	C
GALLATIN		
Spiranthes diluvialis	Ute Ladies' Tresses	LT
Lynx canadensis	Canada Lynx	LT, CH
Ursus arctos horribilis	Grizzly Bear	LT
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C
GARFIELD		
Scaphirhynchus albus	Pallid Sturgeon	LE
Grus americana	Whooping Crane	LE
Charadrius melodus	Piping Plover	LT, CH
Sterna antillarum athalassos	Interior Least Tern	LE
GLACIER		
Ursus arctos horribilis	Grizzly Bear	LT
Lynx canadensis	Canada Lynx	LT, CH
Salvelinus confluentus	Bull Trout	LT, CH
Gulo gulo luscus	Wolverine	P
Lednia tumana	Meltwater Lednian Stonefly	P
Zapada glacier	Western Glacier Stonefly	P
Pinus albicaulis	Whitebark Pine	C
GOLDEN VALLEY		
Lynx canadensis	Canada Lynx	LT
Calidris canutus rufa	Red Knot	LT
Pinus albicaulis	Whitebark Pine	C
GRANITE		
Lynx canadensis	Canada Lynx	LT, CH
Ursus arctos horribilis	Grizzly Bear	LT
Salvelinus confluentus	Bull Trout	LT, CH
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C
HILL		
JEFFERSON		
Spiranthes diluvialis	Ute Ladies' Tresses	LT
Lynx canadensis	Canada Lynx	LT
Ursus arctos horribilis	Grizzly Bear	LT
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C
JUDITH BASIN		
Lynx canadensis	Canada Lynx	LT
Ursus arctos horribilis	Grizzly Bear	LT
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C

County/Scientific Name	Common Name	Status
LAKE		
Ursus arctos horribilis	Grizzly Bear	LT
Howellia aquatilis	Water Howellia	LT
Silene spaldingii	Spalding's Campion	LT
Lynx canadensis	Canada Lynx	LT, CH
Salvelinus confluentus	Bull Trout	LT, CH
Coccyzus americanus	Yellow-billed cuckoo (western pop.)	LT
Gulo gulo luscus	Wolverine	P
Lednia tumana	Meltwater Lednian Stonefly	P
Pinus albicaulis	Whitebark Pine	C
LEWIS AND CLARK		
Ursus arctos horribilis	Grizzly Bear	LT
Lynx canadensis	Canada Lynx	LT, CH
Salvelinus confluentus	Bull Trout	LT, CH
Calidris canutus rufa	Red Knot	LT
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C
LIBERTY		
Calidris canutus rufa	Red Knot	LT
Ursus arctos horribilis	Grizzly Bear	LT
Pinus albicaulis	Whitebark Pine	C
LINCOLN		
Acipenser transmontanus	White Sturgeon (Kootenai River Pop.)	LE
Ursus arctos horribilis	Grizzly Bear	LT
Silene spaldingii	Spalding's Campion	LT
Lynx canadensis	Canada Lynx	LT, CH
Salvelinus confluentus	Bull Trout	LT, CH
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C
MADISON		
Spiranthes diluvialis	Ute Ladies' Tresses	LT
Lynx canadensis	Canada Lynx	LT
Calidris canutus rufa	Red Knot	LT
Ursus arctos horribilis	Grizzly Bear	LT
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C
McCONE		
Scaphirhynchus albus	Pallid Sturgeon	LE
Charadrius melodus	Piping Plover	LT, CH
Sterna antillarum athalassos	Interior Least Tern	LE
Grus americana	Whooping Crane	LE
MEAGHER		
Lynx canadensis	Canada Lynx	LT
Ursus arctos horribilis	Grizzly Bear	LT
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C
MINERAL		
Lynx canadensis	Canada Lynx	LT
Salvelinus confluentus	Bull Trout	LT, CH
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C

County/Scientific Name	Common Name	Status
MISSOULA		
Ursus arctos horribilis	Grizzly Bear	LT
Howellia aquatilis	Water Howellia	LT
Lynx canadensis	Canada Lynx	LT, CH
Salvelinus confluentus	Bull Trout	LT, CH
Coccyzus americanus	Yellow-billed cuckoo (western pop.)	LT
Calidris canutus rufa	Red Knot	LT
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C
MUSSELSHELL		
PARK		
Lynx canadensis	Canada Lynx	LT, CH
Ursus arctos horribilis	Grizzly Bear	LT
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C
PETROLEUM		
Scaphirhynchus albus	Pallid Sturgeon	LE
Calidris canutus rufa	Red Knot	LT
PHILLIPS		
Scaphirhynchus albus	Pallid Sturgeon	LE
Charadrius melodus	Piping Plover	LT, CH
Mustela nigripes	Black-footed Ferret	LE, XN
Grus americana	Whooping Crane	LE
Sterna antillarum athalassos	Interior Least Tern	LE
Calidris canutus rufa	Red Knot	LT
PONDERA		
Charadrius melodus	Piping Plover	LT
Ursus arctos horribilis	Grizzly Bear	LT
Lynx canadensis	Canada Lynx	LT, CH
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C
POWDER RIVER		
Grus americana	Whooping Crane	LE
Scaphirhynchus albus	Pallid Sturgeon	LE
Myotis septentrionalis	Northern Long-eared Bat	LT
POWELL		
Ursus arctos horribilis	Grizzly Bear	LT
Lynx canadensis	Canada Lynx	LT, CH
Salvelinus confluentus	Bull Trout	LT, CH
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C
PRAIRIE		
Scaphirhynchus albus	Pallid Sturgeon	LE
Sterna antillarum athalassos	Interior Least Tern	LE
Grus americana	Whooping Crane	LE
Myotis septentrionalis	Northern Long-eared Bat	LT
Charadrius melodus	Piping Plover	LT

County/Scientific Name	Common Name	Status
RAVALLI		
Salvelinus confluentus	Bull Trout	LT, CH
Lynx canadensis	Canada Lynx	LT
Coccyzus americanus	Yellow-billed cuckoo (western pop.)	LT
Ursus arctos horribilis	Grizzly Bear	LT
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C
RICHLAND		
Scaphirhynchus albus	Pallid Sturgeon	LE
Charadrius melodus	Piping Plover	LT, CH
Sterna antillarum athalassos	Interior Least Tern	LE
Grus americana	Whooping Crane	LE
Myotis septentrionalis	Northern Long-eared Bat	LT
ROOSEVELT		
Scaphirhynchus albus	Pallid Sturgeon	LE
Charadrius melodus	Piping Plover	LT, CH
Sterna antillarum athalassos	Interior Least Tern	LE
Grus americana	Whooping Crane	LE
Calidris canutus rufa	Red Knot	LT
Myotis septentrionalis	Northern Long-eared Bat	LT
ROSEBUD		
Sterna antillarum athalassos	Interior Least Tern	LE
Scaphirhynchus albus	Pallid Sturgeon	LE
Grus americana	Whooping Crane	LE
SANDERS		
Ursus arctos horribilis	Grizzly Bear	LT
Lynx canadensis	Canada Lynx	LT
Salvelinus confluentus	Bull Trout	LT, CH
Silene spaldingii	Spalding's Campion	LT
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C
SHERIDAN		
Charadrius melodus	Piping Plover	LT, CH
Grus americana	Whooping Crane	LE
Sterna antillarum athalassos	Interior Least Tern	LE
Calidris canutus rufa	Red Knot	LT
SILVER BOW		
Salvelinus confluentus	Bull Trout	LT
Ursus arctos horribilis	Grizzly Bear	LT
Lynx canadensis	Canada Lynx	LT
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C
STILLWATER		
Lynx canadensis	Canada Lynx	LT, CH
Charadrius melodus	Piping Plover	LT
Calidris canutus rufa	Red Knot	LT
Ursus arctos horribilis	Grizzly Bear	LT
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C

