4.0 ENVIRONMENTAL IMPACTS

4.1 INTRODUCTION

This chapter of the EA provides an analysis of the impacts or environmental consequences that would result from implementation of Alternative A – No Action Alternative or Alternative B – Proposed Action. An environmental impact or consequence is defined as a modification or change in the existing environment brought about by the action taken.

4.2 DIRECT/INDIRECT IMPACTS

Impacts related to the Alternatives can be direct or indirect in nature and can be initial or residual. For the purpose of this EA, initial impacts are defined as those that would occur during the construction of well pads, roads, and pipelines, and during the drilling and completion of the proposed natural gas wells. Residual impacts are those impacts that remain during the operation of the well field and would last for the LOP or longer. Impact discussions focus on initial impacts. While analyses of the development of wells on State and Tribal leases are included for each Alternative, the BLM only approves the development of Tribal leases following authorization of the BIA during the APD process and does not have the authority to approve development on State leases. Despite this, these analyses were included to further inform the BLM AO on the overall extent of project impacts.

4.2.1 AIR QUALITY

4.2.1.1 Alternative A – No Action Alternative

Impacts to air quality under the No Action Alternative would be similar in nature to those described below under the Proposed Action. Under this alternative, XTO would continue to develop the necessary infrastructure in order to drill 128 wells previously approved under EA No. 1997-49. Although the number of new well pads and roads under this alternative would be similar to the Proposed Action, the number of proposed wells would be approximately 74% less. **Table 4-1** and **4-2** summarize the annual emissions associated with various phases of the RBU Infill No Action Alternative.

Table 4-1. Annual Emissions for Various Phases of the RBU Infill No Action Alternative

Pollutant	Construction Emissions (tons/year) [a]					Total (tons/yr)
	Construction	Drilling	Completion	Interim Reclamation	Wind Erosion	
NO_X	1.02	68	7.3	0.14	0.00	77
CO	0.93	23	4.4	0.65	0.00	29
VOC	0.11	3.2	44	0.09	0.00	48
SO_2	0.03	1.2	0.10	1.10E-03	0.00	1.4
PM_{10}	6.3	108	45	1.22	0.11	166
$PM_{2.5}$	0.79	11.9	4.6	0.12	0.04	18
Benzene	0.00	0.01	0.21	0.00	0.00	0.2
Toluene	0.00	1.97E-03	0.21	0.00	0.00	0.2
Ethylbenzene	0.00	0.0	0.01	0.00	0.00	6.7E-03
Xylene	0.00	1.35E-03	0.06	0.00	0.00	0.1
n-Hexane	0.00	0.0	1.07	0.00	0.00	1.1

Pollutant	Construction Emissions (tons/year) [a]					Total (tons/yr)
	Construction	Drilling	Completion	Interim Reclamation	Wind Erosion	
Formaldehyde	0.02	5.54E-04	5.37E-05	0.00	0.00	2.2E-02
Acrolein	0.00	5.53E-05	5.34E-06	0.00	0.00	6.1E-05
1,3-Butadiene	0.00	0.0	4.35E-08	0.00	0.00	4.4E-08

[a] Assumes average development scenario (16 wells per year for 8-years)

Table 4-2. Total Annual Production Emissions from the No Action Alternative

Pollutant	Tons/Year					Total (tons/year)
	Pump Unit Engines	Production Heaters	Condensate Tanks	TEG Dehydrators	Operations Vehicle	
NO_X	96	70	0.0	0.0	0.3	167
CO	21	59	0.0	0.0	2.8	82
VOC	1.5	0.86	880	892	0.2	2,360
SO_2	0.0	0.0	0.0	0.0	1.8E-02	2.E-02
PM_{10}	2.8	5.3	0.0	0.0	175	183
$PM_{2.5}$	2.8	5.3	0.0	0.0	17.5	26
Benzene	0.22	1.48E-03	5.0	111	0.0	119
Toluene	0.08	2.39E-03	5.8	184	0.0	194
Ethylbenzene	3.48E-03	0.0	0.0	9.36	0.0	9.4
Xylene	0.03	0.0	3.5	113	0.0	119
n-Hexane	0.00	1.27	13.8	15.8	0.0	40
Formaldehyde	2.82	0.05	0.0	0.0	0.0	3
Acrolein	0.4	0.0	0.0	0.0	0.0	0.4
1,3-Butadiene	0.1	0.0	0.0	0.0	0.0	0.1

[a] Assumes maximum development scenario 128 producing wells

Because air quality impacts for the Proposed Action for criteria pollutants are demonstrated to be below significance levels, it follows that impacts under the No Action Alternative would also be below significance levels. Based on wells modeled for the Proposed Action with little influence from the compressor stations; emissions of acrolein from the No Action Alternative are expected to exceed the California EPA reference exposure level for no adverse effects for acute effects and the EPA chronic non-cancer effect reference concentration. Estimated impacts are shown in Table 4-3. More information on the health effects of acrolein is available in the discussion of the Proposed Action. It should be noted that under the No Action Alternative, impact analyses would be conducted for each well prior to development on a site specific basis during the APD process.

Table 4-3. No Action Non-Carcinogenic Acute REL and Chronic RfC Impacts

HAP	REL [a] ($\mu g/m^3$)	Predicted Maximum One-Hour Impact	Percent of REL	RfC [b] ($\mu g/m^3$)	Predicted Maximum Annual Impact ($\mu g/m^3$)	Percent of RfC
Acrolein	0.19	0.7	368%	0.02	0.03	150%

[a] California EPA Reference Exposure Level (REL) for no adverse effects EPA Air Toxics Database, Table 2 (EPA 2007)
[b] EPA Air Toxics Database, Table 1 (EPA 2007)

4.2.1.2 Alternative B - Proposed Action

Pollutant emissions have the potential to affect air quality on both a local and a regional scale. Emission inventories for the criteria pollutants [nitrogen oxides (NO_x), CO, SO_2, particulates (PM_{10} and $PM_{2.5}$)] and HAPs were developed for construction and operational-related activities. Pollutant dispersion modeling was performed to assess the potential air quality impacts from the Proposed Action with respect to various significance criteria. The modeling assessment of the Proposed Action consists of evaluating air quality impacts on sub-grid and full-field scales with the Industrial Source Complex (ISC) dispersion model. The sub-grid analysis modeled air quality impacts from short-term activities such as well pad and road construction activities that would be geographically separated such that air quality impacts from multiple locations would not overlap. A construction scenario was developed for each short-term activity. The full-field analysis involved the impacts within the RBU Project Area that would occur from drilling related emissions, well site separator, dehydrator, pump unit engine, and compressor station emissions during the last year of development.

Emissions

During the development over the next eight years, vehicle and fugitive dust emissions would increase within the RBU Project Area. The primary emission sources would result from well development and well production. Vehicle emissions would result from work crews commuting to and from the work site and from the transportation and operation of equipment to construct well pads, roads, and pipelines. Vehicle tailpipes would emit small quantities of NO_2, SO_2, and CO. Fugitive dust concentrations (PM_{10} and $PM_{2.5}$) would increase with additional vehicle traffic on existing unpaved roads and from wind erosion in areas of soil disturbance. Drill rig operations would result mainly in an increase of NO_2 and CO emissions, with lesser amounts of SO_2. These emissions would produce elevated pollutant levels but would be short-term and localized for the duration of the activities. After construction, NO_x, CO, particulate, and HAP emissions would result from the long-term operation of several compressor engines, separator heaters, dehydrators, and pump unit engines. Additionally, road dust (PM_{10} and $PM_{2.5}$) would be generated by vehicles serving wells and condensate storage tanks would generate HAP emissons.

Production phase emissions from the operation of compressor engines were calculated based on the final horsepower of 103,500 distributed over eight existing compressor stations and one new compressor station. Emissions were estimated based on typical emissions and control rates for a 4-stroke lean-burn engine with an oxidation catalyst. These controls were applied to the CO and formaldehyde emissions because of requirements for permitting through the MACT Federal rules found under Title 40, Section 63, Subpart ZZZZ of the electronic code of Federal regulations. **Table 4-4** and **4-5** summarize the annual emissions associated with various phases of the RBU Infill Proposed Action.

Table 4-4. Annual Emissions for Various Phases of the RBU Infill Proposed Action

Pollutant	Construction Emissions (tons/year) [a]					Total (tons/yr)
	Construction	Drilling	Completion	Interim Reclamation	Wind Erosion	
NO_X	2.91	477	42.6	0.23	0.00	523
CO	2.64	155	25.8	1.02	0.00	184
VOC	0.32	20.9	257	0.13	0.00	279
SO_2	0.09	8.4	0.88	1.08E-02	0.00	9.4

Pollutant	Construction Emissions (tons/year) [a]					Total (tons/yr)
	Construction	Drilling	Completion	Interim Reclamation	Wind Erosion	
PM_{10}	19.1	594	263	10.5	0.20	888
$PM_{2.5}$	2.35	67.6	27.0	1.05	0.08	98
Benzene	0.00	0.04	1.23	0.00	0.00	1.3
Toluene	0.00	0.01	1.25	0.00	0.00	1.3
Ethylbenzene	0.00	0.00	0.04	0.00	0.00	3.9E-02
Xylene	0.00	0.01	0.36	0.00	0.00	0.4
n-Hexane	0.00	0.00	6.22	0.00	0.00	6.2
Formaldehyde	0.06	3.89E-03	3.12E-04	0.00	0.00	6.6E-02
Acrolein	0.00	3.88E-04	3.10E-05	0.00	0.00	4.2E-04
1,3-Butadiene	0.00	0.0	2.53E-07	0.00	0.00	2.5E-07

[a] Assumes maximum development scenario (93 wells developed in one year)

Table 4-5. Total Annual Production Emissions from the Proposed Action[a]

Pollutant	Total Project Production Related Emissions (tons/year) [a]						Total (tons/year)
	Pump Unit Engines	Production Heaters	Oil Tanks	TEG Dehydrators	Operations Vehicle	Compressor Engines	
NO_X	364	270	0	0	1.0	1499	2,134
CO	78	227	0	0	11.3	99.9	416
VOC	5.5	2.02	5,768	3,402	0.6	500	9,678
SO_2	0.0	0	0	0	0.1	0	0.1
PM_{10}	10	20.5	0	0	662	36.1	729
$PM_{2.5}$	10	20.5	0	0	66.2	36.1	133
Benzene	0.84	0.01	32.7	424	0.0	0.80	458
Toluene	0.30	0.01	37.8	6.98	0.0	0.74	46
Ethylbenzene	0.01	0	0.0	0.19	0.0	0.07	0.3
Xylene	0.10	0	22.6	2.33	0.0	0.33	25
n-Hexane	0	4.86	90.6	0.62	0.0	2.01	98
Formaldehyde	10.6	0.20	0	0	0.0	46.0	57
Acetaldehyde	1.48	0	0	0	0	15.2	16.7
Acrolein	1.37	0	0	0	0	9.33	5.8
Methanol	1.63	0	0	0	0	4.54	6.2
1,3-Butadiene	0.35	0	0	0	0	0.48	0.8

[a] Assumes maximum development scenario.484 producing wells. Emission estimates for additional HAPs are included in the inventory. The emissions for HAPs not shown is less than 0.5 tons per year.

Criteria Pollutant Impacts

The major pollutants associated with construction would be PM_{10} and $PM_{2.5}$ generated by earth-moving and traffic activities. Other pollutant emissions would occur from vehicle and equipment exhaust. Based upon XTO's proposed development plan, 14 pads would be constructed, 36 pads would be expanded, and a maximum of 93 wells would be drilled and completed in the maximum development year. Other years would have less development. Screening level modeling indicated

construction to be the phase with the highest particulate impact. A well pad and the nearest 350 meters of the adjoining unpaved access road were included in this analysis. The construction-related air quality impacts were analyzed for one well pad and the associated access road with the assumption that one well pad and access road would be developed at any one time and construction activity would be separated by a sufficient distance and time such that the short-term impacts from one construction and development site would not overlap with another site.

