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TO: Jim Dunnigan, Montana Fish, Wildlife and Parks
FROM: Amy Sacry and Jesse Wallace, Geum Environmental Consulting, Inc.
DATE: November 27, 2019
RE: Therriault Creek 2019 As-built and Maintenance Summary

This memo describes restoration treatment installation and revegetation maintenance work completed in 2019 at the Therriault Creek Restoration Project Site under Montana Fish, Wildlife and Parks (FWP) Task Order 19-0010. Restoration treatments and maintenance tasks were identified by Geum Environmental Consulting (Geum). Installation of restoration treatments and maintenance tasks was completed by Westslope Forest Management (Westslope) and Geum. Weed control was completed by Mountain Valley Plant Management (MVPM).

The Therriault Creek Restoration Project Site was evaluated by Geum on May 13 and 14, 2019. The purpose of the site evaluation was to identify revegetation treatment maintenance needs, determine weed control needs, and finalize lay-out and design of 2019 proposed restoration treatments. A detailed description of observations related to the overall condition of the site is provided in a separate document, *Therriault Creek Restoration Project – Five-year Vegetation Management Plan* (Geum, 2019). This plan identified restoration treatments and a schedule for implementing treatments. Geum and Fish, Wildlife and Parks discussed 2019 restoration treatments in early spring, 2019, and treatment locations were finalized during the May, 2019 site evaluation. Details on these treatments are described in a separate document, *Therriault Creek Restoration Project – Permit Support Information* (Geum, June 6, 2019).

2019 Restoration Treatments

Three types of restoration treatments were installed in 2019: point bar expansion, grass sod scalping and planting, and brush matrix streambank treatments. Each of these treatments, including final installation quantities, are described below. Restoration treatments were installed on October 22-25, and November 4-7, 2019. Figure 1 shows the locations of completed treatments. Materials for restoration treatments were purchased directly by FWP and are listed in Attachment 1.

Point Bar Expansion Treatment

Five locations were lowered to expand point bars and increase floodplain connectivity on inside meander bends (Figure 1, Table 1). These areas were almost all dominated by dense cover of aggressive, introduced, pasture grasses and were previously disturbed during the original stream channel construction in 2004-2005. No previous planting of riparian shrubs and trees had been done in