County/Scientific Name	Common Name	Status
SWEET GRASS		
Lynx canadensis	Canada Lynx	LT, CH
Ursus arctos horribilis	Grizzly Bear	LT
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C
TETON		
Ursus arctos horribilis	Grizzly Bear	LT
Lynx canadensis	Canada Lynx	LT, CH
Calidris canutus rufa	Red Knot	LT
Charadrius melodus	Piping Plover	LT
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C
TOOLE		
Calidris canutus rufa	Red Knot	LT
Ursus arctos horribilis	Grizzly Bear	LT
Pinus albicaulis	Whitebark Pine	C
TREASURE		
No listings at this time		
VALLEY		
Scaphirhynchus albus	Pallid Sturgeon	LE
Sterna antillarum athalassos	Interior Least Tern	LE
Grus americana	Whooping Crane	LE
Charadrius melodus	Piping Plover	LT, CH
Calidris canutus rufa	Red Knot	LT
WHEATLAND		
Lynx canadensis	Canada Lynx	LT
Ursus arctos horribilis	Grizzly Bear	LT
Gulo gulo luscus	Wolverine	P
Pinus albicaulis	Whitebark Pine	C
WIBAUX		
Scaphirhynchus albus	Pallid Sturgeon	LE
Sterna antillarum athalassos	Interior Least Tern	LE
Grus americana	Whooping Crane	LE
Myotis septentrionalis	Northern Long-eared Bat	LT
Charadrius melodus	Piping Plover	LT
YELLOWSTONE		
Grus americana	Whooping Crane	LE
Calidris canutus rufa	Red Knot	LT

Department of Environmental Quality
Permitting & Compliance Division
1520 E. 6th Avenue
PO Box 20090l
Helena, MT 59620-090l
406-444-4323

Department of Fish, Wildlife and Parks
1420 E. 6th
Helena, MT 59620
406-444-2535

Dept. of Natural Resources and
Conservation-Director
1625 11th Avenue
Helena, MT 59601
406-444-2074

State Historic Preservation Office
1410 8th Avenue
PO Box 201202
Helena, MT 59620
406-444-7715

U.S. Army Corps of Engineers
10 West 15th Street, Suite 2200
Helena, MT 59626
406-441-1375

U.S. Fish and Wildlife Service
Ecological Services
585 Shepherd Way, Ste 1
Helena, MT 59601
406-449-5225

Bureau of Indian Affairs
2021 4th Avenue N.
Billings, MT 59101
406-247-7970

Bureau of Land Management
5001 Southgate Drive
Billings, MT 59101
406-896-5000

U.S. Environmental Protection
Agency, Montana Office, Federal
Building
10 West 15th Street, Suite 3200
Helena, MT 59625
406-457-5000

Montana DNRC, Floodplain Management
Program 1424 9th Avenue/ PO Box 201601
Helena, MT 59620-1601
406-444-9724

Jim Woodhull, Preservation Officer
Livingston Historic Preservation
Office 330 North Bennett Street
Livingston, MT 59047
406-222-0083

234 East Babcock Street
Suite 3
Bozeman, MT 59715

406.586.0277
tdhengineering.com

May 21, 2019

RE: CITY OF LIVINGSTON WASTEWATER COLLECTION SYSTEM PRELIMINARY ENGINEERING REPORT-CONSULTATION

TD&H ENGINEERING JOB NO. B15-081-044

To Whom It May Concern,

TD&H Engineering is completing a Collection System Preliminary Engineering Report (PER) for the City of Livingston. The purpose of this letter is to request your review and response regarding any environmental impacts that your agency may identify for the system improvements that we are recommending.

The recommended alternatives are:

The report evaluates five recommended alternatives to upsize existing wastewater mains and resolve capacity issues as follows:

- Alternative 1- N 7th Street Capacity Increase
- Alternative 2- Northern Trunk Main Capacity Increase
- Alternative 3-Park Street Capacity Increase
- Alternative 4-W Geyser Street Replacement
- Alternative 5- E Lewis Street Replacement

Enclosed is a map of the project planning area that depicts the existing wastewater collection system and proposed recommendations to the system.

We request that you advise us of any comments you may have regarding the proposed recommendations within 30 days so that we may complete the PER. You may respond by email or mail, whichever is more convenient to you.

If you have questions concerning the recommended improvements or need any further information, please feel free to contact me at matt.mcgee@tdhengineering.com or 406-586-0277.

Sincerely,

Matt McGee *PE*
Project Manager
TD&H ENGINEERING

ENCL: RECOMMENDED ALTERNATIVES MAP (2 PAGES)

0 500' 1000' 1500'

SCALE

PEAK FOW – PIPE FLOWING <50% FULL

PEAK FLOW – PIPE FLOWING 50% TO 60% FULL

PEAK FLOW – PIPE FLOWING 60% TO 70% FULL

PEAK FLOW – PIPE FLOWING 70 TO 75% FULL

PEAK FLOW – PIPE FLOWING >75% FULL

HIGH RISK AREAS (UNDRSIZED, CLAY TILE PIPE, AND/OR AGING)

TEXT INDENTIFIED DEFECTS

MANHOLE

FLOODED MANHOLE

LIFT STATION

SCENIC TRL

N 9TH STREET

N YELLOWSTONE STREET

N 2ND STREET

W GALLATIN STREET

N 7TH STREET

STAR ROAD

N 13TH STREET

W MONTANA STREET

NOTED SAG

NOTED ROOTS AND OFFSET JOINTS

S MAIN STREET

CONSTELLATION DRIVE

PLEIADES PL

SUN AVE

US HIGHWAY 10 W

S 6TH STREET

W GEYSER STREET

S 10TH STREET

W CRAWFORD STREET

S 13TH STREET

W PARK STREET

9TH STREET LIFT STATION

CRAWFORD LIFT STATION

CLINIC LIFT STATION

ROGERS LANE

CENTENIAL LIFT STATION

ROBIN LANE

NOTED BLOCKAGE

HIGH GROUNDWATER AREA

LOVES LANE

INTERSTATE-90

Alternative 1

NOT FOR CONSTRUCTION

REV	DATE	REVISION

TD&H Engineering
406.586.0277 • tdhengineering.com
234 E. BABCOCK ST., SUITE 3 • BOZEMAN, MONTANA 59715

DRAWN BY:	NMR
DESIGNED BY:	
QUALITY CHECK:	
DATE:	4-26-2019
JOB NO.	B15-081
FIELDBOOK	

LIVINGSTON COLLECTION SYSTEM PER LIVINGSTON, MONTANA

FUTURE FLOW CONDITION AND CAPACITY MAP WEST

B15-081 COMBINED-FF.DWG

SHEET 1

J:\2015\B15-081 City of Livingston\CADD\CIVIL\WW PER\B15-081 COMBINED-FF.dwg, 5/13/2019 2:08:30 PM, NMR

NOT FOR CONSTRUCTION

REV	DATE	REVISION

TD&H Engineering
406.586.0277 • tdhengineering.com
234 E. BABCOCK ST., SUITE 3 • BOZEMAN, MONTANA 59715

DRAWN BY:	NMR
DESIGNED BY:	
QUALITY CHECK:	
DATE:	4-26-2019
JOB NO.	B15-081
FIELDBOOK	

LIVINGSTON COLLECTION SYSTEM PER LIVINGSTON, MONTANA

FUTURE FLOW CONDITION AND CAPACITY MAP EAST

B15-081 COMBINED-FF.DWG

SHEET 1

Alternative 2

Alternative 3

Alternative 4

Alternative 5

WASTEWATER TREATMENT FACILITY

LHC LIFT STATION

US HIGHWAY 89 S

WINEGLASS LANE

E MONTANA STREET

E GALLATIN STREET

L M STREET

BLUE HERON DR

N G STREET

N H STREET LIFT STATION

L PARK STREET

S M STREET

E LEWIS STREET

NOTED ROOT INTRUSION

NOTED POOR CONDITION

INTERSTATE-90

HIGH GROUNDWATER AREA

N 2ND STREET

N YELLOWSTONE STREET

N GALLATIN STREET

N 7TH STREET

S H STREET

S D STREET

S MAIN STREET

E CLARK STREET

NOTED ROOT INTRUSION

FLESHMAN CREEK LIFT STATION

NOTED SAG

NOTED ROOTS AND OFFSET JOINTS

US HIGHWAY 10 W

S 6TH STREET

W GEYSER STREET

S 10TH STREET

N

0 500' 1000' 1500'

SCALE

PEAK FOW – PIPE FLOWING <50% FULL

PEAK FLOW – PIPE FLOWING 50% TO 60% FULL

PEAK FLOW – PIPE FLOWING 60% TO 70% FULL

PEAK FLOW – PIPE FLOWING 70 TO 75% FULL

PEAK FLOW – PIPE FLOWING >75% FULL

HIGH RISK AREAS (UNDERSIZED, CLAY TILE PIPE, AND/OR AGING)

TEXT INDENTIFIED DEFECTS

MANHOLE

FLOODED MANHOLE

LIFT STATION

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
HELENA REGULATORY OFFICE
10 WEST 15TH STREET, SUITE 2200
HELENA, MONTANA 59626

REPLY TO
ATTENTION OF

June 10, 2019

Regulatory Branch
Montana State Program
Corps No. **NWO-2019-00925-MTB**

Subject: City of Livingston – Wastewater Collection System Improvements

City of Livingston
c/o TD&H Engineering
Attn: Matt McGee
234 East Babcock St., Suite 3
Bozeman, Montana 59715

Dear Mr. McGee:

We are responding to your request for comment on behalf of the City of Livingston regarding the Wastewater Collection System Improvements project in Park County, Montana. The project includes five proposed alternatives to replace sewer mains to improve system capacity. The project sites are adjacent to the Yellowstone River, Fleshman Creek, and other tributaries and wetlands, and located in the vicinity of Latitude 45.667243°, Longitude -110.547131°, Section 18, Township 2 S, Range 10 E, Livingston, Park County, Montana.