The highest fugitive dust levels occur during construction activities that include earth moving and increased vehicle traffic that could last five days at any one location. The modeled result of the construction phase activity is shown in **Table 4-6**. The modeling demonstrates that PM_{10} and $PM_{2.5}$ ambient air concentrations would be below standards for the lengths of these development activities. Impacts would be the greatest for well pad and access road construction because activities would be concentrated on the construction site.

Table 4-6. Construction Impacts from the Proposed Action

Pollutant	Period	Project Impact ($\mu g/m^3$)	Uinta Basin Background Concentration ($\mu g/m^3$)	Maximum Project Impact Plus Background ($\mu g/m^3$)	National and Utah Ambient Air Quality Standard ($\mu g/m^3$)	Percent of NAAQS
SO_2	3-Hour	6	20	26	1300	2%
	24-Hour	3	10	13	365	4%
PM_{10}	24-hour Maximum Average	48	28	76	150	51%
$PM_{2.5}$	24-hour Maximum Average [a]	9.8	25	34.8	35	99%
CO	1-hour Maximum	61	1,111	1172	40,000	3%
CO	8-hour Maximum Average	49	1,111	1160	10,000	12%

[a] maximum of 8th average 24-hour maximum of the 4-yrs of data modeled

Impacts from the project activities were evaluated using the ISC dispersion model. Based on the emissions inventory, NO_x from compressor engines, pump unit engines, separator heaters, dehydrator reboilers, and drill rig engines was the only pollutant of concern. A maximum potential impact scenario was modeled with the maximum year of drilling activity occurring with operations emissions from 265 wells (between development year 6 and 7), and 20 representative road segments. The results indicated that the Proposed Action would be in compliance with applicable air quality standards (**Table 4-7**). The maximum modeled concentration for NO_2 reflects an adjustment by a factor of 0.75, in accordance with standard EPA methodology (60:153 FR 40469, Aug 9, 1995) to convert from the modeled NO_x concentration to NO_2. Emissions under the proposed development schedule would be less.

Table 4-7. RBU Proposed Action Development and Operations Combined NO_2 Impacts

Pollutant	Period	Project Impact ($\mu g/m^3$)	Uinta Basin Background Concentration ($\mu g/m^3$)	Maximum Project Impact Plus Background ($\mu g/m^3$)	National and Utah Ambient Air Quality Standard ($\mu g/m^3$)	Percent of NAAQS
NO_2	Annual Mean	76.6	17	93	100	93%

Hazardous Air Pollutant Impacts

Hazardous air pollutant emissions were evaluated against State of Utah thresholds. The State of Utah has adopted TSLs which are applied during the air permitting process to assist in the evaluation of HAPs released into the atmosphere (UDEQ-DAQ 2000). These levels are not standards that must be met, but screening thresholds which if exceeded, would suggest that additional information is needed to evaluate potential health and environmental impacts. The Industrial Source Complex (ISC) dispersion model was used to predict impacts from storage tanks, compressor station dehydrator flare units, compressor engines, pump unit engines, separator heaters, and dehydrator reboilers. Storage tank emissions were based on an average condensate production rate of 3 barrels/day/well. Well site dehydrator emissions were assumed to be directed to drip tanks. Modeled concentrations were compared to TSLs for each pollutant. As shown in **Table 4-8,** formaldehyde is the only HAP exceeding the screening levels.

Table 4-8. RBU Proposed Action Predicted HAP Comparison to State of Utah TSLs

Pollutant and Averaging Period	Ambient Air Concentration ($\mu g/m^3$)[a]		
	Predicted	TSLs[c]	% of TSL
Formaldehyde (1-hour)	77.6	36.8	211%
Acrolein (1-hour)	15.7	22.9	68.6%
Acetaldehyde (1-hour)	29	4,504	0.6%
Benzene[a] (24-hour)	32.9	53.2	61.8%
Toluene (24-hour)	38.0	2,512	1.51%
Ethylbenzene (24-hour)	0.05	14,473	0.00%
Xylenes (24-hour)	22.8	14,473	0.16%
n-Hexane (24-hour)	91.4	5,875	1.56%
Methanol (24-hour)	2.4	9,282	0.02%
1,3-Butadiene (24-hour)	0.26	147	0.18%

[a] μ/m^3 is micrograms of pollutant per cubic meter of air
[b] although there exists an acute TLV for benzene, the State of Utah does not apply a comparison to an acute TSL since the chronic TSL is more stringent.
[c] Source: UDEQ-UDAQ 2008b

Short-term impacts from HAP exposure were assessed by comparing one-hour average impacts to the HAP-specific acute reference exposure level (REL) and annual average impacts to the HAP-specific reference concentration (RfC --for continuous inhalation exposure). The REL is the acute concentration at or below which no non-cancer adverse health effects are expected. The RfC is the average concentration (i.e., an annual average) at or below which no long-term non-

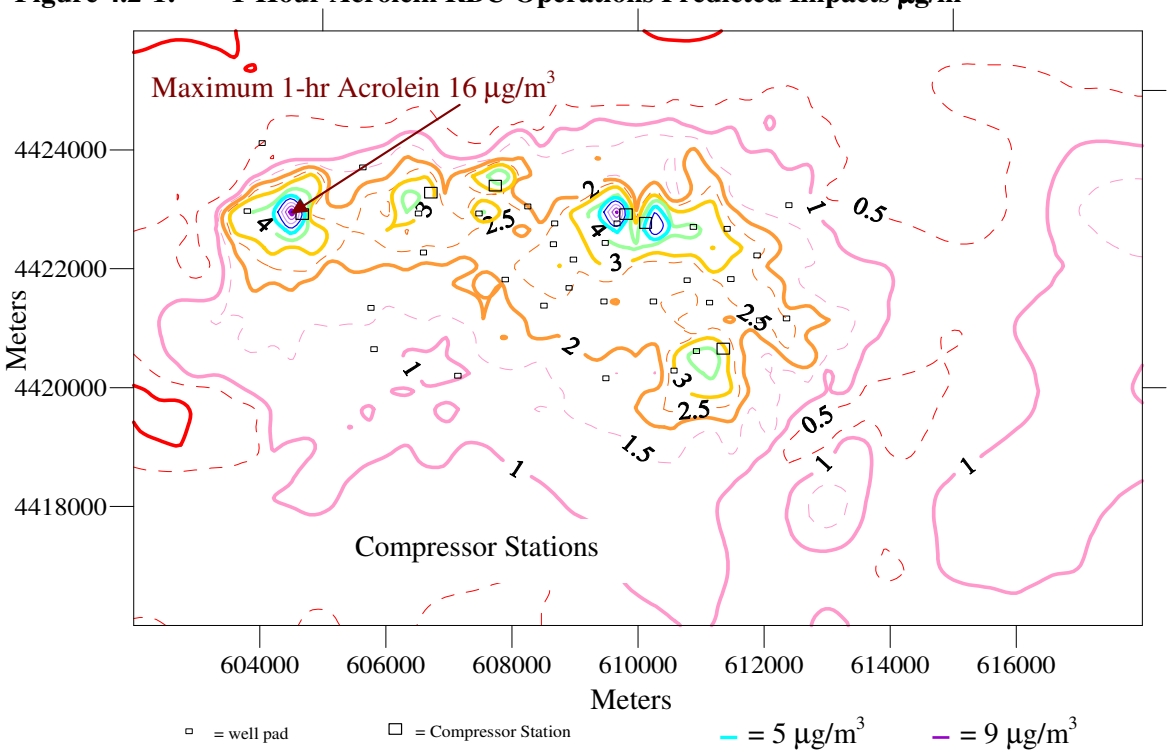
cancer adverse health effects are expected. Table 4-9 presents the acute RELs and chronic RfCs for non-cancer effects for the Proposed Action. The predicted maximum concentrations of all HAPs are compared against the REL and RfC for each pollutant. Predicted concentrations of acrolein for the Proposed Action exceed both the acute and chronic RELs and the RfC. Figure 4.2-1: 1-Hour Acrolein RBU Operations Predicted Impacts shows contour lines of predicted concentrations in the modeled Project Area. The maximum concentration occurs on the corner of a compressor station fenceline.

Table 4-9. Proposed Action Non-Carcinogenic Acute REL and RfC Impacts

HAP	REL [a] ($\mu g/m^3$)	Predicted Maximum One-Hour Impact	Percent of REL	RfC[d] ($\mu g/m^3$)	Predicted Maximum Annual Impact ($\mu g/m^3$)	Percent of RfC
Acrolein	0.19 [a]	15.7	8263%	0.02	0.59	2925%
Acrolein	69[b]	15.7	22.8%	0.06 [g]	0.59	975%
Acrolein	230[c]	15.7	6.83%	6.9 [h]	4.93	71.4%
Acrolein	450[d]	15.7	3.49%	-	-	-
Formaldehyde	94	77.6	82.6%	9.8	2.89	29.5%
Benzene	1,300 [b]	61.5	4.73%	30	2.98	9.93%
Benzene	160,000 [c]	208	0.13%	-	-	-
Toluene	37,000	240	0.65%	5,000	3.58	0.07%
Ethylbenzene	350,000 [c]	0.13	<0.01%	1,000	0.01	<0.01%
Xylenes	22,000	144	0.65%	100	.08	2.08%
n-Hexane	390,000 [c]	576	0.15%	700	8.48	1.21%
1,3-Butadiene	440 [d]	0.82	0.19%	4,000	0.03	<0.01%

[a] California EPA Reference Exposure Level (REL) for no adverse effects EPA Air Toxics Database, Table 2 (EPA 2007)
[b] Acute Exposure Guideline Level (AEGL) for 1-hr and 8-hr exposure with mild effects for once-in-a-lifetime (rare) exposure (for exposure from spills or catastrophic releases), Table 2 (EPA 2007)
[c] Acute Exposure Guideline Level (AEGL) for 1-hr and 8-hr exposure with moderate effects for once-in-a-lifetime (rare) exposure (for exposure from spills or catastrophic releases), Table 2 (EPA 2007)
[d] Immediately Dangerous to Life or Health (IDLH)/10, EPA Air Toxics Database, Table 2 (EPA 2007x) since no available REL
[e] REL for benzene is based on a 6-hr exposure (OEHHA 1999), predicted concentration is a 6-hr average.
[f] EPA Air Toxics Database, Table 1 (EPA 2007)
[g] California EPA chronic REL
[h] Mininum risk level for 1-14-day exposure for no adverse effects set by Agency for Toxic Substances and Disease Registry (ATSDR) from Table 2 (EPA 2007) compared to 24-hr predicted concentration

Figure 4.2-1: 1-Hour Acrolein RBU Operations Predicted Impacts µg/m^3



The sources of acrolein for the Proposed Action include the pump unit engines and the compressor engines. Acrolein is a very reactive compound with a half-life in air of 1-day. Exposure to lower levels of acrolein can cause eye, nose, and throat irritation, and can lower breathing rates. Higher levels of acrolein can damage the lungs and cause death (ATSDR 2007). For perspective the annual average ambient urban background in California is 0.15 µg/m^3 with a 95th percentile of 0.3 µg/m^3. Acrolein levels measured in smoky bars and restaurants ranged from 2.3 to 275 µg/m^3 (OEHHA 2001). A public draft is available through the OEHHA website (dated November 7, 2007) increasing the acute REL to 2.3 µg/m^3, and increasing the chronic level to 0.1 µg/m^3 (OEHHA 2007). The ACGIH has set a threshold limit ceiling value that should never be exceeded in a work environment at 229 µg/m^3 (ACGIH 2007). EPA's website documentation for the acrolein RfC indicates EPA has medium confidence in the RfC as it is based on medium quality data. (http://www.epa.gov/iris/subst/0364.htm)

The risk from long-term exposure to carcinogenic HAP emissions is assessed by comparison to the generally acceptable risk range of one additional cancer per one million exposed persons (1 x 10^{-6}) to one additional cancer per ten thousand exposed persons (1 x 10^{-4}) (EPA 1993). Benzene, formaldehyde, and other HAP carcinogens, are evaluated.

