Vegetation Resources Technical Report for Wyoming Pipeline Corridor Initiative Area

Prepared for:

Wyoming Pipeline Authority

152 N Durbin St # 250
Casper, WY 82601

Prepared by:

Sofia Agudelo, Bret Callaway, and Gretchen Norman

Western EcoSystems Technology, Inc.
4007 State Street, Suite 109
Bismarck, North Dakota 58503

March 2016

TABLE OF CONTENTS

VEGETATION 1
Affected Environment - Vegetation Resources 1
Environmental Consequences - Vegetation Impacts 16
Mitigation Measures - Construction and Restoration Procedures 18
Overall Vegetation 18
Aboveground Facilities 22
Vegetation Communities of Special Concern or Value 23
Wetlands and Riparian 23
Conservation Reserve Program 32
Noxious Weeds and Other Invasive Plants 34
REFERENCES 41

LIST OF TABLES

Table 1. Land cover (acres and percent composition) present within the Wyoming Pipeline Corridor Initiative Area. Source: USGS NLCD 2006. 7

Table 2. Vegetation communities intersected by the Wyoming Pipeline Corridor Initiative with their corresponding corresponding terrestrial habitat types according to the State Wildlife Action Plan (SWAP). Sources: WGDF 2010a,b; Wiken at al. 2011. 8

Table 3. Sensitive plant species with potential or verified occurrence in the counties intersected by the Wyoming Pipeline Corridor Initiative with their Rank/Designation according to the State of Wyoming (WY), the US Fish and Wildlife Service (USFWS), the US Forest Service (USFS), and Bureau of Land Management (BLM). Sources: WYNDD 2012, USDA NRCS 2015b, NatureServe 2015, USFS Regions 2 and 4 (2013, 2015), USFWS 2015a, b), BLM 2010. 13

Table 4. Description of impacts on vegetation resulting from the construction, operation, and maintenance activities associated with the Wyoming Pipeline Corridor Iniciative. 18

Table 5. Proposed measures to avoid, minimize, and mitigate impacts on vegetation resulting from the construction, operation, and maintenance activities associated with the Wyoming Pipeline Corridor Iniciative. Indicators of success are presented for each proposed measure. 21

Table 6. Riparian habitat crossed by the proposed corridors. 27

Table 7. Wyoming-State designated and County declared noxious weeds with potential to occur in the counties intersected by the Wyoming Pipeline Corridor Iniciative. 35

Table 8. Summary of the potential concerns related to plant communities within the proposed pipeline corridors Wyoming Pipeline Corridor Initiative area. 40

LIST OF FIGURES

Figure 1. Ecoregions found within the Proposed Corridors. 3

Figure 2. Land cover/land use types in the Proposed Corridors. 4

Figure 3. Composition (%) of land cover/land use types in the Proposed Corridors. Source: USGS NLCD 2006..... 5

Figure 4. Land ownership in the Proposed Corridors. 6

Figure 5. Herbaceous and Woody Wetlands within the Proposed Corridors.....26

Figure 6. Conservation Reserve Program acres by County in the Proposed Corridors.....33

VEGETATION

This technical report was prepared in support of the Programmatic Environmental Impact Statement (PEIS) for the Wyoming Pipeline Corridor Initiative (WPCI). This technical report describes vegetation resources present within the proposed WPCI corridors and evaluates these general characteristics as related to potential or known impacts on the resources from the proposed project.

This programmatic evaluation was designed to aid in the development of a long-term vision for the WPCI that includes corridor-wide concepts and assists in making informed decisions about the best practices and strategies for near- and long-term implementation. As such, this PEIS defines existing and future potential issues within the proposed corridors, identifies a range of practices and strategies relevant to those issues, and evaluates the potential impacts of the Project on the vegetation at a broad-scale level.

The objectives of this report are: a) to characterize the proposed WPCI at the landscape and regional levels, describing the vegetation resources present within and around the proposed corridors; b) to evaluate the proposed corridors based on vegetation characteristics, assessing potential risks to vegetation and habitats, and c) to address implications for future pipeline project development, making recommendations for avoidance, minimization, and mitigation measures.

This programmatic analysis examines potential impacts at a conceptual level while subsequent NEPA documents for individual projects will include site-specific quantitative analyses of effects and provide avoidance, minimization, and mitigation measures. Individual project will be required to follow all specifications stated in the Plan of Development (POD) and implement them on all lands affected by construction within the proposed corridors unless otherwise specified by the landowner or land management agency.

Vegetation resources were evaluated through a desktop search of existing data; available datasets used to identify biological resources within the proposed corridors included topographical and aerial maps, land use/land cover or gap data, elevation data, data publicly available from several state, federal, and non-governmental agencies, published literature, and field guides. Information about presence (potential or verified) and location of sensitive species was obtained from publicly available information on several websites, including the United States Fish and Wildlife Service (USFWS), the Wyoming Game and Fish Department (WYGFD) and the Wyoming Natural Diversity Database (WYNDD). Information about each species' conservation status was gathered from several state, federal, and non-governmental agencies, including the USFWS, NatureServe, the United States Forest Service (USFS).

Affected Environment - Vegetation Resources

The WPCI Area (1,895 301.35 hectares [ha]; 4,683 391.63 acres [ac]) is located in central and western Wyoming, in Bighorn, Campbell, Carbon, Fremont, Hot Springs, Johnson, Lincoln,

Natrona, Park, Sublette, Sweetwater, and Washakie counties, with the Wyoming Basin and the Northwestern Great Plains Level III Ecoregions being the main ecoregions crossed by the proposed corridors (Figure 1; Chapmen et al. 2004). The general region is characterized by low precipitation and high summer evapotranspiration rates, open grasslands, shrublands, forests, ephemeral-intermittent streams, and a few perennial rivers and wetlands (Wiken et al. 2011), where a mosaic of dryland farming, cattle grazing, residential development, and energy development (oil, coal, and gas) with a large increase in coal-bed methane wells drilled in recent years, has largely replaced the native mixed grass/shortgrass prairies and shrublands (Figure 2; Jin et al. 2013).

The Wyoming Basin Level III Ecoregion is the largest ecoregion in the state of Wyoming, covering nearly 30 million acres that spread into some parts of Colorado, Idaho, Utah, and Montana. The terrain is an inter-montane basin with hills and low mountains and dominated by grasslands and shrublands that have adapted to a dry climate. Nearly surrounded by forest-covered mountains, the region is drier than the Northwestern Great Plains to the northeast and does not have the extensive cover of pinyon-juniper woodland found in the Colorado Plateaus to the south. Major land uses include livestock grazing although many areas lack sufficient forage to support this activity, natural gas and petroleum production, and mining. The Wyoming Basin also has extensive coal deposits along with areas of trona, bentonite, clay, and uranium mining (Omernik and Griffith 2012).

The Northwestern Great Plain Level III Ecoregions covers over 12 million acres in northeastern Wyoming, encompassing the Missouri Plateau section of the Great Plains. This ecoregion is characterized by rolling plains punctuated by occasional buttes and badlands in a semi-arid environment of shale and sandstone derived soils, which produces mostly grassland plant communities with some shrub and woody species in northern areas. Although limited by erratic precipitation and few opportunities for irrigation, wheat farming, along with livestock grazing, is a major land use. Mining for coal and coal-bed methane production is also prevalent, with a large increase in the number of coal-bed methane wells drilled in recent years. Native grasslands and some woodlands persist, especially in areas of steep or broken topography (Omernik and Griffith 2012).

The Southern Rockies and the Middle Rockies Level III Ecoregions are also intersected by the WPCI but constitute a relatively small percentage of the proposed corridors (Figure 1); these areas will be further addressed in later site-specific NEPA analyses as necessary.

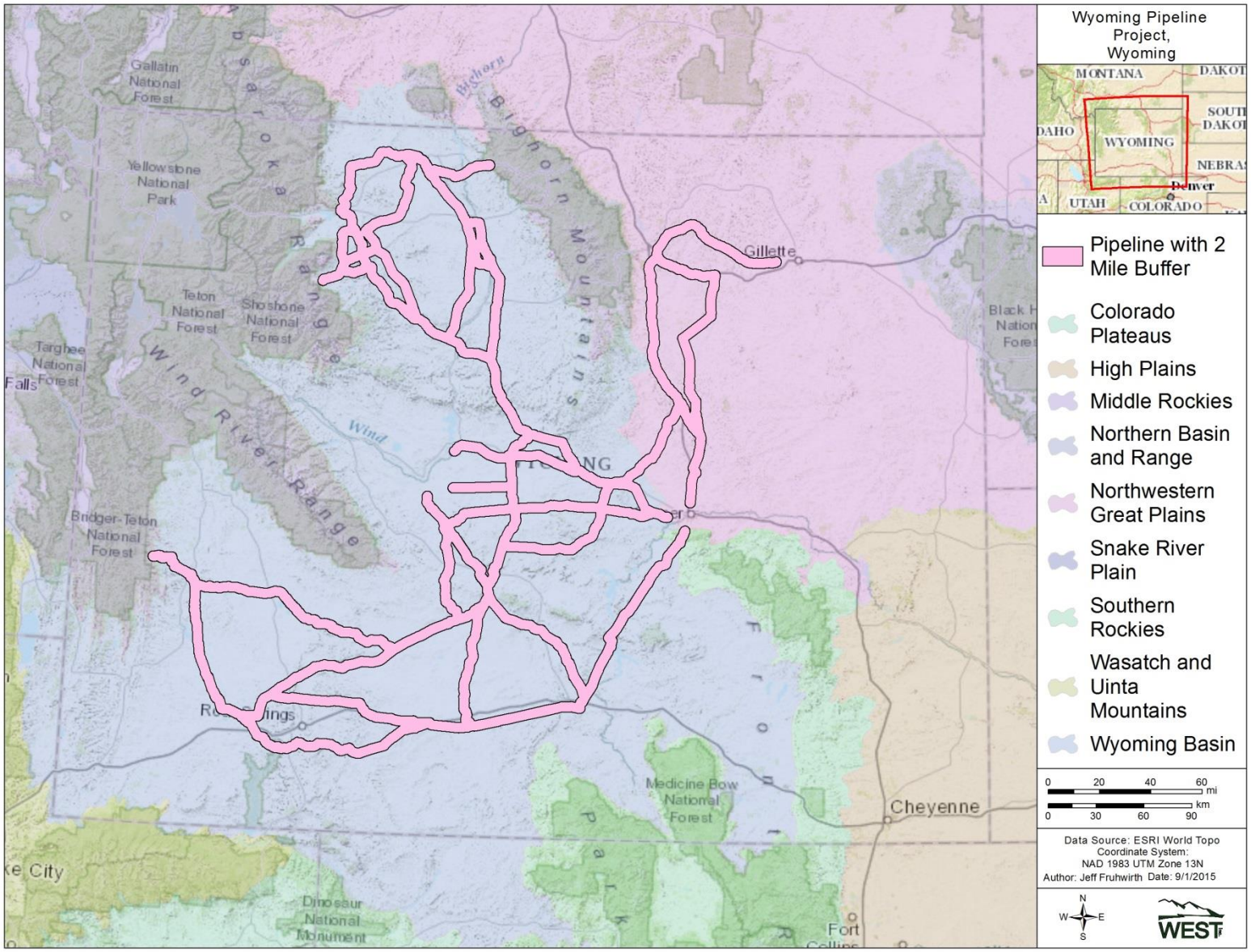

Figure 1. Ecoregions found within the Proposed Corridors.

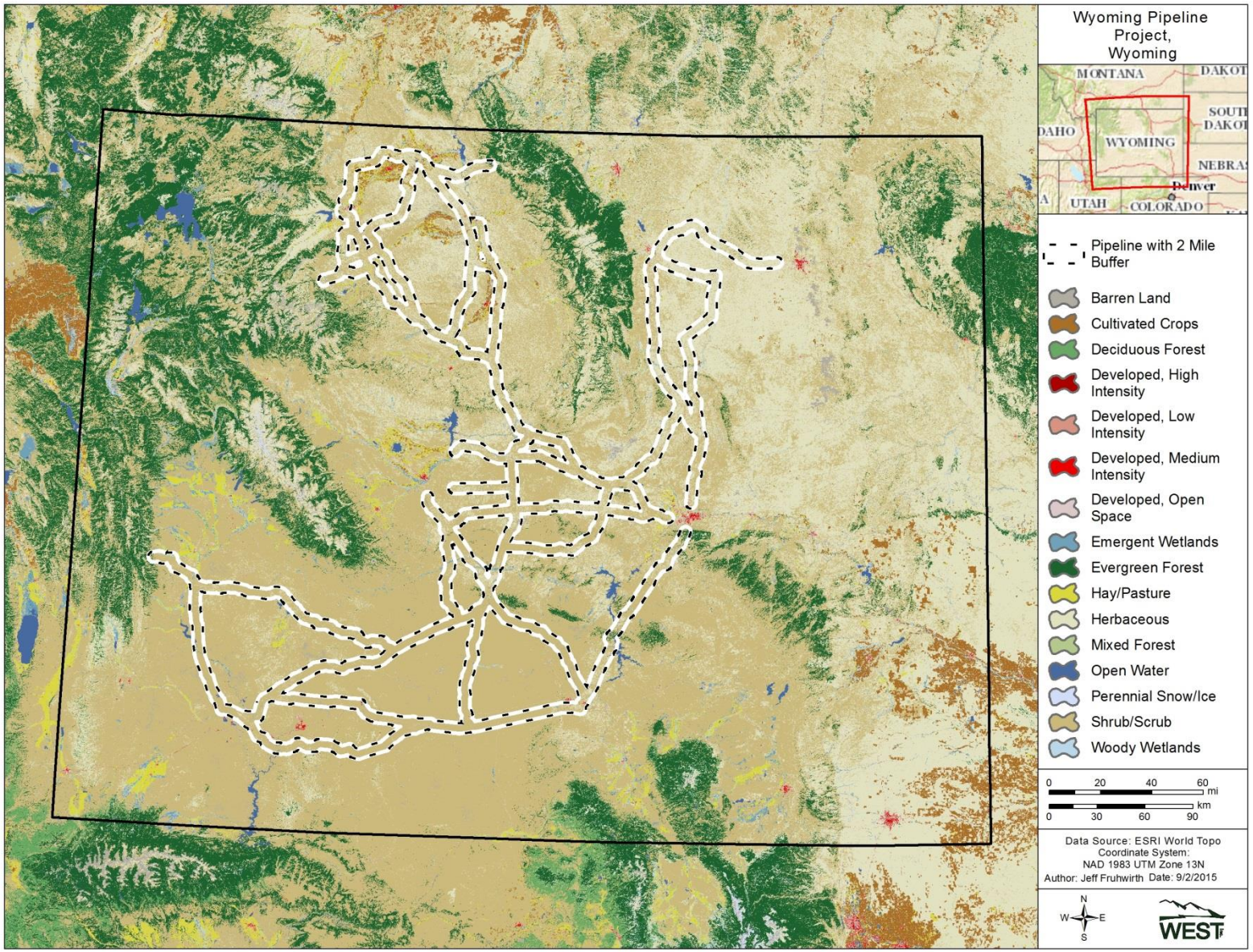

Figure 2. Land cover/land use types in the Proposed Corridors.

