JEFFERSON COUNTY

2019 Preliminary Engineering Report

Solid Waste System

DRAFT

March 2019

Prepared by:

GreatWest engineering®

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Solid Waste System

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Prepared for:
Jefferson County, Montana

Prepared by:
Robert Church, PE

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1.0 EXECUTIVE SUMMARY

1.1 Summary

This Preliminary Engineering Report (PER), authorized by and prepared for the Jefferson County Solid Waste System includes investigations and analyses of existing and proposed solid waste facilities within Jefferson County along with recommendations for future improvements. The major elements of this plan include:

1. Population estimates and projections;
2. Environmental assessments;
3. Analyses of existing solid waste systems;
4. Development and evaluation of alternatives for the proposed solid waste system within the study area; and
5. Recommendations for solid waste system improvements.

Funding for this PER consists of state and local funding. The state share was obtained from the Treasure State Endowment Program (TSEP), which is administered by the Montana Department of Commerce. The local share consists of a financial contribution from the Jefferson County Solid Waste System's operating budget. The study meets all the requirements of the Preliminary Engineering Report Outline within the Uniform Application Supplement for Montana Public Facility Projects adopted by the state and federal funding agencies that are members of the Water, Wastewater and Solid Waste Action Coordination Team (W2ASACT). The County has retained Great West Engineering to complete the PER.

The County generates approximately 7,500 tons of solid waste per year. The solid waste generated in Jefferson County is either collected at the curb by a private hauler or customers haul their own waste to one of the roll-off container sites located in Montana City, Clancy, Jefferson City, Boulder, Whitehall and Basin. The County staffs, services, operates and maintains the container sites. The County transfers waste to the Tri-County Disposal (TCD) Landfill located just south of East Helena, Montana. Tri-County then charges the County a per ton cost for disposal. The County also collects and diverts recyclables from the waste stream generated in the County.

The roll-off containers sites at Boulder and Whitehall were constructed in the early 1990's with the closure of the municipal solid waste landfills at these sites. The age of the container sites at

Montana City, Clancy, and Jefferson City is unknown but were likely constructed in the 1980's based on the condition of these sites. The roll-off container sites are in relatively good condition.

1.2 Problem Definition

The PER provides a thorough description of the County's solid waste system which includes a detailed analysis of the performance and condition of the solid waste infrastructure. The system deficiencies identified in this report include the following:

- The container sites do not meet current Building Code requirements because of the lack of barriers at the tipping area. The existing sites are grandfathered in from a regulatory perspective and the County is not required to upgrade these sites. Any new container sites or modifications to the existing container walls would require the installation of a 42-inch barrier. The County has not had an issue with customers falling from any of the container walls in recent history. The County's site attendants monitor activities and educate their customers on the safe use of the sites. Since this is not a current problem and the County is not required to install barriers, they have elected not to install them at this time.
- The current practice of hauling waste in roll-off containers loose from the Boulder site is inefficient and results in the County incurring excessive operations and maintenance costs due to the additional trucking mileage. The additional trucking mileage increases public health and safety risks on the highways (Appendix A). MACo data in Appendix B also documents five accidents related to trucking of waste in Montana over the last 21 years. The County has elected to install stationary compactors at the Boulder site to reduce hauling mileage and operations costs.
- The County needs to construct a new container site for Montana City since this site is too small to handle current traffic levels. The excessive traffic periodically causes back-up of traffic on McClellan Creek Road which is a significant safety issue. The County has elected to construct a new container site on County-owned property near the existing facility.

1.3 Alternatives Considered

The alternative screening process considered various alternatives for the solid waste system improvements. After an initial evaluation, some alternatives were determined to be non-viable for the County and were eliminated from further review. Alternatives that were determined viable and therefore discussed in greater detail include the following:

Roll-Off Container Site Alternatives:

- Alternative 2A: Existing System (No Action)
- Alternative 2B: Installation of Barrier Gates at Container Sites
- Alternative 2C: Roll-off Load Consolidation with Mini-Excavator
- Alternative 2D: Roll-off Load Consolidation with Stationary Compactors
- Alternative 2E: Closure of Clancy, Jefferson City, and Basin container sites

Montana City Container Site Replacement Alternatives

- Alternative 3D: Construction of New Container Site on County-owned property near existing site
- Alternative 3E: Construction of New Container Site at Tri-County Disposal Site

Pay-As-You-Throw (PAYT) Alternatives

Alternative 4A: Current PAYT system

Alternative 4B: Implementation of Weight-Based PAYT System

Wood Waste Alternatives

Alternative 5A: Current Alternative (Open Burning and Landfilling)

Alternative 5C: Air Curtain Burner for North portion of County

1.4 Preferred Alternatives

The preferred alternatives for the project are as follows:

1.4.1 Alternative 2A – No Action on Container Site Barriers

To meet the current Building Code requirements, the County would need to install 42-inch high barriers at each of the existing container sites. The existing sites are grandfathered in from a regulatory perspective and the County is not required to upgrade these sites. Any new container sites or modifications to the existing container walls would require the installation of a 42-inch barrier. The County has not had an issue with customers falling from any of the container walls in recent history. Installation of barriers also makes the site harder for customers to use particularly when dumping bulky and/or heavy wastes. The County's site attendants monitor activities and educate their customers on the safe use of the sites. Since this is not a current problem and the County is not required to install barriers, they have elected not to install them at this time.

1.4.2 Alternative 2D - Transfer System Improvements - Consolidation of Containers at Boulder site with stationary compactors

This alternative includes installing two stationary compactors at the Boulder site for load consolidation. A diesel-powered generator will also be installed to power the compactors. There will be accompanying operations and maintenance costs for operating the compactors.

1.4.3 Alternative 3D Transfer and Processing System Improvements - Construction of New Roll-off Container site for Montana City site

This project consists of constructing a new eight bay roll-off container site for the Montana City area. The project will be constructed on County-owned property just southeast of the existing facility. The project will also include construction of a new access road to the property which will meet County Road Standards.

1.4.4 Alternative 4A – Current PAYT System

The County has elected to retain its current PAYT system and not implement a weight-based PAYT system. This is essentially the No-Action alternative.

1.4.5 Alternative 5A – Current Wood Waste Alternative

At this time the County has elected to retain its current alternative for wood waste. However, the County will investigate opportunities for backhauling wood waste to Boulder when empty containers are needed back in Boulder from Montana City or Clancy.

Project Costs and Budget

The total project cost for the proposed project is $1,051,000. This cost is detailed in Table 7-3.

The County's preferred funding package for the proposed project is Funding Scenario #2 in Table 8-1, which includes the following sources of funds:

- Intercap Loan (15 years): $1,062,000 (Includes administrative costs)

Table 8-2 presents a detailed project budget based upon the proposed funding strategy. Assuming the overall funding strategy is successful, the project will increase residential user rates by about $10.30 per year per EDU. The current yearly residential solid waste rate is $129.69 per year The user cost per year including the proposed project is $140.00. This equates to 77% of the community's target rate for solid waste. The County is capable of providing the necessary funds to repay the new debt service and meet coverage requirements, while adequately operating and maintaining the system.

2.0 PROJECT PLANNING

2.1 Location

The Jefferson County Solid Waste System includes all of Jefferson County, Montana. Jefferson County is a mountainous area with a large portion of the County consisting of public land ownership. The System and study area boundary is shown on Figure 2-1.

Coordinates of the County courthouse in Boulder are 46 deg 14' 11" N, 112 deg 7' 19" W. The proposed system improvements include the construction of a new container site to replace the existing container site at Montana City and installation of stationary compactors for consolidating containers at the Boulder site.

According the Census Bureau, in 2016, the population of Jefferson County was estimated to be 11,853 persons. Assuming a growth rate of 1.358 percent per year for twenty years, the population of the County could approach 16,096 people by 2038. This may be particularly true if the state regulations governing the use of exempt drinking water wells for residential development are relaxed in the next few years. Such a change could encourage substantial rural development within the County.

With regards to the economics of the County, data from the U.S. Department of Commerce Bureau of Economic Analysis as compiled by Headwaters Economics, reports that in 2016 the three industry sectors with the largest number of jobs in the County were government (798 jobs), farm (422 jobs), and retail trade (384 jobs). In addition, the Bureau indicates that from 2001 to 2016, the three industry sectors that added the highest number of new jobs were real estate and rental and leasing (155 new jobs), accommodation and food services (144 new jobs), and health care and social assistance (112 new jobs).

Land use within the County consists of State and Federal lands, grazing land, private agricultural and timberland, suburban and urban areas.

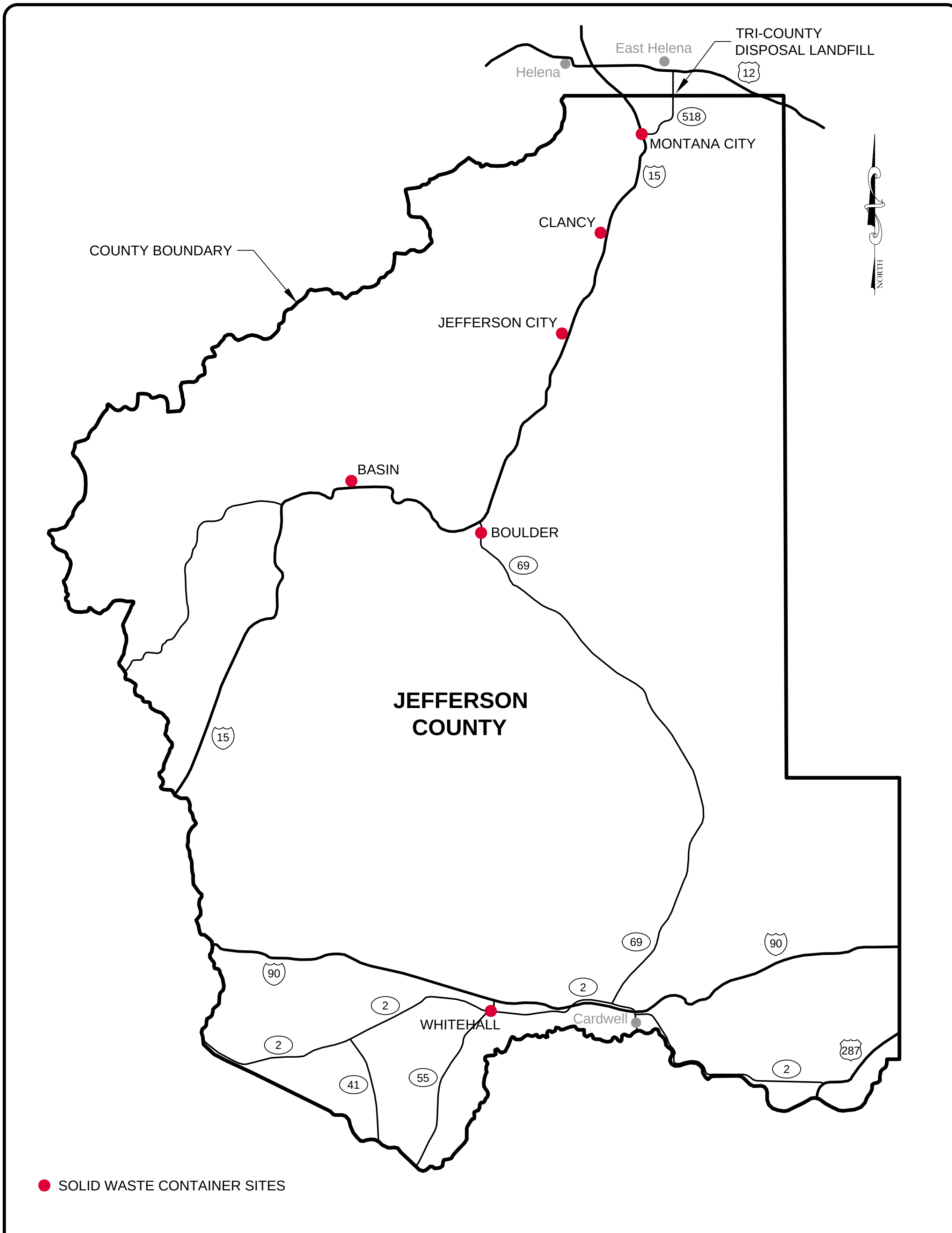

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Figure 2-1
PLANNING AREA

JEFFERSON COUNTY SOLID WASTE SYSTEM
PRELIMINARY ENGINEERING REPORT

F:\1-15272-Jefferson County On-Call 2015\TO 12 - Solid Waste PER\CADD 1-15272-TO12-PER-Fig 2_1.dwg

2.2 Purpose of Analysis

Jefferson County residents are serviced by a county-wide solid waste system. The County Commission authorized an engineering analysis of the public solid waste system and retained the firm of Great West Engineering to conduct the analysis and prepare a Preliminary Engineering Report (PER). The Preliminary Engineering report meets the requirements of the WASACT Uniform PER Outline. The analysis evaluates the condition and adequacy of the existing system, identifies deficiencies, evaluates alternatives and ultimately recommends improvements to the system.

Included in the following parts of this report is a summary of the investigations and recommendations compiled during the analysis. In addition to describing components of the existing solid waste system, present and future population trends and waste generation are analyzed to ensure that any recommended improvements are compatible with the System's long term needs. Alternatives are examined within the report for improvements to the solid waste system. Cost estimates for recommended improvements are given to provide for short and long term financial planning. Implementation recommendations are provided including a proposed funding strategy and budget.

2.3 Environmental Resources

The existing environmental resources and conditions for the project areas (sites) are evaluated in the sections below. Any potential impacts to environmental conditions as part of proposed projects presented in this document will be evaluated in a subsequent Environmental Assessment (EA). That EA document will incorporate all appropriate state and Federal agency comments and required mitigation, as well as public comment.

2.3.1 Topography and Geology

The project areas (sites) are located along Interstate 15 (I-15) and one site along I-90, east of Butte. Mountains dominate the topography of the County. Elevations near the project areas, along the I-15 route, range from approximately 4,000 ft. above mean sea level at the northern end to 5,300 at the Basin, MT site and 4,500 at Whitehall, the southern end of the county. The Boulder Batholith on the western third of the county features narrow gulches that feed in to larger creek bottoms, bordered by steep hillsides that include high mountain parks and meadows.

Various plutonic intrusions occur throughout the area, most forming during the late cretaceous period. Regional uplift brought the deep-seated granite to the surface, where erosion exposed the rocks and the extremely rich mineral veins they contained. Hundreds of millions of dollars of copper, silver, gold, zinc, lead, and other metals have been mined from the batholith in the region. Earthquakes are not common in the county and no active faults are monitored within the county. The selected alternatives will not be impacted by topography or geology.

2.3.2 Soils

Soils underlying the sites reflect the near-surface alluvial geology. The soil descriptions for each project area and accompanying soil maps, compiled from the Natural Resource Conservation Service's Web Soil Survey, are included in Appendix C. The soils for each of the areas are grouped into the following main soil associations:

- **Tri-County Landfill Site**
  - Mostly clay loam and gravelly loam soils.
  - No construction limitations noted.
  - *Farmland of Statewide Importance* soil type.

- **Montana City Site**
  - Fine-loamy alluvium over sandy and gravelly alluvium soil.
  - No construction limitations noted.
  - Not a *Farmland of Statewide Importance* soil type.

- **Clancy Site**
  - Fine-loamy alluvium soils over gravelly weathered granite material.
  - No construction limitations noted.
  - Not a *Farmland of Statewide Importance* soil type.

- **Jefferson City Site**
  - Coarse-loamy alluvium soils derived from weathered granite.
  - No construction limitations noted.
  - Not a *Farmland of Statewide Importance* soil type.

- **Boulder Site**
  - Fine to sandy-loam alluvium soils derived from sandstone-shale.
  - No construction limitations noted.
  - *Farmland of Statewide Importance* soil type.

- **Basin Site**
  - Cobbly loam derived from granite typical of high elevation escarpments or hillsides.
  - No construction limitations noted.
  - Not a *Farmland of Statewide Importance* soil type.

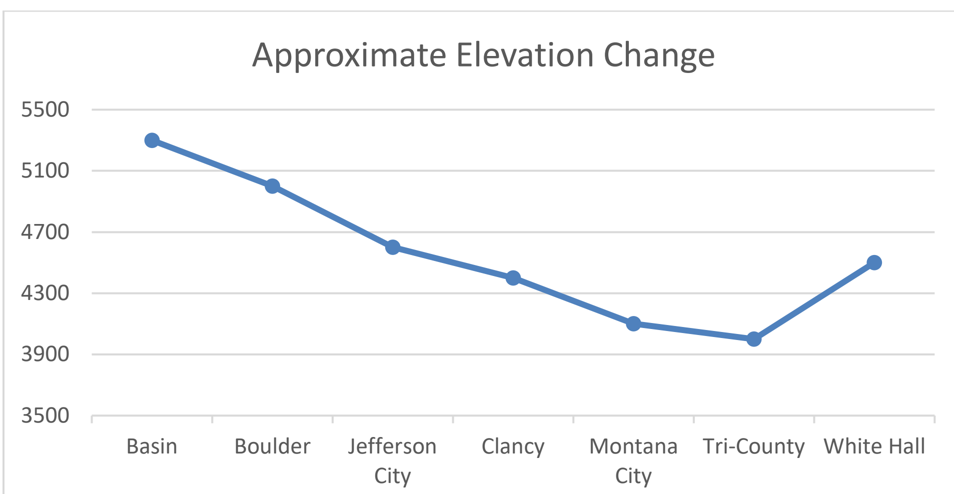
- **Whitehall Site**
  - Cobbly loam derived from alluvial material typical of hillsides or plains.
  - No construction limitations noted.
  - *Farmland of Statewide Importance* soil type.

Although soils at the Tri-County, Boulder and Whitehall sites note *Farmland of Statewide Importance*, no active farmland is within or near either of the sites. All existing sites have all been previously graded and surfaced to accommodate traffic and operational requirements. The selected alternative of a new roll-off container site at Montana City will require new site development and access road with significant soil disturbance. The soil conditions on the proposed site do not have any limiting construction factors.

2.3.3 Climate

The climate at all project areas are classified as a Cfb in the Koeppen system. The criteria for that classification generally include relatively warm summers and cold winters, with no significant monsoonal or other large precipitation fluctuations, typical of a semi-arid Western Montana. With the difference of approximately 1,400 ft. of elevation between the Tri-County Landfill site and the Basin site, precipitation and growing seasons vary.

Figure 2-2 - Approximate Site Elevation Difference



Three weather stations, managed by the Applied Climate Information System (ACIS) and is maintained by the NOAA Regional Climate Centers (RCCs) were used to summarize climate data for the project areas. The weather station data was not available for Basin, Jefferson City or Clancy, MT. Table 2-1 describes the station information used to evaluate the sites. Table 2-2 characterizes average weather conditions at each of the three sites.

Table 2-1 - Weather Station Elevations

Weather Station Name	Approximate Elevation *(above mean sea level)*	Site Representation
Boulder	5,000 ft.	Boulder
Helena Airport	3,900 ft.	Montana City, Tri-County
Whitehall	4,500 ft.	Whitehall

Table 2-2 - Weather Station Climate Data

	Weather Station Name		
	Boulder	Helena Airport	Whitehall
Avg. Max Summer Temp. (May-Sep.)	82.7 F°	83.1 F°	87.3 F°
Avg. Min. Winter Temp. (Oct.-Apr.)	9.6 F°	11.5 F°	12.3 F°
Avg. Total Annual Precipitation	10.97 in.	11.85 in.	10.22 in.
Avg. Growing Season (consecutive frost-free days)	105-120	120-135	90-105

There are not any present climatic conditions that impact operations at the existing solid waste sites. The selected alternatives will not be impacted by area climatic conditions.

2.3.4 Air Quality

None of the existing sites are located within designated DEQ air quality sites of concern. The selected alternatives will be constructed within existing solid waste sites and do not pose air quality concerns.

2.3.5 Land Use/Important Farm Ground/Formally Classified Lands

All seven sites represent land that has been applied to uses other than agricultural purposes and none are on *Formally Classified Lands* such as national forest, wilderness or conservation areas. The Natural Resource Conservation Service (NRCS) database indicates that soils at the Tri-County, Boulder and Whitehall sites note *Farmland of Statewide Importance*, although no active farmland is within or near any of the sites. The selected alternatives will be constructed on land currently used for solid waste purposes and will not convert any land use with the exception of the new Montana City container site.

The Boulder site is approximately 0.65 miles from the end of the Boulder Airport runway although no existing Federal Aviation Administration (FAA) permitting is required. If the site use changes or expands in the future, consultation with the FAA will be required.

2.3.6 Floodplains

Floodplain maps for the Tri-County and Basin planning areas can be found in Appendix D. The other locations have not been mapped. None of the existing seven sites are located within mapped floodplains and those unmapped are not near flood prone areas. Prior to any site expansion or land use change, consultation with the local and state Flood Plain Administrators would be required. The selected alternatives are not proposed within any flood plains.

2.3.7 Wetlands

Wetlands are characteristically in low-lying areas along, or nearby, waterways. The solid waste sites are not located in areas typical of wetlands. The US Fish and Wildlife Service's National Wetland Inventory (NWI) mapping data does not reveal the presence of any wetlands within the boundaries of any of the seven sites. Prior to any proposed site expansion or land use change, the US Fish and Wildlife Service and US Army Corps of Engineers should be consulted for potential wetland impacts. Wetland maps of the project areas are located in Appendix E. The selected alternatives are not located within or near any wetland areas.

2.3.8 Historical/Cultural Resources

The Montana State Historical Preservation Office (SHPO) maintains the *Montana National Register of Historic Places*. There are no listed properties within close proximity to any of the seven solid waste sites. Additionally, Jefferson County is not home to any designated Indian Reservations. The selected alternatives are not located in areas known to be historically or culturally sensitive. Prior to any future construction, consultation with SHPO and area tribal representatives may be required.

2.3.9 Biological Resources

Fauna of Jefferson County consists of typical mammalian species found in the intermountain west, including mule deer, elk, whitetail deer, antelope, coyote, black bear, rabbit, skunk, weasel, rodents and others. Common bird species include the black-billed magpie, American robin, Canadian goose, osprey, blackbird, sparrow, warbler, common waterfowl, other raptors, game birds and others. Aquatic species in the various regional creeks and rivers (Prickly Pear Creek, Jefferson River, Boulder River) may include Brown Trout, Brook Trout, Rainbow Trout, and Westslope Cutthroat Trout.

The Montana Natural Heritage Program database lists a number of animal species of concern in Jefferson County (Appendix F). However, habitat at those properties have already been disturbed and the historical uses and activities make them generally inhospitable to the animal species listed.

The US Fish and Wildlife’s Information for Planning and Consultation (IPaC) tool identifies four *threatened* species in Jefferson County: Canada Lynx, Grizzly Bear, North American Wolverine and the flowering plant Ute Ladies'-tresses. The Whooping Crane is listed as *endangered* in Jefferson County. No critical habitat is identified within the County. The DNRC Sage Grouse Habitat Conservation Map does not identify any habitat within or near any of the seven sites.

Prior to any new solid waste site construction that would expand or create new boundaries, consultation with local, state and Federal wildlife management agencies is required. The selected alternatives are within active solid waste sites, and impact to any threatened or endangered species is not likely.

2.3.10 Water Resources

Surface Water

The seven sites are spread the length of Jefferson County in diverse terrain. All seven sites are within the Upper Missouri watershed. Tri-County, Montana City, Clancy, and Jefferson City are within the Lake Helena TMDL Planning Area (TPA). Boulder and Basin are within the Boulder-Elkhorn TPA and White Hall is within the Upper Jefferson TPA. None of the seven sites are within a current DEQ total maximum daily load (TMDL) priority area currently. Full TMDL plans can be reviewed on the Montana DEQ website. Summarized below are site specific surface water sources and pertinent characteristics:

- **Tri-County Site**
    - Sub-Watershed: Lower Prickly Pear Gulch, 20,315.47 ac. (HUC 100301011310)
    - Nearby surface water: Prickly Pear Creek
        - Beneficial Use Summary: *Not Fully Supporting* Drinking Water and Aquatic Life. *Not Assessed* for Agricultural and Primary Contact Recreation

- **Montana City Site**
    - Sub-Watershed: Middle Prickly Pear Creek, 20,070.38 ac. (HUC 100301011308)
    - Nearby surface water: Prickly Pear Creek
        - Beneficial Use Summary: *Not Fully Supporting* Drinking Water and Aquatic Life. *Not Assessed* for Agricultural and Primary Contact Recreation

- **Clancy Site**
    - Watershed: Upper Prickly Pear Creek, 16,446.38 ac. (HUC 100301011306)
    - Nearby surface water: Clancy Creek discharging to Prickly Pear Creek
        - Beneficial Use Summary: *Not Fully Supporting* Drinking Water and Aquatic Life. *Not Assessed* for Agricultural and Primary Contact Recreation

- **Jefferson City Site**
    - Watershed: Spring Creek, 13,439.12 ac. (HUC 100301011302)
    - Nearby surface water: Spring Creek discharging to Prickly Pear Creek
        - Beneficial Use Summary: *Not Fully Supporting* Drinking Water and Aquatic Life. *Not Assessed* for Agricultural and Primary Contact Recreation

- **Boulder Site**
    - Watershed: Boulder River - Boulder, 28,565.01 ac. (HUC 100200060503)
    - Nearby surface water: Little Boulder River
        - Beneficial Use Summary: *Not Fully Supporting* Aquatic Life. *Fully Supporting* Agricultural and Drinking Water. *Not Assessed* for Primary Contact Recreation.

- **Basin Site**
    - Watershed: Boulder River - High Ore Creek, 17,871.61 ac. (HUC 100200060303)
    - Nearby surface water: Cataract Creek discharging to Boulder River
        - Beneficial Use Summary: *Not Fully Supporting* Drinking Water and Aquatic Life. *Fully Supporting* Primary Contact Recreation*. Not Assessed* for Agricultural.

- **Whitehall Site**
    - Watershed: Lower Whitetail Creek, 16,594.60 ac. (HUC 100200050403
    - Nearby surface water: Whitetail Deer Creek
        - Beneficial Use Summary: *Not Fully Supporting* Primary Contact Recreation and Aquatic Life. *Fully Supporting* Drinking Water and Agricultural.

The selected alternatives are not near any surface water sources.

Groundwater

Groundwater throughout Jefferson County is typically located in unconfined alluvial and Tertiary sediments. The Tri-County landfill owns 8 groundwater wells used for monitoring. The remaining six sites do not have any groundwater wells on property nor are any of concern located within close proximity to property boundaries. The Montana DEQ Leaking Underground Storage Tank database does not indicate impacts to groundwater at any of the locations. If the use of any property changes or expansion is proposed, potential effects to groundwater should be reviewed by a qualified professional prior to construction or implementation. The selected alternatives are unlikely to have any impact on groundwater.

2.3.11 Socio-Economic/Environmental Justice Issues

The project area serves the communities of Montana City, Clancy, Jefferson City, Boulder, Basin and Whitehall, but the solid waste system also serves the rural population outside of those towns. Solid waste service provides for general health and safety for residents within the County. With exception of the Jefferson City site that borders residential property, all sites are located in rural, remote locations away from residential land use. Any future land use changes or property expansions would need to review the potential for a disproportionate increase in environmental or public health to minority and low-income persons as a result. All county residents benefit from a reliable solid waste system from both a safety and economic basis. The selected alternatives are located within existing solid waste sites and do not disproportionately affect County demographics.

2.3.12 Vegetation

Much of Jefferson County is rural, undeveloped rangeland. Surrounding all seven site locations are wooded mountains of mostly douglas fir, lodgepole, ponderosa pine, quaking aspen, spruce, and juniper spread amongst meadows, swamps and sagebrush flats. The Tri-county and Whitehall sites are surrounded by grass rangeland slopes. The Montana City, Clancy, Jefferson City, Boulder and Basin sites are surrounded by vegetated hillsides of dry grasses, shrubs, juniper and sagebrush.

Several species of concern are listed in the Montana Natural Heritage Program (MNHP) database in the vicinity of the seven existing sites (Appendix F). Any action proposed for those locations outside of previously-disturbed ground will require consultation with the MNHP prior to construction. The selected alternative in Montana City will require new ground disturbance although land use of the property will not change significantly.

2.4 Population Trends

The Jefferson County Solid Waste service area includes all of Jefferson County (Figure 2-1). The primary urban population centers in Jefferson County are the City of Boulder and the Town of Whitehall. Unincorporated communities higher population densities include Jefferson City, Clancy and Montana City. For the purpose of waste stream projections, it is anticipated that the current service area configuration will remain the same throughout the planning period.

According to American Community Survey data collected and compiled by Headwaters Economics the population of Jefferson County in 2016 was estimated to be 11,853. Based upon this estimate, the population of the County in 20-years (2018-2038) is projected to be approximately 16,096 people. This projection was developed by using a growth rate of 1.358 percent multiplied times the 2016 population of the County. Based upon the County's previous growth going from 10,052 people in 2000 to 11,853 people in 2016, this is a reasonable growth rate to assume. This may be particularly true if the state regulations governing the use of exempt drinking water wells for residential development are relaxed in the next few years. Such a change could encourage substantial rural development within the County. Table 2-3 summarizes projections for population growth in Jefferson County and the solid waste system service area. Population data on Jefferson County is included within Appendix G.

Table 2-3 - Population Projections 2016-2038

Year	County Population
2016	11,853 [1]
2038	16,096

Economic Profiling System, Headwaters Economics 2017

2.5 Community Engagement

Great West Engineering and Jefferson County conducted Public Hearings at the following locations and dates:

- Boulder, MT February 4, 2019
- Whitehall, MT February 5, 2019
- Basin, MT February 6, 2019
- Jefferson City, MT February 7, 2019
- Clancy, MT February 11, 2019
- Montana City, MT February 12, 2019

During these meetings the proposed project alternatives were explained in detail, including the purpose, the proposed area of the alternatives, activities, budget, funding, and financial impacts that may result for local citizens as a result of each alternative. The public was then given the opportunity to ask questions and express opinions regarding the project alternatives. Copies of the presentations, sign-in sheets, and notes from the meetings are included in Appendix H. Four meetings were held with the County Commission on May 29, 2018, November 13, 2018, December 11, 2018, and February 26, 2019. These meetings which are open to the public were posted on the County Commission's agenda. Copies of these presentations are also included in Appendix H.

3.0 EXISTING FACILITIES

3.1 Location

The County's solid waste infrastructure consists of six solid waste collection sites. The solid waste collection sites are located near the communities of Montana City, Clancy, Jefferson City, Boulder, Whitehall and Basin. Figures 3-1, 3-2, 3-3, 3-4, 3-5, and 3-6 detail the location and schematic layout of these facilities.

3.2 System History

Up until the early 1990's Jefferson County historically disposed of its solid waste at small landfills located near Boulder and Whitehall. In 1991 the United States Environmental Protection Agency (EPA) promulgated the RCRA Subtitle D rules which dramatically increased the technical requirements for municipal solid waste landfills. These rules required implementation of liners and monitoring by 1993 which made most small landfills in Montana financially infeasible. As a result, the number of landfills in Montana went from over 300 in the 1980's to less than 35 by the mid-1990's.

As a result of the Subtitle D rules, the small landfills in the County were closed. As part of the landfill closure work, the County constructed roll-off container sites in the early 1990's near each of the communities which previously had landfills.

3.3 Condition of Solid Waste System

3.3.1 Overall Description of System

The County maintains solid waste collection sites at Montana City, Clancy, Jefferson City, Boulder, Whitehall and Basin. The collection sites utilize roll-off containers to collect waste at each site. The public and commercial users tip their waste from the top of a concrete retaining wall into the open top roll-off containers. There is also private curbside collection available to residents throughout the County. The Town of Whitehall has its own curbside collection.

Municipal solid waste collected at the roll-off container sites is hauled by the County to the Tri-County Disposal Landfill located near East Helena. Private haulers also haul the waste they collect at the curb side to the TCD Landfill. The Town of Whitehall hauls the waste it collects curbside to the Whitehall container site.

A copy of the existing contract with Tri-County is enclosed in Appendix I. The County also collects, processes and sells recyclables including cardboard, aluminum, paper, batteries, and metal.

Information for this analysis was gathered from available existing records and provided by County personnel with knowledge of the area. This analysis was prepared by utilizing the best information available to the Engineer.

3.3.2 Montana City Container Site

The construction date of the Montana City container site is unknown but is suspected to be constructed in the 1980's. Figure 3-1 shows the layout of the existing facility. Facility pictures are included in Appendix J. The container site is open seven days a week from 9:30 a.m. to 5:30 p.m. A gate and perimeter fencing are used to control access to the facility during closed hours.

The Montana City Container site is accessed from McClellan Creek Road. The site has four container walls varying in length and situated in a horseshoe shape. The walls are 10-inches thick and 9-feet tall which are secured with tie backs located 7-feet above ground level and spaced at various intervals along the length of the walls. The date of construction is unknown but it appears that the facility has been expanded several times. A concrete retaining wall provides the grade separation needed to allow the public to dump directly into the top of the containers. The top of the container walls do not have a 42-barrier for protection of customers as mandated under current Building Codes. However, this site was constructed prior to implementation of this Building Code requirement and is therefore grandfathered in.

The container walls have drop gates to prevent waste from being dropped between the container and the wall. The Montana City site can facilitate eight roll-off containers. The containers are used as follows: three containers accept municipal solid waste, one bin for metals, one bin for grass, one bin for tires (which are transferred to Boulder), and two bins for brush.

The site has an attendant present during all hours of operation to direct customers to the proper containers and monitor activities on-site. The County does not charge for municipal or green wastes from Count customers that have a disposal permit from the County. The County charges $20/cubic yard for construction and demolition debris. The attendant estimates the volume of construction and demolition waste being brought in by each customer and charges them the

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0 40 80
SCALE IN FEET

NORTH

Figure 3-1
Montana City Container Site

JEFFERSON COUNTY SOLID WASTE SYSTEM
PRELIMINARY ENGINEERING REPORT

associated fee. The attendant also checks loads to make sure acceptable materials are being brought in. The attendant has a guard shack for keeping records. The container site does not allow commercial loads of construction and demolition debris. These customers are directed to haul their material directly to the landfill.

The Montana City site also accepts clean green wastes. Over the last three plus years, all of the green wastes generated at this site have been hauled to the Tri-County Disposal Landfill and landfilled. In the past the County staff backhauled wood waste to the Boulder site for burning when empty trucks were available for backhauling.

The County collects recyclables at the container site. Recyclables collected include paper, aluminum, metal, cardboard, used batteries, glass and used oil at the site. There is inadequate room for the installation of scales at this site.

3.3.3 Boulder Container Site/Class III Landfill

The Boulder site is a three bay, z-wall construction with 9-foot tall, 10-inch thick retaining walls on footings which was constructed in 1994. The facility is in relatively good condition. Figure 3-2 shows the layout of the existing facility. Facility pictures are included in Appendix J. The container site is located adjacent to the old Boulder landfill. The majority of the Boulder Landfill is closed but the County still has a Class III landfill license for the disposal of inert materials like concrete and tires. The container site is open Monday, Thursday and Saturday from 9:30 a.m. to 5:30 p.m. A gate and perimeter fencing are used to control access to the facility during closed hours.

The containers sit on 10-foot by 50-foot, 8-inch concrete slabs below the retaining walls. The concrete retaining wall provides the grade separation needed to allow the public to dump directly into the top of the containers. The top of the retaining walls are equipped with drop gates to prevent waste dropping between the wall and containers. Each container bay has 5-foot by 14-foot long swing gates to control access to the container bay when not being used for waste disposal. This occurs when the container is full or when no container is parked in the bay. These gates would meet current Building Code requirements if left closed during tipping activities by customers. However, the County keeps the gates open which makes it much easier for customers to throw waste into the containers. This site was constructed prior to implementation of the Building Code requirement for barriers and is therefore grandfathered in.

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Figure 3-2
Clancy Container Site

JEFFERSON COUNTY SOLID WASTE SYSTEM
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F:\1-15272-Jefferson County On-Call 2015\TO 12 - Solid Waste PER\CADD 1-15272-TO12\Exhibits\PER\1-15272-TO12-PER-Fig 3_2.dwg

The container bays are enclosed by an open framed structure spanned with litter control fencing, which stands 20-feet above the retaining wall and encompasses the containers, but has gates for the containers to be removed and switched when the container is full. The structure is designed to control windblown litter from the site. Boulder has asphalt pavement on all working areas and on the access road. The Boulder site has plenty of room for the installation of truck scales, if desired in the future.

Only municipal solid waste is accepted in the containers. Boulder has separate drop areas for metals, clean wood waste, compost, paper, aluminum, batteries used oil, and cardboard. The County also operates a Class III landfill and burn pit at the facility under a license with the Montana DEQ. The Class III landfill accepts only inert materials as defined by the Montana DEQ which include concrete, brick, dirt, and tires. The County is required to cover the active portion of the landfill with soil every 90 days.

Clean wood waste is accepted by the County at the site for no charge. The County stockpiles and periodically burns clean wood waste. The County goes through the proper protocol to obtain a burn permit from the DEQ. This includes public notice of the burn and inspection of the burn pile by the County sanitarian prior to burning to insure materials are acceptable for burning. The County typically conducts burns 1 to 2 times per year. Once the ash has cooled it is hauled off to a municipal solid waste landfill for proper disposal.

The most recent DEQ inspection report of the facility (January 2017) is included in Appendix K and shows the County was operating the facility in full compliance at that time.

The site has an attendant present during all hours of operation to direct customers to the proper containers and monitor activities on-site. The County charges $20/cubic yard for construction and demolition debris. The attendant estimates the volume of construction and demolition waste being brought in by each customer and charges them the associated fee. The container site does not allow commercial loads of construction and demolition debris. These customers are directed to haul their material directly to the landfill. Site attendants also charge $15/cubic yard for inert waste for disposal in the Class III landfill based on their estimate of waste volume.

The attendant also checks loads to make sure acceptable materials are being brought in. The attendant has a guard shack for keeping records. The container site does not allow commercial loads of construction and demolition debris. These customers are directed to haul their material directly to the landfill.

3.3.4 Whitehall Container Site

The Whitehall site is a three bay, z-wall construction with 9-foot tall, 10-inch thick retaining walls on footings which was constructed in 1994. The site is in relatively good condition. Figure 3-3 shows the layout of the existing facility. Facility pictures are included in Appendix J. The container site is located adjacent to the old Whitehall landfill. The majority of the Whitehall Landfill is closed but the County still has a Class III landfill license for the disposal of inert materials like concrete, bricks and tires. The container site is open Tuesday, Wednesday, Friday, and Saturday from 9:30 a.m. to 5:30 p.m. A gate and perimeter fencing are used to control access to the facility during closed hours.

The containers sit on 10-foot by 50-foot, 8-inch concrete slabs below the retaining walls. The concrete retaining wall provides the grade separation needed to allow the public to dump directly into the top of the containers. The top of the retaining walls are equipped with drop gates to prevent waste dropping between the wall and containers. Each container bay has 5-foot by 14-foot long swing gates to control access to the container bay when not being used for waste disposal. This occurs when the container is full or when no container is parked in the bay. These gates would meet current Building Code requirements if left closed during tipping activities by customers. However, the County keeps the gates open which makes it much easier for customers to throw waste into the containers. This site was constructed prior to implementation of the Building Code requirement for barriers and is therefore grandfathered in.

The container bays are enclosed by an open framed structure spanned with litter control fencing, which stands 20-feet above the retaining wall and encompasses the containers, but has gates for the containers to be removed and switched when the container is full. The structure is designed to control windblown litter from the site. Whitehall has two 20-HP stationary solid waste compactors which occupy two of the three container bays. The bays with compactors are equipped with fabricated steel hoppers rather than drop gates. The Whitehall site has plenty of room for truck scales, if desired in the future.

Only municipal solid waste is accepted in the containers. Whitehall has separate drop areas for metals, clean wood waste, compost, aluminum, batteries, used oil, and cardboard. The County also operates a Class III landfill and burn pit at the facility under a license with the Montana DEQ. The Class III landfill accepts only inert materials as defined by the Montana DEQ which include

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Figure 3-3
Jefferson City Container Site

JEFFERSON COUNTY SOLID WASTE SYSTEM
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F:\1-15272-Jefferson County On-Call 2015\TO 12 - Solid Waste PER\CADD 1-15272-TO12\Exhibits\PER\1-15272-PER-Fig 3_3.dwg concrete, brick, dirt, and tires. The County is required to cover the active portion of the landfill with soil every 90 days.

Clean wood waste is accepted by the County at the site for no charge. The County stockpiles and periodically burns clean wood waste. The County goes through the proper protocol to obtain a burn permit from the DEQ. This includes public notice of the burn and inspection of the burn pile by the County sanitarian prior to burning to insure materials are acceptable for burning. The County typically conducts burns 1 to 2 times per year. Once the ash has cooled it is hauled off to a municipal solid waste landfill for proper disposal.

The most recent DEQ inspection report of the facility (January 2017) is included in Appendix K and shows the County was operating the facility in full compliance at that time.

The site has an attendant present during all hours of operation to direct customers to the proper containers and monitor activities on-site. The County charges $20/cubic yard for construction and demolition debris. The attendant estimates the volume of construction and demolition waste being brought in by each customer and charges them the associated fee. The container site does not allow commercial loads of construction and demolition debris. These customers are directed to haul their material directly to the landfill. Site attendants also charge $15/cubic yard for inert waste to be disposed of in the Class III landfillbased on their estimate of waste volume.

3.3.5 Clancy Container Site

The Clancy Container site is accessed from Shady Lane. Figure 3-4 shows the layout of the existing facility. The site is in relatively good condition. Facility pictures are included in Appendix J. The container site is located adjacent to an old closed landfill area. The container site is open Wednesday, Saturday, and Sunday from 9:30 a.m. to 5:30 p.m. A gate and perimeter fencing are used to control access to the facility during closed hours. However, there is a short section of fencing is missing to the west of the entrance gate.

The site has four container walls varying in length and situated in a horseshoe shape that accommodate six containers. The walls are 10-inches thick and 9-feet tall which are secured with tie backs located 7-feet above ground level and spaced at various intervals along the length of the walls. The concrete retaining wall provides the grade separation needed to allow the public to dump directly into the top of the containers. The top of the container walls do not have a 42-barrier for protection of customers as mandated under current Building Codes. However, this site was constructed prior to implementation of this Building Code requirement and is therefore grandfathered in.

The date of construction is unknown but the design appears nearly identical to that at Montana City and Jefferson City. The container walls have drop gates to prevent waste from being dropped between the container and the wall. The Clancy site has three containers that accept municipal solid waste, one bin for brush, one bin for metal and one bin for tires. The site also accepts used oil, cardboard and batteries. There is not room for scales at this site. Trailers are not allowed to dump at this site.

The site has an attendant present during all hours of operation to direct customers to the proper containers and monitor activities on-site. The County does not charge for municipal or green wastes from County customers that have a disposal permit from the County. The County charges $20/cubic yard for construction and demolition debris. The attendant estimates the volume of construction and demolition waste being brought in by each customer and charges them the associated fee. The attendant also checks loads to make sure acceptable materials are being brought in. The attendant has a guard shack for keeping records. The container site does not allow commercial loads of construction and demolition debris. These customers are directed to haul their material directly to the landfill.

3.3.6 Jefferson City Container Site

The Jefferson City Container site is located immediately adjacent to a county road which poses potential traffic issues when vehicles return to the country road from the container site. Figure 3-5 shows the layout of the existing facility. Facility pictures are included in Appendix J. The container site is open Tuesday and Saturday 9:30 a.m. to 5:30 p.m. Gate and perimeter fencing are used to control access to the facility during closed hours.

The container wall design is a straight wall with tie backs located 7-feet above ground level and spaced at various intervals along the length of the wall with wing walls at each end. The date of construction is unknown. The walls are 10-inches thick and 9-feet tall. The wall is 64-feet long with 9-foot long wing walls on either side of the straight wall. A concrete retaining wall provides the grade separation needed to allow the public to dump directly into the top of the containers. The top of the container walls do not have a 42-barrier for protection of customers as mandated under current Building Codes. However, this site was constructed prior to implementation of this Building Code requirement and is therefore grandfathered in.

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Figure 3-4
Boulder Container Site

JEFFERSON COUNTY SOLID WASTE SYSTEM
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The Jefferson City site has two containers that accept municipal solid waste and one twenty cubic yard metal container. Brush is not accepted at this site. This container wall has drop gates to prevent waste from being dropped between the container and the wall. There is not room on the site for scales.

The site has an attendant present during all hours of operation to direct customers to the proper containers and monitor activities on-site. The County does not charge for municipal or green wastes from Count customers that have a disposal permit from the County. The County charges $20/cubic yard for construction and demolition debris. The attendant estimates the volume of construction and demolition waste being brought in by each customer and charges them the associated fee. The attendant also checks loads to make sure acceptable materials are being brought in. The attendant has a guard shack for keeping records. The container site does not allow commercial loads of construction and demolition debris. These customers are directed to haul their material directly to the landfill.

Recycling at the site includes used batteries, metal and used oil.

3.3.7 Basin Container Site

The Basin site has access from Cataract Creek Road and is secured with a chain link fence. Figure 3-6 shows the layout of the existing facility. Facility pictures are included in Appendix J. The Basin site accepts metal and municipal solid waste in two separate open top containers. There is a makeshift container wall for the municipal solid waste container. The top of the container wall does not have a 42-barrier for protection of customers as mandated under current Building Codes. However, this site was constructed prior to implementation of this Building Code requirement and is therefore grandfathered in.

The smaller metal container is just parked on level ground and customers need to throw the metal up into the container. The Basin site is unmanned and is open on Tuesday and Saturday from 8 a.m. to 4 p.m during the months of April through September. During October through March the site is open on Saturday from 8 a.m. to 4 p.m.

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Figure 3-5
Whitehall Container Site

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F:\1-15272-Jefferson County On-Call 2015\TO 12 - Solid Waste PER\CADD 1-15272-TO12\Exhibits\PER\1-15272-TO12-PER-Fig 3_5.dwg

3.3.9 Container Site Facilities Condition and Capacity

The container sites are in relatively good condition considering their age and the heavy service conditions of waste handling.

The most significant deficiency is the lack of a barrier at the top of the container wall. The International Building Code requires that when the public has access to a drop off greater than 30 inches high, the drop off needs to be protect by a guard barrier at least 42 inches high. The top of the container walls are approximately 8 feet above ground level the container sits on.

The building code requirements are not retroactive to already constructed facilities, however the drop offs still represents a significant public health and safety threat to residents that use these facilities. In fact, residents have fallen into containers in Jefferson County in the past. The County has not had an issue with customers falling into containers in recent history, however. Site attendants monitor and educate customers on safe practices. Installation of code-compliant barriers create their own problems because of the difficulties customers face when trying to lift heavy and bulky wastes over the barriers. Barrier alternatives are evaluated in Chapter Five.

Each of the container sites has adequate capacity to handle the volume of waste being generated from each area throughout the entire 20-year planning period with the exception of the Montana City site which is undersized for the volume of traffic and waste currently accepted.

3.3.10 Tri-County Disposal Contract

The County is contracted with Tri-County Disposal to accept waste for disposal at Tri-County's landfill located on Montana Highway 518 between East Helena and Montana City. The most recent contract was signed in September 2013 for a term of five years with the option for two – one year extensions for a total of seven years. The County recently signed the first of the one year extensions which carries the contract until September 2019. The County has to pay the "tipping fee" at the landfill. Tri-County weighs all of the loads so that an accurate measurement of tonnage is made. The current tipping fees are $29.00/ton for municipal solid waste; $23.00/ton for construction and demolition waste; and $23.00/ton for brush and yard waste. Special wastes like asbestos and tires have specific rates. See Appendix I for a copy of the contract with Tri-County. In fiscal year 2016-17 the County paid Tri-County $184,000 for these services.

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Figure 3-6
Basin Container Site

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3.3.11 Giulio Contract

The County has a contract with Giulio Disposal to direct haul waste collected at the curb in Boulder directly to the Tri-County Disposal Landfill rather than hauling it to the Boulder container site. The County pays Giulio per trip to haul the waste directly to the landfill. See Appendix L for a copy of the contract with Gioulio. In fiscal year 2016-17 the County paid Giulio $20,286 for these services.

3.3.12 Operation and Maintenance

The County has operated and maintained its current solid waste system successfully for over twenty years. The County has seven full time employees including the following:

- Two full time truck drivers which haul waste from the container sites to the landfill. When not driving, the truck drivers assist with container site operations tasks
- Four roll-off site attendants
- Solid Waste Supervisor

The County also has several fill site attendants and drivers to fill in during illness, vacation or other absences. The County also provides the solid waste system with part time administrative assistance including the Commission Secretary, Clerk and Recorder, and other County administrative staff. Appendix G contains a typical schedule for employees along with position descriptions. All of the solid waste system alternatives considered in the analysis have estimated operation and maintenance costs. Continued long term operation and maintenance of the County's solid waste system will be a necessity and the user charges need to provide adequate funding to keep the system well maintained and in compliance with Federal and State rules governing public solid waste systems.

The container site attendant's responsibilities include the following:

- Estimating the volume of construction, demolition and inert wastes, collecting payment and writing a receipt for recordkeeping,
- Directing users to the proper disposal area,
- Monitoring material types in loads,

- Coordinating with the Solid Waste Supervisor for container pick-up when the containers are full,
- Insuring special wastes such as scrap metal are properly segregated,
- Separating cardboard,
- Picking up wind-blown litter,
- Overall maintenance of containers and other on-site equipment,
- Filing proper paper work for burning permit and conducting burns,
- Assisting public users and educating them on safe use of the facilities,
- Checking users to ensure that have a County disposal permit and are authorized to use the facilities,
- Insuring that site access is secured during closed hours, and
- Other duties as necessary to properly operate the container sites

Truck driver's responsibilities are as follows:

- Hauling containers from sites to Tri-County Disposal landfill.
- Monitoring truck and trailer condition and scheduling maintenance when required
- Assisting site attendants with their duties, as needed.

The Solid Waste Supervisor's duties include the following:

- Managing employees and overall solid waste operation in accordance with Jefferson County, State and Federal requirements,
- Coordination with County support and administrative staff,
- Reporting to County Commission,

- Annual budgeting,
- Recordkeeping,
- Coordination and communication with vendors, suppliers and contractors,
- Communication with customers,
- Fill-in driver and container site attendant as needed

The County's system is well operated and maintained.

3.4 Financial Status

The County has operated the current solid waste system successfully for over twenty five years. The Jefferson County Commission has the legal responsibility for this Solid Waste Preliminary Engineering Report. The Jefferson County Commission is elected by and directly accountable to the electors within the County limits. The solid waste management system is owned and operated by the County. Capital, operation and maintenance (O&M) costs are paid for by property owners within the County.

Capital, operation and maintenance costs will continue to be paid for by users within the County. Fees for the solid waste system will be assessed to cover the debt service and O&M costs. The County provides administrative assistance to manage the day-to-day business of the County and operators to perform the operation and maintenance of the system.

The County obtains the majority of its solid waste revenues from tax assessments which are based on the approximate number of equivalent household units of solid waste each account generates. The County also generates revenue from special waste fees and recycling income. These revenues are used to operate and maintain the collection sites, service debt, conduct recycling activities and pay for the waste hauling and disposal fees. The County financial status is sound because of quality financial planning and execution. Copies of County revenue and expense statements are included in Appendix M.

Capital, operation and maintenance costs will continue to be paid for by users within the County. Fees for the solid waste system will be assessed to cover the debt service and O&M costs. The County currently has 6,220 solid waste units which are assessed at $129.69 annually per unit.

The $129.69 entitles the user to utilize the County's solid waste facilities. Construction and demolition wastes are charged an additional $20/cubic yard for disposal and inert waste brought to the Whitehall and Boulder Class III landfills is charged at $15/cubic yard. The site attendants are required to estimate the volume of each construction, demolition and inert load and the customer is billed accordingly. Residents who have curbside collection service pay for this service directly to the private provider. Detailed information on the County's unit system and special waste fees are included in Appendix N.

The County also receives monies from recycling revenues. The total estimated current annual revenue of the County solid waste system is $889,000. The current revenue is adequate for the County's current annual needs. Table 3-1 summarizes the County's solid waste revenue history for the last three fiscal years. These revenues are used to operate and maintain the collection sites, pay for the waste hauling costs and disposal fees.

Table 3-1 - Annual Revenue History (rounded to the nearest $1,000)

Item	2014/2015	2015/2016	2016/2017
Real Property Assessments	728,000	728,000	740,000
Personal Assessments	65,000	55,500	61,000
Penalties and Interest	6,500	8,000	6,500
Solid Waste Permits/Collection	1,500	1,500	1,500
Tire Disposal	2,500	3,000	4,000
Refrigerators	2,000	2,500	2,000
Construction Waste Fees	16,000	16,500	15,000
Cardboard		2,000	1,500
Paper		500	500
Aluminum		1,500	1,500
Junk & Metal Salvage	28,000	14,500	21,000
Miscellaneous Revenue	10,000	9,000	11,000
Investment Earnings	1,500	2,000	5,000
Total	861,000	845,000	870,500

Table 3-2 summarizes the County's expense history for the last three fiscal years. The County has no current debt service on the solid waste system.

Table 3-2 - Solid Waste District Expense History

Item	FY 2013-14	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18 (1)
Salaries & Benefits	444119	463109	485368	427006	310445
Equipment Repairs, Maintenance & Parts	39826	37838	40669	32910	23520
Supplies & Equipment	24991	2518	9869	8205	2538
Tipping Fees	160560	181574	188362	184032	143349
Landfill Services (Giulio Hauling)	19561	22954	24937	20286	20151
Fuel & Diesel Fuel	47583	38671	25355	23345	19261
Office & Utility Costs	7715	6689	5871	5577	4327
Wood Processing	15600	240	0	0	0
Recycling	0	0	150	3940	3484
GASB 45	30947	0	0	0	0
Professional Services	21986	9344	7880	7020	4262
Liability Insurance	16028	16176	16548	18359	21286
Licensing	1239	1240	1200	1241	2127
Other Miscellaneous Expenses	10229	8896	11570	7759	8281
Total	840384	789249	817779	739680	563031

(1) Expenses through Feb 2018

Regulatory Requirements

Municipal solid waste is regulated on both the State and Federal levels. The Federal Resource Conservation & Recovery Act (RCRA) adopted in 1976 governs solid waste disposal nationwide. These rules were updated in 1991 through an act called Subtitle D. The State of Montana has its own Administrative Rules of Montana (ARMs) which govern waste disposal and handling in Montana. Montana's rules and program are compliant with the Federal Subtitle D regulations. The Federal and State rules which govern solid waste disposal are enforced at Tri-County Disposal's landfill near East Helena where the County's waste ultimately ends up. The Tri-County landfill is a fully compliant waste disposal facility.

The State of Montana does not regulate container sites which accept less than 3,000 tons of waste per year and utilize containers less than 50 cubic yards in size. All of the County's container sites accept less than the regulatory tonnage limit and utilize containers less than 50 cubic yards. However, the County is required to have Montana Class III landfill licenses for the Whitehall and Boulder sites because these sites operate burn pits for untreated wood waste. The County also operates a Class III landfills at Whitehall and Boulder. Since these sites are licensed, they are periodically inspected by Montana DEQ personnel. Recent inspections have shown the facilities are in compliance. Copies of recent inspections are included in Appendix K.

State and Federal regulations govern the safe and legal transport of waste. The County is required to meet the requirements of the Montana Department of Labor and Industry with regards to safety and how it treats its employees.

The Montana Association of Counties (MACO) and their insurer are concerned about the public's safety at container sites. MACO has requested that the Counties make upgrades to improve safety. MACO has significant influence on the Counties because of their role as an insurer.

3.4.1 Waste Quantities and Types

The County receives detailed landfilled waste tonnage data from Tri-County who weighs every load hauled to the landfill. Table 3-3 details annual tonnages of waste hauled to the landfill as well as diverted waste tonnage over the last three fiscal years and compares it to current population estimates. The table also calculates an average per capita waste generation rate for the County. The average waste generation of 3.6 lb/person/day is significantly less than both the State and national averages. However, it very similar to generation rates for other rural Montana counties.

Table 3-3 - Waste Volume & Population History

Fiscal Year	Annual Landfill Tonnage	Burned Wood Waste	Class III & Tires	Recycled Wastes	Total Waste Tonnage	Population	Waste Generation (lb/person/day)
2014-2015	6,124	500	500 (1)	300	7,424	11,788	3.1
2015-2016	6,415	555	500 (1)	315	7,785	11,853	3.6
2016-2017	6,478	498	500 (1)	320	7,796	11,918	3.6

(1) Estimated total annual Class III tonnage for Whitehall & Boulder sites
(2) Estimated burned wood waste tonnage for 2014-2015
(3) Estimated recycled waste tonnage for 2014-2015

The County also keeps detailed records of diverted wastes. Table 3-4 summarizes the tonnage of waste diverted by the County over the last three fiscal years.

Table 3-4 - Detailed List of Diverted Waste

Fiscal Year	Aluminum Tons	Mixed Paper Tons	Cardboard Tons	Metal Tons	Total Tons
2014-2015					
2015-2016	1.9	29.8	65.4	218	315
2016-2017	1.6	34.4	49	235	320
2017-2018	3.5	21.6	68.6	185	279

Special Wastes, Recycling & Waste Stream Diversion

The County manages special wastes at the container sites, however some wastes are not accepted. Materials are monitored by the site attendant as they come into the site. Special waste fees are detailed in Appendix N. Following is a discussion of special wastes and how the County handles them.

a) **Asbestos** – The County does not accept asbestos materials at any container site. Asbestos generators are required to haul waste directly to a licensed landfill.

b) **Green wastes** – Green wastes include tree limbs and grass clippings. Green waste is accepted at the Montana City, Clancy, Boulder, and Whitehall sites at no charge. The County operates a burn pit at the Boulder and Whitehall sites for clean untreated wood waste. The County also operates low-tech compost piles at the Boulder and Whitehall sites for yard waste. Wood waste from the Montana City and Clancy sites is hauled to the Tri- County Landfill for disposal.

c) **C&D** – This category is construction and demolition debris (C&D). Small loads of C&D from the general public are accepted at the container sites. Commercial C&D loads from contractors are not accepted at the container sites, because the containers do not have the capacity to accept the volume from significant demolition projects. Contractors are required to haul the waste directly to the landfill. Attendants charge customers $20/cubic yard for this type of waste.

d) **Tires** – Tires are accepted at the Boulder and Whitehall sites for a special waste fee. Attendants charge customers $15/cubic yard for this type of waste. Tires are landfilled in the Class III landfill pits as inert waste.

e) **Metal** – The County collects scrap metal in separate roll-offs at all the container sites. Metal is stockpiled at the Boulder and Whitehall sites until an adequate quantity is present to have a private recycler crush the metal. The metal is then hauled to a recycler and sold. Metal consists primarily of white goods and other scrap metal wastes. County staff are licensed to perform freon removal and the public is charged for this service. The County maintains records for freon removal in compliance with Federal law.

f) **MSW** – This category is municipal solid waste that is the bulk of the waste accepted at the container sites.

g) **Liquid & Hazardous Wastes** – Bulk liquid wastes and hazardous wastes are specifically disallowed by the County. Municipal solid waste landfills are specifically not allowed to take these wastes by federal regulation and the County does not have the ability to handle them. Household quantities of these wastes are acceptable. The site attendant screens the waste stream at the container site to help insure that bulk liquid and hazardous wastes are not dumped at the container sites.

h) **Recyclables** – The County collects recyclables at all the container sites. Some sites only collect a few of these materials. Recyclables accepted include paper, metal, aluminum, cardboard, used oil and batteries. The descriptions for each container site earlier in the Chapter outline which materials are accepted at each site. Quantities of these recyclables are shown in Table 3-4.

i) **Cardboard** – The County segregates cardboard at all the site except Basin and Jefferson City. The County then hauls and sells the cardboard.

j) **Used Oil** – The County collects used oil at each of the six container sites. The County pays for a used oil recycler to pick-up used oil it collects.

k) **Batteries** – Used batteries are collected at each of the six container sites. Used batteries are sold by the County which results in additional revenue for the County

l) **Glass** – Glass is currently collected at only the Montana City site. There are few markets in Montana for recycling glass. Therefore, collected glass is hauled to the Tri-County Disposal Landfill and disposed of in their construction and demolition pit. The County is currently exploring whether Ashgrove will accept glass the County collects.

Table 3-4 summarizes wastes recycled or otherwise diverted from the County's waste stream in fiscal years 2015/16, 2016/17, and 2017/18.

3.4.2 Recycling Alternatives

A detailed discussion of recycling alternatives, their economic feasibility and the potential for tonnage diverted from the waste stream is beyond the scope of this report. However as shown on Table 3-4, the County is currently diverting about 10.5% of its waste stream if burned wood waste is included in the diversion total. This is a reasonable effort for a small rural County in Montana, especially given the collapse of the recycling commodity market due to actions taken by China in recent years. Given the small volume of waste generated by the County and the long distance to recycling markets, full scale recycling is clearly not economically feasible for the County. The County's expenses for recycling activities significantly exceed revenues already. The County's current effort is a reasonable and appropriate level of recycling.

3.4.3 Waste Projections

As discussed within Chapter 2, it is anticipated that the population of the service area will increase throughout the 20-year planning period. A large portion of this growth is expected to take place in the northern portion of the County impacting existing facilities at Montana City, Clancy and Jefferson City. For the purposes of the waste stream projections, it is assumed that the per capita waste generation will remain the same as that generated in fiscal year 2017 and that the County will continue landfilling the majority of the wastes received. Table 3-5 estimates the total tonnage throughout the twenty-year planning period.

Table 3-5 - Waste Volume & Service Area Population Projections

Year	Total Waste Tonnage	Population	Waste Generation (lbs/person/day)
2018	7,796	11,983	3.6
2038	10,575	16,096	3.6

Detailed Tonnage Data

The County has maintained detailed hauling logs for each of the container sites by type of material including household and wood. Logs also record each waste container site trip to the Tri-County Disposal Landfill. Table 3-6 details waste tonnage hauled by the County from each container site as well as the total number of containers and the average tonnage per container. On a percentage basis the waste tonnage hauled by the County from each site is as follows:

- Montana City – 38%
- Whitehall – 34%
- Boulder – 12%
- Clancy – 8%
- Jefferson City – 6%
- Basin – 2%

Table 3-6 - Annual Container Site Tonnage

	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18
MONTANA CITY	1737.17	1820.83	1840.5	1188.67
BOXES	414	545	570	374
TONS/BOX	4.2	3.3	3.2	3.2
CLANCY	400.35	396.33	412.98	266.54
BOXES	112	148	146	95
TONS/BOX	3.6	2.7	2.8	2.8
JEFF CITY	276.72	295.87	281.5	173.8
BOXES	83	106	104	66
TONS/BOX	3.3	2.8	2.7	2.6
BASIN	79.45	99.09	109.22	63.47
BOXES	30	42	47	27
TONS/BOX	2.6	2.4	2.3	2.4
BOULDER	543.64	582.66	605.3	376.71
BOXES	91	180	180	119
TONS/BOX	6.0	3.2	3.4	3.2
WHITEHALL	1617.49	1792.97	1676.26	1047.81
BOXES	165	223	158	140
TONS/BOX	9.8	8.0	10.6	7.5

(1) At Whitehall most of the time two containers are hauled, but in the winter a trailer is NOT used when roads are bad

Table 3-7 details the total tonnage of waste landfilled in the County including tonnage hauled by Tri-County Disposal and Giulio Disposal which is picked up curbside. Tri- County primarily operates in the northern portion of the County while Giulio primarily operates in Boulder and the southern portion of the County.

Table 3-7 - Annual Landfilled Solid Waste Tonnage

	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18 [1]
ANNUAL TOTAL	6123.89	6415.43	6478.49	4285.83
JEFF CO CONTAINER SITE TONNAGE	4713.7	4987.75	4925.76	3117
GIULIO CURB SIDE	771.26	779.03	795.74	625.31
TRI-COUNTY DISPOSAL CURB SIDE	638.93	648.65	756.99	543.59

[1] Thru Feb 2018 (2/3) 4 months left (1/3)

The County uses open-top 40 cubic yard roll-offs at the container sites. Roll-off loads are only consolidated at the Whitehall container site which uses stationary compactors. The County hauls two containers per trip in most cases from Whitehall in order to reduce transfer mileage. When road conditions are poor, the County will haul one container at a time from Whitehall. Containers are hauled as single trailers from all the other sites.

Wood Wastes

The County generates a significant amount of wood wastes. Wood is collected at the Montana City, Clancy, Boulder and Whitehall sites. Clean wood waste collected at the Boulder and Whitehall sites is stockpiled and burned 1-2 times per year. The County goes through the proper public notice and air quality permitting process with the DEQ and County Sanitarian prior to open burning. Wood wastes generated at the Montana City and Clancy sites have been hauled to the Tri-County Disposal Facility and landfilled for the last three years. The County used to backhaul wood waste from Montana City to Boulder when empty trucks were running that direction. This obviously saves the disposal cost at the landfill. Table 3-8 shows wood waste quantities the last three years.

Table 3-8 - Wood Waste Quantities

Site	2015/2016	2016/2017	2017/2018[1]
Montana City			
Tons	410 [2]	405	331
Boxes	128	126	103
Tons/Boxes	3.2	3.2	3.2
Clancy			
Tons	68	46	41
Boxes	30	19	17
Tons/Boxes	2.3	2.4	2.4
Boulder			
Tons	105 [3]	120 [3]	60 [3]
Whitehall			
Tons	450 [3]	378 [3]	450 [3]
Total Tons	1,033	946	882

Notes:

(1) Tonnage through March 2018

(2) Tonnage Based on Number of boxes @ 3.2 tons/box measured over last two years

(3) Estimated on burn pile size @ 300 lb/cy

3.4.4 Operation and Maintenance Expenses

The County keeps excellent records of its expenses of the solid waste system. Expenses are tracked in distinct categories. Detailed financial data is included in Appendix M. Annual operations and maintenance costs for the last three years are detailed in Table 3-2.

Expenses directly related to hauling and transfer of waste are critical in the evaluation of hauling alternatives. The County incurs 54,000 to 58,000 miles of waste transfer mileage per year. Expenses directly related to waste transfer activities the last three fiscal years are summarized in Table 3-9.

Table 3-9 - Waste Transportation Costs

	2014/2015	2015/2016	2016/2017	2017/2018 (2)
Insurance (1)	12,900	13,200	14,700	11,400
Fuel	38,700	25,400	23,300	19,300
Vehicle Repair & Maintenance	37,800	40,700	32,900	23,500
Salaries & Benefits	106,500 (3)	111,800 (3)	98,200 (3)	71,400 (3)
Total	195,900	191,100	169,100	125,600

(1) Assume 80% of liability insurance costs are related to transportation
(2) 2017/2018 Data is through February 2018
(3) Estimated Driver position includes 65% of time hauling

The County has two roll-off trucks dedicated to the solid waste operation for hauling from the container sites. The County has historically purchased used trucks and trailers on a cash basis rather than purchasing new equipment. The County then repairs and maintains the trucks/trailers to last as long as possible. When replacements are necessary the County uses its operational reserves to make the purchases. Equipment depreciation is an approach used to factor in the purchase cost of the truck and trailer. Table 3-10 shows the cost per mile for truck and trailer purchase based on a typical life of 400,000 miles. Based on this analysis the equipment depreciation cost is $0.59/mile.

Table 3-10 - Mileage Depreciation of Truck Purchase

Item	Amount
Truck	$180,000.00
Trailer	$80,000.00
Total	$260,000.00
Divided by 400,000 miles	
Cost per mile	$0.65
Less Salvage Value of 10%	
Cost per Mile	$0.59

Table 3-11 develops the County's cost per mile the last three fiscal years to run roll-off trucks. Table 3-11 shows an average cost of $3.83/mile over the last three years. A current industry rule of thumb is $3.50 to $4.00 per mile.

Table 3-11 - Transportation Cost Per Mile

	2014/2015	2015/2016	2016/2017	2017/2018
Transportation Costs	$195,900	$191,100	$169,100	125,600
Mileage		57,457	54,644	38,734
Truck Amortization Cost Per Mile	$0.59	$0.59	$0.59	0.59
Cost Per Mile		$3.92	$3.68	3.83

Energy Usage

Table 3-2 shows that the County's has minimum energy usage costs. The majority of the power bill is for the office, lighting at the container sites and the compactor units at Whitehall. The major energy use by the County for the solid waste system is fuel for waste hauling. As shown in Table 3-2, the County spent $23,000 on fuel the last full fiscal year of record.

Capacity of Sites

All of the existing container sites easily handle the existing traffic and volume of waste currently accepted with the notable exception of the Montana City site. The Montana City site is being overwhelmed with traffic as this portion of the County continues to grow rapidly. Tables 3-12 and 3-13 show traffic counts that were taken at the Montana City site during May of 2016 and May of 2018. This traffic volume regularly exceeds the capacity of the site which manifests itself occasionally in the back-up of traffic on McClellan Creek Road. It should be noted that the peak usage day in May 2016 was 595 users but in May of 2018 the peak day was 725 users which is an increase of over 20% in just two years. Growth is obviously having a significant impact to this site's usage. McClellan Creek Road is a significant County collector road which services several subdivisions. This is a significant public safety issue to motorists on McClellan Creek Road and those leaving the container site.

Table 3-12 - Montana City Site – May 2016 Traffic Counts

Week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
May 1st			219	308	321	313	503
May 8th	595	123	85	175	174	208	356
May 15th	314	202	251	220	169	258	235
May 22nd	469	228	188	265	203	326	383
May 29	479	0	786	258			
Average	464	184.33	245.8	245.2	216.75	276.25	369.25
Peak Day	595	228	486	308	321	326	503

Table 3-13 - Montana City Site – April/May 2018 Traffic Counts

Week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
April 15th			56	165	161	234	349
April 22nd	519	110	320	278	350	388	626
April 29th	711	249	268	302	308	401	575
May 6th	725	384	334	307	361	241	566
May 13th	558	417	303	188			
Peak Day	725	417	334	307	361	401	626
Average	628	290	256	248	295	316	529

All of the other sites adequately handle the current volume of traffic and waste that they receive and are adequate to address the County’s needs through the 20-year planning period.

4.0 NEED FOR PROJECT

4.1 Health, Sanitation and Security

Proper collection and disposal of solid waste is a critical element of public health and safety in modern society. Prior to the implementation of organized solid waste collection and disposal measures in the US in the mid-1800's, disease related to improper solid waste management practices was common.

Municipal solid waste is regulated on both the State and Federal levels. The Federal Resource Conservation & Recovery Act (RCRA) adopted in 1976 governs solid waste disposal nationwide. These rules were updated in 1991 through an act called Subtitle D. The State of Montana has its own Administrative Rules of Montana (ARMs) which govern waste disposal and handling in Montana. Montana's rules and program are compliant with the Federal Subtitle D regulations. The Federal and State rules which govern solid waste disposal are enforced at Tri-County' landfill near East Helena where the County's waste ultimately ends up. The Tri-County landfill is a fully compliant waste disposal facility.

The State of Montana does not regulate container sites which accept less than 3,000 tons of waste per year and utilize containers less than 50 cubic yards in size. All of the County's container sites accept less than the regulatory tonnage limit and utilize containers less than 50 cubic yards. However, the County is required to have Montana Class III landfill licenses for the Whitehall and Boulder sites because these sites operate burn pits for untreated wood waste and the County also operates Class III landfills at Boulder and Whitehall. Since these sites are licensed, they are periodically inspected by Montana DEQ personnel. Recent inspections have shown the facilities are in compliance. Copies of recent inspections are included in Appendix K.

State and Federal regulations govern the safe and legal transport of waste. The County is required to meet the requirements of the Montana Department of Labor and Industry with regards to safety and how it treats its employees.

The Montana Association of Counties (MACO) and their insurer are concerned about the public's safety at container sites. MACO has requested that the Counties make upgrades to improve safety. MACO has significant influence on the Counties because of their role as an insurer.

4.1.1 Construction of New Container Site at Montana City

The existing container site at Montana City is inadequate to handle current traffic volumes much less those which the facility will experience with the projected continued growth in Northern Jefferson County. This has a significant positive impact on public health and safety by eliminating traffic back-ups onto McClellan Creek Road.

4.1.2 Load Consolidation at Boulder site

The load consolidation alternative recommended in Chapter Five for Boulder will reduce the County's annual transfer mileage by 6,700 miles per year. This represents a significant savings in hauling costs per year. This is also a major reduction on the carbon footprint of the County's operation. Reduction in emissions will have a positive impact on air quality which has a positive impact on public health. Reduction in truck mileage also helps protect public safety for motorists on the highways as discussed in more detail in section 4.1.3.

4.1.3 Public Health and Safety Benefits of Reduction in Heavy Truck Traffic

The National Highway Traffic Safety Administration (NHTSA) of the US Department of Transportation keeps detailed traffic safety statistics and data. Of particular interest is data the NHTSA keeps on Large Trucks which is classified as any vehicle with a gross vehicle weight rating greater than 10,000 pounds. All of the trucks operated by the Jefferson County solid waste system meet this definition of large trucks. In 2013 there were 3,964 people killed and an estimated 95,000 people injured in crashes involving large trucks. Please see NHTSA data in Appendix A.

The data within Table 2 of Appendix A shows that the incidence of deaths and injuries related to Large Truck traffic is directly related to the number of miles traveled. Therefore, a reduction in travelled Large Truck miles will reduce the incidence of injuries and deaths on the highways. The proposed project will reduce the Large Truck mileage of the County by 6,700 miles per year.

It is important to understand that many of the health and safety standards adopted in the USA are based on risk analysis evaluated through statistical data. As an example, the Maximum Contaminant Levels (MCLs) established by the EPA under the Safe Drinking Water Act are rigid standards of compliance for public drinking water. MCLs are based on laboratory testing which determine the constituent concentration at which a person has a 1 in 1,000,000 of contracting cancer as a result of drinking that water for 70 years.

Accidents clearly happen with heavy truck traffic. In fact, below a picture of an accident which occurred with one of Sanders County's roll-off container trucks near Plains. The trailer tipped on the highway approach as shown on the picture below. There were no injuries from this accident but there easily could have been. Reducing Large Truck mileage clearly has a public health and safety benefit.

Without reducing Large Truck mileage injury or death may occur in the long term. The NHTSA data shows that accidents are directly related to the amount of Large Truck mileage. According to NHTSA in 2013, large trucks accounted for 9% of all vehicles involved in fatal crashes. The failure to reduce large truck mileage is a significant threat to motorists and is existing, continual and long term. MACo data in Appendix B documents five accidents which occurred over the last 21 years associated with trucking solid waste in Montana. Each of these accidents included large trucks and the public.

4.1.4 Container Site Improvements

The lack of barriers at the existing sites violate the current Unified Building Code which is enforced by the State of Montana. However, all of the existing container sites were constructed prior to this code requirement and are grandfathered in. Any new sites will need to have code-compliant barriers. The County has improved safety at its sites by providing attendants that monitor and educate the public on safe dumping techniques.

4.2 Aging Infrastructure

The existing container sites have experienced significant wear and tear which is typical for solid waste facilities due to the heavy service conditions.

The container sites are in relatively good condition and will continue to service the County throughout the planning period with the exception of the Montana City site which is discussed in more detail within the report.

4.3 Reasonable Growth

Chapter 3 includes population projections for the 20-year planning period. The population is projected to increase by significantly over the planning period. Chapter 3 also uses this data to project future solid waste tonnage. The existing container site facilities, with the exception of the Montana City container site, are adequate to handle significantly more tonnage than that projected based on the population estimates.

4.3.1 General Organizational Context

Other public agencies involved in the planning and coordination of solid waste programs within the area include the Montana Department of Environmental Quality and Region VIII of the U.S. Environmental Protection Agency. Great West Engineering of Helena, MT is assisting the County with planning efforts and the funding agency application process for this particular project.

5.0 SOLID WASTE SYSTEM ALTERNATIVES

5.1 Alternative Screening

5.1.1 Optimal Operation of Existing Facilities

The purpose of this section is to discuss how the current system is being maintained and operated and to explore the possibility of improving operations to either achieve the objectives of this PER in their entirety or to assist in achieving these objectives. Such an approach could either eliminate the need for capital improvements to achieve plan objectives or reduce the extent of the capital improvements.

The County does an excellent job of operating and maintaining its solid waste system. No operational improvements (with the exception of the implementation of load consolidation at Boulder) were noted which would achieve the County's goal of improving the overall solid waste system. The system does provide a good service to the residents of the County. However, the County is interested in exploring capital alternatives for improving the system. This Chapter identifies potential solid waste alternatives and screens them for further analysis within this chapter.

5.1.2 Solid Waste Alternatives Considered

In order to fully evaluate alternatives for improvements to the County's system it is first necessary to identify the full range of alternatives which are available. Some of the alternatives can be relatively easily dismissed or screened from further analysis. The remaining alternatives are examined within detail within the remainder of the Chapter. The alternatives considered in this screening section are itemized below.

Disposal Alternatives

a. Alternative 1A - Tri-County Disposal Landfill in East Helena
b. Alternative 1B – Lewis & Clark County Landfill and Other Regional Landfills
c. Alternative 1C - County constructed and operated landfill
d. Alternative 1D - More comprehensive recycling and waste diversion

Roll-Off Container Site Alternatives

a. Alternative 2A - Existing System
b. Alternative 2B - Barrier System Safety Improvements
c. Alternative 2C - Roll-off load consolidation with backhoe or mini-excavator
d. Alternative 2D - Roll-off load consolidation with stationary compactors
e. Alternative 2E – Closure of Clancy, Jefferson City and Basin container sites

Montana City Container Site Replacement Project

a. Alternative 3A – No Action
b. Alternative 3B – Construction of new site at County Line Subdivision
c. Alternative 3C – Construction of new site on State Lands near Clancy
d. Alternative 3D – Construction of new site on County property near existing site
e. Alternative 3E – Construction of Container Site Improvements at Tri-County Disposal Landfill

Pay-As-You Throw System Alternatives

a. Alternative 4A – Current PAYT system
b. Alternative 4B – Implementation of Weight-Based PAYT system

Wood Waste Alternatives

a. Alternative 5A - Current Alternative (Open Burning and Landfilling)
b. Alternative 5B – Grinding
c. Alternative 5C – Air Curtain Burners

5.1.3 Screening of Disposal Alternatives

Alternative 1A – Tri-County Landfill

The County currently disposes of its waste at the Tri-County regional landfill near East Helena. Tri-County charges $29.00/ton for municipal solid waste, which is competitive for fully-compliant modern landfills. The County is currently under contract with Tri-County for one more year. The Tri-County landfill has well over forty years of life remaining which provides the needs of the County throughout the planning period.

Alternative 1B – Lewis & Clark County Landfill & Other Landfills

There is only one other regional landfill within a reasonable distance of Jefferson County that could be competitive on a cost basis. The Lewis & Clark County landfill is 9.5 miles further from the Montana City Container Site than the Tri-County Landfill using the most direct route on Lake Helena Drive. The tipping fee at Lewis & Clark is very similar to Tri-County's. However, the additional 19-mile round trip would add $72 per trip of transportation costs based on the $3.83 per mile determined earlier in the report. When the County is only hauling 3-3.5 tons per trip, it is easy to see that the additional transportation costs to the Lewis & Clark County Landfill would quickly outweigh any offer for a lower tipping fee on a per ton basis. The financial scenario for hauling to other regional landfills would be worse due to the increased transportation distance.

The County currently has a contract with Tri-County through 2019. For these reasons, this alternative is screened from further analysis in this report. If Tri-County's tipping fees were to dramatically increase in the future, the County may want to reassess this alternative in the future.

Alternative 1C – County-Constructed & Operated Landfill

There are several factors which make this a poor alternative for the County. First, it would be very difficult to site and license a new landfill in Jefferson County. The mountainous terrain of the County limits potential landfill sites. The site soils and hydrogeology are not optimum for landfill development and it would be very costly to develop a new landfill in the County. Second, the population of Jefferson County is too small to financially support a modern landfill. Third, it would likely be very difficult to obtain public support for a new landfill in Jefferson County due to the recreational, environmental and aesthetic values of the area. For these reasons, this alternative is screened from further analysis in this report.

Alternative 1D – More Comprehensive Recycling & Waste Diversion

A detailed evaluation of recycling and waste diversion alternatives is beyond the scope of this report. However, the County has implemented several recycling and waste diversion efforts which are progressive for a rural Montana County with little population.

First, the County collects and recycles paper, aluminum, metal, cardboard, batteries, and used oil. Second, the County operates burn pits and compost piles at both the Boulder and Whitehall sites for the diversion of green wastes.

With these recycling and waste diversion efforts, the County is addressing those portions of the waste streams that are most easily diverted. More comprehensive recycling through material separation or curbside pick-up of recyclables is not financially practical for a community of this population. This is especially true given the crash of recycling commodity value which has happened in the last few years. In fact, the County's expenses for recycling already significantly exceed the revenue received from the commodities. For these reasons, this alternative is screened from further analysis within the report.

5.1.4 Roll-Off Container Site Alternatives

Alternative 2A – Existing Facilities (No Action)

The existing roll-off container site system has serviced the County well over the years. The County has had accidents at the container sites in the past, however there have not been accidents in recent history. Site attendants closely supervise tipping operations and educate customers on safety around the container walls. Therefore, this alternative is evaluated in more detail in this report.

Alternative 2B – Installation of Barriers at Existing Facilities

The County's insurer, MACO, is strongly encouraging County governments to install barriers for the container walls. Installation of barriers help protect the public from fall hazards at the container sites. Alternatives for these barriers are evaluated in more detail within this chapter.

Alternative 2C – Consolidation of Open Top Roll-Off Loads with Backhoe or Mini Excavator Compaction

Consolidation and compaction of loads within containers can significantly reduce hauling costs because fewer loads need to be hauled. One alternative for consolidating loads are backhoes or mini excavators. One advantage of utilizing a backhoe for this task is that this equipment can be used to handle other wastes on site including green wastes and bulky wastes that customers cannot get into the container. A disadvantage of backhoes is that if not used carefully they can damage the containers. Mini-excavators are easier to operate and are less able to significantly damage containers during consolidation operations. The County determined during the PER process that they would prefer mini-excavators to backhoes because of the ease of operation and the lower likelihood that the operators will damage containers.

Initial analysis has shown that the Jefferson City, Basin and Clancy sites do not generate enough tonnage to make consolidation pay off. Whitehall already utilizes stationary compactors. Therefore, these sites are screened from further analysis for consolidaton alternatives. The Boulder and Montana City sites are evaluated for consolidation in more detail within this Chapter.

Alternative 2D – Consolidation of Open Top Roll-Off Loads with Stationary Compactors

Consolidation and compaction of loads within containers can significantly reduce hauling costs because fewer loads need to be hauled. Stationary compactors are another approach to consolidating loads. Stationary compactors have a higher capital cost than the backhoe alternative and there are some materials which cannot be thrown into the compactor. Under this alternative the County would need to maintain at least one roll-off at each site for wastes that cannot be handled in the compactors or have customers haul those wastes directly to the transfer station.

Initial analysis has shown that the Jefferson City, Basin and Clancy sites do not generate enough tonnage to make consolidation pay off. Whitehall already utilizes stationary compactors. Therefore, these sites are screened from further analysis for consolidaton alternatives. The Boulder and Montana City sites are evaluated for consolidation in more detail within this Chapter.

Alternative 2E – Closure of Clancy, Jefferson City and Basin Container Sites

The County could gain some operational efficiencies and cost savings by closing these sites which combined only handle 16% of the waste tonnage hauled by the County. In addition, if the County elects to proceed with the Pay-As-You-Throw alternative or construction of the Montana City container site replacement at the Tri-County Landfill these three sites will need to be closed because there is not room available at these sites for the installation of scales.

5.1.5 Montana City Container Site Replacement Alternatives

Alternative 3A – No Action

Continuing to utilize the existing container at Montana City is not a long-term viable alternative due to the inability of the site to handle the current traffic much less future growth. Therefore, this alternative is screened from further analysis in this report.

Alternative 3B – Construction of new site at County Line Subdivision

This alternative would have consisted of constructing a new five bay container site at the County Line Industrial Subdivision which is immediately adjacent to the Tri-County Disposal Landfill. The Commission screened out this alternative during the PER process because of the duplication of services so close together and the inefficiencies of the County and Tri-County handling the waste twice in such a close proximity. It is clear that Alternative 3E would be much more efficient than this alternative. For these reasons, this alternative was screened out from further analysis in the report.

Alternative 3C – Construction of new site on State Lands near Clancy

This alternative consists of constructing a new eight bay container site on State Lands south of Clancy. This alternative was rejected for several reasons. First, there is poor access to the site via the frontage road which would likely need to be improved at great cost. Second and more importantly, construction of this facility is away from where most of the current population is located and the growth is occurring. This would dramatically increase overall road mileage for County residents that are self-dumping. Third, acquiring the land would involve a very involved process with State Lands to either swap for the land or obtain it through a long-term lease. For these reasons, this alternative was screened out from further analysis in the report.

Alternative 3D – Construction of new site on County property near existing site

This alternative consists of constructing a new eight bay container site on a large parcel owned by the County southeast of the current Montana City container site. This site is large enough to handle the traffic load at Montana City throughout the planning period and is a viable alternative. This alternative is evaluated in more detail within the report.

Alternative 3E – Construction of Container Site Improvements at Tri-County Disposal Landfill

This alternative consists of entering a public/private partnership with Tri-County Disposal and constructing a five bay container site at the existing landfill. This alternative will also require the construction of a scale system to handle the additional traffic generated by the public at the landfill and keep it separate from the commercial traffic. This alternative appears viable and is evaluated in more detail in the report.

5.1.6 Pay-As-You-Throw (PAYT) Alternatives

Alternative 4A – Current PAYT System

The current PAYT system based on periodic reassessment of commercial accounts and a flat rate for all residential units will be compared with implementation of a full weight-based PAYT system in Alternative 4B.

Alternative 4B – Weight-Based PAYT System

Implementation of a weight based PAYT system will be fully evaluated in this report. This will include installation of scales at the new Montana City site, Boulder and Whitehall. The Clancy, Jefferson City and Basin sites will be closed under this alternative.

5.1.7 Wood Waste Alternatives

The current wood waste alternative of Open Burning and Landfilling (Alternative 5A) will be compared with Grinding (Alternative 5B) and Air Curtain Burners (Alternative 5C).

5.1.8 No Action Alternative

The No Action Alternative is typically evaluated in a preliminary engineering report. In this case the no action alternative would involve keeping the same solid waste system the County currently utilizes.

Since each component of the remainder of the existing system is either being evaluated in more detail or being retained after the screening of alternatives, the no action alternative is effectively being considered component by component.

5.1.9 Summary of Solid Waste Alternatives Selected for Further Analysis

The previous discussions selected the solid waste system alternatives that will be considered for more comprehensive analysis within this Chapter of the Preliminary Engineering Report. The alternatives selected for further analysis are summarized below:

Alternative Series 1 - Summary of Disposal Alternatives & Recommended Alternative

All of the disposal alternatives except the current alternative of disposal at the Tri-County Landfill have been screened from further analysis in this report. Disposal at the Tri-County Landfill which is fully compliant with federal and State requirements and is the lowest cost alternative is currently the best alternative available to the County. In addition, the County has implemented a reasonable and progressive level of waste recycling and diversion within its solid waste system. Therefore, Alternative 1A is the preferred disposal alternative without any further analysis needed in this report.

Alternative Series 2 - Summary of Roll-off Container Alternatives

The report will evaluate the alternative of installation of barriers at all the container sites.

The report will also evaluate alternatives for load consolidation at the Boulder and Montana container sites including mini-excavators and stationary compactors. Load consolidation alternatives were ruled out for the Jefferson City, Clancy and Basin sites because of inadequate tonnage to justify it. Whitehall already has stationary compactors so it will also not be evaluated.

This section of the report will also evaluate the closure of the Clancy, Jefferson City and Basin container sites.

Alternative Series 3 - Montana City Container Site Replacement Alternatives

Three alternatives including the No-Action alternative were screened from further consideration. The report will evaluate construction of the new Montana City Container Site on County Property (Alternative 3D) and construction of the new facility at the Tri-County Disposal Landfill (Alternative 3E)

Alternative Series 4 – Pay As You Throw Alternatives

The current PAYT system based on unitizing periodic reassessment of commercial accounts and a flat rate for residential units will be compared with implementation of a full weight-based PAYT system in Alternative 4B in the report.

Alternative Series 5 – Wood Waste Alternatives

The current wood waste alternative of Open Burning and Landfilling (Alternative 5A) will be compared with Grinding (Alternative 5B) and Air Curtain Burners (Alternative 5C).

5.2 Container Site Alternatives

5.2.1 Alternative 2A – No Action on Barrier Installation

The County has had accidents at the container sites in the past, however there have not been accidents in recent history. Site attendants closely supervise tipping operations and educate customers on safety around the container walls. Installation of barriers does hamper public tipping operations because heavy and bulky wastes are difficult to lift over the barrier. These issues are also a safety concern for customers.

5.2.2 Alternative 2B – Installation of Barriers at Roll-off Sites

As discussed in Chapter 3 the most significant deficiency with the roll-off sites is the lack of a barrier at the top of the container wall. The International Building Code requires that when the public has access to a drop off greater than 30 inches high, the drop off needs to be protected by a guard barrier at least 42 inches high. The top of the container walls are approximately 8 feet above ground level the container sits on. All of the Counties existing container site facilities were built before this code change and are exempt from the requirement. Any new facilities or major modifications to existing facilities would require installation of a barrier.

There are several approaches that can be utilized for installing fixed concrete guard barriers including cast-in place walls, pre-cast guardrails or pre-cast blocks. Fixed barriers can also be constructed with steel fencing materials as well. There are several issues with fixed barriers that make them infeasible for Jefferson County's container sites. First, a fixed barrier prevents the facility from being used by packer trucks which currently use one of the container sites (Whitehall). Second and more importantly, a fixed barrier prevents users with heavy or bulky wastes from being able to lift the waste over the barrier and into the container. Therefore, fixed barriers are screened from further consideration. The proposed barrier is a gate system that is normally closed but can be opened by the site attendant for bulky wastes or packer trucks.

Description

The proposed barrier consists of installation of a double-leaf steel gate for each container bay. A detail of this barrier is shown in Figure 5-1. Fixed fencing will also be installed on the end walls of each container bay. Since the Montana City site will be replaced under one of the alternatives outlined under Alternative Series 3, this project estimate does not include gates for Montana City.

The gates are left closed for all operations except when a packer truck or bulky waste arrives at the site. When these types of loads arrive at the site the attendant opens the gate and supervises the dumping operation until complete. Once complete the attendant closes the gate system.

Design Criteria

The proposed design has been approved by Montana Building Codes for other projects in the State. As discussed previously the Montana DEQ does not regulate or license container sites that handle less than 3,000 tons /year which is the case for all of Jefferson County's container sites

Map

Figures 3-1, 3-2, 3-3, 3-4, 3-5, and 3-6 show schematic layouts for each of the six existing container sites.

Environmental Impacts

This alternative consists of installing a gate system on top of the existing concrete container wall at the existing container site facilities. The existing sites have been previously disturbed and there will be no impact to the environment from this project element.

Land Requirements

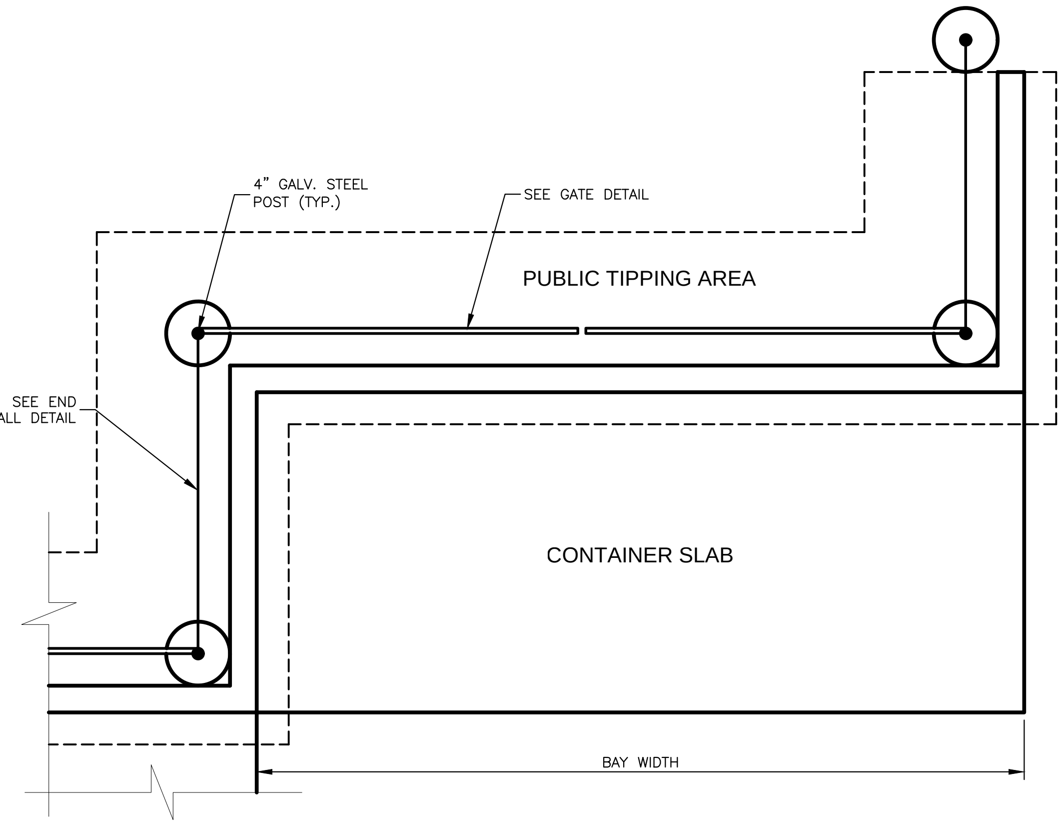
Adequate land owned by the County is available for installation of the barriers as shown on Figures 3-1, 3-2, 3-3, 3-4, 3-5, and 3-6.

Potential Construction Problems

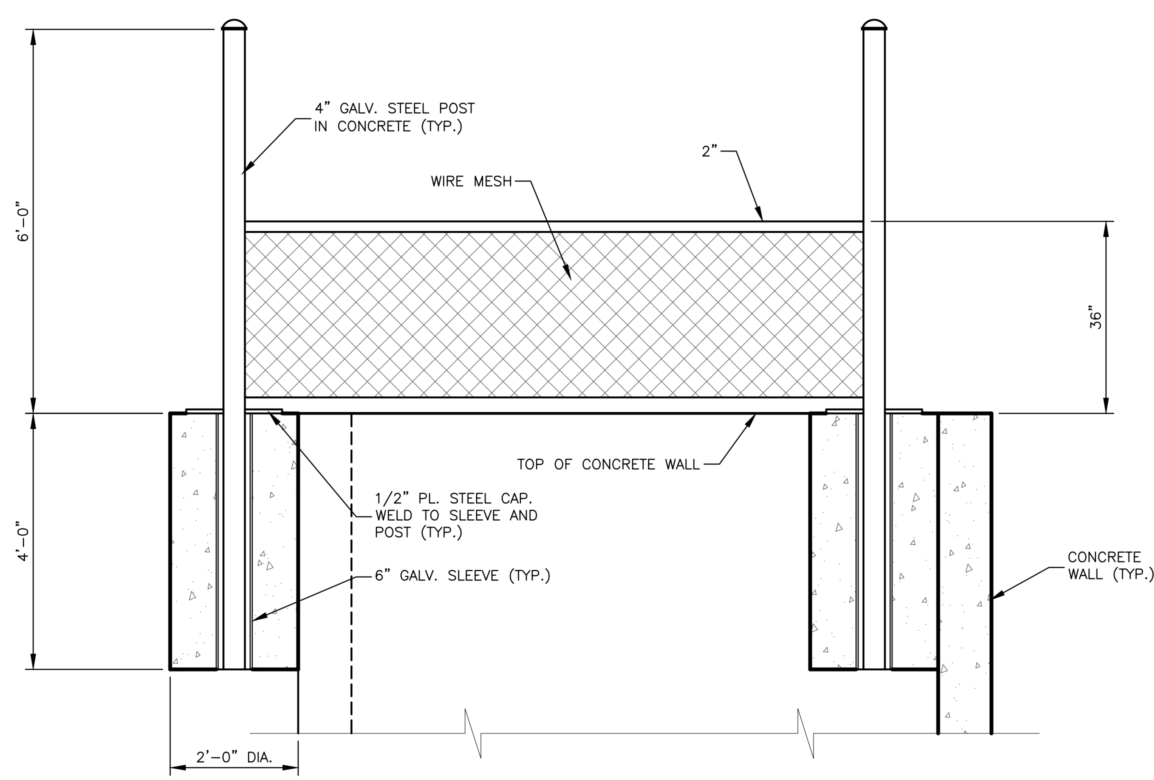
The proposed project is simple and no construction problems are anticipated.

Sustainability Considerations

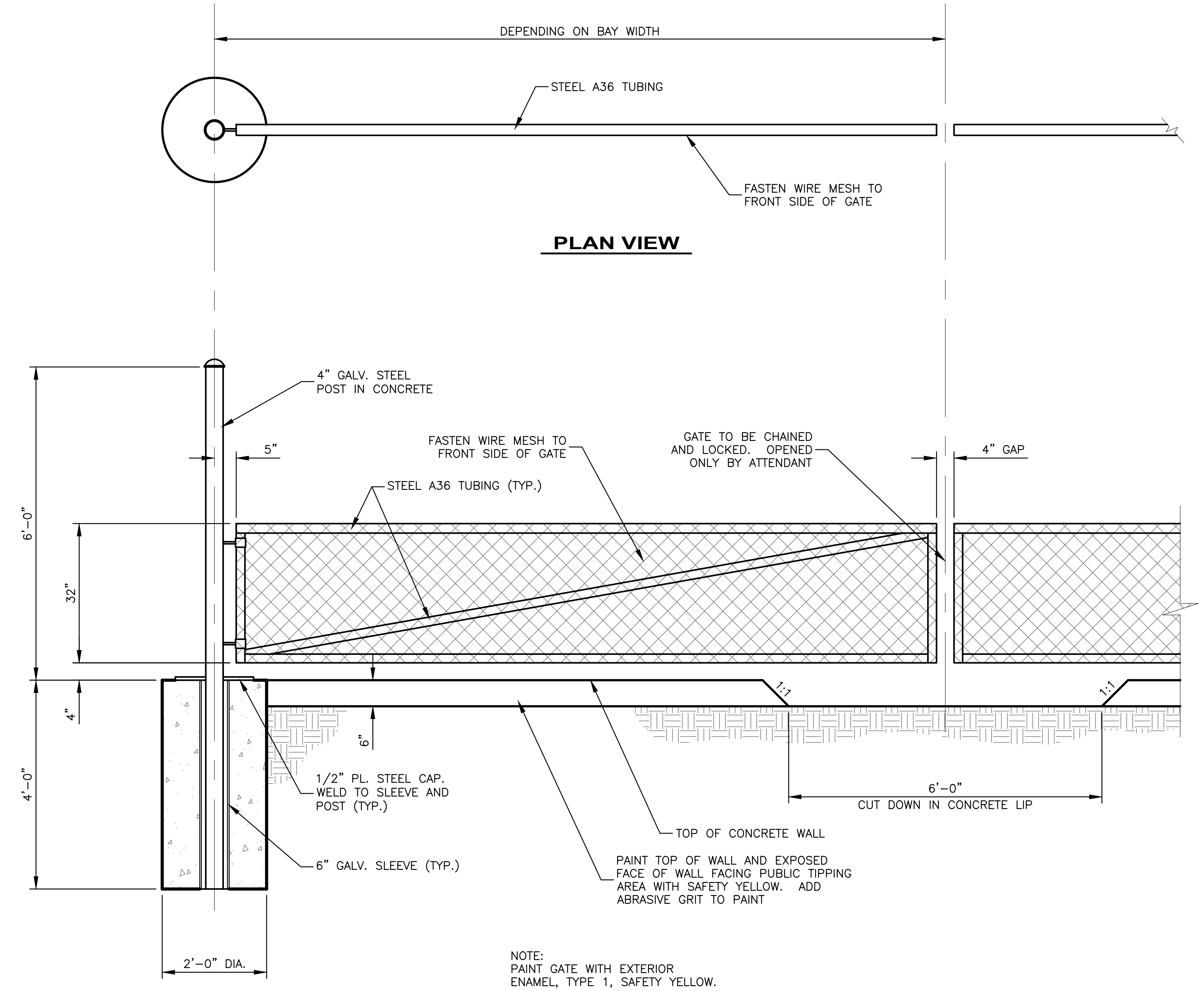
Installation of the barriers has minimal sustainability considerations. Installation of the barriers will make the facilities safer for County residents to use which has social benefits. There are no improvements to water and energy efficiency as a result of this alternative. There are no green infrastructure, environmental or economic sustainability benefits from this alternative.



CONTAINER SITE PLAN VIEW
NOT TO SCALE



END WALL DETAIL
NOT TO SCALE



HINGE POST **ELEVATION VIEW**

GATE DETAIL
NOT TO SCALE

GreatWest engineering®

Figure 5-1
STANDARD SOLID WASTE CONTAINER SITE GATE BARRIER DETAILS

JEFFERSON COUNTY SOLID WASTE SYSTEM
PRELIMINARY ENGINEERING REPORT

Cost Estimate

A capital cost estimate for the project is included in Table 5-1.

Table 5-1 - Opinion of Probable Construction Cost - Container Site Improvements

#	Bid Item	Qty	Units	Unit Price [1]	Total
1	Container Bay Gates/End Wall Fence Whitehall	3	EA	$2000	$6,000.00
2	Container Bay Gates/Wall Fence Clancy	6	EA	$2000	$12,000.00
3	Container Bay Gates/Wall Fence Jefferson City	4	EA	$2000	$8,000.00
4	Container Bay Gates/Wall Fence Boulder	3	EA	$2000	$6,000.00
5	Container Bay Gates/Wall Fence Basin	1	EA	$2000	$2,000.00
	Direct Construction Subtotal				$34,000.00
	Mobilization		10.00%		$3.500.00
	Contingency		10.00%		$3,500.00
	Construction Subtotal				$41,000.00
	Engineering and Construction Management		LS		$7,000.00
	Legal & Administrative				$2,000.00
	Total				$50,000.00

There are no impacts to current operations and maintenance costs associated with installation of guard barriers at the container sites

5.2.3 Alternative 2C – Consolidation of Open Top Roll-Off Loads with Mini-Excavator Compaction

Description

This alternative consists of consolidation and compaction of loads within containers with a mini-excavator. The site attendant periodically uses the mini-excavator to consolidate the waste within the container. This practice can significantly reduce hauling costs because fewer loads need to be hauled. Typically, a 40 cubic yard roll-off container will hold 3.0-3.5 tons per container. By consolidating containers, 7.0 tons or more can be hauled per container. The Boulder and Montana City sites are evaluated independently.

Design Criteria

A typical mini-excavator equipment is recommended for this alternative.

Map

Figures 3-1 and 3-2 show that there is adequate space at each site for storing the mini-excavators.

Environmental Impacts

This alternative has minimal environmental impacts. There are significant environmental benefits related to the reduction in truck mileage with this alternative.

Land Requirements

Figures 3-1 and 3-2 show that there is adequate space on the existing County properties to accommodate the mini-excavators.

Potential Construction Problems

The proposed project is simple and no construction problems are anticipated.

Sustainability Considerations

Load consolidation has environmental and energy sustainability benefits. The benefits are derived from the reduction in fuel usage by the County. This has environmental benefits in the reduction of the County's carbon footprint. Reduction in fuel usage also improves energy sustainability. Implementation of load consolidation is a "green" project. Table 5-4 compares mileage usage with and without load consolidation. Reduction in truck mileage also has an impact on the safety of motorists due to the reduction in heavy truck mileage.

Cost Estimate

A capital cost estimate for the project for the purchase of a low hour used mini-excavator is $35,000. This is based on research conducted on equipmenttrader.com.

Implementation of load consolidation with a mini-excavator results in additional operations and maintenance cost to the County. This includes fuel, maintenance and repair for the mini-excavators. It also includes an equipment amortization allowance for the replacement of the mini-excavators. The Federal Emergency Management Administration (FEMA) has established rates for operation, maintenance and ownership of equipment by local governments. The FEMA rates are used to establish the cost of mini-excavator operation in this analysis. Labor rates are based on current wages for operators in the County multiplied by the benefits package overhead which was determined to be 1.53 for Solid Waste employees.

Table 5-2 shows the incremental operations and maintenance costs for the container site operation under load consolidation at the Boulder site. It is estimated that the mini-excavator will need to operate two hours a day at the Boulder site and 3 hours a day at the Montana City site. Table 5-3 shows the incremental operations and maintenance costs for the container site operation under load consolidation at the Montana City site. These will be used as the basis for comparison with other alternatives including no load consolidation.

Table 5-2 - Opinion of Probable Annual Operation & Maintenance Costs Load Consolidation with Mini-Excavator Boulder Site

#	Bid Item	Qty	Units	Unit Price	Total
1	Operator Labor (2 hrs/day x 150 days/year)	300	HR	$33.00	$9,900.00
2	Backhoe Fuel, Maintenance, Repair & Ownership (FEMA Rate)	300	HR	$18.00	$5,400.00
	Total				$15,300.00

Table 5-3 - Opinion of Probable Annual Operation & Maintenance Costs Load Consolidation with Mini-Excavator Montana City Site

#	Bid Item	Qty	Units	Unit Price	Total
1	Operator Labor (3 hrs/day x 350 days/year)	1050	HR	$33.00	$34,650.00
2	Backhoe Fuel, Maintenance, Repair & Ownership (FEMA Rate)	1050	HR	$18.00	$18,900.00
	Total				$53,350.00

Payback Analysis

Determining whether to implement a waste consolidation alternative is typically based on a payback analysis. Consolidation of waste reduces hauling mileage and the associated costs. The question is whether the hauling savings offset the capital investment and operation of the equipment. Table 5-4 details the payback analysis for mini-excavator load consolidation at the Boulder site.

Table 5-4 - Boulder Container Site-Mini Excavator Consolidation Payback Calculation

Boulder Container Site Mini-Excavator Consolidation – Payback Calculation	
Total Capital Cost Used Mini Excavator	$35,000
Boulder Site in 2016-17	605 tons/180 boxes = 3.4 tons/box (Open Top Containers)
Mini-Excavator Compaction	7.0 tons/box
Ratio of Compacted Container Tons to Open Top Tonnage	7.0/3.4 = 2.06
Annual Mini- Exc Boulder Containers	180 boxes/2.06 = 87 Boxes
Reduction of Annual Boxes with Mini-Exc	180 boxes -87 boxes = 93 boxes
Assume that all trips are single container loads	Save 93 trips per year
Annual miles saved per year 93 trips x 60 miles per round trip	5580 miles
Annual Haul Cost Savings 5580 miles x $3.83/mile	$21,370 per year
Operator Labor 2 hrs/day x 150 days/year x $33/hr	$9,900/year
Mini- Exc Cost of Operation (Annual Fuel, Maintenance, Repair & Depreciation - 2017 FEMA rate $18/hr)	$5,400/year
Total Annual Cost Savings= Haul Cost Savings – Labor – Cost of Operation/Ownership	$21,370 -$9,900-$5,400 = $6,970/year
Payback Min-Exc Alternative	$35,000/$6,970 per year = 5.0 years

Table 5-4 shows that Jefferson County would realize a payback on mini-excavator consolidation at the Boulder site within five years.

Table 5-5 details the payback analysis for mini-excavator load consolidation at the Montana City site.

Table 5-5 -Montana City Container Site-Mini Excavator Consolidation Payback Calculation

Montana City Container Site Mini-Excavator Compactor – Payback Calculation	
Total Capital Cost Used Mini Excavator	$35,000
Montana City Site in 2016-17	1,840 tons/570 boxes = 3.2 tons/box (Open Top Containers)
Mini-Excavator Compaction	7.0 tons/box
Ratio of Compacted Container Tons to Open Top Tonnage	7.0/3.2 = 2.2
Annual Mini- Exc Montana City Containers	570 boxes/2.2 = 259 Boxes
Reduction of Annual Boxes with Mini-Exc	570 boxes -259 boxes = 311 boxes
Assume that all trips are single container loads	Save 311 trips per year
Annual miles saved per year 311 trips x 7.5 miles per round trip	2,332 miles
Annual Haul Cost Savings 2332 miles x $3.83/mile	$8,932 per year
Operator Labor 3 hrs/day x 350 days/year x $33/hr	$34,650/year
Mini- Exc Cost of Operation (Annual Fuel, Maintenance, Repair & Depreciation - 2017 FEMA rate $18/hr)	$18,900/year
Total Annual Costs= Haul Cost Savings – Labor – Cost of Operation/Ownership	$8,932 -$34,650-$18,900 = -$44,618/year
Payback Min-Exc Alternative	No payback

Table 5-5 shows that mini-excavator consolidation is not financially feasible at the Montana City site. This due to the short haul distance and minimal hauling cost savings available to payback the investment. Mini-excavator consolidation is not recommended at the Montana City site.

5.2.4 Alternative 2D – Consolidation of Open Top Roll-Off Loads with Stationary Compactors

Description

This alternative consists of consolidation and compaction of loads within containers with stationary compactors. Stationary compactors utilize a hydraulic ram to compact waste within a specialized reinforced roll-off container which must also be purchased. The compactors can easily be installed on the existing container slabs. The compactors require the construction of a steel hopper into which waste is dumped from the top of the container wall. This alternative requires the installation of three phase power or a diesel-powered generator. The previous analysis for mini-excavator consolidation at Montana City demonstrated that it was not financially feasible. Installation of stationary compactors is more costly so the payback will be even worse for this alternative at Montana City. Therefore, this alternative will be only evaluated for the Boulder site

The Boulder site would require two stationary compactors. The County would also need to purchase reinforced compactor containers to utilize this system.

The site attendant periodically uses the compactor to consolidate the waste within the container. This practice significantly reduces hauling costs because fewer loads need to be hauled. By consolidating containers, 8.0 tons or more can be hauled per container.

An advantage of this system is that maintenance of the compactors is minimal. However, there are several disadvantages of this alternative in comparison to mini-excavator compaction. First, the mini-excavator is not available to conduct other waste handling activities and maintenance activities on site. Another disadvantage is that there are some wastes that are unsuitable for the stationary compactors. One of the three container bays at Boulder would be reserved for bulky wastes and other wastes unsuitable for the stationary compactors.

Design Criteria

All-purpose waste compactors typically use 15-20 horsepower motors which require three phase power. Three phase power is over a mile away from the Boulder site and it would extremely costly to extend it to the site. Therefore, this alternative includes a diesel-powered generator for powering the compactors.

Map

Figure 3-2 shows the location of the Boulder container site and existing bays.

Environmental Impacts

This alternative consists of installing stationary compactors on top of the existing concrete slabs at the Boulder container site facility. The existing site has been previously disturbed and there will be no impact to the environment from this project element.

Land Requirements

The compactors will fit on the existing site footprint so no additional land is needed.

Potential Construction Problems

The proposed project is simple and no construction problems are anticipated.

Sustainability Considerations

Load consolidation has environmental and energy sustainability benefits. The benefits are derived from the significant reduction in fuel usage by the County. This has environmental benefits in the reduction of the County's carbon footprint. Reduction in fuel usage also improves energy sustainability. Implementation of load consolidation is a "green" project.

Cost Estimate

A capital cost estimate for the project is included in Table 5-6.

Table 5-6 - Stationary Compactor Installation with Diesel Generator - Boulder

#	BID ITEM	QTY	UNITS	UNIT PRICE [1]	TOTAL
1	Purchase Stationary Compactors	2	EA	$ 37,500.00	$ 75,000
2	Compactor Installation	2	EA	$ 3,000.00	$ 6,000
3	Hopper Construction	2	EA	$ 10,000.00	$ 20,000
4	Electrical	1	LS	$ 8,000.00	$ 8,000
5	Diesel Powered Generator	1	LS	$40,000.00	$ 40,000
					$ -
	Direct Construction Subtotal				$ 149,000
	Mobilization		10%		$ 15,000
	Contingency		10%		$ 15,000
	Construction Subtotal				$ 179,000
	Engineering		10%		$ 18,000
	Compactor Containers (4)				$ 60,000
	TOTAL				$ 257,000

[1] Estimated unit costs are based upon estimates from suppliers and bid tabs for similar projects throughout Montana.

Implementation of load consolidation with stationary compactors results in minor operations and maintenance costs to the County. This includes maintenance and repair for the compactors and generator. It also includes an annual equipment amortization allowance for the replacement of the compactors. Finally, it includes diesel fuel for the generator. Appendix P has a supplier quote for the compactors and containers.

Payback Analysis

Determining whether to implement a waste consolidation alternative is typically based on a payback analysis. Consolidation of waste reduces hauling mileage and the associated costs.

The question is whether the hauling savings offset the capital investment and operation of the equipment. Table 5-7 details the payback analysis for stationary compactor load consolidation at the Boulder site.

Table 5-7 - Boulder Container Site - Stationary Compactors-Payback Calculation

Boulder Container Site Stationary Compactors – Payback Calculation	
Total Capital Cost with a Generator	$257,000
Boulder Site in 2016-17	605 tons/180 boxes = 3.4 tons/box (Open Top Containers)
Whitehall Site Average 2014-2018	8.98 tons/box (Stationary Compactors)
Ratio of Stationary Compactor Tonnage to Open Top Containers	8.98/3.4 = 2.64
With Stationary Compactors Annual Boulder Containers	180 boxes/2.64 = 68 Boxes
Reduction of Annual Boxes with Stationary Compactor	180 boxes -68 boxes = 112 boxes
Assume that all trips are single container loads	Save 112 trips per year
Annual miles saved per year 112 trips x 60 miles per round trip	6720 miles
Annual Haul Cost Savings 6720 miles x $3.83/mile	$25,737 per year
Estimated Annual Operations and Maintenance Costs	$2,500
Total Cost Savings of Alternative	$23,237
Payback Stationary Compactor/Generator Alternative	$257,000/$23,737 per year = 10.8 years

Table 5-7 shows that Jefferson County would realize a payback on stationary compactor consolidation at the Boulder site within eleven years.

Alternative 2E – Closure of Clancy, Jefferson City and Basin Container Sites

The County could gain some operational efficiencies and cost savings by closing these sites which combined only handle 16% of the waste tonnage hauled by the County. In addition, if the County elects to proceed with the Pay-As-You-Throw alternative or construction of the Montana City container site replacement at the Tri-County Landfill these three sites will need to be closed because there is not room available at these sites for the installation of scales. The cost savings of this alternative need to be weighed against the reduction in services to County residents. Numerous comments were received from the public during the public meeting process in opposition to closing individual sites.

Cost savings of this alternative include site attendant time and the elimination of container hauling from these sites. Existing customers of these sites will likely dump at the new Montana City site.

Therefore, reduction in hauling mileage is based on the distance between these sites and Montana City. Table 5-8 shows the labor savings of this alternative.

Table 5-8 - Labor Savings of Site Closure Alternatives

Item	Days	Hrs	Rate/Hr	Annual Savings
Clancy Attendant	156	8	$27.55	$34,400.00
Jefferson City Attendant	104	8	$27.55	$22,900.00
Total Savings				$57,300.00

Table 5-9 shows the estimated hauling savings of this alternative.

Table 5-9 - Container Hauling Savings of Site Closure Alternative

Item	Boxes/Year	Saved Miles Round Trip	Cost	Total
Clancy	146	14	$3.81	$7,700.00
Jefferson City	104	26	$3.81	$10,300.00
Basin	47	64	$3.81	$11,500.00
Total				$29,500.00

5.3 New Montana City Site Alternatives

5.3.1 Alternative 3D – Construction of new Container site on County property

Description

This alternative consists of constructing a new eight bay container site on a large parcel owned by the County southeast of the current Montana City container site. The container walls would be constructed 4.5 feet tall with 42-inch gates. The 42-inch gates will meet the Building Code requirements for new facilities. The 42-inch gates will be normally closed. Customers will need to throw waste over the gate. Bulky wastes would be placed on the ground and County staff would open the gates to place waste in the containers. The project will also require the construction of a new access road to the site to meet County road width (24-foot minimum) and grade standards (9% maximum). Figure 5-2 shows the conceptual layout of the facility.

Design Criteria

The facility is sized large enough to handle the waste generated in the County throughout the 20-year planning period and beyond. This site is large enough to handle the traffic load at Montana City throughout the planning period. The site also has considerable space for additional expansion of the facility, if needed in the future.

Map

A conceptual layout of the facility is shown on Figure 5-2.

Environmental Impacts

The County property has been previously used as a gravel pit and has been previously disturbed. A minimal amount of new land disturbance will be required with this alternative. No significant environmental impacts are expected as a result of the project. Letters to environmental agencies and their responses are included in Appendix R.

Land Requirements

The parcel owned by the County is large enough to accommodate both the facility and future growth.

Potential Construction Problems

No construction problems are anticipated with this alternative.

Sustainability Considerations

The only sustainability consideration with this alternative is that it will serve this portion of the County throughout the twenty-year planning period. The existing site will be unable to accommodate this growth.

Cost Estimate

Capital costs for Alternative 3D are shown in Table 5-10.

Table 5-10 – Montana City Capital Costs for Alternative 3D

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
1	Mobilization	1	LS	$60,200.00	$60,200
2	Clearing & Grubbing	1.83	AC	$4,000.00	$7,320
3	Excavation	27,400	CY	$5.00	$137,000
4	3/4"-Minus Crushed Aggregate Surfacing (6" Depth)	1,840	CY	$35.00	$64,400
5	1 1/2"-Minus Crushed Aggregate Base Course (8" Depth)	2,845	CY	$30.00	$85,350
6	Concrete Container Pads (8" Depth Concrete on 6" Crushed Agg.)	46	CY	$600.00	$27,600
7	Structural Concrete (10" Retaining Wall, 10" Footing)	110	CY	$700.00	$77,000
8	Chainlink Gate Fall Protection	8	EA	$2,000.00	$16,000
9	Concrete Barrier Rail	622	LF	$60.00	$37,320
10	24" Dia. Culvert	262	LF	$60.00	$15,720
11	48" Dia. Culvert	300	LF	$120.00	$36,000
12	60" Dia. Storm Manhole	1	EA	$8,000.00	$8,000
13	Perimeter Fencing	1,750	LF	$17.00	$29,750
		CONSTRUCTION SUBTOTAL			$601,660
		ENGINEERING DESIGN		12%	$72,199
		CONSTRUCTION ENG		8%	$48,133
		SUBTOTAL			$721,992
		CONTINGENCY		10%	$72,199
		GRAND TOTAL			$794,191

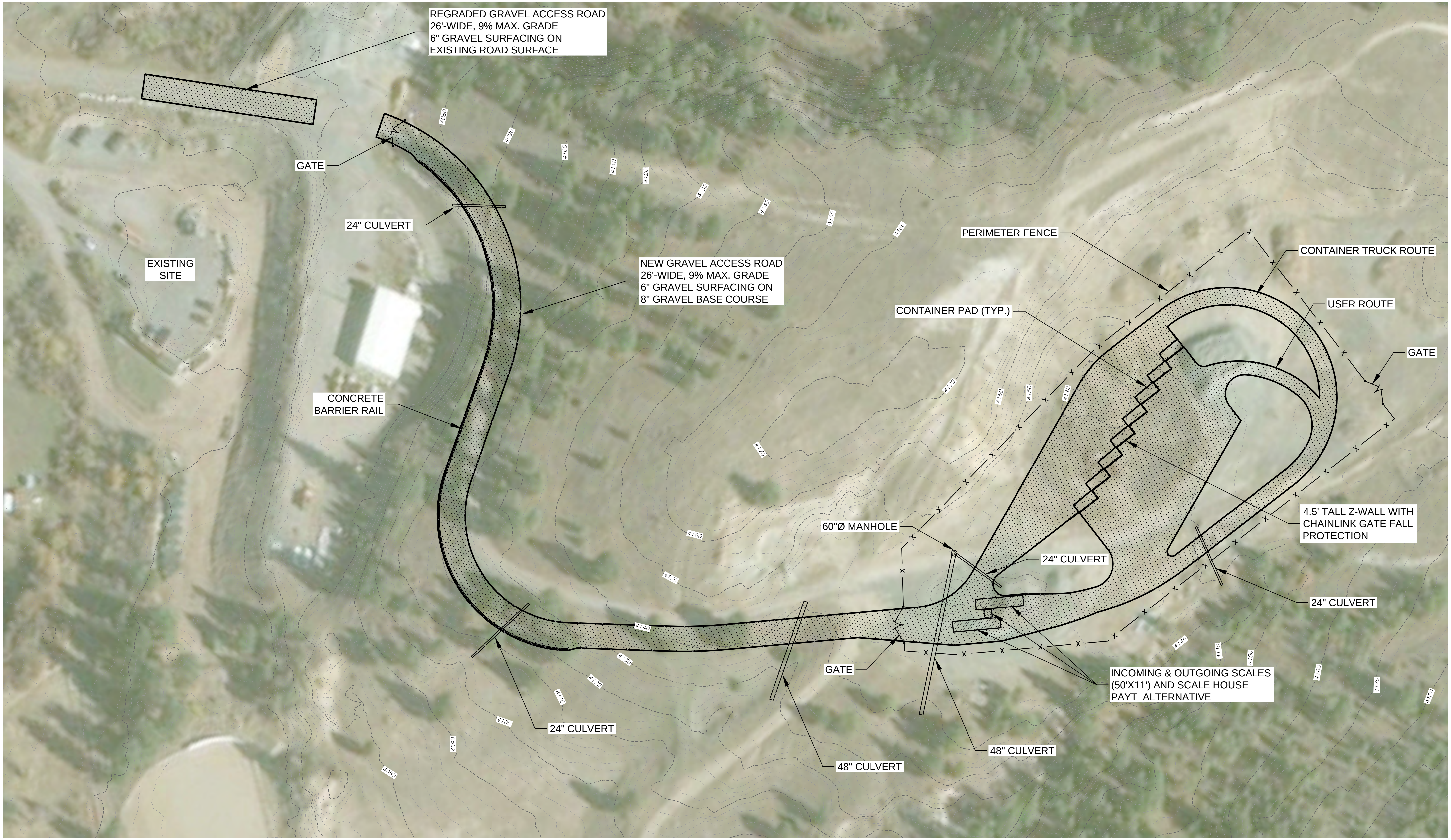


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Figure 5-2
ALTERNATIVE 3D
MONTANA CITY CONTAINER SITE
SITE PLAN

JEFFERSON COUNTY SOLID WASTE SYSTEM
PRELIMINARY ENGINEERING REPORT

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There will be no additional operations and maintenance costs with this alternative when compared to the existing facility.

5.3.2 Alternative 3E – Construction of Container Site Improvements at Tri-County Disposal Landfill

Description

This alternative consists of entering a public/private partnership with Tri-County Disposal and constructing a five bay container site at the existing landfill. Customers hauling wood waste and construction and demolition debris will be directed to the landfill face which reduces the traffic at the container site. The container walls will be constructed 4.5 feet tall with 42-inch gates. The 42-inch gates will meet the Building Code requirements for new facilities. The 42-inch gates will be normally closed. Customers will need to throw waste over the gate. Bulky and heavy wastes that cannot be thrown over the gates will be directed to the landfill face.

This alternative will also require the construction of a scale system to handle the additional traffic generated by the public at the landfill and keep it separate from the commercial traffic. The scale system for the public will consist of a new 50-foot scale for outbound weighing of public customers. This new scale and the existing scale will be used in conjunction with a scale house to serve the public customers. Tri-County will also need to upgrade its software to handle the public customers at the site. This alternative also requires the construction of a new 70-foot scale and automated kiosk to handle the commercial traffic at the site. It is necessary to keep commercial traffic separate from the public traffic.

Since this alternative will include weighing and tracking tonnage from County customers, the container sites at Jefferson City and Clancy will need to be closed to keep them from being overwhelmed by customers that do not want to be weighed. Tri-County Disposal will be responsible for operation of the facility including a dedicated scale attendant and a truck and driver for hauling containers to the landfill working face. Tri-County will also be responsible for maintenance and upkeep of the container site and scale system.

Figure 5-3 shows the conceptual layout of the facility.

Design Criteria

The facility is sized large enough to handle the waste generated in the County throughout the 20-year planning period and beyond. This site is large enough to handle the traffic load throughout the planning period

Map

A conceptual layout of the facility is shown on Figure 5-3.

Environmental Impacts

The project area has been previously disturbed by operations at the landfill. No new land disturbance will be required with this alternative. No significant environmental impacts are expected as a result of the project.

Land Requirements

The parcel owned by Tri-County is large enough to accommodate both the facility and future growth.

Potential Construction Problems

No construction problems are anticipated with this alternative.

Sustainability Considerations

The only sustainability consideration with this alternative is that it will serve this portion of the County throughout the twenty year planning period. The existing site will be unable to accommodate this growth.

Cost Estimate

Capital costs for Alternative 3E are shown in Table 5-11.

Table 5-11 - Tri-County Capital Costs for Alternative 3E

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
1	Mobilization	1	LS	$34,300.00	$34,300
2	Clearing & Grubbing	0.00	AC	$4,000.00	$0
3	Embankment	1,500	CY	$8.00	$12,000
4	3/4"-Minus Crushed Aggregate Surfacing (6" Depth)	800	CY	$35.00	$28,000
5	1 1/2"-Minus Crushed Aggregate Base Course (8" Depth)	1,100	CY	$30.00	$33,000
6	Concrete Container Pads (8" Depth Concrete on 6" Crushed Agg.)	24	CY	$600.00	$14,400
7	Structural Concrete (10" Retaining Wall, 10" Footing)	58	CY	$700.00	$40,600
8	50-Ft Weigh Scale	1	EA	$60,000.00	$60,000
9	Scale House	1	LS	$15,000.00	$15,000
10	Software/Computer/Training	1	LS	$15,000.00	$15,000
11	70-Ft Weigh Scale	1	LS	$75,000.00	$75,000
12	Weighing Kiosk	1	LS	$15,000.00	$15,000
		CONSTRUCTION SUBTOTAL			$342,300
		ENGINEERING DESIGN		12%	$41,076
		CONSTRUCTION ENG		8%	$27,384
		SUBTOTAL			$410,760
		CONTINGENCY		10%	$41,076
		GRAND TOTAL			$451,836

Figure 5-3
ALTERNATIVE 3E
TRI-COUNTY LANDFILL
CONTAINER SITE
SITE PLAN

JEFFERSON COUNTY SOLID WASTE SYSTEM
PRELIMINARY ENGINEERING REPORT

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There will be a significant operations change in this alternative because of Tri-County taking over operations of the container site and the closure of the existing Montana City site as well as the Clancy and Jefferson City sites. The County will be required to pay for Tri-County's operation of the new facility. Table 5-12 compares the cost of Tri-County labor versus Jefferson County labor savings. Table 5-13 estimates the cost savings that the County will realize by not having to haul containers from Clancy, Jefferson City and Basin.

Table 5-12 - Tri-County Disposal Annual Operation Costs (357 day/year) - Existing Facilities vs Tri-County Disposal Alternative

Item	Days	Hrs	Rate/Hr	Annual Cost
Tri-County Labor Costs				
Scale Attendant	357	8	$32.00	$91,400.00
Container Hauling & Site Maintenance	357	4	$40.00	$57,100.00
Total Cost				$148,500.00
Jefferson County Labor Costs				
Item	Days	Hrs	Rate/Hr	Annual Savings
Montana City Attendant	357	8	$27.55	$78,700.00
Clancy Attendant	156	8	$27.55	$34,400.00
Jefferson City Attendant	104	8	$27.55	$22,900.00
Total Savings				$136,000.00
Net Cost of Labor				$12,500.00

Table 5-13 - Container Hauling Savings/Summary of Overall Alternative Cost

Item	Boxes/Year	Miles Round Trip	Cost	Total
Montana City	570	8	$3.81	$17,374.00
Clancy	146	20	$3.81	$11,100.00
Jefferson City	104	32	$3.81	$12,700.00
Total				$41,174.00
Total Cost TCD Operations				$148,500.00
Total Jefferson County Savings				$177,200.00
Net Savings of Alternative				$28,700.00
Capital Cost Improvements at Tri-County				$452,000.00
10-year Payback Annual Cost to County (No interest)				$45,200.00
Net Annual Cost of Alternative				$16,500.00
Additional Cost Per Assessment 6220 units			$2.65/unit	

5.4 Pay-As-You-Throw (PAYT) Alternatives

1. Introduction to Pay-as-you-throw (PAYT) Systems

Pay-as-you-throw (PAYT) is a concept that the EPA has advocated for well over two decades. Under this type of solid waste fee system, residents and other solid waste system customers only pay for the volume or weight of waste they throw away. These systems provide a direct economic incentive for residents to create less waste and reuse/recycle more. More than 7,000 communities in the US had PAYT systems in place in 2006 according the USEPA's fact sheet.

There are several other benefits of PAYT beyond economics. PAYT promotes environmental sustainability. PAYT also makes the solid waste system more equitable by charging residents for the amount of waste they actually dispose of. This is similar to other utilities such as water, gas, or electricity which use meters to charge consumers. Appendix O contains various EPA documents which further describe PAYT. Jefferson County currently employs PAYT on a unit basis for commercial accounts.

Alternative 4A – Current PAYT System

The current PAYT system is based on determining the number of equivalent household units of waste generation for commercial accounts. Household units are assessed one unit per livable structure. This is a very common approach for public waste systems throughout Montana. By periodically re-calculating the volume of waste generated by commercial accounts the number of units they pay can be adjusted. The County has done a comprehensive re-assessment of its solid waste units in the last five years. New commercial accounts and residential units are added annually through coordination with the Montana Department of Revenue.

This system is reasonably equitable for commercial accounts, however it does not account for residential customers that generate more than the average tonnage household of waste. The most typical example in Jefferson County is residential wood waste generators. These are residents that are striving to make their properties more fire safe by removing trees, branches and other undergrowth.

This current system will be compared with implementation of a full weight-based PAYT system in Alternative 4B.

Alternative 4B – Weight-Based PAYT System

Description

Implementation of a weight based PAYT system will be fully evaluated in this report. This will include installation of scales at the new Montana City site, Boulder and Whitehall. The new Montana City site will require two scales to handle the traffic. If the County proceeds with the Tri-County Disposal Alternative 3E for the replacement of the Montana City site, this alternative already includes the scale system. Boulder and Whitehall will only require one scale for each site. All of the sites will need to be equipped with computers and weighing software for accounting for waste by customer.

Typically for waste based PAYT systems there is an annual "free tonnage" amount that each customer receives as part of their assessment. Once that threshold is exceeded, the customer is billed by the ton for the excess. The County current generates 1.2 tons/unit/year (2,400 lbs) on average. This would be a reasonable threshold for the allocated "free tonnage" under this system.

Clancy, Jefferson City and Basin will be closed under this alternative because there is not adequate space for scale installation.

Design Criteria

The facilities will be sized large enough to handle the waste generated in the County throughout the 20-year planning period and beyond. These sites are large enough to handle the traffic load throughout the planning period

Map

A conceptual layout of the scale installation under the new Montana City site alternative is shown on Figure 5-2. The scale installation under the Tri-County Disposal Alternative is shown on Figure 5-3. The layout of the scales at Boulder and Whitehall are not shown however there is plenty of room on these sites for the installation of a scale and scale house.

Environmental Impacts

The project areas have been previously disturbed. No new land disturbance will be required with this alternative. No significant environmental impacts are expected as a result of the project.

Land Requirements

The properties are large enough to accommodate both the scale facilities and future growth.

Potential Construction Problems

No construction problems are anticipated with this alternative.

Sustainability Considerations

Implementation of a weight-based PAYT program will encourage residents to generate less waste and instead recycle or reuse. A PAYT system will increase sustainability of the County's solid waste system

Cost Estimate

Capital costs for installation of a two scale system at the new Montana City site (Alternative 3D) are shown in Table 5-14. Capital costs for the installation of scales at the Boulder and Whitehall sites are included in Table 5-15. The total capital cost of this alternative between the three sites is $474,800.

Table 5-14 - Two Scale System at New Montana City Site-Capital Costs Alternative 3D

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
1	Mobilization	1	LS	$17,000.00	$17,000
2	Clearing & Grubbing	0.00	AC	$4,000.00	$0
3	Site Preparation	1	LS	$3,000.00	$3,000
4	Software Computer	1	LS	$15,000.00	$15,000.00
5	Two 50-ft Weigh Scales	2	EA	$60,000.00	$120,000
6	Scale House	1	LS	$15,000.00	$15,000
		CONSTRUCTION SUBTOTAL			$170,000
		ENGINEERING DESIGN		12%	$20,400
		CONSTRUCTION ENG		8%	$13,600
		SUBTOTAL			$204,000
		CONTINGENCY		10%	$20,400
		GRAND TOTAL			$224,400

Table 5-15 – One Scale System at Boulder and Whitehall Sites

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
1	Mobilization	1	LS	$17,000.00	$17,000
2	Clearing & Grubbing	0.00	AC	$4,000.00	$0
3	Site Preparation	1	LS	$3,000.00	$3,000
4	Computers/Software/Training	1	LS	$20,000.00	$20,000.00
5	Two 50-ft Weigh Scales	2	EA	$60,000.00	$120,000
6	Scale House	2	LS	$15,000.00	$30,000
		CONSTRUCTION SUBTOTAL			$190,000
		ENGINEERING DESIGN		12%	$22,800
		CONSTRUCTION ENG		8%	$15,200
		SUBTOTAL			$228,000
		CONTINGENCY		10%	$22,800
		GRAND TOTAL			$250,800

There will be a significant operations change in this alternative because this alternative will require a full-time scale attendant at Montana City and part time scale attendants at Boulder and Whitehall. There will also be some additional billing and bookkeeping requirements for County administrative staff. There will also be labor savings associated with the closure of the Clancy and Jefferson City sites. Table 5-16 compares operations costs under this alternative with the current operation. Table 5-17 shows anticipated hauling savings by closing the Jefferson City, Clancy and Basin sites.

Table 5-16 - Pay-As-You-Throw Alternative-Additional Labor Costs

Item	Days	Hrs	Rate/Hr	Annual Cost
Scale Attendant MTC	357	8	$27.55	$78,700
PT Scale Attendants Boulder & Whitehall	312	4	$27.55	$34,400
Add Billing and Bookkeeping Time (2 days/month	24	8	$30.00	$5,800
Total Cost				$118,900
Jefferson County Labor Savings				
Item	Days	Hrs	Rate/Hr	Annual Savings
Clancy Attendant	156	8	$27.55	$34,400.00
Jefferson City Attendant	104	8	$27.55	$22,900.00
Total Savings				$57,300.00

Table 5-17 - Container Hauling Savings/Overall Cost of Alternative

Item	Boxes/Year	Miles Round Trip	Cost	Total
Clancy	146	20	$3.81	$11,100.00
Jefferson City	104	32	$3.81	$12,700.00
Total				$23,800.00
Additional Labor Costs				$118,900.00
Labor Savings				$57,300.00
Container Hauling Savings				$23,800.00
Net Annual Operations Cost of Alternative				$31,965.20
Capital Cost Improvements PAYT Alternative				$474,800.00
Annual Debt Service (20 year - 3.875%)				$38,000.00
Total Annual Cost of Alternative				$75,800.00
Additional Cost Per Assessment 6220 units				$11.25/unit

5.5 Wood Waste Alternatives

Alternative 5A - Open Burning and Landfilling (Current Approach)

Description

The County currently accepts wood waste at its Montana City, Clancy, Boulder and Whitehall sites. Clean wood waste is accepted by the County at the sites for no charge. The County stockpiles and periodically burns clean wood waste at the Boulder and Whitehall sites. The County goes through the proper protocol to obtain a burn permit from the DEQ. This includes public notice of the burn and inspection of the burn pile by the County Sanitarian prior to burning to insure materials are acceptable for burning. The County typically conducts burns 1 to 2 times per year. Once the ash has cooled it is hauled off to a municipal solid waste landfill for proper disposal.

Wood waste collected at the Clancy and Montana City sites is hauled to the Tri-County Disposal Landfill and placed in their construction and demolition pit at $23/ton. In the past, when County had empty trucks travelling back to Boulder from Montana City they would backhaul wood waste to the Boulder burn pit. The County has been unable to backhaul for the last three years so all the wood waste collected at Clancy and Montana City has been landfilled over this period

This alternative is the existing approach and does not require any infrastructure to continue. This alternative will be compared with Grinding (Alternative 5B) and Air Curtain Burners (Alternative 5C).

Operations Costs

There are operations costs associated with the current alternative. Table 5-18 shows the estimated costs of the Open Burning Approach.

Table 5-18 - Estimated Cost of Open Burning Alternative Currently Used at Whitehall and Boulder

Boulder Costs				
Item Description	Quantity	Unit	Cost/Unit	Cost/Year
Staff Time	40	Hours/Year/Site	$27.55	$1,102.00
Loader Time	20	Hours/Year/Site	$60.00	$1,200.00
Ash Disposal	15	Tons	$29.00	$435.00
Ash Hauling 2 Single Trips	60	Miles	$3.83	$460.00
Total Estimated Annual Cost of Alternative				$3,197.00
Estimated Cost per Ton			$16.70/Ton	
Whitehall Costs				
Item Description	Quantity	Unit	Cost/Unit	Cost/Year
Staff Time	40	Hours/Year/Site	$27.55	$1,102.00
Loader Time	20	Hours/Year/Site	$60.00	$1,200.00
Ash Disposal	70	Tons	$29.00	$2,030.00
Ash Hauling 4 Tandem Trips	130	Miles	$3.83	$2,000.00
Total Estimated Annual Cost of Alternative				$6,332.00
Estimated Cost per Ton			$16.70/Ton	

Table 5-19 estimates the annual cost of landfilling tonnage from the Clancy and Montana City sites.

Table 5-19 - Estimated Annual Cost of Wood Waste Alternative Currently used for Montana City and Clancy

Item Description	Quantity	Unit	Cost/Unit	Cost
Disposal Cost	450	Tons	$23.00	$10,350
Clancy Hauling Costs	19 Boxes x 20 Miles	Mile	$3.81	$1,448
Mt City Hauling Costs	126 Boxes x 8 Miles	Mile	$3.81	$3,840
Total Annual Cost				$15,638
Cost Per Ton	450	Tons	$34.75/Ton	

Alternative 5B – Grinding

Description

Under this Alternative wood waste would be stockpiled and then a contract secured with a private contractor to periodically grind the waste. This significantly reduces the volume of wood waste and is a usable product in some cases. One key factor with this alternative is that in order for it to be viable an end use or market needs to be identified for the ground waste. If there is no market, the waste will simply be landfilled at the same cost of disposal as landfilling the wood waste in an unprocessed state because the tonnage doesn't change with grinding.

Currently there is a very limited to no market for ground wood waste. Only a few years ago it was more sought after as hog fuel throughout the State. Unfortunately there are no markets for hog fuel in the area. The closest known market for hog fuel is near Kalispell. It is not financially feasible to truck ground waste from Jefferson County to Kalispell to the high cost of trucking. Another approach taken by some entities is to compost the ground wood waste. The County does operate low-tech compost piles at Boulder and Whitehall, however this is only for small quantities of yard waste. In order to operate a full-scale compost operation, the County would need to purchase equipment and develop a water source on the sites. Given the relatively small scale of wood waste generated in the County it is not financially feasible for the County to develop a full-scale composting facility.

Grinding waste does not require any facilities except for a place to stockpile both unprocessed and processed waste.

Operations Costs

There are operations costs associated with this alternative. Contract grinding currently costs about \$5/cubic yard. The County generates about 6,800 cubic yards of wood waste per year (1,000 tons). Therefore, the estimated annual cost for grinding would be \$38,000 which is \$38/ton. It is important note that this does not include County time for stockpiling wood waste and more importantly the cost of disposal of the ground waste. This alternative is not considered viable at this time due to the lack of a market for ground wood waste in this region. If a favorable market for hog fuel returns in the future, the County can re-evaluate this alternative.

Alternative 5C – Air Curtain Burning

Description

This alternative includes purchasing and operating an Air Curtain burner for wood waste. Air Curtain burners are roll-off box size containers that are equipped with a blower system which improves the efficiency of the burn and dramatically reduces the amount of smoke generated by the burn. This allows open burning in areas that have stricter air quality regulations like Montana City which contributes to the air quality of the Helena Valley which is poor at times of the year particularly in the winter. The Air Curtain also provides for safer burning activities during periods which fire danger is high because the burning is completely enclosed in the container. Since the Air Curtain is mounted on a roll-off skid it can easily be transported from one location to another. Under this alternative, the County would utilize the Air Curtain for burning waste collected from the Montana City and Clancy sites. Since the Open Burning Alternative is so much less costly it will continue to be used at Boulder and Whitehall. A product sheet on this equipment is included in Appendix P.

Design Criteria

The Air Curtain should be large enough to burn approximately 5 tons/hour. This is the size the County would require for efficient burning of stockpiled wood waste.

Map

Under this alternative, the County would utilize the Air Curtain for burning waste collected from the Montana City and Clancy sites. There is adequate room for stockpiling wood waste and operating an Air Curtain at the new Montana City site.

Environmental Impacts

The Air Curtain equipment results in a cleaner burn than open burning wood waste, so this alternative would have positive environmental impacts to air quality. This alternative significantly reduces the volume of waste placed in the landfill which also has obvious environmental benefits.

Land Requirements

The existing properties are large enough to accommodate Air Curtain burning with the assumption that the County builds a new site for Montana City.

Potential Construction Problems

No construction problems are anticipated with this alternative.

Sustainability Considerations

The Air Curtain alternative improves the sustainability of Jefferson County's solid waste system

Cost Estimate

An operations and capital cost analysis on this alternative is included in Table 5-20.

Table 5-20 - Air Curtain Alternative for Montana City and Clancy Wood Waste

Operations Cost Comparison Operations Cost (450 tons/Year)				
Item	Units	Number	Rate	Annual Cost
Excavator Operator	Hrs	90	$33.00	$2,970.00
Air Curtain Operation, Fuel & Maintenance	Hrs	90	$20.00	$1,800.00
Ash Hauling from MTC	Trips	8	30	$240.00
Ash Disposal	Tons	60	29	$1,740.00
Excavator (FEMA rate)	Hrs	90	$53.00	$4,770.00
Total Cost				$11,520.00

Jefferson County
Container Hauling Costs Current Alternative/Overall Cost Air Burner Alternative

Item	Boxes/Year	Miles Round Trip	Cost	Total
Montana City	126	7.5	$3.81	$3,600.00
Total				$3,600.00
Additional Labor & Equipment Costs				$11,520.00
Disposal Savings (450 tons x $23/ton)				$10,350.00
Container Hauling Savings				$3,600.00
Net Annual Operations Savings of Alternative				-$2,430.00
Capital Cost Air Curtain Burner				$120,000.00
Annual Debt Service (10 year - 4%)				$14,800.00
Total Additional Annual Cost of Alternative				$12,370.00
Additional Cost Per Assessment 6220 units				$2.00/unit

6.0 SELECTION OF ALTERNATIVES

Each of the technically feasible alternatives considered meet the design criteria and applicable regulations identified in the alternative description. This section will examine advantages and disadvantages of each in terms of life cycle costs, operational and maintenance considerations, regulatory and permitting concerns, social impacts, environmental impacts, and other non-monetary considerations.

6.1 Life Cycle Cost Analysis

The cost of extensive capital improvements to meet minimum health and safety requirements, applicable regulations, and environmental impacts is a great concern to small communities with limited budgets and resources. At the same time, some alternatives may have a low capital cost but high O&M costs that will put a continual burden on the community. A life cycle cost analysis provides a method to compare the costs of each alternative to one another.

To complete the life cycle cost analysis, the anticipated annual increase to O&M costs, and estimated salvage value of any improvements based upon a straight-line depreciation are converted to present day dollars using the “real” discount rate from Appendix C of OMB A-94 (Currently 0.2% for 20 years). The net present value is then calculated for each alternative by adding the estimated capital cost and present worth of the increased O&M and then subtracting the present worth of the calculated salvage value.

Table 6-1 summarizes the life cycle cost analysis for all of the alternatives.

Table 6-1 - Life Cycle Cost Analysis

Container Site Alternatives						
Alternative	Capital Cost	Annual O&M	Present Worth of O&M	20 Year Salvage Value	Present Worth of Salvage	Net Present Value
Alt 2A No Barrier Installation	$0	$0	$0	$0	$0	$0
Alt 2B Barrier Installation	$50,000	$0	$0	$0	$0	$50,000
Alt 2C Load Consolidation with Mini-Excavator at Boulder	$35,000	$15,300	$298,500	$0	$0	$333,500
Alt 2D Load Consolidation with Stationary Compactors at Boulder	$257,000	$2,500	$48,750	$60,000	$57,000	$248,750
Alt 2E Closure of Clancy, Jefferson City and Basin Sites	$0	-$60,255	-1,175,000	$0	$0	-1,175,000
New Montana City Container Site Alternatives						
Alternative	Capital Cost	Annual O&M	Present Worth of O&M	20 Year Salvage Value	Present Worth of Salvage	Net Present Value
Alt 3D New MT City Container Site on County Property	$794,000	$177,200	$3,455.400	$350,000	$332,500	$3,916,900
Alt 3E New MT City Container Site at Tri-County	$452,000	$148,500	$2,895,750	$120,000	$114,000	$3,233,750
Pay As You Throw Alternatives						
Alternative	Capital Cost	Annual O&M	Present Worth of O&M	20 Year Salvage Value	Present Worth of Salvage	Net Present Value
Alt 4A Existing PAYT System	$0	$0	$0	$0	$0	$0
Alt 4B Weight Based PAYT System	$474,800	$32,000	$624,000	$101,000	$96,000	$1,002,800
Alt 5A Open Burning and Landfilling Wood Waste	$0	$25,163	$490,700	$0	$0	$490,700
Alt 5C Air Curtain Burner for MT City and Clancy Wood Waste	$120,000	$18,345	$357,700	$0	$0	$477,700

6.2 Ranking Criteria

A matrix to compare each alternative objectively against the other will be developed to select the preferred alternative. Each alternative will be given a score ranging from 0 to 10 for a number of criteria, with 0 representing a negative impact and 10 representing the maximum benefit to the community. The alternatives will begin with a score of 5 for each criterion, and then the score will be adjusted up or down relative to the benefit of the particular alternative in relation to the other alternatives.

In addition to scoring each alternative, the criteria themselves with be weighted in relation to one another. Weighting factors ranging from 1 to 10 will be used to give greater importance to items such as cost. This is appropriate, as often times higher investments are made to overcome many other problems such as reliability or to mitigate problems with technical feasibility or environmental concerns.

6.2.1 Life Cycle Costs

The cost of extensive capital improvements to meet minimum health and safety requirements, applicable regulations, and environmental impacts is a great concern to small communities with limited budgets and resources. Life cycle costs also include anticipated increases to ongoing O&M costs. Accordingly, this criterion will be provided with the maximum weighting factor of 10. social impact is closely tied to cost also, giving the cost for each alternative even more weight.

In addition to providing the maximum emphasis on costs, a method must be utilized to provide an objective comparison of costs for each alternative relative to one another and not just an overall comparison. Given a range of costs for various alternatives, the relative cost of any alternative can be determined using the lowest cost and the highest cost from the range of costs and the following equation.

5 x [(Lowest Cost) / (Cost) + (Highest Cost – Cost) / (Highest Cost)]

6.2.2 Operational and Maintenance Considerations

Operation and maintenance is an important issue when considering capital improvements. The costs for O&M associated with the alternatives is included in the 20-year life cycle costs compared under the financial feasibility, but there are other considerations that must be weighed for the O&M associated with each alternative.

The County has limited resources and manpower, and some alternatives may have O&M requirements that drastically tax those limited resources creating deficiencies in other areas. County personnel also have a much more intrinsic knowledge of the system than the average resident. Priorities identified by the operators to facilitate the efficient operation of the system must be given some weight.

This criterion will be provided with a weighting factor of 7.

6.2.3 Regulatory and Permitting Issues

Some alternatives may subject to higher regulatory scrutiny from State and Federal agencies. Other alternatives may encounter permitting issues that would significantly delay the project and/or result in additional expenses for the community. Consideration for these concerns will be given under this criterion.

This criterion will be provided with a weighting factor of 3.

6.2.4 Social Impacts

Social impacts will be considered in the final alternative selection as a project poorly supported by the community will have a limited chance of success. Efforts such as public hearings are ways to identify public opinion and perceptions. Costs are always a concern with consumers, but the health and safety of their families is just as important. Level of service provided by local government is also important to the public. Alternatives which inconvenience the public will also receive lower scores.

