4.0 Environmental Consequences

4.1 INTRODUCTION

The previous chapter described the physical, biological, social, and economic characteristics of the environment that may be affected by implementation of the proposed action and the alternatives. Direct, indirect, connected and cumulative effects are described in this chapter. This chapter examines how each of these characteristics may be affected (beneficially or adversely) by implementation of each of the alternatives, including the No Action Alternative. No other proposed action(s) were identified that may be anticipated to occur in the reasonably foreseeable future within the project area or within the geographic scope of the EIS's resource effects analysis. Therefore, the cumulative effects analysis primarily includes past actions, current actions, and the proposed action and its alternative.

4.1.1 No Action Alternative

The No Action Alternative would result in the land remaining under BLM ownership and management which would eliminate the sale of the land to private interests and the connected action of crop production. Current land management regimes that are in place would remain and continue to affect the environment as it currently exists. Therefore, this alternative would likely result in no positive or negative change to the current environment. This alternative however, does not comply with Public Law 106-485 (Nov. 9, 2000; 114 Stat. 2199) (Appendix A).

4.2 LAND FEATURES

4.2.1 General Setting

4.2.1.1 Location

Alternative 1

Land ownership would be conveyed from federal ownership to private ownership. Alternative 1 would result in 16,050 acres being placed into private ownership. The connected action would result in the sale of a portion of these acres to be developed for crop production.

Alternative 2

Alternative 2 would differ from Alternative 1 in that only 11,576 acres would be conveyed from federal to private ownership. The connected action would result in the sale of a portion of these lands to be developed for crop production.

Alternative 3

Alternative 3 would convey 9,740 acres from federal to private ownership. As with the other alternatives, the connected action would result in the sale of a portion of these lands to be developed for crop production.

4.2.1.2 Climate

Alternatives 1, 2 and 3

The microenvironment climate will be altered by the conversion of native vegetation to cropland associated with each of the alternatives. Alternatives 1 and 2 would convey equal amounts of irrigable acreages (9,300 acres), which would likely be converted to cropland, whereas Alternative 3 would convey less irrigable acres (8,280 acres) reducing the potential effects to the microenvironment climate. An increase in humidity and evapotransporation are predicted to occur within the agricultural fields as the local area is converted from an arid environment to a more mesic environment. Although these changes to the microenvironment are anticipated, they are not quantifiable at this time.

4.2.2 Geology and Soils

Alternatives 1 and 2

Previous studies have provided estimates of soil losses from wind and water erosion. The estimates are based on the "Wind Erosion Equation" and the "Universal Soil Loss Equation," both of which require parameter inputs associated with crop types, crop rotations, and management practices. At this time, crop and agricultural practice details remain uncertain for this project, however it is predicted that crops selected would be similar to existing crops in the Bighorn Basin and would include alfalfa, corn, dry beans, malting barley, sugar beets, and grass hay mixtures. Previous studies utilized crop rotations of malt barley, sugar beets, alfalfa, and pasture to calculate an estimated average soil loss of 4.1 tons per acre per year (USDOI, 1988). Based on these calculations it is estimated that 38,130 tons per year of soil would be lost if all 9,300 acres were irrigated. However, this number may be reduced due to the predicted grading of sloping fans, swales, and drainages into the surrounding terraces that would be required to render the area irrigable. It is estimated that this process will effectively reduce the net effects of both wind and water erosion. Certain conservation measures recommended by the NRCS can be implemented to prevent excessive soil losses and to ensure long-term sustainability of agriculture in the project area.

The high salinity of the soils in the project area (e.g., Rairdent-Uffens) would greatly restrict productivity unless the salts are sufficiently leached in order to make them fully productive and suitable for long-term irrigation. Water and soil amendments applied in an agronomic manner, in accordance with crop needs, soil water holding capacities, climatic characteristics, soil infiltration rates, and leaching requirements should not lead to saturated conditions such that a continuous wetting front is established with the regional groundwater system. Sufficient water application for leaching purposes would merely ensure that salts do not accumulate within the root zone. Thus, mass wasting of salts to groundwater and to the Bighorn River should be minimized.

Reclamation of the saline soils would lead to gradual salt wasting and possible trace amounts of selenium in return flows as these constituents are transported with the water fraction that migrates downward by dispersion into the groundwater. Several small wetlands west of the Bighorn River lay down-gradient of the project area. Selenium in irrigation return flows could reach the wetlands and fall stagnant, leading to gradual selenium accumulations that would endanger wildlife habitat. The precise nature and degree of this situation is beyond the scope of

this study. Selenium and salts may also reach the Bighorn River, but accumulation should not be an issue, and concentrations would be negligible, assuming responsible farming practices, according to the USDOI report (1988).

Alternative 3
Under Alternative 3 impacts to geology and soils would be similar to Alternatives 1 and 2, however fewer acres (8,280 versus 9,300) would be irrigable thus the potential impacts would be reduced. Based on the calculations discussed under Alternatives 1 and 2, it is estimated that 33,944 tons per year of soil would be lost if all 8,280 acres associated with Alternative 3 were irrigated. This potential impact would be reduced with the management techniques described for Alternatives 1 and 2 regarding grading and implantation of NRCS conservation measures.

Similar to Alternatives 1 and 2 the high salinity of the soil would need to be reduced prior to crop production. Applications of water and soil amendments as described for Alternatives 1 and 2 would be necessary under Alternative 3; however less water and amendments would be required due to the reduced irrigable acres. Sufficient water application for leaching purposes would merely ensure that salts do not accumulate within the root zone. Therefore, the potential of mass wasting of salts to ground water and to the Bighorn River would be less than Alternative 1 and 2.

The potential for selenium to occur in return flows which could accumulate in nearby wetlands would be reduced as soil reclamation would occur on fewer acres. However, as described under Alternatives 1 and 2, the precise nature and degree of the potential impact is beyond the scope of this assessment.

4.2.3 Mineral Resources

Alternatives 1, 2 and 3
Geologic mineral resource extraction or utilization is unlikely to conflict with surface agricultural activities. It is not anticipated that sand and gravel demand would exceed the availability of alternative reserves. Coal and coal bed methane development prospects are low as the lateral extent and thickness of reserves in the Basin Coal Field are limited and deemed “low priority” for development. There are currently no coal mining operations in the Bighorn Basin. Oil and gas development is active in the area, and it is possible that additional development may proceed under the auspices of federal leasing regulations. The BLM provides oversight of federal lease development.

4.3 WATER RESOURCES

4.3.1 Surface Hydrology

Alternative 1 and 2
The projected water demands for the project were based on system capacities of 50 cfs (3,000 acre-feet per month) for the Washakie County System (Diversion 1) and 33 cfs (2,000 acre-feet per month) for the Big Horn County System (Diversion 2). The maximum total monthly demand for both systems is estimated to be 83 cfs (5,000 acre-feet per month), which will occur during

July. The total water demand for crop production during an irrigation season is estimated to be 18,600 acre-feet per year. Return flows associated with the system capacities described above are estimated at 25 percent of the applied water, resulting in 12.5 cfs for Washakie County, 8.25 cfs for Big Horn County, and a maximum return flow in July of 20.75 cfs.

The "Kirby Area Water Supply Level I Study" (Anderson Consulting Engineers, Inc., 2005) analyzed the water supply available for proposed projects in the Kirby area, which is immediately upstream from Worland. The results determined that there is ample water in the Bighorn River to meet the future requirements associated with the WID Project. It is not anticipated that additional flows would have to be released from Boysen Reservoir to meet project needs. The available flows in the Bighorn River are sufficient to support the project. Consequently, effects on Boysen Reservoir would not occur.

The project impacts to the Bighorn River have been estimated for the irrigation season. Existing and anticipated Bighorn River flows for both dry years and normal years have been summarized in Table 4-1. The existing flows reported in Table 4-1 were measured at the confluence of Fifteenmile Creek and the Bighorn River. The winter maintenance flows for the Bighorn River, as maintained by Bureau of Reclamation, are 18,600 acre-feet per month. No summer maintenance flows have been formulated.

Table 4-1. Existing and Anticipated Bighorn River Flows in Relation to Alternatives Considered for Dry and Normal Years.

DRY YEARS	May (cfs)	June (cfs)	July (cfs)	August (cfs)	September (cfs)
Existing	958	977	940	798	523
Alternatives 1 and 2	911	898	849	732	498
Alternative 3	916	907	859	739	501
NORMAL YEARS					
Existing	1,219	1,596	2,132	1,373	1,123
Alternatives 1 and 2	1,172	1,517	2,041	1,308	1,097
Alternative 3	1,177	1,526	2,051	1,315	1,100

Alternative 3

The projected water demands for the project were based on system capacities of 45 cfs (3,700 acre-feet per month) for the Washakie County System (Diversion 1) and 29 cfs (1,700 acre-feet per month) for the Big Horn County System (Diversion 2). The maximum total monthly demand for both systems is estimated to be 74 cfs (4,400 acre-feet per month), which will occur during July. The total water demand for crop production during an irrigation season is estimated to be 17,444 acre-feet per year. Return flows associated with the system capacities described above are estimated at 25 percent of the applied water, resulting in 11.25 cfs for Washakie County, 7.34 cfs for Big Horn County, and a maximum return flow in July of 18.50 cfs.

As discussed under Alternative 1 and 2, the "Kirby Area Water Supply Level I Study" (Anderson Consulting Engineers, Inc., 2005) indicates there would be ample supply in the Bighorn River to meet the demands associated with Alternative 3 and no additional flow releases would be

required from Boysen Reservoir. Alternative 3 would not result in an impact to Boysen Reservoir.

Potential impacts to flows in the Bighorn River associated with Alternative 3 in relation to dry and normal years are presented in Table 4-1. The winter maintenance flows for the Bighorn River, as maintained by Bureau of Reclamation, are 18,600 acre-feet per month. No summer maintenance flows have been formulated.

4.3.2 Water Quality

Alternative 1 and 2

The conversion of native vegetation to crop land proposed in the connected action would result in an approximate increase of 37 tons/year of sedimentation to the Bighorn River. This increase was calculated by extrapolating results generated by the USDOI study (1988). The USDOI reported that flood irrigation of 4,068 acres of undisturbed land, which occurs within the project area of this EIS, would result in 16 tons/year (~10 percent higher than conditions in 1988) increased sedimentation to the Bighorn River based on the Universal Soil Loss Equation. The USDOI report concludes that the estimated increases would have an insignificant effect on the municipal water supply at Basin, unnoticeable effects on turbidity, and aquatic species would be unaffected. Considering that the scale of the difference is orders of magnitude less than overall Bighorn River sediment load, it is deemed reasonable to assume that the same conclusions hold for both of the current proposed alternatives.