Screening level risk assessment involves application of a HAP specific unit risk factor. The unit risk factor is an upper-bound estimate of the probability of one additional person contracting cancer based on continuous exposure to 1-ug/m^3 of the substance over a 70-year lifetime. Exposure adjustment factors are calculated to adjust for actual exposure times. Cancer risk is estimated for two exposure scenarios: the most likely exposure (MLE) that individuals will experience, and the maximally exposed individual (MEI).

The MLE applies to people living in the RBU Project Area. For the MLE exposure adjustment factor, it is assumed a family stays at a residence an average of nine years and spends 64 percent of the day away from the home (EPA 1997). It is further assumed that households are exposed to one-quarter of the maximum concentration the remainder (36 percent) of the time. This results in an adjustment factor of 0.095 [(9/70)*((0.64*1)+(0.36*0.25))].

An example of an MEI could be a pumper that visits well sites daily and lives near a well pad. For the MEI exposure adjustment factor, exposure is assumed to occur continuously (24 hours per day, 365 days per year) for the LOP (assumed to be 40 years). This results in an adjustment factor of 0.571 [40/70].

Table 4-10 presents the unit risk factor, exposure adjustment factor, and the estimated cancer risk for the MLE and MEI exposure scenarios for project HAP carcinogens. A range of unit risk factors is available for benzene. All cancer risk ranges are in the acceptable range of cancer risk.

Table 4-10. Proposed Action Carcinogenic HAP Risk

Exposure Scenario	Hazardous Air Pollutant	Unit Risk Factor ($1/\mu g/m^3$)	Exposure Adjustment Factor	Modeled Annual Impact ($\mu g/m^3$)	Cancer Risk
MLE	Benzene	2.2×10^{-6} to 7.8×10^{-6}	0.095	2.98	6.2×10^{-7} to 2.2×10^{-6}
	Formaldehyde	1.3×10^{-5}	0.095	2.90	3.6×10^{-6}
	Acetaldehyde	2.2×10^{-6}	0.095	0.91	1.9×10^{-7}
	1,3-Butadiene	3×10^{-5}	0.095	3.0×10^{-2}	8.6×10^{-8}
	1,1,2,2-Tetrachloroethane	5.9×10^{-6}	0.095	4.4×10^{-3}	2.44×10^{-9}
	1,1,2-Trichloroethane	1.6×10^{-5}	0.095	3.5×10^{-3}	5.26×10^{-9}
	1,3-Dichloropropene	4×10^{-6}	0.095	2.9×10^{-3}	1.09×10^{-9}
	Carbon Tetrachloride	1.5×10^{-5}	0.095	4.0×10^{-3}	5.69×10^{-9}
	Dichlorobenzene	1.1×10^{-5}	0.095	8.0×10^{-5}	8.4×10^{-11}
	Ethylene Dibromide	6×10^{-4}	0.095	4.8×10^{-3}	2.75×10^{-7}
	Methylene Chloride	4.7×10^{-7}	0.095	2.2×10^{-3}	9.72×10^{-11}
	Naphthalene	3.4×10^{-5}	0.095	8.1×10^{-3}	2.62×10^{-8}
	Vinyl Chloride	8.8×10^{-6}	0.095	1.6×10^{-3}	1.36×10^{-9}
	Benzo(b)fluoranthene	1.1×10^{-4}	0.095	1.4×10^{-5}	1.4×10^{-10}
	Chrysene	1.1×10^{-5}	0.095	5.7×10^{-5}	6.0×10^{-11}
	TOTAL RISK				**5.8×10^{-6}**
MEI	Benzene	2.2×10^{-6} to	0.571	2.98	3.7×10^{-6} to

Exposure Scenario	Hazardous Air Pollutant	Unit Risk Factor ($1/\mu g/m^3$)	Exposure Adjustment Factor	Modeled Annual Impact ($\mu g/m^3$)	Cancer Risk
		7.8×10^{-6}			1.3×10^{-5}
	Formaldehyde	1.3×10^{-5}	0.571	2.90	2.2×10^{-5}
	Acetaldehyde	2.2×10^{-6}	0.571	0.91	1.1×10^{-6}
	1,3-Butadiene	3×10^{-5}	0.571	3.0×10^{-2}	5.1×10^{-7}
	1,1,2,2-Tetrachloroethane	5.9×10^{-6}	0.571	4.4×10^{-3}	1.5×10^{-8}
	1,1,2-Trichloroethane	1.6×10^{-5}	0.571	3.5×10^{-3}	3.2×10^{-8}
	1,3-Dichloropropene	4×10^{-6}	0.571	2.9×10^{-3}	6.6×10^{-9}
	Carbon Tetrachloride	1.5×10^{-5}	0.571	4.0×10^{-3}	3.4×10^{-8}
	Dichlorobenzene	1.1×10^{-5}	0.571	8.0×10^{-5}	5.0×10^{-10}
	Ethylene Dibromide	6×10^{-4}	0.571	4.8×10^{-3}	1.7×10^{-6}
	Methylene Chloride	4.7×10^{-7}	0.571	2.2×10^{-3}	5.8×10^{-10}
	Naphthalene	3.4×10^{-5}	0.571	8.1×10^{-3}	1.6×10^{-7}
	Vinyl Chloride	8.8×10^{-6}	0.571	1.6×10^{-3}	8.1×10^{-9}
	Benzo(b)fluoranthene/POM6	1.1×10^{-4}	0.571	1.4×10^{-5}	8.8×10^{-10}
	Chrysene/POM7	1.1×10^{-5}	0.571	5.7×10^{-5}	3.6×10^{-10}
	TOTAL RISK				**3.5×10^{-5}**

MEI = maximally exposed individual
MLE = most likely exposure

There is uncertainty associated with adding cancer risk values together, so the addition of cancer risk numbers (TOTAL RISK) from different compounds is likely conservative. The effects of multiple chemical exposure is not well understood. Exposure to multiple chemicals can result in increased (synergistic) effects, decreased (antagonistic) effects, additive effects, or independent effects.

4.2.1.3 Alternative C – Surface Gas Lines

Emissions associated with development and operations for Alternative C are almost the same as Alternative B so no additional modeling was done. Predicted emissions for the development phase, the only phase where there is a difference are presented in Table 4-11. Pipeline installation occurs after completion and has lower impacts compared to construction or drilling. Surface installation of pipeline involves less surface disturbance than burial resulting in one ton per year fewer emissions of PM_{10}. There is no annual standard for PM_{10}, therefore there is no difference between the alternatives for potential air impacts.

Table 4-11. Annual Emissions for Various Phases of the RBU Infill Alternative C

Pollutant	Construction Emissions (tons/year) [a]					Total (tons/yr)
	Construction	Drilling	Completion	Interim Reclamation	Wind Erosion	
NO_X	2.67	477	42.6	0.23	0.00	522
CO	2.58	155	25.8	1.02	0.00	184
VOC	0.31	20.9	257	0.13	0.00	279
SO_2	0.08	8.4	0.88	1.08E-02	0.00	9.4
PM_{10}	18.8	594	263	10.5	0.20	887
$PM_{2.5}$	2.20	67.6	27.0	1.05	0.08	98
Benzene	0.00	0.04	1.23	0.00	0.00	1.3
Toluene	0.00	0.01	1.25	0.00	0.00	1.3
Ethylbenzene	0.00	0.00	0.04	0.00	0.00	3.9E-02
Xylene	0.00	0.01	0.36	0.00	0.00	0.4
n-Hexane	0.00	0.00	6.22	0.00	0.00	6.2
Formaldehyde	0.06	3.89E-03	3.12E-04	0.00	0.00	6.6E-02
Acrolein	0.00	3.88E-04	3.10E-05	0.00	0.00	4.2E-04
1,3-Butadiene	0.00	0.0	2.53E-07	0.00	0.00	2.5E-07

[a] Assumes maximum development scenario (93 wells developed in one year)

4.2.1.4 Recommended Mitigation Measures

- No additional mitigation measures would be necessary under Alternatives A, B, or C.

4.2.2 CULTURAL RESOURCES

4.2.2.1 Alternative A - No Action Alternative

Impacts to cultural resources under the No Action Alternative would be similar in nature to those described below under the Proposed Action. Under the No Action Alternative, XTO would continue to develop the necessary infrastructure in order to drill 128 wells previously approved under EA No. 1997-49 for a total of 332 acres of disturbance. Although the number of new well pads and roads under this alternative would be similar to the Proposed Action, the overall surface disturbance would be approximately 70 percent less. It should be noted that under the No Action Alternative, impact analyses, including site-specific cultural resource clearances, would be conducted for each well prior to development during the APD process.

4.2.2.2 Alternative B - Proposed Action

Oil and gas development in the RBU Project Area is a Federal undertaking in accordance with 36 CFR 800. Any such undertaking must consider potential effects to significant historic properties and must conform to Federal regulations in determining effects that a project may have on significant cultural resources and in mitigating those effects determined to be adverse. As defined in 36 CFR 800, adverse effects to significant historic properties include physical alteration, damage, or destruction; alteration of the character of the setting of a property that contributes to its significance; or neglect that results in deterioration or destruction.

Cultural resources are sensitive and nonrenewable resources that can be directly impacted and irreversibly damaged or destroyed by surface-disturbing activities, such as site and road construction, and secondary surface activities, such as vehicular and pedestrian traffic. The Proposed Action would result in a total surface disturbance of 1,103 acres (786 acres from expansion of existing well pads and 317 acres of new disturbance). Specific potential impacts to cultural resources related to the Proposed Action would not be known until surveys are completed for all of the areas proposed for surface disturbance and, if necessary, cultural resource properties are evaluated for their eligibility for listing on the NRHP. A Class III inventory would be necessary to locate, document, and evaluate the presence of cultural resources within the RBU Project Area and to identify potential impacts that may occur as a result of the Proposed Action.

In addition to direct impacts, cultural resources are also subject to indirect impacts that frequently result from project-related construction and operation, as well as increased vehicular and pedestrian traffic associated with development. Indirect impacts are those impacts that are caused by the action, but occur later in time or are farther removed in distance (40 CFR 1508.8) and can include atmospheric, visual, and auditory intrusions; increased visitation and traffic during well field development and operation; vandalism; Off Highway Vehicle (OHV) and other motorized vehicle use; erosion; and unknown impacts to unidentified Traditional Cultural Properties (TCPs) and cultural landscapes. All of these indirect impacts may contribute to an alteration of the overall setting and feeling of the RBU Project Area. The Proposed Action would result in an increased human presence in the RBU Project Area during development and operation. In addition, roads proposed in the RBU Project Area would provide increased motorized access to areas that may contain cultural resources. Indirect impacts such as those described can lead to the damage, destruction, or removal of significant scientific information; the loss of research potential; the loss of interpretation possibilities; and the destruction of the character or setting of a site. These impacts can be short-term or can continue well into the future as more of an area is opened to energy exploration.