This criterion will be provided with a weighting factor of 5.

6.2.5 Environmental Impacts

Environmental impacts for each alternative, whether detrimental or beneficial, need to be considered in the final selection of a preferred alternative.

This criterion will be provided with a weighting factor of 5.

6.2.6 Public Health and Safety

Alternatives that do not meet the public health and safety requirements as required by the state and federal governments were eliminated during the Alternative Development. The alternatives retained for the Alternative Analysis are designed to meet public health and safety laws, so the scoring for each alternative under this criterion would be expected to be fairly high. However, addressing public health and safety concerns is the main purpose of the entire report, so this category will be give the maximum weighting.

This criterion will be provided with a weighting factor of 10.

6.3 Scoring of Container Site Barrier Alternatives

Barrier installation at the container sites is compared in this section. The alternatives to be scored in this section are:

- Alternative 2A (No Barrier Installation)
- Alternative 2B (Barrier Installation)

6.3.1 Life Cycle Costs

The life cycle costs comparison equation does not work for this comparison since the life cycle cost of Alternative 2A. is zero. Alternative 2B does have a cost but it is minor. Therefore, Alternative 2A is scored slightly higher.

- Alternative 2A (No Barrier Installation) 7.0
- Alternative 2B (Barrier Installation) 5.0

6.3.2 Operational and Maintenance Considerations

Alternative 2A, which is the No Action alternative, would not change the County's current operation and maintenance considerations. Alternative 2B will require a higher operation and maintenance effort the site attendant to work with customers that have bulky or heavy wastes that cannot be lifted over the barrier. The alternatives are scored as follows:

- Alternative 2A (No Barrier Installation) 8.0
- Alternative 2B (Barrier Installation) 4.0

6.3.3 Regulatory and Permitting Issues

Since the County's existing container sites were constructed prior to the Building Code requirement for barriers and are grandfathered in as is, neither alternative is impacted by regulatory factors. As such, they are both ranked the nominal score of 5.

6.3.4 Social Impacts

Public opinion for system improvements are often based on the maximum benefit received by the community that would increase monthly rates the least. In addition, Alternative 2B will result in some customers needing to haul bulky or heavy wastes directly to the landfill. Installation of the barriers will also make public tipping more difficult than the current approach. Accordingly, the alternatives were scored as follows:

- Alternative 2A (No Barrier Installation) 7.0
- Alternative 2B (Barrier Installation) 5.0

6.3.5 Environmental Impacts

Neither alternative has any environmental impacts. As such, they are both ranked the nominal score of 5.

6.3.6 Public Health and Safety

Having no barriers at the container sites is a public health and safety problem. The County has had accidents related to customers falling in the containers in the past. The County has mitigated this safety issue by having its site attendants monitor dumping operations and educating the users on safe practices. Barriers can also cause health issues for users due to lifting injuries. Accordingly, the alternatives were scored as follows:

- Alternative 2A (No Barrier Installation) 3
- Alternative 2B (Barrier Installation) 8

6.4 Scoring of Load Consolidation Alternatives

Two load consolidation alternatives were considered to improve efficiency of the collection and hauling from the Boulder container site. The analysis showed that both alternatives have a reasonable payback time on the capital investment. The alternatives to be scored in this section are:

- Alternative 2C: Load Consolidation with Mini-Excavators
- Alternative 2D: Load Consolidation with Stationary Compactors

6.4.1 Life Cycle Costs

The life cycle costs calculated for each alternative were entered into the equation in Section 6.2.1. Alternatives 2C, and 2D received the following scores:

- Alternative 2C: Load Consolidation with Mini-Excavators 3.7
- Alternative 2D: Load Consolidation with Stationary Compactors 6

6.4.2 Operational and Maintenance Considerations

Alternative 2C will require the operation and maintenance of the mini-excavator which is an additional demand on the site attendant or truck drivers. However, having the mini-excavator at the site will allow the site attendant to more effectively manage special wastes and maintain the site. Alternative 2D has the least operations and maintenance demands on the County, however the site attendant will need to fuel and maintain the generator for powering the stationary compactors. The alternatives are scored as follows:

- Alternative 2C: Load Consolidation with Mini-excavator 6
- Alternative 2D: Load Consolidation with Stationary Compactors 9

6.4.3 Regulatory and Permitting Issues

None of the load consolidation alternatives present any regulatory or permitting issues, as they would each be constructed at the County's existing container site. As such, they are all ranked the nominal score of 5.

6.4.4 Social Impacts

Public opinion for system improvements are often based on the maximum benefit received by the community that would increase monthly rates the least. Neither of these alternatives have any social impacts other than the cost. The life cycle cost of the mini-excavator is slightly more than the stationary compactors. Accordingly, the alternatives were scored as follows:

- Alternative 2C: Load Consolidation with Mini-Excavators 8
- Alternative 2D: Load Consolidation with Stationary Compactors 9

6.4.5 Environmental Impacts

Both of the alternatives require burning fuel so there is no significant difference in environmental impacts. The two alternatives reduce hauling mileage which is a positive environmental impacts. Accordingly, the alternatives were both scored with a nominal score of 5.

6.4.6 Public Health and Safety

The load consolidation alternatives are both positive from a public health and safety perspective because they reduce heavy truck mileage.

- Alternative 2C: Load Consolidation with Mini-Excavators 7
- Alternative 2D: Load Consolidation with Stationary Compactors 7

6.5 Scoring of Site Closure Alternative

This alternative is compared to the No Action Alternative. The alternatives to be scored in this section are:

- No Action
- Alternative 2E: Site Closure Alternative

6.5.1 Life Cycle Costs

The County will have significant operations cost savings with closure of the sites. This is due to labor savings with site attendants and reduced hauling costs. Since the No-Action alternative does not realize these cost savings, it is difficult to utilize the life cycle costs equation to score these alternatives. Since the site closure saves over $1,000,000 the next twenty years it was scored higher.

- No Action 3
- Alternative 2E: Site Closure Alternative 8

6.5.2 Operational and Maintenance Considerations

Alternative 2E will reduce the operation and maintenance demands on the County with the closure of the three sites. The alternatives are scored as follows:

- No Action 3
- Alternative 2E: Site Closure Alternative 8

6.5.3 Regulatory and Permitting Issues

There is no difference on these alternatives from a regulatory or permitting perspective. As such, they are all ranked the nominal score of 5.

6.5.4 Social Impacts

Closure of the three sites will have a significant social impact because residents in the Basin, Jefferson City and Clancy areas will need to drive further to get rid of their waste. This alternative is essentially a reduction in level of services provided by the County. Therefore, the No Action alternative scores significantly higher. Many comments were received from the public during the public meeting process opposing closure of each of the individual sites. The reduced costs of Alternative 2E does provide a social benefit to other users in the system due to the reduced costs incurred by the County.

Accordingly, the alternatives were scored as follows:

- No Action 10
- Alternative 2E: Site Closure Alternative 2

6.5.5 Environmental Impacts

Under the site closure alternative, residents in these areas will burn more fuel hauling their waste to the nearest container site. This will be partially offset by reduced heavy truck hauling mileage by the County. The No Action Alternative is preferable from an environmental impact perspective. Accordingly, the alternatives were scored as follows:

- No Action 7
- Alternative 2E: Site Closure Alternative 5

6.5.6 Public Health and Safety

The No Action alternative is slightly preferable from a public health and safety perspective because of the reduction in residential traffic to dump waste. This is partially offset by the reduced heavy truck mileage by County forces. Accordingly, the alternatives were scored as follows:

- No Action 7
- Alternative 2E: Site Closure Alternative 5

6.6 Scoring of New Montana City Container Site Alternatives

Two alternatives for replacement of the Montana City Container Site were considered in detail within the PER. The alternatives to be scored in this section are:

- Alternative 3D – New Container Site on County-owned Property
- Alternative 3E – New Container Site at Tri-County Disposal Landfill

6.6.1 Life Cycle Costs

The life cycle costs calculated for each alternative were entered into the equation in Section 6.2.1. Alternatives 3D and 3E received the following scores:

- Alternative 3D – New Container Site on County-owned Property 4.1
- Alternative 3E – New Container Site at Tri-County Disposal Landfill 5.9

It should be noted that part of the reason Alternative 3E has a lower life cycle cost is because the cost savings from the closure of Clancy, Jefferson City and Basin factor into the operations cost. This is valid however because Alternative 3E is not operationally feasible without the closure of these sites.

6.6.2 Operational and Maintenance Considerations

Alternative 3E has significantly less operations demands on the County than Alternative 3D since the operation is being turned over Tri-County Disposal. Operationally, Alternative 3D is nearly identical to the level of effort the County expends on the existing Montana City site.

- Alternative 3D – New Container Site on County-owned Property 5

- Alternative 3E – New Container Site at Tri-County Disposal Landfill 7

6.6.3 Regulatory and Permitting Issues

The regulatory and permitting requirements for each alternative are essentially the same and thus they are each scored a median score of 5.

6.6.4 Social Impacts

Construction of the new container site at Tri-County (Alternative 3E) requires closure of the sites at Jefferson City and Clancy. This will have a social impact on residents in these areas because it will be less convenient to haul their own trash. It will also be more inconvenient for Montana City residents to haul their trash. Another factor with Alternative 3E that must be considered is that the County will be giving up some long term control of their solid waste system by entering into a private/public partnership with Tri-County. The County received many comments from the public supporting Alternative 3D, while not one public comment was received supporting Alternative 3E.

Accordingly, the alternatives were scored as follows:

- Alternative 3D – New Container Site on County-owned Property 9
- Alternative 3E – New Container Site at Tri-County Disposal Landfill 2

6.6.5 Environmental Impacts

There are no significant environmental impacts with either alternative and thus they are each scored a median score of 5.

6.6.6 Public Health and Safety

There are no significant public health and safety differences between with either alternative. Both Alternatives will improve public safety with the construction of code-compliant barriers to protect the safety of site users.

The alternatives are scored as follows:

- Alternative 3D – New Container Site on County-owned Property 8
- Alternative 3E – New Container Site at Tri-County Disposal Landfill 8

6.7 Scoring of Pay-As-You-Throw Alternatives

Two alternatives for PAYT systems were considered in detail within the PER. Alternative 4A is essentially the No-Action Alternative. The alternatives to be scored in this section are:

- Alternative 4A – Existing PAYT System (No Action)
- Alternative 4B – Weight-Based PAYT System

6.7.1 Life Cycle Costs

Implementation of Alternative 4B has significant up-front capital costs as well as an increase to operations and maintenance costs. Since the No-Action alternative does have any direct costs, it is difficult to utilize the life cycle costs equation to score these alternatives. Since the implementation of a weight-based PAYT system costs the County over $1,000,000 the next twenty years it was scored lower.

- Alternative 4A – Existing PAYT System (No Action) 8
- Alternative 4B – Weight-Based PAYT System 3

6.7.2 Operational and Maintenance Considerations

Alternative 4B has significantly higher demands on the County than Alternative 4A since the County will be operating scales and this will require additional employees to serve as scale attendants. Also there will be a higher level of demand on the County administrative staff to account for and bill tonnage.

- Alternative 4A – Existing PAYT System (No Action) 8
- Alternative 4B – Weight-Based PAYT System 3

6.7.3 Regulatory and Permitting Issues

The regulatory and permitting requirements for each alternative are essentially the same and thus they are each scored a median score of 5.

6.7.4 Social Impacts

Implementation of weight-based PAYT will make system charges more equitable by charging customers for the actual amount of waste they generate.

Accordingly, the alternatives were scored as follows:

- Alternative 4A – Existing PAYT System (No Action) 5
- Alternative 4B – Weight-Based PAYT System 7

6.7.5 Environmental Impacts

Implementation of a weight-based PAYT system will encourage users to reduce, reuse and recycle waste which will have a positive environmental impact.

- Alternative 4A – Existing PAYT System (No Action) 5
- Alternative 4B – Weight-Based PAYT System 7

6.7.6 Public Health and Safety

There are no significant public health and safety differences between with either alternative, therefore both alternatives were given the median score of 5.

6.8 Scoring of Wood Waste Alternatives

Open burning of wood waste at the Boulder and Whitehall sites is the lowest cost alternative so this practice will continue. Two alternatives which were considered in detail within the PER. Alternative 5A is essentially the No-Action Alternative. The alternatives to be scored in this section are:

- Alternative 5A – Open Burning and Landfilling of Waste (No Action)
- Alternative 5C – Air Curtain Burner for Clancy and Montana City Wood Waste

6.8.1 Life Cycle Costs

The life cycle costs calculated for each alternative were entered into the equation in Section 6.2.1. Alternatives 5A and 5C received the following scores:

- Alternative 5A – Open Burning and Landfilling of Waste (No Action) 4.9
- Alternative 5C – Air Curtain Burner for Clancy and MT City Wood Waste 5.1

6.8.2 Operational and Maintenance Considerations

Alternative 5B has higher demands on the County since staff will be conducting periodic burns with the Air Curtain Burner.

- Alternative 5A – Open Burning and Landfilling of Waste (No Action) 5
- Alternative 5C – Air Curtain Burner for Clancy and MT City Wood Waste 4

6.8.3 Regulatory and Permitting Issues

There will be some additional regulatory and permitting requirements on the County to utilize the Air Curtain Burner at Montana City. These should be achievable because of the clean burn performance of the Air Curtain.

- Alternative 5A – Open Burning and Landfilling of Waste (No Action) 5
- Alternative 5C – Air Curtain Burner for Clancy and MT City Wood Waste 4

6.8.4 Social Impacts

There are no significant social impacts from either of these alternatives. Therefore, they were both assigned the median score of 5.

6.8.5 Environmental Impacts

Landfilling wood waste under Alternative 5A has environmental impacts but so does burning waste under Alternative 5C. Therefore, these alternatives are considered a wash environmentally and are both assigned the median score of 5.

6.8.6 Public Health and Safety

There are no significant public health and safety differences between with either alternative, therefore both alternatives were given the median score of 5.

6.9 Decision Matrix and Selection of Preferred Alternatives

The scores and weighted scores for each alternative were compiled to provide a comparison using a decision matrix, presented in Table 6-2.

The preferred alternatives based on this scoring process are as follows:

- Alternative 2A – No Installation of Barriers at Roll-off Sites
- Alternative 2D: Load Consolidation with Stationary Compactors at Boulder
- Alternative 3D – Construct New Montana City Container Site on County-owned property
- Alternative 4A – Current PAYT System
- Alternative 5A – Current Wood Waste Alternative

Table 6-2 - Decision Matrix

Alternative	Life Cycle Costs		Operation and Maintenance		Permitting		Social Impacts		Environmental Impacts		Public Health and Safety		TOTAL
	Weight:	10	Weight:	7	Weight:	3	Weight:	5	Weight:	5	Weight:	10	
	Score	Wtd.	Score	Wtd.	Score	Wtd.	Score	Wtd.	Score	Wtd.	Score	Wtd.	
2A	7	70	8	56	5	15	7	35	5	25	3	30	231
2B	5	50	4	28	5	15	5	25	5	25	8	80	223
2C	3.7	37	6	42	5	15	8	40	5	25	7	70	229
2D	6	60	9	63	5	15	9	45	5	25	7	70	278
No Action	3	30	3	21	5	15	10	50	7	35	7	70	221
2E	8	80	8	56	5	15	2	10	5	25	5	50	236
3D	4.1	41	5	35	5	15	9	45	5	25	8	80	241
3E	5.9	59	7	49	5	15	2	10	5	25	8	80	238
4A	8	80	8	56	5	15	5	25	5	25	5	50	251
4B	3	30	3	25	5	15	7	35	7	35	5	50	186
5A	4.9	49	5	35	5	15	5	25	5	25	5	50	199
5C	5.1	51	4	28	4	12	5	25	5	25	5	50	191

7.0 PROPOSED PROJECT

Based on the alternatives analysis, the preferred alternative includes the following capital improvements projects as described in Chapter 5:

- Alternative 2D: Load Consolidation with Stationary Compactors at Boulder
- Alternative 3D – Construct New Roll-Off Container Site on County-Owned property near Montana City

7.1 Preliminary Project Design

7.1.1 Alternative 2D - Consolidation of Container Loads at Boulder with Stationary Compactors

This project will include the installation of two stationary compactors at the Boulder site and purchase of compactor containers. The project also includes installation of a diesel-powered generator for powering the compactors.

7.1.2 Alternative 3D – Construction of New Container Site on County-owned property near Montana City

A schematic of this alternative is shown on Figure 5-2.

7.1.3 Waste Disposal

Waste will continue to be disposed of at the Tri-County Landfill. No improvements are included in this project for disposal.

7.2 Project Schedule

If Jefferson County is successful in securing funding for the proposed project, it is anticipated that design would begin in July, 2019. All necessary permit applications (Building Codes) would be submitted and approvals obtained during that same time period from July to December. The project would then advertise for bids in March 2020 and an award could be expected by April 2020, followed by initiation of construction in May 2020. It is anticipated that substantial completion would be achieved by November 2020 with final completion and initiation of operation in December 2020. Chapter 8 includes a detailed implementation schedule.

7.3 Permit Requirements

The design phase of the project will include applying for and obtaining necessary permits related to Building Code approval. Construction permits will likely include a Stormwater Pollution Prevention Plan (SWPPP), which will be the responsibility of the selected contractor.

7.4 Sustainability Considerations

7.4.1 Water and Energy Efficiency

The new facilities will not have a water supply. County employees are required to bring their own drinking water and sanitation is provided by a Porta-Potty.

Implementation of Load Consolidation with stationary compactors at Boulder has a significant impact on energy use by the County. Load consolidation has significant energy sustainability benefits. The benefits are derived from the significant reduction in hauling mileage and therefore fuel usage by the County This has environmental benefits in the reduction of the County's carbon footprint. Table 5-7 shows the County will save 6,700 hauling miles per year with load consolidation at Boulder.

7.4.2 Green Infrastructure

Implementation of load consolidation is a "green" project because of the significant environmental benefit. Stormwater management during the project will include temporary erosion and sediment control measures including the installation and maintenance of temporary structural control measures to reduce or eliminate the erosion of soils and transport of sediment offsite as a result of construction activities.

7.5 Total Project Cost Estimate

Table 7-1 and 7-2 show the capital costs for load consolidation and construction of the new Montana City site.

Table 7-1 - Stationary Compactor Installation with Diesel Generator - Boulder

#	BID ITEM	QTY	UNITS	UNIT PRICE [1]	TOTAL
1	Purchase Stationary Compactors	2	EA	$ 37,500.00	$ 75,000
2	Compactor Installation	2	EA	$ 3,000.00	$ 6,000
3	Hopper Construction	2	EA	$ 10,000.00	$ 20,000
4	Electrical	1	LS	$ 8,000.00	$ 8,000
5	Diesel Powered Generator	1	LS	$40,000.00	$ 40,000
					$ -
	Direct Construction Subtotal				$ 149,000
	Mobilization		10%		$ 15,000
	Contingency		10%		$ 15,000
	Construction Subtotal				$ 179,000
	Engineering		10%		$ 18,000
	Compactor Containers (4)				$ 60,000
	TOTAL				$ 257,000

[1] Estimated unit costs are based upon estimates from suppliers and bid tabs for similar projects throughout Montana.

Table 7-2 - Montana City Capital Costs for Alternative 3D

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
1	Mobilization	1	LS	$60,200.00	$60,200
2	Clearing & Grubbing	1.83	AC	$4,000.00	$7,320
3	Excavation	27,400	CY	$5.00	$137,000
4	3/4"-Minus Crushed Aggregate Surfacing (6" Depth)	1,840	CY	$35.00	$64,400
5	1 1/2"-Minus Crushed Aggregate Base Course (8" Depth)	2,845	CY	$30.00	$85,350
6	Concrete Container Pads (8" Depth Concrete on 6" Crushed Agg.)	46	CY	$600.00	$27,600
7	Structural Concrete (10" Retaining Wall, 10" Footing)	110	CY	$700.00	$77,000
8	Chainlink Gate Fall Protection	8	EA	$2,000.00	$16,000
9	Concrete Barrier Rail	622	LF	$60.00	$37,320
10	24" Dia. Culvert	262	LF	$60.00	$15,720
11	48" Dia. Culvert	300	LF	$120.00	$36,000
12	60" Dia. Storm Manhole	1	EA	$8,000.00	$8,000
13	Perimeter Fencing	1,750	LF	$17.00	$29,750
		CONSTRUCTION SUBTOTAL			$601,660
		ENGINEERING DESIGN		12%	$72,199
		CONSTRUCTION ENG		8%	$48,133
		SUBTOTAL			$721,992
		CONTINGENCY		10%	$72,199
		GRAND TOTAL			$794,191

The total project cost is summarized in Table 7-3.

Table 7-3 - Project Cost Summary

Item	Cost
Stationary Compactor Installation at Boulder	$257,000
New Montana City Facility Construction	$794,000
Total	$1,051,000

7.6 Annual Operating Budget

Table 7-4 itemizes County's solid waste expenses for the fall fiscal year 2017/2018.

Table 7-4 - Jefferson County Solid Waste Expenses 2017/2018

Item	FY 2017-18
Salaries & Benefits	$498,700
Equipment Repairs, Maintenance & Parts	$31,500
Supplies & Equipment	$3,900
Tipping Fees	$211,700
Landfill Services (Giulio Hauling)	$28,900
Fuel & Diesel Fuel	$31,500
Office & Utility Costs	$14,900
Wood Processing	$0
Recycling	$4,500
GASB 45	$0
Professional Services	$20,200
Liability Insurance	$21,300
Licensing	$2,100
Other Miscellaneous Expenses	$300
Total	$869,500

7.6.1 Income

The County solid waste revenue is primarily derived from tax assessments, special user fees, and sale of recyclable commodities. The current tax assessment is $129.69 per equivalent household unit. Commercial and institutional users pay multiple units based on their waste generation. All inhabitable structures are assessed at least household unit.

Special user fees are charged for the disposal of construction and demolition wastes at the container sites. Special waste fees are also charged for inert wastes and tires. Actual revenue from the last three fiscal years is shown in Table 3-1.

Annual O&M Costs

Annual operations and maintenance costs for the system after the implementation of this project are included in Table 7-5.

Table 7-5 - Opinion of Probable Annual O&M Costs (Proposed Project)

Item	Cost
Current Annual Operating Costs	$870,000
Annual Cost Savings with Installation of Compactors at Boulder Site (Table 5-7)	-$23,200
Total	$846,800

7.6.2 Debt Repayments

The County has no existing debt on the solid waste system. The proposed project funding package may include financing with an Intercap Loan. The total debt is estimated to be $1,051,000 with an annual debt repayment of $91,300.

7.6.3 Reserves

Debt Service Reserve

Rural Development requires a 10% annual reserve for debt coverage with its loans.

Short-Lived Asset Reserve

Short-Lived assets were included as part of the O&M costs. Therefore, no additional reserves are required to be included in the project costs.

8.0 CONCLUSIONS AND RECOMMENDATIONS

The previous sections of this report have focused on the need for the project, physical and socio-economic characteristics of the community, project costs, and more extensively the technical viability. This section will focus on the financial strategy and implementation schedule. One of the main goals of a comprehensive PER is to provide a workable funding plan for recommended improvements included in the Preferred Alternative. This section will discuss available funding sources as well as develop various funding scenarios. Ultimately, a preferred funding scenario will be selected and further analyzed along with an associated implementation plan.

8.1 Funding

Due to the high cost of the proposed improvements, Jefferson County plans to pursue outside assistance to fund the project in the form of low interest loans. Prior to examining the funding sources available to the County, it is important to understand the concept of “Target Rate” as established by the Montana Department of Commerce (MDOC). The target rate is used to determine whether or not a municipality is paying its fair share of a project’s cost. In order to apply for grant funding from the MDOC, the user rates after completion of the project must meet or exceed the established target rates.

The target rates are calculated as a percentage of the median household income (MHI) for the municipality or County. The MDOC has determined, based on surveying communities that have undergone recent upgrades to their water and/or wastewater systems that the “fair share” of cost per user after completing a project should be approximately 0.3% of the median household income for solid waste services.

According to MDOC’s website, the MHI for Jefferson County is $60,842 and the target rate for solid waste services is $182.53/year. The existing solid waste tax assessment for the County is $129.69 per year per household unit. The current rate is 71% of the target rate, prior to implementation of this project.

8.1.1 Funding Sources

The following sections provide a brief description of the potential funding sources and whether or not the County would be eligible for those funds.

Treasure State Endowment Program (TSEP)

TSEP is a state funded grant program, which is administered by the Montana Department of Commerce (MDOC). TSEP provides financial assistance to local governments for infrastructure improvements. Grants can be obtained from TSEP for up to $500,000 if the projected user rates are less than 125% of the target rate, for up to $625,000 if projected user rates are between 125% and 150% of the target rate, and for up to $750,000 if the projected user rates are over 150% of the target rate. TSEP grant recipients are required to match the grant dollar for dollar, but the match may come from a variety of sources including other grants, loans, or cash contributions.

Solid waste projects are eligible for TSEP funds, however solid waste projects are not competitive in the program. The County should only consider an application to TSEP for grant funding if there is an indication that the legislature is considering funding all the projects. Because of the legislative cycle, if TSEP funds were obtained they would not be available until July of 2021. This would result in a significant delay in implementation of the project which would also add cost due to inflation. Jefferson County's solid waste user rates are currently at only 71% of the target rate and the proposed project would only increase their rates to 77% of the target rate. Therefore, the County is not eligible for TSEP grant funding and this funding source will not be considered any further.

Renewable Resource Grant and Loan Program (RRGL)

RRGL is a state program that is funded through interest accrued on the Resource Indemnity Trust Fund and the sale or Coal Severance Tax Bonds and is administered by the Montana Department of Natural Resources and Conservation (DNRC). The primary purpose of the RRGL is to enhance Montana's renewable resources. For public facilities projects that conserve, manage, develop, or protect renewable resources, grants of up $125,000 are available.

Since RRGL grants are based on benefits to renewable resources this project is not competitive in that program.

Community Development Block Grant (CDBG)

CDBG is a federally funded program that is also administered by the Montana Department of Commerce (MDOC). The primary purpose of CDBG funds is to benefit low to moderate income (LMI) families. Hence, a municipality must have an LMI of 51% or greater. This is usually determined by the current Census. However, under certain circumstances, the MDOC may allow an income survey to be completed (such as there have been major economic changes since the Census or if a community is only slightly under the required LMI percentage).

The CDBG grant funds can be applied for in an amount of up to $450,000 with a limit of $15,000 per LMI household, so a community needs 30 LMI households to apply for the maximum grant funds. The use of CDBG funds requires a 25% local match that can be provided through cash funds, loans, or a combination thereof.

Jefferson County LMI is 40.1% which makes it ineligible for CDBG funding

State Revolving Fund (SRF)

SRF provides low-interest loan funds for some solid waste projects through the Water Pollution Control State Revolving Fund (WPCSRF). Projects need to protect groundwater quality like liners and leachate collection systems. Discussions with SRF staff have indicated that Jefferson County's project would not be eligible for loan funding from SRF.

USDA Rural Development (RD)

RD provides grant and loan funding to municipalities and County's for solid waste, water and wastewater projects that improve the quality of life and promote economic development in Rural America. Communities with a population of less than 10,000 are eligible to apply, though; priority is given to those with a population of less than 5,500.

Grant eligibility and loan interest rates are based on the community's median household income (MHI) and user rates. If the area to be served has a MHI of $38,205 or lower and the project is necessary to alleviate a health and/or sanitation concern, up to 75% of the project costs are grant eligible. The County's MHI puts them in this category. Up to 45% of the project costs are grant eligible if the planning area has an MHI between $38,205 and $47,757.

The PER estimates the population of the County's solid waste service area to be 11,983 persons. However , the population of the County served by the new Montana City container site and the load consolidation equipment is significantly under 10,000 persons which makes it eligible on a population and basis for RD loan funding. Therefore, the County will consider RD for its proposed funding package.

Montana Coal Board

The Coal Board provides grant funding to municipalities to adequately provide for the expansion of public services or facilities needed as a direct consequence of coal development activities. There is no maximum limit to the amount the Coal Board can fund, but available funding is very limited so it can be difficult to receive any funds from the Coal Board, especially large sums.

The County cannot make a tie to impact due to coal development with the project so a Coal Board grant will not be pursued.

Economic Development Administration (EDA)

EDA provides grant funding for projects that are demonstrated to be needed for the placement of a new business. The amount of grant is dependent on the number of jobs created.

Because the project would not create a large number of jobs, the County has elected to not apply for an EDA grant.

INTERCAP

INTERCAP provides loan funds at a low cost, variable interest rate to local governments. INTERCAP is administered by the Montana Board of Investments and is very flexible in the variety of funding which would include solid waste projects. There is no funding cycle (funds are always available), however, the maximum loan term is 15 years. The current rate is 3.37% so the program is competitive and the County will look at this as an option. The biggest potential drawback to Intercap is the variable rate which is adjusted annually.

8.1.2 Funding Strategy

There are limited alternatives for funding solid waste projects in Montana. Due to the nature of the project and anticipated user rates, the County would have a good chance of obtaining funds through RD or Intercap. The County’s preferred funding package and that recommended by this PER includes:

- $1,051,000 RD Loan or
- $1,051,000 Intercap Loan

Consideration of the two funding strategies are depicted in Table 8.1, along with the resulting user rates.

Table 8-1 - Funding Options

ITEM	SCENARIO #1	SCENARIO #2
	RD Loan (4.25% / 20 yrs)	Intercap Loan (3.37%/15 years)
Load Consolidation Equipment	$257,000	$257,000
New Container Site	$794,000	$794,000
Funding Application	$5,000	1,000
Environmental Report	$5,000	$0
Loan Administration	$20,000	$10,000
Interim Interest	$7,000	$0
Bond Counsel	$15,000	$0
Rounded Total	$1,103,000	$1,062,000
Intercap Loan		$1,062,000
RD Loan	$1,103,000	
Total Project Funds	$1,103,000	$1,062,000
Total Loan Amount	$1,103,000	$1,062,000
Annual Debt Service	$82,900	$91,300
Loan Coverage	$8,300	$0
Total Annual Loan Payment	$91,200	$91,300
Total Payments over Life of Loan (Includes Coverage)	$1,824,000	$1,369,500
Total Interest Paid Over Life of Loan	$555,000	$307,500
TOTAL ANNUAL CAPITAL DEBT SERVICE COST	$91,200	$91,300
Current Annual O&M [1]	$870,000	$870,000
Current Annual Debt Service	$0	$0
Additional O&M Due To Project	-$22,300	-$22,300
TOTAL ANNUAL O&M COSTS	$846,800	$846,800
TOTAL ANNUAL COSTS	$938,000	$938,100
CURRENT SPECIAL REVENUE	$70,000	$70,000
NEEDED ASSESSMENT REVENUE	$868,000	$868,100
USER COST/YEAR FOR PROJECT [2]	$140.00	$140.00
Existing Average User Cost/Year/EDU	$129.69	$129.69
COST/MONTH INCREASE/EDU	$10.30	$10.30
Solid Waste Target Rate	$182.53	$182.53
PERCENT OF COMBINED TARGET RATE	77%	77%

[1] Based on FY 2017/2018 actual expenses.

[2] Table is based on an estimated 6,220 EDU's

Using the preferred Scenario #2 as a basis, a detailed project budget is presented in Table 8.2, which provides a breakdown of each of the line item costs by funding source.

Table 8-2 - Project Budget

Administrative/Finance Costs	Source: Intercap Loan	Source:	Total
Office Costs/Admin			
Professional Services	$11,000.00		$ 11,000.00
Legal Costs			
Audit Fees			
Travel & Training			
Interim Interest			$
Bond Counsel & Related costs			
TOTAL ADMIN COSTS:	$11,000.00	$ -	
Activity Costs:	**Source: RD or Intercap Loan**	**Source:**	**Total**
Engineering Design	$ 80,000.00		
Construction Management & Resident Project Representative	$58,000.00		
Construction	$826,000.00		
Contingency	$87,000		
TOTAL ACTIVITY COSTS	$1,051,000	$ -	
TOTAL COSTS	$1,062,000		

8.2 Implementation

Prior to implementation of the project, all funding must be in place. As noted earlier, the proposed funding package for the Jefferson County project involves RD or Intercap loan funding. RD and Intercap funds are available on an open cycle and do not have a strict deadline.

The implementation schedule anticipates that the project will be complete by June 2020. Upon securing all funding, the project start-up for the loan programs is expected to be about a two-month process. It is anticipated that final design would be completed and bidding could take place in March 2020. Commencement of construction activities is anticipated to start in April 2020. Table 8-3 provides a summary of the Project Implementation Schedule.

Table 8-3 - Project Implementation Schedule

Action	Date
Public Hearings on Draft PER & EA	
Draft PER Complete	March, 2019
County Resolutions for PER adoption and applications	April, 2019
Prepare Final PER	April, 2019
Apply for Intercap Loan	May 2019
Finalize Loan Financing	August, 2019
Begin Design	August, 2019
Design Basis Report/Cost Estimates to the County	September, 2019
Finalize Design	November, 2019
Advertise for Bids	March, 2020
Start Construction	April, 2020
Complete Construction	June, 2020

9.0 REFERENCES

U.S. Department of Commerce, US Census Bureau

http://www.census.gov/quickfacts/table/PST045215/30089

Western Rural Development Center

https://wrdc.usu.edu/files/uploads/Regional%20Data/MT/Jefferson_Montana_CountyData.pdf

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture, Web Soil Survey, http://websoilsurvey.nrcs.usda.gov/app

Montana Bureau of Mines and Geology, Montana Tech of The University of Montana, Groundwater Information Center 2010, http://mbmggwic.mtech.edu/

United States Department of Agriculture, http://www.usda.gov/wps/portal/usdahome

mt.gov, Natural Resources Information System, Montana Geographic Information Clearinghouse, http://nris.state.mt.us/gis/

U.S. Fish and Wildlife Service, National Wetlands Inventory, http://www.fws.gov/wetlands/

Montana Department of Commerce, Census and Economic Information Center, http://ceic.mt.gov/

National Oceanic and Atmospheric Administration (NOAA) Western Regional Climate Center, Historical Climate Information, http://www.wrcc.dri.edu/NEWWEB.html

Appendix A

Trucking Data

DOT HS 812 150

NHTSA
www.nhtsa.gov

Key Findings

- In 2013, there were 3,964 people killed in crashes involving large trucks, only a half-percent-increase from 2012.
- An estimated 95,000 people were injured in crashes involving large trucks in 2013—a decrease of 9 percent from an estimated 104,000 in 2012.
- In 2013, seventy-one percent of people killed in large-truck crashes were occupants of the other vehicles.
- Seventy-nine percent of the fatal crashes involving large trucks in 2013 occurred on weekdays.
- Two percent of the large-truck drivers involved in fatal crashes in 2013 had blood alcohol concentrations (BACs) of .08 g/dL or higher.
- In 2013, drivers of large trucks in fatal crashes were less likely to have previous license suspensions or revocations than were passenger car drivers.
- Large-truck drivers in 2013 had the highest percentage (15%) of previously recorded crashes compared to drivers of other vehicle types (motorcycles, 12.9%; passenger cars, 12.8%; and light trucks, 12.4%).

U.S. Department of Transportation
National Highway Traffic Safety dministration
1200 New Jersey Avenue SE.
Washington, DC 20590

Large Trucks

A large truck, as defined in this fact sheet, is any vehicle with a gross vehicle weight rating greater than 10,000 pounds.

In this fact sheet, the 2013 large-truck information is presented in the following order.

- Overview
- Crash Characteristics
- Large-Truck Drivers
- States

Overview

Table 1 provides an overview of people killed or injured in crashes involving large trucks in 2012 and 2013.

In 2013, there were 3,964 people killed and an estimated 95,000 people injured in crashes involving large trucks. In the United States, an estimated 342,000 large trucks were involved in police-reported traffic crashes during 2013. The majority of the 2013 percentages show minimal change when compared to 2012.

Fatalities in crashes involving large trucks remained relatively level with only a half-percent increase from 3,944 in 2012 to 3,964 in 2013. Of the fatalities in 2013:

- 71 percent were occupants of other vehicles,
- 17 percent were occupants of large trucks, and
- 11 percent were nonoccupants.

From 2012 to 2013 there was a 13-percent increase in the number of nonoccupants killed.

In 2013, there were an estimated 95,000 people injured in crashes involving large trucks—a decrease of 9 percent from an estimated 104,000 in 2012. Of the people injured in 2013:

- 72 percent were occupants of other vehicles,
- 25 percent were occupants of large trucks, and
- 2 percent were nonoccupants.

From 2012 to 2013 there was a 9-percent decrease in the number of occupants of other vehicles injured.

Table 1
People Killed or Injured in Crashes Involving Large Trucks, 2012 and 2013

People Killed	2012		2013	
	Number	Percentage of Total	Number	Percentage of Total
Occupants of Large Trucks	697	18%	691	17%
— Single-Vehicle Crashes	*423*	*11%*	*427*	*11%*
— Multiple-Vehicle Crashes	*274*	*7%*	*264*	*7%*
Occupants of Other Vehicles in Crashes Involving Large Trucks	2,857	72%	2,834	71%
Nonoccupants (Pedestrians, Pedalcyclists, etc.)	390	10%	439	11%
Total	**3,944**	**100%**	**3,964**	**100%**
People Injured	**Number**	**Percentage of Total**	**Number**	**Percentage of Total**
Occupants of Large Trucks	25,000	24%	24,000	25%
— Single-Vehicle Crashes	*9,000*	*9%*	*9,000*	*9%*
— Multiple-Vehicle Crashes	*17,000*	*16%*	*15,000*	*16%*
Occupants of Other Vehicles in Crashes Involving Large Trucks	76,000	73%	69,000	72%
Nonoccupants (Pedestrians, Pedalcyclists, etc.)	3,000	3%	2,000	2%
Total	**104,000**	**100%**	**95,000**	**100%**

Note: Injury totals may not equal the sum of components due to independent rounding.
Sources: 2013 Fatality Analysis Reporting System (FARS) Annual Report File (ARF), 2012 FARS Final File
2013 National Automotive Sampling System (NASS) General Estimates System (GES)

In 2013, large trucks accounted for 4 percent of all registered vehicles and 9 percent of the total vehicle miles traveled. Passenger vehicles (passenger cars, SUVs, pickup trucks, and vans) accounted for 93 percent of all registered vehicles and 90 percent of the total vehicle miles traveled. In 2013, large trucks accounted for 9 percent of all vehicles involved in fatal crashes and 3 percent of all vehicles involved in injury and property-damage-only crashes.

Table 2 summarizes the number of large trucks involved in fatal and injury crashes, the number of registered large trucks, involvement rates for every 100,000 registered large trucks, large-truck miles traveled, and the involvement rates for every 100 million large-truck miles traveled from 2004 to 2013.

Table 2
Large-Truck Involvement in Fatal and Injury Crashes and Involvement Rates, 2004–2013

Year	Number of Large Trucks Involved in Fatal Crashes	Number of Large Trucks Registered	Involvement Rate per 100,000 Registered Large Trucks	Large-Truck Miles Traveled (millions)	Involvement Rate per 100 million Large-Truck-Miles Traveled
2004	4,902	8,171,364	59.99	220,811	2.22
2005	4,951	8,481,999	58.37	222,523	2.22
2006	4,766	8,819,007	54.04	222,513	2.14
2007	4,633	10,752,019	43.09	304,178	1.52
2008	4,089	10,873,275	37.61	310,680	1.32
2009	3,211	10,973,214	29.26	288,306	1.11
2010	3,494	10,770,054	32.44	286,527	1.22
2011	3,633	10,270,693	35.37	267,207	1.36
2012	3,825	10,659,380	35.88	269,207	1.42
2013	3,906	10,597,356	36.86	275,018	1.42 Fatality
Year	**Number of Large Trucks Involved in Injury Crashes**	**Number of Large Trucks Registered**	**Involvement Rate per 100,000 Registered Large Trucks**	**Large-Truck Miles Traveled (millions)**	**Involvement Rate per 100 million Large-Truck Miles Traveled**
2004	87,000	8,171,364	1,062	220,811	39
2005	82,000	8,481,999	971	222,523	37
2006	80,000	8,819,007	911	222,513	36
2007	76,000	10,752,019	705	304,178	25
2008	66,000	10,873,275	608	310,680	21
2009	53,000	10,973,214	487	288,306	19
2010	58,000	10,770,054	541	286,527	20
2011	63,000	10,270,693	609	267,207	23
2012	77,000	10,659,380	719	269,207	28
2013	73,000	10,597,356	690	275,018	27 Injury

Note: In 2011, the Federal Highway Administration implemented an enhanced methodology for estimating registered vehicles and vehicle miles traveled by vehicle type. These revisions were applied to data after 2006. In some cases the changes were significant and should be taken into account when comparing registered vehicle counts and/or vehicle miles traveled for 2006 and earlier years with the numbers for 2007 and later years.
Sources: 2004-2012 FARS Final File, 2013 FARS ARF, 2004-2013 NASS GES, Vehicle miles traveled and registered vehicles – Federal Highway Administration.

Crash Characteristics

In 2013, large trucks were more likely to be involved in fatal multiple-vehicle crashes as opposed to fatal single-vehicle crashes than were passenger vehicles (80% of fatal crashes involving large trucks are multiple-vehicle crashes, compared with 58% for fatal crashes involving passenger vehicles).

In 47 percent of the two-vehicle fatal crashes, both the large trucks and the other vehicles were proceeding straight at the time of the crashes. In 10 percent of the crashes, the other vehicles were turning left or right. In 10 percent the trucks and the other vehicles were negotiating curves. In 7 percent of fatal crashes, either the trucks or the other vehicles were stopped or parked in traffic lanes (5% and 2%, respectively).

Table 3 presents percentages of two-vehicle fatal crashes involving large trucks by initial impact point of the large truck and the other vehicle in 2013. Both vehicles were struck in the front 31 percent of the time. The trucks were struck in the rear almost three times as often as the other vehicles (20% and 7%, respectively).

Table 3
Percentage of Two-Vehicle Fatal Crashes Involving Large Trucks, by Initial Impact Point of the Large Trucks and Other Vehicles, 2013

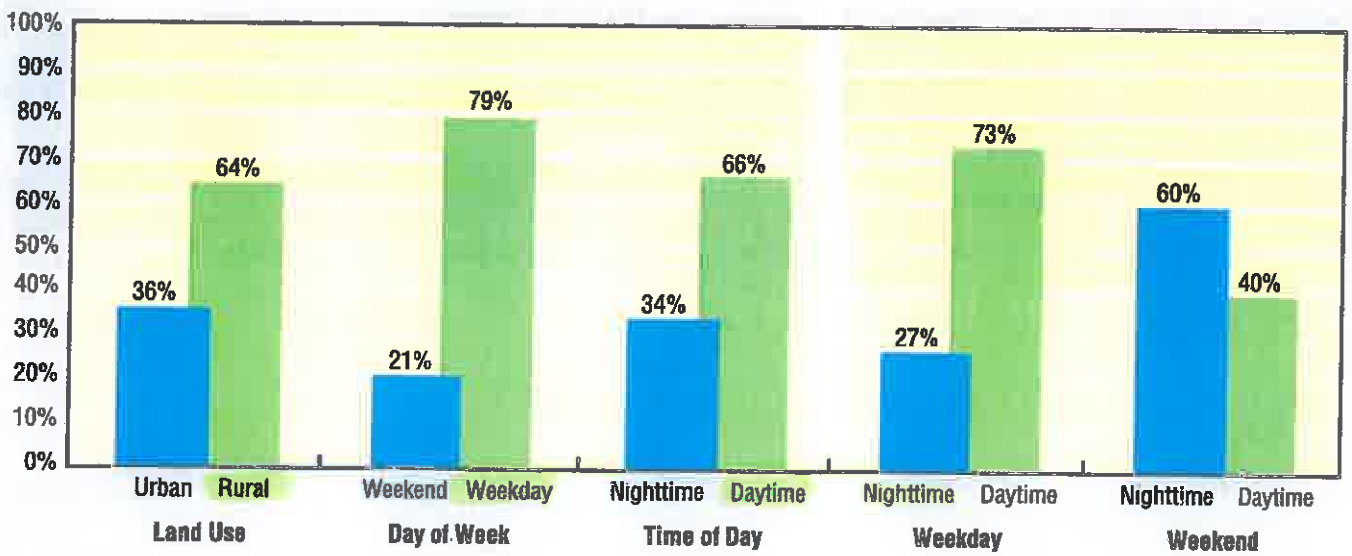
Impact Point on Large Truck	Impact Point on Other Vehicle				
	Front	Left Side	Right Side	Rear	Total
Front	31%	15%	11%	6%	64%
Left Side	9%	1%	1%	0%	11%
Right Side	5%	0%	0%	0%	6%
Rear	19%	0%	0%	0%	20%
Total	**64%**	**17%**	**13%**	**7%**	**100%**

Note: Totals may not equal the sum of components due to independent rounding.
Source: 2013 FARS ARF

Figure 1 shows the percentages of fatal crashes involving large trucks by land use (urban/rural), day of the week (weekday/weekend), and time of day (nighttime/daytime) in 2013.

- Sixty-four percent of the fatal crashes involving large trucks occurred in rural areas.
- Seventy-nine percent of the fatal crashes involving large trucks occurred on weekdays.
- Of those weekday large-truck fatal crashes, 73 percent occurred during the daytime hours of 6 a.m. to 5:59 p.m.

Figure 1
Percentage of Fatal Crashes Involving Large Trucks, by Land Use, Day of Week, Time of Day, Time of Day (Weekday), and Time of Day (Weekend), 2013



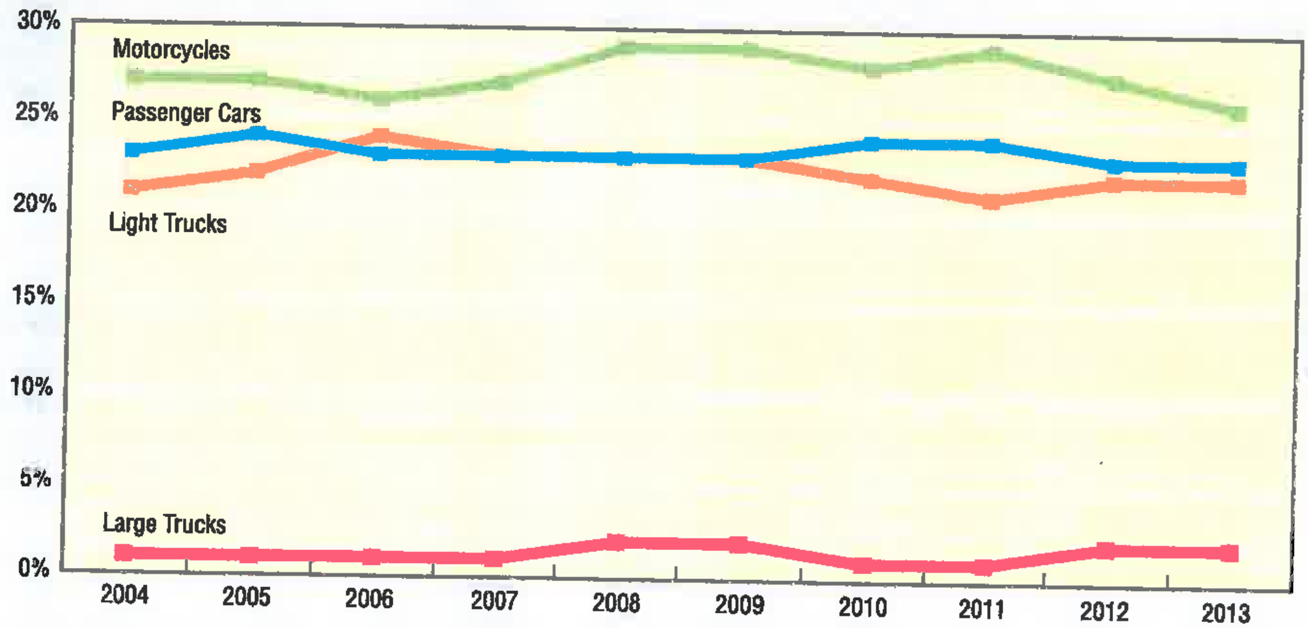
Note: Unknowns were removed before calculating percentages.
Weekday: 6 a.m. Monday to 5:59 p.m. Friday
Weekend: 6 p.m. Friday to 5:59 a.m. Monday
Daytime: 6 a.m. to 5:59 p.m. Nighttime: 6 p.m. to 5:59 a.m.
Source: 2013 FARS ARF

Large-Truck Drivers

The percentage of large-truck drivers involved in fatal crashes who had BACs of .08 g/dL or higher was 2 percent in 2013. For drivers of other types of vehicles involved in fatal crashes in 2013, the percentages of drivers with BACs of .08 g/dL or higher were 23 percent for passenger cars, 21 percent for light trucks, and 27 percent for motorcycles.

Figure 2 displays the 10-year proportions of drivers in fatal crashes with BACs of .08 g/dL or higher by vehicle types (large trucks, passenger cars, light trucks, and motorcycles).

Figure 2
Estimated Proportions of Drivers in Fatal Crashes With BACs .08 g/dL or Higher, 2004–2013

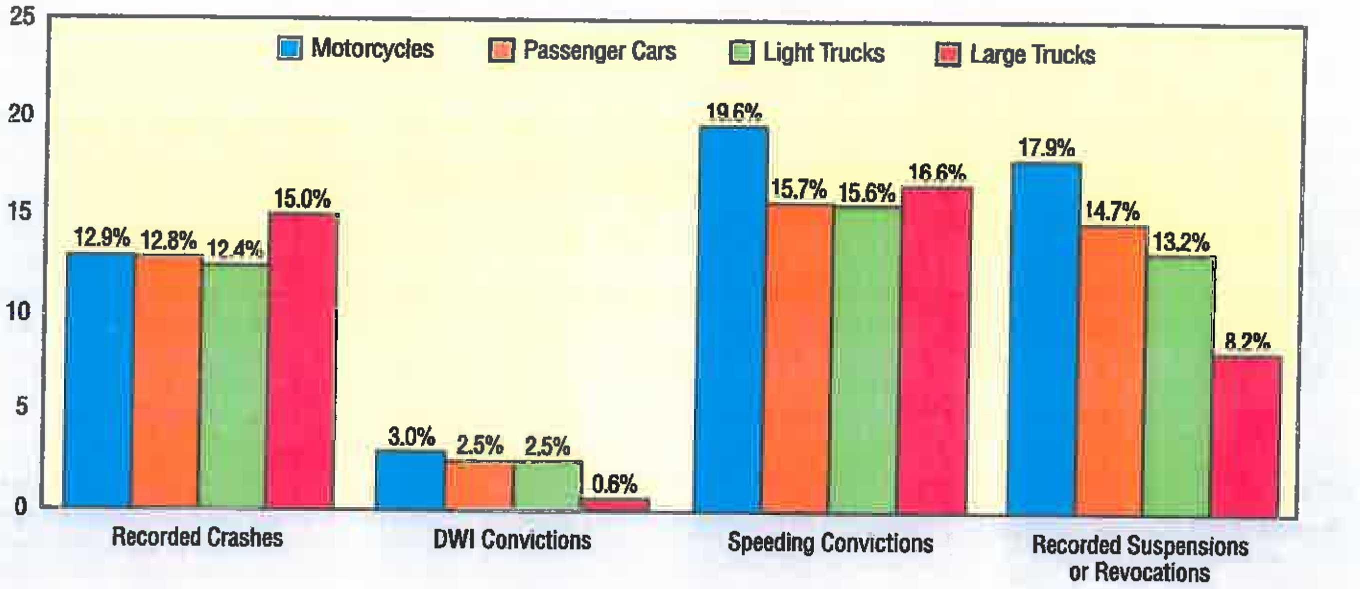


Source: 2004-2012 FARS Final File, 2013 FARS ARF

Figure 3 presents the percentages of drivers involved in fatal crashes with previous driving records (recorded crashes, driving while intoxicated (DWI) convictions, speeding convictions, and recorded suspensions or revocations) by vehicle types (motorcycles, passenger cars, light trucks, and large trucks) in 2013.

- Large-truck drivers have the highest percentage (15%) of previously recorded crashes compared to drivers of other vehicle types (motorcycles, 12.9%; passenger cars, 12.8%; and light trucks, 12.4%).
- Nearly 17 percent of all large-truck drivers involved in fatal crashes had at least one prior speeding conviction, compared to almost 16 percent of passenger car drivers involved in fatal crashes.
- Drivers of large trucks in fatal crashes were less likely to have previous license suspensions or revocations than were passenger car drivers (8.2% and 14.7%, respectively).

Figure 3
Previous Driving Records of Drivers Involved in Fatal Traffic Crashes, by Vehicle Type, 2013



Note: Excludes all drivers with previous records that were unknown.
Source: 2013 FARS ARF

States

For each of the 50 States, District of Columbia, and Puerto Rico in 2013, Table 4 presents the large-truck involvement in fatal crashes. Puerto Rico is not included in the overall U.S. total.

- The national average for large-truck involvement was 8.7 percent.
- The percentage of involvement in the States ranged from 5.1 percent in Connecticut to 29.8 percent in North Dakota.
- In 17 States, large-truck involvement was higher than 10 percent.
- Texas had the highest number of large trucks involved in fatal crashes at 493.

Table 5 presents an overview of the people killed in large-truck crashes by each of the 50 States, District of Columbia, Puerto Rico, and by the person type in 2013. Puerto Rico is not included in the overall U.S. total.

- The number of occupants of other vehicles killed range from 1 in Hawaii to 381 in Texas. Seven States each had more than 100 occupants of other vehicles killed in large-truck crashes.
- The highest number of occupants of large trucks killed was 111 in Texas. The second highest was 33 in California.

Table 4
Large-Truck Involvement in Fatal Crashes, by State, 2013

State	Total Vehicles Involved in Fatal Crashes	Large Trucks Involved in Fatal Crashes		
		Number	Percentage of Total Vehicles	Percentage of U.S. Total for Large Trucks
Alabama	1,116	107	9.6%	2.7%
Alaska	67	4	6.0%	0.1%
Arizona	1,173	69	5.9%	1.8%
Arkansas	638	86	13.5%	2.2%
California	4,125	249	6.0%	6.4%
Colorado	630	51	8.1%	1.3%
Connecticut	375	19	5.1%	0.5%
Delaware	150	10	6.7%	0.3%
Dist of Columbia	31	3	9.7%	0.1%
Florida	3,358	187	5.6%	4.8%
Georgia	1,636	157	9.6%	4.0%
Hawaii	123	7	5.7%	0.2%
Idaho	277	32	11.6%	0.8%
Illinois	1,353	136	10.1%	3.5%
Indiana	1,093	115	10.5%	2.9%
Iowa	434	59	13.6%	1.5%
Kansas	473	66	14.0%	1.7%
Kentucky	880	71	8.1%	1.8%
Louisiana	969	74	7.6%	1.9%
Maine	189	16	8.5%	0.4%
Maryland	648	61	9.4%	1.6%
Massachusetts	417	29	7.0%	0.7%
Michigan	1,363	88	6.5%	2.3%
Minnesota	563	74	13.1%	1.9%
Mississippi	781	57	7.3%	1.5%
Missouri	1,002	77	7.7%	2.0%
Montana	266	19	7.1%	0.5%
Nebraska	279	27	9.7%	0.7%
Nevada	372	24	6.5%	0.6%
New Hampshire	168	11	6.5%	0.3%
New Jersey	750	64	8.5%	1.6%
New Mexico	389	55	14.1%	1.4%
New York	1,579	114	7.2%	2.9%
North Carolina	1,756	125	7.1%	3.2%
North Dakota	215	64	29.8%	1.6%
Ohio	1,485	151	10.2%	3.9%
Oklahoma	972	116	11.9%	3.0%
Oregon	421	34	8.1%	0.9%
Pennsylvania	1,694	170	10.0%	4.4%
Rhode Island	83	5	6.0%	0.1%
South Carolina	1,030	67	6.5%	1.7%
South Dakota	184	18	9.8%	0.5%
Tennessee	1,400	121	8.6%	3.1%
Texas	4,651	493	10.6%	12.6%
Utah	289	21	7.3%	0.5%
Vermont	89	7	7.9%	0.2%
Virginia	1,001	100	10.0%	2.6%
Washington	593	38	6.4%	1.0%
West Virginia	431	48	11.1%	1.2%
Wisconsin	801	85	10.6%	2.2%
Wyoming	106	25	23.6%	0.6%
U.S. Total	**44,868**	**3,906**	**8.7%**	**100%**
Puerto Rico	430	20	4.7%	100%

Note: Percentage of U.S. total for large trucks may not equal the sum of components due to independent rounding.
Source: 2013 FARS ARF

Table 5

Fatalities in Motor Vehicle Traffic Crashes Involving Large Trucks, by State and Person Type, 2013

State	Truck Occupants by Crash Type			Other People			Total
	Single Vehicle	Multiple Vehicle	Total	Occupant of Other Vehicle	Nonoccupant	Total	
Alabama	20	5	25	80	4	84	109
Alaska	0	2	2	2	0	2	4
Arizona	5	6	11	38	14	52	63
Arkansas	13	3	16	57	10	67	83
California	19	14	33	157	53	210	243
Colorado	10	1	11	36	9	45	56
Connecticut	2	0	2	15	2	17	19
Delaware	2	0	2	6	2	8	10
Dist of Columbia	1	0	1	2	0	2	3
Florida	12	13	25	141	31	172	197
Georgia	16	10	26	119	18	137	163
Hawaii	3	0	3	1	3	4	7
Idaho	6	0	6	25	4	29	35
Illinois	6	11	17	110	15	125	142
Indiana	12	4	16	91	9	100	116
Iowa	7	3	10	47	4	51	61
Kansas	11	1	12	55	1	56	68
Kentucky	9	1	10	64	4	68	78
Louisiana	10	3	13	63	8	71	84
Maine	0	0	0	15	3	18	18
Maryland	3	2	5	49	5	54	59
Massachusetts	4	0	4	18	8	26	30
Michigan	2	5	7	75	6	81	88
Minnesota	6	4	10	63	2	65	75
Mississippi	12	5	17	42	4	46	63
Missouri	16	3	19	60	6	66	85
Montana	2	0	2	14	4	18	20
Nebraska	5	1	6	20	3	23	29
Nevada	1	3	4	11	3	14	18
New Hampshire	1	0	1	10	2	12	13
New Jersey	3	6	9	42	9	51	60
New Mexico	7	9	16	29	9	38	54
New York	6	10	16	66	36	102	118
North Carolina	12	4	16	102	20	122	138
North Dakota	11	9	20	42	1	43	63
Ohio	14	13	27	97	7	104	131
Oklahoma	15	14	29	72	11	83	112
Oregon	5	0	5	24	4	28	33
Pennsylvania	15	16	31	110	14	124	155
Rhode Island	0	0	0	3	2	5	5
South Carolina	6	4	10	49	6	55	65
South Dakota	1	1	2	16	0	16	18
Tennessee	8	11	19	92	15	107	126
Texas	69	42	111	381	44	425	536
Utah	4	1	5	11	4	15	20
Vermont	1	0	1	7	0	7	8
Virginia	14	10	24	61	4	65	89
Washington	2	3	5	30	5	35	40
West Virginia	8	1	9	31	6	37	46
Wisconsin	7	6	13	65	5	70	83
Wyoming	3	4	7	18	0	18	25
National	**427**	**264**	**691**	**2,834**	**439**	**3,273**	**3,964**
Puerto Rico	3	2	5	8	5	13	18

Source: 2013 FARS ARF

This fact sheet contains information on motor vehicle fatalities and fatal crashes, based on data from the Fatality Analysis Reporting System (FARS). FARS is a census of fatal crashes within the 50 States, the District of Columbia, and Puerto Rico (although Puerto Rico is not included in U.S. totals). Crash and injury statistics are based on data from the National Automotive Sampling System (NASS) General Estimates System (GES). The NASS GES is a probability-based sample of police-reported crashes, from 60 locations across the country, from which estimates of national totals for injury and property-damage-only crashes are derived.

The suggested APA format citation for this document is:

National Center for Statistics and Analysis. (2015, Revised June). Large trucks: 2013 data. (Traffic Safety Facts. DOT HS 812 150). Washington, DC: National Highway Traffic Safety Administration.

For more information

Information on traffic fatalities is available from the National Center for Statistics and Analysis (NCSA), NVS-424, 1200 New Jersey Avenue SE., Washington, DC 20590. NCSA can be contacted at 800-934-8517 or by e-mail at ncsaweb@dot.gov. General information on highway traffic safety can found at www.nhtsa.gov/NCSA. To report a safety-related problem or to inquire about motor vehicle safety information, contact the Vehicle Safety Hotline at 888-327-4236.

Other fact sheets available from the National Center for Statistics and Analysis are *Alcohol-Impaired Driving, Bicyclists and Other Cyclists, Children, Motorcycles, Occupant Protection, Older Population, Overview, Passenger Vehicles, Pedestrians, Rural/Urban Comparisons, School Transportation-Related Crashes, Speeding, State Alcohol Estimates, State Traffic Data,* and *Young Drivers.* Detailed data on motor vehicle traffic crashes are published annually in *Traffic Safety Facts: A Compilation of Motor Vehicle Crash Data from the Fatality Analysis Reporting System and the General Estimates System.* The fact sheets and annual Traffic Safety Facts reports can found at www-nrd.nhtsa.dot.gov/CATS/index.aspx.

U.S. Department of Transportation
National Highway Traffic Safety Administration

TIGER BENEFIT-COST ANALYSIS (BCA) RESOURCE GUIDE

How to Use This Guide

This BCA Resource Guide is a supplement to the *2014 Benefit-Cost Analysis Guidance for Tiger Grant Applicants* also found on this site (http://www.dot.gov/tiger/guidance). It provides technical information that Applicants will need for monetizing benefits and costs in their Benefit-Cost Analyses, as well as guidance on methodology and a selection of frequently asked questions from past TIGER grant applicants.
This guide is divided into three sections:

I. **Recommended Monetized Values**
For the purposes of providing as fair an "apples-to-apples" comparison as possible, applicants should use standard monetization values recommended in this section, which represent some of the values that are accepted for common practice at the U.S. Department of Transportation.

II. **Technical Methodologies**
This section provides guidance on the technical details of monetizing carbon dioxide (CO_2) emissions costs according to the Social Cost of Carbon standard developed by Federal agencies, converting nominal dollars into real dollars, and calculating the value of fatalities and injuries from vehicular crashes.

III. **Frequently Asked Questions (FAQs)**
This section provides answers to frequently asked questions from past TIGER applicants, with topics ranging from the logistical to the technical.

Updates to this document will be dated accordingly (with the nature of the updates noted on this cover page) and posted to the TIGER Discretionary Grants website (http://www.dot.gov/tiger).

Updated 4/18/14

I. Recommended Monetized Values

Each project generates unique impacts in its respective community, and the TIGER Evaluation process respects these differences, particularly within the context of benefit-cost analysis. While the impacts may differ from place to place, the Department does recognize certain monetized values (and monetizing methodologies) as standard, such that various projects from across the country may be evaluated on a more equivalent "apples-to-apples" basis of comparison. The following table summarizes key values for various types of benefits and costs that the Department recommends that applicants use in their benefit-cost analyses. However, benefits and costs for any reliable analysis are not limited only to this table. The applicant should provide documentation of sources and detailed calculations for monetized values of additional categories of benefits and costs. Similarly, applicants using different values for the benefit/cost categories presented below below should provide sources, calculations, and rationale for divergence from recommended values.

Table 1. Recommended Monetized Values

Cost/Benefit Category	Recommended Monetized Value(s)	Reference and Notes
Value of Statistical Life (VSL)	$9,200,000 per fatality ($2013)	*Guidance on Treatment of the Economic Value of a Statistical Life in U.S. Department of Transportation Analyses (2014)* http://www.dot.gov/office-policy/transportation-policy/guidance-treatment-economic-value-statistical-life

<table>
<tr><th>Cost/Benefit Category</th><th>Recommended Monetized Value(s)</th><th>Reference and Notes</th></tr>
<tr><td>Value of Injuries</td><td>
<table>
<tr><th>AIS Level</th><th>Severity</th><th>Fraction of VSL</th><th>Unit value ($2013)</th></tr>
<tr><td>AIS 1</td><td>Minor</td><td>0.003</td><td>$ 27,600</td></tr>
<tr><td>AIS 2</td><td>Moderate</td><td>0.047</td><td>$ 432,400</td></tr>
<tr><td>AIS 3</td><td>Serious</td><td>0.105</td><td>$ 966,000</td></tr>
<tr><td>AIS 4</td><td>Severe</td><td>0.266</td><td>$ 2,447,200</td></tr>
<tr><td>AIS 5</td><td>Critical</td><td>0.593</td><td>$ 5,455,600</td></tr>
<tr><td>AIS 6</td><td>Unsurvivable</td><td>1.000</td><td>$ 9,200,000</td></tr>
</table>
</td><td>Guidance on Treatment of the Economic Value of a Statistical Life in U.S. Department of Transportation Analyses (2014)

http://www.dot.gov/office-policy/transportation-policy/guidance-treatment-economic-value-statistical-life

NOTE:
Accident data (particularly those provided through law enforcement records) are typically reported as a single number (e.g. "X number of crashes in Year Y") and/or on the KABCO scale of crash severity. Applicants should convert these values to the AIS scale before applying the recommended monetized values. See Part II Section 3 ("Converting Available Accident Data into AIS Data").</td></tr>
</table>

Cost/Benefit Category	Recommended Monetized Value(s)	Reference and Notes
Property Damage Only (PDO) Crashes	$3,927 per vehicle ($2013)	*The Economic and Societal Impact of Motor Vehicle Crashes, 2010 (forthcoming April 2014)* **NOTE:** Basis is PDO value of $3,682 ($2010) per vehicle involved in a PDO crash is an updated value currently used by NHTSA and based on the methodology and original 2000 dollar value referenced in *The Economic and Societal Impact of Motor Vehicle Crashes, 2010*, Page 12, Table 2, Summary of Unit Costs, 2000". Also, while the cost of PDO crashes is presented here in 2010 dollars, applicants should convert this value (along with other monetized values presented in this section) to dollars applicable to whatever base year you are using, using the methodology discussed below in **Part II, Section 2 ("Converting Nominal Dollars into Real (Constant) Dollars")**. The Resource Guide converted this value into 2013 dollars.

Cost/Benefit Category	Recommended Monetized Value(s)	Reference and Notes
Value of Travel Time	(see table and notes below)	*Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis (Revision 2 – corrected)* http://www.dot.gov/office-policy/transportation-policy/guidance-value-time

Recommended Hourly Values of Travel Time Savings (2013 U.S. $ per person-hour)

Category	Surface Modes* (except High-Speed Rail)	Air and High-Speed Rail Travel
Local Travel		
Personal	$12.42	
Business	$25.23	
All Purposes **	$12.98	
Intercity Travel		
Personal	$17.39	$33.05
Business	$24.44	$60.74
All Purposes **	$18.90	$44.24

Truck Drivers	$25.75
Bus Drivers	$26.69
Transit Rail Operators	$45.77
Locomotive Engineers	$38.14
Airline Pilots and Engineers	$83.32

* Surface figures apply to all combinations of in-vehicle and other transit time. Walk access, waiting, and transfer time in personal travel should be valued at $24.85 per hour for personal travel when actions affect only those elements of travel time.

** These are weighted averages, using distributions of travel by trip purpose on various modes. Distribution for local travel by surface modes: 95.4% personal, 4.6% business. Distribution for intercity travel by conventional surface modes: 78.6% personal, 21.4% business. Distribution for intercity travel by air or high-speed rail: 59.6% personal, 40.4% business. Surface figures derived using annual person-miles of travel (PMT) data from the 2001 National Household Travel Survey. http://nhts.ornl.gov/. Air figures use person-trip data.

<table>
<tr><th>Cost/Benefit Category</th><th>Recommended Monetized Value(s)</th><th>Reference and Notes</th></tr>
<tr>
<td>Value of Emissions</td>
<td>
<table>
<tr><th>Emission Type</th><th>$ / short ton ($2013)</th><th>$ / metric ton ($2013)</th></tr>
<tr><td>Carbon dioxide (CO_2)</td><td>(varies)*</td><td>(varies)*</td></tr>
<tr><td>Volatile Organic Compounds (VOCs)</td><td>$1,813</td><td>$1,999</td></tr>
<tr><td>Nitrogen oxides (NOx)</td><td>$7,147</td><td>$7,877</td></tr>
<tr><td>Particulate matter (PM)</td><td>$326,935</td><td>$360,383</td></tr>
<tr><td>Sulfur dioxide (SOx)</td><td>$42,240</td><td>$46,561</td></tr>
</table>
* See "Social Cost of Carbon (3%)" values below.
</td>
<td>Corporate Average Fuel Economy for MY2017-MY2025 Passenger Cars and Light Trucks (August 2012), page 922, Table VIII-16, "Economic Values Used for Benefits Computations (2010 dollars)" http://www.nhtsa.gov/staticfiles/rulemaking/pdf/cafe/FRIA_2017-2025.pdf

The Resource Guide converts these values into 2013 dollars.

NOTE:
Emissions units are frequently reported as "tons" throughout documents such as the CAFE rulemaking referenced above. There is a distinction between short tons, long tons, and metric tons, however. Carbon dioxide emissions (as reported in the SCC guidance and elsewhere) are typically reported in metric tons, whereas emissions for VOCs, NOx, PMs, and SOx are measured in short tons. The English "long ton" is not used in these tabulations. A short ton is 2000 lbs., while a metric ton is approximately 2,205 lbs., and a long ton is 2,240 lbs.</td>
</tr>
</table>

Cost/Benefit Category	Recommended Monetized Value(s)	Reference and Notes
Social Cost of Carbon (3%)	See tables below	*Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866* (May 2013; revised November 2013), page 18, Table A1 "Annual SCC Values: 2010-2050 (2007$/metric ton CO_2)" http://www.whitehouse.gov/sites/default/files/omb/assets/inforeg/technical-update-social-cost-of-carbon-for-regulator-impact-analysis.pdf **NOTE:** - The social cost of carbon as reported by the Technical Update represents the present value (discounted to the year shown) of marginal future climate damage, in five-year intervals through 2050, valued in 2007 dollars per metric ton of carbon dioxide, and discounted to the year shown at varying annual rates. The Resource Guide interpolates between the "3%" values shown in the Technical Update to create an annual series, converts it into 2013 dollars using the GDP deflator, and rounds to the nearest dollar. - See **Part II, Section 1 ("Clarification on the Social Cost of Carbon (SCC) Guidance and the Annual SCC Values")**, for methodology of how to use 3% SCC values in TIGER BCA.

Year	3% SCC (2013$)
2010	36
2011	37
2012	38
2013	39
2014	40
2015	42
2016	43
2017	44
2018	45
2019	46
2020	47
2021	48
2022	49
2023	50
2024	51
2025	53
2026	53
2027	54
2028	55
2029	56
2030	57

Year	3% SCC (2013$)
2031	58
2032	59
2033	60
2034	61
2035	62
2036	63
2037	65
2038	66
2039	67
2040	68
2041	69
2042	70
2043	70
2044	71
2045	72
2046	73
2047	74
2048	76
2049	77
2050	78

II. Technical Methodologies

1. Clarification on the *Social Cost of Carbon* (SCC) Guidance and the Annual SCC Values

As noted in the recommended emissions values from Section I, there is no longer a fixed unit cost to carbon dioxide (CO_2) emissions. The Federal interagency Social Cost of Carbon (SCC) guidance states that the value of carbon dioxide emissions changes over time and should be discounted at the lower discount rates of 2.5%, 3%, or 5%.

However, the lack of 7% SCC values does not mean that applicants should ignore 7% discounting for the BCA. The document and its findings imply that carbon emissions are valued differently from other benefits and costs from the perspective of discount rate. Applicants should continue to calculate discounted present values for all benefits and costs (that *exclude* carbon dioxide emissions) at 7% and 3%, as recommended by OMB Circular A-94[1]. To these non-carbon NPV benefits, the Applicant should then add the corresponding net value of carbon dioxide emissions, as calculated from the 3% SCC value. The methodology for calculating this net value of carbon dioxide emissions is described below:

i. Determine your base year and the life cycle years for the project. Look up the corresponding 3% average value for each corresponding year in which the carbon dioxide emissions occur. The TIGER Program recommends the use of the 3% average values as provided in the document *Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866* (May 2013; updated November 2013)[2] on page 39 in Table A-1 "Annual SCC Values 2010-2050 (in 2007 dollars)".
   a. **Example:** Our project has base year 2014, with project life through 2020. We want to know how to value a carbon dioxide emissions reduction of 100 metric tons in 2020.
   b. **[NOTE]** The SCC values are given in 2007 dollars. We convert these to 2013 base year dollars by multiplying by the corresponding CPI ratio.

ii. Multiply the quantity of tons reduced in 2020 by the 3% SCC value in that same year.
   a. **Example:** 100 tons x $52.00= $5,200.00 benefits in 2020.

iii. Discount forward the 2020 carbon dioxide benefits *only* to the base year (2014) present value at the same SCC discount rate (3%). Recall that

$$PV = \frac{FV}{(1+i)^t}$$

Where
PV= Present discounted value of a future payment from year t
FV = Future Value of payment in year t
i = Discount rate applied
t = Years in the future for payment (where base year of analysis is $t = 0$)

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[1] White House Office of Management and Budget, Circular A-94 *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs* (October 29, 1992) (http://www.whitehouse.gov/sites/default/files/omb/assets/a94/a094.pdf).

[2] Interagency Working Group on Social Cost of Carbon, United States Government, *Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866* (May 2013; revised November 2013) http://www.whitehouse.gov/sites/default/files/omb/assets/inforeg/technical-update-social-cost-of-carbon-for-regulator-impact-analysis.pdf

a. **Example:** NPV in 2014 (for year 2020 benefits) = $5,200.00 / [(1.03)^6] = $4,354.92

iv. Add the sum of these yearly NPV SCC values to the calculated net present value of all other benefits (which will exclude carbon emissions).

   a. **Example:** Add $4,354.92 to the non-Carbon net benefits (discounted at 7% and 3%) for year 2020 to get the total NPV benefits for year 2020.

The spreadsheet on the following page demonstrates what the methodology would look like for a sample multi-year analysis.

Table 2. Sample Calculation for Applying Social Cost of Carbon to TIGER Benefit-Cost Analysis

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Year	Calendar Year	Non-CO2 Benefits (2013$)	Non-CO2 Costs (2013$)	Net non-CO2 Benefits [C+D]	7% NPV Non-CO2 Benefits [E/(1.07^A)]	3% NPV Non-CO2 Benefits [E/(1.03^A)]	CO2 Reduced (Metric Tons)	3% SCC (2013$)	Undiscounted CO2 Costs @ 3% Avg SCC [H*I]	NPV CO2 Costs @ 3% Avg SCC [J/(1.03^A)]	7% NPV Total Benefits [F+K]	3% NPV Total Benefits [G+K]
0	2014	$0	($5,000,000)	($5,000,000)	($5,000,000)	($5,000,000)	-25	$44.00	($1,100.00)	($1,100.00)	($5,001,100)	($5,001,100)
1	2015	$0	($1,500,000)	($1,500,000)	($1,401,869)	($1,456,311)	-25	$45.00	($1,125.00)	($1,092.23)	($1,402,961)	($1,457,403)
2	2016	$0	($1,500,000)	($1,500,000)	($1,310,158)	($1,413,894)	-25	$46.00	($1,150.00)	($1,083.99)	($1,311,242)	($1,414,978)
3	2017	$5,000,000	($150,000)	$4,850,000	$3,959,045	$4,438,437	100	$47.00	$4,700.00	$4,301.17	$3,963,346	$4,442,738
4	2018	$5,000,000	($150,000)	$4,850,000	$3,700,042	$4,309,162	100	$49.00	$4,900.00	$4,353.59	$3,704,396	$4,313,516
5	2019	$5,000,000	($150,000)	$4,850,000	$3,457,983	$4,183,653	100	$51.00	$5,100.00	$4,399.30	$3,462,382	$4,188,052
6	2020	$5,000,000	($150,000)	$4,850,000	$3,231,760	$4,061,799	100	$52.00	$5,200.00	$4,354.92	$3,236,115	$4,066,154
7	2021	$5,000,000	($150,000)	$4,850,000	$3,020,336	$3,943,494	100	$52.00	$5,200.00	$4,228.08	$3,024,564	$3,947,722
8	2022	$5,000,000	($150,000)	$4,850,000	$2,822,744	$3,828,635	100	$54.00	$5,400.00	$4,262.81	$2,827,007	$3,832,898
				TOTALS	$12,479,882	$16,894,975			$27,125.00	$22,623.64	$12,502,507	$16,917,599

2. Converting Nominal Dollars into Real (Constant) Dollars

In providing the recommended monetized values from Section I, this Guide provides numbers from their original source documents whenever possible. This means that the various values provided (and any other additional figures found in the general BCA literature) are monetized in several different years' dollars. However, establishing an "apples-to-apples" comparison of monetized benefits and costs requires a comparison of dollar values for a single base year. Conversion from nominal dollars into real (constant) dollars is a necessary task for Applicants. Two methods for conversion are discussed below.

GDP Price Deflators. In order to convert nominal dollars from one year to another, one can simply multiply by the ratio of annual GDP price deflators, as reported by the US Department of Commerce's Bureau of Economic Analysis.[3]

In order to convert Year Y dollars into Year Z dollars, conduct the following calculation:

(Year Z $) = (Year Y $) x [(Year Z GDP Price Deflator)/(Year Y GDP Price Deflator)]

i. **Example:** What is the 2013 real value of $1,000,000 earned in 2000 using annual GDP price deflators (2010=100)?

(2013 Real Value of $1,000,000) = ($1,000,000) x (105.315/80.911)
= $1,301,615.34

Consumer Price Index (CPI). Another similar method of converting dollars is to multiply by the ratio of annual average Consumer Price Indices (CPIs), as reported by the US Department of Labor's Bureau of Labor Statistics,[4] as in the following calculation:

(Year Z $) = (Year Y $) x [(Year Z CPI)/(Year Y CPI)]

ii. **Example:** What is the 2013 real value of $1,000,000 earned in 2000 using annual average urban CPIs?

(2013 Real Value of $1,000,000) = ($1,000,000) x (232.594/172.2)
= $1,350,720

It is worth noting that the CPI in the above example (and its corresponding hyperlink) is for urban areas only, and that BLS does provide CPI numbers for specific expenditure categories (see http://www.bls.gov/cpi/ for more comprehensive CPI data).

The differences between using the GDP price deflator and CPI are sufficiently small that either methodology is acceptable for the TIGER BCA. For the purposes of transparency, it would be useful for Applicants to note which method they used, if applicable.

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[3] https://research.stlouisfed.org/fred2/series/USAGDPDEFAISMEI

[4] U.S. Department of Labor, Bureau of Labor Statistics, Consumer Price Index – All Urban Consumers (CPI-U), U.S. City Average, All Items (http://www.bls.gov/cpi/cpid1401.pdf).

3. Converting Available Accident Data into AIS Data

As indicated by the information in Section I, this Guide recommends monetizing the value of injuries according to the maximum Abbreviated Injury Scale (AIS).[5] However, the Department does recognize that accident data that are available to Applicants may not be reported as AIS numbers. Law enforcement data may use the KABCO Scale, which is a measure of the observed severity of the victim's functional injury at the crash scene. In some cases, the Applicant may only have a single reported number of accidents on a particular project site, but have no injury and/or injury severity data for any of those accidents. With accidents reported in KABCO-scale or with unknown injury/severity information, it is necessary for the Applicant to convert the available data into AIS.

Table 3. Comparison of Injury Severity Scales (KABCO vs AIS vs Unknown)

Reported Accidents (KABCO or # Accidents Reported)	
O	No injury
C	Possible Injury
B	Non-incapacitating
A	incapacitating
K	Killed
U	Injured (Severity Unknown)
# Accidents Reported	Unknown if Injured

Reported Accidents (AIS)	
0	No injury
1	Minor
2	Moderate
3	Serious
4	Severe
5	Critical
6	Unsurvivable

The National Highway Traffic Safety Administration (NHTSA) provides a conversion matrix (Table 4) that allows KABCO-reported and generic accident data to be re-interpreted as AIS data. The premise of the matrix works in this way: it is understood that an injury observed and reported at the crash site may actually end up being more/less severe than the KABCO scale indicates. Similarly, any accident can – statistically speaking – generate a number of different injuries for the parties involved. Each column of the conversion matrix represents a probability distribution of the different AIS-level injuries that are statistically associated with a corresponding KABCO-scale injury or a generic accident.

[5] The maximum Abbreviated Injury Scale is also sometimes represented by the acronym "MAIS." For the purposes of this Guide, any reference to "MAIS" is equivalent to "AIS".

Table 4. KABCO/Unknown – AIS Data Conversion Matrix

(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)
		O *No injury*	C *Possible Injury*	B *Non-incapacitating*	A *Incapacitating*	K *Killed*	U *Injured Severity Unknown*	**# Non-fatal Accidents** *Unknown if Injured*
AIS	0	0.92534	0.23437	0.08347	0.03437	0.00000	0.21538	0.43676
	1	0.07257	0.68946	0.76843	0.55449	0.00000	0.62728	0.41739
	2	0.00198	0.06391	0.10898	0.20908	0.00000	0.10400	0.08872
	3	0.00008	0.01071	0.03191	0.14437	0.00000	0.03858	0.04817
	4	0.00000	0.00142	0.00620	0.03986	0.00000	0.00442	0.00617
	5	0.00003	0.00013	0.00101	0.01783	0.00000	0.01034	0.00279
	Fatality	0.00000	0.00000	0.00000	0.00000	1.00000	0.00000	0.00000
Sum(Prob)		*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*

Source: National Highway Traffic Safety Administration, July 2011.

For example, if an injury is recorded as "O" on the KABCO scale at the crash site, there is about a 92.5% probability that it is indeed a "No injury" (AIS 0). But there is a 7.26% chance that it is a Minor injury (AIS 1), a 0.198% chance that it may turn out to be a Moderate injury (AIS 2), a small 0.008 chance that it is a Serious injury (AIS 3), and an even smaller 0.003% chance that it is actually a Critical injury (AIS 5). Recalling the Value of Injuries from Table 1, this would mean that one "O" reported injury is valued at about $3,100 ($2013) and interpreted as a willingness-to-pay to avoid the accident. This value results from multiplying the "O" accident's associated AIS-level probabilities by the recommended unit Value of Injuries, and then summing the products.

Table 5. KABCO– AIS Data Conversion for KABCO "O" Accident

AIS 0	0.92534	$ -	$ -
AIS 1	0.07257	$ 27,600	$ 2,002.93
AIS 2	0.00198	$ 432,400	$ 856.15
AIS 3	0.00008	$ 966,000	$ 77.28
AIS 4	0.00000	$ 2,447,200	$ -
AIS 5	0.00003	$ 5,455,600	$ 163.67
AIS 6	0.00000	$ 9,200,000	$ -
		TOTAL	$ 3,100.03

Tables 6 and 7 provide sample calculations for the monetization ($2013) of fatalities and injuries from accidents. By converting KABCO data into AIS and then monetizing according to the recommended values, the Applicant represented in Table 6 may be providing a baseline value of fatalities and injuries caused by 27 accidents reported in the most recent calendar year.[6] The same Applicant may have calculated the values in Table 7 to estimate their benefits of their project, which they anticipate may reduce accident rates (by at least one fatal accident and 5 non-fatal accidents per year).

[6] Accident data may not be presented on an annual basis when it is provided to Applicants (i.e. an available report requested in Fall 2011 may record total accidents from 2005-2010). For the purposes of the BCA, is important to annualize data when possible.

Table 6. Sample Calculation for Monetizing Value ($2013) of 27 Reported KABCO-scaled Accidents (O=15, C-=5, B=5, A=3, K=2, U=2)

(1)		(2)		(3)		(4)		(5)		(6)		(7)	
		O		C		B		A		K		U	
		No injury		Possible Injury		Non-Incapacitating		Incapacitating		Killed		Injured Severity Unknown	
Accident Counts		15	$ Value [Pr(AIS$_x$)*Value(AIS$_x$)]	5	$ Value [Pr(AIS$_x$)*Value(AIS$_x$)]	5	$ Value [Pr(AIS$_x$)*Value(AIS$_x$)]	3	$ Value [Pr(AIS$_x$)*Value(AIS$_x$)]	2	$ Value [Pr(AIS$_x$)*Value(AIS$_x$)]	2	$ Value [Pr(AIS$_x$)*Value(AIS$_x$)]
AIS	0	13.88010	$ -	1.17185	$ -	0.41735	$ -	0.10311	$ -	0.00000	$ -	0.43076	$ -
	1	1.08855	$ 30,043.98	3.44730	$ 95,145.48	3.84215	$ 106,043.34	1.66347	45,911.77	0.00000	$ -	1.25456	$ 34,625.86
	2	0.02970	$ 12,842.28	0.31955	$ 138,173.42	0.54490	$ 235,614.76	0.62724	$ 271,218.58	0.00000	$ -	0.20800	$ 89,939.20
	3	0.00120	$ 1,159.20	0.05355	$ 51,729.30	0.15955	$ 154,125.30	0.43311	$ 418,384.26	0.00000	$ -	0.07716	$ 74,536.56
	4	0.00000	$ -	0.00710	$ 17,375.12	0.03100	$ 75,863.20	0.11958	$ 292,563.64	0.00000	$ -	0.00884	$ 21,633.24
	5	0.00045	$ 2,455.02	0.00065	$ 3,546.14	0.00505	$ 27,550.78	0.05349	$ 291,820.04	0.00000	$ -	0.02068	$ 112,821.81
	Fatality	0.00000	$ -	0.00000	$ -	0.00000	$ -	0.00000	$ -	2.00000	$ 18,400,000.00	0.00000	$ -
SUBTOTALS		15.00	$ 46,500.48	5.00	$ 305,969.46	5.00	$ 599,197.38	3.00	$ 1,319,898.29	2.00	$ 18,400,000.00	2.00	$ 333,556.67

TOTAL VALUE OF FATALITIES & INJURIES	$ 21,005,122.28

Table 7. Sample Calculation for Monetizing ($2013) Accident Reduction (1 Fatal Accident, 5 Non-fatal Accidents)

Accident Counts		1	$ Value Fatalities * VSL	5	$ Value [Pr(AIS$_x$)*Value(AIS$_x$)]
AIS	0	0.00000	$ -	2.18380	$ -
	1	0.00000	$ -	2.08695	$ 57,599.82
	2	0.00000	$ -	0.44360	$ 191,812.64
	3	0.00000	$ -	0.24085	$ 232,661.10
	4	0.00000	$ -	0.03085	$ 75,496.12
	5	0.00000	$ -	0.01395	$ 76,105.62
	Fatality	1.00000	$ 9,200,000.00	0.00000	$ -
SUBTOTALS		1.00	$ 9,200,000.00	5.00	$ 633,675.30

TOTAL VALUE OF FATALITIES & INJURIES	$ 9,833,675.30

III. *Frequently Asked Questions (FAQs)*

1. Are all applicants required to submit a benefit-cost analysis with their TIGER application? We are proposing only a small project and have very limited resources to conduct a full benefit-cost analysis.

A Benefit-Cost Analysis (BCA) is required of all applicants. The TIGER team is sensitive to the fact that different applicants have different resource constraints, and that complex forecasts and analyses are not always a cost-effective option. However, given the quality of BCAs received in previous rounds of TIGER from applicants of all sizes, we also believe that a transparent, reproducible, thoughtful and reasonable BCA is possible for all projects. The goal of a well-produced BCA is to provide a more objective assessment of a project, and why a project sponsor has prioritized that specific project over other alternatives and proposals. An Applicant's evaluative process of assessing benefits and costs can only help to support an already complete application.

2. Where can I find information on how to develop my TIGER application's benefit-cost analysis?

The *2014 Benefit-Cost Analysis Guidance for Tiger Grant Applicants* provides general information and guidance on conducting a benefit-cost analysis for TIGER grant applications. Additionally, the Department has previously sponsored several informational sessions with regard to benefit-cost analysis:

- DOT held an eight-hour workshop to offer technical assistance in developing benefit-cost analyses in 2010. That session can be viewed here: http://mediasite.yorkcast.com/webcast/Viewer/?peid=48d006182cf5438680a75b7c6dfc2c9e
- An archive of the 2011 90-minute webinar on TIGER benefit-cost analysis can be found here: http://fhwa.adobeconnect.com/p2evpxuzqrm/?launcher=false&fcsContent=true&pbMode=normal
- The Department also partnered with Smart Growth America to provide assistance for rural communities as they develop benefit-cost analyses. An archive of the 2-hour webinar can be found here: http://www.smartgrowthamerica.org/2011/09/02/tiger-and-rural-america-part-2-webinar-materials-now-online/

3. Please explain Discounting in the Benefit-Cost Analysis section.

The Notice requires discounting future benefits at a real discount rate of 7% following guidance from OMB in Circulars A-4 and A-94 (http://www.whitehouse.gov/omb/circulars/). Applicants should also provide an alternative analysis with a real discount rate of 3%.

The formula for present discounted value is:

$$PV = \frac{FV}{(1+i)^t}$$

Where
PV= Present discounted value of a future payment from year *t*
FV = Future Value of payment in year *t*
i = Discount rate applied
t = Years in the future for payment (where base year of analysis is *t* = 0)

An example of the present value formula in action (at the 7% and 3% discount rates) is Columns F and G of the *Sample Calculation for Applying Social Cost of Carbon to TIGER Benefit-Cost Analysis* spreadsheet provided under Section II.1 of this guide.

Infrequently, benefits or costs will be the same in constant dollars for all years. In these limited cases, an applicant can calculate the formula for the present value of an ordinary annuity instead of showing a year-by-year calculation (http://en.wikipedia.org/wiki/Annuity_(finance_theory)). For example, 10.594 is the discount factor for a constant benefit stream over 20 years at a discount rate of seven percent (14.877 at three percent). If the constant annual benefit is $500,000, then the present value of the benefits is $5.297 million ($500,000 * 10.594). For analyses based on 20 years, applicants may use these discount factors. For other time horizons, the applicant must show the calculation of the discount factor of the ordinary annuity formula.

4. Could you clarify how the benefit-cost analysis differs from an economic impact analysis?

A benefit-cost analysis measures the dollar value of the benefits and costs to all the members of society. The benefits, for example, are the dollar value of what all the people in society would be willing to pay to have the project built. If people would be willing to pay more than the project actually costs, then the project has positive net benefits (benefits minus costs).

An economic impact analysis, on the other hand, measures "impacts," which are not the same thing as benefits. Impacts, for example, include the dollar value of all jobs created by a project. While jobs are a good thing, the benefit of a job is not measured by how much we pay the person who has a job, but by the increase in the productivity of that person compared with what the person would have been producing if the project were not funded. Economic impact analysis also generally measures local effects of a project, not overall effects on society as a whole. Some projects create positive effects on one community but negative effects on other communities. The "impacts" simply look at the positive effects, while the benefits consider negative effects as well as positive effects.

5. For TIGER transit project applicants, would it be appropriate to use the cost-effectiveness measure (as calculated under New Starts guidance) instead of calculating travel time savings using the TIGER recommended guidance?

Please note that the value of time (VOT) as referenced in the context of TIGER Grants is an actual value of time – that is, a monetized value assigned to each hour of travel time saved by users of the transportation system. The calculation prescribed by the New Starts process that is commonly referenced as value of travel time savings is actually a Cost-Effectiveness value, a measure of what the value of travel time savings would have to be to equal the level of estimated capital and operating costs. This is essentially more of an adjusted program value – not the actual transportation consumer's dollar valuation of time saved or lost through use of the transportation system, and therefore we would not recommend the use of this number in the proposed project TIGER BCA.

If you have a cost-effectiveness measure, you should still calculate the VOT as recommended in Section I of this document ("Recommended Monetized Values"). You should take the estimated travel time savings (hours of personal and business travel saved, as referenced in Section I, Table 1, "Value of Travel Time") from the proposed transit project and multiply by the national hourly values of travel time for each type of travel. The dollar value of benefits other than travel time savings directly generated by the project (highway congestion reduction, economic development, environmental, other indirect benefits) should be calculated separately. Please be sure to include clear documentation of assumptions and calculations in your BCA for all calculated benefits and costs.

6. **Must costs of externalities created during construction be included in the benefit-cost analysis?**

Yes, any external costs incurred during construction phases (especially if that construction phase is lengthy) should be included in the BCA. In general, the calculation of costs for a BCA should not merely be the estimated dollars paid to deliver the project – they should include costs over the entire life cycle of the project (operations and maintenance, scheduled rehabilitation, etc.) as well as external costs (noise, travel time delay, etc.). The *2014 Benefit-Cost Analysis Guidance for Tiger Grant Applicants* addresses these topics specifically under the "Other" section. Specifically, the section states that "applicants should include, to the extent possible, costs to users during construction, such as delays and increased vehicle operating costs associated with work zones or detours."

7. **Our proposed TIGER grant transit project would have multiple impacts in our community beyond travel-time savings – specifically on property values, low-income wages, and automobile operating costs. Do you have any specific sources of information regarding these benefits and how our agency may calculate them?**

The impacts of transit investment vary depending on geographic location and are largely dependent on the travel demand data generated for the proposed project. The TIGER Team assumes that the sponsoring agency and their technical team have developed the most appropriate model for estimating realistic travel demand changes resulting from the proposed project (and its alternatives) and will use the outcomes of that usership model to estimate the direct and indirect benefits and costs for the analysis. It is important to provide a clear explanation of the underlying assumptions, values, and calculations as part of the transparent documentation of the BCA.

Specifically addressing the topics above:

- **Property Values:** Change in property value is one of the benefits generally attributed to transit investment. The topic – along with other benefits and costs considered in transit investments – is discussed well within TCRP Report 78: *Estimating the Benefits and Costs of Public Transit Projects: A*

Guidebook for Practitioners (2002).[7] Please note that the issue of double-counting is an important consideration when calculating economic development benefits for any proposed project. The *2014 Benefit-Cost Analysis Guidance for Tiger Grant Applicants* discusses economic development benefits ("Other"). It is important, when estimating expected property value increases in one metropolitan area based on actual increases in another area, to make sure that the transit improvements in the two areas are comparable. For example, you should not estimate property value increases for a light rail system in one city based on experience with a heavy rail system in another city.

- **Low-income wages and job creation:** A BCA focus on low-income wage earners is relevant when a transportation project can potentially increase the wages of an affected population. In general, wages from project-induced job creation are considered transfer payments and should not be included in a typical benefit-cost analysis. However, the *2014 Benefit-Cost Analysis Guidance for Tiger Grant Applicants* makes the important distinction of increased wages as a reflection of higher labor productivity benefits and leaves its calculation to the discretion of the Applicant. Applicants need to demonstrate rigorously how such productivity benefits are estimated and the exact period of time over which the productivity benefits occur. Simply asserting these gains is inadequate. To this end, Applicants should make sure that productivity benefits from higher-paying jobs are not double-counted with other benefits and are *net* societal estimates (i.e., the productivity benefits are newly generated and not simply transferred from another jurisdiction).

- **Auto operating cost savings:** Any savings from private automobile operating costs would presumably be generated from reduced auto traffic estimated by the travel demand model. The *2014 Benefit-Cost Analysis Guidance for Tiger Grant Applicants* does not provide a specific value of auto operating cost, but such estimates (on a per mile basis) do exist. AAA publishes data on per-mile driving cost that incorporates costs for fuel, maintenance, tires, insurance, fees (license and registration) and taxes, depreciation, and financing.[8]

8. Our agency is proposing to construct the Applicant Project either with TIGER grant funding or toll revenues. Would the toll-funded option be considered an "alternative" in the benefit-cost analysis?

Within the context of the TIGER grants, "alternatives" are generally intended to mean projects that significantly differ from the proposed project in technology, alignment/location, design and/or construction schedule. Alternative projects would generate different levels of benefits and costs in the various societal benefit/cost categories such as travel time savings, emissions, safety, life cycle costs, externalities, etc. Financing a project with a TIGER grant versus toll financing is not really an alternative project, though the difference in financing could affect the travel demand on the project and hence affect the benefits. We would consider alternative financing approaches to be a variation within the same basic project.

A benefit-cost analysis is expected to minimally compare the benefits and costs of the proposed project against the most realistic base case (what would be the most likely scenario if the project were not built)

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[7] Transportation Research Board – National Research Council, TCRP Report 78 – *Estimating the Benefits and Costs of Public Transit Projects: A Guidebook for Practioners* (TCRP Report 78), 2002 (http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp78/guidebook/tcrp78.pdf).

[8] AAA Exchange, "Your Driving Costs" (http://exchange.aaa.com/wp-content/uploads/2013/04/Your-Driving-Costs-2013.pdf).

and any viable alternatives under consideration. The BCA should demonstrate why the proposed project is better than all other alternatives.

9. For reference, is there an accepted ratio for short-term and long-term job creation as a function of the project costs? This would help establish a starting point for more detailed assessment.

After discussions with the White House Council of Economic Advisers, the USDOT estimates that there are 13,000 short-term job-years created per one billion dollars of government investment (or $76,900 per job-year). Previous guidance had stated that every $92,000 of investment is equivalent to one job-year. These estimates include direct on-site jobs, indirect jobs in supplier industries, and jobs that are induced in consumer goods and services industries as workers with direct and indirect jobs spend their increased incomes. These or any other well-documented and reasonable estimates of short-term job creation would be acceptable values to use. Since all projects create about the same number of short-term jobs per million dollars spent, the most important information about short-term job creation is how quickly these jobs are created, so applicants should provide quarter-by-quarter estimates of the timing of short-term job creation, showing how many jobs they expect to create in each quarter. Long-term job creation will vary greatly depending on the nature of the project, so there are no accepted ratios for long-term job creation. Applicants should attempt to measure the level of long-term economic activity induced by the project, and the level of labor-intensity associated with that economic activity. Analysis of such long-term economic activity and job creation should be estimated on a year-by-year basis. Applicants can share their estimated numbers of jobs produced in the qualitative portions of the application.

While we are interested in the short-term economic impact of job creation caused by a TIGER project, these impacts should not be included in the benefit-cost analysis. The benefit-cost analysis should include only the short- and long-term increases in labor productivity associated with the jobs created by the project. The Notice of Funding Availability reminds applicants that job creation is primarily just a transfer payment – the benefits gained by the employee are costs to the employer, and therefore net benefits are zero. New jobs only yield net benefits if the jobs created actually increase the overall productivity of workers. Applicants should fully understand these distinctions before including job creation effects as part of net benefits.

10. Are there specific worksheets, forms, or formats that are required for the BCA?

There is no "specific worksheet" or format that is required for submittal, but the *2014 Benefit-Cost Analysis Guidance for Tiger Grant Applicants* does ask that Applicants "make every effort to make the results of their analyses as *transparent* and *reproducible* as possible". This means that spreadsheets should be accompanied by a narrative describing all of the basic assumptions, methods, and data underlying the analysis – in addition to any narrative text from the BCA and Application themselves. The *2014 Benefit-Cost Analysis Guidance for Tiger Grant Applicants* also provides a sample of a potential layout of how this information can be presented.

11. **We have a project where buses, pedestrians, and bikers cannot go through a tunnel, with no reasonable alternative. Are there standard methods for monetizing these benefits?**

When beginning any BCA, it is necessary to think about at least two different scenarios: one in which the proposed project is built and a second scenario in which is described the most realistic scenario if the project is not built (a base case, or "no-build" alternative). If there were an alternative route that buses, pedestrians, and bicycles could take to avoid the tunnel, then the benefits of the project would be the value of the delays avoided by not having to take that alternative route. If there is no alternative route, then it becomes impossible for bus riders, pedestrians, and bicyclists to travel to destinations served by the tunnel, and the benefits are the value to riders of being able to access those destinations. Measuring the dollar value of these accessibility benefits is difficult – they are analytically equal to the toll that bus riders, pedestrians, and bicyclists would be willing to pay to use the tunnel. It may be possible to gather such information through survey data. The bus fare that passengers would be willing to pay to access these points is one indicator of the value that passengers place on being able to travel on these routes.

12. **Regarding ports and harbors, is it fair to include benefits to the US economy that would be diverted from other nations, say, Canada and Mexico?**

Yes. The benefits to be counted are benefits to U.S. residents. Hence, benefits resulting from diversion of port activity to the U.S. can be considered without deducting any costs associated with loss of port activity in Canada or Mexico. Remember, however, that the dollar value of port activity is not a benefit – it is a payment for a service provided, and hence is a transfer payment, not a net benefit. Benefits would include only the cost savings or increases in productivity associated with the port activity created.

13. **If a project has already been funded for preliminary design and land purchase from a different funding source, yet is seeking construction funds through this program, would the land purchase and preliminary design be included in the benefit-cost analysis?**

Yes. The entire cost of the proposed project (including land purchase, preliminary design, and any other relevant components not funded by TIGER, as well as any indirect costs) must be included in the BCA.

14. **Would you explain more about what might be included in agglomeration benefits and what methodologies might be used to estimate them?**

Methodologies for determining agglomeration benefits are not yet well-established. It is generally agreed that agglomeration benefits can be significant, but it is also agreed that the significance of these benefits falls as the distance between the points joined by a transportation project increases. Agglomeration benefits are therefore generally more significant within the context of a metropolitan area than they are in an intercity context. In general, the methodology for estimating agglomeration benefits involves examining wage rates and output and productivity levels in locations that are well-connected to other populations, and comparing these measures of income and output to locations that are not well-connected to other populations. This can allow estimation of coefficients that measure the impact of connectedness to incomes and output. A summary of recent literature on agglomeration benefits can be found in Daniel J. Graham, "Agglomeration, Productivity, and Transport Investment," *Journal of Transport Economics and Policy*, v. 41, Part 3 (September 2007), pp. 317-343.

Appendix B

MACo Data

PROPERTY & CASUALTY WORKERS' COMPENSATION

MACo PCT & WCT all Landfill/Solid Waste

3/30/16 3:24 PM

Claim LOB Code	Event Date	Claim Number	Desc 5000 Chars	Paid Sum
GC	7/1/1995	P032950000101	[redacted]	0.00
	7/1/1995	P032950000201	[redacted]	186.85
	11/5/1996	P032960009201	[redacted] AT CITY-COUNTY TRANSFER STATION WHILE UNLOADING TRASH,FROM PICKUP TRUCK	6,514.00
	6/24/1999	P032980024801	CLMT WAS PUTTING GARBAGE IN DUMPSTER W/SAFETY WING GAVE WAY AND ONE LEG [redacted]	4,406.04
	6/24/1999	P032980024901	LAWSUIT ALLEGES [redacted]	0.00
	10/31/1999	P032990010701	[redacted] AT ELMO DUMP SITE	198,499.55
	4/22/2000	P032990022501	[redacted] FROM PICKUP 12 FEET AT SWAN LAKE LANDFILL	1,000.00
	10/15/2000	P032000010701	[redacted] ON FROSTY METAL FLIP-OUT BETWEEN HIS PU & DUMP CONTAINER,,FALLING 8-10 FEET LANDING ON HEAD & BACK	1,000.00
	7/10/2001	P032010000601	CLMT FELL OFF 20 FT WALL W/UNLOADING WASTE AT DUMP	146,746.20
	11/6/2001	P032010009401	LAWSUIT ALLEGES CLMT FELL AT ELMO DUMP SITE	36,227.64
	3/29/2002	P032010027201	TT FELL INTO DUMPSTER AND INJURED HIMSELF	299,488.02

8/7/2002	P032020005701	[redacted]ER AT [redacted]	0.00
9/17/2002	P032020009601	CLAIMANT WAS REMOVING CHEST FREEZER FROM BACK OF TRUCK W/HE [redacted], HITTING HEAD ON CEMENT PAD AND FREEZER FALLING ON LEG BREAKING IT.	527.77
12/3/2002	P032020017101	INSURED VEHICLE WAS HIT ON FUEL TANK SIDE.,DRIVER FLED THE SCENE OF THE ACCIDENT	1,584.71
8/11/2004	P032040002301	INSURED WAS REAR ENDED BY UNINSURED DRIVER.	0.00
8/27/2004	P032040017501	[redacted] WASTE SITE DOWN SEVERAL FEET ONTO A CONCRETE PAD.	1,630.55
9/17/2004	P032040006701	INSURED WAS SETTING OFF BOTTLE ROCKETS TO SCARE BIRD AWAY AND STARTLED, CLAIMANT AND HE HURT HIS BACK.	0.00
10/23/2004	P032040011401	[redacted]	3,269.23
3/1/2005	P032040019101	CLAIMANT JUMPED OFF TAILGATE OF HIS TRUCK, LANDED ON A BOARD WITH A NAIL, IN IT, NAIL PUNCTURED RIGHT FOOT.	0.00
4/10/2005	P032040022001	[redacted] BIN [redacted]	63,990.08
9/3/2005	P032050006301	CLAIMANT HIT SOLID WASTE CONTAINER THAT FELL OFF OF INSIRED TRUCK AND, DIED.	307,386.46
9/3/2005	P032050006302	CLAIMANT HIT SOLID WASTE CONTAINER THAT FELL OFF OF INSIRED TRUCK AND, DIED.	8,579.00
9/3/2005	P032050006303	CLAIMANT HIT SOLID WASTE CONTAINER THAT FELL OFF OF INSIRED TRUCK AND, DIED.	0.00
1/11/2006	GCFL15020046	1/24/2006 8:04:40 AM (knopf) THEFT OF COUNTY TOOLS FROM SOLID WASTE VH.	500.00
1/14/2006	GCCS07020045	1/24/2006 7:54:00 AM (knopf) CLMT FELL BETWEEN DUMPSTERS	0.00
3/25/2006	GCFL15020263	4/4/2006 11:47:36 AM (forkan) Solid waste vehicle hit deer.	0.00

4/13/2006	GCFL15020317	4/26/2006 9:23:41 AM (forkan) Windshield broken when something flew off the county landfill truck, bounced off road and hit claimant's windshield.	225.00
7/7/2006	GCFL15020548	7/11/2006 10:45:44 AM (forkan) Claimant was hit in the right temple area of the head by door on dumpster bin.	0.00
8/5/2006	GCLA24022517	[redacted] fell into dumpster at a county transfer site	157,340.15
9/24/2006	GC8065023377	Claimant fell into dumpster.	0.00
11/3/2006	GCFL15020958	Claimant alleges the garbage truck threw a rock up that cracked her window.	0.00
11/8/2006	GCRB44020994	Solid Waste vehicle was travelling on Interstate 94 when a panel broke off a secured portion of the load and hit an on coming car.	1,643.64
2/23/2007	GC8065021367	Insured slid into and rearended claimant's vehicle.	12,926.89
2/23/2007	GC8065021368	Insured slid into and rearended claimant's vehicle.	6,845.79
3/2/2007	GCMU33023372	Claimant's arm crushed in compacting machine.	0.00
3/22/2007	GCSA45021442	SOLID WASTE DEPT. DAMAGED A 40 YARD REFUSE ROLL OFF CONTAINER WHEN THE CONTAINER FELL OFF THEIR TRAILER INTO A DITCH NEAR ARLEE, MT. DAMAGED LID, DOOR AND WHEELS.	2,698.02
4/13/2007	GCLA24021508	CLAIMANT FEELS THAT THE INSURED IS RESPONSIBLE FOR HER BROKEN WINDSHIELD THAT WAS CAUSED BY A ROCK THROWN UP BY A COUNTY TRUCK.	0.00
5/7/2007	GCTO51021617	Vandelized 2005 Caterpillar 950G.	2,944.08
5/8/2007	GCLA24021614	Claimant alleges that rock came off truck and broke windshield.	0.00
5/9/2007	GCLA24021580	CLAIMANT ALLEGES THAT ROCK CAME OFF DISPOSAL TRUCK AND BROKE WINDSHIELD.	0.00
5/16/2007	GCGA16021587	Transfer station caught on fire.	74,641.63

5/16/2007	GCGA16021616	Transfer station caught on fire.	21,500.00
5/18/2007	GCGA16021866	Automatic gate hit side of claimaints truck door	882.20
6/1/2007	GCGA16021657	D8 DOZER BACKED INTO AN ALLIED WASTE GARBAGE TRUCK. HIT ARM ASSEMBLY.	9,350.00
6/3/2007	GCLN27021702	UNKNOWN RAN INTO GARAGE DOOR-DAMAGED BY VEHICLE.	4,943.00
6/7/2007	GCFL15021665	COUNTY VEHICLE WAS DRIVING AND SWERVED TO MISS SOMETHING, METAL OBJECT CAME UP AND HIT CLAIMANT.	1,405.40
6/20/2007	GCGA16021738	LIGHTNING STRIKE CAUSED DAMAGE TO COPIERS, PRINTERS, PC'S, DIGITAL SCALE INDICATORS, SCANNERS, HIGH SPEED LINE, SERVER DAMAGED.	11,354.31
6/21/2007	GCPA34021719	HIT ELK WHILE DELIVERING A ROLL OF DUMPSTER.	6,186.60
7/18/2007	GCSA45021848	High Winds damages Transfer Station building	27,819.50
7/18/2007	GCSA45022301	High Winds damages Transfer Station building	513.96
8/25/2007	GCMA28021960	Truck lid was left up on garbage container-took out electricity and telephone in Sheriday, MT.	112.00
8/25/2007	GCMA28022000	Truck lid was left up on garbage container-took out electricity and telephone in Sheriday, MT.	473.97
8/25/2007	GCMA28022014	Truck lid was left up on garbage container-took out electricity and telephone in Sheriday, MT.	1,481.34
8/25/2007	GCMA28022020	Truck lid was left up on garbage container-took out electricity and telephone in Sheriday, MT.	300.51
8/25/2007	GCMA28022021	Truck lid was left up on garbage container-took out electricity and telephone in Sheriday, MT.	5,768.60
8/25/2007	GCMA28022094	Truck lid was left up on garbage container-took out electricity and telephone in Sheriday, MT.	225.00

8/25/2007	GCMA28022308	Truck lid was left up on garbage container- took out electricity and telephone in Sheriday, MT.	14,772.55
9/20/2007	GCFL15022061	County vehicle and CV were driving side by side when both drifted and side swiped each other.	1,216.00
11/13/2007	GCBR04022210	Severe wind damage to doors, one was destroyed.	14,638.00
11/29/2007	GCGA16022263	Damage to driver side behind cab due to a piece of metal on the ground.	1,836.13
11/29/2007	GCGA16022264	Damage to driver side behind cab due to a piece of metal on the ground.	0.00
1/18/2008	GCFL15022562	Non employee is alleging assault at the dump.	0.00
7/14/2008	GCGA16023068	Claimant's vehicle was backed into by insured dozer.	422.50
8/17/2008	GCJE22023721	Claimants vehicle was dented when solid waste container bin lid was picked up in the wind and hit vehicle.	657.20
9/15/2008	GCSA45023238	[redacted] to falling off steps of the [redacted] bin.	4,316.31
10/3/2008	GCFL15023303	Claimant's windshield damage due to a rock coming off a garbage truck and hitting window.	241.32
10/4/2008	GCCS07024511	[redacted] site [redacted] arm.	0.00
10/7/2008	GCFL15023243	Claimant's 2000 Subaru Legacy broken windshield due to a rock hitting it that came off the road when a garbage truck passed.	0.00
10/24/2008	GCPW39023290	1998 Intl Garbage Truck hit a deer.	0.00
12/31/2008	GCFL15023512	Insured vehicle slid into ditch trying to avoid a collision with another vehicle.	0.00
1/12/2009	GCFL15023568	Insured vehicle backed into claimant's vehicle making a dent.	691.95

1/12/2009	GCFL15023575	Claimant's wind shield chipped from a rock that came off the road while passing a refuse truck.	0.00
3/6/2009	GCFL15023723	Damage to RR crossing sign and lights from insured garbage truck hitting it.	55,350.00
3/8/2009	GCFL15023777	[redacted] in her hand.	16,336.43
4/22/2009	GCGA16023860	Tools were stolen from old shop.	2,845.04
5/17/2009	GCFL15023924	Insured landfill truck backed into claimants Hyndai SUV causing damage.	2,424.19
6/24/2009	GCFL15024086	contract claim	0.00
8/6/2009	GCGA16024171	Heavy rains damaged the fiber optic line and conduits are filled with soot.	0.00
9/27/2009	GCGA16024308	fire in compost tunnel, damage to tunnel doors, concrete near doors, wall above tunnel, and 2 metal covers for the floor air channel.	0.00
9/30/2009	GCFL15024311	[redacted] vehicle causing [redacted] and injuring other driver.	58,017.00
9/30/2009	GCFL15024312	Insured Landfill vehicle collided with other vehicle causing damage to both vehicle and injuring other driver.	6,937.00
9/30/2009	GCFL15024313	Insured Landfill vehicle collided with other vehicle causing damage to both vehicle and injuring other driver.	353,661.58
12/7/2009	GCPH36024538	While unloading a refuse container it poked a hole in the roof of insured 2006 Kenworth T-800.	0.00
3/3/2010	GCLA24024825	Claim seeks injunction, for placement of waste containers by insured.	0.00
3/3/2010	GCMA28024821	Insd struck container	7,373.25
4/16/2010	GCMA28024926	Solid Waste truck hooked a powerline and snapped off the pole. -area without electricity.	4,673.98

6/20/2010	GCFL15025143	Claimant alleges he was struck by something on the loader as it passed him.	3,471.98
6/22/2010	GCCU09025160	Power surge fried the computer on the scales at the landfill.	0.00
6/26/2010	GCLN27025251	Insured ran over can of paint with loader, and splattered it onto claimants pickup.	5,261.55
7/10/2010	GCFL15025226	Claimant alleges something flew off the garbage truck and broke windshield.	150.00
7/29/2010	GCRI42025413	Lawsuit alleges Landfill #102 has caused environmental contamination to plaintiff's property.	0.00
8/27/2010	GCST48025378	[redacted]	2,865.41
8/27/2010	GCST48025379	Insured collided with semi tractor/trailer. Insured driver did not see claimant.	25,980.34
9/20/2010	GCMU33026637	Insured backed the skid steer loader into a dumpster.	13,411.91
10/1/2010	GCFL15025470	Claimant alleges rock flew up and smashed his windshield.	0.00
11/7/2010	GCST48025543	[redacted]	316.50
11/9/2010	GCPA34025655	Struck 2 deer.	3,017.20
11/30/2010	GCBE01026766	Potential wrongful discharge claim. So far only claim is for denial of unemployment benefits.	10.00
12/18/2010	GCFL15025661	Claimant fell on her right side at landfill site while walking back to her vehicle from the cardboard receptacle.	1,050.82
1/7/2011	GCHI21025744	Claimant fell into garbage container	0.00
3/8/2011	GCFL15025954	Claimant alleges dump site damaged his tires.	0.00

5/11/2011	GCSA45026113	Insured gate at Solid Waste site blew closed on claimants vehicle causing scratches on front right bumper.	658.79
5/21/2011	GCME30027032	High winds damaged Insured transfer site.	12,022.00
6/15/2011	GCJE22026358	Claimant fell off the tail gate of his truck into a garbage container at the Clancy Transfer Station	1,000.00
6/22/2011	GCFL15026199	Claimant was unloading garbage and vehicle next to him was unloading a camper with the help of County employee and camper fell off and hit claimants truck.	758.66
7/5/2011	GCRI42026266	Dumpster caught on fire	0.00
7/12/2011	GCRI42026374	Dumpster caught on fire.	0.00
8/20/2011	GCMU33026391	Fire in dump building burning compactor and building.	90,117.24
9/15/2011	GCST48026668	Building was struck by unknown vehicle and driver	53,713.60
9/29/2011	GCSA45026517	A gate hit the outside of claimant right knee.	9,178.74
10/17/2011	GCRI42026565	Fire started in canister @ Lambert, MT	0.00
1/18/2012	GCMA28026836	Ember from wood stove blew into dump site damaging 80 bales of cardboard & 1 porta-potty.	7,398.22
3/3/2012	GCST48026990	Wind blew gate into claimants right rear quarter panel	3,477.32
4/4/2012	GCFL15027080	Insured backed into claimants vehicle at Lakeside dump site.	3,637.99
4/12/2012	GCST48027121	Claimant fell into compactor from pickup tailgate due to gust of wind.	8,772.00
4/13/2012	GCRI42027795	Fire started in dumpster in Sidney	8,400.00

4/17/2012	GCRI42027794	Fire started in dumpster (in Sidney)	8,400.00
5/18/2012	GCBE01027195	[redacted]hile [redacted] garbage.	0.00
5/23/2012	GCGT20027213	Mold discovered growing in corner of waste transfer site.	0.00
6/2/2012	GCWI55027227	Fire broke out at landfill, damaging one dumpster and part of the landfill building.	0.00
6/2/2012	GCWI55027228	Fire broke out at landfill, damaging one dumpster and part of the landfill building.	6,500.00
6/11/2012	GCMC29027244	Scale house & Scales were damaged when motor home hit them.	0.00
7/19/2012	GCFL15027363	Claimant was picking recyclable out of dumpster when dump truck diver placed forks into the dumpster and pushed it forward striking claimant.	40,000.00
8/24/2012	GCLN27027448	[redacted] (2012 CT [redacted]	188,791.15
9/18/2012	GCSA45027509	Battery charger shorted out causing a fire in a van body used to store tools at Hot Springs Refuse Site.	0.00
10/1/2012	GCRI42027796	Fire started in dumpster.	8,550.00
10/4/2012	GCPA34027862	Severe winds ripped some of the metal roofing off the building.	7,500.00
11/2/2012	GCPA34027642	Drove off pavement onto soft shoulder- over corrected and rolled truck onto its side.	45,583.57
11/8/2012	GCLA24027637	Insured backed into claimants vehicle.	927.01
12/23/2012	GCRI42027797	Fire started in dumpster	0.00
3/2/2013	GCLA24027974	~~Woman fell into the container site at Chario Seriously injuring herself~~	753,615.00

4/15/2013	GC8076028021	Driver hit ice, slid off raod, hitting 3 fence posts and barb wire causing damage to rt front, box panel & back tail light--98 Ford 1/2 T	0.00
4/30/2013	GCFL15028069	Garbage truck was higher than the light post and hit them as he went thru the intersection on Hwy 93.	0.00
5/9/2013	GCBE01028079	While pulling a cat it dumped over	19,100.22
6/14/2013	GCST48028176	Twisted ankle when claimant backed into shed with trailer, got out of his pickup and twisted ankle on the rise from the gravel to the cement.	0.00
7/16/2013	GCLA24028266	Rock was thrown up from the tires of the County sanitation truck and broke the claimants windshield and mirror.	0.00
7/25/2013	GCST48028308	Claimant fell into compactor at Park City site.	547.54
9/10/2013	GCMA28028401	Insured went through shop door-Door was not open all the way and he backed out damaging garage door and exhaust stacks on semi	0.00
9/10/2013	GCMA28028402	Insured went through shop door-Door was not open all the way and he backed out damaging garage door and exhaust stacks on semi	0.00
10/10/2013	GCPA34028505	Collision with deer	4,177.80
10/12/2013	GCST48028494	Individual was backed up to disposal site approximately 4' away from pit. She slipped and landed on buttocks at edge of pit.	0.00
10/24/2013	GCSA45028517	There were foggy conditions and a deer ran up from the side of the road and into the vehicle.	2,994.84
12/30/2013	GCRI42028828	Insured & claimant collided-both vehicles were traveling at the time of impact.	9,867.38
1/6/2014	GCSA45028711	Truck stolen from Transfer Station w/ generator in back	15,000.00
1/6/2014	GCSA45028712	Truck stolen from Transfer Station w/ generator in back	3,700.00
2/10/2014	GCFL15029020	Clmts tire fell off and went underneath County truck	16,788.72

2/13/2014	GCST48028932	Chain link & barb wire fence was damaged when a person who had a seizure drove through the fence.	0.00
3/25/2014	GCVA53028941	Insd vehicle backed into unoccupied, parked vehicle	22.14
3/25/2014	GCVA53028942	Insd vehicle backed into unoccupied, parked vehicle	5,356.34
3/26/2014	GCFL15029054	Clmnt alleges that something came off the arm of a garbage truck and struck windshield	0.00
6/1/2014	GCLA24029096	Claimant alleges he struck a sharp piece of metal at the transfer station that slit his tire and cut his rim	754.45
7/3/2014	GCLA24029202	Claimant alleges gravel fell from transfer station truck and broke his windshield	303.89
8/26/2014	GCSA45029370	[redacted]	171,575.00
8/31/2014	GCJE22029378	Clmnt's windshield was struck by rock	185.00
12/16/2014	GCGA16029634	Clmnts allege property damage and bodily injury caused by adjacent Landfill operations	1,982.36
12/16/2014	GCGA16029882	Clmnts allege property damage and bodily injury caused by adjacent Landfill operations	0.00
2/21/2015	GCFL15029864	Clmnt ran into a garbage bin at the landfill	0.00
3/17/2015	GCFL15029917	Claimant alleges he damaged his vehicle at landfill due to it had been raining and the road was very muddy and had ruts.	0.00
4/6/2015	GCDA11029936	County sanitarian was pulling into his residence and made contact with his personal vehicle	205.00
4/6/2015	GCDA11029942	County sanitarian was pulling into his residence and made contact with his personal vehicle	2,879.17
5/10/2015	GCFL15030002	Fire in the Appliance/Metal recycling pile	847.50

	5/21/2015	GCFL15030031	Insured garbage truck was unable to stop in traffic and hit claimant's vehicle in the front	2,871.05
	5/21/2015	GCLA24030029	Insured Scraper parked at the transfer station rolled into an employee's parked car.	3,076.48
	5/27/2015	GCGT20030072	Claimant was backing into the metal bin and accelerated back too fast as if to slam on the brakes and have the stove in the back of the truck slide out and his pickup jumped over the lip and come to rest with the frame of the truck	0.00
	6/12/2015	GCBR04030067	Insured hit top part of the door frame with excavator boom, pushing in the front of the building.	5,441.07
	8/15/2015	GCLA24030225	Claimant alleges rock from insured truck broke their windshield.	0.00
	8/27/2015	GCPA34030257	County truck was rear-ended	4,120.58
	11/6/2015	GCST48030427	Was maneuvering debris box when the rear of the box struck garage's concrete wall, cracking it	0.00
	11/15/2015	GCGT20030467	Unknown person(s) cut padlock at Drummond Dump, stole vehicle and tools.	1,700.00
	11/15/2015	GCGT20030468	Unknown person(s) cut padlock at Drummond Dump, stole vehicle and tools.	3,862.15
	12/10/2015	GCMA28030554	Human Rights Complaint- Alleges insured failed to accommodate because of physical disability	0.00
	1/4/2016	GCLA24030596	Solid Waste semi was involved in serious accident involving 2 other vehicles.	83,623.99
	1/4/2016	GCLA24030608	Solid Waste semi was involved in serious accident involving 2 other vehicles.	0.00
GC			Sum:	3,655,047.79

Claim LOB Code	Event Date	Claim Number	Desc 5000 Chars	Paid Sum
WC	12/29/1995	C032950016301	Died From Hypothermia Exposure After Being Trapped In Garbage Roll-off Containdied From Hypothermia Exposure After Being Trapped In Garbage Roll-off Contain	82,587.34

5/18/2001	C032000055701	Twisted Neck And Back When Ran Over Unknown Objecttwisted Neck And Back When Ran Over Unknown Object	3,099.13
6/8/2001	C032000061201	Od/ Numbness In Both Hand And Lump On Rt Wrist From Driving Truck For Land Filod/ Numbness In Both Hand And Lump On Rt Wrist From Driving Truck For Land Fil	10,507.84
6/27/2001	C032000066301	Strain Back/stepped On Pinecone Getting Out Of Equipment Twisting Backstrain Back/stepped On Pinecone Getting Out Of Equipment Twisting Back	2,288.84
10/4/2001	C032010000701	Strain Rt Elbow Raising Lid On 40yrd Roll Of Boxstrain Rt Elbow Raising Lid On 40yrd Roll Of Box	467.45
4/29/2002	C032010044001	Strain Rt Arm & Shoulder Moving Desk At Land Fillstrain Rt Arm & Shoulder Moving Desk At Land Fill	4,172.90
6/19/2002	C032010055001	Chip Bone In Lt Elbow In Fall From Ladder To Floor Of Containerchip Bone In Lt Elbow In Fall From Ladder To Floor Of Container	0.00
6/26/2002	C032010056701	Od/swollen Knee From Years Of Repetitive Use Of Knee On Gravel & Concreteod/swollen Knee From Years Of Repetitive Use Of Knee On Gravel & Concrete	298.59
7/23/2002	C032010061201	Strain Rt Arm W/lifting Full Garbage Barrel Wind Caught It And Blew Ee Into Truckstrain Rt Arm W/lifting Full Garbage Barrel Wind Caught It And Blew Ee Into	15,145.59
10/9/2002	C032020001601	Strain Rt Arm Pulling Dumpsterstrain Rt Arm Pulling Dumpster	204.50
11/20/2002	C032020010801	Twisted Back Getting Down From Trucktwisted Back Getting Down From Truck	1,861.47
12/23/2002	C032020016601	Strain Low Back W/fell Stepping Out Of Truck Landing On Buttstrain Low Back W/fell Stepping Out Of Truck Landing On Butt	47.11
1/28/2003	C032020022101	Strain Lt Arm/shoulder Lifting Garbage Canstrain Lt Arm/shoulder Lifting Garbage Can	122.45
2/7/2003	C032020025301	Bruised Lt Knee W/striking It On Stairs W/running Up Thembruised Lt Knee W/striking It On Stairs W/running Up Them	65,969.14
4/9/2003	C032020038901	Back Pain For Past 3 Months From Driving Heavy Equipmentback Pain For Past 3 Months From Driving Heavy Equipment	2,555.10
4/10/2003	C032020039101	Strain Back & Stomach W/helping Elderly Man Dump Barrel Of Trash And Elderly Mstrain Back & Stomach W/helping Elderly Man Dump Barrel Of Trash And Elderly M	384.10

4/18/2003	C032020041301	Puncture Rt Foot W/steped On Board W/nail In It At Landfillpuncture Rt Foot W/steped On Board W/nail In It At Landfill	0.00
5/27/2003	C032020048801	Strain To Testicle Area From Lowering Self Off Of Compactor/long Stepstrain To Testicle Area From Lowering Self Off Of Compactor/long Step	0.00
		Od/od/	
6/4/2003	C032020050701	Carpal Tunnel from repetitive work	4,875.07
6/4/2003	C032020050801	Twisted Knee Going Down Stairs From Control Room At Refusetwisted Knee Going Down Stairs From Control Room At Refuse	18,438.48
7/7/2003	C032020059301	Strain Back-tossed Lawnmower Into Roll Off Box.strain Back-tossed Lawnmower Into Roll Off Box.	232.80
8/9/2003	C032020068201	Twisted Lt Knee Getting Down Out Of Backhoetwisted Lt Knee Getting Down Out Of Backhoe	0.00
8/13/2003	C032020069001	Bee Sting To Lower Legbee Sting To Lower Leg	65.19
8/22/2003	C032020071301	Bee Sting To Rt Legbee Sting To Rt Leg	177.85
9/15/2003	C032020075301	Cut Rt Forearm W/slip/fall On Concrete Water Draincut Rt Forearm W/slip/fall On Concrete Water Drain	40.11
9/30/2003	C032020078301	Cut To Lt Index Finger W/drill Bit W/drilling On Stepos Of Garbage Truckcut To Lt Index Finger W/drill Bit W/drilling On Stepos Of Garbage Truck	146.20
9/30/2003	C032020078601	Cut Rt Hand On Wrench Handlecut Rt Hand On Wrench Handle	5,090.00
10/3/2003	C032030000401	Strain Back Installing Seat In Loaderstrain Back Installing Seat In Loader	351.42
10/9/2003	C032030002001	Sleep Apnea,back Pain & Hiatal Hernia-complaints During Commercial Drivers License Renewal-ee Did Not Pass Eye Exam And Then Complained Of The Above Problemssleep Apnea,back Pain & Hiatal	47.80
11/1/2003	C032030006601	Cut Hand/finger W/backhoe Door Shut On Handcut Hand/finger W/backhoe Door Shut On Hand	373.61
11/18/2003	C032030015501	Strain Rt Shoulder In Slip/fall On Icy Equipmentstrain Rt Shoulder In Slip/fall On Icy Equipment	19,085.76

12/9/2003	C032030015701	Twisted Rt Ankle Stepping On Objecttwisted Rt Ankle Stepping On Object	1.30
12/16/2003	C032030017101	Bruised Rt Knee In Slip/fall On Pile Of Debrisbruised Rt Knee In Slip/fall On Pile Of Debris	1,296.66
12/30/2003	C032030017901	Strain Shoulder And Back Shoveling Sandstrain Shoulder And Back Shoveling Sand	557.74
1/13/2004	C032030020401	Strain Groin Lifting Stove Into Garbage Container At Dumpstrain Groin Lifting Stove Into Garbage Container At Dump	1.30
1/29/2004	C032030025201	Fractured Tail Bone In Slip/fall On Icy Getting Down From Loaderfractured Tail Bone In Slip/fall On Icy Getting Down From Loader	148.49
3/29/2004	C032030038501	Cut Head And Bruised Ribs After Vehicle Rolled Over.cut Head And Bruised Ribs After Vehicle Rolled Over.	1.30
4/3/2004	C032030039601	Cut Palm Of Right Hand On Latch Of Gate.cut Palm Of Right Hand On Latch Of Gate.	454.23
4/17/2004	C032030044901	Sore Stomach After Freezer Fell On Him.sore Stomach After Freezer Fell On Him.	4,185.28
4/26/2004	C032030043801	Slipped Off Truc Tire Injuring Back, R. Shoulder And Armslipped Off Truc Tire Injuring Back, R. Shoulder And Arm	335.88
4/26/2004	C032030044601	Burned Eyes From Welding Sparks.burned Eyes From Welding Sparks.	664.33
5/6/2004	C032030046801	Strained Lower Back After Fall From Canister To Ground.strained Lower Back After Fall From Canister To Ground.	110.11
5/7/2004	C032030048801	Sprained Right Knee After Stepping On Tree Limb And Twisting Knee.sprained Right Knee After Stepping On Tree Limb And Twisting Knee.	162.40
5/7/2004	C032030049001	Strained Upper Back And Shoulder Pulling On A Squeegee.strained Upper Back And Shoulder Pulling On A Squeegee.	1.30
5/15/2004	C032030047501	Strained Left Knee After Stepping Off Of Ladder.strained Left Knee After Stepping Off Of Ladder.	22,348.74
5/17/2004	C032030082501	Od/strained Right Arm Moving Re Bar Form.od/strained Right Arm Moving Re Bar Form.	3,715.52

7/15/2004	C032030060901	Changing Frayed Cable On Truck. Unscrewed Cable And It Went Into Rt Palm Of Hand.changing Frayed Cable On Truck. Unscrewed Cable And It Went Into Rt Palm Of	1.30
7/22/2004	C032030061901	Strained Left Knee After Stepping On Something Or Falling In Hole.strained Left Knee After Stepping On Something Or Falling In Hole.	13,926.70
7/25/2004	C032030062601	Strained Back Cranking Up Roll Off Box Lid.strained Back Cranking Up Roll Off Box Lid.	154.39
8/3/2004	C032030066501	Strained Right Groin Area Lifting A Road Tie.strained Right Groin Area Lifting A Road Tie.	1.30
8/14/2004	C032030066701	Cut Finger On Something Sharp In Garbage Bag.cut Finger On Something Sharp In Garbage Bag.	354.19
8/14/2004	C032030071401	Strained Lower Back While Lifting Lid At Landfill.strained Lower Back While Lifting Lid At Landfill.	101.00
8/20/2004	C032030068601	Cut Wrist On Piece Of Metal.cut Wrist On Piece Of Metal.	527.75
8/23/2004	C032030069301	Swollen And Infected Left Arm After Something Poked, Bit Or Stung Him.swollen And Infected Left Arm After Something Poked, Bit Or Stung Him.	597.38
8/25/2004	C032030071701	Strained Left Side Of Body, Back And Leg After Falling On Cement Wall When Limb He Was Handling Broke.strained Left Side Of Body, Back And Leg After Falling On Cement Wall When	252.60
9/22/2004	C032030077001	Strained Lower Back Lifting Asphalt Chunks.strained Lower Back Lifting Asphalt Chunks.	1,313.20
9/24/2004	C032030076601	Strained Right Wrist Lifting A Barrel.strained Right Wrist Lifting A Barrel.	77.06
10/7/2004	C032040003001	Right Eye Got Dust Or Something In It.right Eye Got Dust Or Something In It.	87.84
1/23/2005	C032040020101	Spider Bite To Left Stomach Area.spider Bite To Left Stomach Area.	41.17
3/14/2005	C032040029901	Possible Hernia In Abdomen.possible Hernia In Abdomen.	770.92
3/16/2005	C032040029601	Cut Left Index Finger On Drill Bit Cleaning Metal Shavings Off Of It.cut Left Index Finger On Drill Bit Cleaning Metal Shavings Off Of It.	391.72

3/24/2005	C032040032201	Rt Eye Had Foreign Matter Fall In It (Metal Speck)rt Eye Had Foreign Matter Fall In It (Metal Speck)	33.82
4/5/2005	C032040035201	Multiple Injuriesmultiple Injuries	5,618.54
4/27/2005	C032040038901	[redacted] broken Bone In Heel And Ankle After Falling Into Empty Bin.	19,512.19
5/2/2005	C032040038301	Strained Muscle In Lower Right Abdomen Lifting And Rolling Large Wood Stove.strained Muscle In Lower Right Abdomen Lifting And Rolling Large Wood Stove.	111.88
5/3/2005	C032040037801	Right Eye Injured When Stick He Was Breaking Flew Up And Hit Him.right Eye Injured When Stick He Was Breaking Flew Up And Hit Him.	258.90
5/14/2005	C032040044801	Bug Flew In Right Ear.bug Flew In Right Ear.	1.30
5/24/2005	C032040045701	Strained Back Exiting Loader.strained Back Exiting Loader.	1,246.93
6/25/2005	C032040050801	Sprained Right Ankle Cleaning Brush Pile.sprained Right Ankle Cleaning Brush Pile.	119.86
7/5/2005	C032040056701	Sprained Lower Right Leg Stepping On A Rock.sprained Lower Right Leg Stepping On A Rock.	78.64
7/30/2005	C032040057401	Strained Back Bending Over To Pick Up Paper.strained Back Bending Over To Pick Up Paper.	2.90
8/11/2005	C032040061201	Right Thumb Got Bee Sting.right Thumb Got Bee Sting.	37.22
8/20/2005	C032040063101	Torn Bicep In Right Arm After Lifting Sack Of Garbage.torn Bicep In Right Arm After Lifting Sack Of Garbage.	533.31
8/23/2005	C032040062801	Bruised Ribs After Falling Down.bruised Ribs After Falling Down.	165.38
9/3/2005	C032040066501	Strain Back Moving Materialsstrain Back Moving Materials	123,174.02
9/4/2005	C032040065401	Strained Back Bending Over.strained Back Bending Over.	964.29

9/21/2005	C032040073501	Sprained Right Ankle And Foot After Slipping And Falling In Ladies Room.sprained Right Ankle And Foot After Slipping And Falling In Ladies Room.	118.34
10/12/2005	C032050003401	Multiple Injuries On Multiple Body Parts After Tripping And Falling.multiple Injuries On Multiple Body Parts After Tripping And Falling.	3,682.07
11/1/2005	C032050004701	Fractured Tail Bone After Slipping Off Of Backhoe And Falling On Buttocks.fractured Tail Bone After Slipping Off Of Backhoe And Falling On Buttocks.	463.08
12/9/2005	WCPO37020204	3/14/2006 10:34:26 AM (forkan) Cut top of head when hit by piece of iron that fell from top of ladder.	463.78
12/16/2005	WCSA45019998	1/18/2006 10:31:25 AM (holling) Eye got a foreign object in it.	0.00
12/22/2005	WCSA45019955	1/13/2006 10:52:49 AM (holling) Strained left arm and wrist after slipping and falling on ice.	177.30
2/9/2006	WCPA34020118	2/17/2006 12:24:04 PM (holling) Strained left arm, back and ribs lifting rack onto pick-up.	0.00
3/11/2006	WCLA24020240	3/27/2006 11:17:33 AM (forkan) Cut left foot while smashing trash at Ferndale container site.	0.00
4/3/2006	WCLN27020266	4/6/2006 9:39:15 AM (holling) Bruised right elbow when he hit it on a push arm.	316.37
5/1/2006	WCTE50020330	5/3/2006 9:44:38 AM (forkan) Strained lower back while lifting 75-100 lb. pan.	854.30
5/18/2006	WCLN27020383	5/22/2006 11:10:37 AM (forkan) Cut leg when sharp object was poking out of garbage bag while picking up garbage from container.	57.73
7/15/2006	WCSA45020653	8/3/2006 11:24:22 AM (holling) Mult injuries when a truck backed into the door claimant was standing by.	21,757.64
8/1/2006	WCCS07020860	Strained back while helping customer unload stove at dumpsite.	0.00
8/10/2006	WCLA24020671	8/11/2006 12:01:02 PM (forkan) Strained left shoulder when tripped and fell to ground while dumping truck at landfill.	1,535.42
8/24/2006	WCGT20020727	Bruised her head when the roof on backhoe fell and hit her.	0.00

8/28/2006	WCLC25020746	Strained back after missing step into truck running from hornets.	170.13
10/16/2006	WCLN27021052	Injured wrist and thumb trying to break a fall.	1,849.29
10/18/2006	WCPA34020933	Injured back while unloading a compactor box off truck.	768.50
10/24/2006	WCST48022261	Right shoulder sprain due to falling and landing on it.	0.00
10/25/2006	WCLC25020965	Upper respiratory eposode involving extreme coughing, after exposure to unknown substance in the air.	96.84
12/28/2006	WCJE22021094	Injured left ankle after falling into hole in snowy, cold conditions.	0.00
12/28/2006	WCST48021144	Claimant injured back falling on ice.	128,714.73
12/28/2006	WCST48021217	Claimant lost memory after breathing in fumes from smelt cleaning fluid.	0.00
2/12/2007	WCYS56021338	Claimant lacerated his lip when a boomer hit him.	406.41
2/13/2007	WCST48021394	Claimant got frostbite of right toe due to cold and wet weather.	219.80
2/15/2007	WCTE50021360	Claimant injured both legs, back, neck, right arm, right ribs, after slipping and falling on snow shovel.	1,813.62
5/18/2007	WCHI21021612	CLAIMANT RECEIVED A HEAD LACERATION DUE TO A FALLING TREE BRANCH.	183.94
5/30/2007	WCTE50021651	LEFT HIP BRUISE WORKING WITH LITTER VAC.	412,739.57
5/31/2007	WCTE50021823	Strain back in hip lifing up on Metal pan/roll off part due to tree branch was pinning it down	810.83
6/29/2007	WCLA24021766	BACK STRAIN DUE TO LIFTING LUMBER AND STEEL.	21,005.41

7/19/2007	WCLA24021884	Strain lt shoulder and bruised right knee in fall from concrete wall at container site	4,480.50
10/29/2007	WCTE50022171	Leg and hip injury due to fall.	1,157.70
12/1/2007	WCGT20023086	Snow blind from UV exposure.	0.00
12/21/2007	WCGT20022357	Strain arm from pulling generator pulley 50-60 times a day for 2 wks	157.90
12/31/2007	WCTE50022394	Shoulders, head, neck and ribs inflammation due to falling on ice.	1,034.50
1/4/2008	WCLN27022395	Left ankle sprain due to stepping down off latter onto uneven ground.	813.97
1/19/2008	WCJE22022455	Left thumb sprain due it being jammed by a falling shovel.	546.79
2/1/2008	WCLA24022471	Low back strain due to falling on ice.	0.00
3/11/2008	WCFA13022582	Left middle finger laceration due to being hit by a bolt he was cutting.	338.69
3/11/2008	WCTE50022623	Left shoulder sprain due to pulling a wrench.	43,136.57
3/17/2008	WCDL10022612	Left pinkie finger smashed between a cable and a dempster, broke finger.	193.84
4/3/2008	WCLN27027958	EE reports years of exposure to asbestos dust. DENIED	12,103.13
5/6/2008	WCCS07022811	Right hand and fingers strain and numb due to using a hand crank.	162.83
5/30/2008	WCGA16022821	Knee contusion due to falling and hitting it on concrete floor.	0.00
6/21/2008	WCJE22022916	Andaman hernia due to pushing a dumpster door.	226.93

6/26/2008	WCMA28022969	Dust blew in eyes.	325.78
6/27/2008	WCGA16022944	Low back strain due to lifting.	570.87
8/1/2008	WCSA45024734	Injured LT knee when slipped off a bobcat. DENIED	0.00
8/1/2008	WCST48023071	Allergic reaction from contact with pine branches, rash developed on back of both legs & tights. Branches got stuck in compactor, when claimant went down into the compactor to remove them.	24.52
9/14/2008	WCLA24023178	Leg and hip bruise due to falling on wet floor.	72,805.99
10/29/2008	WCPA34023322	Left knee strain due to tripping when stepping out of truck.	975.76
11/9/2008	WCHI21023500	Strain rectal muscles moving tiles.	0.00
11/19/2008	WCJE22023373	Arms and hips bruised due to falling down.	0.00
1/2/2009	WCMA28023504	Hurt right shoulder in slip/fall on ice at Harrison dumpsite.	0.00
1/9/2009	WCLN27023542	Bruised back in slip fall on ice, striking back on truck step.	421.29
2/10/2009	WCST48023667	Sprained ankle and hit head after stepping in rut and falling.	502.89
2/26/2009	WCRB44023724	Upper back strain from pushing a shovel that stopped suddenly, jarring upper back.	1,012.75
3/23/2009	WCLC25023793	Low back strain due to climbing off landfill compactor.	1,712.00
5/13/2009	WCHI21023920	Left arm strain due to lifting a new rolling onto loader.	7,096.43
6/1/2009	WCBR04024266	Left shoulder strain while winding up canister lid.	3,632.16

7/9/2009	WCHI21024064	Right knee strain due to stepping back in to a small hole.	2,029.64
8/11/2009	WCJE22024194	Wasp sting on left arm.	0.00
8/12/2009	WCBR04024204	Left shoulder strain due to repetitive use.	0.00
8/16/2009	WCST48024362	Hand punctured by a needle in garbage bag.	0.00
8/25/2009	WCPW39024245	Upper body burned when water hose burst on loader and sprayed all over.	0.00
10/24/2009	WCLC25024411	Foreign object in eye while outside by dumpster when wind was blowing.	168.23
11/1/2009	WCLA24024440	Multiple body parts; both hands, wrists, elbows, and knees bruised due to tripping on scale.	0.00
12/12/2009	WCGA16024560	Left leg strain due to slipping on water on concrete while standing up from putting air in truck tire.	0.00
12/27/2009	WCLA24024585	Left elbow bruised due to hitting it against cement pillar.	689.65
1/4/2010	WCTO51024604	Slipped and fell on ice, bruised right side/hip.	834.00
1/6/2010	WCPA34024598	Right shoulder and neck strain due to slipping and falling.	3,869.89
1/14/2010	WCGA16024646	Tripped and fell in doorway, fractured wrist and injured knee. RT wrist	26,837.04
1/20/2010	WCGA16024677	Strained RT shoulder while moving large TV from the ground onto a pallet.	324.28
1/31/2010	WCST48024706	Strained LT shoulder/arm from slipping on ice.	1,784.53
2/2/2010	WCJE22024724	Punctured RT 3rd fingernail from loose plastic window casing of truck.	0.00

2/18/2010	WCLA24024783	Ongoing injury to LT arm, tennis elbow.	3,865.26
3/2/2010	WCSH46024837	Slipped and fell on ice, strained lower back.	224.50
3/5/2010	WCLN27024856	Asbestos exposure due to years of working at the landfill.	16,604.80
3/16/2010	WCLN27024883	Felt RT hamstring pop when foot slipped on a stone.	692.26
4/9/2010	WCLA24024930	Rolled RT ankle on a rock when stepped out of the work truck.	675.73
4/11/2010	WCHI21024911	Hit in mouth by a board off of a window sill while pushing down garbage.	0.00
4/13/2010	WCPH36024936	Releasing a boom on flatbed trailer and felt pull in RT rib area.	0.00
6/8/2010	WCLC25025110	Low back pain after working with landfill compactor all day.	1,058.00
6/22/2010	WCLC25025152	Pain in knee over time due to operating heavy equipment.	174.00
6/22/2010	WCLC25025153	Back pain developed over time by sitting in hard chairs in heavy equipment.	41,470.07
6/26/2010	WCJE22025149	Strained back while moving a stock feeder.	1,731.29
7/10/2010	WCTE50025216	Strained back and neck when lifted metal plates.	1,010.36
7/21/2010	WCSA45025263	Felt pull in LT shoulder while pulling load frame from skidsteer.	265.48
8/3/2010	WCLA24025352	Injured LT arm when getting off of flatbed and fell onto asphalt.	414.23
8/4/2010	WCLN27025332	Strained back, legs and neck while lifting a tv that had been thrown in dumpster.	47,545.78

8/12/2010	WCLA24025334	Strained tendon and nerve in LT elbow while shoveling garbage into containers.	0.00
8/18/2010	WCTE50025385	Strained RT arm/elbow while throwing tires into dumpster.	2,515.80
8/23/2010	WCLA24025400	Struck LT elbow against door frame of excavator.	260.06
8/27/2010	WCRB44025452	Struck in RT wrist by heavy gauge wire.	0.00
8/27/2010	WCST48025387	MVA, no known injuries.	0.00
8/28/2010	WCST48025376	Stepped on rusty nail with RT foot.	93.00
9/1/2010	WCLA24025417	Bilateral elbow tendinitis developed over time from repetitive use.	0.00
10/2/2010	WCJE22025460	Hit in LT hand/fingers from lid handle.	94.57
10/4/2010	WCTE50025550	Scraped RT elbow on siding.	0.00
10/22/2010	WCBE01025520	Felt knee cap pop when twisted to get out of loader.	84,152.71
10/26/2010	WCLC25025535	Felt pop in middle of back while trying to prime the pump.	77.26
11/1/2010	WCLA24025809	Ongoing pain in right elbow and shoulder since Nov 2010.	0.00
11/22/2010	WCGA16025608	Struck on the LT ribs when stepping off of equipment.	0.00
11/29/2010	WCGA16025609	Slipped on ice, fell on RT side, RT elbow and RT hip.	0.00
11/30/2010	WCGA16025606	Smashed RT ring finger cleaning dozer tracks.	413.03

12/7/2010	WCYS56025618	Fell on ice and hit head.	0.00
12/11/2010	WCST48025638	Slipped on the ice, injuring RT wrist,	596.58
1/11/2011	WCDL10025965	While climbing out of loader, EE slipped, hitting left elbow on side of loader.	0.00
1/11/2011	WCGT20025789	Reaching to unload garbage and strained lower back.	0.00
1/20/2011	WCTE50025790	Wind caught gate and caused EE to slip on ice and fall, twisting right knee.	0.00
4/4/2011	WCLA24026002	EE was getting off ladder and foot slipped, causing him to roll left ankle.	967.97
4/13/2011	WCDL10026033	EE caught right ring finger in garbage truck.	2,012.96
4/18/2011	WCDL10026038	EE bent down to pick up garbage and hit left side of head on dumpster peg cutting forehead.	0.00
4/28/2011	WCGA16026070	EE fell outside scalehouse on sidewalk hurting right pinky finger andright side of body.	151.13
4/28/2011	WCSA45026076	As EE was cranking container lid open, he felt a pop in his elbow.	15,573.30
5/28/2011	WCLA24026149	When a plate on hopper dropped into pit, EE fell as well, injuring forearm and both thighs.	629.21
6/7/2011	WCBR04026213	EE was closing door to canister when door slammed shut causing handle to hit left side of forehead.	0.00
6/11/2011	WCGA16026196	EE stepped on nail while cleaning transfer station tunnel, puncturing left foot.	0.00
6/20/2011	WCLA24026185	EE got something in right eye as he walked around truck.	79.00
6/21/2011	WCGA16026197	EE cut left elbow trying to close roll off box.	381.44

6/22/2011	WCGT20026230	EE stepped on iron rod and fell to left, bending wrist backwards, jamming shoulder and sprained neck.	0.00
7/6/2011	WCTR52026248	EE was helping unload a broken toilet and it fell cutting her foot, requiring 7 stitches.	288.19
7/8/2011	WCSH46026601	Loader slipped into high gear and pitched EE into window, injuring neck.	167,432.85
7/23/2011	WCPA34026309	EE caught left thumb in turn buckle of compactor.	579.80
7/27/2011	WCLA24026331	Ee got wood sliver under right middle fingernail while working on work bench.	0.00
8/4/2011	WCLN27026349	Stung by Wasp in right hand	377.35
8/18/2011	WCDL10026411	EE was standing & twisted around to locate a manual & hurt his back.	874.78
8/22/2011	WCLA24026401	EE was pulling metal out of container and broke bottom glass in excavater, cutting finger.	0.00
8/23/2011	WCLA24026427	EE broke left thumb when T-handle broke, smashing thumb.	294.95
8/29/2011	WCLC25026457	EE inhaled unknown substance & had allergic reaction while running compactor.	0.00
9/4/2011	WCVA53026446	EE was opening the splash plates & pulled on lid straining back.	532.50
9/9/2011	WCSA45026475	EE was stung by a bee on the tongue.	0.00
9/10/2011	WCSA45026476	EE was stung by bee on arm causing redness, swelling and itching.	107.25
9/13/2011	WCLA24026474	EE was pushing on pipe wrench and felt right shoulder pop, causing pain.	77,240.38
11/10/2011	WCRB44026635	EE cut two fingers in saw, requiring stitches.	330.00

11/15/2011	WCLN27026801	EE pulled on trailer tongue when he felt back pop & sharp pain, herniated disc C6-7.	6,156.00
12/29/2011	WCSA45026776	EE slipped on floor at Transfer Station, injuring hip.	0.00
1/3/2012	WCLA24026821	EE caught boot on step, twisting left ankle.	0.00
1/17/2012	WCMA28026850	EE pinched hand between door & frame while closing refuse container. LT hand	300.50
1/18/2012	WCSA45026968	EE experienced heart problems after shoveling snow to get unstuck. Denied.	0.00
1/19/2012	WCPW39026841	EE indicates repeated stress on hand & wrist due to picking up litter.	0.00
2/3/2012	WCLA24026906	EE slipped on ice walking into recycling building, landing on his back.	0.00
2/6/2012	WCJE22026905	EE fell off step ladder that slipped on ice, landing on his back & snapping his neck.	1,217.83
2/6/2012	WCPW39026908	EE hurt right shoulder while chipping ice out of a dumpster.	3,639.95
2/16/2012	WCTE50026960	EE felt pain in left shoulder while lifting a battery.	0.00
2/21/2012	WCPA34026934	EE's right thumb was bruised/broken when lid fell on it.	28,580.58
3/3/2012	WCST48027118	Smashed right middle finger when he dropped a exercise machine on it while unloading it.	209.67
3/15/2012	WCTE50027038	EE jumped out of trash container on truck causing knee to ache.	331.00
3/22/2012	WCGA16027073	While opening door to composting tunnel, EE lost balance & fell backwards landing on his elbows & buttocks.	0.00
3/28/2012	WCGA16027065	EE was grinding & got metal in right eye.	92.04

4/26/2012	WCJE22027141	EE was lifting up on flap of dumpster and felt a popping and pain in her chest.	188.66
5/11/2012	WCBE01027171	Hit left knee getting into loader.	0.00
5/17/2012	WCHI21027197	EE was hit in shin by a rubber track, causing a laceration and bruising to his shin and foot.	266.12
6/16/2012	WCJE22027282	EE got dust in his right, scratching it.	578.84
6/22/2012	WCLA24027277	EE pinched middle finger between two recycling bins.	398.40
6/24/2012	WCPA34027278	While crushing a box in the rolloff box with his foot, EE punctured his foot with wire.	761.65
7/5/2012	WCLA24027332	EE twisted right knee on slippery floor.	10,774.31
7/29/2012	WCLA24027388	Lump on left wrist and right hand causing sharp shooting pain in hands.	2,553.37
8/13/2012	WCST48027454	EE stepped our of truck, twisted knee when landing on the ground.	5,969.38
8/16/2012	WCLA24027443	EE picked up a glass bottle that exploded in her face, cutting thumb, neck & cheek.	0.00
8/24/2012	WCLN27027450	EE overcorrected gargabe truck causing it to roll, resulting in fatality.	0.00
9/25/2012	WCST48027544	EE slipped on a swamp cooler, twisting right hip and back, while placing a chain around a freezer within a roll-off box.	0.00
10/9/2012	WCST48027552	While loading garbage into compactor box, EE ran over battery pack which released sulfuric acid in a white cloudy form, causing a strong acid smell & eye irritation.	0.00
10/16/2012	WCPA34027577	While closing door on refuse lock, a gust of wind blew something in left eye.	84.00
10/22/2012	WCHI21027649	EE stepped on nail with right foot.	0.00

11/2/2012	WCPA34027630	While on soft shoulder in truck, truck tipped over, injuring EE's right shoulder, mid back and left knee.	889.00
11/14/2012	WCTE50027668	Twisted right knee stepping out of container.	501.00
11/17/2012	WCST48027675	EE was bitten on hand by a customer's dog she was petting.	0.00
11/28/2012	WCHI21027698	EE felt left elbow pop when lifting an exterior door into container.	1,907.65
12/3/2012	WCLA24027776	EE strained shoulder and neck from the repetitive motion of pulling frozen compact rolls apart and putting into bailer.	0.00
12/10/2012	WCJE22027726	EE experienced back pain after moving refrigerator and gas heater.	1,455.00
12/13/2012	WCST48027741	EE was throwing metal into metal bin when he slipped on the ice, hitting ground with right elbow and hip.	0.00
1/4/2013	WCJE22027779	As EE was walking across lot, she slipped on ice twisting right knee.	112,748.69
1/7/2013	WCHI21027822	While hooking up a blade, the come-a-long broke and EE fell, pinching his legs between blade and mounting bracket.	15.00
2/5/2013	WCST48027857	EE was walking up front steps of courthouse & stubbed right big toe.	0.00
2/21/2013	WCLA24027903	As EE turned to walk out door, she caught right foot on chair, possibly aggrivating a healing fracture.	0.00
2/21/2013	WCPH36027936	While cleaning up garbage by the canister, EE caught his foot on a box frozen to the ground, twisitng his ankle as he fell.	0.00
2/22/2013	WCLA24027904	EE reports severe carpal sunnel syndrome in both wrists.	15,905.06
3/3/2013	WCLA24027960	EE slipped on bulldozer track, grabbed exhaust pipe to keep from falling & burned left hand.	0.00
3/21/2013	WCST48027971	EE slipped and fell when right knee gave away, causing him to fall on his back.	0.00

3/31/2013	WCLA24027986	EE slipped off machine, twisted her right ankle, landing on back, banged up right elbow & hit head on ground.	0.00
4/21/2013	WCLA24028049	While attempting to step from ladder to rear fender on 10-3, the ladder slipped out and EE fell on left shoulder.	157,957.91
4/22/2013	WCBR04028030	While moving trash, EE grabbed a board & tossed it causing instant sharp/shoooting pain in right bicep area.	4,636.61
4/29/2013	WCJE22028137	As EE was opening rear door of solid waste truck, wind caught the chain, jerking EE's right arm & stressing right shoulder.	2,763.87
4/30/2013	WCTE50028059	EE stumbled & fell forward onto outstretched hands.	0.00
5/6/2013	WCDL10028101	While on his knees sanding & drilling on a dumpster, using insulated coveralls as padding a zipper went into knee, causing EE's left knee to be popped out of joint.	332.62
5/8/2013	WCBE01028089	EE was driving a truck, pulling a trailer, when it started to whip, causing him to drive off the road. He has a stiff neck and shoulders.	0.00
5/21/2013	WCPW39028123	EE inhaled noxious fumes.	747.32
5/23/2013	WCTE50028138	While opening door to refuse container, EE was struck by entry door that fell out, brusing upper arm.	2,820.71
5/30/2013	WCJE22028157	EE walked down a slope covered in loose dirt at site & slipped on rock, twisting right knee.	1,836.95
5/31/2013	WCDL10028139	EE was picking up plywood when he threw his lower back out.	0.00
6/3/2013	WCBE01028154	EE was using a post pounder when it caught the tip of post & flipped toward EE, hitting his head.	728.40
6/20/2013	WCLA24028202	EE pulled muscle in her back when pushing a refrigerator.	0.00
7/20/2013	WCDL10028334	EE rolled on a metal pipe and fell, landing on RT wrist.	400.45
8/9/2013	WCGT20028346	EE damaged his RX safety glasses when unloading a stove that fell over and landed on top of him. EE states no injury to himself.	267.38

9/7/2013	WCLA24028407	Was having back ache and two days later it still hurt and went to ER.	265.97
10/15/2013	WCST48028497	Using winch mechanism which malfunctioned, causing the handle to strike the employee in the hands and arms	22,653.43
10/17/2013	WCDL10028502	EE sprained muscles in neck and back by laying under a caterpillar, trying to take off access panels.	5,809.29
10/18/2013	WCJE22028514	Skinned index and middle finger on filing cabinet	825.85
10/24/2013	WCSA45028521	Hit deer in car	0.00
11/3/2013	WCLA24028621	Jammed finger while drilling holes	0.00
11/12/2013	WCST48028551	Ran into skidsteer bucket, causing EE to fall and hurt the hand, arm, knee and hip.	0.00
11/13/2013	WCTE50028589	Loader tipped over onto right side	1,419.03
11/27/2013	WCSA45028618	Container lid fell and pinched right thumb	14,777.49
12/14/2013	WCST48028735	Slipped on ice and fell on right shoulder and hip; also hit head on compactor	0.00
12/18/2013	WCLA24028686	Slipped on ice and fell on left shoulder	0.00
12/26/2013	WCST48028734	EE was trying to open a latch to open the solid waste box and strained hand	0.00
12/30/2013	WCLA24028705	Tripped on pile of snow and fell on ice	0.00
2/18/2014	WCMA28028843	Strained LT hip and leg due to slipping on snowy hill	33,903.41
2/25/2014	WCTE50028877	Lungs were exposed to fumes due to running diesel fuel heater	276.00

3/22/2014	WCGT20029005	Foot was punctured when glass shard went through sole of boot	0.00
4/5/2014	WCLA24028991	Strained lower back after falling off equipment	1,732.30
4/17/2014	WCHI21029007	Burn to forearm due to exhaust from unhooking vacuum hose	0.00
4/22/2014	WCST48029023	Cut top of index finger when breaking down cardboard with box cutters	978.84
6/20/2014	WCLA24029173	RT foot was punctured after stepping on board with a nail in it	100.00
6/21/2014	WCSA45029158	RT foot stepped on nail	0.00
8/5/2014	WCVA53029308	LT big toe was crushed by fridge falling on it	0.00
8/11/2014	WCLA24029325	Pulled shoulder when unloading 2 dead colts by hand RT shoulder	0.00
8/20/2014	WCHI21029362	RT pinky was smashed between square tubing and metal pipe	499.32
9/3/2014	WCRB44029387	Burned face when cutting bolt off pickup; shock exploded and carried flame up the cutting torch	1,276.09
10/4/2014	WCST48029501	Strained lower back after lifting a customer's trailer	590.49
10/14/2014	WCMA28029508	Strained lower back after slipping and falling on cardboard	35,426.62
10/26/2014	WCST48029509	Lacerated fingers with box cutter when cutting down cardboard boxes	121.83
10/31/2014	WCHI21029525	Bruised ribs when bar being used to strap down container on trailer came loose	209.38
2/5/2015	WCLN27029904	Hit his index finger knuckle after the tool he was using slipped.	515.99

2/5/2015	WCPW39029792	RT foot was punctured after stepping on a nail	362.02
2/17/2015	WCHI21029795	Strained ankle after slipping and falling when getting out of skidsteer	184.80
2/18/2015	WCTE50029805	Strained knee while exiting truck LT knee	802.85
3/3/2015	WCJE22029856	Cut/abrasion to inside/outside of lip when bungee cord snapped back and struck him.	0.00
3/5/2015	WCLA24029919	Strain to shoulder while separating cardboard boxes. RT shoulder	0.00
3/10/2015	WCLN27030354	Asbestos related lung disease after working in the landfill	0.00
3/14/2015	WCTE50029862	Twisted left ankle after missing a step	364.76
4/9/2015	WCHI21029945	Laceration to the leg after using power tools and a piece came off and struck him.	971.97
4/23/2015	WCSA45029968	Strain to left hand after slipping when jumping over a trench and hand tried to break the fall.	704.78
4/29/2015	WCTE50030057	Strain to the right elbow after changing cutting edge on scraper.	0.00
5/2/2015	WCLA24030027	Lungs- He was bailing cardboard when he tasted something funny, chest got tight, was coughing and hard to breathe.	476.83
6/8/2015	WCBE01030069	Strain to the back- Using machinery when he ran over a log which caused it to jar his back.	478.53
6/22/2015	WCVA53030088	Strain to the right knee after trying to hook up plow to the trailer.	8,251.95
7/8/2015	WCLA24030134	Contusion to the left shoulder after a sprocket fell and hit him in the shoulder	376.54
7/31/2015	WCBR04030195	Strain to the back while operating excavator	894.38

8/21/2015	WCTE50030241	Bee sting to the forehead above the left eye resulting in his eye swelling shut	259.21
9/18/2015	WCRI42030311	Laceration to the left index finger after knife slipped while trying to open a package.	548.29
9/30/2015	WCLN27030340	Scratch to the left eye after a bare wire got under his glasses while repairing wiring under rear of dump truck	102.00
10/27/2015	WCLN27030397	Carpal tunnel syndrome to the left wrist and right upper extremity as a result of occupational exposures.	2,759.71
11/13/2015	WCBE01030455	Strain to the right arm after slipping on ice when climbing down from the truck and grabbed ladder to catch himself.	24,110.23
11/21/2015	WCTE50030469	Strain to the left lower abdomen after pulling a piece of plywood so container would close.	120.00
11/27/2015	WCDL10030473	Smashed left thumb between the dumpster and the truck after the latch came loose while moving the dumpster	2,287.57
12/5/2015	WCLN27030497	He got something in his eye which caused a scratch to the cornea.	0.00
1/2/2016	WCTE50030571	Strain to the back after lifting sill plate to refuse container.	1,098.38
1/4/2016	WCLA24030570	[illegible] fractured ribs and hematoma on the brain after a MVA with a semi and another vehicle.	104,625.98
1/4/2016	WCLN27030590	Strain to the right thumb after slipping when reaching for the ladder on the compactor and jamming his thumb on the ladder.	234.98
1/9/2016	WCST48030606	Strain to the right shoulder after pulling roll off box with turn buckle.	0.00
1/15/2016	WCJE22030649	Strain to the left shoulder after shoveling snow and sand all day.	369.53
2/20/2016	WCJE22030681	Strain to the right shoulder after assisting a customer with lifting a V-8 engine block out of the back of his truck. The customer dropped his end and EE felt a shock go through his shoulder.	734.23
2/22/2016	WCVA53030694	Strain to the back/neck after slipping on garbage and falling while trying to get a mattress out from under the loader.	0.00

WC	2/23/2016	WCPA34030689	Strain to the left hip after falling while trying to remove a bent safety hazard reflector. The metal broke on the reflector and sent him flying into the road.	0.00
			Sum:	2,343,558.87
			Sum:	5,998,606.66

U.S. Census Bureau
2009-2013 5-Year
American Comm Survey
8.75 = $105/yr
18.13 = $217.56/yr.