The mission of the U.S. Army Corps of Engineers (Corps) Regulatory Program is to protect the Nation's aquatic resources while allowing reasonable development through fair, flexible and balanced permit decisions. In particular, under Section 404 of the Clean Water Act, we work to protect the biological, physical, and chemical integrity of the Nation's aquatic resources. Projects are evaluated on a case-by-case basis to determine the potential benefits and detriments that may occur as a result of the proposal. In all cases an applicant must avoid and minimize impacts to aquatic resources to the greatest extent practicable.

Under the authority of Section 404 of the Clean Water Act (CWA), Department of the Army (DA) permits are required for the discharge of fill material into waters of the U.S. Likewise, DA permits are required for excavation activities resulting in a redeposit of dredged material that would destroy or degrade waters of the U.S., per 33 CFR 323.2(d)(3). Waters of the U.S. include the area below the ordinary high water mark of stream channels and lakes or ponds connected to the tributary system, and wetlands adjacent to these waters. Isolated waters and wetlands, as well as man-made channels, may be waters of the U.S. in certain circumstances, which must be determined on a case-by-case basis.

Based on the information provided in your submittal, it appears that jurisdictional waters of the U.S. may be present within the project area and may be impacted by the proposed work. If the final design includes the placement of fill or dredged material in any of the jurisdictional areas described in the paragraph above, or otherwise requires authorization by a DA permit, please submit a permit application to this office prior to starting any work. We recommend that an aquatic resources delineation be completed in accordance with the 1987 Corps of Engineers Wetlands Delineation Manual and appropriate regional supplement(s) to ascertain the existence and extent of aquatic resources onsite. Any loss of an aquatic site may require mitigation. Mitigation requirements will be determined during the Department of the Army permitting review.

After a review of the materials submitted we will determine what type of permit, if any, will be required. In order to provide the necessary information you may use the Montana Joint Permit Application Form, found at: http://www.dnrc.mt.gov/licenses-and-permits/stream-permitting. If you do not wish to use this form, or do not have internet access please contact our office at the address below to obtain more information.

Note that this letter is not a DA authorization to proceed. It only informs you of your need to obtain a DA permit if waters of the U.S. will be affected. If waters of the U.S. will not be affected by a jurisdictional activity a DA permit is not required for the project.

Please refer to identification number **NWO-2019-00925-MTB** in any correspondence concerning this project. If you have any questions, please contact me at Post Office Box 7032, Billings, Montana 59103, by email at Marena.A.Gilbert@usace.army.mil, or telephone at (406) 657-5912.

Sincerely,

Marena A. Gilbert
Regulatory Project Manager

Copies Furnished:
Barbara Woodbury, Park County Floodplain Administrator, via email at
bwoodbury@parkcounty.org
Jessica Mayo, Park Conservation District, via email at
jessica.anderson@mt.nacdnet.net

MT Fish, Wildlife & Parks
Region 3 Headquarters
1400 S 19th Avenue
Bozeman, MT 59718

June 20, 2019

TD&H Engineering
234 East Babcock Street, Suite 3
Bozeman, MT 59715

RE: City of Livingston Wastewater Collection System Preliminary Engineering Report-Consultation

Dear Mr. Matt McGee:

Montana Fish, Wildlife & Parks would recommend that wastewater meets DEQ standards before being discharged to the Yellowstone River and that any additional improvements needed to accomplish this be completed as part of the project.

Thank you for the opportunity to comment.

Sincerely,

Gina Freund
Region 3 Comment Coordinator
(406) 994-4482

Crystal Kramer - Fwd: City of Livingston Wastewater Collection System

From: Matt McGee
To: Crystal Kramer; Nicole Rediske
Date: 6/30/2019 2:12 PM
Subject: Fwd: City of Livingston Wastewater Collection System

Matt McGee, PE | Civil Engineer
TD&H Engineering
234 E. Babcock Street, Suite 3 | Bozeman, MT 59715
p: 406.586.0277 | c: 307.250.0088 | d: 406.602.4089
www.tdhengineering.com

>>> "Bush, Jodi" <jodi_bush@fws.gov> 6/28/2019 11:45 AM >>>
Mr. McGee:

Thank you for your May 21, 2019 letter and supporting materials, received in this office on May 28, requesting U.S. Fish and Wildlife Service comment on the proposed subject wastewater main upsizing project in the City of Livingston, Park County, Montana. This email represents our official response to your inquiry for your records.

The U.S. Fish and Wildlife Service reviewed the maps and project description and has no comments or concerns regarding federally-listed or proposed threatened or endangered species or other trust species in this developed setting.

Thank you for the opportunity to comment. If you have any questions or comments about this correspondence please contact Jeff Berglund at jeff_berglund@fws.gov or by phone at (406) 449-5225, ext. 206. Thank you. JB

Jodi L. Bush
Office Supervisor
Montana State Ecological Services Office
585 Shepard Way, Suite 1
Helena, MT 59601
(406) 449-5225, ext.205

Montana: 2010

Population and Housing Unit Counts

2010 Census of Population and Housing

Issued September 2012
CPH-2-28

U.S. Department of Commerce
Economics and Statistics Administration
U.S. CENSUS BUREAU
census.gov

United States® Census 2010

Table 4.

Population and Housing Units: 1970 to 2010

[For information concerning historical counts and geographic change, see "User Notes." For information on confidentiality, nonsampling error, and definitions, see Appendixes]