Since measures for avoiding and appropriately mitigating archaeological sites would be followed, the Proposed Action could result in moderate impacts to cultural resources. While the potential for direct impacts to eligible cultural resources is likely to increase with increased surface disturbance, those impacts can be mitigated by preparation and execution of mitigation measures listed below, and as approved by the responsible Federal, State, and Tribal agencies.

4.2.2.3 Alternative C – Surface Gas Lines

Impacts to cultural resources under Alternative C would be similar in nature to those described under the Proposed Action. Under Alternative C, all water lines would be buried, but gas gathering lines would be surface-laid. Alternative C would result in a total surface disturbance of 745 acres (468 acres from expansion of existing well pads; 277 acres from new disturbance). Although the number of new well pads and roads under this alternative would be similar to the Proposed Action, the overall surface disturbance would be approximately 32 percent less. As with the Proposed Action, specific potential impacts to cultural resources related to this alternative would not be known until surveys are completed for all areas proposed for surface disturbance and, if necessary, cultural resource properties are evaluated for their eligibility for listing on the NRHP.

4.2.2.4 Recommended Mitigation Measures

- All vehicular traffic, personnel and equipment movement, as well as construction activities would be confined to the areas approved for surface disturbance and to the existing roadways.

4.2.3 FISH AND WILDLIFE INCLUDING SPECIAL STATUS SPECIES

4.2.3.1 Alternative A - No Action Alternative

Impacts to wildlife resources under the No Action Alternative would be similar in nature to those described below under the Proposed Action. Under the No Action Alternative, XTO would continue to develop the necessary infrastructure in order to drill 128 wells previously approved under EA No. 1997-49. This development would create a total of 332 acres of surface disturbance. Although the number of new well pads and roads under this alternative would be similar to the Proposed Action, the overall surface disturbance would be approximately 70 percent less. Specifically, surface disturbances to big game ranges as described below in **Table 4-12** would be less than those under the Proposed Action. It should be noted that under the No Action Alternative, site-specific impact analyses would be conducted for each well prior to development during the APD process.

Table 4-12. Surface Disturbances to UDWR-designated Big Game Ranges under the No Action Alternative

Big Game Ranges	Total Range in RBU Project Area (Acres)	Existing Disturbance in RBU Project Area (Acres)	Disturbance Associated with the No Action Alternative in RBU Project Area			Percent of Range in RBU Project Area Disturbed by the No Action Alternative
			Expansion of Existing Development (Acres)	New Development (Acres)	Total Development (Acres)	

Mule Deer – Crucial Value Year Long Fawning Habitat	149	0	0	8	8	5%
Pronghorn – Crucial Value Year Long Fawning Habitat	16,478	1,449	27	292	318	2%
Rocky Mtn. Bighorn Sheep – Crucial Value Year Long Habitat	6,806	574	18	125	143	2%

4.2.3.2 Alternative B - Proposed Action

General Wildlife

The Proposed Action would have a direct impact on approximately 1,103 acres of wildlife habitat. Specifically, surface disturbance would include the expansion of existing development (approximately 786 acres) and the construction of new well pads, pipelines, and roads (approximately 317 acres). This would reduce habitat availability for a variety of common wildlife species. However, this habitat reduction is expected to have a minor impact on general wildlife species because many of the species are considered habitat generalists, meaning they are not tightly restricted to specific habitat types (i.e., cottontail rabbits, coyotes, ravens, rodents, and snakes).

Impacts to general wildlife species would include visual and noise disturbances from construction, drilling, production activities, completion activities, and associated traffic. These disturbances could displace wildlife from habitats in areas of human activity. Construction, drilling, and completion may result in displacement from affected habitats during the entire construction period of wells; however, production activities would result in displacement only during well visits. If displaced, individual animals could move into less suitable habitats, potentially increasing levels of competition. An increased level of competition could lead to deteriorated physical conditions, lowered breeding success rates, and increased general distress.

It is important to note that the RBU Project Area already contains 324 well pads, 108 miles of road, and 137 miles of pipeline ROW, and seven compressor stations. Much of the surface disturbance under the Proposed Action would occur as an expansion of existing infrastructure. Because of the ecological edge effect, areas around existing structures have most likely changed and degraded over time, and hold more exotic and invasive species than the surrounding undisturbed landscape (Hansen and Clevenger 2005; Rowley et al. 1999). As such, these areas already hold lower habitat value for wildlife species.

Overall, the severity of impacts to general wildlife species under the Proposed Action would depend on the seasonal and daily timing of construction, drilling, production and completion activities; the site-specific topography and vegetation; the species' sensitivity to human disturbance; and the availability of suitable habitat within and adjacent to the RBU Project Area.

Big Game

Impacts associated with the Proposed Action would be similar for all big game species that utilize habitats in the RBU Project Area. Potential impacts to these species include the following:

- Decreased habitat values and reduced habitat use within and/or near disturbed areas due to direct habitat loss and fragmentation of habitat;
- Decreased nutritional conditions from increased energy expenditure as a physical response to disturbance;
- Increased stress from intra- and inter-specific competition for resources due to increased animal densities in adjoining or unsuitable habitats;
- Increased potential for collisions between vehicles and big game; and
- Increased harassment and/or poaching of big game species.

Species-specific habitat losses for big game ranges found within the RBU Project Area are listed in **Table 4-13.**

Several big game herds are currently below UDWR-designated population objectives, the above-mentioned impacts could further preclude big game populations from meeting these objectives.

Pronghorn fawning areas are characterized as flat, open areas dominated by grasslands with shrub cover. Dense shrubs provide opportunities for concealment from predators. Surface-disturbing activities that remove vegetation in crucial value, year-long fawning habitat for pronghorn could affect pronghorn fawn activities in the RBU Project Area. The direct removal of vegetation could displace fawns into areas that do not provide adequate density or height of vegetation, or adequate forb and grass production. The removal of vegetation could also reduce relative habitat values for pronghorn fawning sites, if fawning habitat no longer offers concealment and exposes fawns to predators. Increased noise from vehicular traffic on access roads in the RBU Project Area could also displace fawns from suitable foraging areas or fawn bed sites. These activities could hinder the Book Cliffs pronghorn herd unit (Herd Unit #10) from reaching its population objective. However, in addition to the 16,678 acres of crucial value, year-long fawning habitat for pronghorn in the RBU Project Area, the UDWR has also identified 149,568 acres of this habitat outside and adjacent to the RBU Project Area, which could be utilized by pronghorn for fawning.

In accordance with lease stipulations, XTO would limit surface development to the extent possible on Federal lease U-76500 to protect the pronghorn during the kidding period of May 15 to June 20.

Table 4-13. Surface Disturbances to UDWR-designated Big Game Ranges under the Proposed Action

Big Game Ranges	Total Range in RBU Project Area (Acres)	Existing Disturbance in RBU Project Area (Acres)	Disturbance Associated with the Proposed Action in RBU Project Area			Percent of Range in RBU Project Area Disturbed by the Proposed Action
			Expansion of Existing Development (Acres)	New Development (Acres)	Total Development (Acres)	

Mule Deer – Crucial Value Year Long Fawning Habitat	149	0	1	8	9	6%
Pronghorn – Crucial Value Year Long Fawning Habitat	16,478	1,449	781	304	1,085	7%
Rocky Mtn. Bighorn Sheep – Crucial Value Year Long Habitat	6,806	574	305	128	433	6%

It is important to note that the RBU Project Area already contains 324 well pads, 108 miles of road, and 137 miles of pipeline ROW, and seven compressor stations. Additionally, much of the surface disturbance under the Proposed Action would occur as an expansion of existing infrastructure and in locations where big game species already encounter visual and noise disruptions (**Table 4-13**).

Successful interim reclamation of areas not utilized for production activities as well as final reclamation efforts could re-establish some big game ranges over time. In addition, ACEPMs that include measures to reduce speeding on area roads and to prevent harassment and/or poaching of big game species would further reduce potential impacts associated with the Proposed Action.

Migratory Birds

It is important to note that numerous well pads and associated pipeline and road ROWs currently exist within the RBU Project Area. Because oil and gas development in this area began in the early 1950's, migratory birds occupying the RBU Project Area may have adapted to visual and noise impacts associated with oil and gas development. Of the approximately 1,103 acres of total surface disturbance associated with the Proposed Action, approximately 786 acres (or 71%) would occur as an expansion of existing well pads and infrastructure, and thus would occur in locations where birds already encounter visual and noise disruptions.

The intensity of impacts from the Proposed Action on migratory birds that utilize the RBU Project Area, as well as the Green River BHCA (BHCA #37), would depend on seasonal timing of construction, drilling, and completion activities. If these activities were to be conducted in the late fall, many of the migratory species would have left the RBU Project Area for wintering grounds. Surface disturbance, visual, and noise impacts during this time would not impact most individual birds or nesting locations. However, if construction, drilling, and completion activities were to occur during the spring or summer months, the Proposed Action could result in temporary displacement from nesting habitats or deter nest establishment.

The intensity of impacts from the Proposed Action on migratory birds that utilize the Green River BHCA (BHCA#37) would also depend on the location of proposed development in the RBU Project Area. Surface disturbance, visual, and noise impacts related to the expansion of existing development and new construction would be expected to effect more migratory birds near the

western edge of the RBU Project Area than those that occupy lands in the eastern portion of the RBU Project Area (i.e., further from the Green River).

Construction, drilling, and completion activities, as well as production and maintenance activities, could result in the following impacts to migratory birds. Fragmentation of habitat and associated edge avoidance by migratory birds has been documented as leading to lower levels in productivity (Renfrew et al. 2005). Associated noise and increased human presence could cause displacement from foraging and nesting habitats. If displaced, birds could move to less suitable habitats which could cause an increase in competition and deteriorated physical condition. Increased roads and vehicle traffic levels could also lead to the increased potential for collisions between migratory birds and vehicles. However as mentioned previously, much of the surface disturbance under the Proposed Action would only occur as an expansion of existing infrastructure and in locations where birds already encounter visual and noise disruptions.

Specific actions under the Proposed Action, including the ACEPMs, would reduce both direct and indirect impacts to migratory birds. Successful interim and final reclamation efforts would re-establish migratory bird habitat over time. Measures to reduce speeding on area roads would reduce the potential for collisions between migratory birds and vehicles. Provisions to remove visible accumulation of oil from reserve pits would prevent exposure of migratory birds and other wildlife to petroleum products.

Raptors

Implementation of the Proposed Action could affect nesting and breeding raptors that utilize the RBU Project Area. These impacts could be direct, such as a displacement due to visual and noise disturbances, or indirect, such as reduction in habitat for prey species.

Direct impacts to raptors could result from surface-disturbing activities, or areas with concentrated human activity, in close proximity to an active raptor nest. This could lead to temporary displacement from nesting sites, avoidance of affected areas, and deterrence from establishing other nesting sites. Steidl and Anthony (2000) suggest that the greatest energetic costs from disturbance occur in nestlings, potentially decreasing overall reproductive success. Displacement could also lead to increased use of adjacent habitats, which could lead to increased inter- and intra-specific competition for resources.

Surface disturbance associated with the Proposed Action would result in the loss of approximately 1,103 acres of habitat for raptor prey species such as small mammals, songbirds, and reptiles. Of this habitat loss, approximately 786 acres (or 71%) would be related to the expansion of existing development, while approximately 317 acres (or 29%) would consist of the construction of new well pads, pipelines, and roads. Rodriguez-Estrella et al. (1998) identified loss or fragmentation of habitat of prey species as a contributor to raptor population declines. In addition, increased vehicle traffic in the RBU Project Area could directly impact raptors by increasing the potential for collisions between vehicles and raptors.