Reasonable and recommended application of pesticides associated with the proposed crop production would not likely result in a significant increase to the current concentrations of pesticides in the Bighorn River. The existing extensive crop production that occurs along the Bighorn River has only resulted in trace amounts of pesticides being detected, therefore it is reasonable to conclude that the addition of 9,300 acres of crop production will not likely result in a large increase in the concentration of pesticides in the Bighorn River. Loading of trace constituents from runoff on the Bighorn River at Basin was modeled in the USDOI 1988 report. All concentrations were orders of magnitude below ambient water quality. Assuming appropriate and recommended application practices are followed, increase in pesticide concentrations in the Bighorn River would pose no threat to human or aquatic life (USDOI, 1988).

Alternative 3

With the reduction of irrigable acres, the potential increase in sedimentation resulting from the conversion of native vegetation to crop land would be approximately 33 tons/year of sedimentation to the Bighorn River. This estimation was based on the calculations discussed under Alternatives 1 and 2. This increase in sedimentation would be considered insignificant based on the analysis presented under Alternatives 1 and 2.

Similar to Alternatives 1 and 2, with reasonable and recommended application of pesticides associated with the proposed crop production, Alternative 3 would not likely result in a significant increase to the current concentrations of pesticides in the Bighorn River.

4.3.3 Groundwater Resources

Alternatives 1, 2 and 3

Potential impacts to groundwater resources associated with all three alternatives were evaluated by extrapolating the analyses conducted in the USDOI (1988) report. The USDOI analysis (1988) included a mass balance assessment of groundwater quality in relation to additional application of water through sprinkler irrigation to the project area. The analysis considered effects of trace constituents/metallic elements, pesticides and nitrate along a 15.5 mile eastern project boundary (which closely approximates the present proposed project boundary). Constituents potentially exceeding the Environmental Policy Act (EPA) standards include arsenic and iron. The USDOI report (1988) estimated that resultant iron concentrations in the adjoining alluvial groundwater system would exceed Federal Secondary Drinking water standards. Other trace metal constituents remained within standard limits. These conclusions hold true in the extrapolation of these results to account for the additional irrigated acreage under the present Alternatives 1 and 2, and Alternative 3 (Table 4-2).

Table 4-2. Groundwater Quality Estimation.

Constituent (ppb)	EPA Standard Concentration of Acute Toxicity	Existing Irrigation/ Current Conditions[1]	USDOI (1988) Additional Acres[2] (4,068 Acres)	Alternative 1 and 2[3] (9,300 Acres)	Alternative 3[3] (8,280 Acres)
Arsenic	10	2	19	23	21
Cadmium	5	0	3	4	3.5
Iron	300	508	1492	1737	1602
Selenium	5	4	5	5	5
Aldicarb	3,000	253	337	358	346
Dicamba	28,000	5	6	6	6
Carbaryl	330	Not Applicable--never more than 0.05 percent of the annual applied would be leached below the crop rooting zone.			
Nitrate	10	141	Must be assessed in advanced planning phases.		

[1]Irrigated acreage below the Big Horn Canal between Tenmile and Alamo Creeks, including canal seepage, and groundwater quality estimated from Bighorn River data.
[2]Mass balance analysis from USDOI 1988 report.
[3]Mass balance extrapolated from USDOI 1988 report.

The use of pesticides associated with crop production would not likely result in degradation of groundwater. Aldicarb in soil rapidly degrades to nontoxic sulfide and sulfone products. Dicamba when applied at the recommended rates would not present a hazard to human or livestock use of the groundwater. Carbaryl leaching would be limited to no more than 0.05 percent of the annually applied amount, and no adverse effects would be anticipated to occur (USDOI, 1988). At the low predicted concentrations (which are either broken down to nontoxic constituents, do not bioaccumulate, or do not leach below the root zone), the responsible use of these typical pesticides would not likely result in hazardous or toxic conditions to the groundwater.

There are several domestic wells in the area. The State Engineer's Office records indicate 15 domestic (or domestic/stock) wells west of the Bighorn River that are less than 50-feet deep.

Although precise recharge characteristics and the overall groundwater flow regime are unknown, it is possible that these wells would suffer adverse impacts. The precise nature of these impacts cannot be stated beyond the estimates provided in the Table 4-2. It may be prudent to document the baseline water quality of potentially affected wells in the area. Additionally, installing a suite of up-gradient monitor wells in order to document that the level of leached chemicals and pesticides do not increase inordinately nor approach levels of toxicity may be required.

4.3.4 Water Rights

Alternatives 1 and 2

It is has been estimated that Wyoming has over 1,500,000 acre-feet of water available in the Bighorn Basin for future uses. (BRS, Inc., 2003) Of this amount, the WID would divert to the project area a total of about 18,600 acre-feet per year. This diversion amount is based upon the actual crop demand schedule developed for the proposed project and is substantially less than typical for a full irrigation requirement (30,000 acre-feet).

Due to the amount of proposed diversion relative to availability, no impacts to existing water users are anticipated as a result of Alternative 1 or 2. Those existing water users who may be concerned about potential impacts must request water right regulation from the Water Division III Superintendent of the State Board of Control. The Superintendent will then make a determination if the proposed project is impacting existing senior appropriations downstream and will remedy the situation through their regulatory authority.

Alternative 3

Under Alternative 3, WID would divert to the project area a total of about 17,444 acre-feet per year. Similar to Alternatives 1 and 2, this diversion amount is based upon the actual crop demand schedule developed for the proposed project and is substantially less than typical for a full irrigation requirement (30,000 acre-feet). Based on the amount of proposed diversion relative to water available in the Bighorn Basin (over 1,500,000 acre-feet), no impacts to existing water users are anticipated as a result of Alternative 3. As mentioned under Alternatives 1 and 2, concerned water users are directed to the Water Division III Superintendent of the State Board of Control to request a determination if the proposed project is impacting existing appropriations downstream.

4.4 AIR QUALITY

Alternatives 1, 2, and 3

The effects from the land conveyance and connected actions on air quality would be seasonal as crop production cycles through the tilling, planting, growing, and harvest stages. While the land is being tilled to create cropland, there may be an increase in fugitive dust resulting from the barren land. After the land is converted into cropland, fugitive dust would be an issue during planting and harvest seasons when the vegetation cover is minimal. While the soil is exposed during these periods, dust storms are likely to occur.

Vehicle emissions are a potential source for reducing the air quality of the area. Increased emissions would primarily be generated from the use of farming equipment. Due to topography of the area and the prevailing atmospheric conditions the potential increase in emissions would readily dissipate to a level that is insignificant.

The potential increase in fugitive dust and vehicle emissions are anticipated to occur at levels that are insignificant and would not result in an adverse effect to the region.

4.5 NOISE

Alternatives 1, 2, and 3
The primary sources of existing noise in the region are farm equipment and intermittent highway traffic. The increase of agriculture activities resulting from the connected actions would not differ between the two alternatives because there would be no additional farming activities on the larger parcel sold. Either alternative would result in a slight increase in the noise levels associated with agriculture activities and vehicle travel. However, farm equipment is used on a seasonal basis, thus the increase in noise levels would not result in a new source of constant noise levels.

Sensitive noise receptors that may be adversely affected by increases to ambient noise levels are sage grouse leks, big game on crucial winter ranges, and nesting raptors. No sage grouse leks or nesting raptors were located within the project area. The closest raptor nests were along the Bighorn River where croplands dominate the landscape and nesting raptors have either acclimated to the farm noise that occurs or have already vacated the region. The area proposed for conveyance does contain crucial winter range for pronghorn antelope and mule deer. However, farm equipment generally is not utilized in the winter months when big game would be utilizing the winter ranges. Increase in noise levels associated with the project would not affect animals on the winter ranges.

4.6 BIOLOGICAL RESOURCES

4.6.1 Vegetation

Alternatives 1 and 2
The conversion of native vegetation into cropland associated with Alternatives 1 and 2 would result in the loss of native plant communities. The total loss of native vegetation would be identical for either alternative as the overall amount of irrigable land, and those most likely to be converted from native vegetation to cropland, is the same. Other activities associated with the alternatives, such as road construction, infrastructure development, and fencing would not likely result in a direct loss of habitat as these features are expected to occur within the area identified as irrigable.

The conversion to cropland associated with Alternatives 1 and 2 would result in a permanent loss of approximately 9,300 acres of Wyoming big sagebrush. This equals approximately 0.62

percent of the Wyoming big sagebrush plant community that occurs within the Bighorn Basin (Map 3-1). This loss would not likely result in a significant impact to the Wyoming big sagebrush plant community.

Both alternatives require the creation of two diversion pumping stations along the Bighorn River. The installation of the pumps will result in the loss of approximately five acres of vegetation at each location. The northern diversion point will result in the loss of emergent vegetation associated with a fringe wetland. The southern diversion point will result in the loss of riparian vegetation that consists of trees and herbaceous vegetation. The construction of pipelines from the diversion points to the edge of the land conveyed will result in temporary disturbance to vegetation. The pipelines will follow roads as much as possible, but it is likely there will be some lengths of the pipeline that will cross irrigated crop land. Areas along road sides that would be disturbed by trenching would likely be revegetated with invasive species if not reseeded.

Alternative 3
Approximately 8,280 acres of native vegetation would be permanently lost due to the conversion to cropland under Alternative 3. This is estimated to be 0.55 percent of the Wyoming big sagebrush plant community within the Bighorn Basin.

Alternative 3 would require the creation of two diversion pumping stations as discussed under Alternative 1 and 2. Therefore as with Alternatives 1 and 2, the loss of approximately five acres of vegetation at each pumping station and temporary disturbance from pipeline construction would occur under Alternative 3.

4.6.2 Wildlife

4.6.2.1 Big Game

Alternatives 1 and 2
The conversion of native vegetation into cropland associated with Alternatives 1 and 2 would result in a loss of seasonal habitat for pronghorn antelope, mule deer, and white-tailed deer (Table 4-3). Other activities associated with the alternatives, such as road construction, infrastructure development, and fencing would not likely result in a direct loss of habitat as these features are expected to occur within the area identified as irrigable. Fence construction could restrict pronghorn antelope and mule deer, but fencing recommendations of the WGFD could be employed to avoid these impacts. Proper fence design would insure that big game animals may move through the property during periods of severe winter when access to crucial winter range is essential.