State County/County Equivalent	Population					Housing units				
	2010	2000	1990	1980	1970	2010	2000	1990	1980	1970
Montana	**989,415**	**902,195**	**799,065**	**786,690**	**694,409**	**482,825**	**412,633**	**361,155**	**328,465**	**246,603**
Beaverhead County	9,246	9,202	8,424	8,186	8,187	5,273	4,571	4,128	3,741	3,210
Big Horn County	12,865	12,671	11,337	11,096	10,057	4,695	4,655	4,304	3,867	2,900
Blaine County	6,491	7,009	6,728	6,999	6,727	2,843	2,947	2,930	2,583	2,382
Broadwater County	5,612	4,385	3,318	3,267	2,526	2,695	2,002	1,593	1,449	925
Carbon County	10,078	9,552	8,080	8,099	7,080	6,441	5,494	4,828	4,360	3,369
Carter County	1,160	1,360	1,503	1,799	1,956	810	811	816	795	761
Cascade County	81,327	80,357	77,691	80,696	81,804	37,276	35,225	33,063	32,199	27,190
Chouteau County	5,813	5,970	5,452	6,092	6,473	2,879	2,776	2,668	2,689	2,625
Custer County	11,699	11,696	11,697	13,109	12,174	5,560	5,360	5,405	5,473	4,356
Daniels County	1,751	2,017	2,266	2,835	3,083	1,111	1,154	1,220	1,303	1,281
Dawson County	8,966	9,059	9,505	11,805	11,269	4,233	4,168	4,487	4,637	3,755
Deer Lodge County	9,298	9,417	10,356	12,518	15,652	5,122	4,958	4,830	5,199	5,150
Fallon County	2,890	2,837	3,103	3,763	4,050	1,470	1,410	1,525	1,519	1,357
Fergus County	11,586	11,893	12,083	13,076	12,611	5,836	5,558	5,732	5,392	4,738
Flathead County	90,928	74,471	59,218	51,966	39,460	46,963	34,773	26,979	22,485	14,098
Gallatin County	89,513	67,831	50,463	42,865	32,505	42,289	29,489	21,350	17,173	10,761
Garfield County	1,206	1,279	1,589	1,656	1,796	844	961	924	868	732
Glacier County	13,399	13,247	12,121	10,628	10,783	5,348	5,243	4,797	4,002	3,458
Golden Valley County	884	1,042	912	1,026	931	476	450	432	472	366
Granite County	3,079	2,830	2,548	2,700	2,737	2,822	2,074	1,924	1,635	1,345
Hill County	16,096	16,673	17,654	17,985	17,358	7,250	7,453	7,345	7,194	5,843
Jefferson County	11,406	10,049	7,939	7,029	5,238	5,055	4,199	3,302	2,867	1,566
Judith Basin County	2,072	2,329	2,282	2,646	2,667	1,336	1,325	1,346	1,360	1,115
Lake County	28,746	26,507	21,041	19,056	14,445	16,588	13,605	10,972	9,038	5,927
Lewis and Clark County	63,395	55,716	47,495	43,039	33,281	30,180	25,672	21,412	18,571	12,359
Liberty County	2,339	2,158	2,295	2,329	2,359	1,043	1,070	1,007	1,154	792
Lincoln County	19,687	18,837	17,481	17,752	18,063	11,413	9,319	8,002	7,018	5,907
McCone County	1,734	1,977	2,276	2,702	2,875	1,008	1,087	1,161	1,121	1,055
Madison County	7,691	6,851	5,989	5,448	5,014	6,940	4,671	3,902	2,741	2,141
Meagher County	1,891	1,932	1,819	2,154	2,122	1,432	1,363	1,259	1,201	1,043
Mineral County	4,223	3,884	3,315	3,675	2,958	2,446	1,961	1,635	1,646	1,083
Missoula County	109,299	95,802	78,687	76,016	58,263	50,106	41,319	33,466	30,534	18,891
Musselshell County	4,538	4,497	4,106	4,426	3,734	2,054	2,017	2,103	2,039	1,577
Park County	15,636	15,694	14,484	12,869	11,197	9,375	8,247	6,926	6,074	4,648
Petroleum County	494	493	519	655	675	324	292	293	306	269
Phillips County	4,253	4,601	5,163	5,367	5,386	2,335	2,502	2,765	2,514	2,153
Pondera County	6,153	6,424	6,433	6,731	6,611	2,659	2,834	2,618	2,702	2,267
Powder River County	1,743	1,858	2,090	2,520	2,862	1,022	1,007	1,096	1,123	962
Powell County	7,027	7,180	6,620	6,958	6,660	3,105	2,930	2,835	2,830	2,453
Prairie County	1,179	1,199	1,383	1,836	1,752	673	718	749	808	706
Ravalli County	40,212	36,070	25,010	22,493	14,409	19,583	15,946	11,099	9,133	5,333
Richland County	9,746	9,667	10,716	12,243	9,837	4,550	4,557	4,825	4,690	3,514
Roosevelt County	10,425	10,620	10,999	10,467	10,365	4,063	4,044	4,265	3,809	3,386
Rosebud County	9,233	9,383	10,505	9,899	6,032	4,057	3,912	4,251	3,787	2,055
Sanders County	11,413	10,227	8,669	8,675	7,093	6,678	5,271	4,335	3,843	2,833
Sheridan County	3,384	4,105	4,732	5,414	5,779	2,089	2,167	2,417	2,416	2,086
Silver Bow County	34,200	34,606	33,941	38,092	41,981	16,717	16,176	15,474	16,071	15,631
Stillwater County	9,117	8,195	6,536	5,598	4,632	4,803	3,947	3,291	2,681	1,959
Sweet Grass County	3,651	3,609	3,154	3,216	2,980	2,148	1,860	1,639	1,479	1,387
Teton County	6,073	6,445	6,271	6,491	6,116	2,892	2,910	2,725	2,747	2,265
Toole County	5,324	5,267	5,046	5,559	5,839	2,336	2,300	2,354	2,432	2,163
Treasure County	718	861	874	981	1,069	422	422	448	462	448
Valley County	7,369	7,675	8,239	10,250	11,471	4,879	4,847	5,304	5,611	5,289
Wheatland County	2,168	2,259	2,246	2,359	2,529	1,197	1,154	1,129	1,140	1,009
Wibaux County	1,017	1,068	1,191	1,476	1,465	538	587	563	680	536
Yellowstone County	147,972	129,352	113,419	108,035	87,367	63,943	54,563	48,781	42,756	29,169

Table 8.

Population and Housing Units: 1990 to 2010; and Area Measurements and Density: 2010—Con.

[For information concerning historical counts and geographic change, see "User Notes." For information on confidentiality, nonsampling error, and definitions, see Appendixes]