It is important to note that the RBU Project Area already contains 324 well pads, 108 miles of road, 137 miles of pipeline ROW, and seven compressor stations. Much of the surface disturbance under the Proposed Action would only occur as an expansion of existing infrastructure and in locations where raptors already encounter visual and noise disruptions. In addition, as increased noise levels and visual disturbances associated with construction and drilling activities would be localized and short-term, displacement to adjacent habitats would likely be temporary in nature and would not likely alter the productivity of current raptor

populations within the RBU Project Area. Although human activity has been shown to adversely impact breeding raptors, some evidence of raptor habituation to human-induced disturbances has also been documented (Anderson et al. 1989; Rodriguez-Estrella et al. 1998; Steidl and Anthony 2000). In addition, the cliffs on which the active raptor nests were found face the Green River and away from the RBU Project Area. As such, these nests are most likely shielded from most project activity.

Specific actions under the Proposed Action, including the ACEPMs, would reduce both direct and indirect impacts to raptors. Prior to surface disturbance during the breeding season, a site-specific assessment would be conducted and species-specific seasonal/temporal buffers would be applied as necessary and under the direction of SMA biologists to protect any active raptor nests from disturbance. Consideration of topography and vegetative screening when locating well pads and project-related facilities could further reduce or minimize indirect impacts to raptor species within the RBU Project Area. Successful interim reclamation of areas not utilized for production activities, as well as final reclamation efforts, could reestablish some raptor and prey habitat over time. Measures to reduce speeding and contacting the UDWR to remove carrion on area roads would reduce direct impacts associated with the Proposed Action.

Special Status Fish and Wildlife Species

It is important to note that the RBU Project Area already contains 324 well pads, 108 miles of road, 137 miles of pipeline ROW, and seven compressor stations. Much of the surface disturbance (approximately 786 acres or 71%) under the Proposed Action would occur as an expansion of existing infrastructure, and therefore would occur in locations where special status wildlife species may already encounter visual and noise disruptions. In addition, the majority of new well pad and associated infrastructure construction is proposed for the northeastern portion of the RBU Project Area, and therefore special status species that occur mainly near the Green River (located west of the RBU Project Area) would be minimally affected by these construction activities. A discussion for each special status fish and wildlife species associated with proposed development in the RBU Project Area follows.

White-tailed Prairie Dog

Potential impacts to WTPDs associated with oil and gas development include the following: habitat loss due to clearing and crushing of vegetation; fragmentation of available habitat due to pad expansion; temporary displacement of animals; and increased potential for vehicle collisions with prairie dogs. Habitat quality for these species can also be degraded by the introduction of noxious and invasive weeds. Weed invasions may lead to a decrease in the amount of native perennial species and bare ground, thereby degrading habitat for prairie dogs by decreasing visibility, forage quality, and burrow development.

Specific actions under the Proposed Action, including the ACEPMs, would reduce impacts to WTPDs. Successful interim and final reclamation efforts could re-establish some WTPD habitat over time. Measures to reduce speeding on area roads would reduce the potential for collisions between prairie dogs and vehicles. Weed control would reduce habitat degradation. In addition, implementation of recommended mitigation measures that include provisions to avoid active white-tailed prairie dog colonies during construction could further reduce impacts related to habitat loss and fragmentation in the RBU Project Area. Overall, the Proposed Action may indirectly impact potential WTPD, but would not likely result in a trend towards Federal listing of this species.

Yellow-billed Cuckoo

The yellow-billed cuckoo is an obligate riparian species that feeds in cottonwood groves and nests in willow thickets. Riparian habitat that could be utilized by the yellow-billed cuckoo occurs west, but outside, of the RBU Project Area along the Green River. Therefore the Proposed Action would not have direct impacts to this species or its habitat. Indirect impacts to the yellow-billed cuckoo habitat could result from increased soil erosion and potential for spills and leaks. However, these indirect impacts would be reduced with successful revegetation, soil stabilization techniques, and spill containment measures. Overall, the Proposed Action may indirectly impact potential yellow-billed cuckoo habitat, but would not likely result in a trend towards Federal listing of this species.

Bald Eagle

Although no bald eagle nesting has been reported within or near the RBU Project Area, three roosting sites have been documented in cottonwood trees along the Green River within ½-mile of the RBU Project Area. These sites are located along the Green River, which is surrounded by cliffs and tall canyon walls. Because of this topography, each of the roosting sites is sheltered from the RBU Project Area. As such, increased human presence, traffic, and associated noise during the winter (early November to late March) would also be screened and would not prevent bald eagles from feeding or taking shelter along the Green River, west of the RBU Project Area.

Under the Proposed Action, indirect impacts to bald eagles would include the loss of approximately 1,103 acres of prey species habitat (e.g., prairie dogs, rabbits, mice, and small birds) associated with surface disturbance and vegetation loss/disturbance from project development. However, approximately 786 acres (or 71%) of this surface disturbance would occur as an expansion of existing infrastructure, and therefore would occur in foraging habitats where bald eagles may already encounter visual and noise disruptions. Although the loss of some prey species may limit foraging opportunities for individual eagles in the RBU Project Area, specific actions under the Proposed Action, including the ACEPMs, could reduce impacts to foraging bald eagles related to the loss of prey species. Successful interim and final reclamation efforts would reestablish some prey species habitat over time. Measures to reduce speeding on area roads and remove carrion from roadways would reduce the potential for collisions between carrion-feeding eagles and vehicles. In addition, implementation of recommended mitigation measures to seasonally restrict all surface-disturbing activities within ½-mile of known bald eagle winter roost locations could further reduce impacts related to the loss of foraging habitat in the RBU Project Area.

Based upon the analysis above, the Proposed Action could reduce the relative habitat value of bald eagle foraging habitat, but would not likely result in a trend towards Federal re-listing of this species, or result in decreased use of bald eagle winter roosting habitats near the RBU Project Area.

Golden Eagle

Two golden eagle nests have been identified along the northwestern boundary of the RBU Project Area boundary. However, these nests occur on cliffs along the Green River that face away from the RBU Project Area. Therefore, these nests are likely shielded from proposed surface-disturbing activities in the RBU Project Area. As nesting and foraging habitat exist throughout and adjacent to the RBU Project Area, golden eagles could be affected by implementation of the

Proposed Action. Potential impacts to golden eagles within the RBU Project Area under the Proposed Action would include the following:

- Direct habitat loss of foraging areas due to construction activities;
- Temporary displacement or avoidance of potential nesting sites caused by increased human activity, traffic, and noise levels; and
- Increased potential for collisions with vehicles when foraging on carrion.

These potential impacts to golden eagles would be reduced by specific actions of the Proposed Action, including ACEPMs that include provisions for raptor nest inventories prior to surface-disturbing activities, spatial/temporal buffers around active nests, interim and final reclamation, adherence to speed limits, and measures to contact the UDWR for carrion removal. Based on adherence to these measures, the Proposed Action would not likely result in a trend toward Federal listing of this species, nor would it result in a loss of golden eagle populations or density within the RBU Project Area.

Greater Sage-grouse

Surface disturbances associated with the Proposed Action would result in the direct loss of approximately 272 acres of UDWR-designated crucial value, brooding habitat in the southwestern and south central portions of the RBU Project Area (less than one percent of the defined UDWR designated brooding habitat in and around the Project area). Of this disturbance, approximately 254 acres (or 93 percent) would result from expansion of existing development, while only 18 acres (or 7 percent) would result from construction of new well pads, and associated roads and pipelines. As such, the proposed development would primarily occur in sage-grouse brooding habitat where sage-grouse may already encounter and may have somewhat habituated to, visual and noise disruptions.

Numerous studies have determined that sage-grouse are affected by human activity (Braun 1998; Lyon and Anderson 2003). The primary effect of the Proposed Action on sage-grouse in the RBU Project Area would be potential displacement or avoidance of potentially suitable habitats due to increased disturbance from human activity, increased traffic, and noise associated with construction and drilling activities. As no leks have been documented within the RBU Project Area, direct impacts to breeding activity would not occur under the Proposed Action.

Based on the extent of existing development within the UDWR designated brooding habitat (about 467 acres) and absence of leks in the RBU Project Area, implementation of the Proposed Action may affect individual sage-grouse, but would not likely result in a loss of viability, nor cause a trend toward Federal listing of the species.

Burrowing Owl

The primary impact to burrowing owls under the Proposed Action would be the loss and increased fragmentation of potential nesting habitat within the RBU Project Area. Surface-disturbing activities or areas with concentrated human activity in proximity of an active burrowing owl nest could lead to nest abandonment, thereby affecting the breeding pair and their annual productivity. Since burrowing owls alternate between nest sites within a breeding territory, any surface facilities where ongoing traffic or human presence occurs in or near active prairie dog colonies could prevent burrows from being used as nest sites in the future.

Construction, drilling, and completion activities could also result in visual disturbance on the landscape, increased noise from equipment use, and increased vehicle traffic, all of which could cause burrowing owls to avoid disturbed areas. Such displacement and avoidance could lead to an increased use of adjacent habitat, which could then lead to increased inter-specific and intra-specific competition for resources in these areas.

Under the Proposed Action, ACEPMs that include provisions for site-specific field surveys for burrowing owls prior to surface-disturbing activities, spatial/temporal buffers around active nests, and adherence to speed limits, could reduce or minimize displacement or nest abandonment of burrowing owls. In addition, implementation of recommended mitigation measures that include provisions to avoid active WTPD colonies during construction could further reduce impacts related to the loss of potential nesting habitat in the RBU Project Area. Based on adherence to these measures, the Proposed Action would not likely result in a trend towards Federal listing of this species, nor would it result in a loss of viability for potential burrowing owl populations within the RBU Project Area.

Special Status Fish Species

As discussed in **Chapter 3**, habitat for four Federally-listed fish species (the humpback chub, bonytail, razorback sucker, Colorado pikeminnow) and three conservation agreement fish species (flannelmouth sucker, bluehead sucker, and roundtail chub) is located in the Green River west of the RBU Project Area. Although no ground-disturbing activities would occur in aquatic habitat for these species as a result of the Proposed Action, these fish could be impacted by water depletion activities, increased siltation due to soil erosion, and hazardous substances in the case of an accidental spill or leak.

Water Depletions

The proposed project would utilize water from the Upper Colorado River system (i.e., Green River, Willow Creek, and underground wells that potentially draw water from the system) for drilling and completion activities, as well as dust abatement. The drilling of all 484 proposed wells would consume about 10,164,000 barrels (or 1,307 acre-feet) of water over a period of 8 years (between 100 and 251 acre-feet per year). In addition, approximately 775 barrels (or 0.1 acre-feet) of water per well pad would be utilized for dust abatement each year. As such, water utilized for dust abatement for a maximum of 398 well pads and associated roads would be approximately 12,338,000 barrels (1,592 acre-feet) over a 40-year project life (40 acre-feet/year). Based upon these water-use estimates, between 140 and 291 acre-feet of water per year could be used for drilling, completion, and dust abatement over the first 8 years of the project. Following drilling and completion activities, water usage would then be limited to 40 acre-feet per year for dust abatement for the remainder of the project life. Depletions can reduce the ability of the Green River to create and maintain the physical habitat (areas inhabited or potentially habitable to

special status fish for use of spawning, development of fish larvae, feeding, or serving as corridors between these areas) and the biological environment. Water depletions can also contribute to alterations in flow regimes that favor non-native fish.