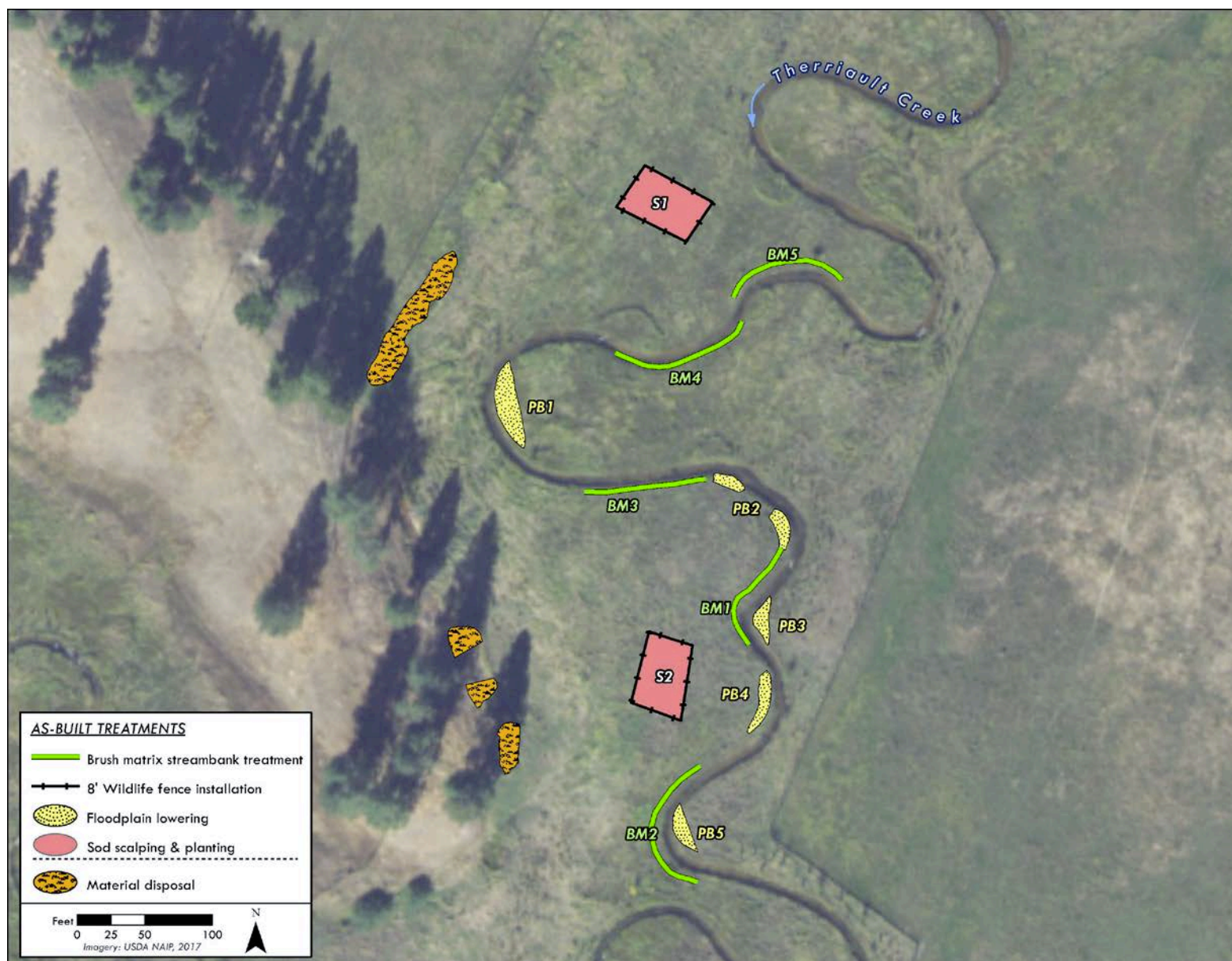


Figure 1. Therriault Creek Restoration Project Fall 2019 As-built treatment locations.

these areas. This treatment removed the dense pasture grasses, exposing bare substrates that can be colonized by woody riparian shrubs; and lowered the floodplain elevation, creating areas of increased connectivity with the channel that will allow high flows to create natural disturbances necessary for riparian vegetation community initiation. Willows were installed in a trench approximately 1 foot above the low flow water surface elevation at each point bar expansion location. A total of 350 willow cuttings were installed in these treatments. Each point bar expansion area was seeded with a mix of native wetland grasses (Table 2). Before and after photographs of each treatment location are shown in Figure 2 through Figure 6. Excess material generated from point bar lowering treatments was placed in ponds shown on Figure 1.

Table 1. Area of each point bar treatment installed at the Therriault Site in Fall 2019.

Point Bar Lowering	Area (sq ft)
PB1	808
PB2	458
PB3	263
PB4	353
PB5	301
Total Area	2,183

Table 2. Seed mix used in Fall 2019 Therriault Site restoration treatments.

Species Name		Seeding Rate (PLS lb/ac)
Slender wheatgrass	<i>Elymus trachycaulus</i>	6
American sloughgrass	<i>Beckmannia syzigachne</i>	1.25
American mannagrass	<i>Glyceria grandis</i>	1
Tufted hairgrass	<i>Deschampsia cespitosa</i>	0.5
Bluejoint reedgrass	<i>Calamagrostis canadensis</i>	0.25
		9



Figure 2. Point Bar Lowering Site 1 before (photo left) and after (photo right) treatment.



Figure 3. Point Bar Lowering Site 2 before (top left photo) and after (top right and bottom photos) treatment.



Figure 4. Point Bar Lowering Site 3 before (photo left) and after (photo right) treatment.



Figure 5. Point Bar Lowering Site 4 before (photo left) and after (photo right) treatment.



Figure 6. Point Bar Lowering Site 5 before (photo left) and after (photo right) treatment.

Grass Sod Scalping and Planting Treatment

Sod scalping and planting occurred in two locations at the Site in Fall 2019 (Figure 1). The purpose of this treatment was to remove the aggressive grass species and expose the bare mineral soil underneath to allow desirable species to establish. The exposed soil was seeded with the seed mix shown in (Table 2) and planted with a mix of willow species (Table 4). Willows were planted at a very tight spacing (approximately 2 to 3 feet on center) to increase willow cover. The two planted areas were fenced with 8-foot tall heavy duty net fencing to prevent browse and damage by ungulates and rodents. Figure 7 and Figure 8 show the sod scalping and planting treatment areas before and after treatment. Excess material generated from sod scalping treatments was placed in ponds shown on Figure 1. Excavated sod was also used to reclaim the surfaces of these ponds once filled.