Herbaceous and shrub/scrub are the dominant land cover/land use types found in the WPCI representing 94.12% of the proposed corridors (Figure 3). Hay/pasture areas, especially wheat (*Triticum aestivum*) and alfalfa (*Medicago sativa*) fields follow far behind covering only 1.91% of the proposed corridors, while wetlands, forests, and developed areas constitute only small percentages of the proposed corridors (Table 1; Jin et al. 2013). The Bureau of Land Management (BLM) manages the majority (1,108.31 miles [mi]) of the land crossed by the WPCI. Privately owned land follows with 707.73 mi, and state lands make up for only 123.45 mi of the proposed corridors (Figure 4, POD 2014). The proposed corridors cross 1.05 mi of US Forest Service (USFS), 0.02 mi of US Department of Defense (USDOD) and 42.13 mi of the US Bureau of Reclamation (USBOR) managed lands located throughout the State (Figure 4).

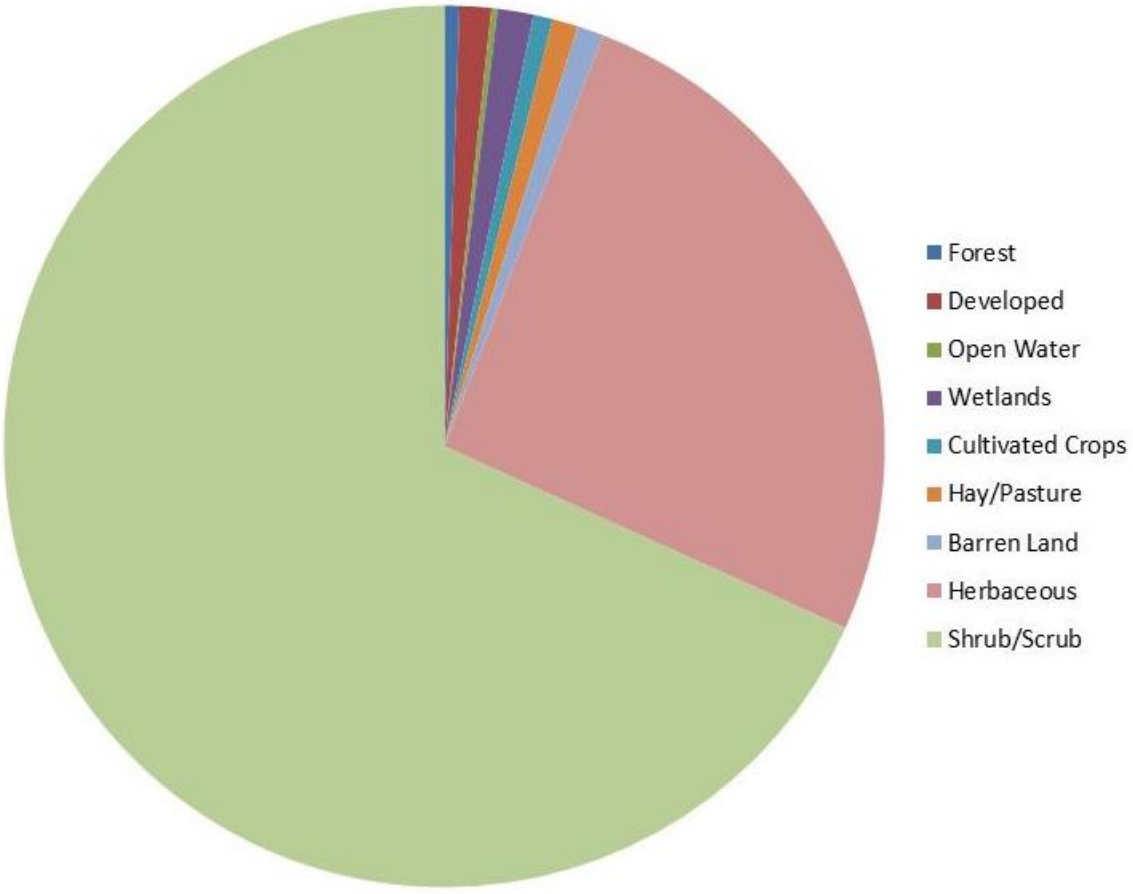

Figure 3. Composition (%) of land cover/land use types in the Proposed Corridors. Source: USGS NLCD 2006.

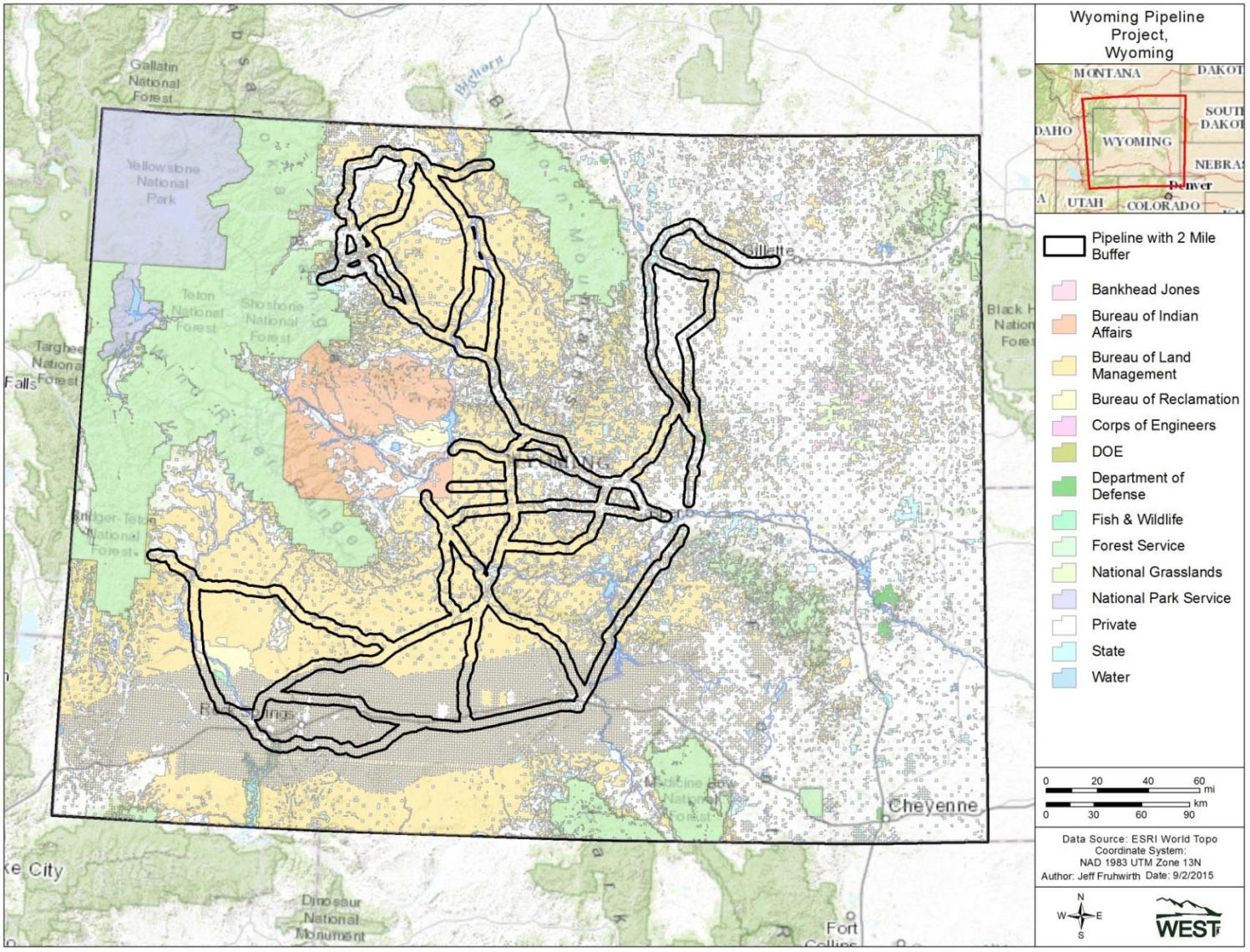

Figure 4. Land ownership in the Proposed Corridors.

The proposed corridors would cross 1,983.97 miles (mi) impacting about 4,683,391.6 acres (ac) of the following land cover/land use types: shrub/scrublands, herbaceous/grasslands, hay/pastures, croplands, herbaceous and woody wetlands, evergreen forests, deciduous forests, and mixed forests (Table 1).

Table 1. Land cover (acres and percent composition) present within the Wyoming Pipeline Corridor Initiative Area. Source: USGS NLCD 2006.

Land Cover	Acreage	% Composition
Shrub/Scrub	3, 195 665.34	68.23
Herbaceous/Grassland	1, 212 561.77	25.89
Barren Land	45, 344.98	0.97
Hay/Pasture	44, 063.44	0.94
Developed-Open	35, 678.42	0.76
Cropland	33, 356.55	0.71
Woody Wetlands	31, 683.92	0.68
Herbaceous Wetlands	30, 032.32	0.64
Evergreen Forests	24, 801.70	0.53
Developed-Low	14, 961.67	0.32
Open Water	10, 370.64	0.22
Developed-Medium	3, 265.53	<0.1
Deciduous Forest	909.14	<0.1
Developed-High	492.11	<0.1
Mixed Forest	204.09	<0.1
Total	**4, 683 391.63**	**100**

Shrub/Scrub (68.2%) and Herbaceous (32.1%) covers are extensive and represent the majority of the area potentially impacted by the WPCI, followed by far by barren land (0.97%) and hay/pasture (0.94%). All other land cover/use types represent less than 0.9% of the proposed project area (Table 1, Figures 2 and 3). Land cover/land use types and topography are homogeneous throughout the proposed corridors, with only slight differences. The northern portion has more cultivated crops and herbaceous cover, while hay/pastures are more prevalent in the western portion of the proposed corridors. Wetlands and riparian habitats are scarce despite the existence of several small creeks, rivers, and stock ponds, scattered throughout the proposed corridors (Figure 2), while forests and woodlands are mostly associated with riverine habitats, tree rows, and highly localized on the foothills of the dry mountain ranges scattered across the region. Open space (0.76%) and low intensity (0.32%) developed areas occur as farmsteads, oil wells, barns and buildings, highways and secondary roads, and transmission lines (USGS GAP 2015a). Topography is predominantly gently rolling, with some badlands mainly on the southwestern and central portions of the proposed corridors (USDA NRCS 2015a).

Among the challenges to conservation identified by the State's Wildlife Action Plan ([SWAP], WGFD 2010a), rural subdivision and development, energy development, climate change, invasive species, and disruption of historic disturbance regimes were the leading causes of concern. The following section on assessment of impacts from activities related to the construction, operation, and maintenance of the WPCI takes into account the entire length of the construction right-of-way (ROW) for the pipelines and extra temporary workspaces (ETWS); aboveground facilities, access roads, camps, and storage yards are not considered here since

they will be covered in site-specific NEPA analyses, as necessary. Actual acreage impacted during construction may differ from proposed acreage, due to changes in the width of the ROW resulting from site-specific considerations.

Characterized by arid and semi-arid grasslands and shrublands, the terrestrial habitat types (as described in the SWAP; WGFD 2010a) prevalent within the proposed corridors are: a) sagebrush shrublands; b) desert shrublands; c) prairie grasslands; d) xeric forests; e) deciduous forests; f) montane/subalpine forests, g) wetlands/riparian areas. A detailed description of the vegetative communities intersected by the proposed corridors and considered in the evaluation of potential environmental impacts from construction and operation, is presented in Table 2, Figure 2.

The SWAP (WGFD 2010a), lists the major habitat types and priority areas within each habitat type that represent unique natural communities or that are especially important to species of greatest conservation need. The mixed-grass/short-grass prairie landscape and associated shrub/scrub habitats, the Conservation Reserve Program (CRP) associated with the tame/planted grassland habitat type, and the wetlands/riparian landscape type associated with rivers and wetlands, are included among these focus areas. The vulnerability of these habitats to development and climate change has been assessed by the Nature Conservancy (TNC), the Wyoming Game and Fish Department (WYGFD), and the Wyoming Natural Diversity Database, ranking them according to their overall susceptibility to these disturbances as low, moderate, and high risk habitats (Pocewicz et al. 2014).

Table 2. Vegetation communities intersected by the Wyoming Pipeline Corridor Initiative with their corresponding corresponding terrestrial habitat types according to the State Wildlife Action Plan (SWAP). Sources: WGDF 2010a,b; Wiken at al. 2011.

Vegetation Community	SWAP Habitat type	Description	Representative Plant Species
Shrub/Scrub	Sagebrush shrublands	Potential natural vegetation is mostly sagebrush steppe, with the eastern edge of the region having more mixed grass prairie. Cheatgrass usually replaces native perennial grasses in over-grazed sagebrush habitats. European annual grasses have replaced the sagebrush vegetation in areas affected by frequent fires. Livestock ranches are common. Rangeland provides wildlife habitat for several species. Scattered oil, gas, and coal deposits.	Wyoming big sagebrush, basin big sagebrush, silver sagebrush, black sagebrush, mountain big sagebrush, Lahontan sagebrush, low sagebrush, mountain big sagebrush, bitterbrush, and rabbitbrush, fringed sage, western wheatgrass, needle-and-thread grass, blue grama, and junegrass

Table 2. Vegetation communities intersected by the Wyoming Pipeline Corridor Initiative with their corresponding corresponding terrestrial habitat types according to the State Wildlife Action Plan (SWAP). Sources: WGDF 2010a,b; Wiken at al. 2011.