Appendix C

Soils Data

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Jefferson County Area and Part of Silver Bow County, Montana

January 21, 2019

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

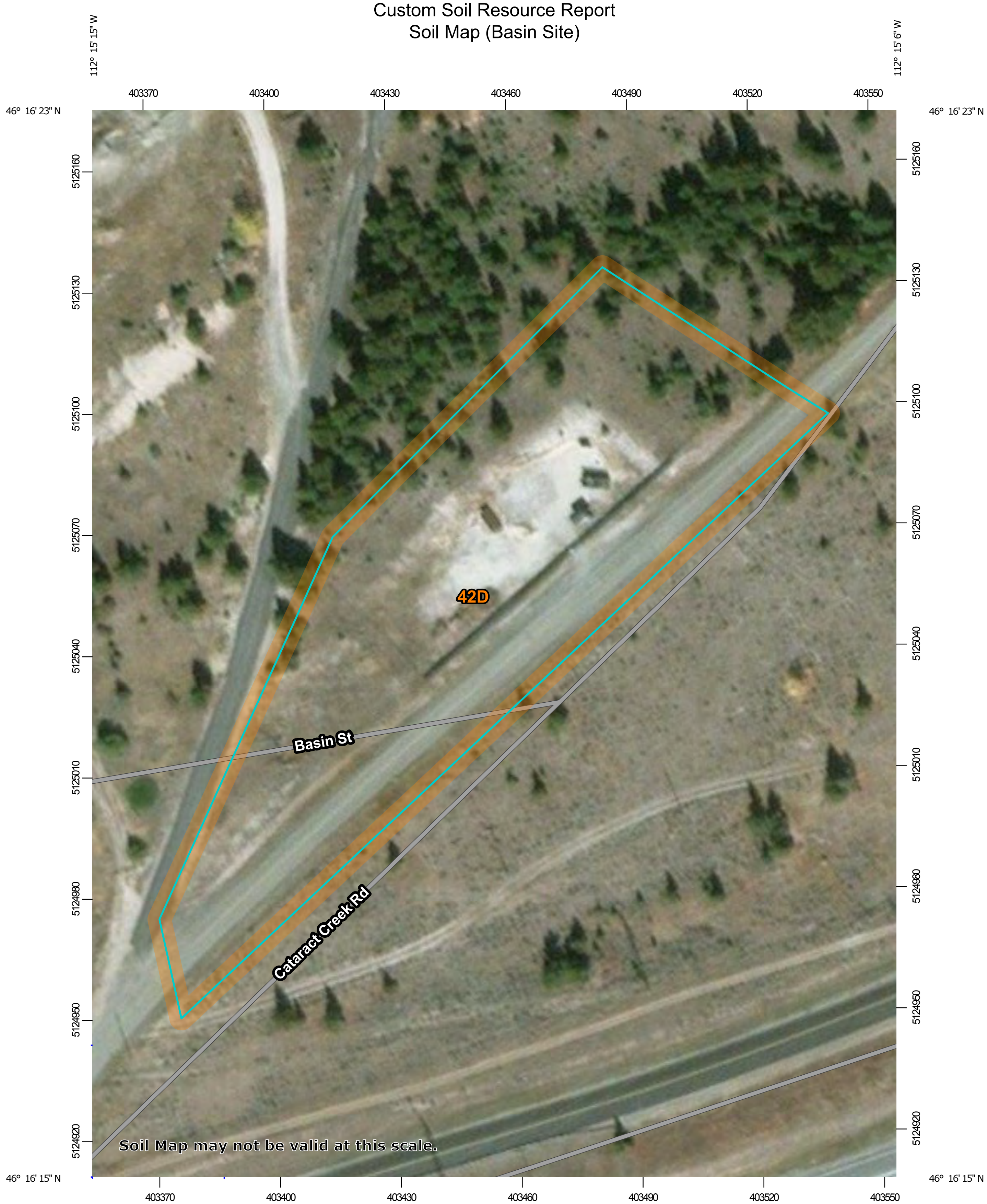
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map (Basin Site)



Map Scale: 1:1,290 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 15, 30, 60, 90

Feet: 0, 50, 100, 200, 300

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jefferson County Area and Part of Silver Bow County, Montana
Survey Area Data: Version 19, Sep 5, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 4, 2013—Nov 12, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND	MAP INFORMATION
	imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Basin Site)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
42D	Perma cobbly loam, 4 to 15 percent slopes, stony	2.6	100.0%
Totals for Area of Interest		**2.6**	**100.0%**

Map Unit Descriptions (Basin Site)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Jefferson County Area and Part of Silver Bow County, Montana

42D—Perma cobbly loam, 4 to 15 percent slopes, stony

Map Unit Setting

National map unit symbol: 526q
Elevation: 4,400 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 80 to 95 days
Farmland classification: Not prime farmland

Map Unit Composition

Perma, stony, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Perma, Stony

Setting

Landform: Alluvial fans, escarpments, hillsides, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly colluvium derived from basalt

Typical profile

A - 0 to 7 inches: cobbly loam
Bw - 7 to 36 inches: very cobbly loam
BC - 36 to 60 inches: extremely gravelly loam

Properties and qualities

Slope: 4 to 15 percent
Percent of area covered with surface fragments: 0.1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Silty-Droughty (SiDr) 15-19" p.z. NOT KNOWN (R043BS686MT), Upland Sagebrush Shrubland (R043BP819MT)
Hydric soil rating: No

Minor Components

Wimper, stony

Percent of map unit: 4 percent
Landform: Alluvial fans, hillsides, terraces

Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (Si) 15-19" p.z. (R043BS310MT)
Hydric soil rating: No

Hilger

Percent of map unit: 3 percent
Landform: Alluvial fans, escarpments, hillsides
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-Droughty (SiDr) 15-19" p.z. NOT KNOWN (R043BS686MT)
Hydric soil rating: No

Shawmut, stony

Percent of map unit: 3 percent
Landform: Alluvial fans, escarpments, hillsides
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-Droughty-Steep (SiDrStp) 15-19" p.z. (R043BS720MT)
Hydric soil rating: No

Soil Information for All Uses

Suitabilities and Limitations for Use

The Suitabilities and Limitations for Use section includes various soil interpretations displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each interpretation.

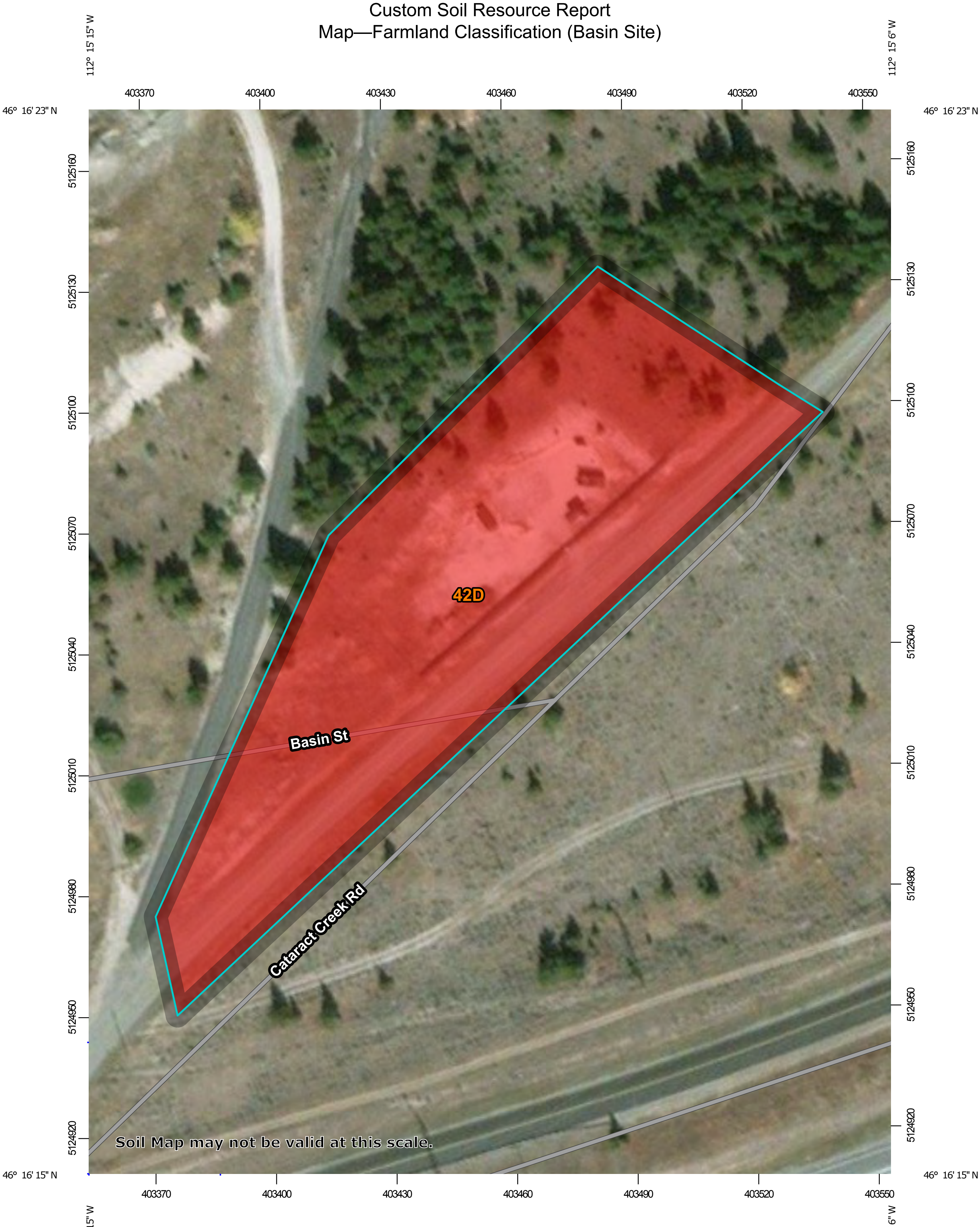
Land Classifications

Land Classifications are specified land use and management groupings that are assigned to soil areas because combinations of soil have similar behavior for specified practices. Most are based on soil properties and other factors that directly influence the specific use of the soil. Example classifications include ecological site classification, farmland classification, irrigated and nonirrigated land capability classification, and hydric rating.

Farmland Classification (Basin Site)

Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978.

Custom Soil Resource Report
Map—Farmland Classification (Basin Site)



Map Scale: 1:1,290 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 15, 30, 60, 90

Feet: 0, 50, 100, 200, 300

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Soil Rating Lines

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Soil Rating Points

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
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- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Water Features

MAP INFORMATION

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jefferson County Area and Part of Silver Bow County, Montana
Survey Area Data: Version 19, Sep 5, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 4, 2013—Nov 12, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Farmland Classification (Basin Site)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
42D	Perma cobbly loam, 4 to 15 percent slopes, stony	Not prime farmland	2.6	100.0%
Totals for Area of Interest			**2.6**	**100.0%**

Rating Options—Farmland Classification (Basin Site)

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower

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United States Department of Agriculture

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Jefferson County Area and Part of Silver Bow County, Montana

January 21, 2019

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map (Boulder Site)

Map Scale: 1:5,990 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 50, 100, 200, 300

Feet: 0, 250, 500, 1000, 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

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Date(s) aerial images were photographed: May 4, 2013—Nov 12, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND	MAP INFORMATION
	imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Boulder Site)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1180E	Farnuf loam, 15 to 35 percent slopes, stony	9.2	5.3%
1272D	Placerton-Connieo-Jeffcity complex, 4 to 15 percent slopes	10.0	5.7%
1273E	Placerton-Farnuf-Breeton complex, 15 to 35 percent slopes	5.1	2.9%
1603C	Farnuf sandy loam, 2 to 8 percent slopes	129.8	74.5%
1607D	Farnuf-Placerton-Martinsdale complex, 4 to 15 percent slopes	20.1	11.6%
Totals for Area of Interest		**174.3**	**100.0%**

Map Unit Descriptions (Boulder Site)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Jefferson County Area and Part of Silver Bow County, Montana

1180E—Farnuf loam, 15 to 35 percent slopes, stony

Map Unit Setting

National map unit symbol: 51mr
Elevation: 4,400 to 6,500 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 80 to 95 days
Farmland classification: Not prime farmland

Map Unit Composition

Farnuf, stony, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Farnuf, Stony

Setting

Landform: Alluvial fans, hillsides, terraces
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy alluvium derived from sandstone-shale

Typical profile

A - 0 to 7 inches: loam
Bt - 7 to 14 inches: sandy clay loam
Bk - 14 to 32 inches: gravelly coarse sandy loam
BC - 32 to 60 inches: gravelly coarse sandy loam

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 0.1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Thin Silty (TSi) 15-19" p.z. (R043BS318MT), Upland Sagebrush Shrubland (R043BP819MT)
Hydric soil rating: No

Minor Components

Wilspring

Percent of map unit: 3 percent
Landform: Escarpments, hillsides, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-Droughty-Steep (SiDrStp) 15-19" p.z. (R043BS720MT)
Hydric soil rating: No

Quaint, very stony

Percent of map unit: 3 percent
Landform: Hillsides, ridges, plateaus
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Very Shallow (VSw) 15-19" p.z. (R043BS319MT)
Hydric soil rating: No

Rock outcrop, volcanic, sandstone

Percent of map unit: 2 percent
Hydric soil rating: No

Placerton

Percent of map unit: 2 percent
Landform: Hillsides, ridges, divides, mountain slopes
Landform position (three-dimensional): Mountainbase
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy-Coarse (SyC) 15-19" p.z. (R043BS708MT)
Hydric soil rating: No

1272D—Placerton-Connieo-Jeffcity complex, 4 to 15 percent slopes

Map Unit Setting

National map unit symbol: 51p1
Elevation: 4,400 to 6,000 feet
Mean annual precipitation: 12 to 19 inches
Mean annual air temperature: 36 to 43 degrees F
Frost-free period: 80 to 95 days
Farmland classification: Farmland of local importance

Map Unit Composition

Placerton and similar soils: 35 percent
Connieo and similar soils: 30 percent
Jeffcity and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Placerton

Setting

Landform: Hillsides, ridges, divides, mountain slopes
Landform position (three-dimensional): Mountainbase
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy slope alluvium derived from granite over residuum weathered from granite

Typical profile

A - 0 to 7 inches: gravelly sandy clay loam
Bt - 7 to 21 inches: gravelly clay loam
Bk - 21 to 29 inches: gravelly sandy loam
Cr - 29 to 58 inches: weathered bedrock
R - 58 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 4 to 15 percent
Depth to restrictive feature: 20 to 60 inches to lithic bedrock; 40 to 60 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Silty-Droughty (SiDr) 15-19" p.z. NOT KNOWN (R043BS686MT), Upland Sagebrush Shrubland (R043BP819MT)
Hydric soil rating: No

Description of Connieo

Setting

Landform: Escarpments, hillsides, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy residuum weathered from granite

Typical profile

A - 0 to 8 inches: gravelly sandy clay loam
Bt - 8 to 14 inches: gravelly sandy clay loam
Cr - 14 to 18 inches: weathered bedrock
R - 18 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 4 to 15 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: Very Shallow (VSw) 15-19" p.z. (R043BS319MT), Shallow Sagebrush Shrubland (R043BP811MT)
Hydric soil rating: No

Description of Jeffcity

Setting

Landform: Escarpments, hillsides, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy residuum weathered from granite

Typical profile

A - 0 to 7 inches: loam
Bt - 7 to 14 inches: gravelly sandy clay loam
Bk - 14 to 33 inches: gravelly coarse sandy loam
Cr - 33 to 38 inches: weathered bedrock
R - 38 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 4 to 15 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: Silty-Droughty (SiDr) 15-19" p.z. NOT KNOWN (R043BS686MT), Upland Sagebrush Shrubland (R043BP819MT)
Hydric soil rating: No

Minor Components

Rock outcrop, granite

Percent of map unit: 2 percent
Hydric soil rating: No

Farnuf

Percent of map unit: 2 percent

Landform: Alluvial fans, hillsides, terraces
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (Si) 15-19" p.z. (R043BS310MT)
Hydric soil rating: No

Ashbray, bouldery
Percent of map unit: 2 percent
Landform: Escarpments, hillsides, ridges
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Douglas-fir/Idaho fescue (PK220)
Hydric soil rating: No

Kounter, bouldery
Percent of map unit: 2 percent
Landform: Hillsides, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Very Shallow (VSw) 15-19" p.z. (R043BS319MT)
Hydric soil rating: No

Cedric, bouldery
Percent of map unit: 2 percent
Landform: Ridges, divides, hills
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Very Shallow (VSw) 15-19" p.z. (R043BS319MT)
Hydric soil rating: No

1273E—Placerton-Farnuf-Breeton complex, 15 to 35 percent slopes

Map Unit Setting
National map unit symbol: 51p2
Elevation: 4,400 to 6,000 feet
Mean annual precipitation: 12 to 19 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 80 to 95 days
Farmland classification: Not prime farmland

Map Unit Composition
Placerton and similar soils: 35 percent
Farnuf and similar soils: 30 percent
Breeton and similar soils: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Placerton

Setting

Landform: Hillsides, ridges, divides, mountain slopes
Landform position (three-dimensional): Mountainbase
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy slope alluvium derived from granite over residuum weathered from granite

Typical profile

A - 0 to 7 inches: sandy loam
Bt - 7 to 21 inches: gravelly clay loam
Bk - 21 to 29 inches: gravelly sandy loam
Cr - 29 to 58 inches: weathered bedrock
R - 58 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: 20 to 60 inches to lithic bedrock; 40 to 60 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Sandy-Droughty (SyDr) 15-19" p.z. (R043BS719MT), Upland Sagebrush Shrubland (R043BP819MT)
Hydric soil rating: No

Description of Farnuf

Setting

Landform: Alluvial fans, hillsides, terraces
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy alluvium derived from sandstone-shale

Typical profile

A - 0 to 7 inches: loam
Bt - 7 to 14 inches: sandy clay loam
Bk - 14 to 32 inches: gravelly coarse sandy loam
BC - 32 to 60 inches: gravelly coarse sandy loam

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Thin Silty (TSi) 15-19" p.z. (R043BS318MT), Upland Sagebrush Shrubland (R043BP819MT)
Hydric soil rating: No

Description of Breeton

Setting

Landform: Alluvial fans, hillsides, terraces
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy slope alluvium derived from granite

Typical profile

A - 0 to 12 inches: coarse sandy loam
Bw - 12 to 26 inches: gravelly coarse sandy loam
BC - 26 to 60 inches: gravelly coarse sandy loam

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: Thin Sandy (TSy) 15-19" p.z. (R043BS317MT), Upland Sagebrush Shrubland (R043BP819MT)
Hydric soil rating: No

Minor Components

Rock outcrop, granite

Percent of map unit: 4 percent
Hydric soil rating: No

Jeffcity, stony

Percent of map unit: 4 percent
Landform: Escarpments, hillsides, ridges

Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy-Droughty (SyDr) 15-19" p.z. (R043BS719MT)
Hydric soil rating: No

Cedric, bouldery

Percent of map unit: 4 percent
Landform: Ridges, divides, hills
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Very Shallow (VSw) 15-19" p.z. (R043BS319MT)
Hydric soil rating: No

Ashbray, bouldery

Percent of map unit: 3 percent
Landform: Escarpments, hillsides, ridges
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Douglas-fir/Idaho fescue (PK220)
Hydric soil rating: No

1603C—Farnuf sandy loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 51r9
Elevation: 3,940 to 6,000 feet
Mean annual precipitation: 12 to 19 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 80 to 105 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Farnuf and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Farnuf

Setting

Landform: Alluvial fans, hillsides, terraces
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy alluvium derived from sandstone-shale

Typical profile

A - 0 to 7 inches: sandy loam

Bt - 7 to 14 inches: sandy clay loam
Bk - 14 to 32 inches: gravelly coarse sandy loam
BC - 32 to 60 inches: gravelly coarse sandy loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Sandy (Sy) 15-19" p.z. (R043BS307MT), Upland Grassland (R043BP818MT)
Hydric soil rating: No

Minor Components

Faith

Percent of map unit: 2 percent
Landform: Alluvial fans, terraces, drainageways, flood-plain steps
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (Si) 15-19" p.z. (R044XS355MT)
Hydric soil rating: No

Placerton

Percent of map unit: 2 percent
Landform: Hillsides, ridges, divides, mountain slopes
Landform position (three-dimensional): Mountainbase
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-Droughty (SiDr) 15-19" p.z. NOT KNOWN (R043BS686MT)
Hydric soil rating: No

Martinsdale

Percent of map unit: 1 percent
Landform: Alluvial fans, hillsides, terraces
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (Si) 15-19" p.z. (R043BS310MT)
Hydric soil rating: No

1607D—Farnuf-Placerton-Martinsdale complex, 4 to 15 percent slopes

Map Unit Setting

National map unit symbol: 51rg
Elevation: 4,400 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 36 to 43 degrees F
Frost-free period: 80 to 95 days
Farmland classification: Farmland of local importance

Map Unit Composition

Farnuf and similar soils: 40 percent
Placerton and similar soils: 35 percent
Martinsdale and similar soils: 20 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Farnuf

Setting

Landform: Alluvial fans, hillsides, terraces
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy alluvium derived from sandstone-shale

Typical profile

A - 0 to 7 inches: loam
Bt - 7 to 14 inches: sandy clay loam
Bk - 14 to 32 inches: gravelly coarse sandy loam
BC - 32 to 60 inches: gravelly coarse sandy loam

Properties and qualities

Slope: 4 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Silty (Si) 15-19" p.z. (R043BS310MT), Upland Sagebrush Shrubland (R043BP819MT)

Hydric soil rating: No

Description of Placerton

Setting

Landform: Hillsides, ridges, divides, mountain slopes
Landform position (three-dimensional): Mountainbase
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy slope alluvium derived from granite over residuum weathered from granite

Typical profile

A - 0 to 7 inches: sandy loam
Bt - 7 to 21 inches: gravelly clay loam
Bk - 21 to 29 inches: gravelly sandy loam
Cr - 29 to 58 inches: weathered bedrock
R - 58 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 4 to 15 percent
Depth to restrictive feature: 20 to 60 inches to lithic bedrock; 40 to 60 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Sandy-Coarse (SyC) 15-19" p.z. (R043BS708MT), Upland Sagebrush Shrubland (R043BP819MT)
Hydric soil rating: No

Description of Martinsdale

Setting

Landform: Alluvial fans, hillsides, terraces
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous fine-loamy slope alluvium derived from fine-grained sandstone, siltstone and metamorphic rocks

Typical profile

A - 0 to 6 inches: loam
Bt - 6 to 16 inches: clay loam
Bk1 - 16 to 36 inches: gravelly sandy clay loam
Bk2 - 36 to 60 inches: very gravelly sandy clay loam

Properties and qualities

Slope: 4 to 15 percent

Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 35 percent
Gypsum, maximum in profile: 1 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: Silty (Si) 15-19" p.z. (R043BS310MT), Upland Sagebrush Shrubland (R043BP819MT)
Hydric soil rating: No

Minor Components

Connieo

Percent of map unit: 3 percent
Landform: Escarpments, hillsides, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Very Shallow (VSw) 15-19" p.z. (R043BS319MT)
Hydric soil rating: No

Kounter, bouldery

Percent of map unit: 2 percent
Landform: Hillsides, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Very Shallow (VSw) 15-19" p.z. (R043BS319MT)
Hydric soil rating: No

Soil Information for All Uses

Suitabilities and Limitations for Use

The Suitabilities and Limitations for Use section includes various soil interpretations displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each interpretation.

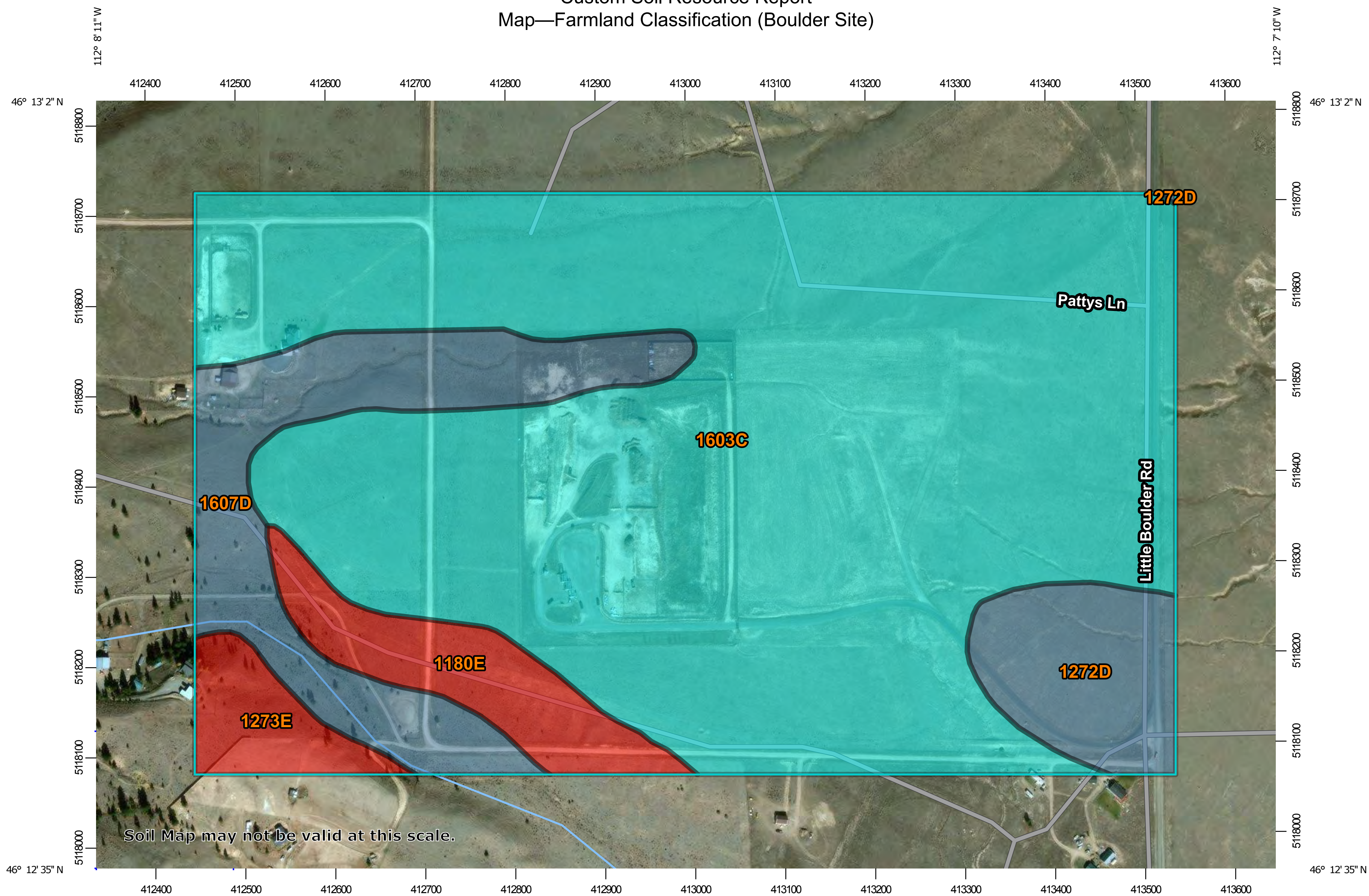
Land Classifications

Land Classifications are specified land use and management groupings that are assigned to soil areas because combinations of soil have similar behavior for specified practices. Most are based on soil properties and other factors that directly influence the specific use of the soil. Example classifications include ecological site classification, farmland classification, irrigated and nonirrigated land capability classification, and hydric rating.

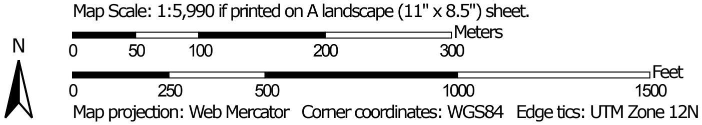
Farmland Classification (Boulder Site)

Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978.

Map—Farmland Classification (Boulder Site)



Map Scale: 1:5,990 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Soil Rating Lines

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Soil Rating Points

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Water Features

MAP INFORMATION

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jefferson County Area and Part of Silver Bow County, Montana
Survey Area Data: Version 19, Sep 5, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 4, 2013—Nov 12, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Farmland Classification (Boulder Site)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1180E	Farnuf loam, 15 to 35 percent slopes, stony	Not prime farmland	9.2	5.3%
1272D	Placerton-Connieo-Jeffcity complex, 4 to 15 percent slopes	Farmland of local importance	10.0	5.7%
1273E	Placerton-Farnuf-Breeton complex, 15 to 35 percent slopes	Not prime farmland	5.1	2.9%
1603C	Farnuf sandy loam, 2 to 8 percent slopes	Farmland of statewide importance	129.8	74.5%
1607D	Farnuf-Placerton-Martinsdale complex, 4 to 15 percent slopes	Farmland of local importance	20.1	11.6%
Totals for Area of Interest			**174.3**	**100.0%**

Rating Options—Farmland Classification (Boulder Site)

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower

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United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Jefferson County Area and Part of Silver Bow County, Montana

January 21, 2019

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

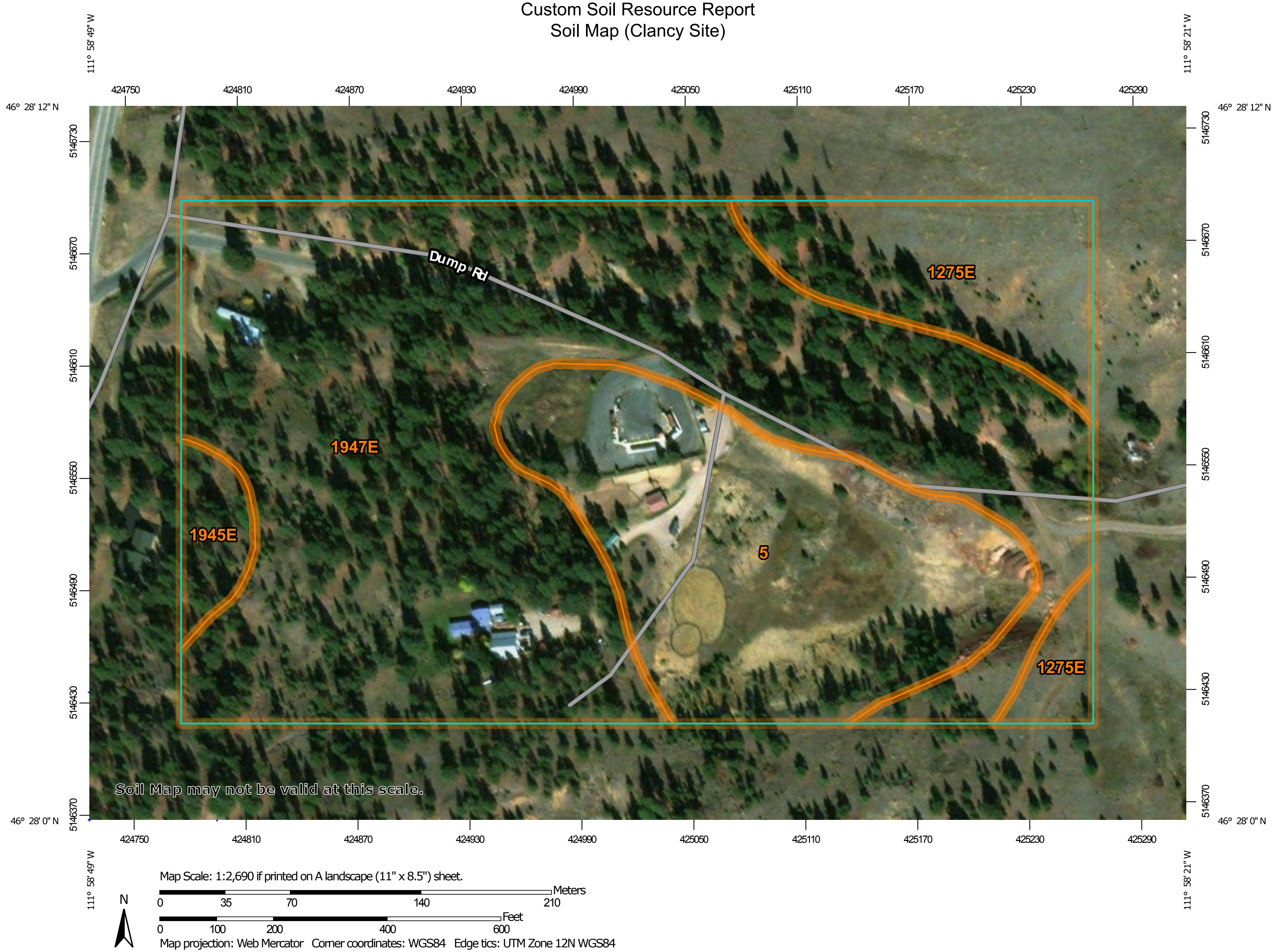
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map (Clancy Site)



Map Scale: 1:2,690 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 35, 70, 140, 210

Feet: 0, 100, 200, 400, 600

Map projection: Web Mercator   Corner coordinates: WGS84   Edge tics: UTM Zone 12N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jefferson County Area and Part of Silver Bow County, Montana
Survey Area Data: Version 19, Sep 5, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 4, 2013—Nov 12, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND	MAP INFORMATION
	imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Clancy Site)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
5	Borrow areas and Gravel pits	8.3	24.4%
1275E	Placerton-Farnuf-Connieo complex, 15 to 35 percent slopes	3.8	11.3%
1945E	Elmark, bouldery-Lumpgulch, very bouldery-Rock outcrop complex, 8 to 35 percent slopes, dry	0.8	2.3%
1947E	Elmark, bouldery-Burtoner-Rock outcrop complex, 8 to 45 percent slopes	21.0	62.1%
Totals for Area of Interest		**33.9**	**100.0%**

Map Unit Descriptions (Clancy Site)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it

was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Jefferson County Area and Part of Silver Bow County, Montana

5—Borrow areas and Gravel pits

Map Unit Composition

Gravel pits: 50 percent
Borrow areas: 50 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

1275E—Placerton-Farnuf-Connieo complex, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: 51p4
Elevation: 4,400 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 36 to 43 degrees F
Frost-free period: 90 to 105 days
Farmland classification: Not prime farmland

Map Unit Composition

Placerton and similar soils: 50 percent
Farnuf and similar soils: 25 percent
Connieo and similar soils: 15 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Placerton

Setting

Landform: Hillsides, ridges, divides, mountain slopes
Landform position (three-dimensional): Mountainbase
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy slope alluvium derived from granite over residuum weathered from granite

Typical profile

A - 0 to 7 inches: sandy clay loam
Bt - 7 to 21 inches: gravelly clay loam
Bk - 21 to 29 inches: gravelly sandy loam
Cr - 29 to 58 inches: weathered bedrock
R - 58 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: 20 to 60 inches to lithic bedrock; 40 to 60 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Thin Silty (TSi) 15-19" p.z. (R043XC435MT), Upland Grassland (R043BP818MT)
Hydric soil rating: No

Description of Farnuf

Setting

Landform: Alluvial fans, hillsides, terraces
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy alluvium derived from sandstone-shale

Typical profile

A - 0 to 7 inches: loam
Bt - 7 to 14 inches: sandy clay loam
Bk - 14 to 32 inches: gravelly coarse sandy loam
BC - 32 to 60 inches: gravelly coarse sandy loam

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Thin Silty (TSi) 15-19" p.z. (R043XC435MT), Upland Grassland (R043BP818MT)
Hydric soil rating: No

Description of Connieo

Setting

Landform: Escarpments, hillsides, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy residuum weathered from granite

Typical profile

A - 0 to 8 inches: gravelly sandy clay loam
Bt - 8 to 14 inches: gravelly sandy clay loam
Cr - 14 to 18 inches: weathered bedrock

R - 18 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: Shallow (Sw) 15-19" p.z. (R043XC425MT), Shallow Grassland (R043BP810MT)
Hydric soil rating: No

Minor Components

Farnuf, lesser slope

Percent of map unit: 6 percent
Landform: Alluvial fans, hillsides, terraces
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (Si) 15-19" p.z. (R043XC427MT)
Hydric soil rating: No

Rock outcrop, granite

Percent of map unit: 4 percent
Hydric soil rating: No

1945E—Elmark, bouldery-Lumpgulch, very bouldery-Rock outcrop complex, 8 to 35 percent slopes, dry

Map Unit Setting

National map unit symbol: 51wk
Elevation: 4,400 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 90 to 105 days
Farmland classification: Not prime farmland

Map Unit Composition

Elmark, bouldery, and similar soils: 40 percent
Lumpgulch, very bouldery, and similar soils: 25 percent
Rock outcrop, granite: 15 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Elmark, Bouldery

Setting

Landform: Escarpments, hillsides, mountainsides, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy slope alluvium over sandy and gravelly residuum weathered from granite

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 9 inches: sandy clay loam
Bt - 9 to 21 inches: sandy clay loam
BC - 21 to 32 inches: gravelly sandy loam
Cr - 32 to 59 inches: weathered bedrock
R - 59 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 35 percent
Percent of area covered with surface fragments: 0.1 percent
Depth to restrictive feature: 40 to 60 inches to lithic bedrock; 40 to 60 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: Upland Cool Woodland (F043BP910MT)
Other vegetative classification: Douglas-fir/rough fescue (PK230)
Hydric soil rating: No

Description of Lumpgulch, Very Bouldery

Setting

Landform: Escarpments, hillsides, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy slope alluvium derived from granite over residuum weathered from granite

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material

A - 1 to 8 inches: sandy clay loam
Bt - 8 to 23 inches: gravelly sandy clay loam
Cr - 23 to 28 inches: weathered bedrock
R - 28 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 35 percent
Percent of area covered with surface fragments: 1.5 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: Upland Cool Woodland (F043BP910MT)
Other vegetative classification: Douglas-fir/rough fescue (PK230)
Hydric soil rating: No

Minor Components

Elmark, very bouldery

Percent of map unit: 6 percent
Landform: Escarpments, hillsides, mountainsides, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Douglas-fir/rough fescue (PK230)
Hydric soil rating: No

Kellygulch, very bouldery

Percent of map unit: 5 percent
Landform: Escarpments, hillsides, ridges, divides
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Douglas-fir/rough fescue (PK230)
Hydric soil rating: No

Shaboom, very bouldery

Percent of map unit: 5 percent
Landform: Escarpments, hillsides, ridges
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Douglas-fir/rough fescue (PK230)
Hydric soil rating: No

Hoyt

Percent of map unit: 4 percent
Landform: Alluvial fans, hillsides
Down-slope shape: Linear
Across-slope shape: Linear

Other vegetative classification: Douglas-fir/rough fescue (PK230)
Hydric soil rating: No

1947E—Elmark, bouldery-Burtoner-Rock outcrop complex, 8 to 45 percent slopes

Map Unit Setting

National map unit symbol: 51wm
Elevation: 4,400 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 70 to 105 days
Farmland classification: Not prime farmland

Map Unit Composition

Elmark, bouldery, and similar soils: 50 percent
Burtoner and similar soils: 25 percent
Rock outcrop, granite: 10 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Elmark, Bouldery

Setting

Landform: Escarpments, hillsides, mountainsides, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy slope alluvium over sandy and gravelly residuum weathered from granite

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 9 inches: gravelly coarse sandy loam
Bt - 9 to 21 inches: gravelly sandy clay loam
BC - 21 to 32 inches: gravelly sandy loam
Cr - 32 to 59 inches: weathered bedrock
R - 59 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 45 percent
Percent of area covered with surface fragments: 0.1 percent
Depth to restrictive feature: 40 to 60 inches to lithic bedrock; 40 to 60 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Available water storage in profile: Low (about 3.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: Upland Cool Woodland (F043BP910MT)
Other vegetative classification: Douglas-fir/rough fescue (PK230)
Hydric soil rating: No

Description of Burtoner

Setting

Landform: Escarpments, hillsides, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy residuum weathered from granite

Typical profile

A - 0 to 8 inches: sandy clay loam
Bt - 8 to 23 inches: sandy clay loam
Cr - 23 to 28 inches: weathered bedrock
R - 28 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 45 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: Silty-Coarse (SiC) 15-19" p.z. (R043XC665MT), Upland Warm Woodland (F043BP911MT)
Hydric soil rating: No

Minor Components

Clancy, very stony

Percent of map unit: 5 percent
Landform: Escarpments, ridges, hills
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy-Droughty (SyDr) 15-19" p.z. (R043XC716MT)
Hydric soil rating: No

Shaboom, bouldery

Percent of map unit: 4 percent
Landform: Escarpments, hillsides, ridges
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Linear

Across-slope shape: Linear
Other vegetative classification: Douglas-fir/rough fescue (PK230)
Hydric soil rating: No

Hoyt

Percent of map unit: 3 percent
Landform: Alluvial fans, hillsides
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Douglas-fir/rough fescue (PK230)
Hydric soil rating: No

Baxton

Percent of map unit: 3 percent
Landform: Hillsides, mountainsides, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy-Droughty (SyDr) 15-19" p.z. (R043XC716MT)
Hydric soil rating: No

Soil Information for All Uses

Suitabilities and Limitations for Use

The Suitabilities and Limitations for Use section includes various soil interpretations displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each interpretation.

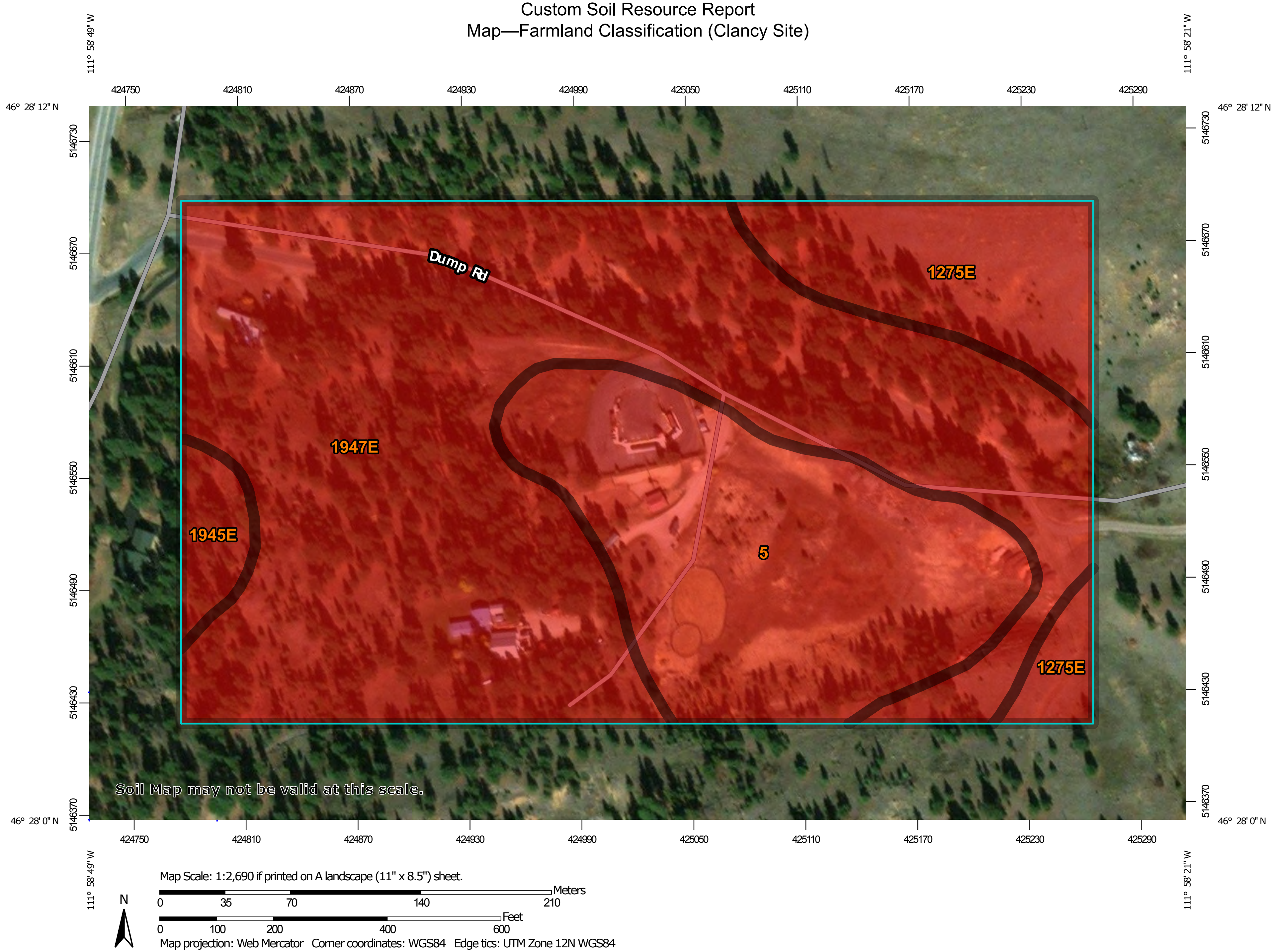
Land Classifications

Land Classifications are specified land use and management groupings that are assigned to soil areas because combinations of soil have similar behavior for specified practices. Most are based on soil properties and other factors that directly influence the specific use of the soil. Example classifications include ecological site classification, farmland classification, irrigated and nonirrigated land capability classification, and hydric rating.

Farmland Classification (Clancy Site)

Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978.

Map—Farmland Classification (Clancy Site)



Map Scale: 1:2,690 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 35, 70, 140, 210

Feet: 0, 100, 200, 400, 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Soil Rating Lines

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Soil Rating Points

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Water Features

MAP INFORMATION

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jefferson County Area and Part of Silver Bow County, Montana
Survey Area Data: Version 19, Sep 5, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 4, 2013—Nov 12, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Farmland Classification (Clancy Site)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
5	Borrow areas and Gravel pits	Not prime farmland	8.3	24.4%
1275E	Placerton-Farnuf-Connieo complex, 15 to 35 percent slopes	Not prime farmland	3.8	11.3%
1945E	Elmark, bouldery-Lumpgulch, very bouldery-Rock outcrop complex, 8 to 35 percent slopes, dry	Not prime farmland	0.8	2.3%
1947E	Elmark, bouldery-Burtoner-Rock outcrop complex, 8 to 45 percent slopes	Not prime farmland	21.0	62.1%
Totals for Area of Interest			**33.9**	**100.0%**

Rating Options—Farmland Classification (Clancy Site)

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower

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United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Jefferson County Area and Part of Silver Bow County, Montana

January 21, 2019

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map (Jefferson City Site)

Map Scale: 1:1,200 if printed on A landscape (11" x 8.5") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jefferson County Area and Part of Silver Bow County, Montana
Survey Area Data: Version 19, Sep 5, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 4, 2013—Nov 12, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND	MAP INFORMATION
	imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Jefferson City Site)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
329C	Faith-Slickens complex, 0 to 8 percent slopes, impacted	0.5	15.9%
1245E	Baxton-Connieo complex, 15 to 35 percent slopes	1.7	50.8%
1651C	Sawbuck-Sawbuck, very stony-Clasoil complex, 2 to 8 percent slopes	1.1	33.3%
Totals for Area of Interest		**3.3**	**100.0%**

Map Unit Descriptions (Jefferson City Site)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Jefferson County Area and Part of Silver Bow County, Montana

329C—Faith-Slickens complex, 0 to 8 percent slopes, impacted

Map Unit Setting

National map unit symbol: 5255
Elevation: 3,800 to 6,000 feet
Mean annual precipitation: 10 to 19 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 80 to 115 days
Farmland classification: Not prime farmland

Map Unit Composition

Faith and similar soils: 50 percent
Slickens: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Faith

Setting

Landform: Alluvial fans, terraces, drainageways, flood-plain steps
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy alluvium

Typical profile

A - 0 to 8 inches: sandy loam
Bw - 8 to 26 inches: loam
2Cg - 26 to 60 inches: stratified very gravelly sandy loam to loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 42 to 60 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Sandy (Sy) 15-19" p.z. (R043XC424MT), Bottomland (R043BP801MT)
Hydric soil rating: No

Minor Components

Pieriver

Percent of map unit: 5 percent
Landform: Flood plains, drainageways, flood-plain steps
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Subirrigated (Sb) 9-14" p.z. (R044XS343MT)
Hydric soil rating: No

Breeton

Percent of map unit: 5 percent
Landform: Alluvial fans, hillsides, terraces
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (Si) 15-19" p.z. (R043XC427MT)
Hydric soil rating: No

Wetsand

Percent of map unit: 5 percent
Landform: Flood plains, drainageways, flood-plain steps
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Subirrigated (Sb) 9-14" p.z. (R044XS343MT)
Hydric soil rating: Yes

1245E—Baxton-Connieo complex, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: 51nm
Elevation: 4,400 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 36 to 43 degrees F
Frost-free period: 80 to 105 days
Farmland classification: Not prime farmland

Map Unit Composition

Baxton and similar soils: 50 percent
Breeton and similar soils: 25 percent
Connieo and similar soils: 15 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Baxton

Setting

Landform: Hillsides, mountainsides, ridges
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Coarse-loamy residuum weathered from granite

Typical profile

A - 0 to 11 inches: sandy loam
Bw1 - 11 to 22 inches: gravelly coarse sandy loam
Bw2 - 22 to 31 inches: gravelly coarse sandy loam
Cr - 31 to 57 inches: weathered bedrock
R - 57 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: 40 to 60 inches to lithic bedrock; 40 to 60 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: Sandy-Droughty (SyDr) 15-19" p.z. (R043XC716MT), Upland Grassland (R043BP818MT)
Hydric soil rating: No

Description of Breeton

Setting

Landform: Alluvial fans, hillsides, terraces
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy slope alluvium derived from granite

Typical profile

A - 0 to 12 inches: coarse sandy loam
Bw - 12 to 26 inches: gravelly coarse sandy loam
BC - 26 to 60 inches: gravelly coarse sandy loam

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A

Ecological site: Thin Sandy (TSy) 15-19" p.z. (R043XC434MT), Upland Grassland (R043BP818MT)
Hydric soil rating: No

Description of Connieo

Setting

Landform: Escarpments, hillsides, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy residuum weathered from granite

Typical profile

A - 0 to 8 inches: coarse sandy loam
Bt - 8 to 14 inches: gravelly sandy clay loam
Cr - 14 to 18 inches: weathered bedrock
R - 18 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 1.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: Shallow (Sw) 15-19" p.z. (R043XC425MT), Shallow Grassland (R043BP810MT)
Hydric soil rating: No

Minor Components

Baxton, lesser slope, bouldery

Percent of map unit: 5 percent
Landform: Hillsides, mountainsides, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy-Coarse (SyC) 15-19" p.z. (R043BS708MT)
Hydric soil rating: No

Breeton, lesser slope

Percent of map unit: 3 percent
Landform: Alluvial fans, hillsides, terraces
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy (Sy) 15-19" p.z. (R043XC424MT)
Hydric soil rating: No

Rock outcrop, granite

Percent of map unit: 2 percent

Hydric soil rating: No

1651C—Sawbuck-Sawbuck, very stony-Clasoil complex, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 51s2
Elevation: 4,400 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 36 to 45 degrees F
Frost-free period: 80 to 105 days
Farmland classification: Not prime farmland

Map Unit Composition

Sawbuck and similar soils: 45 percent
Sawbuck, very stony, and similar soils: 20 percent
Clasoil and similar soils: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sawbuck

Setting

Landform: Alluvial fans, escarpments, hillsides, mountain slopes
Landform position (three-dimensional): Mountainbase
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly colluvium derived from basalt over residuum weathered from granite

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 7 inches: gravelly loam
Bt - 7 to 24 inches: very gravelly sandy clay loam
BC - 24 to 47 inches: very gravelly sandy clay loam
Cr - 47 to 60 inches: weathered bedrock

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: 46 to 60 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Silty-Coarse (SiC) 15-19" p.z. (R043XC665MT), Upland Sagebrush Shrubland (R043BP819MT)
Hydric soil rating: No

Description of Clasoil

Setting

Landform: Alluvial fans, hillsides
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy alluvium derived from granite

Typical profile

A - 0 to 13 inches: gravelly loam
Bt - 13 to 34 inches: gravelly sandy clay loam
BC - 34 to 60 inches: cobbly sandy loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.0 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Silty (Si) 15-19" p.z. (R043XC427MT), Upland Sagebrush Shrubland (R043BP819MT)
Hydric soil rating: No

Description of Sawbuck, Very Stony

Setting

Landform: Alluvial fans, escarpments, hillsides, mountain slopes
Landform position (three-dimensional): Mountainbase
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly colluvium derived from basalt over residuum weathered from granite

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 7 inches: cobbly loam
Bt - 7 to 24 inches: very gravelly clay loam
BC - 24 to 47 inches: very gravelly sandy clay loam
Cr - 47 to 60 inches: weathered bedrock

Properties and qualities

Slope: 2 to 8 percent
Percent of area covered with surface fragments: 1.5 percent
Depth to restrictive feature: 46 to 60 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: Silty-Coarse (SiC) 15-19" p.z. (R043XC665MT), Upland Sagebrush Shrubland (R043BP819MT)
Hydric soil rating: No

Minor Components

Sawicki, stony

Percent of map unit: 6 percent
Landform: Alluvial fans, escarpments, hillsides, mountain slopes
Landform position (three-dimensional): Mountainbase
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-Droughty (SiDr) 15-19" p.z. NOT KNOWN (R043BS686MT)
Hydric soil rating: No

Clasoil, very bouldery

Percent of map unit: 5 percent
Landform: Alluvial fans, hillsides
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy-Stony (SySt) 15-19" p.z. (R043XC721MT)
Hydric soil rating: No

Breeton

Percent of map unit: 4 percent
Landform: Alluvial fans, hillsides, terraces
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy (Sy) 15-19" p.z. (R043XC424MT)
Hydric soil rating: No

Soil Information for All Uses

Suitabilities and Limitations for Use

The Suitabilities and Limitations for Use section includes various soil interpretations displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each interpretation.

Land Classifications

Land Classifications are specified land use and management groupings that are assigned to soil areas because combinations of soil have similar behavior for specified practices. Most are based on soil properties and other factors that directly influence the specific use of the soil. Example classifications include ecological site classification, farmland classification, irrigated and nonirrigated land capability classification, and hydric rating.

Farmland Classification (Jefferson City Site)

Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978.

Custom Soil Resource Report
Map—Farmland Classification (Jefferson City Site)

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Soil Rating Lines

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Soil Rating Points

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Water Features

MAP INFORMATION

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jefferson County Area and Part of Silver Bow County, Montana
Survey Area Data: Version 19, Sep 5, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 4, 2013—Nov 12, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Farmland Classification (Jefferson City Site)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
329C	Faith-Slickens complex, 0 to 8 percent slopes, impacted	Not prime farmland	0.5	15.9%
1245E	Baxton-Connieo complex, 15 to 35 percent slopes	Not prime farmland	1.7	50.8%
1651C	Sawbuck-Sawbuck, very stony-Clasoil complex, 2 to 8 percent slopes	Not prime farmland	1.1	33.3%
Totals for Area of Interest			**3.3**	**100.0%**

Rating Options—Farmland Classification (Jefferson City Site)

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower

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United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Jefferson County Area and Part of Silver Bow County, Montana

January 21, 2019

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

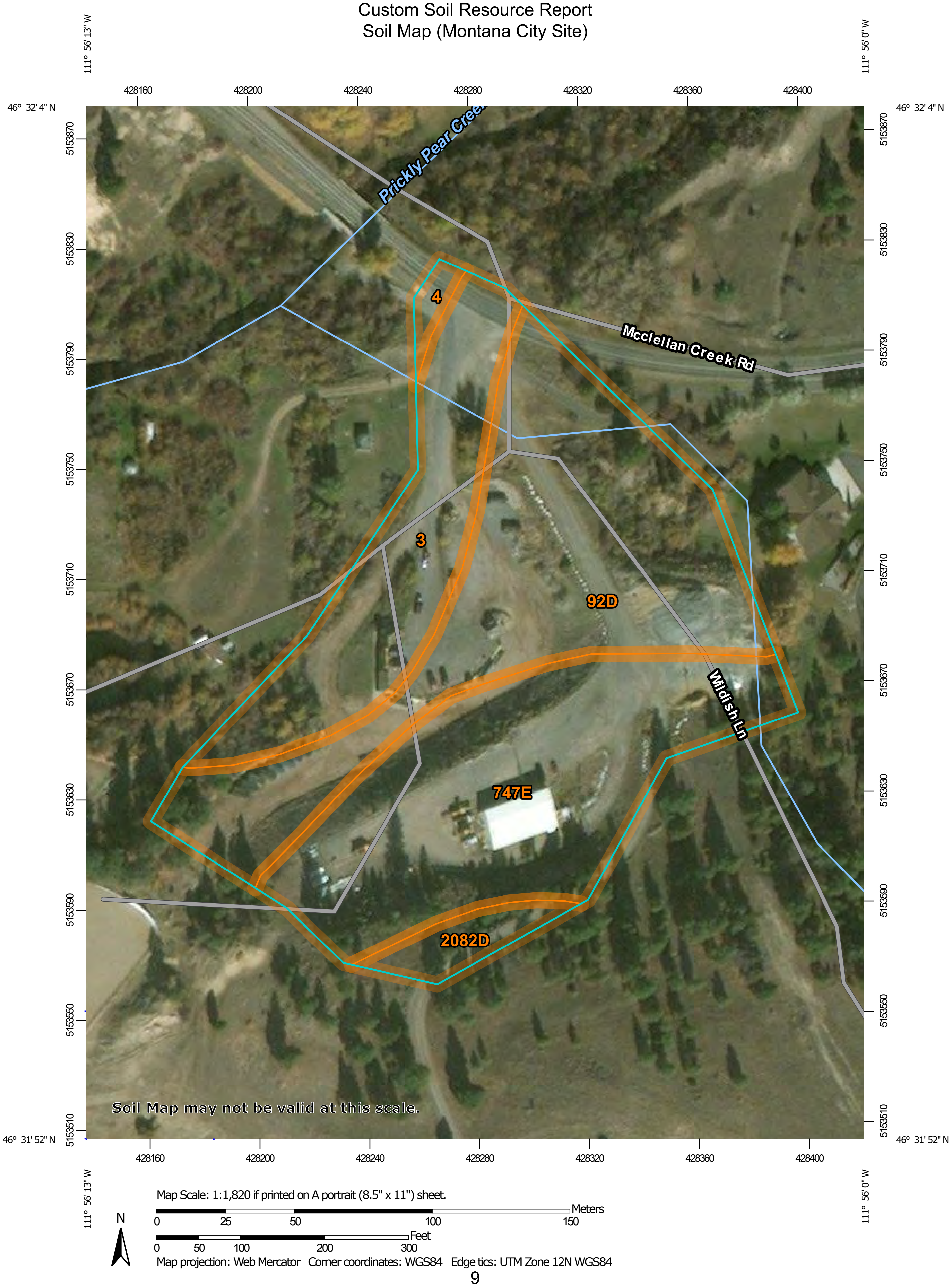
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map (Montana City Site)



Map Scale: 1:1,820 if printed on A portrait (8.5" x 11") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jefferson County Area and Part of Silver Bow County, Montana
Survey Area Data: Version 19, Sep 5, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 4, 2013—Nov 12, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND	MAP INFORMATION
	imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Montana City Site)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
3	Dumps, mine	1.5	19.9%
4	Bronec, Clunton, Channeled, and Amesha soils, 0 to 8 percent slopes	0.1	1.1%
92D	Clunton, Cometcrik, and Perma, stony, soils, 0 to 15 percent slopes	3.1	39.8%
747E	Shawmut, stony-Tolbert, very stony, complex, 15 to 35 percent slopes	2.8	35.9%
2082D	Windham-Judell complex, 8 to 15 percent slopes, warm	0.3	3.4%
Totals for Area of Interest		**7.7**	**100.0%**

Map Unit Descriptions (Montana City Site)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it

was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Jefferson County Area and Part of Silver Bow County, Montana

3—Dumps, mine

Map Unit Composition

Dumps, mine: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dumps, Mine

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: Unranked

4—Bronec, Clunton, Channeled, and Amesha soils, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 5260
Elevation: 3,800 to 5,000 feet
Mean annual precipitation: 10 to 16 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 90 to 115 days
Farmland classification: Not prime farmland

Map Unit Composition

Bronec and similar soils: 35 percent
Clunton and similar soils: 30 percent
Amesha and similar soils: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bronec

Setting

Landform: Alluvial fans, escarpments, hillsides, valley floors
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy and gravelly calcareous tertiary valley fill alluvium

Typical profile

A - 0 to 9 inches: very gravelly loam
Bk - 9 to 48 inches: very gravelly loam
BC - 48 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 1 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 40 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 4.0
Available water storage in profile: Low (about 5.9 inches)

Interpretive groups
Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Silty-Droughty (SiDr) 9-14" p.z. (R044XS705MT), Upland Grassland (R044BP818MT)
Hydric soil rating: No

Description of Clunton

Setting
Landform: Flood plains, flood-plain steps
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy alluvium over sandy and gravelly alluvium

Typical profile
Ag - 0 to 14 inches: loam
Cg1 - 14 to 38 inches: silty clay loam
2Cg2 - 38 to 60 inches: gravelly sandy loam

Properties and qualities
Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Frequent
Frequency of ponding: Rare
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: High (about 9.8 inches)

Interpretive groups
Land capability classification (irrigated): 5w
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: Wet Meadow (WM) 9-14" p.z. (R044XS349MT), Bottomland (R044BP801MT)
Hydric soil rating: Yes

Description of Amesha

Setting
Landform: Alluvial fans, hillsides, knolls, plains
Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous coarse-loamy tertiary valley fill alluvium

Typical profile

A - 0 to 4 inches: gravelly loam
Bk - 4 to 29 inches: loam
BC - 29 to 60 inches: gravelly loam

Properties and qualities

Slope: 1 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 35 percent
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Limy (Ly) 9-14" p.z. (R044XS341MT), Limy Grassland (R044BP804MT)
Hydric soil rating: No

Minor Components

Sappington

Percent of map unit: 3 percent
Landform: Alluvial fans, hillsides, knolls, plains
Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (Cy) 9-14" p.z. (R044XS330MT)
Hydric soil rating: No

Amesha, cobbly

Percent of map unit: 3 percent
Landform: Alluvial fans, hillsides, knolls, plains
Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Limy (Ly) 9-14" p.z. (R044XS341MT)
Hydric soil rating: No

Bronec, very stony

Percent of map unit: 3 percent
Landform: Alluvial fans, escarpments, hillsides, valley floors
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-Stony (SiSt) 9-14" p.z. (R044XS706MT)
Hydric soil rating: No

Wetsand

Percent of map unit: 2 percent
Landform: Flood plains, drainageways, flood-plain steps
Down-slope shape: Linear

Across-slope shape: Linear
Ecological site: Subirrigated (Sb) 9-14" p.z. (R044XS343MT)
Hydric soil rating: Yes

Meadowcreek

Percent of map unit: 2 percent
Landform: Flood plains, terraces, drainageways, flood-plain steps
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Subirrigated (Sb) 9-14" p.z. (R044XS343MT)
Hydric soil rating: No

Havre

Percent of map unit: 2 percent
Landform: Flood plains, drainageways, flood-plain steps
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (Si) 9-14" p.z. (R044XS339MT)
Hydric soil rating: No

92D—Clunton, Cometcrik, and Perma, stony, soils, 0 to 15 percent slopes

Map Unit Setting

National map unit symbol: 52rl
Elevation: 3,940 to 6,000 feet
Mean annual precipitation: 12 to 19 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 80 to 105 days
Farmland classification: Not prime farmland

Map Unit Composition

Clunton and similar soils: 40 percent
Cometcrik and similar soils: 35 percent
Perma, stony, and similar soils: 20 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Clunton

Setting

Landform: Flood plains, flood-plain steps
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy alluvium over sandy and gravelly alluvium

Typical profile

Ag - 0 to 14 inches: loam

Cg1 - 14 to 38 inches: silty clay loam
2Cg2 - 38 to 60 inches: gravelly sandy loam

Properties and qualities
Slope: 0 to 4 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Frequent
Frequency of ponding: Rare
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: High (about 9.8 inches)

Interpretive groups
Land capability classification (irrigated): 5w
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: Wet Meadow (WM) LRU 43B-Y (R043BY181MT), Bottomland (R044BP801MT), Bottomland (R043BP801MT)
Hydric soil rating: Yes

Description of Cometcrik

Setting
Landform: Flood plains, drainageways, flood-plain steps
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy alluvium

Typical profile
A - 0 to 12 inches: loam
Bw - 12 to 42 inches: loam
2Cg1 - 42 to 58 inches: gravelly coarse sand
3Cg2 - 58 to 60 inches: stratified gravelly fine sandy loam to silty clay loam

Properties and qualities
Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: High (about 9.5 inches)

Interpretive groups
Land capability classification (irrigated): 5w
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: Meadow (M) LRU 43B-Y (R043BY082MT), Bottomland (R044BP801MT), Bottomland (R043BP801MT)
Hydric soil rating: Yes

Description of Perma, Stony

Setting

Landform: Alluvial fans, escarpments, hillsides, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly slope alluvium and/or colluvium derived from basalt and/or metavolcanics

Typical profile

A - 0 to 7 inches: cobbly loam
Bw - 7 to 36 inches: very cobbly loam
BC - 36 to 60 inches: extremely gravelly loam

Properties and qualities

Slope: 4 to 15 percent
Percent of area covered with surface fragments: 0.1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Droughty (Dr) LRU 43B-C (R043BC036MT), Upland Sagebrush Shrubland (R044BP819MT), Upland Cool Woodland (F043BP910MT)
Hydric soil rating: No

Minor Components

Meadowcreek

Percent of map unit: 3 percent
Landform: Flood plains, terraces, drainageways, flood-plain steps
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Subirrigated (Sb) LRU 43B-Y (R043BY150MT)
Hydric soil rating: No

Faith

Percent of map unit: 2 percent
Landform: Alluvial fans, terraces, drainageways, flood-plain steps
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy (Lo) LRU 43B-C (R043BC032MT)
Hydric soil rating: No

747E—Shawmut, stony-Tolbert, very stony, complex, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: 52gb
Elevation: 4,400 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 80 to 105 days
Farmland classification: Not prime farmland

Map Unit Composition

Shawmut, stony, and similar soils: 70 percent
Tolbert, very stony, and similar soils: 20 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Shawmut, Stony

Setting

Landform: Alluvial fans, escarpments, hillsides
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly colluvium derived from basalt

Typical profile

A - 0 to 5 inches: very gravelly loam
Bt - 5 to 15 inches: very gravelly sandy clay loam
Bk1 - 15 to 22 inches: very gravelly sandy clay loam
Bk2 - 22 to 60 inches: extremely gravelly sandy loam

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 0.1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 30 percent
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: B
Ecological site: Silty-Droughty (SiDr) 15-19" p.z. (R043XC626MT), Upland Grassland (R043BP818MT)
Hydric soil rating: No

Description of Tolbert, Very Stony

Setting

Landform: Escarpments, hillsides, ridges, interfluves
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly residuum weathered from basalt; gravelly residuum weathered from fine-grained sandstone

Typical profile

A - 0 to 7 inches: cobbly loam
Bt - 7 to 12 inches: very cobbly clay loam
R - 12 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 1.5 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 1.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: Very Shallow (VSw) 15-19" p.z. (R043XC436MT), Shallow Grassland (R043BP810MT)
Hydric soil rating: No

Minor Components

Wimper

Percent of map unit: 5 percent
Landform: Alluvial fans, hillsides, terraces
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-Droughty-Steep (SiDrStp) 15-19" p.z. (R043BS720MT)
Hydric soil rating: No

Martinsdale

Percent of map unit: 3 percent
Landform: Alluvial fans, hillsides, terraces
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (Cy) 15-19" p.z. (R043XC422MT)

Hydric soil rating: No

Rock outcrop, volcanic

Percent of map unit: 2 percent
Hydric soil rating: No

2082D—Windham-Judell complex, 8 to 15 percent slopes, warm

Map Unit Setting

National map unit symbol: 51yg
Elevation: 4,400 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 80 to 105 days
Farmland classification: Farmland of local importance

Map Unit Composition

Windham and similar soils: 50 percent
Judell and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Windham

Setting

Landform: Escarpments, hillsides, ridges, divides
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly slope alluvium derived from limestone

Typical profile

A - 0 to 7 inches: gravelly loam
Bk1 - 7 to 25 inches: very gravelly loam
Bk2 - 25 to 60 inches: extremely gravelly loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 60 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: Silty-Coarse (SiC) 15-19" p.z. (R043XC665MT), Limy Grassland (R043BP804MT)
Hydric soil rating: No

Description of Judell

Setting

Landform: Alluvial fans, hillsides, terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy slope alluvium derived from limestone, unspecified

Typical profile

A - 0 to 5 inches: loam
Bk1 - 5 to 26 inches: gravelly loam
Bk2 - 26 to 60 inches: gravelly loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 60 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Silty (Si) 15-19" p.z. (R043XC427MT), Limy Grassland (R043BP804MT)
Hydric soil rating: No

Minor Components

Windham, stony

Percent of map unit: 6 percent
Landform: Escarpments, hillsides, ridges, divides
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-Droughty (SiDr) 15-19" p.z. (R043XC626MT)
Hydric soil rating: No

Judell, cobbly

Percent of map unit: 4 percent
Landform: Alluvial fans, hillsides, terraces
Down-slope shape: Linear

Across-slope shape: Linear
Ecological site: Silty (Si) 15-19" p.z. (R043XC427MT)
Hydric soil rating: No

Soil Information for All Uses

Suitabilities and Limitations for Use

The Suitabilities and Limitations for Use section includes various soil interpretations displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each interpretation.

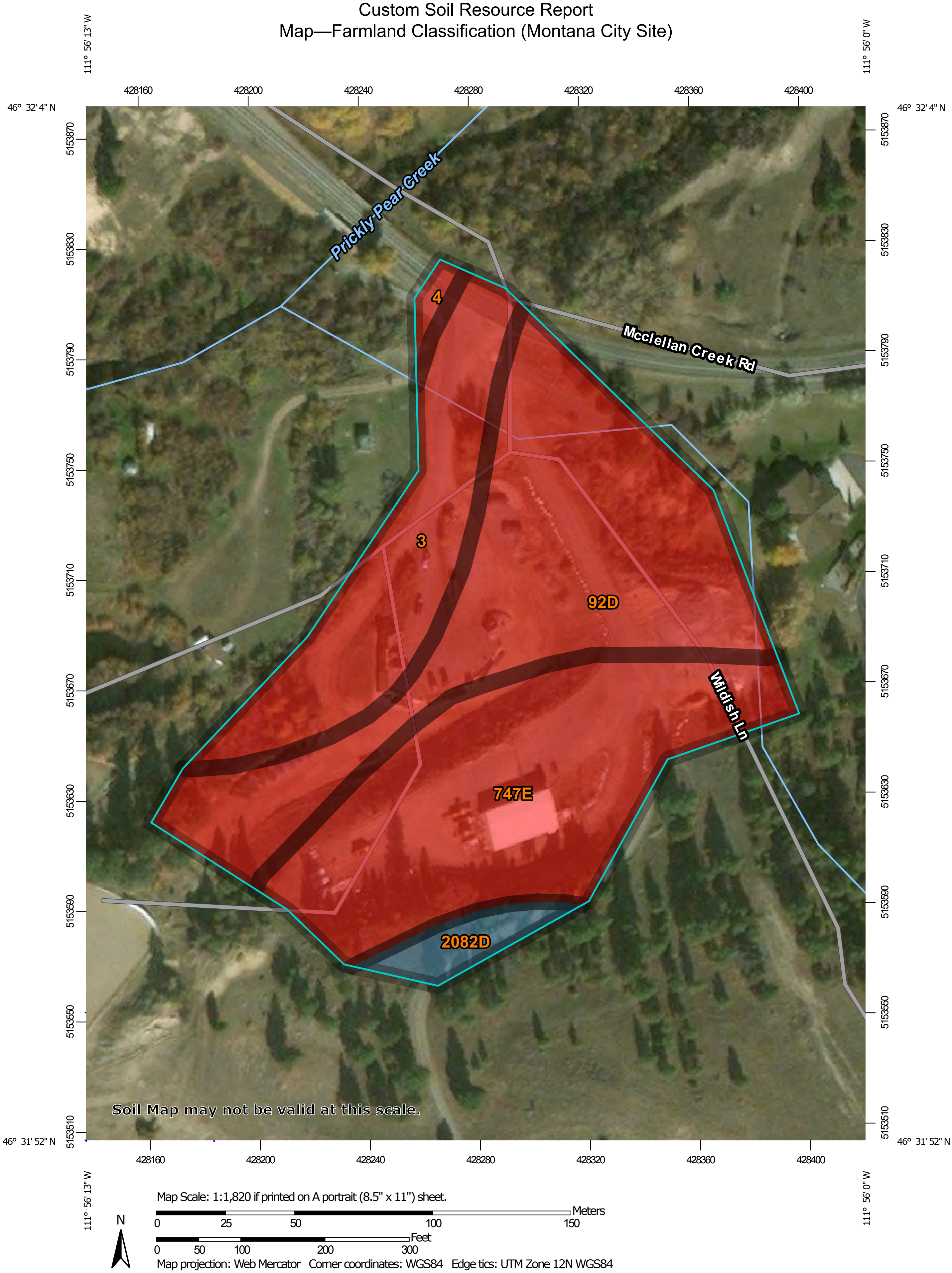
Land Classifications

Land Classifications are specified land use and management groupings that are assigned to soil areas because combinations of soil have similar behavior for specified practices. Most are based on soil properties and other factors that directly influence the specific use of the soil. Example classifications include ecological site classification, farmland classification, irrigated and nonirrigated land capability classification, and hydric rating.

Farmland Classification (Montana City Site)

Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978.

Map—Farmland Classification (Montana City Site)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Soil Rating Lines

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Soil Rating Points

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Water Features

MAP INFORMATION

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jefferson County Area and Part of Silver Bow County, Montana
Survey Area Data: Version 19, Sep 5, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 4, 2013—Nov 12, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Farmland Classification (Montana City Site)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
3	Dumps, mine	Not prime farmland	1.5	19.9%
4	Bronec, Clunton, Channeled, and Amesha soils, 0 to 8 percent slopes	Not prime farmland	0.1	1.1%
92D	Clunton, Cometcrik, and Perma, stony, soils, 0 to 15 percent slopes	Not prime farmland	3.1	39.8%
747E	Shawmut, stony-Tolbert, very stony, complex, 15 to 35 percent slopes	Not prime farmland	2.8	35.9%
2082D	Windham-Judell complex, 8 to 15 percent slopes, warm	Farmland of local importance	0.3	3.4%
Totals for Area of Interest			**7.7**	**100.0%**

Rating Options—Farmland Classification (Montana City Site)

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower

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United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Jefferson County Area and Part of Silver Bow County, Montana

January 21, 2019

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map (Tri-County Landfill Site)

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jefferson County Area and Part of Silver Bow County, Montana
Survey Area Data: Version 19, Sep 5, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 4, 2013—Nov 12, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND	MAP INFORMATION
	imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Tri-County Landfill Site)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
274C	Bronec complex, 2 to 8 percent slopes	0.5	3.6%
532C	Sappington-Amesha complex, 2 to 8 percent slopes	8.4	64.6%
533C	Sappington clay loam, 2 to 8 percent slopes	1.3	10.1%
539B	Sappington-Amesha complex, 2 to 8 percent slopes, cobbly	0.7	5.4%
3233C	Geohrock-Crago very cobbly loams, 2 to 8 percent slopes	2.1	16.3%
Totals for Area of Interest		**13.0**	**100.0%**

Map Unit Descriptions (Tri-County Landfill Site)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it

was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Jefferson County Area and Part of Silver Bow County, Montana

274C—Bronec complex, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 523z
Elevation: 3,800 to 5,000 feet
Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 90 to 115 days
Farmland classification: Farmland of local importance

Map Unit Composition

Bronec and similar soils: 55 percent
Bronec, very cobbly, and similar soils: 25 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bronec

Setting

Landform: Alluvial fans, escarpments, hillsides, valley floors
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy and gravelly calcareous tertiary valley fill alluvium

Typical profile

A - 0 to 9 inches: very gravelly loam
Bk - 9 to 48 inches: very gravelly loam
BC - 48 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 40 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 4.0
Available water storage in profile: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Silty-Droughty (SiDr) 9-14" p.z. (R044XS705MT), Upland Grassland (R044BP818MT)
Hydric soil rating: No

Description of Bronec, Very Cobbly

Setting

Landform: Alluvial fans, escarpments, hillsides, valley floors
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy and gravelly calcareous tertiary valley fill alluvium

Typical profile

A - 0 to 5 inches: very cobbly loam
Bk - 5 to 35 inches: very gravelly loam
BC - 35 to 60 inches: very gravelly sandy loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 40 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 4.0
Available water storage in profile: Low (about 5.8 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Silty-Droughty (SiDr) 9-14" p.z. (R044XS705MT), Limy Grassland (R044BP804MT)
Hydric soil rating: No

Minor Components

Bronec, very stony

Percent of map unit: 7 percent
Landform: Alluvial fans, escarpments, hillsides, valley floors
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-Stony (SiSt) 9-14" p.z. (R044XS706MT)
Hydric soil rating: No

Amesha

Percent of map unit: 6 percent
Landform: Alluvial fans, hillsides, knolls, plains
Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Limy (Ly) 9-14" p.z. (R044XS341MT)
Hydric soil rating: No

Sappington

Percent of map unit: 4 percent
Landform: Alluvial fans, hillsides, knolls, plains

Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (Cy) 9-14" p.z. (R044XS330MT)
Hydric soil rating: No

Geohrock

Percent of map unit: 3 percent
Landform: Alluvial fans, terraces, valley floors
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey-Coarse (CyC) 9-14" p.z. (R044XS702MT)
Hydric soil rating: No

532C—Sappington-Amesha complex, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 527l
Elevation: 3,800 to 5,200 feet
Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 90 to 115 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Sappington and similar soils: 50 percent
Amesha and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sappington

Setting

Landform: Alluvial fans, hillsides, knolls, plains
Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous coarse-loamy tertiary valley fill alluvium

Typical profile

A - 0 to 4 inches: clay loam
Bt - 4 to 8 inches: clay loam
Bk1 - 8 to 28 inches: loam
Bk2 - 28 to 60 inches: loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Clayey (Cy) 9-14" p.z. (R044XS330MT), Upland Sagebrush Shrubland (R044BP819MT), Upland Alpine (R043BP821MT)
Hydric soil rating: No

Description of Amesha

Setting

Landform: Alluvial fans, hillsides, knolls, plains
Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous coarse-loamy tertiary valley fill alluvium

Typical profile

A - 0 to 4 inches: loam
Bk - 4 to 32 inches: loam
BC - 32 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 35 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Limy (Ly) 9-14" p.z. (R044XS341MT), Limy Sagebrush Shrubland (R044BP805MT), Limy Alpine (R043BP822MT)
Hydric soil rating: No

Minor Components

Sappington, greater slope

Percent of map unit: 4 percent
Landform: Alluvial fans, hillsides, knolls, plains
Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (Cy) 9-14" p.z. (R044XS330MT)
Hydric soil rating: No

Varney

Percent of map unit: 3 percent
Landform: Alluvial fans, hillsides, knolls, terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (Cy) 9-14" p.z. (R044XS330MT)
Hydric soil rating: No

Amesha, cobbly

Percent of map unit: 3 percent
Landform: Alluvial fans, hillsides, knolls, plains
Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Limy (Ly) 9-14" p.z. (R044XS341MT)
Hydric soil rating: No

Brocko

Percent of map unit: 3 percent
Landform: Alluvial fans, hillsides, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Limy (Ly) 9-14" p.z. (R044XS341MT)
Hydric soil rating: No

Floweree

Percent of map unit: 2 percent
Landform: Alluvial fans, knolls, terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (Si) 9-14" p.z. (R044XS339MT)
Hydric soil rating: No

533C—Sappington clay loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 527n

Elevation: 3,800 to 5,200 feet
Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 90 to 115 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Sappington and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sappington

Setting

Landform: Alluvial fans, hillsides, knolls, plains
Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous coarse-loamy tertiary valley fill alluvium

Typical profile

A - 0 to 4 inches: clay loam
Bt - 4 to 8 inches: clay loam
Bk1 - 8 to 28 inches: loam
Bk2 - 28 to 60 inches: loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Clayey (Cy) 9-14" p.z. (R044XS330MT), Upland Sagebrush Shrubland (R044BP819MT)
Hydric soil rating: No

Minor Components

Sappington, greater slope

Percent of map unit: 3 percent
Landform: Alluvial fans, hillsides, knolls, plains
Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (Cy) 9-14" p.z. (R044XS330MT)

Hydric soil rating: No

Amesha

Percent of map unit: 3 percent
Landform: Alluvial fans, hillsides, knolls, plains
Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Limy (Ly) 9-14" p.z. (R044XS341MT)
Hydric soil rating: No

Varney

Percent of map unit: 2 percent
Landform: Alluvial fans, hillsides, knolls, terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (Cy) 9-14" p.z. (R044XS330MT)
Hydric soil rating: No

Geohrock, stony

Percent of map unit: 2 percent
Landform: Alluvial fans, terraces, valley floors
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey-Coarse (CyC) 9-14" p.z. (R044XS702MT)
Hydric soil rating: No

539B—Sappington-Amesha complex, 2 to 8 percent slopes, cobbly

Map Unit Setting

National map unit symbol: 527y
Elevation: 3,800 to 5,200 feet
Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 90 to 115 days
Farmland classification: Farmland of local importance

Map Unit Composition

Sappington and similar soils: 50 percent
Amesha and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sappington

Setting

Landform: Alluvial fans, hillsides, knolls, plains
Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Calcareous coarse-loamy tertiary valley fill alluvium

Typical profile

A - 0 to 4 inches: cobbly clay loam
Bt - 4 to 8 inches: clay loam
Bk1 - 8 to 34 inches: loam
Bk2 - 34 to 60 inches: loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 40 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.0 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Clayey (Cy) 9-14" p.z. (R044XS330MT), Upland Sagebrush Shrubland (R044BP819MT)
Hydric soil rating: No

Description of Amesha

Setting

Landform: Alluvial fans, hillsides, knolls, plains
Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous coarse-loamy tertiary valley fill alluvium

Typical profile

A - 0 to 5 inches: cobbly loam
Bk - 5 to 29 inches: loam
BC - 29 to 60 inches: gravelly loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 35 percent
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): 4e

Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Limy (Ly) 9-14" p.z. (R044XS341MT), Limy Sagebrush Shrubland (R044BP805MT)
Hydric soil rating: No

Minor Components

Amesha, greater slope

Percent of map unit: 4 percent
Landform: Alluvial fans, hillsides, knolls, plains
Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Limy (Ly) 9-14" p.z. (R044XS341MT)
Hydric soil rating: No

Sappington, very cobbly

Percent of map unit: 4 percent
Landform: Alluvial fans, hillsides, knolls, plains
Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (Cy) 9-14" p.z. (R044XS330MT)
Hydric soil rating: No

Varney

Percent of map unit: 3 percent
Landform: Alluvial fans, hillsides, knolls, terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (Cy) 9-14" p.z. (R044XS330MT)
Hydric soil rating: No

Bronec, very stony

Percent of map unit: 3 percent
Landform: Alluvial fans, escarpments, hillsides, valley floors
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-Stony (SiSt) 9-14" p.z. (R044XS706MT)
Hydric soil rating: No

Geohrock, stony

Percent of map unit: 1 percent
Landform: Alluvial fans, terraces, valley floors
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey-Coarse (CyC) 9-14" p.z. (R044XS702MT)
Hydric soil rating: No

3233C—Geohrock-Crago very cobbly loams, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 52t7
Elevation: 3,600 to 4,300 feet
Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 105 to 120 days
Farmland classification: Not prime farmland

Map Unit Composition

Geohrock and similar soils: 60 percent
Crago and similar soils: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Geohrock

Setting

Landform: Alluvial fans, terraces, valley floors
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly alluvium; gravelly slope alluvium

Typical profile

A - 0 to 4 inches: very cobbly loam
Bt - 4 to 10 inches: very gravelly clay loam
Btk - 10 to 18 inches: very gravelly loam
Bk - 18 to 60 inches: extremely gravelly loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 3.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B

Ecological site: Silty-Droughty (SiDr) 10-14" p.z. (R044XC456MT), Upland Grassland (R044BP818MT), Upland Grassland (R043BP818MT)
Hydric soil rating: No

Description of Crago

Setting

Landform: Alluvial fans, escarpments, hillsides, plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly alluvium derived from limestone; gravelly colluvium derived from limestone; gravelly slope alluvium derived from limestone

Typical profile

A - 0 to 4 inches: very cobbly loam
Bk1 - 4 to 32 inches: very cobbly clay loam
Bk2 - 32 to 60 inches: extremely cobbly sandy loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 70 percent
Available water storage in profile: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: Silty-Stony (SiSt) 10-14" p.z. (R044XC458MT), Limy Grassland (R044BP804MT), Limy Grassland (R043BP804MT)
Hydric soil rating: No

Minor Components

Geohrock, greater slope

Percent of map unit: 5 percent
Landform: Alluvial fans, terraces, valley floors
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-Droughty (SiDr) 10-14" p.z. (R044XC456MT)
Hydric soil rating: No

Nippt

Percent of map unit: 5 percent
Landform: Terraces, flood-plain steps
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Shallow to Gravel (SwGr) 10-14" p.z. (R044XC454MT)
Hydric soil rating: No

Soil Information for All Uses

Suitabilities and Limitations for Use

The Suitabilities and Limitations for Use section includes various soil interpretations displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each interpretation.

Land Classifications

Land Classifications are specified land use and management groupings that are assigned to soil areas because combinations of soil have similar behavior for specified practices. Most are based on soil properties and other factors that directly influence the specific use of the soil. Example classifications include ecological site classification, farmland classification, irrigated and nonirrigated land capability classification, and hydric rating.

Farmland Classification (Tri-County Landfill Site)

Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978.

Custom Soil Resource Report
Map—Farmland Classification (Tri-County Landfill Site)

Map Scale: 1:1,620 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 20, 40, 80, 120

Feet: 0, 50, 100, 200, 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Soil Rating Lines

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Soil Rating Points

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Water Features

MAP INFORMATION

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jefferson County Area and Part of Silver Bow County, Montana
Survey Area Data: Version 19, Sep 5, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 4, 2013—Nov 12, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Farmland Classification (Tri-County Landfill Site)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
274C	Bronec complex, 2 to 8 percent slopes	Farmland of local importance	0.5	3.6%
532C	Sappington-Amesha complex, 2 to 8 percent slopes	Farmland of statewide importance	8.4	64.6%
533C	Sappington clay loam, 2 to 8 percent slopes	Farmland of statewide importance	1.3	10.1%
539B	Sappington-Amesha complex, 2 to 8 percent slopes, cobbly	Farmland of local importance	0.7	5.4%
3233C	Geohrock-Crago very cobbly loams, 2 to 8 percent slopes	Not prime farmland	2.1	16.3%
Totals for Area of Interest			**13.0**	**100.0%**

Rating Options—Farmland Classification (Tri-County Landfill Site)

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower

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United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Jefferson County Area and Part of Silver Bow County, Montana

February 6, 2019

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

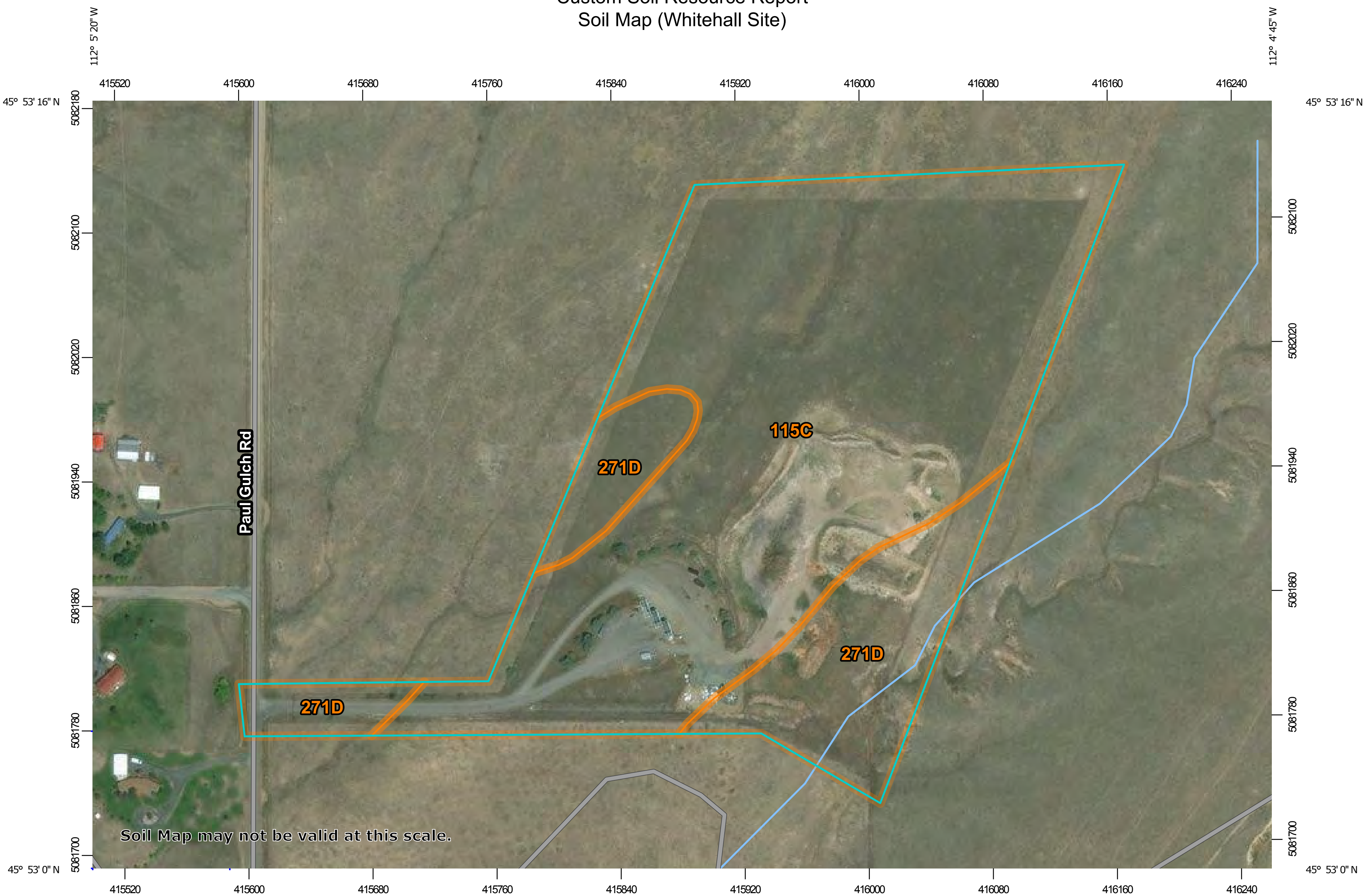
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map (Whitehall Site)



Map Scale: 1:3,480 if printed on A landscape (11" x 8.5") sheet.

N

0 50 100 200 300 Meters

0 150 300 600 900 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jefferson County Area and Part of Silver Bow County, Montana
Survey Area Data: Version 19, Sep 5, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 14, 2015—Sep 28, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND	MAP INFORMATION
	imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Whitehall Site)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
115C	Amesha gravelly loam, 2 to 8 percent slopes	20.4	76.8%
271D	Bronec-Amesha complex, 8 to 15 percent slopes	6.2	23.2%
Totals for Area of Interest		**26.6**	**100.0%**

Map Unit Descriptions (Whitehall Site)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Jefferson County Area and Part of Silver Bow County, Montana

115C—Amesha gravelly loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 51m5
Elevation: 3,800 to 5,000 feet
Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 90 to 115 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Amesha and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Amesha

Setting

Landform: Alluvial fans, hillsides, knolls, plains
Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous coarse-loamy tertiary valley fill alluvium

Typical profile

A - 0 to 4 inches: gravelly loam
Bk - 4 to 29 inches: loam
BC - 29 to 60 inches: gravelly loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 35 percent
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Limy (Ly) 9-14" p.z. (R044XS341MT), Limy Sagebrush Shrubland (R044BP805MT)
Hydric soil rating: No

Minor Components

Bronec, very stony

Percent of map unit: 5 percent
Landform: Alluvial fans, escarpments, hillsides, valley floors

Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-Stony (SiSt) 9-14" p.z. (R044XS706MT)
Hydric soil rating: No

Amesha, steeper slopes
Percent of map unit: 3 percent
Landform: Alluvial fans, hillsides, knolls, plains
Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Limy (Ly) 9-14" p.z. (R044XS341MT)
Hydric soil rating: No

Sappington
Percent of map unit: 2 percent
Landform: Alluvial fans, hillsides, knolls, plains
Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (Cy) 9-14" p.z. (R044XS330MT)
Hydric soil rating: No

271D—Bronec-Amesha complex, 8 to 15 percent slopes

Map Unit Setting
National map unit symbol: 523r
Elevation: 3,800 to 5,000 feet
Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 90 to 115 days
Farmland classification: Farmland of local importance

Map Unit Composition
Bronec and similar soils: 50 percent
Amesha and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bronec

Setting
Landform: Alluvial fans, alluvial fans, escarpments, hillsides, valley floors
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy and gravelly calcareous alluvium; sandy and gravelly calcareous slope alluvium; sandy and gravelly calcareous tertiary valley fill alluvium; sandy and gravelly colluvium

Typical profile
A - 0 to 5 inches: cobbly loam

Bk - 5 to 35 inches: very gravelly loam
BC - 35 to 60 inches: very gravelly sandy loam

Properties and qualities
Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 40 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 4.0
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups
Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Silty-Droughty (SiDr) 9-14" p.z. (R044XS705MT), Limy Sagebrush Shrubland (R044BP805MT)
Hydric soil rating: No

Description of Amesha

Setting
Landform: Alluvial fans, alluvial fans, hillsides, knolls, knolls, plains
Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous coarse-loamy tertiary valley fill alluvium; calcareous gravelly colluvium

Typical profile
A - 0 to 4 inches: gravelly loam
Bk - 4 to 29 inches: loam
BC - 29 to 60 inches: gravelly loam

Properties and qualities
Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 35 percent
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups
Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B

Ecological site: Limy (Ly) 9-14" p.z. (R044XS341MT), Limy Sagebrush Shrubland (R044BP805MT)
Hydric soil rating: No

Minor Components

Geohrock

Percent of map unit: 5 percent
Landform: Alluvial fans, terraces, valley floors
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey-Coarse (CyC) 9-14" p.z. (R044XS702MT)
Hydric soil rating: No

Sappington

Percent of map unit: 5 percent
Landform: Alluvial fans, alluvial fans, hillsides, knolls, knolls, plains
Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (Cy) 9-14" p.z. (R044XS330MT)
Hydric soil rating: No

Amesha, greater slope

Percent of map unit: 5 percent
Landform: Alluvial fans, alluvial fans, hillsides, knolls, knolls, plains
Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-Steep (SiStp) 9-14" p.z. (R044XS347MT)
Hydric soil rating: No

Bronec, stony

Percent of map unit: 5 percent
Landform: Alluvial fans, alluvial fans, escarpments, hillsides, valley floors
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-Droughty-Steep (SiDrStp) 9-14" p.z. (R044XS340MT)
Hydric soil rating: No

Soil Information for All Uses

Suitabilities and Limitations for Use

The Suitabilities and Limitations for Use section includes various soil interpretations displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each interpretation.

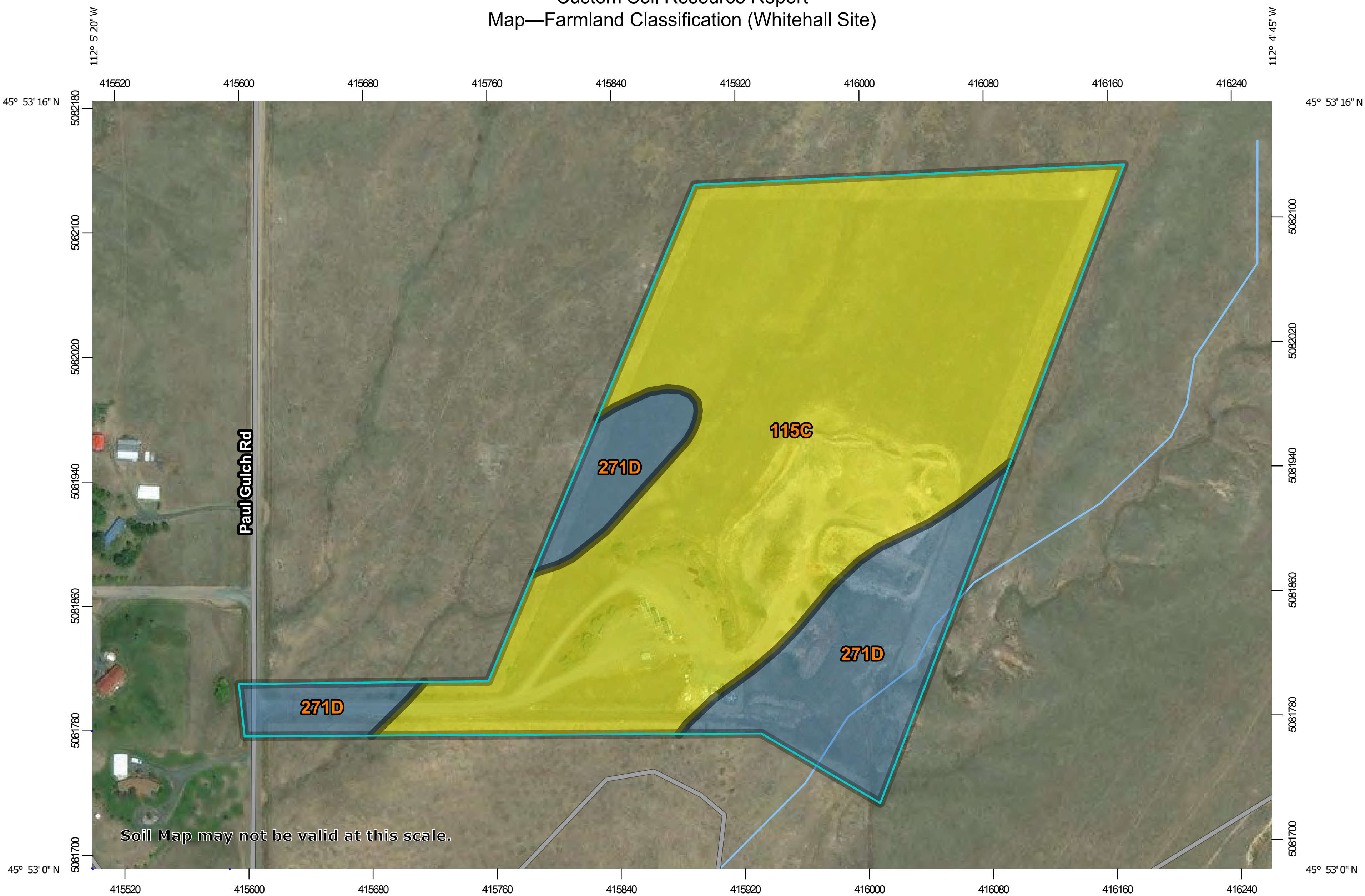
Land Classifications

Land Classifications are specified land use and management groupings that are assigned to soil areas because combinations of soil have similar behavior for specified practices. Most are based on soil properties and other factors that directly influence the specific use of the soil. Example classifications include ecological site classification, farmland classification, irrigated and nonirrigated land capability classification, and hydric rating.

Farmland Classification (Whitehall Site)

Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978.

Map—Farmland Classification (Whitehall Site)



Map Scale: 1:3,480 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 50, 100, 200, 300

Feet: 0, 150, 300, 600, 900

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Soil Rating Lines

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Soil Rating Points

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Water Features

MAP INFORMATION

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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Soil Survey Area: Jefferson County Area and Part of Silver Bow County, Montana
Survey Area Data: Version 19, Sep 5, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 14, 2015—Sep 28, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Farmland Classification (Whitehall Site)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
115C	Amesha gravelly loam, 2 to 8 percent slopes	Prime farmland if irrigated	20.4	76.8%
271D	Bronec-Amesha complex, 8 to 15 percent slopes	Farmland of local importance	6.2	23.2%
Totals for Area of Interest			**26.6**	**100.0%**

Rating Options—Farmland Classification (Whitehall Site)

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

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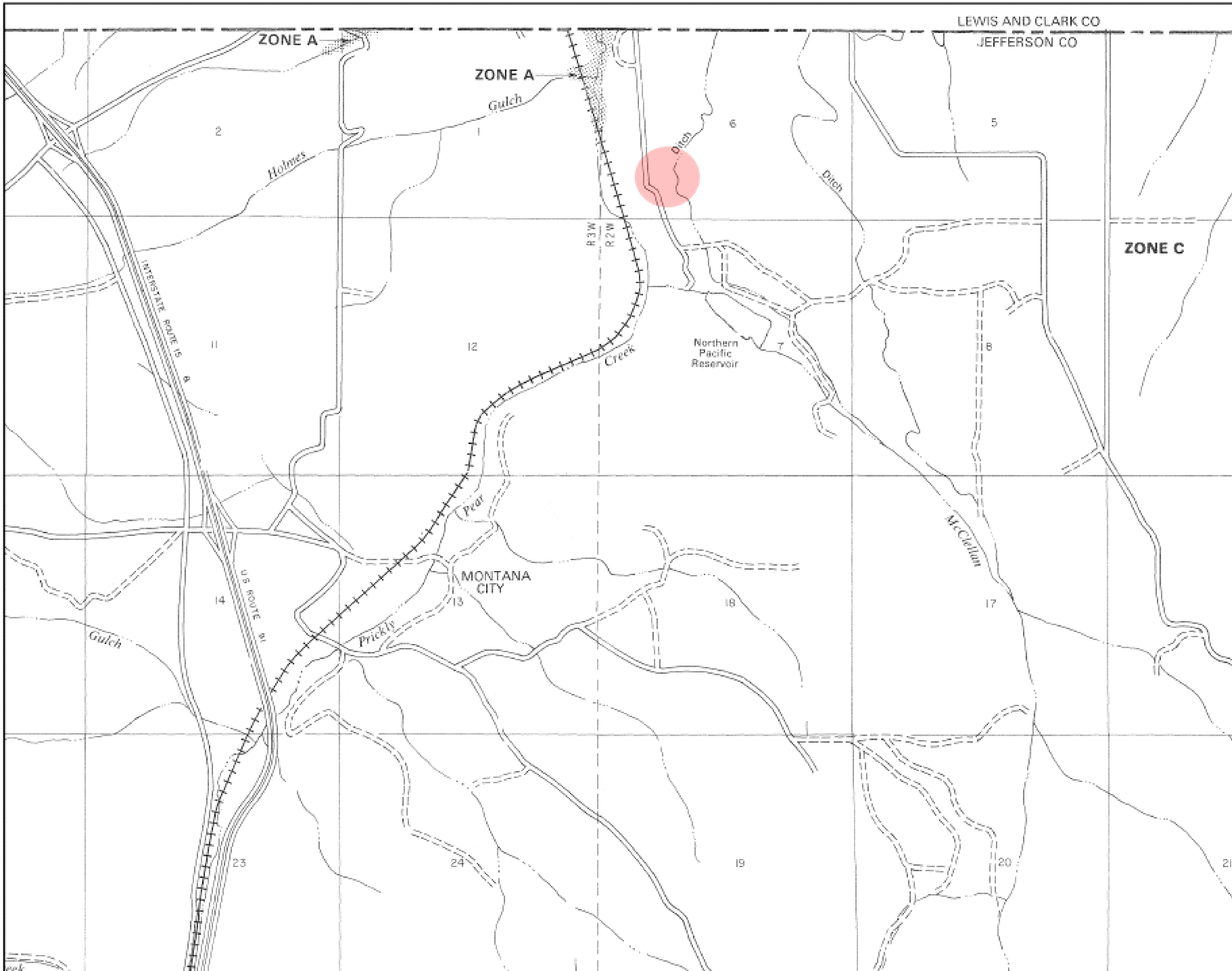
Appendix D

Floodplain Maps



APPROXIMATE SCALE IN FEET

2000 0 2000

Tri-County Site

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

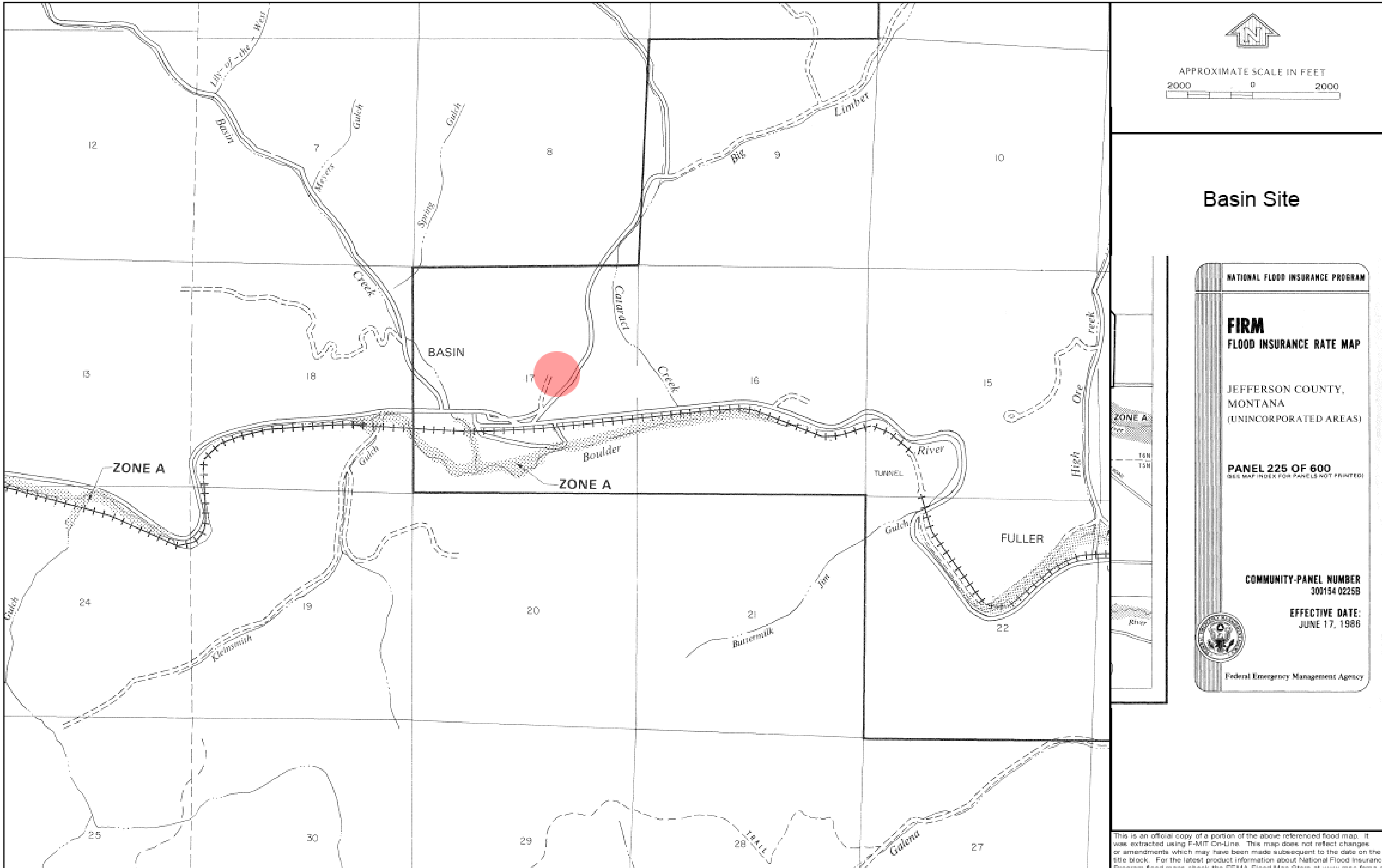
JEFFERSON COUNTY,
MONTANA
(UNINCORPORATED AREAS)

PANEL 50 OF 600
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
300154 0050B

EFFECTIVE DATE:
JUNE 17, 1986

Federal Emergency Management Agency


APPROXIMATE SCALE IN FEET
2000
0
2000
Basin Site
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
JEFFERSON COUNTY, MONTANA
(UNINCORPORATED AREAS)
PANEL 225 OF 600
COMMUNITY-PANEL NUMBER
300154 0225B
EFFECTIVE DATE:
JUNE 17, 1986
Federal Emergency Management Agency
BASIN
FULLER
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ZONE A
TUNNEL
Boulder
River
Basin
Creek
Cataract
Creek
Big
Limber
Lily-of-the-West
Meyers
Gulch
Spring
Gulch
Gulch
High
Ore
Creek
Kleinsmith
Buttermilk
Jim
Gulch
Galena
TRAIL
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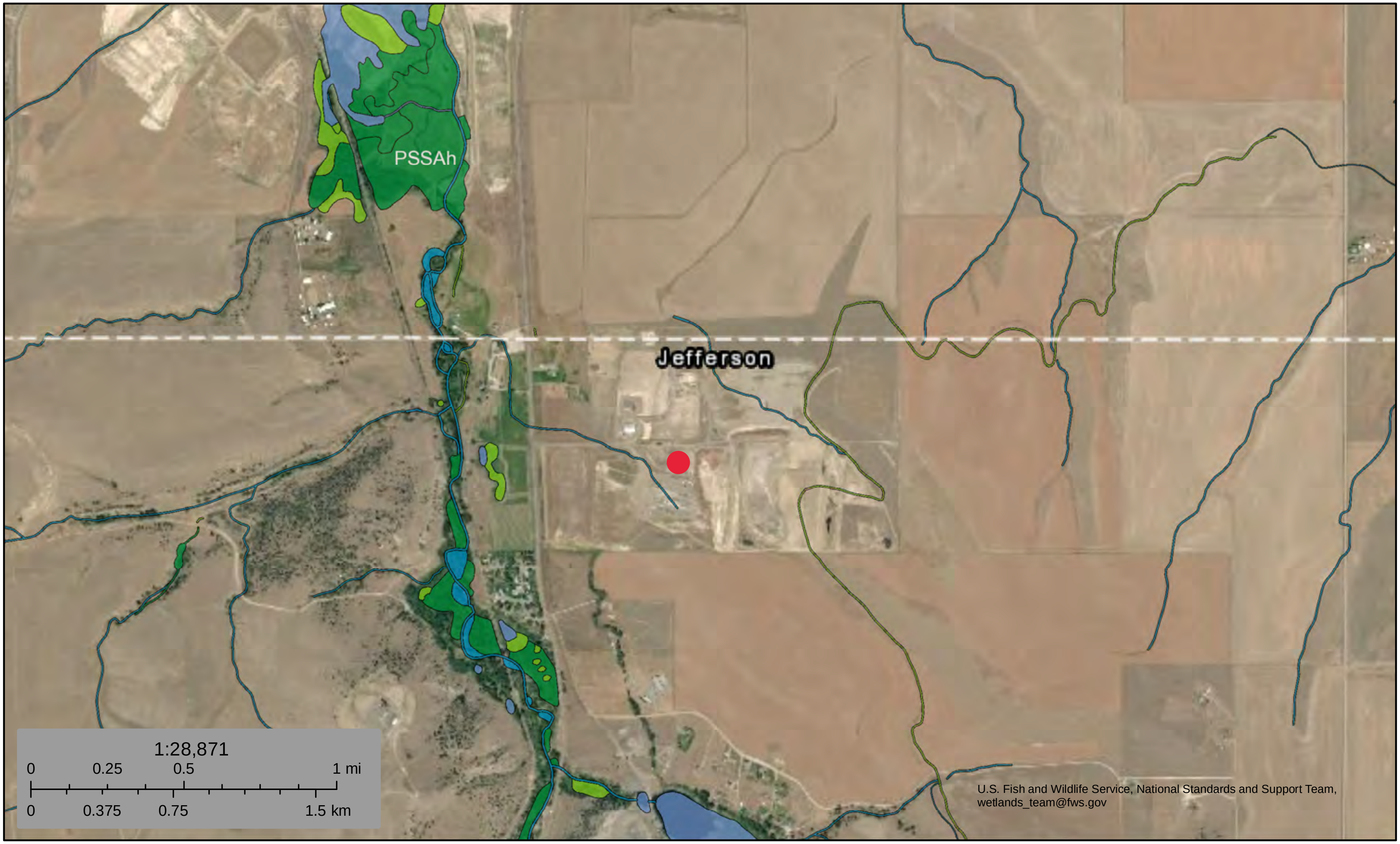
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Appendix E

Wetlands Maps

U.S. Fish and Wildlife Service
National Wetlands Inventory

Tri-County Site



February 6, 2019

Wetlands

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

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

U.S. Fish and Wildlife Service

National Wetlands Inventory

Montana City Site

February 6, 2019

Wetlands

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

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

U.S. Fish and Wildlife Service
National Wetlands Inventory

Jefferson City Site

February 6, 2019

Wetlands

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

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

U.S. Fish and Wildlife Service

National Wetlands Inventory

Clancy Site

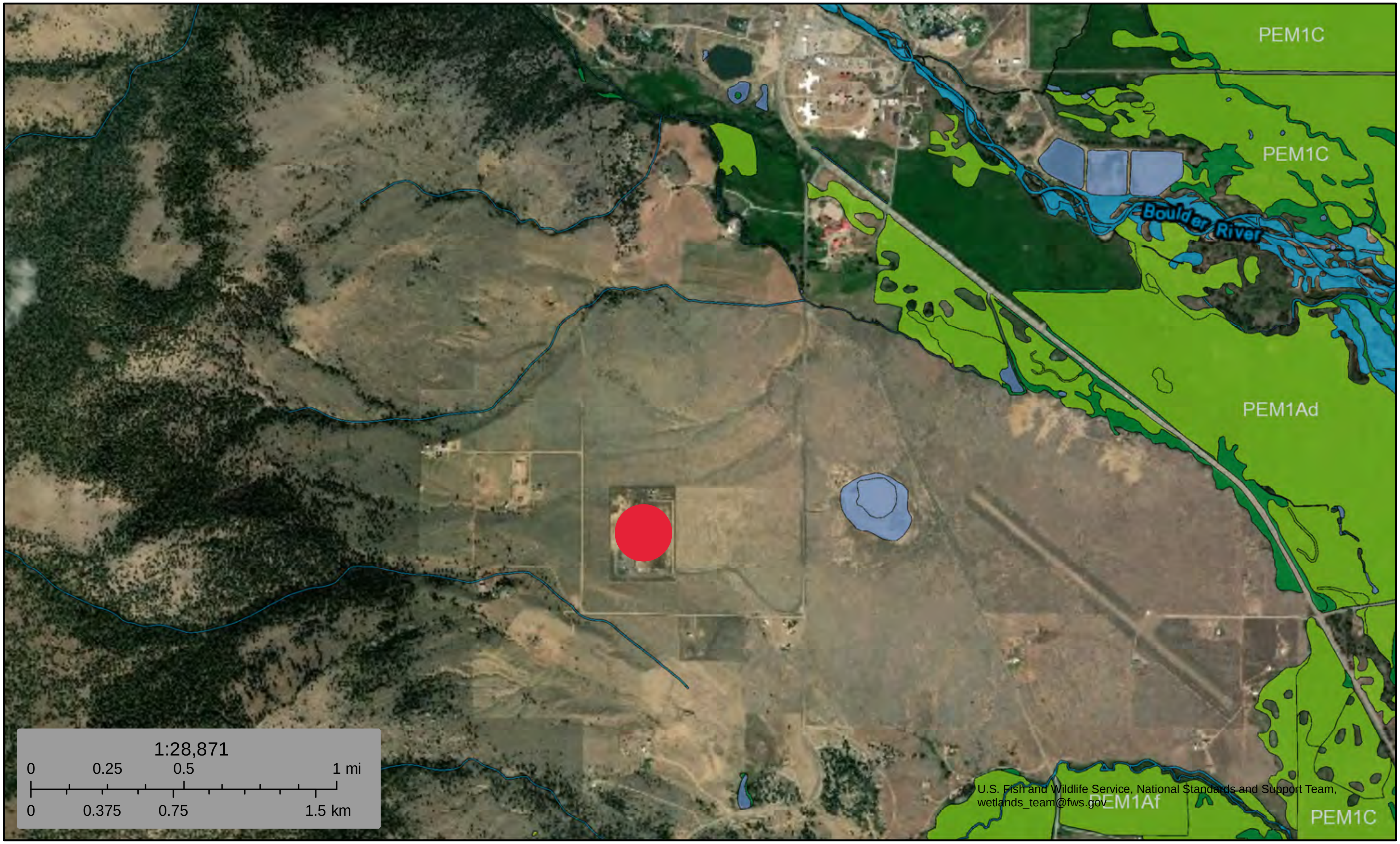
February 6, 2019

Wetlands

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

U.S. Fish and Wildlife Service
National Wetlands Inventory

Boulder Site



February 6, 2019

Wetlands

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

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

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

U.S. Fish and Wildlife Service
National Wetlands Inventory

Basin Site

February 6, 2019

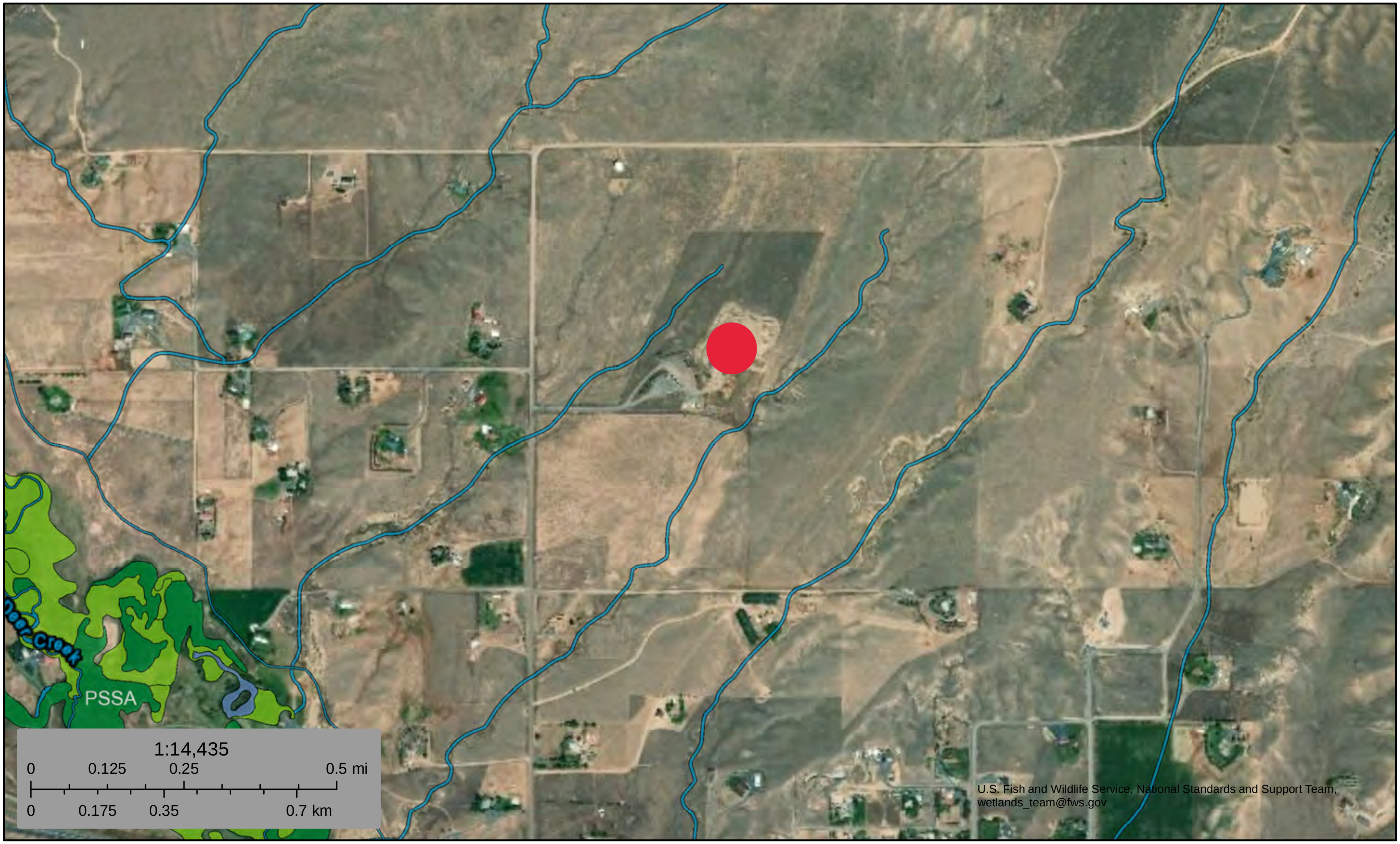
Wetlands

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

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

U.S. Fish and Wildlife Service
National Wetlands Inventory

Whitehall Site



February 6, 2019

Wetlands

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

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

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

Appendix F

Natural Heritage Program Data

Species_Subgroup	Species_Section	ELCODE	S_Sci_Name	S_Com_Name	Alt_Sci_Names	Alt_Com_Names	Family_Sci_Name	Family_Com_Name	G_Rank	S_Rank	S_Rank_Reasons	USESA	USFS_Formatted	BLM	FWP_SWAP	COUNTY	MT_Status	Pcnt_Breed_Rng_In_MT	Pcnt_MT_Is_Breed_Rng	Short_Habitat
Mammals (Mammalia)		AMACC08010	Corynorhinus townsendii	Townsend's Big-eared Bat			Vespertilionidae	Bats	G4	S3	Species is widespread, but uncommon and appears to occur at low densities. Disturbance of cave and mine roosts and the hard closure of occupied mines threaten long-term persistence.		Sensitive - Known on Forests (BD, BRT, CG, FLAT, HLC, KOOT, LOLO)	SENSITIVE	SGCN3	Beaverhead, Big Horn, Blaine, Broadwater, Carbon, Carter, Cascade, Chouteau, Custer, Fergus, Flathead, Gallatin, Garfield, Granite, Jefferson, Judith Basin, Lake, Lewis and Clark, Lincoln, Madison, Mccone, Meagher, Mineral, Missoula, Musselshell, Park, Phillips, Powder River, Powell, Prairie, Ravalli, Richland, Roosevelt, Rosebud, Sanders, Silver Bow, Treasure, Valley, Yellowstone	SOC	5	87	Caves in forested habitats
Mammals (Mammalia)		AMAFB06010	Cynomys ludovicianus	Black-tailed Prairie Dog			Sciuridae	Squirrels	G4	S3	Across much of eastern Montana this species occurs in areas with suitable soil and topography. However sylvatic plague has caused the species to decline and has affected colony size and dynamics. Ongoing threats from disease and persecution due to perceived competition with grazing make long-term status of this species		Sensitive - Known on Forests (CG)	SENSITIVE	SGCN3	Big Horn, Blaine, Carbon, Carter, Cascade, Chouteau, Custer, Fallon, Fergus, Garfield, Golden Valley, Hill, Jefferson, Judith Basin, Lewis and Clark, Liberty, Mccone, Musselshell, Petroleum, Phillips, Powder River, Prairie, Richland, Rosebud, Stillwater, Sweet Grass, Toole, Treasure, Valley, Wheatland, Yellowstone	SOC	15	71	Grasslands
Mammals (Mammalia)		AMACC07010	Euderma maculatum	Spotted Bat			Vespertilionidae	Bats	G4	S3	Little is known about this species in Montana. Although widely distributed, the species is quite rare in almost all of its range. Little is known about treats, trends in abundance or occupancy, or life history.		Sensitive - Known on Forests (BD, CG)	SENSITIVE	SGCN3, SGIN	Beaverhead, Big Horn, Blaine, Broadwater, Carbon, Cascade, Chouteau, Dawson, Fergus, Gallatin, Jefferson, Lewis and Clark, Madison, Musselshell, Phillips, Powder River, Richland, Rosebud, Silver Bow, Treasure, Yellowstone	SOC	5	27	Cliffs with rock crevices
Mammals (Mammalia)		AMAJF03010	Gulo gulo	Wolverine			Mustelidae	Weasels	G4	S3		P	Proposed on Forests (BD, BRT, CG, FLAT, HLC, KOOT, LOLO)	SENSITIVE	SGCN3	Beaverhead, Broadwater, Carbon, Cascade, Deer Lodge, Flathead, Gallatin, Glacier, Granite, Jefferson, Judith Basin, Lake, Lewis and Clark, Lincoln, Madison, Meagher, Mineral, Missoula, Park, Pondera, Powell, Ravalli, Sanders, Silver Bow, Stillwater, Sweet Grass, Teton, Wheatland	SOC	0	37	Boreal Forest and Alpine Habitats
Mammals (Mammalia)		AMACC05030	Lasiurus cinereus	Hoary Bat			Vespertilionidae	Bats	G3G4	S3					SGCN3	Beaverhead, Big Horn, Blaine, Broadwater, Carbon, Carter, Cascade, Chouteau, Custer, Daniels, Dawson, Deer Lodge, Fallon, Fergus, Flathead, Gallatin, Garfield, Glacier, Golden Valley, Granite, Hill, Jefferson, Judith Basin, Lake, Lewis and Clark, Liberty, Lincoln, Madison, Mccone, Meagher, Mineral, Missoula, Musselshell, Park, Petroleum, Phillips, Pondera, Powder River, Powell, Prairie, Ravalli, Richland, Roosevelt, Rosebud, Sanders, Sheridan, Silver Bow, Stillwater, Sweet Grass, Teton, Toole, Treasure, Valley, Wheatland, Wibaux, Yellowstone	SOC	2	100	Riparian and forest
Mammals (Mammalia)		AMACC01010	Myotis lucifugus	Little Brown Myotis		Little Brown Bat	Vespertilionidae	Bats	G3	S3	Species is common and widespread, but under significant threat of catastrophic declines due to White-Nose Syndrome, a fungal disease responsible for the collapse of populations of this species in the eastern US.				SGCN3	Beaverhead, Big Horn, Blaine, Broadwater, Carbon, Carter, Cascade, Chouteau, Custer, Daniels, Dawson, Deer Lodge, Fallon, Fergus, Flathead, Gallatin, Garfield, Glacier, Golden Valley, Granite, Hill, Jefferson, Judith Basin, Lake, Lewis and Clark, Lincoln, Madison, Mccone, Meagher, Mineral, Missoula, Musselshell, Park, Petroleum, Phillips, Pondera, Powder River, Powell, Prairie, Ravalli, Richland, Roosevelt, Rosebud, Sanders, Sheridan, Silver Bow, Stillwater, Sweet Grass, Teton, Toole, Treasure, Valley, Wheatland, Wibaux, Yellowstone	SOC	3	100	Generalist
Mammals (Mammalia)		AMACC01090	Myotis thysanodes	Fringed Myotis			Vespertilionidae	Bats	G4	S3	Although this species is distributed across much of Montana, recent surveys have found it to be uncommon within range. Species occasionally uses caves to over-winter so threats to persistence from White-Nose Syndrome are a concern, but due to its western distribution the extent of impacts are as yet unknown.			SENSITIVE	SGCN3	Beaverhead, Big Horn, Blaine, Broadwater, Carbon, Carter, Cascade, Custer, Deer Lodge, Fergus, Flathead, Gallatin, Granite, Jefferson, Judith Basin, Lake, Lewis and Clark, Lincoln, Madison, Meagher, Mineral, Missoula, Powder River, Powell, Prairie, Ravalli, Rosebud, Sanders, Silver Bow, Teton, Treasure	SOC	0	64	Riparian and dry mixed conifer forest
Birds (Aves)		ABNKC12060	Accipiter gentilis	Northern Goshawk			Accipitridae	Hawks / Kites / Eagles	G5	S3		MBTA			SGCN3	Beaverhead, Big Horn, Broadwater, Carbon, Carter, Cascade, Deer Lodge, Fergus, Flathead, Gallatin, Glacier, Granite, Jefferson, Judith Basin, Lake, Lewis and Clark, Liberty, Lincoln, Madison, Meagher, Mineral, Missoula, Park, Pondera, Powder River, Powell, Ravalli, Rosebud, Sanders, Silver Bow, Stillwater, Sweet Grass, Teton, Wheatland	SOC	2	68	Mixed conifer forests
Birds (Aves)		ABNKC22010	Aquila chrysaetos	Golden Eagle			Accipitridae	Hawks / Kites / Eagles	G5	S3		BGEPA; MBTA; BCC17		SENSITIVE	SGCN3	Beaverhead, Big Horn, Blaine, Broadwater, Carbon, Carter, Cascade, Chouteau, Custer, Dawson, Deer Lodge, Fallon, Fergus, Flathead, Gallatin, Garfield, Glacier, Golden Valley, Granite, Hill, Jefferson, Judith Basin, Lake, Lewis and Clark, Liberty, Lincoln, Madison, Mccone, Meagher, Missoula, Musselshell, Park, Petroleum, Phillips, Pondera, Powder River, Powell, Prairie, Ravalli, Richland, Roosevelt, Rosebud, Sanders, Sheridan, Silver Bow, Stillwater, Sweet Grass, Teton, Toole, Treasure, Valley, Wheatland, Wibaux, Yellowstone	SOC	3	100	Grasslands

Birds (Aves)		ABNGA04010	Ardea herodias	Great Blue Heron			Ardeidae	Bitterns / Egrets / Herons / Night-Herons	G5	S3	Small breeding population size, evidence of recent declines, and declining regeneration of riparian cottonwood forests due to altered hydrology and grazing.	MBTA			SGCN3	Beaverhead, Big Horn, Blaine, Broadwater, Carbon, Carter, Cascade, Chouteau, Custer, Dawson, Deer Lodge, Fallon, Fergus, Flathead, Gallatin, Garfield, Glacier, Golden Valley, Granite, Hill, Jefferson, Judith Basin, Lake, Lewis and Clark, Liberty, Lincoln, Madison, Mccone, Meagher, Mineral, Missoula, Musselshell, Park, Petroleum, Phillips, Pondera, Powder River, Powell, Prairie, Ravalli, Richland, Roosevelt, Rosebud, Sanders, Sheridan, Silver Bow, Stillwater, Sweet Grass, Teton, Treasure, Valley,	SOC	3	100	Riparian forest
Birds (Aves)		ABNSB10010	Athene cunicularia	Burrowing Owl			Strigidae	Owls	G4	S3B	Species has a negative short-term population trend.	MBTA; BCC17	Sensitive - Known on Forests (CG) Sensitive - Suspected on Forests (HLC)	SENSITIVE	SGCN3	Beaverhead, Big Horn, Blaine, Broadwater, Carbon, Carter, Cascade, Chouteau, Custer, Dawson, Fallon, Fergus, Gallatin, Garfield, Glacier, Golden Valley, Hill, Jefferson, Lewis and Clark, Liberty, Madison, Mccone, Musselshell, Petroleum, Phillips, Pondera, Powder River, Prairie, Ravalli, Roosevelt, Rosebud, Sheridan, Stillwater, Teton, Toole, Treasure, Valley, Wheatland,	SOC	2	82	Grasslands
Birds (Aves)		ABNKC19120	Buteo regalis	Ferruginous Hawk			Accipitridae	Hawks / Kites / Eagles	G4	S3B		MBTA; BCC10; BCC17		SENSITIVE	SGCN3	Beaverhead, Blaine, Broadwater, Carter, Cascade, Chouteau, Custer, Daniels, Dawson, Fallon, Fergus, Gallatin, Garfield, Glacier, Golden Valley, Hill, Jefferson, Judith Basin, Lewis and Clark, Liberty, Madison, Mccone, Meagher, Musselshell, Park, Petroleum, Phillips, Pondera, Powder River, Prairie, Roosevelt, Rosebud, Sheridan, Stillwater, Teton,	SOC	11	95	Sagebrush grassland
Birds (Aves)		ABPBJ18080	Catharus fuscescens	Veery			Turdidae	Thrushes	G5	S3B		MBTA		SENSITIVE	SGCN3	Beaverhead, Big Horn, Blaine, Broadwater, Carbon, Cascade, Chouteau, Custer, Deer Lodge, Fergus, Flathead, Gallatin, Glacier, Granite, Jefferson, Lake, Lewis and Clark, Liberty, Lincoln, Madison, Mccone, Meagher, Mineral, Missoula, Musselshell, Park, Petroleum, Phillips, Pondera, Powder River, Powell, Ravalli, Richland, Roosevelt, Rosebud, Sanders, Silver Bow, Stillwater, Sweet Grass, Teton, Wheatland,	SOC	6	100	Riparian forest
Birds (Aves)		ABPBA01010	Certhia americana	Brown Creeper			Certhiidae	Creepers	G5	S3		MBTA			SGCN3	Beaverhead, Broadwater, Carbon, Carter, Cascade, Chouteau, Deer Lodge, Fergus, Flathead, Gallatin, Glacier, Golden Valley, Granite, Jefferson, Judith Basin, Lake, Lewis and Clark, Lincoln, Madison, Meagher, Mineral, Missoula, Park, Powder River, Powell, Ravalli, Rosebud, Sanders, Silver Bow,	SOC	4	53	Moist conifer forests
Birds (Aves)		ABNNB03100	Charadrius montanus	Mountain Plover			Charadriidae	Plovers	G3	S2B		MBTA; BCC11; BCC17		SENSITIVE	SGCN2	Blaine, Broadwater, Carbon, Fergus, Garfield, Golden Valley, Jefferson, Madison, Musselshell, Petroleum, Phillips, Rosebud, Teton, Toole, Treasure, Valley, Wheatland	SOC	20	73	Grasslands
Birds (Aves)		ABPBY09020	Coccothraustes vespertinus	Evening Grosbeak			Fringillidae	Finches	G5	S3	Populations in Montana and across North America have experienced rangewide declines, although the causes of these declines are unclear (Bonter and Harvey 2008).	MBTA			SGCN3	Beaverhead, Broadwater, Carbon, Carter, Cascade, Chouteau, Fergus, Flathead, Gallatin, Glacier, Golden Valley, Granite, Jefferson, Judith Basin, Lake, Lewis and Clark, Lincoln, Madison, Meagher, Mineral, Missoula, Musselshell, Park, Pondera, Powder River, Powell, Ravalli, Sanders, Silver Bow, Stillwater, Sweet	SOC	3	100	Conifer forest
Birds (Aves)		ABPBXA9010	Dolichonyx oryzivorus	Bobolink			Icteridae	Blackbirds	G5	S3B	Species has undergone recent large population declines in Montana and a patchwork of declines and increases have been documented in surrounding states and provinces.	MBTA			SGCN3	Beaverhead, Big Horn, Blaine, Broadwater, Carbon, Carter, Cascade, Chouteau, Custer, Daniels, Dawson, Fallon, Fergus, Flathead, Gallatin, Garfield, Glacier, Granite, Hill, Jefferson, Judith Basin, Lake, Lewis and Clark, Liberty, Madison, Mccone, Meagher, Missoula, Musselshell, Park, Petroleum, Phillips, Powder River, Powell, Prairie, Ravalli, Richland, Roosevelt, Rosebud, Sanders, Sheridan, Stillwater, Sweet Grass, Teton, Valley, Wheatland, Wibaux, Yellowstone	SOC	9	100	Moist grasslands
Birds (Aves)		ABNYF12020	Dryocopus pileatus	Pileated Woodpecker			Picidae	Woodpeckers	G5	S3		MBTA			SGCN3	Beaverhead, Broadwater, Cascade, Deer Lodge, Flathead, Gallatin, Glacier, Granite, Jefferson, Lake, Lewis and Clark, Lincoln, Madison, Meagher, Mineral, Missoula, Park, Powell, Ravalli, Sanders, Silver Bow	SOC	1	27	Moist conifer forests
Birds (Aves)		ABNKD06070	Falco peregrinus	Peregrine Falcon			Falconidae	Falcons	G4	S3		DM; MBTA; BCC10; BCC11; BCC17	Sensitive - Known on Forests (BD, BRT, CG, FLAT, HLC, KOOT, LOLO)	SENSITIVE	SGCN3	Beaverhead, Big Horn, Blaine, Broadwater, Carbon, Cascade, Chouteau, Deer Lodge, Flathead, Gallatin, Glacier, Granite, Jefferson, Lake, Lewis and Clark, Lincoln, Madison, Meagher, Mineral, Missoula, Park, Pondera, Powell, Prairie, Ravalli, Sanders, Silver Bow, Stillwater, Sweet Grass, Teton, Toole, Treasure,	SOC	2	100	Cliffs / canyons
Birds (Aves)		ABPAV07010	Gymnorhinus cyanocephalus	Pinyon Jay			Corvidae	Jays / Crows / Magpies	G5	S3		MBTA; BCC17			SGCN3	Big Horn, Blaine, Broadwater, Carbon, Carter, Cascade, Chouteau, Custer, Fergus, Gallatin, Garfield, Golden Valley, Jefferson, Lewis and Clark, Musselshell, Park, Petroleum, Phillips, Powder River, Rosebud, Stillwater, Sweet Grass, Wheatland,	SOC	5	55	Open conifer forest
Birds (Aves)		ABPBY04030	Haemorhous cassinii	Cassin's Finch			Fringillidae	Finches	G5	S3		MBTA; BCC10			SGCN3	Beaverhead, Big Horn, Broadwater, Carbon, Cascade, Chouteau, Custer, Deer Lodge, Fergus, Flathead, Gallatin, Glacier, Golden Valley, Granite, Jefferson, Judith Basin, Lake, Lewis and Clark, Lincoln, Madison, Meagher, Mineral, Missoula, Musselshell, Park, Petroleum, Phillips, Powder River, Powell, Ravalli, Rosebud, Sanders, Silver Bow, Stillwater, Sweet Grass, Teton, Wheatland, Yellowstone	SOC	11	62	Drier conifer forest

Birds (Aves)		ABPBR01030	Lanius ludovicianus	Loggerhead Shrike			Laniidae	Shrikes	G4	S3B		MBTA; BCC10; BCC17		SENSITIVE	SGCN3	Beaverhead, Big Horn, Blaine, Broadwater, Carbon, Carter, Cascade, Chouteau, Custer, Daniels, Dawson, Fallon, Fergus, Gallatin, Garfield, Glacier, Golden Valley, Hill, Jefferson, Liberty, Madison, Mccone, Meagher, Musselshell, Petroleum, Phillips, Pondera, Powder River, Prairie, Richland, Roosevelt, Rosebud, Sheridan, Stillwater, Sweet Grass, Teton, Toole, Valley, Wheatland, Wibaux, Yellowstone	SOC	4	100	Shrubland
Birds (Aves)		ABPBY02010	Leucosticte atrata	Black Rosy-Finch			Fringillidae	Finches	G4	S2		MBTA; BCC10			SGCN2, SGIN	Beaverhead, Broadwater, Carbon, Cascade, Deer Lodge, Granite, Jefferson, Judith Basin, Madison, Meagher, Missoula, Park, Powell, Ravalli, Silver Bow, Stillwater	SOC	38	20	Alpine
Birds (Aves)		ABNYF04010	Melanerpes lewis	Lewis's Woodpecker			Picidae	Woodpeckers	G4	S2B		MBTA; BCC10; BCC17		SENSITIVE	SGCN2	Big Horn, Carter, Cascade, Deer Lodge, Flathead, Granite, Jefferson, Lake, Lewis and Clark, Lincoln, Missoula, Musselshell, Powder River, Powell, Ravalli, Rosebud, Sanders, Sweet Grass, Yellowstone	SOC	8	78	Riparian forest
Birds (Aves)		ABPAV08010	Nucifraga columbiana	Clark's Nutcracker			Corvidae	Jays / Crows / Magpies	G5	S3		MBTA			SGCN3	Beaverhead, Big Horn, Broadwater, Carbon, Carter, Cascade, Chouteau, Custer, Deer Lodge, Fergus, Flathead, Gallatin, Glacier, Golden Valley, Granite, Jefferson, Judith Basin, Lake, Lewis and Clark, Liberty, Lincoln, Madison, Meagher, Mineral, Missoula, Musselshell, Park, Petroleum, Phillips, Pondera, Powder River, Powell, Ravalli, Sanders, Silver Bow, Stillwater, Sweet Grass, Teton, Toole, Wheatland, Yellowstone	SOC	9	84	Conifer forest
Birds (Aves)		ABNNF07070	Numenius americanus	Long-billed Curlew			Scolopacidae	Sandpipers	G5	S3B		MBTA; BCC10; BCC11; BCC17		SENSITIVE	SGCN3	Beaverhead, Big Horn, Blaine, Broadwater, Carbon, Carter, Cascade, Chouteau, Custer, Daniels, Dawson, Deer Lodge, Fallon, Fergus, Flathead, Gallatin, Garfield, Glacier, Golden Valley, Granite, Hill, Jefferson, Judith Basin, Lake, Lewis and Clark, Liberty, Madison, Mccone, Meagher, Missoula, Musselshell, Park, Petroleum, Phillips, Pondera, Powder River, Powell, Prairie, Ravalli, Richland, Roosevelt, Rosebud, Sanders, Sheridan, Stillwater, Sweet Grass, Teton, Toole, Treasure, Valley, Wheatland, Wibaux, Yellowstone	SOC	19	100	Grasslands
Birds (Aves)		ABPBK04010	Oreoscoptes montanus	Sage Thrasher			Mimidae	Thrashers / Mockingbirds / Catbirds	G4	S3B		MBTA; BCC10; BCC17		SENSITIVE	SGCN3	Beaverhead, Big Horn, Broadwater, Carbon, Carter, Chouteau, Custer, Fallon, Gallatin, Garfield, Golden Valley, Jefferson, Lewis and Clark, Madison, Musselshell, Park, Petroleum, Phillips, Powder River, Prairie, Richland, Rosebud, Sanders, Silver Bow, Stillwater, Sweet Grass, Valley, Wheatland, Yellowstone	SOC	9	84	Sagebrush
Birds (Aves)		ABPBX74010	Pipilo chlorurus	Green-tailed Towhee			Passerellidae	New World Sparrows	G5	S3B	Populations in Montana and across the Northern Rockies have undergone recent declines.	MBTA			SGCN3	Beaverhead, Big Horn, Blaine, Broadwater, Carbon, Chouteau, Custer, Deer Lodge, Fergus, Gallatin, Garfield, Granite, Jefferson, Judith Basin, Lewis and Clark, Madison, Meagher, Musselshell, Park, Petroleum, Phillips, Powder River, Silver Bow, Stillwater, Sweet Grass, Valley, Wheatland, Yellowstone	SOC	3	60	Shrub woodland
Birds (Aves)		ABPBJ08010	Polioptila caerulea	Blue-gray Gnatcatcher			Polioptilidae	Gnatcatchers	G5	S2B		MBTA	Sensitive - Known on Forests (CG)	SENSITIVE	SGCN2	Broadwater, Carbon, Jefferson	SOC	0	1	Utah juniper
Birds (Aves)		ABNSB01020	Psiloscops flammeolus	Flammulated Owl			Strigidae	Owls	G4	S3B		MBTA; BCC10	Sensitive - Known on Forests (BD, BRT, FLAT, HLC, KOOT, LOLO) Sensitive - Suspected on Forests (CG)	SENSITIVE	SGCN3	Beaverhead, Broadwater, Flathead, Gallatin, Granite, Jefferson, Lake, Lewis and Clark, Lincoln, Madison, Mineral, Missoula, Powell, Ravalli, Sanders	SOC	2	36	Dry conifer forest
Birds (Aves)		ABPBX94040	Spizella breweri	Brewer's Sparrow			Passerellidae	New World Sparrows	G5	S3B	Species faces threats from loss of sagebrush habitats it is dependent on as a result of habitat conversion for agriculture and increased frequency of fire as a result of weed encroachment and drought.	MBTA; BCC10; BCC17		SENSITIVE	SGCN3	Beaverhead, Big Horn, Blaine, Broadwater, Carbon, Carter, Chouteau, Custer, Dawson, Deer Lodge, Fallon, Fergus, Flathead, Gallatin, Garfield, Glacier, Golden Valley, Granite, Hill, Jefferson, Lake, Lewis and Clark, Liberty, Lincoln, Madison, Mccone, Meagher, Missoula, Musselshell, Park, Petroleum, Phillips, Pondera, Powder River, Powell, Prairie, Ravalli, Richland, Roosevelt, Rosebud, Sanders, Silver Bow, Stillwater, Sweet Grass, Teton, Toole, Treasure, Valley, Wheatland, Wibaux, Yellowstone	SOC	12	100	Sagebrush
Birds (Aves)		ABNSB12040	Strix nebulosa	Great Gray Owl			Strigidae	Owls	G5	S3		MBTA		SENSITIVE	SGCN3, SGIN	Beaverhead, Carbon, Deer Lodge, Flathead, Gallatin, Granite, Jefferson, Judith Basin, Lake, Lewis and Clark, Lincoln, Meagher, Missoula, Park, Powell, Ravalli, Silver Bow, Sweet Grass, Teton, Wheatland	SOC	2	46	Conifer forest near open meadows
Birds (Aves)		ABPBG09090	Troglodytes pacificus	Pacific Wren			Troglodytidae	Wrens	G5	S3		MBTA			SGCN3	Beaverhead, Broadwater, Fergus, Flathead, Gallatin, Glacier, Granite, Jefferson, Judith Basin, Lake, Lewis and Clark, Lincoln, Madison, Meagher, Mineral, Missoula, Park, Powell, Ravalli, Sanders, Stillwater, Sweet Grass, Teton	SOC	1	39	Moist conifer forests

Amphibians (Amphibia)		AAABB01030	Anaxyrus boreas	Western Toad			Bufonidae	True Toads	G4	S2	Over the last few decades this species has undergone serious declines in abundance due primarily to infection with Chytrid fungus. While declines in breeding site occupancy appear to have stabilized in the last decade, changes to abundance across the species range within Montana remain unknown. Significant threats to the persistence of this species remain from continued impacts of disease and mortality of adults and young during breeding and local migration.		Sensitive - Known on Forests (BD, BRT, CG, FLAT, HLC, KOOT, LOLO)	SENSITIVE	SGCN2	Beaverhead, Chouteau, Deer Lodge, Flathead, Gallatin, Glacier, Granite, Jefferson, Judith Basin, Lake, Lewis and Clark, Lincoln, Madison, Meagher, Mineral, Missoula, Park, Pondera, Powell, Ravalli, Sanders, Silver Bow, Teton	SOC	6	38	Wetlands, floodplain pools
Fish (Actinopterygii)		AFCHA02088	Oncorhynchus clarkii lewisi	Westslope Cutthroat Trout			Salmonidae	Trout	G4T4	S2	The Westslope Cutthroat trout is currently ranked "S2" in Montana because it is at risk due to very limited and/or potentially declining population numbers, range and/or habitat, making it vulnerable to extirpation in the		Sensitive - Known on Forests (BD, BRT, CG, FLAT, HLC, KOOT, LOLO)	SENSITIVE	SGCN2	Beaverhead, Broadwater, Cascade, Chouteau, Deer Lodge, Fergus, Flathead, Gallatin, Glacier, Granite, Jefferson, Judith Basin, Lake, Lewis and Clark, Lincoln, Madison, Meagher, Mineral, Missoula, Park, Pondera, Powell, Ravalli, Sanders, Silver Bow, Teton, Wheatland	SOC		34	Mountain streams, rivers, lakes
Invertebrates - Insects	Dragonflies	IIODO39020	Erythemis collocata	Western Pondhawk			Libellulidae	Skimmer Dragonflies	G5	S1S2	This dragonfly is currently listed as an "S1S2" Species of Concern in MT due to extremely limited and/or rapidly declining population numbers, range and/or habitat, making it highly vulnerable to extirpation in the state. Restricted to one warm spring habitat in the Tobacco Root Mountains of the state.					Jefferson, Madison	SOC	5	6	Wetlands
Invertebrates - Insects	Dragonflies	IIODO44010	Leucorrhinia borealis	Boreal Whiteface			Libellulidae	Skimmer Dragonflies	G5	S1	This dragonfly is currently listed as an "S1" Species of Concern in MT due to extremely limited and/or rapidly declining population numbers, range and/or habitat, making it highly vulnerable to extirpation in the state. This restricted range may be due to lack of suitable surveys to detect this dragonfly. With more surveys this species will likely be found in more areas across the western portion of the state.					Beaverhead, Deer Lodge, Jefferson, Lewis and Clark, Powell, Silver Bow	SOC	10	36	Wetlands and Ponds
Invertebrates - Insects	Springtails	IICLL18090	Oncopodura cruciata	A Springtail			Oncopoduridae	Elongate Springtails	G1G2	S1S2						Jefferson	SOC	100	1	Caves
Invertebrates - Mollusks		IMBIV27020	Margaritifera falcata	Western Pearlshell			Margaritiferidae	Margaritiferid Mussels	G5	S2	The Western Pearlshell is currently ranked a "S2" Species of Concern in MT and is at risk because of very limited and/or potentially declining population numbers, range and/or habitat, making it vulnerable to extirpation in the state. This species is widespread in geographic area, but is declining in terms of area occupied and the number of sites with viable individuals; populations showing repeated reproduction (at least several age classes) are now the exception rather than the rule. Montana currently has only 14 "excellent" viable populations out of ~200 known locations (Stagliano 2010). Short term trends show populations declining by ~20% over the last decade (Stagliano 2015).		Sensitive - Known on Forests (BD, BRT, CG, HLC, KOOT, LOLO) Sensitive - Suspected on Forests (FLAT)	SENSITIVE	SGCN2	Beaverhead, Broadwater, Cascade, Deer Lodge, Gallatin, Granite, Jefferson, Lake, Lewis and Clark, Lincoln, Madison, Meagher, Missoula, Powell, Ravalli, Sanders, Silver Bow	SOC	10	26	Mountain streams, rivers
Invertebrates - Other	Arachnids	ILARAB4010	Sclerobunus cavicolens	A Cave Obligate Harvestman	Sclerobunus cavid		Triaenonychidae	Daddy Longlegs / Harvestmen	G1G2	S1S2						Jefferson, Madison	SOC	100	1	Caves

Montana Natural Heritage - SOC Report Species List Last Updated **09/25/2018**

Plant Species of Concern

442 Species of Concern
90 Potential Species of Concern
All Records (no filtering)

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

Introduction

The Montana Natural Heritage Program (MTNHP) serves as the state's information source for Species of Concern (SOC) – plants and animals that are rare, threatened, and/or have declining populations and as a result are at risk or potentially at risk of extirpation in Montana. This report is based on information gathered from field inventories, publications, reports, herbaria specimens, and the knowledge of botanists and other taxonomic experts. Taxa in the SOC category generally include all vascular plant taxa ranked S1, S2, S3 or SH. Nonvascular taxa (bryophytes and lichens) which are not as well documented or studied as vascular plant taxa in the state, are listed as SOC using similar criteria as vascular taxa but are more strictly limited to those taxa which are believed to be the rarest or most vulnerable to extirpation based on current information.