The conversion to cropland associated with Alternatives 1 and 2 would result in a loss of crucial winter/yearlong range for pronghorn antelope and mule deer, as well as parturition range for pronghorn antelope. The pronghorn antelope herd unit that occupies the project area would lose an estimated 3.5 percent of the total crucial winter/yearlong habitat available to the herd as a result of the conversion (see Map 3-7). Additionally, the pronghorn antelope would lose approximately 0.3 percent of the total winter/yearlong range identified in the unit and approximately 14.6 percent of the identified parturition range. At the present time parturition range is not considered a limiting resource such that it controls the capacity of the area to support

pronghorn. It is unknown if the loss of 14.6 percent of the identified parturition range would result in a change in this condition. Mule deer would lose approximately 1.6 percent of the total crucial winter/yearlong habitat available in the region. Mule deer and white-tailed deer would both lose yearlong habitat equaling 1.5 percent and 0.1 percent, respectively, of the total available yearlong habitat. It is difficult to predict the impact to a herd due to a partial loss of crucial winter habitat. However, it is anticipated that over the long term, there would be a reduction in population based on the reduction in carrying capacity during a severe winter, when available crucial winter range limits the number of surviving individuals. The loss of crucial winter range reduces the capacity of the herd unit to support animals and therefore, over the long term, the population size of the herd would be expected to decline.

Table 4-3. Quantity of Seasonal Range Lost Due to Conversion to Cropland.

Species and Seasonal Range	Number of Acres Available in Herd Unit	Number of Acres Lost Under Alternative 1 or 2	Percent of Seasonal Range Lost Under Alternative 1 or 2	Number of Acres Lost Under Alternative 3	Percent of Seasonal Range Lost Under Alternative 3
Pronghorn Antelope (HU #204, Fifteen Mile)					
Crucial winter/yearlong	241,211	8,394	3.5	6,864	2.8
Winter/yearlong	996,491	3,177	0.3	2,876	0.3
Parturition	4,470	651	14.6	635	14.2
Mule Deer (HU #209, Basin)					
Crucial winter/yearlong	264,654	4,132	1.6	3,531	1.3
Yearlong	509,960	7,439	1.5	6,209	1.2
White-tailed Deer (HU# 201 Bighorn Basin)					
Yearlong	857,208	765	0.1	443	0.1

Alternatives 1 and 2 will result in a loss of public ownership and multiple use management of these seasonal ranges. Due to the greater number of acres conveyed in Alternative 1, there will be a greater loss associated with Alternative 1 (Table 4-4). Alternative 2 contains no additional acres of seasonal ranges other than those considered for conversion to cropland, therefore the percentages for Alternative 2 did not change. The noticeable differences between Alternative 1 and Alternative 2 regarding loss of seasonal range management occurs in the pronghorn antelope crucial winter/yearlong range (4.7 percent versus 3.5 percent loss), pronghorn antelope parturition (28.7 percent versus 14.6 percent), and mule deer crucial winter/yearlong (2.4 percent versus 1.6 percent). The other seasonal ranges showed 0.5 percent or less difference between the two alternatives.

Table 4-4. Quantity of Seasonal Range Removed from Public Ownership and Multiple Use Management.

Species and Seasonal Range	Number of Acres Available in Herd Unit	Alternative 1 Percent of Seasonal Range Lost	Alternative 2 Percent of Seasonal Range Lost	Alternative 3 Percent of Seasonal Range Lost
Pronghorn Antelope (HU #204, Fifteen Mile)				
Crucial winter/yearlong	241,211	4.7	3.5	2.8
Winter/yearlong	996,491	0.5	0.3	0.3
Parturition	4,470	28.7	14.6	14.2
Mule Deer (HU #209, Basin)				
Crucial winter/yearlong	264,654	2.4	1.6	1.3
Yearlong	509,960	2.0	1.5	1.2
White-tailed Deer (HU# 201 Bighorn Basin)				
Yearlong	857,208	0.2	0.1	0.1

Depending upon the crops selected for planting, there may be an available forage source created to some degree in particular during the mid to late summer months when all green native range vegetation has cured. However, the increase in forage during the crop growing season would not offset the loss of forage during the winter season. Also, the utilization of the crops by wildlife may result in a reduction in the amount of crops harvested, resulting in damage under state statute (Law 23-I-901). There is the potential that damage to crops by big game will result in an increase in depredation harvests by the WGFD of the animals in this area. A reduction in the herd unit population would be the likely outcome of the increased depredation harvests.

Alternative 3

The loss of seasonal habitat for pronghorn antelope, mule deer, and white-tailed deer under Alternative 3 would be reduced based on the fewer irrigable acres associated with this alternative (Table 4-3). As with Alternatives 1 and 2, other activities would not likely result in a direct loss of habitat as these features are expected to occur within the area identified as irrigable. As discussed under Alternatives 1 and 2, fence construction could restrict pronghorn antelope and mule deer, but fencing recommendations of the WGFD could be employed to avoid these impacts. Proper fence design would insure that big game animals may move through the property during periods of severe winter when access to crucial winter range in essential.

Similar to Alternatives 1 and 2, the conversion to cropland associated with Alternative 3 would result in a loss of seasonal and parturition ranges for pronghorn. Under Alternative 3, the loss of seasonal ranges for pronghorn would be similar to losses identified for Alternatives 1 and 2 (Table 4-3) with the greatest losses associated with the parturition range (14.2 percent) and crucial winter/yearlong habitat (2.8 percent). Similar to Alternatives 1 and 2, it is unknown if the loss of 14.2 percent of the identified parturition range would become a limiting resource that controls the capacity of the area to support pronghorn. Under Alternative 3, the loss of mule deer and white-tailed deer seasonal ranges would be similar to those discussed for Alternatives 1 and 2 (Table 4-3). Mule deer would lose approximately 1.3 percent of the total crucial winter/yearlong habitat available in the region. Mule deer and white-tailed deer would both lose yearlong habitat equaling 1.2 percent and 0.1 percent, respectively, of the total available

yearlong habitat. As discussed for Alternatives 1 and 2, it is difficult to predict the impact to a herd due to a partial loss of crucial winter habitat. However, it is anticipated that over the long term, there would be a reduction in population based on the reduction in carrying capacity during a severe winter, when available crucial winter range limits the number of surviving individuals. The loss of crucial winter range reduces the capacity of the herd unit to support animals and therefore, over the long term, the population size of the herd would be expected to decline.

Alternative 3 will result in a loss of public ownership and multiple use management of these seasonal ranges. As with Alternative 2, Alternative 3 contains no additional acres of seasonal ranges other than those considered for conversion to cropland, therefore the percentages for Alternative 3 did not change.

4.6.2.2 Raptors

The land conveyed and the connected actions associated with all three alternatives would not result in the loss of any known nest sites for raptors. No cottonwood trees along the Bighorn River would be lost and the land to be conveyed, while in the breeding range and habitat for ferruginous hawk and northern harrier, provides little suitable nesting habitat. No impacts to nesting raptors are expected from either alternative.

Currently, raptor foraging opportunities on the site are minimal. There are low density populations of ground squirrels, cottontail or jackrabbits, two small prairie dog colonies and likely other small rodents within the land proposed for conveyance. However, should the land be converted to irrigated agriculture, the current small mammal community would likely change as species that are common in croplands are likely to invade from nearby fields east of the Big Horn Canal. Over time the prey base of small mammals on the site is expected to change, although it is not certain whether abundance and overall prey biomass would increase or decrease. Quantifying change in small mammal abundance and biomass is difficult, however, it is expected that foraging opportunities for raptors would be impacted equally by Alternative 1 and 2, with slightly reduced impacts under Alternative 3.

4.6.2.3 Mammals

<u>Alternative 1 and 2</u>

Conversion of native vegetation into irrigated cropland is the same for Alternative 1 and 2 and would result in a loss of 9,300 acres of Wyoming big sagebrush habitat for mammals in the area. The area impacted by the conversion represents 0.62 percent of that habitat type available in the Bighorn Basin. This loss would not likely result in a significant impact to any mammalian populations in the basin. Larger, mobile mammalian species such as rabbits, foxes and coyotes would be displaced due to the conversion, however the habitat loss is not crucial to effected populations of mammals excluding big game species discussed in Section 4.6.2.1, thus displacement should not reduce their abundance. Small, burrowing mammals may be killed during the tilling process to convert the native vegetation into irrigated cropland. This may possibly alter the composition and relative abundance of small, burrowing mammals in the area. However, these species are typically abundant in established agricultural areas, thus impacts would be considered insignificant.

Alternative 3
Under Alternative 3, a loss of 8,280 acres of Wyoming big sagebrush habitat would be converted to cropland, which represents approximately 0.55 percent of available Wyoming big sagebrush habitat within the Bighorn Basin. The conversion would likely result in displacement for more mobile mammal species, while some small, burrowing mammals are likely to be killed. Similar to Alternatives 1 and 2 this may alter the composition and relative abundance of small, burrowing mammals in the area; however, these species are typically abundant in established agricultural areas, thus impacts would be considered insignificant.

4.6.2.4 Reptiles and Amphibians

Alternative 1 and 2
Tilling activities associated with crop production would cause a decrease in the number of reptiles and amphibians that occupy the area. However, the area impacted by the conversion represents only approximately 0.62 percent of Wyoming big sagebrush plant community available in the Bighorn Basin (refer to Section 4.6.1). In general, due to the limited availability of wetlands and habitat, few amphibians occur in the project area. Therefore, impacts to amphibians from conversion of the land from native plant communities to crops would be minimal.

Some species of reptiles (snakes and lizards) that can live in dry environments are expected to be more common in the project area. The conversion of land into irrigated cropland may cause a decrease in the number of these species that occupy the area; however, the change to irrigated cropland would be expected to increase the small rodent population over time which is used by a variety of snakes for prey. These types of impacts are difficult to quantify, however, it would be expected that the reptile and amphibian community of the site would change over time in terms of species composition and numbers and could potentially increase as a result of the land conversion.

Alternative 3
Potential impacts to reptiles and amphibians associated with Alternative 3 would be similar to Alternatives 1 and 2. The primary difference would be the reduction of acreage that is being converted to cropland; therefore Alternative 3 would have a reduced potential impact on reptiles and amphibians as described under Alternative 1 and 2.