Vegetation Community	SWAP Habitat type	Description	Representative Plant Species
	Desert shrublands	Vegetation is a sparse cover of arid land shrubs, with composition and density gradients determined by moisture, salinity, and topography. Generally occurs at lower to middle elevations and at many locations intergrades with a number of other arid and semiarid habitats such as desert grasslands and sagebrush steppe. This arid landscape is very sensitive to grazing pressure which may promote the invasion of weeds such as Russian thistle, cheatgrass, and the toxic halogeton. Oil, bentonite, and coal deposits are extensive throughout the basin	Greasewood, shadscale, fourwing saltbush, Gardner's saltbush, winter-fat, spiny hop-sage, kochia, Indian ricegrass, three-awn, alkali sacaton, saltgrass, and sand dropseed.
Herbaceous/ Grassland	Prairie Grasslands	Characterized by natural disturbances. Located in eastern Wyoming and in basins of central and western Wyoming. Perennial grasses, sedges, and herbaceous forbs dominate. Livestock grazing is common. Many invaded by the noxious and invasive plant that occur in agricultural lands.	Needle-and-thread, western wheatgrass, blue grama, Sandberg's bluegrass, prairie Junegrass, upland sedges, Indian ricegrass, smooth brome, dropseed, and red clover.

Table 2. Vegetation communities intersected by the Wyoming Pipeline Corridor Initiative with their corresponding corresponding terrestrial habitat types according to the State Wildlife Action Plan (SWAP). Sources: WGDF 2010a,b; Wiken at al. 2011.

Vegetation Community	SWAP Habitat type	Description	Representative Plant Species
Mixed forests	Xeric/Lower montane forests	Scattered dry mountain ranges and foothill slopes. Small forested areas occur at higher elevations. Land use is mostly livestock grazing and wildlife habitat.	Predominant shrub species include true mountain mahogany, curl-leaf mountain mahogany (associated with open juniper woodlands on dry rocky sites), serviceberry (in association with big sagebrush, pinon pine, juniper and aspen on dry ridges and slopes), antelope bitterbrush a (on areas with higher precipitation or where snow accumulates), skunkbush sumac, currant, gooseberry, and snowberry. Mountain big sagebrush and silver sagebrush are also common. Choke cherry may also be present, sometimes in abundance in moist sites. Associated grasses and forbs include arrow-leaf balsam-root, hairy golden-aster, Junegrass, and lupine.
Deciduous forests	Aspen/ Deciduous forest	Aspen, bur oak, Gambel oak, or bigtooth maple are dominant species. Varies in type from grasses and grasslike plants to shrubs, deciduous trees, and conifer trees depending on climate, terrain, soils, stream size, and disturbance. Associated with river channels, lake shores, hummocks, and wetland edges. Provides important wildlife habitat	Common species include narrowleaf and plains cottonwood, green ash, boxelder, elm, choke cherry, Rocky Mountain maple, alder, and peachleaf willow. These cover types are closely related to riparian habitats. Other deciduous woody species include bur oak (in Northeastern Wyoming only), Gambel oak (in south central Wyoming only), choke cherry, boxelder, and wild plum. Paper birch co-occurs with aspen in the upper elevations of the Wyoming Black Hills.

Table 2. Vegetation communities intersected by the Wyoming Pipeline Corridor Initiative with their corresponding corresponding terrestrial habitat types according to the State Wildlife Action Plan (SWAP). Sources: WGDF 2010a,b; Wiken at al. 2011.

Vegetation Community	SWAP Habitat type	Description	Representative Plant Species
Evergreen forest	Montane/Sub-alpine forests	Generally at elevations greater than 7,000 ft., with vegetation gradients determined by snow accumulation, aspect, soil type, temperature and evapotranspiration rates along an elevational gradient. Used mostly for timber, recreation, and wildlife.	Douglas-fir at lower and Ponderosa pine elevations; lodgepole pine at mid-elevations; and Engelmann spruce, subalpine fir, and whitebark pine at higher elevations. Limber pine is also present, which grows from low elevations up to tree line, is another subalpine tree species. Intermingled grasslands and meadows, aspen groves, wetlands, riparian areas, and mountain shrublands with mountain lakes and streams. Persistent aspen stands and mountain shrublands occur most often on south aspects.
Herbaceous/ Woody wetlands	Wetlands/ Riparian	Wet habitats on soils that are seasonally covered with water or in associated with riverine systems. Located in areas of high drainage beneath surrounding mountain ranges, or in areas with high water tables that keep the soil moist much of the year. Includes floodplains, low terraces, alluvial fans, riparian wetlands, wet meadows, potholes, playas, and marshes. Man-made irrigation projects have increased the areal extent of this vegetation type.	Willows and sedges on upper elevations, alder, tall willows, Engelmann spruce, narrowleaf cottonwood, lodgepole pine, and aspen, and occasionally blue spruce and balsam poplar follow a decreasing elevational gradient. Cottonwoods and boxelders common on lowland riparian. Understory characterized by Understory shrubs include chokecherry, hawthorn, rubber rabbitbrush, silver buffalo berry, silver sagebrush, skunkbush sumac, wild rose, and various species of willow. Hydrophilic wetland plants, such as horsetail, spikerush, sedges, and tufted hairgrass, line the drainages.
Cropland and Pasture	Excluded	The majority of crops are irrigated. Agricultural land can harbor populations of noxious and invasive plants. Pastures are used by livestock for forage	Routinely planted crops include barley, wheat, corn, potatoes, onions, beans, and alfalfa. Pastures include smooth brome, western wheatgrass, barley, oats, and red clover. Invasive species include cheatgrass, musk thistle, dandelion, field bindweed, bull and Canada thistle, sand bur, foxtail barley, puncture vine, and cocklebur.

Two federally-threatened, one federally-endangered, two candidate and 33 sensitive plant species (BLM 2010, USFWS 2015a) with potential/verified occurrences in the counties

intersected by the WPCI may occur in the proposed corridors. Table 3 shows the USFWS federally-listed and candidate, and BLM sensitive plant species that may occur in the counties intersected by the proposed WPCI (USFWS 2015a, BLM 2010), with their conservation status according to the Wyoming Natural Diversity Database (Heidel 2012) and the US Forest Service (USFS 2013, 2015).

Additionally, the Wyoming Natural Diversity Database monitors the trends and status of vegetation types and species of concern in Wyoming, maintaining a list of plant species/varieties of concern that includes 434 vascular plants with State Rank S1, considered to be of greatest conservation concern in the state (Heidel 2012); non-vascular species have not been ranked because nonvascular floristic baselines are non-existent for much of the state (WYNDD 2015). Given the extensive list, the lack of status and knowledge gaps on distribution and habitat requirements of several species, and the potential for occurrence in the counties intersected by the WPCI, further investigation into plant species and their habitat may be warranted as more defined locations for individual projects are determined within the proposed corridors.

These results indicate shrub/scrub and herbaceous vegetation occurring in areas dominated by native grassland/shrubland complexes of the mixed-grass prairies and sagebrush and semi-arid shrublands of the great plains and cold deserts, will face the majority of impacts in the areas potentially affected by the construction and operation of the WPCI (Figures 1 and 2). The SWAP habitat types with the highest vulnerability ranks and the potential impacts resulting from the activities associated with the WPCI are discussed in the following paragraphs.

Sagebrush Shrublands (High vulnerability)

Sagebrush shrub-steppe occurs scattered throughout the mixed- and short-grass prairie landscapes of Wyoming (Knight et al. 2004). Sagebrush can occur as scattered shrubs contributing little cover. Distribution of sagebrush shrublands varies based on the sagebrush species and subspecies, but ranges from basins and valley bottoms, to undulating terraces and foothills, to steep slopes and mountainous areas. Soils associated with sagebrush shrublands are xeric soil types and vary in texture and depths.

Sagebrush stands can be dense, patchy or sparse dominated by a single species or subspecies of sagebrush or consist of a mosaic of multiple species of sagebrush. Often the mosaic stands are intermixed with other shrubs, such as rabbitbrush, antelope bitterbrush, greasewood, shadscale, winter-fat, and spiny hop-sage (Paige and Ritter 1999). Typically, sagebrush communities contain three to four vegetation layers: 1) a shrub layer, 12-40 inches tall, 2) forbs and caespitose grasses, 8-24 inches, 3) low-growing grasses and forbs less than 4-8 inches tall, and 4) a biological soil crust (Miller and Eddleman 2000). Sagebrush shrublands are associated with other plant communities including aspen, mountain shrubs, salt desert shrubs and open conifers (Wyoming Interagency Vegetation Community 2002).

Table 3. Sensitive plant species with potential or verified occurrence in the counties intersected by the Wyoming Pipeline Corridor Initiative with their Rank/Designation according to the State of Wyoming (WY), the US Fish and Wildlife Service (USFWS), the US Forest Service (USFS), and Bureau of Land Management (BLM). Sources: WYNDD 2012, USDA NRCS 2015b, NatureServe 2015, USFS Regions 2 and 4 (2013, 2015), USFWS 2015a, b), BLM 2010.

Common name	Scientific name	Bighorn	Campbell	Carbon	Fremont	Hot Springs	Johnson	Lincoln	Natrona	Park	Sublette	Sweetwater	Washakie	WY[1]	USFWS[2]	USFS[3]	BLM[4]
Absaroka beardtongue	*Pentsemon absarokensis*				x					x				S2		S	S
Barneby's clover	*Trifoliumm barnebyi*				x									S1			S
beaver rim phlox	*Phlox pungens*				x			x			x			S3			S
blowout pentsemon	*Pentsemon haydenii*			x										S1	E		
cedar rim thistle	*Cirsium aridum*			x	x						x	x		S2			S
cedar mountain easter daisy	*Townsendia microcephala*											x		S1			S
desert yellowhead	*Yermo xanthocephalus*				x									S1	T,CH		S
Dorn's twinpod	*Physaria dornii*							x						S1			S
Dubois milkvetch	*Astragalus gilviflorus var. purpureus*				x	x								S2			S
dune wildrye	*Elymus simplex var. luxurians*											x		S1			S
entire-leaved peppergrass	*Lepidium integrifolium var. integrifolium*							x						S1			S
Evert's wafer-parsnip	*Cymopterus evertii*									x				S2			S
Fremont bladderpod	*Lesquerella fremontii*				x									S2		S	S
green river greenthread	*Thelesperma caespitosum*											x		S1		S	S
hyattville milkvetch	*Astragalus jejunos var. articulatus*	x												S1			S
large-fruited bladderpod	*Lesquerella macrocarpa*				x			x			x	x		S2			S
many-stemmed spider-flower	*Cleome multicaulis*								x					S1			S
meadow milkvetch	*Astragalus diversifolius*											x		S2		S	S
meadow pussytoes	*Antennaria arcuata*				x						x			S3			S
owl creek miner's candle	*Cryptantha subcapitata*				x									S2			S
Ownbey's thistle	*Cirsium ownbeyi*											x		S2			S

Table 3. Sensitive plant species with potential or verified occurrence in the counties intersected by the Wyoming Pipeline Corridor Initiative with their Rank/Designation according to the State of Wyoming (WY), the US Fish and Wildlife Service (USFWS), the US Forest Service (USFS), and Bureau of Land Management (BLM). Sources: WYNDD 2012, USDA NRCS 2015b, NatureServe 2015, USFS Regions 2 and 4 (2013, 2015), USFWS 2015a, b), BLM 2010.

Common name	Scientific name	Bighorn	Campbell	Carbon	Fremont	Hot Springs	Johnson	Lincoln	Natrona	Park	Sublette	Sweetwater	Washakie	WY[1]	USFWS[2]	USFS[3]	BLM[4]
persistent sepal yellowcress	*Rorippa calycina*	x		x	x					x		x	x	S3			S
Porter's sagebrush	*Artemisia porteri*				x		x		x					S2			S
precocious milkvetch	*Astragalus proimanthus*											x		S1			S
prostrate bladderpod	*Lesquerella prostrata*							x						S2			S
rocky mountain twinpod	*Physaria saximontana var. saximontana*			x	x	x				x				S3			S
shoshonea	*Shoshonea pulvinata*				x	x				x				S2		S	S
small rockcress	*Boechera pusilla*				x									S1	C		S
stemless beardtongue	*Penstemon acaulis var. acaulis*											x		S1		S	S
trelease's milkvetch	*Astragalus racemosus var. treleasei*										x			S2			S
tufted twinpod	*Physaria condensata*							x			x			S2			S
Uinta greenthread	*Thelesperma pubescens*											x		S1		S	S
Ute ladies'- tresses	*Spiranthes diluvialis*	x	x	x	x	x	x	x	x	x	x	x	x	S1	T		S
whitebark pine	*Pinus albicaulis*				x	x		x		x	x			S3	C	S	S
Williams' wafer-parsnip	*Cymopterus williamsii*	x					x		x				x	S2			S
Winward's naroow leaf goldenweed	*Ericameria discoidea var. winwardii*							x						S1			S
Wyoming tansymustard	*Descurainia torulosa*				x					x		x		S2		S	S

[1] (State Ranks): S1 = Critically Imperiled, S2 = Imperiled, S3 = Vulnerable, S4 = Apparently Secure, S5 = Secure, SU = No Rank, SX = Presumed Extirpated, SH = Possibly Extirpated, SR = Reported

[2] (USFWS Status): E= Listed endangered under the U.S. Endangered Species Act (ESA 1973),; T= Listed threatened under the U.S. Endangered Species Act (ESA 1973); P= Proposed; C= Candidate; DM= Recovered, delisted, and being monitored; XN= Experimental non-essential population; PS:value = Partial Status; CH = Critical Habitat (USFWS 2004, 50 CFR 17: 12278-12290)

[3] (USFS Status): S = Listed as a sensitive species by USFS Rocky Mountain Region (R2)/Intermountain Region (R4)

[4] (BLM Status): S = Denotes a species listed as sensitive on BLM lands

Wyoming big sagebrush communities are found below 6,000 feet and mountain big sagebrush communities above 7,000 feet. The transition from 6,000 to 7,000 feet these two communities grow together and are difficult to separate. Additionally, black sagebrush is located on shallow to very shallow rock soils and grows in association with Wyoming and big sagebrush between 5,000 and 7,000 feet. Basin sagebrush is associated with deep soils in drainage bottoms and stream terraces; silver sagebrush is abundant in the sandy soils at lower elevations on shrub sand dunes.