Designation as a Species of Concern is not a statutory or regulatory classification. Instead, these designations provide a basis for resource managers and decision-makers to make proactive decisions regarding species conservation and data collection priorities in order to maintain viable populations and avoid extirpation of species from the state. MTNHP may designate additional taxa as Potential Species of Concern (PSOC). Taxa in this designation include species or subspecies which may be rare, have a restricted range in the state or are otherwise vulnerable to extirpation in at least part of their range but otherwise do not meet the criteria for inclusion as a SOC. An additional designation of Status Under Review is used for those taxa for which additional information is needed to accurately assign a status rank or for which conflicting information exists. Taxa designated as Status Under Review are not included in this document but can be found in the on-line **Fieldguide (http://fieldguide.mt.gov/)**.

This web-based report, which replaces the 2006 Plant Species of Concern publication, identifies vascular plant Species of Concern (SOC), bryophyte SOC and lichen SOC in Montana. The MTNHP continuously reviews and updates status ranks as new information and data become available through field surveys, research, and submitted observations. Status ranks and information supporting them are reviewed by botanists and resource specialists. If you wish to comment or contribute information to this process please contact the MTNHP Botanist. The information we receive from botanists and others throughout the state is essential in this process, and contributes to more accurate assessments of species' status. We continue to ask that all observations for SOC, PSOC and Review Status plants be reported to the Heritage Program. A copy of the field survey form specifying the information that should be submitted is available on our **website (http://mtnhp.org/)**.

Information concerning plant species contained on the SOC, PSOC or Review lists may be viewed on the MTNHP's on-line Montana Plant Field Guide. The Field Guide provides information for vascular and non-vascular plants, including species' characteristics, identification, habitat, distribution, state rank reasons and references, as well as technical illustrations and photographs of the plants and their habitats. For each species, a link to the NatureServe website (http://www.natureserve.org/) provides access to information on the status of the species throughout North America, assembled from state and provincial Natural Heritage databases. Information in the Montana Field Guide is continuously updated and expanded, so please check it often for current species' information. If you have questions concerning the field guide or find errors or omissions please contact the MTNHP.

Status lists of SOC plants may be queried on-line by county and/or township; taxonomic group or one of several rank/status criteria. More detailed information or additional assistance can be requested from MTNHP using the Information Request function on our **website**, or by phone, e-mail or mail.

How to Read the Lists

The SOC list is organized alphabetically by scientific name (Genus and specific epithet followed by subspecific epithet if any) within the major groups of Vascular Plants, Bryophytes (Mosses and Liverworts) and Lichens. Vascular plants are further sorted by the subgroups: Ferns and Fern Allies, Gymnosperms (if any), Flowering Plants-Dicots and Flowering Plants-Monocots. The list can also be sorted alphabetically by the common name. Additional scientific names as well as the Family name are included in adjacent columns for each species. The nomenclature and taxonomy for many groups of plants continues to change as new research is conducted and published, and as a result no one nomenclatural reference is followed. Publications and web resources which are most relevant to Montana plants include Vascular Plants of Montana (Dorn 1984), NatureServe Explorer, The USDA PLANTS database, Flora of North America (1993-), Grasses of Montana (Lavin and Seibert 2011) and Flora of the Pacific Northwest (Hitchcock and Cronquist 1973). Additionally, an abundance of scientific literature pertinent to Montana plants is available and indispensable in the process of determining the nomenclature and taxonomic concepts used in this report.

Species that have been added to or deleted from the SOC list due to changes in their global or state rank are reported in separate sections below. These changes are also reflected in the date displayed at the top of the report which shows when an addition or deletion to the list last occurred.

County Distribution

Montana counties of record are listed alphabetically with each species. County records of occurrence are determined directly from mapped species occurrences (SO's) in MTNHP databases. A record of occurrence for a particular county may be based on a historical observation which may no longer be extant. Additionally, some plant observations with vague locality information are not mapped in MTNHP databases and as result would not be included in the county distribution for that particular species.

Montana Species Ranking Codes (GRank, SRank)

Montana employs a standardized ranking system to denote **global** (range-wide) and **state** status (NatureServe 2006). Species are assigned numeric ranks ranging from 1 (highest risk, greatest concern) to 5 (demonstrably secure), reflecting the relative degree of risk to the species' viability, based upon available information.

A number of factors are considered in assigning ranks — the number, size and quality of known occurrences or populations, distribution, trends (if known), intrinsic vulnerability, habitat specificity, and definable threats. The process of assigning state ranks for each taxon relies heavily on the number of occurrences and Species Occurrence (OE) ranks, which is a ranking system of the quality (usually A through D) of each known occurrence based on factors such as size (# of individuals) and habitat quality. The remaining factors noted above are also incorporated into the ranking process when they are known. The "State Rank Reason" field in the **Montana Field Guide** provides additional information on the reasons for a particular species' rank.

Rank		Definition
G1	**S1**	At high risk because of **extremely limited** and/or **rapidly declining** population numbers, range and/or habitat, making it highly vulnerable to global extinction or extirpation in the state.
G2	**S2**	At risk because of **very limited** and/or **potentially declining** population numbers, range and/or habitat, making it vulnerable to global extinction or extirpation in the state.
G3	**S3**	Potentially at risk because of **limited** and/or **declining** numbers, range and/or habitat, even though it may be abundant in some areas.
G4	**S4**	Apparently secure, though it may be quite rare in parts of its range, and/or suspected to be declining.
G5	**S5**	Common, widespread, and abundant (although it may be rare in parts of its range). Not vulnerable in most of its range.
GX	**SX**	Presumed Extinct or Extirpated - Species is believed to be extinct throughout its range or extirpated in Montana. Not located despite intensive searches of historical sites and other appropriate habitat, and small likelihood that it will ever be rediscovered.
GH	**SH**	Historical, known only from records usually 40 or more years old; may be rediscovered.
GNR	**SNR**	Not Ranked as of yet.
GU	**SU**	Unrankable - Species currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
GNA	**SNA**	A conservation status rank is not applicable because the species or ecosystem is not a suitable target for conservation activities as a result of being: 1) not confidently present in the state; 2) non-native or introduced; 3) a long distance migrant with accidental or irregular stopovers; or 4) a hybrid without conservation value.

Combination or Range Ranks

G#G# or **S#S#**	Indicates a range of uncertainty about the status of the species *(e.g., G1G3 = Global Rank ranges between G1 and G3).*
S#, S#	Indicates that populations in different geographic portions of the species' range in Montana have a different conservation status *(e.g., S1 west of the Continental Divide and S4 east of the Continental Divide).*

Sub-rank

T#	Rank of a subspecies or variety. Appended to the global rank of the full species, *e.g. G4T3*

Qualifiers

Q	**Questionable** taxonomy that may reduce conservation priority-Distinctiveness of this entity as a taxon at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or inclusion of this taxon in another taxon, with the resulting taxon having a lower-priority (numerically higher) conservation status rank. Appended to the global rank, *e.g. G3Q*
?	**Inexact Numeric Rank** - Denotes uncertainty; inexactness.
HYB	**Hybrid** - Entity not ranked because it represents an interspecific hybrid and not a species.
C	**Captive or Cultivated Only** - Species at present exists only in captivity or cultivation, or as a reintroduced population not yet established.
A	**Accidental** - Species is accidental or casual in Montana, in other words, infrequent and outside usual range. Includes species (usually birds or butterflies) recorded once or only a few times at a location. A few of these species may have bred on the few occasions they were recorded.
SYN	**Synonym** - Species reported as occurring in Montana, but the Montana Natural Heritage Program does not recognize the taxon; therefore the species is not assigned a rank.
B	**Breeding** - Rank refers to the breeding population of the species in Montana. Appended to the state rank, *e.g. S2**B**,S5N = At risk during breeding season, but common in the winter*
N	**Nonbreeding** - Rank refers to the non-breeding population of the species in Montana. Appended to the state rank, *e.g. S5B,S2**N** = Common during breeding season, but at risk in the winter*
M	**Migratory** - Species occurs in Montana only during migration.

Federal Status

Designations in this column reflect the status of a species under the U.S. Endangered Species Act (ESA), or as "sensitive" by the U.S. Forest Service (USFS) or Bureau of Land Management (BLM).

U.S. Fish and Wildlife Service (Endangered Species Act)

Status of a taxon under the federal Endangered Species Act of 1973
(16 U.S.C.A. § 1531-1543 (Supp. 1996))

Designation Descriptions

LE	**Listed endangered:** Any species in danger of extinction throughout all or a significant portion of its range (16 U.S.C. 1532(6)).
LT	**Listed threatened:** Any species likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range (16 U.S.C. 1532(20)).
C	**Candidate:** Those taxa for which sufficient information on biological status and threats exists to propose to list them as threatened or endangered. We encourage their consideration in environmental planning and partnerships; however, none of the substantive or procedural provisions of the Act apply to candidate species.
P	**Proposed threatened:** Any species that is proposed in the Federal Register to be listed under section 4 of the Act.
DM	**Recovered, delisted, and being monitored** - Any previously listed species that is now recovered, has been delisted, and is being monitored.
NL	**Not listed** - No designation.
XE	**Experimental - Essential population** - An experimental population whose loss would be likely to appreciably reduce the likelihood of the survival of the species in the wild.
XN	**Experimental - Nonessential population** - An experimental population of a listed species reintroduced into a specific area that receives more flexible management under the Act.
CH	**Critical Habitat** - The specific areas (i) within the geographic area occupied by a species, at the time it is listed, on which are found those physical or biological features (I) essential to conserve the species and (II) that may require special management considerations or protection; and (ii) specific areas outside the geographic area occupied by the species at the time it is listed upon determination that such areas are essential to conserve the species.
PS	**Partial status** - status in only a portion of the species' range. Typically indicated in a "full" species record where an infraspecific taxon or population, that has a record in the database has USESA status, but the entire species does not. For example, Yellow-billed Cuckoo (*Coccyzus americanus*) is ranked **PS:LT**. Partial Status - Listed Threatened. Designated as Threatened in the Western U.S. Distinct Population Segment (DPS) (subspecies *occidentalis*)
BGEPA	**The Bald and Golden Eagle Protection Act of 1940 (BGEPA)** - (16 U.S.C. 668-668c) prohibits anyone, without a permit issued by the Secretary of the Interior, from taking bald or golden eagles, including their parts, nests, or eggs. The BGEPA provides criminal and civil penalties for persons who take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle ... [or any golden eagle], alive or dead, or any part, nest, or egg thereof. The BGEPA defines take as pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb. "Disturb" means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior. In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagles return, such alterations agitate or bother an eagle to a degree that injures an eagle or substantially interferes with normal breeding, feeding, or sheltering habits and causes, or is likely to cause, a loss of productivity or nest abandonment.
MBTA	**The Migratory Bird Treaty Act (MBTA)** - (16 U.S.C. §§ 703-712, July 3, 1918, as amended 1936, 1960, 1968, 1969, 1974, 1978, 1986 and 1989) implements four treaties that provide for international protection of migratory birds. The statute's language is clear that actions resulting in a "taking" or possession (permanent or temporary) of a protected species, in the absence of a U.S. Fish and Wildlife Service (USFWS) permit or regulatory authorization, are a violation of the MBTA. The MBTA states, "Unless and except as permitted by regulations ... it shall be unlawful at any time, by any means, or in any manner to pursue, hunt, take, capture, kill ... possess, offer for sale, sell ... purchase ... ship, export, import ... transport or cause to be transported ... any migratory bird, any part, nest, or eggs of any such bird .... [The Act] prohibits the taking, killing, possession, transportation, import and export of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior." The word "take" is defined by regulation as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect." The USFWS maintains a **list of species protected by the MBTA** at 50 CFR 10.13. This list includes over one thousand species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines. The USFWS also maintains a **list of species not protected by the MBTA**. MBTA does not protect species that are not native to the United States or species groups not explicitly covered under the MBTA; these include species such as the house (English) sparrow, European starling, rock dove (pigeon), Eurasian collared-dove, and non-migratory upland game birds.
BCC	The 1988 amendment to the Fish and Wildlife Conservation Act mandates the U.S. Fish and Wildlife Service to identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act. **Birds of Conservation Concern 2008 (BCC 2008)** is the most recent effort to carry out this mandate. The overall goal of this report is to accurately identify the migratory and non-migratory bird species (beyond those already designated as federally threatened or endangered) that represent the Service's highest conservation priorities. BCC10, BCC11, and BCC17 designations represent inclusion on the Birds of Conservation Concern list for Bird Conservation Region 10, 11, and 17 in Montana, respectively.

Bureau of Land Management (BLM)

BLM Sensitive Species are defined by the BLM 6840 Manual as native species found on BLM-administered lands for which the BLM has the capability to significantly affect the conservation status of the species through management, and either: (1) there is information that a species has recently undergone, is undergoing, or is predicted to undergo a downward trend such that the viability of the species or a distinct population segment of the species is at risk across all or a significant portion of the species range, or; (2) the species depends on ecological refugia or specialized or unique habitats on BLM-administered lands, and there is evidence that such areas are threatened with alteration such that the continued viability of the species in that area would be at risk.

Designation Descriptions

Endangered	Denotes species that are listed as Endangered under the Endangered Species Act
Threatened	Denotes species that are listed as Threatened under the Endangered Species Act
Sensitive	Denotes species listed as Sensitive on BLM lands

U.S. Forest Service (USFS)

Designation Descriptions

Endangered	Listed as Endangered (LE) under the U.S. Endangered Species Act.
Threatened	Listed as Threatened (LT) under the U.S. Endangered Species Act.
Proposed	Any species that is proposed in the Federal Register to be listed under section 4 of the Act.

Candidate	Those taxa for which sufficient information on biological status and threats exists to propose to list them as threatened or endangered. We encourage their consideration in environmental planning and partnerships; however, none of the substantive or procedural provisions of the Act apply to candidate species.
Sensitive	U.S. Forest Service Manual (2670.22) defines Sensitive Species on Forest Service lands as those for which population viability is a concern as evidenced by a significant downward trend in population or a significant downward trend in habitat capacity. These designations were last updated in 2011 and they apply only on USFS-administered lands with land management plans finalized prior to 2017. Sensitive Species designations are being replaced by Species of Conservation Concern designations on individual National Forest as revised land management plans are finalized under the 2012 planning rule.
Species of Conservation Concern	A species, other than federally recognized Threatened, Endangered, Proposed, or Candidate species, that is known to occur in the plan area and for which the regional forester has determined that the best available scientific information indicates substantial concern about the species' capability to persist over the long-term in the plan area (36 CFR 219.9). Species of Conservation Concern replace regional forester Sensitive Species on individual National Forests as revised land management plans are finalized under the 2012 planning rule.

Acknowledgements

We would like to gratefully acknowledge the many people who contributed information on plant species' occurrences and distribution throughout Montana over the years – those contributions are the building blocks of the MTNHP databases and this publication. We encourage you to continue submitting data for SOC, PSOC and Under Review taxa so that status ranks and this document are as accurate and comprehensive as possible.

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Species of Concern
442 Species
All Records (no filtering)

FERNS AND FERN ALLIES (PTERIDOPHYTA) — 35 SPECIES

SCIENTIFIC NAME COMMON NAME TAXA SORT	OTHER NAMES	FAMILY (SCIENTIFIC) FAMILY (COMMON)	GLOBAL RANK	STATE RANK	USFWS	USFS	BLM	MNPS THREAT CATEGORY	HABITAT
Asplenium trichomanes-ramosum Limestone Maidenhair Spleenwort	Asplenium viride	Aspleniaceae Spleenwort Family	G5	S3					
			Species Occurrences verified in these Counties: Carbon, Fergus, Flathead, Glacier, Lake, Lewis and Clark, Pondera, Teton **State Rank Reason:** S3 SOC: Aspleniumtrichomanes-ramosumplants are never common, grow in habitat that is limited in Montana, and occur where land management (example: national park, wilderness) provides some protections.						
Botrychium adnatum Adnate Moonwort		Ophioglossaceae Adder's-Tongue / Moonworts	G1?	S1S2					Grasslands (Fescue)
			Species Occurrences verified in these Counties: **State Rank Reason:** A tentatively recognized species that has not been formally published; currently known only fromnorthwest Montana.						
Botrychium ascendens Upward-lobed Moonwort		Ophioglossaceae Adder's-Tongue / Moonworts	G3	S3		Sensitive - Known on Forests (FLAT, HLC, KOOT)		2	Various Mesic Sites
			Species Occurrences verified in these Counties: **State Rank Reason:** This moonwort species is documented in Montana primarily fromthe northwest corner of the state. Almost all observations are on federally-managed lands. Most occurrences are small in size and occupy roadsides or other similarly open or disturbed habitats. As such, it is vulnerable to activities such as weed invasion, weed spraying and road maintenance.						
Botrychium campestre Prairie Moonwort		Ophioglossaceae Adder's-Tongue / Moonworts	G3G4	S1S2				4	Various Mesic Sites
			Species Occurrences verified in these Counties: **State Rank Reason:** Reported froma very small number of sites in Montana. All occurrences are small with the largest population count at a single site being approximately 2 dozen plants. All known sites are in northwest Montana.						
Botrychium crenulatum Wavy Moonwort	Botrychium dusenii	Ophioglossaceae Adder's-Tongue / Moonworts	G3	S3		Sensitive - Known on Forests (BD, FLAT, HLC, KOOT, LOLO)		2	Various Mesic Sites
			Species Occurrences verified in these Counties: **State Rank Reason:** This moonwort species is known fromnumerous observations in western Montana. Most populations are located on either National Forest or State lands. Populations are generally small in size and occupy roadsides or other similarly open or disturbed habitats. As such, it is vulnerable to activities such as weed invasion, weed spraying and road maintenance.						
Botrychium gallicomontanum Frenchman's Bluff Moonwort		Ophioglossaceae Adder's-Tongue / Moonworts	G2	S1S2					Grasslands (Fescue)
			Species Occurrences verified in these Counties: **State Rank Reason:** A globally rare species, recently documented in Montana fromGlacier National Park						
Botrychium hesperium Western Moonwort	Botrychium matricariifolium, Botrychium michiganense [in part]	Ophioglossaceae Adder's-Tongue / Moonworts	G4	S3		Sensitive - Known on Forests (BD, FLAT, KOOT)		2	Various Mesic Sites
			Species Occurrences verified in these Counties: **State Rank Reason:** This moonwort species is known from25-30 extant sites in western Montana, mostly in Glacier National Park or on National Forest lands. Many sites are poorly documented in terms of population size or are small in size, though several sites have been observed with >100 plants. Many populations occur on roadsides or other similarly open or disturbed habitats. As such, the species is vulnerable to activities such as weed invasion, weed spraying and road maintenance.						
Botrychium lanceolatum Lanceleaf Moonwort		Ophioglossaceae Adder's-Tongue / Moonworts	G5	S3					
			Species Occurrences verified in these Counties: **State Rank Reason:** Reported fromapproximately two dozen sites. Population levels are poorly documented. As this species was not previously tracked in the state, it may be under-reported.						
Botrychium lineare Linearleaf Moonwort	Slender Moonwort	Ophioglossaceae Adder's-Tongue / Moonworts	G3	S1S2				4	Various Mesic Sites
			Species Occurrences verified in these Counties: **State Rank Reason:** This moonwort species is known to occur in western Montana from6 locations, 5 of which are on federally-managed lands and the remaining site is located in a tribal wilderness area. However, occurrences are generally small in size and occupy roadsides or other similarly open or disturbed habitats. As such, it is vulnerable to activities such as weed invasion, weed spraying and road maintenance.						

Botrychium michiganense Michigan Moonwort	**Botrychium hesperium s.l.**	**Ophioglossaceae** Adder's-Tongue / Moonworts	G3	S2					Various Mesic Sites	**Species Occurrences verified in these Counties:** **State Rank Reason:** This species recently has been split from *B. hesperium*, although it has not yet been formally published (Donald Farrar, Iowa State Univeristy). Some of the sites for *B. hesperium* almost certainly belong here. See *B. hesperium* for additional information on habitat and characteristics which are very similar. This enity would be included within the concept of *B. hesperium* as used by the Forest Service on their Sensitive species list.
Botrychium pallidum Pale Moonwort		**Ophioglossaceae** Adder's-Tongue / Moonworts	G3	S1S2				2	Grasslands (Fescue)	**Species Occurrences verified in these Counties:** **State Rank Reason:** Reported from a very small number of sites in Montana. All occurrences are small with the largest population count at a single site being approximately 30 plants. All known sites are in northwest Montana.
Botrychium paradoxum Peculiar Moonwort		**Ophioglossaceae** Adder's-Tongue / Moonworts	G3G4	S3		Sensitive - Known on Forests (BD, FLAT, HLC, KOOT) Sensitive - Suspected on Forests (LOLO)		2	Meadows (Mesic Montane/Subalpine)	**Species Occurrences verified in these Counties:** **State Rank Reason:** This moonwort species is known to occur in western Montana from over two dozen extant occurrences, almost all of which are on federally-managed lands. Many occurrences are small in size and occupy mesic meadows and bunchgrass communities. Potential impacts to the these sites include livestock grazing, weed invasion and recreational uses. Though some threats exist to individual occurrences, the species as a whole is not highly threatened by any single or combination of potential impacts in the state.
Botrychium pedunculosum Stalked Moonwort		**Ophioglossaceae** Adder's-Tongue / Moonworts	G3G4	S2		Sensitive - Known on Forests (FLAT, KOOT)		3	Forests (Mesic bottmlands)/Open sites	**Species Occurrences verified in these Counties:** **State Rank Reason:** This moonwort species is known to occur in western Montana from approximately a dozen extant occurrences, almost all of which are on National Forest lands. Many occurrences are small in size and occupy western redcedar forests and roadsides or other similarly open or disturbed habitats. Several site records are based upon specimen collections with no available population data; almost all other sites have population counts with <10 plants observed. One site has been observed with >100 plants. Sites could be negatively impacted by timber harvesting or road-related activities.
Botrychium pinnatum Northern Moonwort	**Botrychium boreale ssp. obtusilobum**	**Ophioglossaceae** Adder's-Tongue / Moonworts	G5	S3						**Species Occurrences verified in these Counties:**
Botrychium simplex Least Moonwort		**Ophioglossaceae** Adder's-Tongue / Moonworts	G5	S2						**Species Occurrences verified in these Counties:**
Botrychium sp. (SOC) Moonworts (SOC)		**Ophioglossaceae** Adder's-Tongue / Moonworts	G1G3	S1S3						**Species Occurrences verified in these Counties:** Deer Lodge, Flathead, Glacier, Granite, Jefferson, Lake, Lewis and Clark, Lincoln, Missoula, Park, Pondera, Powell, Ravalli, Sanders, Sweet Grass, Teton **State Rank Reason:** This is a general record for Botrychium species tracked by MTNHP. MTNHP tracks and maintains observation data for all Botrychium species in the state excluding *B. multifidum* and *B. virginianum* which are fairly common and readily identifiable from all other Botrychiums. Global and State Ranks for this record are placeholders only to allow Botrychium SOC to appear in searches using global and state ranks. For information pertinent to specific Botrychium species, please see the individual species' accounts.
Botrychium spathulatum Spoon-leaf Moonwort		**Ophioglossaceae** Adder's-Tongue / Moonworts	G3	S1					Forests (Mesic bottmlands)/Open sites	**Species Occurrences verified in these Counties:** **State Rank Reason:** One of the rarest moonwort species in Montana, currently reported from 2 sites in northwest Montana. Population levels at these sites are undocumented.
Botrychium tunux Moosewort		**Ophioglossaceae** Adder's-Tongue / Moonworts	G3G4	S1						**Species Occurrences verified in these Counties:** **State Rank Reason:** A globally rare species, recently documented in Montana from Glacier National Park.
Botrychium yaaxudakeit Yakutat Moonwort		**Ophioglossaceae** Adder's-Tongue / Moonworts	G3G4	S1					Open sites (mesic)	**Species Occurrences verified in these Counties:** **State Rank Reason:** A globally rare species, recently documented in Montana from Glacier National Park.
Cryptogramma cascadensis Cascade Rockbrake		**Pteridaceae** Maidenhair Fern Family	G5	S3						**Species Occurrences verified in these Counties:** Lincoln, Missoula, Ravalli, Sanders **State Rank Reason:** Cryptogramma cascadensis is known from 11 locations in western Montana, of which 2 locations are poorly defined and considered historical, 5 locations occur in Wilderness areas, and the remaining 4 locations occur on U.S. Forest Service lands. Although the fern is thought to be undercollected and could be more common, current population and location data is needed to remove this plant from the Species of Concern list.

Dryopteris cristata Crested Shieldfern		**Dryopteridaceae** Wood Fern Family	G5	S3		Sensitive - Known on Forests (BRT, FLAT, KOOT, LOLO)		3	Wetland/Riparian
			Species Occurrences verified in these Counties: Flathead, Lake, Lincoln, Missoula, Ravalli **State Rank Reason:** Rare to uncommon in Montana where it is known fromscattered occurrences across the western portion of the state. Most documented occurrences are on National Forest lands, though State Trust Lands and private lands also host significant populations.						
Equisetum palustre Marsh Horsetail		**Equisetaceae** Horsetails	G5	S3					
			Species Occurrences verified in these Counties: Beaverhead, Flathead, Glacier, Lake, Lincoln, Madison, Missoula, Ravalli, Sanders **State Rank Reason:** Equisetumpalustre is known froma small number of sites in seven counties of western Montana.						
Equisetum pratense Meadow Horsetail		**Equisetaceae** Horsetails	G5	S2					
			Species Occurrences verified in these Counties: Cascade, Chouteau, Flathead, Judith Basin, Lincoln, Madison, Meagher, Powell, Ravalli, Teton **State Rank Reason:** Equisetumpratense has accurately been identified to occur in a few places within three counties of Montana. This species can be easily mis-identified. Specimens deposited in herbaria outside of Montana will need to be examined before it can be demonstrated that this plant is more widely distributed.						
Isoetes echinospora Spiny-spore Quillwort	**Isoetes tenella**	**Isoetaceae** Quillworts	G5	S3					feshwater lakes
			Species Occurrences verified in these Counties: Flathead, Lake, Madison, Missoula, Ravalli, Sanders **State Rank Reason:** *Isoetes echinospora* is known from8 occurrences scattered in western Montana. At one occurrence, the species has been observed in 1940, 1967, and 1998 indicating persistence. However, current survey work is needed to document locations, population sizes, and threats.						
Isoetes howellii Howell's Quillwort		**Isoetaceae** Quillworts	G4G5	S3					feshwater lakes
			Species Occurrences verified in these Counties: Flathead, Glacier, Lake, Missoula **State Rank Reason:** *Isoetes howellii* is known fromabout 5 locations in Northwestern Montana. Based on limited information threats appear to be minimal, but survey work to document locations, population sizes, and threats is greatly needed.						
Isoetes occidentalis Western Quillwort	**Isoetes lacustris var. paupercula**	**Isoetaceae** Quillworts	G4G5	S1					feshwater lakes
			Species Occurrences verified in these Counties: Flathead, Missoula **State Rank Reason:** *Isoetes occidentalis* is known fromtwo locations in northwest Montana. Survey work to identify other locations, document population sizes, and determine threats is greatly needed.						
Lycopodium dendroideum Treelike Clubmoss	**Lycopodium obscurum var. dendroideum, Dendrolycopodium dendroideum**	**Lycopodiaceae** Club-moss (Lycopod) Family	G5	S2		Sensitive - Known on Forests (KOOT) Sensitive - Suspected on Forests (FLAT)		3	Forests (Mesic valley and montane)
			Species Occurrences verified in these Counties: Flathead, Glacier, Lewis and Clark, Lincoln **State Rank Reason:** Rare in Montana where the species has been documented fromonly a few sites in the northwest corner of the state. Trend data are unavailable. Known populations do not appear to be immediately threatened by any activities. Populations may be susceptible to negative impacts fromfire.						
Lycopodium inundatum Northern Bog Clubmoss	**Lycopodiella inundata**	**Lycopodiaceae** Club-moss (Lycopod) Family	G5	S2		Sensitive - Known on Forests (FLAT) Sensitive - Suspected on Forests (KOOT)		3	Fens
			Species Occurrences verified in these Counties: Flathead, Missoula **State Rank Reason:** Rare in Montana where it is known fromonly a few occurrences in the western portion of the state. Trend data are unavailable. One population may be negatively impacted or extirpated in the future by proposed activities and all populations are susceptible to changes in hydrology.						
Lycopodium lagopus Running-pine	**Lycopodium clavatum var. lagopus**	**Lycopodiaceae** Club-moss (Lycopod) Family	G5	S2		Sensitive - Known on Forests (KOOT) Sensitive - Suspected on Forests (FLAT)		3	Alpine
			Species Occurrences verified in these Counties: Flathead, Glacier, Lincoln **State Rank Reason:** Rare in Montana. Currently known fromtwo occurrences in the northwest portion of the state. Trend data are unavailable. The known sites do not appear likely to be negatively impacted or threatened fromhuman activity at the current time.						
Marsilea oligospora Pepperwort		**Marsileaceae** Water-Clover Family	G5	S2					
			Species Occurrences verified in these Counties: Lake **State Rank Reason:** Marsilea oligospora has relatively recently been segregated fromMarsilea vestita (FNA 1993). It is quite common around Ninepipes National Wildlife Refuge, but has not been documented elsewhere in Montana. Observation data is greatly needed to further assess its distribution and viability in Montana.						
Ophioglossum pusillum Adder's Tongue	**Ophioglossum vulgatum [misapplied]**	**Ophioglossaceae** Adder's-Tongue / Moonworts	G5	S3		Sensitive - Known on Forests (FLAT, KOOT)		3	Fens, Wet meadows

			Species Occurrences verified in these Counties: Flathead, Lake, Lincoln, Missoula **State Rank Reason:** Rare in Montana, where it is known from a couple dozen fens and wet meadows in the northwest corner of the state. Its viability in the state generally does not appear to be at risk from any human-caused impacts at this time.						
Phegopteris connectilis Northern Beechfern	Thelypteris phegopteris	Thelypteridaceae Beechfern-Marsh Fern Family	G5	S2S3		Sensitive - Known on Forests (KOOT) Sensitive - Suspected on Forests (FLAT)		2	Forests (Mesic valley to subalpine)
			Species Occurrences verified in these Counties: Flathead, Glacier, Lincoln, Sanders **State Rank Reason:** Rare in Montana where it is known from the extreme northwest corner of the state to Glacier National Park. Past timber harvesting likely led to declines in the species' abundance and distribution. Invasive weeds (Orange and Meadow Hawkweeds), proposed mining activity, timber harvesting and fires all have the potential to detrimentally impact the species in the future.						
Polystichum kruckebergii Kruckeberg's Swordfern	Kruckeberg's Hollyfern	Dryopteridaceae Wood Fern Family	G4	S2S3					Alpine
			Species Occurrences verified in these Counties: Deer Lodge, Flathead, Gallatin, Lake **State Rank Reason:** Sparsely distributed across western Montana on alpine and subalpine cliffs and talus slopes. Very little data are available for the locations in Montana, though the habitats occupied by the species are not generally impacted by human activities or disturbance. Additional survey and monitoring data are needed.						
Polystichum scopulinum Mountain Swordfern	Mountain Hollyfern	Dryopteridaceae Wood Fern Family	G4	S1S2					Rock Crevices
			Species Occurrences verified in these Counties: Ravalli, Sanders **State Rank Reason:** Only two known locations from western Montana. Very little data are available for the known occurrences. Additional surveys are needed.						
Selaginella selaginoides Northern Spikemoss		Selaginellaceae Spike-mosses	G5	S2S3				3	Wet, mossy soil (montane/subalpine)
			Species Occurrences verified in these Counties: Beaverhead, Deer Lodge, Granite, Madison **State Rank Reason:** Rare in Montana, where it is known from a few occurrences from the southwest portion of the state. Little survey data are available for known occurrences.						

GYMNOSPERM (CONIFERS) — 1 SPECIES

SCIENTIFIC NAME COMMON NAME TAXA SORT	OTHER NAMES	FAMILY (SCIENTIFIC) FAMILY (COMMON)	GLOBAL RANK	STATE RANK	USFWS	USFS	BLM	MNPS THREAT CATEGORY	HABITAT
Pinus albicaulis Whitebark Pine		Pinaceae Fir / Hemlock / Larch / Pine / Spruce	G3G4	S3	C	Candidate on Forests (BD, BRT, CG, FLAT, HLC, KOOT, LOLO)	SENSITIVE		Subalpine forest, timberline
			Species Occurrences verified in these Counties: Beaverhead, Broadwater, Carbon, Cascade, Deer Lodge, Fergus, Flathead, Gallatin, Glacier, Granite, Jefferson, Judith Basin, Lake, Lewis and Clark, Liberty, Lincoln, Madison, Meagher, Mineral, Missoula, Park, Pondera, Powell, Ravalli, Sanders, Silver Bow, Stillwater, Sweet Grass, Teton, Toole, Wheatland **State Rank Reason:** Whitebark pine is a common component of subalpine forests and a dominant species of treeline and krummholtz habitats. It occurs in almost all major mountain ranges of western and central Montana. Populations of whitebark pine in Montana and across most of western North America have been severely impacted by past mountain pine beetle outbreaks and by the introduced pathogen, white pine blister rust. The results of which have been major declines in whitebark pine populations across large areas of its range. Additionally, negative impacts associated with encroachment and increased competition from other trees, primarily subalpine fir have occurred as a result of fire suppression in subalpine habitats.						

FLOWERING PLANTS - DICOTS (MAGNOLIOPSIDA) — 247 SPECIES

SCIENTIFIC NAME COMMON NAME TAXA SORT	OTHER NAMES	FAMILY (SCIENTIFIC) FAMILY (COMMON)	GLOBAL RANK	STATE RANK	USFWS	USFS	BLM	MNPS THREAT CATEGORY	HABITAT
Adoxa moschatellina Musk-root		Adoxaceae Moschatel Family	G5	S3		Sensitive - Known on Forests (BD, CG, LOLO)			Rock/Talus
			Species Occurrences verified in these Counties: Carbon, Cascade, Granite, Jefferson, Madison, Meagher, Park, Stillwater **State Rank Reason:** Sparsely distributed across southwest Montana. Populations are generally small, though they occur in habitats not generally impacted by human disturbance or invasive weeds. Building of roads and trails may potentially impact populations.						
Agastache cusickii Cusick's Horsemint		Lamiaceae Mints	G3G4	S2S3		Sensitive - Known on Forests (BD)	SENSITIVE		Rock/Talus

			Species Occurrences verified in these Counties: Beaverhead **State Rank Reason:** This species is known in Montana from only a few locations in the Tendoy and Beaverhead Mountains. The steeply sloping habitat and relative remoteness of most populations minimizes its vulnerability to grazing and timber harvest -- the principle current land uses. However, these slopes can be vulnerable to destabilization if impacted by activities such as mining or road maintenance; the largest occurrence is in an area that is quarried for rock/gravel.						
Ageratina occidentalis Western Joepye-weed	**Eupatorium occidentale** Western Boneset	**Asteraceae** Aster/Sunflowers	G4	S2		Sensitive - Known on Forests (BRT) Sensitive - Suspected on Forests (BD, KOOT, LOLO)			Rock/Talus
			Species Occurrences verified in these Counties: Beaverhead, Lewis and Clark, Mineral, Ravalli, Teton **State Rank Reason:** This peripheral species in Montana is known from a handful of small to large populations in the extreme western part of the state. Minor impacts associated with a rock quarry at one location and rock climbing at another site are possible. Otherwise, few threats have been documented for the species in Montana.						
Almutaster pauciflorus Alkali Marsh Aster	**Aster pauciflorus**	**Asteraceae** Aster/Sunflowers	G4	S1					mesic grasslands
			Species Occurrences verified in these Counties: Richland, Sheridan, Valley, Wheatland **State Rank Reason:** Almutaster pauciflorus was first documented in 1988, and is now known from five sites in central and northeastern Montana. It grows in wet meadows or calcareous soil of fens within the plains.						
Alnus rubra Red Alder		**Betulaceae** Birch/Alder	G5	S2S3				3	Forest (Mesic)
			Species Occurrences verified in these Counties: Flathead, Lincoln, Sanders **State Rank Reason:** Rare in Montana, where it occurs only in the extreme western portion of the state. The species is at the eastern end of its range in the state.						
Ammannia robusta Scarlet Ammannia	**Ammannia coccinea ssp. robusta**	**Lythraceae** Loosestrife Family	G5	S2					Wetland/Riparian
			Species Occurrences verified in these Counties: Park, Phillips, Rosebud, Valley, Yellowstone **State Rank Reason:** Known from a few extant populations and a historical collection in northeastern Montana. Likely occurs in additional wetlands in Montana east of the Continental Divide, though many of these would be on private lands and are unlikely to be surveyed for its presence.						
Amorpha canescens Lead Plant		**Fabaceae** Pea Family	G5	SH					Prairie
			Species Occurrences verified in these Counties: Carter, Rosebud **State Rank Reason:** Known from three historical collections from southeast Montana.						
Antennaria densifolia Dense-leaved Pussytoes		**Asteraceae** Aster/Sunflowers	G3G4	S1		Sensitive - Known on Forests (BD)			Alpine
			Species Occurrences verified in these Counties: Deer Lodge, Granite, Ravalli **State Rank Reason:** Known from one high elevation site in the Anaconda-Pintler Wilderness on the border of Deerlodge and Granite counties. The single occurrence is in a designated wilderness, which should protect it from most human-caused disturbance. However, it is susceptible to trail-building and maintenance activities.						
Aquilegia brevistyla Short-styled Columbine		**Ranunculaceae** Buttercup Family	G5	S2S3		Sensitive - Known on Forests (CG, HLC)			Forest (Mesic)
			Species Occurrences verified in these Counties: Judith Basin **State Rank Reason:** See rank details.						
Aquilegia formosa Sitka Columbine		**Ranunculaceae** Buttercup Family	G5	S3					Forest (Mesic)
			Species Occurrences verified in these Counties: Beaverhead, Madison, Park **State Rank Reason:** Known from several areas in southwest Montana. However, only four of these are large, high quality populations. Effects of human disturbance, such as logging, on the species are uncertain.						
Arctostaphylos patula Greenleaf Manzanita	**Arctostaphylos x media**	**Ericaceae** Heath Family	G4	S1				1	Forest (Montane)
			Species Occurrences verified in these Counties: Lake, Ravalli, Sanders **State Rank Reason:** Known from two or three seperate locations in Montana. Population sizes are very small and are susceptible to the negative effects associated with such. Additional negative impacts from timber harvesting, invasive weeds and development are possible. Primarily a species of the Great Basin and California, and disjunct in Montana. Not known from either Idaho or Wyoming.						
Artemisia tilesii Tilesius Wormwood		**Asteraceae** Aster/Sunflowers	G5	S3					grassland, meadows
			Species Occurrences verified in these Counties: Glacier, Lake, Lewis and Clark, Ravalli, Sweet Grass **State Rank Reason:** *Artemisia tilesii* is known from seven locations located at higher elevations in western Montana. This species can be difficult to separate from *Artemisia ludoviciana* and *A. michauxiana*. Survey work to identify occurrences, determine population sizes, and assess threats is greatly needed before re-evaluating its status.						
Asclepias incarnata Swamp Milkweed		**Asclepiadaceae** Milkweeds	G5	S1?					Wetland/Riparian

										Species Occurrences verified in these Counties: Carbon, Wibaux **State Rank Reason:** Known in Montana fromCarbon County. One of the known sites is likely extirpated. Additional information is needed on the species' distribution, abundance, potential trends and threats within Montana.
Asclepias ovalifolia Ovalleaf Milkweed		**Asclepiadaceae** Milkweeds	G5?	S1S2		Sensitive - Known on Forests (CG)			Prairie	**Species Occurrences verified in these Counties:** Carter, Rosebud, Sheridan **State Rank Reason:** Known in the state fromtwo sites in extreme eastern Montana. Additional information on population levels, threats and trends are needed.
Asclepias stenophylla Narrowleaf Milkweed		**Asclepiadaceae** Milkweeds	G4G5	S2					Sandy sites	**Species Occurrences verified in these Counties:** Carter, Rosebud **State Rank Reason:** In Montana, *Asclepias stenophylla* is known fromonly a few occurrences in two southeastern counties. So far, surveys in Montana have documented a total population that numbers only several hundred plants. Trends are unknown.
Astragalus aretioides Sweetwater Milkvetch	**Astragalus sericoleucus var. aretioides, Orophaca aretioides**	**Fabaceae** Pea Family	G4	S2S3				3	Exposed ridges and slopes	**Species Occurrences verified in these Counties:** Big Horn, Carbon **State Rank Reason:** Sweetwater milkvetch is a reginal regional endemic fromMontana south through Wyoming to Colorado and Utah, known in Montana only fromexposed ridges and outcrops in the Pryor Mountains / Bighorn Canyon area. Threats to the species' viability in Montana appear to be minimal. Trend data are unavailable.
Astragalus barrii Barr's Milkvetch		**Fabaceae** Pea Family	G3	S3		Sensitive - Known on Forests (CG)		2	Sparsely vegetated knobs and buttes	**Species Occurrences verified in these Counties:** Big Horn, Carbon, Carter, Powder River, Rosebud **State Rank Reason:** Barr's Milkvetch is endemic to southwestern South Dakota, northeastern Wyoming, Nebraska and southeastern Montana. In Montana, it is known fromnumerous watersheds, several of which contain large, expansive populations. The habitat occupied by this species is not typically suitable for grazing, and the location of its habitat makes it less vulnerable to all but large-scale developments. Proposed resource extraction in southeast Montana may eventually impact the species. Invasive weeds have the potential to be a threat but currently are not posing problems to the species.
Astragalus ceramicus Pottery Milkvetch		**Fabaceae** Pea Family	G4	S3					sandy sites, sand dunes	**Species Occurrences verified in these Counties:** **State Rank Reason:** *Astragalus ceramicus* is found in Beaverhead County and in the eastern-most counties of Montana. Populations represent two varieties which together are known fromabout 25 occurrences observed between 1903 and 2005. Plants grow in sand, very sandy soil of sandhills, or below sandstone outcrops which in Montana represent specialized habitats. Most sites have not been revisited since the 1980s to 1990s; therefore, current data on locations, population sizes, and threats is greatly needed.
Astragalus ceramicus var. apus Painted Milkvetch		**Fabaceae** Pea Family	G4T3	S1S2			SENSITIVE	2	sandy sites, sand dunes	**Species Occurrences verified in these Counties:** Beaverhead **State Rank Reason:** *Astragalus ceramicus* variety *apus* is known only fromthe upper Snake River Plains of southeast Idaho and adjacent Montana, where it is restricted to the Centennial Valley of Beaverhead County. The disruption of natural disturbance regimes, including fire, ungulate grazing and pocket gopher activity, can lead to dune stabilization, reducing the extent of blowout areas with early successional vegetation, upon which this species depends. Portions of its habitat lie on private or public lands without sensitive species management policies in place.
Astragalus ceramicus var. filifolius Pottery Milkvetch		**Fabaceae** Pea Family	G4T4	S3					sandy sites, sand dunes	**Species Occurrences verified in these Counties:** Big Horn, Carter, Dawson, Powder River, Sheridan **State Rank Reason:** *Astragalus ceramicus* variety *filifolius* is associated with sandy soils of the sandhills and sandstone outcrops in eastern Montana. It is known fromabout 20 occurrences observed mostly from1983 to 2000. Some populations occur in State Parks. The Flora of the Great Plains (1986) considered it rare for the region except in the Nebraska sandhill area where it was somewhat common. Based on aging data, limited distribution, and an association to specific habitat types it is considered a Species of Concern. Current data on locations, populations sizes, and threats is greatly needed.
Astragalus convallarius Lesser Rushy Milkvetch	**Astragalus diversifolius [misapplied]**	**Fabaceae** Pea Family	G5	S3				2	Grasslands (Intermountain)	**Species Occurrences verified in these Counties:** Beaverhead, Broadwater, Jefferson, Lewis and Clark **State Rank Reason:** The distribution of *A. convallarius* in Montana is limited to two disjuct localities in the state: the Helena Valley vicinity and an area in extreme southwest Montana in Beaverhead County. The species has been and continues to be negatively impacted by development in the Helena area. Past development in the Helena Valley likely eliminated extensive areas of previously occupied habitat resulting in the more fragmented distribution seen today. The grassland habitats this species occupies are also being invaded by several noxious weeds, partcularly in the Helena vicinity. However, the species appears to tolerate some levels of disturbance and degradation of habitat quality. Several large occurrences are presently known and some areas of potentially suitable habitat remain unsurveyed.
Astragalus geyeri Geyer's Milkvetch		**Fabaceae** Pea Family	G4	S2				3	Sandy sites	**Species Occurrences verified in these Counties:** Carbon, Garfield **State Rank Reason:** Geyer's milkvetch has a very limited distribution in Montana, primarily limited to Carbon County. Size of the population in Montana is estimated to be in the thousands, but population levels likely fluctuate significantly fromyear to year. Approximately half the populations occur entirely or partially on federally managed lands.
Astragalus grayi Gray's Milkvetch		**Fabaceae** Pea Family	G4?	S2S3			SENSITIVE		Sagebrush-Grassland	**Species Occurrences verified in these Counties:** Carbon, Fergus **State Rank Reason:** Rare in the state. Locally restricted to Carbon and Big Horn counties. Population levels, trends and threats to the species are poorly documented. Additional information is needed for the species within Montana.

Astragalus lackschewitzii Lackschewitz Milkvetch		**Fabaceae** Pea Family	G2G3	S2S3		Sensitive - Known on Forests (HLC) Sensitive - Suspected on Forests (FLAT)		3	Alpine
			Species Occurrences verified in these Counties: Pondera, Teton **State Rank Reason:** Montana endemic restricted to high elevation, gravelly and rocky slopes and ridges. Several of the known occurrences are in designated wilderness and the habitats occupied by the species are not generally subject to human disturbance.						
Astragalus oreganus Wind River Milkvetch		**Fabaceae** Pea Family	G4?	S2				1	Sandy sites/Sagebrush-Grassland
			Species Occurrences verified in these Counties: Carbon **State Rank Reason:** Wind River milkvetch is a regional endemic known in Montana only from southern Carbon County. Although populations are relatively large, there are few known occurrences in the state and negative impacts or potential impacts to the species from livestock grazing, ORV use and extractive industries have been noted.						
Astragalus racemosus Raceme Milkvetch		**Fabaceae** Pea Family	G5	S2S3				3	Grasslands (Clay soils)
			Species Occurrences verified in these Counties: Carter, Fallon, Missoula **State Rank Reason:** Raceme milkvetch occurs near the margin of its range in Montana, where several, mostly small populations have been found in Carter and Fallon counties. Its response to grazing is unknown, however it accumulates selenium and may be toxic to livestock. Accurate population and trend data are lacking.						
Astragalus scaphoides Bitterroot Milkvetch		**Fabaceae** Pea Family	G3	S3		Sensitive - Known on Forests (BD)	SENSITIVE	3	Sagebrush-grassland
			Species Occurrences verified in these Counties: Beaverhead, Granite **State Rank Reason:** Bitterroot milkvetch occurs only in Lemhi County, Idaho and Beaverhead County, Montana. In Montana, the documented occurrences are confined to an area from the Grasshopper Creek drainage south to the Tendoy Mountains. The total number of individual plants has been estimated in the tens of thousands, but occupied habitat is likely less than 700 acres.						
Astragalus terminalis Railhead Milkvetch		**Fabaceae** Pea Family	G3	S2S3			SENSITIVE	3	Sagebrush steppe
			Species Occurrences verified in these Counties: Beaverhead, Gallatin, Madison **State Rank Reason:** *Astragalus terminalus* is a regional endemic known from southwest Montana, east-central Idaho and northwest Wyoming. In Montana it is documented from Beaverhead County and the Upper Madison River Valley. The species appears to be vulnerable to intensive grazing and competition from noxious weeds, at least in low-elevation areas.						
Athysanus pusillus Sandweed		**Brassicaceae** Mustards	G4	S1S2		Sensitive - Known on Forests (BRT) Sensitive - Suspected on Forests (LOLO)		1	Rock/talus-Mesic
			Species Occurrences verified in these Counties: Ravalli, Sanders **State Rank Reason:** Known in Montana from a limited area of the Bitterroot Mountains. Only three occurrences have a large number of indivuals and several occurrences have populations of spotted knapweed and/or cheatgrass established. Invasive weeds may threaten the long-term viability of the species in Montana.						
Atriplex truncata Wedge-leaf Saltbush		**Amaranthaceae** Amaranth (Pigweed) Family	G5	S3				3	Wetland/Riparian
			Species Occurrences verified in these Counties: Beaverhead, Deer Lodge, Jefferson, Lake, Lewis and Clark, Madison, Park, Powell **State Rank Reason:** Known from two extent occurrences; one in the Centennial Valley and the other near Warm Springs. Also, known historically from four collections in the western half of the state. Additional population and trend data are needed to better evaluate the species' vulnerability.						
Bacopa rotundifolia Roundleaf Water-hyssop		**Plantaginaceae** Plantain Family	G5	S3?				3	Wetland/Riparian
			Species Occurrences verified in these Counties: Cascade, Fergus, Garfield, Phillips, Powder River, Yellowstone **State Rank Reason:** A rare species known in Montana from only a few observations in the central and eastern portions of the state. However, the species is widely distributed and appears tolerant of brackish waters as well as some degree of nutrient enrichment. As such, it is unclear to what extent the species' viability is at risk in the state and whether it responds negatively to human-induced impacts to water quality. Additional populations of the species are likely to occur in Montana.						
Balsamorhiza hookeri Hooker's Balsamroot	**Balsamorhiza hispidula**	**Asteraceae** Aster/Sunflowers	G5	S3				3	Sagebrush-grassland
			Species Occurrences verified in these Counties: Beaverhead, Deer Lodge **State Rank Reason:** Known in Montana only from the vicinity of Monida and within the Mount Haggin WMA.						
Berberis nervosa Longleaf Oregon-grape	**Mahonia nervosa**	**Berberidaceae** Barberries	G5	S1					
			Species Occurrences verified in these Counties: Sanders **State Rank Reason:** Berberis nervosa is disjunct in northern Idaho. In Montana it is known from 2-3 locations in Sanders County, of which one population in 2001 is reported to have over 1,000 plants. Additional data on locations and population sizes are greatly needed.						
Bidens beckii Beck Water-marigold	**Megalodonta beckii**	**Asteraceae** Aster/Sunflowers	G5	S2		Sensitive - Known on Forests (FLAT, KOOT, LOLO)		3	Aquatic

			Species Occurrences verified in these Counties: Broadwater, Flathead, Lake, Lincoln, Missoula **State Rank Reason:** Known from ten occurrences in the western valleys of the state, including 6 moderate to large populations and one historical occurrence from Salmon Lake dating to 1937. However, the species may be more abundant in the state than what current data suggests. Threats and impacts to populations in Montana include boating activity, lake shore development, aquatic weeds and use of aquatic herbicides.						
Boechera demissa Daggett Rockcress	**Arabis demissa**	**Brassicaceae** Mustards	G5	S1S3				3	Open woodland and sagebrush steppe
			Species Occurrences verified in these Counties: Carbon **State Rank Reason:** Daggett rockcress is at the northern edge of its range in Montana, where it is known only from the vicinity of the Pryor Mountains and adjacent Bighorn Canyon. Detailed survey information for most occurrences is lacking.						
Boechera fecunda Sapphire Rockcress	**Arabis fecunda**	**Brassicaceae** Mustards	G2	S2		Sensitive - Known on Forests (BD) Sensitive - Suspected on Forests (BRT, LOLO)	SENSITIVE	1	Rocky, calcareous, montane slopes
			Species Occurrences verified in these Counties: Beaverhead, Ravalli, Silver Bow **State Rank Reason:** Sapphire rockcress is a state endemic known from several locations in southwest Montana where it is restricted to specific and localized habitats. Encroachment of spotted knapweed threatens several populations, particularly in Ravalli County. It is unclear whether grazing has significant negative impacts						
Brasenia schreberi Watershield		**Cabombaceae** Watershields	G5	S1S2		Sensitive - Known on Forests (KOOT, LOLO) Sensitive - Suspected on Forests (FLAT)		4	Aquatic
			Species Occurrences verified in these Counties: Flathead, Lake, Lincoln, Missoula, Powell **State Rank Reason:** Restricted in Montana to shallow waters in the valleys of the northwest corner of the state where it is known from eight occurrences, including six relatively high quality populations. Potential threats to the species include boating activity, aquatic weeds, and several populations are subject to runoff from adjacent agricultural fields, though it is uncertain if this has negatively impacted any populations.						
Braya humilis Low Braya	**Neotorularia humilis**	**Brassicaceae** Mustards	G5	S2				2	Alpine
			Species Occurrences verified in these Counties: Beaverhead, Fergus, Teton **State Rank Reason:** Known from four locations in the state, including one site in which only one plant was observed. One population occurs in an area with historical mining activity and may have been detrimentally impacted. Another populations occurs along the Rocky Mtn Front and is actively monitored; population levels may be declining at this site based upon preliminary data.						
Brickellia oblongifolia Mojave Brickellbush		**Asteraceae** Aster/Sunflowers	G5	S1S2				1	Rock/Talus
			Species Occurrences verified in these Counties: Park, Silver Bow **State Rank Reason:** Few collections known for Montana. Only known extant occurrences are all near Melrose. The current status of one historical occurrence near Wilsall is unknown. Invasive weeds do not apear to be a threat at this time and the rocky, sparsely-vegetated slopes that the species occupies are not generally subject to human impacts. Livestock grazing may be negatively impacting the species at one site. Updated population and site data are needed for the known occurrences. Other occurrences of the species are likely to be found in Montana.						
Camissonia andina Obscure Evening-primrose	**Oenothera andina, Holmgrenia andina**	**Onagraceae** Evening-primrose Family	G4	S2				3	Sandy sites
			Species Occurrences verified in these Counties: Carbon, Missoula **State Rank Reason:** This species is at the edge of its range in Montana, where it has been documented from just a few locations. All known extant locations are from Carbon County. These populations collectively cover less than 20 acres, but they can vary greatly in size from year to year. It tolerates grazing well, and moderate grazing may be important in maintaining a suitable seedbed of exposed soil. Invasive weeds may pose the greatest risk.						
Camissonia parvula Small Camissonia	**Oenothera parvula**	**Onagraceae** Evening-primrose Family	G5	S1S2				3	Sandy sites
			Species Occurrences verified in these Counties: Carbon **State Rank Reason:** *Camissonia parvula* is currently known from one extant location in Montana on the southern edge of the Pryor Mountains in Carbon County. Populations are thought to be small, but may vary widely from year to year. As an annual plant, it may tolerate - or even respond positively to - moderate levels of disturbance. Additional population and site data are needed for this species in Montana.						
Cardamine oligosperma var. kamtschatica Few-seeded Bittercress	**Cardamine umbellata**	**Brassicaceae** Mustards	G5T4T5	S2?				3	Alpine
			Species Occurrences verified in these Counties: Flathead **State Rank Reason:** Only known from 1 collection in Montana. Additional data are needed to reliably determine the species' conservation status and needs in Montana.						
Cardamine rupicola Cliff Toothwort		**Brassicaceae** Mustards	G3	S3				3	Alpine
			Species Occurrences verified in these Counties: Flathead, Lake, Lewis and Clark, Missoula, Powell **State Rank Reason:** State endemic known from 3 population clusters. These are in the Mission Mtns, Swan Range and the Rocky Mtn Front Range. Many occurrences have not been surveyed for 30 or more years and many are based on a single herbarium specimen. However, the species grows at high elevations in rock and scree fields that generally are not subject to disturbance or other threats. Many populations also occur in designated wilderness areas which offer further protection. Additional occurrences likely exist across the known range of the species.						

Castilleja cervina Deer Indian Paintbrush		**Orobanchaceae** Broomrape Family	G4	SH					Wetland/Riparian	**Species Occurrences verified in these Counties:** Flathead, Madison, Missoula, Powell **State Rank Reason:** Known from 3 widely separated collections in western Montana, including a 1901 collection in Missoula County near "Sunset Hill", a 1960 collection near Deer Lodge and an 1894 collection near Columbia Falls.
Castilleja covilleana Coville Indian Paintbrush		**Orobanchaceae** Broomrape Family	G3G4	S3		Sensitive - Known on Forests (BRT) Sensitive - Suspected on Forests (BD)		2	Subalpine slopes	**Species Occurrences verified in these Counties:** Flathead, Lake, Missoula, Ravalli **State Rank Reason:** This species is known in Montana, primarily from the West Fork of the Bitterroot River on the Bitterroot National Forest. 5 occurrences are known from historical collections or have unknown status. A few occurrences contain minor amounts of spotted knapweed and others occur in habitats that are susceptible to invasion by knapweed and other invasive species. Timber harvest activities may also pose a threat to some populations.
Castilleja exilis Annual Indian Paintbrush	**Castilleja minor ssp. minor**	**Orobanchaceae** Broomrape Family	G5T5	S2				2	Wetland/Riparian	**Species Occurrences verified in these Counties:** Broadwater, Deer Lodge, Fergus, Gallatin, Jefferson, Madison, Park **State Rank Reason:** Annual Indian Paintbrush is known from a half dozen counties in southwest Montana with the majority of documented locations on private lands. Many areas of suitable habitat have been converted to agricultural uses and/or are used for livestock grazing. Additionally, populations are susceptible to hydrologic changes and may negatively impacted by invasive weeds.
Castilleja gracillima Slender Indian Paintbrush	**Castilleja miniata ssp. miniata**	**Orobanchaceae** Broomrape Family	G3G4	S2					Wetland/Riparian	**Species Occurrences verified in these Counties:** Beaverhead, Cascade, Fergus, Gallatin, Madison, Meagher, Park **State Rank Reason:** This plant is a regional endemic, known in Montana from a limited number of populations, with most being relatively small. No threats have been observed, though it could be vulnerable to hydrologic alterations or noxious weeds.
Castilleja kerryana Kerry's Paintbrush		**Orobanchaceae** Broomrape Family	G3	S3						**Species Occurrences verified in these Counties:** Lewis and Clark **State Rank Reason:** Castilleja kerryana is a recently recognized species that grows in alpine habitat in a portion of the Scapegoat Wilderness in Montana. Populations tend to be small and scattered on slopes and ridges, and apparently absent on broad, fairly flat alpine terrain. Although Castilleja species in general have brittle stems that are easily damaged by livestock, grazing is not known to occur where Kerry's Paintbrush grows. The plant appears to be limited geographically in Montana, and additional surveys are needed to accurately determine its range.
Castilleja nivea Snow Indian Paintbrush		**Orobanchaceae** Broomrape Family	G3	S3					Alpine	**Species Occurrences verified in these Counties:** Carbon, Fergus, Golden Valley, Madison, Park, Sweet Grass **State Rank Reason:** Currently known from a few collections from the Beartooths, Crazy Mtns, Tobacco Root Mtns and the Centennial Range. It is very likely that additional occurrences exist in the known mountain ranges as well as additional mountain ranges. Additionally, the high elevation habitat generally limits the potential for impacts to the species.
Celastrus scandens Bittersweet		**Celastraceae** Bittersweet Family	G5	S1					Wetland/Riparian	**Species Occurrences verified in these Counties:** Dawson, Richland **State Rank Reason:** *Celastrus scandens* occurs frequently in woodlands, rocky hillsides, thickets, fence rows, and roadsides in the Great Plains (McGregor et al. 1986). The previous Montana rank of SH was based on a vague location provided on a 1975 herbarium specimen. In recent years it has been collected at four locations in woody draws. It appears that the Montana sites represent the western edge of its range, and currently it ranks as an S1. Additional surveys of woody draws are needed to accurately document its distribution and population size in Montana.
Centunculus minimus Chaffweed	**Anagallis minima**	**Myrsinaceae** Myrsine Family	G5	S2					Wetland/Riparian	**Species Occurrences verified in these Counties:** Cascade, Lake, Missoula, Phillips, Powell, Ravalli, Sheridan, Valley **State Rank Reason:** Known from scattered locations across the state, though it is rare to uncommon in Montana. May be susceptible to some adverse impacts from human-caused disturbance due to its preference for vernally moist habitats in valley loctions.
Cercocarpus montanus Alderleaf mountain-mahogany		**Rosaceae** Rose Family	G5	S2S3				3	Open, stony slopes	**Species Occurrences verified in these Counties:** Beaverhead, Treasure **State Rank Reason:** This widespread western species is only known in the state from one area of Treasure County where it is reported to be fairly extensive. Additional data on population size and extent are needed to more precisely rank the species.
Chenopodium subglabrum Smooth Goosefoot	**Chenopodium leptophyllum var. subglabrum**	**Amaranthaceae** Amaranth (Pigweed) Family	G3G4	S2				4	Sandy sites	**Species Occurrences verified in these Counties:** Carter, Cascade, Custer, Fergus, Garfield, Mccone, Phillips, Powder River, Sheridan **State Rank Reason:** Smooth goosefoot is known from just a few locations in Montana, one of which may be extirpated. It occupies an early-succession habitat that is vulnerable to loss of natural disturbance regimes such as fire and flooding. Invasion of exotic plants may also pose a threat. Population data and trend monitoring data are lacking though the populations likely flucuate widely from year to year.

Cirsium longistylum Long-styled Thistle		**Asteraceae** Aster/Sunflowers	G2G3	S2S3				1	Meadows (Montane-subalpine)
			Species Occurrences verified in these Counties: Broadwater, Cascade, Fergus, Jefferson, Judith Basin, Lewis and Clark, Meagher, Wheatland **State Rank Reason:** Population estimates of approximately 30,000 plants, including seven high quality populations, scattered over four mountain ranges are promising for the long-term viability of the species. Habitat in the largest populations is generally of high quality with few if any problem weeds posing significant and immediate threats. In the near future, little change in habitat quality is expected in these populations. Sites are mostly on National Forest lands that provide a degree of protection and two large populations on private lands that have a history of light to moderate grazing appear stable. Also of benefit at this time is the active weed control program employed by the private landowners on their lands. Long- and short-term population trends are difficult to gauge due to the lack of good survey data over many years. However, available data and observations provide some evidence that population levels have at least remained fairly stable over the past decade, with significant yearly fluctuations possible. Threats posed by invasive weeds and the introduced bio-control agent do provide reason for concern.						
Cirsium pulcherrimum Wyoming Thistle		**Asteraceae** Aster/Sunflowers	G5	S3					Sparsely-vegetated soils
			Species Occurrences verified in these Counties: Big Horn, Carbon, Powder River, Prairie **State Rank Reason:** Known in Montana from one badlands area of Powder River County with a small number of scattered individuals observed in 2006. Also, reported for Dawson and Garfield Counties by Flora of the Great Plains and 1 collection from each of Carbon and Custer Counties.						
Clarkia rhomboidea Diamond Clarkia		**Onagraceae** Evening-primrose Family	G5	S3		Sensitive - Known on Forests (BRT, KOOT, LOLO)		2	Forests (Open, montane)
			Species Occurrences verified in these Counties: Lake, Lincoln, Ravalli, Sanders **State Rank Reason:** Rare in Montana, where it is known from only a small portion of the northwest corner of the state, primarily along the lower Clark Fork River drainage. Some detrimental impacts from invasive weeds and subsequent herbicide treatments are possible as are loss of habitat due to fire suppression.						
Claytonia arenicola Sand Springbeauty	**Montia arenicola**	**Portulacaceae** Purslane Family	G4	S2S3		Sensitive - Known on Forests (LOLO)		3	Mesic, rocky slopes
			Species Occurrences verified in these Counties: Sanders **State Rank Reason:** Rare in Montana, where it is currently known from only one localized area in the western portion of the state. As an annual, populations likely fluctuate widely from year to year. No specific threats have been identified.						
Cleome lutea Yellow Beeplant	**Peritoma lutea**	**Cleomaceae** Cleome Family	G5	S1S2				3	Sagebrush-grassland (Low-elevation)
			Species Occurrences verified in these Counties: Big Horn, Carbon, Deer Lodge **State Rank Reason:** Rare in Montana, where it is currently known from only a small area in the south-central portion of the state. Current population levels and trends are undocumented, though populations likely fluctuate widely from year to year. Additional monitoring is needed.						
Collomia debilis var. camporum Alpine Collomia		**Polemoniaceae** Phlox Family	G5T2	S1S2					Rock/Talus (Valleys to Montane)
			Species Occurrences verified in these Counties: Granite, Missoula, Ravalli **State Rank Reason:** Only known from a few sites in western Montana and Lemhi County, Idaho, from low elevation scree, talus or rocky slopes. Negative impacts from human disturbance and weed invasion are possible. Current status of most of the documented locations is not known. Survey and monitoring data are needed.						
Corydalis sempervirens Pale Corydalis		**Fumariaceae** Fumary family	G5	S2		Sensitive - Known on Forests (FLAT, KOOT)		4	Forests/Meadows (Recently-burned)
			Species Occurrences verified in these Counties: Flathead, Glacier, Lincoln, Powell **State Rank Reason:** Known to occur in northwest Montana from approximately a dozen recently documented (past 25 years) occurrences. Another five historical occurrences are also known. This species occurs in disturbed habitats, predominantly burned forests and it depends heavily on historical fire regimes to maintain populations. Thus, the main threat to this species' viability appears to be from fire suppression activities. Invasive weeds also threaten habitat occupied by the species.						
Cryptantha fendleri Fendler Cat's-eye		**Boraginaceae** Borage Family	G5	S2			SENSITIVE	2	Sandy sites
			Species Occurrences verified in these Counties: Beaverhead, Gallatin, Sheridan **State Rank Reason:** Fendler cat's-eye is restricted to very localized sandhills habitat in the far southwestern and northeastern corners of Montana where it is known from a total of three moderate to large-sized populations. It responds positively to disturbance that maintains its sparsely vegetated habitat. Fire suppression and dune stabilization efforts have likely had an adverse effect on populations of this species.						
Cryptantha humilis Round-headed Cryptantha		**Boraginaceae** Borage Family	G4?	SH					Sagebrush Steppe (low-elevation)
			Species Occurrences verified in these Counties: Beaverhead, Jefferson **State Rank Reason:** Known from 3 historical collections in the state, including a 1955 collection west of Dillon in the Grasshopper Valley, a 1952 collection 3 miles south of Lima and an undated collection from the Yellowstone Valley in Park County.						
Cryptantha scoparia Miner's Candle		**Boraginaceae** Borage Family	G4?	S2				3	Sagebrush Steppe (low-elevation)

			Species Occurrences verified in these Counties: Carbon **State Rank Reason:** This species is documented from a single area in Carbon County, where it is widely disjunct from the nearest known occurrences in southwest Wyoming and central Idaho. In 1991 about 1,000 plants were reported occupying less than one acre. The habitat is subject to grazing, and may be affected by exotic weed encroachment. Additional surveys and monitoring data are needed.						
Dalea enneandra Nine-anther prairie clover		**Fabaceae** Pea Family	G5	S2S3				3	Grasslands (Plains)
			Species Occurrences verified in these Counties: Big Horn, Custer, Fallon, Richland **State Rank Reason:** In Montana, known from a few poorly documented occurrences in the eastern half of the state. Additional surveys and updated population data are needed.						
Dalea villosa Silky prairie clover	**Petalostemon villosus**	**Fabaceae** Pea Family	G5	S2					Sandy sites
			Species Occurrences verified in these Counties: Carter, Fallon, Richland, Sheridan **State Rank Reason:** In Montana, known from a few, small occurrences in the extreme eastern portion of the state. Current population levels and trends are unknown.						
Delphinium burkei Meadow Larkspur	**[including] Delphinium distichum**	**Ranunculaceae** Buttercup Family	G4	S1S2					Meadows (Moist, low-elevation)
			Species Occurrences verified in these Counties: Beaverhead, Flathead, Silver Bow **State Rank Reason:** Only known from a few collections from the western half of the state.						
Delphinium depauperatum Slim Larkspur		**Ranunculaceae** Buttercup Family	G5	S2					
			Species Occurrences verified in these Counties: Beaverhead, Flathead, Pondera **State Rank Reason:** Delphinium depauperatum has been identified in Beaverhead, Flathead, and possibly Jefferson Counties in western Montana. It is found in common habitats, yet relatively few occurrences have been documented.						
Delphinium glaucum Pale Larkspur		**Ranunculaceae** Buttercup Family	G5	S1?					
			Species Occurrences verified in these Counties: Mineral **State Rank Reason:** Based on the discrepancy in the number of herbarium specimens identified as Delphinium glaucum (CPNWH 2015) and in its Montana County distribution (Lesica 2012), there seems to be an issue in how to accurately identify this species. Specimens deposited in herbaria outside of Montana will need to be examined before it can be demonstrated that this plant is more widely distributed.						
Descurainia torulosa Wyoming Tansymustard		**Brassicaceae** Mustards	G2	S1					
			Species Occurrences verified in these Counties: Park **State Rank Reason:** One collection from Park County, MT.						
Douglasia conservatorum Bloom Peak Douglasia		**Primulaceae** Primrose Family	G1G2	S1					Ridges (Open, subalpine)
			Species Occurrences verified in these Counties: Sanders **State Rank Reason:** Described as a new species in 2010 from a single location along the Idaho/Montana border. The population of this newly described species is apparently closely allied to *Douglasia idahoensis*, *D. laevigata* and *D. nivalis* (Bjork 2010). Additional research may be needed to determine if this population warrants recognition at the specific level or if it should be treated as conspecific with *D. idahoensis* or *D. nivalis*. However, the discovery of this population is significant in that it is a new addition to the state flora no matter if it is treated as a distinct species or as a population of one of the previously mentioned species.						
Downingia laeta Great Basin Downingia		**Campanulaceae** Bellflower Family	G5	S2S3				3	Wetland/Riparian (Shallow water ponds, lakes)
			Species Occurrences verified in these Counties: Beaverhead, Lewis and Clark, Madison, Meagher, Teton, Wheatland **State Rank Reason:** Rare in Montana, where it is currently known from a few scattered sites in the western half of the state, most of these sites were documented several decades ago and are in need of follow-up surveys. Current population levels and trends are unknown.						
Draba crassa Thick-leaf Whitlow-grass		**Brassicaceae** Mustards	G3G4	S3				3	Alpine
			Species Occurrences verified in these Counties: Beaverhead, Carbon, Deer Lodge, Granite, Madison, Park, Stillwater **State Rank Reason:** Scattered across southwest Montana where it is known from alpine slopes in several mountain ranges. Overall abundance and distribution is still poorly known, though it is likely to be more common than collections indicate.						
Draba daviesiae Bitterroot Draba	**Draba apiculata var. daviesiae**	**Brassicaceae** Mustards	G3	S3				3	Alpine
			Species Occurrences verified in these Counties: Beaverhead, Granite, Ravalli **State Rank Reason:** A Montana endemic, known from several occurrences in alpine areas of the Bitterroot Mountains. Overall abundance and distribution are still poorly known though the high elevation habitat would likely limit most potential impacts.						
Draba densifolia Dense-leaf Draba		**Brassicaceae** Mustards	G5	S2				2	Alpine
			Species Occurrences verified in these Counties: Beaverhead, Flathead, Gallatin, Glacier, Granite, Jefferson, Lewis and Clark, Park, Pondera, Powell, Ravalli, Silver Bow, Sweet Grass **State Rank Reason:** *Draba densifolia* is distributed in the western half of the state in four moderate to large populations, six small occurrences and nine historical or poorly documented occurrences. Occupied habitats are at moderate to high elevation which help to minimize disturbance to some of the populations. However, livestock grazing, invasive weeds and off-road ATV use impact some populations.						
Draba fladnizensis White Arctic Draba		**Brassicaceae** Mustards	G4G5	S2?					Alpine
			Species Occurrences verified in these Counties: Deer Lodge, Madison, Stillwater **State Rank Reason:** Rare in Montana, where it is currently known from a few scattered alpine locations in the southern half of the state. Additional sites are likely to be documented in the future and the species does not appear to be at significant risk due to the remoteness of its habitat.						

Draba globosa Round-fruited Draba	Draba apiculata	Brassicaceae Mustards	G3	S2S3					Alpine
			Species Occurrences verified in these Counties: Beaverhead, Madison **State Rank Reason:** Round-fruited draba is a regional endemic, known from widely separated sites in Colorado, northeastern Utah, northwest Wyoming and adjacent Montana. It has been found in three southwest Montana mountain ranges. Current population levels and trends are unknown. However, its high-elevation habitat is relatively inaccessible, and there are no obvious threats. Additional sites are likely to be documented.						
Draba macounii Macoun's Draba		Brassicaceae Mustards	G5?	S2S3				3	Alpine
			Species Occurrences verified in these Counties: Flathead, Glacier **State Rank Reason:** Known in Montana from only a few occurrences in Glacier National Park. Current population levels and trends are unknown. However, its high-elevation habitat is relatively inaccessible, and there are no obvious threats. Additional sites are likely to be documented.						
Draba porsildii Porsild's Draba		Brassicaceae Mustards	G3G4	S2S3				3	Alpine
			Species Occurrences verified in these Counties: Carbon, Madison **State Rank Reason:** Only known in Montana from a few collections on the Beartooth Plateau and the Madison Range. Current population levels and trends are unknown. However, its high-elevation habitat is relatively inaccessible, and there are no obvious threats. Additional sites are likely to be documented.						
Draba ventosa Wind River Draba		Brassicaceae Mustards	G3	S2S3				3	Alpine
			Species Occurrences verified in these Counties: Madison **State Rank Reason:** *Draba ventosa* is known from one site in the Madison Range and has been reported from a second site in the Snowcrest Range. Current population levels and trends are unknown. However, its high-elevation habitat is relatively inaccessible, and there are no obvious threats. Additional sites are likely to be documented.						
Drosera anglica English Sundew		Droseraceae Sundew Family	G5	S3		Sensitive - Known on Forests (BD, BRT, CG, FLAT, HLC, KOOT, LOLO)		2	Fens
			Species Occurrences verified in these Counties: Beaverhead, Flathead, Granite, Lake, Lewis and Clark, Lincoln, Madison, Missoula, Park, Powell, Ravalli, Sanders **State Rank Reason:** Known from over two dozen populations in the state, most of these are moderate to large-sized, healthy populations. Most occurrences are on federally managed lands with several of these in designated wilderness areas, research natural areas or Glacier National Park which help to protect the occurrences from many potential threats. However, one population is vulnerable to ski area expansion and activity, and the species may be negatively impacted by fire as observations at one location appear to indicate. Plants are also sensitive to and negatively impacted by trampling of peat mats on which the species grow.						
Drosera linearis Slenderleaf Sundew		Droseraceae Sundew Family	G4G5	S2		Sensitive - Known on Forests (FLAT, HLC) Sensitive - Suspected on Forests (KOOT)		3	Fens
			Species Occurrences verified in these Counties: Flathead, Lake, Lewis and Clark, Powell **State Rank Reason:** Only known from four populations in Montana though all are moderate to large-sized occurrences that are located in either the Bob Marshall Wilderness or Indian Meadows Research Natural Area which afford all known populations some protection from disturbance.						
Dryas integrifolia Entire-leaved Avens		Rosaceae Rose Family	G5	S2S3				4	Alpine
			Species Occurrences verified in these Counties: Fergus, Golden Valley **State Rank Reason:** Known in Montana from the Big Snowy Mountains and possibly from the Tobacco Root Mountains, though location of this latter specimen collection is unknown and cannot be confirmed. Current population levels and trends are unknown. However, its high-elevation habitat is relatively inaccessible, and there does not appear to be any significant threats.						
Ericameria discoidea var. discoidea Whitestem Goldenbush	Haplopappus macronema var. macronema	Asteraceae Aster/Sunflowers	G4G5T4	S2		Sensitive - Known on Forests (BD, CG) Sensitive - Suspected on Forests (BRT)		3	Rock/Talus
			Species Occurrences verified in these Counties: Beaverhead, Gallatin **State Rank Reason:** Rare in Montana where it is only known from a couple of sites in the southwest corner of the state. Population levels are poorly documented. One site is relatively inaccessible and not likely to be threatened by human impacts.						
Ericameria parryi var. montana Parry's Mountain Rabbitbrush	Chrysothamnus parryi ssp. montanus	Asteraceae Aster/Sunflowers	G5T2	S2				3	Grasslands (subalpine)
			Species Occurrences verified in these Counties: Beaverhead **State Rank Reason:** A globally rare endemic, restricted to a small area of southwest Montana and adjacent Idaho. Though only known from one population in Montana with an estimated couple hundred plants, its habitat is remote and there are no apparent threats to its viability in the near future. Additional data on population levels and trend should be collected.						
Erigeron allocotus Big Horn Fleabane		Asteraceae Aster/Sunflowers	G3	S3				3	Rock outcrops/Ridges (low-elevation)

			Species Occurrences verified in these Counties: Big Horn, Carbon **State Rank Reason:** A regional endemic of Montana and Wyoming. In Montana, it is known only from the Pryor Mountain Desert - Bighorn Basin area of Carbon and Big Horn Counties. The species can be common in areas where it is found.						
Erigeron asperugineus Idaho Fleabane		**Asteraceae** Aster/Sunflowers	G4	S2		Sensitive - Known on Forests (BD, BRT)		3	Alpine
			Species Occurrences verified in these Counties: Beaverhead, Carbon, Madison, Ravalli **State Rank Reason:** Idaho fleabane is a regional endemic that has been documented from a few locations in Montana. It grows in alpine habitats, which tend to be relatively isolated from anthropogenic disturbance. Updated population data are needed for most occurrences and it is likely that a few additional occurrences will be documented.						
Erigeron evermannii Evermann Fleabane		**Asteraceae** Aster/Sunflowers	G4	S2?		Sensitive - Known on Forests (BRT)			Alpine
			Species Occurrences verified in these Counties: Ravalli **State Rank Reason:** Rare in Montana, where it is currently known from two alpine peaks in the Bitterroot Mountains. Available data are based on specimen collections from the 1960's and 1970's, though there is no reason to believe that these populations no longer exist or that they have been negatively impacted. More current data are needed.						
Erigeron flabellifolius Fan-leaved Fleabane		**Asteraceae** Aster/Sunflowers	G3	S3				3	Alpine
			Species Occurrences verified in these Counties: Carbon, Lincoln, Meagher, Park, Sanders, Sweet Grass **State Rank Reason:** Restricted to rocky, alpine habitats in the mountains of south-central Montana. Though uncommon and restricted in distribution, the high elevation habitat tends to reduce the potential for any impacts to the species.						
Erigeron formosissimus Beautiful Fleabane		**Asteraceae** Aster/Sunflowers	G5	S1S3					Meadows (Montane/subalpine)
			Species Occurrences verified in these Counties: Beaverhead, Carbon, Gallatin, Madison, Park **State Rank Reason:** Species has been documented for southern Montana from a few collections. Additional data are needed for this species to more precisely determine its conservation status and need.						
Erigeron grandiflorus Large-flower Fleabane		**Asteraceae** Aster/Sunflowers	G5	S1S3					Alpine
			Species Occurrences verified in these Counties: Carbon, Lincoln, Mineral **State Rank Reason:** Only a few collections from Carbon and Sweet Grass counties.						
Erigeron lackschewitzii Lackschewitz' Fleabane		**Asteraceae** Aster/Sunflowers	G3	S3		Sensitive - Known on Forests (FLAT, HLC)		3	Alpine
			Species Occurrences verified in these Counties: Flathead, Glacier, Granite, Lewis and Clark, Pondera, Powell, Teton **State Rank Reason:** Endemic to Montana and adjacent Alberta though the large majority of the species' range is in Montana. Though many of the individual occurrences are small in size, the species is distributed over a relatively wide area along the Rocky Mtn Front south to the Flint Creek Range. The high elevation habitat reduces the potential for detrimental impacts.						
Erigeron leiomerus Smooth Fleabane		**Asteraceae** Aster/Sunflowers	G4	S2				3	Alpine
			Species Occurrences verified in these Counties: Beaverhead, Madison **State Rank Reason:** Rare in Montana, where it is currently known from only a couple of alpine sites in the southwest portion of the state. Current population levels and trends are unknown. However, its high-elevation habitat is relatively inaccessible, and there are no obvious threats. Additional sites are likely to be documented if surveys were to be conducted.						
Erigeron linearis Linear-leaf Fleabane		**Asteraceae** Aster/Sunflowers	G5	S2				2	Sagebrush/Grasslands (Foothills to Montane)
			Species Occurrences verified in these Counties: Beaverhead, Deer Lodge, Lewis and Clark, Mineral, Missoula, Park, Ravalli, Sanders, Silver Bow **State Rank Reason:** *Erigeron linearis* is a peripheral species known from a few small and moderate-sized, localized occurrences. Almost all populations are on federally-managed lands or lands under conservation easement. However, development on adjacent lands may fragment some areas of suitable habitat. Two historical locations are also known. The occupied habitats and population are susceptible to negative impacts from invasive weeds.						
Erigeron parryi Parry's Fleabane		**Asteraceae** Aster/Sunflowers	G2G3	S2S3				3	Slopes and ridges (Open, Montane)
			Species Occurrences verified in these Counties: Beaverhead, Big Horn, Broadwater, Carbon, Jefferson, Madison **State Rank Reason:** Though the species is restricted to southwest Montana, it is locally common at many of the sites it occupies. Additionally, threats to the species appear to be low as a result of the rocky, sparsely vegetated habitat it prefers.						
Erigeron tener Slender Fleabane		**Asteraceae** Aster/Sunflowers	G4	S2?				3	Slopes (Open, limestone, montane)
			Species Occurrences verified in these Counties: Beaverhead **State Rank Reason:** Rare in Montana, where it is currently known from a single locality in the southwest corner of the state. Current population levels and trends are unknown.						
Eriogonum caespitosum Mat Buckwheat		**Polygonaceae** Buckwheat Family	G5	S2S3				3	Sagebrush steppe (Montane)

										Species Occurrences verified in these Counties: Beaverhead, Lewis and Clark, Meagher, Park, Powell, Rosebud **State Rank Reason:** Rare in Montana, where it is has been documented from a few sites from Beaverhead County. Trends are unknown, though the potential for negative impacts to known populations appears to be low.
Eriogonum crosbyae Crosby's Buckwheat	Eriogonum capistratum var. muhlickii, Eriogonum chrysops [misapplied]	Polygonaceae Buckwheat Family	G4	S3					Alpine	**Species Occurrences verified in these Counties:** Deer Lodge, Gallatin, Granite, Ravalli **State Rank Reason:** Rare to Uncommon. This entity is restricted to high elevation sites in the Bitterroot Range and in the Anaconda-Pintlers, where it may be locally common in some areas. Good population data are lacking for most occurrences, though it's long-term viability does not appear to be a major concern at this time due, in part, to the remoteness of its habitat.
Eriogonum salsuginosum Smooth Buckwheat	Stenogonum salsuginosum	Polygonaceae Buckwheat Family	G4?	S1S2				2	Clay Barrens	**Species Occurrences verified in these Counties:** Carbon **State Rank Reason:** This species is on the northern edge of its range in south-central Montana, where it has been documented from only two small areas on the south side of the Pryor Mountains. There is active bentonite mining in the immediate vicinity of one of the known occurrences. Follow-up visits are needed to document the extent of the populations and to monitor population trends.
Eriogonum soliceps Railroad Canyon Wild Buckwheat		Polygonaceae Buckwheat Family	G3	S3				3	Ridges/slopes (Open, Montane)	**Species Occurrences verified in these Counties:** Beaverhead, Deer Lodge, Madison **State Rank Reason:** See rank details. Described as a new species in 2004 (Reveal and Bjork).
Eriogonum visheri Visher's Buckwheat		Polygonaceae Buckwheat Family	G3	S2			SENSITIVE	3	Clay Barrens	**Species Occurrences verified in these Counties:** Carter, Powder River **State Rank Reason:** *Eriogonum visheri* is a regional endemic known in Montana since 1997 from only one area in Carter County. This population grows on sparsley vegetated alluvial outwash in badlands topography and as such does not appear to be threatened by weeds, livestock or other activities at this time.
Eupatorium maculatum Spotted Joepye-weed	Eupatoriadelphus maculatus, Eutrochium maculatum	Asteraceae Aster/Sunflowers	G5	S1S2				4	Wetland/Riparian	**Species Occurrences verified in these Counties:** Big Horn, Carbon **State Rank Reason:** Widespread species known in Montana from a few occurrences in the south-central part of the state on a variety of ownerships. Four of the occurrences are moderate to large-sized populations.
Euphrasia subarctica Arctic Eyebright	Euphrasia arctica var. disjuncta, Euphrasia disjuncta [misapplied]	Orobanchaceae Broomrape Family	G5	S2				3	Alpine	**Species Occurrences verified in these Counties:** Glacier **State Rank Reason:** In Montana, only known from a few locations in Glacier National Park, including one historical collection from 1897. Some plants in at least one population are subject to trampling by hikers. Current population levels and trends are unknown. However, its high-elevation habitat is relatively inaccessible, and there are no significant threats. Additional sites are likely to be documented.
Gentiana glauca Glaucous Gentian		Gentianaceae Gentians	G5	S2S3				3	Alpine	**Species Occurrences verified in these Counties:** Flathead **State Rank Reason:** Rare in Montana, where it is has been documented only from Glacier National Park. Current population levels and trends are unknown, though it was described as locally common at the collection sites. Its high-elevation habitat is inaccessible, and there are no obvious threats. Additional sites are likely to be documented if surveys were to be conducted.
Gentianopsis macounii Macoun's Gentian	Gentiana macounii, Gentianella crinita ssp. macounii, Gentianopsis procera ssp. macounii, Gentiana detonsa, Gentianopsis virgata ssp. macounii	Gentianaceae Gentians	G5	S2		Sensitive - Known on Forests (HLC)		2	Fens	**Species Occurrences verified in these Counties:** Glacier, Lincoln, Madison, Teton **State Rank Reason:** Rare in Montana, where it is known from several sites just east of the Continental Divide.
Gentianopsis simplex Hiker's Gentian	Gentiana simplex, Gentianella simplex	Gentianaceae Gentians	G5	S2		Sensitive - Known on Forests (BD, CG) Sensitive - Suspected on Forests (KOOT, LOLO)		3	Fens, wet meadows, seeps	**Species Occurrences verified in these Counties:** Beaverhead, Carbon, Madison, Mineral, Missoula, Park, Stillwater, Sweet Grass **State Rank Reason:** Rare in Montana, where it is known from several widely scattered locations. Current population levels and trends are unknown, though potential threats to known populations appear to be minimal or non-existent at this time. Additional sites are likely to be documented if surveys were to be conducted.
Githopsis specularioides Common Blue-cup	Githopsis calycina	Campanulaceae Bellflower Family	G5	S1S2				3	Cliffs	**Species Occurrences verified in these Counties:** Sanders **State Rank Reason:** This plant is known from only one location in Montana -- more than 150 miles disjunct from the nearest documented populations in eastern Washington. The Montana population is small, however its cliff habitat is not thought to be particularly vulnerable to human disturbance.

Glossopetalon spinescens Spiny Greasebush	**Glossopetalon nevadense**	**Crossosomataceae** Greasebush	G5	S1		Sensitive - Known on Forests (BRT)		1	Rock/Talus
			Species Occurrences verified in these Counties: Ravalli **State Rank Reason:** A peripheral species in Montana where it is only known from one small occurrence on the Bitterroot National Forest. Population is vulnerable to human impacts as it occurs adjacent to a road.						
Gratiola ebracteata Bractless Hedge-hyssop		**Plantaginaceae** Plantain Family	G4	S2				3	Wetland/Riparian
			Species Occurrences verified in these Counties: Flathead, Glacier, Pondera, Teton, Yellowstone **State Rank Reason:** Rare and peripheral in Montana. Currently known from approximately a half-dozen wetlands along the Rocky Mountain Front and from a couple historical collections. Available data for the species are limited. However, threats to existing populations appear to be minimal. As an annual, population levels likely fluctuate widely from year to year.						
Grayia spinosa Spiny Hopsage		**Amaranthaceae** Amaranth (Pigweed) Family	G5	S2				4	Shrublands (Dry)
			Species Occurrences verified in these Counties: Big Horn, Carbon, Park, Rosebud **State Rank Reason:** *Grayia spinosa* is located in Montana primarily in the Pryor Mountain Desert with a couple additional records from southwest Montana. In the Pryor Mounatin area, it is known from less than a dozen, generally small ocurrences. The total population of the species in the state likely numbers less than 2,000 individuals. As the plant is highly palatable, negative impacts associated with heavy grazing are possible. Cheatgrass invasion may also pose a threat to the species by reducing seedling establishment and increasing fire frequency.						
Grindelia howellii Howell's Gumweed	**Grindelia paysonorum**	**Asteraceae** Aster/Sunflowers	G3	S2S3		Sensitive - Known on Forests (FLAT, LOLO) Sensitive - Suspected on Forests (HLC, KOOT)		1	Vernally moist sites (Open, Low-elevation)
			Species Occurrences verified in these Counties: Granite, Missoula, Powell **State Rank Reason:** In Montana, *Grindelia howellii* is known from over 100 mapped occurrences. However, most populations are small and many occur on roadsides or other similarly disturbed habitat. This habitat preference in conjunction with the short-lived nature of the species means occurrences may drift from place to place or from year to year and as a result many occurrences may be ephemeral. These attributes make determination of population numbers as well as the number of extant populations at any given time difficult to assess. Invasive weeds are a threat to many occurrences, as the habitat occupied by *G. howellii* is also favorable for many weedy species. Application of herbicides to control these weeds, especially along roadsides may also have a direct, negative impact.						
Gymnosteris parvula Small-flower Gymnosteris		**Polemoniaceae** Phlox Family	G4	S2				3	Grasslands/Sagebrush steppe
			Species Occurrences verified in these Counties: Beaverhead, Gallatin **State Rank Reason:** Known in Montana from one 1932 collection near West Yellowstone and one recent collection from Beaverhead County.						
Heterocodon rariflorum Western Pearl-flower		**Campanulaceae** Bellflower Family	G5	S2		Sensitive - Known on Forests (BRT, KOOT, LOLO) Sensitive - Suspected on Forests (FLAT)		2	Vernally moist habitats
			Species Occurrences verified in these Counties: Beaverhead, Lake, Lincoln, Mineral, Missoula, Powell, Ravalli, Sanders **State Rank Reason:** Over a dozen known occurrences, including a half-dozen moderate to large-sized populations, a few small populations and several occurrences that need further survey work to document population sizes. Most populations are on National Forest lands. Invasive weeds infest several populations and are likely infest others. Hiking and ORV trails occur though or adjacent to a few populations and associated use may impact *H. rariflorum* plants.						
Hornungia procumbens Hutchinsia	**Hutchinsia procumbens**	**Brassicaceae** Mustards	G5	S2				3	Sagebrush Steppe
			Species Occurrences verified in these Counties: Beaverhead, Carbon, Flathead, Powell **State Rank Reason:** Rare in Montana. Currently known from approximately a half-dozen occurrences scattered across the mountainous portion of the state. Trend and population data are generally lacking, though it is an annual and populations probably fluctuate widely from year to year. Threats to the species' viability in Montana appear to minimal.						
Howellia aquatilis Water Howellia		**Campanulaceae** Bellflower Family	G3	S3	LT	Threatened on Forests (FLAT, LOLO)		2	Aquatic
			Species Occurrences verified in these Counties: Lake, Missoula **State Rank Reason:** Water howellia is restricted in Montana to depressional wetlands in the Swan Valley, typically occupying small basins where the water level recedes partially or completely by the Fall. Montana contains the largest number of occupied ponds and wetlands though the total occupied area is small and it is clustered in a small portion of the state, making it vulnerable to localized events and management actions. Reed canary grass (*Phalaris arundinacea*) has invaded into some wetlands in the Swan Valley and it has the potential to form dense monocultures, thereby decreasing the amount of available habitat, though it has only been found in a small percentage of occupied water howellia sites so far. Additionally, water howellia is an annual species, which is solely dependent on recruitment from seed; and it has very narrow habitat and moisture requirements which leaves it vulnerable to extirpation as a result of consecutive years of unfavorable growing conditions.						

Idahoa scapigera Scalepod		**Brassicaceae** Mustards	G5	S1S2		Sensitive - Known on Forests (BRT, FLAT) Sensitive - Suspected on Forests (LOLO)		1	Vernally moist, rock ledges	**Species Occurrences verified in these Counties:** Flathead, Ravalli **State Rank Reason:** Rare and peripheral in Montana. Currently known fromapproximately a half-dozen sites in western Montana, mostly along the lower slopes of the Bitterroot Mountains. Populations are highly susceptible to negative impacts frominvasive weeds, primarily spotted knapweed and cheatgrass. Data on population trends are lacking, though levels likely fluctuate widely fromyear to year.
Impatiens aurella Pale-yellow Jewel-weed		**Balsaminaceae** Impatiens	G4	S3					riparian	**Species Occurrences verified in these Counties:** Cascade, Flathead, Gallatin, Jefferson, Lake, Lewis and Clark, Mineral, Missoula, Ravalli, Sanders **State Rank Reason:** *Impatiens aurella* is known fromabout 20 locations documented from1886 to 2016. It is considered uncommon in Lake and Flathead Counties, where the majority of observations have been found, and rare in other counties of western Montana. It grows in wet, often organic soil in both disturbed and undisturbed wetlands, and rarely appears abundant. However, it may require or persist better with some hydrological disturbance. Revisits to known locations and more surveys are needed to better document locations, population sizes, and threats.
Ipomoea leptophylla Bush morning-glory		**Convolvulaceae** Morning-glory Family	G3G5	S1S2					Prairie	**Species Occurrences verified in these Counties:** Big Horn, Rosebud, Treasure, Yellowstone **State Rank Reason:** Known in Montana fromonly a few collections in the southeastern part of the state, only 1 of these collections was in the last 2 decades. This is a very conspicuous, attractive species, so it is probably not undercollected.
Ipomopsis congesta ssp. crebrifolia Ballhead Ipomopsis	**Gilia congesta var. crebrifolia**	**Polemoniaceae** Phlox Family	G5T3T4	S2S3				3	Sagebrush Steppe	**Species Occurrences verified in these Counties:** Beaverhead **State Rank Reason:** Rare and peripheral in Montana. Currently known fromonly a small geographic area encompassing parts of the Centennial Mountains to the Monida Pass area in southwest Montana. Additional data on population levels are needed, though it is expected that populations are stable. Potential threats to the known occurrences appear to be minimal or non-existent at the current time.
Ipomopsis minutiflora Small-flower Ipomopsis	**Gilia minutiflora, Microgilia minutiflora**	**Polemoniaceae** Phlox Family	G4	S1S2					Sagebrush (Open)	**Species Occurrences verified in these Counties:** Ravalli **State Rank Reason:** Rare and peripheral in Montana. Currently documented in the state fromone collection fromthe Bitterroot Valley. Very little is known about this species in the state. Additional surveys are needed. Species may be overlooked/undercollected or perhaps the Montana occurrence could be the result of a more recent and isolated establishment event.
Kelloggia galioides Kelloggia		**Rubiaceae** Bedstraws / Madder Family	G5	SH					Forest (Open/low-elevation)	**Species Occurrences verified in these Counties:** Mineral **State Rank Reason:** Known in Montana fromone 1971 collection in the South Fork Fish Creek valley approximately 12 miles west-northwest of Alberton and a 0.5 mile north of the junction with Deer Creek.
Kochia americana Red Sage	**Bassia americana** Green Molly	**Amaranthaceae** Amaranth (Pigweed) Family	G5	S2				2	Saline/Alkaline Sites	**Species Occurrences verified in these Counties:** Beaverhead, Petroleum **State Rank Reason:** The species is at the periphery of its range in Beaverhead County where it is known fromone large extant population on BLM and private lands, two historical locations and two other locations that need additional survey work. Agricultural conversion has significantly reduced available habitat. Additional impacts to *K. americana* fromagriculture, grazing and/or invasive weeds are possible.
Koenigia islandica Island Koenigia		**Polygonaceae** Buckwheat Family	G4	S2				3	Alpine	**Species Occurrences verified in these Counties:** Carbon **State Rank Reason:** Rare in Montana, where it is only known fromseveral, high elevation sites on the Beartooth Plateau. Data are insufficient for accurately determining population levels and trend, though populations probably flucuate widely fromyear to year. The known occurrences and their habitat do not appear to be at any significant risk of adverse impacts fromhuman activities.
Lagophylla ramosissima Slender Hareleaf		**Asteraceae** Aster/Sunflowers	G5	S1				2	Grasslands (Dry/Valley)	**Species Occurrences verified in these Counties:** Sanders **State Rank Reason:** Species is poorly documented in Montana where it is known fromthree occurrences in close proximity to each other. More survey work for the species is needed to determine sizes of existing populations at a minimum. Invasive weeds occur at or near existing sites, though impacts of invasive weeds on *L. ramosissima* are unknown.
Lathyrus bijugatus Latah Tule Pea		**Fabaceae** Pea Family	G4	S2S3		Sensitive - Known on Forests (KOOT) Sensitive - Suspected on Forests (FLAT)			Forest (Open/Valley)	**Species Occurrences verified in these Counties:** Flathead, Lincoln **State Rank Reason:** Rare and peripheral in Montana. Currently documented fromthree, widely scattered sites in the valleys-lower mountains of northwest Montana.

Leptodactylon caespitosum Mat Prickly-phlox	**Linanthus caespitosus, Linanthus cespitosus**	**Polemoniaceae** Phlox Family	G4	S2S3				3	Sandy Breaks/Outcrops
			Species Occurrences verified in these Counties: Carbon **State Rank Reason:** This plant occurs in Montana at the edge of a broad but patchy range. It is known from only a dozen or so mostly small populations, all in the Pryor Mountains - Bighorn Canyon area, and is confined to a very specific substrate. The habitat of this plant receives little human disturbance and there are no evident threats.						
Lewisia columbiana Columbia Lewisia		**Portulacaceae** Purslane Family	G4G5	S1S2				3	Rock Crevices
			Species Occurrences verified in these Counties: Ravalli **State Rank Reason:** Rare and peripheral in Montana, where it is known from only one location in the Bitterroot Mountains. Its relatively inaccessible habitat reduces the potential for negative impacts.						
Ligusticum verticillatum Idaho Lovage		**Apiaceae** Parsley/Carrot Family	G4G5	S3					
			Species Occurrences verified in these Counties: Granite, Lincoln, Missoula, Ravalli **State Rank Reason:** Ligusticum verticillatum occurs in northern Idaho, western Montana, and British Columbia. It has been found in Lincoln and Ravalli Counties, growing in moist forests and meadows of spruce-fir habitats, becoming common in Idaho. Herbarium specimens from Missoula and Granite Counties may be mis-identified. Current data on locations, population sizes, and threats is greatly needed.						
Lobelia kalmii Kalm's Lobelia		**Campanulaceae** Bellflower Family	G5	S3					
			Species Occurrences verified in these Counties: Deer Lodge, Flathead, Lake, Lincoln, Powell, Sheridan, Teton, Wheatland **State Rank Reason:** Lobelia kalmii occurs in fens and other high-organic wetlands in northwest, central, and northeast Montana. Approximately 34 observations have been made at about 23 unique locations. The central Montana location has not been observed since 1934. Current observation, population size, and threat information at documented sites is needed.						
Lobelia spicata Pale-spiked Lobelia		**Campanulaceae** Bellflower Family	G5	S2?					Moist meadows
			Species Occurrences verified in these Counties: Dawson, Richland, Sheridan **State Rank Reason:** Rare and peripheral in Montana, where it is known from a few locations in the northeast corner of the state. Additional data on population levels and trends are needed. Unclear if any of the documented occurrences are subject to negative impacts or disturbances.						
Lomatium attenuatum Taper-tip Desert-parsley		**Apiaceae** Parsley/Carrot Family	G3	S3				3	Slopes and Scree (Dry)
			Species Occurrences verified in these Counties: Beaverhead, Madison, Mineral **State Rank Reason:** *Lomatium attenuatum* is restricted to northwest Wyoming and southwest Montana, with most of its range in Montana. It is known from several locations in Beaverhead and Madison counties. Some populations may be vulnerable to impacts from mining activities and noxious weed invasion.						
Lomatium geyeri Geyer's Biscuitroot		**Apiaceae** Parsley/Carrot Family	G4	S2		Sensitive - Known on Forests (KOOT)		4	Rocky sites (Mesic)
			Species Occurrences verified in these Counties: Lincoln **State Rank Reason:** Geyer's biscuitroot occurs in northwest Montana in less than a dozen occurrences, including several large, extensive populations. Encroachment of invasive weeds from nearby infestations into habitat occupied by the species is the primary concern.						
Lomatium nuttallii Nuttall Desert-parsley		**Apiaceae** Parsley/Carrot Family	G3	S2				2	Rocky, pine woodlands
			Species Occurrences verified in these Counties: Big Horn, Rosebud **State Rank Reason:** The few populations of Nuttall's desert-parsley in the upper Tongue River drainage of Montana are disjunct from the main range of the species in southeastern Wyoming and adjacent Nebraska and Colorado. Its position on mid and lower slopes along drainages in conjunction with its occurrence on private land may make it susceptible to negative impacts from development activities. Potential future coal and/or coalbed methane development could eventually impact the species. Weeds are not currently a problem at any of the known sites. Additional locations are likely to be fond in the vicinity of the known occurrences with additional surveys.						
Lomatogonium rotatum Marsh Felwort		**Gentianaceae** Gentians	G5	S1S2				2	Wetland/Riparian
			Species Occurrences verified in these Counties: Beaverhead, Ravalli **State Rank Reason:** Only two known occurrences in Montana on BLM and private lands, including one moderate-sized population. Livestock grazing occurs in the occupied habitat, though it is unclear what effect it may have on *L. rotatum*. Changes in the hydrology, particularly lowering of the water table may adversely affect populations.						
Malacothrix torreyi Desert Dandelion		**Asteraceae** Aster/Sunflowers	G4	S1S2				3	Open slopes (low-elevation)
			Species Occurrences verified in these Counties: Carbon **State Rank Reason:** Desert dandelion is limited in Montana to a few localized sites on the south side of the Pryor Mountains. Impacts of grazing are unknown, but it may respond positively to moderate levels of disturbance. Additional data on population levels and trends are needed.						
Mentzelia nuda Bractless blazingstar		**Loasaceae** Blazingstar / Stickleaf Family	G5	S1S2					Open areas (sandy or gravelly solis)
			Species Occurrences verified in these Counties: Big Horn, Custer, Dawson, Powder River, Roosevelt, Rosebud, Valley **State Rank Reason:** Rare and peripheral in Montana, where it is known from a few locations in the eastern half of the state. Additional data on population levels and trends are needed.						
Mentzelia pumila Dwarf mentzelia		**Loasaceae** Blazingstar / Stickleaf Family	G4	S2S3				3	Shrublands (Dry, sandy soils)

			Species Occurrences verified in these Counties: Big Horn, Carbon **State Rank Reason:** Rare in Montana, where it is known only from sandy sites within the Bighorn Basin area. Additional data on population levels and trends are needed.						
Mertensia bella Oregon Bluebells		**Boraginaceae** Borage Family	G4	S2S3		Sensitive - Known on Forests (LOLO)		2	Vernally moist soil (Montane)
			Species Occurrences verified in these Counties: Missoula **State Rank Reason:** Rare in Montana, where it is known only from the Lolo National Forest. Some disturbance may be beneficial or at least tolerated. Mining activity occurs near one site though it is unknown if this has had any impact on *M. bella*. Additional monitoring of the populations is needed to determine trends.						
Micranthes apetala Tiny Swamp Saxifrage	**Saxifraga integrifolia Hook. var. apetala, Saxifraga apetala**	**Saxifragaceae** Saxifrage Family	G3Q	S2?				3	Alpine
			Species Occurrences verified in these Counties: Beaverhead, Carbon, Deer Lodge, Granite, Madison, Silver Bow **State Rank Reason:** Known from two occurrences, one in the East Pioneers and one in the Absaroka-Beartooth Wilderness. Both occurrences are known from single specimen collections. Though little data are available for the species in Montana, the alpine habitat in which it grows is not generally subject to negative impacts from human disturbance.						
Micranthes tempestiva Storm Saxifrage	**Saxifraga tempestiva**	**Saxifragaceae** Saxifrage Family	G2G3	S2S3		Sensitive - Known on Forests (BD, BRT) Sensitive - Suspected on Forests (HLC)		3	Alpine
			Species Occurrences verified in these Counties: Beaverhead, Deer Lodge, Granite, Ravalli **State Rank Reason:** State endemic known from approximately a dozen extant sites in southwest Montana. The high elevation habitat of the species in conjuction with approximately half of the populations in designated wilderness areas minimize the potential for negative impacts to the species.						
Mimulus ampliatus Stalk-leaved Monkeyflower	**Mimulus patulus, Mimulus washingtonensis**	**Phrymaceae** Lopseed Family	G3	S3		Sensitive - Known on Forests (FLAT, KOOT)			Vernally moist soil (Valleys to subalpine)
			Species Occurrences verified in these Counties: Flathead, Glacier, Lincoln, Missoula, Park, Ravalli, Sanders **State Rank Reason:** See rank details.						
Mimulus breviflorus Short-flowered Monkeyflower		**Phrymaceae** Lopseed Family	G4	S1S2		Sensitive - Known on Forests (KOOT) Sensitive - Suspected on Forests (FLAT)		3	Rock/Talus (Mesic, Montane)
			Species Occurrences verified in these Counties: Beaverhead, Flathead, Glacier, Lincoln **State Rank Reason:** Rare in Montana, where it is known from a few, scattered locations in the northwest corner of the state.						
Mimulus clivicola North Idaho Monkeyflower		**Phrymaceae** Lopseed Family	G4	S2?		Sensitive - Known on Forests (LOLO) Sensitive - Suspected on Forests (KOOT)			
			Species Occurrences verified in these Counties: Mineral, Sanders **State Rank Reason:** See rank details.						
Mimulus floribundus Floriferous Monkeyflower		**Phrymaceae** Lopseed Family	G5	SH					
			Species Occurrences verified in these Counties: Beaverhead, Cascade, Flathead, Glacier, Lincoln, Park, Ravalli, Sanders, Stillwater						
Mimulus hymenophyllus Thinsepal monkeyflower		**Phrymaceae** Lopseed Family	G2	S1S2					
			Species Occurrences verified in these Counties: Carbon, Lake, Park, Stillwater **State Rank Reason:** See rank details. Surveys of the previous collection sites are needed to document the species' status. Without additional data, a rank of "SH" will be applicable.						
Mimulus nanus Dwarf Purple Monkeyflower		**Phrymaceae** Lopseed Family	G5	S2S3		Sensitive - Known on Forests (BRT, CG)		2	Open slopes (low-elevation)
			Species Occurrences verified in these Counties: Gallatin, Ravalli **State Rank Reason:** *Mimulus nanus* is only known from a few extent occurrences in the state, plus two historical collections. Populations are generally small and in habitats susceptible to weed invasion. At least a few of the occurrences contain scattered spotted knapweed plants.						
Mimulus primuloides Primrose Monkeyflower		**Phrymaceae** Lopseed Family	G4	S3		Sensitive - Known on Forests (BD, BRT)		3	Fens and wet meadows
			Species Occurrences verified in these Counties: Beaverhead, Deer Lodge, Gallatin, Ravalli **State Rank Reason:** Known from several watersheds in southwest Montana, occurring almost entirely on National Forest lands. Eight of the occurrences are moderate to large-sized populations. Two historical locations are also known. Fire may adversely impact *M. primuloides* though more study is needed. It is also vulnerable to changes in hydrology and one population could be adversely affected by activity at an adjacent ski area.						

Mimulus ringens Square-stem Monkeyflower		**Phrymaceae** Lopseed Family	G5	S2?					Wetland/Riparian
			Species Occurrences verified in these Counties: Cascade, Chouteau, Fergus **State Rank Reason:** Rare. Currently known from a few riparian sites along the Missouri River in central Montana. Additional survey data are needed.						
Nama densum Nama		**Hydrophyllaceae** Waterleaf Family	G5	S1S2				3	Sagebrush (Sandy soil)
			Species Occurrences verified in these Counties: Carbon **State Rank Reason:** Nama occurs in Montana on the northeastern edge of its range. It has been found at a single location on the south side of the Pryor Mountains in 1991, occupying less than one acre of habitat. Additional survey data are needed.						
Noccaea parviflora Small-flowered Pennycress	**Thlaspi parviflorum**	**Brassicaceae** Mustards	G3	S3				3	Meadows (Moist, Montane to alpine)
			Species Occurrences verified in these Counties: Beaverhead, Carbon, Cascade, Madison, Meagher, Mineral, Park, Silver Bow **State Rank Reason:** *Noccaea parviflora* is a regional endemic, known in Montana from several southwestern counties. It is a small, short-lived plant that likely requires some disturbance to maintain its habitat.						
Nuttallanthus texanus Blue Toadflax	**Linaria canadensis var. texana**	**Plantaginaceae** Plantain Family	G4G5	S1S2				2	Grasslands/woodlands (sandy to clay soils)
			Species Occurrences verified in these Counties: Carter, Dawson **State Rank Reason:** Known from one extant occurrence in southeastern Montana near Alzada and another occurrence from Makoshika State Park. Additional surveys and monitoring are needed.						
Nymphaea leibergii Pygmy Water-lily	**Nymphaea tetragona ssp. leibergii**	**Nymphaeaceae** Water-lily Family	G5	S1				3	Aquatic
			Species Occurrences verified in these Counties: Flathead, Lake, Missoula **State Rank Reason:** Known from 4 extant occurrences in western valleys and one historical collection from Salmon Lake in the Seeley Lake area. Populations are susceptible to impacts from development, recreation, siltation and aquatic weeds.						
Oenothera pallida ssp. pallida Pale Evening-primrose	**Oenothera pallida var. idahoensis**	**Onagraceae** Evening-primrose Family	G5T4Q	S1					Sandy sites
			Species Occurrences verified in these Counties: Beaverhead **State Rank Reason:** Limited in Montana to the sandhills of the Centennial Valley in Beaverhead County. A reduction in natural disturbances, including fire, ungulate grazing and pocket gopher activity has led to greater dune stabilization and reduced the extent of early successional (blowout) habitat in the area.						
Oxytropis campestris var. columbiana Columbia Locoweed	**Oxytropis columbiana**	**Fabaceae** Pea Family	G5T2	S1				1	Wetland/Riparian, Gravelly shoreline
			Species Occurrences verified in these Counties: Lake **State Rank Reason:** Originally known in Montana from six occurrences all around Flathead Lake. However, two of the occurrences are now extirpated. Private lands, which are subject to development in the area, play a vital role in maintaining viable populations of this plant in Montana.						
Oxytropis deflexa var. foliolosa Nodding Locoweed		**Fabaceae** Pea Family	G5T5	S2S3				3	Alpine
			Species Occurrences verified in these Counties: Beaverhead, Gallatin, Madison, Park **State Rank Reason:** Rare in Montana, where it has been documented from a few, high-elevation sites in the mountains of the southwest portion of the state.						
Oxytropis parryi Parry's Locoweed		**Fabaceae** Pea Family	G5	S2S3				3	Alpine
			Species Occurrences verified in these Counties: Beaverhead, Madison **State Rank Reason:** Rare in Montana where it is known only from a few occurrences in the southwestern portion of the state. However, the species high-elevation habitat and its viability do not appear to be at significant risk at the current time.						
Oxytropis podocarpa Stalked-pod Locoweed		**Fabaceae** Pea Family	G4G5	S1		Sensitive - Known on Forests (HLC) Sensitive - Suspected on Forests (BD, FLAT)		3	Alpine
			Species Occurrences verified in these Counties: Glacier, Teton **State Rank Reason:** Rare in Montana, where it is known from a small area of the Rocky Mountain Front. The remote habitat should limit the possibily of negative impacts.						
Papaver pygmaeum Alpine Glacier Poppy	**Papaver radicatum var. pygmaeum**	**Papaveraceae** Poppy Family	G3	S2S3				3	Alpine
			Species Occurrences verified in these Counties: Flathead, Glacier, Lewis and Clark **State Rank Reason:** See rank details.						
Papaver radicatum ssp. kluanensis Alpine Poppy	**Papaver kluanense, Papaver kluenensis**	**Papaveraceae** Poppy Family	G5T4	S2S3				3	Alpine
			Species Occurrences verified in these Counties: Carbon, Park, Sweet Grass **State Rank Reason:** See rank details.						
Pedicularis contorta var. ctenophora Pink Coil-beaked Lousewort		**Orobanchaceae** Broomrape Family	G5T3	S2S3				3	Slopes (Montane/Subalpine)
			Species Occurrences verified in these Counties: Beaverhead, Judith Basin, Madison, Ravalli, Teton **State Rank Reason:** Restricted to extreme southwestern Montana where it is documented from a few populations. Limited data is available for the species and it may be more common than the few collections indicate.						

Pedicularis contorta var. rubicunda Selway Coil-beaked Lousewort		**Orobanchaceae** Broomrape Family	G5T3	S2S3					Ridgetops and meadows (subalpine and alpine)
			Species Occurrences verified in these Counties: Ravalli **State Rank Reason:** Restricted in Montana to the Bitterroot Mountains where it is documented from several occurrences. Limited data are available for the species and it may be more common than the few collections indicate.						
Pedicularis crenulata Scallop-leaf Lousewort		**Orobanchaceae** Broomrape Family	G4	S1				1	Wetland/Riparian
			Species Occurrences verified in these Counties: Beaverhead **State Rank Reason:** Two known populations in Montana. Much of the riparian meadow habitat occupied by this species has been converted to agriculture or is being used as hay meadows.						
Pedicularis pulchella Mountain Lousewort		**Orobanchaceae** Broomrape Family	G3	S3					Alpine
			Species Occurrences verified in these Counties: Carbon, Deer Lodge, Gallatin, Granite, Madison, Park, Powell **State Rank Reason:** Restricted to high elevation areas of southern Montana. Limited data are available for the species and it may be more common than the few collections indicate.						
Penstemon angustifolius Narrowleaf Penstemon		**Plantaginaceae** Plantain Family	G5	S2S3				3	Sandy sites
			Species Occurrences verified in these Counties: Carter, Dawson, Fallon, Granite **State Rank Reason:** Over a dozen, small extant and/or presumed extant occurrences are known in southeast Montana, plus a few historical collections from the same area. Only one of the known populations appears to be relatively large. Additional suitable, but unsurveyed habitat likely exists in eastern Montana.						
Penstemon caryi Cary's Beardtongue		**Plantaginaceae** Plantain Family	G3	S3				3	Grasslands and slopes (Open, montane)
			Species Occurrences verified in these Counties: Carbon **State Rank Reason:** Restricted in Montana to the Pryor Mountains.						
Penstemon flavescens Yellow Beardtongue		**Plantaginaceae** Plantain Family	G3	S3				3	Rocky slopes (Open, montane)
			Species Occurrences verified in these Counties: Mineral, Missoula, Ravalli **State Rank Reason:** Restricted in Montana to the Bitterroot Range primarily in Ravalli County but also documented from Mineral County. The species can be relatively common or widely scattrered in areas of suitable habitat, though detailed information on the abundance of the species is lacking. More detailed information documenting the abundance, distribution and any potential threats is needed.						
Penstemon grandiflorus Large Flowered Beardtongue		**Plantaginaceae** Plantain Family	G5?	S1					Sandy soils
			Species Occurrences verified in these Counties: Custer **State Rank Reason:** Rare in Montana, where it is known from only a few sites on the plains of eastern Montana.						
Penstemon humilis Low Beardtongue		**Plantaginaceae** Plantain Family	G5	S1S3					Sagebrush steppe (Montane)
			Species Occurrences verified in these Counties: Beaverhead, Gallatin, Lewis and Clark, Lincoln, Madison, Meagher, Missoula, Park, Powell, Ravalli **State Rank Reason:** Known in Montana from 1 collection from Beaverhead County						
Penstemon lemhiensis Lemhi Beardtongue		**Plantaginaceae** Plantain Family	G3	S3		Sensitive - Known on Forests (BD, BRT)		2	Sagebrush-grasslands
			Species Occurrences verified in these Counties: Beaverhead, Deer Lodge, Ravalli, Silver Bow **State Rank Reason:** *Penstemon lemhiensis* is a regional endemic that occurs only in southwest Montana and adjacent Idaho. There are numerous occurrences in Beaverhead and Ravalli Counties with a few additional occurrences located in Deer Lodge and Silver Bow Counties in Montana, but most are small to moderate in size. The number of plants in Montana is estimated at approximately 10,000 individual plants based on recent survey efforts. Plants occur on a mix of federal, state and private ownerships with National Forest lands supporting the majority of the occurrences. The species is primarily sensitive to negative impacts associated with drought conditions and fire suppression, both of which are believed to have played a significant role in the species' decline. Additional impacts to populations are occurring from noxious weed invasion, primarily spotted knapweed in the Bitterroot region. Heavy livestock grazing also negatively impacts the species. Several occurrences are found adjacent to roadsides and thus may be impacted by activities associated with road construction, maintenance and use.						
Penstemon payettensis Payette Beardtongue		**Plantaginaceae** Plantain Family	G4	S1		Sensitive - Known on Forests (BRT)		1	Slopes (Open, Montane)
			Species Occurrences verified in these Counties: Beaverhead, Ravalli **State Rank Reason:** Known in Montana from only two small occurrences in close proximity on the Bitterroot National Forest. Spotted knapweed invasion, fire suppression and road construction/maintenance are all concerns for the viability of the species in Montana. Additional data on the species in Montana are needed.						
Penstemon whippleanus Whipple's Beardtongue		**Plantaginaceae** Plantain Family	G5	S2					Open areas (subalpine and alpine)

			Species Occurrences verified in these Counties: Beaverhead, Gallatin, Madison **State Rank Reason:** Whipple's beardtongue occurs at the edge of its range in Montana, and is known here from just two collections, only one of which is recent. The species occupies high elevation, rocky habitat that is relatively unthreatened.						
Petasites frigidus var. frigidus Arctic Sweet Coltsfoot		**Asteraceae** Aster/Sunflowers	G5T5	S2		Sensitive - Known on Forests (FLAT)		2	Wetland/Riparian
			Species Occurrences verified in these Counties: Flathead, Glacier **State Rank Reason:** Rare in Montana, where it is at the southern edge of its range. Known from a few widely scattered sites in the northwest corner of the state.						
Phacelia incana Hoary Phacelia		**Hydrophyllaceae** Waterleaf Family	G3G4	S3				3	Rocky slopes (foothills)
			Species Occurrences verified in these Counties: Beaverhead **State Rank Reason:** *Phacelia incana* occurs in Idaho, Nevada, Utah, Colorado and Montana. In Montana, it is known from approximately ten occurrences in Beaverhead County. It is difficult to estimate the size of populations because the plant is an annual, and seed germination varies greatly with climate. Habitat is probably not threatened by anthropogenic sources.						
Phacelia thermalis Hot Spring Phacelia		**Hydrophyllaceae** Waterleaf Family	G3G4	S1S3					Barren clay slopes
			Species Occurrences verified in these Counties: Fergus, Garfield, Phillips, Valley **State Rank Reason:** Hot spring phacelia is known from a very small number of sites in northeastern Montana, where it is disjunct from its primary range (northern California to southwestern Idaho). The species is an annual and may be vulnerable to competition from invasive exotics, particularly sweet clover, which is widespread in the type of habitat where hot spring phacelia has been found.						
Phlox kelseyi var. missoulensis Missoula Phlox	**Phlox missoulensis**	**Polemoniaceae** Phlox Family	G3	S3		Sensitive - Known on Forests (BD, HLC) Sensitive - Suspected on Forests (LOLO)		2	Slopes/ridges (Open, foothills to subalpine)
			Species Occurrences verified in these Counties: Cascade, Granite, Jefferson, Judith Basin, Lewis and Clark, Madison, Meagher, Missoula, Powell, Teton **State Rank Reason:** Missoula phlox is a state endemic known from over 2 dozen occurrences in west-central Montana, most of which are moderate to large-sized. Populations occur on a mix of ownerships, including private lands which host several occurrences. The Waterworks Hill population is infested with several noxious weeds and heavy recreational trail use also occurs within the occupied habitat. Other populations appear to be at much less risk though some impacts from invasive weeds, recreational use and development are possible.						
Physaria brassicoides Double Bladderpod		**Brassicaceae** Mustards	G5	S3				3	Breaklands/badlands
			Species Occurrences verified in these Counties: Carbon, Carter, Custer, Petroleum, Phillips, Powder River, Stillwater **State Rank Reason:** Double bladderpod is endemic to a restricted area of the northern Great Plains, and is known in Montana only from a handful of populations. Populations occur on a mix of federal, state and private ownerships. Impacts to the species from livestock grazing and invasive weeds are minimal at this time as the typically steep, sparsely-vegetated habitat is not conducive to grazing. Yellow sweetclover was observed at one location and it may eventually have a negaitive impact on the species.						
Physaria carinata Keeled Bladderpod	**Lesquerella carinata, Lesquerella carinata var. languida, Lesquerella paysonii [misapplied in MT], Physaria carinata ssp. carinata**	**Brassicaceae** Mustards	G3G4	S1S2		Sensitive - Known on Forests (BD)		1	Grassland slopes (low-elevation)
			Species Occurrences verified in these Counties: Beaverhead, Granite, Musselshell **State Rank Reason:** *Physaria carinata* is restricted to areas of calcareous limestone substrates on low elevation, south-facing grasslands of Granite and Beaverhead Counties. Population numbers appear to have declined significantly in at least several of the occurrences in the Garnet Mountains from the time they were first documented in the 1980's and early 1990's. During this time period, spotted knapweed densities have increased in the area and the noxious weed is now a dominant plant in most of the keeled bladderpod sites. At least one previous study has documented decreased vigor and survivorship of keeled bladderpod in knapweed infested areas.						
Physaria didymocarpa var. lanata Woolly Twinpod		**Brassicaceae** Mustards	G5T2	S2S3				2	Grasslands/Shrublands (Open, plains)
			Species Occurrences verified in these Counties: Big Horn, Rosebud **State Rank Reason:** Only a few known occurrences in Montana, including two potentially large populations. However, lots of unsurveyed potential habitat exists. Both BLM and private lands are important to the viability of the species in Montana. Oil and gas development, coalbed methane, and invasive weeds have the potential to detrimentally impact populations.						
Physaria douglasii Douglas Bladderpod	**Lesquerella douglasii**	**Brassicaceae** Mustards	GNR	S1				2	Woodlands (Sandy soils, low-elevation)
			Species Occurrences verified in these Counties: Lincoln **State Rank Reason:** Known from one population in northwest Montana at the edge of Lake Koocanusa. Impacts to the population from ORV use, recreation and erosion of the sandy bluffs are possible, though additional monitoring is needed to determine what impacts if any are occurring.						
Physaria humilis Bitterroot Bladderpod	**Lesquerella humilis**	**Brassicaceae** Mustards	G2	S2		Sensitive - Known on Forests (BRT)		2	Alpine
			Species Occurrences verified in these Counties: Ravalli **State Rank Reason:** Montana endemic restricted to a very small area of the Bitterroot Mountains with only a few known occurrences. All occurrences are in the Selway-Bitterroot Wilderness. However, activity related to hiking trails and a lookout tower may adversely impact *P. humilis* plants or its habitat.						
Physaria klausii Divide Bladderpod	**Lesquerella klausii**	**Brassicaceae** Mustards	G3	S3				3	Slopes (Open, Montane/subalpine)

			Species Occurrences verified in these Counties: Broadwater, Lewis and Clark, Meagher **State Rank Reason:** State endemic restricted to central-Montana with the majority of populations occurring in the Big Belt Mountains and extending north to the southern end of the Rocky Mountain Front. Many large populations exist and the species typically occurs on gravelly slopes that are not usually subject to human disturbance.						
Physaria lesicii Lesica's Bladderpod	**Lesquerella lesicii**	**Brassicaceae** Mustards	G2	S2			SENSITIVE	1	Woodlands/Grasslands (Montane)
			Species Occurrences verified in these Counties: Carbon **State Rank Reason:** Lesica's bladderpod occurs only in Montana, where it is restricted to a few areas of limestone outcrops in the eastern Pryor Mountains. All known populations are on federal lands. While it occurs largely on steep terrain that is relatively inaccessible to humans, trampling and terracing through its habitat by wild horses may be negatively impacting the plant.						
Physaria ludoviciana Silver Bladderpod	**Lesquerella ludoviciana**	**Brassicaceae** Mustards	G5	S2S3					Sandy sites
			Species Occurrences verified in these Counties: Carbon, Carter, Cascade, Chouteau, Fallon, Fergus, Golden Valley, Lewis and Clark, Mccone, Petroleum, Phillips, Powder River, Rosebud, Sheridan, Teton, Valley **State Rank Reason:** Rare in Montana. Primarily a plains species which barely enters eastern Montana where it is restricted to sandy sites. Locally common at one site and threats to the species' viability appear to be minimal at this time.						
Physaria pachyphylla Thick-leaf Bladderpod		**Brassicaceae** Mustards	G2G3	S2S3					Rocky slopes (foothills)
			Species Occurrences verified in these Counties: Carbon **State Rank Reason:** See rank details.						
Physaria pulchella Beautiful Bladderpod	**Lesquerella pulchella, Physaria carinata ssp. pulchella**	**Brassicaceae** Mustards	G3	S3		Sensitive - Known on Forests (BD)	SENSITIVE	3	Open slopes (Calcaeous soils, foothills to alpine)
			Species Occurrences verified in these Counties: Beaverhead **State Rank Reason:** Beautiful bladderpod is a state endemic - occurring only in Montana - and is known only from a few locations, where it is restricted to small areas of sparsely vegetated habitat.						
Physaria saximontana var. dentata Rocky Mountain Twinpod		**Brassicaceae** Mustards	G3T3	S3					Gravelly slopes/talus (Montane/subalpine)
			Species Occurrences verified in these Counties: Beaverhead, Broadwater, Carbon, Chouteau, Fergus, Flathead, Gallatin, Glacier, Lewis and Clark, Madison, Park, Pondera, Powell, Silver Bow, Sweet Grass, Teton **State Rank Reason:** State endemic known from several counties across central and southern Montana mountain ranges.						
Plagiobothrys leptocladus Slender-branched Popcorn-flower		**Boraginaceae** Borage Family	G4	S2S3					Wetland/Riparian (low-elevation)
			Species Occurrences verified in these Counties: Beaverhead, Custer, Glacier, Park, Phillips, Valley **State Rank Reason:** Rare in Montana, where it is known from a few widely scattered sites in the state. Additional data on population levels, trends and threats to the known ocuurences are needed to more precisely evaluate its status. As it occurs in drying mud of ponds, wetlands, stockponds, etc it is likely that additional populations exist in Montana.						
Pleiacanthus spinosus Spiny Skeletonweed	**Stephanomeria spinosa, Lygodesmia spinosa**	**Asteraceae** Aster/Sunflowers	G4	S2S3				3	Grasslands (low-elevation)
			Species Occurrences verified in these Counties: Beaverhead, Carbon, Madison, Park **State Rank Reason:** This plant occurs in Montana at the northeastern edge of its range, where it is known only from grasslands in the Madison Valley. Currently, there are only a few extant occurrences and three historical collections from this area. No specific threats have been reported. Trend data are not available. However, parts of the Madison Valley are being subdivided and habitat is likely to be negatively impacted.						
Potentilla brevifolia Short-leaved Cinquefoil		**Rosaceae** Rose Family	G4	S2S3				3	Alpine
			Species Occurrences verified in these Counties: Madison **State Rank Reason:** Rare in Montana, where it is currently only from a few collections from the Madison Range. The remote, high-elevation habitat should greatly minimize the potential for any negative impacts to the viability of the species in the state. Accurate estimates of population levels are lacking.						
Potentilla hyparctica Low Arctic Cinquefoil	**Potentilla nana, Potentilla flabellifolia var. emarginata**	**Rosaceae** Rose Family	G4G5	S2				3	Alpine
			Species Occurrences verified in these Counties: Carbon, Flathead, Glacier **State Rank Reason:** Rare in Montana, where it is currently only from a couple collections from the Beartooth Mtns. The remote, high-elevation habitat should greatly minimize the potential for any negative impacts to the viability of the species in the state. Accurate estimates of population levels are lacking.						
Potentilla nivea var. pentaphylla Five-leaf Cinquefoil	**Potentilla quinquefolia**	**Rosaceae** Rose Family	G5T4	S3		Sensitive - Known on Forests (BD, FLAT, HLC)		4	Alpine
			Species Occurrences verified in these Counties: Flathead, Glacier, Lincoln, Madison, Park, Pondera **State Rank Reason:** Rare in Montana, though several large populations are known and most populations, as well as the species' habitat, are not being negatively impacted.						
Potentilla plattensis Platte Cinquefoil		**Rosaceae** Rose Family	G4	S3				4	Grasslands/Sagebrush (Mesic)
			Species Occurrences verified in these Counties: Beaverhead, Carbon, Judith Basin, Valley **State Rank Reason:** Rare in Montana, where it is known from several collections, particularly from Beaverhead County.						