In order to address depletion (and other) impacts to the endangered Colorado River fish, a Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin (Recovery Program) was initiated on January 22, 1988. Under the 1988 Recovery Program, any water depletions from tributary waters within the Colorado River drainage are considered to "*jeopardize the continued existence"* of these fish. In order to further define and clarify the recovery processes in the Recovery Program, a Section 7 agreement was implemented on October 15, 1993, by Recovery Program participants. Incorporated into this agreement is a Recovery Implementation Program Recovery Action Plan (RIPRAP). The RIPRAP identifies actions currently required to recover the endangered fish species in the most expeditious manner. Included in the RIPRAP was the requirement that a one-time depletion fee would be paid to help support the Recovery Program for all non-historic water depletions (i.e., occurring after January 1988) from the Upper Colorado River Basin. The depletion fees ($17.79 per acre-foot as of October 1, 2007) were intended to be the reasonable and prudent alternative to avoid jeopardy to the endangered fishes by depletion of the Upper Colorado River Basin (USFWS 2007b). In 1995, the USFWS eliminated these water depletion fees for water depletions from the Upper Colorado River Basin of 100 acre-feet or less (USFWS 1995). However, as depletions would exceed 100 acre-feet per year under the Proposed Action, XTO would be responsible for paying a one-time depletion fee.

Similar to the Colorado River fish, the above-mentioned water depletion impacts could also affect the flannelmouth sucker, bluehead sucker, and roundtail chub, but would not likely result in a loss of viability, nor cause a trend towards Federal listing of these species. It should be noted that some depletion-related impacts to these species would be reduced as XTO and/or their contractors have voluntarily committed to avoid pumping water from low flow environments and would use a maximum of ¼-inch mesh screening on the pump intake while pumping water. If impinged fish are observed on the intake, XTO would immediately stop work and contact the USFWS and UDWR.

Other Project Activities

Implementation of the Proposed Action could also degrade USFWS-designated critical habitat for the Colorado River fish in the Green River by increasing erosion, sediment yield, and the potential for exposure to hazardous substances in the case of an accidental spill. As discussed in **Section 4.2.6**, the Proposed Action would increase sediment loading to the Green River. Turbidity and salinity would be expected to increase as well. However, these impacts would be minimized by certain actions set out under the Proposed Action which include provisions to minimize surface disturbance, implement interim and final reclamation, implement a SPCC plan, utilize appropriate erosion control measures, and utilize closed-loop drilling systems for all proposed wells located in the 100-year floodplain of Willow Creek and in all named drainages within 5 river miles of the Green River.

Conclusion

Based on non-historic water depletions from the Upper Colorado River system, the Proposed Action ***"may affect, is likely to adversely affect"*** the Colorado River fish and USFWS-designated critical habitat for the Colorado River fish in the Green River. As such, Section 7 consultation with the USFWS would be required to evaluate impacts to the Colorado River fish and these critical habitats. It should be noted that some depletion-related impacts to the Colorado River fish would be reduced as XTO and/or their contractors have voluntarily committed to avoid pumping water from low flow environments and would use a maximum of ¼-inch mesh screening on the pump intake while pumping water. If impinged fish are observed on the intake, XTO would immediately stop work and contact the USFWS and UDWR.

4.2.3.3 Alternative C – Surface Gas Lines

Impacts to wildlife resources under Alternative C would be identical in nature, but slightly less in extent, than those described above under the Proposed Action. As all gas lines would be surface-laid under Alternative C, total surface disturbance in the RBU Project Area would be approximately 32 percent less than under the Proposed Action. Specifically, surface disturbances to big game ranges would be less, as detailed below in **Table 4-14**.

Table 4-14. Surface Disturbances to UDWR-designated Big Game Ranges under Alternative C

Big Game Ranges	Total Range in RBU Project Area (Acres)	Existing Disturbance in RBU Project Area (Acres)	Disturbance Associated with Alternative C in RBU Project Area			Percent of Range in RBU Project Area Disturbed by Alternative C
			Expansion of Existing Development (Acres)	New Development (Acres)	Total Development (Acres)	
Mule Deer – Crucial Value Year Long Fawning Habitat	149	0	0	7	7	5%
Pronghorn – Crucial Value Year Long Fawning Habitat	16,478	1,449	466	266	732	4%
Rocky Mtn. Bighorn Sheep – Crucial Value Year Long Habitat	6,806	574	181	110	291	4%

4.2.3.4 Recommended Mitigation Measures

- If surface disturbing activities were to be conducted within ½-mile of known bald eagle roost locations between April 1 and November 1, they would be conducted during hours when eagles are not on roosting sites (i.e., 9:00 AM to 4:00 PM).
- During construction, all active WTPD towns would be avoided as feasible.

- To avoid entrainment, water should be pumped from an off-channel location – one that does not connect to the river during high spring flows. An infiltration gallery constructed in a BLM and Service approved location is best.
- If the pump head is located in the river channel where larval fish are known to occur the following measures apply:
    - the pump should not be situated in a low-flow or no-flow area as these habitats tend to concentrate larval fishes;
    - the amount of pumping should be limited, to the greatest extent possible, during that period of the year when larval fish may be present; and
    - the amount of pumping should be limited, to the greatest extent possible; during the pre-dawn hours as larval drift studies indicate that this is a period of greatest daily activity

4.2.4 LIVESTOCK GRAZING

4.2.4.1 Alternative A – No Action Alternative

Impacts to livestock grazing under the No Action Alternative would be similar in nature to those described below under the Proposed Action. Under the No Action Alternative, XTO would continue to develop the necessary infrastructure in order to drill 128 wells previously approved under EA No. 1997-49. Although the number of new well pads and roads under this alternative would be similar to the Proposed Action, Alternative A activities would result in disturbance to approximately 142 useable acres (or approximately 1%) in grazing allotments within the RBU Project Area. Disturbance under Alternative A would be approximately 79 percent less than under the Proposed Action. Of the 142 useable acres, 24 acres (or 17 percent) would occur as a result of expansion of existing surface disturbance, while 118 acres (or 83 percent) would occur as a result of new surface disturbance. It should be noted that under the No Action Alternative, site-specific impact analyses would be conducted for each well prior to development during the APD process. **Table 4-15** provides a breakdown of the estimated loss of livestock acres and AUMs by grazing allotment.

Table 4-15. Estimated Livestock Acres and AUMs Affected by the No Action Alternative

Allotment Name	Acres					AUMs	
	Usable[1] Allotment Acres w/in RBU Project Area	Existing Disturbance on Allotments w/in RBU Project Area	Loss of Usable Acres due to Alternative A[1]			Permitted AUMs w/in RBU Project Area	Loss of AUMs w/in RBU Project Area due to Alt A
			Loss of Usable Acres due to Expansion of Existing Disturbance	Loss of Usable Acres due to New Disturbance	Total Loss of Usable Acres w/in RBU Project Area		
Green River AMP	102	0	0	3	3	6	<1
Sand Wash	2,028	166	0	73	73	160	6
Wild Horse Bench	7,993	836	24	42	66	2,244	18
Total	**10,123**	**1,002**	**24**	**118**	**142**	**2,410**	**24**

Source: BLM 2007a

[1] Usable land is defined as BLM land that has a slope lower than 40%.

4.2.4.2 Alternative B – Proposed Action

The Proposed Action would result in the removal of approximately 662 usable acres (defined as BLM-administered lands on slopes less than 40 percent) of vegetation (involving 147 livestock AUMs) in grazing allotments in the RBU Project Area. ,Of the 662 useable acres, 538 acres (or 81 percent) would occur as a result of expansion of existing surface disturbance, while 123 acres (or 19 percent) would occur as a result of new surface disturbance. **Table 4-16** provides a breakdown of the estimated loss of livestock AUMs by grazing allotment.

Table 4-16. Estimated Livestock Acres and AUMs Affected by the Proposed Action

Allotment Name	Acres					AUMs	
	Usable[1] Allotment Acres w/in RBU Project Area	Existing Disturbance on Allotments w/in RBU Project Area	Loss of Usable Acres due to Proposed Action			Permitted AUMs w/in RBU Project Area	Loss of AUMs w/in RBU Project Area due to Proposed Action
			Loss of Usable Acres due to Expansion of Existing Disturbance	Loss of Usable Acres due to New Disturbance	Total Loss of Usable Acres w/in RBU Project Area		
Green River AMP	102	0	0	3	3	6	<1
Sand Wash	2,028	166	87	78	165	160	13
Wild Horse Bench	7,993	836	451	42	494	2,244	133
Total	**10,123**	**1,002**	**538**	**123**	**662**	**2,410**	**147**

Source: BLM 2007a,
[1] Usable land is defined as BLM land that has a slope lower than 40%.

Indirect effects to livestock grazing could include reduced forage quality due to potential weed infestations; increased gas development-related traffic; and potential traffic delays to ranchers accessing the RBU Project Area during the construction and drilling phases.

Under the Proposed Action, mitigation measure would be implemented that would reduce impacts to disturbed grazing habitats. These measures include re-vegetation of disturbed areas and implementation of noxious weed control and monitoring. Where impacts cannot be avoided, any livestock facilities (e.g. fences, cattle guards, gates, drift fences and natural barriers) that are damaged by the Proposed Action would be repaired or replaced. Additional cattle guards or gates would also be installed as needed and maintained for the LOP.

Adherence to the above mentioned measures would effectively mitigate the anticipated impacts to livestock, forage, and existing livestock facilities within the RBU Project Area.

4.2.4.3 Alternative C – Surface Gas Lines

Impacts to livestock grazing under Alternative C would be similar in nature to those described under the Proposed Action. Although the number of well pads and associated infrastructure under this alternative would be identical to the Proposed Action, the overall surface disturbance

would be approximately 57 percent less due to surface laid gas lines. Alternative C would result in the removal of approximately 427 useable acres (or approximately 7 percent) of vegetation in grazing allotments in the RBU Project Area. Of the 427 useable acres, 22 acres (or 75 percent) would occur as a result of expansion of existing surface disturbance, while 105 acres (or 25 percent) would occur as a result of new surface disturbance. **Table 4-17** provides a breakdown of the estimated loss of livestock AUMs by grazing allotment.

Table 4-17. Estimated Livestock AUMs Affected by Alternative C

Allotment Name	Acres					AUMs	
	Usable[1] Allotment Acres w/in RBU Project Area	Existing Disturbance on Allotments w/in RBU Project Area	Loss of Usable Acres due to Alternative C			Permitted AUMs w/in RBU Project Area	Loss of AUMs w/in RBU Project Area due to Alt C
			Loss of Usable Acres due to Expansion of Existing Disturbance	Loss of Usable Acres due to New Disturbance	Total Loss of Usable Acres w/in RBU Project Area		
Green River AMP	102	0	0	3	3	6	<1
Sand Wash	2,028	166	50	69	119	160	9
Wild Horse Bench	7,993	836	272	33	305	2,244	82
Total	**10,123**	**1,002**	**322**	**105**	**427**	**2,410**	**92**

Source: BLM 2007a
[1] Usable land is defined as BLM land that has a slope lower than 40%.

4.2.4.4 Recommended Mitigation Measures

No additional mitigation measures are recommended under Alternatives A, B, or C.

4.2.5 PALEONTOLOGICAL RESOURCES

4.2.5.1 Alternative A – No Action Alternative

Impacts to paleontological resources under the No Action Alternative would be similar in nature to those described below under the Proposed Action. Under the No Action Alternative, XTO would continue to develop the necessary infrastructure in order to drill 128 wells previously approved under EA No. 1997-49, accounting for approximately 332 acres of disturbance. Although the number of new well pads and roads under this alternative would be similar to the Proposed Action, the overall surface disturbance would be approximately 70 percent less. It should be noted that under the No Action Alternative, site-specific impact analyses, including site-specific paleontological resource clearances, would be conducted prior to development during the APD process.