Desert Shrubland (High Vulnerability)

Vegetation is dominated by xerophytic, drought-tolerant sub-shrubs and grasses, and is second only to sagebrush ecosystems in land area and importance. Mountains and high plateaus with cooler and wetter climates promote the intermixing of mountain shrublands with pinyon-juniper woodlands, treeless meadows and forests of pine, fir, spruce and quaking aspen. Desert shrublands typically occur in basins at elevations between 4,980 and 7,220 feet where less than 10 inches of precipitation falls annually (Knight 1994). Soils are often poorly developed and are characterized by being fine-textured, moderately deep, with lower infiltration rates, and a tendency to alkalinity or salinity. With the exception of soil salinity, desert shrublands share many features with sagebrush habitats including a predominance of shrubs, moisture, and nutrient limitations to plant growth and sensitivity to various forms of herbivory (Knight 1994).

Key management issues within this region include invasive species, tree encroachment in sagebrush ecosystems, excessive livestock and wildlife grazing, altered fire regimes, climate change and human population growth.

Prairie Grasslands (High vulnerability)

Most grasslands in Wyoming have been classified into two types: shortgrass prairie and mixed-grass. Shortgrass prairies are found primarily in the southeast corner of the state, while mixed grass prairies cover about 17% of the state and extend northward into Montana with common plant species include needle-and-thread, western wheatgrass, blue grama, Sandberg's bluegrass, prairie Junegrass, upland sedges, and Indian ricegrass (Knight et al. 2014). Prairie grasslands generally occur on deep, well developed soils. Frequent and occasionally intense natural disturbances, such as drought, fire and grazing characterize prairie grasslands (Nicholoff 2003). This level of disturbance results in a predominance of perennial grasses, sedges, and herbaceous forbs that have their buds at or just below the soil surface minimizing their susceptibility to damage (Knight 1994). Regular disturbances create areas of vegetation in various stages of recovery resulting in mosaic habitat diversity. Along with the disturbance, availability of water through snow drifts is another factor influencing the local composition of prairie plants.

Wetlands and Riparian (High vulnerability)

Riparian areas are distinct green corridors demarcating streams from uplands. Wetlands are defined as those areas that are inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands

generally include swamps, marshes, bogs, and similar areas (US EPA 2005). They are vital zones of ecological processes that connect landscapes and they support diverse plant and animal communities (Gregory et al. 1991). These areas buffer water loss from uplands, filter chemical and organic wastes, trap sediment, build and maintain stream banks reducing soil erosion, and moderate stream temperatures. The diversity in plant species makes these areas valuable to wildlife through high quality forage, nesting habitats and corridors for wildlife movement. Riparian areas are used for agriculture, recreation, travel, water development and housing. A detailed description of the Riparian vegetation intersected by the Corridor is discussed in a separate section (see Wetlands and Riparian Section).

The habitats described above provide refugia for several sensitive and federally-listed plant species, such as various species of sagebrush or regional endemics such as the precocious and trelease's milkvetch, which are facing major potential threats from oil/gas and mining development, among others (Fertig 2000, Heidel 2009).

Environmental Consequences - Vegetation Impacts

Vegetation within the proposed corridors would be primarily affected by cutting, clearing, topsoil removal and grading activities associated with pipeline construction. The magnitude of the impact would depend on several factors including the type and amount of vegetation affected during construction and the frequency and type of vegetation recovery plans and restoration practices implemented on the right-of-way (ROW) during pipeline operation, but in general, disturbances associated with construction activities would be minimal because they would be limited to specific approved areas (WPCI POD). The degree and duration of construction-related impacts would vary between vegetation communities; impacts on these communities during operation would vary depending on the nature of specific projects, the amount of above ground structures, the frequency of surface travel along the ROW, and the implementation of restoration plans, among other factors.

In general, restoration would include cleaning up, backfilling, grading, topsoiling, installing erosion control devices, preparing seedbeds, and establishing cover by seeding with the appropriate seed mixes. Site-specific maintenance activities would be conducted in accordance with WPCI POD (Sections 3.0 and 4.0), which describes routine vegetation maintenance every three years within the ROW (with the exception of riparian areas), with annual maintenance performed on corridors less than 10 feet wide, centered over the pipeline. These clearing activities will keep the surrounding vegetation in a native, herbaceous state (WPCI POD, Appendix E). Potential impacts, their frequency, magnitude, and effects are discussed below.

Short-term impacts on agricultural lands, hay/pastures, and herbaceous/grassland communities were predicted to be low, primarily as the result of construction activities and it is expected that these vegetative communities would recover returning to their original plant composition and structure within one to three growing seasons after disturbance, with the reclamation success depending largely on the proper implementation of restoration and revegetation plans (see WPCI POD, Erosion and Revegetation Plan [Appendix E], and Restoration and Revegetation Plan [Appendix F]). Grassland/herbaceous areas would recover following construction and

would typically not require maintenance mowing. The development of noxious weeds in agricultural lands, pasture, and grassland and the spread of weeds or seed from infested areas to adjacent un-infested vegetation communities that could occur without proper measures, would be prevented, mitigated, and controlled by the implementation of the measures delineated in the Noxious and Invasive Weed Control Plan described on Appendix H of the WPCI POD (see Noxious and Other Invasive Plants Section).

Areas planted with field crops would likely be replanted in the next growing season, while long-term impacts on prairie grasslands are less clear. Long term studies suggest annual rainfall patterns are ecological drivers of change in these ecosystems thus, the rate of recovery will largely depend on the plant species present at the time of disturbance, weather conditions, the history and nature of grazing pressure on the site, and management practices during the time of recovery.

Long-term impacts on forests and shrub/scrublands, resulting from right-of-way construction and maintenance activities would be expected. Although ROW access and surface traffic will be limited to periodic inspections and surveys, and emergency repairs (WPCI POD), mature trees would be replaced for many years by herbaceous plants, shrubs, saplings, and other successional species due to the selective cutting and vegetation maintenance activities (WPCI POD). Slow growth rates, arid environments, current land use practices, and resilience of these ecosystems will largely determine the rate of recovery in these ecosystems during the abandonment phase. These impacts, their magnitude, and duration are influenced by several variables including grazing rates, rainfall, elevation, invasive plant species, and soil type, which would largely determine the outcome of restoration plans.

Direct impacts on vegetation include reduction in cover resulting from vegetation clearing activities (both permanent and temporal) and from uprooting activities (conducted once during construction) and reduction in plant species diversity and richness during construction and maintenance activities. Additional indirect impacts might include an increase in soil loss and sediment runoff through an increased exposure to hydric and eolic erosion processes and an alteration of soil morphology; changes in water quality and soil chemistry through the alteration of infiltration patterns and groundwater recharge rates or from potential accidental spills; an increased susceptibility to invasive or exotic species. A description of the potential impacts on vegetation resulting from the WPCI is shown in Table 4.

Table 4. Description of impacts on vegetation resulting from the construction, operation, and maintenance activities associated with the Wyoming Pipeline Corridor Iniciative.

Impact	Type	Description	Magnitude
Reduction on vegetation cover and plant species abundance	Direct	Construction and maintenance activities would affect several vegetation communities, including sagebrush steppe, prairie grasslands, and riparian areas. Construction activities would require permanent and temporal vegetation and topsoil removal, and grading activities within the ROW (WPCI POD Appendices E and F).	The impact would be localized, the duration will be both short and long term. Routine vegetation maintenance would be conducted every three years within the ROW (with the exception of riparian areas), and every year within 10 feet wide corridors centered over the pipeline to keep the surrounding vegetation in a native, herbaceous state. Reduction in vegetation cover and in abundance of plant species would potentially effect on the local fauna and might cause displacement of some species. Plant species of concern could also be affected.
Alteration of ecosystem function and processes	Indirect	Vegetation clearing might affect abiotic processes such as wind and water erosion, runoff and infiltration rates, soil quality, and physicochemical properties of the soil that might render the physical environment unsuitable for some plant species and might affect vegetation recovery rates.	The impacts would be localized but would have ecosystem-level effects. The duration of the impacts would be long term and would occur during vegetation clearing, construction, and during maintenance and operation.
Alteration of landscape	Indirect	Landscape attributes would be affected through reduction of plant cover, alteration of habitat quality, removal of sensitive species, and anthropogenic disturbances during the construction, maintenance, and operation phases.	This impact would be long term, and would occur at the local and landscape levels. The effects would include increased susceptibility to invasive or exotic species, increased human activity, fragmentation and edge effects, and alteration of visual attributes.

Mitigation Measures - Construction and Restoration Procedures

Overall Vegetation

Prevention, mitigation and compensation measures would be implemented in order to maintain the functional integrity of the ecosystems and biotic communities intersected by the WPCI. The success of implemented measures would be evaluated through indicators that would also be used to determine any additional measures necessary to minimize impacts.

Initial construction activities include surveying and staking construction ROWs, removal of vegetation and topsoil, grading ROWs, and pretreatment of dense stands of noxious and invasive weeds identified during pre-construction field surveys. Restoration activities will involve backfilling the excavated trench, restoring pre-existing terrain contours, replacing stockpiled subsoil and topsoil/vegetation mixtures, installing erosion control devices, preparing seedbeds,

and seeding. These measures are fully detailed in WPCI POD (Appendices E through I), and include the implementation of Best Management Practices (BMP) and the avoidance, minimization, and mitigation activities during preconstruction, construction, and operation phases discussed below.

In some areas, resource constraints may require a narrowed construction ROW and implementation of alternative procedures. These locations will be determined during future NEPA processes for project specific permitting and could include cultural resource sites, wetlands, and habitat for protected species, among others. In these locations, the construction ROW may be narrowed to 75-feet, following the specifications delineated in WPCI POD (Appendix A). Grading will not occur over historic trails, drainages, wetlands or most ETWS.

To limit sediment transportation and erosion, BMPs would be initiated according to the Upland Erosion Control and Sediment Control Plan described in the WPCI POD (Appendix E). To reduce bank erosion, crossing approaches would be tapered to gradual slopes and bars would be installed to eliminate abrupt changes in elevation, BMPs would be initiated as described in Appendix E, and reclamation measures would be initiated and implemented as described in Appendix F. Grading would be limited to help preserve vegetation and to limit erosion and improve reclamation success, but where slopes run across ROW, a level work area would be cut out of the hillside for safe construction; in this case approximately 4-6 inches of topsoil (where available) would be stripped from the full construction ROW before cut, fill or other grading operations. In some areas, it may not necessary to grade and topsoil. Access roads would be reclaimed according to BLM and landowner directions.

Individual projects within the proposed corridors are likely to fragment the habitat, creating edges with consequences for many ecological processes (including seed dispersal, predation rates, and movement of organisms), influencing material and energy flow across the landscape (Cadenasso et al. 2003); soft (low contrast) edges are generally considered better for wildlife, while hard (high contrast) edges are considered to decrease habitat suitability for many species. The creation of hard edges should be avoided to the extent possible by removing shrubs and saplings in such a way that transitional changes from one habitat type to another can be created; in visually sensitive areas, ROW alignments would have an uneven edge by either leaving shrubs in place when clearing, or seeding/planting “clumps” of shrubs along the perimeter.

Mixing topsoil with subsoil would be prohibited without approval from applicable land management agencies or private landowners and separation would be maintained throughout all construction activities. Topsoil would be stockpiled separately (see Appendix A) from subsoil and would not be used to pad the trench or construct trench breakers. Topsoil would be used as the final layer of soil during the reclamation process and cannot be used for padding pipelines. In deep soils, where the topsoil layer is greater than 12 inches, at least 12 inches of topsoil would be segregated. To the extent possible, the ditch-plus-spoil-side topsoiling method should be used for individual projects; when application of this method is not plausible (e.g. steep

slopes, weed infestations, etc.), alternative methods can be used as described in Appendix E of the WPCI POD (see also Wetlands and Riparian section).

The primary method for seeding within the ROW, ETWS, and access roads would be planting by drilling; broadcasting would be performed in those areas with access limitations and broadcast seeding rates would be double the drill-seeding rates. In general, unless otherwise specified, mulch (which will consist of weed free straw or hay, wood fiber hydro mulch, erosion control fabric, or a functional equivalent) would be spread uniformly over seeded areas to cover at least 75% of the surface at a rate of up to 2 tons/acre (see Appendix E of the WPCI POD).

Seeding mixes would represent the native plant species that would be disturbed by each individual project according to the reclamation procedures in the Restoration and Revegetation Plan described in the WPCI POD (Appendix F). These specific actions, intended to return the disturbed portions of the construction workspace to pre-construction conditions as closely as possible, include replacement of the topsoil over the ROW from, reseeding and mulching, and installation of permanent BMPs. These actions would be applied to ROWs, ETWs, and sections of access roads that would be restored to expedite revegetation and reduce the potential for weed establishment and soil erosion, with indicators to measure plan establishment success. Species and seeding rates effective in controlling erosion would be selected for reseeding based on climate, soil, and palatability and cover for wildlife characteristics. Appropriate seed mixes will correspond with surrounding vegetation types.

The success of revegetation and restoration activities would largely depend on the native seed base contained in the topsoil and the amount of weedy species present in that layer, therefore the implementation of additional measures for noxious and invasive weed control would be put in place according to site specific requirements, within the framework described in the Noxious and Invasive Weed Control Plan of the WPCI POD. Herbicide application would be the primary treatment method for weed control, but other methods can be implemented as described in the WPCI POD (Appendix H); preconstruction control measures would be implemented in areas where surveys have identified the presence of invasive and noxious weeds, post construction weed establishment would be controlled through the implementation of project-specific protocols.

The proposed measures aim to avoid impacts to the extent possible through construction practices, to minimize the magnitude of impacts by limiting specific activities, and to restore the affected resources through recovery actions and monitoring plans. These impacts, the reclamation activities, and indicators of success are presented in Table 5.

Table 5. Proposed measures to avoid, minimize, and mitigate impacts on vegetation resulting from the construction, operation, and maintenance activities associated with the Wyoming Pipeline Corridor Iniciative. Indicators of success are presented for each proposed measure.