Primula alcalina Alkali Primrose		**Primulaceae** Primrose Family	G2	S2		Sensitive - Known on Forests (BD)	SENSITIVE	1	Wetland/Riparian	**Species Occurrences verified in these Counties:** Beaverhead, Madison **State Rank Reason:** *Primula alcalina* is a regional endemic, occuring only in east-central Idaho and adjacent Montana, where it is known from just one recently documented population in Beaverhead County on BLM and National Forest lands. Another population documented by a historical collection from 1920 by F. Rose has not been relocated. The extant location is actively grazed and the species may be vulnerable to impacts associated with cattle grazing and activities that alter the hydrology (irrigation, diversions).
Primula incana Mealy Primrose		**Primulaceae** Primrose Family	G5	S3		Sensitive - Known on Forests (BD) Sensitive - Historically known, not recently documented on Forests (CG)		2	Wetland/Riparian	**Species Occurrences verified in these Counties:** Beaverhead, Broadwater, Carbon, Deer Lodge, Gallatin, Jefferson, Madison, Meagher, Powell, Sheridan, Silver Bow, Teton **State Rank Reason:** *Primula incana* is known froma few dozen extant occurrences in Montana, including several moderate to large populations. However, most known populations are small, and the status of several populations is uncertain. Ownership of the occupied areas is varied and includes federal, state and private lands, including several locations managed or protected for their conservation values. However, unprotected private lands host many occurrences. Cattle grazing may have some negative effects on the species including the direct effects of herbivory and trampling. The species is also vulnerable to activities that alter the hydrology of the wetlands it occupies. Continued threats and potentially declining trends, particularly in regards to habitat quality make the species' vulnerable to local extirpation.
Prunus pumila Sand Cherry		**Rosaceae** Rose Family	G5	S1S3				2	Sandy or rocky soils (Plains)	**Species Occurrences verified in these Counties:** Fallon **State Rank Reason:** The sole known extant location in Montana occurs along a county road and is susceptible to road construction and maintenance activities. A 1960 collection with vague locational data has not been relocated but it apparently occurred in native habitat.
Psilocarphus brevissimus Dwarf woolly-heads		**Asteraceae** Aster/Sunflowers	G4	S2S3		Sensitive - Known on Forests (KOOT)		3	Wetland/Riparian	**Species Occurrences verified in these Counties:** Cascade, Lincoln, Petroleum, Phillips, Sanders, Valley **State Rank Reason:** Limited data combined with the posibility that several reported observations from western MT may be mis-identified with other Psilocarphus species make a precise determination of the species' status difficult.
Pyrrocoma carthamoides var. subsquarrosa Beartooth Large-flowered Goldenweed	**Haplopappus carthamoides var. subsquarrosus**	**Asteraceae** Aster/Sunflowers	G4G5T3	S3		Sensitive - Known on Forests (CG)	SENSITIVE	3	Sagebrush-Grassland	**Species Occurrences verified in these Counties:** Carbon **State Rank Reason:** The Beartooth large-flowered goldenweed is a local endemic to the eastern front of the Beartooth Mountains and the foothills of the Pryor Mountains and adjacent areas of Wyoming. Although several populations are large, it is vulnerable to increased shrub and tree cover due to fire suppression and to competition from invasive plants.
Quercus macrocarpa Bur Oak		**Fagaceae** Beech / Oaks	G5	S2				1	Shale ridges	**Species Occurrences verified in these Counties:** Big Horn, Carter **State Rank Reason:** Bur oak is at the extreme western edge of its range in Montana, where it occurs in a localized, though fairly large, occurrence in Carter County. Bentonite mining is active in this area and exotic weeds are prevalent though negative impacts to bur oak have not been documented due to a lack of surveys and monitoring.
Ranunculus cardiophyllus Heart-leaved Buttercup		**Ranunculaceae** Buttercup Family	G5	S3				2	Grasslands (Moist, Montane)	**Species Occurrences verified in these Counties:** Chouteau, Glacier, Sweet Grass, Toole **State Rank Reason:** Rare in Montana, where it is primarily distributed in the north-central part of the state.
Ranunculus grayi Arctic Buttercup	**Ranunculus karelinii, Ranunculus verecundus, Ranunculus gelidus**	**Ranunculaceae** Buttercup Family	G4G5	S3				3	Alpine	**Species Occurrences verified in these Counties:** Carbon, Deer Lodge, Flathead, Glacier, Madison, Meagher, Park, Stillwater **State Rank Reason:** Also includes *R. verecundus*, which was formerly tracked as a separate Species of Concern.
Ranunculus orthorhynchus Straightbeak Buttercup		**Ranunculaceae** Buttercup Family	G5	S1S2				1	Wetland/Riparian (Montane)	**Species Occurrences verified in these Counties:** Deer Lodge, Flathead, Glacier, Granite, Lake, Mineral, Missoula, Sanders **State Rank Reason:** Rare in Montana, where is is known from the western portion of the state based upon several specimen collections. However, only one collection has been made in the past two decades. Additional data are need to determine this species' status.
Ranunculus pedatifidus Northern Buttercup		**Ranunculaceae** Buttercup Family	G5	S3				2	Meadows/Woodlands (Montane to Alpine)	**Species Occurrences verified in these Counties:** Carbon, Flathead, Glacier, Granite, Liberty, Teton **State Rank Reason:** Rare in Montana. Documented in the state from several collections. Additional data are needed to more precisely determine the species' status.

Ribes laxiflorum Trailing Black Currant		**Grossulariaceae** Currants / Gooseberries	G5	S2?					Shrublands (Rocky, montane)
			Species Occurrences verified in these Counties: Flathead, Lincoln **State Rank Reason:** Rare in Montana, where it is known from a single collection from Lincoln County. The documented population does not appear to be at risk. Additional data are needed.						
Ribes triste Swamp Red Currant		**Grossulariaceae** Currants / Gooseberries	G5	S2?					Forest openings (Mesic, montane/subalpine)
			Species Occurrences verified in these Counties: Beaverhead, Deer Lodge, Granite, Mineral, Ravalli **State Rank Reason:** Rare in Montana, where it is known from a few collections from the western portion of the state. Additional data are needed.						
Rorippa calycina Persistent-sepal Yellow-cress		**Brassicaceae** Mustards	G3	SH					Wetland/Riparian
			Species Occurrences verified in these Counties: Big Horn, Custer, Mccone, Rosebud, Treasure, Yellowstone **State Rank Reason:** *Rorippa calycina* is a regional endemic currently known only from four Montana records. The species was last observed in Montana more than 30 years ago. Surveys are needed.						
Rotala ramosior Toothcup		**Lythraceae** Loosestrife Family	G5	S1S2				4	Wetland/Riparian
			Species Occurrences verified in these Counties: Lake, Missoula, Ravalli **State Rank Reason:** Rare in Montana, where it is known from approximately a half-dozen wetland sites in the valley bottoms in the western portion of the state. Potential threats and impacts to the known occurrences, as well as population trends, need to be evaluated.						
Rubus arcticus Nagoonberry	**Rubus acaulis, Rubus arcticus ssp. acaulis**	**Rosaceae** Rose Family	G5	S2					
			Species Occurrences verified in these Counties: Flathead **State Rank Reason:** *Rubus acaulis* may be rare or common where its habitat is present. However, its habitat (hummocks in *Sphagnum*-moss dominated fens, high elevation wet-meadows, etc.) is very specific and often limited in Montana.						
Sagina nivalis Arctic Pearlwort		**Caryophyllaceae** Pink Family	G5	S2S3				3	Alpine
			Species Occurrences verified in these Counties: Carbon, Glacier, Stillwater **State Rank Reason:** Rare in Montana, where it is known from Glacier National Park and the Beartooth Plateau. The remote, high-elevation habitat should greatly minimize the potential for any negative impacts to the viability of the species in the state. Accurate estimates of population levels are lacking.						
Salix barrattiana Barratt's Willow		**Salicaceae** Willows / Poplar	G5	S2		Sensitive - Known on Forests (CG) Sensitive - Suspected on Forests (FLAT, HLC)		3	Alpine
			Species Occurrences verified in these Counties: Carbon, Glacier, Madison **State Rank Reason:** Rare in Montana. Known from two disjunct sites, one in Glacier National Park and one on the Beartooth Plateau. Populations are small, but the remote, high-elevation habitat should greatly minimize the potential for any negative impacts to the viability of the species in the state.						
Salix cascadensis Cascade Willow		**Salicaceae** Willows / Poplar	G5	S2					Alpine
			Species Occurrences verified in these Counties: Deer Lodge, Sanders, Teton **State Rank Reason:** Rare in Montana. Species is known in Montana only from a small area of the Anaconda-Pintlers. The remote, high-elevation habitat should greatly minimize the potential for any negative impacts to the viability of the species in the state. Accurate estimates of population levels are lacking.						
Salix serissima Autumn Willow		**Salicaceae** Willows / Poplar	G5	S3				3	Wetland/Riparian
			Species Occurrences verified in these Counties: Cascade, Flathead, Glacier, Meagher, Pondera, Teton **State Rank Reason:** This willow is primarily found in Montana along the Rocky Mountain Front. Approximately half the occurrences are on lands managed in part for their conservation value. The species is primarily susceptible to impacts associated with heavy grazing and changes in the hydrology of the fens and wet meadows which it occupies.						
Sandbergia perplexa Puzzling Rockcress	**Halimolobos perplexa**	**Brassicaceae** Mustards	G4	S2		Sensitive - Known on Forests (BRT)		2	Shrubland/woodland slopes (Open, Montane)
			Species Occurrences verified in these Counties: Ravalli **State Rank Reason:** Rare in Montana, where it is known only from the very southern end of the Bitterroot Valley on the Bitterroot National Forest. Spotted knapweed is known from at least one of the populations and further spread of invasive weeds at the known occurrences is likely without control measures. Trend data and repeat observations of the known occurrences are lacking.						
Satureja douglasii Yerba Buena	**Clinopodium douglasii**	**Lamiaceae** Mints	G5	S3					Forest (Moist, montane)
			Species Occurrences verified in these Counties: Mineral, Missoula, Ravalli, Sanders **State Rank Reason:** Rare in Montana, where it is known from several sites near the Idaho border. It is primarily a coastal species, disjunct in western Montana. Population levels appear healthy and may be increasing in some areas.						
Saussurea densa Dwarf Saw-wort	**Saussurea nuda var. densa**	**Asteraceae** Aster/Sunflowers	G4Q	S2S3				3	Alpine
			Species Occurrences verified in these Counties: Flathead, Lewis and Clark, Pondera, Teton **State Rank Reason:** Known from a handful of small occurrences along the Rocky Mountain Front, primarily in the Bob Marshall Wilderness Complex. Limited data are available for most occurrences leading to the uncertainty in the species' rank.						

Saussurea weberi Weber's Saw-wort		**Asteraceae** Aster/Sunflowers	G2G3	S2		Sensitive - Known on Forests (BD)		3	Alpine	**Species Occurrences verified in these Counties:** Deer Lodge, Granite, Park **State Rank Reason:** Known from one large occurrence in the Anaconda-Pintler Range in the alpine zone. The remote, high-elevation habitat should greatly minimize the potential for any negative impacts to the viability of the species in the state. Population estimates from the single, documented occurrence vary widely. Additional population data are needed.
Saxifraga hirculus Yellow Marsh Saxifrage		**Saxifragaceae** Saxifrage Family	G5	S1S2				3	Alpine	**Species Occurrences verified in these Counties:** Carbon **State Rank Reason:** Known from one small population in the Absorka-Beartooth Wilderness. Though little data are available for the species in Montana, the alpine habitat in which it grows is not generally subject to negative impacts from human disturbance.
Senecio amplectens Clasping Groundsel	**Ligularia amplectens**	**Asteraceae** Aster/Sunflowers	G4	S1S2				1	Alpine	**Species Occurrences verified in these Counties:** Carbon, Glacier **State Rank Reason:** In Montana, only known from the Beartooth (Line Creek) Plateau. Additional data on population size, trends and potential threats are needed to evaluate the species' vulnerability.
Senecio elmeri Elmer's Ragwort	**Senecio spribillei**	**Asteraceae** Aster/Sunflowers	G4	S2					Alpine	**Species Occurrences verified in these Counties:** Lincoln, Sanders **State Rank Reason:** Rare in the state. Known from only one high-elevation site in the Cabinet Mountains. Its location in a designated wilderness and its high-elevation habitat should prevent most detrimental imapcts to the species' viability in Montana.
Senecio eremophilus Desert Groundsel		**Asteraceae** Aster/Sunflowers	G5	S1S2					Wetland/Riparian	**Species Occurrences verified in these Counties:** Big Horn, Blaine, Hill, Lake, Phillips **State Rank Reason:** Known from at least 5 occurrences, including two historical collections. Little data are available for this species in Montana. More information is needed. May be more common than collections indicate.
Senecio hydrophilus Alkali-marsh Ragwort		**Asteraceae** Aster/Sunflowers	G5	S3						**Species Occurrences verified in these Counties:** Beaverhead, Broadwater, Cascade, Flathead, Gallatin, Lincoln, Madison, Meagher, Missoula, Park, Powell **State Rank Reason:** Senecio hydrophilus is present in alkaline habitats within a portion of southwest Montana. Plants are not that common, and occur in low-elevation wetlands that can be victum to dewatering.
Senecio integerrimus var. scribneri Scribner's Ragwort		**Asteraceae** Aster/Sunflowers	G5T2T3	S2S3						**Species Occurrences verified in these Counties:** Carbon, Custer, Fergus, Golden Valley, Hill, Liberty, Musselshell, Park, Phillips, Rosebud, Valley, Wheatland, Yellowstone **State Rank Reason:** See rank details.
Shoshonea pulvinata Shoshonea		**Apiaceae** Parsley/Carrot Family	G3	S2		Sensitive - Known on Forests (CG)	SENSITIVE	3	Rock Outcrops	**Species Occurrences verified in these Counties:** Carbon **State Rank Reason:** Known in Montana only from the Pryor Mountains and the eastern slope of the Beartooth Plateau. Occurrences are located mostly on federal lands.
Sidalcea oregana Oregon Checker-mallow		**Malvaceae** Mallow Family	G5	S2S3				1	Grasslands (low-elevation)	**Species Occurrences verified in these Counties:** Gallatin, Lake **State Rank Reason:** Known from two widely separate sites in Gallatin and Lake counties. Habitats occupied by the species are susceptible to weed invasion and both locations have a large component of weedy species. However, *S. oregana* appears capable of tolerating at least some competition from these weedy species. The Lake County population occurs near and along Highway 93 and has the potential to be significantly negatively impacted by highway construction.
Silene spaldingii Spalding's Catchfly	Spalding's Campion	**Caryophyllaceae** Pink Family	G2	S2	LT	Threatened on Forests (FLAT, KOOT, LOLO)		1	Grasslands (Intermountain)	**Species Occurrences verified in these Counties:** Flathead, Lake, Lincoln, Sanders **State Rank Reason:** *Silene spaldingii* exists in only a few locations in the northwest corner of the state. Extant occurrences are known in the following areas: Tobacco Plains area, Lost Trail National Wildlife Refuge, the Niarada area and on Wild Horse Island. The majority of occurrences have less than 100 individuals, though 3 sites are each known to contain over 1,000 individuals and the total population size in Montana is likely 20,000+ mature plants based upon 2011 data. One historical occurrence exists from the Columbia Falls area. Several threats affect the long-term viability of the species in the state. Invasive weeds are the most widespread threat and are negatively impacting the bunchgrass habitat occupied by *S. spaldingii*. Housing development and subdivision are directly impacting populations in the Tobacco Plains and has the potential to further isolate known occurrences in the area. Cattle grazing is affecting several populations and two other occurrences have apparently been extirpated recently from the severe impacts associated with llama grazing. Fire exclusion and the successive build-up of litter compared to historical conditions appears to be having negative impacts on survival and reproduction. Populations are also at risk due to the small numbers of individuals and their isolated nature, which reduces the chances of cross-pollination and gene flow between populations. Long- and short-term trends are difficult to gauge due to the lack of survey and monitoring data. Estimates of trends and population size are also compounded by *S. spaldingii* plants exhibiting summer dormancy at rates that vary widely from year to year.

Solidago ptarmicoides Prairie Goldenrod	Oligoneuron album, Aster ptarmicoides	Asteraceae Aster/Sunflowers	G5	S2S3					Grasslands (Plains)
			Species Occurrences verified in these Counties: Carter, Richland, Wibaux **State Rank Reason:** Rare in Montana, where it has been documented from only a few locations on the eastern plains.						
Sphaeromeria argentea Chicken-sage	Tanacetum nuttallii, Artemisia macarthurii	Asteraceae Aster/Sunflowers	G3G4	S3			SENSITIVE	3	Sagebrush steppe (low-elevation)
			Species Occurrences verified in these Counties: Beaverhead **State Rank Reason:** *Sphaeromeria argentea* occurs in east-central Idaho and adjacent Beaverhead County, Montana with disjunct populations in Nevada as well as southwest Wyoming and adjacent Colorado. There are nearly 20 known locations south of Dillon; many populations are sparse but spread over large areas, so population estimates are difficult. All known populations are subject to livestock grazing; however chicken sage is aromatic and most likely unpalatable to cattle.						
Stellaria crassifolia Fleshy Stitchwort		Caryophyllaceae Pink Family	G5	S2					Wetland/Riparian
			Species Occurrences verified in these Counties: Beaverhead, Carbon, Glacier, Granite **State Rank Reason:** Rare in Montana where it is known from a few sparsely distributed locations that are mostly poorly documented.						
Sullivantia hapemanii Wyoming Sullivantia		Saxifragaceae Saxifrage Family	G3	S2S3				3	Rock/Talus
			Species Occurrences verified in these Counties: Big Horn, Carbon **State Rank Reason:** Wyoming Sullivantia is regional endemic known in Montana only from a few, clustered locations. It grows in small, fragile aquatic habitats that may be vulnerable to hydrologic changes from water development or diversion, or trampling.						
Symphyotrichum molle Soft Aster		Asteraceae Aster/Sunflowers	G3	S1S3					NA
			Species Occurrences verified in these Counties: Big Horn, Carbon **State Rank Reason:** Known in Montana from 1 collection from the Bighorn Mtns. Though its exact status is uncertain, its rarity warrants its inclusion as a Species of Concern.						
Synthyris canbyi Mission Mountain kittentails		Plantaginaceae Plantain Family	G2G3	S2S3				3	Alpine
			Species Occurrences verified in these Counties: Flathead, Granite, Lake, Missoula, Ravalli **State Rank Reason:** State endemic with 10 occurrences restricted to high elevation, open, rocky slopes in the Mission and Swan Ranges. As such, habitat is not generally prone to human disturbance and most occurrences are in designated wilderness areas. Additional occurrences likely exist across the known range of the species.						
Thalictrum alpinum Alpine Meadowrue		Ranunculaceae Buttercup Family	G5	S2		Sensitive - Known on Forests (BD) Sensitive - Suspected on Forests (CG, HLC)		2	Wetland/Riparian
			Species Occurrences verified in these Counties: Beaverhead, Deer Lodge, Granite **State Rank Reason:** Rare in Montana, where it is known from approximately two dozen sites mostly on public land. Its habitat is vulnerable to hydrological alteration. Grazing can be beneficial, except where it leads to streamdowncutting and loss of riparian habitat.						
Thelypodium paniculatum Northwestern Thelypody	Thelypodium sagittatum var. crassicarpum	Brassicaceae Mustards	G2	SH					Wetland/Riparian
			Species Occurrences verified in these Counties: Beaverhead, Gallatin, Madison **State Rank Reason:** Known only from an 1899 collection in Beaverhead County, although Dorn (1984) also reports it for Madison County.						
Thelypodium sagittatum Slender Thelypody		Brassicaceae Mustards	G4	S2				3	Alkaline meadows (Valleys and Montane)
			Species Occurrences verified in these Counties: Beaverhead, Gallatin **State Rank Reason:** Known from numerous occurrences in extreme southwestern Montana.						
Tonestus aberrans Idaho Goldenweed	Haplopappus aberrans, Triniteurybia aberrans, Eurybia aberrans	Asteraceae Aster/Sunflowers	G3	S1S2		Sensitive - Known on Forests (BRT)		1	Rock/Talus
			Species Occurrences verified in these Counties: Ravalli **State Rank Reason:** Known from two moderate-sized occurrences and two smaller occurrences on the Bitterroot National Forest and adjacent private land. One population occurs adjacent to a road, where construction may have impacted the population. No negative impacts to the populations are currently known to be occurring. However, populations are susceptible to potential impacts associated with roads and rock climbing.						
Townsendia condensata Cushion Townsend-daisy		Asteraceae Aster/Sunflowers	G4	S1S3				2	Alpine
			Species Occurrences verified in these Counties: Beaverhead, Flathead, Glacier, Park **State Rank Reason:** Cushion townsendia is known in Montana from one presumed extant occurrence in Glacier National Park and three other historical collections from GNP and the Beartooth Mountains. Risks are likely minimal given the remoteness of its alpine habitat.						
Townsendia florifer Showy Townsend-daisy	Townsendia florifera	Asteraceae Aster/Sunflowers	G5	S2				3	Grasslands and Sagebrush
			Species Occurrences verified in these Counties: Beaverhead, Park, Sweet Grass **State Rank Reason:** Known in Montana from only a few, small occurrences in the southwestern corner of the state.						
Trifolium cyathiferum Cup Clover		Fabaceae Pea Family	G4	S3					
			Species Occurrences verified in these Counties: Missoula, Ravalli **State Rank Reason:** Trifoliumcyathiferumoccurs in two counties with limited information on population size. One occurrence was re-visited in 1998 and found to be absent due to habitat succession.						

Trifolium eriocephalum Woolly-head Clover		**Fabaceae** Pea Family	G5	S2		Sensitive - Known on Forests (BRT) Sensitive - Suspected on Forests (BD, LOLO)		2	Open areas (foothills and montane)
			Species Occurrences verified in these Counties: Beaverhead, Ravalli **State Rank Reason:** Known from eight large occurrences on the Bitterroot National Forest. Invasive weeds, particularly spotted knapweed, are a problem in the habitat occupied by the species. Timber harvest and related road-building activities may also negatively impact populations. However, *Trifolium eriocephalum* appears capable of tolerating some level of disturbance.						
Trifolium gymnocarpon Hollyleaf Clover		**Fabaceae** Pea Family	G5	S2		Sensitive - Known on Forests (BRT, LOLO) Sensitive - Suspected on Forests (BD)		2	Open areas (foothills and montane)
			Species Occurrences verified in these Counties: Granite, Ravalli **State Rank Reason:** Known from many sites within the West Fork Bitterroot River drainage, which would encompass one large metapopulation. Also known in Montana from one disjunct occurrence in the Rock Creek drainage on the Lolo National Forest. Invasive weeds, particularly spotted knapweed, are a problem in some of the habitat occupied by the species. However, *Trifolium gymnocarpon*, as with other clover species, appears capable of tolerating or even benefitting from some disturbance.						
Trifolium microcephalum Woolly Clover		**Fabaceae** Pea Family	G5	S3					
			Species Occurrences verified in these Counties: Missoula, Ravalli						
Triodanis leptocarpa Slim-pod Venus'-looking-glass	**Specularia leptocarpa**	**Campanulaceae** Bellflower Family	G5?	S3					
			Species Occurrences verified in these Counties: Big Horn, Carter, Cascade, Chouteau, Custer, Park, Petroleum, Phillips, Powder River, Rosebud, Stillwater, Sweet Grass, Valley **State Rank Reason:** Triodanis leptocarpa is common in the southern Great Plains and extends into eastern and central Montana. It occurs in grasslands, grass-dominated rocky slopes, and sagebrush-dominated grasslands. It has been found in grazed and ungrazed lands and appears to tolerate some disturbance. Approximately 14 locations were documented prior to 1958 and occur in central Montana. Approximately 14 locations were documented since 1974 and mostly occur in eastern Montana. Re-visits to known locations and current population data is greatly needed.						
Utricularia intermedia Flatleaf Bladderwort		**Lentibulariaceae** Bladderworts	G5	S2		Sensitive - Known on Forests (KOOT) Sensitive - Suspected on Forests (FLAT)		3	Fens (Aquatic)
			Species Occurrences verified in these Counties: Blaine, Flathead, Glacier, Lake, Lincoln, Madison **State Rank Reason:** Only known from a few occurrences in the western half of the state.						
Utricularia ochroleuca Northern Bladderwort		**Lentibulariaceae** Bladderworts	G4G5	S1					
			Species Occurrences verified in these Counties: Deer Lodge, Glacier						
Vaccinium myrtilloides Velvetleaf Huckleberry		**Ericaceae** Heath Family	G5	S2				2	Forests
			Species Occurrences verified in these Counties: Flathead, Glacier **State Rank Reason:** Only known in Montana from several sites in the vicinity of West Glacier. Some of the known population and associated habitat has been negatively impacted by development (visitor and transportation facilities) within Glacier National Park.						
Viburnum lentago Nannyberry		**Caprifoliaceae** Honeysuckle Family	G5	S2S3				2	Riparian forest
			Species Occurrences verified in these Counties: Big Horn, Richland, Roosevelt **State Rank Reason:** Three known occurrrences in eastern Montana.						
Viguiera multiflora Many-flowered Viguiera	**Heliomeris multiflora**	**Asteraceae** Aster/Sunflowers	G4G5	S2S3				3	Aspen woodlands
			Species Occurrences verified in these Counties: Beaverhead, Carbon, Cascade, Gallatin, Madison, Park, Phillips **State Rank Reason:** Known from one extant occurrence in Beaverhead County and four historical collections from Beaverhead, Gallatin and Madison Counties.						
Viola selkirkii Great-spurred Violet		**Violaceae** Violets	G5	S2		Sensitive - Known on Forests (KOOT) Sensitive - Suspected on Forests (FLAT)			Wetland/Riparian

SCIENTIFIC NAME COMMON NAME TAXA SORT	OTHER NAMES	FAMILY (SCIENTIFIC) FAMILY (COMMON)	GLOBAL RANK	STATE RANK	USFWS	USFS	BLM	MNPS THREAT CATEGORY	HABITAT
			Species Occurrences verified in these Counties: Lincoln **State Rank Reason:** Only known in Montana from a few locations in the northwest corner of the state. Additional survey data are needed to document population sizes and extent.						
Waldsteinia idahoensis Idaho Barren Strawberry		**Rosaceae** Rose Family	G3	S2S3		Sensitive - Known on Forests (LOLO)			Forests (Ponderosa Pine)
			Species Occurrences verified in these Counties: Mineral, Missoula **State Rank Reason:** Only one known site in Montana on National Forest land. Population is in an area susceptible to impacts from timber harvesting and road maintenance, though population appears to be stable or perhaps increasing in size.						

FLOWERING PLANTS - MONOCOTS (LILIOPSIDA) — 77 SPECIES

SCIENTIFIC NAME COMMON NAME TAXA SORT	OTHER NAMES	FAMILY (SCIENTIFIC) FAMILY (COMMON)	GLOBAL RANK	STATE RANK	USFWS	USFS	BLM	MNPS THREAT CATEGORY	HABITAT
Acorus americanus Sweetflag	Acorus calamus [misapplied name]	**Acoraceae** Sweetflag/Calamus Family	G5	S1S2					Wetland/Riparian
			Species Occurrences verified in these Counties: Flathead, Lake **State Rank Reason:** This species occurs at the edge of its range in Montana, where it has been collected from two localities in the vicinity of Flathead Lake. Current status of these populations is largely unknown. The species has likely been negatively impacted by hydrologic alterations and development in the area.						
Allium acuminatum Tapertip Onion		**Liliaceae** Lillies	G5	S2S3		Sensitive - Known on Forests (BD, BRT, LOLO)			Dry Forest-Grassland
			Species Occurrences verified in these Counties: Lincoln, Madison, Ravalli, Sanders **State Rank Reason:** Rare in Montana, where it is known from several widely scattered sites in the western half of the state. Trend data are lacking. Threats to populations do not appear to be significant at this time, though invasive weeds may eventually pose problems at some sites.						
Allium columbianum Columbia Onion		**Liliaceae** Lillies	G3	S1					Open, mesic sites
			Species Occurrences verified in these Counties: Lincoln, Ravalli, Sanders **State Rank Reason:** Known from one occurrence in Camas Prairie. Part of this occurrence has been replaced by a gravelpit. Nearly all suitable habitat in the area has been converted to agriculture. Invasive weeds may also negatively impact the remaining habitat and threaten the population. Survey and monitoring data are needed.						
Allium geyeri var. geyeri Geyer's Onion		**Liliaceae** Lillies	G4G5T4	S3					
			Species Occurrences verified in these Counties: Beaverhead, Big Horn, Broadwater, Carbon, Flathead, Madison **State Rank Reason:** S3 SOC: This variety of Allium geyeri appears to be found in limited numbers with a limited distribution in Montana.						
Allium parvum Small Onion		**Liliaceae** Lillies	G5	S3		Sensitive - Known on Forests (BRT) Sensitive - Suspected on Forests (BD)			Dry Forest-Grassland
			Species Occurrences verified in these Counties: Beaverhead, Ravalli **State Rank Reason:** Known from southwest Montana, primarily on the Bitterroot National Forest. Many of the the documented occurrences have large numbers of individuals and cover extensive areas. However, many of the sites are also infested with spotted knapweed and/or cheatgrass and continued increases in the density and spread of both invasive weeds are likely, further degrading the habitat occupied by Allium parvum.						
Allium simillimum Dwarf Onion		**Liliaceae** Lillies	G4	S2?					Mesic Grasslands-Meadows
			Species Occurrences verified in these Counties: Gallatin, Lincoln, Ravalli **State Rank Reason:** Rare in Montana, where it is known from only a few locations in the southwest portion of the state near the Idaho border. Available survey data are limited for the species in Montana.						
Amerorchis rotundifolia Round-leaved Orchis	Orchis rotundifolia	**Orchidaceae** Orchids	G5	S3		Sensitive - Known on Forests (FLAT, HLC, KOOT) Sensitive - Suspected on Forests (LOLO)			Wetland/Riparian
			Species Occurrences verified in these Counties: Flathead, Glacier, Lake, Lewis and Clark, Lincoln, Pondera, Powell, Teton **State Rank Reason:** In Montana, this species is restricted to the Rocky Mountain Front, Bob Marshall Wilderness Complex, Swan Valley and the northwest corner of the state. Several dozen occurrences are known in Montana with many being large, healthy populations. However, information on threats faced by the species, as well as trend data are lacking.						
Bolboschoenus fluviatilis River Bulrush	Scirpus fluviatilis, Schoenoplectus fluviatilis	**Cyperaceae** Sedges	G5	S1					
			Species Occurrences verified in these Counties: Sheridan, Valley **State Rank Reason:** S1 SOC: Accurate identifications of Bolboshchoenus fluviatilis are found in very few populations within three counties of Montana.						

Calamagrostis tweedyi Cascade reedgrass		**Poaceae** Grasses	G3	S3					Montane Forest
			Species Occurrences verified in these Counties: Mineral, Missoula, Ravalli, Sanders **State Rank Reason:** A species of limited distribution and currently considered to be globally rare. Restricted in Montana to the extreme western portion of the state.						
Calochortus bruneaunis Bruneau Mariposa Lily		**Liliaceae** Lillies	G5	S1S3					Grasslands (Intermountain)
			Species Occurrences verified in these Counties: Beaverhead **State Rank Reason:** Known in Montana from one 1941 collection by M. Ownbey approximately 1.5 miles southeast of Lima and a 2009 observation from the Centennial Mtns, though specific observation and locality data are unknown.						
Carex amplifolia Big-leaf Sedge		**Cyperaceae** Sedges	G4	S3		Sensitive - Known on Forests (KOOT)			Wetland
			Species Occurrences verified in these Counties: Flathead, Sanders **State Rank Reason:** *Carex amplifolia* occurs in temperate western North America where it is usually uncommon or rare from coastal lowlands to middle elevations in the mountains (FNA 2002). The previous SH rank in Montana was based on a 1978 herbarium specimen. In recent years it has been collected from several wetlands in Sanders and Flathead Counties. Additional wetland surveys are needed to accurately document its distribution and population size in Montana.						
Carex chordorrhiza Creeping Sedge		**Cyperaceae** Sedges	G5	S3		Sensitive - Known on Forests (FLAT, KOOT) Sensitive - Suspected on Forests (LOLO)		3	Wetland/Riparian
			Species Occurrences verified in these Counties: Flathead, Lincoln, Powell **State Rank Reason:** Rare in Montana, where it is known from fens and wet meadows in the northwest corner of the state. Generally does not appear to be threatened by any particular activities, though populations are susceptible to hydrologic changes.						
Carex comosa Bristly Sedge		**Cyperaceae** Sedges	G5	S1S2				1	Wetland/Riparian
			Species Occurrences verified in these Counties: Flathead **State Rank Reason:** Only one known location in Montana on the shore of Flathead Lake. Occurrence is threatened by erosion caused by wave action and artificially high lake levels.						
Carex crawei Crawe's Sedge		**Cyperaceae** Sedges	G5	S2S3				2	Wetland/Riparian
			Species Occurrences verified in these Counties: Cascade, Pondera, Powell, Prairie, Teton **State Rank Reason:** Rare in Montana, where it is known from several areas. A few sites contain moderate to large populations. Trend data are lacking for the species. Negative impacts to populations from hydrologic changes are a potential threat.						
Carex glacialis Alpine Sedge		**Cyperaceae** Sedges	G5	S3					
			Species Occurrences verified in these Counties: Flathead, Lewis and Clark, Pondera **State Rank Reason:** Carex glacialis occurs throughout Canada, and has recently been discovered in the United States where it occurs at 4 locations in Montana. It grows in limestone fellfield habitats within the alpine. Populations are few, but appear stable. Surveys are needed to explore potential habitat, map its distribution, and determine population sizes.						
Carex gravida Heavy Sedge		**Cyperaceae** Sedges	G5	S3		Sensitive - Known on Forests (CG)		2	Wetland/Riparian
			Species Occurrences verified in these Counties: Big Horn, Carter, Fallon, Mccone, Powder River, Richland, Rosebud **State Rank Reason:** *Carex gravida* has been found at a few widely scattered locations in eastern Montana, and is not generally abundant where it occurs. However, it is likely that the species is more abundant than the current data shows. Habitats include moist, green ash woodlands, which are attractive to livestock, and it may be particularly vulnerable to moderate grazing because of its cespitose growth form. These habitats are also quite vulnerable to invasion by non-native plants.						
Carex idahoa Idaho Sedge	**Carex parryana ssp. idahoa**	**Cyperaceae** Sedges	G3	S3		Sensitive - Known on Forests (BD)	SENSITIVE	2	Wetland/Riparian
			Species Occurrences verified in these Counties: Beaverhead, Broadwater, Deer Lodge, Gallatin, Madison, Powell, Silver Bow **State Rank Reason:** Idaho sedge is a regional endemic known from several dozen sites in Montana which cluster into approx 15-20 populations, most on public lands. The estimated number of stems is in the tens of thousands, but total occupied habitat has been estimated at less than 200 acres. The species is palatable, and populations may be affected by heavy grazing. Other risks are competition from exotic species, hydrologic alterations, agricultural development and road construction/maintenance. Updated population data and related site information are needed.						
Carex incurviformis Coastal Sand Sedge	**Carex maritima var. incurviformis**	**Cyperaceae** Sedges	G4G5	S2?				3	Wetland/Riparian
			Species Occurrences verified in these Counties: Deer Lodge, Glacier, Madison, Teton **State Rank Reason:** Five known occurrences in Montana, three are in Wilderness areas or Glacier National Park. However, all populations are apparently small to moderate in size based on limited survey data for the species. All occurrences are in alpine habitat that is not generally subject to human impacts.						
Carex lacustris Lake-bank Sedge		**Cyperaceae** Sedges	G5	S1S2		Sensitive - Known on Forests (FLAT)		2	Fens and marshes
			Species Occurrences verified in these Counties: Lake, Missoula **State Rank Reason:** A rare species in Montana, known only from a few occurrences from Lake County.						

Carex multicostata Many-ribbed Sedge		Cyperaceae Sedges	G5	S2S3					Grasslands (Montane)
			Species Occurrences verified in these Counties: Beaverhead, Carbon, Gallatin, Granite, Missoula, Park, Ravalli **State Rank Reason:** A rare species in Montana, scattered in the mountains of the southwest and south-central portions of the state. Very little data are available for the species in Montana. However, the potential for negative impacts to the popoulations appears to be low.						
Carex occidentalis Western Sedge		Cyperaceae Sedges	G4	SH					Dry, montane to alpine
			Species Occurrences verified in these Counties: Beaverhead, Gallatin, Silver Bow **State Rank Reason:** Known in Montana from an 1887 collection by Tweedy near "Boulder Creek" and a 1930 collection on Willow Creek in Beaverhead County.						
Carex petricosa Rock Sedge		Cyperaceae Sedges	G4	S1S2				3	Alpine
			Species Occurrences verified in these Counties: Beaverhead, Glacier, Powell, Silver Bow **State Rank Reason:** Rare in Montana, where it is currently known from one site in Glacier National Park. Very little data are available for the species in Montana. However, the potential for negative impacts to the popoulations appears to be low.						
Carex plectocarpa Goose-grass Sedge	Carex lenticularis var. dolia	Cyperaceae Sedges	G3	S3				2	Alpine
			Species Occurrences verified in these Counties: Flathead, Glacier, Park **State Rank Reason:** Known in Montana primarily from Glacier National Park and from one population in the Absarokas. Some plants in the Logan Pass area are subject to trampling by hikers. Otherwise, the potential for negative impacts to the species appears to be low.						
Carex prairea Prairie Sedge		Cyperaceae Sedges	G5	S3		Sensitive - Known on Forests (KOOT)		4	Fens
			Species Occurrences verified in these Counties: Flathead, Lewis and Clark, Lincoln **State Rank Reason:** Rare in Montana, where it is currently known from a small area in the northwest corner of the state. The potential for negative impacts to the popoulations appears to be low.						
Carex rostrata Glaucus Beaked Sedge		Cyperaceae Sedges	G5	S2S3		Sensitive - Known on Forests (KOOT, LOLO) Sensitive - Suspected on Forests (FLAT)		3	Fens
			Species Occurrences verified in these Counties: Flathead, Gallatin, Lincoln, Missoula, Stillwater **State Rank Reason:** This is a rare species in Montana, not to be confused with the more common *Carex utriculata*, which had been mistakenly treated under the name *Carex rostrata* in many past Floras.						
Carex scoparia Pointed Broom Sedge		Cyperaceae Sedges	G5	S1S2					Wetland/Riparian (Valleys)
			Species Occurrences verified in these Counties: Beaverhead, Lake, Missoula, Park, Phillips, Ravalli **State Rank Reason:** Rare in Montana, where it is currently known from only a few sites in the Clark Fork and Bitterroot River drainages.						
Carex stenoptila Small-winged Sedge		Cyperaceae Sedges	G3	S2S3					Grasslands (Montane)
			Species Occurrences verified in these Counties: Carbon, Gallatin, Madison, Mineral, Park, Ravalli, Sheridan, Stillwater, Sweet Grass, Teton **State Rank Reason:** A globally rare species, which is known from several widely scattered locations in Montana. Very little data are available for the species in Montana, as the sites are known only from specimen collections with sparse information.						
Carex stevenii Steven's Scandinavian Sedge	Carex norvegica ssp. stevenii	Cyperaceae Sedges	G5T4?	S2?					Wetland/Riparian (Subalpine)
			Species Occurrences verified in these Counties: Beaverhead, Deer Lodge, Stillwater **State Rank Reason:** Rare in Montana, where it is currently known from a few scattered sites in mountainous areas across the southern half of the state. Additional data on population levels are needed. Survey of suitable habitats will likely document additional occurrences.						
Carex sychnocephala Many-headed Sedge		Cyperaceae Sedges	G5	S1S2				1	Wetland/Riparian
			Species Occurrences verified in these Counties: Cascade, Flathead, Garfield, Glacier, Lake, Lincoln, Sheridan **State Rank Reason:** Currently known in the state from three occurrences that are believed to be extant. Also, known from one 1891 collection near Great Falls and two locations in northwest Montana now believed to be extirpated or severly impacted as a result of wetland draining and construction of a dock. The remaining populations are on the Blackfeet Indian Reservation and a Nature Conservancy Preserve. Due to the habitats in which the species grows, it is vulnerable to development and hydrologic alterations.						
Carex tenuiflora Thin-flowered Sedge		Cyperaceae Sedges	G5	S2				3	Fens
			Species Occurrences verified in these Counties: Flathead **State Rank Reason:** Rare in Montana, where it is currently known from only one site in Glacier National Park. The potential for negative impacts to the occurrence are minimal.						
Carex vaginata Sheathed Sedge		Cyperaceae Sedges	G5	S2?		Sensitive - Known on Forests (KOOT)			Wetland/Riparian
			Species Occurrences verified in these Counties: Lincoln **State Rank Reason:** Rare in Montana, where it is currently known from one area in the northwest corner of the state, which is at the southern edge of the species' range. Additional data on population levels and trends are needed.						

Cyperus acuminatus Short-pointed Flatsedge		Cyperaceae Sedges	G5	S1					Wetland/Riparian
			Species Occurrences verified in these Counties: Missoula, Sanders **State Rank Reason:** Rare in Montana, where it is currently known from only 2 collections in the western portion of the state.						
Cyperus bipartitus Shining Flatsedge	Cyperus rivularis	Cyperaceae Sedges	G5	S1					Wetland/Riparian
			Species Occurrences verified in these Counties: Missoula, Ravalli **State Rank Reason:** Rare in Montana, where it is currently known from only the Bitterroot Valley.						
Cyperus erythrorhizos Red-root Flatsedge		Cyperaceae Sedges	G5	S2?					Wetland/Riparian
			Species Occurrences verified in these Counties: Prairie **State Rank Reason:** Known in Montana from one Prairie County collection in 2008. Previous reports were based upon mis-identified specimens. Survey work in appropriate habitat would likely discover additional locations in Montana. Additional site and population information is needed to more precisely rank the species.						
Cyperus schweinitzii Schweinitz's Flatsedge		Cyperaceae Sedges	G5	S2				4	Sandy sites
			Species Occurrences verified in these Counties: Carter, Cascade, Custer, Powder River, Roosevelt, Sheridan **State Rank Reason:** Rare in Montana, where it is currently known from a few widely scattered sandy sites.						
Cypripedium fasciculatum Clustered Lady's-slipper		Orchidaceae Orchids	G4	S3		Sensitive - Known on Forests (FLAT, KOOT, LOLO)		1	Forests (Montane)
			Species Occurrences verified in these Counties: Lake, Mineral, Missoula, Sanders **State Rank Reason:** Clustered lady's-slipper is known for Montana from the northwest portion of the state, where it is documented from 10 moderate to large populations, 3 historical occurrences and many additional small occurrences. Most populations occur on National Forest lands. Potential negative impacts to the species have mainly been related to timber harvesting.						
Cypripedium passerinum Sparrow's-egg Lady's-slipper		Orchidaceae Orchids	G5	S2S3		Sensitive - Known on Forests (FLAT, HLC, KOOT) Sensitive - Suspected on Forests (LOLO)		2	Forests (Mesic bottoms)
			Species Occurrences verified in these Counties: Flathead, Glacier, Lake, Lewis and Clark, Lincoln, Pondera, Powell, Teton **State Rank Reason:** Sparrow's-egg lady's-slipper is known from over a dozen moderate to large-sized populations, a few dozen small occurrences and one historical location. Several of the occurrences are either in designated wilderness areas or in Glacier National Park. The main threat to populations appears to be from potential hydrologic changes.						
Dichanthelium oligosanthes var. scribnerianum Scribner's Panic Grass	Panicum oligosanthes var. scribnerianum, Panicum scribnerianum	Poaceae Grasses	G5T5	S1S2					Mesic, sandy woodlands (low-elevation)
			Species Occurrences verified in these Counties: Carter, Lake, Powder River, Sanders **State Rank Reason:** Scribner's panic grass is a plant of dry woodlands, known from widely separated sites in southeastern and northwestern Montana. Only one large-sized population is known in the state, two others are very small, and the fourth occurrence is known only from a historical collection. Occurrences in eastern Montana may be negatively impacted by cattle grazing. The largest occurrence in the state lies adjacent to Highway 93 and negative impacts associated with expansion of the highway is likely. Invasive weeds and forest encroachment are also problems at this site.						
Eleocharis rostellata Beaked Spikerush		Cyperaceae Sedges	G5	S3		Sensitive - Known on Forests (BD, CG, FLAT, HLC)		3	Wetlands (Alkaline)
			Species Occurrences verified in these Counties: Carbon, Cascade, Flathead, Gallatin, Lake, Lewis and Clark, Lincoln, Madison, Meagher, Park, Sanders, Sweet Grass, Teton **State Rank Reason:** Known from over a dozen extant sites and a few historical locations. Private and state lands host many occurrences that are vital to the viability of the species in the state. The species is vulnerable to hydrologic alteration and development.						
Elodea bifoliata Long-sheath Waterweed	Elodea longivaginata	Hydrocharitaceae Waterweeds	G4G5	S2?				3	Wetland/Riparian (Shallow water)
			Species Occurrences verified in these Counties: Beaverhead, Fergus, Glacier, Lake, Liberty, Phillips, Stillwater **State Rank Reason:** Rare in Montana, where it is currently known from a few widely scattered locations across the state. Additional population and trend data are needed for the species within Montana.						
Elymus flavescens Sand Wildrye	Leymus flavescens	Poaceae Grasses	G4	S1S2			SENSITIVE	2	Sandy sites
			Species Occurrences verified in these Counties: Beaverhead **State Rank Reason:** Sand wildrye occurs at the edge of its range in Montana, where it is known from one small population in the Centennial Valley sandhills. It requires early successional sandy habitats, which are localized in sand deposition areas of the dunes. This habitat is at risk from dune succession and stabilization that can result from suppression of natural disturbance regimes such as fire and grazing.						
Elymus innovatus Northern Wildrye	Leymus innovatus	Poaceae Grasses	G5	S2		Sensitive - Known on Forests (HLC)		3	Wetland/Riparian (mesic openings /streambanks, low-elevation)

			Species Occurrences verified in these Counties: Cascade, Glacier, Pondera, Teton **State Rank Reason:** Rare in Montana, where it is currently known from a few scattered sites east of the Divide. Additional population data are needed for the species witin Montana. Population trends are unknown and two occurrences are only known from historical collections.						
Epipactis gigantea Giant Helleborine		**Orchidaceae** Orchids	G4	S2S3		Sensitive - Known on Forests (BD, FLAT, HLC, LOLO) Sensitive - Suspected on Forests (BRT, CG, KOOT)		2	Wetland/Riparian
			Species Occurrences verified in these Counties: Carbon, Flathead, Granite, Lake, Lewis and Clark, Lincoln, Madison, Powell, Sanders, Teton **State Rank Reason:** Known from several dozen occurrences across western and southern Montana where it is associated with seeps and springs, fens, and thermal waters. Several sites are likely extirpated, while others are known only from historical collections. National Forest, state and private lands all host significant populations. The species is primarily vulnerable to hydrologic changes and development.						
Eriophorum callitrix Sheathed Cotton-grass		**Cyperaceae** Sedges	G5	S2S3				3	Alpine
			Species Occurrences verified in these Counties: Carbon **State Rank Reason:** Rare in Montana, where it is has been documented only from the Beartooth Plateau. Additional population data for the species in Montana are needed. However, based on the locality and habitat of the known sites, the species does not appear to be at a high degree of risk from human impacts. Additional occurrences likely exist on the Beartooth Plateau.						
Eriophorum gracile Slender Cottongrass		**Cyperaceae** Sedges	G5	S3		Sensitive - Known on Forests (CG, FLAT, KOOT)		2	Fens
			Species Occurrences verified in these Counties: Beaverhead, Flathead, Gallatin, Lake, Lincoln, Madison, Missoula, Park, Powell **State Rank Reason:** Known from a very few large populations, several smaller populations and a half dozen historical or poorly documented locations. Populations occur on a mix of federal, state and private ownerships in northwest Montana at low to moderate elevations. Populations are vulnerable to any activities that may alter the hydrology of occupied sites.						
Festuca viviparoidea Northern Fescue	**Festuca vivipara, Festuca ovina var. vivipara**	**Poaceae** Grasses	G4G5	S2?				3	Alpine
			Species Occurrences verified in these Counties: Flathead, Glacier **State Rank Reason:** Rare in Montana, where it is only know from a few sites in Glacier National park. Population numbers are apparently very low. However, the species generally occurs in areas and habitats that either are not susceptible or not experiencing negative impacts.						
Goodyera repens Northern Rattlesnake-plantain		**Orchidaceae** Orchids	G5	S3		Sensitive - Known on Forests (HLC) Sensitive - Suspected on Forests (CG)		2	Mesic Forest
			Species Occurrences verified in these Counties: Fergus, Flathead, Judith Basin, Meagher, Wheatland **State Rank Reason:** A widespread species that is found in Montana in the Little Belt and Big Snowy Mountains and at one site in Glacier National Park. The species occupies moist, montane forests with a mossy understory. Occurrences are vulnerable to disturbances that open or reduce the canopy such as timber harvesting and fire. Monitoring of the species in the Little Belt Mountains have documented negative impacts associated with both disturbances. However, *Goodyera repens* is known from approximately 20 moderate to large-sized populations and many additional, smaller occurrences. Recent trends are unknown.						
Heteranthera dubia Water Star-grass		**Pontederiaceae** Water-hyacinth Family	G5	S1S2		Sensitive - Known on Forests (FLAT)		2	Aquatic
			Species Occurrences verified in these Counties: Flathead, Sanders **State Rank Reason:** Three occurrences known in Montana, two are moderate-sized populations and the third is of undocumented size. One population is adjacent to a campground and related human activity at this site may have extirpated the population. All sites are vulnerable to changes in hydrology, water quality and recreational impacts.						
Juncus acuminatus Tapered Rush		**Juncaceae** Rushes	G5	S1				2	Wetland/Riparian
			Species Occurrences verified in these Counties: Lake, Lincoln, Teton **State Rank Reason:** Rare in Montana. Only known in the state from one wetland site in Teton County.						
Juncus covillei Coville's Rush		**Juncaceae** Rushes	G5	S2S3					Wetland/Riparian
			Species Occurrences verified in these Counties: Flathead, Mineral, Missoula, Ravalli, Sweet Grass **State Rank Reason:** Rare and peripheral in Montana. Currently known from approximately a half-dozen widely scattered wetland/riparian sites in the mountainous portion of the state.						
Juncus triglumis var. albescens Three-flowered Rush	**Juncus albescens**	**Juncaceae** Rushes	G5	S3				3	Alpine
			Species Occurrences verified in these Counties: Carbon, Flathead, Glacier, Madison, Park, Stillwater **State Rank Reason:** Rare in Montana, where it is known from a few, moist, alpine sites in Glacier National Park and the Absaroka-Beartooth Mountains. The potential for negative impacts from human-caused activities appears to be minimal.						
Kobresia sibirica Large-fruited Kobresia	**Kobresia macrocarpa**	**Cyperaceae** Sedges	G5	S2				3	Alpine

			Species Occurrences verified in these Counties: Carbon **State Rank Reason:** Rare in Montana. Only known in the state from a small area of the Beartooth Plateau.						
Kobresia simpliciuscula Simple Kobresia		**Cyperaceae** Sedges	G5	S3				3	Alpine
			Species Occurrences verified in these Counties: Beaverhead, Carbon, Glacier, Granite, Park, Teton **State Rank Reason:** Rare in Montana, where it is known from over a dozen sites from montane wetlands to mesic, alpine tundra. The species has a wide distribution and is scattered across the mountainous portion of the state.						
Lilaea scilloides Flowering Quillwort	**Triglochin scilloides**	**Juncaginaceae** Arrow-grass family	G5?	S1S2					Wetland/Riparian
			Species Occurrences verified in these Counties: Lake, Phillips **State Rank Reason:** Known in Montana from a couple recent collections and previously from a 1933 collection by C. L. Hitchcock about 2 miles southeast of Charlo and a 1965 collection about 1.5 miles southwest of Ninepipe Reservoir. Population sizes and trends for the species are unknown. However, addiditonal populations are likely to exist as many suitable, though un-surveyed ponds and wetlands exist across the state.						
Lilium columbianum Columbia Lily		**Liliaceae** Lillies	G5	S2					
			Species Occurrences verified in these Counties: Lincoln **State Rank Reason:** Lilium columbianum is currently only known from Lincoln County, where six locations have been documented in the 1970's and 1980's. This species is vulnerable to extirpation in Montana because its attractiveness, potential to be over-collected, and limited range. Native lilies have rarely survived in gardens. Current information on known locations is greatly needed.						
Lilium philadelphicum Wood Lily		**Liliaceae** Lillies	G5	S3					
			Species Occurrences verified in these Counties: Carbon, Carter, Fergus, Lewis and Clark, Lincoln, Pondera, Powder River, Stillwater, Sweet Grass, Teton **State Rank Reason:** Lilium philadelphicum has a patchy, but wide distribution in Montana, and is often found in specialized habitats. Observations in eastern Montana have not been made since the 1930's and 1940's. This species is vulnerable to extirpation in Montana because of its attractiveness, potential to be over-collected, and habitat requirements. Native lilies have rarely survived in gardens. Current information on known locations, especially in the eastern counties, is greatly needed.						
Liparis loeselii Loesel's Twayblade		**Orchidaceae** Orchids	G5	S2		Sensitive - Known on Forests (FLAT)		3	Wetland/Riparian
			Species Occurrences verified in these Counties: Lake **State Rank Reason:** Known from several occurrences clustered in a small area of the Swan Valley. Susceptible to changes in hydrology. May also be susceptible to impacts from fire.						
Najas guadalupensis Guadalupe Water-nymph		**Najadaceae** Water-nymph Family	G5	S2S3					Aquatic
			Species Occurrences verified in these Counties: Blaine, Carter, Cascade, Flathead, Lake, Pondera, Ravalli **State Rank Reason:** Rare. Currently documented from a few fresh water sites in the western and central portions of the state. Species is poorly documented in Montana and additional information on population levels, trends and threats is needed.						
Phippsia algida Ice Grass		**Poaceae** Grasses	G5	S2S3				3	Alpine
			Species Occurrences verified in these Counties: Carbon, Stillwater **State Rank Reason:** Rare in Montana, where it has been documented from only a few sites on the Beartooth Plateau. Additional surveys of suitable habitat and revisits of documented occurrences are needed to more accurately assess the species' conservation status.						
Poa laxa ssp. banffiana Banff Bluegrass		**Poaceae** Grasses	G5?T1	S1					Alpine
			Species Occurrences verified in these Counties: Glacier						
Potamogeton obtusifolius Blunt-leaved Pondweed		**Potamogetonaceae** Pondweeds	G5	S3		Sensitive - Known on Forests (FLAT, HLC) Sensitive - Suspected on Forests (LOLO)		2	Aquatic
			Species Occurrences verified in these Counties: Flathead, Glacier, Lake, Missoula, Powell **State Rank Reason:** Known from over a dozen occurrences in northwest Montana. Several contain moderate to large-size populations and occur in valley and foothill locations in a variety of federal, state, and private ownerships. A few populations are on lands managed specifically for their conservation value. Some populations are vulnerable to impacts associated with development, recreation and increased sediment and nutrient loads.						
Puccinellia lemmonii Lemmon's Alkaligrass		**Poaceae** Grasses	G4	S1S2				2	Wetland/Riparian
			Species Occurrences verified in these Counties: Beaverhead, Madison **State Rank Reason:** Very rare in Montana where it is known only from Beaverhead County on BLM and State Trust Lands. At least one site is actively grazed, though its susceptibility and response to such activity is uncertain.						
Scheuchzeria palustris Pod Grass		**Scheuchzeriaceae** Pod-grasses	G5	S3		Sensitive - Known on Forests (BD, FLAT, KOOT, LOLO) Sensitive - Suspected on Forests (BRT)		2	Wetland/Riparian

			Species Occurrences verified in these Counties: Flathead, Granite, Lake, Lincoln, Missoula **State Rank Reason:** Known in Montana from several dozen fens west of the Continental Divide. Several locations are known only from historical surveys or collections, or from sites that need additional surveys to document the populations. The majority of populations are on National Forest lands with MT State Trust lands, private and National Park lands supporting the remaining occurrences. Populations are primarily vulnerable to activities that change the hydrology of the occupied fen and wetland habitats.						
Schoenoplectus heterochaetus Slender Bulrush	**Scirpus heterochaetus**	**Cyperaceae** Sedges	G5	S1S2					Wetland/Riparian
			Species Occurrences verified in these Counties: Carter, Glacier, Lake, Phillips, Sheridan **State Rank Reason:** Information on the species is lacking within montana where it is recorded from only two poorly documented sites. However, its apparent rarity in the state warrants a high conservation status rank.						
Schoenoplectus subterminalis Water Bulrush	**Scirpus subterminalis**	**Cyperaceae** Sedges	G5	S3		Sensitive - Known on Forests (FLAT, HLC, KOOT, LOLO)		2	Wetland/Riparian
			Species Occurrences verified in these Counties: Flathead, Lake, Lewis and Clark, Lincoln, Missoula **State Rank Reason:** Over a dozen known occurrences in western Montana, most of which are moderate to large-sized populations primarily on National Forest lands. Populations are potentially vulnerable to changes in water levels or increases in nutrient and sediment loads associated with development, agriculture or adjacent timber harvesting.						
Scolochloa festucacea Sprangletop		**Poaceae** Grasses	G5	S1					
			Species Occurrences verified in these Counties: Flathead **State Rank Reason:** Scolochloa festucacea occurs through most of Canada and in portions of mid-western and western States. In Montana it is known from 3 locations collected from 1949 to 1999 in Flathead County. A fourth location from a specimen with a poorly defined location in Carbon county needs to be verified. Surveys to find this species have been unsuccessful.						
Sisyrinchium septentrionale Northern Blue-eyed-grass		**Iridaceae** Irises	G4	S1S2				3	Wetland/Riparian
			Species Occurrences verified in these Counties: Sheridan **State Rank Reason:** Rare in Montana, where it is known from one prairie site in the northeastern corner of the state. Population information and related habitat data from the known location are lacking.						
Spiranthes diluvialis Ute ladies'-tresses		**Orchidaceae** Orchids	G2G3	S1S2	LT			2	Wetland/Riparian
			Species Occurrences verified in these Counties: Beaverhead, Broadwater, Gallatin, Jefferson, Madison **State Rank Reason:** *Spiranthes diluvialis* (Ute ladies'-tresses) is known from only a handful of occurrences in southwest and south-central Montana in the Missouri, Jefferson, Beaverhead, Ruby and Madison River drainages. *S. diluvialis* is restricted in area by specific hydrologic requirements. Many populations have less than 100 individuals, though a couple have over 500 plants. Sites are susceptible to hydrologic changes and weed invasion. Large areas of habitat have been converted to agricultural uses. Livestock grazing is also a common use of these habitats. Two populations occur along highway right-of-ways. Most populations occur on private lands and only one occurrence is currently provided some potential protection or management for its conservation value.						
Sporobolus compositus Tall Dropseed	**Sporobolus asper**	**Poaceae** Grasses	G5	SH					Forests/Grasslands (open, plains)
			Species Occurrences verified in these Counties: Big Horn, Carter, Custer **State Rank Reason:** Known in Montana from 3 collections; a 1939 collection near Ekalaka, a 1957 collection from Fort Keogh Livestock and Range Laboratory and a 1980 collection from Bighorn County.						
Sporobolus neglectus Small Dropseed		**Poaceae** Grasses	G5	S1S2					Grasslands (low-elevation)
			Species Occurrences verified in these Counties: Gallatin, Sanders, Wheatland **State Rank Reason:** Rare in Montana, where it is known from a few widely scattered and poorly documented sites.						
Stipa lettermanii Letterman's Needlegrass	**Achnatherum lettermanii**	**Poaceae** Grasses	G5	S1S3					Talus and Grasslands (low-elevation)
			Species Occurrences verified in these Counties: Beaverhead, Big Horn, Broadwater, Carbon, Gallatin, Jefferson, Madison, Mineral, Park, Powell **State Rank Reason:** Documented from several locations in the southern portion of the state. However, population levels, site characteristics and related information needed to determine the species' status are lacking.						
Tofieldia pusilla Small Tofieldia		**Liliaceae** Lillies	G5	S2				3	Alpine
			Species Occurrences verified in these Counties: Flathead, Glacier **State Rank Reason:** Very rare in Montana, where it is known from only a very small area in Glacier National Park.						
Trichophorum alpinum Hudson's Bay Bulrush	**Scirpus hudsonianus, Eriophorum alpinum**	**Cyperaceae** Sedges	G5	S2				2	Fens and cold, wet slopes
			Species Occurrences verified in these Counties: Flathead, Glacier **State Rank Reason:** Rare in Montana, where it is only known from a few sites in the northwest corner of the state.						
Trichophorum cespitosum Tufted Club-rush	**Scirpus cespitosus, Trichophorum caespitosum**	**Cyperaceae** Sedges	G5	S2		Sensitive - Known on Forests (BD, FLAT, HLC, KOOT)		3	Fens and wet meadows
			Species Occurrences verified in these Counties: Beaverhead, Flathead, Glacier, Lake, Lincoln, Powell, Teton **State Rank Reason:** Rare in Montana, where it is currently documented from over a dozen fens and wet meadows in the mountainous portion of western Montana.						

Trichophorum pumilum Rolland's bulrush	Scirpus pumilus, Scirpus rollandii	Cyperaceae Sedges	G5	S3				3	Fens
			Species Occurrences verified in these Counties: Glacier, Teton **State Rank Reason:** Rare in Montana, where it is currently documented from only a few calcareous fens near the Rocky Mtn Front.						
Veratrum californicum California False-hellebore		Liliaceae Lillies	G5	S2		Sensitive - Known on Forests (BD, BRT) Sensitive - Suspected on Forests (CG, HLC)			Wetland/Riparian
			Species Occurrences verified in these Counties: Flathead, Gallatin, Granite, Lake, Lewis and Clark, Lincoln, Meagher, Powell, Ravalli **State Rank Reason:** Rare in Montana, where it is known from a very localized area in the southwestern corner of the state.						
Wolffia columbiana Columbia Water-meal		Lemnaceae Duckweeds	G5	S2S3					Aquatic
			Species Occurrences verified in these Counties: Flathead, Lake, Missoula, Ravalli **State Rank Reason:** Rare. Known from several water bodies in the valleys of western Montana. Additional information on the species is needed within Montana to more precisely determine the species' conservation status.						

BRYOPHYTES (BRYOPHYTA) 50 SPECIES

SCIENTIFIC NAME COMMON NAME TAXA SORT	OTHER NAMES	FAMILY (SCIENTIFIC) FAMILY (COMMON)	GLOBAL RANK	STATE RANK	USFWS	USFS	BLM	MNPS THREAT CATEGORY	HABITAT
Aloina brevirostris Short-beaked Aloe Moss		Pottiaceae	G4G5	S1					
			Species Occurrences verified in these Counties: Flathead, Lincoln						
Catoscopium nigritum Black Golf Club Moss		Catoscopiaceae	G5	S1					
			Species Occurrences verified in these Counties: Flathead, Glacier, Lewis and Clark, Lincoln						
Cinclidium stygium A Cinclidium Moss		Mniaceae	G5	S1					
			Species Occurrences verified in these Counties: Teton						
Cynodontium tenellum A Cynodontium Moss		Dicranaceae	G5	S1					
			Species Occurrences verified in these Counties:						
Dichodontium olympicum Olympic Dichodontium Moss	Olympic Fork Moss	Dicranaceae	G3G5	S1					
			Species Occurrences verified in these Counties:						
Dicranella schreberiana Schreber's Dicranella Moss	Dicranella grevilleana Schreber's Fork Moss	Dicranaceae	G5	S1					
			Species Occurrences verified in these Counties: Flathead, Glacier **State Rank Reason:** D. grevilleana had previously been ranked S1, but is now a synonym for D. schreberiana. Until a full review of the species can be performed, D. schreberiana (previously unranked) will be given the rank assigned to D. grevilleana.						
Dicranum acutifolium Acuteleaf Dicranum Moss		Dicranaceae	G5	S1					
			Species Occurrences verified in these Counties: Ravalli						
Eucladium verticillatum Lime-Seep Eucladium Moss	Whorled Tufa Moss	Pottiaceae	G4	S1					
			Species Occurrences verified in these Counties: Granite, Powell						
Fabronia pusilla Silky Urn Moss	Fabronia Moss	Fabroniaceae	G4G5	S1					
			Species Occurrences verified in these Counties: Madison						
Fissidens fontanus Flat Pocket Moss	A Pocket Moss	Fissidentaceae	G5	S1					
			Species Occurrences verified in these Counties: Granite						
Grimmia brittoniae Britton's Dry Rock Moss	Britton's Black Rock Moss	Grimmiaceae	G2	S2		Sensitive - Known on Forests (KOOT, LOLO) Sensitive - Suspected on Forests (FLAT)			
			Species Occurrences verified in these Counties: Flathead, Sanders						
Grimmia incurva Curved Dry Rock Moss	Curved Black Rock Moss	Grimmiaceae	G4G5Q	S1					
			Species Occurrences verified in these Counties: Ravalli						

Hamatocaulis vernicosus Hamatocaulis Moss	Drepanocladus vernicosus	Amblystegiaceae	G5	S1						**Species Occurrences verified in these Counties:** Flathead, Lincoln
Haplodontium macrocarpum Waterfall Copper Moss	Mielichhoferia macrocarpa, Bryum porsildii	Bryaceae	G2G3	S1						**Species Occurrences verified in these Counties:** **State Rank Reason:** One specimen collected froma population growing on a wet limestone cliff in Park County, MT in 1973.
Hennediella heimii Heim's Hennediella Moss	Desmatodon heimii	Pottiaceae	G5	S1						**Species Occurrences verified in these Counties:** Ravalli
Homalothecium megaptilum Giant Golden Moss	Trachybryum megaptilum	Brachytheciaceae	G4	S1						**Species Occurrences verified in these Counties:** Mineral **State Rank Reason:** Endemic to western North America. In Montana it occurs on the eastern edge of its distribution.
Hygroamblystegium varium ssp. noterophilum A Conecap Moss	Hygroamblystegium noterophilum A Hygroamblystegium Moss	Amblystegiaceae	G4	S1						**Species Occurrences verified in these Counties:**
Leucolepis acanthoneuron Umbrella Moss	Leucolepis menziesii	Mniaceae	G4G5	S1						**Species Occurrences verified in these Counties:** Lincoln, Sanders
Meesia longiseta Meesia Moss		Meesiaceae	G5	S1						**Species Occurrences verified in these Counties:** Flathead
Meesia triquetra Meesia Moss		Meesiaceae	G5	S2		Sensitive - Known on Forests (BRT, CG, FLAT, KOOT) Sensitive - Suspected on Forests (LOLO)				**Species Occurrences verified in these Counties:** Carbon, Flathead, Glacier, Lake, Lincoln, Ravalli, Sanders, Teton
Meesia uliginosa Meesia Moss	Broad-leaved Hump Moss	Meesiaceae	G5	S1S2						**Species Occurrences verified in these Counties:** Flathead, Glacier, Lincoln
Meiotrichum lyallii Lyall's Polytrichum Moss	Polytrichum lyallii, Polytrichadelphus lyallii, Polytrichastrum lyallii	Polytrichaceae	G3G5	S1						**Species Occurrences verified in these Counties:**
Myurella tenerrima A Mousetail Moss		Pterigynandraceae	G5	S1						**Species Occurrences verified in these Counties:** Glacier
Neckera douglasii Douglas' Neckera Moss		Neckeraceae	G4	S1						**Species Occurrences verified in these Counties:** Flathead, Lake, Sanders
Paludella squarrosa Angled Paludella Moss		Meesiaceae	G5	S1S2						**Species Occurrences verified in these Counties:** Carbon, Flathead, Glacier
Paraleucobryum enerve A Windblown Moss		Dicranaceae	G5?	S1						**Species Occurrences verified in these Counties:** Flathead, Glacier
Physcomitrium hookeri Hooker's Physcomitrium Moss		Funariaceae	G2G4	S1						**Species Occurrences verified in these Counties:**
Porotrichum bigelovii Bigelow's Porotrichum Moss		Thamnobryaceae	G4	S1						**Species Occurrences verified in these Counties:** Ravalli
Pseudocrossidium obtusulum A Pseudocrossidium Moss		Pottiaceae	GU	S1						**Species Occurrences verified in these Counties:** Musselshell, Ravalli
Ptychostomum schleicheri Schleicher's Ptychostomum Moss	Bryum schleicheri	Bryaceae	G5?	S1						**Species Occurrences verified in these Counties:** Glacier

Rhynchostegium aquaticum Aquatic Rhynchostegium Moss	**Eurhynchium riparioides, Platyhpnidium riparioides, Platyhpnidium aquaticum**	**Brachytheciaceae**	G4	S1					
			Species Occurrences verified in these Counties: Lincoln						
Sarmentypnum exannulatum Warnstorfia Moss	**Warnstorfia exannulata**	**Amblystegiaceae**	G5	S1					
			Species Occurrences verified in these Counties: Lincoln						
Scorpidium revolvens Limprichtia Moss	**Drepanocladus revolvens, Limprichtia revolvens**	**Amblystegiaceae**	G5	S1					
			Species Occurrences verified in these Counties: Lake						
Scorpidium scorpioides A Scorpidium Moss		**Amblystegiaceae**	G5	S2		Sensitive - Known on Forests (FLAT, HLC, KOOT)			
			Species Occurrences verified in these Counties: Flathead, Glacier, Lake, Lewis and Clark, Lincoln, Missoula, Teton						
Sphagnum angustifolium Narrowleaf Peatmoss		**Sphagnaceae** Peat Mosses	G5	S2					
			Species Occurrences verified in these Counties: Sanders						
Sphagnum centrale A Peatmoss		**Sphagnaceae** Peat Mosses	G5	S1					
			Species Occurrences verified in these Counties: Flathead, Ravalli, Sanders						
Sphagnum compactum Cushion Peatmoss	Low Peatmoss	**Sphagnaceae** Peat Mosses	G5	S1					
			Species Occurrences verified in these Counties: Granite						
Sphagnum contortum Contorted Sphagnum Moss		**Sphagnaceae** Peat Mosses	G5	S1					
			Species Occurrences verified in these Counties: Flathead, Lincoln						
Sphagnum fimbriatum Fringed Bogmoss	Ragged Hair Peatmoss	**Sphagnaceae** Peat Mosses	G5	S1					
			Species Occurrences verified in these Counties: Lewis and Clark						
Sphagnum fuscum Brown Hair Peatmoss	Brown Peatmoss	**Sphagnaceae** Peat Mosses	G5	S2					
			Species Occurrences verified in these Counties: Lincoln, Ravalli						
Sphagnum girgensohnii Star Hair Peatmoss	Girgensohn's Peatmoss	**Sphagnaceae** Peat Mosses	G5	S1					
			Species Occurrences verified in these Counties:						
Sphagnum magellanicum Red Spoon Peatmoss	Magellan's Peatmoss	**Sphagnaceae** Peat Mosses	G5	S1					
			Species Occurrences verified in these Counties: Flathead, Lincoln, Missoula, Ravalli						
Sphagnum mendocinum Mendocino Peatmoss		**Sphagnaceae** Peat Mosses	G4G5	S1					
			Species Occurrences verified in these Counties: Missoula						
Sphagnum riparium Streamside Peatmoss	Streamside Sphagnum Moss	**Sphagnaceae** Peat Mosses	G5	S1					
			Species Occurrences verified in these Counties: Missoula						
Sphagnum wulfianum Wulf's Peatmoss		**Sphagnaceae** Peat Mosses	G5	S1					
			Species Occurrences verified in these Counties: Lake, Lincoln						
Stegonia latifolia Wideleaf Stegonia Moss	A Twist Moss	**Pottiaceae**	G5T4T5	S1					
			Species Occurrences verified in these Counties:						
Syntrichia bartramii Bartram's Syntrichia Moss	**Tortula bartramii** Bartram's Twist Moss	**Pottiaceae**	G2G4	S1					
			Species Occurrences verified in these Counties: Ravalli **State Rank Reason:** *Tortula* species with leaves turning red in 2% KOH solution, among other characteristics, have been placed in *Henediella*, *Microbryum*, or *Syntrichia*. Reduction in sporophyte development, such as capsule and peristome development, is prominent in *Tortula* but for which there is little evidence in *Syntrichia* (FNA 2007).						
Syntrichia norvegica Norwegian Syntrichia Moss	**Tortula norvegica** Norwegian Twist Moss	**Pottiaceae**	G5	S1					
			Species Occurrences verified in these Counties: Glacier, Lake, Madison						
Syntrichia papillosissima Antler Twist Moss	**Tortula papillosissima** Antler Moss	**Pottiaceae**	G3G5	S1					
			Species Occurrences verified in these Counties: Musselshell, Ravalli, Sanders						
Tortula acaulon Elfin Crisp Moss	**Phascum acaulon, Phascum cuspidatum** Entire-Leaf Nitrogen Moss	**Pottiaceae**	G5	S1					
			Species Occurrences verified in these Counties: Ravalli						

LICHENS (FUNGI) 32 SPECIES

SCIENTIFIC NAME COMMON NAME TAXA SORT	OTHER NAMES	FAMILY (SCIENTIFIC) FAMILY (COMMON)	GLOBAL RANK	STATE RANK	USFWS	USFS	BLM	MNPS THREAT CATEGORY	HABITAT
Arctomia delicatula Delicate Arctic Scale Lichen		Arctomiaceae	GNR	S1					
			Species Occurrences verified in these Counties:						
Arctoparmelia subcentrifuga Subcentric Ring Lichen		Parmeliaceae	G4G5	S1					
			Species Occurrences verified in these Counties: Missoula **State Rank Reason:** In Montana known froma few sites in the western and central regions of the state.						
Cetraria commixta Friendly Camouflage Lichen	Cetrariella commixta, Melanelia commixta	Parmeliaceae	G5	S1					
			Species Occurrences verified in these Counties: Flathead, Glacier **State Rank Reason:** Known from very few locations in northwest Montana.						
Circinaria rogeri Roger's Vagabond Lichen	Aspicilia fruticulosa, Aspicilia rogeri	Megasporaceae	G2G3	S1					
			Species Occurrences verified in these Counties: Carbon **State Rank Reason:** In Montana known from one location in south-central region of the state.						
Cladonia botrytes Stump Pixie-Cup Lichen	Stump Soldiers, Wooden Soldiers	Cladoniaceae	G5	S1					
			Species Occurrences verified in these Counties: Flathead, Lincoln **State Rank Reason:** This species is common northward, but is found sporadically in Montana and east to the Black Hills and south to Colorado.						
Cladonia uncialis Thorny Pixie-Sticks		Cladoniaceae	G5	S1					
			Species Occurrences verified in these Counties: Lake **State Rank Reason:** Known to occur at one location in Montana.						
Collema curtisporum Pustulate Tarpaper Lichen		Collemataceae	G3	S1		Sensitive - Known on Forests (FLAT, KOOT)			
			Species Occurrences verified in these Counties: Flathead, Glacier, Lake, Mineral, Sanders **State Rank Reason:** In Montana this lichen occurs in a few locations and is not always present where habitat appears to be suitable.						
Dactylina ramulosa Frosted Finger Lichen		Parmeliaceae	G5	S2					
			Species Occurrences verified in these Counties: Park, Ravalli						
Gyalectaria diluta Diluted Wart Lichen	Pertusaria diluta	Coccotremataceae	GNR	S1					
			Species Occurrences verified in these Counties: **State Rank Reason:** This species was first recognized in Montana. The Type specimen is from the Cabinet Mountains and is currently the only Montana occurrence.						
Lobaria amplissima Large Lungwort Lichen		Lobariaceae	GNR	SNR					
			Species Occurrences verified in these Counties: **State Rank Reason:** Known from one location in western Montana.						
Lobaria anomala Netted Lungwort Lichen	Pseudocyphellaria anomala	Lobariaceae	G2G4	S1					
			Species Occurrences verified in these Counties: Lake **State Rank Reason:** Known in western Montana from a few locations.						
Lobaria hallii Gray Lungwort Lichen		Lobariaceae	G4?	S2					
			Species Occurrences verified in these Counties: Flathead, Lake, Lincoln, Missoula, Sanders **State Rank Reason:** Known from several locations in western Montana.						
Lobaria linita Cabbage Lungwort Lichen		Lobariaceae	G5	S1					
			Species Occurrences verified in these Counties: Ravalli **State Rank Reason:** Known from very few locations in western Montana.						
Lobaria scrobiculata Textured Lungwort Lichen		Lobariaceae	G5	S1					
			Species Occurrences verified in these Counties: Lake, Mineral **State Rank Reason:** Known from one location in western Montana.						
Melanohalea septentrionalis Northern Camouflage Lichen		Parmeliaceae	G5	S1					
			Species Occurrences verified in these Counties: **State Rank Reason:** Montana occurs on the southern edge of this species range, where it has been found occasionally.						

Nodobryoria subdivergens Alpine Foxtail Lichen	Alectoria subdivergens, Bryoria subdivergens	Parmeliaceae	G2G3	S1S2		Sensitive - Known on Forests (BRT, KOOT)			
			Species Occurrences verified in these Counties: Glacier, Lincoln, Ravalli **State Rank Reason:** Known fromseveral locations in western Montana where its abundance is always sparse.						
Normandina pulchella Elf-Ear Lichen		Verrucariaceae	G4G5	S1					
			Species Occurrences verified in these Counties: Missoula, Ravalli **State Rank Reason:** In the Rocky Mountains, this lichen has a spotty distribution. Known in Montana fromone location.						
Parmeliella triptophylla Fingered Shingle Lichen	Pannaria triptophylla Black-bordered Shingle Lichen	Pannariaceae	G5	S1					
			Species Occurrences verified in these Counties: Glacier, Lake, Missoula, Ravalli **State Rank Reason:** Locally rare when found.						
Peltigera gowardii Western Waterfan Lichen	Peltigera hydrothyria [name misapplied in western North America]	Peltigeraceae	G3G4	S1					
			Species Occurrences verified in these Counties: Missoula, Ravalli **State Rank Reason:** Known froma fewsites in western Montana.						
Peltigera pacifica Fringed Pelt Lichen		Peltigeraceae	G3G4	S1					
			Species Occurrences verified in these Counties: **State Rank Reason:** Known fromone location in western Montana, but expected to be more present.						
Phaeophyscia kairamoi Least Shadow Lichen		Physciaceae	G4G5	S2					
			Species Occurrences verified in these Counties: Flathead, Lake **State Rank Reason:** This species occurs sporadically in the northern United States and southern Canada and is known froma few locations in western Montana.						
Ramalina labiosorediata Chalky Bush Lichen	Ramalina pollinaria	Ramalinaceae	G4	S1					
			Species Occurrences verified in these Counties: Lake **State Rank Reason:** Known in western Montana fromseveral locations.						
Ramalina obtusata Hooded Bush Lichen		Ramalinaceae	G5	S2					
			Species Occurrences verified in these Counties: Flathead, Lake, Ravalli **State Rank Reason:** In Montana sporadic occurrences have been found in western Montana.						
Rhizoplaca haydenii Hayden's Rimmed Navel Lichen		Lecanoraceae	G2G3	S1S2					
			Species Occurrences verified in these Counties: Beaverhead, Carbon **State Rank Reason:** Known froma few locations in south-central to southeastern Montana. This species is also likely to be found in appropriate habitats in southwestern Montana. Both subspecies are found in Montana: R. haydenii ssp. haydenii and R. haydenii ssp arbuscular.						
Sclerophora amabilis Lovely Pin Lichen		Coniocybaceae	G4G5	S1					
			Species Occurrences verified in these Counties: Lincoln **State Rank Reason:** In Montana known fromone location.						
Solorina bispora Lesser Tundra Owl Lichen		Peltigeraceae	G5	S1S2					
			Species Occurrences verified in these Counties: Beaverhead, Carbon, Flathead, Glacier, Missoula **State Rank Reason:** Known froma few locations in western Montana.						
Solorina octospora Greater Tundra Owl Lichen		Peltigeraceae	G3G5	S1					
			Species Occurrences verified in these Counties: **State Rank Reason:** In Montana known fromone location in the northwest.						
Solorina spongiosa Fringed Chocolate Chip Lichen		Peltigeraceae	G4G5	S1S2					
			Species Occurrences verified in these Counties: Flathead, Lake, Lewis and Clark **State Rank Reason:** Known froma few locations in western and central portions of Montana.						
Sphaerophorus tuckermanii Tuckermann's Coral Lichen		Sphaerophoraceae	G5	S1					
			Species Occurrences verified in these Counties: **State Rank Reason:** Known fromtwo locations in northwestern Montana.						
Stereocaulon paschale Easter Foam Lichen		Stereocaulaceae	G5	S1S2					
			Species Occurrences verified in these Counties: Lake **State Rank Reason:** Known froma few locations in northwest and south-central Montana.						
Umbilicaria hirsuta Granulating Rocktripe Lichen		Umbilicariaceae	G2G4	S1					
			Species Occurrences verified in these Counties: **State Rank Reason:** This species is apparently rare throughout its range in North America. In Montana it is known fromone location.						

Verrucaria kootenaica Kootenai Speck Lichen		**Verrucariaceae**	G2	S1S2					
			Species Occurrences verified in these Counties: Flathead, Lake **State Rank Reason:** Known in western Montana from a few locations.						

Potential Species of Concern
90 Species
All Records (no filtering)

FERNS AND FERN ALLIES (PTERIDOPHYTA) — 4 SPECIES

SCIENTIFIC NAME COMMON NAME TAXA SORT	OTHER NAMES	FAMILY (SCIENTIFIC) FAMILY (COMMON)	GLOBAL RANK	STATE RANK	USFWS	USFS	BLM	MNPS THREAT CATEGORY	HABITAT
Asplenium trichomanes Maidenhair Spleenwort		**Aspleniaceae** Spleenwort Family	G5	SH					Rock/Talus
			Species Occurrences verified in these Counties: Flathead **State Rank Reason:** Known fromone 1895 collection with imprecise location data near "Columbia Falls" in Flathead County.						
Botrychium montanum Mountain Moonwort		**Ophioglossaceae** Adder's-Tongue / Moonworts	G3	S3S4					Forests (Mesic bottmlands)/Open sites
			Species Occurrences verified in these Counties: **State Rank Reason:** This moonwort species is known fromnumerous observations in western Montana. Populations are often small and most have been found in old growth Western Red Cedar forest, though some have been documented fromsecond growth forests. Populations occur on a mix of federal, state and private ownerships. Montana supports a significant percentage of the species range-wide populations.						
Botrychium sp. (Non-SOC) Moonworts (Non-SOC)		**Ophioglossaceae** Adder's-Tongue / Moonworts	GNR	S3S5					
			Species Occurrences verified in these Counties: Cascade, Deer Lodge, Flathead, Glacier, Granite, Lake, Lewis and Clark, Lincoln, Mineral, Missoula, Pondera, Powell, Sanders, Teton **State Rank Reason:** This is a general record for Botrychiumspecies tracked by MTNHP. MTNHP tracks and maintains observation data for all Botrychium species in the state excluding B. multifidumand B. virginianumwhich are fairly common and readily identifiable fromall other Botrychiums. Global and State Ranks for this record are placeholders only to allow BotrychiumSOC to appear in searches using global and state ranks. For information pertinent to specific Botrychiumspecies, please see the individual species' accounts.						
Cystopteris montana Mountain Bladder Fern		**Dryopteridaceae** Wood Fern Family	G5	SH					Rock/talus
			Species Occurrences verified in these Counties: Flathead, Glacier, Sanders **State Rank Reason:** Reported for Montana fromone collection in 1932 near Gunsight Pass in Glacier National Park.						

FLOWERING PLANTS - DICOTS (MAGNOLIOPSIDA) — 53 SPECIES

SCIENTIFIC NAME COMMON NAME TAXA SORT	OTHER NAMES	FAMILY (SCIENTIFIC) FAMILY (COMMON)	GLOBAL RANK	STATE RANK	USFWS	USFS	BLM	MNPS THREAT CATEGORY	HABITAT
Agoseris lackschewitzii Pink Agoseris	**Agoseris aurantiaca var. aurantiaca, Agoseris carnea**	**Asteraceae** Aster/Sunflowers	G4Q	S3S4					
			Species Occurrences verified in these Counties: Beaverhead, Carbon, Cascade, Deer Lodge, Gallatin, Granite, Judith Basin, Liberty, Madison, Meagher, Park, Silver Bow, Sweet Grass **State Rank Reason:** See rank details.						
Allotropa virgata Candystick		**Ericaceae** Heath Family	G4	S3S4					
			Species Occurrences verified in these Counties: Beaverhead, Deer Lodge, Granite, Ravalli **State Rank Reason:** Limited distribution and small population sizes make the species potentially vulnerable to impacts to its habitat, primary lodgepole pine stands. Trend and monitoring data for the species are lacking. However, populations are presumed to be relatively stable at the present time.						
Aquilegia jonesii Jones' Columbine		**Ranunculaceae** Buttercup Family	G3	S3S4					
			Species Occurrences verified in these Counties: Fergus, Flathead, Gallatin, Glacier, Judith Basin, Lewis and Clark, Stillwater, Sweet Grass, Teton						
Arabidopsis lyrata Lyre-leaf Rockcress	**Arabis lyrata, Arabis kamchatica**	**Brassicaceae** Mustards	G5	SH					NA
			Species Occurrences verified in these Counties: Flathead **State Rank Reason:** Known fromone 1952 collection near Mount Brown in Glacier National Park.						
Atriplex canescens Four-wing Saltbush		**Amaranthaceae** Amaranth (Pigweed) Family	G5	S3S4					
			Species Occurrences verified in these Counties: Blaine, Carbon, Carter, Jefferson, Mccone, Musselshell, Park, Pondera, Powder River, Rosebud, Silver Bow, Toole, Wheatland						
Atriplex suckleyi Suckley's Saltbush	**Atriplex dioica (Nutt.) Macbr. [not Raf.], Endolepis dioica**	**Amaranthaceae** Amaranth (Pigweed) Family	G4	S3S4					

			Species Occurrences verified in these Counties: Carter, Phillips, Roosevelt, Valley, Wheatland, Yellowstone **State Rank Reason:** Few collections from Montana, mostly along the Missouri River Breaks. However, this species has weedy tendencies. MONT collections from Valley, McCone Counties.						
Balsamorhiza macrophylla Large-leaved Balsamroot		**Asteraceae** Aster/Sunflowers	G3G5	S3S4		Sensitive - Known on Forests (BD, CG)		3	Sagebrush-grassland
			Species Occurrences verified in these Counties: Beaverhead, Gallatin, Madison **State Rank Reason:** This species occurs in Montana at the edge of its range where it is known from three southwestern Montana mountain ranges. Most of the known populations are moderate to large in size and in generally good-quality habitat. One occurrence in Gallatin County is only known from a 1931 collection. Invasive weeds are not a problem at sites occupied by *Balsamorhiza macrophylla* and livestock grazing at some of the sites does not appear to be negatively impacting the species.						
Camissonia minor Small-flowered Evening-primrose	**Oenothera minor**	**Onagraceae** Evening-primrose Family	G4	S3S4					
			Species Occurrences verified in these Counties: Carbon						
Ceanothus herbaceus New Jersey Tea		**Rhamnaceae** Buckthorn Family	G5	SH					Forests (Dry, Open)
			Species Occurrences verified in these Counties: Powder River **State Rank Reason:** Known from one 1948 specimen collection with imprecise location data in Powder River County that noted a "few" plants. Subsequent surveys have not been able to relocate this species.						
Centaurium exaltatum Western Centaury	**Zeltnera exaltata**	**Gentianaceae** Gentians	G5	SH					Wetland/Riparian
			Species Occurrences verified in these Counties: Big Horn, Treasure, Yellowstone **State Rank Reason:** Known from one 1890 collection with imprecise location data from Big Horn County, "seven miles south of Custer Station".						
Collomia tinctoria Yellow-staining Collomia		**Polemoniaceae** Phlox Family	G5	SH					Grasslands/Rocky slopes (Valleys to Montane)
			Species Occurrences verified in these Counties: Flathead, Teton **State Rank Reason:** Has not been collected in Montana for over 100 years.						
Cryptantha flavoculata Pale Yellow Cryptantha		**Boraginaceae** Borage Family	G5	S3S4					
			Species Occurrences verified in these Counties: Carbon						
Delphinium bicolor ssp. calcicola Limestone Larkspur		**Ranunculaceae** Buttercup Family	G4G5T3T4	S3S4				3	
			Species Occurrences verified in these Counties: Beaverhead, Broadwater, Carbon, Jefferson, Lewis and Clark, Madison, Missoula, Silver Bow **State Rank Reason:** A Montana endemic.						
Delphinium glaucescens Electric Peak Larkspur		**Ranunculaceae** Buttercup Family	G3G4	S3S4					
			Species Occurrences verified in these Counties: Beaverhead, Deer Lodge, Granite, Madison, Park, Silver Bow **State Rank Reason:** Occurs in southwest Montana at relatively high elevations. Though it has a restricted distribution, it may not be that uncommon.						
Drosera rotundifolia Roundleaf Sundew		**Droseraceae** Sundew Family	G5	S3S4					Fens
			Species Occurrences verified in these Counties: Flathead, Granite, Lake, Lewis and Clark, Lincoln, Missoula, Ravalli, Sanders **State Rank Reason:** Our most common sundew. Numerous occurrences in fens across western Montana.						
Epilobium densiflorum Dense Spike-primrose	**Boisduvalia densiflora**	**Onagraceae** Evening-primrose Family	G5	SH					Wetland/Riparian
			Species Occurrences verified in these Counties: Petroleum, Sanders, Teton **State Rank Reason:** Known from one historical collection in Sanders County from 1938.						
Epilobium suffruticosum Shrubby Willowherb		**Onagraceae** Evening-primrose Family	G5	S3S4					
			Species Occurrences verified in these Counties: Gallatin, Park						
Ericameria nana Dwarf Goldenweed	**Haplopappus nanus**	**Asteraceae** Aster/Sunflowers	G5	SH					Rock/Talus
			Species Occurrences verified in these Counties: Beaverhead **State Rank Reason:** Known from one 1952 collection south of Upper Red Rock Lake.						
Erigeron eatonii Eaton's Fleabane		**Asteraceae** Aster/Sunflowers	G5	SH					Sagbrush/Woodlands (Open, Montane)
			Species Occurrences verified in these Counties: Sweet Grass **State Rank Reason:** This species has only been collected once in Montana, several decades ago in Stillwater County. The population where this specimen was collected is likely still extant, but no surveys have been conducted to try and re-locate it.						
Erigeron lanatus Woolly Fleabane		**Asteraceae** Aster/Sunflowers	G4	S3S4					
			Species Occurrences verified in these Counties: Beaverhead, Flathead, Glacier, Sweet Grass **State Rank Reason:** Only known in Montana from a few occurrences in Glacier National Park, though the high elevation habitat as well as the occurrences all being within the Park boundary greatly diminish the potential for negative impacts. The likelihood of additional occurrences being located appears good.						

Eriogonum brevicaule var. canum Rabbit Buckwheat	**Eriogonum lagopus, Eriogonum pauciflorum var. canum**	**Polygonaceae** Buckwheat Family	G3G4	S3S4				3		**Species Occurrences verified in these Counties:** Carbon **State Rank Reason:** Regional endemic taxa restricted in Montana to the Bighorn Basin/Pryor Mountain Desert area where it is locally abundant in some locality and is a dominant component of some vegetation communities. Trends are unknown, though likely stable.
Eutrema salsugineum Saltwater Cress	**Arabidopsis salsuginea, Thellungiella salsuginea**	**Brassicaceae** Mustards	G5?	SH						**Species Occurrences verified in these Counties:**
Gaultheria ovatifolia Slender Wintergreen		**Ericaceae** Heath Family	G5	S3S4						**Species Occurrences verified in these Counties:** Flathead, Glacier, Lake, Lincoln, Mineral, Park, Sanders, Teton
Geocaulon lividum Northern Toadflax	**Comandra lividum**	**Santalaceae** Sandalwood Family	G5	S3S4						**Species Occurrences verified in these Counties:** Flathead, Lake, Lincoln, Missoula
Gilia tweedyi Tweedy's Gilia	**Gilia sinuata var. tweedyi, Gilia inconspicua var. tweedyi**	**Polemoniaceae** Phlox Family	G4G5Q	S3S4						**Species Occurrences verified in these Counties:** Beaverhead, Carbon **State Rank Reason:** Gilia tweedyi is locally common on the south and west sides of the Pryor Mountains in the drainages of the Bighorn and Clarks Fork of the Yellowstone rivers and is also known from Beaverhead County.
Hedysarum alpinum Alpine Sweet-vetch		**Fabaceae** Pea Family	G5	S3S4						**Species Occurrences verified in these Counties:** Flathead, Gallatin, Lake, Mineral, Missoula, Phillips, Pondera
Hymenoxys torreyana Torrey Bitterweed	**Tetraneuris torreyana**	**Asteraceae** Aster/Sunflowers	G4	S3S4						**Species Occurrences verified in these Counties:** Carbon
Impatiens ecalcarata Spurless Touch-me-not		**Balsaminaceae** Impatiens	G3G4	S3S4						**Species Occurrences verified in these Counties:** Lake, Missoula
Linanthastrum nuttallii Nuttall's Linanthus	**Linanthus nuttallii, Leptosiphon nuttallii**	**Polemoniaceae** Phlox Family	G5	S3S4						**Species Occurrences verified in these Counties:** Ravalli **State Rank Reason:** Reported as locally common in the Bitterroot Mountains by Lesica & Shelly (1991).
Lomatium bicolor Bicolor Biscuitroot		**Apiaceae** Parsley/Carrot Family	G4	S3S4						**Species Occurrences verified in these Counties:** Ravalli
Lorandersonia linifolia Spearleaf Rabbitbrush	**Chrysothamnus viscidiflorus var. linifolius, Chrysothamnus linifolius**	**Asteraceae** Aster/Sunflowers	G5	S3S4						**Species Occurrences verified in these Counties:**
Madia minima Small-headed Tarweed	**Hemizonella minima**	**Asteraceae** Aster/Sunflowers	G4	S3S4						**Species Occurrences verified in these Counties:** Granite, Lincoln, Missoula, Ravalli, Sanders
Mimulus suksdorfii Suksdorf Monkeyflower		**Phrymaceae** Lopseed Family	G4	S3S4						**Species Occurrences verified in these Counties:** Beaverhead, Carbon, Gallatin, Lewis and Clark, Madison, Missoula, Park, Rosebud, Silver Bow
Musineon vaginatum Rydberg's Parsley		**Apiaceae** Parsley/Carrot Family	G3G4	S3S4						**Species Occurrences verified in these Counties:** Big Horn, Carbon, Rosebud **State Rank Reason:** See rank details.
Orobanche corymbosa Flat-topped Broomrape		**Orobanchaceae** Broomrape Family	G4	S3S4						**Species Occurrences verified in these Counties:** Beaverhead, Deer Lodge, Granite, Jefferson, Madison, Ravalli
Oxytropis lagopus var. conjugans Hare's-foot Locoweed		**Fabaceae** Pea Family	G4G5T3T4	S3S4				3	Sagebrush (low-elevation)	**Species Occurrences verified in these Counties:** Granite, Lewis and Clark **State Rank Reason:** See rank details.
Pedicularis oederi Oeder's Lousewort		**Orobanchaceae** Broomrape Family	G5	S3S4						**Species Occurrences verified in these Counties:** Carbon
Pediomelum hypogaeum Little Indian Breadroot		**Fabaceae** Pea Family	G5	S3S4				3	Grasslands/Woodlands (Open, sandy soil)	**Species Occurrences verified in these Counties:** Carter, Cascade, Chouteau, Fergus, Golden Valley, Petroleum, Powder River, Rosebud **State Rank Reason:** See rank details.
Penstemon laricifolius Larch-leaf Beardtongue		**Plantaginaceae** Plantain Family	G4	S3S4						**Species Occurrences verified in these Counties:** Big Horn, Carbon, Meagher **State Rank Reason:** In Montana, *Penstemon laricifolius* is known from Carbon County where it is common on the south and west flanks of the Pryor Mountains.

Phacelia scopulina Dwarf Phacelia	**Phacelia lutea var. scopulina**	**Hydrophyllaceae** Waterleaf Family	G4	SH					Alkaline sites
			Species Occurrences verified in these Counties: Beaverhead, Madison, Silver Bow **State Rank Reason:** Known in Montana from one 1885 collection by P.A. Rydberg near Melrose, probably in Silver Bow County.						
Phlox andicola Plains Phlox		**Polemoniaceae** Phlox Family	G4	S3S4				3	Open sites (Sand to clay soils)
			Species Occurrences verified in these Counties: Carter, Dawson, Phillips, Powder River, Rosebud, Sheridan **State Rank Reason:** Plains phlox reaches the western margin of its range in Montana's eastern counties. It has been documented from relatively few locations, but surveys during its early blooming season have been few, and additional spring inventory work may locate more populations. It likely tolerates grazing and may benefit from some level of disturbance.						
Polygonum austiniae Austin's Knotweed	**Polygonum douglasii ssp. austiniae**	**Polygonaceae** Buckwheat Family	G5T4	S3S4		Sensitive - Known on Forests (BD, FLAT, HLC) Sensitive - Suspected on Forests (CG)		2	Rock/Talus
			Species Occurrences verified in these Counties: Broadwater, Flathead, Glacier, Granite, Lewis and Clark, Madison, Meagher, Park, Pondera, Powell, Teton **State Rank Reason:** Austin's knotweed is sparsely distributed in mountainous areas of Montana from the Rocky Mountain Front to the Madison and Gallatin Ranges. Sites are usually on open, gravelly, sparsely-vegetated slopes with shale-derived soils and as such are not generally impacted by human activity. Some sites however, are along forest roads and are susceptible to weed invasion and other disturbances. The probability of finding additional occurrences appears to be good since large areas of suitable habitat across western and central Montana remain unsurveyed for the species.						
Ranunculus hyperboreus High Northern Buttercup	**Ranunculus natans**	**Ranunculaceae** Buttercup Family	G5	S3S4					Wetland/Riparian (Montane)
			Species Occurrences verified in these Counties: Beaverhead, Carbon, Deer Lodge, Gallatin, Jefferson, Madison, Missoula, Silver Bow, Valley **State Rank Reason:** Known from several southwest and south-central counties in Montana. See rank details for additional information.						
Sedum borschii Borsch's Stonecrop	**Sedum leibergii**	**Crassulaceae** Stonecrops	G4?	S3S4					
			Species Occurrences verified in these Counties: Beaverhead						
Solidago velutina Three-nerved Goldenrod	**Solidago sparsiflora**	**Asteraceae** Aster/Sunflowers	G5?	SH					NA
			Species Occurrences verified in these Counties: **State Rank Reason:** Few-flowered goldenrod is known in Montana from 1 specimen collection from the Stillwater River Valley, which lacks precise locality data. Other reports of this species from the state are based on mis-identified specimens. Additional data are needed.						
Sphaeralcea munroana White-stemmed globemallow		**Malvaceae** Mallow Family	G4	S3S4				3	Sagebrush-Grasslands (low-elevation)
			Species Occurrences verified in these Counties: Beaverhead, Jefferson, Park **State Rank Reason:** Peripheral in southwest Montana where it is known from a few locations. Additional survey and monitoring data are needed. Most documented locations are along roads and 2-tracks, as such, at least several of the populations may be adventive or introduced. Species appears to be tolerant of or perhaps benefits from some disturbance activity. Additional information concerning the conservation needs and population dynamics of this species in Montana is needed to clarify its status.						
Stanleya tomentosa Woolly Prince's plume		**Brassicaceae** Mustards	G4	S3S4					
			Species Occurrences verified in these Counties: Beaverhead, Carbon **State Rank Reason:** See rank details.						
Stanleya viridiflora Green Prince's plume		**Brassicaceae** Mustards	G4	S3S4					
			Species Occurrences verified in these Counties: Beaverhead, Madison **State Rank Reason:** See rank details.						
Stenotus multicaulis Many-stem Goldenweed	**Oonopsis multicaulis, Haplopappus multicaulis**	**Asteraceae** Aster/Sunflowers	G4	S3S4					
			Species Occurrences verified in these Counties: Carter, Fallon **State Rank Reason:** Though restricted in distribution in Montana to Carter County, it is common in some habitats, including along some roadsides at least on BLM lands. No apparent, substantial threats to the species' viability in the state exist.						
Streptanthella longirostris Streptanthella		**Brassicaceae** Mustards	G5	S3S4					
			Species Occurrences verified in these Counties: Carbon **State Rank Reason:** Uncommon in Montana and restricted in distribution to Carbon County. Population sizes are poorly documented and associated information on trends and threats are also lacking.						
Synthyris missurica Western Mountain kittentails		**Plantaginaceae** Plantain Family	G4	S3S4					
			Species Occurrences verified in these Counties: Ravalli **State Rank Reason:** Uncommon in Montana and restricted in distribution to the Bitterroot Mtns. Population sizes are poorly documented and associated information on trends and threats are also lacking.						
Tonestus pygmaeus Pygmy Goldenweed	**Haplopappus pygmaeus**	**Asteraceae** Aster/Sunflowers	G4	SH					Alpine
			Species Occurrences verified in these Counties: **State Rank Reason:** Known in Montana from 1 historical collection from Lolo Peak. Other historical locations previously reported for MT have all been based on mis-identified specimens of Tonestus lyallii						

Townsendia spathulata Sword Townsend-daisy		**Asteraceae** Aster/Sunflowers	G3	S3S4				3	
			Species Occurrences verified in these Counties: Beaverhead, Broadwater, Carbon, Madison, Park, Silver Bow **State Rank Reason:** Sword townsendia occurs in limestone areas of southwest and south-central Montana. Overall, The species' viability in the state does not appear to be at risk due in part to its relatively widespread distribution and its overall abundance. The population in the Limestone Hills in Broadwater County may be negatively impacted by proposed mine expansion and military activities.						

FLOWERING PLANTS - MONOCOTS (LILIOPSIDA) — 7 SPECIES

SCIENTIFIC NAME COMMON NAME TAXA SORT	OTHER NAMES	FAMILY (SCIENTIFIC) FAMILY (COMMON)	GLOBAL RANK	STATE RANK	USFWS	USFS	BLM	MNPS THREAT CATEGORY	HABITAT
Carex nelsonii Nelson's Sedge		**Cyperaceae** Sedges	G3	S3S4					
			Species Occurrences verified in these Counties: Carbon, Park, Stillwater **State Rank Reason:** See rank details.						
Cyperus strigosus Straw-colored Flatsedge		**Cyperaceae** Sedges	G5	SH					
			Species Occurrences verified in these Counties: **State Rank Reason:** Known in Montana from two historical collections (Flathead and Missoula Counties).						
Cypripedium parviflorum Small Yellow Lady's-slipper	Cypripedium calceolus	**Orchidaceae** Orchids	G5	S3S4		Sensitive - Known on Forests (CG, FLAT, HLC, KOOT, LOLO) Sensitive - Suspected on Forests (BRT)		2	
			Species Occurrences verified in these Counties: Big Horn, Carter, Flathead, Gallatin, Granite, Jefferson, Judith Basin, Lake, Lewis and Clark, Lincoln, Missoula, Pondera, Stillwater, Sweet Grass, Teton **State Rank Reason:** Many occurrences known from the western half of the state, including a dozen or so historical or poorly documented sites. Many occurrences have small population numbers, though approximately two dozen occurrences are moderate to large populations. Populations occur on variety of federal, state and private ownerships with varied land uses and management. A variety of land uses and activities, including development, livestock grazing and timber harvesting may have detrimental impacts to populations. However, yellow lady's-slipper appears to be tolerant to some disturbances at low levels and the number of populations scattered over a wide area reduces the risk to the species. A loss of populations or a significant decline in numbers may warrant a re-listing as a Species of Concern in Montana, and populations should continue to be monitored on a semi-regular basis. Moderate to large occurrences should be managed to maintain habitat and viable population numbers.						
Damasonium californicum Fringed Water-plantain	Machaerocarpus californicus	**Alismataceae** Water-plantains	G4	SH					
			Species Occurrences verified in these Counties: **State Rank Reason:** Collected once in Montana along the Kootenai river near Rexford prior to the creation of Lake Koocanusa.						
Lipocarpha micrantha Dwarf Bulrush	Hemicarpha micrantha	**Cyperaceae** Sedges	G5	SH					Sandy soil (Moist)
			Species Occurrences verified in these Counties: Carbon **State Rank Reason:** Known in Montana from a 1941 Collection by W. E. Booth near Fromberg.						
Maianthemum canadense Wild Lily-of-the-valley		**Liliaceae** Lillies	G5	SH					Riparian forest
			Species Occurrences verified in these Counties: Carter **State Rank Reason:** Documented for Montana from one 1948 collection by W. E. Booth near Alzada.						
Sphenopholis intermedia Slender Wedgegrass	Sphenopholis obtusata var. major	**Poaceae** Grasses	G5	S3S4					Mesic sites (low-elevation)
			Species Occurrences verified in these Counties: Big Horn, Broadwater, Fergus, Flathead, Gallatin, Judith Basin, Lake, Lewis and Clark, Phillips, Wheatland **State Rank Reason:** Rare in Montana, where it has only been documented from a very few collections, though the population data required to more precisely assign a conservation rank are lacking.						

BRYOPHYTES (BRYOPHYTA) — 18 SPECIES

SCIENTIFIC NAME COMMON NAME TAXA SORT	OTHER NAMES	FAMILY (SCIENTIFIC) FAMILY (COMMON)	GLOBAL RANK	STATE RANK	USFWS	USFS	BLM	MNPS THREAT CATEGORY	HABITAT
Amblyodon dealbatus An Amblyodon Moss		**Meesiaceae**	G3G5	SH					
			Species Occurrences verified in these Counties: Cascade, Flathead **State Rank Reason:** Known from 1 collection from Flathead County in 1895.						
Brachythecium turgidum Stiff Matt Moss	Stiff Brachythecium Moss	**Brachytheciaceae**	G5	SH					

			Species Occurrences verified in these Counties: Flathead, Glacier						
Callicladium haldanianum Pretty Branch Moss		Hypnaceae	G5	SH					
			Species Occurrences verified in these Counties: Flathead						
Calliergon richardsonii Richardson's Calliergon Moss		Amblystegiaceae	G5	SH					
			Species Occurrences verified in these Counties: Glacier						
Dendroalsia abietina A Dendroalsia Moss		Leucodontaceae	G4	SH					
			Species Occurrences verified in these Counties:						
Dicranum fragilifolium Fragile Leaf Dicranum Moss		Dicranaceae	G4G5	SH					
			Species Occurrences verified in these Counties: Flathead, Glacier, Lake						
Dicranum spadiceum A Dicranum Moss	Dicranum angustum	Dicranaceae	G5	SNR					
			Species Occurrences verified in these Counties: **State Rank Reason:** MT Botanist Mincemoyer downgraded species from S1 to SH for lack of knowledge of specimens after 1972 and was not aware of specimens collected in 1994 from Glacier NP and 1995 from Pine Butte.						
Distichium inclinatum Incline Thread Moss	Incline Distichium Moss	Ditrichaceae	G5	SH					
			Species Occurrences verified in these Counties: Glacier						
Entosthodon rubiginosus Rusty Cord Moss	Entosthodon Moss	Funariaceae	G1G3	SH					
			Species Occurrences verified in these Counties: Cascade						
Grimmia mollis A Dry Rock Moss	Hydrogrimmia mollis A Black Rock Moss	Grimmiaceae	G5	SH					
			Species Occurrences verified in these Counties: Flathead, Glacier						
Hygrohypnum cochlearifolium Ear-leaf Boat Moss	Ear-leaf Hygrohypnum Moss	Amblystegiaceae	G4	SH					
			Species Occurrences verified in these Counties: Lincoln						
Plagiobryum zieri Zierian Hump-Moss		Bryaceae	G5	SH					
			Species Occurrences verified in these Counties:						
Pseudocalliergon trifarium Blunt Water Moss	Calliergon trifarium Worm Moss	Amblystegiaceae	G5	SH					
			Species Occurrences verified in these Counties: Flathead, Glacier, Missoula						
Pseudocalliergon turgescens A Pseudocalliergon Moss	Scorpidium turgescens, Calliergon turgescens	Amblystegiaceae	G4G5	SH					
			Species Occurrences verified in these Counties: Flathead, Glacier						
Sarmentypnum sarmentosum A Sarmenthypnum Moss	Calliergon sarmentosum	Amblystegiaceae	G5	SNR					
			Species Occurrences verified in these Counties:						
Tayloria acuminata Acuminate Dung Moss		Splachnaceae	G3G4	SH					
			Species Occurrences verified in these Counties:						
Thamnobryum neckeroides Necker's Thamnobryum Moss	A Tree Moss	Thamnobryaceae	G4	SH					
			Species Occurrences verified in these Counties: Sanders						
Tortula cernua A Tortella Moss	Desmatodon cernuus	Pottiaceae	G4G5	SH					
			Species Occurrences verified in these Counties:						

LICHENS (FUNGI) — 8 SPECIES

SCIENTIFIC NAME COMMON NAME TAXA SORT	OTHER NAMES	FAMILY (SCIENTIFIC) FAMILY (COMMON)	GLOBAL RANK	STATE RANK	USFWS	USFS	BLM	MNPS THREAT CATEGORY	HABITAT
Brigantiaea praetermissa Brick-Spored Firedot Lichen		Brigantiaeaceae (Brigantiaeaceae)	GNR	S2S3					
			Species Occurrences verified in these Counties: Lake **State Rank Reason:** The type specimen is from Sanders County. This lichen is considered uncommon in western Montana and widely scattered in the Pacific Northwest.						

Cetraria sepincola Chestnut Wrinkled Lichen	**Tuckermannopsis sepincola**	**Parmeliaceae**	G5	S2S3					
			Species Occurrences verified in these Counties: Flathead, Lake, Madison, Mineral **State Rank Reason:** Known frommany locations, associated with bogs, in western Montana.						
Evernia divaricata Mountain Oakmoss Lichen		**Parmeliaceae**	G4G5	S1S2					
			Species Occurrences verified in these Counties: Carbon, Lake, Missoula **State Rank Reason:** Populations have a very spotty distribution in Montana.						
Parmelia fraudans Pea-green Shield Lichen		**Parmeliaceae**	G5	S1					
			Species Occurrences verified in these Counties: **State Rank Reason:** Rare in the Pacific Northwest (McCune and Goward 2009); Infrequently collected in Montana and adjacent states.						
Platismatia herrei Tattered Rag Lichen		**Parmeliaceae**	G5	S1					
			Species Occurrences verified in these Counties: **State Rank Reason:** Known froma few locations in northwestern Montana.						
Platismatia stenophylla Ribbon Rag Lichen		**Parmeliaceae**	G5	S1					
			Species Occurrences verified in these Counties: Lake, Ravalli **State Rank Reason:** Known froma few locations in western Montana.						
Psora rubiformis Pea-green Scale Lichen		**Psoraceae**	G3G5	S1S2					
			Species Occurrences verified in these Counties: Flathead, Glacier, Lake, Madison, Rosebud **State Rank Reason:** In Montana widely scattered populations have been found in northwest, southwest, and southeast.						
Umbilicaria havaasii Havaas' Rocktripe Lichen		**Umbilicariaceae**	G4	S1					
			Species Occurrences verified in these Counties: Flathead, Ravalli **State Rank Reason:** Known froma few locations in western Montana. Montana occurs on the eastern edge of this species range.						

Special Status Species

0 Species

All Records (no filtering)

This section is not Filtered

ADDITIONS TO STATEWIDE LIST

SPECIES	DATE	NOTES
Isoetes howellii Howell's Quillwort	9/25/2018	Isoetes howellii is known from about 5 locations in Northwestern Montana. Based on limited information threats appear to be minimal, but survey work to document locations, population sizes, and threats is greatly needed.
Isoetes echinospora Spiny-spore Quillwort	9/25/2018	Isoetes echinospora is known from 8 occurrences scattered in western Montana. At one occurrence, the species has been observed in 1940, 1967, and 1998 indicating persistence. However, current survey work is need to document locations, population sizes, and threats.
Isoetes occidentalis Western Quillwort	9/25/2018	Isoetes occidentalis is known from two locations in northwest Montana. Survey work to identify other locations, document population sizes, and determine threats is greatly needed.
Celastrus scandens Bittersweet	9/25/2018	Celastrus scandens occurs frequently in woodlands, rocky hillsides, thickets, fence rows, and roadsides in the Great Plains (McGregor 1986). The previous SH rank in Montana was based on a vague location provided on a 1975 herbarium specimen. In recent years it has been been collected at four locations in woody draws. It appears that the Montana sites represent the western edge of its range, and currently it ranks as an S1. Additional surveys of woody draws are needed to accurately document its distribution and population size in Montana.
Impatiens aurella Pale-yellow Jewel-weed	9/25/2018	Impatiens aurella is known from about 20 locations documented from 1886 to 2016. It is consider uncommon in Lake and Flathead Counties, where the majority of observations have been found, and rare in other counties of western Montana. It grows in wet, often organic soil in both disturbed and undisturbed wetlands, and rarely appears abundant. However, it may require or persist better with some hydrological disturbance. Re-visits to known locations and more surveys are needed to better document locations, population sizes, and threats.
Astragalus ceramicus var. filifolius Pottery Milkvetch	9/25/2018	Astragalus ceramicus variety filifolius is associated with sandy soils of the sandhills and sandstone outcrops in eastern Montana. It is known from about 20 occurrences observed mostly from 1983 to 2000. Some populations occur in State Parks, and current data on population sizes and theats is needed. The Flora of the Great Plains (1986) considered it rare in the Great Plains except for the Nebraska sandhill region where it was somewhat common. Based on aging data, limited distribution, and an association to specific habitat types it is considered a Species of Concern.
Astragalus ceramicus Pottery Milkvetch	9/25/2018	Astragalus ceramicus variety filifolius is associated with sandy soils of the sandhills and sandstone outcrops in eastern Montana. It is known from about 20 occurrences observed mostly from 1983 to 2000. Some populations occur in State Parks, and current data on population sizes and theats is needed. The Flora of the Great Plains (1986) considered it rare in the Great Plains except for the Nebraska sandhill region where it was somewhat common. Based on aging data, limited distribution, and an association to specific habitat types it is considered a Species of Concern.
Artemisia tilesii Tilesius Wormwood	9/25/2018	Artemisia tilesii is known from seven locations located at higher elevations in western Montana. The species can be difficult to separate from Artemisia ludoviciana and A. michauxiana. Survey work to identify occurrences, determine population sizes, and assess threats is greatly needed before re-evaluating its status.
Carex amplifolia Big-leaf Sedge	9/25/2018	Carex amplifolia occurs in temperate western North America where it is usually uncommon or rare from coastal lowlands to middle elevations in the mountains (FNA 2002). The previous SH rank in Montana was based on a 1978 herbarium specimen. In recent years it has been collected from several wetlands in Sanders and Flathead Counties. Additional wetland surveys are needed to accurately document its distribution and population size in Montana.
Cryptogramma cascadensis Cascade Rockbrake	9/27/2017	Cryptogramma cascadensis is known from 11 locations in western Montana, of which 2 locations are poorly defined and considered historical, 5 locations occur in Wilderness areas, and the remaining 4 locations occur on U.S. Forest Service lands. Although the fern is thought to be undercollected and could be more common, current population and location data is needed to remove this plant from the Species of Concern list.
Marsilea oligospora Pepperwort	9/27/2017	Marsilea oligospora has relatively recently been segregated from Marsilea vestita (FNA 1993). It is quite common around Ninepipes National Wildlife Refuge, but has not been documented elsewhere in Montana. Observation data is greatly needed to further assess its distribution and viability in Montana.
Almutaster pauciflorus Alkali Marsh Aster	9/27/2017	Almutaster pauciflorus was first documented in 1988, and is now known from five sites in central and northeastern Montana. It grows in wet meadows or calcareous soil of fens within the plains.
Ligusticum verticillatum Idaho Lovage	9/27/2017	Ligusticum verticillatum occurs in northern Idaho, western Montana, and British Columbia. It has been found in Lincoln and Ravalli Counties, growing in moist forests and meadows of spruce-fir habitats, becoming common in Idaho. Herbarium specimens from Missoula and Granite Counties may be mis-identified. Current data on locations, population sizes, and threats is greatly needed.
Lobelia kalmii Kalm's Lobelia	9/27/2017	Lobelia kalmii occurs in fens and other high-organic wetlands in northwest, central, and northeast Montana. Approximately 34 observations have been made at about 23 unique locations. The central Montana location has not been observed since 1934. Current observation, population size, and threat information at documented sites is needed.
Castilleja kerryana Kerry's Paintbrush	9/27/2017	Castilleja kerryana is a recently recognized species that is found in alpine habitat within a portion of the Scapegoat Wilderness in Montana. Populations tend to be small and scattered on slopes and ridges, and apparently absent on broad, fairly flat alpine terrain. Although Castilleja species in general have brittle stems that are easily damaged by livestock, grazing is not known to occur where Kerry's Paintbrush grows. The plant appears to be limited geographically in Montana, and additional surveys are needed to accurately determine its range.
Berberis nervosa Longleaf Oregon-grape	9/27/2017	Berberis nervosa is disjunct in northern Idaho. In Montana it is known from 2-3 locations in Sanders County, of which one population in 2001 is reported to have over 1,000 plants. Additional data on locations and population sizes are greatly needed.
Triodanis leptocarpa Slim-pod Venus'-looking-glass	9/27/2017	Triodanis leptocarpa is common in the southern Great Plains and extends into eastern and central Montana. It occurs in grasslands, grass-dominated rocky slopes, and sagebrush-dominated grasslands. It has been found in grazed and ungrazed lands and appears to tolerate some disturbance. Approximately 14 locations were documented prior to 1958 and occur in central Montana. Approximately 14 locations were documented since 1974 and mostly occur in eastern Montana. Re-visits to known locations and current population data is greatly needed.
Carex glacialis Alpine Sedge	9/27/2017	Carex glacialis occurs throughout Canada, and has recently been discovered in the United States where it occurs at 4 locations in Montana. It grows in limestone fellfield habitats within the alpine. Populations are few, but appear stable. Surveys are needed to explore potential habitat, map its distribution, and determine population sizes.
Lilium columbianum Columbia Lily	9/27/2017	Lilium columbianum is currently only known from Lincoln County, where six locations have been documented in the 1980's and 1990's. This species is vulnerable to extirpation in Montana because its attractiveness, potential to be over-collected, and limited range. Native lilies have rarely survived in gardens. Current information on known locations is greatly needed.
Scolochloa festucacea Sprangletop	9/27/2017	Scolochloa festucacea occurs through most of Canada and in portions of mid-western and western States. In Montana it is known from 3 locations collected from 1949 to 1999 in Flathead County. A fourth location from a specimen with a poorly defined location in Carbon county needs to be verified. Surveys to find this species have been unsuccessful.
Lilium philadelphicum Wood Lily	9/27/2017	Lilium philadelphicum has a patchy, but wide distribution in Montana, and is often found in specialized habitats. Observations in eastern Montana have not been made since the 1930's and 1940's. This species is vulnerable to extirpation in Montana because of its attractiveness, potential to be over-collected, and habitat requirements. Native lilies have rarely survived in gardens. Current information on known locations, especially in the eastern counties, is greatly needed.

ADDITIONS TO STATEWIDE LIST

SPECIES	DATE	NOTES
Asplenium trichomanes-ramosum Limestone Maidenhair Spleenwort	10/4/2016	Limited habitat in MT. Limited populations.
Equisetum palustre Marsh Horsetail	10/4/2016	Equisetum palustre is known from a small number of sites in seven counties of western Montana.
Equisetum pratense Meadow Horsetail	10/4/2016	Equisetum pratense has accurately been identified to occur in a few places within three counties of Montana.
Trifolium cyathiferum Cup Clover	10/4/2016	Trifolium cyathiferum occurs in two counties with limited information on population size. One occurrence was re-visited in 1998 and found to be absent due to habitat succession.
Delphinium glaucum Pale Larkspur	10/4/2016	Based on the discrepancy in the number of herbarium specimens identified as Delphinium glaucum (CPNWH 2015) and in its Montana County distribution (Lesica 2012), there seems to be an issue in how to accurately identify this species. Specimens deposited in herbaria outside of Montana will need to be examined before it can be demonstrated that this plant is more widely distributed.
Delphinium depauperatum Slim Larkspur	10/4/2016	Delphinium depauperatum has been identified in Beaverhead, Flathead, and possibly Jefferson Counties in western Montana. It is found in common habitats, yet relatively few occurrences have been documented.
Trifolium microcephalum Woolly Clover	10/4/2016	Trifolium microcephalum occurs in two counties of Montana with limited population sizes.
Descurainia torulosa Wyoming Tansymustard	10/4/2016	Descurainia torulosa is known in Montana from one location in Park County; in Wyoming this species is also considered rare.
Piperia elongata Dense-flower Rein Orchid	10/4/2016	Piperia elongata has been observed once in 1957 in Lincoln County, Montana.
Allium geyeri var. geyeri Geyer's Onion	10/4/2016	In Montana this variety of Allium geyeri has been found in limited numbers with a limited distribution.
Piperia elegans Hillside Rein Orchid	10/4/2016	Between 1902 and 1995, Piperia elegans has been observed at 16 locations in northwest Montana. Observations since 1995 have not been reported.
Bolboschoenus fluviatilis River Bulrush	10/4/2016	Accurate identifications of Bolboshchoenus fluviatilis are found in very few populations within three counties of Montana.
Stellaria crassifolia Fleshy Stitchwort	6/18/2014	Rare in Montana where it is known from a few sparsely distributed locations.
Utricularia ochroleuca Northern Bladderwort	6/18/2014	Rare in Montana, where it is currently known from one population that may be detrimentally impacted by an adjacent gravelpit.
Senecio integerrimus var. scribneri Scribner's Ragwort	4/2/2013	Regional endemic with the core of its range in Montana. Few documented locations, though the species may be under-reported/under-collected. Some loss and degradation of habitat has likely occurred, primarily from agricultural uses.
Physaria pachyphylla Thick-leaf Bladderpod	11/5/2012	Local Endemic restricted to Carbon County and probably adjacent Big Horn County as well as adjacent WY. Currently known from only a few observations.
Pedicularis pulchella Mountain Lousewort	11/1/2012	Regional endemic from southern Montana and adjacent Wyoming with few documented locations, though the species may be under-reported/under-collected. High-elevation habitat does not appear to be at risk. Collection of additional population information may show that the viability of the species is not at risk in the state.
Mimulus clivicola North Idaho Monkeyflower	4/22/2011	Recently documented in Montana from 1 collection from 2010.
Erigeron grandiflorus Large-flower Fleabane	2/14/2011	Known in Montana from only a couple of collections.
Botrychium lunaria Common Moonwort	2/11/2011	Rare in the state. Few observation records and population levels are poorly documented.
Botrychium lanceolatum Lanceleaf Moonwort	2/11/2011	Rare in the state. Very few observation records and population levels are poorly documented.
Botrychium simplex Least Moonwort	2/11/2011	Rare in the state. Very few observation records and population levels are poorly documented.
Botrychium pinnatum Northern Moonwort	2/11/2011	Rare in the state. Very few observation records and population levels are poorly documented.
Pinus albicaulis Whitebark Pine	2/11/2011	Large declines in population levels and continued threats from white pine blister rust and mountain pine beetle attacks threaten the long-term viability of the species.

ADDITIONS TO STATEWIDE LIST

SPECIES	DATE	NOTES
Mimulus floribundus Floriferous Monkeyflower	2/11/2011	Known in Montana from two historical collections.
Symphyotrichum molle Soft Aster	2/11/2011	Known in Montana from 1 collection from the Bighorn Mtns. Though its exact status is uncertain, its rarity warrants its inclusion as a Species of Concern.
Mimulus hymenophyllus Thinsepal monkeyflower	2/11/2011	Known in Montana from only 1 locality.
Penstemon humilis Low Beardtongue	12/16/2010	Known in Montana from 1 collection from Beaverhead County.
Douglasia conservatorum Bloom Peak Douglasia	3/16/2010	Described as a new species in 2010 based on a single location along the Idaho/Montana border.
Senecio elmeri Elmer's Ragwort	10/26/2009	Senecio elmeri is the correct identity for the single Montana location of what was previously and incorrectly called Senecio spribillei.
Physaria ludoviciana Silver Bladderpod	6/8/2009	Restricted in Montana to sandy sites in the extreme eastern portion of the state.
Botrychium adnatum Adnate Moonwort	2/1/2008	A recently described species which is globally rare and recently discovered in northwest Montana.
Botrychium gallicomontanum Frenchman's Bluff Moonwort	2/1/2008	A recently described species which is globally rare and recently discovered in northwest Montana.
Botrychium michiganense Michigan Moonwort	2/1/2008	A recently described species which is globally rare and recently discovered in northwest Montana.
Botrychium tunux Moosewort	2/1/2008	A recently described species which is globally rare and recently discovered in northwest Montana.
Botrychium yaaxudakeit Yakutat Moonwort	2/1/2008	A recently described species which is globally rare and recently discovered in northwest Montana.
Delphinium burkei Meadow Larkspur	2/1/2008	Rare. Currently known from a few locations in western Montana in mesic meadows and grasslands.
Castilleja nivea Snow Indian Paintbrush	12/14/2007	Rare. Currently known from only a few collections from sw and south-central Montana mountain ranges. Most of these collections were made more than 30 years ago.
Cirsium pulcherrimum Wyoming Thistle	12/15/2006	
Botrychium montanum Mountain Moonwort	6/1/2006	
Collomia debilis var. camporum Alpine Collomia	6/1/2006	
Erigeron allocotus Big Horn Fleabane	6/1/2006	
Draba daviesiae Bitterroot Draba	6/1/2006	
Ipomoea leptophylla Bush morning-glory	6/1/2006	
Penstemon caryi Cary's Beardtongue	6/1/2006	
Cardamine rupicola Cliff Toothwort	6/1/2006	
Polygonum polygaloides ssp. confertiflorum Dense-flower Knotweed	6/1/2006	
Senecio eremophilus Desert Groundsel	6/1/2006	

ADDITIONS TO STATEWIDE LIST

SPECIES	DATE	NOTES
Physaria klausii Divide Bladderpod	6/1/2006	
Erigeron flabellifolius Fan-leaved Fleabane	6/1/2006	
Castilleja crista-galli Greater Red Indian Paintbrush	6/1/2006	
Oxytropis lagopus var. conjugans Hare's-foot Locoweed	6/1/2006	
Delphinium bicolor ssp. calcicola Limestone Larkspur	6/1/2006	
Camissonia subacaulis Long-leaf Evening-primrose	6/1/2006	
Cirsium longistylum Long-styled Thistle	6/1/2006	
Synthyris canbyi Mission Mountain kittentails	6/1/2006	
Brickellia oblongifolia Mojave Brickellbush	6/1/2006	
Erigeron parryi Parry's Fleabane	6/1/2006	
Pedicularis contorta var. ctenophora Pink Coil-beaked Lousewort	6/1/2006	
Eriogonum brevicaule var. canum Rabbit Buckwheat	6/1/2006	
Eriogonum soliceps Railroad Canyon Wild Buckwheat	6/1/2006	
Sphaeromeria capitata Rock-tansy	6/1/2006	
Physaria saximontana var. dentata Rocky Mountain Twinpod	6/1/2006	
Pedicularis crenulata Scallop-leaf Lousewort	6/1/2006	
Pedicularis contorta var. rubicunda Selway Coil-beaked Lousewort	6/1/2006	
Castilleja gracillima Slender Indian Paintbrush	6/1/2006	
Townsendia spathulata Sword Townsend-daisy	6/1/2006	
Draba crassa Thick-leaf Whitlow-grass	6/1/2006	
Penstemon flavescens Yellow Beardtongue	6/1/2006	
Calamagrostis tweedyi Cascade reedgrass	6/1/2006	

ADDITIONS TO STATEWIDE LIST

SPECIES	DATE	NOTES
Listera borealis Northern Twayblade	6/1/2006	
Papaver pygmaeum Alpine Glacier Poppy	6/1/2001	
Salix cascadensis Cascade Willow	6/1/2001	
Githopsis specularioides Common Blue-cup	6/1/2001	
Physaria douglasii Douglas Bladderpod	6/1/2001	
Viola selkirkii Great-spurred Violet	6/1/2001	
Cryptantha humilis Round-headed Cryptantha	6/1/2001	
Mimulus ringens Square-stem Monkeyflower	6/1/2001	
Carex chalciolepis Copper-scale Sedge	6/1/2001	Previously referred to as C. chalcidepis
Carex lacustris Lake-bank Sedge	6/1/2001	
Acorus americanus Sweetflag	6/1/2001	
Botrychium pallidum Pale Moonwort	3/1/1999	
Balsamorhiza hookeri Hooker's Balsamroot	3/1/1999	
Alnus rubra Red Alder	3/1/1999	
Erigeron tener Slender Fleabane	3/1/1999	
Mimulus ampliatus Stalk-leaved Monkeyflower	3/1/1999	Previously referred to as M. patulus
Ribes laxiflorum Trailing Black Currant	3/1/1999	
Puccinellia lemmonii Lemmon's Alkaligrass	3/1/1999	
Sisyrinchium septentrionale Northern Blue-eyed-grass	3/1/1999	
Carex pallescens Palish Sedge	3/1/1999	
Lycopodium sitchense Alaskan Clubmoss	6/1/1997	
Botrychium campestre Prairie Moonwort	6/1/1997	
Botrychium pedunculosum Stalked Moonwort	6/1/1997	
Eriogonum visheri Visher's Buckwheat	6/1/1997	
Carex chalciolepis Copper-scale Sedge	6/1/1997	Previously referred to as C. chalcidepis

ADDITIONS TO STATEWIDE LIST

SPECIES	DATE	NOTES
Carex nelsonii Nelson's Sedge	6/1/1997	
Carex vaginata Sheathed Sedge	6/1/1997	
Evax prolifera Big-head Evax	5/1/1996	
Potentilla hyparctica Low Arctic Cinquefoil	5/1/1996	
Elatine brachysperma Short-seeded Waterwort	5/1/1996	
Eriophorum viridicarinatum Green-keeled Cottonsedge	5/1/1996	
Carex prairea Prairie Sedge	5/1/1996	
Spiranthes diluvialis Ute ladies'-tresses	5/1/1996	
Botrychium lineare Linearleaf Moonwort	5/1/1995	
Physaria brassicoides Double Bladderpod	5/1/1995	
Heterotheca villosa var. depressa Low Hairy Goldenaster	5/1/1995	
Lomatogonium rotatum Marsh Felwort	5/1/1995	
Primula incana Mealy Primrose	5/1/1995	
Lomatium nuttallii Nuttall Desert-parsley	5/1/1995	
Asclepias ovalifolia Ovalleaf Milkweed	5/1/1995	
Eustoma grandiflorum Showy Prairie-gentian	5/1/1995	
Gymnosteris parvula Small-flower Gymnosteris	5/1/1995	
Asclepias incarnata Swamp Milkweed	5/1/1995	
Poa laxa ssp. banffiana Banff Bluegrass	5/1/1995	
Trisetum orthochaetum Missoula County Oats	5/1/1995	
Scirpus pendulus Pendulous Bulrush	5/1/1995	
Poa arnowiae Short-leaved Bluegrass	5/1/1995	Previously called P. curta
Eriophorum gracile Slender Cottongrass	5/1/1995	
Botrychium ascendens Upward-lobed Moonwort	5/1/1994	

ADDITIONS TO STATEWIDE LIST

SPECIES	DATE	NOTES
Pyrrocoma carthamoides var. subsquarrosa Beartooth Large-flowered Goldenweed	5/1/1994	
Physalis heterophylla Clammy Ground-cherry	5/1/1994	
Senecio pauciflorus Few-flowered Butterweed	5/1/1994	
Penstemon globosus Globe Beardtongue	5/1/1994	
Stellaria jamesiana James Stitchwort	5/1/1994	
Delphinium bicolor ssp. calcicola Limestone Larkspur	5/1/1994	Referrable to D. bicolor ssp. novum prior to 1995
Cryptantha humilis Round-headed Cryptantha	5/1/1994	
Townsendia leptotes Slender Townsend-daisy	5/1/1994	
Ipomopsis minutiflora Small-flower Ipomopsis	5/1/1994	
Lomatium attenuatum Taper-tip Desert-parsley	5/1/1994	
Physaria didymocarpa var. lanata Woolly Twinpod	5/1/1994	
Saxifraga hirculus Yellow Marsh Saxifrage	5/1/1994	
Carex luzulina var. atropurpurea Black and Purple Sedge	5/1/1994	
Oryzopsis contracta Contracted Indian Ricegrass	5/1/1994	
Scheuchzeria palustris Pod Grass	5/1/1994	
Cyperus erythrorhizos Red-root Flatsedge	5/1/1994	
Eriophorum scheuchzeri Scheuchzer Cotton-grass	5/1/1994	
Primula alcalina Alkali Primrose	4/1/1993	
Papaver pygmaeum Alpine Glacier Poppy	4/1/1993	
Draba daviesiae Bitterroot Draba	4/1/1993	
Sphaeromeria argentea Chicken-sage	4/1/1993	
Cardamine rupicola Cliff Toothwort	4/1/1993	
Oxytropis campestris var. columbiana Columbia Locoweed	4/1/1993	

ADDITIONS TO STATEWIDE LIST

SPECIES	DATE	NOTES
Erigeron flabellifolius Fan-leaved Fleabane	4/1/1993	
Vernonia fasciculata ssp. corymbosa Fascicled Ironweed	4/1/1993	
Cuscuta pentagona Field Dodder	4/1/1993	
Oxytropis lagopus var. conjugans Hare's-foot Locoweed	4/1/1993	
Cymopterus hendersonii Henderson's Wavewing	4/1/1993	
Penstemon grandiflorus Large Flowered Beardtongue	4/1/1993	
Braya humilis Low Braya	4/1/1993	
Viguiera multiflora Many-flowered Viguiera	4/1/1993	
Stenotus multicaulis Many-stem Goldenweed	4/1/1993	
Cryptantha scoparia Miner's Candle	4/1/1993	
Synthyris canbyi Mission Mountain kittentails	4/1/1993	
Nama densum Nama	4/1/1993	
Oxytropis deflexa var. foliolosa Nodding Locoweed	4/1/1993	
Eriogonum ovalifolium var. ovalifolium Oval-leaf Buckwheat	4/1/1993	Previously referred to as E. ovalifolium var. nevadense
Oxytropis parryi Parry's Locoweed	4/1/1993	
Physalis pumila ssp. hispida Prairie Ground-cherry	4/1/1993	Previously referred to as P. virginiana var. hispida
Eriogonum brevicaule var. canum Rabbit Buckwheat	4/1/1993	E. lagopus
Sphaeromeria capitata Rock-tansy	4/1/1993	
Physaria saximontana var. dentata Rocky Mountain Twinpod	4/1/1993	
Draba globosa Round-fruited Draba	4/1/1993	
Claytonia arenicola Sand Springbeauty	4/1/1993	
Pedicularis contorta var. rubicunda Selway Coil-beaked Lousewort	4/1/1993	

ADDITIONS TO STATEWIDE LIST

SPECIES	DATE	NOTES
Mimulus breviflorus Short-flowered Monkeyflower	4/1/1993	
Pediocactus simpsonii Simpson's Hedgehog Cactus	4/1/1993	
Camissonia parvula Small Camissonia	4/1/1993	
Eriogonum salsuginosum Smooth Buckwheat	4/1/1993	
Chenopodium subglabrum Smooth Goosefoot	4/1/1993	
Solidago velutina Three-nerved Goldenrod	4/1/1993	
Transberingia bursifolia ssp. virgata Twiggy Halimolobos	4/1/1993	
Symphyotrichum lanceolatum White Panicle Aster	4/1/1993	Previously referred to as Aster simplex var. ramosissimus
Polygonum polygaloides White-margin Knotweed	4/1/1993	
Penstemon flavescens Yellow Beardtongue	4/1/1993	
Muhlenbergia minutissima Annual Muhly	4/1/1993	
Carex rostrata Glaucus Beaked Sedge	4/1/1993	
Phippsia algida Ice Grass	4/1/1993	
Carex eburnea Ivory Sedge	4/1/1993	
Stipa lettermanii Letterman's Needlegrass	4/1/1993	
Liparis loeselii Loesel's Twayblade	4/1/1993	
Trisetum orthochaetum Missoula County Oats	4/1/1993	
Agrostis mertensii Northern Bentgrass	4/1/1993	
Scirpus pallidus Pale Bulrush	4/1/1993	
Eriophorum callitrix Sheathed Cotton-grass	4/1/1993	
Acorus americanus Sweetflag	4/1/1993	
Juncus triglumis Three-flowered Rush	4/1/1993	
Stipa thurberiana Thurber's Needlegrass	4/1/1993	
Dichanthelium wilcoxianum Wilcox's Panic Grass	4/1/1993	

This section is not Filtered

SPECIES REMOVED FROM STATEWIDE LIST

SPECIES	DATE	NOTES
Pediomelum hypogaeum Little Indian Breadroot	6/10/2013	Moved to PSOC status. Status re-determined as relatively low risk, low to moderate priority due to widespread geographic range, occurrence in over a dozen subwatersheds and low threat levels. Population numbers are small according to the limited data available, though additional surveys would likely find more populations as well as document many more individuals.
Sphaeralcea munroana White-stemmed globemallow	5/30/2013	Species was moved to PSOC status pending the collection and availability of additional information concerning the species' conservation needs and population dynamics in Montana. Most documented occurrences are from roadsides and these may be adventive or introductions.
Polygonum austiniae Austin's Knotweed	5/29/2013	Status re-determined as relatively low risk, low to moderate priority due to widespread geographic range, occurrence in many subwatersheds, low threat levels and habitat trends that appear to be stable.
Phlox andicola Plains Phlox	5/29/2013	Status re-determined as relatively low risk, low to moderate priority due to widespread geographic range, moderate population levels, low intrinsic vulnerability and low threat levels.
Solidago velutina Three-nerved Goldenrod	5/24/2013	Species is only known in Montana from one 1980 collection in the Stillwater River Valley with little additional data available. Until additional documentation on the species distribution, abundance, habitat preferences and vulnerbaility becomes available, status as a Species of Concern is unwarranted.
Ranunculus hyperboreus High Northern Buttercup	5/20/2013	Status re-determined as low risk, low priority due to relatively widespread geographic range, occurrence in numerous subwatersheds and low threat levels. Additionally, the species does does not appear to be restricted to rare habitats nor have instrinsic characteristics that make it especially vulnerable. See state rank details for additional information.
Sphenopholis intermedia Slender Wedgegrass	2/22/2013	Rare to uncommon in the state, where it is sporadically distributed in various mesic sites. Species may respond favorably to some disturbance and threats appear to be minimal, as such its viability in the state does appear to be at significant risk. As a result, the species was moved to the Potential Species of Concern Status pending additional information.
Balsamorhiza macrophylla Large-leaved Balsamroot	1/4/2013	Status re-determined as relatively low risk, low to moderate priority due to combination of moderate population levels, low threat levels, and habitat trends that appear to be stable. Additionally, the species does does not appear to be restricted to rare habitats nor have instrinsic characteristics that make it especially vulnerable.
Botrychium montanum Mountain Moonwort	6/7/2012	Status re-determined as relatively low risk, low to moderate priority due to widespread geographic range, occurrence in many subwatersheds, low threat levels and habitat trends that appear to be stable.
Cirsium brevistylum Short-styled Thistle	6/7/2012	Dropped from SOC status pending additional information and a re-evaluation of its status to determine if the species' viability or its habitat is at risk. Unclear if the species has benefited or expanded its range from human-caused disturbances.
Botrychium lunaria Common Moonwort	6/1/2012	Status re-determined as low risk, low priority due to widespread geographic range, occurrence in numerous subwatersheds, low threat levels and habitat trends that appear to be stable. See additional state rank details.
Stellaria crassifolia Fleshy Stitchwort	5/29/2012	Species is poorly documented from Montana and its conservation priority and needs cannot be accurately assessed without additional information. Dropped from SOC status pending additional information and a re-evaluation of its status to determine if the species' viability or its habitat is at risk.
Stellaria jamesiana James Stitchwort	5/29/2012	Species is poorly documented from Montana and its conservation priority and needs cannot be accurately assessed without additional information. Dropped from SOC status pending additional information and a re-evaluation of its status to determine if the species' viability or its habitat is at risk.
Suckleya suckleyana Poison Suckleya	5/29/2012	Species is poorly documented from Montana and its conservation priority and needs cannot be accurately assessed without additional information. Dropped from SOC status pending additional information and a re-evaluation of its status to determine if the species' viability or its habitat is at risk.
Listera borealis Northern Twayblade	5/4/2012	Status re-determined as low risk, low priority due to widespread geographic range, occurrence in many subwatersheds, low threat levels and habitat trends that appear to be stable.
Juncus hallii Hall's Rush	3/12/2012	Status re-determined as low risk, low priority due to its occurrence in at least 15 subwatersheds, low threat levels, habitat trends that appear stable and overall low risk scores in all vulnerability factors.
Sphaeromeria capitata Rock-tansy	1/5/2012	Regional endemic, though population levels are robust, threats to the species' viability are minimal and large areas of intact habitat exist.
Penstemon globosus Globe Beardtongue	3/18/2011	Though rare in the state, it is more common and widespread in southwest Montana than previously reported by MTNHP. Its habitat and viability generally do not appear to be at risk in Montana.
Castilleja crista-galli Greater Red Indian Paintbrush	3/18/2011	Though uncommon in the state, it is more common and widespread in southwest Montana than previously reported by MTNHP. Its habitat and viability generally do not appear to be at risk in Montana.
Potentilla uniflora One-flowered Cinquefoil	3/1/2011	Though rare in the state, the species does not appear to be at any significant risk of extirpation as a result of relatively healthy population levels and lack of threats to those populations and the species' habitat.
Poa arnowiae Short-leaved Bluegrass	3/3/2010	Moved to Status Under Review pending further taxonomic clarification of Poa arnowiae in relation to Poa wheeleri and the previously used name Poa curta. Additional review of Montana material is needed.
Eustoma grandiflorum Showy Prairie-gentian	2/11/2010	Removed from SOC status due to insufficient information on the habitat and locality of the single Montana collection. May have been an isolated introduction into the state.
Townsendia spathulata Sword Townsend-daisy	9/16/2009	The species' viability in the state does not appear to be at risk due in part to its relatively widespread distribution in southwest and south-central montana and its overall abundance.

SPECIES REMOVED FROM STATEWIDE LIST

SPECIES	DATE	NOTES
Delphinium bicolor ssp. calcicola Limestone Larkspur	9/11/2009	A Montana endemic that is widespread in sw Montana and locally common in some habitats. The viability of this endemic subspecies does not appear to be at risk.
Orogenia linearifolia Great Basin Indian-potato	5/27/2009	More common than previously known with few potential threats to the viability of the species in MT
Ranunculus jovis Jove's Buttercup	5/27/2009	More common than previously known with very few potential threats to the viability of the species in MT
Erigeron radicatus Taprooted Fleabane	4/8/2008	Removed due to overall abundance and lack of threats to high elevation habitats.
Eriogonum brevicaule var. canum Rabbit Buckwheat	12/15/2006	Locally common in parts of Carbon and Big Horn Counties.
Trifolium cyathiferum Cup Clover	6/1/2006	Status of the species in Montana requires additional review. At least 2 of the 3 documented locations in Montana are likely adventive.
Senecio pauciflorus Few-flowered Butterweed	6/1/2006	Status of the species in Montana requires additional review.
Carex chalciolepis Copper-scale Sedge	6/1/2006	Reports of this species from Montana require additional review.
Carex pallescens Palish Sedge	6/1/2006	Occurrences of this species in Montana are likely introduced.
Cypripedium parviflorum Small Yellow Lady's-slipper	6/1/2006	Moved to PSOC list due in part to the number of known occurrences, level of threat to the species and the relatively wide distribution in the state.
Cirsium longistylum Long-styled Thistle	12/15/2004	Removed from SOC status at the time as a result of review showing that a state rank of S3 was warranted.
Lycopodium sitchense Alaskan Clubmoss	4/1/2003	
Botrychium montanum Mountain Moonwort	4/1/2003	
Allotropa virgata Candystick	4/1/2003	
Chrysosplenium tetrandrum Northern Golden-carpet	4/1/2003	
Castilleja gracillima Slender Indian Paintbrush	4/1/2003	
Carex livida Pale Sedge	4/1/2003	
Senecio eremophilus Desert Groundsel	6/1/2001	S. eremophilus var eremophilus
Eurybia glauca Gray Aster	6/1/2001	
Viola renifolia Kidney-leaf White Violet	6/1/2001	
Salix wolfii var. wolfii Wolf Willow	6/1/2001	
Carex magellanica Poor Sedge	6/1/2001	
Botrychium minganense Mingan Island Moonwort	3/1/1999	
Salix cascadensis Cascade Willow	3/1/1999	

SPECIES REMOVED FROM STATEWIDE LIST

SPECIES	DATE	NOTES
Myosotis verna Early Forget-me-not	3/1/1999	
Conioselinum scopulorum Hemlock Parsley	3/1/1999	
Helenium hoopesii Orange Sneezeweed	3/1/1999	
Cryptantha flavoculata Pale Yellow Cryptantha	3/1/1999	
Agoseris lackschewitzii Pink Agoseris	3/1/1999	
Gentiana prostrata Pygmy Gentian	3/1/1999	
Cryptantha humilis Round-headed Cryptantha	3/1/1999	
Gentianella tenella Slender Gentian	3/1/1999	
Halenia deflexa Spurred Gentian	3/1/1999	
Bidens comosa Three-lobe Beggarticks	3/1/1999	
Carex neurophora Alpine Nerved Sedge	3/1/1999	
Calamagrostis tweedyi Cascade reedgrass	3/1/1999	
Carex chalciolepis Copper-scale Sedge	3/1/1999	Previously referred to as C. chalcidepis
Allium fibrillum Fringed Onion	3/1/1999	
Carex nelsonii Nelson's Sedge	3/1/1999	
Agrostis mertensii Northern Bentgrass	3/1/1999	
Juncus triglumis Three-flowered Rush	3/1/1999	
Papaver pygmaeum Alpine Glacier Poppy	6/1/1997	
Evax prolifera Big-head Evax	6/1/1997	
Physaria klausii Divide Bladderpod	6/1/1997	
Erigeron flabellifolius Fan-leaved Fleabane	6/1/1997	
Cuscuta pentagona Field Dodder	6/1/1997	
Heterotheca villosa var. depressa Low Hairy Goldenaster	6/1/1997	Chrysopsis villosa
Spiraea x pyramidata Pyramidal Spiraea	6/1/1997	

SPECIES REMOVED FROM STATEWIDE LIST

SPECIES	DATE	NOTES
Eriogonum brevicaule var. canum Rabbit Buckwheat	6/1/1997	E. lagopus
Erigeron flagellaris Running Fleabane	6/1/1997	
Pedicularis contorta var. rubicunda Selway Coil-beaked Lousewort	6/1/1997	
Madia minima Small-headed Tarweed	6/1/1997	
Bidens vulgata Tall Bur-marigold	6/1/1997	Specifically B. vulgata var. schizantha
Symphyotrichum lanceolatum White Panicle Aster	6/1/1997	Previously referred to as Aster simplex var. ramosissimus
Polygonum polygaloides White-margin Knotweed	6/1/1997	
Lilium columbianum Columbia Lily	6/1/1997	
Oryzopsis contracta Contracted Indian Ricegrass	6/1/1997	
Eriophorum viridicarinatum Green-keeled Cottonsedge	6/1/1997	
Carex eburnea Ivory Sedge	6/1/1997	
Trisetum orthochaetum Missoula County Oats	6/1/1997	
Scirpus pendulus Pendulous Bulrush	6/1/1997	
Astragalus platytropis Broad-keeled Milkvetch	5/1/1996	
Penstemon caryi Cary's Beardtongue	5/1/1996	
Castilleja pilosa var. longispica Parrot-head Indian Paintbrush	5/1/1996	C. longispica
Physalis pumila ssp. hispida Prairie Ground-cherry	5/1/1996	Previously referred to as P. virginiana var. hispida
Carex luzulina var. atropurpurea Black and Purple Sedge	5/1/1996	
Carex torreyi Torrey's Sedge	5/1/1996	
Erigeron allocotus Big Horn Fleabane	5/1/1995	Regional endemic, secure
Draba daviesiae Bitterroot Draba	5/1/1995	Regional endemic, secure
Physalis heterophylla Clammy Ground-cherry	5/1/1995	Adventive
Cardamine rupicola Cliff Toothwort	5/1/1995	State endemic, secure

SPECIES REMOVED FROM STATEWIDE LIST

SPECIES	DATE	NOTES
Astragalus chamaeleuce Ground Milkvetch	5/1/1995	Many populations, low threats
Oxytropis lagopus var. conjugans Hare's-foot Locoweed	5/1/1995	State endemic, secure
Cymopterus hendersonii Henderson's Wavewing	5/1/1995	Taxonomic revision pending
Delphinium bicolor ssp. calcicola Limestone Larkspur	5/1/1995	Referable to D. bicolor ssp. novum prior to 1995
Ericameria discoidea var. linearis Linear-leaved Whitestem Goldenbush	5/1/1995	Many populations, low threats
Stenotus multicaulis Many-stem Goldenweed	5/1/1995	New populations, low threats
Synthyris canbyi Mission Mountain kittentails	5/1/1995	Regional endemic, secure
Sphaeromeria capitata Rock-tansy	5/1/1995	Many populations, low threats
Physaria saximontana var. dentata Rocky Mountain Twinpod	5/1/1995	
Epilobium suffruticosum Shrubby Willowherb	5/1/1995	Many populations, low threats
Gaultheria ovatifolia Slender Wintergreen	5/1/1995	Many populations, low threats
Lorandersonia linifolia Spearleaf Rabbitbrush	5/1/1995	Locally common, low threats
Townsendia spathulata Sword Townsend-daisy	5/1/1995	Many populations, low threats
Trifolium latifolium Twin Clover	5/1/1995	Many populations, low threats
Trifolium microcephalum Woolly Clover	5/1/1995	Many populations, low threats
Penstemon flavescens Yellow Beardtongue	5/1/1995	Regional endemic, secure
Muhlenbergia minutissima Annual Muhly	5/1/1995	Many populations, low threats
Eriophorum viridicarinatum Green-keeled Cottonsedge	5/1/1995	Many populations, locally common
Amphiscirpus nevadensis Nevada Bulrush	5/1/1995	Many populations, low threats
Scirpus pallidus Pale Bulrush	5/1/1995	Many populations, low threats
Dichanthelium acuminatum Panic Grass	5/1/1995	Many populations, low threats. Previously referred to as Panicum occidentale
Acorus americanus Sweetflag	5/1/1995	Specimen review needed
Stipa thurberiana Thurber's Needlegrass	5/1/1995	Probably accidental

SPECIES REMOVED FROM STATEWIDE LIST

SPECIES	DATE	NOTES
Carex vallicola Valley Sedge	5/1/1995	Many populations, low threats
Dichanthelium wilcoxianum Wilcox's Panic Grass	5/1/1995	Many populations, low threats
Lycopodium alpinum Alpine Clubmoss	5/1/1994	More common than previously known
Orobanche corymbosa Flat-topped Broomrape	5/1/1994	More common than previously known
Astragalus lentiginosus Freckled Milkvetch	5/1/1994	Limited distribution
Stanleya viridiflora Green Prince's plume	5/1/1994	Limited distribution
Arenaria kingii King's Arenaria	5/1/1994	More common than previously known
Eriogonum ovalifolium var. ovalifolium Oval-leaf Buckwheat	5/1/1994	More common than previously known. Previously referred to as E. ovalifolium var. nevadense
Astragalus leptaleus Park Milkvetch	5/1/1994	Limited distribution
Castilleja flava var. rustica Rustic Indian Paintbrush	5/1/1994	More common than previously known. Many populations, low threats
Astragalus argophyllus Silver-leaved Milkvetch	5/1/1994	More common than previously known
Pediocactus simpsonii Simpson's Hedgehog Cactus	5/1/1994	More common than previously known
Erigeron gracilis Slender Fleabane	5/1/1994	More common than previously known
Mimulus suksdorfii Suksdorf Monkeyflower	5/1/1994	More common than previously known
Senecio debilis Weak Groundsel	5/1/1994	Limited distribution
Trisetum orthochaetum Missoula County Oats	5/1/1994	Sterile hybrid
Selaginella watsonii Watson's Spikemoss	4/1/1993	More common than previously known
Ipomopsis pumila Dwarf Ipomopsis	4/1/1993	More common than previously known
Ligusticum filicinum Fern-leaf Lovage	4/1/1993	More common than previously known
Gilia leptomeria Great Basin Gilia	4/1/1993	More common than previously known
Townsendia incana Hoary Townsend-daisy	4/1/1993	More common than previously known
Geocaulon lividum Northern Toadflax	4/1/1993	More common than previously known
Claytonia multiscapa Rydberg's Springbeauty	4/1/1993	1994 note: More common than previously known
Camissonia minor Small-flowered Evening-primrose	4/1/1993	More common than previously known

SPECIES REMOVED FROM STATEWIDE LIST

SPECIES	DATE	NOTES
Phacelia ivesiana var. glandulifera Sticky Scorpion-weed	4/1/1993	More common than previously known
Streptanthella longirostris Streptanthella	4/1/1993	More common than previously known
Gilia tweedyi Tweedy's Gilia	4/1/1993	More common than previously known. Previously referred to as G. inconspicua var. tweedyi
Xylorhiza glabriuscula Woody Aster	4/1/1993	More common than previously known
Stanleya tomentosa Woolly Prince's plume	4/1/1993	More common than previously known
Scirpus cyperinus Woolgrass	4/1/1993	Adventive

Appendix G

Employee Information

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Month Year						
Suzie - MT City Roy - Clancy Pat – L Worker	Suzie - MT City Roy - Boulder Pat - L Worker	Suzie - MT City Roy - Jeff City Sally - Whitehall Pat - L Worker	Mike - MT City Roy - Clancy Sally - Whitehall Kelly - Driver Pat - L Worker	Mike - MT City Suzie - Boulder Kelly - Driver	Mike - MT City Sally - Whitehall Kelly - Driver	Kip - MT City Roy - Clancy Suzie - Boulder Mike - Jeff City Sally - Whitehall Kelly - Driver
	SITE HOURS	9:30-5:30	MTC Staff get 8.5 hrs - need to be there early + time for closing			

Manager Candice Bell 406-225-4159 cbell@jeffersoncounty-mt.gov
Office hours are now 9:00am-5:30pm Monday-Friday 406-225-4159 Fax 406-225-4169 or
solidwaste@jeffco.mt.gov

County Cell Phones:

Candice	**437-1223**
Boulder	**437-1743**
Clancy	**949-9246**
Montana City	**422-6923**
Whitehall	**422-6348**

Basin is un-manned
April - Sept. Tues + Sat 8a-4p
Oct - Mar Sat 8a-4p
Truck Driver opens + closes

EMPLOYEES

1. Pat Rosin – Lead Worker/Driver FTE 40
2. Kelly McCall – Driver FTE 40
3. Roy McLane – Site Attendant FTE 40
4. Sally Griffis – Site Attendant PPTE 32 — NOTE: Will retire in May 2018
5. Mike Schmaus – Site Attendant PPTE 33.5
6. Suzie Marty/Rogers – Site Attendant FTE 40 — NOTE: Will take over Whitehall site in May 2018
7. Kip Stone – Fill In Site attendant/Driver 8 — NOTE: May be hired as PPT in May, 3-4 days at MTC/Boulder

ON-CALL EMPLOYEES

1. Leon Elbert – On Call Driver
2. Loren Holmgren - Fill-in Site Attendant
3. Robert Tomich – Fill-in Site Attendant
4. Need to Hire
5. Need to Hire

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Job Description

The County is an equal opportunity employer. The County shall, upon request, provide reasonable accommodations to otherwise qualified individuals with disabilities.