4.6.3 Aquatic Resources

4.6.3.1 Fisheries

Alternatives 1 and 2
Water to be used for irrigation of the conveyed land would be from currently unappropriated water from the Bighorn River estimated at 18,600 acre-feet per year (see Section 4.3.1 and 4.3.4) with a maximum monthly depletion of approximately 5,000 acre-feet per month (83 cfs) during July. These depletions are not measurable losses as they will occur during the growing season when there are large fluctuations already occurring within the river. During dry years, the water flow in the Bighorn River is variable during the irrigation season (May through September) and is estimated to vary from 523 cfs to 977 cfs (see Section 4.3.1). Irrigation of the converted land would reduce these flows by approximately 25 cfs to 91 cfs (see Section 4.3.1), which falls well

within the existing range of variability of flows. The fish populations that occur in the Bighorn River exist within the already fluctuating water levels. The additional depletions due to the irrigation of the WID lands will not result in a measurable change in water volume in the river over existing conditions. It is not expected that fish in the Bighorn River would be impacted by a reduction in water volumes greater than the existing conditions.

Increased sediment loads and degradation of the Bighorn River are not expected to be significant (see Section 4.3.2). In summary, it was determined that there would be unnoticeable effects on sediment loads or water quality. Thus, it is anticipated that there would be no significant impact to the fish populations in the Bighorn River due to changes associated with the land conversion**.**

There is potential for individual fish, primarily young-of-the-year and downstream migrants, to be pulled into the water intake valves of the pumps that would be located in the Bighorn River. However, it is standard practice to equip intake valves associated with irrigation systems with screens to minimize the amount of debris and aquatic life that enters the system (V. Anderson, President SWWRC, pers. comm.).

Alternative 3

Alternative 3 would utilize an estimated 17,444 acre-feet per year (see Section 4.3.1 and 4.3.4) of unappropriated water from the Bighorn River with a maximum monthly depletion of approximately 4,400 acre-feet per month (74 cfs) during July. As with Alternatives 1 and 2, these depletions are not measurable losses as they will occur during the growing season when there are large fluctuations already occurring within the river. Irrigation of the converted land during dry years would reduce the flows by approximately 22 cfs to 81 cfs (see Section 4.3.1), which falls well within the existing range of variability of flows similar to Alternatives 1 and 2. Under Alternative 3, depletions during the irrigation season when water volume in the Bighorn River fluctuates would be less than Alternatives 1 and 2, thus the fish populations would likely not be impacted by the reduction in water volumes associated with Alternative 3.

As with Alternatives 1 and 2, increased sediment loads and degradation of the Bighorn River are not expected to be significant (see Section 4.3.2). In summary, there would be unnoticeable effects on sediment loads or water quality. Thus, it is anticipated that there would be no significant impact to the fish populations in the Bighorn River due to changes associated with the land conversion**.**

Potential direct impacts to fish being pulled into the water intake valves and pumps, would be minimized by equipping intake valves with irrigation system screens as described under Alternatives 1 and 2.

4.6.3.2 Invertebrate Community

As with fisheries, there will be no anticipated net change in the amount of water in the Bighorn River under any of the alternatives, thus no significant impacts to the aquatic invertebrate community are anticipated.

4.6.4 Wetlands

Alternatives 1, 2 and 3

The connected action of crop production would not likely impact the existing fringe wetlands along the Bighorn River. The amount of water that will be utilized to irrigate the acres identified in Alternative 1 and 2 would diminish the Bighorn River existing flow rate approximately 25 cfs to 91 cfs during the irrigation season, while Alternative 3 would reduce the existing flow rate approximately 22 cfs to 81 cfs during the irrigation season (see Table 4-1) (see Section 4.3.1). Additionally, it is not anticipated that any change in flooding out of the river bank would occur that might impact wetlands within the flood plain due to the activities associated with any of the alternatives.

All three alternatives would require the installation of two pumps at the Bighorn River. It is estimated that 5 acres at each location would be disturbed during the installation of the pumps. The areas that would be disturbed during construction of the pump stations would over time revert back to near present conditions. Permanent structures that will be constructed to install and operate the pumps, such as access roads, culverts and pump stations will result in a permanent loss to wetlands that occur within the 5 acres. Wetlands that do occur at these two locations are limited to narrow fringe wetlands along the river. Once installed, the operation of these pumps would not result in any continued disturbance to existing fringe wetlands.

Wetlands that have been identified within the project area were all within the boundaries of Alternative 1 (Table 4-5). No wetlands occurred within the Alternative 2 or Alternative 3 boundaries. Direct impacts to these wetlands would not occur as the wetlands are outside of the identified irrigable land. Indirect impacts to these wetlands would potentially result from changes in runoff patterns, contaminants in the runoff, and migration of chemicals utilized in crop production. However, chemicals and pesticides utilized in crop production are not expected to result in a significant impact to the return flow (see Section 4.3.2); therefore, it is not anticipated that these chemicals will impact the wetlands. Activities associated with the reclamation of high saline soils could potentially result in selenium accumulation in wetlands (see Section 4.2.2).

Table 4-5. Wetlands Affected within Alternative 1, Alternative 2, or Alternative 3 Boundaries.

Wetland Type	Wetland Number	Alternative 1 (acres)	Alternatives 2 and 3 (acres)
Palustrine forested	4b	0.85	0
Palustrine scrub-shrub	2	0.52	0
	3a	0.06	0
	3b	0.06	0
	3e	0.1	0
	5a	0.81	0
	5b	1.36	0
		Total = 2.91	Total = 0

Table 4-5. Wetlands Affected within Alternative 1, Alternative 2, or Alternative 3 Boundaries.

Wetland Type	Wetland Number	Alternative 1 (acres)	Alternatives 2 and 3 (acres)
Palustrine emergent	1	1.94	0
	3c	0.82	0
	3d	0.02	0
	3f	0.35	0
	4a	0.01	0
	6	0.67	0
		Total = 3.81	Total = 0

4.6.5 Special Status Species

4.6.5.1 USFWS Threatened, Endangered, and Sensitive Species

4.6.5.1.1 Black-Footed Ferret

Alternatives 1, 2 and 3

No impacts to black-footed ferret are expected because they are unlikely to occur in the area due to lack of habitat.

4.6.5.1.2 Ute Ladies'-Tresses

Alternatives 1, 2 and 3

No Ute ladies'-tresses were located in the project area and none of the wetlands found were considered suitable habitat for Ute ladies'-tresses (WEST 2005). Therefore, it is unlikely that any of the alternatives would result in impacts to Ute ladies'-tresses.

4.6.5.2 Migratory Birds

Alternatives 1, 2 and 3

Conversion of native vegetation into irrigated cropland would result in the loss of approximately 9,300 acres under Alternatives 1 and 2, and 8,280 acres under Alternative 3 of Wyoming big sagebrush habitat for birds in the area. The conversion from a sagebrush community to agriculture would eliminate potential nesting and perching sites that a shrub dominated plant community offers migratory birds. This loss of the sagebrush community represents a small portion of the available Wyoming big sagebrush plant community in the Bighorn Basin, approximately 0.62 percent for Alternatives 1 and 2, and 0.55 percent for Alternative 3, which would not likely result in a significant impact to the bird populations occurring in the area.

Studies have shown that mountain plovers will occupy agricultural fields for several months (Shackford and Leslie 1995, Young and Good 2000) during the nesting season and are presumed to be breeding. Thus, the conversion from Wyoming big sagebrush to cropland associated with any of the alternatives would not likely result in a negative impact to the mountain plover.

Nesting opportunities in the project area for golden eagles are limited to trees along the Bighorn River. The land conveyance and the subsequent conversion to cropland are not anticipated to result in the removal of existing trees along the river corridor. Therefore, potential nesting sites

for golden eagles will not be altered. Foraging opportunities for golden eagles are less clear and may increase or decrease depending on the type of agriculture practiced and its impact on the small mammal populations of the area.

There are no known winter concentrations of bald eagles in the vicinity of the proposed project area; however bald eagle sightings in the area all occurred during the winter. Crop production activities generally do not occur within winter months; therefore, the potential to displace foraging and roosting activities of the wintering populations is not likely to occur. Additionally there is suitable habitat throughout the Bighorn Basin and the bald eagle population has been increasing over the last 20 years. It is expected that bald eagles would continue to use the project area as wintering habitat and would likely increase in numbers over time.

4.6.5.3 BLM Sensitive Species

Alternatives 1, 2, and 3

The BLM sensitive species that have been documented in the project area or within the region consist mainly of bird species, plus long-eared myotis and white-tailed prairie dog. The conversion from Wyoming big sagebrush to irrigated cropland would result in the loss of potential nesting and perching sites for these species. This loss of the sagebrush community under Alternatives 1 and 2 represents approximately 0.62 percent of the available Wyoming big sagebrush plant community in the Bighorn Basin while Alternative 3 would result in approximately 0.55 percent loss, neither amount would likely result in a significant impact to the populations of these bird species. Ferruginous hawks occur in sagebrush vegetation types in the Bighorn Basin but nesting opportunities are limited and no nests were found in the project area. Foraging opportunities for ferruginous hawk may increase if the project results in an increase in the small mammal populations of the area. Sage grouse are not expected to occur in the project area and no impacts to sage grouse from the project are anticipated. Long-billed curlews may occupy nearby agricultural lands particularly during migration. Use of the project area may increase following the conversion from shrub community to crop land. Yellow-billed cuckoo could occupy habitat along the Bighorn River, but are not expected to be affected by the project. No sage grouse leks were documented within the land proposed for conveyance and the habitat on the site is not considered conducive to nesting due to poor ground cover and sagebrush density conditions. No impacts to sage grouse leks or nesting are expected from either alternative.

Two white-tailed prairie dog colonies occur within the project area (Map 3-13). One of the colonies within the project area occurs within the boundary of Alternative 2 and would be destroyed due to tilling and planting activities associated with the connected action. The remaining colony within the project area does not occur on or near the area that would be converted to cropland, therefore it is anticipated that it would not be affected by the proposed actions. Under Alternative 3, both the white-tailed prairie dog colonies are outside of the boundary for the alternative and would not be directly impacted. Long-eared myotis are believed to primarily occupy forest vegetation types and could potentially occur along the Bighorn River riparian corridor. It is not expected that they would be affected by the project.