Table 3. Area of grass sod scalped and planted and total length of fence installed in each treatment area at the Therriault Site in Fall 2019.

Grass Sod Scalping and Planting Treatment	Area (sq ft)	Fence Perimeter (linear feet)
S1	2,076	188
S2	1,984	183
Total	4,060	371

Table 4. Containerized plant species and quantities planted at sod scalping treatment areas S1 and S2 at the Therriault Site in Fall 2019.

Species Name		Plant Container Size	
		10 cubic inch	40 cubic inch
Bebb willow	<i>Salix bebbiana</i>	98	60
Booth's willow	<i>Salix boothii</i>	0	200
Drummond willow	<i>Salix drummondiana</i>	188	76
sandbar willow	<i>Salix exigua</i>	0	200
Geyer willow	<i>Salix geyeriana</i>	0	200
Total Area	Total	286	736



Figure 7. Grass Sod Scalping and Planting Site 1 (S1) before (photo left) and after (photo right).



Figure 8. Grass Sod Scalping and Planting Site 2 (S2) before (photo left) and after (photo right).

Brush Matrix Streambank Treatment

Brush matrix streambank treatments were installed at five locations at the Site in Fall 2019 (Figure 1). The purpose of this treatment was to increase riparian woody vegetation cover along the stream and increase aquatic habitat cover. This treatment used small logs and woody brush material combined with dormant willow cuttings. A total of 499 liner feet of brush matrix streambank treatment was installed (Figure 5). A total of 1,500 6 to 8-foot long and ½" to 1" diameter willow cuttings were installed in brush matrix streambank treatments. Excess material generated from brush matrix streambank treatments was placed in ponds shown on Figure 1.

Table 5. Length of brush matrix streambank treatments installed in fall 2019.

Brush Matrix Streambank Treatments	Length (ft)
BM1	88
BM2	118
BM3	90
BM4	107
BM5	96
Total	499



Figure 9. Brush Matrix Site 1 before (top left photo) and after (top right and bottom photos).



Figure 10. Brush Matrix Site 2 before (top photos) and after (bottom photo).



Figure 11. Brush Matrix Site 3 before (left photo) and after (right photo).



Figure 12. Brush Matrix Site 4 before (left photo) and after (right photo).



Figure 13. Brush Matrix Site 5 before (left photo) and after (right photo).

2019 Maintenance Observations and Completed Maintenance

All previous installed revegetation treatments were observed during the 2019 site evaluation for maintenance needs. Three types of maintenance were identified during the site evaluation:

- Riparian protection fence repair
- Browse protector maintenance
- Removal of browse protectors and replacement with wire cages

A brief description of the observations and maintenance work associated with each of these items is provided below.

Riparian Protection Fence Repair

Several locations were identified where the riparian protection fence netting was sagging, ripped, or where deer had created holes underneath the fence (Figure 14). Fewer maintenance locations were identified in 2019 compared to 2018. Specific maintenance tasks provided to the maintenance subcontractor with instructions to address the repairs as follows:

- Patch larger rips and tears in the netting with zip ties, salvaged fence, and/or browse protector materials.
- Re-secure fencing to posts with zip ties, and straighten any damaged or leaning posts.
- Re-secure fence netting to the ground with ground staples.
- Repair holes under the fence with salvaged fence material and/or browse protector materials.
- The subcontractor was also instructed to make repairs to any additional locations they observed.



Figure 14. Examples of riparian fence damage requiring maintenance (top photos). Hole under fence from deer (bottom left photo). Open gate at downstream, west side of project that was open again in 2019 (bottom right photo).