This job description is intended to reflect core areas of responsibility and an incumbent employees' knowledge and skill set needed to complete those functions. This document is not intended to catalog each individual duty; employees are routinely called upon to address emerging employer requirements in alignment with individual work units and assignments of jobs. The job description does not constitute an employment agreement between the employer and employee and is subject to change by the employer as the needs of the employer change.

Job Title:	Heavy Truck Driver/Operator	**FLSA Status:**	☒ **Non-Exempt** ☐ **Exempt**
Department	Solid Waste District	**Reports to:**	Solid Waste District Manager

Work Unit Overview: The Solid Waste Department is responsible for solid waste planning and for financing, designing, constructing and operating a solid waste management system consistent with the State of Montana's solid waste management plan and applicable state laws and regulations. The District must plan and implement the complementary use of a variety of waste management practices to safely and effectively handle the municipal solid waste stream with the least adverse impact on human health and the environment. The program includes: (1) the reduction of waste generated at the source; (2) reuse; (3) recycling; (4) composting; and (5) landfilling.

Job Summary Drive a tractor-trailer combination or operate heavy equipment. Position may be required to unload transfer boxes if items do not empty properly. This position performs technical and labor duties requiring adherence to safety procedures. May work in extreme temperatures; varying work schedule; works weekends and may work holidays. Requires Commercial Class A Type 2 drivers' license.

Essential Functions (Major Duties or Responsibilities): *These duties are the essential functions and are not all-inclusive of all duties that the incumbent performs.*

- Operate a tractor-trailer truck with a capacity of at least 26,000 pounds Gross Vehicle Weight (GVW) for official county Solid Waste District operations according to established safety procedures and applicable rules and laws. This includes loading vehicles and delivering solid waste to the landfill , removing debris, and operating related mechanical equipment such as backhoes, excavator, loader, etc.

- Check vehicles to ensure that mechanical, safety, and emergency equipment is in good working order.

- Maneuver trucks into loading or unloading positions, follow signals from loading crew and check that vehicle and loading equipment are properly positioned.

- Maintain logs of working hours or of vehicle service or repair status, following applicable state and federal regulations.

- Report vehicle defects, accidents, traffic violations, or damage to the vehicles.

- Secure cargo for transport, using ropes, blocks, chains, binders, or covers.

- Inventory and inspect goods to be moved to determine quantities and conditions.

- Obey traffic laws and follow established traffic and transportation procedures.

- Inspect and maintain vehicle supplies and equipment, such as gas, oil, water, tires, lights, or brakes, to ensure that vehicles are in proper working condition.

- Report any mechanical problems, to the mechanic at Central Shop, encountered with vehicles.

- Report delays, accidents, or other traffic and transportation situations to bases or other vehicles, using telephones or mobile two-way radios.

Non-Essential Functions:

- Practices customer service in all dealings with other county employees, vendors, and the public.

- Conducts special assignments as instructed to meet a need within county government operations.

- May operate vehicle in emergency situations such as floods, wildfires, and earthquakes, or manmade disasters under guidance from emergency services commanders.

Physical Demands and Working Conditions: *The demands and conditions described here are representative of those the employee must meet to perform the essential functions of the job.*

- Frequently required to walk, sit, talk, and hear. Required to use hands and arms in driving a heavy vehicle and completing routine maintenance.
- Must routinely lift and/ or move up to 75 pounds.
- Specific vision abilities required by this job include close vision, distance vision, color vision, peripheral vision, depth perception, and the ability to adjust focus.
- Work locations include the container sites, Class III landfills and public areas as assigned.

Supervision Received: This position reports directly to the Solid Waste Manager.

Supervision Exercised: The primary function of this job is not in a supervisory capacity; an incumbent may be asked to train newer employees.

Knowledge, Skills, and Abilities:
This position requires knowledge of basic mechanical operations of a Heavy vehicle; knowledge of all traffic laws and standard processes for the safe operation of a vehicle within a public roadway. This position requires knowledge of Class III landfill management, hazardous waste screening and emergency response, including knowledge of safety principles involved in operating a heavy truck in an environment with multiple individuals involved in various phases of waste handling. Prepares daily summaries of operation, performs manual labor and ground maintenance work such as mowing weeds, collection of blowing debris and general site clean-up, monitors and helps coordinate rotation of transfer boxes and recycling. Maintains composting piles and Class III burn pits. Monitors and maintains tire pits and wood waste piles. Maintains vehicle and equipment usage reports.

This position requires skill in operating a large vehicle in both basic traffic conditions as well as large scale landfills in all weather conditions.

This position requires the ability to perform routine maintenance and troubleshooting of mechanical failures on light vehicles and small equipment.

Education and Experience:
The job requires education and experience equivalent to graduation from high school. An incumbent in this position is required to obtain a Commercial Class A Type 2 Driver's License (CDL) and maintain all conditions associated with this license. Three years' experience in operating tractor trailer trucks and operating heavy equipment. Must successfully complete training in Class III landfill management, landfill hazardous waste screening, and emergency response as feasible after hire.

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Job Title:	Truck Driver/Lead Worker	**FLSA Status:**	☒ **Non-Exempt** ☐ **Exempt**
Department:	Solid Waste	**Reports to:**	Solid Waste District Manager

Work Unit Overview: The Solid Waste Department is responsible for solid waste planning and for financing, designing, constructing and operating a solid waste management system consistent with the State of Montana's solid waste management plan and applicable state laws and regulations. The District must plan and implement the complementary use of a variety of waste management practices to safely and effectively handle the municipal solid waste stream with the least adverse impact on human health and the environment. The program includes: (1) the reduction of waste generated at the source; (2) reuse; (3) recycling; (4) composting; and (5) landfilling.

Job Summary: The Lead Worker provides day-to-day field oversight of Solid Waste District daily container site operations including employees, repair of roll-off collection and transfer equipment: Class III landfills, burn pits and recycling sites; represents the Solid Waste District Manager in manager's absence; drives specialized large trucks and trailer to transport containers from waste container sites to approved landfills and/or recycling centers; acts as the on-the-job trainer in the program to train backup truck drivers; performs other duties as assigned and as necessary for effective operations of the Solid Waste District.

Essential Functions (Major Duties or Responsibilities): *These duties are the essential functions and are not all-inclusive of all duties that the incumbent performs.*

- Performs guidance of Solid Waste District employees, assuring appropriate safety precautions are followed including input to the District Manager on their work quality. Lead Worker has input in employee evaluations and possible discipline.

- Lead Worker is responsible for the following: scheduling for transport of boxes from the transfer site to the approved landfills; conducting regular and ongoing safety inspections of container sites, operations and waste transfer equipment; scheduling for transport and sale of salvage materials; performing field supervision of the operation of the Class III landfills, burn pits and recycling operations.

- Drives heavy equipment, including tractor-truck, to transport transfer boxes from the waste container sites to the approved landfills – many times in adverse and potentially hazardous road and weather conditions.

- Schedules and supervises the regular maintenance and repair of the solid waste transport truck and trailer. Reports repairs needed on all waste collection transfer boxes, transfer equipment, and sites to District Manager.

- Performs manual labor and grounds maintenance work such as mowing weeds, collection of blowing debris and genera site clean-up.

- Informs the Solid Waste Manager of all significant complaints or concerns of the staff or public.

- In the district Manager's absence, the Lead Worker shall assume responsibilities for: Supervision of District employees including work schedules leave request approval, initiative of corrective/disciplinary actions; assures supervision of employees regarding; proper handling of solid waste and hazardous materials, management of an occasional hostile individual; preventing loss or damage to equipment, container sites, records maintenance; safety policy and procedures.

Non-Essential Functions:

- Compile and submit activity reports, equipment logs, inspection reports, and other records to provide accurate, complete, and timely information.

- Perform other duties as assigned including managing special projects, attending meetings and conferences, providing backup for other staff, participating in training, etc.

Physical Demands and Working Conditions: *The demands and conditions described here are representative of those the employee must meet to perform the essential functions of the job.*

- *Physical Demands:* Essential functions involve significant physical demands related to repeated lifting of up to 75 pounds; carrying tools, materials, and equipment over rough terrain; climbing, reaching and bending; and operating gas, diesel, and electrically powered equipment.

- *Working Conditions:* Work is at container sites, landfills and outdoor conditions involving pervasive hazards associated with heavy equipment and tool operations; speeding traffic; loud and constant noise; and regular exposure to chemicals, dust, fumes, and combustible materials. The job is required to work outdoors on varied and often unstable terrain in all weather conditions. Predominant working conditions require special precautions and the use of protective gear (e.g., respirator masks, steel toed boots, gloves, etc.). Employee often works alone, works weekends and may work holidays.

Supervision Received: this position reports directly to the Solid Waste Manager.

Supervision Exercised: *Position exercises daily supervision of department employees in the field.*

Knowledge, Skills, and Abilities:
This position requires the knowledge and skills to operate solid waste transport equipment, transport truck; hazardous waste screening and accident prevention; recording and reporting of accurate data on a weekly basis; knowledge of State laws regarding container sites, landfills, Class III waste landfills; safety procedures in working with waste and near equipment; recycling; and identifying unacceptable waste and different types of waste. Position requires ability to effectively communicate with the public, employees and manager.

Education and Experience:
This position requires education and experience equivalent to three (3) years' experience in heavy equipment operations, two (2) years' experience in field oversight of employees, or a related trade/technical field. Equivalencies include completion of a heavy equipment operator certification or apprenticeship, and two (2) years solid waste experience.

Requires a Class A CDL, Type 2 driver's license. Requires completion of the following training/accreditations within six months of hire:

- Class III Landfill Management
- First Aid/CPR
- Landfill Hazardous Waste Screening

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This job description is intended to reflect core areas of responsibility and an incumbent employees' knowledge and skill set needed to complete those functions. This document is not intended to catalog each individual duty; employees are routinely called upon to address emerging employer requirements in alignment with individual work units and assignments of jobs. The job description does not constitute an employment agreement between the employer and employee and is subject to change by the employer as the needs of the employer change.

Job Title:	Site Attendant	**FLSA Status:**	☒ **Non-Exempt**	☐ **Exempt**
Department	Solid Waste District	**Reports to:**	Solid Waste Manager	

Work Unit Overview: The Solid Waste Department is responsible for solid waste planning and for financing, designing, constructing and operating a solid waste management system consistent with the State of Montana's solid waste management plan and applicable state laws and regulations. The District must plan and implement the complementary use of a variety of waste management practices to safely and effectively handle the municipal solid waste stream with the least adverse impact on human health and the environment. The program includes: (1) the reduction of waste generated at the source; (2) reuse; (3) recycling; (4) composting; and (5) landfilling.

Job Summary: Responsible for operation and maintenance of Waste District Container Site, Class III landfills, burn pits, and recycling sites.

Essential Functions (Major Duties or Responsibilities): *These duties are the essential functions and are not all-inclusive of all duties that the incumbent performs.*

- Assist the public, screens for hazardous waste, writes invoices for volume charges and records data.

- This position greets container site customers and directs refuse to the proper area; inspects customer loads for unacceptable waste; rejects unwanted waste according to check list; determines fees; issues invoices and records fees; answers questions concerning fees, dumping, hazardous waste, recycling, and other waste related management matters, refers customers to manager as necessary.
- May supervise community service workers through the Jefferson County Youth and Adult Court Community Service Program.
- Compiles data on volumes, sources, types; prepares periodic summaries of operation of their location(s).

- Performs manual labor and grounds maintenance work such as mowing weeds, collection of litter and general site clean-up; monitors and helps coordinate rotation of roll off containers and recycling.
- Maintains Class III and burn pit areas at each site; performs maintenance on buildings and grounds as required.
- Informs the Solid Waste Manager of all significant complaints or concerns of the public.

- Executes special assignments as necessary, attends appropriate classes; performs other related duties as required.

Non-Essential Functions:

- Compile and submit activity reports, equipment logs, inspection reports, and other records to provide accurate, complete, and timely information
- Perform other duties as assigned including managing special projects, attending meetings and conferences, providing backup for other staff, participating in training, etc.

Physical Demands and Working Conditions: *The demands and conditions described here are representative of those the employee must meet to perform the essential functions of the job.*

- Essential functions involve significant physical demands related to repeated lifting of up to 75 pounds; carrying tools, materials, and equipment over rough terrain; climbing, reaching and bending; and operating gas, diesel, and electrically powered equipment.

- Work is at container sites, landfills and outdoor conditions involving pervasive hazards associated with heavy equipment and tool operations; loud and constant noise; and regular exposure to chemicals, dust, fumes, and combustible materials.
- The job is required to work outdoors on varied and often unstable terrain in all weather conditions.
- Predominant working conditions require special precautions and the use of protective gear (e.g., steel toed boots, gloves, etc.).
- Employee often works alone, works weekends and may work holidays.

Supervision Received:
This position reports directly to the Solid Waste Manager and Lead Worker.

Supervision Exercised:
May supervise Community Service workers through the Jefferson County Youth and Adult Court Community Service Program.

Knowledge, Skills, and Abilities:
This position must acquire a knowledge of hazardous waste screening and accident prevention; knowledge of state laws regarding container sites, Class III (inert) waste landfills; safety procedures in

working with waste, near equipment and with the public; recycling; and record keeping. Some of this knowledge may be acquired after employment.

This position requires skills in effective communication with the public, recording accurate data, identify unacceptable waste and different types of waste; use judgement, basic mathematics, reasoning and problem-solving skills; ability to supervise community service workers. Identify unacceptable waste and different types of waste; calculate fees; record user information; visually inspect areas; use hand and power tools; operation of portable radio and cell phone; maintain building and grounds; walk on uneven ground; lift objects weighing up to 75 pounds; pick up litter; hear customer and approaching equipment. Employee often works alone requiring self-discipline and problem solving skills to identify and complete tasks. Must be able to deal well with the public in, sometimes stressful, circumstances.

This position requires the ability to: follow safety procedures; use of independent judgement, reasoning, planning and problem-solving skills; maintain accurate records including use of basic math; work in adverse weather conditions; requiring arduous physical demands for extended periods; handle potentially stressful situations; work independently; communicate effectively; follow verbal and written instruction; establish effective working relationships with fellow employees, supervisors, and the public and community service workers. Supervision of up to three community service workers.

Education and Experience:
The above knowledge, skills, and abilities are typically acquired through a combination of education and experience equivalent to:

- High School/GED
- Must possess a valid Montana driver's license
- Must successfully complete training in Class III Landfill management, landfill hazardous waste screening and emergency response three (3) months after hire.
- Experience in identifying hazardous waste and recording data preferred.

Appendix H

Meeting Handouts/Sign Up Sheets/Public Comments

JEFFERSON COUNTY

Solid Waste Preliminary Engineering Report

Work Session #1

May 29, 2018

GreatWest engineering

Table _______ - Waste Volume & Population History

Fiscal Year	Annual Landfill Tonnage	Diverted Waste	Total Waste Tonnage	Population	Waste Generation (lb/person/day)
2014-2015	6,124			11,788	2.85
2015-2016	6,415			11,853	2.97
2016-2017	6,478			11,918	3.01

Table _____ - Waste Volume & Service Area Population Projections

Year	Annual Landfill Tonnage	Diverted Waste	Total Waste Tonnage	Population	Waste Generation (lbs/person/day)
2018	6,561		6,561	11,983	3.0
2038	8,813		8,813	16,096	3.0

Table _____ - Annual Container Site Tonnage

	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18
MONTANA CITY	1737.17	1820.83	1840.5	1188.67
BOXES	414	545	570	374
TONS/BOX	**4.2**	**3.3**	**3.2**	**3.2**
CLANCY	400.35	396.33	412.98	266.54
BOXES	112	148	146	95
TONS/BOX	**3.6**	**2.7**	**2.8**	**2.8**
JEFF CITY	276.72	295.87	281.5	173.8
BOXES	83	106	104	66
TONS/BOX	**3.3**	**2.8**	**2.7**	**2.6**
BASIN	79.45	99.09	109.22	63.47
BOXES	30	42	47	27
TONS/BOX	**2.6**	**2.4**	**2.3**	**2.4**
BOULDER	543.64	582.66	605.3	376.71
BOXES	91	180	180	119
TONS/BOX	**6.0**	**3.2**	**3.4**	**3.2**
WHITEHALL	1617.49	1792.97	1676.26	1047.81
BOXES	165	223	158	140
TONS/BOX	**9.8**	**8.0**	**10.6**	**7.5**

(1) At Whitehall most of the time two containers are hauled, but in the winter a trailer is NOT used when roads are bad

Table _____ - Annual Solid Waste Tonnage

	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18 (1)
ANNUAL TOTAL	6123.89	6415.43	6478.49	4285.83
JEFF CO CONTAINER SITE TONNAGE	4713.7	4987.75	4925.76	3117
GIULIO CURB SIDE	771.26	779.03	795.74	625.31
TRI-COUNTY DISPOSAL CURB SIDE	638.93	648.65	756.99	543.59

(1) Thru Feb 2018 (2/3) 4 months left (1/3)

Table _____ - Solid Waste District Expense History

Item	FY 2013-14	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18 (1)
Salaries & Benefits	444119	463109	485368	427006	310445
Equipment Repairs, Maintenance & Parts	39826	37838	40669	32910	23520
Supplies & Equipment	24991	2518	9869	8205	2538
Tipping Fees	160560	181574	188362	184032	143349
Landfill Services (Giulio Hauling)	19561	22954	24937	20286	20151
Fuel & Diesel Fuel	47583	38671	25355	23345	19261
Office & Utility Costs	7715	6689	5871	5577	4327
Wood Processing	15600	240	0	0	0
Recycling	0	0	150	3940	3484
GASB 45	30947	0	0	0	0
Professional Services	21986	9344	7880	7020	4262
Liability Insurance	16028	16176	16548	18359	21286
Licensing	1239	1240	1200	1241	2127
Other Miscellaneous Expenses	10229	8896	11570	7759	8281
Total	**840384**	**789249**	**817779**	**739680**	**563031**

(1) Expenses through Feb 2018

Table _____- Annual Revenue History (rounded to the nearest $500)

Item	2014/2015	2015/2016	2016/2017
Real Property Assessments	728,000	728,000	740,000
Personal Assessments	65,000	55,500	61,000
Penalties and Interest	6,500	8,000	6,500
Solid Waste Permits/Collection	1,500	1,500	1,500
Tire Disposal	2,500	3,000	4,000
Refrigerators	2,000	2,500	2,000
Construction Waste Fees	16,000	16,500	15,000
Cardboard		2,000	1,500
Paper		500	500
Aluminum		1,500	1,500
Junk & Metal Salvage	28,000	14,500	21,000
Miscellaneous Revenue	10,000	9,000	11,000
Investment Earnings	1,500	2,000	5,000
Total	**861,000**	**845,000**	**870,500**

Table _____ - Waste Transportation Costs

	2014/2015	2015/2016	2016/2017	2017/2018 (2)
Insurance (1)	12,900	13,200	14,700	11,400
Fuel	38,700	25,400	23,300	19,300
Vehicle Repair & Maintenance	37,800	40,700	32,900	23,500
Salaries & Benefits	106,500 (3)	111,800 (3)	98,200 (3)	71,400 (3)
Total	**195,900**	**191,100**	**169,100**	**125,600**

(1) Assume 80% of liability insurance costs are related to transportation

(2) 2017/2018 Data is through February 2018

(3) Estimated Driver position includes 65% of time hauling

Table ____ - Mileage Depreciation of Truck Purchase

Item	Amount
Truck	$180,000.00
Trailer	$80,000.00
Total	$260,000.00
Divided by 400,000 miles	
Cost per mile	$0.65
Less Salvage Value of 10%	0.06
Cost per Mile Truck Amortization	**$0.59**

Table ____- Transportation Cost Per Mile

	2014/2015	2015/2016	2016/2017	2017/2018
Transportation Costs	**$195,900**	**$191,100**	**$169,100**	**125,600**
Mileage		57,457	54,644	38,734
Truck Amortization Cost Per Mile	$0.59	$0.59	$0.59	0.59
Cost Per Mile		$3.92	$3.68	3.83

Table ____- Montana City Site – May 2016 Traffic Counts

Week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
May 1st			219	308	321	313	503
May 8th	595	123	85	175	174	208	356
May 15th	314	202	251	220	169	258	235
May 22nd	469	228	188	265	203	326	383
May 29	479	0	786	258			
Average	464	184.33	245.8	245.2	216.75	276.25	369.25
Peak Day	595	228	486	308	321	326	503

Table _____- Montana City Site – April/May 2018 Traffic Counts

Week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
April 15th			56	165	161	234	349
April 22nd	519	110	320	278	350	388	626
April 29th	711	249	268	302	308	401	575
May 6th	725	384	334	307	361	241	566
May 13th	558	417	303	188			
Peak Day	725	417	334	307	361	401	626
Average	628	290	256	248	295	316	529

Table _____- Yard Waste Quantities

Site	2015/2016	2016/2017	2017/2018 (1)
Montana City			
Tons	410 (2)	405	331
Boxes	128	126	103
Tons/Boxes	3.2	3.2	3.2
Clancy			
Tons	68	46	41
Boxes	30	19	17
Tons/Boxes	2.3	2.4	2.4
Boulder			
Tons		120 (3)	60 (3)
Whitehall			
Tons		378 (3)	450 (3)
Total Tons		**946**	**882**

Notes:

(1) Tonnage through March 2018

(2) Tonnage Based on Number of boxes @ 3.2 tons/box measured over last two years

(3) Estimated on burn pile size @ 300 lb/cy

Montana City Container Site Alternatives

Alternatives Goals

- Provide long term solution for solid waste management in Northern Jefferson County
- Allow for growth
- Safely accommodate customers and traffic
- Reduce operations and maintenance demands and costs, where possible
- Look at opportunities for equitability (Those who use the system the most should pay more)
- Prefer lower capital cost alternatives
- Maintain level of service

Alternatives Evaluated In Detail

1) **Do Nothing** – Continued traffic, capacity and safety issues, inequitable situation with wood waste producers.
2) **Construct New Container Site on property above exist MTC site**
    a. Features
        i. Full height walls with 32-inch gates – Building Code Requirements
        ii. Continue to accept wood waste
        iii. May be able to process wood waste on site – grinding, composting, burning
        iv. Eight bays to accept all waste
        v. Requires construction of new access road to County road width and 9% maximum grade standard.
    b. Cons
        i. High Capital Cost
        ii. Pay As You Throw (PAYT) for wood waste would require installation of scales
        iii. Road maintenance during winter
        iv. New site will require construction of 32-inch barriers
    c. Pros
        i. Continuation of existing service near existing site and access road
        ii. Same level of service currently provided
        iii. Upgraded modern facility with plenty of space to accommodate growth
        iv. Room for expansion as well as wood waste processing and stockpiling
        v. Would provide space for scales and PAYT if added later
        vi. Already owned by County
    d. Cost - **$826,000** Two scale system adds an additional $217,000

3) **Build new site on purchased five-acre parcel – No wood waste (One option would be County Line Subdivision)**
    a. Features
        i. Five bay roll-off site
        ii. Barrier provided by leaving 32-inch concrete wall above tipping grade – Larger and heavier objects that cannot be lifted over barrier would be hauled directly to landfill

        iii. No wood waste accepted - wood waste hauled directly to landfill and paid for by public
    b. Pros
        i. New modern site laid with room for traffic growth and elimination of traffic conflicts
        ii. Would provide space for scales if County elects to proceed with PAYT in future
    c. Cons
        i. Relatively high capital cost includes purchase price
        ii. New location for public
        iii. Will require 32 inch barrier (concrete wall)
    d. **Cost - $545,000 includes $232,000 lot purchase price** Two scale system would add additional $217,000

4) **Build new site at Tri-County disposal – No Wood waste**
    a. Features
        i. Four bay site
        ii. Barrier provided by leaving 32-inch concrete wall above tipping grade – Larger and heavier objects that cannot be lifted over barrier would be hauled directly to landfill
        iii. No wood waste accepted - wood waste hauled directly to landfill and paid for by public
        iv. Requires installation of additional scale and scale house
        v. TCD would charge County for tonnage plus operations cost for scale attendant and driver
        vi. Requires long term relationship between TCD and County
    b. Pros
        i. New modern site laid with room for traffic growth and elimination of traffic conflicts,
        ii. Tri-County Disposal may pay for part or all of new infrastructure
    c. Cons
        i. Would require scales because TCD would charge
        ii. Will require installation of 32 inch barrier
    d. **Cost - $330,000**

5) **MTC – MSW only site, no wood waste accepted, customers direct haul wood waste to landfill**
    a. Features
        i. No improvements to MTC site
        ii. Wood waste no longer allowed at site – residents must haul to landfill and pay by ton there
    b. Pros
        i. No capital cost option
        ii. Equitable – Wood waste customers pay for what they produce
        iii. Will not be required to construct 32-inch barrier – existing MTC site is grandfathered in

c. Cons
   i. With growth the MTC site is still too small and issues with traffic will continue
   ii. Will need to close Clancy for wood waste as well
   iii. Reduction in level of service provided by County
   iv. Will need to charge for wood waste at Whitehall and Boulder for equitability

Alternatives Screened out after initial analysis

6) **Close all container sites and possibly mandate curbside collection in northern JeffCo**
   a. Features
      i. All waste would either be hauled by individuals or they would have curbside collection
      ii. Could allocate annual tonnage per resident and excess would be charged at per ton fee
   b. Pros
      i. No facility costs or O&M
   c. Cons
      i. Significantly reduced service to residents would likely be unpopular

7) **Build new site on State Lands Property located between Clancy and Jefferson City**
   a. Features
      i. Eight bay site with MSW and wood waste handling,
      ii. Would require construction of 1300 feet of new County Road to get to high and dry site to avoid wetlands
      iii. Would require 32-inch barrier
   b. Pros
      i. Plenty of property available for construction and traffic on site
   c. Cons
      i. Away from population center – will increase residential vehicle miles
      ii. Would require closure of Clancy site to avoid overwhelming that site
      iii. Would require acquisition through State lands through either land swap or long term lease
      iv. Would result in traffic and infrastructure impacts to Old Alhambra Road south of Clancy which is a narrow and winding road through subdivision
      v. Would be most expensive alternative

Financing Alternatives

- Not competitive in traditional grant programs like TSEP or DNRC
- SRF Loan would be 2.5% 20 years with 110% coverage requirement
  - SRF program believes it is not an eligible solid waste project but they are checking into it
  - $500,000 Loan under these terms would add $5.50/ year to annual assessment
- USDA Rural Development

- Income level – no grant eligibility
- RD Loan at 3.875% interest, 20 years with 10% coverage
- $500,000 Loan under these terms would add $6.50/unit to annual assessment

- Intercap Loan
    - 3.15% initially, 15 years with no coverage requirement
    - Variable rate program may be risky under current environment
    - $500,000 Loan under these terms would add $6.80/unit to annual assessment (If variable rate remained at 3.15%)

Future topics
PAYT Alternatives including scales
Wood Waste alternatives

Grind and compost or sell as fuel
Burn in air curtain box 2 -10 tons/hour
Landfill
Open Burning

GreatWest engineering

OPINION OF PROBABLE COST

PROJECT	PROJECT NO.	DATE
JEFFERSON COUNTY SOLID WASTE PER	*1-15272 T.O. #12*	*5/20/2018*

MONTANA CITY TRANSFER STATION SITE

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
	Mobilization	1	LS	*$62,600.00*	$62,600
	Clearing & Grubbing	1.83	AC	*$4,000.00*	$7,320
	Excavation	27,400	CY	*$5.00*	$137,000
	3/4"-Minus Crushed Aggregate Surfacing (6" Depth)	1,840	CY	*$35.00*	$64,400
	1 1/2"-Minus Crushed Aggregate Base Course (8" Depth)	2,845	CY	*$30.00*	$85,350
	Concrete Container Pads (8" Depth Concrete on 6" Crushed Agg.)	46	CY	*$600.00*	$27,600
	Structural Concrete (10" Retaining Wall, 10" Footing)	141	CY	*$700.00*	$98,700
	Chainlink Gate Fall Protection	8	EA	*$2,000.00*	$16,000
	Concrete Barrier Rail	622	LF	*$60.00*	$37,320
	24" Dia. Culvert	262	LF	$60.00	$15,720
	48" Dia. Culvert	300	LF	$120.00	$36,000
	60" Dia. Storm Manhole	1	EA	$8,000.00	$8,000
	Perimeter Fencing	1,750	LF	$17.00	$29,750
					$0

CONSTRUCTION SUBTOTAL		**$625,760**
ENGINEERING DESIGN	12%	$75,091
CONSTRUCTION ENG	8%	$50,061
SUBTOTAL		**$750,912**
CONTINGENCY	10%	$75,091
GRAND TOTAL		**$826,003**

ESTIMATE BY:

CHECKED BY:

REVISED BY:

This Opinion of Probable Cost is the opinion of the engineer of the probable construction cost, and is supplied as a guide only. Since the engineer has no control over the costs of labor and materials or over competitive bidding and market conditions, the engineer does not guarantee the accuracy of such opinion as compared to contractor's bids or actual costs to the owner. Estimate is calculated in 2018 dollars.

GreatWest engineering

OPINION OF PROBABLE COST

PROJECT	PROJECT NO.	DATE
JEFFERSON COUNTY SOLID WASTE PER	*1-15272 T.O. #12*	*5/20/2018*

HYDRAULIC LANE TRANSFER STATION SITE

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
	Mobilization	1	LS	*$23,800.00*	$23,800
	Clearing & Grubbing	1.65	AC	*$4,000.00*	$6,600
	Embankment	2,500	CY	*$8.00*	$20,000
	3/4"-Minus Crushed Aggregate Surfacing (6" Depth)	840	CY	*$35.00*	$29,400
	1 1/2"-Minus Crushed Aggregate Base Course (8" Depth)	1,270	CY	*$30.00*	$38,100
	Concrete Container Pads (8" Depth Concrete on 6" Crushed Agg.)	30	CY	*$600.00*	$18,000
	Structural Concrete (10" Retaining Wall, 10" Footing)	92	CY	*$700.00*	$64,400
	24" Dia. Culvert	120	LF	*$60.00*	$7,200
	Perimeter Fencing	1,750	LF	$17.00	$29,750
					$0
					$0
					$0
					$0
					$0

CONSTRUCTION SUBTOTAL		**$237,250**
ENGINEERING DESIGN	12%	$28,470
CONSTRUCTION ENG	8%	$18,980
SUBTOTAL		**$284,700**
LAND PURCHASE		$232,000
CONTINGENCY	10%	$28,470
GRAND TOTAL		**$545,170**

ESTIMATE BY:

CHECKED BY:

REVISED BY:

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GreatWest engineering

OPINION OF PROBABLE COST

PROJECT	PROJECT NO.	DATE
JEFFERSON COUNTY SOLID WASTE PER	*1-15272 T.O. #12*	*5/20/2018*

TRI-COUNTY DISPOSAL LANDFILL SITE

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
	Mobilization	1	LS	*$25,000.00*	$25,000
	Clearing & Grubbing	0.00	AC	*$4,000.00*	$0
	Embankment	1,500	CY	*$8.00*	$12,000
	3/4"-Minus Crushed Aggregate Surfacing (6" Depth)	800	CY	*$35.00*	$28,000
	1 1/2"-Minus Crushed Aggregate Base Course (8" Depth)	1,100	CY	*$30.00*	$33,000
	Concrete Container Pads (8" Depth Concrete on 6" Crushed Agg.)	24	CY	*$600.00*	$14,400
	Structural Concrete (10" Retaining Wall, 10" Footing)	75	CY	*$700.00*	$52,500
	Weigh Scales	1	EA	*$60,000.00*	$60,000
	Scale House	1	LS	$15,000.00	$15,000
	Software/Computer	1	LS	$10,000.00	$10,000
					$0
					$0
					$0
					$0
					$0

CONSTRUCTION SUBTOTAL		**$249,900**
ENGINEERING DESIGN	12%	$29,988
CONSTRUCTION ENG	8%	$19,992
SUBTOTAL		**$299,880**
CONTINGENCY	10%	$29,988
GRAND TOTAL		**$329,868**

ESTIMATE BY:

CHECKED BY:

REVISED BY:

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GreatWest engineering

OPINION OF PROBABLE COST

PROJECT	PROJECT NO.	DATE
JEFFERSON COUNTY SOLID WASTE PER	***1-15272 T.O. #12***	***5/20/2018***

STANDARD TWO SCALE SYSTEM COST

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
	Mobilization	1	LS	*$16,500.00*	$16,500
	Clearing & Grubbing	0.00	AC	*$4,000.00*	$0
	Site Preparation	1	LS	*$3,000.00*	$3,000
	Software Computer	1	LS	*$10,000.00*	*$10,000.00*
	Two 50-ft Weigh Scales	2	EA	*$60,000.00*	$120,000
	Scale House	1	LS	$15,000.00	$15,000
					$0
					$0
					$0
					$0
					$0
					$0

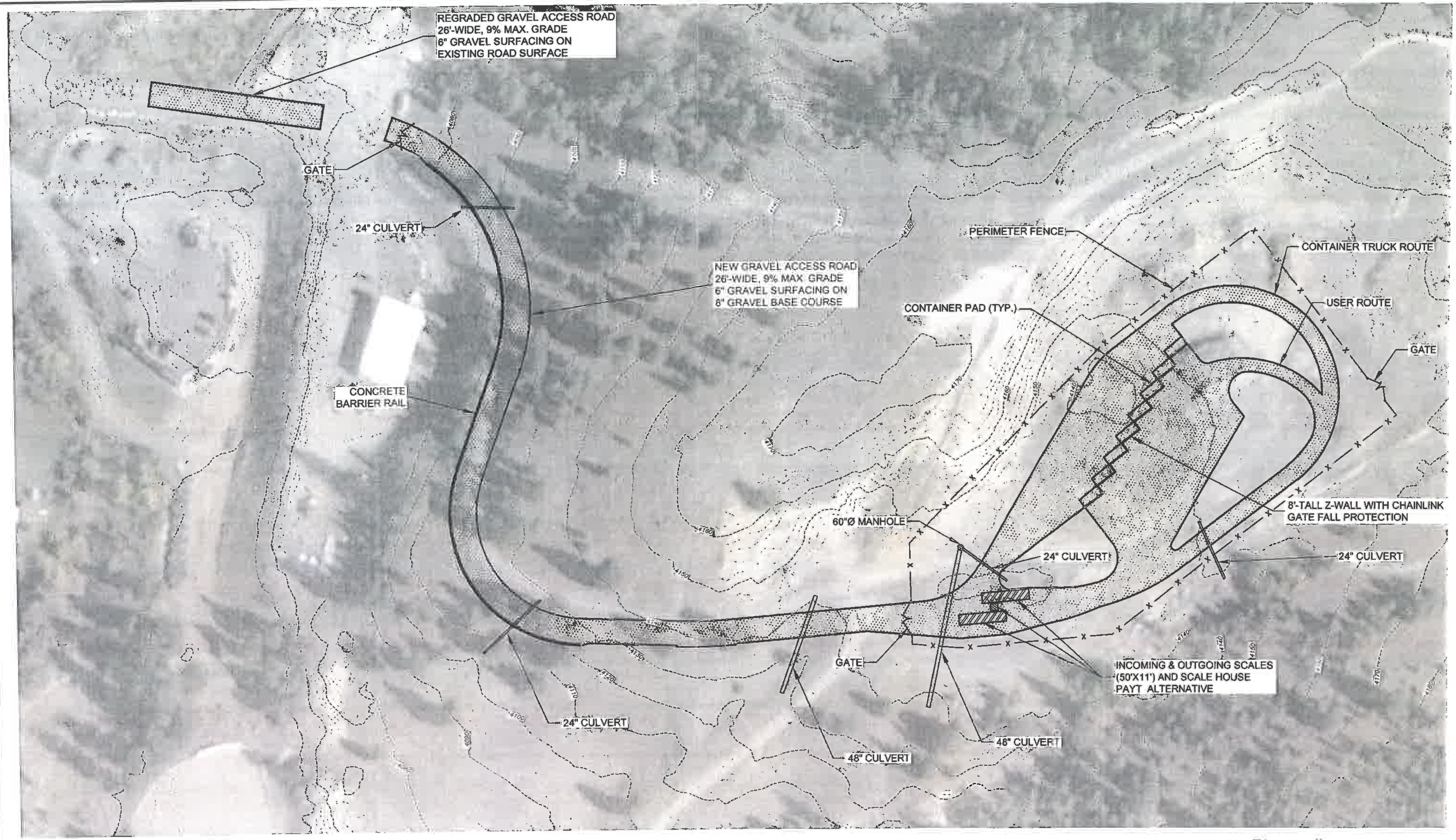
CONSTRUCTION SUBTOTAL		**$164,500**
ENGINEERING DESIGN	12%	$19,740
CONSTRUCTION ENG	8%	$13,160
SUBTOTAL		**$197,400**
CONTINGENCY	10%	$19,740
GRAND TOTAL		**$217,140**

ESTIMATE BY:

CHECKED BY:

REVISED BY:

This Opinion of Probable Cost is the opinion of the engineer of the probable construction cost, and is supplied as a guide only. Since the engineer has no control over the costs of labor and materials or over competitive bidding and market conditions, the engineer does not guarantee the accuracy of such opinion as compared to contractor's bids or actual costs to the owner. Estimate is calculated in 2018 dollars.



GreatWest engineering

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SCALE IN FEET

Figure #
ALTERNATIVE 2
MONTANA CITY CONTAINER SITE
SITE PLAN

JEFFERSON COUNTY SOLID WASTE SYSTEM
PRELIMINARY ENGINEERING REPORT
JEFFERSON COUNTY, MONTANA

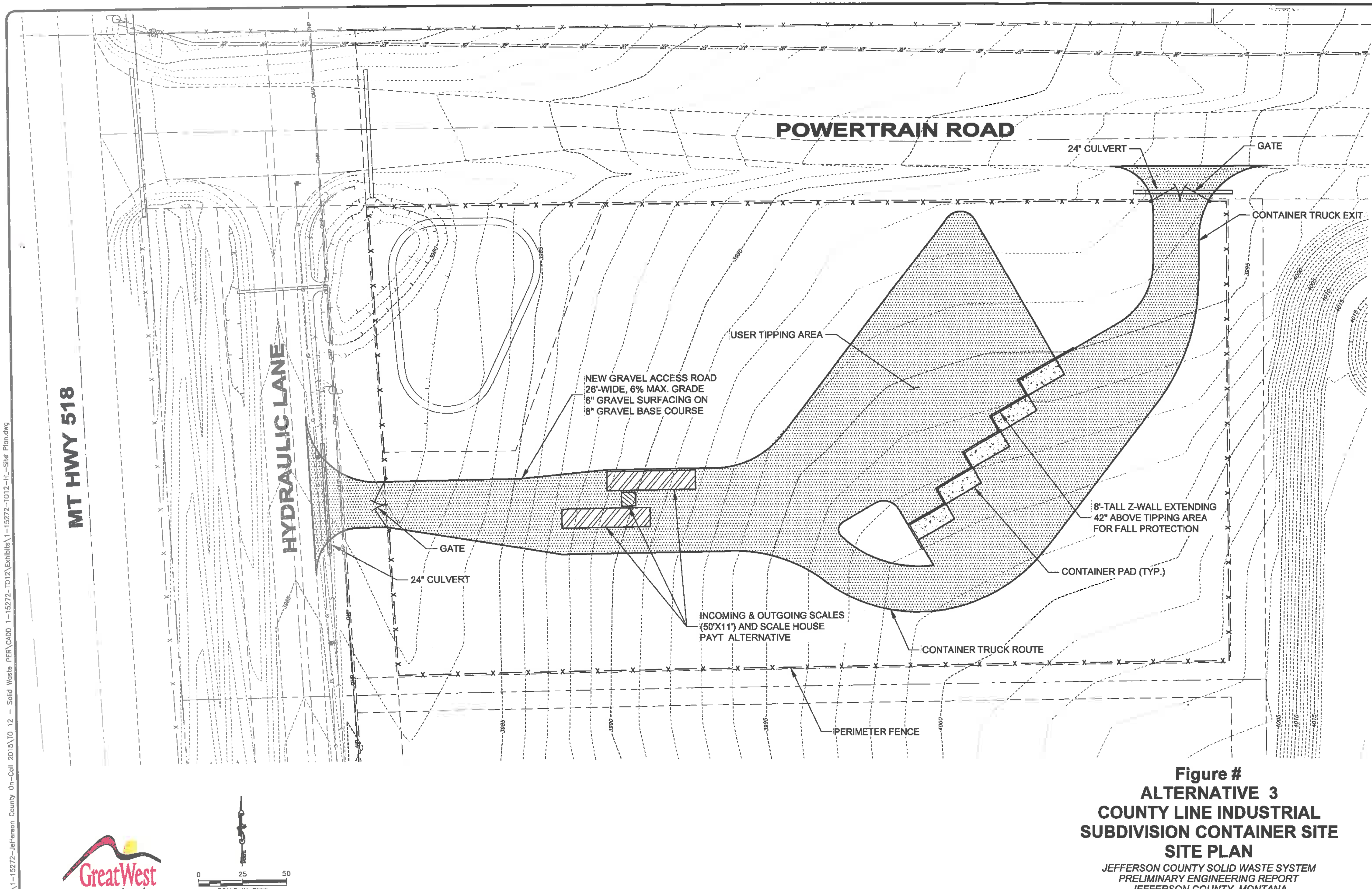

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Figure #
ALTERNATIVE 3
COUNTY LINE INDUSTRIAL SUBDIVISION CONTAINER SITE
SITE PLAN

JEFFERSON COUNTY SOLID WASTE SYSTEM
PRELIMINARY ENGINEERING REPORT
JEFFERSON COUNTY, MONTANA

Figure #
ALTERNATIVE 4
TRI-COUNTY LANDFILL
CONTAINER SITE
SITE PLAN

JEFFERSON COUNTY SOLID WASTE SYSTEM
PRELIMINARY ENGINEERING REPORT
JEFFERSON COUNTY, MONTANA

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JEFFERSON COUNTY SOLID WASTE BOARD
PO BOX H
BOULDER, MT 59632
PHONE 406 225-4025
FAX 406 225-4148
County website: www.jeffersoncounty-mt.gov

LEONARD WORTMAN   CORY KIRSCH, CHAIR   ROBERT MULLEN

AGENDA

November 13, 2018

MEETING TO BE HELD IN C&R CONFRENCE ROOM

CALL MEETING TO ORDER AT 10:00 A.M.

✦MINUTES

October 6, 2018

✦MANAGER'S REPORT
Incidents – None to report
Updates:
Staff status 3 new fill-in employees one with CDL
Recycling –
Yard Waste
Permit Updates

✦CORRESPONDENCE
Tire Shearing Vendor from Three Forks

✦ PUBLIC COMMENT

Conv site – TCD
shift hours
for public
occassionally

✦ ITEMS FOR BOARD'S ACTION, REVIEW OR CONSENT

Metal Pile Bids Review and accept

Great West Engineering, Bob Church Review of PER

✦ APPLICATIONS FOR ADJUSTMENT AND/OR CANCELLATION

✦ ADJOURN

JEFFERSON COUNTY

Solid Waste Preliminary Engineering Report

Work Session #2

November 13, 2018

GreatWest engineering

Table _______ - Waste Volume & Population History

Fiscal Year	Annual Landfill Tonnage	Burned Wood Waste	Class III & Tires	Total Waste Tonnage	Population	Waste Generation (lb/person/day)
2014-2015	6,124		500 (1)	6,624	11,788	3.1
2015-2016	6,415	555	500 (1)	7,470	11,853	3.5
2016-2017	6,478	498	500 (1)	7,476	11,918	3.4

(1) Estimated total annual Class III tonnage for Whitehall & Boulder sites

Table _____ - Waste Volume & Service Area Population Projections

Year	Total Waste Tonnage	Population	Waste Generation (lbs/person/day)
2018	7,476	11,983	3.4
2038	9,987	16,096	3.4

Table _____ - Annual Container Site Tonnage

	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18
MONTANA CITY	1737.17	1820.83	1840.5	1188.67
BOXES	414	545	570	374
TONS/BOX	**4.2**	**3.3**	**3.2**	**3.2**
CLANCY	400.35	396.33	412.98	266.54
BOXES	112	148	146	95
TONS/BOX	**3.6**	**2.7**	**2.8**	**2.8**
JEFF CITY	276.72	295.87	281.5	173.8
BOXES	83	106	104	66
TONS/BOX	**3.3**	**2.8**	**2.7**	**2.6**
BASIN	79.45	99.09	109.22	63.47
BOXES	30	42	47	27
TONS/BOX	**2.6**	**2.4**	**2.3**	**2.4**
BOULDER	543.64	582.66	605.3	376.71
BOXES	91	180	180	119
TONS/BOX	**6.0**	**3.2**	**3.4**	**3.2**
WHITEHALL	1617.49	1792.97	1676.26	1047.81
BOXES	165	223	158	140
TONS/BOX	**9.8**	**8.0**	**10.6**	**7.5**

(1) At Whitehall most of the time two containers are hauled, but in the winter a trailer is NOT used when roads are bad

Table _____ - Annual Solid Waste Tonnage

	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18(1)
ANNUAL TOTAL	6123.89	6415.43	6478.49	4285.83
JEFF CO CONTAINER SITE TONNAGE	4713.7	4987.75	4925.76	3117
GIULIO CURB SIDE	771.26	779.03	795.74	625.31
TRI-COUNTY DISPOSAL CURB SIDE	638.93	648.65	756.99	543.59

(1) Thru Feb 2018 (2/3) 4 months left (1/3)

Table ____ - Solid Waste District Expense History

Item	FY 2013-14	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18 (1)
Salaries & Benefits	444119	463109	485368	427006	310445
Equipment Repairs, Maintenance & Parts	39826	37838	40669	32910	23520
Supplies & Equipment	24991	2518	9869	8205	2538
Tipping Fees	160560	181574	188362	184032	143349
Landfill Services (Giulio Hauling)	19561	22954	24937	20286	20151
Fuel & Diesel Fuel	47583	38671	25355	23345	19261
Office & Utility Costs	7715	6689	5871	5577	4327
Wood Processing	15600	240	0	0	0
Recycling	0	0	150	3940	3484
GASB 45	30947	0	0	0	0
Professional Services	21986	9344	7880	7020	4262
Liability Insurance	16028	16176	16548	18359	21286
Licensing	1239	1240	1200	1241	2127
Other Miscellaneous Expenses	10229	8896	11570	7759	8281
Total	**840384**	**789249**	**817779**	**739680**	**563031**

(1) Expenses through Feb 2018

Table _____- Annual Revenue History (rounded to the nearest $500)

Item	2014/2015	2015/2016	2016/2017
Real Property Assessments	728,000	728,000	740,000
Personal Assessments	65,000	55,500	61,000
Penalties and Interest	6,500	8,000	6,500
Solid Waste Permits/Collection	1,500	1,500	1,500
Tire Disposal	2,500	3,000	4,000
Refrigerators	2,000	2,500	2,000
Construction Waste Fees	16,000	16,500	15,000
Cardboard		2,000	1,500
Paper		500	500
Aluminum		1,500	1,500
Junk & Metal Salvage	28,000	14,500	21,000
Miscellaneous Revenue	10,000	9,000	11,000
Investment Earnings	1,500	2,000	5,000
Total	**861,000**	**845,000**	**870,500**

Table _____ - Waste Transportation Costs

	2014/2015	2015/2016	2016/2017	2017/2018 (2)
Insurance (1)	12,900	13,200	14,700	11,400
Fuel	38,700	25,400	23,300	19,300
Vehicle Repair & Maintenance	37,800	40,700	32,900	23,500
Salaries & Benefits	106,500 (3)	111,800 (3)	98,200 (3)	71,400 (3)
Total	**195,900**	**191,100**	**169,100**	**125,600**

(1) Assume 80% of liability insurance costs are related to transportation
(2) 2017/2018 Data is through February 2018
(3) Estimated Driver position includes 65% of time hauling

Table _____ - Mileage Depreciation of Truck Purchase

Item	Amount
Truck	$180,000.00
Trailer	$80,000.00
Total	$260,000.00
Divided by 400,000 miles	
Cost per mile	$0.65
Less Salvage Value of 10%	0.06
Cost per Mile Truck Amortization	**$0.59**

Table _____- Transportation Cost Per Mile

	2014/2015	2015/2016	2016/2017	2017/2018
Transportation Costs	**$195,900**	**$191,100**	**$169,100**	**125,600**
Mileage		57,457	54,644	38,734
Truck Amortization Cost Per Mile	$0.59	$0.59	$0.59	0.59
Cost Per Mile		$3.92	$3.68	3.83

Table _____- Montana City Site – May 2016 Traffic Counts

Week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
May 1st			219	308	321	313	503
May 8th	595	123	85	175	174	208	356
May 15th	314	202	251	220	169	258	235
May 22nd	469	228	188	265	203	326	383
May 29	479	0	786	258			
Average	464	184.33	245.8	245.2	216.75	276.25	369.25
Peak Day	595	228	486	308	321	326	503

Table _____- Montana City Site – April/May 2018 Traffic Counts

Week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
April 15th			56	165	161	234	349
April 22nd	519	110	320	278	350	388	626
April 29th	711	249	268	302	308	401	575
May 6th	725	384	334	307	361	241	566
May 13th	558	417	303	188			
Peak Day	725	417	334	307	361	401	626
Average	628	290	256	248	295	316	529

Table _____- Yard Waste Quantities

Site	2015/2016	2016/2017	2017/2018 (1)
Montana City			
Tons	410 (2)	405	331
Boxes	128	126	103
Tons/Boxes	3.2	3.2	3.2
Clancy			
Tons	68	46	41
Boxes	30	19	17
Tons/Boxes	2.3	2.4	2.4
Boulder			
Tons	105 (3)	120 (3)	60 (3)
Whitehall			
Tons	450 (3)	378 (3)	450 (3)
Total Tons	1,033	946	882

Notes:

(1) Tonnage through March 2018

(2) Tonnage Based on Number of boxes @ 3.2 tons/box measured over last two years

(3) Estimated on burn pile size @ 300 lb/cy

Montana City Container Site Alternatives

Alternatives Goals

- Provide long term solution for solid waste management in Northern Jefferson County
- Allow for growth
- Safely accommodate customers and traffic
- Reduce operations and maintenance demands and costs, where possible
- Look at opportunities for equitability (Those who use the system the most should pay more)
- Prefer lower capital cost alternatives
- Maintain level of service
- Minimize increases in solid waste assessments

Alternatives Evaluated In Detail

1) **Do Nothing** – Continued traffic, capacity and safety issues, inequitable situation with wood waste producers.
2) **Construct New Container Site on property above exist MTC site**
   a. Features
      i. Use short walls (4.5 feet) with 42-inch gates (Need to throw over 42-inch barrier) – Building Code Requirements
      ii. Continue to accept wood waste
      iii. May be able to process wood waste on site – grinding, composting, burning
      iv. Eight bays to accept all waste
      v. Requires construction of new access road to County road width and 9% maximum grade standard.
   b. Cons
      i. High Capital Cost
      ii. Pay As You Throw (PAYT) for wood waste would require installation of scales
      iii. Road maintenance during winter
      iv. New site will require construction of 42-inch barriers
   c. Pros
      i. Continuation of existing service near existing site and access road
      ii. Same level of service currently provided
      iii. Upgraded modern facility with plenty of space to accommodate growth
      iv. Room for expansion as well as wood waste processing and stockpiling
      v. Would provide space for scales and PAYT if added later
      vi. Already owned by County

   d. Cost - **$794,000** - Two scale system adds an additional $224,000
   e. Increase to Assessment ($794,000 project) = $10.30/unit (20 year RD loan @3.875%)

Reclaimed old site – cost + value

3) **Build new site at Tri-County Disposal**
   a. Features

i. Four bay site
ii. Use short walls (4.5 feet) with 42-inch gates (Need to throw over 42-inch barrier) – Building Code Requirements
iii. Larger and heavier objects that cannot be lifted over barrier would be hauled directly to landfill
iv. Wood waste will be hauled directly to landfill face
v. Requires installation of two additional scales and scale house
vi. TCD would charge County for tonnage plus operations cost for scale attendant and driver
vii. County residents would receive permit tags and TCD would track their tonnage annually. If household exceeded agreed tonnage limit set by County, County could bill customer for excess. Current average annual generation rate is 1.2 tons/unit (2400 lbs/unit)
viii. Requires long term relationship between TCD and County to be agreed upon through either contract or MOU.
ix. TCD would like to have minimum charge to reduce traffic. These charges would be credited to the County's solid waste charges. This is negotiable according to TCD.
x. TCD would purchase any extra containers that Jefferson County does not want to keep

b. Pros
   i. New modern site laid with room for traffic growth and elimination of traffic conflicts,
   ii. Tri-County Disposal would pay for new infrastructure. However County would pay back investment cost over 10 years at either no interest or small interest rate (Negotiated). $45,000/year for 10 years
   iii. $2.65 increase to annual assessment – See attached analysis
   iv. Could be used as first step to convert County to PAYT

c. Cons
   i. Would require scales because TCD needs to track tonnage for billing County
   ii. Also requires commercial scale so County can keep commercial and public traffic separate
   iii. Will require installation of 42 inch barrier
   iv. Includes closure of Clancy and Jefferson City sites to prevent these sites from being overwhelmed and allowing PAYT
   v. With closure of Clancy and Jefferson City this is a reduction in level of service

d. Cost - **$452,000**

Table Operations Cost Comparison Existing Facilities vs Tri-County Disposal Alternative Tri-County Disposal Annual Operation Costs (357 days/year)				
Item	**Days**	**Hrs**	**Rate/Hr**	**Annual Cost**
Scale Attendant	357	8	$32.00	$91,400.00
Container Hauling & Site Maintenance	357	4	$40.00	$57,100.00
Total Cost				**$148,500.00**
Jefferson County Labor Savings				
Item	**Days**	**Hrs**	**Rate/Hr**	**Annual Savings**
Montana City Attendant	357	8	$27.55	$78,700.00
Clancy Attendant	156	8	$27.55	$34,400.00
Jefferson City Attendant	104	8	$27.55	$22,900.00
Total Savings				**$136,000.00**

2 people on weekend 16hrs/week + 2 week 12 weeks

141,000

Jefferson County
Container Hauling Savings

Item	Boxes/Year	Miles Round Trip	Cost	Total
Montana City	570	8	$3.81	$17,374.00
Clancy	146	20	$3.81	$11,100.00
Jefferson City	104	32	$3.81	$12,700.00
Total				**$41,174.00**

Total Cost TCD Operations		$148,500.00
Total Jefferson County Savings		$177,200.00
Net Savings of Alternative		**$28,700.00**
Capital Cost Improvements at Tri-County		$452,000.00
10-year Payback Annual Cost to County (No interest)		$45,200.00
Net Annual Cost of Alternative		**$16,500.00**
Additional Cost Per Assessment 6220 units	**$2.65/unit**	

Alternatives Screened out after initial analysis

1) **Build new site on purchased five-acre parcel – No wood waste (One option would be County Line Subdivision) – Screened Out by Commission- Did not want to duplicate landfill and container site services so close together**
    a. Features
        i. Five bay roll-off site
        ii. Barrier provided by leaving 42-inch concrete wall above tipping grade – Larger and heavier objects that cannot be lifted over barrier would be hauled directly to landfill
        iii. No wood waste accepted - wood waste hauled directly to landfill and paid for by public
    b. Pros
        i. New modern site laid with room for traffic growth and elimination of traffic conflicts
        ii. Would provide space for scales if County elects to proceed with PAYT in future
    c. Cons
        i. Relatively high capital cost includes purchase price
        ii. New location for public
        iii. Will require 42 inch barrier (concrete wall)
    d. **Cost - $545,000 includes $242,000 lot purchase price** Two scale system would add additional $217,000
    e.
2) **MTC – MSW only site, no wood waste accepted, customers direct haul wood waste to landfill**
    a. Features
        i. No improvements to MTC site
        ii. Wood waste no longer allowed at site – residents must haul to landfill and pay by ton there
    b. Pros
        i. No capital cost option
        ii. Equitable – Wood waste customers pay for what they produce
        iii. Will not be required to construct 42-inch barrier – existing MTC site is grandfathered in
    c. Cons
        i. With growth the MTC site is still too small and issues with traffic will continue
        ii. Will need to close Clancy for wood waste as well

   iii. Reduction in level of service provided by County
   iv. Will need to charge for wood waste at Whitehall and Boulder for equitability

3) **Close all container sites and possibly mandate curbside collection in northern JeffCo**
   a. Features
      i. All waste would either be hauled by individuals or they would have curbside collection
      ii. Could allocate annual tonnage per resident and excess would be charged at per ton fee
   b. Pros
      i. No facility costs or O&M
   c. Cons
      i. Significantly reduced service to residents would likely be unpopular

4) **Build new site on State Lands Property located between Clancy and Jefferson City**
   a. Features
      i. Eight bay site with MSW and wood waste handling,
      ii. Would require construction of 1300 feet of new County Road to get to high and dry site to avoid wetlands
      iii. Would require 42-inch barrier
   b. Pros
      i. Plenty of property available for construction and traffic on site
   c. Cons
      i. Away from population center – will increase residential vehicle miles
      ii. Would require closure of Clancy site to avoid overwhelming that site
      iii. Would require acquisition through State lands through either land swap or long term lease
      iv. Would result in traffic and infrastructure impacts to Old Alhambra Road south of Clancy which is a narrow and winding road through subdivision
      v. Would be most expensive alternative

Financing Alternatives

- Not competitive in traditional grant programs like TSEP or DNRC
- SRF Loan – Project not eligible for SRF Loan according to staff
- USDA Rural Development
  - Income level – no grant eligibility
  - RD Loan at 3.875% interest, 20 years with 10% coverage
  - For each $100,000 in Loan under these terms would add $1.30/unit to annual assessment
- Intercap Loan
  - 3.15% initially, 15 years with no coverage requirement
  - Variable rate program may be risky under current environment

- For each $100,000 Loan under these terms would add $1.36/unit to annual assessment (If variable rate remained at 3.15%)

Future topics

2 **Compactor/Mini- Exc Consolidation – Need to decide preferred MTC alternative before evaluating**

1 **PAYT Alternatives including scales – Need to Decide MTC alternative**

3 **Wood Waste alternatives**

Grind and compost or sell as fuel

Burn in air curtain box 2 -10 tons/hour

Landfill

Open Burning

PUBLIC MTGS

Request Six month Extension on Commerce Schedule

Schedule next meeting (December 11th ?)

GreatWest engineering

OPINION OF PROBABLE COST

PROJECT	PROJECT NO.	DATE
JEFFERSON COUNTY SOLID WASTE PER	***1-15272 T.O. #12***	***11/9/2018***

NEW MONTANA CITY TRANSFER STATION SITE (Alternative 2)

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
	Mobilization	1	LS	*$60,200.00*	$60,200
	Clearing & Grubbing	1.83	AC	*$4,000.00*	$7,320
	Excavation	27,400	CY	*$5.00*	$137,000
	3/4"-Minus Crushed Aggregate Surfacing (6" Depth)	1,840	CY	*$35.00*	$64,400
	1 1/2"-Minus Crushed Aggregate Base Course (8" Depth)	2,845	CY	*$30.00*	$85,350
	Concrete Container Pads (8" Depth Concrete on 6" Crushed Agg.)	46	CY	*$600.00*	$27,600
	Structural Concrete (10" Retaining Wall, 10" Footing)	110	CY	*$700.00*	$77,000
	Chainlink Gate Fall Protection	8	EA	*$2,000.00*	$16,000
	Concrete Barrier Rail	622	LF	*$60.00*	$37,320
	24" Dia. Culvert	262	LF	$60.00	$15,720
	48" Dia. Culvert	300	LF	$120.00	$36,000
	60" Dia. Storm Manhole	1	EA	$8,000.00	$8,000
	Perimeter Fencing	1,750	LF	$17.00	$29,750
					$0

CONSTRUCTION SUBTOTAL		$601,660
ENGINEERING DESIGN	12%	$72,199
CONSTRUCTION ENG	8%	$48,133
SUBTOTAL		$721,992
CONTINGENCY	10%	$72,199
GRAND TOTAL		$794,191

ESTIMATE BY:

CHECKED BY:

REVISED BY:

This Opinion of Probable Cost is the opinion of the engineer of the probable construction cost, and is supplied as a guide only. Since the engineer has no control over the costs of labor and materials or over competitive bidding and market conditions, the engineer does not guarantee the accuracy of such opinion as compared to contractor's bids or actual costs to the owner. Estimate is calculated in 2018 dollars.

GreatWest engineering

OPINION OF PROBABLE COST

PROJECT	PROJECT NO.	DATE
JEFFERSON COUNTY SOLID WASTE PER	***1-15272 T.O. #12***	***11/9/2018***

NEW CONTAINER SITE AT TRI-COUNTY DISPOSAL LANDFILL (Alternative 3)

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
	Mobilization	1	LS	*$34,300.00*	$34,300
	Clearing & Grubbing	0.00	AC	*$4,000.00*	$0
	Embankment	1,500	CY	*$8.00*	$12,000
	3/4"-Minus Crushed Aggregate Surfacing (6" Depth)	800	CY	*$35.00*	$28,000
	1 1/2"-Minus Crushed Aggregate Base Course (8" Depth)	1,100	CY	*$30.00*	$33,000
	Concrete Container Pads (8" Depth Concrete on 6" Crushed Agg.)	24	CY	*$600.00*	$14,400
	Structural Concrete (10" Retaining Wall, 10" Footing)	58	CY	*$700.00*	$40,600
	50-Ft Weigh Scale	1	EA	*$60,000.00*	$60,000
	Scale House	1	LS	$15,000.00	$15,000
	Software/Computer/Training	1	LS	$15,000.00	$15,000
	70-Ft Weigh Scale	1	LS	$75,000.00	$75,000
	Weighing Kiosk	1	LS	$15,000.00	$15,000
					$0
					$0
					$0

	CONSTRUCTION SUBTOTAL		$342,300
ESTIMATE BY:	ENGINEERING DESIGN	12%	$41,076
	CONSTRUCTION ENG	8%	$27,384
CHECKED BY:	SUBTOTAL		$410,760
REVISED BY:	CONTINGENCY	10%	$41,076
	GRAND TOTAL		**$451,836**

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GreatWest engineering

OPINION OF PROBABLE COST

PROJECT	PROJECT NO.	DATE
JEFFERSON COUNTY SOLID WASTE PER	***1-15272 T.O. #12***	***11/9/2018***

STANDARD TWO SCALE SYSTEM COST

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
	Mobilization	1	LS	*$17,000.00*	$17,000
	Clearing & Grubbing	0.00	AC	*$4,000.00*	$0
	Site Preparation	1	LS	*$3,000.00*	$3,000
	Software Computer	1	LS	*$15,000.00*	*$15,000.00*
	Two 50-ft Weigh Scales	2	EA	*$60,000.00*	$120,000
	Scale House	1	LS	$15,000.00	$15,000
					$0
					$0
					$0
					$0
					$0
					$0

	CONSTRUCTION SUBTOTAL		**$170,000**
ESTIMATE BY:	ENGINEERING DESIGN	12%	$20,400
	CONSTRUCTION ENG	8%	$13,600
CHECKED BY:	**SUBTOTAL**		**$204,000**
REVISED BY:	CONTINGENCY	10%	$20,400
	GRAND TOTAL		**$224,400**

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JEFFERSON COUNTY

Solid Waste Preliminary Engineering Report

Work Session #3

December 11, 2018

Great West engineering

TABLE - ____
JEFFERSON COUNTY
ANNUAL CONTAINER SITE TONNAGE

	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18
MONTANA CITY	1737.17	1820.83	1840.5	1188.67
BOXES	414	545	570	374
TONS/BOX	**4.2**	**3.3**	**3.2**	**3.2**
CLANCY	400.35	396.33	412.98	266.54
BOXES	112	148	146	95
TONS/BOX	**3.6**	**2.7**	**2.8**	**2.8**
JEFF CITY	276.72	295.87	281.5	173.8
BOXES	83	106	104	66
TONS/BOX	**3.3**	**2.8**	**2.7**	**2.6**
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BOXES	30	42	47	27
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WHITEHALL	1617.49	1792.97	1676.26	1047.81
BOXES	165	223	158	140
TONS/BOX	**9.8**	**8.0**	**10.6**	**7.5**

(1) At Whitehall most of the time two containers are hauled, but in the winter a trailer is NOT used when roads are bad

Consolidation Alternatives

- Consolidation means compacting containers so that more waste is hauled per trip, thereby reducing mileage and transportation costs.
- Compaction alternatives include stationary compactors like those at Whitehall or utilizing backhoes/mini-excavators
- Jefferson County averages about 3 tons/container with loose waste
- Whitehall stationary compactors average nearly 9 tons/container
- Mini-excavators can typically achieve 7-8 tons/container

Boulder Stationary Compaction Consolidation Alternatives

- Includes installation of two 20-Hp stationary compactors, hoppers and generator at Boulder site
- Line power not a financially viable alternative for powering stationary compactors at this site. Lengthy extension of 3 phase power to site is very costly.
- Extension of single phase power is more cost effective but power company will only allow converted single phase up to 15 Hp motors. For this application Jefferson County needs 20 Hp compactors

- Powering compactors with a diesel generator is a viable alternative. One compactor will run at a time
- Estimated capital cost of alternative is $257,000. Estimated payback on stationary compactors at Boulder is 10 years
- Contracting with Giulio to direct haul curbside customers is financially advantageous for County

Boulder Mini-Excavator Compaction Consolidation Alternative

- County would purchase late model used mini-excavator to consolidate loads
- Requires operator 1-2 hours/day to consolidate loads in containers
- Used mini-excavator approximately $35,000
- Estimated payback 5 years

Montana City Mini-Excavator Compaction Consolidation Alternative

- County would purchase late model used mini-excavator to consolidate loads
- Requires operator 2-3 hours/day to consolidate loads in containers
- Used mini-excavator approximately $35,000
- Not a financially viable alternative – no payback primarily because of extremely short haul

Table M Jefferson County Container Site Boulder Container Site Stationary Compactor – 2018 Payback Calculation	
Total Capital Cost with a Generator	$257,000
Boulder Site in 2016-17	605 tons/180 boxes = 3.4 tons/box (Open Top Containers)
Whitehall Site Average 2014-2018	8.98 tons/box (Stationary Compactors)
Ratio of Stationary Compactor Tonnage to Open Top Containers	8.98/3.4 = 2.64
With Stationary Compactors Annual Boulder Containers	180 boxes/2.64 = 68 Boxes
Reduction of Annual Boxes with Stationary Compactor	180 boxes -68 boxes = 112 boxes
Assume that all trips are single container loads	Save 112 trips per year
Annual miles saved per year 112 trips x 60 miles per round trip	6720 miles
District Annual Haul Cost Savings 6720 miles x $3.83/mile	$25,737 per year
Giulio Trips FY16-17	796 tons/132 trips = 6.0 tons/trip (Packer Truck)
Ratio of Stationary Compactor Tonnage to Packer Trucks	8.98/6.0 = 1.5
Number of County trips	132 trips/1.5 = 88 trips
Additional County Haul Cost	88 trips x 60 miles/trip x $3.83/mile = $20,200
Giulio Cost Savings	132 trips x $154/trip = $20,328/year
Total Cost Savings –County direct haul savings – Direct haul cost additions + Giulio haul charges	$25,737/year -$20,200/ year +$20,300/year = $25,837/year
Payback Generator Alternative	$257,000/$25,737 per year = 10.0 years

Table M Jefferson County Container Site Boulder Container Site Mini-Excavator Compactor – 2018 Revised Payback Calculation	
Total Capital Cost Used Mini Excavator	$35,000
Boulder Site in 2016-17	605 tons/180 boxes = 3.4 tons/box (Open Top Containers)
Mini-Excavator Compaction	7.0 tons/box
Ratio of Mini-Exc Compacted Tonnage to Open Top Containers	7.0/3.4 = 2.06
With Mini- Exc Annual Boulder Containers	180 boxes/2.06 = 87 Boxes
Reduction of Annual Boxes with Mini-Exc	180 boxes -87 boxes = 93 boxes
Assume that all trips are single container loads	Save 93 trips per year
Annual miles saved per year 93 trips x 60 miles per round trip	5580 miles
District Annual Haul Cost Savings 5580 miles x $3.83/mile	$21,370 per year
Operator Labor 2 hrs/day x 150 days/year x $33/hr	$9,900/year
Mini- Exc Cost of Operation (Annual Fuel, Maintenance, Repair & Depreciation - 2017 FEMA rate $18/hr)	$5,400/year
Total Annual Cost Savings= Haul Cost Savings – Labor – Cost of Operation/Ownership	$21,370 -$9,900-$5,400 = $6,970/year
Payback Min-Exc Alternative	$35,000/$6,970 per year = 5.0 years

Table M Jefferson County Container Site New Montana City Container Site Mini-Excavator Compactor – 2018 Revised Payback Calculation	
Total Capital Cost Used Mini Excavator	$35,000
Montana City Site in 2016-17	1,840 tons/570 boxes = 3.2 tons/box (Open Top Containers)
Mini-Excavator Compaction	7.0 tons/box
Ratio of Mini-Exc Compacted Tonnage to Open Top Containers	7.0/3.2 = 2.2
With Mini- Exc Annual Boulder Containers	570 boxes/2.2 = 259 Boxes
Reduction of Annual Boxes with Mini-Exc	570 boxes -259 boxes = 311 boxes
Assume that all trips are single container loads	Save 311 trips per year
Annual miles saved per year 311 trips x 7.5 miles per round trip	2,332 miles
District Annual Haul Cost Savings 2332 miles x $3.83/mile	$8,932 per year
Operator Labor 3 hrs/day x 150 days/year x $33/hr	$14,850/year
Mini- Exc Cost of Operation (Annual Fuel, Maintenance, Repair & Depreciation - 2017 FEMA rate $18/hr)	$8,100/year
Total Annual Costs= Haul Cost Savings – Labor – Cost of Operation/Ownership	$8,932 -$14,850-$8,100 = -$14,018/year
Payback Min-Exc Alternative	No payback

Pay-As-You-Throw Concepts and Advantages

- Under a Pay-As-You-Throw (PAYT) system solid waste customers pay only for the volume of waste they throw away
- Jefferson County already has a PAYT system for commercial customers because these businesses pay multiple assessment units based on the volume of waste they generate
- PAYT provides an economic incentive to throw away less waste
- PAYT systems are more equitable because customers pay for the extent they use the system. This is similar to other utilities like gas, water or electricity which us meters to charge customers
- Wood waste volumes in Jefferson County are very high with residential customers generating a large percentage of this waste.
- Some entities report lower waste volumes with implementation of PAYT – Unlikely to be significant in Jefferson County due to low waste generation rate.

PAYT Alternative

- Requires installation of two scale system at either new Montana City Site or Tri-County Disposal Site
- Boulder and Whitehall could be served by single scale each
- Alternative also includes scale house, software and computers for tracking and billing customers
- County could set "free" tonnage level covered under existing assessment until extra tonnage is billed. Typically set at 1-1.5 tons (Current generation rate is 1.2 tons/unit/year)
- Jefferson City, Clancy and Basin sites would need to be closed under this alternative
- New Montana City Site Two-Scale System - $224,000
- Installation of Scales & Supporting Infrastructure at Boulder/Whitehall - $250,800
- **Total Capital Cost of PAYT Alternative $474,800**
- Alternative would require full time scale attendant for MTC and part time attendants for Boulder and Whitehall
- **See Financial Evaluation of Alternative**

Table
Operations Cost Comparison
Pay-As-You-Throw Alternative
Additional Labor Costs

Item	Days	Hrs	Rate/Hr	Annual Cost
Scale Attendant MTC	357	8	$27.55	$78,682.80
PT Scale Attendants Boulder & Whitehall	312	4	$27.55	$34,382.40
Total Cost				**$113,065.20**

Jefferson County Labor Savings

Item	Days	Hrs	Rate/Hr	Annual Savings
Clancy Attendant	156	8	$27.55	$34,400.00
Jefferson City Attendant	104	8	$27.55	$22,900.00
Total Savings				**$57,300.00**

Jefferson County Container Hauling Savings				
Item	Boxes/Year	Miles Round Trip	Cost	Total
Clancy	146	20	$3.81	$11,100.00
Jefferson City	104	32	$3.81	$12,700.00
Total				**$23,800.00**
Additional Labor Costs				**$113,065.20**
Labor Savings				$57,300.00
Container Hauling Savings				$23,800.00
Net Annual Operations Cost **of Alternative**				**$31,965.20**
Capital Cost Improvements PAYT Alternative				$474,800.00
Annual Debt Service (20 year - 3.875%)				$38,000.00
Total Annual Cost of Alternative				**$70,000.00**
Additional Cost Per Assessment 6220 units				**$11.25/unit**

Wood Waste

Table _____- Yard Waste Quantities

Site	2015/2016	2016/2017	2017/2018 (1)
Montana City			
Tons	410 (2)	405	331
Boxes	128	126	103
Tons/Boxes	3.2	3.2	3.2
Clancy			
Tons	68	46	41
Boxes	30	19	17
Tons/Boxes	2.3	2.4	2.4
Boulder			
Tons		120 (3)	60 (3)
Whitehall			
Tons		378 (3)	450 (3)
Total Tons		**946**	**882**

Notes:

(1) Tonnage through March 2018

(2) Tonnage Based on Number of boxes @ 3.2 tons/box measured over last two years

(3) Estimated on burn pile size @ 300 lb/cy

Current Wood Waste Approach

- Wood waste collected at Boulder and Whitehall Sites is stockpiled and open burned 1-2 times/year
- Wood waste collected at MT City and Clancy is backhauled to Boulder when County forces have time
- Last 2-3 years wood waste collected at MT City and Clancy has been landfilled at Tri-County Disposal Landfill at $23/ton

Wood Waste Alternatives

- Grind waste and sell as hog fuel – no current market
- Grind waste and utilize as compost
- Burn in Air Curtain Container
- Continue to Open Burn and/or Landfill

Grinding

- Typical Cost -$5/cubic yard plus mobilization
- Still need to dispose of - or reuse ground waste – composting possibility
- County generates about 1,000 tons/year of wood waste which is approximately 6,800 cubic yards of material
- Estimated cost of grinding wood waste for entire County $38,000 annually = **$38/ton**

Estimated Cost of Open Burning Alternative Currently Used at Whitehall and Boulder

- Staff time estimated at 40 hours/year per site
- Staff time cost 2 x 40 hours x $27.55/hr = $2,200/year
- Loader time 20 hours/year per site x $60/hr = $2,400/year
- Ash Disposal Whitehall 70 tons x $29/ton = $2,030
- Ash Hauling Whitehall 4 tandem trips 130 miles x 3.83/mile = $2,000
- Ash Disposal Boulder 15 tons x $29/ton = $435
- Ash Hauling Boulder 2 single trips 60 miles x 3.83/mile = $460
- Total Estimated Annual Cost of Alternative= $9,525
- Estimated Cost per ton = $9525/570 tons = **$16.70/ton**

Estimated Annual Cost of Wood Waste Alternative Currently Used for Montana City and Clancy

- Disposal Costs (450 tons x $23/ton) = $10,350
- Hauling Costs (See Table) = $5,048
- Total Annual Cost = $15,398
- Cost Per Ton = $15,938/450 tons = **$35.40/ton**

Estimated Annual Cost Air Curtain Alternative for MT City and Clancy

- Operation of Air Curtain $8,640 Annually (See Table)
- Loader Operation 20 hours/year x $60/hr = $1,200
- Ash Disposal 65 tons x $29/ton = $1,885
- Hauling cost = $230
- Annual Debt Service on $120,000 purchase price (10 year service life) = $14,800/year
- Total Annual Cost = $26,775
- Cost Per Ton = $26,775/450 tons = **$59.45/ton**

Estimated Annual Cost to Haul (Not Backhaul) MT City and Clancy waste to Boulder and Open Burn

- Hauling Costs = $28,963 = $64/ton
- Open Burning Cost = $16.70/ton
- Cost Per Ton = **$80.70/ton**

- Public meeting schedule
- Request for extension from Commerce

GreatWest engineering

OPINION OF PROBABLE COST

PROJECT	PROJECT NO.	DATE
JEFFERSON COUNTY SOLID WASTE PER	***1-15272 T.O. #12***	***11/9/2018***

TWO SCALE SYSTEM AT NEW MONTANA CITY SITE

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
	Mobilization	1	LS	*$17,000.00*	$17,000
	Clearing & Grubbing	0.00	AC	*$4,000.00*	$0
	Site Preparation	1	LS	*$3,000.00*	$3,000
	Software Computer	1	LS	*$15,000.00*	*$15,000.00*
	Two 50-ft Weigh Scales	2	EA	*$60,000.00*	$120,000
	Scale House	1	LS	$15,000.00	$15,000
					$0
					$0
					$0
					$0
					$0
					$0

CONSTRUCTION SUBTOTAL		**$170,000**
ENGINEERING DESIGN	12%	$20,400
CONSTRUCTION ENG	8%	$13,600
SUBTOTAL		**$204,000**
CONTINGENCY	10%	$20,400
GRAND TOTAL		**$224,400**

ESTIMATE BY:

CHECKED BY:

REVISED BY:

This Opinion of Probable Cost is the opinion of the engineer of the probable construction cost, and is supplied as a guide only. Since the engineer has no control over the costs of labor and materials or over competitive bidding and market conditions, the engineer does not guarantee the accuracy of such opinion as compared to contractor's bids or actual costs to the owner. Estimate is calculated in 2018 dollars.

GreatWest engineering

OPINION OF PROBABLE COST

PROJECT	PROJECT NO.	DATE
JEFFERSON COUNTY SOLID WASTE PER	***1-15272 T.O. #12***	***11/9/2018***

INSTALL 1 SCALE SYSTEMS AT BOULDER & WHITEHALL SITES

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
	Mobilization	1	LS	*$17,000.00*	$17,000
	Clearing & Grubbing	0.00	AC	*$4,000.00*	$0
	Site Preparation	1	LS	*$3,000.00*	$3,000
	Computers/Software/Training	1	LS	*$20,000.00*	*$20,000.00*
	Two 50-ft Weigh Scales	2	EA	*$60,000.00*	$120,000
	Scale House	2	LS	$15,000.00	$30,000
					$0
					$0
					$0
					$0
					$0
					$0

CONSTRUCTION SUBTOTAL		**$190,000**
ENGINEERING DESIGN	12%	$22,800
CONSTRUCTION ENG	8%	$15,200
SUBTOTAL		**$228,000**
CONTINGENCY	10%	$22,800
GRAND TOTAL		**$250,800**

ESTIMATE BY:

CHECKED BY:

REVISED BY:

This Opinion of Probable Cost is the opinion of the engineer of the probable construction cost, and is supplied as a guide only. Since the engineer has no control over the costs of labor and materials or over competitive bidding and market conditions, the engineer does not guarantee the accuracy of such opinion as compared to contractor's bids or actual costs to the owner. Estimate is calculated in 2018 dollars.

TABLE 10-2
OPINION OF PROBABLE COST
JEFFERSON COUNTY CONTAINER SITE UPGRADES PROJECT
STATIONARY COMPACTOR INSTALLATION W/DIESEL GENERATOR
BOULDER

#	BID ITEM	QTY	UNITS	UNIT PRICE [1]	TOTAL
1	Purchase Stationary Compactors	2	EA	$ 37,500.00	$ 75,000
2	Compactor Installation	2	EA	$ 3,000.00	$ 6,000
3	Hopper Construction	2	EA	$ 10,000.00	$ 20,000
4	Electrical	1	LS	$ 8,000.00	$ 8,000
5	Diesel Powered Generator	1	LS	$40,000.00	$ 40,000
					$ -
	Direct Construction Subtotal				**$ 149,000**
	Mobilization		10%		$ 15,000
	Contingency		10%		$ 15,000
	Construction Subtotal				**$ 179,000**
	Engineering		10%		$ 18,000
	Compactor Containers (4)				$ 60,000
	TOTAL				**$ 257,000**

[1] Estimated unit costs are based upon estimates from suppliers and bid tabs for similar projects throughout Montana.

AirBurners

S-119R
Tier 4 Final Version

ROLL-OFF FIREBOX SPECIFICATIONS

General: A self-contained, completely assembled above ground Air Curtain Burner (air curtain incinerator or FireBox) with a refractory lined burn-container and double steel floor and fittings for cable-hoist trucks in accordance with ANSI Specification Z245.60 for portable applications.

Designed for the high temperature burning of forest slash, agricultural green waste, land clearing debris, storm debris, and other waste streams in compliance with the requirements of US EPA 40CFR60. The FireBox is also used for disaster recovery and Department of Homeland Security contingencies.

Hook-lift and Continuous Chain Roll-off versions also available. Shipped from the factory completely assembled ready for immediate use.

1	Power	Three-cylinder Turbo Diesel Engine approx. 49 HP, HATZ Model 3H50TIC (Requires no DEF) or equivalent engine; Emissions certified US EPA Tier 4 FINAL; Engine mounted PTO
2	Burn Container (Firebox)	4" (102 mm) thick refractory panels filled with proprietary thermal ceramic material; Two full height rear doors; Two ignition holes
3	Safety Systems	Engine over temperature and overspeed shut down; Loss of cooling fluid shutdown; Loss of oil pressure shutdown; Lockable steel front deck security enclosure
4	Instrument Panel	Murphy PowerView PV380-R2 electronic engine control with preset throttle settings: key switch, tachometer, hour meter, fuel gauge, oil pressure and water temperature and safety shutdown features
5	Air Supply	Custom heavy duty fan
6	Fuel Tank	58 Gallon (220 L) minimum fuel tank capacity
7	Transportation & Set-up	Shipped completely assembled; Ready for immediate use; Lifting pads provided for crane lifting; Unit can be dragged on siteon its skids
8	Options	Ash clean-out rake with standard universal quick disconnect for Skidsteer or Bobcat; Hook-lift and Continuous Chain Roll-off Versions
9	Average Through-put	3-5 Tons per Hour (Average – See Note)
10	Fuel Consumption	Approx. 3.1 Gal/Hr (9.5 L/Hr)
11	Weight	39,700 lbs (18,007kg)

		Overall Size L × W × H	Fire Box L × W × H
12	Dimensions	27' 4" × 7' 5" × 8' 6" (8.3m × 2.2m × 2.6m)	19' × 5' × 6' (5.8m × 1.5m × 1.8m)

Note:
Achievable through-put depends on several variables, especially the nature of the waste material, the burn chamber temperature and the loading rate.
All weights and dimensions are approximate and metric conversions are rounded. Specifications are subject to change without notice.

AIR BURNERS, INC.
4390 SW Cargo Way • Palm City, FL 34990
Phone 772-220-7303 • FAX 772-220-7302
E-mail: info@airburners.com • www.AirBurners.com

Rev. 11.16.2018

JEFFERSON COUNTY SOLID WASTE
PRELIMINARY ENGINEERING REPORT
SUMMARY OF ALTERNATIVES
January 2019

MONTANA CITY SITE ALTERNATIVES

1) **Do Nothing** – Continued traffic, capacity and safety issues, inequitable situation with wood waste producers.
2) **Construct New Container Site on property above exist MTC site**
    a. Features
        i. Continue to accept wood waste
        ii. May be able to process wood waste on site – grinding, composting, burning
        iii. Eight bays to accept all waste
        iv. Requires construction of new access road to County road width and 9% maximum grade standard.
    b. Cons
        i. High Capital Cost
        ii. Pay As You Throw (PAYT) for wood waste would require installation of scales
        iii. Road maintenance during winter
        iv. New site will require construction of 42-inch barriers
    c. Pros
        i. Continuation of existing service near existing site and access road
        ii. Same level of service currently provided
        iii. Upgraded modern facility with plenty of space to accommodate growth
        iv. Room for expansion as well as wood waste processing and stockpiling
        v. Access Road improvements would facilitate construction of new road shop on property in future
        vi. Would provide space for scales and PAYT if added later
        vii. Already owned by County
        viii. County retains control of solid waste system

    d. Cost - **$794,000** - Two scale system adds an additional $224,000
    e. **Increase to Assessment** ($794,000 project) = **$10.30/unit** (20 year RD loan @3.875%)

3) **Build new site at Tri-County Disposal**
    a. Features
        i. Four bay site
        ii. Wood waste will be hauled directly to landfill face
        iii. Requires installation of two additional scales and scale house
        iv. TCD would charge County for tonnage plus operations cost for scale attendant and driver
        v. County residents would receive permit tags and TCD would track their tonnage annually. If household exceeded agreed tonnage limit set by County, County could bill customer for excess. Current average annual generation rate is 1.2 tons/unit (2400 lbs/unit)
        vi. Requires long term relationship between TCD and County to be agreed upon through either contract or MOU.

vii. TCD would like to have minimum charge to reduce traffic. These charges would be credited to the County's solid waste charges. This is negotiable according to TCD.
viii. TCD would purchase any extra containers that Jefferson County does not want to keep

b. Pros
    i. New modern site laid with room for traffic growth and elimination of traffic conflicts,
    ii. Tri-County Disposal would pay for new infrastructure. However County would pay back investment cost over 10 years at either no interest or small interest rate (To be negotiated). **$45,000/year for 10 years**
    iii. **Estimated $2.65 increase to annual assessment**
    iv. Could be used as first step to convert County to PAYT

c. Cons
    i. Requires scales because TCD needs to track tonnage for billing County
    ii. Also requires commercial scale so County can keep commercial and public traffic separate
    iii. Will require installation of 42 inch barrier
    iv. Includes closure of Clancy and Jefferson City sites to prevent these sites from being overwhelmed and allowing PAYT
    v. Requires long-term relationship with Tri-County Disposal

d. Cost - **$452,000**

<u>**CONSOLIDATION ALTERNATIVES**</u>

a. **Boulder**
    a. Stationary Compactors - $257,000 cost, 10 year pay back
    b. Mini-Excavator Compaction - $35,000 cost, 5 year pay back, requires operator time and machine maintenance costs
b. **Montana City, Clancy and Jefferson City –** No payback on consolidation, haul too short (Montana City) or not enough waste (Clancy, Jefferson City)

<u>**PAY-AS-YOU-THROW**</u>

- Under a Pay-As-You-Throw (PAYT) system solid waste customers pay only for the volume of waste they throw away
- Jefferson County already has a PAYT system for commercial customers because these businesses pay multiple assessment units based on the volume of waste they generate
- PAYT provides an economic incentive to throw away less waste
- PAYT systems are more equitable because customers pay for the extent they use the system. This is similar to other utilities like gas, water or electricity which us meters to charge customers
- Wood waste volumes in Jefferson County are very high with residential customers generating a large percentage of this waste.
- Some entities report lower waste volumes with implementation of PAYT – Unlikely to be significant in Jefferson County due to already low waste generation rate.

PAYT Alternative

- Requires installation of two scale system at either new Montana City Site or Tri-County Disposal Site

- Boulder and Whitehall could be served by single scale each
- Alternative also includes scale house, software and computers for tracking and billing customers
- County could set "free" tonnage level covered under existing assessment until extra tonnage is billed. Typically set at 1-1.5 tons (Current generation rate is 1.2 tons/unit/year)
- Jefferson City, Clancy and Basin sites would need to be closed under this alternative
- New Montana City Site Two-Scale System - $224,000
- Installation of Scales & Supporting Infrastructure at Boulder/Whitehall - $250,800
- **Total Capital Cost of PAYT Alternative $474,800**
- Alternative would require full time scale attendant for MTC and part time attendants for Boulder and Whitehall
- Additional Operations Cost of $32,000/year
- **$11.25 increase in annual assessment to pay debt plus additional operations costs**

<u>**WOOD WASTE ALTERNATIVES**</u>

Wood Waste Alternatives

- Grind waste and sell as hog fuel – no current market
- Grind waste and utilize as compost
- Burn in Air Curtain Container
- Continue to Open Burn and/or Landfill

Grinding

- Typical Cost -$5/cubic yard plus mobilization
- Still need to dispose of - or reuse ground waste – composting possibility
- Estimated cost of grinding wood waste for entire County $38,000 annually = **$38/ton**

Estimated Cost of Open Burning Alternative Currently Used at Whitehall and Boulder

- Estimated Cost per ton = **$16.70/ton**

Estimated Annual Cost of Wood Waste Alternative Currently Used for Montana City and Clancy

- Disposal Costs (450 tons x $23/ton) = $10,350
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- Total Annual Cost = $15,398
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- Cost Per Ton = $26,775/450 tons = **$59.45/ton**

Estimated Annual Cost to Haul (Not Backhaul) MT City and Clancy waste to Boulder and Open Burn

- Hauling Costs = $28,963 = $64/ton
- Open Burning Cost = $16.70/ton
- Cost Per Ton = **$80.70/ton**

JEFFERSON COUNTY SOLID WASTE SYSTEM

Preliminary Engineering Report

By: Bob Church, PE

Boulder, MT

February 4, 2019

GreatWest engineering.

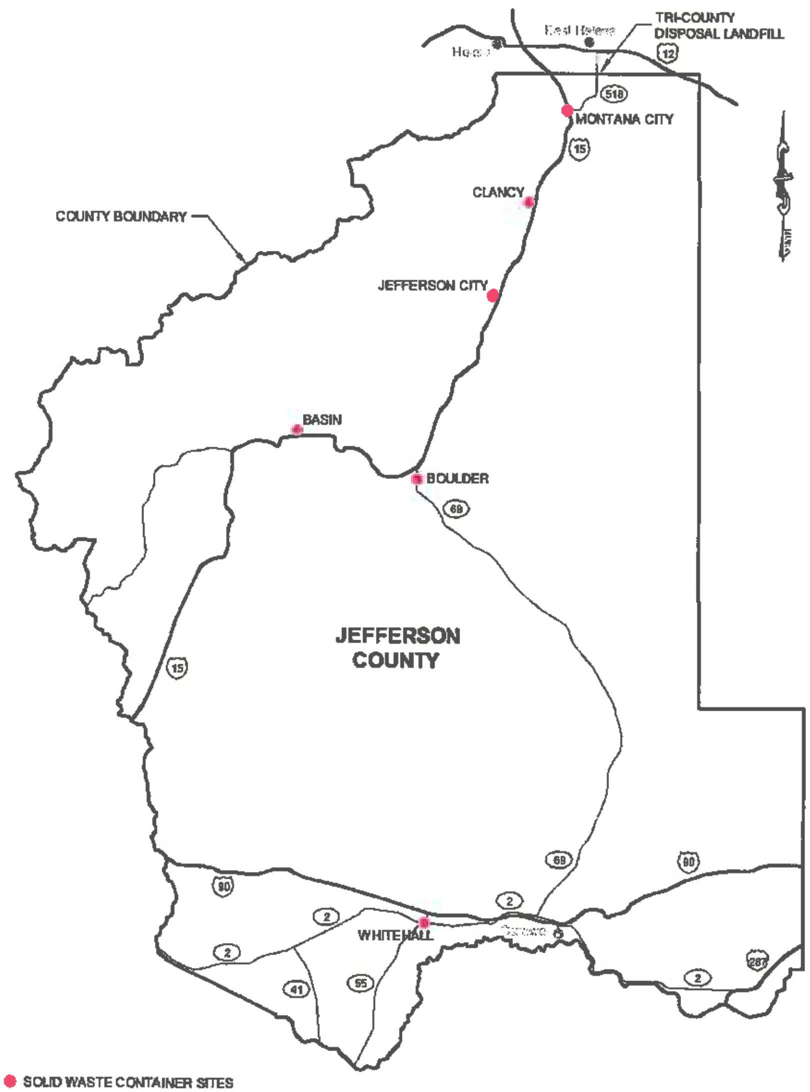


Figure 2-1
PLANNING AREA
JEFFERSON COUNTY SOLID WASTE SYSTEM PRELIMINARY ENGINEERING REPORT

F:\1-15272-Jefferson County On-Call 2015\TO 12 - Solid Waste PER\CADD 1-15272-TO12\Exhibits\PER\1-15272-TO12-PER-Fig 2_1.dwg

COUNTY SOLID WASTE SYSTEM

- County operates six solid waste collection sites
- Municipal solid waste
- Wood waste
- Metal
- Other recyclables
- All sites attended except Basin
- Operating hours vary by site
- County operates inert waste landfills at Boulder & Whitehall

WASTE HAULING

- County hauls containers from collection sites to Tri-County Disposal Landfill
- Tri-County Disposal collects curbside & hauls direct to landfill (northern portion of county)
- Giulio Disposal collects curbside & hauls direct to landfill (primarily Boulder area)

SOLID WASTE SYSTEM STAFF

- Solid waste supervisor
- 2 full time truck drivers
- 4 full time site attendants
- Fill-in drivers & attendants

SOLID WASTE SYSTEM REVENUE

- Property tax assessments ($129.69/unit/year)
- Inert & special waste fees
- Metal recycling
- Other recyclable revenue

SOLID WASTE SYSTEM REVENUE

Table 3-1 – Annual Revenue History (rounded to the nearest $1,000)

Item	2014/2015	2015/2016	2016/2017
Real Property Assessments	728,000	728,000	740,000
Personal Assessments	65,000	55,500	61,000
Penalties and Interest	6,500	8,000	6,500
Solid Waste Permits/Collection	1,500	1,500	1,500
Tire Disposal	2,500	3,000	4,000
Refrigerators	2,000	2,500	2,000
Construction Waste Fees	16,000	16,500	15,000
Cardboard		2,000	1,500
Paper		500	500
Aluminum		1,500	1,500
Junk & Metal Salvage	28,000	14,500	21,000
Miscellaneous Revenue	10,000	9,000	11,000
Investment Earnings	1,500	2,000	5,000
Total	861,000	845,000	870,500

EXPENSE HISTORY

Table 3-2 – Solid Waste District Expense History

Item	FY 2013-14	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18 [1]
Salaries & Benefits	444119	463109	485368	427006	310445
Equipment Repairs, Maintenance & Parts	39826	37838	40669	32910	23520
Supplies & Equipment	24991	2518	9869	8205	2538
Tipping Fees	160560	181574	188362	184032	143349
Landfill Services (Giulio Hauling)	19561	22954	24937	20286	20151
Fuel & Diesel Fuel	47583	38671	25355	23345	19261
Office & Utility Costs	7715	6689	5871	5577	4327
Wood Processing	15600	240	0	0	0
Recycling	0	0	150	3940	3484
GASB 45	30947	0	0	0	0
Professional Services	21986	9344	7880	7020	4262
Liability Insurance	16028	16176	16548	18359	21286
Licensing	1239	1240	1200	1241	2127
Other Miscellaneous Expenses	10229	8896	11570	7759	8281
Total	840384	789249	817779	739680	563031

[1] Expenses through Feb 2018

POPULATION PROJECTION

Table 2-1 – Population Projections 2018-2038

Year	County Population
2018	11,983 [1]
2038	16,096 [1]

(1) Regional Economic Models, Inc.

WASTE TONNAGE HISTORY & PROJECTIONS

Table 3-3 – Waste Volume & Population History

Fiscal Year	Annual Landfill Tonnage	Burned Wood Waste	Class III & Tires	Recycled Wastes	Total Waste Tonnage	Population	Waste Generation (lb/person / day)
2014-2015	6,124	500 (1)	500 (1)	300 (1)	7,424	11,788	3.1
2015-2016	6,415	555	500 (1)	315	7,785	11,853	3.6
2016-2017	6,478	498	500 (1)	320	7,796	11,918	3.6

(1) Estimated tonnage based on previous year's information

WASTE TONNAGE HISTORY & PROJECTIONS

Table 3-4 – Detailed List of Diverted Waste

Fiscal Year	Aluminum Tons	Mixed Paper Tons	Cardboard Tons	Metal Tons	Total Tons
2014-2015					
2015-2016	1.9	29.8	65.4	218	315
2016-2017	1.6	34.4	49	235	320
2017-2018	3.5	21.6	68.6	185	279

Table 3-5 – Waste Volume & Service Area Population Projections

Year	Total Waste Tonnage	Population	Waste Generation (lbs/person/day)
2018	7,796	11,983	3.6
2038	10,575	16,096	3.6

WASTE ORIGINATION

Table 3-6 – Annual Container Site Tonnage

	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18
MONTANA CITY	1737.17	1820.83	1840.5	1188.67
BOXES	414	545	570	374
TONS/BOX	4.2	3.3	3.2	3.2
CLANCY	400.35	396.33	412.98	266.54
BOXES	112	148	146	95
TONS/BOX	3.6	2.7	2.8	2.8
JEFF CITY	276.72	295.87	281.5	173.8
BOXES	83	106	104	66
TONS/BOX	3.3	2.8	2.7	2.6
BASIN	79.45	99.09	109.22	63.47
BOXES	30	42	47	27
TONS/BOX	2.6	2.4	2.3	2.4
BOULDER	543.64	582.66	605.3	376.71
BOXES	91	180	180	119
TONS/BOX	6.0	3.2	3.4	3.2
WHITEHALL	1617.49	1792.97	1676.26	1047.81
BOXES	165	223	158	140
TONS/BOX	9.8	8.0	10.6	7.5

(1) At Whitehall most of the time two containers are hauled, but in the winter a trailer is NOT used when roads are bad

WASTE ORIGINATION

Table 3-7 – Annual Landfilled Solid Waste Tonnage

	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18 [1]
ANNUAL TOTAL	6123.89	6415.43	6478.49	4285.83
JEFF CO CONTAINER SITE TONNAGE	4713.7	4987.75	4925.76	3117
GIULIO CURB SIDE	771.26	779.03	795.74	625.31
TRI-COUNTY DISPOSAL CURB SIDE	638.93	648.65	756.99	543.59

[1] Thru Feb 2018 (2/3) 4 months left (1/3)

ALTERNATIVES EVALUATED IN DETAIL

- Load consolidation at Boulder (Alternatives 2C & 2D)
- Closure of Clancy, Jefferson City & Basin sites (Alternative 2E)
- Replacement of Montana City site (Alternatives 3D & 3E)
- Pay-as-you-Throw alternatives (Alternatives 4A & 4B)
- Wood waste alternatives (Alternatives 5A & 5C)

Figure 3-4
Boulder Container Site

JEFFERSON COUNTY SOLID WASTE SYSTEM
PRELIMINARY ENGINEERING REPORT

F:\1-15272-Jefferson County On-Call 2015\TO 12 - Solid Waste PER\CADD 1-15272-TO12\Exhibits\PER\1-15272-TO12-PER-Fig 3_4.dwg

ALTERNATIVE 2C – MINI EXCAVATOR LOAD CONSOLIDATION AT BOULDER SITE

- Mini-excavator consolidation will increase average container tonnage from 3.2 tons/container to 7.0 tons/container
- Reduction in hauling mileage provides cost savings
- $35,000 late model mini-excavator
- Operations, maintenance & ownership costs = $15,300/year
- Hauling cost savings = $21,400/year
- Payback 6 years

ALTERNATIVE 2D – STATIONARY COMPACTOR CONSOLIDATION AT BOULDER

- 2 stationary compactors/ 4 compactor containers
- Generator required for 3 phase power at site
- Increases container tonnage from 3.2 tons to 9.0 tons/container
- Capital cost = $257,000
- Annual O&M = $2,500/year
- Hauling cost savings = $25,700/year
- Payback = 10.8 years

ALTERNATIVE 2E – CLOSURE OF CLANCY, JEFFERSON CITY & BASIN SITES

- **3 sites combine for 16% of tonnage collected by county**
- **Clancy (8%), Jefferson City (6%), Basin (2%)**

Item	Savings
Labor Cost Savings	$57,300/year
Container Hauling Cost Savings	$29,500/year
Total Annual Savings	**$86,800/year**
Annual Savings Per Unit	$14/unit

- **Alternative results in reduction in services to County residents in these areas**

CAPACITY OF SITES

- All sites adequate to handle traffic & tonnage through planning period except Montana City.
- Traffic counts – Montana City
  - Peak day May 2016 – 595 vehicles
  - Peak day May 2018 – 725 vehicles
- Traffic issues on McClellan Creek Road

Figure 3-1
Montana City Container Site

JEFFERSON COUNTY SOLID WASTE SYSTEM
PRELIMINARY ENGINEERING REPORT

GreatWest engineering

F:\1-15272-Jefferson County On-Call 2015\TO 12 - Solid Waste PER\CADD 1-15272-TO12\Exhibits\PER\1-15272-TO12-PER-Fig 3_1.dwg

MONTANA CITY SITE ALTERNATIVES

- No action (not viable)
- Construct new container site on County owned property (Alternative 3D)
- Construct new container site at Tri-County Landfill (Alternative 3E)

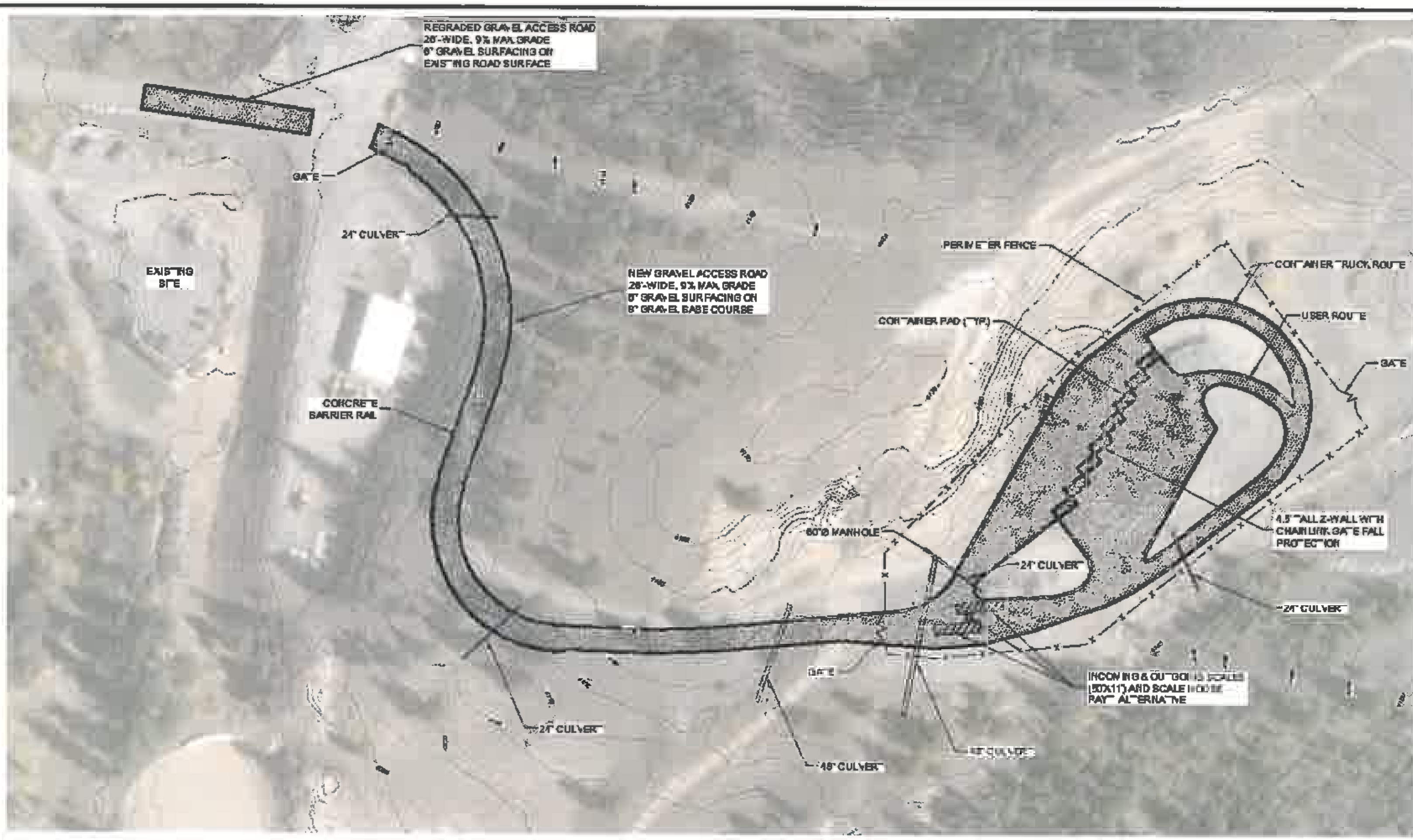


Figure 5-2
ALTERNATIVE 3D
MONTANA CITY CONTAINER SITE
SITE PLAN

JEFFERSON COUNTY SOLID WASTE SYSTEM
PRELIMINARY ENGINEERING REPORT

ALTERNATIVE 3D – NEW CONTAINER SITE ON COUNTY OWNED PROPERTY

- 8 bay container site
- Access road improvements
- Plenty of room for future traffic & staging
- Room for future expansion/special waste handling
- County retains control of system
- $794,000 construction cost
- Estimated increase to assessment ($10.30/unit)

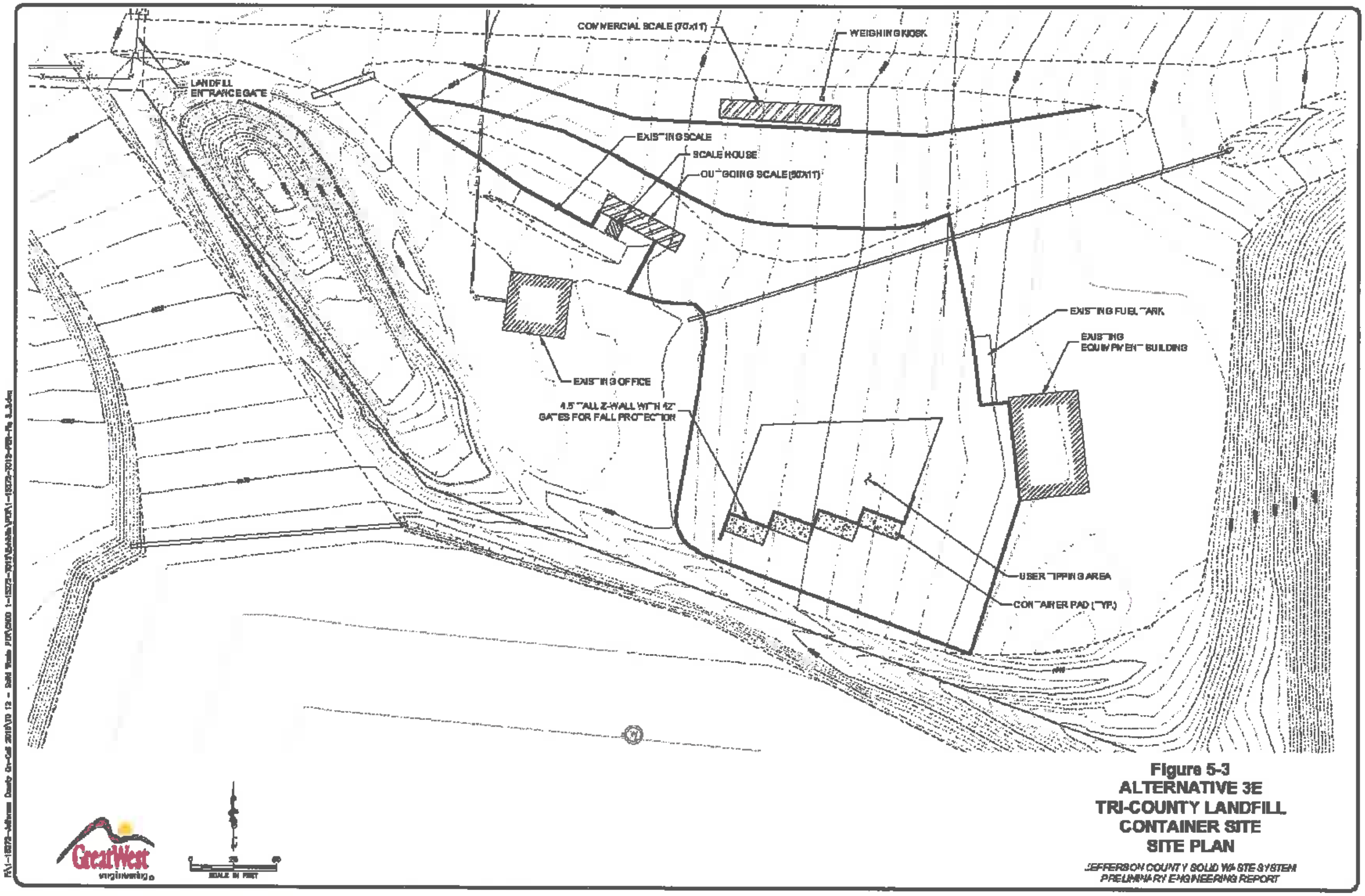


Figure 5-3
ALTERNATIVE 3E
TRI-COUNTY LANDFILL
CONTAINER SITE
SITE PLAN

JEFFERSON COUNTY SOLID WASTE SYSTEM
PRELIMINARY ENGINEERING REPORT

ALTERNATIVE 3E – CONSTRUCT NEW CONTAINER SITE AT TRI-COUNTY LANDFILL

- New 4 bay container site
- Wood & bulky wastes hauled directly to landfill face
- Scale system upgrade
  - Addition of outbound scale & scale house for public customers
  - Separate commercial scale
  - Software/computer upgrades

ALTERNATIVE 3E – CONSTRUCT NEW CONTAINER SITE AT TRI-COUNTY LANDFILL

- Requires long term commitment to Tri-County Disposal
- County will pay for Tri-County Disposal labor for container site operation (scale attendant & truck driver)
- Requires closure of Clancy & Jefferson City sites because of scales

ALTERNATIVE 3E –NEW CONTAINER SITE AT TRI-COUNTY LANDFILL

Item	Cost/Savings
Capital Cost	$452,000
Payback over 10 years	$45,200/year
Tri-County Disposal Annual Labor Costs	$148,500/year
County Labor Cost Savings (Montana City, Clancy & Jefferson City)	$136,000/year
Container Hauling Savings (Montana City, Clancy & Jefferson City)	$41,200/year
Net Annual Cost of Alternative	$16,500/Year
Additional Cost/Assessment	$2.65/unit

ALTERNATIVE 4A – CURRENT PAY-AS-YOU-THROW (PAYT) SYSTEM

- Under PAYT customers pay only for the volume of waste they generate
- Residential currently assessed single units
- Commercial accounts charged multiple units based on waste generation
- Does not account for residential accounts with high or low system usage
- Not equitable for residential users

ALTERNATIVE 4B – WEIGHT-BASED PAYT SYSTEM

- Equitable
- Economic incentive for reduction, reuse & recycling
- Typically customer allocated "free tonnage' per unit assessed
- Current average generation rate = 1.2 tons/year

ALTERNATIVE 4B – WEIGHT-BASED PAYT SYSTEM

- Installation of scales
  - 2 scale system Montana City
  - 1 scale system Boulder & Whitehall
- Closure of Clancy, Jefferson City & Basin sites (inadequate space for scales)
- Scale houses, software, computers
- Full time scale attendant Montana City
- Part time scale attendant Boulder & Whitehall

ALTERNATIVE 4B – WEIGHT-BASED PAYT SYSTEM

Item	Cost/Savings
Capital Cost	$474,800
Labor Cost Increase	$118,900/year
Labor Savings (site closures)	$57,300/year
Container Hauling Savings (site closures)	$23,800/year
Net Annual Labor Cost	$37,800/year
Annual Debt Service (20 year-3.875%)	$38,000/year
Total Annual Cost of Alternative	$75,800/year
Cost to User	$12.18/unit

WOOD WASTE TONNAGE

Table 3-8 – Wood Waste Quantities

Site	2015/2016	2016/2017	2017/2018[1]
Montana City			
Tons	410 [2]	405	331
Boxes	128	126	103
Tons/Boxes	3.2	3.2	3.2
Clancy			
Tons	68	46	41
Boxes	30	19	17
Tons/Boxes	2.3	2.4	2.4
Boulder			
Tons	105 [3]	120 [3]	60 [3]
Whitehall			
Tons	450 [3]	378 [3]	450 [3]
Total Tons	1,033	946	882

Notes:

[1] Tonnage through March 2018

[2] Tonnage Based on Number of boxes @ 3.2 tons/box measured over last two years

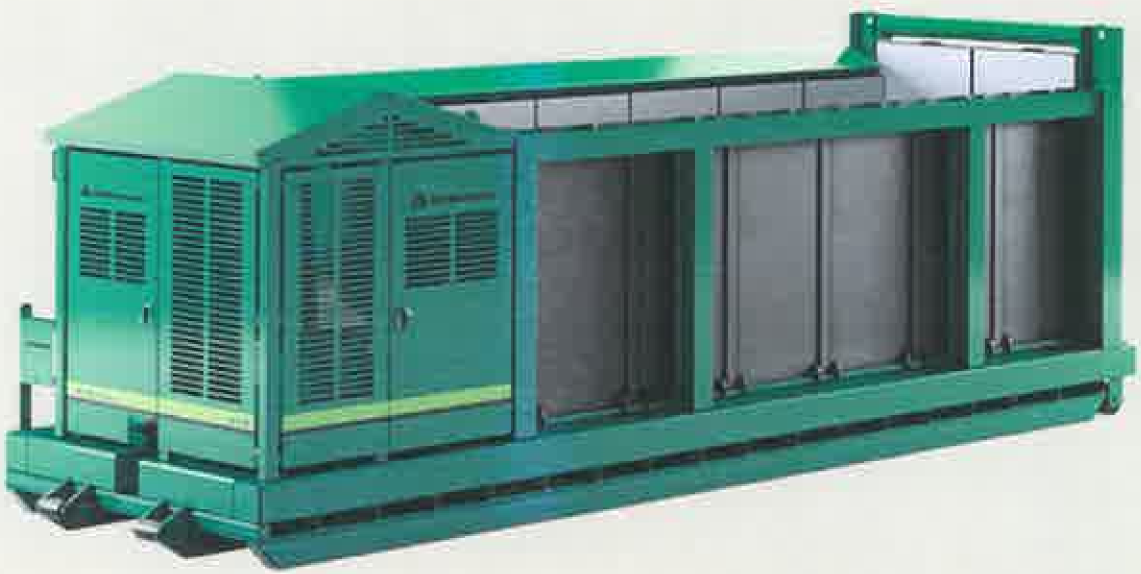
[3] Estimated on burn pile size @ 300 lb/cy

WOOD WASTE SYSTEM

- Wood waste collected at Boulder & Whitehall - Stockpiled & open burned
- Wood waste collected at Clancy & Montana City – Landfilled
- Open burning is lowest cost alternative (estimated at $16.70/ton)
- Alternatives examined for Clancy/Montana City wood waste
- Alternative 5A is current approach

ALTERNATIVE 5C – AIR CURTAIN BURNING CLANCY/MONTANA CITY WOOD WASTE

- Air curtain burn
- Allows clean & contained burn
- Fed with excavator (5 tons/hour)



ALTERNATIVE 5C – AIR CURTAIN BURNER ALTERNATIVE

Item	Cost
Capital Cost	$120,000
Additional Operations & Maintenance Costs	$11,500/year
Container Hauling Savings	$3,600/year
Disposal Savings	$10,400/year
Net Annual Operations Savings	$2,500/year
Annual Debt Collection (10 years-4%)	$14,800/year
Total Annual Cost of Alternative	$12,300/year
Cost to User	$2.00/unit/year

THANK YOU!

GreatWest engineering®

JFFERSON COUNTY
SOLID WASTE SYSTEM
Preliminary Engineering Report – Boulder, MT
February 4, 2019
Sign-In Sheet

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JEFFERSON COUNTY SOLID WASTE SYSTEM

Preliminary Engineering Report

By: Bob Church, PE

Basin, MT

February 6, 2019

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JFFERSON COUNTY
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Preliminary Engineering Report – Basin, MT
February 6, 2019
Sign-In Sheet

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JFFERSON COUNTY
SOLID WASTE SYSTEM
Preliminary Engineering Report – Basin, MT
February 6, 2019
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Preliminary Engineering Report – Basin, MT
February 6, 2019
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JEFFERSON COUNTY SOLID WASTE SYSTEM

Preliminary Engineering Report

By: Bob Church, PE

Clancy, MT

February 11, 2019

GreatWest engineering

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SOLID WASTE SYSTEM
Preliminary Engineering Report – Clancy, MT
February 11, 2019
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JFFERSON COUNTY
SOLID WASTE SYSTEM
Preliminary Engineering Report – Clancy, MT
February 11, 2019
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JEFFERSON COUNTY SOLID WASTE SYSTEM

Preliminary Engineering Report

By: Bob Church, PE

Jefferson City, MT

February 7, 2019

Great West engineering

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JFFERSON COUNTY
SOLID WASTE SYSTEM
Preliminary Engineering Report – Jefferson City, MT
February 7, 2019
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SOLID WASTE SYSTEM
Preliminary Engineering Report – Jefferson City, MT
February 7, 2019
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JEFFERSON COUNTY SOLID WASTE SYSTEM

Preliminary Engineering Report

By: Bob Church, PE

Montana City, MT

February 12, 2019

GreatWest engineering

JFFERSON COUNTY
SOLID WASTE SYSTEM
Preliminary Engineering Report – Montana City, MT
February 12, 2019
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JFFERSON COUNTY
SOLID WASTE SYSTEM
Preliminary Engineering Report – Montana City, MT
February 12, 2019
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JFFERSON COUNTY
SOLID WASTE SYSTEM
Preliminary Engineering Report – Montana City, MT
February 12, 2019
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JEFFERSON COUNTY SOLID WASTE SYSTEM

Preliminary Engineering Report

By: Bob Church, PE

Whitehall, MT

February 5, 2019

Great West engineering

Great West engineering

JFFERSON COUNTY
SOLID WASTE SYSTEM
Preliminary Engineering Report – Whitehall, MT
February 5, 2019
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Suzie Mandy	Whitehall	

Bob Church

From: Dave Leitheiser <dave2mt@bresnan.net>
Sent: Tuesday, February 26, 2019 9:27 AM
To: 'Cory Kirsch'; Bob Church
Cc: 'Dave Leitheiser'
Subject: Comments on Draft Solid Waste Plan

Good Morning,
I was unable to make the public meetings due to previous commitments. However, I've heard (hopefully correctly) of several proposals and I have comments to them:

1) Use scales to weigh in and out at sites with a cap on yearly tonnage and additional fees past this tonnage. Comment is it is a very bad idea on several levels with bad assumptions.
    a. I'm like a lot of people that drop off one or two kitchen bags of trash on my way to Helena; this is only a couple pounds and I can't/don't stockpile for one big trip. How is such a small amount going to be weighed in and out?
    b. A strong wind rocking a vehicle, snow on vehicle drops off, or if scale has poor maintenance, etc. can give a false weight.
    c. You think lines are long now, have people que up to enter and leave the scale and see what happens. Or use two scales? More expense and costs.
    d. Scales can be easily damaged by a fast vehicle stopping quickly on the scale, knocking it out of service. What then? Close down until the scale is fixed and calibrated? There is a fee involved with use of the scales so they will require State approved calibrations.
    e. Eventually it would be determined a structure is needed to house the scale to protect it. That will be costly.
    f. This is the least cost-effective option. It sounds like what they do in Helena and I've never met anyone from Helena that doesn't cuss how their transfer site is operated, how costly it is, and how inefficient using it is.
    g. I'd rather pay more per year and not have this implemented.
2) Close Jefferson City site. Comment, I'm against as it would be too long of a drive for them to make it to the waste sites.
3) Close Clancy site. Comment, I'm ok with this as the site has a steep access and has a small pad; I generally use the Montana City site because of this.
4) Expand Montana City site with the brush/grass dumpsters relocated. Comments, I think it is a good idea. The brush/grass dumpsters are generally used by pickups with utility trailers; they hold others up as they need more space and time to back in to the dumpsters. Moving the brush/grass dumpsters would free up their current locations for garbage drop-offs; speeding things up.
5) Please keep the drop-off tables where people can drop-off reusable items for others to take. This is a great recycling method that keeps a lot of otherwise reusable items out of the dumpsters and the landfill. I'm all for reuse instead of tossing out where possible.

Dave Leitheiser
16 North Main Street
Clancy MT 59634
406-949-8281

Bob- FYI

Linda Kindrick, Jackson Creek Rd 1

Montana City Transfer Station update

Just visited with Cory Kirsch. There are two meetings left to learn about the results of the report prepared by Great West Engineering - one tonight and one tomorrow.

The options for the Montana City Transfer station being considered or recommended are:

1. Move the existing facility to a site above the current location - the current one is too small (which we have all seen)

2. Close Montana City Transfer and have us haul our waste to the Tri County Landfill in East Helena - JeffCo would loose all control and we would weigh in and out when hauling trash.

"The County Commissioners/Solid Waste Board will be holding public hearings throughout the county the next couple of weeks. We have an updated Preliminary Engineering Report with several options for updating our countywide solid waste program. We would very much appreciate the public to be involved in this process. The outcome of this process could very likely effect your current solid waste services and rates so please attend one of the hearings and let us know your thoughts.
Don't hesitate to call with any questions or concerns. 225-4025

All hearings start at 6pm
Feb 4th: Boulder, Clerk & Recorder's Conference Rm
Feb 5th: Whitehall, Borden's Conference Rm
Feb 6th: Basin, Community Center
Feb 7th: Jefferson City, Community Center
Feb 11th: Clancy, Elementary School
Feb 12th: MT City, Main Fire Station, 1192 Highway 282"

It is important your voice is heard!

Cost / Tax Comments
Keep Sites Open
New MTC Site

Helen Auch

From:	Bob Mullen
Sent:	Thursday, February 21, 2019 8:26 AM
To:	Helen Auch
Subject:	Fwd: Solid Waste

Operations/Consultation
Curbside
Air Curtain
Close Sites

A SW comment.

Begin forwarded message:

> **From:** josiehope <josiehope@gmail.com>
> **Date:** February 20, 2019 at 11:22:19 PM MST
> **To:** <bmullen@jeffersoncounty-mt.gov>
> **Subject: Solid Waste**
>
> I vote for an increase of $20 to $25 per year on my taxes to improve the Montana City site and leave the other sites as they are.
>
> JoAnn Hopewell

Helen Auch

From: Bob Mullen
Sent: Tuesday, February 12, 2019 12:30 PM
To: Leonard Wortman; Cory Kirsch; Helen Auch
Subject: Fwd: Failure Notice

Solid Waste proposal comments.

Sent from my iPhone

Begin forwarded message:

> **From:** J Dennis Sheehy <mtsheehys@aol.com>
> **Date:** February 12, 2019 at 10:48:07 AM MST
> **To:** <bmullen@jeffersoncounty-mt.gov>
> **Subject: Fwd: Failure Notice**
>
> Bob,
>
> I have not been able to attend any of the meetings on the waste management proposals. I have read through the PE plan and I have a few concerns/comments:
>
> First - the taxes on county homeowners continues to go up resulting in higher house payment which makes it tough on fixed incomes.
> Second - The staff at the Montana City dump site for the most part do an excellent job (there is one fellow recently hired who tends to lounge and take regular naps)
>
> I tend to disagree with the report on the usage and traffic element of the existing Montana City dump site. I have been in the County for 35 years and seen all the various systems for waste management. The Current MC location has served the purpose well.
>
> I know there are times - Saturday and Sunday am, days after holidays when there can be a three or four vehicle backup, but there is no access or traffic problem on McClellan Creek road. I have found if you use this dump at nonprime times there is no wait or backup. I think the usage and traffic data is over stated .
>
> The other problems I see with this facility:
>
> shouldn't be happening
>
> -Contractors use this dump for large construction, renovation and demolition projects. They use large vehicles and trailers and make many trips often filling up containers all by themselves. I think it is reasonable to make these contractors and large projects haul to the landfill instead, both to reduce tonnage and congestion.
>
> -Sometimes the staff is busy and there are vehicles with non Jefferson plates dumping on a regular basis. I have heard non County people make the comment that with the cost so high in LC County that it is worth the trip to dump at MC. Very few people display their dump pass.
>
> - There is a lot of Scavenging at the MC dump. At times there are several vehicle waiting while those at the dump sites peruse the items people leave as potentially usable. There are several professional resellers who regularly show up at the dump to see what they can resell. It is not a bad idea to recycle this stuff but move it away from where people are trying to dump garbage or hire a contractor to resell this stuff.

-I think with a little renovation this site could remain viable. With less than a $10.00 p/unit cost.

Close the JC and Basin location. Keep Montana City, Clancy and Boulder locations open. I have experience with weight systems they are slow and cumbersome. Doesn't option 3D use the same road as currently used. 5C to burn wood may be a good option. -NO

Thank you for the opportunity to respond

J. Dennis Sheehy

69 Greenwood Trail
Clancy, MT 59634

Helen Auch

From:	Cory Kirsch
Sent:	Wednesday, February 13, 2019 2:34 PM
To:	Helen Auch
Subject:	Fwd: road access for option 3-d
Attachments:	A977A0C0661644C9A1F0B7E6B7F5FA55.png; A977A0C0661644C9A1F0B7E6B7F5FA55.png

Hi Helen,
Additional comments on solid waste PER.

Cory

Begin forwarded message:

> **From:** Craig Byington <cbbyington@mgeoscience.com>
> **Date:** February 13, 2019 at 11:14:05 AM MST
> **To:** "Ckirsch@jeffersoncounty-mt.gov" <Ckirsch@jeffersoncounty-mt.gov>, " bmullen@jeffersoncounty-mt.gov" <bmullen@jeffersoncounty-mt.gov>, "lwortman@jeffersoncounty-mt.gov" <lwortman@jeffersoncounty-mt.gov>
> **Subject: road access for option 3-d**
>
> Gentlemen,
>
> Again, thanks for walking the solid waste disposal issue through; I'm sure that consumes a great deal of your time. It is much appreciated by all.
>
> I support the option using the old quarry (3d) for the Montana City waste drop off site. I also like the use of the air curtain machine and the mini-excavator as appropriate.
>
> However, having laid out and constructed many mountainside roads I would like to suggest a better route from the county shop building pad. In the figure attached herein, the road distance proposed (magenta line) would be 1003 feet in length as compared to 906 for the current proposed route (white line) or an increase of about 100 feet. The grade would be about 7.2% average with an elevation change of about 72 feet as near as I can measure. Given that there is an old road coming up the gulley at the bottom, and that the proposed road ties into the existing (white line) road at the top, the amount of new road construction would be about 580 feet. It is laid out so as to make the curves broad and gentle so that folks don't spin out coming up, to reduce the grade on the steeper sections, and to avoid cutting the proposed road in the rock outcrop. Perhaps the best argument for it is the lack of need for a guard rail as it doesn't follow the cut bank behind the shop area making less danger for users and snow won't need to be plowed into the backyard of the shop area. In any event take this as just a suggestion; your choice either way will be acceptable to me.
> Craig Byington

Bob Church

From: Bob Mullen <bmullen@jeffersoncounty-mt.gov>
Sent: Friday, February 22, 2019 11:26 AM
To: Joel Hinckley
Cc: Helen Auch; Leonard Wortman; Cory Kirsch; Bob Church; Brian Hohn
Subject: Re: Comment on Solid Waste Proposals

Thank you for your thoughtful comments.

Sent from my iPhone

On Feb 21, 2019, at 5:28 PM, Joel Hinckley <joelhinck@hotmail.com> wrote:

> Mr Mullen,
> I apologize for the lateness of my comments... I managed to let it slip my mind. I hope an email is an appropriate format.
>
> I was in attendance at your county solid waste system public meeting last week at the Clancy School. I wish to congratulate you and you people on doing so much with what resources are available to the county when it comes to solid waste disposal.
>
> A few folks at the meeting that I attended seemed to indicate that the county should evaluate the feasibility of making curbside garbage pickup mandatory or at least more common place. My understanding is that curbside trash pickup merely increases the cost to the resident receiving the service without solving any county waste disposal costs. The only benefit that I can see is of less traffic at the various transfer stations. For those of us willing to transport our trash, it seems curbside trash pickup is an necessary waste of resources.
>
> I would like to voice my support for a new container site on county owned property behind the current Montana City transfer station. I have talked to several Montana City residents this week. Every one the residents feel that an increase of $10.30 per year on their property taxes is very reasonable for the service we would get. Several have used the term "no brainer," indicating that this is obviously the most practical choice with little real expense. I was actually surprised with low cost. I had been expecting that amount per month. My understanding is that expanding the Montana City transfer station would also enable the other sites to remain open, which is of course desirable for all of the smaller communities. This would also assist in reducing diverted traffic from other stations to the Montana City area.
>
> Load consolidation at the Boulder transfer station also seems to be another obvious choice. Especially since both the mini-excavator and stationary compactor essentially pay themselves

off. I did not see what the cost to me would be. If the community at large was concerned about cost, the mini-excavator seems to be the best first trial at compacting.

The idea of transporting and paying for our wood waste to be buried at a landfill seems silly. The air curtain burner is intriguing. This would be even more intriguing if it were able to generate electricity.

With property taxes seeming to always be on the increase, I highly doubt anybody would even notice the paltry increase in cost.

Thank You,

Joel B. Hinckley

Montana City Resident

h/

February, 2019

Daniel C. Mock
39 Microwave Hill RD
Jefferson County
Clancy, MT 59634

Jefferson County Commissioners

We, in this county, have clean forests and back roads. Why? Because the citizenry think their garbage can be dumped free, if they just haul it. You and I know this is not true. The county levies a tax which everyone pays. Which is fair. Sanitation works for every-one.

I lived 70 years on the west side of Oregon and Washington. The amount of personal garbage dumped off back roads is maddening. Go hunting, hiking, fishing, canoing, photographing or berry picking, every trail head has refrigerators, stoves, building materials, personal garbage and cars strewn about. Is this what we want for our very clean Montana? I think not!

If we charge for garbage there will be unwanted consequences.

Roadside dumping will increase dramatically.

We will end up having garbage detectives paid by county taxes. Many times they find letters, magazines and bills with addresses. They levy a ticket with two levels of fines: $45 fine, you go pick it up within 48 hours, $250 fine levied by the sheriff if past 48 hours. Then a clean-up-crew cleans up the mess. Paid for by the county. This service would be available on public or personal property. This system is very costly.

Years ago a personal friend put this system into action. He opened a special dump in Columbia County, Oregon and personally investigated every illegal dumping transgression he could find. It worked. Bob Mickey is now diseased.

All personal timberlands on the west side of the Cascades are now gated to stop property destruction and dumping. It was not that way 20 years ago. However, State lands and Federal lands still have the problems.

Montana has maybe 3% of the back roads dump problems of the West. Why do we want to open ourselves to a problem Oregon and Washington have not been able to solve. Our existing system works extremely well. The Jefferson county tax payers want clean lands, lets keep and improve the system we obviously use.

Other systems end up costing society more money and hassle in the long run.

Thank you for your attention

Daniel C. Mock
Jefferson County Citizen

Helen Auch

From: JERE D HOY <jdhoy@msn.com>
Sent: Tuesday, February 12, 2019 3:22 PM
To: Helen Auch
Subject: My City transfer station

Good afternoon. I hope you can forward this message to the appropriate commissioner or committee. I would like to go on record as being in favor of keeping the current Montana City solid waste transfer station in place or relocating it in the area. I am against shutting it down and having to use the facilities in East Helena or elsewhere. The present facility is quite busy which testifies to the fact that it is both beneficial and convenient to the people who use it. It functions perfectly well as a transfer point and saves multiple trips to East Helena as well as a large amount of fuel. I would be willing to see slight bump in my present tax bill to help pay for the convenience of retaining this facility in the present location or somewhere nearby. Thank you.

Jere and Kay Hoy
35 Forest Park Dr
Clancy, MT 59634

Jdhoy@msn.com
406-933-5827

Comments on Jefferson County Solid Waste System

Thank you for coming to Clancy to explain the Preliminary Engineering Report. It was well presented and we particularly liked all the comments from homeowners.

Some of our thoughts since reflecting back on what we heard.

1. Montana City: It's is apparent that the Montana City site is the main concern. That is where the bulk of the northern Jefferson County tonnage is collected. Temporarily it would seem that increasing both opening and closing times during late spring, summer and early fall may be a viable option to reduce traffic. A plan beyond that would be to make the improvements to the site as outlined in 3D
2. Jefferson City and Clancy sites: These should remain open in view of the fact that closing those sites would put additional pressure on the Montana City site. In addition, since projections show continued growth, the pressure will only get worse as time goes on.
3. Costs: The county has not done the best job it could in not adjusting the cost of property assessment for inflation since 2002 (this is what we heard). Based just on 2% the assessment should be more like $160 at this point which would have allowed for improvements so that we would not be in a more difficult financial situation.
4. Tri-County Landfill: This alternative raised many issues residents hauling - traffic, hazards to school children w/ increased traffic by the school, debris flying out of vehicles which already is a problem at even slower speeds. Those vehicles from Jefferson City and Clancy would most likely travel the interstate would could be hazardous as well with flying debris. This would also be the case with a Montana City site only.
5. Curbside Delivery: It sounded good, but on further reflection, there is the possibility of increased interaction with wildlife (bears, etc.) if more curbside delivery were to implemented on rural roads, etc.

We hope that this will help you in determining the future of our Solid Waste System.

Thank you again!

Len & Concetta Eckel
19 Rocky Mountain Drive
Clancy, MT 59634
406-933-8300

Bob Church

From: Bob Mullen <bmullen@jeffersoncounty-mt.gov>
Sent: Wednesday, February 13, 2019 3:30 PM
To: Bob Church
Subject: Fwd: road access for option 3-d
Attachments: image001.png; image001.png

Follow-up from Mr. Byington. Disregard prior note.

Begin forwarded message:

> **From:** Craig Byington <cbbyington@mgeoscience.com>
> **Date:** February 13, 2019 at 3:03:46 PM MST
> **To:** Bob Mullen <bmullen@jeffersoncounty-mt.gov>, Cory Kirsch <CKirsch@jeffersoncounty-mt.gov>, Leonard Wortman <lwortman@jeffersoncounty-mt.gov>
> **Subject: RE: road access for option 3-d**
>
> Gents,
> I apologize for my error but please disregard my suggested location for the access road. I just went down and walked the route I suggested and it won't work nearly as well as the existing road. The topo map I used didn't show the lobe of waste rock that extends out from the quarry to the west and my suggestion would require climbing up over that hump; doesn't make sense.
> Best regards,
> CB
>
> Sent from Mail for Windows 10
>
> **From:** Bob Mullen
> **Sent:** Wednesday, February 13, 2019 2:32 PM
> **To:** 'Craig Byington'; Cory Kirsch; Leonard Wortman
> **Subject:** RE: road access for option 3-d
>
> Thanks Craig for the great input.
>
> **From:** Craig Byington [mailto:cbbyington@mgeoscience.com]
> **Sent:** Wednesday, February 13, 2019 11:14 AM
> **To:** Cory Kirsch <CKirsch@jeffersoncounty-mt.gov>; Bob Mullen <bmullen@jeffersoncounty-mt.gov>; Leonard Wortman <lwortman@jeffersoncounty-mt.gov>
> **Subject:** road access for option 3-d
>
> Gentlemen,
> Thanks for taking the time with me yesterday and considering my proposal for the Mount Washington mine area near Montana Tunnels.
>
> Again, thanks for walking the solid waste disposal issue through; I'm sure that consumes a great deal of your time. It is much appreciated by all.

I support the option using the old quarry (3d) for the Montana City waste drop-off site. I also like the use of the air curtain machine and the mini-excavator as appropriate.

However, having laid out and constructed many mountainside roads I would like to suggest a better route from the county shop building pad. In the figure attached herein, the road distance proposed (magenta line) would be 1003 feet in length as compared to 906 for the current proposed route (white line) or an increase of about 100 feet. The grade would be about 7.2% average with an elevation change of about 72 feet as near as I can measure. Given that there is an old road coming up the gulley at the bottom, and that the proposed road ties into the existing (white line) road at the top, the amount of new road construction would be about 580 feet. It is laid out so as to make the curves broad and gentle so that folks don't spin out coming up, to reduce the grade on the steeper sections, and to avoid cutting the proposed road in the rock outcrop. Perhaps the best argument for it is the lack of need for a guard rail as it doesn't follow the cut bank behind the shop area making less danger for users and snow won't need to be plowed into the backyard of the shop area. In any event take this as just a suggestion; your choice either way will be acceptable to me.
Craig Byington

SOLID WASTE PUBLIC MEETINGS
February 4 ~ 12, 2019

All of the public hearings opened with an introduction by a Commissioner, followed by a PowerPoint presentation of the draft PER by Bob Church, Great West Engineering

Boulder
February 4, 2019

Present: Commissioners Wortman, Mullen and Kirsch; Bob Church, Great West Engineering; John Blodgett, *Boulder Monitor*; Connie Grenz

Connie's only questions were regarding recycling. She also stated that she has no problem paying more on a yearly basis. She thinks that the County does a great job with the Solid Waste.

Whitehall
February 5, 2019

Present: Commissioners Wortman, Mullen and Kirsch; Brian Hohn, Solid Waste Manager; Bob Church, Great West Engineering; Esther Kirsch, Terry Murphy, Mayor Hensleigh, Suzie Marty

Mayor Hensleigh stated that the Town of Whitehall is very happy with the current system.

Basin
February 6, 2019

Present: Commissioners Wortman, Mullen and Kirsch; Bob Church, Great West Engineering; Esther Kirsch, Rhandi Rachlis, Richard & DeeDe Rhodes, MJ Williams, Brian Gasch, Mike Jellison, Lynne Clasen, Tony Deunas, Rayna Ryan, Steve Ryan, Gill Hagman, Joy Lewis, Charles & Helen Goodwin, Nancy Owens, Nissa Manley, Byrne Manley, Kip Stone, David Brachanna, Alex Sotola, Vanessa Martin, Scott Sherwood, Jr., Charlie Goodwin IV, Allen & Danneil Gehuke, Willow Sheehan, Tina Steele, Karen Davidson

Rhandi Rachlis had questions regarding recycling, particularly plastics. Mike Jellison noted that WalMart takes all plastics.

Joy Lewis asked about the difference between the compactor and excavator.

DeDee Rhodes asked about labor cost savings, and how Bob came up with the numbers. Bob stated that we know what the wages and benefits are, the hours the sites are open; we just do the math. Basin doesn't have an attendant, so the number is based on closure of Clancy and Jefferson City.

Bryne Manley stated that Basin is insignificant; there are not really any substantial savings by closing the Basin site.

Nissa Manley asked if the savings in the option are enough to offset changes elsewhere, or would they be closed and still need to do more.

DeeDe Rhodes stated that they know the math, know the sites, and know the barriers that they face; Basin is pretty isolated. There are barriers to getting their garbage easily disposed of.

Mike Jellison stated that if they lose service due to closures, the county will lose revenue. Commissioner Wortman stated that there will be no loss of service; they will still have services in Boulder. He noted that there is nothing between Boulder and Whitehall; people in that area have to drive substantial distance to get rid of their garbage.

Celeste Sotola asked if they are going to compensate for their time and fuel.

Willow Sheehan stated that she was born in Basin and is a family nurse practitioner in Boulder. As such, she is aware of the portion of the population in Basin with no vehicle, and therefore no option to haul their garbage to Boulder. As a nurse practitioner, she is concerned with the health repercussions of garbage sitting around.

Vanessa Martin asked if there is a way that Boulder and Basin can work together; they pick up a full container, and drop off an empty one. We are a small community, so we are getting picked on. There are a lot of seniors and a lot of veterans living in Basin, and she doesn't see that it would make a big difference to close the site.

Celeste Sotola asked the Commission to look at the size of the crowd; they are obviously passionate about the service.

Brian Gasch asked about the Basin 2% versus annual savings, which is figured on closing Basin, Clancy and Jefferson City. He would like to know the actual cost savings of closing Basin.

Debbie Sheehan asked why people on the north end of the county are paying the same if they are the problem. Commissioner Wortman stated that the county is one district, and all are paying the same. If there were different districts, the central and southern parts of the county couldn't afford it.

Bill Hagman stated that the problem is volume not weight; food waste decomposes, while construction waste, etc. takes up a lot of space.

Danielle Gurke stated that if we switch to scales, there will be a lot of back road dumping. Some people aren't going to pay to dump their garbage.

Celeste Sotolo asked how much does it cost specifically, to haul the container to the landfill. Bob stated that it costs $3.80/mile. Celeste asked why it isn't hauled to Boulder. Bob stated that it couldn't be hauled to Boulder; it doesn't work to try to add it to another container.

DeeDee Rhodes asked what the hours are in Boulder. If the hours aren't expanded in Boulder, the existing hours may not be feasible with her schedule.

Mike Jellison stated that the Commissioners know how we stand in Basin; if at all possible, they would like to keep site in Basin open.

M.J. Williams asked about the rates, and if they are set by state law. Commissioner Wortman stated that the County is one district, and everyone within the district must be charged the same amount.

Bill Hagman asked if a central location could be found in the county for a new landfill that everyone could use. Commissioner Wortman stated that it wouldn't be feasible; which is why the County moved away from landfills when the federal regulations changed in the early 90s. Bob stated that he has looked at this option for other clients, and there is no w ay that the County could afford it.

Jefferson City
February 7, 2019

Present: Commissioners Wortman, Mullen and Kirsch; Brian Hohn, Solid Waste Manager, Bob Church, Great West Engineering; Candace Bell, Marjorie Bally, Lois Reilly, Scott Owens, Fred Bell, Bret Lian, David Cooper, Candace Hecken, JoAnn Hopewell, Denise Key, Carol Todd, Rose Hagerty, Dave Duffy, Terri Kuntz

Dave Cooper asked about wood burning in Whitehall and Boulder, and if Montana City has wood collection and burning. Bob Church stated that woody waste from Montana City is currently landfilled, but there is an option to deal with it.

Candice Bell asked about the excavator option, and how often you would have to replace the containers if the operator isn't skilled. Bob Church stated that one county did the mini excavator for that reason; it is harder to damage containers.

Denise Key asked what people who don't drive or have a vehicle are supposed to do if the Jefferson City site is closed: sites would be closed to address the population growth north of us.

Carol Todd asked if the County chooses the option to close, do those savings come off of taxes. Commissioner Wortman stated that wouldn't necessarily be the case. We are looking at how to save money in the Solid Waste District, noting that we need to do the best for everyone in the county.

Terri Kuntz, stated that she understands the concerns. She acknowledges that it is much easier to dump garbage here, but she talks to other counties and our rate is pretty good.

Brett Lian stated that half of the County's sites provide 16% of the tonnage. He noted that Jefferson City is going to grow, noting the 50 empty lots up the road.

Linda Minik asked what is the impetus for this process, is there a net loss? Bob Church stated that there are a number of deficiencies overall. One of the biggest is that the Montana City site is way too small. Linda stated that it doesn't seem fair that the rest of the County is punished because of Montana City.

Dave Cooper stated that it would be helpful for him to see the numbers separated out across the three sites. Bob Church stated that after the hearings done, he will have more numbers and information.

Fred Bell stated that the real reason for the meeting is obvious; if you are going to raise rates, you need to have public hearings. He asked if it wouldn't be better to just raise the rate somewhat and keep what we have. He knows the fee is going to go up, but do we have to make a bunch of changes. Commissioner Wortman stated that the reason for the hearings is not to raise rates, but to get public comment. We have issues in the north end, and have not been able to save money for updating equipment.

Bob Church stated that when you have a system like this, you can't decide to stop investing in it. He noted that the newest infrastructure in the county is 25 years old. This system hasn't been looked at comprehensively for over 20 years.

A woman questioned if is there a law that requires a County to have a solid waste district. Bob Church stated that the County could pass it on to a private company or companies. She further asked if it is legal to require that everyone hire a private company to pick up their garbage. Commissioner Wortman stated that this would be a question of affordability for county residents.