Impact	Avoidance, Minimization, and Mitigation Measures	Indicators of Success
Reduction on vegetation cover and plant species abundance	Vegetation clearing would occur only on designated areas only. Grading would not occur on drainages, wetlands and most ETWS. Revegetation and restoration activities would not be conducted in areas where permanent, above ground infrastructure would be placed. Restoration and revegetation plans would be implemented according the WPCI POD (Appendices E, F, and G) in all other areas where temporal activities will take place, including ROW, ETWS, and Access Roads. Sensitive plants surveys would be conducted prior construction activities, and mitigation measures would be implemented according to the WPCI POD (Appendix I).	Density and cover of vegetation (at least 80%) Crop yields Species composition, density, and cover of vegetation Number of species of conservation concern
Alteration of ecosystem function and processes	Best Management Practices would be implemented before construction activities to limit sediment transport and erosion. Areas requiring of specific BMPS would be designated. Grading would be limited to preserve vegetation and to limit erosion and improve reclamation. Revegetation plans would be put in place. Topsoil mitigation measures, including topsoil segregation, erosion control measures, and revegetation measures would be implemented according to the WPCI POD (Appendix E), to mitigate the impacts. Weed control plans would be implemented according to the WPCI POD (Appendix H).	Substantial and/or new erosion in reference to BLM indicators Plant density, vegetation cover, bare ground, and plant litter Survival of plantings Invasive/exotic species
Alteration of landscape	Vegetation removal would be kept to a minimum and limited only to approved areas. Maintenance activities would be limited to the extent possible. Zig-zag clearing patterns would be implemented for vegetation clearing to minimize the amount of hard edges. Restoration and Reclamation plants would be implemented according to the WPCI POD. Mitigation measures for habitat fragmentation would be put in place according to the WPCI POD (Appendix I)	Type of infrastructure and number of facilities installed Visual obstruction Level of fragmentation Extent to which restored areas blend in with adjacent, undisturbed areas

The vegetation within the WPCI area includes various grasses, shrubs, and trees that represent both indigenous and introduced species. The maintenance of a perennial grass cover provides protection from wind and water erosion, as well as feed and cover for grazing animals and wildlife. Shrubs are an important component of the rangelands in Wyoming. Coniferous and deciduous trees are tied to specific geographic and ecological sites within the State. Cottonwood trees, once predominant in riparian areas of the State, have seen a decline in the

last 20 years due to insects and drought. Successful reclamation of vegetative communities could include restoration efforts for re-establishment of shrub communities on rangelands and cottonwood trees in riparian areas.

Reclamation success would be evaluated during post restoration monitoring through indicators used to evaluate long-term soil stability, vegetative cover and density, habitat quality, and noxious and invasive weed densities. These indicators include the degree of similarity in density and cover of non-nuisance vegetation in disturbed and adjacent undisturbed lands; crop yields in disturbed and adjacent undisturbed lands; vegetative species composition, density, and cover that meet the requirements established for Sage Grouse Core Areas; and presence and amount of noxious/invasive plant species. Proponents of future projects would monitor restoration success for a minimum of 5 years, or consistent with requirements of applicable land management agencies.

Aboveground Facilities

Pipeline construction activities such as clearing, grading, excavation, backfilling, and heavy equipment traffic could result in adverse impacts on vegetation resources along the construction ROW, ETWS, and other permanent aboveground facilities and related infrastructure. While the pipelines constructed in the WPCI corridors would be buried, a few aboveground facilities would be installed where necessary for safe and efficient operation of the pipeline. These facilities include block valves installed within the construction ROW, occupying an area of 30*30 ft. each; pigging equipment located at metering locations or block valves; and pump and compressor stations within a 3 to 10-acrea fenced area. Additionally, while existing federal, state, county and private BLM roads would be used to gain access to the ROW during construction, modifications may be required on some roads, and opening of new access roads may be necessary for year-round access through the operation and maintenance phases.

Clearing would remove protective vegetation cover and could potentially increase soil erosion and the transport of sediment to sensitive areas such as wetlands or waterbodies. Grading, excavation, and backfilling could result in the mixing of topsoil with subsoil and in loss/alteration of seed banks, which could result in long-term reduction of productivity and introduction of noxious weed. Increased traffic and use of heavy equipment could reduce porosity and percolation rates through the effects of soil compaction, resulting in potential runoff potential.

Soil contamination from equipment spills and/or leakage of fuels, lubricants, and coolants could also have consequences for vegetation. The implementation of some of the practices described in the Waste and Spill Management Plan (Appendix C), the Erosion Control Plan (Appendix E), the Restoration and Revegetation Plan (Appendix F), and the Noxious and Invasive Weed Control Plan (Appendix H), would help avoid, minimize, and mitigate impacts on vegetation.

Impacts from spills can have consequences beyond the localized impact, interacting with vegetation, sediments (such as beach sand and gravel), and terrestrial and aquatic habitats causing erosion as well as contamination. Contamination along the corridor could result from spills of hazardous materials (oils, fuels, chemicals) or waste (residual waters) during all

projects phases (pre-construction, construction, operation, maintenance) and even as a result of improper implementation of some of the mitigation practices (application of weed killers) described in the WPCI POD. Contractors would be deemed the generator of wastes resulting from spills. For spills to land, the cleanup of affected areas would be initiated by removing (excavating) the soil and placing it into suitable containers, followed by remediation procedures; for spills that enter water, spills will be contained and removed using pumps or absorbent materials. Specific procedures for minimizing impacts from spills are described in Appendix C of the WPCI POD. These measures include proper storage and handling of waste/hazardous materials, regulating locations for equipment maintenance activities, and having a response plan in place.

Vegetation Communities of Special Concern or Value

The WPCI intersects several Protected Areas with different conservation status by GAP scores (USGS GAP 2015b). A small section of the proposed Corridor (1.06 mi) overlaps with the northernmost portion of the Flaming Gorge National Recreation Area (Sweetwater County), part of the USFS Ashley National Forest, which offers recreational and learning opportunities for the public, as well as suitable habitat for several special status animal and plant species, including USFWS candidate greater sage grouse (*Centrocercus urophasianus*, USFS 2014) and specialized ecological refugia for the BLM sensitive cedar rim thistle (*Cirsium aridum)* and the endemic Ownbey's thistle *(Cirsium ownbeyi,* BLM 2010). According to the USFS, active greater sage grouse leks are located along the National Recreation Area, therefore, individual project's placement and construction activities need to consider concentrated wildlife use of certain areas for planning purposes.

Proponents will survey their proposed construction ROWs, ETWS, roads, and aboveground facility locations prior to construction for sensitive plant species identified during the site-specific NEPA process. Observed plants will be mitigated during construction activities either by relocating the plants or the pipeline facilities or developing equivalent off-site mitigation in consultation with land management agencies, landowners and, where appropriate, the U. S. Fish and Wildlife Service.

Minimum conservation measures for construction and operation of pipeline projects to reduce impacts to vegetative communities, wildlife, and fisheries resources are outlined in Appendix I of the WPCI POD. Implementation of additional measures might be required for site specific impacts. Conservation and mitigation measures for federal threatened and endangered species would be addressed in a separate Biological Assessment (BA) developed through the site-specific NEPA process.

Wetlands and Riparian

Riparian and wetland habitats in maintaining hydrologic, geomorphic, and ecological processes that directly affect standing and flowing waterbodies such as lakes, ponds, wetlands, streams, and stream tributaries. These habitats provide important areas for breeding birds and other wildlife species (Knopf and Samson 1994, Scott et al. 2003). However, most wetland and riparian areas in North America have been degraded as a result of altered flood cycles,

drainage, grazing impacts, and invasive exotic species, which reduce quality and extent of these habitats, posing great challenges to these threatened ecosystems (Dugan, 1990).

In the Intermountain West, more than 140 bird species and 25 mammal species are either dependent on or associated with wetlands (Gammonley, 2004). In Wyoming, more than 80% of wildlife use wetlands and riparian habitats daily or seasonally during their life cycle and about 70% of Wyoming bird species are wetland or riparian obligates (McKinstry et al. 2003, Nicholoff et al., 2003).

In Wyoming, about 38% of the original wetland acreage has been lost, with the majority of this loss attributable to agriculture (ASWM 2015); although less than 3% of the surface area of Wyoming currently qualifies as wetland, many varieties of wetlands occur in Wyoming (Environmental Law Institute [ELI] 2008). These include emergent wetlands, freshwater marshes, saline marshes, wet meadows, playas, forested wetlands, and shrub-scrub wetlands; lacustrine wetlands are limited to the lake shallows, while riverine wetlands are associated with high-gradient streams (mainly in the mountainous areas) and low-gradient and intermittent streams (more prevalent in basins and plains).

Since wetlands are considered a valuable public resource, they are protected under Section 404 of the Clean Water Act (CWA) regulations that require outright avoidance of wetlands, if possible. Wetland protection by the State of Wyoming is primarily done through the Wyoming Wetlands Act (WWA), the CWA §401/404 permitting process, land use planning by the USFS and the BLM, cooperative agreements among agencies, conservation easements, and land purchases

According to the CWA, when wetlands cannot be avoided, regulations then require impacts to be minimized to the greatest extent practicable; any remaining wetland impacts must then be mitigated via creation, restoration or rarely, by enhancement. Measures proposed in the WPCI POD Wetland and Waterbody Construction and Mitigation Plan (Appendix G) would need to be applied on a project-by-project basis. Long term, direct impact from specific projects within the WPCI is expected, as woody wetlands and riparian areas might not return to their original conditions for several decades after disturbance. Indirect impacts could also occur as the result of spills, contamination erosion, and alteration of water flow dynamics, affecting the surrounding vegetation and wildlife species associated with these areas. The implementation of adequate avoidance, minimization, and mitigation measures during all phases of the individual projects would determine to a great extent the magnitude of these impacts.

Formal wetland delineations for the proposed corridors (NWI; USGS NWI 2007, 2012) indicate the existence of freshwater emergent and woody wetlands covering a small percentage (0.64% and 0.68%, respectively) of the proposed project area (Table 2, Figures 2 and 3). There are approximately 61,716.2 ac (24,975.7 ha) of wetlands, not including open water, found throughout the proposed corridors (Figure 5), with woody and emergent wetlands covering similar percentages of the proposed corridors (31,683.9 ac [12, 822 ha] and 30,032.2 ac [12,

153.6 ha], respectively). Several drainages lined with wetland and riparian features run through the WPCI (Table 6; USGS NHD 2015).

Waterways and jurisdictional wetlands can often be avoided with proper siting. Wetland crossings will be conducted consistent with the Federal Energy Regulatory Commission's Wetland and Waterbody Construction and Mitigation Procedures (FERC 2013) current at the time of construction (see Appendix G of the WPCI POD); once actual wetland impacts have been determined and a mitigation plan developed, the necessary permit from the Cheyenne Office of the U.S. Army Corps of Engineers will be require. The specific measures to avoid, minimize, and mitigate impacts in riparian and wetland areas described in in the WPCI POD are discussed in the following paragraphs.

Wetland boundaries would be flagged before construction, and topsoil removal would generally range between 12-18 inches. In floodplains, the topsoil depth can range from 6-12 inches. In wetlands, the double-ditching method would be implemented by only removing the topsoil on the trench line and segregating before digging and removing the subsoil. Dry drainages or washes that cross the right-of-way would not be blocked with topsoil piles. Topsoil would be placed on the banks of the drainage (typically in ETWS) so natural flows are not impeded, and topsoil is not washed away.

Operation of individual projects would be conducted in a manner that reduces risk of spills or accidental exposure of fuels or hazardous materials to waterbodies or wetlands. A buffer area of at least 500 feet from a water supply wells or spring, waterbodies, and wetlands boundaries would be maintained for all activities. Additional precautions would be taken within the 500 feet buffer, as detailed in the WPCI POD (Appendices C, E, and G).

Erosion controls would be properly installed and maintained, as necessary, to prevent sediment flow into wetlands, waterbodies, sensitive areas, and onto roads, following the specifications provided in Appendix E of the WPCI POD. Temporary and permanent control erosion devices would be installed as needed, following the specifications provided on the WPCI POD (Appendix G).

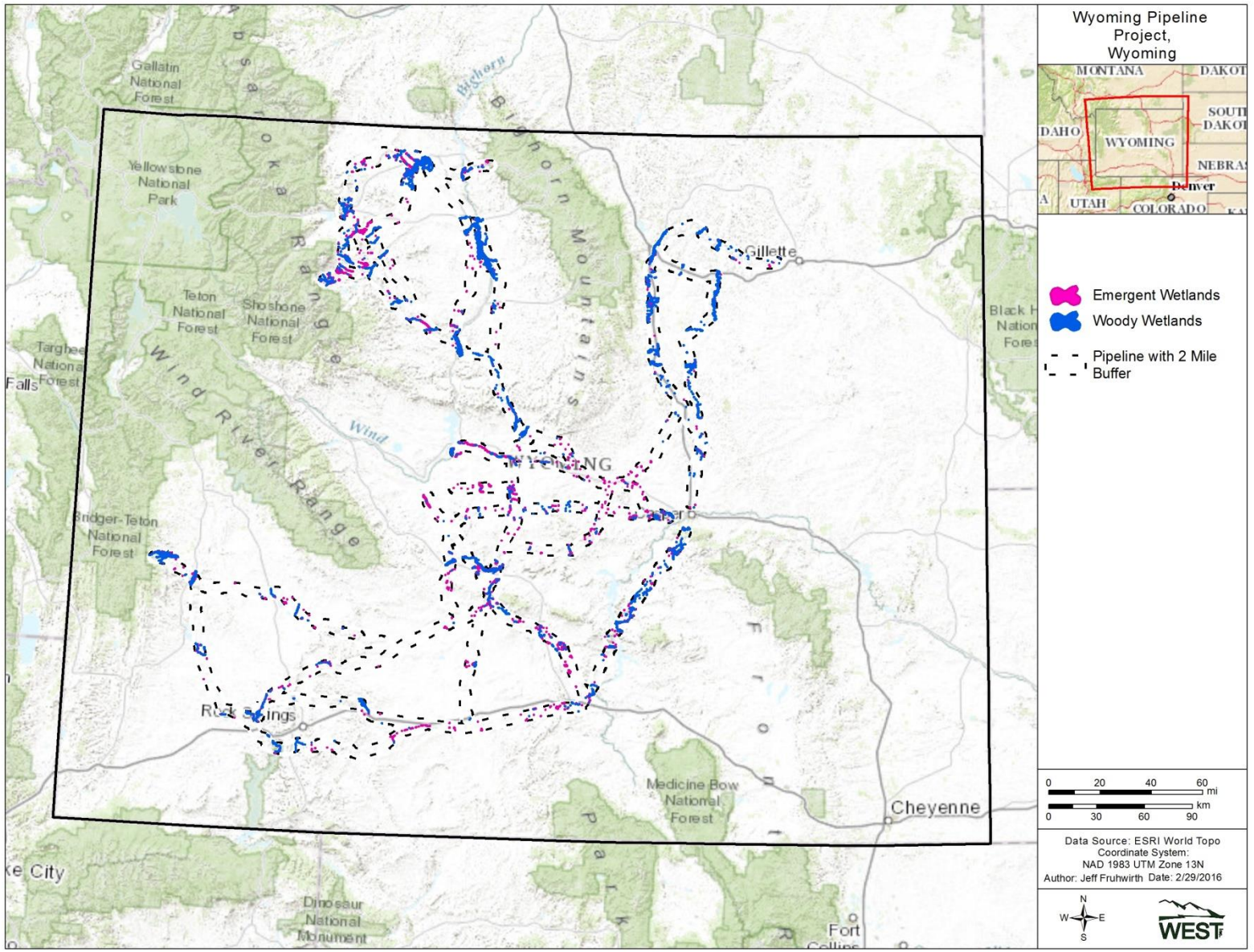

Figure 5. Herbaceous and Woody Wetlands within the Proposed Corridors.