State County/County Equivalent County Subdivision Place	Population			Housing units			Area measurements in square miles		Average per square mile of land	
	2010	2000	1990	2010	2000	1990	Total area	Land area	Population density	Housing unit density
Montana—Con.										
Mineral County	4,223	3,884	3,315	2,446	1,961	1,635	1,223.26	1,219.44	3.5	2.0
Alberton CCD	801	727	537	460	372	270	297.81	296.96	2.7	1.5
Alberton town	420	374	354	202	175	145	0.60	0.57	736.8	354.4
Superior CCD	2,206	2,060	1,816	1,174	978	817	477.73	475.85	4.6	2.5
Riverbend CDP	484	442	(X)	253	216	(X)	4.24	3.93	123.2	64.4
Superior town	812	893	881	431	410	386	1.16	1.04	780.8	414.4
West End CCD	1,216	1,097	962	812	611	548	447.72	446.63	2.7	1.8
De Borgia CDP	78	69	(X)	52	42	(X)	5.87	5.87	13.3	8.9
St. Regis CDP	319	315	(X)	166	161	(X)	0.88	0.86	370.9	193.0
Missoula County	109,299	95,802	78,687	50,106	41,319	33,466	2,618.32	2,593.42	42.1	19.3
Flathead Reservation CCD	880	902	(X)	395	360	(X)	163.57	162.73	5.4	2.4
Evaro CDP	322	329	(X)	132	117	(X)	17.16	17.15	18.8	7.7
Frenchtown-Wye CCD	7,448	6,112	4,375	2,987	2,298	1,704	334.08	332.06	22.4	9.0
Frenchtown CDP	1,825	883	(X)	677	302	(X)	6.78	6.74	270.8	100.4
Huson CDP	210	(X)	(X)	87	(X)	(X)	0.74	0.74	283.8	117.6
Wye CDP	511	381	(X)	183	126	(X)	3.10	3.10	164.8	59.0
Lolo CCD	14,611	13,855	5,794	6,122	5,376	2,117	538.84	536.62	27.2	11.4
Carlton CDP	694	(X)	(X)	290	(X)	(X)	6.13	6.13	113.2	47.3
Lolo CDP	3,892	3,388	2,746	1,517	1,263	953	9.64	9.46	411.4	160.4
Missoula city (part)	717	465	(X)	356	312	(X)	0.93	0.93	771.0	382.8
Orchard Homes CDP (part)	5,003	5,014	(X)	2,094	2,002	(X)	6.19	5.91	846.5	354.3
Missoula CCD	82,600	71,390	65,984	37,317	30,649	27,727	560.33	557.13	148.3	67.0
Bonner-West Riverside CDP	1,663	1,693	1,669	769	723	705	1.61	1.52	1,094.1	505.9
Clinton CDP	1,052	549	(X)	446	216	(X)	3.36	3.27	321.7	136.4
East Missoula CDP	2,157	2,070	(X)	957	828	(X)	1.38	1.35	1,597.8	708.9
Missoula city (part)	66,071	56,588	42,918	30,326	24,913	18,488	26.75	26.58	2,485.7	1,140.9
Orchard Homes CDP (part)	194	185	10,317	110	89	4,339	0.09	0.09	2,155.6	1,222.2
Piltzville CDP	395	(X)	(X)	162	(X)	(X)	0.70	0.70	564.3	231.4
Turah CDP	306	(X)	(X)	121	(X)	(X)	1.29	1.29	237.2	93.8
Seeley Lake-Blackfoot Valley CCD	3,760	3,543	2,534	3,285	2,636	1,918	1,021.50	1,004.89	3.7	3.3
Condon CDP	343	(X)	(X)	316	(X)	(X)	21.59	21.40	16.0	14.8
Seeley Lake CDP	1,659	1,436	(X)	1,262	938	(X)	12.45	12.22	135.8	103.3
Musselshell County	4,538	4,497	4,106	2,654	2,317	2,183	1,870.91	1,868.16	2.4	1.4
Klein CCD	1,574	1,395	1,002	922	689	549	398.70	398.67	3.9	2.3
Klein CDP	168	188	(X)	107	90	(X)	12.85	12.85	13.1	8.3
Melstone CCD	412	476	584	298	284	287	610.41	610.19	0.7	0.5
Melstone town	96	136	166	75	87	88	0.69	0.69	139.1	108.7
Musselshell CDP	60	60	(X)	49	49	(X)	2.55	2.55	23.5	19.2
Roundup CCD	2,552	2,626	2,520	1,434	1,344	1,347	861.81	859.30	3.0	1.7
Camp Three CDP	173	138	(X)	115	104	(X)	4.43	4.43	39.1	26.0
Roundup city	1,788	1,931	1,808	973	978	1,006	1.34	1.34	1,334.3	726.1
Park County	15,636	15,694	14,484	9,375	8,247	6,926	2,813.49	2,803.06	5.6	3.3
Gardiner-Cooke City CCD	1,493	1,792	1,845	1,305	1,299	974	744.90	740.20	2.0	1.8
Cooke City CDP	75	(X)	(X)	160	(X)	(X)	9.59	9.59	7.8	16.7
Corwin Springs CDP	109	(X)	(X)	115	(X)	(X)	1.49	1.41	77.3	81.6
Gardiner CDP (part)	875	851	(X)	556	497	(X)	5.84	5.74	152.4	96.9
South Glastonbury CDP (part)	50	(X)	(X)	54	(X)	(X)	9.28	9.07	5.5	6.0
Jardine CDP	57	(X)	(X)	32	(X)	(X)	14.75	14.75	3.9	2.2
Silver Gate CDP	20	(X)	(X)	145	(X)	(X)	4.46	4.46	4.5	35.9
Livingston CCD	12,325	12,016	11,132	7,028	6,042	5,236	1,126.72	1,123.24	11.0	6.3
Emigrant CDP	468	(X)	(X)	384	(X)	(X)	11.82	10.77	45.3	31.3
South Glastonbury CDP (part)	234	(X)	(X)	157	(X)	(X)	8.64	8.51	27.5	18.4
Livingston city	7,044	6,851	6,701	3,779	3,360	3,137	6.03	6.02	1,170.1	627.7
Pray CDP	661	(X)	(X)	455	(X)	(X)	29.15	28.62	23.8	15.9
Springdale CDP	42	(X)	(X)	21	(X)	(X)	0.13	0.13	323.1	161.5
Wineglass CDP	256	(X)	(X)	120	(X)	(X)	6.27	6.27	40.8	19.1
Shields Valley CCD	1,785	1,886	1,585	1,027	906	716	796.66	794.94	2.2	1.3
Clyde Park town	288	310	282	153	157	130	0.32	0.32	900.0	478.1
Wilsall CDP	178	237	(X)	106	119	(X)	1.01	1.01	176.2	105.0
Yellowstone National Park CCD	33	(X)	(X)	15	(X)	(X)	145.20	144.69	0.2	0.1
Gardiner CDP (part)	–	(X)	(X)	–	(X)	(X)	0.03	0.03	–	–
Petroleum County	494	493	519	324	292	293	1,673.80	1,654.87	0.3	0.2
Winnett North CCD	133	143	155	90	89	86	1,056.39	1,039.27	0.1	0.1
Winnett South CCD	361	350	364	234	203	207	617.42	615.60	0.6	0.4
Winnett town	182	185	188	132	124	114	0.98	0.98	185.7	134.7

Nicole Rediske - Fwd: RE: Sewer Crossing

From: Nicole Rediske
To: Nicole Rediske
Date: 6/5/2019 11:22 AM
Subject: Fwd: RE: Sewer Crossing
Attachments: IMAGE.jpeg; IMAGE.jpeg; IMAGE.jpeg; IMAGE.jpeg; 20190502115255.pdf

>>> Mathew Whitman <mwhitman@livingstonmontana.org> 5/2/2019 11:55 AM >>>
Matt,

The growth rate looks good. Attached is the map with areas of growth. The design flow looks good for when there is no infiltration. The flow double or triples when the water table comes up. We can discuss the areas where I think that is the most likely to come from if you would like.

Thanks
Matt

From: Matt McGee [Matt.McGee@tdhengineering.com]
Sent: Wednesday, May 01, 2019 2:40 PM
To: Mathew Whitman <mwhitman@livingstonmontana.org>
Subject: Re: Sewer Crossing

Thank you Matt. Will you be able to review that WW memo regarding growth rate and anticipated development areas so we can keep moving on the collection system PER?

Best,

Matt McGee, PE | Civil Engineer
TD&H Engineering
234 E. Babcock Street, Suite 3 | Bozeman, MT 59715
p: 406.586.0277 | c: 307.250.0088 | d: 406.602.4089
www.tdhengineering.com

>>> Mathew Whitman <mwhitman@livingstonmontana.org> 5/1/2019 9:57 AM >>>
Matt,

I looked at our plans for the 5th street sewer crossing the railroad and there is a 24" casing for 133' under all three tracks. Just wanted to let you know in case that helps with the sewer collection PER.

Thanks
Matt

LIVINGSTON Montana
GO BEYOND YELLOWSTONE
www.livingstonmontana.org

Matt Whitman PROJECT MANAGER
CITY OF LIVINGSTON PUBLIC WORKS DEPARTMENT
o: 406-222-5667 c: 406-223-8268
e: mwhitman@livingstonmontana.org