Browse Protector Maintenance

Browse protectors were installed on all planted trees and shrubs in 2007 and 2010. Browse protectors were also installed on hundreds of residual shrubs from the original 2005 planting. Browse protectors have been removed, repaired, or expanded every year, as needed, since 2008. After installation of the riparian protection fence in 2013 and 2014, browse protectors were removed from all plants in the 2007 planting area. Protectors have been selectively removed from plants within the 2010 planting area. All protectors on living shrubs and trees were left on plants outside of the riparian protection fence. Due to the extensive browse observed within the riparian protection fence in 2018, Geum determined that no additional browse protectors should be removed from living plants even within the fence. Instead, these protectors were repaired and enlarged as needed in 2018. Less browse was observed in May, 2019 compared to 2018, likely because perimeter fence repairs in 2018 were still functioning. Within the riparian protection fence, additional browse protector removals, repairs and expansions were identified in 2019. Outside of the riparian protection fence, many browse protectors were down due to rotting of the wooden posts, and others required removal due to the loss of plants. Instead of repairing the protectors around living plants, in 2019, it was determined that a better long-term solution would be to replace the plastic browse protectors with wooden posts with metal cages and steel t-posts.

These plants require longer-term protection from ungulate browse, and the existing browse protectors have exceeded their expected life span of five years. Photographs showing browse protector maintenance needs are provided in Figure 15. Geum recorded the approximate number of browse protectors to be removed, repaired, enlarged, or replaced in each 2010 planting unit and provided the following instructions to the maintenance crew:

- Within the riparian protection fence:
 - Remove browse protectors from all dead plants and re-use protectors for the following two tasks: 1) enlarge protectors around plants that have outgrown the protector; and 2) install new protectors on shrubs outside of the riparian protection fence with no existing browse protection.
- Outside of the riparian protection fence:
 - Remove all damaged or outgrown black plastic browse protectors and install metal browse protectors around surviving trees and shrubs. Some intact and functioning black plastic browse protectors were left in place.



Figure 15. Example of browse protectors needing repair.