Table 6. Riparian habitat crossed by the proposed corridors.

Waterbody	Length of riparian habitat intersected by the proposed corridors
Streams with no name (Most likely Ephemeral/intermittent)	89,155,437.63
Affalter Ditch	7,092.99
Alamo Creek	30,727.62
Alkali Creek	240,274.90
Alkali Creek Patch	49,880.87
Antelope Creek	48,788.91
Arapahoe Creek	71,301.71
Arapahoe Ditch	2,551.66
Ashworth Creek	22,830.90
Badwater Creek	42,851.19
Barber Creek	95,919.11
Bare Ring Slough	46,657.89
Bates Creek	38,771.08
Bear Creek	73,179.76
Bear Spring Creek	16,763.93
Beaver Creek	66,568.33
Big Red Creek	38,994.72
Bilderback Creek	43,725.03
Bitter Creek	95,001.98
Black Butte Creek	44,167.60
Bolton Creek	36,533.23
Bridger Creek	117,318.94
Buck Creek	23,905.38
Buck Springs Creek	9,748.16
Buffalo Creek	101,235.50
Bull Creek	19,704.64
Bush Creek	63,561.63
Cabin Creek	59,294.31
Caley Creek	1,412.41
Canyon Creek	40,374.51
Castle Creek	146,291.11
Cherokee Creek	4,108.01
Chokecherry Creek	9,367.62
Cloud Creek	1,596.85
Coal Creek	77,071.26
Conant Creek	72,408.00
Coon Creek	4,245.65
Corral Creek	10,192.62
Cottonwood Creek	260,289.21
Cow Camp Creek	45,404.93
Cow Creek	27,122.65
Coyote Creek	94,269.23
Crazy Woman Creek	92,734.80
Crooked Creek	27,599.02
Crooks Creek	132,841.25
Cut Creek	3,529.74
Davis Branch	2,936.04
Dead Horse Creek	77,875.69
Deer Creek	49,562.99
Ditch H-28	2,367.53

Table 6. Riparian habitat crossed by the proposed corridors.

Waterbody	Length of riparian habitat intersected by the proposed corridors
Dobie Creek	33,350.54
Dorsey Creek	2,431.93
Double Crossing Creek	15,541.38
Dry Cheyenne Creek	26,165.46
Dry Coyote Creek	19,319.99
Dry Creek	370,433.21
Dry Ditch	2,186.69
Dry Fork	16,881.07
Dry Lake Creek	5,876.31
Dry Piney Creek	33,253.46
Dry Sandy Creek	29,514.56
Dugout Creek	138,745.63
E-K Creek	26,212.51
Eaglenest Creek	5,868.66
East Alkali Creek	40,230.24
East Bridger Creek	7,260.79
East Canyon Creek	34,329.80
East Fork Antelope Creek	3,666.46
East Fork Bear Creek	9,662.84
East Fork Horse Ranch Creek	14,647.21
East Fork Nowater Creek	36,079.60
East Fork Wild Horse Creek	37,438.41
East Teapot Creek	54,866.50
Elk Creek	51,640.84
Elk Springs Creek	21,330.34
Fales Creek	22,218.44
Fifteenmile Creek	59,320.09
Fillmore Creek	50,169.56
First Creek	5,517.96
Fish Creek	8,539.12
Five Springs Creek	78,846.06
Fivemile Creek	34,295.33
Fivemile Ditch	28,530.40
Flying E Creek	9,971.10
Fortification Creek	7,252.80
Four Bear Creek	15,066.42
Fourmile Creek	104,266.91
Fourteenmile Creek	20,642.21
Fourth Creek	5,598.38
Francs Fork	12,726.86
Garden Creek	16,716.84
Gooseberry Creek	195,718.16
Government Creek	20,541.11
Grass Creek	129,746.30
Hamilton Creek	22,514.77
Happy Spring Creek	779.25
Hay Creek	5,751.26
Highland Hanover Canal	397.98
Hoodoo Creek	23,785.38
Horner Creek	15,151.80
Horse Creek	51,538.90
Horseshoe Creek	52,517.74

Table 6. Riparian habitat crossed by the proposed corridors.

Waterbody	Length of riparian habitat intersected by the proposed corridors
Hot Water Creek	776.51
Hurt Creek	20,695.95
Ice Slough	24,357.24
Idaho Creek	29,733.08
Indian Creek	50,888.42
Indian Springs Creek	33,195.39
Iron Creek	29,432.16
Iron Springs Creek	45,175.50
Jack Morrow Creek	47,117.48
Jack Parnell Creek	52,004.52
Jenks Creek	2,266.62
Jost Creek	9,130.93
Katy Creek	1,817.38
Kelly Creek	5,625.18
Killpecker Creek	60,543.39
Kingsbury Creek	46,378.80
Kirby Creek	218,039.27
Lake Creek	34,542.42
Landon Creek	44,312.25
Lane Creek	25,315.36
Ledge Creek	39,938.33
Little Bitter Creek	45,216.27
Little Buffalo Creek	21,501.19
Little Cottonwood Creek	8,040.69
Little Dry Creek	132,727.85
Little Gooseberry Creek	36,087.26
Little Polecat Creek	17,874.18
Little Rawhide Creek	12,564.50
Little Red Creek	51,497.56
Little Rose Creek	5,245.87
Little Sandy Creek	51,860.39
Little Slick Creek	31,486.87
Lone Tree Creek	4,998.18
Long Creek	10,907.57
Lost Creek	75,266.58
Lost Soldier Creek	82,576.30
Lysite Creek	13,208.92
MacNales Creek	15,747.06
Marking Pen Creek	10,550.27
Mason Creek	18,452.49
Meadow Creek	52,166.70
Meeteetse Creek	97,658.94
Middle Creek	16,770.80
Middle Fork Casper Creek	201,466.04
Middle Fork Crazy Woman Creek	49,845.99
Middle Fork Tenmile Creek	42,985.25
Middle Piney Creek	36,572.92
Modoc Ditch	1,851.01
Monument Creek	26,117.53
Moone Creek	12,294.04
Morgan Creek	17,588.13
Muskrat Creek	90,262.29

Table 6. Riparian habitat crossed by the proposed corridors.

Waterbody	Length of riparian habitat intersected by the proposed corridors
Nancy Creek	22,686.35
Negro Creek	58,403.52
Ninemile Creek	57,770.83
Nitch Creek	46,855.55
No Name Creek	15,063.00
North Alkali Creek	13,052.91
North Branch Crooked Creek	3,365.30
North Fork Canyon Creek	16,460.96
North Fork Casper Creek	34,869.48
North Fork Cottonwood Creek	24,522.00
North Fork Crazy Woman Creek	141,207.28
North Fork Crystal Creek	8,823.61
North Fork Dead Horse Creek	43,798.84
North Fork Dry Creek	45,811.63
North Fork Little Gooseberry Creek	25,971.51
North Fork Ninemile Creek	10,563.93
North Fork Powder River	73,777.60
North Fork Tenmile Creek	28,356.35
North Pacific Creek	18,790.62
North Prong Soldier Creek	16,353.70
Nowater Creek	56,310.03
O'Brian Creek	28,243.81
O'Brien Creek	10,313.70
Oil Springs Creek	30,264.08
Pacific Creek	44,630.26
Pickett Creek	18,466.40
Poison Creek	226,760.29
Poison Spider Creek	186,468.17
Powder River	225,119.43
Pumpkin Creek	7,061.82
Question Creek	14,240.40
Rankin Creek	1,895.68
Rawhide Creek	96,009.51
Red Creek	70,293.04
Redman Ditch	1,665.89
Reed Creek	20,702.65
Reservoir Creek	25,579.75
Rock Cabin Creek	27,355.53
Rock Creek	29,238.75
Rose Creek	25,983.06
Rush Creek	31,976.46
Sage Creek	184,621.80
Sage Hen Creek	19,330.18
Salt Creek	269,634.24
Salt Wells Creek	54,351.73
Sand Creek	85,282.87
Sand Springs Creek	35,454.96
Scott Creek	20,321.86
Separation Creek	48,722.92
Sheep Creek	39,499.69
Sherwood Creek	16,810.00
Short Fork Meeteetse Creek	29,587.49

Table 6. Riparian habitat crossed by the proposed corridors.

Waterbody	Length of riparian habitat intersected by the proposed corridors
Shute Creek	28,318.07
Sixmile Creek	17,836.89
Slate Creek	5,359.89
Slick Creek	34,407.88
Soap Creek	62,237.44
Soldier Creek	3,915.05
South Bar Creek	28,945.69
South Beaver Creek	239.45
South Bridger Creek	34,824.36
South Eaglenest Creek	11,662.49
South Fork Badwater Creek	4,616.39
South Fork Bull Creek	6,897.68
South Fork Canyon Creek	9,114.77
South Fork Casper Creek	118,100.88
South Fork Crazy Woman Creek	107,445.10
South Fork Dry Creek	109,732.38
South Fork Elk Creek	37,459.19
South Fork Fifteenmile Creek	11,382.81
South Fork Powder River	91,277.23
South Fork Sage Creek	32,669.16
South Fork Sand Creek	59,981.02
South Fork Shute Creek	29,643.27
South Piney Creek	135,641.93
South Prong Barber Creek	3,307.41
South Prong Wallows Creek	770.72
Spring Creek	211,491.57
Squaw Creek	28,070.57
Stinking Creek	3,917.78
Stone Cabin Creek	22,059.78
Stone Creek	23,180.88
Sugar Creek	116,991.31
Sulphur Creek	89,155.25
Sweetwater Creek	22,039.95
Teapot Creek	53,108.75
Tex Springs Creek	1,426.93
Threemile Ditch	8,405.84
Trail Creek	19,519.68
Wall Creek	40,680.41
Wallace Creek	52,610.84
Wallows Creek	32,535.64
Warm Springs Creek	33,385.79
Wash-Out Creek	4,478.73
West Alkali Creek	9,251.74
West Branch Whistle Creek	1,849.70
West Bridger Creek	30,547.71
West Canyon Creek	24,088.01
West Fork Antelope Creek	1,757.85
West Fork Bear Creek	36,534.57
West Fork Coon Creek	31,483.78
West Fork Crooks Creek	32,091.77
West Fork Garden Creek	19,771.09
West Fork Long Creek	19,438.96

Table 6. Riparian habitat crossed by the proposed corridors.

Waterbody	Length of riparian habitat intersected by the proposed corridors
West Kirby Creek	38,350.23
West Sage Hen Creek	36,002.52
Whistle Creek	141,309.84
Wild Horse Creek	47,985.44
Willow Creek	25,644.62
Wolf Creek	19,938.63
Total	**100,947,716.92**

Conservation Reserve Program

The U.S. Department of Agriculture (USDA) Farm Service Agency (FSA) administers the Federal government's largest private land environmental improvement program known as the Conservation Reserve Program (CRP). CRP is a voluntary program authorized by the Food Security Act of 1985, as amended, that supports the implementation of long-term conservation measures designed to improve the quality of ground and surface waters, control soil erosion, and enhance wildlife habitat on environmentally sensitive agricultural land.

In exchange for annual rental payments and cost-share assistance, producers take eligible lands out of agricultural production and establish approved resource conserving covers to accomplish the goals of CRP: improve water quality, control erosion, and enhance wildlife habitat. The land is enrolled in long-term contracts of ten to 15 years.

Wyoming has approximately 190,000 acres enrolled in CRP (NRCS 2016). The southeast counties and Campbell County have the highest CRP enrollments each ranging from 15,001acres to 304,000 acres, but only Campbell County is crossed by the proposed corridors (Figure 6). Five of the other counties crossed including Sublette, Sweetwater, Carbon, Washakie, and Park have no CRP acres enrolled.

Short and long-term impacts and mitigation measures for CRP land would be the same as impacts described for agricultural lands, hay/pastures, and herbaceous/grassland communities. Prevention, mitigation and compensation measures described in preceding sections would apply to CRP lands with consideration to reseeding with a seed mix recommended by the NRCS, FSA, or the landowner.

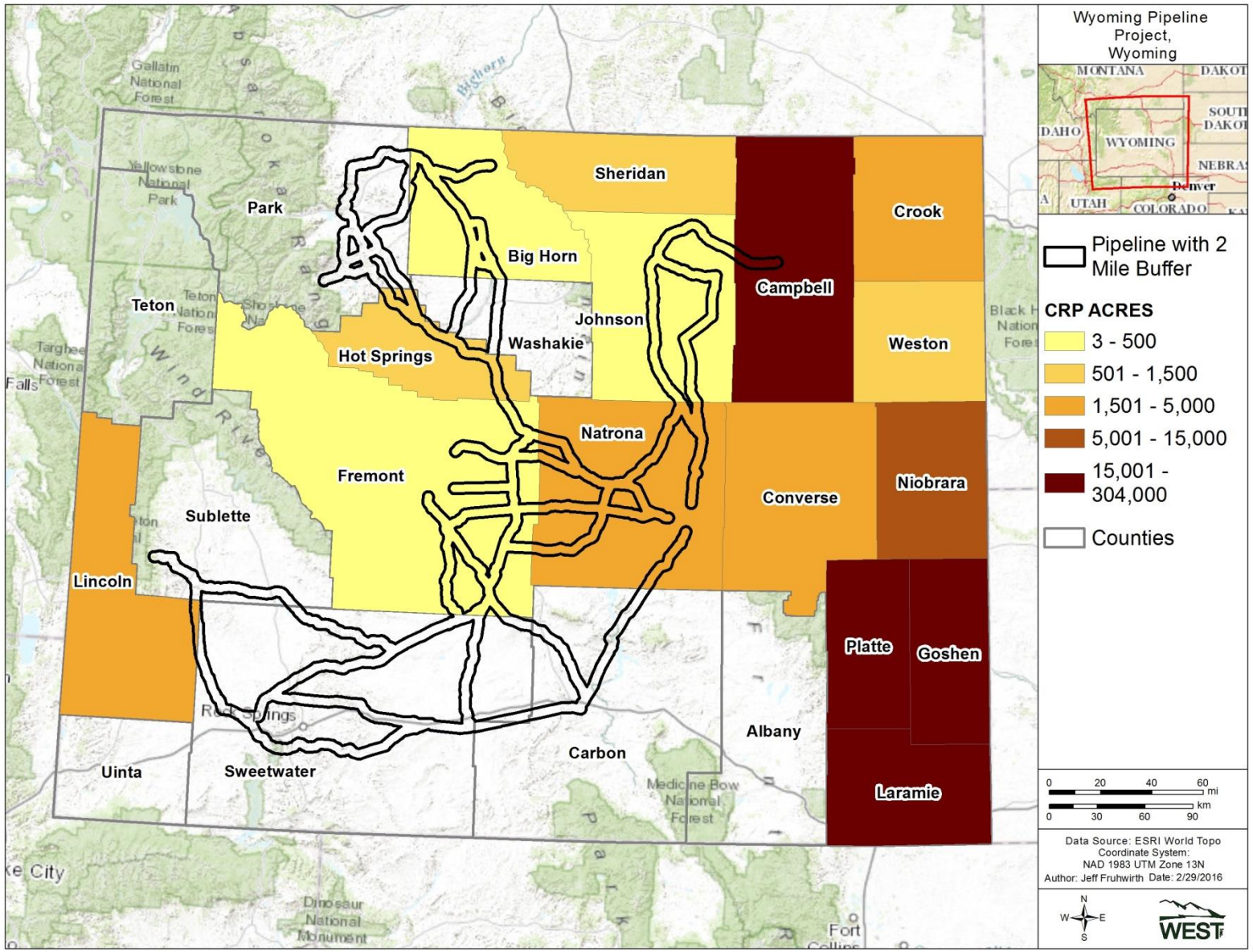

Figure 6. Conservation Reserve Program acres by County in the Proposed Corridors.