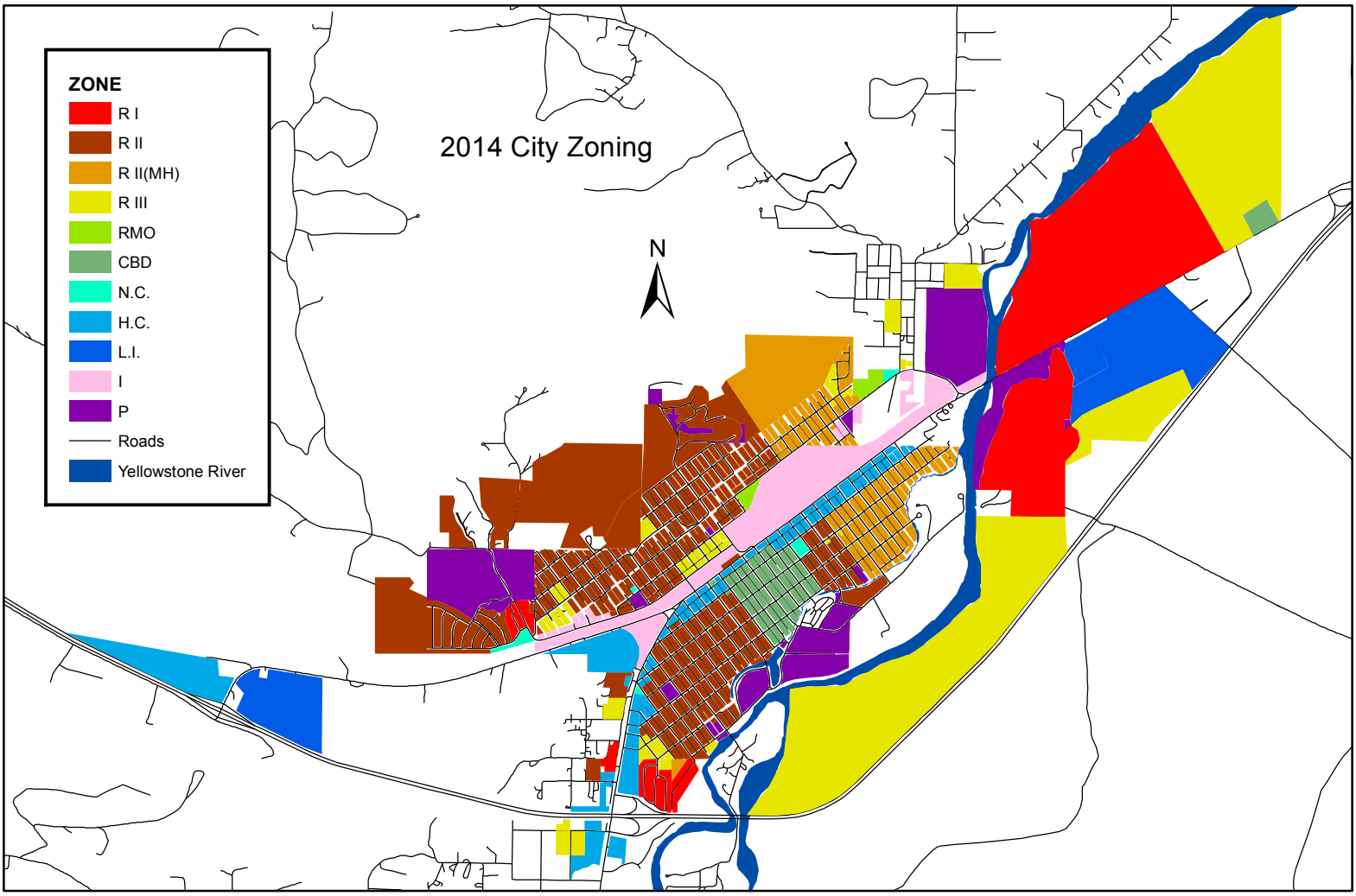
APPENDIX 2
Existing Facilities

City Zoning Map

City Correspondence- Planning Boundary Map

Flow Rate Calculations

Static Groundwater Depths Map


ZONE
R I
R II
R II(MH)
R III
RMO
CBD
N.C.
H.C.
L.I.
I
P
Roads
Yellowstone River
2014 City Zoning
N

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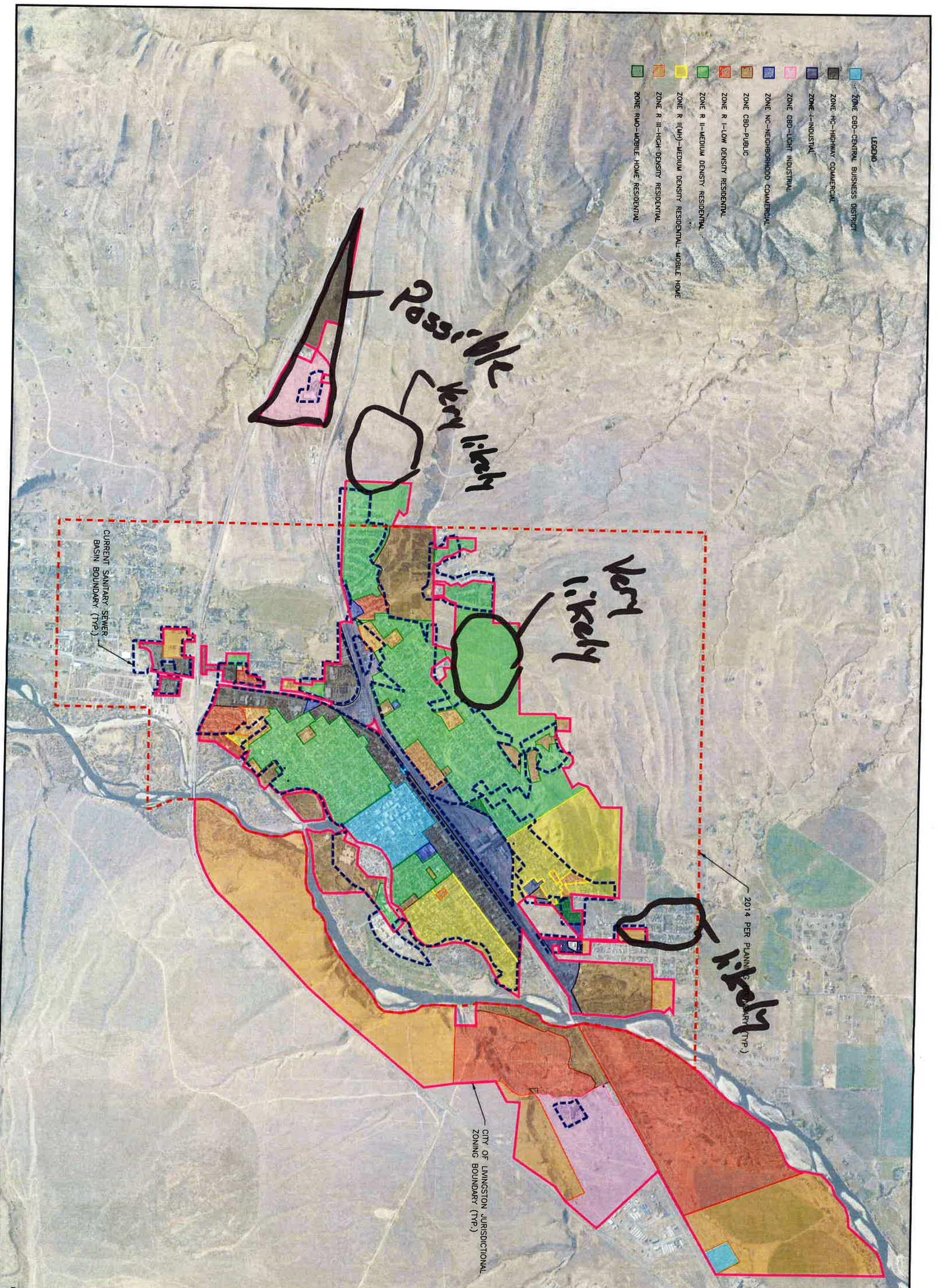

LIVINGSTON COLLECTION SYSTEM PER
LIVINGSTON, MONTANA

PLANNING BOUNDARY

DRAWN BY: NMR
DESIGNED BY:
QUALITY CHECK:
DATE: 4-26-2019
JOB NO. B15-081
FIELDBOOK

TD&H Engineering
406.586.0277 • tdhengineering.com
234 E. BABCOCK ST., SUITE 3 • BOZEMAN, MONTANA 59715

REV	DATE	REVISION

NOT FOR CONSTRUCTION

B15-081 PLANNING BOUNDARY.DWG
SHEET 1

City of Livingston
Wastewater Collection System PER
Existing Subbasin Flow Calculations

Zone	Abbreviation	Flow Rate (gpd/acre)
Low Density Residential	R I	1030
Medium Density Residential	R II	1030
High Density Residential	R III	1030
Residential Mobile Home	RMO	1030
Neighborhood Commercial	NC	1200
Highway Commerical	HC	1200
Central Business District	CBD	1200
Industiral	I	960
Light Industiral	LI	960
Public	P	1030