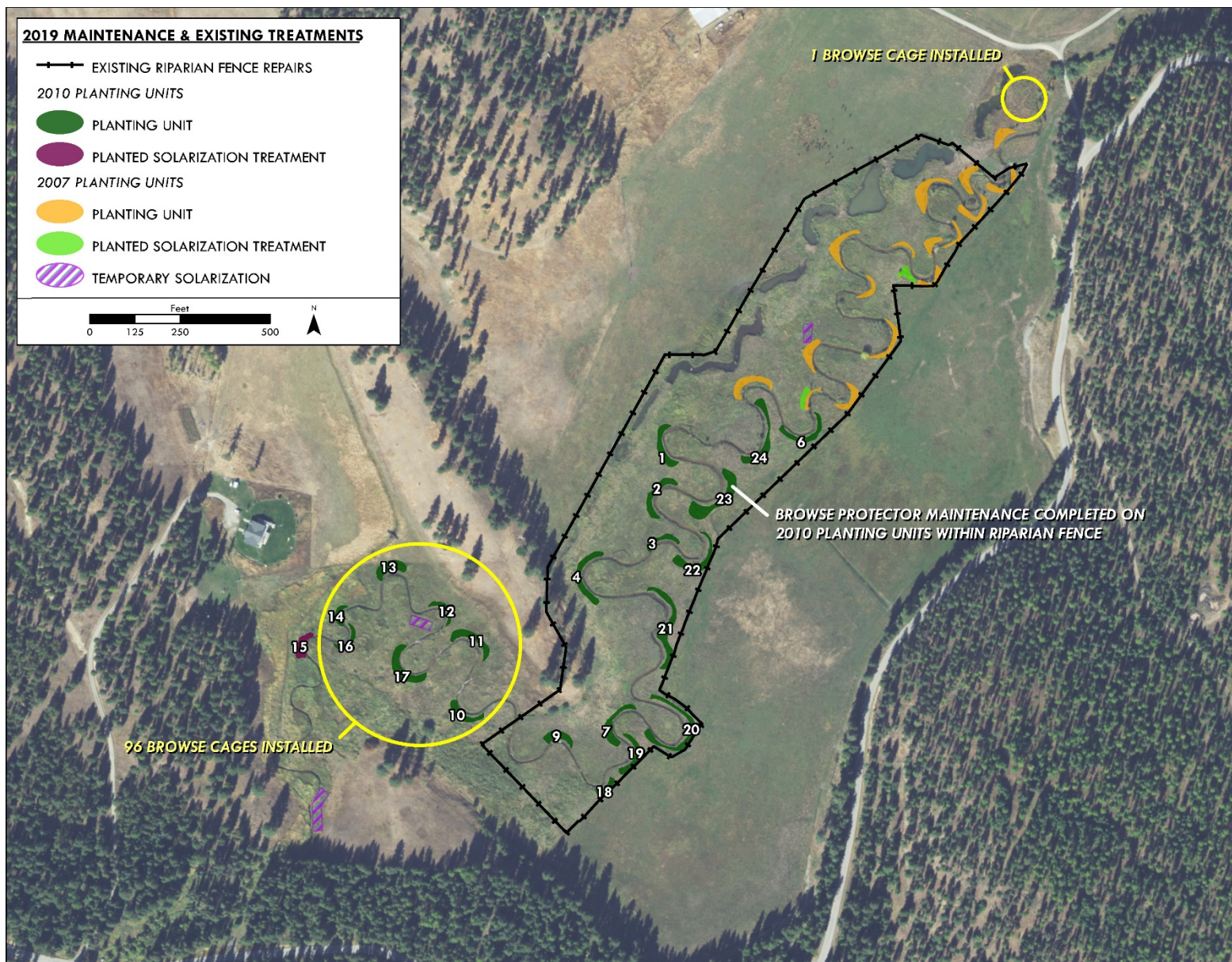


Figure 16. Completed maintenance locations at the Therriault Site in 2019.

Completed Maintenance

Maintenance work was completed between October 22-25 and November 4-7, 2019, by Westslope. Table 1 summarizes Geum's initial estimate of maintenance work to be completed in 2019 and the actual work completed by Westslope. Figure 16 shows the locations of completed maintenance work. A brief description of completed maintenance tasks is included below. Materials for wire cages were purchased directly by FWP and are listed in Attachment 1.

Table 6. Summary of estimated and completed maintenance quantities.

Task	Unit	Estimated Quantity	Completed Quantity
Riparian protection fence repair	Linear feet	NA ¹	290
Metal browse protector installation	Each	100	97
Browse protector maintenance	Each	100	266

¹ Specific fence repair locations and total quantities of repairs were not estimated in 2019.

Riparian Protection Fence Repair

A total of 290 linear feet of riparian protection fence was repaired in 2019 (Table 1). Repair of the existing riparian fence included patching small holes and tears in the fence netting, straightening bent or damaged fence posts, re-securing fence netting to existing fence posts, re-securing fence netting to the ground, and patching holes under the fence. Exact locations of fence repairs in 2019 were not recorded.

Browse Protector Maintenance

A total of 174 browse protectors were removed and 92 were enlarged or installed for a total of 266 browse protectors maintained in 2018 (Table 6 and Table 7). Browse protector maintenance included removing browse protectors (netting and posts) from dead shrubs, enlarging existing browse protectors around shrubs that had outgrown original browse protectors, and installing new browse protectors on shrubs without browse protection. Removed browse protectors were used to enlarge other protectors or install protectors on plants with no protection. The removal of the majority of black plastic browse protectors outside of the riparian protection fence was not included in the original estimate, and sufficient materials were available to complete additional browse protector maintenance inside the fence, resulting in the completion of more browse protector maintenance than originally estimated. Table 7 summarizes the actual number of browse protectors removed and enlarged/installed within each 2010 planting unit.

Metal Browse Cage Installation

A total of 97 metal browse cages were installed in planting units outside of the riparian fence in 2019. Browse cages were installed on larger trees and shrubs that had outgrown the existing black plastic browse protectors. Black plastic browse protectors were removed prior to metal cage installation, and removed materials were discarded or reused for browse protector maintenance depending on condition. Metal browse cages consist of 5-foot tall welded metal wire attached to two steel t-posts, and are approximately 3 feet in diameter. Table 7 summarizes the number of metal browse cages installed within each 2010 planting unit outside of the riparian fence.

Table 7. Summary of browse cage installation and browse protector maintenance completed by planting unit in 2019

2010 Planting Unit	Metal Browse Cage Installation	Browse Protector Removal	Browse Protector Expansion	Browse Protector Installation	Total Maintenance Units
1				10	10
2			5	3	8
3			4	2	6
4			8	1	9
6					0
7		9	5		14
9		3	3	1	7
10	10	11			21
11	12	14			26
12	6	8			14
13	14	17			31
14	14	14			28
15					0
16	14	18			32
17	26	26			52
18					0
19					0
20		16	8		24
21		4	16		20
22		13	7	6	26
23		5	4		9
24		3	9		12
Misc.*	1	13			14
Totals	97	174	69	23	363

Weed Control

Figure 17 shows the distribution of weeds at the Site in 2018. No weed control was completed in 2018 and the distribution and density of weeds observed during the May 2019 site review was similar to 2018. 2018 weed observations are described in the 2018 Management Plan and a separate memo, *Therriault Creek 2018 Maintenance Summary* (Geum, January 15, 2019).