Brian Hohn stated that you may pay a private business monthly to pick up and transport your trash, but the County pays the tipping fees out of the taxes.

Linda Minnek stated that people have to remember that what a private business picks up is just household garbage; this doesn't include metal, recycling, etc.

Brett Lian said that Montana City isn't the "other"; he uses the Jefferson City site two2 out of three times, but the other time he goes to Montana City. The traffic problems aren't just from people who live in Montana City.

There was a question regarding the balance and purpose of the reserve fund. It was also noted that the Solid Waste District is an enterprise fund, so the money collected from solid waste fees can't be used for anything else.

JoAnn Hopewell asked about a pre-pay system or color coded bags. She lived in an area where you could buy different color bags and those were the only bags that were allowed in the containers. Bob Church stated that the county would have to go to curbside only. These types of system has been tried elsewhere. He urged her to look in the container the next time she goes to the transfer station; a lot of stuff doesn't fit in a bag. Dave Cooper also asked what happens to things that don't fit in a bag.

JoAnn Hopewell asked if there are any incinerators in Montana. Brian Hohn stated that in 1992 the Montana Legislature put a moratorium on incinerators.

Denise King asked about the alternative container site at Montana City; if this alternative were chosen, would they be able to keep other sites open? Bob Church stated that the closures are a separate option.

JoAnn Hopewell stated that she pays Tri-County $15/month and pays tax amount too, of which about $30 is used to cover tipping fees. What happens to the other $100? Bob stated that it goes for the operation of the district. JoAnn asked if everyone used a private service, would that alleviate the problem? Bob stated that a lot of people like to haul their own garbage.

Linda Minnek stated that in all of these alternatives, she is still not sure why having to fix Montana City necessitate closing sites. Bob stated that if the scales alternative are chosen, they will need to close so people don't overwhelm smaller sites.

Terri stated that if the fee is $130/year now, we are still probably going to get an increase. Bob stated that he thinks that there will probably be an increase regardless.

Denise King stated that when making a decision, the Commissioners need to consider that items that won't be making it to the dump.

Dave Cooper stated that we have an increase in traffic volume, particularly in Montana City. Do we know to what extent of that is driven by behavior (dumping a bag a day) and how much by volume. Candace Bell stated that there are some people who bring a bag of kitchen garbage every day as they drive by; but she doesn't what percentage. Also, if we start getting spring in April, we are getting yard waste all the way through October. There are some people that have large lots, doing fire mitigation, cleaning up every pine needle on their property, etc. Here, there is no yard waste bin in Jefferson City, so if you want to get rid of large amounts of yard waste, you need to haul it to Clancy, Montana City or Boulder. Also, there are people south of Montana City that are heading to Helena to go shopping, that might drop off their garbage at Montana City on the way, if their site isn't open that day.

Dave Cooper said that they talked about Basin operating with no staff, where Jefferson City and Clancy with staff. He asked how does that work. Candace stated not well. Bob Church stated that the counties in Montana are insured jointly through the Montana Association of Counties

(MACo). Over the years, a lot of accidents have happened at container sites when people fall into containers. MACo has stopped just short of prohibiting unattended sites, but they've made it known that it is highly discouraged. Candance informed the people that if they didn't take care of the site, they would lose the site. Commissioner Wortman noted that in Basin, people have to put garbage up into the bin from the ground, rather that dropping it in from above.

Dave Cooper asked if in the alternatives, if they looked at the cost savings of operating fewer days per week. Bob Church stated that the County has run the sites for years; they have a feel of the traffic and what is needed.

Commission Kirsch stated that one good comment we got last night in Basin was why are we paying for the north end. He noted that the population on the north is one of the reasons why rates are so low. It comes down to if you want to pay an extra $10 or lose the site.

Brent Lian stated that he advocates for keeping Jefferson City open; we are- going to need it with the coming growth that is happening in the area.

Dave Cooper suggested that they make sure the issue of one bag a day is discussed at the Montana City meeting. People may not realize that they are creating a problem that may cost everyone in the County.

Lois Reilly stated that she understands the need to make changes, but she would not be a happy camper if the rates are raised and service taken.

Clancy
February 11, 2019

Present: Commissioners Mullen and Kirsch; Bob Church, Great West Engineering; Dave Duffy, Tri-County; Steve Marks, Linda Kendrick, Bob Johnson, Joel Hinckley, Ken Tucker, Wanda & Mel White, Len and Conchette Eckle, Bruce Nevins, Jane Hammon, Mark & Sharon Liar, Rick & Becky Forette, Ginny Kalchbrenner, Ron Zelenton, Chuck Huxley, Tom Burns, Ray Patrick

Bob Johnson questioned the expenses on recycling. Bob Church stated that the County has to process and truck the materials. Brian Hohn stated that we pay for used motor oil. When the service was first set up, we were paid for it, but now we have to pay to get rid of it. We get a bit of revenue for cardboard and paper, but the markets are soft right now. There is currently no market for plastics.

Linda Kendrick asked about staffing, and how we can have only four site attendants. Brian stated that the sites aren't all open on the same days.

Joel Hinkley asked if the County pays by the ton or by the container. Bob Church stated that the County pays Tri-County by the ton, but the County pays more for the more trips it takes.

Ken Tucker asked if the County can take stuff from Basin to Boulder and compact it? Bob Church stated that it is not efficient; he has had a couple clients that tried this and it is an operation nightmare.

Len Eckel asked about the populations of the three communities combined.

Ken Tucker stated that he can't haul his garbage to another site for $15/year.

Conchetta Eckel noted that the projection is for the County to increase in population, but there is a proposal to have lesser places to go. That will have added traffic on those roads.

Ken Tucker stated that he has lived in areas where users have to haul their garbage various distances. The farther the trip, the more garbage along the roads.

Bruce Nevins - with reductions in services, reduction in fee? Bc - everyone in the district pays the same rate - brian - when at a spot where barely making expenses, doesn't make sense to cut revenue
Bruce nevins - money left over at the end of the year - where money going Brian - cash reserve - newest truck is a 97 and has half million miles - new truck costs quarter million
Steve - tipping fee at Tri-county - suggested excavator years ago - never tried - Bob could look at it Steve - why pay the county when Tri-county picks up dave duffy - pay to pick up, not dispose
Lynn Eckle - what Tri-County charge - why not charge that monthly fee - just raise rate and let them keep their site

Lynn - clarification of costs

Linda Kendrick - would there be employees lost with tri-county option
Bob - potentially - brian - would probably increase hours at other sites to keep employees
Linda - uses the montana city site - have been clearing property doing fire mitigation - not sure how would handle that at tri-county - if moved site, people had to go there, would use cut-through by school, speed higher to east helena - more garbage blowing off

bob johnson - understand concern with mcclellan creek - but - if add traffic from clancy and jeff city - also - highway to e helena terrible safety records - need to look at accident records for road

wanda white - tell people what days to go dump based on name or whatever
bob church - people aren't happy with change
bruce nevins - regards to mt city - what are the hours - extending hours bob -church - need to add lighting bruce - spring and summer are bad times - lighting not a problem
Bob Church - could help some, but doesn't answer the overall problem of growth - also, woody waste is a huge part of the problem - good that people are cleaning up their property and making it fire safe, but county is paying for it

bruce nevins - time-frame for input - more meetings
bob church - comments until the 15th, will get together and go over comments - he needs to do

the final engineering report after the commissioners make their decision on the alternatives
steve - study the cost of curb-side pickup
conchetta - we have quite a few new homes in lump gulch - most are getting curbside - several in lump gulch who walk and see and pick up lots of trash
joel - some people curbside is a viable option - it isn't for him
dave duffy - only time they have trouble picking up in clancy and jeff city is during the winter - if roads bad, use big container in central location

bob johnson - if people have to pay to get rid of pine needles and branches - going to end up in the forest

Jane Hammon - find a place at this end of the county for open burning

joel hinkley - if install wood burner in mt city - still need to implement another alternative as well bob church - with growth, would need it, but could be an interim step

Montana City
February 12, 2019

Present: Commissioners Wortman, Mullen and Kirsch; Bob Church, Great West Engineering; Brian Hohn, Solid Waste Supervisor; Rick Abraham, Lance Vossler, Dave Duffy, Jim Pearson, Ron Pearson, Robin Trenbeth, Julia Walker, Nancy Cobble, Matt Weber, Julie Kreage, Janet Mathes, Judy Rogers, Mark Dockter, Bryan Magnuson, Matthew Kent, Dean & Betty Ellis, John Hilton, Mike & Arlis Pfeffer, Don Paul, George Donne, Billy Moyer, Robert Poirier, Dave Jeseritz, Clarence Sparrow, Jeanne Wells, Keith Kramlick, Tony & Theresa Quibedeaux, Joel & Amy Riebli, Pat & Gordon Tallent, Janice Frisch, Wendell Rafter, Nate Hagen, Jim Weilbrenner, Elizabeth Bergstrom, Chris Barry, John Lieberherr, Dennis Spencer, Mark Lere, David Sturm, Stephanie Champagne, Alexander Nystrom, Robin & Tim Renner, Mark Limesard, Meredith Krutar, Carrie & Scott Greeley, Tim & Mary Thompson, Darlene Moyer, Roger Poseh, Jeff Kindrick, Jim Gillett, Michael Ziegler, Kendra Waddell, Matt Weber, David Steele, Mark Zitzka,

Robin Trenbeth - questioned if comments and questions can be posted on the website, with answers - will be checked into

julie walker - 3.6 lbs. Include curbeside - yes

robin trenbeth - cons related to mt city - only two
jim pearson - traffic on McClellan Creek - hasn't seen
nancy cobble - glass recycle - ?? Bob - no market at this time
Janice Frisch looking 20 years into the future - any plans to be more environmentally conscious?
Bob - current commodities prices - challenge - depends of public's willingness to pay more
JF - critical societal issue
matt weber - glass - a lot of tonnage - we should be providing the glass to Ash Grove instead of Helena - seems logical

John - helena recycling - ash grove was permitted to take more glass about six months ago
craig byington - asked about property line of current mt city site
John Leiber - waste origination - numbers are going down - bob - last column is a partial year

julie kreski - questioned hauling of boulder waste to tri-county - no land by whitehall to make landfill? - bob - current rules (adopted in early 90s) cost prohibitive to create landfill 1/4 million acre for disposal space - most small governments have moved away from landfills

?? - tri-county staying where it is
bob- currently have 40+ years of live at that landfill

lance vossler - fair amount of experience compacting garbage in dumpsters - might want to factor in damage to containers
ron pearson - consolidating trash - his understanding when city of helena consolidates trash - easy to overload the trucks - bob - with county trucks - not easy to overload containers
bryan xx - issue in boulder - bob - just an option for cost savings

darlene moyer - doesn't understand why Clancy only generates 8% - pretty large area
Julie Kreski - Jeff City used to be open - honor system - people from out of county would dump there - now fenced and only open two days a week
?? - if sites closed - garbage going to end up everywhere
darlene - take account for growth? Jeff city going to be the new montana city
Janice Frisch - as a Clancy person, would rather lose a day or two and still have site open - carbon footprint

?? - population isn't around the tri-county site - also - up-cycling at mt city lessens waste going to landfill

carrie kreelie - if do new site option, could leave regular waste and current site and use upper site for woody waste, etc. Bob - them operating two sites - doubling operations
robin trenbeth - if had two sites, why have to have both manned? Bob - problem is that the county is insured for its operations through MACo, a lot more liability issues with un-manned sites - insurer strongly encouraged to have sites manned - for him, would be a step back for the county - safety issues ck- another issue - road department stores sand up there - would have to move it down

wood waste regulated? Bob - construction waste - has to be regulated to make sure that it is clean
Dennis Spenser - asked how close county site is to subdivisions in the area bob - a ways a way
ck - if can't see the sand/gravel piles, won't be able to see the site

?? - wood waste - if make harder to get rid of - people are going to find another way to get rid of - people may start burning discussion of rest of county paying for problem in montana city

bart - ?? Consider reconfiguring existing site bob - not large enough

julie kreski - if close jeff city and clancy - added traffic to mt city site

?? - if wages are paid by tri-county and they decide to raise wages - is jeff co stuck? Bob - would recommend a 10-year contract

if go with tri-co option, would existing employees lose jobs
brian - not necessarily - other sites could be opend additional days

?? - cost savings go to capital fund?
Robin trenbeth - container hauling savings - but don't factor in additional costs to tax payers for additional miles

Jim Gillette - reason to weight-in at tri-county site is to bill the county - weigh the containers at jeff city and clancy -

tim thompson - if open tri-county, close clancy, jeff city and montana city - where employees go
brian - if go to tri-county and use scales - would put scales in boulder and whitehall as well, would need scale attendants

high traffic in may - yard waste - spring and summer - light longer and could be open later without added lights

?? - going to add scales in boulder and whitehall - not in this proposal lw - in another alternative

?? - county land site - steep road - bob - part of cost is to upgrade the road and put in barriers

ron pearson - tri-county - confused that need a scale if there - bob - when dump at mt city - container weighed when gets to landfill - if go directly to landfill - not weighed

?? - comment on yard waste - why not put in quarry - let decompose bob - whenever stockpile wood have to worry about fires - lake county had massive gravel pit that stockpiled wood waste for years - about 5 years caught on fire - spent about $million fighting, still not out

rick abraham - do promote everyone doing the right thing and cleaning up their property - we appreciate the county taking the initiative to take care of wood waste - this is mitigation work - he wonders if there is grant money available to purchase an air burner - the feds have them - work well - need to talk to Pat McKelvey

lyndon washington won an award because they used heat three times before it was gone -

?? - people want to keep their sites open - scales are pretty expensive to install and maintain -

willing to pay increased rates - like to option for the new site at mt city - convenient

robin - if did air burner alternative - leave the mt city site as it is bob - not large enough

ron pearson - mt city fire district trustee - been his recollection that roadway from the other side of the interstate - been on more fatal wrecks on the road to east helena that on interstate

xx - in favor of upgrading mt city site - add a couple $ a year to keep all the sites open

jim gillette - wood waste - county pays tipping fee - if want to cut down # of cars - get rid of wood waste - most of the traffic - have hauled to tri-county and county pay for
#2 - having people use home container site - different color sticker Bob - could do that - one thing that he has heard from mt city attendees, don't have time to even look at the vehicles

mark ? - a lot of the driveways aren't subdivisions like in helena - may have long driveway and difficult to haul to end drive for commercial pickup

joel ripley - really like the quarry option - sets up for long term - when make a decision lw - probably sometime this spring - hopefully before budget time - any more meetings - lw - possibly - depends on what options are chosen - this commission likes to have public involvement

mark - operates water system for saddle mountain - have pre-existing easement from BLM - if get back into that area - need to be aware of water line

?? - does burner open the county up to liability

bob church - once commissioners make an initial decision - will be put out in draft that allow additional comment period

lw - hear all the time about notice and people not being notified - required by law to notice everything in paper of record

JEFFERSON COUNTY COMMISSIONERS
COURTHOUSE, PO BOX H
BOULDER, MT 59632
PHONE 406 225-4025
FAX 406 225-4148
County website: http://jeffersoncounty-mt.gov

LEONARD WORTMAN, CHAIR   BOB MULLEN   CORY KIRSCH

AGENDA

February 26, 2019

MEETING TO BE HELD IN THE CLERK AND RECORDER MEETING ROOM

9:30 CALL MEETING TO ORDER

CLAIMS APPROVAL

A list of claims to be approved will be in the Clerk & Recorder's office by Friday of the previous week.

10:00 MEETING WITH ROAD DEPARTMENT

10:30 MEETING WITH VARIOUS DEPARTMENT HEADS

Planning Department
Health Nurse

12:00 Recess for lunch

Re-Convene at 1:30 P.M.

- **PLEDGE OF ALLEGIANCE**
- **MINUTES**
- **REPORTS**
- **CORRESPONDENCE**
  Copies of all incoming and outgoing correspondence are on file in the Commission office for public review.
- **CALENDAR REVIEW**
- **COMMISSION REPORTS**
- **OPPORTUNITY FOR PUBLIC COMMENT**
  The Commission welcomes and encourages public comment, and comments related to agenda items will be taken at the time the item is dealt with. The Commission may limit the amount of time for comment if they become extensive. The Commission will take no action on comments not related to agenda items at this meeting. To insure that others who want to address the same issue have the opportunity to do so, the item may be placed on an agenda for a later meeting.

- **ITEMS FOR COMMISSIONERS' ACTION OR REVIEW**

Time Specific:

2:00 Bob Church, Great West Engineering - Solid Waste District options

Non Time Specific:

Non time-specific items will be dealt with at any time during the agenda, as time allows. Items to be acted on and supporting and informational documents are available for viewing in the Clerk and Recorder's office.

Kaleena Miller - MSU Extension Ag Agent
Discuss and decide on Cowboy Hall of Fame issues

JEFFERSON COUNTY SOLID WASTE
PRELIMINARY ENGINEERING REPORT
ALTERNATIVES SELECTION MEETING
February 2019

CONSOLIDATION ALTERNATIVES

a. Boulder
    a. Stationary Compactors - $257,000 cost, 10 year pay back
    b. Mini-Excavator Compaction - $35,000 cost, 5 year pay back, requires operator time and machine maintenance costs
b. **Montana City, Clancy and Jefferson City** – No payback on consolidation, haul too short (Montana City) or not enough waste (Clancy, Jefferson City)
c. **Public Comments of Note**
    a. Marks – Put mini-excavator on lowboy and transport around other sites – No payoff
    b. Vossler/Bell– Mini-Exc compactors can damage containers without good operating practices
    c. Several comments supporting mini-excavator alternative. One comment supporting both mini-exc and stationary compactor alternative

SITE CLOSURE ALTERNATIVES

a. **Cost Breakdown by Site**
b. **Public Comments of Note**
    a. Many comments about loss of convenience for residents, particularly elderly and less mobile citizens
    b. Many comments supporting keeping Basin, JC and Clancy sites open
    c. Several comments mentioning resident's willingness to pay to keep existing sites open
    d. Several comments on potential for illegal dumping as a result of site closures
    e. One comment supporting closure of JC and Basin
    f. Consideration of future growth potential in Jefferson City/Clancy area – Concern about overwhelming new Montana City site if these sites are closed
    g. Comment received on Contractor's using MT City site for construction waste
    h. Comment on out of County users at MT City – Staff too busy to check passes
    i. Comment on color coding passes so residents can only use assigned site
    j. Basin – comments on dangerous winter time driving conditions to Boulder
    k. Comment on public health impacts of making waste disposal more difficult for residents in areas where sites are closed
    l. Comment on minimal savings with Basin site because it is unattended
    m. Brian – comment on potential winter time closure of Clancy site
    n. Bob- If County doesn't reduce employees with site closure alternatives most of the projected savings under this alternative are not realized.

MONTANA CITY SITE ALTERNATIVES

1) **Construct New Container Site on property above exist MTC site**
    a. Features
        i. Continue to accept wood waste

ii. May be able to process wood waste on site – grinding, composting, burning
iii. Eight bays to accept all waste
iv. Requires construction of new access road to County road width and 9% maximum grade standard.

b. Cons
   i. High Capital Cost
   ii. Road maintenance during winter
   iii. New site will require construction of 42-inch barriers
c. Pros
   i. Continuation of existing service near existing site and access road
   ii. Same level of service currently provided
   iii. Upgraded modern facility with plenty of space to accommodate growth
   iv. Room for expansion as well as wood waste processing and stockpiling
   v. Access Road improvements would facilitate construction of new road shop on property in future
   vi. Would provide space for scales and PAYT if added later
   vii. Already owned by County
   viii. County retains control of solid waste system

d. Cost - **$794,000**
e. **Increase to Assessment** ($794,000 project) = **$10.30/unit** (20 year RD loan @3.875%)

2) **Build new site at Tri-County Disposal**
   a. Features
      i. Four bay site
      ii. Wood waste will be hauled directly to landfill face
      iii. Requires installation of two additional scales and scale house
      iv. TCD would charge County for tonnage plus operations cost for scale attendant and driver
      v. County residents would receive permit tags and TCD would track their tonnage annually. If household exceeded agreed tonnage limit set by County, County could bill customer for excess. Current average annual generation rate is 1.2 tons/unit (2400 lbs/unit)
      vi. Requires long term relationship between TCD and County to be agreed upon through either contract or MOU.
      vii. TCD would like to have minimum charge to reduce traffic. These charges would be credited to the County's solid waste charges. This is negotiable according to TCD.
      viii. TCD would purchase any extra containers that Jefferson County does not want to keep
   b. Pros
      i. New modern site laid with room for traffic growth and elimination of traffic conflicts,
      ii. Tri-County Disposal would pay for new infrastructure. However County would pay back investment cost over 10 years at either no interest or small interest rate (To be negotiated). **$45,000/year for 10 years**
      iii. **Estimated $2.65 increase to annual assessment**

    iv. Could be used as first step to convert County to PAYT
c. Cons
    i. Requires scales because TCD needs to track tonnage for billing County
    ii. Also requires commercial scale so County can keep commercial and public traffic separate
    iii. Will require installation of 42 inch barrier
    iv. Includes closure of Clancy and Jefferson City sites to prevent these sites from being overwhelmed and allowing PAYT
    v. Requires long-term relationship with Tri-County Disposal
d. Cost - **$452,000**

3) **Public comments**
    a. Several public comments in support of County owned site and associated rate hike
    b. Several public comments voiced with concern about traffic safety impacts, litter and inconvenience of Tri-County site alternative
    c. A couple public comments on delaying improvements to MT City site by refusing wood waste and having customers haul direct – **Tri-County doesn't currently have facilities for handling this traffic load and would probably charge users direct**
    d. A few comments on increasing hours of operation to delay needed improvements to MT City
    e. Public comment on running two sites at MT City one for wood waste and one for MSW – **Added operations costs for two sites**
    f. No favorable comments on Tri-County alternative
    g. Public comments on negative impacts of loss of County employees under Tri-County alternative

PAY-AS-YOU-THROW

- Under a Pay-As-You-Throw (PAYT) system solid waste customers pay only for the volume of waste they throw away
- Jefferson County already has a PAYT system for commercial customers because these businesses pay multiple assessment units based on the volume of waste they generate
- PAYT provides an economic incentive to throw away less waste
- PAYT systems are more equitable because customers pay for the extent they use the system. This is similar to other utilities like gas, water or electricity which us meters to charge customers
- Wood waste volumes in Jefferson County are very high with residential customers generating a large percentage of this waste.
- Some entities report lower waste volumes with implementation of PAYT – Unlikely to be significant in Jefferson County due to already low waste generation rate.

PAYT Alternative

- Requires installation of two scale system at either new Montana City Site or Tri-County Disposal Site
- Boulder and Whitehall could be served by single scale each
- Alternative also includes scale house, software and computers for tracking and billing customers
- County could set "free" tonnage level covered under existing assessment until extra tonnage is billed. Typically set at 1-1.5 tons (Current generation rate is 1.2 tons/unit/year)
- Jefferson City, Clancy and Basin sites would need to be closed under this alternative

- New Montana City Site Two-Scale System - $224,000
- Installation of Scales & Supporting Infrastructure at Boulder/Whitehall - $250,800
- **Total Capital Cost of PAYT Alternative $474,800**
- Alternative would require full time scale attendant for MTC and part time attendants for Boulder and Whitehall
- Additional Operations Cost of $32,000/year
- **$11.25 increase in annual assessment to pay debt plus additional operations costs**

Public Comments

- Several comments both in favor and against mandatory curbside collection – **Affordability vs. Convenience**
- Several comments about not all waste can be picked up at the curb
- Comments on potential for illegal dumping

WOOD WASTE ALTERNATIVES

Wood Waste Alternatives

- Grind waste and sell as hog fuel – no current market
- Grind waste and utilize as compost
- Burn in Air Curtain Container
- Continue to Open Burn and/or Landfill

Grinding

- Typical Cost -$5/cubic yard plus mobilization
- Still need to dispose of - or reuse ground waste – composting possibility
- Estimated cost of grinding wood waste for entire County $38,000 annually = **$38/ton**

Estimated Cost of Open Burning Alternative Currently Used at Whitehall and Boulder

- Estimated Cost per ton = **$16.70/ton**

Estimated Annual Cost of Wood Waste Alternative Currently Used for Montana City and Clancy

- Disposal Costs (450 tons x $23/ton) = **$10,350**
- Hauling Costs (See Table) = $5,048
- Total Annual Cost = $15,398
- Cost Per Ton = $15,938/450 tons = **$35.40/ton**

Estimated Annual Cost Air Curtain Alternative for MT City and Clancy

- Operation of Air Curtain $8,640 Annually (See Table)
- Loader Operation 20 hours/year x $60/hr = $1,200
- Ash Disposal 65 tons x $29/ton = $1,885
- Hauling cost = $230
- Annual Debt Service on $120,000 purchase price (10 year service life) = $14,800/year
- Total Annual Cost = $26,775
- Cost Per Ton = $26,775/450 tons = **$59.45/ton**

Estimated Annual Cost to Haul (Not Backhaul) MT City and Clancy waste to Boulder and Open Burn

- Hauling Costs = $28,963 = $64/ton

- Open Burning Cost = $16.70/ton
- Cost Per Ton = **$80.70/ton**

Public Comments

- Several public comments in support of Air Curtain alternative

Appendix I

Tri-County Contract

ITEM 8
TCD CONTRAC

Solid Waste Disposal Agreement

This Contract is between the Jefferson County Solid Waste District (District), whose address is P.O. Box H, Boulder, Montana, 59632, and whose phone number is 406-225-4159, and City County Sanitation dba Tri County Disposal (Contractor), whose Federal ID Number is 81-050-7081, whose address is 3630 York Road, Helena Montana, 59602, and whose and phone number is 406-227-6300.

THE PARTIES AGREE AS FOLLOWS:

2. EFFECTIVE DATE, DURATION AND RENEWAL

(a) This Contract is effective upon execution of the agreement by both parties. The Contract shall terminate after a period of 5 years, unless terminated earlier in accordance with the terms of this Contract.

(b) This Contract and its identical terms may be renewed by the District for two additional periods of one year duration, not to exceed seven years total.

3. SERVICES AND/OR SUPPLIES

Contractor agrees to provide to District Class II solid waste disposal, with the below noted exceptions, allowed by State Operating Permit # 296A.

a. No large volumes of liquids will be accepted.

b. No hazardous waste, as defined by Montana State Law and Administrative Rule.

4. CONSIDERATION/PAYMENT

In consideration for the services to be provided, District shall pay within thirty days after the date of the monthly invoice

a. All refuse taken to the disposal site shall be weighted on the Contractor's scale and properly recorded. A monthly invoice of all usage shall be compiled and submitted to the District. All disposal invoices must possess an invoice number and source for each load for tracking purposes. The Rate:

1) Class II regular Waste	$29.00 / per ton
2) Construction Debris	$23.00 / per ton
3) Brush and Yard Waste	$23.00 per ton
4) Other specified waste accepted	$30.00 per CY/ asbestos, glass $29.00 ton Tires .10 / pound
	Contaminated Soils price varies
5) List any special Handling Fees	None

b. The District may withhold payments to the Contractor if the Contractor has not performed in accordance with this Contract. Such withholding cannot be greater than the additional costs to District caused by the lack of performance.

5. ACCESS AND RETENTION OF RECORDS

(a) The Contractor agrees to provide District, Legislative Auditor or their authorized agent's access to any records necessary to determine Contract compliance.

(b) The Contractor agrees to create and retain records supporting the services rendered (or supplies delivered) for a period of three years after either the completion date of this Contract or the conclusion of any claim, litigation or exception relating to this Contract taken by the District or a third party.

6. ASSIGNMENT, TRANSFER AND SUBCONTRACTING

The Contractor shall not assign, transfer or subcontract any portion of this Contract without the express written consent of District.

7. FAVORABLE PRICES

Contractor agrees that, through the term of the initial Contract and any agreed-upon extension, District will be entitled to any lower prices made available to any other customer of comparable volume.

8. HOLD HARMLESS/INDEMNIFICATION

The Contractor agrees to indemnify the District, its officials, agents, and employees, while acting within the scope of their duties as such, harmless from and against all claims, demands, and causes of action of any kind or character, including the cost of defense, arising in favor of the Contractor's employees or third parties on account of bodily or personal injuries, death, or damage to property arising out of services performed, goods or rights to intellectual property provided or omissions of services or in any way resulting from the acts or omission of the Contractor and/or its agents, employees, subcontractors or its representatives under this or a subsequent contract, all to the extent of the Contractors negligence.

9. INSURANCE

(a) The Contractor shall maintain for the duration of the Contract, at its cost, primary insurance coverage against claims for injuries to persons or damages to property including contractual liability that may arise from work performed under this Contract. This insurance shall cover such claims as may be caused by any act, omission, or negligence of the Contractor or its officers, agents, representatives, assigns, or servants.

(b) The Contractor must provide a certificate for Commercial General Liability and Commercial Automobile Liability (Occurrence Coverage), to include bodily injury, personal injury and property damage with combined single limits of $500,000 per claim and $1 million aggregate per year, from an insurer with a Best's Rating of no less than A-.

(c) This certificate MUST name the District as an additional insured party under the Contractor's policy including the Contractor's general supervision, products, premises and automobiles used.

(d) A Certificate of Insurance, indicating compliance with the required coverage's, has been filed with the District.

10. WORKERS/ COMPENSATION/INDEPENDENT CONTRACTOR

Contractors are required to maintain Workers' Compensation or an Independent Contractors Exemption covering the Contractor and/or employees while performing work for the State of Montana in accordance with 39-71-120/401/405, Montana Code Annotated. This insurance/exemption must be valid for the entire contract period.

11. COMPLIANCE WITH LAWS

The Contractor must, in performance of work under this Contract, fully comply with all applicable Federal, state, or local laws, rules and regulations, including the Montana Human Rights Act, the Civil Rights Act of 1964, the Age Discrimination Act of 1975, the Americans with Disabilities Act of 1990, and Section 504 of the Rehabilitation Act of 1973. Any subletting or subcontracting by the Contractor subjects subcontractors to the same provision. In accordance with Section 49-3-207, MCA, the Contractor agrees that the hiring of persons to perform this Contract will be made on the basis of merit and qualifications and there will be no discrimination on the basis of race, color, religion, creed, political ideas, sex, age, marital status, physical or mental disability, or national origin by the persons performing this Contract.

12. CONTRACT TERMINATION

(a) District may, by written notice to the Contractor, terminate this Contract in whole or in part at any time the Contractor fails to perform this Contract.

(b) District, at its sole discretion, may terminate or reduce the scope of this Contract if available funding is reduced for any reason. (See 18-4-313(3), MCA).

13. LIAISON AND SERVICE OF NOTICES

Written notices or complaints will first be directed to the liaison.

Contractor Liaison:

(Name) Dave Duffy / Deanna Linkenbach

(Vendor's Name) City County Sanitation, dba Tri County Disposal

(Address) 3630 York Road

(City, State, ZIP) Helena, Montana, 59602

(Telephone #) 406-227-6300, 406-439-3379

(Fax #) 406-227-0188

District _Liaison:

Jefferson Solid Waste District Manager

P.O. Box H

Boulder, MT. 59632

406-225-4159 Fax(406-225-4169

solidwaste@jeffersoncounty-mt.gov

14. PROJECT MANAGEMENT AND IMPLEMENTATION

All project management and coordination on behalf of District shall be through a single point of contact designated as the District Manager. Contractor shall designate a Contractor Project Manager who will provide the single point of contact for management and coordination of Contractor's work. All work performed pursuant to this contract shall be coordinated between the District Manager and the Contractor Project Manager.

Kathi Aultman will be the District Representative.

Dave Duffy will be the General Manager.

District Representative/General Manager may be changed by written notice to the other party.

15. CHOICE OF LAW AND VENUE

This Contract is governed by the laws of Montana. The parties agree that any litigation concerning this bid, proposal or subsequent contract must be brought in the Fifth Judicial District in and for the County of Jefferson, State of Montana and each party shall pay its own costs and attorney fees. (See 18-1-401, MCA).

16. SCOPE, AMENDMENT AND INTERPRETATION

(a) In the case of dispute or ambiguity about the minimum levels of performance by the Contractor the order of precedence of document interpretation is in the same order.

(b) These documents contain the entire agreement of the parties. Any enlargement, alteration or modification requires a written amendment signed by both parties.

17. EXECUTION

The parties through their authorized agents have executed this Contract on the dates set out below.

JEFFERSON COUNTY

SOLID WASTE DISTRICT

IN WITNESS WHERE OF the Jefferson County Solid Waste District has caused this Agreement to be executed in duplicate, and to be signed in its corporate name, its signature hereby made by Leonard Wortman, County Commissioner of Jefferson County and attested, and its corporate seal hereto to be affixed by _______________, its Clerk and Recorder, this ________ day of September, 2013.

Leonard Wortman ____________ Date; 09-20-13

Leonard Wortman, County Commissioner

Dave Duffy Date; 9-20-2013

Dave Duffy, General Manager, Tri-County Disposal

3630 York Rd.

Helena, MT. 59602

Bonnie Ramey

CLERK AND RECORDER

STATE OF MONTANA)

County of Jefferson):

Appendix J

Facility Pictures

Basin Container Wall

Basin Entrance and Scale House

Basin Waste Regulations Sign

Boulder Class 3 Landfill

Boulder Container Site

Boulder Container Site

Clancy Tipping Area

Clancy Tipping Area

Clancy Tire Disposal Container

Clancy Metal Container

Clancy Used Oil Disposal

Jefferson City Container Site

Montana City Container Site Entrance

Montana City Tipping Area

Montana City Tipping Area

Whitehall Container Site

Appendix K

DEQ Inspections

Item 18

DEQ
Montana Department
of Environmental Quality

January 9, 2017

Candice Bell, Manager
JEFFERSON COUNTY SOLID WASTE DISTRICT
PO Box H
Boulder, MT 59632

RE: WHITEHALL CLASS III LANDFILL – LICENSE #370 – INSPECTION REPORT

Dear Candice:

On December 29, 2017, David Sanborn and I inspected the Whitehall Class III Landfill and Burn Site for compliance with the Montana laws and rules for solid waste management and disposal. The On-Site Inspection Form is enclosed for your records, along with photos from our inspection. No violations were observed and the facility was in satisfactory compliance at the time of the inspection.

The facility looks great! We noticed the burn pile was getting large. Kelly told us that you had a burn scheduled for January 9th in Whitehall. Make sure to remove the treated wood before you burn. You guys do a great job. Please thank Kelly for taking the time to talk with us.

If you have any questions, please feel free to contact me directly by phone or email, or David Sanborn by phone at 406-444-1434, or email at dsanborn@mt.gov.

Sincerely,

Fred Collins

Fred Collins – Environmental Science Specialist
Waste and Underground Tank Management Bureau
Solid Waste Section
Phone: 406-444-9879
Email: fcollins2@mt.gov

Enc: On-Site Inspection Form, PhotoLog
cc: Jefferson County Sanitarian, Megan Bullock, PO Box H., Boulder, MT 59632

File: Jefferson County/Class III/License #370/Inspections

Montana Department of Environmental Quality
Permitting and Compliance Division
Solid Waste Section
PO Box 200901
Helena, MT 59620-0901
(406) 444-5300

Date: 12/29/2016
Time of Arrival: 11:45 am
Time of Departure: 12:30 pm
Credentials Presented? Yes ☑ No ☐

Class III Solid Waste Management System: On-Site Inspection Form

Facility Name: Jefferson Co. Whitehall **License Number:** 370
Type of Facility: Class III
Operator: Jefferson Co.- Ms. Candice Bell **Phone** 406 225-4171
Address: PO Box H Boulder, Montana 59632
General Site Location: 60 Paul Gulch Road, Whitehall
Facility Representatives: Kelly **Phone**
DEQ Representatives: David Sanborn, Fred Collins **Phone** 406-444-9879

(Fill in prior to inspection.)

Date of Last Inspection: July 2016
Is license current? Yes
Are fees paid up-to-date? Yes
Date of Last O&M Plan on File: May 2011
Is a Closure Plan on file? No
Montana Pollutant Discharge Elimination System Permit issued ? Yes ☐ No ☑
Does the facility have a current burn permit? Yes ☑ No ☐

Summary of Today's Inspection:

Major Violation(s): None
Minor Violation(s): None

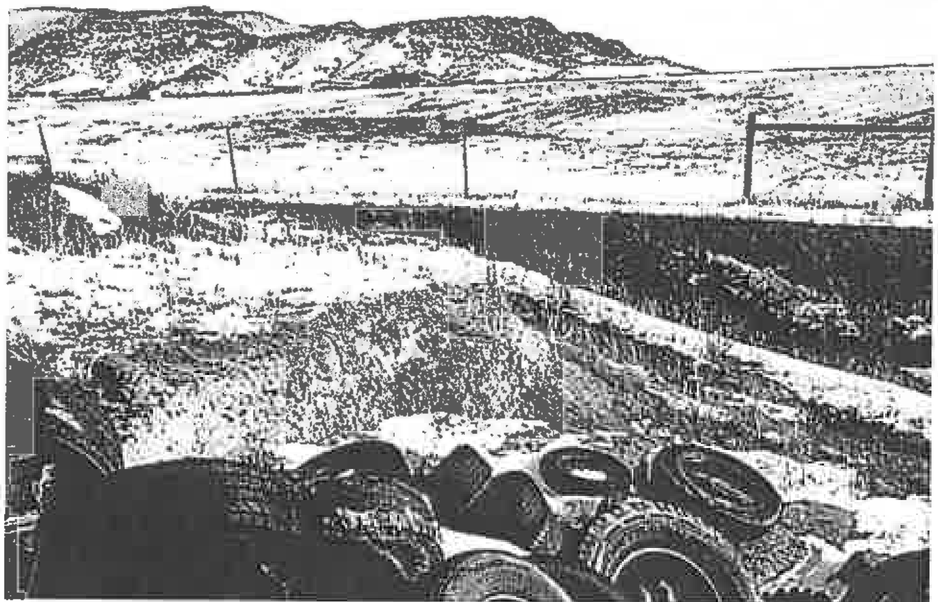
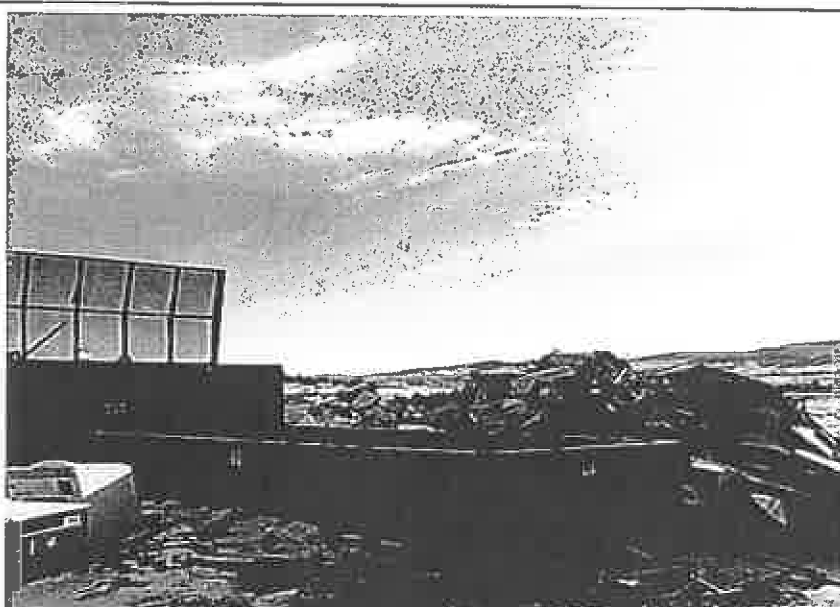
Needed Improvements:

General Comments:
This facility looks excellent! Thank you for the good work that you are doing, and thank Kelly for being so kind when we were there!

Notes:

Regulatory Compliance Checklist

Item	Yes	No	N/A
1. Is approach road properly maintained?	☑	☐	☐
2. Is site access controlled?	☑	☐	☐
3. Is waste landfilled?	☑	☐	☐
4. Has quarterly cover been applied?	☑	☐	☐
a. Date of last cover application:			☐
5. Is disposal limited to Group III waste?	☑	☐	☐
a. Unacceptable waste:			☐
6. Does the site burn untreated wood waste?	☑	☐	☐
a. Is it part of an approved O&M Plan?	☑	☐	☐
b. Date of last burn: Fall 2015			☐
c. Has ash been removed?	☑	☐	☐
7. Is the burn pile contaminated?	☐	☑	☐
a. Unacceptable waste:			☑
8. Is the ash disposed of at a Class II landfill?	☑	☐	☐
a. Where? Valleyview Landfill			☐
9. Is ash mixed on-site with Class III waste?	☐	☑	☐
a. Is ash mixed appropriately?	☐	☐	☑
b. Is it part of an approved O&M Plan?	☐	☐	☑
c. Has an Ash Characterization been submitted?	☐	☐	☑
10. Does the facility compost? Separate License #519	☑	☐	☐
a. Is this part of an approved O&M Plan?	☑	☐	☐
b. Composting method used: Static pile			☐
c. Compost end use: On-site			☐
d. Is the compost contaminated?	☐	☑	☐
11. Does the facility recycle? Batteries, oil, pesticide containers, paper, steel	☑	☐	☐
a. Is it part of an approved O&M Plan?	☑	☐	☐
12. Are white goods stored on-site?	☑	☐	☐
a. If so, has CFC removal been documented?	☑	☐	☐
b. Are doors removed or disabled?	☑	☐	☐
13. Is waste confined to a manageable area?	☑	☐	☐
14. Is litter controlled?	☑	☐	☐
15. Does the facility have run-on/run-off controls in place?	☑	☐	☐

MTDEQ/WUTM **WM&R DIVISION** **PHOTO #:** 001 **SUBJECT: Whitehall Inspection** **LOCATION: Whitehall, MT** **COUNTY: Jefferson** **DATE: December 29, 2016** **WEATHER: Sunny** **PHOTOGRAPHER:** Fred Collins **PHOTOGRAPHER** (sig). FC **CAMERA:** iPhone 6 **EXPLANATION: Remove the prohibited items before you burn.**	
MTDEQ/WUTM **WM&R DIVISION** **PHOTO #:** 002 **SUBJECT: Whitehall Inspection** **LOCATION: Whitehall, MT** **COUNTY: Jefferson** **DATE: December 29, 2016** **WEATHER: Sunny** **PHOTOGRAPHER:** Fred Collins **PHOTOGRAPHER** (sig). FC **CAMERA:** iPhone 6 **EXPLANATION: Recent deposit of tires.**	
MTDEQ/WUTM **WM&R DIVISION** **PHOTO #:** 003 **SUBJECT: Whitehall Inspection** **LOCATION: Whitehall, MT** **COUNTY: Jefferson** **DATE: December 29, 2016** **WEATHER: Sunny** **PHOTOGRAPHER:** Fred Collins **PHOTOGRAPHER** (sig) FC **CAMERA:** iPhone 6 **EXPLANATION: Metal recycling area.**	

DEQ
Montana Department
of Environmental Quality

January 9, 2017

Candice Bell, Manager
JEFFERSON COUNTY SOLID WASTE DISTRICT
PO Box H
Boulder, MT 59632

RE: WHITEHALL COMPOST FACILITY – LICENSE #516 – INSPECTION REPORT

Dear Candice:

On December 29, 2017, David Sanborn and I inspected the Whitehall Compost facility for compliance with the Montana laws and rules for solid waste management and disposal. The On-Site Inspection Form is enclosed for your records, along with photos from our inspection. No violations were observed and the facility was in satisfactory compliance at the time of the inspection.

Be sure to keep your compost wet in the spring when it gets warmer. Keeping the compost in larger piles may help speed up decomposition and will make it easier to keep the piles moist. Please thank Kelly for talking with us. You have a very friendly staff!

If you have any questions, please feel free to contact me directly by phone or email, or David Sanborn by phone at 406-444-1434, or email at dsanborn@mt.gov.

Sincerely,

Fred Collins

Fred Collins – Environmental Science Specialist
Waste and Underground Tank Management Bureau
Solid Waste Section
Phone: 406-444-9879
Email: fcollins2@mt.gov

Enc: On-Site Inspection Form, PhotoLog
cc: Jefferson County Sanitarian, Megan Bullock, PO Box H., Boulder, MT 59632

File: Jefferson County/Class III/License #516/Inspections

Compost Facility Inspection Form

Montana Department of Environmental Quality **Permitting and Compliance Division** **Solid Waste Section** **PO Box 200901** **Helena, MT 59620-0901** **406-444-5300**	Date: 12/29/2016 Time of Arrival: 11:45 am Time of Departure: 12:30 pm Credentials Presented: Yes ☒ No ☐

Facility Name: Jefferson County Whitehall Compost License Number: 516

Small Composter ☒ Large Composter ☐ Animal Composter ☐

Operator: Jefferson County Solid Waste District Phone: 406-225-4159

Address: Po Box H, Boulder, MT 59632

General Site Location: 60 Paul Gulch Road, Whitehall

Facility Representative: Kelly Phone:

DEQ Representative: David Sanborn, Fred Collins Phone: 406-444-9879

Date of Last Inspection: July 2016

Is License Current: Yes ☒ No ☐

Are Fees Up-to-date: Yes ☒ No ☐

Date of Last O&M Plan on File: 2012

Is a Closure Plan on File: Yes ☒ No ☐

Is a Montana Pollutant Discharge Elimination System permit Issued: Yes ☐ No ☒

On-site Inspection

1. Is the approach properly maintained: Yes ☒ No ☐
2. Is access to the site controlled: Yes ☒ No ☐ Signs: Yes ☒ No ☐
   Gates: Yes ☒ No ☐ Fence: Yes ☒ No ☐
   Supervision: Yes ☒ No ☐
3. Where are the operational records kept: Boulder site
4. Composting method used: Static pile, windrow
5. Types and amounts of raw compost material on site:

Raw Materials	Weight or Volume
Grass, Leaves, Wood, Straw	10-20 cu. Yds
Other	

6. Amount of finished compost on site: approx.. 10 cu. Yds.
7. If biosolids or food residuals are composted, how are PFRP and VAR documented?
   Yes ☐ No ☒
8. Approximate size of working area: 2 acres
9. Any sign of animal disturbance: Yes ☐ No ☒
10. Run-on/run-off controls: Yes
11. Annual facility production: 700 cu. Yards
12. Date of most recent lab analysis of the finished compost: NA
13. Compost end use: On-site

Compost Facility Inspection Form

Inspection Summary	
Major Violation(s)	None
Minor Violation(s)	None
Needs Improvement	
General Comments	Be sure to keep the compost wet when you are able to in the spring when it warms up! Perhaps, keep them in larger piles so they are able to break down a little quicker!
Notes	Please thank Kelly for talking with us. You guys have a great facility, and a friendly staff.

MTDEQ/WUTM **WM&R DIVISION** **PHOTO #:** 001 **SUBJECT: Whitehall Inspection** **LOCATION: Whitehall, MT** **COUNTY: Jefferson** **DATE: December 29, 2016** **WEATHER: Sunny** **PHOTOGRAPHER:** Fred Collins **PHOTOGRAPHER** (sig). **CAMERA:** iPhone 6 **EXPLANATION: Make bigger compost piles to help the composting process.**	

Montana Department of Environmental Quality

January 23, 2017

Candice Bell, Manager
Jefferson County Solid Waste District
PO Box H
Boulder, Montana 59632

RE: BOULDER COMPOST – LICENSE # 515 – INSPECTION REPORT

Dear Candice:

On December 29, 2017, David Sanborn and I inspected the Boulder Compost facility for compliance with the Montana law and rules for solid waste management. The On-Site Inspection Form is enclosed for your records, along with photos from our inspection. No violations were observed and the facility was in compliance at the time of the inspection.

The facility looks great! Your compost looks fantastic. Keep up the good work!

If you have any questions or comments, please feel free to contact me directly by phone or email, or contact David Sanborn at 406-444-1434, or e-mail dsanborn@mt.gov.

Sincerely,

Fred Collins – Environmental Science Specialist
Waste and Underground Tank Management Bureau
Solid Waste Section
Phone: 406-444-9879
Email: fcollins2@mt.gov

Encl: On-Site Inspection Form, PhotoLog

File: Jefferson County/Compost/License #515/Inspections

Compost Facility Inspection Form

Montana Department of Environmental Quality **Permitting and Compliance Division** **Solid Waste Section** **PO Box 200901** **Helena, MT 59620-0901** **406-444-5300**	Date: 7/29/2015 Time of Arrival: 4:00 pm Time of Departure: 4:50 pm Credentials Presented: Yes ☒ No ☐

Facility Name: Jefferson County Whitehall Compost License Number: 516

Small Composter ☒ Large Composter ☐ Animal Composter ☐

Operator: Jefferson County Solid Waste District Phone: 406-225-4159

Address: Po Box H, Boulder, MT 59632

General Site Location: 2 miles down Little Boulder Road on the right, south of Boulder

Facility Representative: Suzie Phone:

DEQ Representative: David Sanborn, Fred Collins Phone: 406-444-9879

Date of Last Inspection: July 2015

Is License Current: Yes ☒ No ☐

Are Fees Up-to-date: Yes ☒ No ☐

Date of Last O&M Plan on File: 2012

Is a Closure Plan on File: Yes ☒ No ☐

Is a Montana Pollutant Discharge Elimination System permit Issued: Yes ☐ No ☒

On-site Inspection

1. Is the approach properly maintained: Yes ☒ No ☐
2. Is access to the site controlled: Yes ☒ No ☐ Signs: Yes ☒ No ☐
   Gates: Yes ☒ No ☐ Fence: Yes ☒ No ☐
   Supervision: Yes ☒ No ☐
3. Where are the operational records kept: Boulder site
4. Composting method used: Static pile, windrow
5. Types and amounts of raw compost material on site:

Raw Materials	Weight or Volume
Grass, Leaves, Wood, Straw	10-20 cu. Yds
Other	

6. Amount of finished compost on site: approx.. 10 cu. Yds.
7. If biosolids or food residuals are composted, how are PFRP and VAR documented?
   Yes ☐ No ☒
8. Approximate size of working area: 2 acres
9. Any sign of animal disturbance: Yes ☐ No ☒
10. Run-on/run-off controls: Yes
11. Annual facility production: 700 cu. Yards
12. Date of most recent lab analysis of the finished compost: NA
13. Compost end use: On-site

Compost Facility Inspection Form

Inspection Summary	
Major Violation(s)	None
Minor Violation(s)	None
Needs Improvement	
General Comments	
Notes	Your compost in Boulder looks great! Keep up the good work!

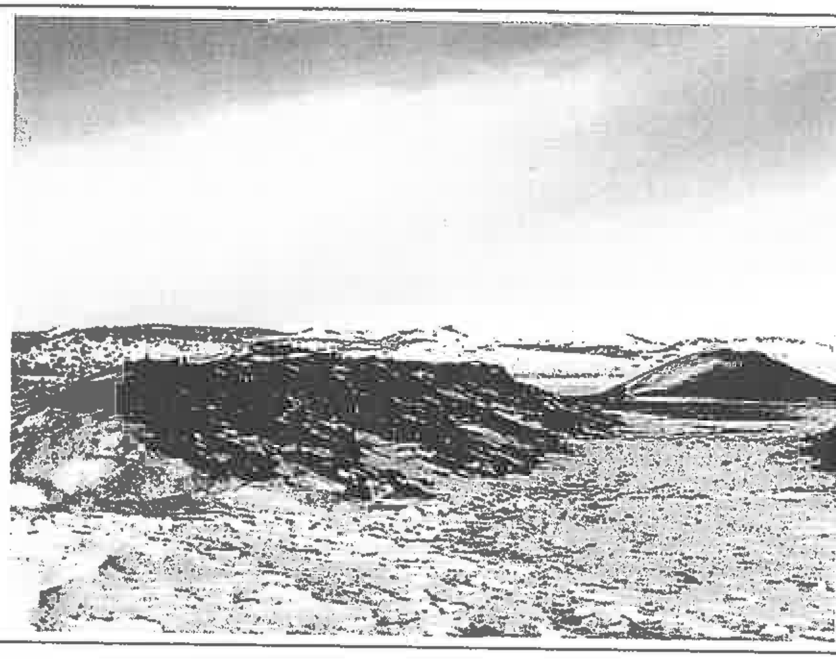
MTDEQ/WUTM WM&R DIVISION

PHOTO #: 001

SUBJECT: Boulder Compost Inspection
LOCATION: Boulder, MT
COUNTY: Jefferson
DATE: December 29, 2016
WEATHER: Sunny
PHOTOGRAPHER: Fred Collins
PHOTOGRAPHER (sig) FC

CAMERA: iPhone 6

EXPLANATION: Compost looks great! Keep it up.



DEQ

Montana Department of Environmental Quality

January 24, 2017

Candice Bell, Manager
Jefferson County Solid Waste District
PO Box H
Boulder, Montana 59632

RE: BOULDER CLASS III LANDFILL – LICENSE # 368 – INSPECTION REPORT

Dear Candice:

On December 29, 2017, David Sanborn and I inspected the Boulder Class III Landfill and burn site for compliance with the Montana law and rules for solid waste management and disposal. The On-Site Inspection Form is enclosed for your records, along with photos from our inspection. One minor violation was noted for contamination in the burn pile.

According to ARM 17.50.503,

(b) Group III wastes include wood wastes and non-water soluble solids. These wastes are characterized by their general inert nature and low potential for adverse environemtal impacs. Examples include, but are not limited to, the following:

(ii) clean, untreated, unglued wood materials, brush, unpainted or untreated lumber, and vehicle tires.

There were prohibited items in the burn pile during our inspection. Please submit documentation that the prohibited items have been removed by February 3, 2017. The facility looked great, otherwise. Please thank Suzie for taking the time to talk with us!

If you have any questions or comments, please feel free to contact me directly by phone or email, or contact David Sanborn at 406-444-1434, or e-mail dsanborn@mt.gov.

Sincerely,

Fred Collins

Fred Collins – Environmental Science Specialist
Waste and Underground Tank Management Bureau
Solid Waste Section
Phone: 406-444-9879
Email: fcollins2@mt.gov

Encl: On-Site Inspection Form, PhotoLog
File: Jefferson County/Class III/Licenses/Inspections

Montana Department of Environmental Quality
Permitting and Compliance Division
Solid Waste Section
PO Box 200901
Helena, MT 59620-0901
(406) 444-5300

Date: 12/29/2016
Time of Arrival: 1:00 pm
Time of Departure: 1:30 pm
Credentials Presented? Yes ☑ No ☐

Class III Solid Waste Management System: On-Site Inspection Form

Facility Name: Jefferson Co. Boulder **License Number:** 368
Type of Facility: Class III
Operator: Jefferson Co.- Ms. Candice Bell **Phone** 406 225-4171
Address: PO Box H Boulder, Montana 59632
General Site Location: South of Boulder on Little Boulder Road, 2 miles on right
Facility Representatives: Suzie **Phone**
DEQ Representatives: David Sanborn, Fred Collins **Phone** 406-444-9879

(Fill in prior to inspection.)

Date of Last Inspection:	June 2014
Is license current?	Yes
Are fees paid up-to-date?	Yes
Date of Last O&M Plan on File:	May 2011
Is a Closure Plan on file?	No

Montana Pollutant Discharge Elimination System Permit issued ? Yes ☐ No ☑
Does the facility have a current burn permit? Yes ☑ No ☐

Summary of Today's Inspection:

Major Violation(s): None
Minor Violation(s): 1

Needed Improvements:
There were prohibited items in the burn pile during our inspection. Please submit photo documentation that the prohibited items have been removed by February 3, 2017.

General Comments:
Your facility is well-maintained and very clean. Please thank Suzie for talking with us!

Notes:

Regulatory Compliance Checklist

	Yes	No	N/A
1. Is approach road properly maintained?	☑	☐	☐
2. Is site access controlled?	☑	☐	☐
3. Is waste landfilled?	☑	☐	☐
4. Has quarterly cover been applied?	☑	☐	☐
a. Date of last cover application:			☐
5. Is disposal limited to Group III waste?	☑	☐	☐
a. Unacceptable waste:			☐
6. Does the site burn untreated wood waste?	☑	☐	☐
a. Is it part of an approved O&M Plan?	☑	☐	☐
b. Date of last burn: Fall 2015			☐
c. Has ash been removed?	☑	☐	☐
7. Is the burn pile contaminated?	☐	☑	☐
a. Unacceptable waste:			☐
8. Is the ash disposed of at a Class II landfill?	☑	☐	☐
a. Where? Valleyview			☐
9. Is ash mixed on-site with Class III waste?	☐	☑	☐
a. Is ash mixed appropriately?	☐	☐	☑
b. Is it part of an approved O&M Plan?	☐	☐	☑
c. Has an Ash Characterization been submitted?	☐	☐	☑
10. Does the facility compost? Separate license	☑	☐	☐
a. Is this part of an approved O&M Plan?	☑	☐	☐
b. Composting method used: Static pile			☐
c. Compost end use: On-site			☐
d. Is the compost contaminated?	☐	☑	☐
11. Does the facility recycle?	☑	☐	☐
a. Is it part of an approved O&M Plan?	☑	☐	☐
12. Are white goods stored on-site?	☑	☐	☐
a. If so, has CFC removal been documented?	☑	☐	☐
b. Are doors removed or disabled?	☑	☐	☐
13. Is waste confined to a manageable area?	☑	☐	☐
14. Is litter controlled?	☑	☐	☐
15. Does the facility have run-on/run-off controls in place?	☑	☐	☐

MTDEQ/WUTM **WM&R DIVISION**

PHOTO #: 001

SUBJECT: Boulder Inspection
LOCATION: Boulder, MT
COUNTY: Jefferson
DATE: December 29, 2016
WEATHER: Sunny
PHOTOGRAPHER: Fred Collins
PHOTOGRAPHER (sig). FC

CAMERA: iPhone 6

EXPLANATION: Be sure to remove the prohibited items from the burn pile by February 3, 2017.

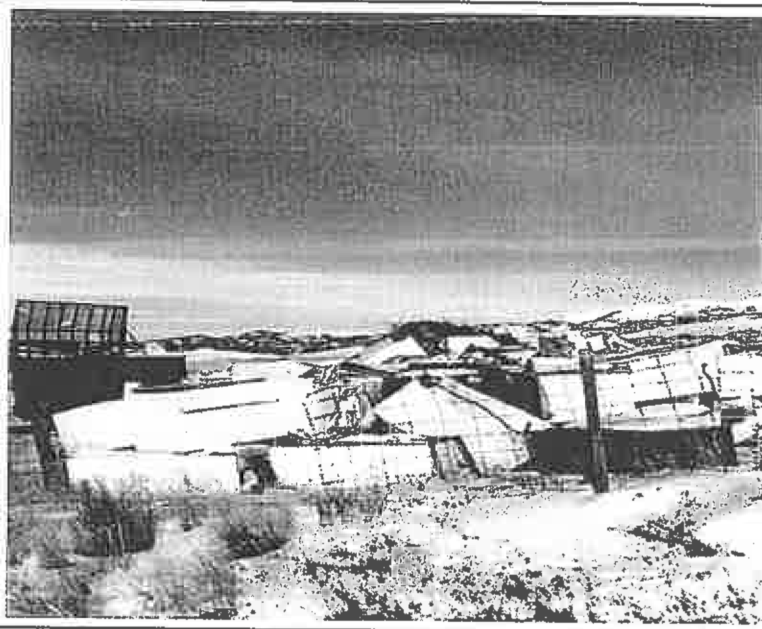
MTDEQ/WUTM **WM&R DIVISION**

PHOTO #: 002

SUBJECT: Boulder Inspection
LOCATION: Boulder, MT
COUNTY: Jefferson
DATE: December 29, 2016
WEATHER: Sunny
PHOTOGRAPHER: Fred Collins
PHOTOGRAPHER (sig). FC

CAMERA: iPhone 6

EXPLANATION: Refrigerators with Freon removed.



MTDEQ/WUTM **WM&R DIVISION**

PHOTO #: 003

SUBJECT: Boulder Inspection
LOCATION: Boulder, MT
COUNTY: Jefferson
DATE: December 29, 2016
WEATHER: Sunny
PHOTOGRAPHER: Fred Collins
PHOTOGRAPHER (sig). FC

CAMERA: iPhone 6

EXPLANATION: Tire pit.

Appendix L

Giulio Contract

/

ITEM 9 FILE Contracts Giulio

JEFFERSON COUNTY SOLID WASTE DISTRICT

111 Odyssey Lane PO Box H Boulder, Montana 59632

Phone 406-225-4159 email: solidwaste@jeffersoncounty-mt.gov Fax 406-225-4169

September 26, 2017

Giulio Disposal Service, Inc.
Gordon Giulio
PO Box 206
Boulder, MT. 59632

Gordon,

According to Solid Waste Disposal Agreement 2, Effective Date, Duration and Renewal; Jefferson County Solid Waste District is requesting to exercise to option to extend the Agreement for one (1) additional one (1) year term. The new term would terminate in September 2017.

As stated in the Agreement, the Disposal Rate is $ 153.45 per load.

If you agree with the renewal of this contract for one (1) year, please sign, date and return a copy of this letter.

Thank you.

Candice Bell 9/26/17
Candice Bell Date
District Manager
Jefferson County Solid Waste District

Gordon Giulio 9/30/17
Gordon Giulio Date
Giulio Disposal Services, Inc.
Boulder, Montana

Appendix M

System Financial Data

FY 13-14

Description	REQUESTED FY13-14	Expended
HRLY PERSONAL	$312,308.08	$283,622.23
SEAS./TEMP.EMP	$17,000.00	$38,925.59
OVRTME	$4,500.00	$2,379.34
RETIREMNT	$27,580.82	$22,327.66
WORK COMP	$18,624.09	$18,351.00
FICA/MED	$26,145.33	$24,664.73
U.E.	$1,879.74	$1,771.27
HLTH INS	$63,346.74	$52,168.44
W COMP COM SERV	$0.00	
OPEB GASB 45	$14,361.00	$30,947.00
CLOTHING ALLOWANCE	2,400.00	$1,888.61
SM.EQUIP	23,900.00	$11,994.62
SMALL TOOLS & EQUIPMENT	1,000.00	$38.47
SAFETY EQUIP.	1,500.00	$1,188.64
SUPPLIES	5,500.00	$9,374.03
SIGN SUPPLIES	1,000.00	$507.61
FUEL	4,500.00	$3,822.83
DIESEL FUEL	41,000.00	$43,760.02
TIRES	7,000.00	$7,319.26
MACHINERY/EQUIP REPAIRS	18,000.00	$19,812.58
OIL	0.00	$0.00
PARTS	16,000.00	$11,467.97
FREIGHT	0.00	$0.00
LANDFILL OPERATING LICENS	2,241.00	$1,239.00
PRINTING	2,000.00	$1,512.01
UTILITIES	2,300.00	$1,994.74
PHONE	4,000.00	$4,208.01
COMPACTOR COSTS	2,000.00	$1,226.12
TIPPING FEE	180,000.00	$160,560.09
PROF.SERV	31,100.00	$21,986.02
EDUCATION/TRAINING SERVIC	1,500.00	$670.00
MEDICAL FEES	500.00	$130.00
ROAD SIDE SPRAYING	1,000.00	$860.79
SERVICES	0.00	$0.00
TRAVEL	1,000.00	$169.10
BUTTE/ELK PARK CONTRACT	1,000.00	$798.00
WOOD GRINDING CONTRACT	18,000.00	$15,599.70
LANDFILL SERVICES	28,000.00	$19,560.89
WOOD WASTE	0.00	$0.00
RECYCLING CONTRACT	7,000.00	$0.00
COMP.LIAB.INS.	16,027.82	$16,027.82
RENT	6,892.00	$6,732.00
RENT to ROAD DEPT.	0.00	$0.00
SPECIAL ASSMT.-REFUNDS	6,850.41	$778.14
REFUNDS	0.00	$0.00

OUTLAY	45,000.00	$0.00
INTEREST	0.00	$0.00
DEPR.	44,000.00	$0.00
INTERFUND OPERATING TRANSFER		
	$1,007,957.03	$840,384.33

233 - MACH/EQUIP REPAIR

Payable To:	Date	Amount	Budget
			$18,000.00
J-D Truck Repair	8/20/2013	$124.61	$17,875.39
Central Shop	8/30/2013	$1,521.28	$16,354.11
Central Shop	8/30/2013	$799.59	$15,554.52
J-D Truck Repair	10/1/2013	$56.50	$15,498.02
Central Shop	10/21/2013	$1,341.96	$14,156.06
Central Shop	10/31/2013	$1,464.75	$12,691.31
Pacific Steel	12/10/2013	$201.77	$12,489.54
Motion Industries	12/17/2013	$112.95	$12,376.59
Central Shop	12/31/2013	$3,413.33	$8,963.26
T&Equip	1/14/2014	$109.07	$8,854.19
Motor Power KW	1/14/2014	$267.80	$8,586.39
Motor Power KW	1/14/2014	$143.83	$8,442.56
Central Shop	1/31/2014	$590.63	$7,851.93
HCL Equipment	2/4/2014	$273.00	$7,578.93
Mtn West Auto	2/4/2014	$84.99	$7,493.94
Mtn West Auto	2/4/2014	$9.79	$7,484.15
Interstate Battery	2/4/2014	$329.85	$7,154.30
Olympic Sales	2/18/2014	$1,740.00	$5,414.30
Central Shop	2/28/2014	$1,231.65	$4,182.65
Motor Power KW	3/11/2014	$78.35	$4,104.30
Motor Power KW	3/11/2014	-$31.50	$4,135.80
Mtn West Auto	3/11/2014	$9.79	$4,126.01
Mtn West Auto	3/11/2014	$32.99	$4,093.02
Central Shop	3/31/2014	$1,300.59	$2,792.43
Central Shop	11/29/2013	$236.25	$2,556.18
Smith Supply	4/29/2014	$381.00	$2,175.18
Central Shop	5/29/2014	$1,323.00	$852.18
Central Shop	6/30/2014	$22.50	$829.68
			$829.68
			$829.68
TOTAL		$17,170.32	

241 - PARTS

Payable To:	Date	Amount	Budget
			$16,000.00
Inland Truck Parts	7/2/2013	68.51	$15,931.49
Butte Auto Center	7/16/2013	$25.34	$15,906.15
Boulder Auto Parts	7/16/2013	$69.50	$15,836.65
Dunne Communications	7/16/2013	$195.00	$15,641.65
Grizzly Diesel Service	7/16/2013	$188.57	$15,453.08
Inland Truck Parts	7/23/2013	$76.20	$15,376.88
Motor Power KW	7/23/2013	$61.89	$15,314.99
Mtn West Auto	8/6/2013	$13.99	$15,301.00
Mtn West Auto	8/6/2013	$12.99	$15,288.01
Mtn West Auto	8/6/2013	$109.74	$15,178.27
Boulder Auto Parts	8/13/2013	$35.00	$15,143.27
Motor Power KW	8/13/2013	$269.91	$14,873.36
Mtn West Auto	8/20/2013	$45.66	$14,827.70
Butte Auto Center	9/3/2013	$539.70	$14,288.00
Waste Equip - Oregon	9/3/2013	$671.00	$13,617.00
Motor Power KW	9/10/2013	$31.29	$13,585.71
Motor Power KW	10/1/2013	$163.98	$13,421.73
Motor Power KW	10/1/2013	$144.06	$13,277.67
Modern Machinery	10/1/2013	$15.52	$13,262.15
Inland Truck Parts	10/15/2013	$555.00	$12,707.15
Inland Truck Parts	10/15/2013	$140.00	$12,567.15
Motor Power KW	10/29/2014	$52.12	$12,515.03
Boulder Auto Parts	10/29/2014	$45.00	$12,470.03
Mtn West Auto	12/10/2013	$20.38	$12,449.65
Modern Machinery	12/31/2013	$355.80	$12,093.85
Modern Machinery	12/31/2013	$90.30	$12,003.55
Pacific Steel	1/7/2014	$60.55	$11,943.00
Central Parts Co.	1/14/2014	$42.57	$11,900.43
Central Parts Co.	1/14/2014	$52.08	$11,848.35
Inland Truck Parts	1/14/2014	$38.00	$11,810.35
Inland Truck Parts	1/14/2014	$2,360.11	$9,450.24
Inland Truck Parts	1/14/2014	$180.62	$9,269.62
C&R - Petty Cash Mtn W	1/14/2014	$4.28	$9,265.34
Modern Machinery	1/21/2014	$48.43	$9,216.91
Mach Power & Equip	3/24/2014	$75.28	$9,141.63
Placer Motors	3/24/2014	$339.86	$8,801.77
TITAN Rentals	3/24/2014	$108.25	$8,693.52
TITAN Rentals	3/24/2014	$17.98	$8,675.54
J&D Truck Repair	4/1/2014	$220.50	$8,455.04
Motor Power KW	4/3/2014	$283.00	$8,172.04
Mtn West Auto	4/3/2014	$81.77	$8,090.27
Boulder Auto Parts	4/29/2014	$42.00	$8,048.27
McCloskeys Auto	4/29/2014	$275.50	$7,772.77
Mtn West Auto	4/30/2014	$79.26	$7,693.51
Wastequip	5/5/2014	$533.00	$7,239.77

241 - PARTS

Inland Truck Parts	5/5/2014	$1,562.57	$5,677.20
Inland Truck Parts	5/22/2014	$21.44	$5,655.76
Central Shop	5/29/2014	$47.26	$5,608.50
Central Parts Co.	6/6/2014	$21.54	$5,586.96
Modern Machinery	6/6/2014	$294.10	$5,292.86
Mtn West Auto	6/20/2014	$86.26	$5,206.60
Central Shop	6/30/2014	$152.36	$5,054.24
TOTAL		$11,025.02	

FY 14-15

Description	REQ FY14-15	Expended
HRLY PERSONAL	$305,547.84	$312,004.25
SEAS./TEMP.EMP	$24,660.48	$8,923.92
OVRTME	$4,500.00	$1,343.85
RETIREMNT	$27,010.96	$24,376.81
WORK COMP	$28,129.43	$28,202.26
FICA/MED	$25,698.19	$24,458.21
U.E.	$2,176.31	$2,094.71
HLTH INS	$71,084.16	$61,705.25
OPEB GASB 45	$32,000.00	$0.00
CLOTHING ALLOWANCE	$2,400.00	$1,691.71
SM.EQUIP	$23,900.00	-$1,978.74
SMALL TOOLS & EQUIPMENT	$1,000.00	$174.94
SAFETY EQUIP.	$2,000.00	$1,047.67
SUPPLIES	$6,500.00	$1,583.13
SIGN SUPPLIES	$1,000.00	$0.00
FUEL	$4,500.00	$1,728.20
DIESEL FUEL	$41,000.00	$36,671.07
TIRES	$7,000.00	$6,874.91
MACHINERY/EQUIP REPAIRS	$18,000.00	$18,009.85
PARTS	$16,000.00	$11,681.40
LANDFILL OPERATING LICENS	$2,241.00	$1,240.00
PRINTING	$2,000.00	$858.00
UTILITIES	$2,300.00	$1,874.44
PHONE	$4,000.00	$3,956.83
COMPACTOR COSTS	$2,000.00	$1,272.16
TIPPING FEE	$180,000.00	$181,573.98
PROF.SERV	$31,100.00	$9,343.66
EDUCATION/TRAINING SERVIC	$1,500.00	$0.00
MEDICAL FEES	$1,000.00	$20.00
ROAD SIDE SPRAYING	$1,000.00	$336.80
TRAVEL	$1,000.00	$818.27
BUTTE/ELK PARK CONTRACT	$1,000.00	$676.00
LANDFILL SERVICES	$27,760.00	$22,953.93
WOOD WASTE	$240.00	$240.00
RECYCLING CONTRACT	$27,000.00	$0.00
COMP.LIAB.INS.	$16,175.50	$16,175.50
RENT	$6,903.00	$6,732.00
SPECIAL ASSMT.-REFUNDS	$3,000.00	$583.62
OUTLAY	$20,000.00	$0.00
SUB TOTAL	$974,326.87	$789,248.59
INTEREST	$0.00	$0.00
DEPR.	$44,000.00	$0.00
INTERFUND OPERATING TRANSFE		

$1,018,326.87	$789,248.59

233 - MACH/EQUIP REPAIRS

$ 18,000.00

DATE	DESCRIPTION	AMOUNT		
			$18,000.00	
7/30/2014	Central Shop	$2,911.61	$15,088.39 ◊	
8/30/2014	Central Shop	$393.75	$14,694.64 ◊	
7/31/2014	Central Shop	$16,090.49	-$1,395.85 ◊	
8/26/2014	Central Shop	-$16,090.49	$14,694.64 ◊	
9/30/2014	Central Shop	$1,042.50	$13,652.14	
10/30/2014	Central Shop	$1,601.25	$12,050.89 ◊	
10/30/2014	Pacific Steel	$1,670.42	$10,380.47 ◊	
11/25/2014	Central Shop	$1,931.72	$8,448.75 ◊	
1/6/2015	Pacific Steel	$15.14	$8,433.61 ◊	
12/31/2014	Central Shop	$421.60	$8,012.01 ◊	
1/29/2015	Central Shop	$400.95	$7,611.06 ◊	
2/26/2015	Central Shop	$341.25	$7,269.81 ◊	
3/4/2015	Pacific Steel	$468.69	$6,801.12 ◊	
3/30/2015	Central Shop	$1,072.57	$5,728.55 ◊	68%
4/15/2015	Pacific Steel	$243.36	$5,485.19 ◊	
4/29/2015	Central Shop	$3,607.26	$1,877.93 ◊	
4/24/2015	Returned check already PD	-$243.36	$2,121.29 ◊	
5/28/2015	Central Shop	$715.95	$1,405.34	
6/4/2015	Pacific Steel	$263.49	$1,141.85	
6/29/2015	Central Shop	$1,151.70	-$9.85	100.05%
			-$9.85	
			-$9.85	
			-$9.85	
			-$9.85	
			-$9.85	
			-$9.85	
			-$9.85	
			-$9.85	
		$18,009.85		

241 - PARTS

$ 16,000.00

DATE	DESCRIPTION	AMOUNT	BALANCE	
			$16,000.00	
8/22/2014	Motion Industries	$30.00	$15,970.00 ◊	
7/30/2014	Central Shop	$294.40	$15,675.60 ◊	
8/4/2014	Motor Power Kenworth	$2,287.30	$13,388.30 ◊	
9/3/2014	WASTEQUIP	$533.00	$12,855.30 ◊	
9/30/2014	Central Shop	$158.73	$12,696.57 ◊	
10/30/2014	Mtn West Automotive	$49.37	$12,647.20 ◊	
10/16/2014	Boulder Auto	$35.00	$12,612.20 ◊	
10/1/2014	Mtn West Automotive	$41.03	$12,571.17 ◊	
12/2/2014	Mtn West Automotive	$72.76	$12,498.41 ◊	
12/3/2014	Modern Machinery	$92.24	$12,406.17 ◊	
12/3/2014	Inland Truck Parts	$49.64	$12,356.53 ◊	
11/10/2014	Ace Hardware - Whitehall	$15.37	$12,341.16 ◊	
11/28/2014	Central Shop	$309.36	$12,031.80 ◊	
12/15/2014	Motor Power Kenworth	$204.00	$11,827.80 ◊	
12/15/2014	Modern Machinery	$242.01	$11,585.79 ◊	
1/6/2015	Inland Truck Parts	$28.05	$11,557.74 ◊	
12/31/2014	Central Shop	$32.00	$11,525.74 ◊	
1/29/2015	Central Shop	$144.03	$11,381.71 ◊	
3/3/2015	Mtn West Automotive	$64.44	$11,317.27 ◊	
3/9/2015	Inland Truck Parts	$150.77	$11,166.50 ◊	
3/9/2015	Modern Machinery	$65.18	$11,101.32 ◊	
3/12/2015	Pioneer Equipment	$14.90	$11,086.42 ◊	
3/25/2015	Titan Machinery	$900.31	$10,186.11 ◊	
3/30/2015	Central Shop	$451.51	$9,734.60 ◊	
4/15/2015	Northwest Pipe Fittings	$116.50	$9,618.10 ◊	
4/15/2015	Mtn West Automotive	$172.86	$9,445.24 ◊	
4/15/2015	Inland Truck Parts	$29.76	$9,415.48 ◊	
4/15/2015	McCloskeys Auto Electric	$275.00	$9,140.48 ◊	
3/4/2015	Motor Power Kenworth	$73.02	$9,067.46 ◊	40%
3/24/2015	Dunne Communications	$90.35	$8,977.11 ◊	
4/29/2015	Central Shop	$220.27	$8,756.84 ◊	
4/29/2015	Titan Machinery	$1,112.35	$7,644.49	
5/6/2015	Motion Industries	$19.27	$7,625.22	
5/6/2015	Motor Power Kenworth	$122.15	$7,503.07	
5/28/2015	Central Shop	$144.03	$7,359.04	
6/4/2015	NAPA - Central Parts	$61.75	$7,297.29	
6/15/2015	WASTEQUIP	$520.00	$6,777.29	
6/17/2015	Inland Truck Parts	$38.00	$6,739.29	
6/17/2015	Titan Machinery	$103.32	$6,635.97	
6/17/2015	Northwest Pipe Fittings	$2,136.51	$4,499.46	
6/29/2015	Central Shop	$144.03	$4,355.43	
6/29/2015	Mtn West Automotive	$39.98	$4,315.45	
6/29/2015	Titan Machinery	$301.80	$4,013.65	
7/1/2015	Motor Power Kenworth	$106.42	$3,907.23	76%

241 - PARTS
$ 16,000.00

$3,907.23
$3,907.23

$12,092.77

FY 15-16

Description	REQ FY15-16	Expended
HRLY PERSONAL	$305,644.00	$316,932.46
SEAS./TEMP.EMP	$25,143.00	$12,186.34
OVRTME	$4,500.00	$722.80
RETIREMNT	$27,423.00	$27,535.03
WORK COMP	$29,408.00	$30,412.92
FICA/MED	$25,649.00	$24,793.51
U.E.	$1,174.00	$1,154.37
HLTH INS	$68,798.00	$71,631.00
OPEB GASB 45	$32,000.00	$0.00
CLOTHING ALLOWANCE	$2,800.00	$2,426.10
SM.EQUIP	$10,000.00	$1,644.05
SMALL TOOLS & EQUIPMENT	$1,000.00	$79.96
SAFETY EQUIP.	$1,500.00	$97.40
SUPPLIES	$6,300.00	$5,542.49
SIGN SUPPLIES	$1,000.00	$80.00
FUEL	$4,500.00	$1,148.09
DIESEL FUEL	$45,500.00	$24,206.80
TIRES	$8,000.00	$8,183.81
MACHINERY/EQUIP REPAIRS	$22,000.00	$21,691.52
PARTS	$11,000.00	$9,249.47
LANDFILL OPERATING LICENS	$1,200.00	$1,200.00
PRINTING	$1,500.00	$637.80
UTILITIES	$3,000.00	$1,983.19
PHONE	$4,200.00	$3,249.60
COMPACTOR COSTS	$2,000.00	$1,574.66
TIPPING FEE	$195,000.00	$188,361.57
PROF.SERV	$14,400.00	$7,880.28
EDUCATION/TRAINING SERVIC	$1,000.00	$0.00
MEDICAL FEES	$1,000.00	$213.23
ROAD SIDE SPRAYING	$1,000.00	$440.88
TRAVEL	$1,000.00	$0.00
BUTTE/ELK PARK CONTRACT	$1,000.00	$676.00
LANDFILL SERVICES	$29,000.00	$24,937.62
WOOD GRINDING	$1,500.00	$0.00
RECYCLING CONTRACT	$8,000.00	$149.92
COMP.LIAB.INS.	$16,548.00	$16,547.54
RENT	$6,903.00	$6,902.00
SPECIAL ASSMT.-REFUNDS	$4,000.00	$3,306.65
OUTLAY	$10,000.00	$0.00
INTEREST	$0.00	$0.00
DEPR.	$44,000.00	$0.00
INTERFUND OPERATING TRANSFI		
	$979,590.00	$817,779.06
	$935,590.00	

233 - MACH/EQUIP REPAIRS
$ 20,000.00

DATE	DESCRIPTION	AMOUNT	
			$20,000.00
7/30/2015	Central Shop	$3,658.16	$16,341.84 ◊
8/31/2015	Central Shop	$144.03	$16,197.81 ◊
9/29/2015	Central Shop	$689.70	$15,508.11 ◊
10/29/2015	Central Shop	$349.52	$15,158.59 ◊
11/25/2015	Central Shop	$132.75	$15,025.84 ◊
11/24/2015	Olympic Sales	$404.40	$14,621.44 ◊
12/30/2015	Central Shop	$1,190.17	$13,431.27 ◊
1/28/2016	Central Shop	$1,269.87	$12,161.40 ◊
2/16/2016	Olympic Sales	$105.54	$12,055.86 ◊
2/29/2016	Central Shop	$1,923.45	$10,132.41 ◊
3/7/2016	Pacific Steel	$133.68	$9,998.73 ◊
3/30/2016	Central Shop	$6,520.50	$3,478.23 ◊
4/26/2016	J&D Truck Repair	$530.83	$2,947.40 ◊
4/27/2016	Central Shop	$1,459.22	$1,488.18 ◊
5/31/2016	Central Shop	$631.05	$857.13 ◊
6/2/2016	J&D Truck Repair	$534.72	$322.41 ◊
6/2/2016	Olympic Sales	$335.48	-$13.07 ◊
6/2/2016	Transfer from 350 - Prof Serv	-$2,000.00	$1,986.93 ◊
6/29/2016	Central Shop	$1,678.45	$308.48 ◊
			$308.48
			$308.48
			$308.48
			$308.48
			$308.48
			$308.48
			$308.48
			$308.48
			$308.48
		$19,691.52	

241 - PARTS
$ 10,000.00

DATE	DESCRIPTION	AMOUNT	BALANCE	
			$10,000.00	
7/30/2015	Central Shop	$188.19	$9,811.81	◊
8/6/2015	T & Equip	$46.38	$9,765.43	◊
8/31/2015	Central Shop	$2,080.95	$7,684.48	◊
7/15/2015	Mountain West	$39.98	$7,644.50	◊ Last yr?
7/15/2015	Titan Machinery	$301.80	$7,342.70	◊ Last yr?
7/15/2015	Motor Power KW	$106.42	$7,236.28	◊ Last yr?
9/29/2015	Central Shop	$144.03	$7,092.25	◊
9/30/2015	Mountain West	$376.29	$6,715.96	◊
10/29/2015	Modern Machinery	$507.35	$6,208.61	◊
11/3/2015	Motor Power KW	$54.01	$6,154.60	◊
10/29/2015	Central Shop	$165.33	$5,989.27	◊
11/25/2015	Central Shop	$29.94	$5,959.33	◊
12/3/2015	Mountain West	$87.99	$5,871.34	◊
12/3/2015	Motor Power KW	$37.04	$5,834.30	◊
12/3/2015	T & Equip	$29.41	$5,804.89	◊
12/4/2015	Modern Machinery	$65.43	$5,739.46	◊
12/30/2015	Central Shop	$178.49	$5,560.97	◊
1/4/2016	Murdoch's Ranch & Home	$12.49	$5,548.48	◊
1/6/2016	Motor Power KW	$23.64	$5,524.84	◊
1/11/2016	Modern Machinery	$574.40	$4,950.44	◊
1/7/2016	Mill Supply - Credit Card	$18.08	$4,932.36	◊
1/28/2016	Central Shop	$197.33	$4,735.03	◊
2/4/2016	T & Equip	$88.92	$4,646.11	◊
2/4/2016	J&D Truck	$435.00	$4,211.11	◊
2/18/2016	Pat Rosin - Rock Hand	$16.99	$4,194.12	◊
2/18/2016	Pioneer Equipment & Supply	$222.50	$3,971.62	◊
1/26/2016	Mountain West	$133.93	$3,837.69	◊
2/29/2016	Central Shop	$144.03	$3,693.66	◊
2/29/2016	Mountain West	$1,130.57	$2,563.09	◊
3/7/2016	T & Equip	$9.38	$2,553.71	◊
3/7/2016	Inland Truck Parts	$522.12	$2,031.59	◊
3/7/2016	HCL Truck Equipment	$170.00	$1,861.59	◊
3/7/2016	Pacific Steel	$47.63	$1,813.96	◊
3/30/2016	Mountain West	$288.76	$1,525.20	◊
4/4/2016	Inland Truck Parts	$112.00	$1,413.20	◊
4/4/2016	J&D Truck	$55.00	$1,358.20	◊
4/27/2016	Central Shop	$309.36	$1,048.84	◊
5/31/2016	Central Shop	$20.92	$1,027.92	◊
6/1/2016	Mountain West	$133.36	$894.56	◊
6/2/2016	Transfer from 350 - Prof Serv	-$1,000.00	$1,894.56	◊
6/29/2016	Central Shop	$144.03	$1,750.53	◊
7/5/2016	Motor Power KW	$188.45	$1,562.08	
7/5/2016	Inland Truck Parts	$123.06	$1,439.02	
7/5/2016	Mountain West	$122.33	$1,316.69	

241 - PARTS
$ 10,000.00

$8,683.31

FY 16-17

Description	REQ FY16-17	Expended
HRLY PERSONAL	$287,903.00	$269,643.28
SEAS./TEMP.EMP	$29,588.00	$15,837.09
OVRTME	$4,500.00	$1,166.83
RETIREMNT	$26,951.00	$23,692.22
WORK COMP	$27,503.00	$25,487.46
FICA/MED	$24,633.00	$21,543.69
U.E.	$1,127.00	$1,003.31
HLTH INS	$73,649.00	$68,635.10
OPEB GASB 45	$32,000.00	$0.00
CLOTHING ALLOWANCE	$2,800.00	$2,033.51
SM.EQUIP	$7,000.00	$2,557.35
SMALL TOOLS & EQUIPMENT	$450.00	$38.46
SAFETY EQUIP.	$1,550.00	$1,504.51
SUPPLIES	$6,300.00	$1,896.87
SIGN SUPPLIES	$1,000.00	$175.00
FUEL	$4,500.00	$1,028.52
DIESEL FUEL	$45,500.00	$22,315.86
TIRES	$11,300.00	$10,595.69
MACHINERY/EQUIP REPAIRS	$18,700.00	$14,428.64
PARTS	$12,000.00	$6,655.15
LANDFILL OPERATING LICENS	$1,200.00	$1,240.85
PRINTING	$1,000.00	$333.90
UTILITIES	$3,000.00	$2,268.65
PHONE	$4,000.00	$2,975.01
COMPACTOR COSTS	$2,000.00	$1,230.92
TIPPING FEE	$200,000.00	$184,032.22
PROF.SERV	$10,000.00	$7,019.57
EDUCATION/TRAINING SERVIC	$1,500.00	$0.00
MEDICAL FEES	$1,000.00	$0.00
ROAD SIDE SPRAYING	$1,000.00	$400.00
TRAVEL	$1,000.00	$0.00
BUTTE/ELK PARK CONTRACT	$1,000.00	$0.00
LANDFILL SERVICES	$29,000.00	$20,285.87
WOOD GRINDING	$1,500.00	$0.00
RECYCLING CONTRACT	$8,000.00	$3,940.10
COMP.LIAB.INS.	$18,359.00	$18,358.91
RENT	$6,903.00	$6,902.00
SPECIAL ASSMT.-REFUNDS	$3,000.00	$453.92
OUTLAY	$10,000.00	$0.00
INTEREST	$0.00	$0.00
DEPR.	$44,000.00	$0.00
INTERFUND OPERATING TRANSFE		
	$922,416.00	$739,680.46
	$966,416.00	$739,680.46
	$846,416.00	

233 - MACH/EQUIP REPAIRS
$ 22,000.00

DATE	DESCRIPTION	AMOUNT	
			$22,000.00
7/27/2016	Central Shop	$739.38	$21,260.62 ◊
8/30/2016	Central Shop	$1,398.93	$19,861.69 ◊
9/29/2016	Central Shop	$2,297.67	$17,564.02 ◊
10/28/2016	Central Shop	$577.50	$16,986.52 ◊
11/28/2016	Central Shop	$526.60	$16,459.92 ◊
12/28/2016	Central Shop	$264.10	$16,195.82 ◊
1/27/2017	Central Shop	$684.10	$15,511.72 ◊
2/27/2017	Central Shop	$1,681.60	$13,830.12 ◊
3/9/2017	Motion Industries	$58.96	$13,771.16 ◊
3/28/2017	Central Shop	$3,492.85	$10,278.31 ◊
5/1/2017	Central Shop	$2,155.70	$8,122.61 ◊
5/26/2017	Central Shop	$551.25	$7,571.36 ◊
6/2/2017	Pacific Steel	$20.64	$7,550.72
6/8/2017	BUDGET TRANSFER to 232	$3,300.00	$4,250.72
6/19/2017	Central Shop	$1,812.85	$2,437.87
			$2,437.87
			$2,437.87
			$2,437.87
			$2,437.87
			$2,437.87
			$2,437.87
			$2,437.87
			$2,437.87
			$2,437.87
			$2,437.87
			$2,437.87
			$2,437.87
			$2,437.87

$19,562.13

241 - PARTS
$ 12,000.00

DATE	DESCRIPTION	AMOUNT	BALANCE	
			$12,000.00	
7/27/2016	Central Shop	$176.47	$11,823.53	◊
7/26/2016	Northwest Battery	$292.35	$11,531.18	◊
7/27/2016	Central Shop	$87.59	$11,443.59	◊
7/29/2016	Tractor & Equipment	$137.58	$11,306.01	◊
8/4/2016	Motor Power	$23.64	$11,282.37	◊
8/4/2016	Tractor & Equipment	$366.97	$10,915.40	◊
8/4/2016	J&D Truck Repair	$6.00	$10,909.40	◊
8/30/2016	Central Shop	$153.60	$10,755.80	◊
8/31/2016	Mtn West Auto	$55.74	$10,700.06	◊
9/6/2016	Motor Power	$363.42	$10,336.64	◊
9/6/2016	NAPA	$88.00	$10,248.64	◊
9/6/2016	J&D Truck Repair	$4.00	$10,244.64	◊
9/6/2016	Grizzly Diesel Service	$3.05	$10,241.59	◊
9/23/2016	Tractor & Equipment	$45.24	$10,196.35	◊
9/26/2016	Mtn West Auto	$33.59	$10,162.76	◊
9/29/2016	Central Shop	$278.38	$9,884.38	◊
10/6/2016	Grizzly Diesel Service	$165.00	$9,719.38	◊
10/6/2016	Motor Power	$789.22	$8,930.16	◊
7/16/2016	Inland Truck Parts	$123.06	$8,807.10	◊
7/16/2016	Motor Power	$188.45	$8,618.65	◊
7/16/2016	Mtn West Auto	$122.33	$8,496.32	◊
11/2/2016	Motor Power	$536.36	$7,959.96	◊
11/7/2016	McCloskey's Auto Elect.	$320.79	$7,639.17	◊
11/28/2016	Central Shop	$32.00	$7,607.17	◊
11/28/2016	Mtn West Auto	$19.98	$7,587.19	◊
12/2/2016	NAPA - Central Parts	$37.65	$7,549.54	◊
12/2/2016	Motor Power	$99.22	$7,450.32	◊
12/5/2016	Inland Truck Parts	$107.36	$7,342.96	◊
12/19/2016	Tractor & Equipment	$75.36	$7,267.60	◊
12/28/2016	Central Shop	$32.00	$7,235.60	◊
12/30/2016	HCL Truck Equipment	$184.00	$7,051.60	◊
1/4/2017	Wastequip, LLC	$500.00	$6,551.60	◊
1/25/2017	Northwest Battery	$96.55	$6,455.05	◊
1/25/2017	Mtn West Auto	$39.27	$6,415.78	◊
1/27/2017	Central Shop	$32.00	$6,383.78	◊
2/7/2017	NAPA - Central Parts	$175.72	$6,208.06	◊
2/27/2017	Central Shop	$32.00	$6,176.06	◊
2/27/2017	Titan Machinery	$57.00	$6,119.06	◊
3/2/2017	J&D Truck Repair	$49.00	$6,070.06	◊
3/14/2017	Modern Machinery	$11.95	$6,058.11	◊
3/28/2017	Central Shop	$32.00	$6,026.11	◊
3/28/2017	Inland Truck Parts	$383.00	$5,643.11	◊
3/28/2017	Mtn West Auto	$52.31	$5,590.80	◊
4/11/2017	Motor Power	$30.00	$5,560.80	◊

241 - PARTS
$ 12,000.00

			$5,560.80
5/1/2017	Central Shop	$64.00	$5,496.80 ◊
5/5/2017	Motor Power	$130.69	$5,366.11 ◊
5/25/2017	Mtn West Auto	$21.26	$5,344.85 ◊
6/19/2017	Central Shop	$32.00	$5,312.85
6/19/2017	Modern Machinery	$169.00	$5,143.85
6/19/2017	J&D Truck Repair	$86.00	$5,057.85
6/19/2017	Inland Truck Parts	$599.16	$4,458.69
6/21/2017	Motor Power	$271.31	$4,187.38
6/21/2017	Inland Truck Parts	$40.82	$4,146.56
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$7,853.44

Item 4

FY 17-18

THRU FEB 18

Still have 4 mo.

Description	REQ FY17-18	Expended
HRLY PERSONAL	$288,911.00	$178,225.37
SEAS./TEMP.EMP	$30,182.00	$27,323.51
OVRTME	$4,500.00	$1,668.74
RETIREMNT	$27,790.00	$16,923.06
WORK COMP	$30,434.00	$20,088.97
FICA/MED	$25,099.00	$15,665.20
U.E.	$1,476.00	$932.49
HLTH INS	$80,919.00	$50,550.86
OPEB GASB 45	$0.00	$0.00
CLOTHING ALLOWANCE	$2,500.00	$1,240.89
SM.EQUIP	$5,000.00	$129.99
SMALL TOOLS & EQUIPMENT	$1,000.00	$96.04
SAFETY EQUIP.	$1,000.00	$635.67
SUPPLIES	$6,000.00	$315.61
SIGN SUPPLIES	$1,000.00	$120.00
FUEL	$4,500.00	$1,128.62
DIESEL FUEL	$46,000.00	$18,132.73
TIRES	$9,000.00	$6,940.34
MACHINERY/EQUIP REPAIRS	$22,000.00	$9,306.67
PARTS	$12,000.00	$6,386.54
LANDFILL OPERATING LICENS	$2,100.00	$2,127.04
PRINTING	$1,000.00	$747.50
UTILITIES	$3,600.00	$1,508.82
PHONE	$4,000.00	$2,071.36
COMPACTOR COSTS	$2,400.00	$886.67
TIPPING FEE	$210,000.00	$143,349.48
PROF.SERV	$10,000.00	$4,262.01
EDUCATION/TRAINING SERVIC	$1,500.00	$0.00
MEDICAL FEES	$1,000.00	$188.65
ROAD SIDE SPRAYING	$1,000.00	$0.00
TRAVEL	$1,000.00	$100.44
BUTTE/ELK PARK CONTRACT	$4,000.00	$676.00
LANDFILL SERVICES	$28,300.00	$20,151.75
WOOD GRINDING	$0.00	$0.00
RECYCLING CONTRACT	$8,000.00	$3,484.00
COMP.LIAB.INS.	$21,287.00	$21,286.19
RENT	$6,903.00	$6,732.00
SPECIAL ASSMT.-REFUNDS	$3,000.00	$648.46
OUTLAY	$10,000.00	$0.00
INTEREST	$0.00	$0.00
DEPR.	$44,000.00	$0.00
INTERFUND OPERATING TRANSFE		
	$918,401.00	$564,031.67
	$962,401.00	$564,031.67

233 - MACH/EQUIP REPAIRS
$ 22,000.00

			$22,000.00	
DATE	DESCRIPTION	AMOUNT		
			$22,000.00	
8/2/2017	Central Shop	$1,105.70	$20,894.30	◊
10/2/2017	Central Shop	$1,893.20	$19,001.10	◊
11/1/2017	Central Shop	$395.35	$18,605.75	◊
12/4/2017	Central Shop	$78.75	$18,527.00	◊
1/3/2018	Central Shop	$1,102.50	$17,424.50	◊
2/7/2018	Central Shop	$396.95	$17,027.55	◊
2/8/2018	J&D Truck Repair	$4,122.62	$12,904.93	◊
3/5/2018	Central Shop	$211.60	$12,693.33	◊
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			$12,693.33	
		$9,306.67		

241 - PARTS
$ 12,000.00

DATE	DESCRIPTION	AMOUNT	BALANCE
			$12,000.00
			$12,000.00
7/10/2017	Tractor & Euipment	$51.42	$11,948.58 ◊
8/2/2017	Motor Power KW	$418.12	$11,530.46 ◊
8/2/2017	Central Shop	$64.00	$11,466.46 ◊
8/28/2017	Mtn West Automotive	$232.22	$11,234.24 ◊
9/5/2017	NAPA	$15.98	$11,218.26 ◊
9/5/2017	Inland Truck Parts	$1,901.03	$9,317.23 ◊
9/6/2017	J&D Truck Repair	$149.00	$9,168.23 ◊
9/6/2017	Motor Power KW	$2,063.78	$7,104.45 ◊
10/2/2017	Central Shop	$64.00	$7,040.45 ◊
10/4/2017	Motor Power KW	$58.02	$6,982.43 ◊
10/26/2017	Mtn West Automotive	$167.88	$6,814.55 ◊
11/1/2017	Central Shop	$32.00	$6,782.55 ◊
11/6/2017	NAPA	$42.38	$6,740.17 ◊
12/6/2017	Titan Machinery	$246.00	$6,494.17 ◊
12/19/2017	McCloskey's Auto	$425.00	$6,069.17 ◊
12/27/2017	Mtn West Automotive	$74.60	$5,994.57 ◊
1/16/2018	Olympic Sales	$243.14	$5,751.43 ◊
1/26/2018	Mtn West Automotive	$41.97	$5,709.46 ◊
2/7/2018	Central Shop	$64.00	$5,645.46 ◊
3/1/2018	Mtn West Automotive	$15.54	$5,629.92
3/5/2018	Central Shop	$32.00	$5,597.92 ◊
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			$5,597.92
		$6,402.08	$5,597.92
			$5,597.92
			$5,597.92

JEFFERSON COUNTY
Statement of Revenue Budget vs Actuals
For the Accounting Period: 6 / 15

5410 SOLID WASTE

Account	Received Current Month	Received YTD	Estimated Revenue	Revenue To Be Received	% Received
310000 TAXES/ASSESSMENTS					
312000 INTEREST & PENALTY	1,113.14	6,284.85	7,000.00	715.15	90 %
Account Group Total:	**1,113.14**	**6,284.85**	**7,000.00**	**715.15**	**90 %**
330000 INTERGOVERNMENTAL REVENUES					
336020 REVENUE - ON-BEHALF PAYMT	9,624.01	9,624.01	0.00	-9,624.01	** %
Account Group Total:	**9,624.01**	**9,624.01**	**0.00**	**-9,624.01**	**** %**
340000 CHARGES FOR SERVICES					
343041 GARBAGE COLLECTION CHG.	50.00	1,140.40	1,580.00	439.60	72 %
343044 S.W.DUMP PERMITS	95.00	535.00	290.00	-245.00	184 %
343045 ADVERTISING FEES	0.00	0.00	50.00	50.00	0 %
343047 TIRES	275.00	2,465.00	2,700.00	235.00	91 %
343048 REFRIGERATORS	264.00	2,239.00	2,105.00	-134.00	106 %
343049 CONSTRUCTION WASTE	1,824.00	15,911.00	14,175.00	-1,736.00	112 %
Account Group Total:	**2,508.00**	**22,290.40**	**20,900.00**	**-1,390.40**	**107 %**
360000 MISC. REVENUE					
360000 MISC. REVENUE	0.00	102.14	0.00	-102.14	** %
363000 REAL ASSESSMENTS	-259.38	727,751.82	728,205.71	453.89	100 %
363001 PERSONAL ASSESSMENTS	65,363.76	65,124.70	65,493.45	368.75	99 %
367000 SALE OF JUNK AND SALVAGE	3,417.33	28,107.25	46,000.00	17,892.75	61 %
Account Group Total:	**68,521.71**	**821,085.91**	**839,699.16**	**18,613.25**	**98 %**
370000 INVESTMENTS					
371010 INVESTMENT EARNINGS	570.46	1,488.40	250.00	-1,238.40	595 %
Account Group Total:	**570.46**	**1,488.40**	**250.00**	**-1,238.40**	**595 %**
Fund Total:	**82,337.32**	**860,773.57**	**867,849.16**	**7,075.59**	**99 %**
Grand Total:	**82,337.32**	**860,773.57**	**867,849.16**	**7,075.59**	**99 %**

JEFFERSON COUNTY
Statement of Revenue Budget vs Actuals
For the Accounting Period: 6 / 16

5410 SOLID WASTE

Account	Received Current Month	Received YTD	Estimated Revenue	Revenue To Be Received	% Received
310000 TAXES/ASSESSMENTS					
312000 INTEREST & PENALTY	885.40	7,937.59	6,300.00	-1,637.59	126 %
Account Group Total:	**885.40**	**7,937.59**	**6,300.00**	**-1,637.59**	**126 %**
330000 INTERGOVERNMENTAL REVENUES					
336020 REVENUE - ON-BEHALF PAYMT	9,273.05	9,273.05	0.00	-9,273.05	** %
Account Group Total:	**9,273.05**	**9,273.05**	**0.00**	**-9,273.05**	**** %**
340000 CHARGES FOR SERVICES					
343041 GARBAGE COLLECTION CHG.	200.00	984.40	1,150.00	165.60	86 %
343044 S.W.DUMP PERMITS	95.00	680.00	550.00	-130.00	124 %
343047 TIRES	418.00	2,911.00	2,480.00	-431.00	117 %
343048 REFRIGERATORS	354.00	2,341.00	2,280.00	-61.00	103 %
343049 CONSTRUCTION WASTE	2,240.00	16,278.50	15,975.00	-303.50	102 %
Account Group Total:	**3,307.00**	**23,194.90**	**22,435.00**	**-759.90**	**103 %**
360000 MISC. REVENUE					
363000 REAL ASSESSMENTS	-97.26	728,562.38	730,799.53	2,237.15	100 %
363001 PERSONAL ASSESSMENTS	-907.83	55,539.73	63,677.79	8,138.06	87 %
367000 SALE OF JUNK AND SALVAGE	2,769.25	14,325.43	28,200.00	13,874.57	51 %
367001 SALE OF ALUMINUM MATERIALS	312.55	1,280.80	2,600.00	1,319.20	49 %
367002 SALE OF CARDBOARD MATERIALS	265.20	2,009.70	0.00	-2,009.70	** %
367003 SALE OF PAPER MATERIALS	148.25	741.50	0.00	-741.50	** %
Account Group Total:	**2,490.16**	**802,459.54**	**825,277.32**	**22,817.78**	**97 %**
370000 INVESTMENTS					
371010 INVESTMENT EARNINGS	272.27	2,235.82	1,500.00	-735.82	149 %
Account Group Total:	**272.27**	**2,235.82**	**1,500.00**	**-735.82**	**149 %**
Fund Total:	**16,227.88**	**845,100.90**	**855,512.32**	**10,411.42**	**99 %**
Grand Total:	**16,227.88**	**845,100.90**	**855,512.32**	**10,411.42**	**99 %**

JEFFERSON COUNTY
Statement of Revenue Budget vs Actuals
For the Accounting Period: 6 / 17

5410 SOLID WASTE

Account	Received Current Month	Received YTD	Estimated Revenue	Revenue To Be Received	% Received
310000 TAXES/ASSESSMENTS					
312000 INTEREST & PENALTY	701.51	6,534.91	7,940.00	1,405.09	82 %
Account Group Total:	**701.51**	**6,534.91**	**7,940.00**	**1,405.09**	**82 %**
330000 INTERGOVERNMENTAL REVENUES					
336020 REVENUE - ON-BEHALF PAYMT	7,681.34	7,681.34	0.00	-7,681.34	** %
Account Group Total:	**7,681.34**	**7,681.34**	**0.00**	**-7,681.34**	**** %**
340000 CHARGES FOR SERVICES					
343041 GARBAGE COLLECTION CHG.	-599.00	-132.00	1,000.00	1,132.00	-13 %
343044 S.W.DUMP PERMITS	55.00	1,594.50	700.00	-894.50	228 %
343047 TIRES	1,304.00	4,155.00	3,000.00	-1,155.00	139 %
343048 REFRIGERATORS	240.00	2,003.00	2,350.00	347.00	85 %
343049 CONSTRUCTION WASTE	1,894.00	15,188.00	16,300.00	1,112.00	93 %
Account Group Total:	**2,894.00**	**22,808.50**	**23,350.00**	**541.50**	**98 %**
360000 MISC. REVENUE					
360000 MISC. REVENUE	0.00	129.69	0.00	-129.69	** %
363000 REAL ASSESSMENTS	0.00	738,967.37	739,356.46	389.09	100 %
363001 PERSONAL ASSESSMENTS	-259.38	60,824.61	61,343.37	518.76	99 %
367000 SALE OF JUNK AND SALVAGE	251.30	21,210.30	14,325.00	-6,885.30	148 %
367001 SALE OF ALUMINUM MATERIALS	781.25	1,382.90	1,280.00	-102.90	108 %
367002 SALE OF CARDBOARD MATERIALS	501.50	1,667.90	2,000.00	332.10	83 %
367003 SALE OF PAPER MATERIALS	245.20	417.95	745.00	327.05	56 %
Account Group Total:	**1,519.87**	**824,600.72**	**819,049.83**	**-5,550.89**	**101 %**
370000 INVESTMENTS					
371010 INVESTMENT EARNINGS	638.42	4,796.89	2,250.00	-2,546.89	213 %
Account Group Total:	**638.42**	**4,796.89**	**2,250.00**	**-2,546.89**	**213 %**
380000 OTHER FINANCING SOURCES					
382010 SALE OF GENERAL FIXED ASSET	0.00	4,037.00	0.00	-4,037.00	** %
Account Group Total:	**0.00**	**4,037.00**	**0.00**	**-4,037.00**	**** %**
Fund Total:	**13,435.14**	**870,459.36**	**852,589.83**	**-17,869.53**	**102 %**
Grand Total:	**13,435.14**	**870,459.36**	**852,589.83**	**-17,869.53**	**102 %**

JEFFERSON COUNTY
Statement of Expenditure - Budget vs. Actual Report
For the Accounting Period: 6 / 18

5410 SOLID WASTE

Account	Object	Committed Current Month	Committed YTD	Original Appropriation	Current Appropriation	Available Appropriation	% Committed
430000 PUBLIC WORKS							
430800 SOLID WASTE SERVICES							
115	HOURLY PERSONNEL	19,047.85	272,700.81	288,911.00	288,911.00	16,210.19	94 %
117	SEASONAL/TEMPORARY EMPLOYEES	6,886.32	43,796.28	30,182.00	30,182.00	-13,614.28	145 %
120	OVERTIME	276.20	2,799.46	4,500.00	4,500.00	1,700.54	62 %
140	RETIREMENT	2,607.96	26,515.51	27,790.00	27,790.00	1,274.49	95 %
141	WORKER'S COMPENSATION	3,362.20	31,999.23	30,434.00	30,434.00	-1,565.23	105 %
143	FICA/MEDICARE	2,660.52	24,822.86	25,099.00	25,099.00	276.14	99 %
145	UNEMPLOYMENT	155.19	1,474.08	1,476.00	1,476.00	1.92	100 %
146	HEALTH INSURANCE	4,814.40	74,375.47	80,919.00	80,919.00	6,543.53	92 %
195	PENSION EXPENSE PER GASB 68	20,190.92	20,190.92	0.00	0.00	-20,190.92	%
201	CLOTHING ALLOWANCE	0.00	1,900.17	2,500.00	2,500.00	599.83	76 %
216	SMALL ITEMS OF EQUIPMENT<THAN	0.00	129.99	5,000.00	5,000.00	4,870.01	3 %
217	SMALL TOOLS & EQUIPMENT	115.91	219.20	1,000.00	1,000.00	780.80	22 %
218	SAFETY EQUIPMENT	0.00	726.17	1,000.00	1,000.00	273.83	73 %
220	OPERATING SUPPLIES	16.96	872.03	6,000.00	6,000.00	5,127.97	15 %
222	SIGN SUPPLIES	0.00	120.00	1,000.00	1,000.00	880.00	12 %
230	FUEL	75.60	1,407.63	4,500.00	4,500.00	3,092.37	31 %
231	DIESEL FUEL	3,273.62	30,141.12	46,000.00	46,000.00	15,858.88	66 %
232	TIRES	37.00	8,322.34	9,000.00	9,000.00	677.66	92 %
233	MACHINERY/EQUIPMENT REPAIRS	55.00	14,533.34	22,000.00	22,000.00	7,466.66	66 %
241	PARTS	397.97	7,441.69	12,000.00	12,000.00	4,558.31	62 %
312	LANDFILL OPERATING LICENSE	0.00	2,127.04	2,100.00	2,100.00	-27.04	101 %
320	PRINTING, DUPLICATING, TYPING &	0.00	874.50	1,000.00	1,000.00	125.50	87 %
340	UTILITIES	118.68	2,439.65	3,600.00	3,600.00	1,160.35	68 %
345	PHONE	243.76	3,137.65	4,000.00	4,000.00	862.35	78 %
346	COMPACTOR COSTS	103.82	1,313.04	2,400.00	2,400.00	1,086.96	55 %
347	TIPPING FEE	23,755.76	211,690.66	210,000.00	215,000.00	3,309.34	98 %
350	PROFESSIONAL SERVICES	13,424.98	20,175.51	10,000.00	10,000.00	-10,175.51	202 %
353	EDUCATION/TRAINING SERVICES	0.00	0.00	1,500.00	1,500.00	1,500.00	%
355	MEDICAL FEES	175.00	363.65	1,000.00	1,000.00	636.35	36 %
359	NON-COMPLIANCE ROAD SIDE SPRAYING	0.00	0.00	1,000.00	1,000.00	1,000.00	%
370	TRAVEL	0.00	100.44	1,000.00	1,000.00	899.56	10 %
394	BUTTE/ELK PARK CONTRACT	0.00	676.00	4,000.00	1,000.00	324.00	68 %
396	LANDFILL SERVICES	2,608.65	28,919.95	28,300.00	28,300.00	-619.95	102 %
398	RECYCLING CONTRACT	731.00	4,516.50	8,000.00	8,000.00	3,483.50	56 %
515	COMPREHENSIVE LIABILITY INSURANCE	0.00	21,286.19	21,287.00	21,287.00	0.81	100 %
530	RENT	0.00	6,732.00	6,903.00	6,903.00	171.00	98 %
540	SPECIAL ASSESSMENT REFUNDS	0.00	648.46	3,000.00	1,000.00	351.54	65 %
940	CAPITAL OUTLAY>THAN 15,000.00	0.00	0.00	10,000.00	10,000.00	10,000.00	%
	Account Total:	105,135.27	869,489.54	918,401.00	918,401.00	48,911.46	95 %
	Account Group Total:	105,135.27	869,489.54	918,401.00	918,401.00	48,911.46	95 %
510000 MISCELLANEOUS							
510400 DEPRECIATION							
830	DEPRECIATION	12,767.98	12,767.98	44,000.00	44,000.00	31,232.02	29 %
	Account Total:	12,767.98	12,767.98	44,000.00	44,000.00	31,232.02	29 %
	Account Group Total:	12,767.98	12,767.98	44,000.00	44,000.00	31,232.02	29 %
	Fund Total:	117,903.25	882,257.52	962,401.00	962,401.00	80,143.48	92 %

Grand Total:	117,903.25	882,257.52	962,401.00	962,401.00	80,143.48	92 %

5410 SOLID WASTE

Account	Received Current Month	Received YTD	Estimated Revenue	Revenue To Be Received	% Received
310000 TAXES/ASSESSMENTS					
312000 INTEREST & PENALTY	484.58	5,107.13	6,500.00	1,392.87	79 %
Account Group Total:	**484.58**	**5,107.13**	**6,500.00**	**1,392.87**	**79 %**
330000 INTERGOVERNMENTAL REVENUES					
336020 REVENUE - ON-BEHALF PAYMT	6,984.43	6,984.43	0.00	-6,984.43	** %
Account Group Total:	**6,984.43**	**6,984.43**	**0.00**	**-6,984.43**	**** %**
340000 CHARGES FOR SERVICES					
343041 GARBAGE COLLECTION CHG.	-216.00	-19.00	0.00	19.00	** %
343044 S.W.DUMP PERMITS	60.00	480.00	1,500.00	1,020.00	32 %
343047 TIRES	560.00	2,530.00	4,150.00	1,620.00	61 %
343048 REFRIGERATORS	240.00	2,241.00	2,000.00	-241.00	112 %
343049 CONSTRUCTION WASTE	1,831.00	13,770.00	15,190.00	1,420.00	91 %
Account Group Total:	**2,475.00**	**19,002.00**	**22,840.00**	**3,838.00**	**83 %**
360000 MISC. REVENUE					
360000 MISC. REVENUE	0.00	226.51	0.00	-226.51	** %
363000 REAL ASSESSMENTS	0.00	745,062.84	747,267.56	2,204.72	100 %
363001 PERSONAL ASSESSMENTS	0.00	57,906.60	60,111.32	2,204.72	96 %
367000 SALE OF JUNK AND SALVAGE	0.00	12,292.05	21,200.00	8,907.95	58 %
367001 SALE OF ALUMINUM MATERIALS	0.00	1,525.25	1,300.00	-225.25	117 %
367002 SALE OF CARDBOARD MATERIALS	159.33	2,300.43	1,670.00	-630.43	138 %
367003 SALE OF PAPER MATERIALS	0.00	316.65	410.00	93.35	77 %
Account Group Total:	**159.33**	**819,630.33**	**831,958.88**	**12,328.55**	**99 %**
370000 INVESTMENTS					
371010 INVESTMENT EARNINGS	1,478.36	10,126.34	4,790.00	-5,336.34	211 %
Account Group Total:	**1,478.36**	**10,126.34**	**4,790.00**	**-5,336.34**	**211 %**
Fund Total:	**11,581.70**	**860,850.23**	**866,088.88**	**5,238.65**	**99 %**
Grand Total:	**11,581.70**	**860,850.23**	**866,088.88**	**5,238.65**	**99 %**

Appendix N

Solid Waste Fee Data

Solid Waste

Solid Waste Sites will be closed on November 11 for Veteran's Day and November 23 for Thanksgiving

Currently there is no charge to residents with permits when they dispose of residential waste generated on Jefferson County property if the annual $129.69 unit assessment (on your tax statement) has been paid. Permits can be obtained from the Solid Waste District office located at 111 Odyssey Lane (at the south end of Boulder) or call (406) 225-4159. There is a $5 fee for each permit. Expired permits can be renewed at the container site.

Construction and demolition waste is charged at $20.00 per cubic yard. Inert waste (concrete, bricks, ceramic tile, rocks, dirt, masonry waste, etc.) is charged at $15.00 per cubic yard.

Residents without a permit and non-Jefferson County residents can purchase a Special Use Permit for a daily, quarterly or annual fee depending on volume of waste.

Tires are charged at $3.00, with $7.00, or $10.00 charged for larger sizes.

What's Accepted:

All garbage, rubbish and trash produced through typical residential activity. **Please bring your own tools needed to unload-Jefferson County does NOT provide tools or staff for unloading.**

Inert waste (Class III waste) must have all bagging removed.

What's Not Accepted:

Liquid waste
Infectious waste
Flammable products
EPA rated hazardous waste
Radioactive waste
Herbicides
Cooking grease
Asbestos
Contaminated dirt
Sludge
Sewage tanks
Burn Barrels
Poles or wood treated with pentachlorophenol
Fuel tanks

Note that rock, dirt, bricks, large truck loads (greater than 4 feet in height, width or length) of wire, big chunks of iron, engine blocks, axles, big pipes, tractor/truck tires, etc. are only accepted at the Boulder and Whitehall sites. Also note that this is not an all-inclusive list of restrictions; please sheck with the Solid Waste Department before taking large loads to a container site.

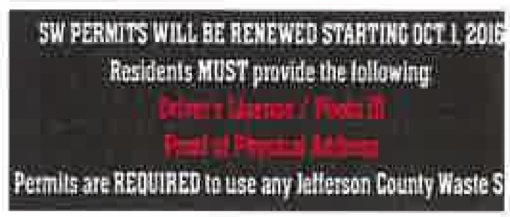
PLEASE COVER & SECURE YOUR LOAD!
Let's all do our part to keep our county clean. Leave your trash at the container sites, not along the roadside.

Contact Us

Brian Hohn, Manager, Solid Waste District

Box H
Boulder, MT 59632
Office Hours:
8:00 am - 4:30 pm, Mon - Fri
PH: (406) 225-4159
Fax: (406) 225-4169

Map of Solid Waste Site Locations



HOURS: 9:30 am to 5:30 pm

Boulder 70 Little Boulder Rd	Monday Thursday Saturday
Whitehall: 60 Paul Gulch Rd	Tuesday Wednesday Friday Saturday
Montana City: 50 McClellan Creek Rd	Monday - Sunday (Open every day)
Clancy: 18 Shady Lane	Wednesday Saturday Sunday
Jefferson City: 21 Spring St	Tuesday Saturday
Basin: 1 Cataract Rd	Saturday *8am -4pm*

Elk Park: A contract was implemented October 15, 1994 so Elk Park residents could use either the Butte Silver-Bow landfill or any Jefferson County container site.

What Recyclable materials are collected at each site:

Each site has a "Re-Use-It area" also called "Up-For-Grabs" for useable donated items.

Boulder Transfer Site: Aluminum cans, steel/tin cans, paper, cardboard, bulk metals, used oil, anti-freeze, paint & car batteries. Also clean yard waste such as limbs, brush and grass clippings and inert waste (but no plastic bags).

Whitehall Transfer Site: Aluminum cans, steel/tin cans, paper, cardboard, bulk metals, used oil, anti-freeze, paint & car batteries. Also clean yard and inert waste (but no plastic bags).

Montana City Transfer Site: Aluminum cans, steel/tin cans, paper, cardboard, bulk metals, used oil, anti-freeze, paint & car batteries. Also clean yard waste such as limbs, brush and grass clippings and inert waste (but no plastic bags).

Jefferson City Transfer Site: Bulk metals, used oil, anti-freeze, paint & car batteries.

Clancy Site: Bulk metals, used oil, anti-freeze, paint, cardboard & car batteries.

Basin Site: Used oil, anti-freeze, paint & car batteries. Also clean yard waste such as limbs, brush and grass clippings and inert waste (but no plastic bags).

Please, all cans and bottles must be cleaned and all cardboard boxes must be empty and broken down.

Used motor oil is accepted in clean plastic sealed containers of 5 gallons or less.

The Whitehall and Boulder container site has a Class III (inert waste) disposal pit. Items that can be disposed of in the Group III waste pit include wood and non-water soluble solids such as concrete, brick, vehicle tires, brush and unpainted lumber.

Appendix O

Pay-As-You-Throw Documents

EPA Power Point

Paying for Waste Disposal

What Are the Choices?

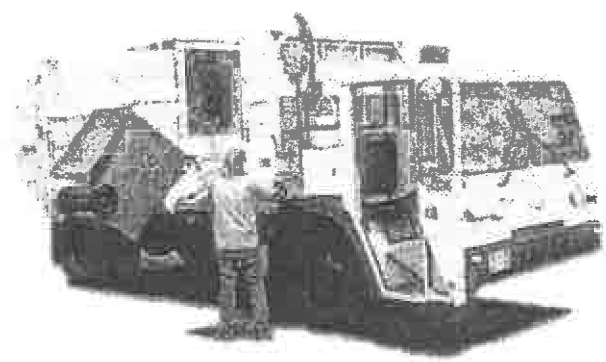
Tax Base
General Fund

Flat Fee

User Fee
(Pay-As-You-Throw)

Challenges in MSW Management

- More garbage to collect and dispose
- Higher costs of collection services
- Limited municipal budgets
- Public-sector pressure to more cost-efficient

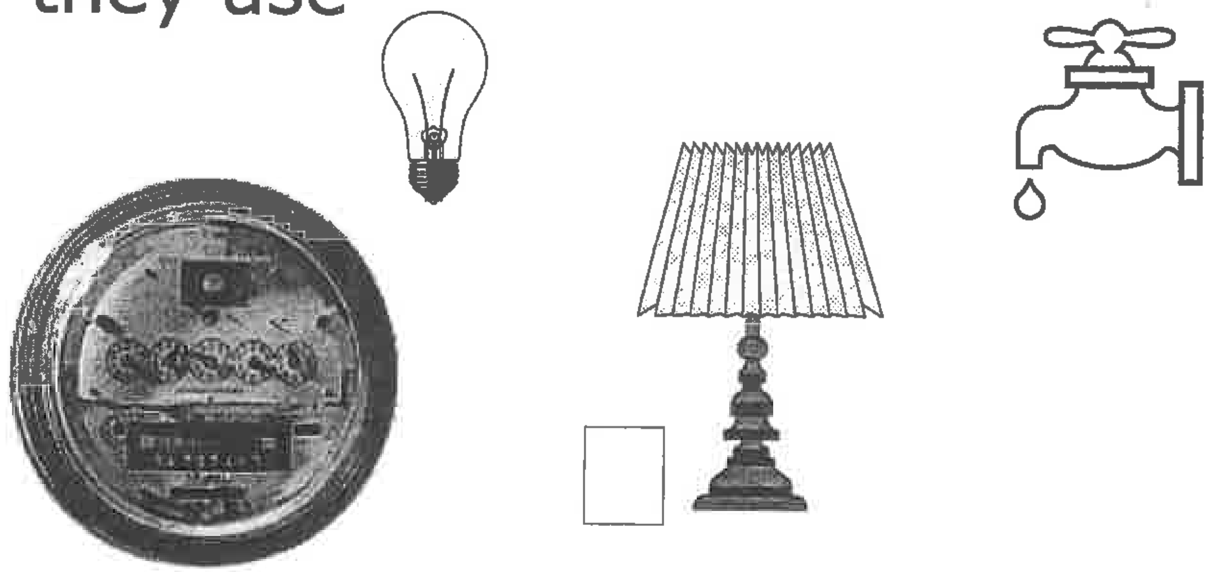


"3E" Benefits of Pay-As-You-Throw

- ***Environmental Sustainability***: Effectively promotes waste reduction
- ***Economic Stability***: Stable revenue covers cost of services
- ***Equity***: Economically fair delivery of services

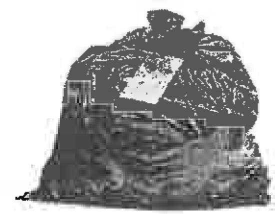
How PAYT Programs Work

- Pay for MSW service based on garbage thrown out
- Pay for waste like a utility
- Residents only pay for what they use



Types of PAYT Programs

- **Cans:** Residents pay higher fees for larger containers
- **Bags:** Residents pay a fee for garbage bags

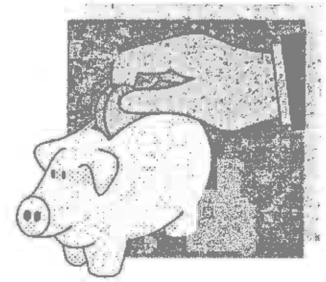


- **Stickers:** Residents pay for stickers affixed to bags/containers

Environmental Research Results

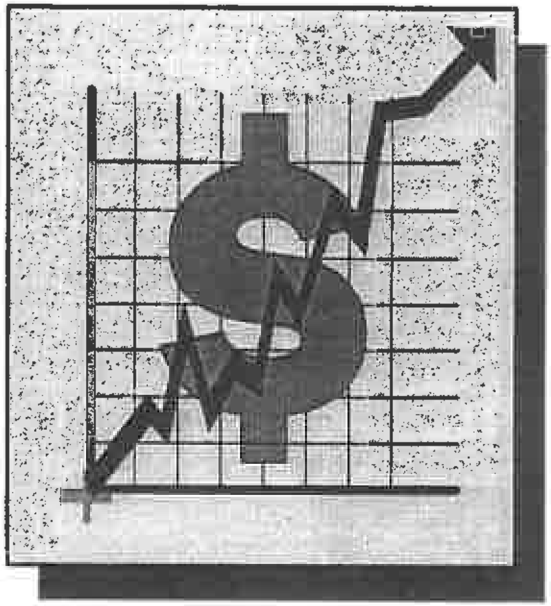
- **Duke University National Study**
  - 14 to 27% average waste reduction
  - 32 to 59% increase in recycling
  - 19% found slight increase in illegal dumping

Examples of U.S. City Savings



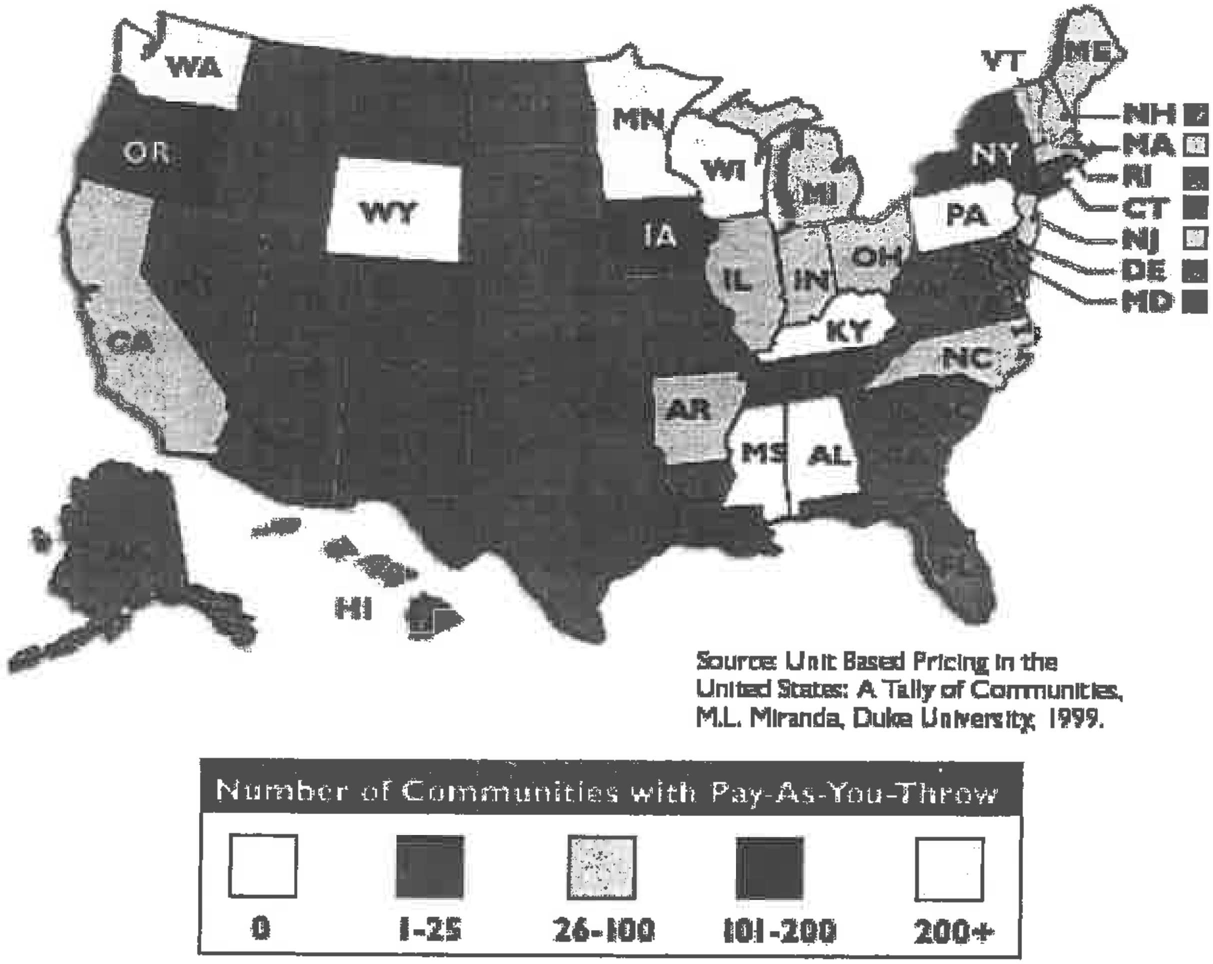
- **Wilmington, NC—** (Population: 75,000) $400,000 per year
- **Littleton, NH—** (Population: 5,800) $40,000 in extra funds with PAYT
- **Gainesville, FL—** (Population: 96,000) $186,200 savings
- **San Jose, CA—** (Population: 850,000) reduced cost by $4 million annually

PAYT Growing in the U.S.



- More than **5,000** communities in U.S. practice PAYT
- Cities large and small, rural and urban
- More than **60** cities with populations above **100,000** practice PAYT

Map of PAYT Communities



Source: Unit Based Pricing in the United States: A Tally of Communities, M.L. Miranda, Duke University, 1999.

Large Cities and PAYT

City	Population	Recycling Rate
San Jose, CA	782,248	43%
San Francisco	723,959	Approx. 33%
Portland, OR	437,319	50% (1996)
Seattle	516,259	44% (1996)
Worcester, MA	169,759	54% (1996)

What People Say about PAYT

Approval from elected officials to environmental groups and residents

- PAYT offers "a direct economic payback to the people"—San Jose elected official
- High recycling rates in cities correlates with PAYT
- Surveys indicate residential approval
- Positive changes in consumer purchasing behavior

Lessons Learned from PAYT

- Economic incentives encourage behavioral changes
- Treating MSW services as a utility — you pay for what you use
- **Win-win**: high recycling rate and economic stability

EPA Tools/Technical Assistance

What is EPA doing to support PAYT?

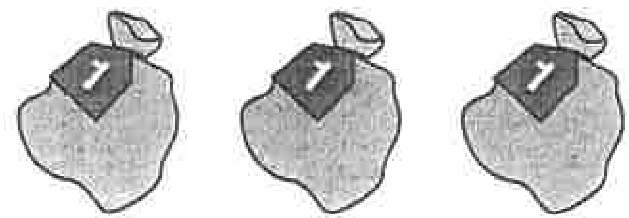
- Tool kit, PAYT Video, Fact sheets, Testimonials, Guidebook
- Technical assistance workshops in cities across the U.S.
- Web site: **www.epa.gov/payt**

Climate Change

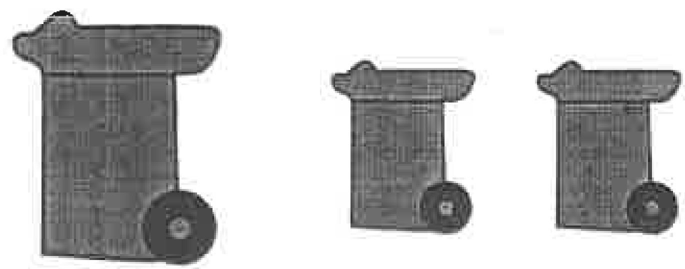
- PAYT helps reduce the greenhouse gas emissions associated with making, distributing, and disposing of products.
- If 200 more communities adopted PAYT and reduced waste by 20%, greenhouse gas emissions would be cut by 3.8 million MTCE.
- This equals taking almost 2.8 million cars off the road for almost a year.

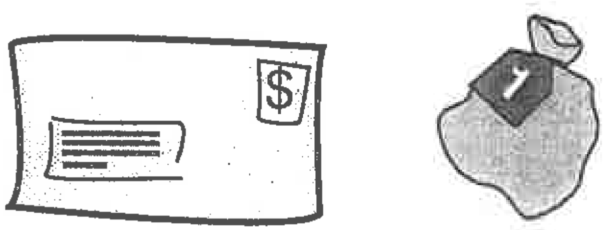
Pricing Systems

- Proportional



- Variable

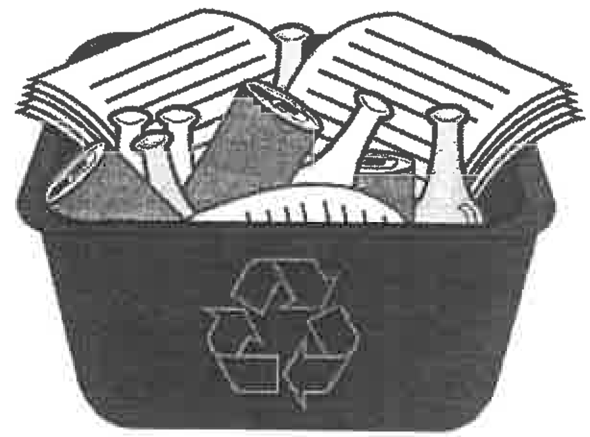




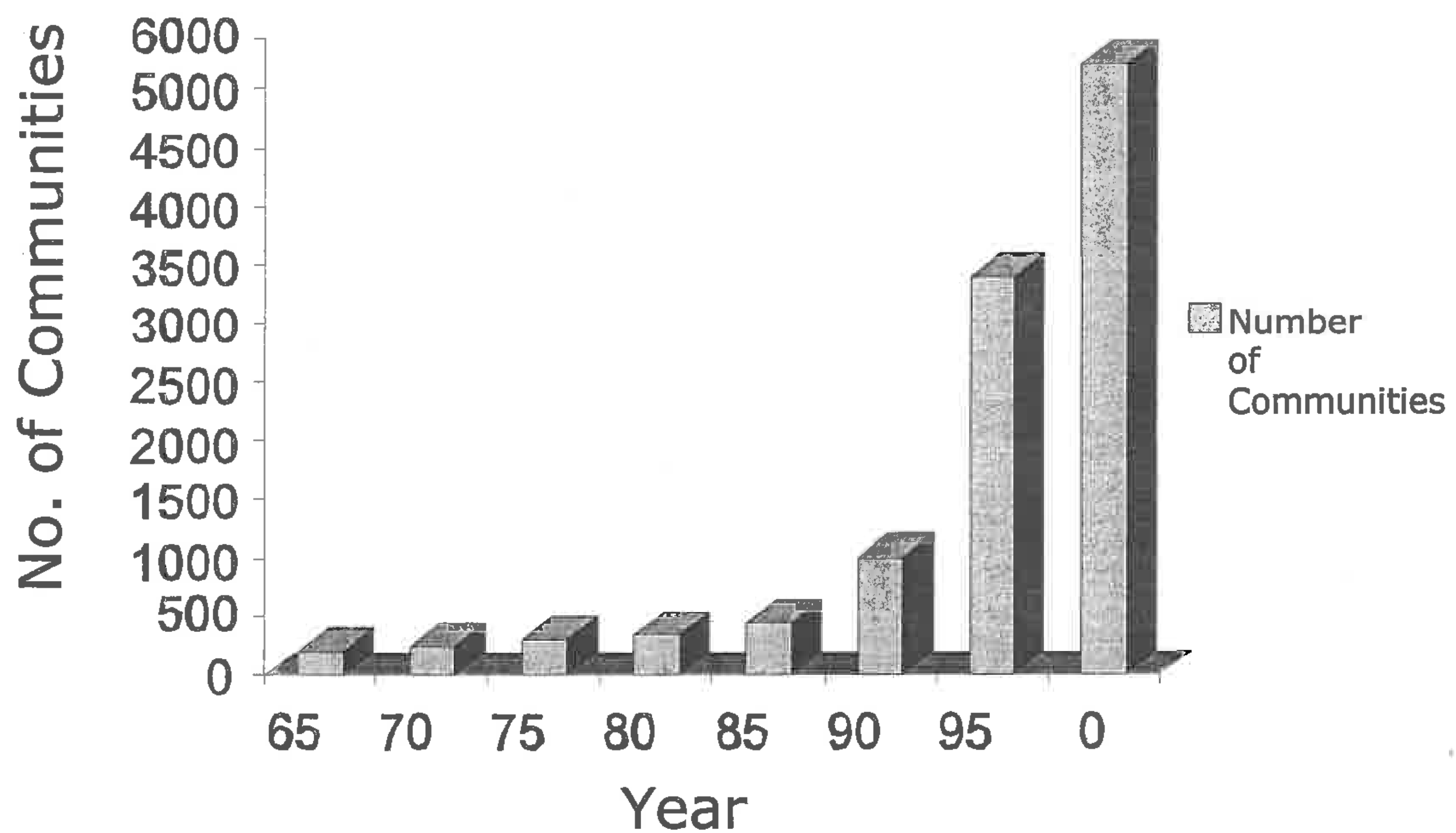
- Two-tiered/ Multi-tiered

Complementary Programs

- Curbside Recycling
- Yard Trimmings and Composting
- Bulky Items and White Goods



Growth in PAYT Programs



San Jose, California

Population	Start Date	Prgm. Type	Container
850,000	July 1993	Four-Sort	Cans

- Before PAYT: Unlimited collection for $12.50/month.
- Before PAYT: Three 32-gallon garbage cans/week.
- City reduced costs by over $4 million/year.
- 87% of residents use the 32-gallon size container.
- Recyclables/yard trimmings double pre-PAYT level.
- Residents happy with program
  (80% approval in 1993, 90% in 1996).

San Francisco, California

Population	Start Date	Prgm. Type	Container
723,959	1900s	Variable	Cans

- PAYT program one of the oldest in the country.
- 1999: City recycling rate 42%.
- "Fantastic 3" program: three 32-gallon carts.
- First program to collect food scraps at curbside.
- All apartment buildings have access to PAYT.

Seattle, Washington

Population	Start Date	Prgm. Type	Container
516,259	1981	Variable	Cans

- City offers 10, 20, 30, 60, or 90-gallon cans.
- City uses totes, semi-automated collection for containers over 30 gallons.
- 25% of resident use 20-gallon cans.
- Water/trash bills issued jointly:
  City pays for trash, shuts off water.

Austin, Texas

Population	Start Date	Prgm. Type	Container
465,622	1991	Variable	Cans

- 2000: Recycling rate 28.5%.
- 1991 (program began): Recycling rate 9.8%.
- Switch to fully automated, one-person crews.
- Residents can use 30-, 60-, or 90-gallon carts.
- Excess garbage placed in bag with $2 sticker.
- Bags without stickers charged $4/untagged bag.

Vancouver, Washington

Population	Start Date	Prgm. Type	Container
69,000	1990	Variable	Cans

- Second-can rate 84% greater than first can.
- 500 residents switched to the mini-can.
- Weekly recycling costs $3.10/month.
- Set out 96 gallons of yard debris: $5.55/month.
- City exceeded 50% recycling goal by 1995.

Portland, Maine

Population	Start Date	Prgm. Type	Container
64,000	1999	Variable	Bags

- Residents purchase bags for $0.68 each.
- Pre-PAYT: No curbside recycling; recycling rate 7%.
- After PAYT: Recycling rate now 35%.
- Waste decreased by 80-100 tons/week.
- City set up Q&A hotline before program began.

Wilmington, North Carolina

Population	Start Date	Prgm. Type	Container
64,513	1992	Two-tiered	Cans

- Combat illegal dumping: City used newspapers, radio, and TV.
- Citizen focus groups gathered support.
- 40-, 90-gallon roll-out carts collect waste weekly.
- Biweekly pickup or stickers for overflow available.
- Increase: 10% recyclables, 40% yard debris.

The pay-as-you-throw payoff

Oct 1, 2003 12:00 PM
By Janice Canterbury and Ryan Newill

More than 6,000 cities are turning garbage disposal into dollars through pay-as-you-throw (PAYT), a solid waste collection program that promotes environmental benefits and economic savings. Often municipal solid waste (MSW) collection is perceived as a free service by residents, as the costs are covered by property taxes or flat monthly or quarterly fees. Thus, no matter how much or how little residents recycle, compost or reduce their weekly waste, they incur no financial consequence.

Similar to the way utilities charge their customers for water and electricity, PAYT charges residents based on the number or size of trash containers discarded. As a result, cities are able to generate a relatively stable funding source, as well as increase recycling rates and reduce landfill costs.

A flexible solution

Connecting residents' disposal choices to their wallets is the centerpiece of PAYT programs, but the widespread success of PAYT is rooted in its flexibility. With PAYT, administrators can analyze their municipality's needs based on its unique circumstances and construct a PAYT system most advantageous to the city. By selecting from key features — tag or container type (bag or can), pick-up schedules, accounting systems and rate design — planners can tailor a PAYT program that matches their community's goals and needs.

No two PAYT communities are alike. For example, in 1997, residents in Mount Vernon, Iowa, a suburban college town of 3,700 residents, saved an average of $47 per household compared to the preceding year — savings of $46,000 for the city's 980 households. The city also estimates that, over five years, the average household reduced the amount of landfilled trash by 40 percent.

Keeping its system simple was one of Mount Vernon's goals. The city opted to use a tag program. Residents purchase tags for $2 each at either city hall or a local retail store. The tag is placed on the bag or container and allows residents to dispose of 30 gallons of waste. In addition to the cost of the tags, Mount Vernon residents also receive an $8 monthly waste bill, which helps offset the cost of the city's recycling program. By using a variable rate for garbage and a fixed rate for recycling collection, residents are encouraged to discard less and recycle more.

Simplicity was not an option for San Jose, Calif., because it serves 186,000 households. The city uses four sizes of cans with prices based on the cart's size. The program also offers residents an extensive, free recycling program. Under PAYT, San Jose has reduced MSW costs by $4 million per year using private contractors. Additionally, the city more than doubled its amount of collected yard trimmings and recyclables.

New system meets challenges

PAYT has a proven record of success in a variety of cities, but each has faced challenges. For example, Dover, N.H., found that the most common and difficult obstacle in changing its MSW program was the resistance from some of its 26,000 residents who had grown accustomed to the myth of garbage collection being a "free" service.

In 1991, Dover debated PAYT in three meetings, and each was marked by vocal public dissent. However, the city used the meetings to educate residents, explaining that they would not be charged for recycled and composted materials left at the curb, but they would be charged for trash that required disposal.

After adopting a PAYT program in 1991, the Dover City Council formed a Citizen's Solid Waste Advisory Committee, which allowed residents some voice in oversight of the program. Over the next eight years, the city reduced its disposal by 7,100 tons per year, and the MSW budget decreased by $322,000 since PAYT implementation.

Although PAYT programs establish a rate system, Pasadena, Calif., discovered that it had to meet the needs of a special part of its population of 136,237. Following the introduction of its PAYT program, Pasadena's elderly, fixed-income residents expressed concerns about their ability to pay for disposal. To accommodate their concerns, the city gave residents a choice of three container sizes — 32, 60 or 100 gallons — and charged for collection based on the size of the container. If residents want to change sizes, there is no charge within the first year, but it costs $35 after that. Changes made during Environmental Awareness Month every November are free.

Similarly, Seattle — one of the largest and most urban PAYT cities with 563,374 residents — also developed processes within its program to address its special-needs populations, including low-income and elderly residents.

The problem with success

In some cases, the success of a PAYT program can cause problems. In Austin, Texas, for example, the city implemented a multi-can system with the consumer price based on the size of the cart. The city, however, was not prepared for the number of residents who would select the smallest can immediately.

"Right off the bat, we went $2,100 in the hole because of all the people who were going to do the 'right thing' and picked the smaller 30-gallon carts. In other words, be prepared for your program to become successful," says Austin's Jamy Poth Kazanoff, the city's former public information and marketing manager.

To manage the initial misreading of the public's enthusiasm, Austin allowed customers to exchange their cart once for free but then charged $15 for any subsequent exchange. That fee helps offset the cost of exchanging carts and keeps Austin's PAYT program operating smoothly. Between October 1999 and September 2000, Austin diverted 28.5 percent of its waste from the landfill, compared with 9.8 percent in 1991.

While the conversion to PAYT may be a radical shift in the way most communities address MSW, the efforts clearly pay dividends. As some 6,000 communities across the United States have proven, PAYT is not only an environmental solution that promotes source reduction and increased recycling rates, but it also is an economic one. By providing an equitable accounting of costs versus services provided, municipalities can make residents more conscious of their waste disposal behaviors, which can lead to savings for both residents and municipalities.

Janice Canterbury is the PAYT project manager at the Washington, D.C.-based U.S. Environmental Protection Agency. Ryan Newill is a technical communications specialist with Arlington, Va.-based ERG.

Pay-as-you-throw results

Portland, Ore.

Increased recycling rate from 7 percent to 35 percent one year after implementing PAYT in 1992.

Austin, Texas

Increased recycling rate from 9.8 percent to 28.5 percent between 1991 and 2000.

Worcester, Mass.

Reduced waste by 40 million pounds from 1992 to 1999.

Dover, N.H.

Reduced waste by 7,100 tons each year from 1991 to 1999, achieved a 50 percent recycling rate, and saved $322,000 annually.

Falmouth, Maine

After beginning a PAYT program in 1992, the city immediately increased its recycling rate by more than 50 percent to 21 percent; trash disposal volumes decreased by about 35 percent; and it saved $88,000.

Fort Collins, Colo.

In 1996, the city increased its recycling rate to 79 percent participation in single-family and duplex households — up from 53.5 percent in 1995.

Gainesville, Fla.

In 1994, the first year of the city's program, solid waste collected decreased by 18 percent from 1993, recyclables collected increased by 25 percent, and the city saved $186,000.

Mount Vernon, Iowa

Solid waste collected decreased by 40 percent from 1990 to 1995.

San Jose, Calif.

Recyclables and yard trimmings collected increased by 50 percent between 1993 and 1994, and residents reported a 90 percent satisfaction rate in 1996.

South Kingstown, R.I.

Recycling rates consistently reach 40 to 60 percent; families now save $40 per year on trash.

Vancouver, Wash.

Exceeded 50 percent recycling goal by the end of 1995.

Source: U.S. Environmental Protection Agency

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DESIGNING A RATE STRUCTURE FOR

Pay-As-You-Throw

What signal are we sending to the American public when we offer them free or unlimited trash disposal? Are we telling them that it is okay to consume as much as they want, and we will just take their waste and bury it somewhere? Aren't our natural resources worth more than that? There is another signal, a price signal, that communities are using to encourage residents to pay attention to what they discard—pay-as-you-throw (PAYT).

Janice Canterbury

Ms. Canterbury is an Environmental Specialist with the Municipal Waste Reduction Branch of the Environmental Protection Agency, Washington, D.C.

PAYT charges residents for trash collection based on how much waste they throw away. PAYT (also called variable-rate or unit-based pricing) continuously reminds and financially motivates people to reduce waste.

Today, over 4,000 communities serving 20 million individuals-up from 10 million individuals since 1990—have implemented PAYT programs while averaging waste reductions of 14 to 27 percent. Also, according to a recent Institute for Local Self Reliance (Washington, D.C.) study, PAYT achieves high recycling rates when combines with comprehensive recycling programs. Over half of the sampled communities with a 50 percent recycling rate credit PAYT.

Planners and local officials need information on how to determine the appropriate price to charge residents for each unit of garbage collected, a process called rate structure design. EPA reviewed the rate structure design methods used by various communities and developed this article to explain the key elements they considered in setting their PAYT rates.

Communities commonly choose among three basic types of PAYT pricing systems-proportional, variable, or multi-tiered.

Proportional Systems-Residents are charged the same amount of money for each unit of waste they set out for collection. These are usually bag-or tag-systems, with the bags sold at local retail stores or municipal offices.

Variable Rate Pricing Systems—Residents are charged different amounts per unit of garbage. Container capacities range from 10- to 96-gallons.

Two-Tiered or Multi-Tiered Systems-Residents pay a flat fee for a base level of service, and then pay a "second-tier" fee based on how much waste they set out. Second-tier fees can be either proportional or variable rate.

Decisions about pricing systems and other rate structure components depend on a community's circumstances and goals for its PAYT program. Clear goals help determine a community's approach. To maximize recycling, for instance, some communities use variable rates that charge substantially more for a second or larger trash can. If a more equitable system is a primary goal, implementing a bag system allows residents to be charged for exactly what they dispose of in small increments (e.g., 32-gallon bags instead of 96-gallon carts). If covering solid waste management costs is the concern, a two-tiered system can help ensure a reliable revenue stream. Here, basic "fixed" costs (expenses not tied to the amount of MSW generated) can be recovered through a utility or tax bill, while "variable" costs such as landfill disposal fees are recovered through a separate per-unit fee.

APPROACHES TO RATE STRUCTURE DESIGN

In general, solid waste planners follow one of three methods when choosing a community's rate structure: drawing from comparable communities, building from community data, and analyzing full MSW costs.

Drawing from comparable communities. Some communities start by examining successful payt programs, particularly those cities or towns with similar demographic profiles. Sometimes this is sufficient to arrive at an appropriate fee.

Oconee County, Georgia (population 25,000) looked south to Tift County before deciding on a proportional system that set its fee at $1.50 per bag. "Tift County guided us a bit (on setting the price), but we also felt that $1.50 was probably the maximum people were going to pay to cooperate with this program, : said John McNally, executive director of the Oconee County Clean and Beautiful Commission. The county concluded that $1.50 was about right after doing an informal, man-on-the-street type interview.