One BLM sensitive plant species, persistent sepal yellowcress, has the potential to occur along the Bighorn River within the project area. If the plant occurs within the areas where construction

will occur for the installation of the pumps and associated infrastructure needs, then there is the potential for loss of individuals. Persistent sepal yellowcress that may occur between the two diversion points or downstream from the project area are not likely to experience any negative impact as the project is not anticipated to result in a measurable effect to the stream flow in the Bighorn River (see Section 4.3.1 and 4.6.3.1)

4.7 LAND USE

Alternatives 1, 2 and 3

The primary land uses of the project area are grazing, rights-of-way, and recreation administered through the BLM. Both alternatives would result in the conversion of public land into private ownership to be utilized for crop production, thus reducing the public use of the project area for grazing and recreation. Currently, there are 968,000 acres of public land in the GCRPA. The conversion of 16,050 (Alternative 1), 11,576 (Alternative 2), or 9,740 (Alternative 3) acres from public to private land would be approximately 2 percent, 1 percent, and 1 percent respectively, of the existing public land in the GCRPA. Although these percentages seem small, the local population would notice the reduced access to public land, primarily for hunting.

There are six grazing allotments that would be affected by the conversion of public land into private ownership. Four of the six allotments, Buchanan, West Fivemile, Sixmile, and Alamo Creek, are primarily contained within the alternatives, with the exception of Sixmile under Alternative 3. The conversion of native land to cropland would considerably reduce the viability of Buchanan West Fivemile and Sixmile under Alternatives 1 and 2 as a 70 to 100 percent reduction in AUMs would be expected (Table 4-6). Alternative 3 would have similar reductions for Buchanan and West Fivemile, however only an estimated 35 percent reduction would result for Sixmile. The viability of Alamo Creek under Alternative 1 would be greatly reduced; however Alternatives 2 and 3 would have a less of an impact on the viability of the allotment. Only portions of the remaining two allotments, East Fivemile and Tenmile, would be affected by any of the three alternatives (Table 4-6). These three grazing allotments could continue to be managed for grazing, but with a reduced stocking rate (AUM).

Table 4-6. Grazing Allotments Affected by Alternative 1, Alternative 2, and Alternative 3.

Allotment Name and Number	Total Public AUMs	Public AUMs Lost Alternative 1	Public AUMs Lost Alternative 2	Public AUMs Lost Alternative 3
Buchanan #00539	125	116	94	94
West Fivemile #00651	100	100	100	100
Six Mile #00528	134	116	94	48
Alamo Creek #00664	25	20	7	7
East Fivemile #00559	400	157	124	124
Tenmile #00671	1651	590	453	379
Total Allotment Reduction		**1099**	**872**	**752**

Any conveyance of land to the WID would be made so as to protect the valid existing rights of the holders of current authorizations. In the project area, this consists primarily of ROW. There is

one Recreation and Public Purposes lease in the area for a landfill, however it is inactive and the landfill was closed in 1988. There are also several oil and gas leases, some currently producing. Since the minerals would remain in Federal ownership, rights under the leases would not be affected and they would be managed post-conveyance under the BLM's procedures related to split-estate lands.

Existing ROW holders would be offered the following options at the time of any land conveyance:

- Maintain the ROW under the current terms and conditions, including expiration date. The patent would be issued "Subject To" the ROW, and the patentee would succeed to the interest of the United States.
- Negotiate an easement with the patentee that would become effective prior to the time of patent issuance.
- Submit an application to the BLM to amend the ROW to a term of perpetuity (30 years for Mineral Leasing Act (MLA) grants, and in perpetuity for Federal Land Policy and Management Act (FLPMA) grants.)
- Submit an application to the BLM to amend the ROW to a perpetual easement (30-year term for MLA grants, and in perpetuity for FLPMA grants.)

4.8 SOCIOECONOMICS

4.8.1 Population and Employment

Alternative 1

This alternative would have a modest positive impact on area employment and population. Construction of a water delivery system for the irrigable land would create some new jobs. Approximately 35 construction workers would be employed for a period of six months, and 15 of the 35 jobs would last another six months (V. Anderson, SWWRC, pers. comm.). However, these employment opportunities are unlikely to have any significant impacts upon area population. As shown in Table 3-13, there are over 800 workers in the local construction workforce, and the project would probably be built using local labor without the need to import workers or their families.

Irrigation of project lands would increase employment opportunities in several sectors of the local economy. A 1998 study by the University of Wyoming College of Agriculture estimated that the Westside Irrigation Project, as then envisioned, would support up to 216 additional local jobs (University of Wyoming 1998). That estimate was based on an assumption that the project would bring 17,000 acres of land under irrigation. Scaling that estimate to the 9,300 acre irrigable land base in Alternative 1 and 2, an estimated 118 new jobs in the local economy would be created.

Most of those new jobs would be available to area residents that are either unemployed or under employed and would have no significant impact upon long-term population trends in the area. For example, in 2004 there were 435 individuals on the unemployment rolls and seeking work in

the two-county area, and an unknown number of additional workers that are underemployed in their present jobs (State of Wyoming 2006b). Although unemployment rolls may shrink in the future as Wyoming's energy economy continues to grow, it is doubtful that new jobs in agriculture and related sectors would trigger significant immigration because of relative low wage rates. The primary population impact associated with this alternative is likely to be a slowing in the trend of population decreases that Worland has experienced in recent decades.

Alternative 2

The primary difference between Alternative 1 and Alternative 2 is that the latter would leave 4,474 acres of non-irrigable land in BLM grazing allotments and management for wildlife habitat rather than in WID ownership. This distinction between the alternatives would have no significant effect on local population or employment.

The conveyance of 11,576 acres to the WID would result in population and employment impacts that are very similar to those for the Proposed Action Alternative. The irrigation project would cover the same acreage, and the same number of construction workers would be required to build it. In the long run, about 118 new jobs would be created in the local economy as a result of increased crop production. The primary population impact associated with these new jobs would likely be a slowing in the trend of population decreases that Worland has experienced in recent decades.

Alternative 3

Alternative 3 would consist of approximately 8,280 irrigable acres as opposed to the 9,300 acres under Alternative 1 or 2, therefore it is anticipated that approximately 35 construction workers would be employed for a period of six months, and 15 of the 35 jobs would last another six months (V. Anderson, SWWRC, pers. comm.). Similar to Alternative 1 and 2, the existing work force would likely be able to meet the labor required without the need to import workers or their families. There would be no significant impact to the area population under this alternative.

Under Alternative 3, approximately 6,310 acres of non-irrigable land would remain in BLM grazing allotments and management for wildlife habitat rather than in WID ownership. The increased acreage left in BLM grazing allotments and management would have no significant effect on local population or employment.

Population and employment impacts resulting from the conveyance of only 9,740 acres to the WID would be very similar to those for the other alternatives. An estimated 105 new jobs in the local economy would be expected under Alternative 3, using the assumptions presented under Alternative 1 and scaling the estimate to the 8,280 acre irrigable land base. As discussed under Alternative 1, most of these new jobs would be available to area residents that are either unemployed or under employed and would have no significant impact upon long-term population trends in the area.

4.8.2 Income

Alternative 1
The 1998 University of Wyoming study estimated that the Westside Project, as then envisioned, would significantly increase local labor earnings. The project description at that time involved irrigating 17,000 acres. That additional agricultural activity would have put an estimated $4.9 million in earnings into the local economy each year. Alternative 1 would convey 16,050 acres to the WID, but only 9,300 have been proposed for irrigation. Scaling the University of Wyoming earnings estimate to the 9,300 irrigated acres in Alternative 1, and updating to current dollars, gives an estimated $3.23 million in annual earnings that would be generated by the project. These earnings reflect both direct employment in irrigated agriculture on project lands and indirect employment in other sectors of the local economy. Averaged between the projected 118 new jobs that would be created by the project, the earnings are equivalent of an average annual wage rate of about $27,400 (2004 dollars).

The annual earnings projected at $3.23 million generated by this project would be slightly lower than estimated because of the offsetting effects removing 16,050 acres of grazing land out of production. This effect is not expected to be significant, however, because the ability of the lands to produce forage under current conditions is limited by the arid climate and lack of irrigation water.

Alternative 2
Alternative 2 would result in income effects similar to Alternative 1. The primary difference between Alternative 1 and Alternative 2 is that the latter would leave 4,474 acres of non-irrigable land in BLM grazing allotments and management for wildlife habitat, rather than in WID ownership. This distinction between the alternatives would have no significant effect on local earnings.

Thus, approximately $3.23 million in earnings would be generated by the project annually, spread across 118 new jobs with an average annual wage of $27,400 (2004 dollars). As with Alternative 1, the annual earnings would be slightly lower than estimated above because of the offsetting effects of taking acreage out of grazing allotments. Alternative 2 would result in 4,474 acres remaining in grazing allotments rather than being converted to WID ownership, thus the offset to annual earnings would be slightly less for Alternative 2. The effect of grazing allotments offsetting the estimated annual earnings is not expected to be significant, however, because the ability of the lands to produce forage under current conditions is limited by the arid climate and lack of irrigation water.

Alternative 3
The primary difference between Alternative 2 and Alternative 3 is that the latter would leave 6,310 acres of land in BLM grazing allotments and management for wildlife habitat, rather than in WID ownership. Although more acreage would remain in grazing allotments and management by the BLM under Alternative 3, there would be no significant effect on local earnings.

Approximately $2.88 million in annual earnings would be generated under this alternative, spread across 105 new jobs with an annual wage of $27,400 (204 dollars). As with the other

alternatives, the annual earnings would be slightly lower than estimated because of the offsetting effects removing acreage from grazing allotments. Alternative 3 would result in 6,310 acres remaining in grazing allotments rather than being converted to WID ownership, thus the offset to annual earnings would be slightly less for Alternative 3.

4.8.3 Irrigated Agriculture

Alternative 1

Under this alternative, 16,050 acres of federal land would be conveyed to the WID with the goal of eventually developing 9,300 acres of irrigated cropland using water pumped from the Bighorn River and applied using low-pressure center pivot sprinklers. Development of this irrigated land would increase the 140,000 irrigated acre land base in the two-county area by almost seven percent. Although cropping patterns for the 9,300 acres of irrigable land have not been finalized, the project proponent has indicated that crops will likely include some combination of alfalfa, corn, barley, and sugar beets. Table 3-15 in Section 3.8.3 shows that with above average management, such a cropping rotation could generate gross returns of up to $646 per acre annually. Total gross returns of the irrigation of these 9,300 acres could approach $6.0 million annually, which represents an almost 10 percent increase in the annual value of all agricultural production in the two-county area.