Noxious Weeds and Other Invasive Plants

The abundance and diversity of invasive species is considered a component of plant community integrity due to their potential effects on wildlife habitats and can be used to assess the resilience of ecosystems and communities to changes induced by external stressors (Litt and Pearson 2013). Invasive plants benefit from disturbances to native plant communities such as roads, well pads, pipeline corridors, tilling, and other actions that remove native vegetation and disturb the soil; these disturbances promote the spreading and establishment of non-native and exotic species giving them a competitive advantage over native plants, having a potential disproportionate impact on the native communities (Ortega and Pearson 2005).

The Federal Plant Protection Act of 2000 (7 USC §§ 2801-2814), which consolidates and modernizes all major statutes pertaining to plant protection and quarantine (Federal Plant Pest Act, Federal Plant Quarantine Act, Federal Noxious Weed Act) contains a list of 137 federally restricted and regulated federal noxious weeds, including 19 aquatic and wetland weeds, 62 parasitic weeds, and 56 terrestrial weeds (7 CFR Chapter III, Part 360). Each state is federally mandated to uphold the rules and regulations set forth by the Federal Plant Protection Act and manage its lands accordingly.

In Wyoming, invasive and exotic plants such as leafy spurge, toadflax and the knapweeds have been a long standing problem in the State (WGFD 2010a), while others such as cheatgrass, are beginning to spread at an alarming rate, or are causing problems in specific habitats, such as the Russian olive and tamarisk in riparian systems (WGFD 2010b). A total of 26 State designated noxious weed species occur in Wyoming (Table 7; USDA NRCS 2015c, WWPC-WYAGRIC 2012); forb/herbs constitute the predominant growth habit, with Canada thistle, musk thistle, and leafy spurge being among the most abundant and widespread invasive plant species (University of Georgia Center for Invasive Species and Ecosystems Health 2015).

The Wyoming Weed and Pest Council (WWPC) in joint resolution with the Wyoming Board of Agriculture (WYAGRIC) has a county-level list of plants declared by the State as weeds, defined by Wyoming Statutes as “any plant found to be detrimental to the general welfare of persons residing within a district, either by virtue of its direct effect, or as a carrier of disease or parasites” (Wyoming Weed and Pest Control Act of 1973 §11-5-101, 11-5-303). According to this declared list, Campbell, Carbon, Fremont, Hot Springs and Sublette counties being among the top 10 counties with the least invasive plant species reported, and Bighorn, Natrona, and Washakie being among the Counties with the most species recorded (WWPC-WYAGRIC 2015).

Table 7. Wyoming-State designated and County declared noxious weeds with potential to occur in the counties intersected by the Wyoming Pipeline Corridor Iniciative.

Plant		County												Legal Status		
Common Name[1]	Scientific Name[1]	Big Horn	Campbell	Carbon	Fremont	Hot Springs	Johnson	Lincoln	Natrona	Park	Sublette	Sweetwater	Washakie	Native Status[2]	Weed County Status[3]	Weed State Status[4]
absinth wormwood	*Artemisia absinthium*												x	I	NW	
alkali swainsonpea	*Sphaerophysa salsula*	x			x								x	I	NW	
American (wild) licorice	*Glycyrrhiza lepidota*						x		x			x	x	N	NW	
Austrian yellowcres (fieldcress)	*Rorippa austriaca*										x			I	NW	
baby's breath	*Gypsophila paniculata*	x												I	NW	
black henbane	*Hyoscyamus niger*													I		NW
black medic	*Medicago lupulina*								x					I	NW	
broadleaved pepperweed	*Lepidium latifolium*													I		NW
buffalobur nightshade	*Solanum rostratum*		x				x		x					N	NW	
bulbous bluegrass	*Poa bulbosa*								x					I	NW	
bull thistle	*Cirsium vulgare*					x		x		x				I	NW	
Canada thistle	*Cirsium arvense*													I		NW
cheatgrass / downy brome	*Bromus tectorum*								x		x			I	NW	
chicory	*Cichorium intybus*									x				I	NW	
coastal sandbur	*Cenchrus spinifex (incertus)*												x	N	NW	
lesser (common) burdock	*Arctium minus*													I		NW
common crupina	*Crupina vulgaris*	x											x	I	NW	
common gorse	*Ulex europaeus*	x												I	NW	
common mullein	*Verbascum thapsus*						x	x		x			x	I	NW	
common reed	*Phragmites australis*											x		I/N	NW	
common St. Johnswort	*Hypericum perforatum*													I		NW
common tansy	*Tanacetum vulgare*													I		NW
common viper's bugloss	*Echium vulgare*	x												I	NW	
crossflower (blue mustard)	*Chorispora tenella*									x				I	NW	
curly dock	*Rumex crispus*						x		x					I	NW	
curlycup gumweed	*Grindelia squarrosa*					x	x		x					N	NW	
Dalmatian toadflax	*Linaria dalmatica*													I		NW
dames rocket	*Hesperis matronalis*								x	x				I	NW	

Table 7. Wyoming-State designated and County declared noxious weeds with potential to occur in the counties intersected by the Wyoming Pipeline Corridor Iniciative.

Plant		County												Legal Status		
Common Name[1]	Scientific Name[1]	Big Horn	Campbell	Carbon	Fremont	Hot Springs	Johnson	Lincoln	Natrona	Park	Sublette	Sweetwater	Washakie	Native Status[2]	Weed County Status[3]	Weed State Status[4]
diffuse knapweed	*Centaurea diffusa*													I		NW
dyers woad	*Isatis tinctoria*													I		NW
field bindweed	*Convolvulus arvensis*													I		NW
field dodder	*Cuscuta pentagona*	x												N	NW	
field scabiosa (scabious)	*Knautia arvensis*										x			I	NW	
field (perennial) sowthistle	*Sonchus arvensis*													I		NW
flixweed	*Descurainia sophia*									x				I	NW	
flower of an hour	*Hibiscus trionum*	x											x	I	NW	
foxtail barley	*Hordeum jubatum*								x			x		N	NW	
Fuller's teasel	*Dipsacus fullonum*	x											x	I	NW	
Geyer's larkspur	*Delphinium geyeri*			x										N	NW	
hardheads	*Acroptylon repens*													I		NW
heartleaf (wild) four o'clock	*Mirabilis nyctaginea*									x				N	NW	
hoary alyssum	*Berteroa incana*										x			I	NW	
houndstongue	*Cynoglossum officinale*													I		NW
Iberian knapweed (starthistle)	*Centaurea iberica*	x											x	I	NW	
Italian plumeless thistle	*Carduus pycnocephalus*	x											x	I	NW	
Japanese knotweed	*Fallopia japonica*	x												I	NW	
lains pricklypear	*Opuntia polyacantha*			x										N	NW	
lanceleaf sage	*Salvia reflexa*									x				N	NW	
leafy spurge	*Euphorbia esula*													I		NW
medusahead	*Taeniatherum medusae*	x											x	I	NW	
mountain goldenbanner (thermopsis)	*Thermopis montana*											x		N	NW	
nodding plumeless (musk) thistle	*Carduus nutans*													I		NW
orange hawkweed	*Hieracium aurantiacum*					x							x	I	NW	

Table 7. Wyoming-State designated and County declared noxious weeds with potential to occur in the counties intersected by the Wyoming Pipeline Corridor Iniciative.

Plant		County												Legal Status		
Common Name[1]	Scientific Name[1]	Big Horn	Campbell	Carbon	Fremont	Hot Springs	Johnson	Lincoln	Natrona	Park	Sublette	Sweetwater	Washakie	Native Status[2]	Weed County Status[3]	Weed State Status[4]
oxeye daisy	*Leucanthemum vulgare (Chrysatnthemum leucantheum)*													I		NW
poison hemlock	*Conium maculatum*	x						x						I	NW	
professor weed (goatsrue)	*Galega officinalis*	x												I	NW	
puncturevine	*Tribulus terrestris*	x			x	x	x		x				x	I	NW	
purple loosestrife	*Lythrum salicaria*													I		NW
quackgrass	*Elymus repens (Agropyron repens)*													I		NW
red (purple) star-thistle	*Centaurea calcitrapa*	x											x	I	NW	
redstem storksbill (filaree)	*Erodium cicutarium*	x								x				I	NW	
rough (common) cocklebur	*Xanthium strumarium*		x	x			x							N	NW	
rush skeletonweed	*Chondrilla juncea*	x											x	I	NW	
Russian olive	*Elaeagnus angustifolia*													I		NW
saltover (halogeton)	*Halogeton glomeratus*			x					x					I	NW	
scentlessfalse mayweed (chamomile)	*Matricaria perforatum (perforata)*	x									x		x	I	NW	
Scotch broom	*Cytisus scoparius*	x											x	I	NW	
Scotch cottonthistle	*Onopordum acanthium*													I		NW
showy milkweed	*Asclepias speciosa*								x	x				N	NW	
skeletonleaf bur ragweed	*Ambrosia tormentosa*													N		NW
spiny plumeless thistle	*Carduus acanthoides*													I		NW
spotted knapweed	*Centaurea stoebe micranthos/ C. maculosa*													I		NW
squarrose knapweed	*Centaurea virgata squarrosa*	x												x	I	NW
stinking willie (tansy ragwort)	*Senecio jacobaea*	x												x	I	NW
sulfur cinquefoil	*Potentilla recta*	x												x	I	NW

Table 7. Wyoming-State designated and County declared noxious weeds with potential to occur in the counties intersected by the Wyoming Pipeline Corridor Iniciative.

Plant		County												Legal Status		
Common Name[1]	Scientific Name[1]	Big Horn	Campbell	Carbon	Fremont	Hot Springs	Johnson	Lincoln	Natrona	Park	Sublette	Sweetwater	Washakie	Native Status[2]	Weed County Status[3]	Weed State Status[4]
Syrian beancaper	*Zygophyllum fabago*	x													I	NW
tall mountain larkspur	*Delphinium occidentale*							x						x	N	NW
tamarisk (saltcedar)	*Tamarix sp*													I		NW
Tyrol (meadow) knapweed	*Centaurea nigrescens*	x											x	I	NW	
western water hemlock	*Cicuta douglasii*							x			x			N	NW	
whitetop	*Cardaria draba/C. pubescens*													I		NW
wild oat	*Avena fatua*					x		x						I	NW	
woolly distaff thistle	*Carthamus lanatus*	x											x	I	NW	
Wyeth lupine	*Lupinus wyethii*			x										N	NW	
yellow hawkweed	*Hieracium fendleri*	x											x	N	NW	
yellow spring (lady's) bedstraw	*Galium verum*											x		I	NW	
yellow starthistle	*Centaurea solstitialis*	x							x				x	I	NW	
butter and eggs (yellow toadflax)	*Linaria vulgaris*													I		NW

[1] Synonyms are shown in parenthesis
[2] Native Status according to the USDA NRCS PLANTS Database (2015b). N= Native; I= Invasive
[3] County-level declared Status according to the Wyoming Weed and Pest Council and Wyoming Board of Agriculture (2015). NW= Noxious Weed
[4] State-level designated Status according to the State of Wyoming (USDA NRCS 2015c; WWPC 2012). NW= Noxious Weed

Vegetation communities are more susceptible to infestations of invasive or noxious weed species following soil disturbances. In general, plant communities with more bare ground, such as cropland, sagebrush, salt desert scrub, and relatively dry or open forests are more susceptible to invasion than areas that have relatively closed canopy cover or have extreme climate or soils that are tolerated by fewer noxious weeds. Openings resulting from vegetation removal or disturbance of soils could promote the establishment or spreading of invasive or noxious plants to establish; movement of equipment could also provide opportunities for seed transport into new un-infested areas promoting the spreading of noxious weeds, which might reduce ROW revegetation success by competing for soil water, nutrients, space, and sunlight. The development of noxious weeds in agricultural lands, pasture, and grassland and the spread of weeds or seed from infested areas to adjacent vegetation communities could occur without proper safeguards.

Individual projects within the proposed corridors would implement the Noxious and Invasive Weed Control Plan delineated in Appendix H of the WPCI POD to control and prevent the spread of noxious and invasive weeds along the construction ROW and avoid introduction of new weeds throughout the different phases of the project. Noxious weeds would be monitored, controlled, and mitigated consistent with applicable regulations and using guidance from the appropriate county weed and pest district. During pre-construction and construction, herbicide application (spot or broad area depending on need) would be the primary treatment method. Other methods (as described in Appendix H) can be implemented when needed. Specific measures include: a) pre-treatment of dense stands of noxious and invasive weeds identified during pre-construction surveys with approved herbicides, before vegetation clearing begins, b) application of fertilizers limited to specific situations, as they may encourage weed growth, c) use of weed-free certified materials necessary for construction of facilities and infrastructures, and of soils imported for agricultural or residential use, d) implementation of cleaning programs to prevent transport of seeds and other propagules.