Basin	area (sf)	area (acres)	Zone	Zone Flow Rate (gpd/acre)	Base Flow Rate (gpd)	Base Flow (cfs)	Into Junction	Com/Res?	SCALEING FACTOR
189	1,546,136.94	35.49	CBD	1,200	42,593	0.065902	MH-348	Commercial	
188	1,371,089.57	31.48	R II	1,030	32,420	0.050162	MH-398	Residential	
187	922,524.06	21.18	R II	1,030	21,814	0.033751	MH-79	Residential	
186	471,364.17	10.82	R II	1,030	11,146	0.017245	MH-30	Residential	
185	660,263.84	15.16	R II	1,030	15,612	0.024156	MH-13	Residential	
183	286,830.89	6.58	R II	1,030	6,782	0.010494	MH-34	Residential	
182	486,879.24	11.18	R II	1,030	11,513	0.017813	MH-585	Residential	
181	428,806.79	9.84	R II	1,030	10,139	0.015688	MH-39	Residential	
180	410,509.27	9.42	R II	1,030	9,707	0.015019	MH-18	Residential	
179	407,821.58	9.36	R II	1,030	9,643	0.014920	MH-618	Residential	75%
178	695,790.46	15.97	R II	1,030	16,452	0.025456	MH-546	Residential	
177	869,125.06	19.95	R II	1,030	20,551	0.031797	MH-97	Residential	
176	275,102.74	6.32	NC	1,200	7,579	0.011726	MH-686	Commercial	75%
175	440,538.13	10.11	LI	960	9,709	0.015022	LHC	Commercial	50%
174	507,147.85	11.64	I	960	11,177	0.017293	MH-484	Commercial	50%
173	412,476.18	9.47	R III	1,030	9,753	0.015091	MH-668	Residential	
172	1,327,374.26	30.47	R II	1,030	31,386	0.048562	MH-218	Residential	
171	464,499.37	10.66	I	960	10,237	0.015839	MH-215	Commercial	
170	1,035,633.27	23.77	R II	1,030	24,488	0.037889	MH-187	Residential	
169	2,572,415.55	59.05	I	960	56,692	0.087716	MH-178	LIFT STATION	75%
168	952,706.35	21.87	R II	1,030	22,527	0.034855	MH-177	Residential	
167	568,550.95	13.05	R II	1,030	13,444	0.020801	MH-140	Residential	
166	928,888.26	21.32	R II	1,030	21,964	0.033984	MH-130	Residential	
165	888,569.76	20.40	R II	1,030	21,011	0.032508	MH-539	Residential	
164	1,142,962.50	26.24	R II	1,030	27,026	0.041815	MH-168	Residential	
163	1,092,934.13	25.09	R II	1,030	25,843	0.039985	MH-527	Residential	
162	742,502.98	17.05	R III	1,030	17,557	0.027165	MH-154	Residential	
161	721,277.70	16.56	R II	1,030	17,055	0.026388	MH-157	Residential	
160	317,602.29	7.29	R II	1,030	7,510	0.011620	MH-533	Residential	
159	462,624.05	10.62	R III	1,030	10,939	0.016925	MH-528	Residential	
158	1,621,612.74	37.23	R II	1,030	38,344	0.059327	MH-107	Residential	
157	1,373,471.00	31.53	R II	1,030	32,476	0.050249	MH-73	Residential	
156	991,359.25	22.76	R I	1,030	23,441	0.036269	MH-47	Residential	
155	292,845.05	6.72	R II	1,030	6,924	0.010714	MH-277	Residential	
154	259,174.40	5.95	R I	1,030	6,128	0.009482	MH-287	Residential	
153	348,579.40	8.00	HC	1,200	9,603	0.014858	MH-698	Commercial	
152	54,840.86	1.26	HC	1,200	1,511	0.002338	MH-359	Commercial	
151	152,056.17	3.49	HC	1,200	4,189	0.006481	MH-671	Commercial	
150	201,218.03	4.62	HC	1,200	5,543	0.008577	MH-480	Commercial	
149	214,297.87	4.92	HC	1,200	5,904	0.009134	MH-364	Commercial	
148	208,295.84	4.78	HC	1,200	5,738	0.008878	MH-479	Commercial	
147	261,568.70	6.00	HC	1,200	7,206	0.011149	MH-490	Commercial	
146	155,611.06	3.57	HC	1,200	4,287	0.006633	MH-370	Commercial	
145	247,835.09	5.69	HC	1,200	6,827	0.010564	MH-374	Commercial	
144	226,054.10	5.19	HC	1,200	6,227	0.009635	MH-454	Commercial	

City of Livingston
Wastewater Collection System PER
Existing Subbasin Flow Calculations

143	208,273.39	4.78	HC	1,200	5,738	0.008877	MH-476	Commercial	
142	215,852.53	4.96	HC	1,200	5,946	0.009200	MH-383	Commercial	
141	248,196.56	5.70	HC	1,200	6,837	0.010579	MH-314	Commercial	
140	228,719.66	5.25	HC	1,200	6,301	0.009749	MH-431	Commercial	
139	215,836.76	4.95	HC	1,200	5,946	0.009200	MH-250	Commercial	
138	1,625,079.82	37.31	R II	1,030	38,426	0.059454	MH-361	Residential	
137	820,192.63	18.83	R II	1,030	19,394	0.030007	MH-352	Residential	
136	1,124,263.99	25.81	R II	1,030	26,584	0.041131	MH-443	Residential	
135	1,844,804.45	42.35	R II	1,030	43,621	0.067493	MH-354	Residential	
134	622,415.45	14.29	R II	1,030	14,717	0.022771	MH-445	Residential	
133	545,485.93	12.52	R II	1,030	12,898	0.019957	MH-752	Residential	
132	1,836,728.97	42.17	P	1,030	43,430	0.067197	MH-747	Commercial	75%
131	269,443.56	6.19	HC	1,200	7,423	0.011485	MH-458	Commercial	
130	137,732.27	3.16	HC	1,200	3,794	0.005871	MH-331	Commercial	
129	142,953.21	3.28	HC	1,200	3,938	0.006093	MH-330	Commercial	
128	81,117.76	1.86	NC	1,200	2,235	0.003458	MH-327	Commercial	
127	406,925.40	9.34	HC	1,200	11,210	0.017345	MH-737	Commercial	
126	635,640.66	14.59	HC	1,200	17,511	0.027093	MH-322	Commercial	
125	284,541.51	6.53	HC	1,200	7,839	0.012128	MH-325	Commercial	
124	872,260.25	20.02	R I	1,030	20,625	0.031912	MH-312	Residential	
123	308,678.60	7.09	R III	1,030	7,299	0.011293	MH-320	Residential	
122	1,046,944.88	24.03	R II	1,030	24,756	0.038303	MH-510	Residential	
121	649,235.00	14.90	R II	1,030	15,352	0.023752	MH-391	Residential	
120	259,046.85	5.95	R II	1,030	6,125	0.009477	9th_ST	Residential	
119	179,772.35	4.13	R II	1,030	4,251	0.006577	MH-393	Residential	
118	1,194,354.01	27.42	R II	1,030	28,241	0.043696	MH-394	Residential	
117	1,727,691.85	39.66	R II	1,030	40,852	0.063208	MH-465	Residential	
116	219,301.03	5.03	HC	1,200	6,041	0.009347	MH-463	Commercial	
115	187,478.49	4.30	HC	1,200	5,165	0.007991	MH-464	Commercial	
114	205,251.62	4.71	HC	1,200	5,654	0.008749	MH-433	Commercial	
113	191,348.93	4.39	HC	1,200	5,271	0.008156	MH-472	Commercial	
112	1,494,083.00	34.30	R II	1,030	35,328	0.054661	MH-400	Residential	
111	193,973.21	4.45	NC	1,200	5,344	0.008268	MH-441	Commercial	
110	841,142.47	19.31	CBD	1,200	23,172	0.035852	MH-401	Commercial	
109	1,044,599.28	23.98	CBD	1,200	28,777	0.044524	MH-344	Commercial	
108	878,558.70	20.17	R III	1,030	20,774	0.032142	MH-295	Residential	75%
107	773,775.46	17.76	HC	1,200	21,316	0.032981	MH-298	Commercial	75%
106	1,318,853.95	30.28	HC	1,200	36,332	0.056214	MH-265	Commercial	50%
105	313,528.96	7.20	I	960	6,910	0.010691	MH-101	Commercial	75%
104	1,340,802.16	30.78	R II	1,030	31,704	0.049053	MH-593	Residential	75%
103	551,875.89	12.67	R II	1,030	13,049	0.020190	MH-531	Residential	75%
102	781,781.91	17.95	R II	1,030	18,486	0.028602	MH-571	Residential	50%
101	391,745.27	8.99	LI	960	8,634	0.013358	MH-680	Commercial	75%

City of Livingston
Wastewater Collection System PER
Future Subbasin Flow Rate Calculations

Zone	Abbreviation	Flow Rate (gpd/acre)
Low Density Residential	R I	1030
Medium Density Residential	R II	1030
High Density Residential	R III	1030
Residential Mobile Home	RMO	1030
Neighborhood Commercial	NC	1200
Highway Commerical	HC	1200
Central Business District	CBD	1200
Industiral	I	960
Light Industiral	LI	960
Public	P	1030