4.2.5.2 Alternative B – Proposed Action

The Uinta and Green River Formations are categorized as Class 4a (high) paleontological formations. Class 4 formations are known to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils. Surface-disturbing activities, such as site and road construction, and secondary surface activities, such as vehicular and pedestrian traffic, can irreversibly damage or destroy sensitive paleontological resources and result in the loss of scientifically important fossils. Alternatively, construction of well pads, access roads, and pipeline corridors may have a positive effect by uncovering or revealing scientifically important fossils.

Where surface-disturbing activities occur on previously disturbed areas, fossil resources would not be affected. However, where surface disturbance is proposed on undisturbed areas, paleontological resources could be at risk. Where fossils occur on the surface within these areas, they may potentially be broken or destroyed during surface-disturbing activities. Disturbance of bedrock for the construction of reserve pits and access roads also results in the potential for exposing, breaking, and destroying fossils. However, as surveys for paleontological resources would be conducted prior to construction activities, these impacts would be reduced or eliminated.

4.2.5.3 Alternative C – Surface Gas Lines

Impacts to paleontological resources under Alternative C would be identical in nature, but slightly less in extent than those described above under the Proposed Action. As all gas lines would be surface-laid under Alternative C, total surface disturbance in the RBU Project Area would be approximately 32 percent less than under the Proposed Action. As such, the overall potential for exposure of, or damage to, fossils during excavation or construction activities would be less under Alternative C. Further, as surveys for paleontological resources would be conducted prior to any surface disturbance and appropriate mitigation measures would be taken if fossils are discovered (during surveys or excavation), potential impacts to fossil resources in the Uinta Formation would be reduced or eliminated.

4.2.5.4 Recommended Mitigation Measures

- If significant paleontological resources are discovered during the surveys, the AO would recommend a mitigation plan which could include avoidance of the site, salvage of fossil materials, or monitoring of construction activities.

4.2.6 SOIL RESOURCES

Soils in the RBU Project Area, as described in **Section 3.2.6**, are generally rated poor in reclamation potential. Impacts to soils are typically described in terms of short-term (or initial) and long-term (or residual) impacts. In disturbed areas where interim reclamation is implemented, ground cover by herbaceous species could potentially re-establish within 5 to 7 years following seeding of native plant species and diligent weed control efforts, consequently reducing soil erosion. These reclaimed areas have often been referred to as short-term disturbances. However, it is important to note that all surface disturbances could remain as long-term (or even permanent) impacts on the landscape if reclamation efforts are not successful.

4.2.6.1 Alternative A – No Action Alternative

Impacts to soil resources under the No Action Alternative would be similar in nature to those described below under the Proposed Action. Under the No Action Alternative, XTO would continue to develop the necessary infrastructure in order to drill 128 wells previously approved under EA No. 1997-49, resulting in a total of approximately 332 acres of disturbance. Although the number of new well pads and roads under this alternative would be similar to the Proposed Action, the overall surface disturbance would be approximately 70 percent less. As such, the potential for ground disturbing activities to impact soil resources in the RBU Project Area would be lower. It should be noted that under the No Action Alternative, a site-specific review would be conducted for each well prior to development during the APD process.

4.2.6.2 Alternative B – Proposed Action

The Proposed Action would cause disturbance of soil for construction and expansion of well pads, roads, and pipelines. Potential impacts to soils would primarily include increased wind and water erosion from the removal of vegetation; mixing of soil horizons; soil compaction; and destruction of biological soil crusts. In addition, increased natural gas facilities in the RBU Project Area would increase the potential for contamination of soils with petroleum products, fuels, or produced water.

Erosion and Sedimentation

Previous oil and gas development in the RBU Project Area has disturbed approximately 1,461 acres. Construction activities associated with the Proposed Action would disturb an additional 1,103 acres of soils. Therefore, the total surface disturbance within the RBU Project Area would increase to 2,564 acres, or about 15 percent of the total surface area in the RBU Project Area.

The primary effect of surface disturbances on soil resources is increased erosion and the resulting potential increase in sediment yield. Erosion would be particularly evident if project related activities are conducted during wet or muddy periods. The increased erosion of soils could potentially lead to increased loss of vegetative cover and increased sedimentation in ephemeral drainages, Willow Creek, the Green River and/or ephemeral drainages. The actual amount of additional sedimentation that would reach the drainages in the RBU Project Area depends on the effectiveness of the reclamation and erosion control measures and natural factors, including the water available for overland flow; the texture of the eroded material, the amount and kind of ground cover; the shape, gradient, and length of the slope; and surface roughness (Barfield et al 1981).

Soil Contamination

Sources of potential contamination include leaks or spills of natural gas condensate liquids from wellheads, gas and water lines, produced water sumps, and condensate storage tanks. To reduce the potential for hydrocarbon contamination of soils, gas lines and water lines would be designed to minimize the potential for spills and leaks. Storage tanks would be surrounded by berms capable of holding at least 110 percent of the largest single tank volume. Leaks or spills of saline water, hydrofracturing chemicals, fuels, and lubricants could also result in soil contamination. Depending on the size and type of spill, the effect on soils would primarily consist of the potential loss of soil productivity. Implementation of the project SPCC plan would minimize the risk of such spills by providing safeguards against spills and detailing reporting and cleanup measures to

be taken in the event of a spill. Thus, the potential for impacts to soils from spills is considered to be minor.

Destruction of Biological Soil Crusts

Mapping of biological soil crusts has not been performed in the RBU Project Area. However, based upon the physical and biological characteristics of the existing soils, biological soil crusts could occur. In addition, to direct disturbances associated with construction activities, biological soil crusts are also vulnerable to vehicle traffic, livestock grazing, and pedestrian traffic. The fibers that compose the tensile strength of biological soil crusts are weak in comparison to the compressional strength placed on the crusts by machinery, human footprints, big game, and livestock. The impact of a given surface disturbance on biological soil crusts depends upon its severity, frequency, timing, and type, as well as the weather conditions during and after the disturbance (Belnap et al. 2001). Biological soil crusts occurring in the RBU Project Area have been disturbed primary by previous natural gas development as well as livestock grazing. Surface disturbances associated with the Proposed Action would add to these disturbances by breaking, overturning, and burying soil crusts to various degrees (Belnap et al. 2001). As stated in **Section 3.2.6,** it is assumed that biological soil crusts may occur across the entire Project Area, and therefore, the Proposed Action could result in the direct disturbance of 1,103 acres of biological soil crusts.

4.2.6.3 Alternative C – Surface Gas Lines

Impacts to soil resources under Alternative C would be similar in nature to those described under the Proposed Action. Although the number of well pads and associated infrastructure under this alternative would be similar to the Proposed Action, the overall surface disturbance would be approximately 32 percent less due to surface-laid gas line. Correspondingly, impacts to soils including biological soil crusts related to potential increase in erosion, sediment yield, and spills of hazardous material in the RBU Project Area would be proportionately less under Alternative C.

4.2.6.4 Recommended Mitigation Measures

- Reclamation techniques including, but not limited to, mulching, hydroseeding,erosion control blankets, and mychorrizal bacteria supplements would be utilized as directed by the AO.

4.2.7 VEGETATION INCLUDING SPECIAL STATUS PLANT SPECIES AND INVASIVE OR NOXIOUS WEEDS

4.2.7.1 Alternative A – No Action Alternative

Impacts to vegetation resources under the No Action Alternative would be similar in nature as those described below under the Proposed Action. Under the No Action Alternative, XTO would continue to develop the necessary infrastructure in order to drill 128 wells previously approved under EA No. 1997-49. Although the number of new well pads and roads under this alternative would be similar to the Proposed Action, the overall surface disturbance would be approximately 332 acres (or 70%) less than the Proposed Action. Of the 332 acres, 27 acres (or 8 percent) would occur as a result of expansion of existing surface disturbance, while 305 acres (or 92 percent) would occur as a result of new surface disturbance (**Table 4-18**). It should be noted that under the No Action Alternative, impact analyses, including site-specific T&E plant clearances,

would be conducted for each well prior to development during the APD process. As such, implementation of the No Action ***"may affect, is not likely to adversely affect"*** the clay reed-mustard and the Uinta Basin hookless cactus.

Table 4-18. Surface Disturbance by Vegetation Community for Alternative A[1]

Vegetation Community	Acres w/in RBU Project Area	Existing Disturbance w/in RBU Project Area	Loss of Acres due to Alternative A			% of Acres within RBU Project Area Disturbed by Alt A
			Surface Disturbance due to Expansion of Existing Disturbance	Surface Disturbance due to New Disturbance	Total Surface Disturbance Under Alt. A	
Desert Shrub	11,336	1,074	25	115	140	1 %
Sagebrush	1,234	86	0	33	33	3 %
Badland/Rock Outcrop	64	1	0	0	0	0 %
Greasewood	18	0	0	0	0	0 %
Unknown (Tribal land)	4,075	298	1	158	159	4 %
Total	**16,719**	**1,461**	**26**	**305**	**332**	**8%**

[1]Totals in this table reflect actual surface disturbance numbers, however, due to rounding errors associated with GIS data analyses, the totals of each row/column may not equal this amount.

4.2.7.2 Alternative B - Proposed Action

General Vegetation

Under the Proposed Action, a maximum of 1,103 acres of existing vegetation would be removed in the RBU Project Area. Of this, approximately 786 acres (or 71 percent) would result from expansion of existing development, while 317 acres (or 29 percent) would occur as a result of new surface disturbance. **Table 4-19** provides a breakdown of disturbance by vegetation community from the Proposed Action.

Table 4-19. Surface Disturbance by Vegetation Community for the Proposed Action[1]

Vegetation Community	Acres w/in RBU Project Area	Existing Disturbance w/in RBU Project Area	Loss of Acres due to the Proposed Action			% of Acres within RBU Project Area lost due to Proposed Action
			Surface Disturbance due to Expansion of Existing Disturbance	Surface Disturbance due to New Disturbance	Total Surface Disturbance Under the Proposed Action	
Desert Shrub	11,336	1,074	586	119	705	6 %
Sagebrush	1,234	86	42	35	77	6 %
Badland/Rock Outcrop	64	1	1	0	1	2 %
Greasewood	18	0	0	0	0	0 %

Vegetation Community	Acres w/in RBU Project Area	Existing Disturbance w/in RBU Project Area	Loss of Acres due to the Proposed Action			% of Acres within RBU Project Area lost due to Proposed Action
			Surface Disturbance due to Expansion of Existing Disturbance	Surface Disturbance due to New Disturbance	Total Surface Disturbance Under the Proposed Action	
Unknown (Tribal land)	4,075	298	158	163	321	8 %
Total	**16,719**	**1,461**	**787**	**317**	**1,104**	**22%**

[1]Totals in this table reflect actual surface disturbance numbers, however, due to rounding errors associated with GIS data analyses, the totals of each row/column may not equal this amount.

Vegetation removal and soil handling associated with the Proposed Action would have both direct and indirect impacts on vegetation resources. Direct impacts would include removal of vegetation and modification of species composition and structure. Indirect impacts may include increased potential for weed invasion, increased exposure of soils to accelerated erosion, increased potential for fugitive dust, and degradation and loss of topsoil and soil microorganisms. It is important to note that under the Proposed Action much of the surface disturbance would occur as an expansion of existing infrastructure. Because of the ecological edge effect, areas adjacent to previously disturbed areas have most likely changed and degraded over time, and may hold more exotic and invasive species than the surrounding undisturbed landscape (Hansen and Clevenger 2005; Rowley et al. 1999). Therefore, activities associated with the Proposed Action would most likely disturb already degraded vegetation communities with an existing exotic and invasive species component. Specific actions set out under the Proposed Action, such as revegetation of disturbed areas, controlling noxious weeds, and re-establishing soil conditions would reduce impacts to vegetation communities in the RBU Project Area. ACEPMs which include added weed control efforts, erosion controls, dust abatement, and measures that reduce soil impacts would further reduce impacts from the Proposed Action.