The economic and financial viability of developing newly irrigated acreage using water pumped from the Bighorn River centers on whether irrigators would generate enough income after production expenses to repay costs associated with land acquisition, water delivery systems, and on-farm irrigation systems. Production expense estimates for the lands proposed for development were derived from crop enterprise budgets prepared by the University of Idaho for center pivot crop production in south central and southeastern Idaho (University of Idaho 2001a, University of Idaho 2001b). Cropping patterns, yields, and irrigation systems in these areas were deemed to be the most representative of conditions that might be expected in the project area (Table 4-7). Cropping percentage estimates are based upon University of Wyoming studies, while the production cost estimates are based upon the Idaho data (Table 4-6). University of Wyoming studies were not used for production cost estimates because they assume non-center pivot irrigation. The current production cost estimates are updated to 2004 dollars using production costs indices for Wyoming published by the Wyoming Agricultural Statistics Service (Wyoming Agricultural Statistics Service 2005).

Table 4-7. Center Pivot Production Cost Estimates.

Crop	Cropping Percentage[1]	Estimated Production Costs per Acre (2001)	Estimated Current Production Costs per Acre (2004)
Alfalfa	12.6	$ 278.38	$ 306.22
Corn for Grain	10.8	345.32	379.85
Corn Silage	10.8	429.52	472.47
Malting Barley	31.7	232.25	255.48
Sugar Beets	29.9	732.32	805.55
Total/Weighted Average	95.8%	$ 411.35	$ 452.48

[1]Percentages do not add to 100.0 because some lands are newly seeded to alfalfa each year and non-productive. Amortized production costs for these lands are included in the alfalfa production cost estimate.

The results in Table 4-7 show an estimated overall average production cost of $452 per acre. This figure does not include any expenses associated with land, water delivery, or irrigation system acquisitions. It does, however, include all other materials and equipment expenses, as well as labor and management charges for an owner-operator and any needed hired help. The $452 per acre production cost estimate is $194 per acre less than estimated gross returns of $646 per acre. This net return would be available to reduce project costs associated with land acquisition, water delivery and on-farm irrigation systems, as well as ongoing pumping costs.

The WID's intent is to develop the irrigated lands with financial assistance from the WWDC. According to current guidelines, the WWDC would not provide financial assistance for land acquisition or on-farm irrigation systems, but might provide up to a 67 percent grant for a water delivery system. The remaining 33 percent of this cost could be financed over 20 years at four percent interest. The financial implications of a WWDC funded project to irrigate the lands are summarized in Table 4-8.

Table 4-8. Alternative 1 Costs* and Returns.

Item (Per Acre)	Washakie County	Big Horn County
Irrigable Land Acquisition Cost **	$200	$200
Land Leveling and Irrigation System Cost	1,100	1,100
Water Delivery System Cost	1,256	1,464
Local Investment Per Acre	**2,556**	**2,764**
Annual WWDC Debt Service (20 yrs. @ 4%)	92	108
Annual Private Debt Service (20 yrs. @ 7%)	123	123
Annual Pumping Cost	71	60
Annual Cost Per Acre	**286**	**291**
Annual Return Per Acre	**194**	**194**
Net Return to Land and Water	**(92)**	**(97)**

*All cost estimates except land acquisition were developed by States West Water Resources (2006a and 2006b). Land acquisition cost estimate was provided by Roger Bower of the Wyoming Business Council.

** Cost of irrigable land includes repayment to the WID for purchasing 16,050 acres and the associated AUMs.

Estimates of the capital costs that irrigators would incur to farm WID land are given in the first four rows of Table 4-8. Raw land acquisition would cost about $200 per acre, and land preparation and sprinkler installation would add another $1,100 per acre to project costs. The land acquisition cost estimate is based upon the assumption that the 9,300 acres of irrigable land would be acquired at an average cost of $125 per acre, while the 6,750 acres of non-irrigable land would cost $100 per acre, for a total cost of $1.8 million. In order for the WID to recover the cost of purchasing the non-irrigable land, the total cost of the 16,050 acres would be spread across the 9,300 acres of irrigable land when sold to irrigators. This would result in an average cost of $200 per irrigable acre for irrigators.

Total water delivery system costs are $3,805 per acre for the Washakie County part of the system, and $4,435 per acre for the Big Horn County portion of the system. The water delivery system cost estimates in Table 4-8 assume a 67 percent WWDC grant, leaving 33 percent of the cost to be borne locally. Total local investment requirements for irrigators would range from $2,556 per acre for the Big Horn County portion of the project to $2,764 per acre for the Washakie County portion.

Assuming that water delivery system costs would be financed by the WWDC over 20 years at four percent interest, and land and irrigation system costs would be financed at market rates, the resulting annual costs range $286 to $291 per acre, which exceeds the estimated annual return of $194 per acre. These results indicate that the financial viability of the project is dependent upon either obtaining more favorable funding terms than are currently available from the WWDC or private sources, or possibly diversifying into higher valued specialty crops that could support the capital and operating costs of the project.

The WID has considered applying for Pick-Sloan electric power that is supplied by the Bureau of Reclamation at less than market rates. An assessment of the financial ramifications of Pick-Sloan power reduces the negative return on a per acre bases by approximately 30-35 percent (Table 4-9). Although acquisition of Pick-Sloan power would improve project finances, financial viability would still require more favorable funding terms or alternative crops.

Table 4-9. Alternative 1 Costs and Returns with Pick-Sloan Power.

Item (Per Acre)	Washakie County	Big Horn County
Irrigable Land Acquisition Cost	$200	$200
Land Leveling and Irrigation System Cost	1,100	1,100
Water Delivery System Cost	1,256	1,464
Local Investment Per Acre	**2,556**	**2,764**
Annual WWDC Debt Service (20 yrs. @ 4%)	92	108
Annual Private Debt Service (20 yrs. @ 7%)	123	123
Annual Pumping Cost	40	30
Annual Cost Per Acre	**255**	**261**
Annual Return Per Acre	**194**	**194**
Net Return to Land and Water	**(61)**	**(67)**

Alternative 2

The irrigation impacts of conveying 11,576 acres of primarily irrigable land to the WID would be very similar to those for Alternative 1 because the amount of irrigated acreage would be the same for both alternatives. One difference is that with Alternative 2 the WID's financial commitment for non-irrigable land acquisition would be smaller (2,276 acres). Assuming an average price of $100 per acre for non-irrigable land and $125 for irrigable land (9,300 acres), the WID's financial commitment for land acquisition would be $1.4 million under this alternative. The WID would spread the total cost for land acquisition across the 9,300 acres resulting in an average acre price of $150 for irrigable land.

The lower land costs associated with this alternative translate into an average annual savings of about $5 per acre when amortized over 20 years at 7 percent interest Table 4-10). Additionally, an assessment of the financial ramifications of Pick-Sloan power reduces the negative return on a per acre bases by approximately 33-35 percent (Table 4-11). Although Alternative 2 would improve project finances relative to Alternative 1, financial viability would still require more favorable funding terms or alternative crops.

Table 4-10. Alternative 2 Costs* and Returns.

Item (Per Acre)	Washakie County	Big Horn County
Irrigable Land Acquisition Cost**	$150	$150
Land Leveling and Irrigation System Cost	1,100	1,100
Water Delivery System Cost	1,256	1,464
Local Investment Per Acre	**2,506**	**2,714**
Annual WWDC Debt Service (20 yrs. @ 4%)	92	108
Annual Private Debt Service (20 yrs. @ 7%)	118	118
Annual Pumping Cost	71	60
Annual Cost Per Acre	**281**	**286**
Annual Return Per Acre	**194**	**194**
Net Return to Land and Water	**(87)**	**(92)**

*All cost estimates except land acquisition were developed by States West Water Resources (2006a and 2006b). Land acquisition cost estimate was provided by Roger Bower of the Wyoming Business Council.

** Cost of irrigable land includes repayment to the WID for purchasing 11,576 acres and the associated AUMs.

Table 4-11. Alternative 2 Costs and Returns with Pick-Sloan Power.

Item (Per Acre)	Washakie County	Big Horn County
Irrigable Land Acquisition Cost	$150	$150
Land Leveling and Irrigation System Cost	1,100	1,100
Water Delivery System Cost	1,256	1,464
Local Investment Per Acre	**2,506**	**2,714**
Annual WWDC Debt Service (20 yrs. @ 4%)	92	108
Annual Private Debt Service (20 yrs. @ 7%)	118	118
Annual Pumping Cost	40	30

Table 4-11. Alternative 2 Costs and Returns with Pick-Sloan Power.

Item (Per Acre)	Washakie County	Big Horn County
Annual Cost Per Acre	**250**	**256**
Annual Return Per Acre	**194**	**194**
Net Return to Land and Water	**(56)**	**(62)**

Alternative 3

Under Alternative 3, the amount of irrigated acreage would be reduced from that of Alternative 1 or 2, thus development of this irrigated land would increase the 140,000 irrigated acre land base in the two-county area by only approximately six percent. As described for Alternative 1, the cropping patterns for the 8,280 acres of irrigable land have not been finalized, the project proponent has indicated that crops will likely include some combination of alfalfa, corn, barley, and sugar beets. Table 3-15 in Section 3.8.3 illustrates that with above average management, such a cropping rotation could generate gross returns of up to $646 per acre annually. Total gross returns of the irrigation of these 8,280 acres could approach $5.3 million annually, which represents an almost 9 percent increase in the annual value of all agricultural production in the two-county area.

As with Alternative 2 the WID's financial commitment for non-irrigable land acquisition would be smaller (1,460 acres). Assuming an average price of $100 per acre for non-irrigable land and $125 for irrigable land (8,280 acres), the WID's financial commitment for land acquisition would be approximately $1.2 million under this alternative. The WID would spread the total cost for land acquisition across the 8,280 acres resulting in an average acre price of $143 for irrigable land.

The lower land costs associated with this alternative translate into an average annual savings of about $8 per acre when amortized over 20 years at 7 percent interest compared to Alternative 1 and only $1 per acre when compared to Alternative 2 (Table 4-8, Table 4-10, and Table 4-12). Similar to Alternative 2, the assessment of the financial ramifications of Pick-Sloan power reduces the negative return on a per acre bases by approximately 33-36 percent (Table 4-13). Although Alternative 3 would improve project finances relative to Alternative 1 and 2, financial viability would still require more favorable funding terms or alternative crops.