The weed distribution map shown on Figure 17 was provided to the weed control contractor to direct 2019 weed control activities. Weed control was completed by MVP on July 15 through July 18, 2019. Canada thistle (*Cirsium arvense*) was the primary weed targeted. Musk thistle (*Carduus nutans*), houndstongue (*Cynoglossum officinale*), and yellow toadflax (*Linaria vulgaris*) were also treated. Approximately 26 acres were treated at the site. Herbicide application records are provided in Attachment 2. Weed control activities in the hayfield east of the project area were completed by the landowner.

Next Steps

Following the 2019 Management Plan, the following activities are planned for 2020:

- June/July 2020: Annual Site Review
- July 2020: Weed Control
- September/October 2020: Site Maintenance
- October 2020: Follow -up Weed Control

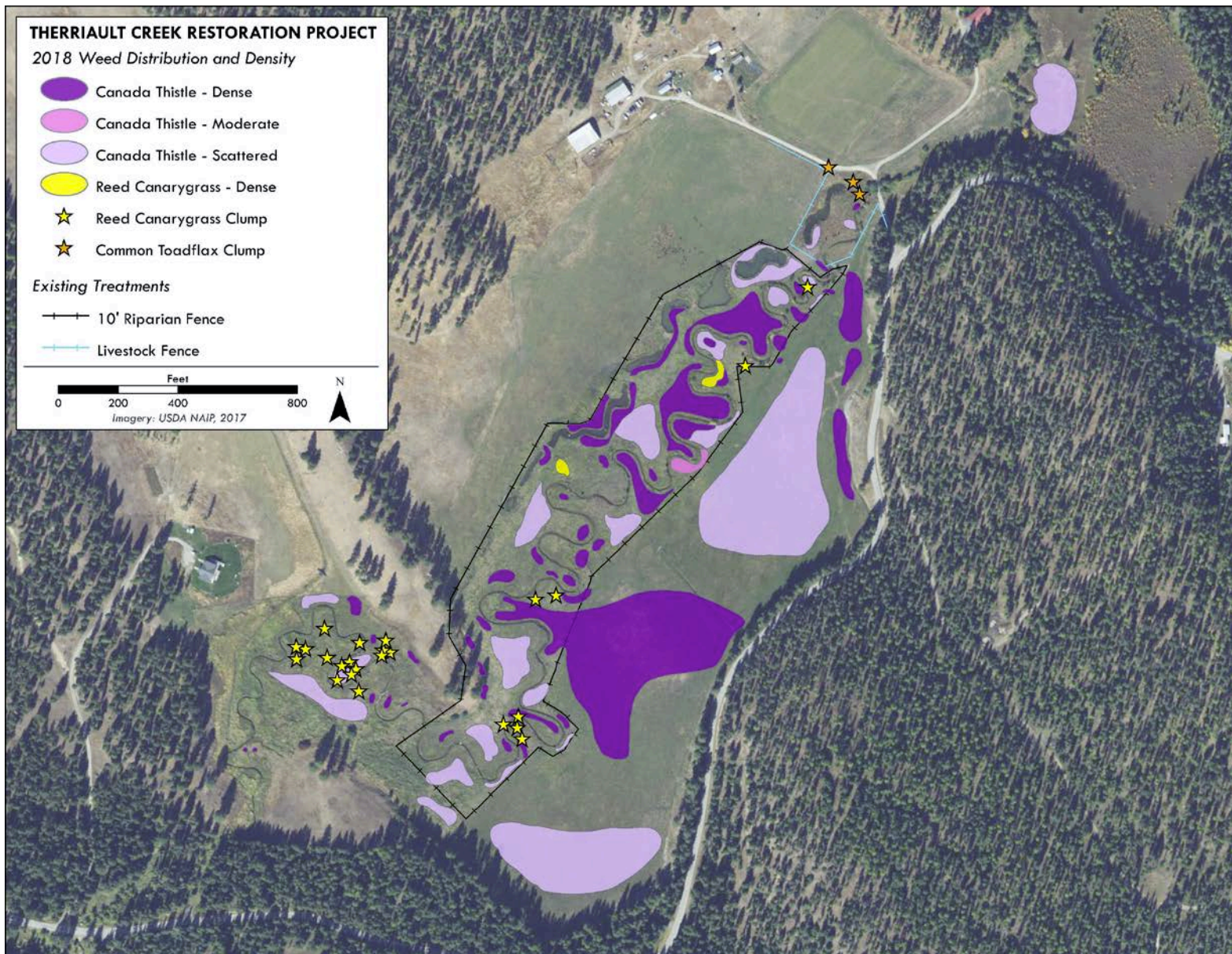


Figure 17. Weed species and densities mapped at the Site in 2018. This information was used to guide weed control treatment in 2019.

Attachment 1: Materials purchased directly by Fish, Wildlife and Parks

Type of Material	Source	Quantity Purchased/ Provided
8' x 100' Elk and Large Animal Fence	Deerbusters	400 linear feet (4 rolls)
10' tall x 4" diameter wooden posts	Feed Bin (Eureka, MT)	30
5' tall wire fence	Local	1,000 linear feet (10 rolls)
T-posts	Local	200
Seed	Granite Seed	9 PLS pounds
Plants: 40 cubic inch	The Confederated Salish & Kootenai Tribes Nursery	736
Plants: 10 cubic inch	The Confederated Salish & Kootenai Tribes Nursery	286
Small logs and brush	FWP office in Libby	Approx. 8 trailer loads

Attachment 2: 2019 Herbicide Application Records



APPLICATION RECORD

406-544-6582 / 406-544-5496