Non-target plants could be impacted from spray-over, drift, or accidental spillage/discharge of herbicides. Applications would be controlled to minimize impacts on surrounding native vegetation and in areas of dense infestation, or where impacts on native species would be difficult to avoid, broader application methods may be used and a follow-up seeding programs would be implemented. Application of herbicides would comply with EPA standards, according to the applicable regulatory agencies, and in coordination with landowners. Monitoring would be required to ensure the success of control measures; monitoring programs would be conducted during pre-construction activities and during the first growing season after construction has been completed.

Table 8. Summary of the potential concerns related to plant communities within the proposed pipeline corridors Wyoming Pipeline Corridor Initiative area

Concern	Resource	Project Considerations	Potential Future Studies
Areas to be avoided	Riparian/wetland areas	Wetlands and Waters of the US occupy less than 2% of the WPCI. Site away from higher wetland concentration areas to minimize impacts	Wetland delineations of areas to be impacted during construction and operations. Additional inventory and monitoring of the location and condition of riparian habitats.
	Sagebrush and desert shrublands	High proportion of shrub/scrub habitat within the WPCI. Siting of infrastructure to minimize impacts. Mitigation can be difficult due to soil characteristics and low precipitation levels. Establishment of roads can be problematic due to their length, drainage crossings, and overall change in hydrologic processes.	Pre-construction plant inventories. Invasive species mapping
	Native prairies	Substantial native prairies may be present in the WPCI. Site away from undisturbed native prairie areas to minimize impacts.	Use of currently available information likely sufficient.
State and Federal	Protection of native Grassland/shrubland complexes and Riparian areas. State sensitive and Federal listed species issues exist.	Designation of Critical Habitat for Federally-listed Species. Habitat types found within the WPCI are common throughout the region. A large proportion of prairies and shrubland complexes increase likelihood of rare plants being present.	Pre-construction inventories and post construction monitoring studies to determine occurrence of sensitive species and assess effectiveness of Mitigation Plans

REFERENCES

Chapman, S.S., Bryce, S.A., Omernik, J.M., Despain, D.G., ZumBerge, J., and Conrad, M., 2004, Ecoregions of Wyoming (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,400,000)

Cadenasso M. L, S. T. A. Pickett, K. C. Weathers, C. G. Jones . 2003. A framework for a theory of ecological boundaries. BioScience 53:750–758

Connelly, J. W., S. T. Knick, M. A. Schroeder, and S. J. Stiver. 2004. Conservation Assessment of Greater Sage-Grouse and Sagebrush Habitats. Western Association of Fish and Wildlife Agencies. Unpublished Report. Cheyenne, Wyoming. Pp. 7-46.

Dugan, P. J. (Ed.), 1990. Wetland Conservation: A review of current issues and required action. IUCN, Gland, Switzerland. 96 pp.

Endangered Species Act (ESA). 1973. 16 United States Code (USC) § 1531-1544, Public Law (PL) 93-205, December 28, 1973, as amended, PL 100-478 [16 USC 1531 *et seq.*]; 50 Code of Federal Regulations (CFR) 402.

Fertig W. 2000. State Species Abstract for Artemisia porteri (Porter's Sagebrush) [online]. Wyoming. Natural Diversity Database, Laramie, WY. Available: http://www.uwyo.edu/wynddsupport/docs/Reports/SpeciesAbstracts/Artemisia_porteri.pdf.

Gammonley, J. H., 2004. Wildlife of natural palustrine wetlands. In M.C. McKinstry, W.A. Hubert, and S.H. Anderson (Eds.). Wetland and riparian areas of the Intermountain West. (pp. 130-154). Austin, Texas: University of Texas Press.

Gregory, S. V., F. J. Swanson, W. A. McKee, and K. A. Cummins. 1991. An Ecosystem Perspective of Riparian Zones. Bioscience 41: 540-551.

Hagen, Sandra K., Patrick T. Isakson, and Steve R. Dyke. 2005. North Dakota Comprehensive Wildlife

Conservation Strategy. North Dakota Game and Fish Department. Bismarck, ND. 454 pp. http://www.nd.gov/gnf/conservation/cwcs.html

Heidel, B. 2009. Status of Meadow milkvetch (Astragalus diversifolius) in southcentral Wyoming. Prepared for the Bureau of Land Management, Rawlins and Rock Springs Field Offices. Wyoming Natural Diversity Database, Laramie, WY. Available: http://www.uwyo.edu/wyndd/_files/docs/reports/wynddreports/u09hei03wyus.pdf

Environmental Law Institute (ELI). 2008. State Wetland Protection. Status, Trends, and Model Approaches. Wyoming. Available: http://www.eli.org/freshwater-ocean/state-wetland-programs.

Federal Energy Regulatory Commission (FERC). 2013. Wetland and Waterbody Construction and Mitigation Procedures. May 2013 Version. Washington DC 20426. Available: www.ferc.gov/industries/gas/enviro/procedures.pdf

Heidel, B. 2012. Wyoming Natural Diversity Database (WYNDD), University of Wyoming. April 7, 2012. Available online at http://www.uwyo.edu/wyndd/_files/docs/soc-plants/2012_plant_soc.pdf

Jin, S., Yang, L., Danielson, P., Homer, C., Fry, J., and Xian, G. 2013. A comprehensive change detection method for updating the National Land Cover Database to circa 2011. Remote Sensing of Environment, 132: 159 – 175.

Knight, D. H. 1994. Mountains and Plains: The Ecology of Wyoming Landscapes. Yale University Press.

Knight, D. H., G. P. Jones, W. A. Reiners, and W. H. Romme. 2014. Mountains and Plains. The Ecology f Wyoming landscapes. Second Edition. 416 Pp. Yale University Press

Knopf, F. L. and F. B. Samson. 1994. Scale Perspectives on Avian Diversity in Western Riparian Ecosystems. Conservation Biology 8(3): 669-676.

Litt, A. R., and D. E. Pearson. 2013. Invasive plants and wildlife in the Intermountain West. Invited contribution, special issue of The Wildlife Society Bulletin 37:517-526

McKinstry, M., P. Caffrey, Stanley Anderson. 2002. The importance of beavers to duck populations in Wyoming. Birdscapes. p 24.

Miller, R. F. and L. E. Eddleman. 2000. Spatial and Temporal Changes of Sage-Grouse Habitat in the Sagebrush Biome. Oregon Agricultural Experiment Station Technical Bulletin 151, Oregon State University, Corvallis, Oregon.

Natural Resources Conservation Service (NRCS). 2016. Conservation Reserve Program (CRP), Wyoming. NRCS, US Department of Agriculture (USDA). Accessed February 2016. Available: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/wy/programs/?cid=nrcs142p2_026724

NatureServe. 2015. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://explorer.natureserve.org. Accessed: September 8, 2015.

Nicholoff, S. H. compiler, 2003. Wyoming Bird Conservation Plan, Version 2.0. Wyoming Partners In Flight. Wyoming Game and Fish Department,

Lander, Wyoming, USA. Available: http://www.blm.gov/wildlife/plan/WY/Wyoming%20Bird%20Conservation%20Plan.htm

Omernik, J., & Griffith, G. (2012). Ecoregions of Wyoming (EPA). Retrieved from http://www.eoearth.org/view/article/152236

Ortega, Y. K., and D. E. Pearson. 2005. Weak vs. strong invaders of natural plant communities: assessing invasibility and impact. Ecological Applications 15:651–661

Paige, C. and S. A. Ritter. 1999. Birds in a Sagebrush Sea: Managing Sagebrush Habitats for Bird Communities. Partners in Flight Western Working Group, Boise, Idaho. Available online at: https://fishandgame.idaho.gov/public/wildlife/nongame/brochureBirdSagebrush1.pdf

Pocewicz, A., H.E. Copeland, M.B. Grenier, D.A. Keinath, and L.M. Waskoviak. 2014. Assessing the future vulnerability of Wyoming's terrestrial wildlife species and habitats. Report prepared by The Nature Conservancy, Wyoming Game and Fish Department and Wyoming Natural Diversity Database.

Scott, M. L., S. K. Skagen, and M. F. Merigliano. 2003. Relating Geomorphic Change and Grazing to Avian Communities in Riparian Forests. Conservation Biology 17(284-296):

US Department of Agriculture (USDA) Natural Resources Conservation Service. 2015a. Web Soil Survey. Accesses on September 1, 2015. Available online at: (NRCS)http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

United States Department of Agriculture (USDA). Natural Resources Conservation Service (NRCS). 2015b. PLANTS Database. Available online at: http://plants.usda.gov/java/. Accessed on September 27, 2015

United States Department of Agriculture (USDA). Natural Resources Conservation Service (NRCS). 2015c. Introduced, Invasive, and Noxious Plants. Wyoming. Available http://plants.usda.gov/java/noxious?rptType=State&sort=noxComname&statefips=56. Accessed September 28, 2015.

United States Department of the Interior. Bureau of Indian Affairs. 2015. Wind River Agency. Accessed on September 20, 2015. Available online at: http://www.bia.gov/WhoWeAre/RegionalOffices/RockyMountain/WeAre/WindRiver/

United States Department of Energy (USDOE). 2015. Petroleumm Reserves. Available http://energy.gov/fe/services/petroleum-reserves. Accessed September 3, 2015.

United States Department of the Interior . Bureau of Land Management (BLM). 2010. Wyoming Sensitive Species Policy and List. March 31, 2010. Available: http://www.blm.gov/style/medialib/blm/wy/resources/efoia/IMs/2010.Par.41285.File.dat/wy2010-027atch2.pdf

United States Department of the Interior. Bureau of Reclamation. Great Plains Region. Accessed on September 20, 2015. Available online at: http://www.usbr.gov/gp/wyao/

United States Forest Service (USFS) Intermountain Region (R4). 2013.Threatened, Endangered, Proposed and Sensitive species. February 2013 Update. Available: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5370041.pdf. Accessed: September 25, 2015.

United States Forest Service. 2014. Ashley National Forest. Monitoring Report for Fiscal Year 2014. Available online at: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3822623.pdf

United States Forest Service (USFS). 2015. Forest Service Manual. Rocky Mountain Region (R2), Denver, Co. August 29, 2015. R2 – 2600 – 2015 – 1. Page 1 of 23. Available: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3843364.pdf. Accessed September 25, 2015

United States Environmental Protection Agency. 2005. National Management Measures to Protect and Restore Wetlands and Riparian Areas for the Abatement of Nonpoint Source Pollution. EPA-841-B-05-003. July 2005. Available: http://water.epa.gov/polwaste/nps/wetmeasures/upload/2005_08_19_NPS_wetmeasures_ch2.pdf

United States Fish and Wildlife Service (USFWS). 2004. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Desert Yellowhead; Final Rule. Department of the Interior Fish and Wildlife Service. 50 Code of Federal Regulations (CFR) Part 17. RIN 1018-AAI69. 69 Federal Register (FR) 12278-12290. March 16, 2004.

United States Fish and Wildlife Service (USFWS). Wyoming Ecological Services. 2015a. Federally listed, proposed and Candidate Species . Available: http://www.fws.gov/wyominges/Pages/Species/Species_Endangered.html. Accessed September 27, 2015

--------- 2015b. Information for Planning and Conservation System (IPaC). Available: https://ecos.fws.gov/ipac/. Accessed September 20, 2015

United States Geological Survey (USGS). National Gap Analysis Program (GAP). 2015a. Land Cover Data Viewer. Accessed on September 15, 2015. Available online at: http://gis1.usgs.gov/csas/gap/viewer/land_cover/Map.aspx

--------- 2015b. Protected Areas Data Viewer. Accessed on Septemner 10, 2015. Available online at: http://gis1.usgs.gov/csas/gap/viewer/padus/Map.aspx

United States Geological Survey (USGS). The National Map. 2015. Available: http://nationalmap.gov/small_scale/printable/fedlands.html#wy. Accessed September 22, 2015.

United States Geological Survey (USGS). National Hydrography Dataset (NHD). 2015. Available: http://nhd.usgs.gov/. Accessed: August 25, 2015.

United States Geological Survey (USGS). National Land Cover Database (NLCD). 2006. Land Use/Land Cover, USGS NLCD 2001 Data. USGS Headquarters, USGS National Center. Reston, Virginia. http://www.mrlc.gov/nlcd2006.php

University of Georgia. Center for Invasive Species and Ecosystem Health. Early Detection & Distribution Mapping System. 2015.. Available online at: http://www.eddmaps.org/tools/statereport.cfm?id=us_wy. Accessed on September 15, 2015.

Wiken, Ed, Francisco Jiménez Nava, and Glenn Griffith. 2011. North American Terrestrial Ecoregions—Level III. Commission for Environmental Cooperation, Montreal, Canada

Wyoming Game and Fish Department (WGFD). 2010a. Wyoming State Wildlife Action Plan (SWAP). WGFD, Cheyenne, Wyoming. Available online at: https://wgfd.wyo.gov/WGFD/media/content/PDF/Habitat/SWAP/SWAP.pdf.

---------- 2010b. Wyoming Wetlands Conservation Strategy. WGFD, Cheyenne, Wyoming. Available: https://wgfd.wyo.gov/WGFD/media/content/PDF/Habitat/Habitat%20Information/Wyoming%20Wetlands%20Conservation%20Strategy/Wyoming-Wetlands-Conservation-Strategy.pdf

Wyoming Interagency Vegetation Community. 2002. Wyoming Guidelines for Managing Sagebrush Communities with Emphasis on Fire Management. Wyoming Game and Fish Department (WGFD) and Wyoming Bureau of Land Management (BLM), Cheyenne, Wyoming

Wyoming Natural Diversity Database (WYNDD). 2012. Plant Species of Concern. Available: http://www.uwyo.edu/wyndd/species-of-concern/plants/. Accessed: September 26, 2015.

Wyoming Pipeline Authority (WPA). 2014. Wyoming Pipeline Corridor Initiative, Plan of Development (POD). May 2014

Wyoming Weed and Pest Council in junction with the Wyoming Board of Agriculture. 2012. Wyoming Weed and Pest Control Act. State designated weed and pests. Available http://www.wyoweed.org/images/Designated_List.pdf. Accessed September 15, 21015

---------- 2015. Weed and Pest declared list by county. Amended February 2015. Available http://www.wyoweed.org/images/2015_Declared_List.pdf . Accessed September 15, 2015.