Table 4-12. Alternative 3 Costs* and Returns.

Item (Per Acre)	Washakie County	Big Horn County
Irrigable Land Acquisition Cost**	$143	$143
Land Leveling and Irrigation System Cost	1,100	1,100
Water Delivery System Cost***	1,256	1,464
Local Investment Per Acre	**2,499**	**2,707**
Annual WWDC Debt Service (20 yrs. @ 4%)	92	108
Annual Private Debt Service (20 yrs. @ 7%)	117	117
Annual Pumping Cost	71	60

Annual Cost Per Acre	**280**	**285**
Annual Return Per Acre	**194**	**194**
Net Return to Land and Water	**(86)**	**(91)**

*All cost estimates except land acquisition were developed by States West Water Resources (2006a and 2006b). Land acquisition cost estimate was provided by Roger Bower of the Wyoming Business Council.
** Cost of irrigable land includes repayment to the WID for purchasing 9,740 acres and the associated AUMs.
***Water delivery system costs were assumed to be the same as for 9,300 acres

Table 4-13. Alternative 2 Costs and Returns with Pick-Sloan Power.

Item (Per Acre)	Washakie County	Big Horn County
Irrigable Land Acquisition Cost	$143	$143
Land Leveling and Irrigation System Cost	1,100	1,100
Water Delivery System Cost	1,256	1,464
Local Investment Per Acre	**2,499**	**2,707**
Annual WWDC Debt Service (20 yrs. @ 4%)	92	108
Annual Private Debt Service (20 yrs. @ 7%)	117	117
Annual Pumping Cost	40	30
Annual Cost Per Acre	**249**	**255**
Annual Return Per Acre	**194**	**194**
Net Return to Land and Water	**(55)**	**(61)**

4.8.4 Local Infrastructure

4.8.4.1 Housing

Alternative 1 and 2

No significant impact upon local housing prices or availability is expected to result from Alternative 1 or 2. Most of the relatively small peak construction workforce of 35 persons for the water delivery system would be hired locally and not require housing. A few non-local workers could be accommodated in local motels or apartments.

Full irrigation development would eventually create 125 new jobs, but most of these jobs would be available to currently unemployed or underemployed residents and would not significantly affect area population or housing demand. The project would inject $3.43 million in new annual earnings into the area, which could have some upward pressure on housing prices. Housing prices are currently below statewide averages, however, and any such pressures would not be significant.

Alternative 3

Similar to Alternatives 1 and 2 no significant impact upon local housing prices or availability is expected to result from Alternative 3. Under Alternative 3, only 105 new full irrigation jobs would eventually be created, and these jobs would be available to currently unemployed or underemployed residents. The injection of approximately $2.88 million in new annual earnings into the area would possibly have some upward pressure on housing prices, however as presented for Alternative 1 and 2 prices are currently below statewide averages and such pressure would not be significant.

4.8.4.2 Transportation

Alternative 1

Construction of a water delivery system for the project would result in a minor temporary traffic increase near the project site. At peak, 35 construction workers would be commuting from nearby communities and rural areas, and there would be some truck traffic hauling construction materials and equipment to and from the site. Most of this activity would be along State Highway 433, which is lightly traveled and the increased activity should pose no significant safety problems.

Long-term transportation impacts include the need for access roads to farmhouses and the irrigable land, along with some local highway traffic increases associated with increased farming activity. Access roads could vary from primitive four-wheel drive paths to irrigated fields to graded all-season roads to farmhouses. Assuming two miles of access road would be needed for each 640-parcel means that approximately 30 miles of new rural roads would need to be constructed. Primitive access paths could be developed with little expense, while all season road construction would cost an estimated $50,000 per mile (SWWRC, pers. comm.). Assuming that 30 miles of new roads would be needed means that an additional $1.5 million in expenses for road construction could be incurred under this alternative.

Alternative 2

Alternative 2 would also result in a minor temporary traffic increase near the project site. At peak, 35 construction workers would be commuting from nearby communities and rural areas, and there would be some truck traffic hauling construction materials and equipment to and from the site. Most of this activity would be along State Highway 433, which is lightly traveled and the increased activity should pose no significant safely problems.

Long-term transportation impacts for this alternative would be similar to those for Alternative 1, although almost 5,000 fewer acres would be conveyed to private ownership. The reduction in acres would be land that is non-irrigable, thus access roads would not be needed, and therefore Alternative 1 and 2 would require the same amount of access roads.

Alternative 3

Alternative 3 would also result in a minor temporary traffic increase near the project site. Similar to the other Alternatives at peak, 35 construction workers would be commuting from nearby communities and rural areas, and there would be some truck traffic hauling construction materials and equipment to and from the site. Most of this activity would be along State Highway 433, which is lightly traveled and the increased activity should pose no significant safely problems.

Long-term transportation impacts for this alternative would be similar to those for Alternative 1 and 2. However, under Alternative 3 the need for access roads would be reduced as most of the acres eliminated to create Alternative 3 are considered irrigable and would have required access roads.

4.8.4.3 Local Public Services

Alternative 1, 2 and 3

No significant impacts upon local public services would be expected to result from the construction or operation of any of the considered alternatives. Worland's population has been declining for some time, leaving excess capacity in most public services. Furthermore, the area has not experienced impacts from the recent energy boom that have affected other parts of the state. While most project jobs would be filled locally, there is enough excess capacity in most public services to handle a small influx of workers if needed (Baker 2006). One exception may be electric power. Additional facilities may be needed to supply electric power for pumping water to project lands. There should be adequate lead-time to address this need, however, given the lengthy permitting process involved in developing newly irrigated lands.

4.8.5 Public Revenues

Alternative 1

Alternative 1 would have a short-term positive impact on sales and use tax revenues. The water delivery system for this alternative is estimated to cost $38.2 million dollars (States West 2006a). Of this amount, about 35 percent, or $13.4 million would be spent for materials and equipment subject to sales and use taxes. The on-farm irrigation systems for the 9,300 acres of irrigable land would cost another $10.2 million, of which about 55 percent, or $5.6 million, would be subject to sales and use taxes. Sales and use tax rates are currently five percent in Big Horn and Washakie Counties. The $19 million in materials and equipment for the project would thus generate about $950,000 in additional sales and use tax revenue during project construction. The total additional revenue would be even higher because some unknown portion of construction worker payroll would also be spent on taxable items. This additional revenue would be shared among governmental entities based upon formulas established by the State of Wyoming.

Alternative 1 would have a long-term positive impact on sales and use taxes in the area due to increased purchases of equipment, materials, and supplies for farming an additional 9,300 acres of land. Purchased materials alone, such as fertilizer, pesticides, and seed, can range from $25 per acre for alfalfa to over $200 per acre for sugar beets. Assuming an average expenditure of $75 per acre on taxable items means that sales tax revenues would increase by about $35,000 annually. Some of the additional money spent for farm labor would also be captured in the form of sales and use taxes.

Another long-term positive impact due to Alternative 1 would be an increase in property tax revenues. In fiscal year 2003, there were 158,900 acres of irrigated land on local tax roles in the area with an assessed valuation of $13.5 million. Assuming an average valuation for 9,300 acres of irrigable land in this alternative means that total irrigated land valuations would increase to $14.3 million. Although 6,700 acres of rangeland would also be added to property tax roles with this alternative, the revenue impacts of this addition would not be significant. The average assessed valuation of rangeland in the area is less than $5 per acre (State of Wyoming 2003).

Conveying 16,050 acres of BLM land to private ownership would have a minor negative impact upon grazing lease revenues received by the BLM as a direct loss from the AUM's being retired. It would also negatively affect Payments In Lieu of Taxes (PILT) for federal land that the federal

government makes to state and local governments. Estimates developed by the BLM indicate that foregone grazing lease revenues would average roughly $3,200 annually, while PILT payments would be reduced by about $9,000 annually (D. Ogaard, BLM, pers. comm.).

Alternative 2

Alternative 2 would have almost the same public revenue impacts as Alternative 1. That is, the $19 million in materials and equipment for the project would generate about $950,000 in additional sales and use tax revenue during project construction. The total additional revenue would be even higher because some unknown portion of construction worker payroll would also be spent on taxable items. This additional revenue would be shared among governmental entities based upon formulas established by the State of Wyoming.

Alternative 2 would also have a long-term positive impact on sales and use taxes in the area due to increased purchases of equipment, materials, and supplies for farming an additional 9,300 acres of land. Purchased materials alone, such as fertilizer, pesticides, and seed, can range from $25 per acre for alfalfa to over $200 per acre for sugar beets. Assuming an average expenditure of $75 per acre on taxable items means that sales tax revenues would increase by about $35,000 annually. Some of the additional money spent for farm labor would also be captured in the form of sales and use taxes.

The assessed valuation of irrigated land in the area would increase from about $13.5 to $14.3 million, and the assessed valuation of rangeland would remain largely unchanged because there would be no conveyance of rangeland ownership under this alternative.

Conveying 11,576 acres of BLM land to private ownership would have a minor negative impact upon grazing lease revenues received by the BLM as a direct loss from the AUM's being retired. It would also negatively affect PILT for federal land that the federal government makes to state and local governments. Estimates developed by the BLM indicate that foregone grazing lease revenues would average roughly $2,300 annually, while PILT payments would be reduced by about $6,300 annually (D. Ogaard, BLM, pers. comm.).

Alternative 3

Alternative 3 would have similar public revenue impacts as Alternative 1 and 2 in relation to the water delivery system as it was assumed the system would be similar to that presented in Alternative 1 and 2. Therefore under Alternative 3 approximately $13.4 million would be spent for materials and equipment subject to sales and use taxes. The on-farm irrigation systems for the 8,280 acres of irrigable land would be slightly lower than Alternative 1 or 2 with a cost of approximately $9.0 million, of which about 55 percent, or $5.0 million, would be subject to sales and use taxes. Sales and use tax rates are currently five percent in Big Horn and Washakie Counties. The $18 million in materials and equipment for the project would thus generate about $900,000 in additional sales and use tax revenue during project construction. As with Alternative 1 and 2, the total additional revenue would be even higher because some unknown portion of construction worker payroll would also be spent on taxable items. This additional revenue would be shared among governmental entities based upon formulas established by the State of Wyoming.