mountainvalleyplant@gmail.com

NAME: Geom Environmental attn Amy Sacry
ADDRESS: Therriault Meadows Wetland mitigation
EMAIL: PHONE: 406 381 0858
APPLICATOR: Nick Holden 100819-12

	APPLICATION 1	APPLICATION 2
LOCATION:	Inside Exclosure W side	Inside Exclosure E side
DATE	7/15/19	7/16/19
START/STOP:	8 Am - 430 Pm	930 Am - 12:00P
TEMPERATURE:	76°	58°
WIND SPEED/DIRECTION (from)	1-5 Light + Variable	L + V
HERBICIDE CODE: T M E G O	M + E	M + E
RATE:	7oz + 1oz/12.5 gallons = 1 Acre	
CROP OR SITE:	Non Crop	
PEST(S):	Canada Thistle Hand stongue	Musk Thistle Yellow Toad flax
EQUIPMENT USED: 2013 ATV		
ACRES/ AREA / HOURS TREATED:	16	8 (24 Total)

HERBICIDE CODES:

T=TORDON 22K= DOW, 62719-6
M=MILESTONE= DOW, 62719-519
E=ESCORT XP = BAYER, 432-1549
G=GLYPHOSATE=

O=OTHER=

RECOMMENDATION:

App Fee \$100 x 24 Acres
Herb fee ~~0~~ Chemical included
\$ 2400



APPLICATION RECORD

406-544-6582 / 406-544-5496
mountainvalleyplant@gmail.com

NAME: Geum Environmental Attn Amy Sacry
ADDRESS: Theriault Meadow Wetlands Site
EMAIL: PHONE: 406 381 0858
APPLICATOR: Nick Holden 100819-12

	APPLICATION 1	APPLICATION 2
LOCATION:	Inside Exclosure	"
DATE	7/17/19	7/18/19
START/STOP:	1 ^{PM} 8:30 PM	10 ^{AM} 6:30 PM
TEMPERATURE:	72°	10 ^{AM} 6:30 PM
WIND SPEED/DIRECTION (from)	1-5 Gusts at times	Wind
HERBICIDE CODE: T M E G O	M + E	Transline + Escort
RATE:	2oz + 1/4oz / 4gallons	4oz + 1/4oz / 4gall
CROP OR SITE:	Non Crop	
PEST(S):	Thistle Toadflax	
EQUIPMENT USED:	SPG Pro	SPG Pro
ACRES / AREA / HOURS TREATED:	.8 Acres	.6 Acres
HERBICIDE CODES:		
T=TORDON 22K= DOW, 62719-6		
M=MILESTONE= DOW, 62719-519		
E=ESCORT XP = BAYER, 432-1549		
G=GLYPHOSATE=		
O=OTHER=		

RECOMMENDATION:
App fee \$70.00 x 7.5 hrs
Chemical included
525.00