Basin	area (sf)	area (acres)	Zone	Zone Flow Rate (gpd/acre)	Base Flow Rate (gpd)	Base Flow (cfs)	Into Junction	Com/Res?	CITY NOTES	Column1	Column2
201	630,159.01	14.47	R II	1,030	14,900	0.023054	MH-554	Residential	VERY LIKELY	1	
202	1,847,099.55	42.40	HC	1,200	50,884	0.078730	MH-676	Commercial	POSSIBLE	0.8	
203	2,613,472.48	60.00	LI	960	57,597	0.089116	MH-683	Commercial	POSSIBLE	0.8	
204	832,303.94	19.11	R II	1,030	19,680	0.030450	MH-577	Residential	VERY LIKELY	1	
205	1,276,364.98	29.30	R II	1,030	30,180	0.046696	MH-560	Residential	VERY LIKELY	1	
206	352,746.64	8.10	R II	1,030	8,341	0.012905	MH-705	Residential	VERY LIKELY	1	
207	1,913,438.21	43.93	R II	1,030	45,244	0.070003	MH-589	Residential	VERY LIKELY	1	
208	1,104,085.04	25.35	R II	1,030	26,107	0.040393	MH-584	Residential	VERY LIKELY	1	
209	2,159,091.89	49.57	R II	1,030	51,053	0.078991	MH-86	Residential	VERY LIKELY	1	
210	517,749.85	11.89	R II	1,030	12,242	0.018942	MH-116	Residential	VERY LIKELY	1	
211	1,187,214.31	27.25	R II	1,030	28,072	0.043434	MH-520	Residential	VERY LIKELY	1	
212	580,509.52	13.33	R II	1,030	13,726	0.021238	MH-137	Residential	NO COMMENT	0.8	
213	140,333.79	3.22	R II	1,030	3,318	0.005134	MH-179	Residential	NO COMMENT	0.8	
214	3,478,333.71	79.85	R II	1,030	82,247	0.127255	MH-189	Residential	NO COMMENT	0.8	
215	830,867.75	19.07	R II	1,030	19,646	0.030397	MH-198	Residential	NO COMMENT	0.8	
216	316,031.53	7.26	R II	1,030	7,473	0.011562	MH-209	Residential	NO COMMENT	0.8	
217	2,513,325.11	57.70	R III	1,030	59,429	0.091950	MH-669	Residential	LIKELY	1	
218	568,685.93	13.06	R III	1,030	13,447	0.020805	MH-631	Residential	NO COMMENT	0.8	
219	1,387,084.78	31.84	P	1,030	32,798	0.050747	MH-743	Commercial	NO COMMENT	0.25	
220	9,952,889.01	228.49	R I	1,030	235,341	0.364128	MH-762	Residential	NO COMMENT	0.25	
221	6,824,537.99	156.67	LI	960	150,403	0.232709	MH-763	Commercial	NO COMMENT	0.25	
222	26,847,796.04	616.34	R I	1,030	634,831	0.982232	MH-764	Residential	NO COMMENT	0.25	
223	172,574.34	3.96	R III	1,030	4,081	0.006314	MH-281	Residential	NO COMMENT	0.7	
224	729,790.64	16.75	R I	1,030	17,256	0.026700	MH-498	Residential	NO COMMENT	0.7	
225	406,614.42	9.33	HC	1,200	11,201	0.017331	MH-285	Commercial	NO COMMENT	0.7	

J:\2015\B15-081 City of Livingston\CADD\CIVIL\WW PER\B15-081 GROUNDWATER.dwg, 6/5/2019 11:37:06 AM, NMR

NOT FOR CONSTRUCTION

REV	DATE	REVISION

TD&H Engineering
406.761.3010 • tdhengineering.com
1800 RIVER DR. NO. • GREAT FALLS, MONTANA 59401

DRAWN BY:	NMR
DESIGNED BY:	
QUALITY CHECK:	
DATE:	05-13-2019
JOB NO.	B15-081
FIELDBOOK	

LIVINGSTON COLLECTION SYSTEM PER LIVINGSTON, MONTANA

STATIC GROUNDWATER ELEVATIONS

B15-081 GROUNDWATER.DWG

FIGURE SHT #

WASTEWATER TREATMENT FACILITY
LHC LIFT STATION
N H STREET LIFT STATION
FLESHMAN CREEK LIFT STATION
9TH STREET LIFT STATION
CRAWFORD LIFT STATION
CLINIC LIFT STATION
CENTENIAL LIFT STATION
HIGH STATIC GROUNDWATER
STATIC GROUNDWATER LEVEL UKNOWN (TYP.)
US HIGHWAY 89 S
US HIGHWAY 10 W
INTERSTATE-90
WINEGLASS LANE
BLUE HERON DR
SCENIC TRL
STAR ROAD
CONSTELLATION DR
PLEIADES PL
SUN AVE
ROGERS LANE
LOVES LANE
E MONTANA STREET
E GALLATIN STREET
E PARK STREET
E LEWIS STREET
N G STREET
N M STREET
S M STREET
S H STREET
S D STREET
N 9TH STREET
N 7TH STREET
N YELLOWSTONE STREET
N 2ND STREET
N 15TH STREET
W MONTANA STREET
W GALLATIN STREET
S MAIN STREET
W PARK STREET
S 6TH STREET
S 7TH STREET
S 10TH STREET
W CROSS STREET
W CRAWFORD STREET

0 1000' 2000' 3000'
SCALE

- STATIC GROUNDWATER LESS THAN 5 FEET DEEP
- STATIC GROUNDWATER 5 TO 10 FEET DEEP
- STATIC GROUNDWATER 10 TO 15 FEET DEEP
- STATIC GROUNDWATER 15 TO 20 FEET DEEP
- STATIC GROUNDWATER 20 TO 30 FEET DEEP
- STATIC GROUNDWATER GREATER THAN 30 FEET DEEP

* STATIC GROUNDWATER DEPTH REPORTED IN THE MONTANA BUREAU OF MINES AND GEOLOGY'S GROUNDWATER INFORMATION CENTER WELL LOGS

APPENDIX 4

Civic Center Calculations

Historic Water Usage

Depth of Cover Calculations

Table 2-1: Civic Center Water Usage

Date	Usage (gallons)	Usage (gallons per day)
2018		
November	5,000	167
October	6,000	194
September	141,000	4,700
August	393,000	12,677
July	353,000	11,387
June	144,000	4,800
May	5,000	161
April	4,000	133
March	8,000	258
February	21,000	750
January	14,000	451
2017		
December	3,000	
November	6,000	200
October	8,000	258
September	283,000	9,433
August	605,000	19,516
July	482,000	15,548
June	406,000	13,533
May	5,000	161
April	5,000	167
March	11,000	355
February	18,000	643
January	24,000	774

Livingston Recreation and Civic Center PER

ROUTE #1A - SURVEYED

MH	DIRECTION	RIM ELEVATION (FT)	INVERT IN	INVERT OUT	LENGTH (FT)	SLOPE	MH DEPTH (FT)
MH #9		4485.12	77.66	77.65			7.47
	MH 9 to MH 10				140.28	0.40%	
MH #10		4486.81	78.31	78.21			8.60
	MH 10 to MH 1A				131.76	0.40%	
MH #1A		4486.8	78.84	78.74			8.06
	MH 1A to MH 2A				620.65	0.40%	
MH #2A		4487.12	81.32	81.22			5.90
	MH 2A to MH 3A				656.11	0.40%	
MH #3A		4490.21	83.95	83.85			6.36
	MH 3A to MH 4A				181.97	0.40%	
MH#4A		4489.64	84.67	84.57			5.07
	MH 3A to MH 5A				601.06	0.40%	
MH #5A		4493.54	87.08	86.98			6.56
	MH 5A to MH 6A				345.89	0.40%	
MH #6A		4494.65	88.46	88.36			6.29
	MH 6A to MH 7A				392.57	0.40%	
MH #7A		4492.67		89.93			2.74

APPENDIX 5

Selection of an Alternative Decision Matrix

Decision Ranking Matrix												
Alternative	**Cost Analysis**		**Technical and Logistical Feasibily**		**Operations and Maintencance Complexity**		**Public Health and Saftey**		**Environmental Impacts**		**Total**	**Ranking**
Scaling Factor	**1**		**1**		**3**		**4**		**2**			
	Score	**Scaled Score**	**Score**	**Scaled Score**	**Score**	**Scaled Score**	**Score**	**Scaled Score**	**Score**	**Scaled Score**		
2-N 5th Street Capacity Increase	2	2	4	4	4	12	8	32	5	10	**60**	**3**
3-Northern Trunk Main Capacity Increase	6	6	8	6	4	12	7	28	5	10	**62**	**1**
4-Park Street Capacity Increase	1	1	1	1	4	12	5	20	1	2	**36**	**5**
5-W Geyser Street Capacity Increase	5	5	8	6	4	12	6	24	7	14	**61**	**2**
6- E Lewis Street Replacement	3	3	3	3	4	12	1	4	7	14	**36**	**6**
7- Green Acres Subdivision	4	4	8	8	2	6	1	4	3	6	**28**	**7**
8- Civic Center	7	7	5	5	2	6	1	4	3	6	**28**	**7**
9- Centennial Lift Station	8	8	2	2	4	12	4	16	1	2	**40**	**4**
	8	8	8	8	8	24	8	32	8	16	**88**