Although slightly less than alternatives 1 and 2, Alternative 3 would also have a long-term positive impact on sales and use taxes in the area due to increased purchases of equipment, materials, and supplies for farming an additional 8,280 acres of land. As presented under Alternative 2, assuming an average expenditure of $75 per acre on taxable items means that sales tax revenues would increase by about $31,050 annually. Some of the additional money spent for farm labor would also be captured in the form of sales and use taxes.

The assessed valuation of irrigated land in the area would increase from about $13.5 to $14.2 million, and the assessed valuation of rangeland would remain largely unchanged because there would be limited conveyance of rangeland ownership under this alternative.

Conveying 9,740 acres of BLM land to private ownership would have a minor negative impact upon grazing lease revenues received by the BLM as a direct loss from the AUM's being retired. It would also negatively affect PILT for federal land that the federal government makes to state and local governments. Estimates developed by the BLM indicate that foregone grazing lease revenues would average roughly $1,940 annually, while PILT payments would be reduced by about $10,421 annually (A. Tkach, BLM, pers. comm.).

4.9 CULTURAL AND PALEONTOLOGICAL RESOURCES

4.9.1 Cultural Resources

Alternative 1, 2 and 3
Cultural resources have not been addressed under any of the alternatives for the effects of the water diversions and transport routes of water or power to the areas to be conveyed. Under all alternatives the conveyance of ownership from public to private represents an irretrievable resource commitment. Once the land is conveyed, the significant cultural resources will not be afforded any protection by the federal government. In order to mitigate this adverse effect, a data recovery plan will be designed and implemented to mitigate the impact caused by the land conveyance. All three alternatives will be required to address effects on historic properties through adherence to the BLM and State Historical Preservation Office Programmatic Agreement (PA).

Alternative 1
Alternative 1 would result in a total of 437 cultural resources being conveyed by the land conveyance, of which 44 are eligible for the NRHP. The sites potentially impacted include five sites the Northern Arapaho tribe consider important and need to be protected along with the Big Horn Canal. A total of 26.5 percent of the acreage associated with Alternative 1 falls within the high or very high sensitivity zone.

Alternative 2
Alternative 2 would convey a total of 305 cultural sites as a result of the connected actions associated with the land conveyance, of which 22 are eligible for the NRHP. These sites include three sites the Northern Arapaho tribe consider important and need to be protected along with the Big Horn Canal. The locations of these sites are within the area to be converted to croplands,

thus the sites would be destroyed due to the tilling and equipment operation. A total of 23.7 percent of the acreage associated with Alternative 2 falls within the high or very high sensitivity zone.

Alternative 3
Alternative 3 would convey a total of 206 cultural sites as a result of the connected actions associated with the land conveyance. These sites include two sites that are eligible for the NRHP. All of the sites the Northern Arapaho tribe consider important are excluded from this alternative. A total of 22.6 percent of the acreage associated with Alternative 3 falls within the high or very high sensitivity zone.

4.9.2 Paleontological Resources

Alternative 1, 2 and 3
Under all alternatives the conveyance of ownership from public to private represents an irretrievable resource commitment. Once the land is conveyed, paleontological resources will not be afforded protection by the federal government. Additionally, there would be a loss of paleontological research opportunities in areas that are converted into cropland. From a paleontological standpoint the most important geologic formation in the area is the Willwood Formation. Because of the Pleistocene overburden that covers much of the area, the Willwood Formation is not visible at the surface over much of the conveyance area. An inventory of paleontological resources, would be performed under all alternates prior to land conveyance.

Alternative 1
Alternative 1 proposes to convey approximately 9,735 acres of Willwood Formation surface exposure. The land that is converted to cropland would directly impact this resource through farming practices. Those areas not converted and not involved with infrastructure development may be affected in regards to the fossil record found in the Willwood Formation by unauthorized collecting or physical damage due to unregulated activities.

Alternative 2
Alternative 2 proposes to convey approximately 6,105 acres of Willwood Formation surface exposure. The entire 6,105 acres potentially would be directly impacted by their conversion to cropland through tilling, planting and harvesting.

Alternative 3
Under Alternative 3, a reduced amount of total acres would be conveyed consisting of only 8,280 acres that would be irrigable. Of the conveyed acres, approximately 5,128 acres of Willwood Formation surface exposure would be included. The entire 5,128 acres would potentially be directly impacted by the conversion to cropland through tilling, planting and harvesting.

4.10 RECREATIONAL RESOURCES

4.10.1 Non-Consumptive Use

Two critical recreation resource values associated with this area; remoteness and scenery, would be altered due to any of the three alternatives. Currently, users of the area experience less than five human encounters per day. The number of human encounters will likely increase due to the increase of farming activity in the area. The current natural state is influenced by the existing oil field and nearby agriculture. The conversion to more agricultural fields associated with Alternative 1, 2 or 3 in the area will further reduce the natural state and alter the viewing of natural state scenery. The degree of impact will be the same for Alternatives 1 or 2 as the amount of irrigable land does not differ, however under Alternative 3 approximately 1,000 more acres would remain in the natural state and not be converted to cropland. Under any of the three alternatives, users pursuing an area that is remote and unaffected will lose this area as a possible option.

4.10.2 Fishing

No significant impacts to the fish population in the Bighorn River are anticipated and therefore, it is anticipated that none of the alternatives would alter the current recreational fishing that occurs along the Bighorn River.

Access to the Bighorn River would not be altered by this project. The only activity associated with the project that will occur adjacent to the Bighorn River is the creation of two diversion points. It is estimated that the area required for constructing the pumps and necessary facilities will be five acres for each diversion location. Therefore, the project will only affect an estimated ten acres along the Bighorn River in relation to public access for fishing and hunting.

4.10.3 Hunting

The current local pronghorn antelope and mule deer herd sizes would potentially be reduced over time due to the loss of crucial winter/yearlong range as a result of the connected actions associated with the conveyance of land. The hunting area for pronghorn antelope and mule deer that includes the project area consists of 720,000 and 620,000 acres, respectively, and provides seasonal range for pronghorn antelope, mule deer and white tailed deer according to information from the WGFD. The amount of animals that are actually harvested off the project area is unknown, but is considered very small. Therefore, based on the size of the hunt area and the number of animals that utilize that area, it is anticipated that the land conveyance and conversion to cropland would not have a significant impact on big game hunting activities around the project area.

The land conveyance and connected actions will likely result in an increase in upland game bird-hunting opportunities as species such as ring-necked pheasant and Hungarian partridge invade the new croplands. The availability of this opportunity to the general public will be based largely on the willingness of the policies of the WID and the new landowners to accommodate hunting.

4.11 VISUAL/AESTHETICS

Alternative 1 and 2
There would be a visual difference on the landscape as a result of Alternative 1 and 2 due to the conversion of native vegetation to cropland. The change would result in an extension of the already existing cropland along the Bighorn River corridor, which borders the land proposed for conveyance on the east. Therefore, the visual change would not be a drastic change or considered obtrusive or out of the ordinary, thus it is anticipated that there would be no significant impact as a result of the conversion to cropland.

Alternative 3
Under alternative 3, approximately 1,000 acres would not be converted to cropland compared to Alternatives 1 and 2. The visual change to the area from the conversion to cropland would be lessened by the reduced acreage, but as described for Alternative 1 and 2 the potential visual change is not anticipated to result in a significant impact.

4.12 HAZARDOUS MATERIAL

Alternative 1, 2 and 3
The conversion from native vegetation to irrigated cropland would result in an increase in use of hazardous materials associated with crop production. These materials include pesticides, herbicides, fuels, lubricants, coolants, and miscellaneous hazardous materials such as solvents and paints. The increased use of these materials presents a potential for spills or misuse to create localized hazardous conditions.

4.13 ADVERSE EFFECTS WHICH CANNOT BE AVOIDED

Implementation of the land conveyance and the connected action of converting the native vegetation to cropland would result in some unavoidable adverse effects. Implementation of mitigation measures would be unsuccessful in minimizing these effects.

The land that would be conveyed would be removed from Federal ownership and eventually sold to private individuals.

Crop production would result in microclimate and nutrient cycling changes in the vicinity of the agricultural fields.

The cultivation of previously untilled soils would result in changes in the soil carbon inventories.

The land that would be converted into cropland would be graded and leveled from the current topography.

Air quality of the region is considered good, but tilling activities would have minor and temporary effect on air quality.

Noise levels would be increased due to the additional use of farm equipment and vehicle traffic in the area.

All alternatives would convert native vegetation into irrigated cropland. This would result in permanent loss of 9,300 acres of Wyoming big sagebrush.

Trenching along roads for the irrigation pipeline would result in a disturbed area that is likely to revegetate with invasive plant species.

The conversion would result in a change in the appearance of the landscape by increasing the amount of cropland present adjacent to the Bighorn River corridor.

Pronghorn antelope and mule deer would lose 3.5 percent and 1.6 percent, respectively, of available crucial winter/yearlong habitat due to the conversion of native vegetation into irrigated cropland.

Wildlife would lose the Wyoming big sagebrush community and associated values such as perching and cover sites, nesting sites, and foraging opportunities.

Some small mammals, reptiles, and passerines will be destroyed due to tilling and farming practices.

Wetlands within the project area would be indirectly impacted by the alteration of the surface runoff and potential contaminants.

A white-tailed prairie dog colony could potentially be destroyed due to tilling of the soil.

Loss of BLM land would result in the loss of grazing rights for six grazing allotments equaling potentially 1099 AUMs.

Cultural sites have been identified that would be lost to the public and/or adversely impacted by the connected action.

A loss to the public of paleontological resources would occur, either due to the loss of research opportunities or conveyance to private ownership.

The project will displace recreational users currently using this area for a remote and solitudinous experience.

4.14 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

A permanent loss or reduction of a resource, for at least the foreseeable future, is considered an irreversible and irretrievable commitment of resources. This project would result in the loss of public land. This loss of public land would result in the loss of six grazing allotments

administered by the BLM. Additionally, cultural resource sites and paleontological resources would lose their current protection from unauthorized collecting. The connected actions would result in the conversion of native vegetation to cropland. The conversion would result in the loss of Wyoming big sagebrush plant community and the associated habitats for wildlife species, specifically crucial winter range for pronghorn antelope and mule deer. The irrigated fields would alter the recreation value of the area and displace those users using the area for its primitive scenic settings for the feeling of remoteness and solitude. The conversion to cropland would also result in the destruction of cultural resource sites and paleontological resources within the irrigable land.