Oconee County had two goals for its PAYT program-to cover the cost of using neighboring Clark County's landfill (Oconee County recently closed its landfill) and to encourage recycling. McNally said the public's desire to recycle surprised the county commissioners. "We sent survey forms home with school children asking them to have their parents fill them out. The public was pretty much aware of the need to recycle. They wanted to do it." The county established six one-acre fenced and manned collection sites that included recycling centers and switched to a 32-gallon blue bag system for household trash. Residents take both their trash bags and recyclables to these locations. They pay $1.50 for the trash bags, but recycling is free.

McNally said the $1.50 charge per bag is covering the county's solid waste costs, even though blue bag sales are decreasing as residents recycle more. "People are finding out if they recycle they don't have to buy as many blue bags." Although the overall MSW tonnage remains the same (about 200 tons per month), McNally credits the PAYT program with offsetting the waste that is generated by a rapidly increasing population.

Building from community data. Other communities use data on their waste generation amounts, program costs, and other factors to calculate PAYT rates. This approach provides a more accurate rate than examining programs in similar communities, yet it does not require the more extensive analysis required by the full MSW cost method.

Lansing, Michigan (population 130,000) added together all of its solid waste program costs and divided the total by the number of bags it expected to collect to arrive at a $1.50 per bag fee. Although residents annually pay an additional flat fee of $50 per household for curbside recycling, this represents a proportional pricing system, since the feecovers all MSW collection and disposal costs. According to Robert Moye, solid waste supervisor, the rate structure's main goal is to cover the program's costs, since it operates from an enterprise fund. Because the city competes with private haulers for residential customers, however, the rate must also be low. Moye said it actually costs, including labor and disposal fees, closer to $1.45 per bag, but rounding to $1.50 gives the city a small cushion and keeps it from having to raise the rates every year.

Platteville, Wisconsin (population 10,000) residents are charged $1 for each extra bag of trash that is set out beyond a 35-gallon limit. The $1 per bag fee reflects the cost of collecting, hauling, and tipping "excess" MSW, as well as the cost of the bags, the incentive for stores to carry the bags ($0.10 each), administrative tasks, and the yard waste collection and composting operation. Residents that request yard waste collection are required to bag their yard trimmings.

Platteville's program encourages recycling. According to Director of Public Works Howard Crofoot, a city ordinance states that setting out more than 35 gallons per week of trash is excessive. (This is 10 gallons a week less than the Wisconsin Department of Natural Resources' guidelines, which mandate PAYT for any quantities over 45 gallons per week). Residents are provided with weekly collection of one 35-gallon clear bag or 50-lb garbage can. City taxes pay for both this service and curbside recyclables collection. This is a two-tiered pricing system since residents are charged on two levels—a base service charge on the tax bill and unit-fees on excess garbage.

Crofoot explained that the first thing to consider when establishing a rate structure is the actual cost of service. He cautioned that it also is important to get input from the public, explaining that too high a price can create problems with illegal dumping. The city thus determined

PAYT Tools and Full Cost Accounting

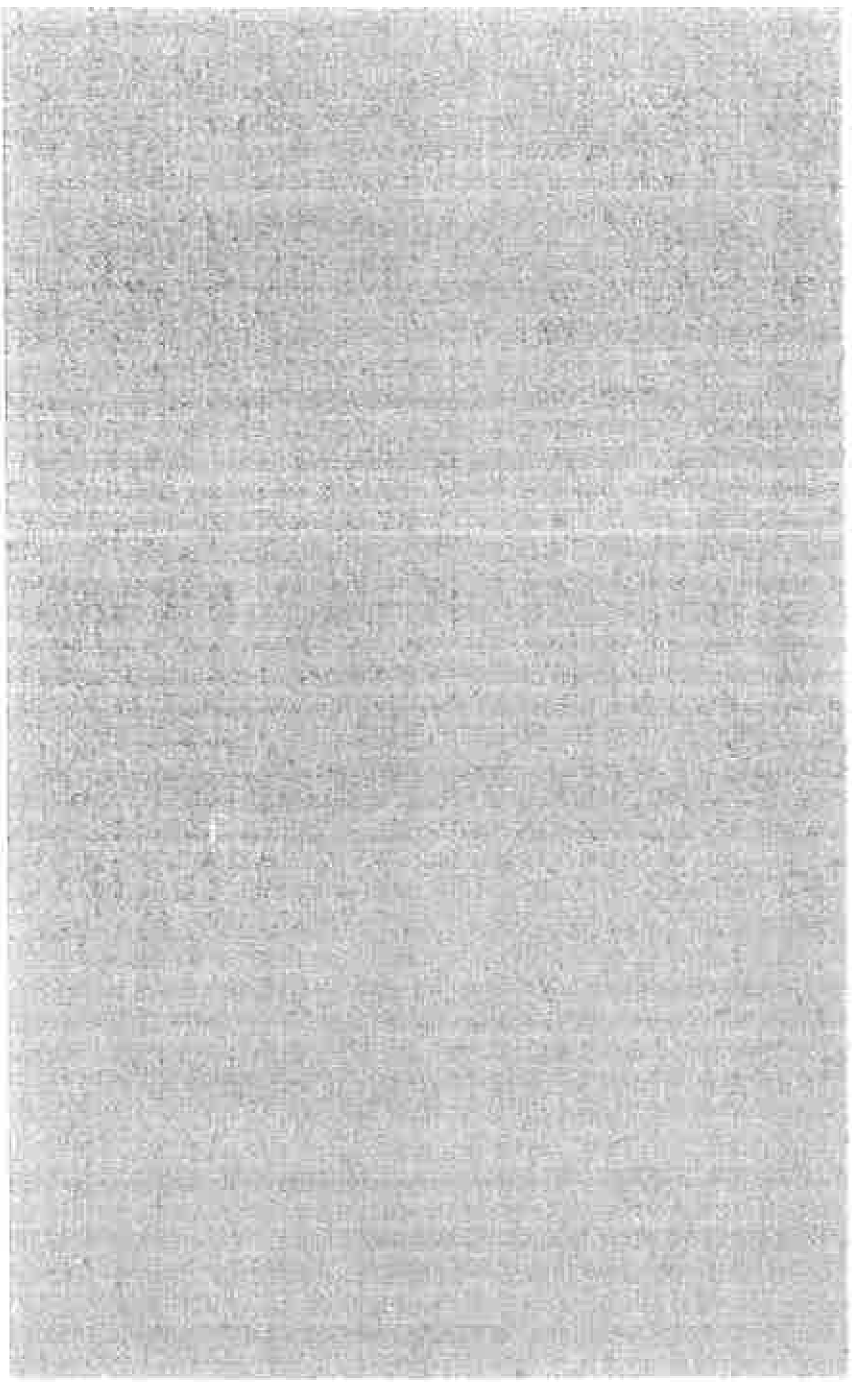
Various products are available from EPA to inform communities about the experience of pioneering PAYT programs. The Pay-As-You-Throw Tool Kit includes detailed guidebooks, an extensive workbook, and a videotape to help solid waste decision makers learn more about PAYT and to plan and implement their own program. Another important resource for communities is Pay-As-You-Throw Success Stories, a collection of testimonials by various PAYT municipalities.

To learn more about these free products and tools contact the PAYT Helpline at 888 EPA-PAYT (372-7298). You also can access most of these items online through the PAYT Web site at www.epa.gov/payt.

More detailed information on analyzing MSW costs is provided in EPA's *Full Cost Accounting for Municipal Solid Waste Management: A Handbook, (EPA530-R-95-041),* September 1997, available from the RCRA Hotline at (800) 424-9346. Also, visit EPA's Full Cost Accounting Web site at www.epa.gov/fca.

the best rate to be $1 per bag, although the actual costs are slightly lower, said Crofoot. The city's recycling rate is about 35 percent, or about 10 percentage points higher than the state's 25 percent goal.

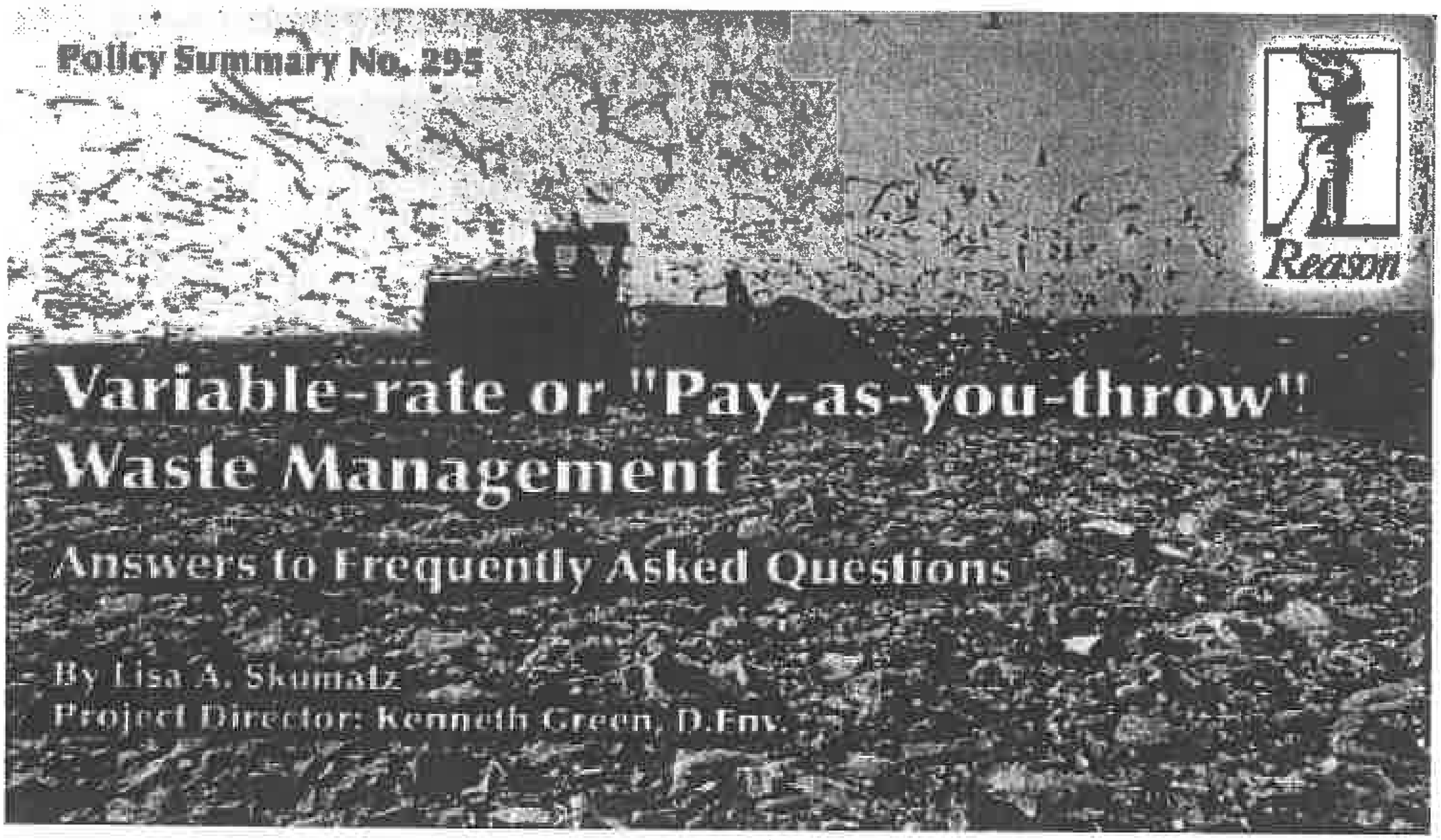
Trinity County, California (population 13,000) residents pay $5 per cubic yard, or $1 a bag (the sixth bag is free, since the county estimates that there are six bags in a cubic yard), for solid waste disposal. The PAYT system was implemented because a $100 annual benefit assessment collected from households was insufficient to run the county's landfill and eight collection centers. Although it might have been easier to raise the assessment, the county's supervisors were against it. Instead, they estimated their additional costs at about $5 a cubic yard and opted for the unit-based system. The fee was set as low as possible to discourage illegal dumping. The county also felt a per-bag fee would be fairer and hoped it would encourage recycling.



The combination of the benefit assessment and per-bag (or cubic yard) fee make this a two-tiered system. According to Barbara Rapinac, lead gate attendant, the system is successful, although the fee will soon increase to cover the cost of transferring waste to another disposal facility after the county's landfill closes. The fees are covering expenses, residents pay only for what they generate, and recycling has increased. Waste generation has also decreased. To reduce their disposal fees, more residents are requesting permits from the U.S. Forest Service to burn yard trimmings in their backyard when seasonal conditions permit.

Analyzing full municipal solid waste costs. A third approach to rate structure design is to analyze costs to Wilmington, North Carolina, used a calculate an appropriate unit price. form of full cost accounting to identify all costs before establishing its pricing system, According to Bill Reed, superintendent of operations, the city's fees must cover program costs, since it operates from an enterprise fund. Reed explained that "setting your fees depends on how exact you want or need to be."

The city's main goal was to reward residents that generate less trash. Consequently, the city offers several options in its variable rate pricing system, from weekly collection of a 40-gallon cart ($12.75 per month), to weekly collection of a 90-gallon cart ($15.75 per month), to weekly collection of two 90-gallon carts ($22.35), to twice weekly collection of one 90-gallon cart ($31.30). Residents can buy stikers for overflow trash for $1 per 33-gallon bag. Making trash rates more equitable increased recycling. Reed would like to switch to an all bag system, though. He believes that with carts, people feel, "If I'm paying for it, I might as well use it." People have more incentive to recycle with bags, contended Reed. Consequently, the city is switching to a bag system in its central business district this year. PW



Policy Summary No. 295

Reason

Variable-rate or "Pay-as-you-throw" Waste Management

Answers to Frequently Asked Questions

By Lisa A. Skumatz
Project Director: Kenneth Green, D.Env.

Executive Summary

As landfills fill up and recycling opportunities increase, more communities across the nation are interested in reducing waste disposal and its costs. City managers are considering a variety of strategies to improve incentives to recycling and composting, as well as to increase the variety of materials that can be recycled or composted.

Currently, in most parts of the country, garbage is removed once or twice a week with revenues coming from a portion of property taxes or from a flat fee-for-service system that does not vary with respect to the amount of garbage taken away.

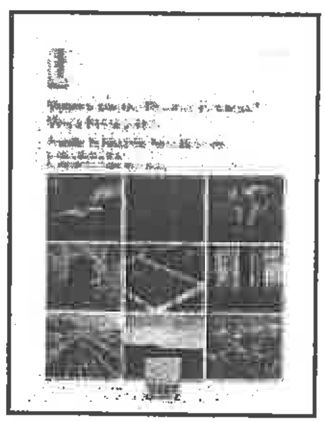
Neither of these methods provides any incentives to reduce waste, and, facing large volumes of solid waste, areas using these payment methods have sometimes implemented mandatory recycling programs to reduce the volume of their solid waste stream.

Variable-rate pricing, or "pay as you throw," is a market-based strategy with a growing number of advocates. Under a variable-rate system, customers are provided an economic signal to reduce the waste they throw away because garbage bills increase with the volume or weight of waste. Variable-rate pricing is being adopted in thousands of communities to create incentives for additional recycling in the residential sector.

Variable-rate programs are very flexible and have been implemented by communities in many different forms. The most common types of variable-rate programs are can programs, bag programs, tag and sticker programs, and hybrid programs. Each type of variable-rate system has strengths and weaknesses, as will be discussed in this study. The study also provides information on appropriate program selection, implementation issues and tips, and rate setting for communities that wish to implement a variable-rate waste disposal system.

Rate incentives in solid waste have strong and measurable effects on waste-disposal behavior and waste disposal.

This is a summary of *Variable-rate or "Pay-as-you-throw" Waste Management*, Policy Study No. 295, July 2002, www.rppi.org/ps295.html.



For more information go to http://www.rppi.org/ps295.html

Towns implementing variable-rate programs can expect to see reductions of more than 15 percent in tons disposed as well as increases in recycling and yard-waste diversion.

Variable rates can help reduce the burden on solid-waste disposal systems and lead to more efficient resource use, reduced environmental burden, and lower solid-waste system management costs. While these programs may not be appropriate in all communities, many communities can benefit from variable rates.

What is variable-rate waste disposal, and what are its benefits?

Systems of pricing trash for disposal are known by a variety of names: variable rate, pay by the bag, variable-can rate, volume-based, pay as you throw, among others. However, the basic concept underlying all these terms is very straightforward: customers that put out more waste for collection pay more than those who put out less.

Variable-rate programs provide a number of advantages for communities and residents including greater equity, stronger economic linkage with behavior, unrestricted consumer choice, cost-effectiveness, waste reduction, ease of implementation, flexibility, and environmental benefits.

Using variable rates to reduce the burden on the disposal system can lead to more efficient use of services, improved environmental and resource use, and lower long-run solid-waste system management costs.

What are the different types of variable-rate waste-disposal pricing systems?

Variable-rate systems can be categorized into five major types:

- In Variable Can or Subscribed Can systems, customers select the appropriate number or size of containers (one can, two cans, etc., or 30–35 gallons, 60–65 gallons, etc.) for their standard weekly disposal amount.
- In Bag programs, customers purchase bags imprinted with a particular logo, and any waste they want collected must be put in the appropriately marked bags.

  In Tag or Sticker programs customers affix a special logo sticker or tag to the waste they want collected, but can use whatever bags they wish.
- Hybrid systems combine elements of the current collection system with new incentive-based elements. Instead of receiving unlimited collection for payment of the monthly fee or tax bill, the customer gets only a smaller, limited volume of service for the fee, and must pay extra for additional volume.
- Weight-based systems use truck-based scales to weigh garbage containers and charge customers based on the actual pounds of garbage set out for disposal.

Who is implementing variable-rate waste-disposal pricing?

As Figure 1 shows, the program count and population coverage for variable-rate programs have increased dramatically in the 1990s, and variable-rate programs are now available to more than 20 percent of the national population. Figure 2 shows the distribution of these programs by region.

How much waste reduction will variable-rate programs produce?

The key impact communities have found from implementing variable-rate programs include reduction in disposal tonnage and an increase in recycling and yard-waste diversion as well as source reduction.

Studies using data gathered from over 500 communities across the nation show that variable-rate programs decrease residential disposal by about 17 percent in weight, with 8–11 percent being diverted directly to recycling and yard programs, and another 6 percent decreased by source-reduction efforts.

How does variable-rate waste-disposal pricing relate to source reduction?

A significant amount of source reduction currently results from the existing variable-rate programs in operation across the United States Even though these rate-incentive programs cover only 20 percent of the population, an estimated 1.3 million tons are being source-reduced from the existing variable-rate communities. To date, residential disposal has been reduced by 1.7 percent and residential waste-generation by 1.2 percent nationwide from just the source-reduction impact of these existing programs.

A town implementing variable-rate programs can expect to see reductions in tons disposed on the order of 16 percent, with one-third going to increased recycling, one-third to increased yard-waste diversion, and about one-third being avoided entirely through source reduction. Additional diversion (5-7 percent) can be realized from the source-reduction impact- of variable rate programs.

Which types of variable-rate waste-disposal programs are more effective at increasing recycling?

Although variable-rate waste-disposal programs in general lead to higher recycling than communities without variable rates, bag programs deliver significantly more recycling than can programs—up to 4 or more percentage points of residential recycling. Hybrid programs are also strong performers, delivering 4 or more percentage points of diversion than can programs. Sticker and tag programs were not common enough to provide reliable separate results for these programs.

Does variable-rate waste disposal automatically increase recycling?

Conversion to a variable-rate program results in the single most effective change that could be made to a curbside (or drop-off) program. Implementing variable rates has a larger impact on recycling than adding additional materials, changing frequency of collection, or other changes and modifications to programs. Variable-rate programs increase recying by 5–6 percent (with similar increases for both curbside and drop-off programs). A survey in Iowa found that recycling increased by 30 percent to 100 percent, and averaged about 50 percent.

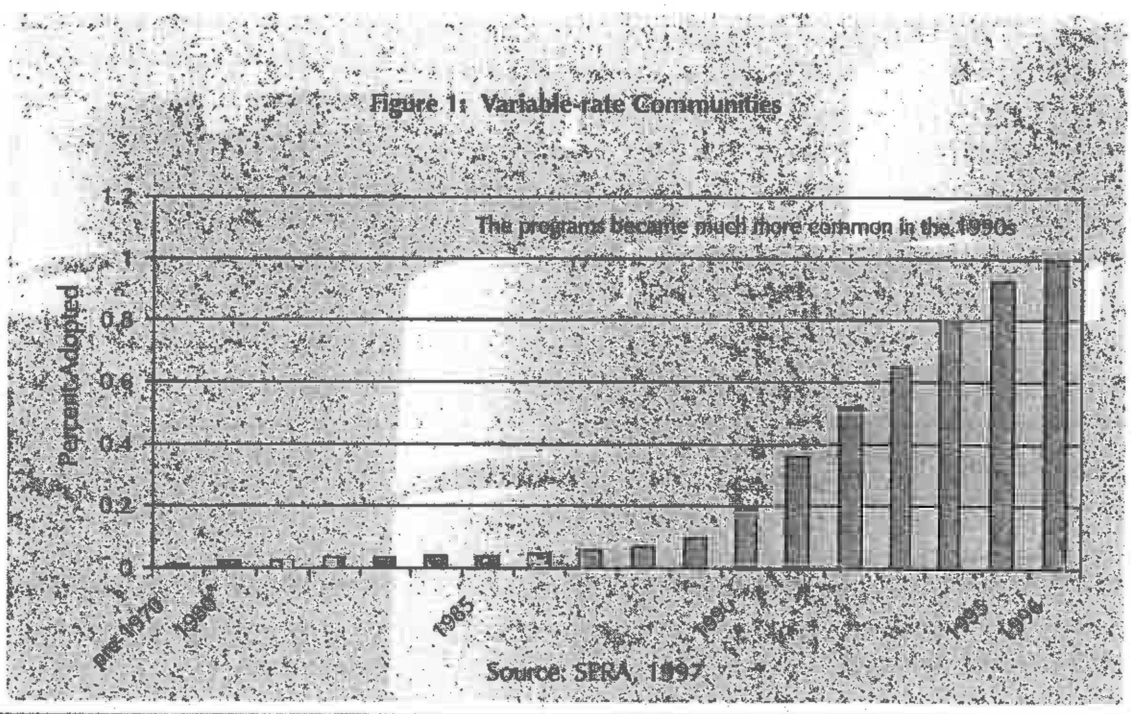


Figure 1: Variable-rate Communities

How does variable-rate waste-disposal programs reduce waste volumes at the curb?

Variable rates reduce set out garbage dramatically—from 90 gallons to 30–45 gallons in many communities that also have active recycling and yard-waste programs. Some of this is accomplished through actual tonnage reductions, and additional decreases are due solely to deliberate compaction. Research from variable-rate program communities shows that in areas with curbside recycling and yard-waste programs, households set out between 30 and 45 gallons of garbage on a weekly basis; in rural areas this figure can be lower because some bring waste directly to transfer stations and some burn their waste. "Set-out" decreases are important because they reflect the new unit of revenue and are crucial to rate-setting.

What are the implementation and administration costs of variable-rate waste-disposal pricing?

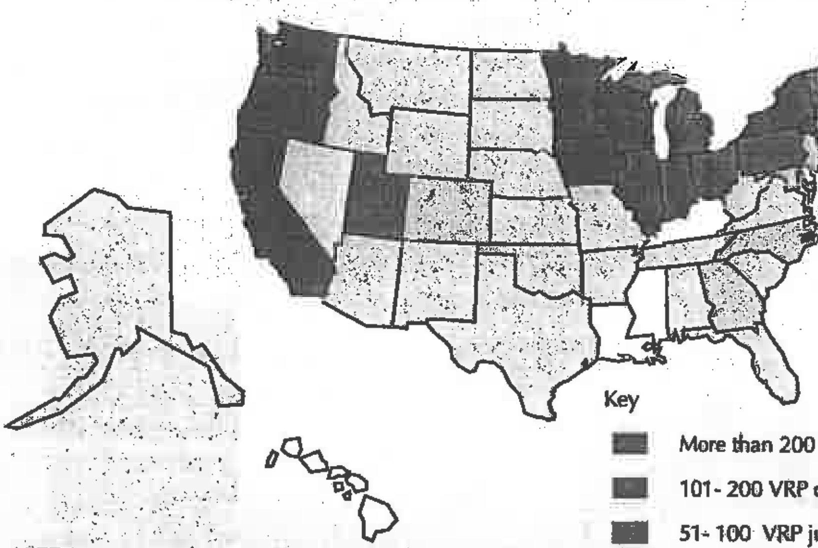
Concerns about costs are an issue for every community. Studies conducted by the states of Wisconsin and Iowa found that for two-thirds of the communities implementing variable rates, costs stayed the same or decreased. Only one-third had an increase in costs. This demonstrates that 1) these programs do not have to be expensive to implement, and 2) communities can find program types that fit well with their existing or planned solid-waste management system.

What are the key elements of a variable-rate pricing waste-disposal program?

There are two key elements to a successful variable-rate waste-disposal program: rates that vary and provide an

Figure 2: Variable-rate Communities

SERA's 2000 survey found more than 5,000* variable rates communities and only 4 states without programs. Programs are available to 20% of population.



*SERA counts only 800 communities in MN; EPA adds 1,000 more so SERA count using EPA procedures would exceed 6,000 communities covered by PAYT/VR.

incentive, and legal alternatives for materials, including recycling, reduction, and composting information and programs. Each system type presents its own rate-setting opportunities and challenges, but there are several rate-setting issues that are common to all the systems.

Rates accomplish two basic functions: recovering revenues, and creating incentives for customers to handle their solid waste as efficiently as possible. Because of these dual functions of solid-waste rates, it is critical the planners review their solid-waste goals and priorities during the rate-setting process. There is no best way to design rates, and choices will need to be made based on an assessment of key priorities.

How can people get variable-rate waste-disposal programs implemented in their community?

Getting variable-rate programs approved is often harder than designing and running the actual system. The most important issue is to provide information to residents, the press, and stakeholders about the purpose of the change, what the community hopes to achieve through the change, and how to make the program work for residential customers.

Several key strategies and activities may be useful in helping communities move in this direction, including the pursuit of political support, hauler input, customer education, and creation of a "starter kit" distributed free to potential customers. In addition, people wanting to bring variable-rates to their community are encouraged to find a "policy champion" within existing waste-management institutions; meet with editorial boards to drum up positive press coverage of the idea; and to consider establishing a broad-based task force composed of people from supportive and oppositional interest groups.

ABOUT THE AUTHOR

Dr. Lisa A. Skumatz, an economist, is principal of the Colorado-based research and consulting firm Skumatz Economic Research Associates, Inc. (SERA). She is especially known for her work in variable-rate waste disposal, and her quantitative work measuring the impact of recycling, yard waste, and source-reduction programs. Much of Dr. Skumatz's recent work has focused on developing strategies and programs to revitalize recycling at the state level. SERA (www.serainc.com) specializes in the economics of solid-waste management, especially program evaluation and cost-effectiveness, rate studies, incentives, integrated planning, and modeling/forecasting. SERA has worked with community, state, and federal solid-waste agency clients across the nation, and has published numerous documents and reports on solid-waste economics. Dr. Skumatz received her undergraduate degree from the University of Wisconsin at Madison and her Ph.D. from Johns Hopkins University. ❑

U.S. Environmental Protection Agency

Pay As You Throw

Introduction

In communities with pay-as-you-throw programs (also known as unit pricing or variable-rate pricing), residents are charged for the collection of municipal solid waste—ordinary household trash—based on the amount they throw away. This creates a direct economic incentive to recycle more and to generate less waste.

Traditionally, residents pay for waste collection through property taxes or a fixed fee, regardless of how much—or how little—trash they generate. Pay-as-you-throw (PAYT) breaks with tradition by treating trash services just like electricity, gas, and other utilities. Households pay a variable rate depending on the amount of service they use.

Most communities with PAYT charge residents a fee for each bag or can of waste they generate. In a small number of communities, residents are billed based on the weight of their trash. Either way, these programs are simple and fair. The less individuals throw away, the less they pay.

EPA supports this new approach to solid waste management because it encompasses three interrelated components that are key to successful community programs:

Environmental sustainability. Communities with programs in place have reported significant increases in recycling and reductions in waste, due primarily to the waste reduction incentive created by PAYT. Less waste and more recycling mean that fewer natural resources need to be extracted. In addition, greenhouse gas emissions associated with the manufacture, distribution, use, and subsequent disposal of products are reduced as a result of the increased recycling and waste reduction PAYT encourages. In this way, PAYT helps slow the buildup of greenhouse gases in the Earth's atmosphere which leads to global climate change. For more information on the link between solid waste and global climate change, go to EPA's Climate Change and Waste Web site.

Economic sustainability. PAYT is an effective tool for communities struggling to cope with soaring municipal solid waste management expenses. Well-designed programs generate the revenues communities need to cover their solid waste costs, including the costs of such complementary programs as recycling and composting. Residents benefit, too, because they have the opportunity to take control of their trash bills.

Equity. One of the most important advantages of a variable-rate program may be its inherent fairness. When the cost of managing trash is hidden in taxes or charged at a flat rate, residents who recycle and prevent waste subsidize their neighbors' wastefulness. Under PAYT, residents pay only for what they throw away.

EPA believes that the most successful programs bring these components together through a process of careful consideration and planning. This Web site was developed as part of EPA's ongoing efforts to provide information and tools to local officials, residents, and others interested in PAYT. To find out more about how these programs work, review the following sections:

Communities

- View maps showing the kinds of programs communities are using, read testimonials from local planners, or find a program near you.

Articles & Research

- Read through studies from the growing body of PAYT research and browse more than 50 magazine articles on PAYT.

Publications

- Explore products designed to help communities plan and implement a program.

Events

- Find an upcoming PAYT event near you.

Topics

- Find detailed information on PAYT organized by topic, complete with links to case studies and related products.

Links

- Connect to other Web sites containing additional ideas and material on PAYT.

FAQ

- Review answers to frequently asked questions about these programs.

Site Map

- Scan a complete, linked list of this site's contents for the information you need.

Thousands of communities across the country are using PAYT to manage trash in a way that is fair, economically sound, and environmentally sustainable. EPA hopes that this Web site will provide you and your organization with all the information you need.

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Last updated on Wednesday, February 22nd, 2006
URL: http://www.epa.gov/epaoswer/non-hw/payt/intro.htm

United States Environmental Protection Agency
Solid Waste and Emergency Response (5305W)
EPA530-F-96-031
April 1997

EPA

Pay-As-You-Throw

A Fact Sheet for Elected Officials

As an elected official in your community, you have many responsibilities besides municipal solid waste (MSW) management-but it's an important service.

Residents in most communities have come to expect efficient, reliable trash collection and disposal, and they tend to support those officials who can get the job done.

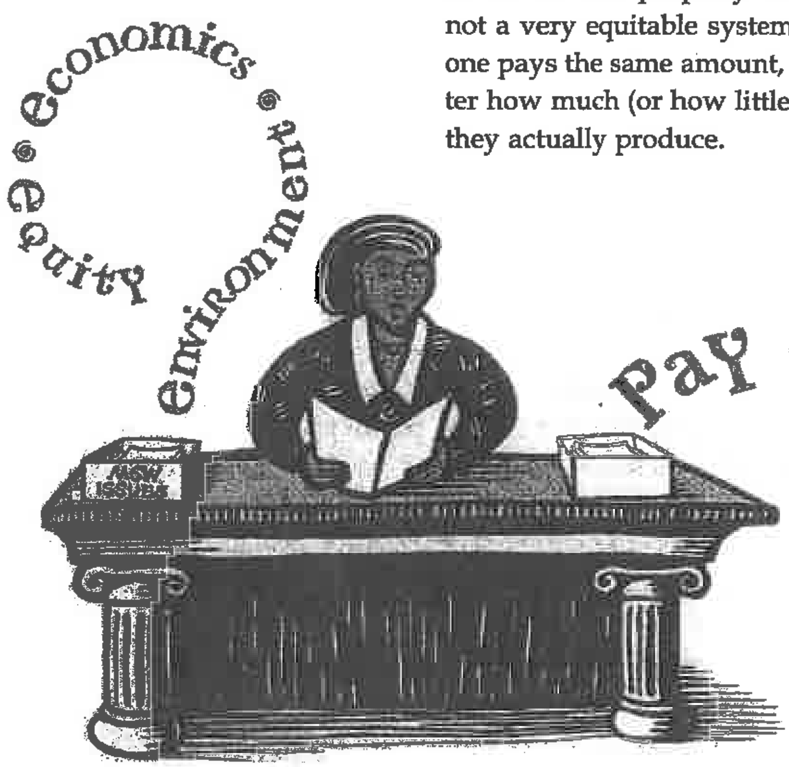
This task has been growing more complicated, however. First of all, it's likely that your residents are generating more waste each year, even if you have a recycling program in place.

That can mean escalating costs. And whether your residents pay for MSW services through a direct, flat fee or via their property taxes, it's not a very equitable system: everyone pays the same amount, no matter how much (or how little) trash they actually produce.

What is pay-as-you-throw?

Fortunately, there is a system that can help your MSW management personnel meet these challenges. In nearly 2,000 communities across the country, a program called "pay-as-you-throw" is offering residents a more equitable way to pay for collection and disposal of their trash-while, at the same time, encouraging them to create less waste and increase the amount they recycle.

Pay-as-you-throw programs, also called unit-based or variable-rate pricing, provide a direct economic incentive for residents to reduce waste. Under pay-as-you-throw, households are charged for waste collection based on the amount of waste they throw away-in the same way that they are charged for electricity, gas, and other utilities. If they throw away less, they pay less. Some communities charge residents for each bag or can of waste they generate. In a few communities, households are billed based on the weight of their trash.



What are the benefits of pay-as-you-throw?

Pay-as-you-throw gives residents greater control over their costs. While they may not realize it, your constituents are paying for waste management services. And whether they pay through taxes or with a flat fee, residents who generate less and recycle more are paying for neighbors that generate two or even three times as much waste. When a few residents generate more waste, everyone pays for it. With pay-as-you-throw, residents who reduce and recycle are rewarded with a lower trash bill.

As a result, households under pay-as-you-throw tend to generate less waste. Communities with programs in place have reported reductions in waste amounts ranging from 25 to 35 percent, on average. Recycling tends to increase significantly as well. And less waste means that a community might be able to spend less of its municipal budget on waste collection and disposal-possibly even freeing up funds for other essential services like education and police protection.

Because residents stand to pay less (if they generate less), pay-as-you-throw communities have typically reported strong public support for their programs. The initial reaction from residents can vary, however-some residents might feel that the program is no more than an added charge. To address this, it is important to explain to residents at the outset how the program works, why it is a more equitable system, and how they can benefit from it. Pay-as-you-throw has tended to work best where elected officials and other community leaders have reached out to residents with a thorough education campaign.

Many of the resulting programs have been highly successful and have often attracted attention. In some cases, pay-as-you-throw has worked so well that the communities have become models in their region, demonstrating how MSW services can be improved. And within the community, elected officials can point to pay-as-you-throw as an example of municipal improvements they helped bring about.

equity

Pay-as-you-throw is fair; residents pay only for the waste they throw away.

economics

Residents who reduce and recycle save money—and less waste helps municipalities cut costs, too.

environment

Fewer natural resources are used and landfill space is saved, reducing the need to site new facilities.

Are there disadvantages to pay-as-you-throw?

While there are potential barriers to a successful program, communities with pay-as-you-throw report that they have found effective solutions. Illegal dumping is a frequently raised issue. While it is often assumed that illegal dumping will increase once residents are asked to pay for each container of waste they generate, most communities with pay-as-you-throw have found this not to be the case. This is especially true when communities offer their residents recycling, composting for yard trimmings, and other programs that allow individuals to reduce waste legally. Others, particularly lower-income residents, worry about the amount they will have to pay. In many communities, however, coupon or voucher programs are being used to help reduce trash collection costs for these households.

How can I learn more about pay-as-you-throw?

EPA has developed a series of products for anyone interested in pay-as-you-throw. Individuals looking for more information on these programs can request additional fact sheets, community success stories, and other materials. For local solid waste planners interested in bringing pay-as-you-throw to their community, EPA has developed a comprehensive set of tools to help them design and implement a successful program. To find out more about EPA's collection of products, call the Pay-as-you-throw Helpline toll free at 888-EPA-PAYT.

U.S. Environmental Protection Agency

Pay As You Throw

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Volume- vs. Weight-Based Programs

Communities considering pay-as-you-throw must determine whether they will charge residents for waste management services based on the volume or weight of their trash. The two program types have very different design and equipment requirements.

Most communities charge residents by volume, using either bags or cans (or tags or stickers indicating specific can or bag sizes) as their program's unit of measure. A small number of communities are trying weight-based programs, under which collection crews measure at the curb the amount of waste a household sets out for collection. Solid waste planners need to decide which approach to use, based on overall program goals, budget constraints, and other factors.

RELATED TOPICS

- Goal Setting
- Container Options
- Rate Structure Design
- Enforcement
- Administration and Staffing

Volume-based programs

Under a volume-based system, residents are charged for waste collection based on the number and size of waste containers that they use. In some communities, households are charged directly for waste collection (usually through direct billing) based on the number of bags or cans set out at the curb. Others require their residents to purchase special trash bags, tags, or stickers that include the cost of waste collection in the purchase price. Communities basing their programs on trash volumes typically select a rate structure design that includes one of these two options.

Volume-based systems tend to be significantly less expensive to set up, operate, and administer than weight-based programs. In some communities, simple programs using bags, tags, or stickers have been implemented without requiring a large number of waste management changes or incurring major new expenses. As a result, the vast majority of pay-as-you-throw (PAYT) programs currently are based on volume.

One potential disadvantage of volume-based programs is trash compaction. Since residents pay based on the size of their containers, there is a temptation to try to fit as much trash as possible into each bag or can. This can make the task of picking up trash harder for collection crews. It also may reduce the waste reduction incentive for residents. To address this, many cities and towns have placed a weight limit per bag or can and enforce this limit during curbside collections.

Weight-based programs

Under weight-based systems, waste is weighed at the curb and residents are billed for collection and disposal by the pound. Depending on the equipment used, the program can either require residents to use standard, municipally supplied cans or allow them to continue using their own cans. Weight-based systems offer the most direct incentive to reduce waste: every pound of trash that residents prevent, recycle, or compost results in direct savings. In addition, residents often easily understand this type of system and perceive it as fair.

Weight-based systems tend to be more expensive to implement and operate than a volume-based approach. Special equipment is required, including truck-mounted scales for weighing waste and some type of system (for example, bar-coding on waste cans) for recording this information and entering it into a computer. Residents then need to be billed for this service, which may increase a municipality's staffing needs.

As a result, very few communities have fully implemented weight-based PAYT systems. Currently, however, innovations in equipment to weigh and record data are beginning to make these systems more feasible for some communities. For example, bar codes or radio-frequency identification tags are declining in price, scales can weigh cans on an incline or in motion, and computerized data collection and billing systems have been improved.

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United States Environmental Protection Agency
Solid Waste and Emergency Response (5305W)
EPA530-F-96-028
April 1997

EPA

Pay-As-You-Throw

Throw Away Less and Save

Pay As You Throw

You probably know how much you spend per month on your electricity and gas utilities. But do you know how much you spend on garbage?

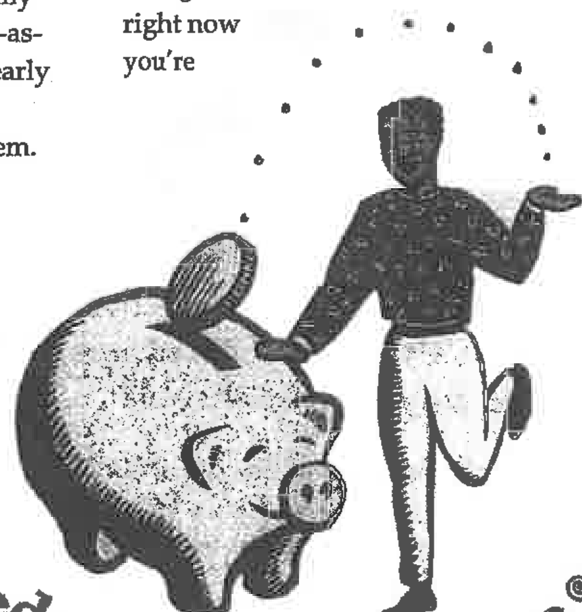
Each time your city or town sends a truck down your street to pick up your trash, it costs money. It costs money even if you drop off your trash at a local dump. Ultimately, you pay for this service, usually through your local taxes. And it's not likely that you have much control over the amount you pay, regardless of how much garbage you create.

There is a different system, however, under which residents are asked to pay for waste collection directly-based on the amount of garbage they actually generate. They're called "pay-as-you-throw" programs, and nearly 2,000 communities across the country have begun using them.

What is pay-as-you-throw?

Pay-as-you-throw is a different way of paying for waste collection and disposal services. In some pay-as-you-throw communities, it works on a per-container basis: households are charged for each bag or can of waste they generate. A few communities bill residents based on the weight of their trash. Either way, the system motivates people to recycle more and think about how to generate less waste in the first place.

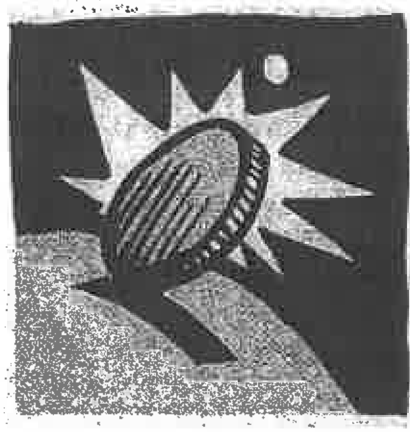
For community residents, however, the most important advantage of pay-as-you-throw may be the fairness and greater control over costs that it offers. Do you have neighbors who never seem to recycle and always leave out six or seven bags of trash? While you may not have thought about it, right now you're



Save As You Reduce and Recycle

helping them pay for that waste. Under pay-as-you-throw, everyone pays only for what they generate-so you won't have to subsidize your neighbor's wastefulness any more. It's only fair. With pay-as-you-throw, when you recycle and prevent waste, you're rewarded with a lower trash bill.

Because of these potential cost savings, both you and your neighbors will naturally want to reduce the amount of waste that you generate. And when people reduce waste, that can mean lower costs for your community, since it costs less to collect and dispose of everyone's trash. This might even free up funding for other municipal services you depend upon-like schools and fire and police protection.



When people generate less waste and recycle more, fewer natural resources are used and there is less pollution from manufacturing.

In addition, the pay-as-you-throw incentive to put less waste at the curb can make a big environmental difference. When people generate less waste and recycle more, fewer natural resources are used and there is less pollution from manufacturing. Valuable landfill space is conserved as well, reducing the need to site new facilities.

Are there disadvantages to pay-as-you-throw?

While there are potential barriers to a successful program, communities with pay-as-you-throw report that they have found effective solutions. Illegal dumping is a frequently raised issue. While people often assume that illegal dumping will increase once residents are asked to pay for each container of waste they generate, most communities with pay-as-you-throw have found this not to be the case. This is especially true when communities offer their residents recycling, composting for yard trimmings, and other programs that allow individuals to reduce waste legally. Others, particularly lower-income residents, worry about how much they will have to pay. In many communities, however, coupon or voucher programs are helping to defray their expenses.

What can I do?

If you're interested in pay-as-you-throw, talk to your town planner or local elected representatives! Ask them if they know about pay-as-you-throw and whether they would consider using it in your community. In addition, if you want to learn more about pay-as-you-throw, or if your local town planner is seeking specific tools to help design and implement pay-as-you-throw in your community, EPA has developed a wide range of products that can help. To find out more about EPA's collection of community success stories, program-planning tools, guidebooks, and other products, call the Pay-as-you-throw Helpline toll free at 888-EPA-PAYT.

Appendix P

Air Burner, Stationary Compactor & Scale Data

SWS Equipment, Inc.

P.O. Box 13040
Spokane Valley, WA 99213-3040
509-533-9000   1-800-892-7831

QUOTE

Quote #:	ROCBQ8174
Date:	02/06/19
Sales Rep:	Roger Beatty
Customer No:	

Quote To:
Great West Engineering
Bob Church

Helena MT
406-495-6177   Fax:

Ship To:
Great West Engineering
Bob Church

Helena MT
406-495-6177

FOB:	Boulder MT
Ship Via:	BESTWAY
Est. Ship Date:	
Terms:	BUDGET QUOTE

We are pleased to propose the following for your consideration

Qty	Description	Unit Price	Ext. Price
1	RJ-450	$67,000.00	$67,000.00
2	RJ-40-OC (7 gauge sides) — Containers		
	Tri-Volt 208, 230, 460 power units		
1	Pressure Gauge (fluid filled) - mounted on Remote Power Pack		
1	Photoelectric Cycle Control (includes Full Container Light, Automatic Shut-down, Start-Up Alarm, and Adv Warning Light)		
Top 1	Side Feed Hopper - 3 Sided 3 & 4 cy (mounted) Specify LH or RH open		
1	Container Guide - 15'L x 3 1/2" H with stops		
1	Hinged Breaker Bar Teeth - mounted		
1	NO Install Quote at this time		
1	Steel Surcharge		
1	Freight to Boulder MT		
		Order Total	**$67,000.00**

PRICES SUBJECT TO CHANGE DUE TO CHANGING STEEL PRICES - THANK YOU!

By:____________________ Accepted____________________ Date________

QUOTE VALID FOR 30 DAYS

PAYMENT DUE UPON COMPLETION OF WORK OR AS SPECIFIED ABOVE

Mini Transfer stations

Municipal recycling drop off enters

Large warehouses

Distribution centers

Manufacturing facilicites

RJ-450 4 Cubic Yard Compactor

The RJ-450 compactor from Marathon features an extra-large 60-inch (1524mm) by 67 1/2-inch (1715mm) clear top opening that accepts large, bulky items with ease. Ruggedly built to meet the challenge, this unit packs a powerful 56,500 (25,628 kg) pounds of crushing force. And, the RJ-450 is built for performance and reliability as only Marathon, the solid waste inudustry's specialist in on-site compaction systems, can provide.

Industrial Grade Systems

The RJ-450 features industrial-grade electrical and hydraulic systems that are UL and CUL Listed. This means trouble-free operation and top performance year after year. Marathon's side-mounted power unit combines the convenience and ease-of-maintenance that comes with a remote power pack with the space savings and ease-of-installation of an integrated power pack.

Cart Dumpers, Chutes, and Hoppers

The RJ-450 can be fitted with a variety of material handling equipment such as chutes, hoppers, and dumpers. The compactor shown is fitted with a side fed hopper and a ground level dumper. Cart dumpers can be custom built to your specifications to accomodate existing cart systems.

The RJ-450 features Marathon's side-mounted power unit. The power unit offers the convenience and ease-of-maintenance of a remote power pack with the space savings of an integrated power pack. The configuration also eliminates ALL electrical components from inside the compactor.

Images shown with optional equipment

Ram Guide System

The packing ram is supported by specially formulated cast iron shoes which ride on replaceable wear strips. This exclusive design protects the charge box floor from the full force of the packing ram, extending its life and dramatically reducing compaction-robbing friction.

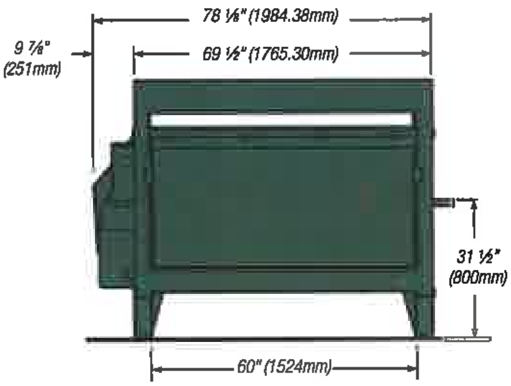
Control Station

The RJ-450 features an advanced, simplified 2-button control system. It is a key-operated, fully automatic and contained in a weatherproof NEMA 4 enclosure. Connected to the power pack with 13-feet (3.96m) of Sealtite®, the controls can be located for operator convenience.

Dimensions

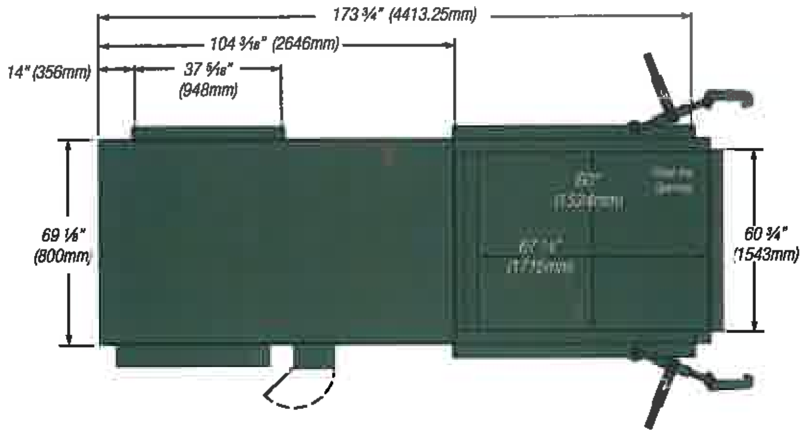
RJ-450

FRONT VIEW

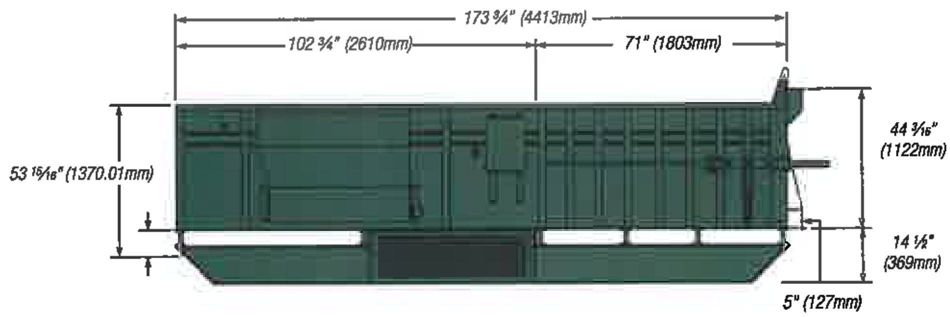


TOP VIEW

22 ½" (572mm) Retracted Min.
31 ½" (800mm)" Extended Max.



SIDE VIEW



RJ-450 Stationary Compactor

Dimensions and Specifications

Specifications	RJ-450	
Charge Box Capacity		
[Mfr. Rating]	4.0 cu yd	3.06 m³
[NWRA Rating]	2.97 cu yd	2.27 m³
Clear Top Opening	67 1/2"L x 60"W	1715mm x 1524mm
Performance Characteristics:		
Cycle Time	50 sec.	50 sec.
Total Normal Force	48,000 lbs	214 kN
Total Maximum Force	56,500 lbs.	25,628 kg
Normal Ram Face Pressure	23.5 psi	162 kPa
Maximum Ram Face Pressure	27.7 psi	191 kPa
Ram Penetration	13"	330mm
Electrical Equipment:		
Electric Motor 3/60/230-460	15 hp	11.1kW
Electric Control Voltage	120 VAC	120VAC
UL® and CUL® Listed Panel Box: NEMA Type, All Circuits Fused		
3-Button Controls: Keylock Start, Stop, Reverse		
Hydraulic Equipment:		
Hydraulic Pump	18.5 gpm	38 L/min
Normal Pressure	1700 psi	117 bar
Maximum Pressure	2000 psi	138 bar
Hydraulic Cylinder - Bore	6"	152mm
Hydraulic Cylinder - Rod	4"	102mm
Weight	8,000 lbs	3629 kg

PANDORA
INTELLIGENT NETWORKS

You can add the Pandora Remote Monitoring System to many of our most popular compactors. For information about adding Pandora, please contact your Marathon salesperson.

Compactor Rental and Leasing Programs Available

For detailed specifications, recommendations, or free economic studies comparing various systems, contact Marathon Customer Care at ***1-800-633-8974***.

RAMJET
Stationary and self-contained compactors.

Authorized Dealer:

MARATHON® A DOVER COMPANY
Marathon Equipment Company
P.O. Box 1798
Vernon, AL 35592-1798
800.633.8974
www.marathonequipment.com

NJPA Contract #060612-ESG

National Waste & Recycling Association
Collect. Recycle. Innovate.

ISRI MEMBER

Environmental Solutions Group
A DOVER COMPANY
www.doveresg.com

You Tube

Pictures in this literature are illustrative only. Specifications are subject to change without notice in order to accommodate improvements to the equipment. Certified in compliance with ANSI standard Z245.2, applicable OSHA Regulations, and certified under WASTEC's Stationary Compactor Certification Program. Products must be used with safe practice and in accordance with said regulations and standards.

Gallatin Scales, Inc.
PO Box 610
Manhattan, MT 59741

QUOTE

10-04-18
Great West Engineering
Attn: Bob Church
Helena, MT

RE: Truck Scales / Tri County

One Cardinal model 1010225 Armor Steel Deck Truck Scale 80 ton, 50 ton CLC ,11 ft x 50 ft with 225D Digital Indicator	$ 40,870.00
One Cardinal model 1010227 Armor Steel Deck Truck Scale 135 ton, 50 ton CLC 11 ft x 70 ft	$ 49,488.00
One Cardinal SAT225DPHB Unattended Weight Indicator includes Digital Indicator, Printer and Badge Reader	$ 7,189.00
Requires Cardinal WinVRS Software to operate	$ 4,695.00
TOTAL	$ 102,242.00

NOTE: Price Does not include Freight or Foundation work
NOTE: Optional 4 inch pipe Siderails $ 59.00 per foot x length of scale

Bob, if you have any questions please call me.

Gallatin Scales, Inc
Brian Ritts 406-284-6672
406-581-6672

Badge Cost

Cardinal®

ARMOR® TRUCK SCALES

SMARTCELL® DIGITAL LOAD CELLS

STEEL DECK SERIES

- *SmartCell® stainless steel, waterproof digital load cells*
- *No moving parts below the scale deck, including load cells*
- *IoT-enabled iSite remote monitoring software*
- *Heavyweight 50-ton CLC standard*

Cardinal Scale's ARMOR® digital truck scales come in a wide variety of standard models available (listed on the back page), plus custom-engineered designs.

UNDISPUTED HEAVYWEIGHT CHAMPION

DIGITAL TRUCK SCALES OFFERING UNMATCHED PERFORMANCE BUILT TO LAST A LIFETIME

Cardinal Scale's ARMOR® series digital truck scales with SmartCell® load cells offer unmatched performance built to last a lifetime of heavy-duty weighing use. Every facet of the scale weighbridge and electronics have been specifically built for long-lasting endurance, minimal upkeep, and IoT monitoring convenience. The long-lasting, baked-on, anti-corrosion tan powder coat paint finish ensures a lifetime of trouble-free protection.

The NTEP legal-for-trade ARMOR® series arrives fully prepared for quick installation with load cells and stands pre-installed. Cardinal Scale's unique axis® frictionless centering system provides gravity-driven dynamic centering to restrain deck movement and vibration. Every ARMOR® steel deck truck scale is 100% assembled, pre-calibrated, and tested before shipping.

EXCLUSIVE LOAD CELL PROTECTION

Load cells are the most sensitive part of any truck scale and Cardinal Scale offers the ultimate protection in the ARMOR's SmartCells. Each IP69K-rated waterproof stainless steel load cell is completely encapsulated and filled with a potting compound to fill all internal voids and prevent any potential for moisture entering the load cell and causing premature failure.

SmartCell® digital load cell cables are metal braided and run in a continuous galvanized steel conduit for optimal protection against rodents.

Optional bolt-on guide rails are available to help drivers stay centered on the scale.

225 NAVIGATOR

iSITE

The Cloud-based iSite remote monitoring software comes standard with all ARMOR digital truck scales and offers e-mail and/or text alerts to your authorized Cardinal Scale dealer ensuring your scale is performing at all times during peak operations.

Cardinal's 225D Navigator weight indicator provides truck ID numbers and truck tares, plus diagnostic readouts onscreen for individual digital load cells.

TAKE A LOOK INSIDE AN ARMOR® WEIGHBRIDGE TO SEE WHY IT'S THE BEST TRUCK SCALE ON THE MARKET

MORE STRUCTURAL STEEL THAN THE COMPETITION

ARMOR® steel deck weighbridges utilize a tight concentration of 7.5-inch I-beam spacing which minimizes unsupported deck plate area and ensures that truck tire contact patches are always directly supported by one I-beam. Four rows of welded stiffeners provide maximum structural rigidity and safeguard against I-beam deflection under loads for optimal strength and longevity.

ARMOR TRUCK SCALES®

SMARTCELL® DIGITAL LOAD CELLS

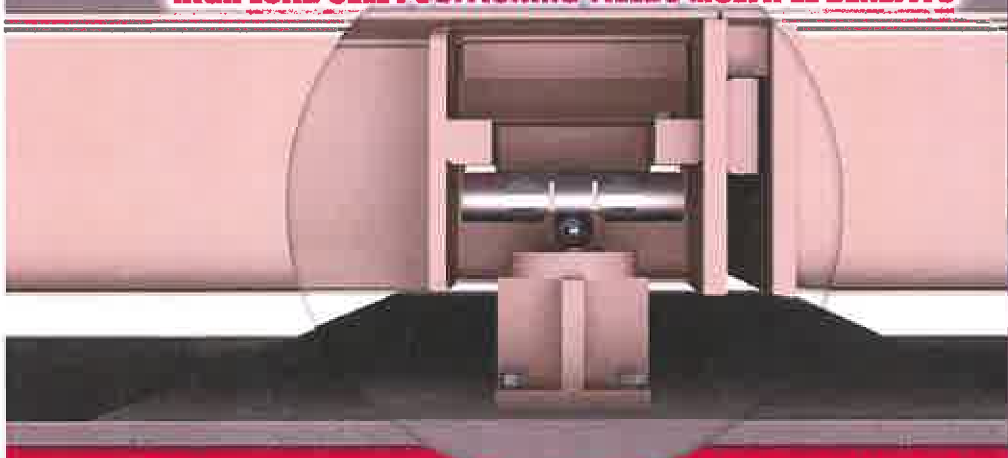
Cardinal Scale's SmartCell® digital load cells are the newest solution in advanced load cell technology. Messy, time-consuming wiring is no longer necessary—cables connect plug-and-play to the cell through metal braided rodent-proof cables. An added bonus for such a simple cell-to-cable design is load cells are linked directly to one another, yielding a more convenient, user-friendly load cell system. Internal cell circuitry eliminates the need for a junction box. Individual cells may be monitored remotely via iSite Cloud-based software.

axis® FRICTIONLESS CENTERING SYSTEM

axis® Frictionless Centering System

Cardinal Scale's axis® frictionless centering system is the new frontier for load-centering technology and provides gravity-driven dynamic centering. The axis' durable ball suspension system utilizes gravity to restrain deck movement and vibration; in fact, the heavier the load is, the better. Since the ball is constantly seeking its radius in the stand cup below and the load cell above, it will absorb movements from the truck moving on the weighbridge and bring the weighbridge to rest more quickly and smoothly.

HIGH LOAD CELL POSITIONING YIELDS MULTIPLE BENEFITS



There are no moving parts below the ARMOR® weighbridge, including the load cells, which eliminates build-up failures due to corrosion, sediment, and debris. The axis® load cell stands are fabricated from one-inch-thick steel to minimize rust and corrosion damage and ensure long-term strength and durability.

WEIGHBRIDGE DESIGN STRENGTH ADVANTAGES

The ARMOR's SmartCell® load cell pockets are surrounded on both sides by I-beams which run the entire length of the weighbridge. This alleviates any potential structural weakness around the load cell region like in competitors' truck scales. The no-bolt bridge connections feature interconnecting load blocks and receivers welded directly to the I-beams for strength and durability.

ARMOR® TRUCK SCALES

SMARTCELL® DIGITAL LOAD CELLS

ARMOR® Digital Truck Scale Steel Deck Models

LENGTH	Overall Capacity	CLC	Number Of Sections	WIDTH 10 Ft.	11 Ft.	12 Ft.	14 Ft.
12 ft.	50 tons	50 tons	2	1010200	1010219	1010238	1010257
20 ft.	50 tons	50 tons	2	1010201	1010220	1010239	1010258
25 ft.	50 tons	50 tons	2	1010202	1010221	1010240	1010259
30 ft.	70 tons	50 tons	3	1010203	1010222	1010241	1010260
40 ft.	70 tons	50 tons	3	1010204	1010223	1010242	1010261
47 ft.	70 tons	50 tons	3	1010205	1010224	1010243	1010262
50 ft.	80 tons	50 tons	4	1010206	1010225	1010244	1010263
60 ft.	110 tons	50 tons	4	1010207	1010226	1010245	1010264
70 ft.	135 tons	50 tons	4	1010208	1010227	1010246	1010265
75 ft.	135 tons	50 tons	4	1010209	1010228	1010247	1010266
80 ft.	135 tons	50 tons	5	1010210	1010229	1010248	1010267
90 ft.	135 tons	50 tons	5	1010211	1010230	1010249	1010268
100 ft.	135 tons	50 tons	6	1010212	1010231	1010250	1010269
110 ft.	135 tons	50 tons	6	1010213	1010232	1010251	1010270
117 ft.	135 tons	50 tons	6	1010214	1010233	1010252	1010271
120 ft.	135 tons	50 tons	6	1010215	1010234	1010253	1010272
125 ft.	135 tons	50 tons	6	1010216	1010235	1010254	1010273
140 ft.	135 tons	50 tons	7	1010217	1010236	1010255	1010274
160 ft.	135 tons	50 tons	8	1010218	1010237	1010256	1010275

LEGAL FOR TRADE

ARMOR Weighbridge:
Cert. No. 17-047

SCBD Load Cell:
Cert. No. 16-088

MEASUREMENT CANADA

Notice of Approval
AM-4890

ARMOR® Digital Truck Scale Steel Deck Multi-Platform Models

LENGTH	Overall Capacity	CLC	WIDTH 11 Ft.
12, 20, 40 ft.	135 tons	50 tons	1010750
15, 15, 50 ft.	135 tons	50 tons	1010751
20, 20, 40 ft.	135 tons	50 tons	1010752

CLC = Concentrated Load Capacity: The maximum axle-load concentration for a group of two axles with a center line spaced 4' apart and an axle width of 8' that can safely be applied to the scale.

Other sizes and capacities readily available. Please consult the Cardinal Scale factory for more options.

Cardinal Scale reserves the right to improve, enhance, or modify features and specifications without prior notice.

Cardinal®

Cardinal Scale Manufacturing Co.
203 E. Daugherty, Webb City, MO 64870 USA
Ph: 417-673-4631 or 800-441-4237 • Fax: 417-673-2153
www.CardinalScale.com

Mobile: m.cardinalscale.com

SOLD BY:

Cardinal®

Bulletin No. 405

SATELLITE
UNATTENDED WEIGHING

Unattended Truck Scale Terminals

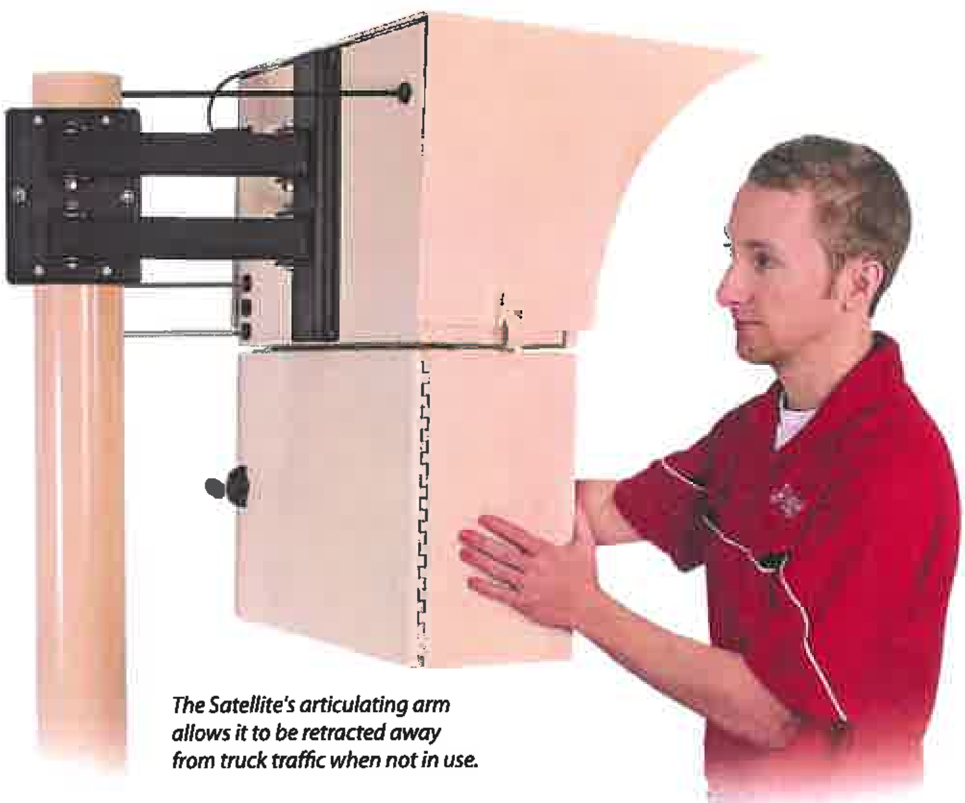
Cardinal Scale's USA-made Satellite series unattended weighing kiosks provide the ultimate experience in unmanned truck scale efficiency and streamlined data integration.
The lockable, weather-proof enclosure features a modern design aesthetic with optional rainhood/sun deflector. Select a Satellite model with the features you need, including a high-speed thermal cutbar tape printer, proximity badge reader (AWID and HID), backlit LCD graphics display, and with or without a rainhood.

True to its name, the Satellite offers independent remote control over your weighing operations and connects the truck scale to SB500 remote displays with integrated traffic signals, existing computer networks, other digital weight indicators, and WinVRS vehicle recording software.

LED lighting strip included for night time visibility on all models that include a rainhood.

Allows the Driver to Remain in the Vehicle While Weighing

Reduces Risk Associated with Drivers Walking Across Platforms



The Satellite's articulating arm allows it to be retracted away from truck traffic when not in use.

Retractable Articulating Arm

Cardinal's Satellite may be mounted on a wall or pole (complete mounting bracket included), and the unique articulating arm allows the kiosk to be pulled toward the truck driver while weighing and then retracted away from the truck when not in use (11 in/27 cm extension).

The weatherproof QWERTY keyboard with navigation arrow keys and main soft keys provides driver input prompting controls. Fast, accurate, and easy to operate, the Satellite series offers models with a brilliant 640 x 480 pixel full-color graphics LCD touch-screen display and 10/100 Base-T Ethernet standard (TCP/IP or EIP). USB-B connectivity is standard on all models.

Easily Change Ticket Rolls

Printing unattended truck weight tickets has never been easier than with the Satellite's high-speed thermal cutbar tape printer. The printer with silkscreened sign on the front of the enclosure easily identifies for drivers where they are to retrieve their ticket. To easily refill paper rolls, simply swing out the articulating arm and unlock the cabinet from the back for internal printer access. An interior heater with thermostat comes standard in all Satellite printer cabinets for year-round, weather-proof usage.

These unattended weighing terminals allow the driver to remain in their vehicle while weighing which reduces the risk associated with walking across truck scale platforms and traffic lanes. Not only is this a safer method of receiving truck weights, but it also speeds the weighing process for optimal efficiency and reduces overall operating costs.

6-inch diameter x 3.15-inch wide direct thermal paper roll (6600-1080)

High-Speed Thermal Printer | Easy to Refill Paper Rolls

WinVRS

Vehicle Recording Software Data Management Integration

The Satellite unattended weighing kiosk may be interfaced via Wi-Fi or wired Ethernet to Cardinal's WinVRS Vehicle Recording System for seamless acquisition and integration of weight data to generate versatile reports of transactions. Truck ID storage comes standard in the Satellite series, and versatile connectivity ports allow weight data to be sent directly into recordkeeping software.

- Transportation / Ports
- Solid Waste / Landfills / Transfer Stations
- Mining / Sand & Gravel / Aggregates
- Agriculture / Grain Terminals
- Construction Materials / Recycling
- Manufacturing / Textiles
- Load-out Facilities
- Chemical Plants

USA MADE

SAT225PH	Unattended Weighing Kiosk with 225 Indicator / Printer / Rainhood	• 225 Weight Indicator/Terminal • Thermal Cutbar Tape Printer • Wall or Pole Mounted, Weatherproof Enclosure with Articulating Arm • Internal Heater With Thermostat • With Rainhood And LED Lamp
SAT225P	Unattended Weighing Kiosk with 225 Indicator / Printer	• 225 Weight Indicator/Terminal • Thermal Cutbar Tape Printer • Wall or Pole Mounted, Weatherproof Enclosure with Articulating Arm • Internal Heater With Thermostat
SAT225PHB1	Unattended Weighing Kiosk with 225 Indicator / Printer / Proximity Badge Reader / Rainhood	• 225 Weight Indicator/Terminal • Proximity Badge Reader • Thermal Cutbar Tape Printer • Wall or Pole Mounted, Weatherproof Enclosure with Articulating Arm • Internal Heater With Thermostat • With Rainhood And LED Lamp
SAT225PB1	Unattended Weighing Kiosk with 225 Indicator / Printer / Proximity Badge Reader	• 225 Weight Indicator/Terminal • Proximity Badge Reader • Thermal Cutbar Tape Printer • Wall or Pole Mounted, Weatherproof Enclosure with Articulating Arm • Internal Heater With Thermostat
SAT825PH	Unattended Weighing Kiosk with 825 Indicator / Printer / Rainhood	• 825 Weight Indicator/Terminal • Thermal Cutbar Tape Printer • Wall or Pole Mounted, Weatherproof Enclosure with Articulating Arm • Internal Heater With Thermostat • With Rainhood And LED Lamp
SAT825P	Unattended Weighing Kiosk with 825 Indicator / Printer	• 825 Weight Indicator/Terminal • Thermal Cutbar Tape Printer • Wall or Pole Mounted, Weatherproof Enclosure with Articulating Arm • Internal Heater With Thermostat
SAT825PHB1	Unattended Weighing Kiosk with 825 Indicator / Printer / Proximity Badge Reader / Rainhood	• 825 Weight Indicator/Terminal • Proximity Badge Reader • Thermal Cutbar Tape Printer • Wall or Pole Mounted, Weatherproof Enclosure with Articulating Arm • Internal Heater With Thermostat • With Rainhood And LED Lamp
SAT825PB1	Unattended Weighing Kiosk with 825 Indicator / Printer / Proximity Badge Reader	• 825 Weight Indicator/Terminal • Proximity Badge Reader • Thermal Cutbar Tape Printer • Wall or Pole Mounted, Weatherproof Enclosure with Articulating Arm • Internal Heater With Thermostat
SATP	Satellite Outdoor Printer	Aftermarket Add-on Option
SATH	Satellite Rainhood	Aftermarket Add-on Option

DIMENSIONS

SAT225PH / SAT225PHB1 / SAT825PH / SAT825PHB1	21.7 in W x 18.1 in D x 28 in H / 55 cm W x 46 cm D x 71 cm H
SAT225P / SAT225PB1 / SAT825P / SAT825PB1	21.3 in W x 8.3 in D x 28 in H / 54 cm W x 21 cm D x 71 cm H
SATP (Satellite Printer Only)	21.3 in W x 8.3 in D x 14 in H / 54 cm W x 21 cm D x 36 cm H
SATH (Satellite Rainhood Only)	21.7 in W x 18.1 in D x 13.8 in H / 55 cm W x 46 cm D x 35 cm H

Cardinal Scale reserves the right to improve, enhance or modify features and specifications without prior notice. All registered trademarks are the property of their respective owners.

USA MADE   ISO REGISTERED 9001   SINCE 1950

Cardinal®
Cardinal Scale Manufacturing Co.
203 E. Daugherty, Webb City, MO 64870 USA
Ph: 417-673-4631 or 800-441-4237 • Fax: 417-673-5001
www.CardinalScale.com
Mobile: m.cardinalscale.com

SOLD BY:

WIZARD
Waste WORKS
WALKER

Carolina Software, Inc.
Phone: 910-799-6767 - Fax: 910-799-1177
PO Box 3097 - Wilmington, NC - 28406
www.wasteworks.com

WasteWIZARD

Proposal #
BO43406

WasteWORKS for Solid Waste Management

Estimate for WasteWIZARD kiosk (stainless)(keypad entry)

WasteWORKS and WasteWIZARD
Bob Church/Tri-County Disposal
bchurch@greatwasteno.com

Updated
11/2/2018

Section 1 - WasteWIZARD Software and Hardware -	Unit Price	Qty	WasteWIZARD Ext. Price
WasteWORKS-SQL Additional Site License (core system)	$5,950.00	1	$5,950.00
WasteWORKS Support and Maintenance for Additional Site: $500/quarter			
WasteWIZARD Automation License	$4,950.00	1	$4,950.00
WasteWIZARD Additional Lane License	$2,950.00	0	$0.00
WasteWIZARD Support and Maintenance is $200/quarter			
(WasteWIZARD Kiosk Hardware(Stainless model))			
Keypad with backlit display	$677.05	1	$677.05
Proximity Card Reader	$575.87	0	$0.00
Proximity Cards	$6.02	0	$0.00
Digi PortServer TS 4 port server device (one for each box)(printers/scales)	$699.00	1	$699.00
Digi PortServer TS 2 port server device (connect scales to network)	$575.50	1	$575.50
IP Intercom System- Base Station, Controller and Door Mounted Remote	$1,732.50	1	$1,732.50
WasteWORKS PLC Controller for Red/Green Kiosk lights and gate	$587.50	1	$587.50
Relay for Gate	$100.00	1	$100.00
Stainless Steel 20x20x12 enclosure	$1,386.96	1	$1,386.96
Electric Heater/Fan for Enclosure 200W (with Thermo)	$450.00	1	$450.00
Custom white powder coated steel 20x20x12 enclosure	$1,386.96	0	$0.00
Electric Fan with Filter for Enclosure	$450.00	0	$0.00
Galvanized Flanges for mounting (box and floor flange) (if needed)	$79.50	0	$0.00
Swing-Away Hood: 4 sided	$850.00	1	$850.00
Swing-Away Hood Post	$625.00	1	$625.00
Build Wizard box and install components	$2,000.00	1	$2,000.00
Cables and connectors - lot (includes ethernet switch,wiring,terminals,breakers)	$700.00	1	$700.00
Kiosk ticket printer (Telpar) (**Outbound printer only)	$787.50	1	$787.50
Inside Serial Printer (Star TS700)	$581.67	1	$581.67
Shipping (hardware to shop from vendors- and to job site)	$1,000.00	1	$1,000.00
(Subtotal Section 1- Vendor Software and Hardware Cost)			$23,652.68

$11,000 SOFTWARE

$12,500 KIOSK

Section 2: Optional WasteWORKS Vision (may be added later)			
(Optional WasteWORKS Vision)			
WasteWORKS Vision Image Capture Software (per lane)	$1,000.00	1	$1,000.00
WasteWORKS Vision Camera (outdoor, vari-focal, bullet camera)	$499.00	1	$499.00
WasteWORKS Vision Video Server (converts video signal to IP)	$427.50	1	$427.50
Totals - Optional WasteWORKS Vision Image Capture System (single camera)			**$1,926.50**

CAMERA

Section 3: Installation and Training			
Remote Assistance	$990.00	1.00	$990.00
On-site installation & training	$990.00	2.00	$1,980.00
Meals and lodging per diem	$400.00	3.00	$1,200.00
Airfare	$1,000.000	1	$1,000.00
(Subtotal Section 3 - Installation and Training Cost)			$5,170.00

Install & Training

Grand Totals - WasteWIZARD Installed **$30,749.18**

OPTIONAL:

Additional training days @ $990/day plus per diem, if needed

Mileage/Airfare will be billed at actual (if applicable)
We will install the newest version of WasteWORKS for Windows on your computers (if applicable)
We will provide training for all applicable WasteWORKS functions (if applicable)
We will assist with connection between scale and computer(s) if needed
Prices do not include shipping or sales tax, if any
Does not include prices for any additional hardware that may be needed
This is an estimate.
Installation and training to be invoiced upon completion.
We will install PCAnywhere for data transfer and dial-up support. (If needed/may be provided by customer)
Software is not custom.
Customer to provide PC's to spec including any network connections required.
Customer to provide adequate UPS protection for all powered devices.

(WasteWIZARD)
Box Mounting and Wiring
WasteWIZARD comes standard with keypad interface for vehicle identification.
We will provide drawings and specs for WasteWIZARD box mounting.
Customer (or other contractor (scale company/electrician)) to provide for mounting and wiring of WasteWIZARD enclosures.
Customer (or other) to provide protective bollards to protect WIZARD box (if not installed in standard Swing-Arm system)
WasteWIZARD Box(es) to be mounted by customer prior to installation date
Recommended WasteWIZARD Mounting - *Site study should be conducted for precise placement, based on average vehicle height of of main automation population. Customer or contractor responsible selectiong appropriate mounting location.
Documentation provided with general specifications for mounting. See accompanying documents.

(the following is standard connectivity for WasteWIZARD. The County should provide electrical to box and network connectivity to the desired mounting area)
Customer (or other) to provide (separate) electrical and data conduits for WIZARD (EACH box)- to include:
- Electrical (each lane): 20 Amp/120V Service to power connection. See inside of door for connection diagram.

- Customer to provide fiber connection to each Wizard box. (Fiber) Media converter required for fiber connections. Customer to provide fiber terminations (ST) in WasteWZARD box and in scale house (customer to provide fiber swith in scale house).
- Intercom: IP intercom provided. Dedicated IP required.
- Switch/Media converter provided with WasteWIZARD enclosure. Customer to provide terminations.

Lane Control and Vision Notes
Customer or other responsible for installing and mounting gates(if any) and power/wiring for gate equipment.
Customer or other responsible for running gate wires and making connections to Wizard box.
WasteWORKS Vision is intended as a WasteWORKS enhancement. Carolina Software cannot guarantee that every transaction will be accompanied with one or more stored WasteVision pictures and cannot guarantee that the photo captured provides detailed images of every driver or license plate. WasteWORKS Vision provides printed warnings for 'off-line' cameras.

Carolina Software will provide replacements for any 'dead on arrival' hardware. All warranties for hardware are provided by the manufacturer. Warranty and support information provided on existing WasteWORKS License Agreement.
All hardware is brand new, tested, and pre-configured by Carolina Software (where applicable.)

Approved by: ______________________

Title ______________________

Date ____________ PO Number ____________

Shipping Address:
____
____
____

Waste WORKS® Walker® Wizard®

Now with *Container Billing* and Waste WORKS® *Vision!*

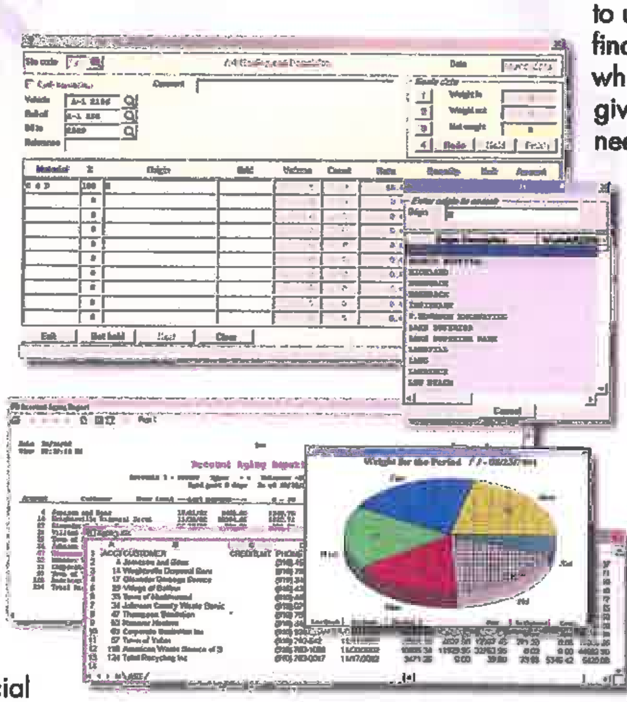
"The customer service, attention to detail and training from the WasteWORKS staff has been excellent. Thanks WasteWORKS." Mark Wilson, Director of Solid Waste - Leavenworth County, KS

Since 1988, Carolina Software, Inc. has been installing and supporting Waste WORKS software for solid waste management at locations across the U.S., Canada, and Puerto Rico. Waste WORKS has become the industry leader by providing a cost-effective, complete, turnkey solution for managing landfills, transfer stations, waste-to-energy facilities, MRFs, and recycling facilities. From small, single pc installations, to major U.S. cities and counties, Waste WORKS provides a total, Windows-based package for ticketing, billing and reporting. Hundreds of satisfied customers have chosen Waste WORKS to provide their facilities with a simple and efficient point-of-sale module, flexible and secure scale lane automation, container billing, and a solid and fully integrated receivables package.

WasteWORKS-SQL combines all of the benefits of a Microsoft SQL Server platform with an easy to maintain, affordable, off-the-shelf solution for managing your facility.

The Waste WORKS family of products is designed to provide a comprehensive approach to waste management information. The products are designed to be easy to use while providing the timely and accurate data you need to manage your waste facilities.

Waste WORKS is the centerpiece of Carolina Software's waste solution strategy. Information enters the system as your weigh masters greet vehicles arriving at your sites. Waste WORKS reads the vehicle's weight automatically from your scale, then computes the charge by ton, cubic yard or quantity, and finally prints a ticket for cash or charge-on-account transactions. Hidden error checking works while the data is entered to ensure accuracy, and pop-up choices and online help allow your weigh master to focus on your customer, not the computer. Meanwhile, the software computes pricing, including special contracts and discounts as well as special taxes, all behind the scenes.



However, generating a refuse ticket is only the beginning. Waste WORKS is the complete solution for waste disposal management and includes customer billing and financial reporting in the base product, so there is no additional accounting software to purchase and learn to use. Your auditors will like the financial side of WasteWORKS, which was designed by a CPA to give them the information they need and to help you maximize your collections.

Since Waste WORKS was designed from the beginning specifically for the waste industry, there are also lots of management reports for the solid waste director. Graphs quickly show you where you're the busiest or most productive, and the included full-featured report writer allows you to create your own reports in addition to the dozens that come with Waste WORKS already.

Turn over to learn more about additional Waste WORKS products ••••• ▶

The complete software for solid waste management.
WWW.WASTEWORKS.COM

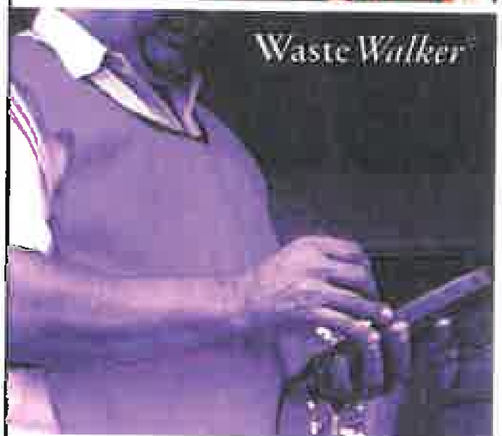
CAROLINA SOFTWARE

Waste *Wizard*®

Turn your scale lane into an express lane!

Carolina Software, Inc., developer of the industry's leading solid waste management software, leads the way with Waste *Wizard*, the latest technology in scale lane automation! What can Waste *Wizard* do for you?

- By adding Waste *Wizard* to your operation, you can eliminate those long and costly lines by allowing your drivers to do the work.
- What Else? Waste *Wizard* is the perfect solution for after-hours transactions, and can enhance your facility's security with optional password prompts and gate interface!
- And now with the addition of WasteWORKS *Vision*, you'll have a snapshot of the driver to give your site the ultimate in automation and security!

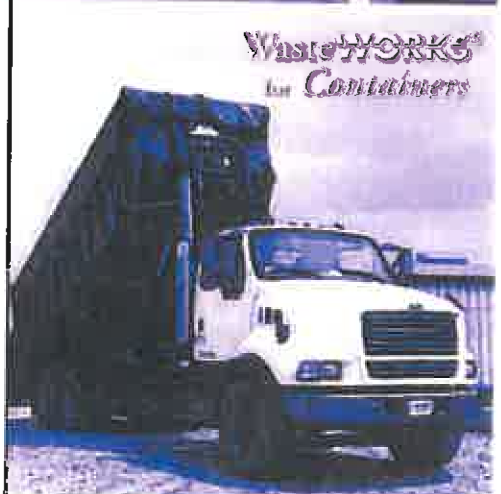


Waste *Walker*®

Take your operations on the go & eliminate long lines!

The Waste *Walker* system consists of a desktop application plus a handheld application using the power and mobility of Symbol Technology's rugged Symbol MC70 PocketPC computer. It also includes a lightweight, industrial-strength thermal Cameo 3 printer. Its small size, rugged durability, and quick connectivity to your scale house computers makes Waste *Walker* the perfect portable companion for your existing Waste WORKS installation.

- The new Waste *Walker's* intuitive screens provide users with a simple method of gathering and calculating quantities for volume-based materials.
- The ability to handle up to five line items per transaction is a welcomed new addition for household hazardous waste facilities and convenience centers.
- With the ability to enter weights, the new Waste *Walker* can tackle just about any 'down-time' situation with ease. A true Waste WORKS backup!



WasteWORKS® for *Containers*

Make roll-off management easy!

WasteWORKS now offers even more functionality with the addition of *Container Billing*, a module with features for roll-off management. *Container Billing* helps track containers so you know where you put it, who has it, and what day of the week you're going to pick it up. Now you can use the power of WasteWORKS to manage your container business!

- Easily manage work orders, service locations and routes.
- Generate your rental charges and billing with ease.
- Maximize efficiency with a simple, easy-to-use interface.

WasteWORKS® *Vision*

Enhance security with image captures on your tickets!

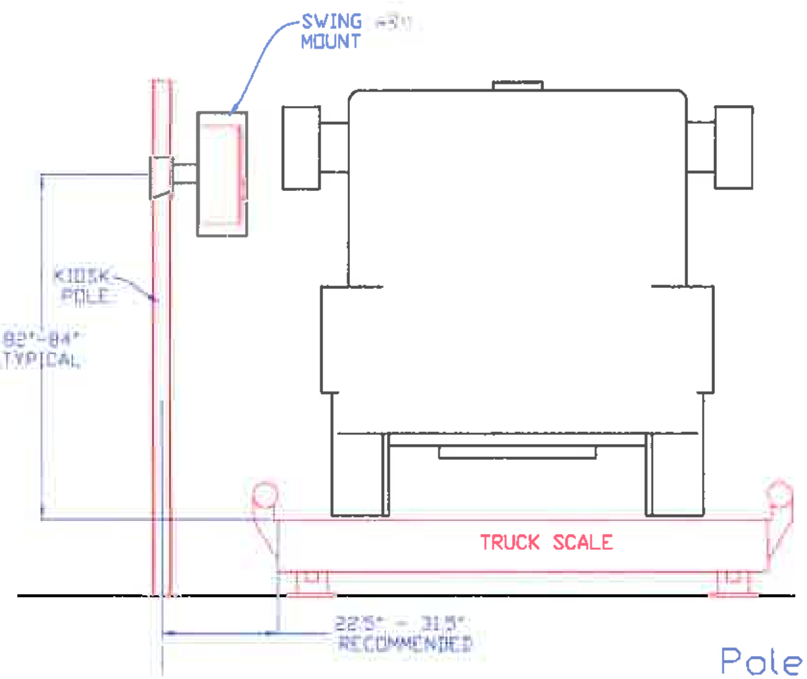
Waste WORKS *Vision* is an exciting new product that provides enhanced security to sites using Waste WORKS and Waste *Wizard* scale lane automation. By combining the same ticket information that prints on your ticket with one or more snapshots of a vehicle, the driver or the license plate of a vehicle, you will have a powerful security tool for your facilities. Each image is stored and numbered to match your tickets for easy viewing in the future. Each system is capable of taking multiple pictures of up to four scale lanes!

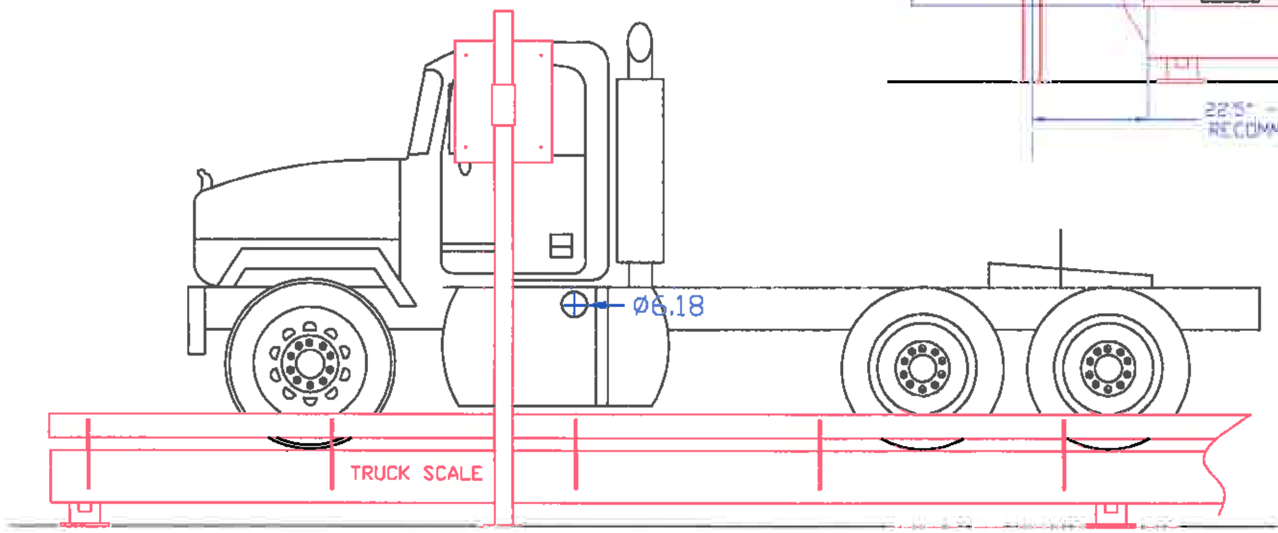
Unattended Kiosk - Swing Arm Mount

120VAC Power Required at Kiosk Location

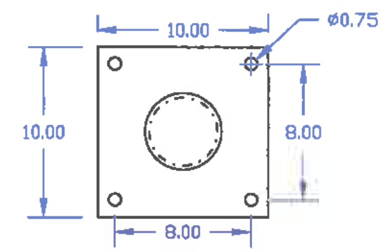
Ethernet communication required at Kiosk.

Customer Ultimately Responsible for Determining Final Mounting Location





Pole Base

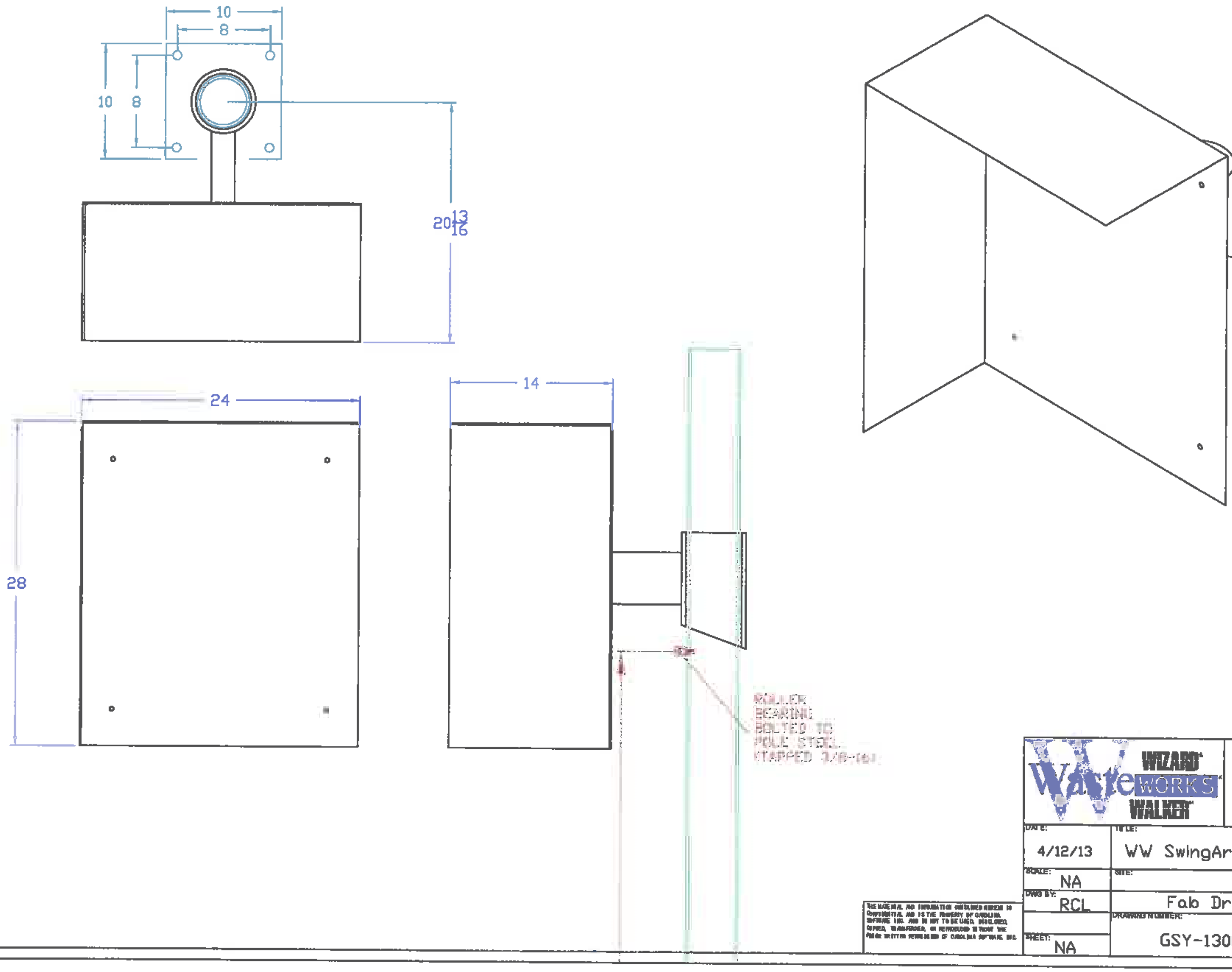


WIZARD WasteWORKS WALKER

Carolina Software Inc
PO Box 3097
Wilmington, NC 28406

910-799-6767
www.wasteworks.com

DATE: 5/17/13	TITLE: Standard Pole Location
SCALE: NA	SITE: NA
DWG BY: MLW	NA
SHEET: NA	DRAWING NUMBER: GSY-13005
	REV: A

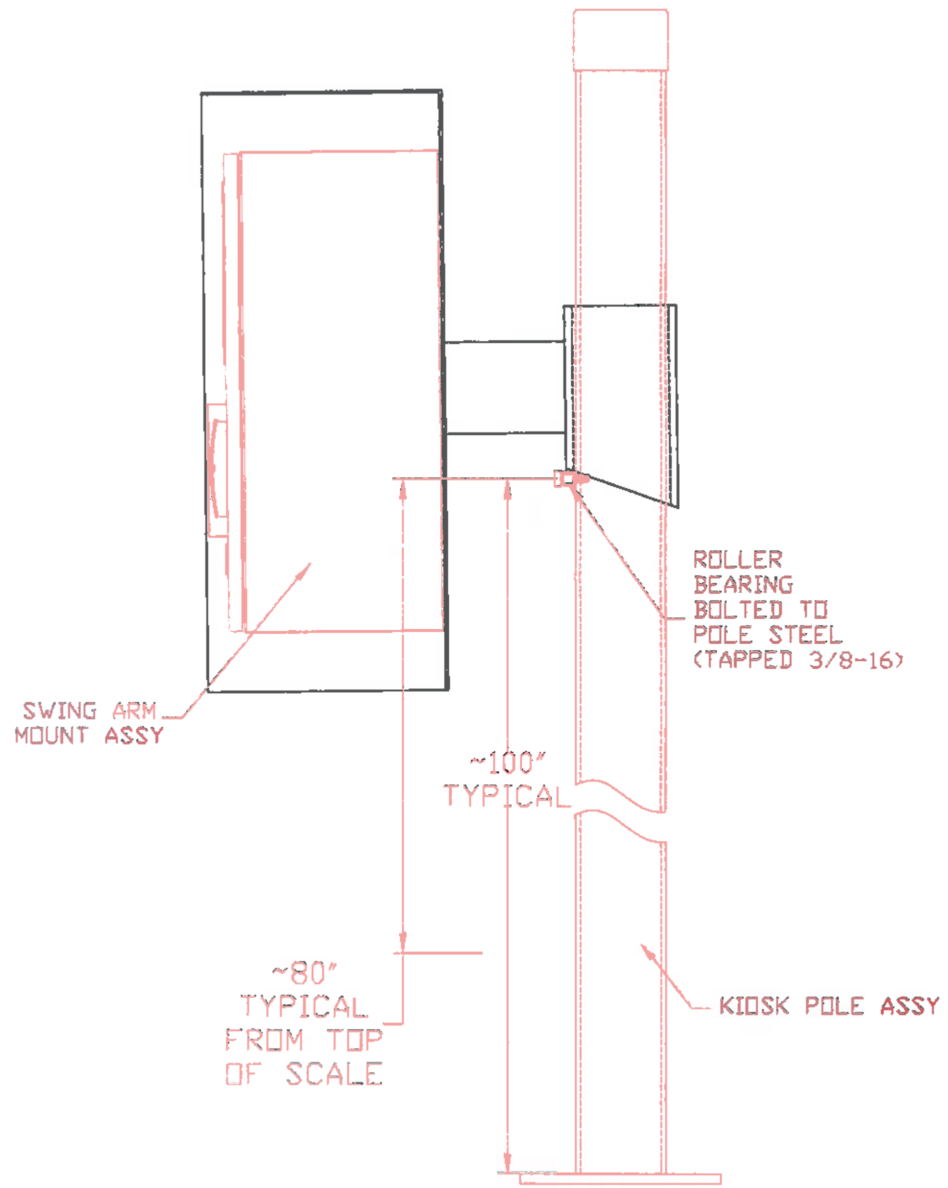


Wizard WasteWorks Walker

Carolina Software Inc
PO Box 3097
Wilmington, NC 28406

910-799-6767
www.wasteworks.com

DATE: 4/12/13	TITLE: WW SwingArm, Left Side		
SCALE: NA	SITE:		
DWG BY: RCL	Fab Drawing		
SHEET: NA	DRAWING NUMBER: GSY-13004L	REV: A	



PARTS REQUIRED:

1 EA SHOULDER BOLT
1 EA NEEDLE BEARING
1 EA SWING ARM ASSEMBLY
1 EA KIOSK POLE ASSEMBLY
1 EA 3/8-16 TAP AND DRILL

WasteWORKS WIZARD WALKER
Carolina Software Inc
PO Box 3097
Wilmington, NC 28406
910-799-6767
www.wasteworks.com

DATE: 5/17/13	TITLE: Standard Pole Mounting
SCALE: NA	SITE: NA
DWG BY: MLW	NA
SHEET: NA	DRAWING NUMBER: GSY-13006 — REV: A

Generic System- NO Camera

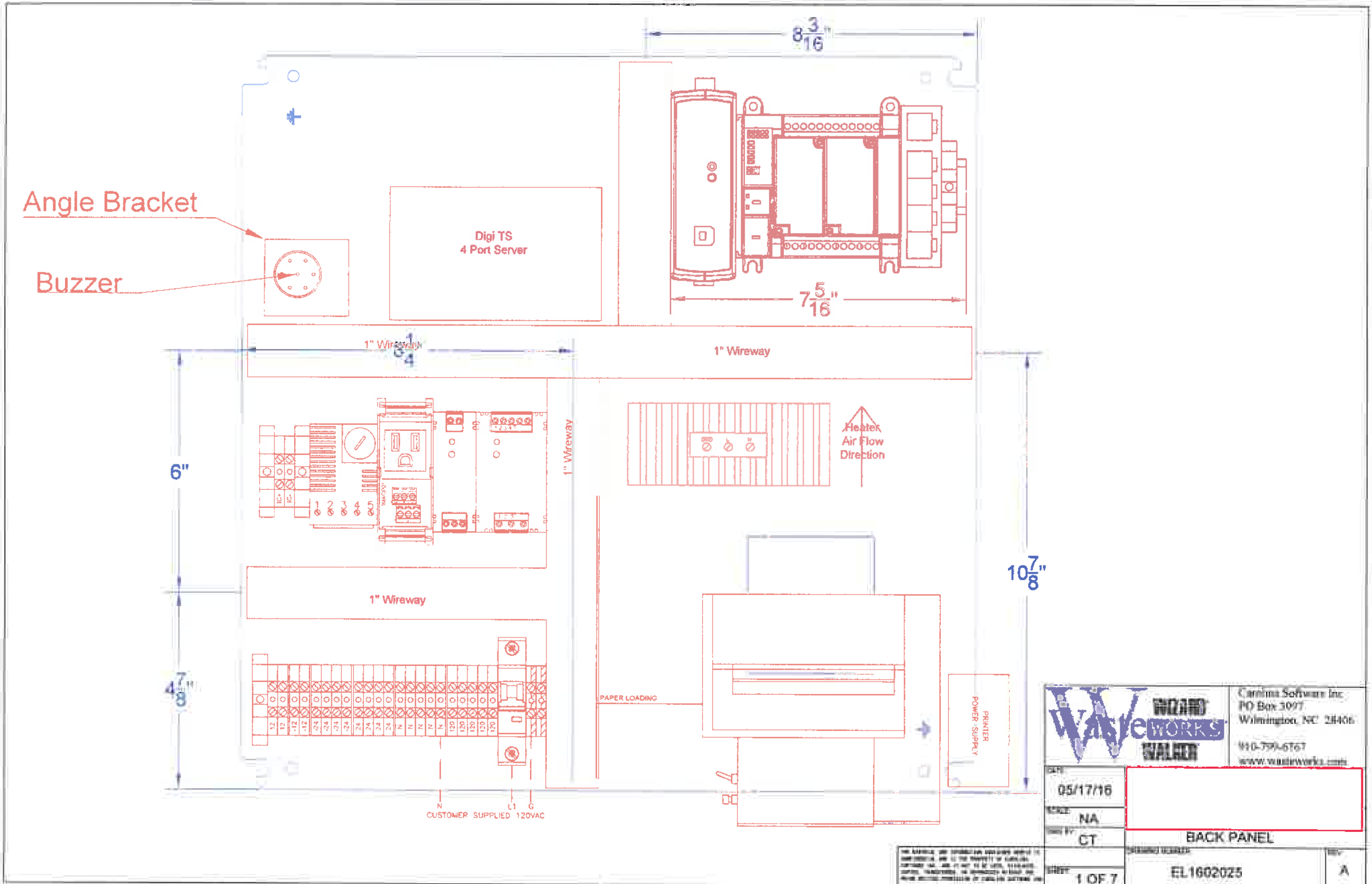
SHEET SCHEDULE

1	ENCLOSURE BACK PANEL	11	XX	21	XX
2	ENCLOSURE DOOR DETAIL	12	XX	22	XX
3	POWER WIRING	13	XX	23	XX
4	24VDC WIRING	14	XX	24	XX
5	I/O WIRING	15	XX	25	XX
6	COMMUNICATION WIRING	16	XX	26	XX
7	ETHERNET	17	XX	27	XX
8	XX	18	XX	28	XX
9	XX	19	XX	29	XX
10	XX	20	XX	30	XX

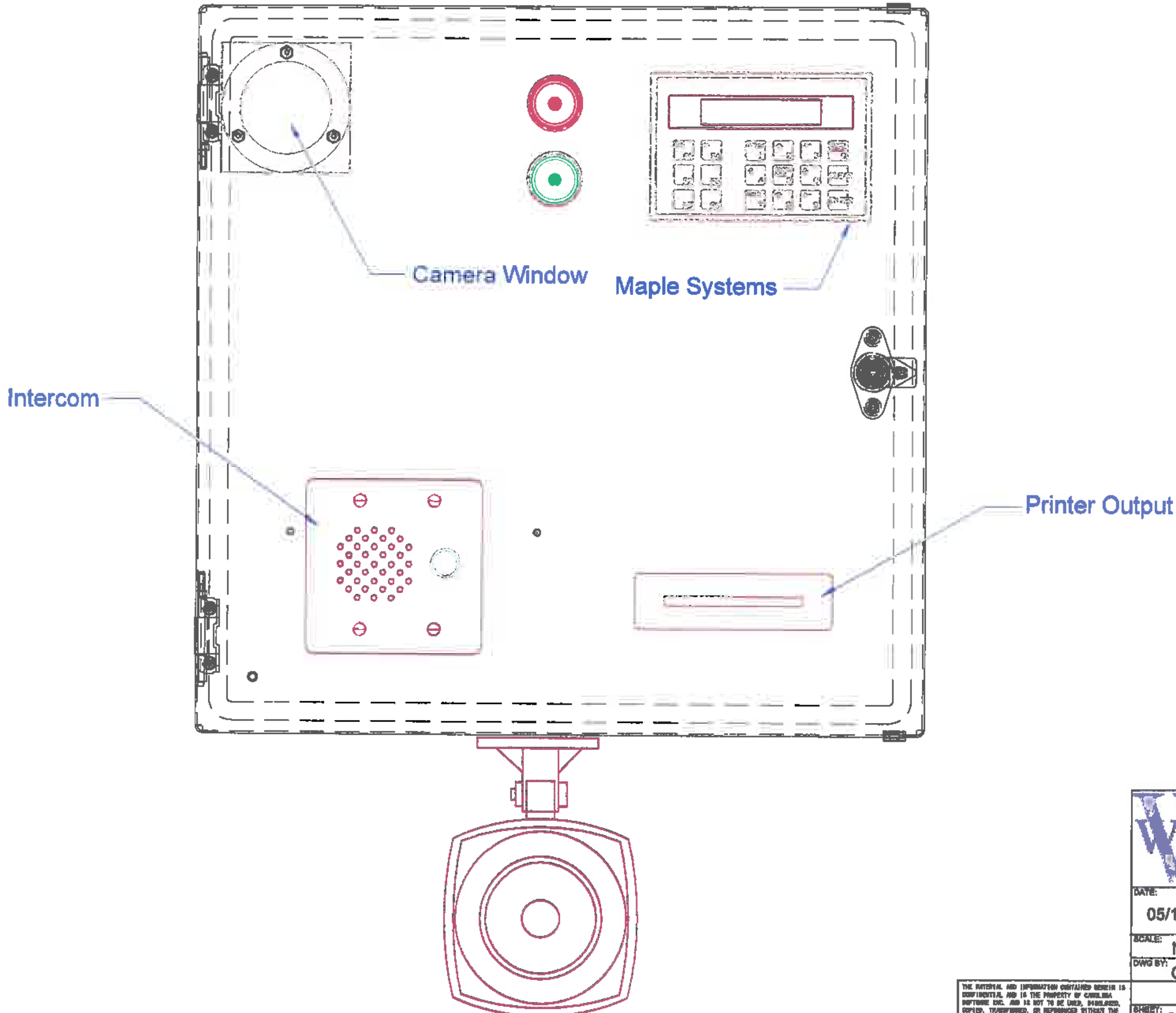
WIZARD WasteWORKS WALKER

Carolina Software Inc
PO Box 3097
Wilmington, NC 28406
910-799-6767
www.wasteworks.com

DATE: 05/17/16			
SCALE: NA			
DWG BY: CT	SHEET SCHEDULE		
SHEET: NA	DRAWING NUMBER: EL1602025	REV: A	



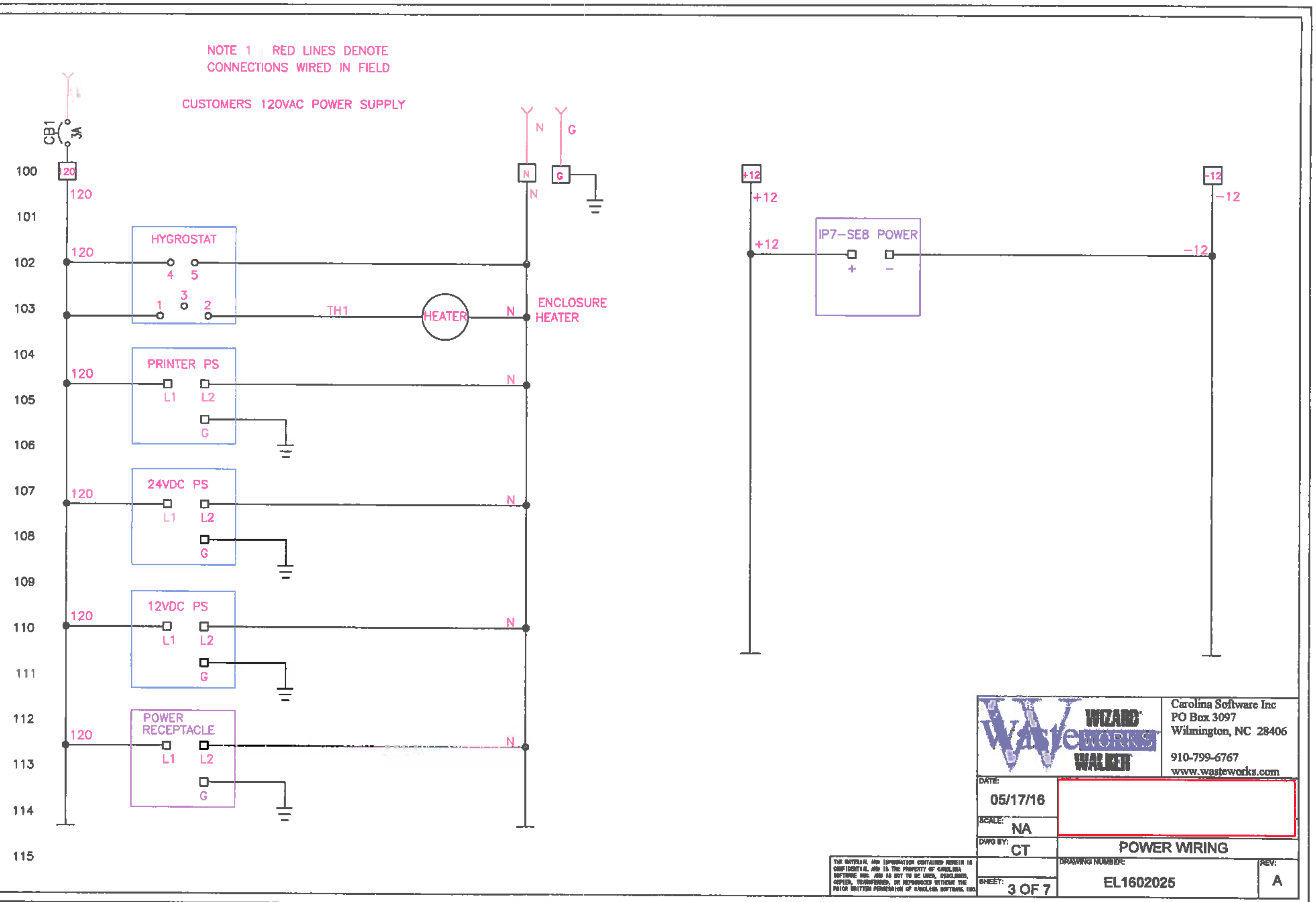
Angle Bracket
Buzzer
Digi TS
4 Port Server
8 3/16"
7 5/16"
1" Wireway
6 1/4
1" Wireway
1" Wireway
1" Wireway
Heater
Air Flow
Direction
6"
4 7/8"
10 7/8"
PAPER LOADING
PRINTER
POWER SUPPLY
N
L1
G
CUSTOMER SUPPLIED 120VAC
Carolina Software Inc
PO Box 3097
Wilmington, NC 28406
910-799-6767
www.wasteworks.com
05/17/16
NA
CT
BACK PANEL
1 OF 7
EL1602025
A



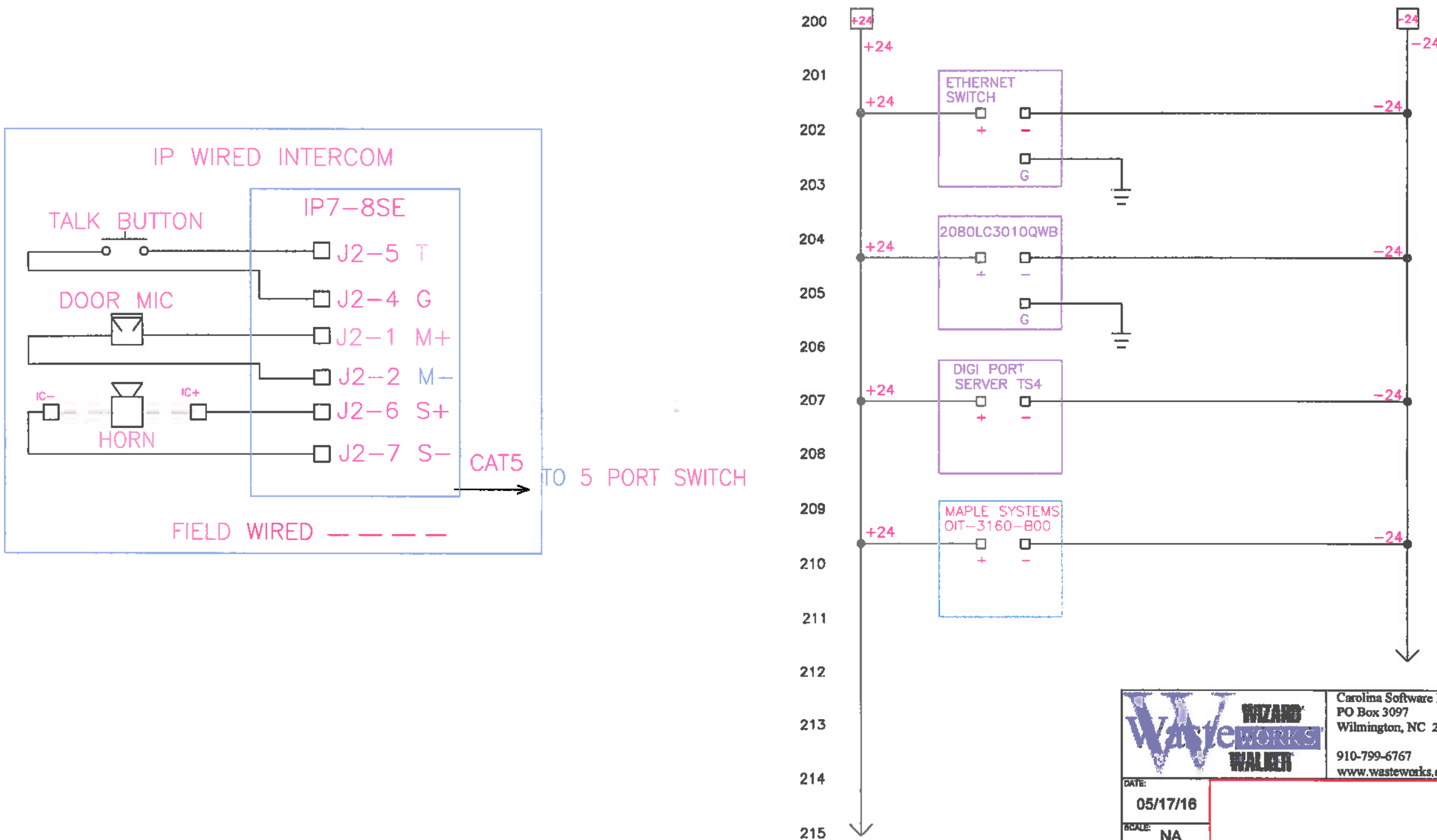
Carolina Software Inc
PO Box 3097
Wilmington, NC 28406

910-799-6767
www.wasteworks.com

DATE: 05/17/16	TITLE: LANE CONTROLLER
SCALE: NA	SITE: BREVARD
DWG BY: CT	DOOR LAYOUT
SHEET: 2 OF 7	DRAWING NUMBER: EL1602025 — REV: A

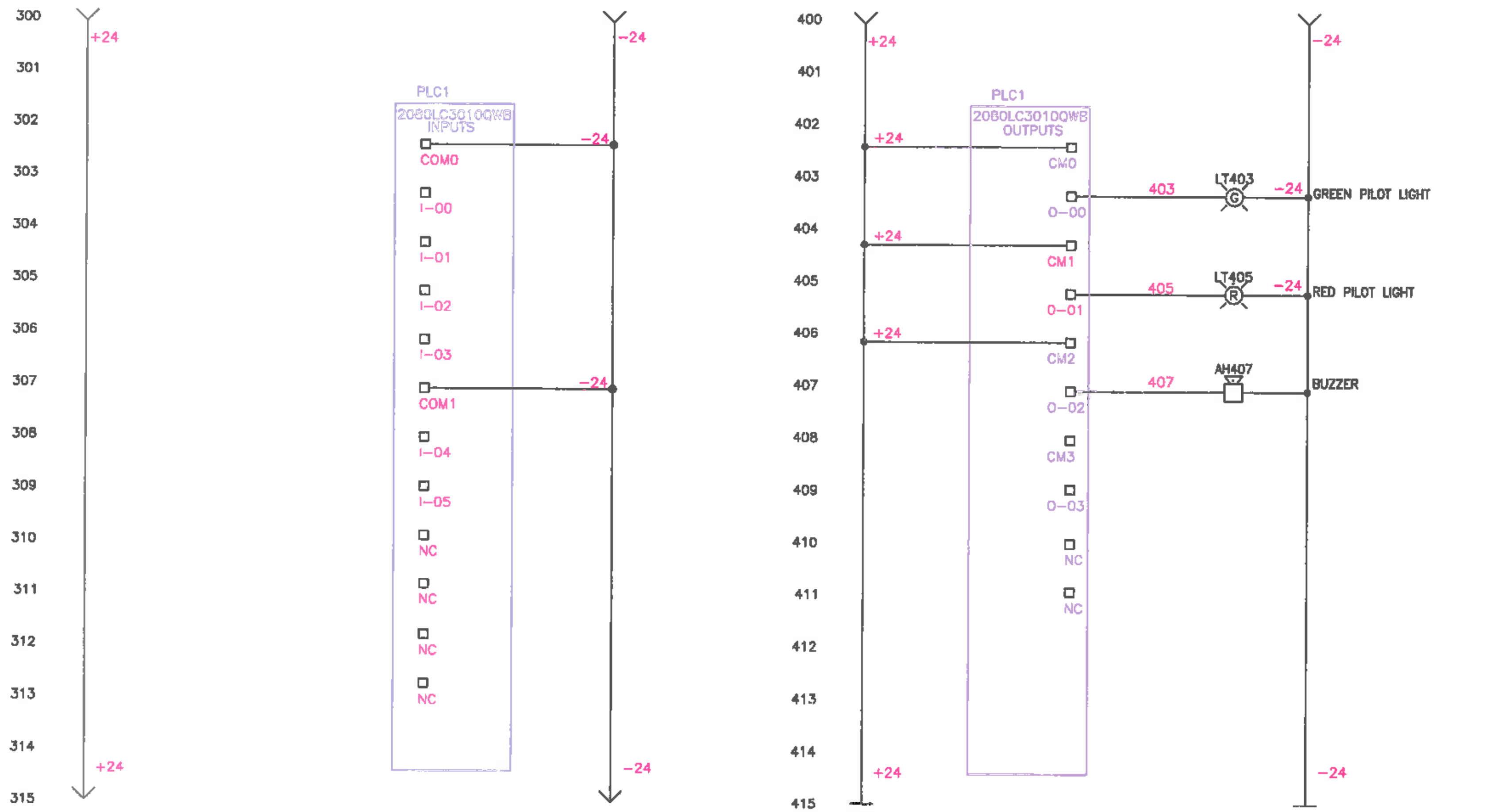


NOTE 1 RED LINES DENOTE CONNECTIONS WIRED IN FIELD
CUSTOMERS 120VAC POWER SUPPLY
CB1
3A
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
120
N
G
HYGROSTAT
4
5
1
3
2
TH1
HEATER
ENCLOSURE HEATER
PRINTER PS
L1
L2
G
24VDC PS
12VDC PS
POWER RECEPTACLE
+12
-12
IP7-SE8 POWER
+
−
WIZARD
WASTEWORKS
WALKER
Carolina Software Inc
PO Box 3097
Wilmington, NC 28406
910-799-6767
www.wasteworks.com
DATE:
05/17/16
SCALE:
NA
DWG BY:
CT
POWER WIRING
DRAWING NUMBER:
EL1602025
SHEET:
3 OF 7
REV:
A



Carolina Software Inc
PO Box 3097
Wilmington, NC 28406
910-799-6767
www.wasteworks.com

DATE: 05/17/16		
SCALE: NA		
DWG BY: CT	24V WIRING	
SHEET: 4 OF 7	DRAWING NUMBER: EL1602025	REV: A

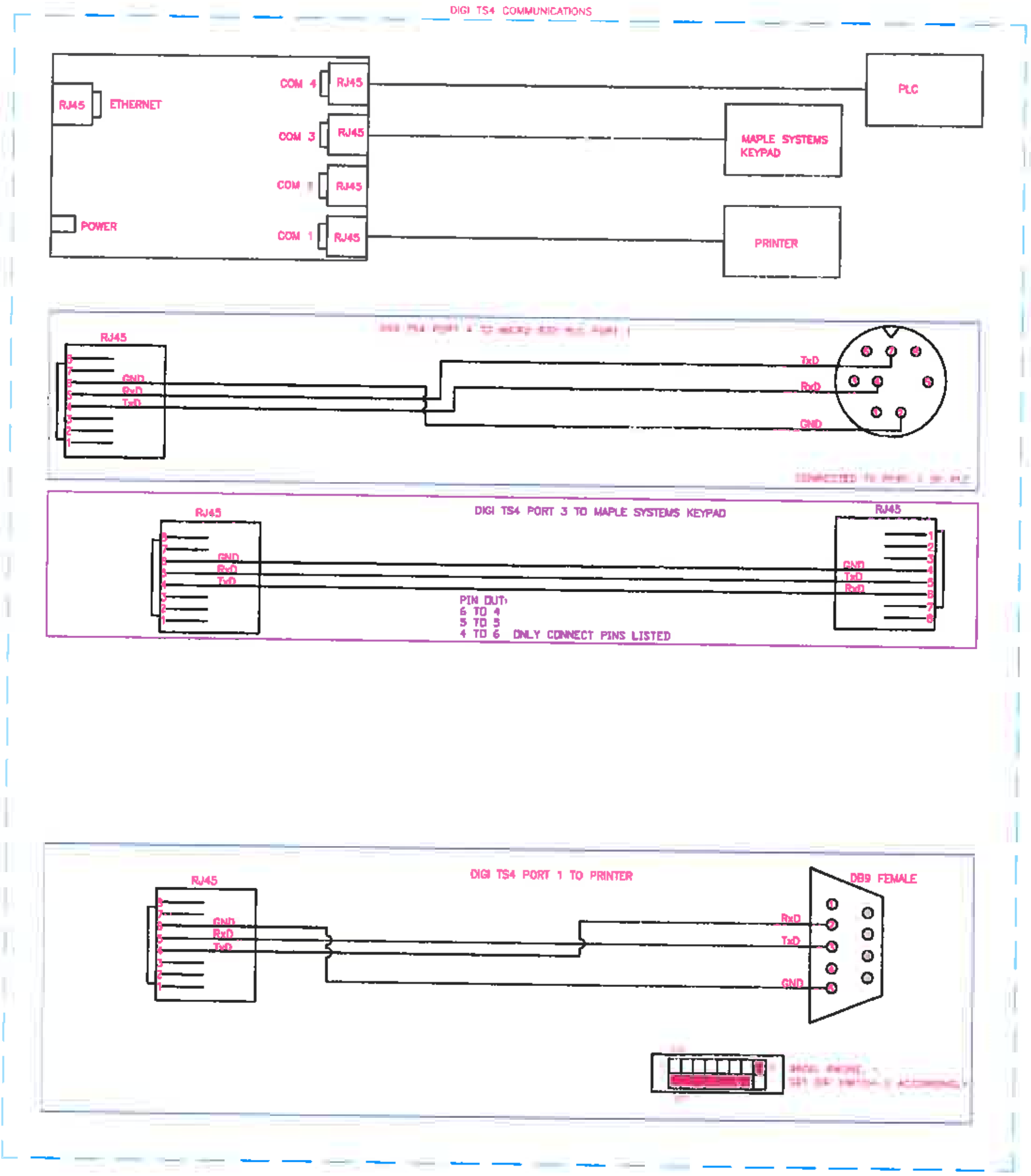


WIZARD WASTEWORKS WALKER

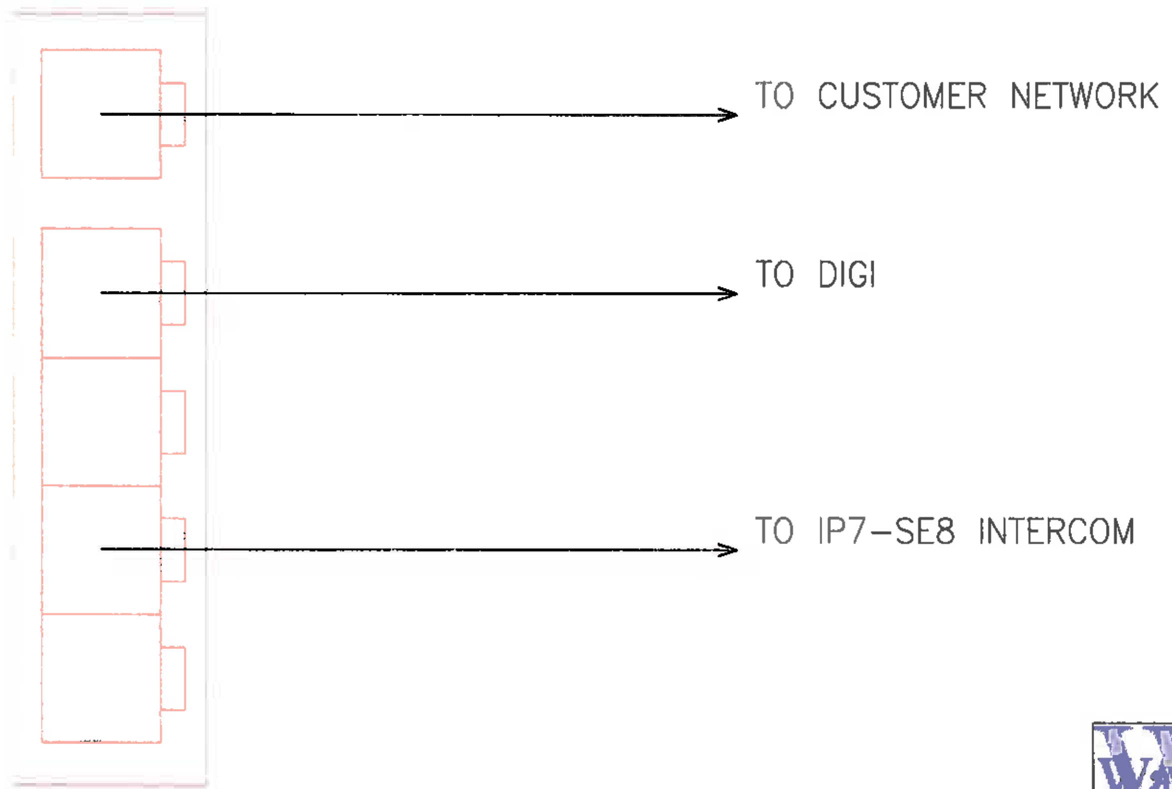
Carolina Software Inc
PO Box 3097
Wilmington, NC 28406

910-799-6767
www.wasteworks.com

DATE:	05/17/16
SCALE:	NA
DWG BY:	CT
SHEET:	5 OF 7
TITLE:	I/O WIRING
DRAWING NUMBER:	EL1602025
REV:	A



WasteWORKS WIZARD WALKER	Carolina Software Inc PO Box 3097 Wilmington, NC 28406 910-799-6767 www.wasteworks.com
DATE: 05/17/16	
SCALE: NA	
DWG BY: CT	COMMUNICATION
SHEET: 6 OF 7	DRAWING NUMBER: EL1602025 — REV: A



WIZARD WasteWORKS WALKER
Carolina Software Inc
PO Box 3097
Wilmington, NC 28406
910-799-6767
www.wasteworks.com

DATE: 05/17/16		
SCALE: NA		
DWG BY: CT	ETHERNET	
SHEET: 7 OF 7	DRAWING NUMBER: EL1602025	REV: A

Minimum Hardware Recommendations for WasteWORKS-SQL Installations

Recommendations for Client Workstations

Component	Requirement
Processor	Dual Core Processor at 2.0 GHz or faster
Memory (RAM)	Recommended: 4 GB or higher – Minimum: 2 GB
Operating System	Windows 7 32-bit and 64-bit Windows 10 32-bit and 64-bit
Hard Disk	100 GB
Monitor and Video	17 inch or larger with at least 1280 x 1024 resolution.
.NET Framework	Minimum: 4.0 – Recommended: 4.6
Com Ports	Quantity needed dependent on number of peripherals- scales, serial printers, and serial cash drawers to be connected into the system.
For Installations requiring additional COM ports, the use of an Inside Out Networks, Edgeport4/8 USB-Serial Hub (available in 4 port or 8 port) is available, or for network sharing of COM ports a Digi PortServer TS/4 is available. **Requires network connectivity for all necessary PCs*	
Battery Backup	UPS boxes on all powered components
Cash Drawers	APG – S484- Serial Only- Available from CSI
Printers	Laser Printers at all locations (recommended-HP1320 or higher) with first page out settings of 8 seconds or better Serial Printers (TSP700 thermal) may be used at ticketing locations.
LAN\WAN connections	100Mbps connection **required** for connection to central data server for "live" data processing. A 1000Mbps connection is recommended for minimum network latency.
Scale Connection	RS232, continuous output is required for connection between scale indicators and WasteWORKS / WasteWIZARD.
Backup	Tape / Server backup recommended

Recommendations for Central Data Servers

(backups to be performed by network admin/DBA)

(also consult Microsoft's Website for a more detailed listing http://technet.microsoft.com/en-us/windowsserver/bb414778)

Component	Requirement
Processor	Dual Core Processor at 2.0 GHz or higher **Note:** An Intel Itanium 2 processor is required for Windows Server 2008 for Itanium-Based Systems
Operating System	Microsoft Windows Server 2012 or higher (w/appropriate TS licenses for all connecting workstations – where needed).
Database Architecture	Microsoft SQL Server 2012/2014/2016 or Microsoft SQL Server 2012/2014/2016 Express. *(see below for SQL Server requirements)*
Memory (RAM)	Recommended: 4GB RAM or greater Maximum (32-bit systems): 4GB (Standard) or 64GB (Enterprise and Datacenter) Maximum (64-bit systems): 32GB (Standard) or 2TB (Enterprise, Datacenter and Itanium-Based Systems)
Hard Disk	250+ GB

Minimum Hardware Recommendations for WasteWORKS-SQL Installations

SQL Server 2012 Enterprise

The following table shows the system requirements for SQL Server 2012 Enterprise

Component	Requirement
Processor	2.0 GHz or faster
Operating System	Windows Server 2012 64-bit Windows Server 2012 R2 64-bit
Memory (RAM)	Minimum 1 GB Recommended 4 GB or more (should be increased as database size increases to ensure optimal performance) Maximum 2 TB or Operating system maximum, whichever is lower
DB Size	Unlimited

SQL Server 2012 Express

The following table shows the system requirements for SQL Server Express, SQL Server Express with Tools, and SQL Server Express with Advanced Services 2012

Component	Requirement
Processor	2.0 GHz or faster
Operating System	Windows Server 2012 64-bit Windows Server 2012 R2 64-bit Windows 7 SP1 32/64-bit Windows 10 32/64-bit
Memory (RAM)	Minimum 512 MB Recommended 1.024 GB Maximum 1 GB for the Database Engine, 4 GB for Reporting Services
DB Size	Maximum 10 GB

For a more detail listing of SQL requirements go to http://msdn.microsoft.com/en-us/library/ms143506.aspx.

Minimum Hardware Recommendations for WasteWORKS-SQL Installations

SQL Server 2014 Enterprise

The following table shows the system requirements for SQL Server Express, SQL Server Express with Tools, and SQL Server Express with Advanced Services 2012

Component	Requirement
Processor	2.0 GHz or faster
Operating System	Windows Server 2016 Windows Server 2012 64-bit Windows Server 2012 R2 64-bit
Memory (RAM)	Minimum 1 GB Recommended 1 GB Maximum 1 GB for the Database Engine, 4 GB for Reporting Services
DB Size	Maximum 10 GB

SQL Server 2014 Express

The following table shows the system requirements for SQL Server Express, SQL Server Express with Tools, and SQL Server Express with Advanced Services 2012

Component	Requirement
Processor	2.0 GHz or faster
Operating System	Windows Server 2016 Windows Server 2012 64-bit Windows Server 2012 R2 64-bit Windows 7 SP1 32/64-bit Windows 10 32/64-bit
Memory (RAM)	Minimum 512 MB Recommended 1 GB Maximum 1 GB for the Database Engine, 4 GB for Reporting Services
DB Size	Maximum 10 GB

For more details of Microsoft SQL requirements go to https://msdn.microsoft.com/en-us/library/ms143506(v=sql.120).aspx.

Minimum Hardware Recommendations for WasteWORKS-SQL Installations

SQL Server 2016 Enterprise

The following table shows the system requirements for SQL Server 2016 Enterprise

Component	Requirement
Processor	2.0 GHz or faster (x64 only)
Operating System	Windows Server 16 Windows Server 12
Memory (RAM)	Minimum 1 GB Recommended 4 GB or more (should be increased as database size increases to ensure optimal performance) Maximum 2 TB or Operating system maximum, whichever is lower
DB Size	Unlimited

SQL Server 2016 Express

The following table shows the system requirements for SQL Server Express, SQL Server Express with Tools, and SQL Server Express with Advanced Services 2016

Component	Requirement
Processor	2.0 GHz or faster (x64 only)
Operating System	Windows Server 16 Windows Server 12 Windows 10 32/64-bit
Memory (RAM)	Minimum 512 MB Recommended 1 GB Maximum 1 GB for the Database Engine, 4 GB for Reporting Services
DB Size	Maximum 10 GB

For a more detail listing of SQL requirements go to https://docs.microsoft.com/en-us/sql/sql-server/install/hardware-and-software-requirements-for-installing-sql-server

AirBurners

S-119R
Tier 4 Final Version

ROLL-OFF FIREBOX SPECIFICATIONS

General: A self-contained, completely assembled above ground Air Curtain Burner (air curtain incinerator or FireBox) with a refractory lined burn-container and double steel floor and fittings for cable-hoist trucks in accordance with ANSI Specification Z245.60 for portable applications.

Designed for the high temperature burning of forest slash, agricultural green waste, land clearing debris, storm debris, and other waste streams in compliance with the requirements of US EPA 40CFR60. The FireBox is also used for disaster recovery and Department of Homeland Security contingencies.

Hook-lift and Continuous Chain Roll-off versions also available. Shipped from the factory completely assembled ready for immediate use.

1	Power	Three-cylinder Turbo Diesel Engine approx. 49 HP, HATZ Model 3H50TIC (Requires no DEF) or equivalent engine; Emissions certified US EPA Tier 4 FINAL; Engine mounted PTO	
2	Burn Container (Firebox)	4" (102 mm) thick refractory panels filled with proprietary thermal ceramic material; Two full height rear doors; Two ignition holes	
3	Safety Systems	Engine over temperature and overspeed shut down; Loss of cooling fluid shutdown; Loss of oil pressure shutdown; Lockable steel front deck security enclosure	
4	Instrument Panel	Murphy PowerView PV380-R2 electronic engine control with preset throttle settings: key switch, tachometer, hour meter, fuel gauge, oil pressure and water temperature and safety shutdown features	
5	Air Supply	Custom heavy duty fan	
6	Fuel Tank	58 Gallon (220 L) minimum fuel tank capacity	
7	Transportation & Set-up	Shipped completely assembled; Ready for immediate use; Lifting pads provided for crane lifting; Unit can be dragged on siteon its skids	
8	Options	Ash clean-out rake with standard universal quick disconnect for Skidsteer or Bobcat; Hook-lift and Continuous Chain Roll-off Versions	
9	Average Through-put	3-5 Tons per Hour (Average – See Note)	
10	Fuel Consumption	Approx. 3.1 Gal/Hr (9.5 L/Hr)	
11	Weight	39,700 lbs (18,007kg)	
12	Dimensions	Overall Size L × W × H 27' 4" × 7' 5" × 8' 6" (8.3m × 2.2m × 2.6m)	Fire Box L × W × H 19' × 5' × 6' (5.8m × 1.5m × 1.8m)

Note:
Achievable through-put depends on several variables, especially the nature of the waste material, the burn chamber temperature and the loading rate.

All weights and dimensions are approximate and metric conversions are rounded. Specifications are subject to change without notice.

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Rev. 11.16.2018

Appendix Q

Newspaper Articles

County Commission Update

by Jefferson County Commissioner Leonard Wortman

Hi Folks,

At our regular meeting last week Bob Church, with Great West Engineering, attended to discuss the Public comments and Public Hearings that we held around the County. He will now prepare the Draft Preliminary Engineering Report that will show building a new container site on County owned property at Montana City. The Report will also have the addition of stationary compactors at the Boulder site. At this time the plan is to keep all of the current sites open. There will be some increase in the annual fees, but, we are not sure at this time just what those will be. I would guess, somewhere in the $15 to $20 per year range. The comment period will remain open until a final decision is made, probably sometime in April.

Kaleena Miller the new MSU Extension Ag Agent introduced herself and told us a little about her background. She is spending some of her time getting to know the counties and some of the people she will be working with. It is great to have her on board.

We discussed and decided to put out a Request for Proposals for a Preliminary Architectural Report and will also have a detailed Economic Feasibility Study done for the development of the property at the Boulder interchange on I-15 for a Western Legacy Center/Cowboy and Cowgirl Hall of Fame.

FYI: This has certainly been a February to remember. I certainly don't remember ever having this much snow and record setting cold for so long a period. I have a great deal of sympathy for those who have been calving in this weather.

Prepare for flooding right now

HELENA, Mont. — As winter weather continues to dump large amounts of snow throughout Montana, Insurance Commissioner Matt Rosendale is advising Montanans to consider flood insurance and start preparing for floods right now, before it's too late.

Flood insurance policies age flood claim in Montana is nearly $13,000. Statistics indicate there is a one-in-four chance that a homeowner will experience a flood over a span of 30 years. 25 percent of flood insurance claims come from moderate to low risk flood areas.

Most flood policies are se- tions than ever. In 2015, the Montana legislature passed House Bill 94, which opened the marketplace to consumers by allowing a multi-peril insurance product that protects against flood, landslide, and earthquake. These programs are often more affordable and can provide better insurance

Apr 8, 2019 950
GREAT WEST ENGINEERING
PO BOX 4817
HELENA MT 59604

'S — P. 7

THE BOULDER
ONITOR

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WEDNESDAY, FEBRUARY 20, 2019

…l building Feb. 8. (Photo by Eric Dietrich)

Residents weigh in on draft solid waste plans

By JOHN BLODGETT
Editor

Six hearings recently held to discuss proposed improvements to Jefferson County's solid waste system generated high public participation and several additional ideas for the county to consider as planning proceeds.

"I thought the public hearings went very well with outstanding participation from the public," Bob Church of Great West Engineering said by email. "The biggest surprise to me was the level of public interest in most communities."

The County Commission tapped Church to develop a countywide planning document called a Preliminary Engineering Report partly in response to traffic and capacity issues at the county's Montana City container site.

Church and the commissioners shared a draft of the PER at hearings held from Feb. 4 to Feb. 12 in Boulder, Whitehall, Basin, Jefferson City, Clancy and Montana City — the six communities where the county runs solid waste collection sites.

In addition to overviewing the county's solid waste system, the draft report describes cost-saving and other measures — called alternatives — the county might consider. These included replacing the Montana City site, increasing capacity at the Boulder site and closing the Clancy, Jefferson City and Basin sites.

The best-attended meetings were in Montana City, where 60 people showed up, and in Basin, where 30 people came to voice their support for keeping their site open.

"I would say the number one item the County learned from the meetings was how important the individual solid waste sites are to residents in each community," Church wrote.

County Commissioner Cory Kirsch said the meetings were a "good experience" and fulfilled the commissioners' goal to engage residents in decision making.

The next step, Church wrote, is for the commissioners to decide on the preferred alternatives. The agenda for their Feb. 26 meeting indicates their decision might happen on that day.

Church will then revise the draft PER, which will be made available for public comment likely by the end of March, he said.

Kirsch said he was "almost positive" that another public hearing would be held in Montana City as well.

See WASTE, p. 3

…Christian principles …s in the details'

…t his person- …lling abortion … culture and …t your own

…f at least …DeVries has …all minorities …inst routine, …ted bills …l giving state

seek to defund and weaken it," Jefferson City resident Melissa Kwasny wrote in a letter to the Monitor.

Drew Dawson, a Boulder City Council member, took issue with DeVries's vote on the state employee pay bill in a letter, writing that he estimates 10 percent of Jefferson County residents are state employees who among

TAKING OUT THE TRASH

Commissioners study changes in solid waste operations/fees

by **Jan Anderson**, editor

An ongoing engineering study looking into revising Jefferson County's solid waste disposal services should be ready for public presentation and comment early next year, county officials said last week.

Bob Church of Great West Engineering told the county commission discussions and research in recent months had narrowed the focus to two main ideas. One would involve a roughly $800,000 revision of the Montana City collection site, and the other would be a $452,000 public/private partnership with Tri-County Disposal between Montana City and East Helena.

Growth in the solid waste site usage at Montana City has been rapid, according to the study. From an average of 464 vehicle trips into the site on Sundays in May two years ago, the traffic count has risen to an average of 628 in a count done in the spring of 2018. Sundays, the busiest day at the site, saw a peak of 725 vehicle trips in the 2018 count.

Ether alternative would require an increase in annual solid waste fees charged to residences: about $10.30 per unit for the Montana City site revision and about $2.65 per unit for the Tri-County option, Church told the commission.

The main advantage to the Montana City option, he said, is that the service would remain totally under county government control. It would allow plenty of space to accommodate future growth and would allow future installation of scales to set up a "pay as you throw" system in which service users are charged based on how much they bring to the site, he said.

Partnering with the private Tri-County Disposal landfill comes with the advantage of lower cost but has at least one disadvantage that the commissioners said is not likely to be popular. At the Tri-County site incoming trash would have to be weighed so the private company could track tonnage to bill the county, and any loads exceeding agreed upon limits could result in a bill to the customer. That would likely mean the Clancy and Jefferson City collection sites would be closed to prevent those sites from being overwhelmed, said Church.

"Closing sites is never going to be popular," said commission chair Cory Kirsch.

Church said it might be necessary to close those two sites under either alternative.

The commissioners asked about the county's ability to build infrastructure on private property and who would own the buildings at the end of the contract. They also asked about reclamation costs for the existing Montana City site.

Church agreed to look into those questions before the December solid waste board meeting. He also said he would have further analysis of going to a "pay as you throw" system.

One of several options already rejected during the study, said Church, was to have no container sites in northern Jefferson County and require area residents to either pay for curbside pickup or haul to a landfill in Boulder.

The commissioners said they will be scheduling public hearings on the options after the first of the new year.

Subsurface fire at Boulder landfill site addressed

by **Jan Anderson**, editor

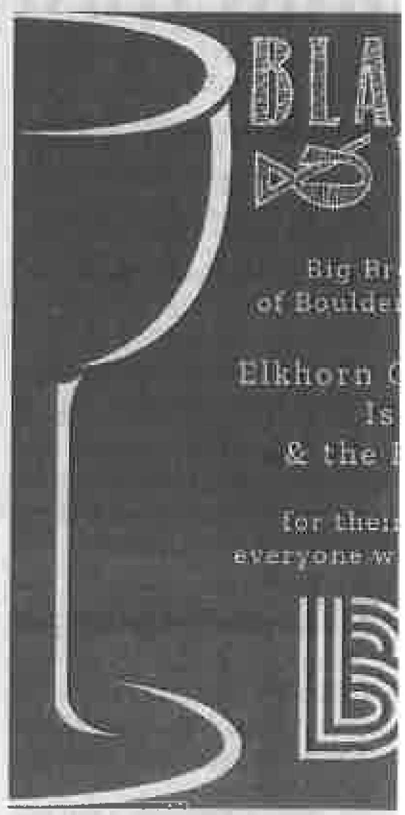
A subsurface fire was burning last week at the Boulder landfill site.

Officials said the fire began after an intentional burn to do away with wood waste, but the fire got into an underground area where waste had been loosely piled in an old pit and covered with too little dirt cover. Officials said the fire would probably be smothered with extra dirt, but that approach would have to be approved by state Department of Environmental Quality officials. It would also probably require contracting with someone to bring in heavier equipment than the county solid waste department owns, they said.

In Appreciation

Thank you to the followi
ciously provided dinner for
School staff during our Fall
ences! We are all so gratef
port and generosity of the c

Sarah Ahlers
Kari Bowman
Brady Dawson
Megan Dawson
Sunni Dean
Nicole St



Boulder Area Ev

NOVEMBER

21 Senior Citizens Meeting 1 pm a

22 Happy Thanksgiving!

26 Mariah's Challenge Meetin

DECEMBER

5 Boulder Elementary Holiday

Effort to turn Capital Hill Mall into museum revived

to change them. Their erasers don't work real well."

If Jefferson County is going to get serious about being a recreational mecca, it needs a paid staffer to oversee recreational issues, the commissioner maintained.

See FOREST ROADS, p. 16

eggs from the Jefferson City Easter Egg Hunt. At right a youngster shows bubbly delight over winning a jar of bubble solution at the Boulder egg hunt. For more photos from each event, see pages 8 & 9. (Photos by Bud Sideris and Jan Anderson)

MDC future remains in hands of legislature

TWO COMPETING BILLS REMAIN ALIVE; LIKELY HEADED TO NEGOTIATIONS

by **Jan Anderson**, editor

Two competing bills crafted to determine the future of the Montana Developmental Center and mitigation funds to the community of Boulder appear headed for a showdown.

House Bill 387 and Senate Bill 271 offer differing views over what should happen, though each carries a core provision that would keep the MDC operating on some level for up to two additional years. Both also stand to establish a crisis intervention facility of up to 12 beds, though provisions differ over the longevity of those facilities.

Major differences in the current versions of the bills:

• HB 387 caps the census of the MDC at 24, a provision not addressed in SB 271.

• HB 387 calls for increased authorization for spending for direct care services by private community providers. Wages for those providers are not addressed in SB 271.

• HB 387 calls for the continued operation of the state-operated intensive care unit already in existence, but ends emergency admissions there on March 31, 2019. SB 271 calls for the establishment of a 12-bed intensive behavior center without reference to the location of that service.

• HB 387 contains no reference to the proposed $500,000 "Boulder Development Fund" originally placed in the governor's budget to help the community mitigate impacts from the closure of the MDC. SB 271

See MDC BILLS, p. 3

Commissioners say solid waste rate increase could be considered

by **Jan Anderson**, editor

Increasing amounts of waste entering the Jefferson County Solid Waste stream means it is time to talk options, the county commission said last week.

The tonnage of waste has increased precipitously, said Commissioner Leonard Wortman, and the number of new users is also up. The biggest increase, he said, is at Montana City where the transfer site is open seven days a week and an average 400 users visit the site each day.

The solid waste budget reserves are dwindling, he said, and some equipment needs to be replaced.

Solving the problem will require some changes, said Wortman, perhaps in the form of a rate increase or maybe with the addition of a scale to enable charging by weight.

Rates have not been raised in many years, but costs of disposing of the waste has continued to rise, said the commissioners. Expanded service hours have also played a role, they said

No meeting has been set yet, said the commission, but there will probably be public meetings to discuss options in late May or early June.

Weather Statistics

Date	H	L	Precip
Tues	56	19	.00
Wed	59	34	.03
Thurs	60	19	.19
Fri	50	30	.01
Sat	50	26	.01
Sun	57	21	.00
Mon	55	34	.02

Weather statistics reported here are not the official National Weather Service records.