Invasive and Noxious Weeds

Roads provide a major conduit for the spread of exotic plants into natural areas, particularly in arid and semiarid landscapes of the American West (Gelbard and Belnap 2003). Clearing of vegetation and soils, addition of fill, and grading of roads and well pads would create areas of deep, bare soil that would be susceptible to exotic seed establishment (Trombulak and Frissell 2000). As such, these actions could lead to the transport and establishment of weeds throughout the RBU Project Area. Overall, the Proposed Action could increase establishment of invasive and noxious weeds, such as hoary cress (*Cardaria draba*), Russian knapweed (*Centaurea repens*), Russian thistle, halogeton, black henbane (*Hyoscyamus niger*), houndstongue (*Hieracium cynoglossoides*) and cheatgrass. Specific negative effects of noxious and invasive weeds can include: 1) reduction in the overall visual character of an area; 2) competition with, or elimination of native plants; 3) reduction or fragmentation of wildlife and threatened and endangered plant habitats; and 4) increased soil erosion (Gelbard and Belnap 2003). Approximately 108 miles of existing road are present in the Project Area. Under Alternative B, an additional 16 miles of road are proposed.

As XTO has committed to mitigation measures that include controlling and monitoring noxious weeds on disturbed sites, power-washing construction equipment and vehicles, and reclaiming/revegetating disturbed sites, the potential impacts described above would be minimized.

Special Status Plant Species

Under the Proposed Action, XTO would follow all special status plant conservation measures (**Appendix D**). The measures include pre-construction plant surveys and avoidance of occupied habitat for identified endangered or threatened plant species. As such, there would be no direct disturbance to the clay reed-mustard or the Uinta Basin hookless cactus as a result of the Proposed Action. Therefore, potential impacts would be limited to indirect impacts including loss or modification of potential habitat and illegal collection due to increased human access. These impacts are discussed in detail below.

Increased roadway infrastructure and vehicle traffic in the RBU Project Area could lead to a potential increase in illegal collecting of the Uinta Basin hookless cactus, loss/modification of suitable habitat due to the spread of invasive weed species, and an increase in fugitive dust. Illegal collection of the Uinta Basin hookless cactus, which is highly prized for its flowers, has been responsible for the loss of 200 to 300 individuals in Colorado (USFWS 1990). Weed species may compete with individual special status plants, potentially resulting in loss of individuals and degradation of suitable special status plant habitat. Fugitive dust from areas cleared of vegetation such as roadways may affect photosynthesis, respiration, transpiration and allow the penetration of phytotoxic gaseous pollutants (Farmer 1993).

Specific actions set out under the Proposed Action, including the ACEPMs, would reduce impacts to both special status plant species. These actions include: noxious and invasive species control and monitoring, use of existing roads when possible, minimizing new surface disturbance, dust abatement, and adherence to species-specific conservation measures (**Appendix D**). The species-specific conservation measures for all special status plant species include pre-construction surveys in potential habitat, avoidance of occupied habitat, use of buffers between surface activities and known populations of plants, limiting off-road travel, and monitoring the effectiveness of these measures.

Based on adherence to the above-mentioned actions and the limited potential habitat that exists in the RBU Project Area, the Proposed Action ***"may affect, is not likely to adversely affect"*** the clay reed-mustard and the Uinta Basin hookless cactus.

4.2.7.3 Alternative C – Surface Gas Lines

Impacts to vegetation resources under Alternative C would be similar in nature to those described under the Proposed Action. Although the number of well pads and associated infrastructure under this alternative would be similar to the Proposed Action, the overall surface disturbance would be approximately 32 percent less due to surface laid gas lines. In addition, 468 acres (or 63 percent) of the surface disturbance would occur as a result of expansion of existing surface disturbance, while 277 acres (or 37 percent) would occur as a result of new surface disturbance. **Table 4-20** provides a breakdown of disturbance by vegetation community from the Proposed Action.

Table 4-20. Surface Disturbance by Vegetation Community for Alternative C[1]

Vegetation Community	Acres w/in RBU Project Area	Existing Disturbance w/in RBU Project Area	Loss of Acres due to Alternative C			% of Acres within RBU Project Area lost due to Proposed Action
			Surface Disturbance due to Expansion of Existing Disturbance	Surface Disturbance due to New Disturbance	Total Surface Disturbance Under the Proposed Action	
Desert Shrub	11,336	1,074	349	102	452	4%
Sagebrush	1,234	86	25	32	58	5%
Badland/Rock Outcrop	64	1	1	0	1	2%
Greasewood	18	0	0	0	0	0%
Unknown (Tribal land)	4,075	298	94	142	236	6%
Total	**16,719**	**1,461**	**468**	**277**	**745**	**15%**

[1]Totals in this table reflect actual surface disturbance numbers, however, due to rounding errors associated with GIS data analyses, the totals of each row/column may not equal this amount.

4.2.7.4 Recommended Mitigation Measures

No additional mitigation measures are recommended for Alternative A, B or C.

4.2.8 WATER RESOURCES

4.2.8.1 Alternative A – No Action Alternative

Potential impacts to water resources under the No Action Alternative would be similar in nature as those described below under the Proposed Action. Under the No Action Alternative, XTO would continue to develop the necessary infrastructure in order to drill 128 wells previously approved under EA No. 1997-49, resulting in a total of 332 acres of surface disturbance. Although the number of new well pads and roads under this alternative would be similar to the Proposed Action, the overall surface disturbance would be approximately 70 percent less, with a corresponding decrease in the magnitude of potential impacts to surface water. It should be noted that under the No Action Alternative, site-specific impact analyses would be conducted for each well prior to development during the APD process.

4.2.8.2 Alternative B – Proposed Action

Surface Water

Potential impacts to surface water resources in the RBU Project Area from the Proposed Action include:

- Increased sedimentation and turbidity of surface water as a result of surface disturbance and increased sediment delivery into streams via runoff;
- Increased sediment loading to the Green River and Willow Creek, potentially increasing salinity levels in the Colorado River system;

- Adverse effects on surface water quality – e.g., potential contamination of surface water resources from spills or discharges of drilling fluids, petroleum, dust suppressants, or other chemicals used for natural gas drilling and production activities;
- Depletion of stream flows in the Green River from the removal of water for drilling operations;
- Physical disturbances to surface water features from road and gas line crossings; and
- Direct and indirect impacts to floodplains.

The magnitude of these potential impacts depends on several factors, including the proximity of surface disturbances to ephemeral tributaries of Willow Creek and the Green River, slope aspect and gradient, soil type, the duration and timing of the construction activity, and the success or failure of reclamation and mitigation measures. The potential for adverse impacts to surface water resources would be greatest during project construction activities and would likely decrease in time due to natural stabilization, interim and final reclamation, and revegetation efforts. Coordination with the Army Corps of Engineers would occur as necessary.

Increased Sedimentation

Slightly increased erosion and subsequent increased sedimentation of Willow Creek and ephemeral drainages within the RBU Project Area is possible. The increased erosion could also potentially lead to an increase in turbidity and salinity in the Green River. Both of these effects could have negative impacts on aquatic habitat within affected drainages.

The actual amount of sediment that would be transported to the ephemeral drainages within the RBU Project Area and on to Willow Creek and the Green River depends on natural factors and the effectiveness of the erosion control devices employed, but is expected to be minimal based the generally flat nature of the RBU Project Area. Natural factors which attenuate the transport of sediment into creeks include water available for overland flow, the texture of the eroded material, the amount and kind of ground cover, the slope shape, gradient, and length, and surface roughness (Barfield et al 1981).

The erosion control measures employed would be of two types: non-structural controls, and structural controls. Non-structural controls include proper clearing, grading, and construction practices, including surface roughening. Structural erosion control devices (e.g., water bars, silt fences, sedimentation ponds, etc.) would be used as necessary to minimize the amount of sediment that reaches any ephemeral drainage in the RBU Project Area. The erosion control devices used would be specified during the APD process for each well pad.

Water Use and Stream Flow Regimes

Water would be obtained from the existing springs, groundwater wells, and surface water diversion points listed in **Table 2-3**. Approximately 21,000 barrels of water (2.7 acre-feet) would be needed to drill and complete each well. Thus, the total water use for the drilling of all 484 wells would be approximately 1,307 acre-feet over the 8-year development period (between 100 and 251 acre-feet per year). In addition, approximately 775 barrels (0.1 acre-feet) of water per well pad could be utilized for dust abatement each year. As such, water utilized for dust abatement for a maximum of 398 well pads and associated roads could be approximately 12,338,000 barrels (1,592 acre-feet) over a 40-year project life (40 acre-feet/year). Based upon these water use estimates, the maximum annual amount of water depleted from the Green River

would be approximately 291 acre-feet. The average annual flow in the Green River at Ouray is about 4,064,290 acre-feet (based on flow data from the USGS gauging station at Ouray). Therefore, even if it is assumed that the all water used depletes the flow in the river, the Proposed Action would deplete the flow by a maximum of only 0.007 percent per year. Due to the minimal nature of this depletion, no changes in stream flow regimes are likely to occur.

Increased Runoff

Soils compacted on well pads and roads contribute slightly greater runoff than undisturbed sites. The increased runoff could lead to slightly higher peak flows in the ephemeral streams in the RBU Project Area and Willow Creek, potentially increasing erosion of the channel banks. The increased erosion could lead to slightly increased turbidity in these streams during storm events.

Water Quality

Contamination of surface water can occur in oil and gas fields. Sources of potential contamination include leaks from wellheads, gas lines, water lines, produced water and condensate storage tanks, and tanker trucks. Leaching of contaminants from impacted soils near these facilities also has the potential to contaminate surface water. In addition to leaks from facilities, accidental spills of hydrocarbon products, including fuels and petroleum products produced by the wells, would have the potential to contaminate surface waters if the spills were to occur directly into a stream or when runoff is present that could transmit these fluids to the ephemeral washes of the RBU Project Area. The Proposed Action would increase the chance for such an occurrence due to the higher levels of drilling activity.

Groundwater

Groundwater exists in shallow unconsolidated alluvium along ephemeral washes and in deeper bedrock formations beneath the RBU Project Area. Spills of fuels or produced fluids have the potential to contaminate groundwater resources, especially the shallow alluvial groundwater. Spills from facilities located adjacent to ephemeral washes and Willow Creek would have the greatest potential to contaminate groundwater.

Floodplains

Floodplains are protected by Executive Order 11988 which requires that all Federal agencies take action to reduce the risk of flood loss; to minimize the impact of floods on human safety, health, and welfare; and to restore and preserve the natural and beneficial values served by floodplains. Potential impacts to floodplains from the Proposed Action include increased sedimentation, pollution of surface water or shallow groundwater due to accidental spills or loss of containment of petroleum products, fuels and other chemicals, and damage to or loss of riparian vegetation. Eight proposed well pads and associated roads and pipeline would be constructed on the Willow Creek floodplain. In addition, three existing wells pads located in the Willow Creek floodplain would be expanded. Estimated surface disturbance in the Willow Creek floodplain associated with this development would be approximately 41 acres. All proposed construction activities occurring in the Willow Creek floodplain would be located on Tribal lands. If wetlands are encountered, the Operator would consult with the Army Corps of Engineers to determine if a permit is necessary.

While there is no published information available, riparian areas are known to exist in isolated areas along the Willow Creek floodplain. As mentioned above, all proposed construction

activities occurring in the Willow Creek floodplain would be located on Tribal lands. As such, management prescriptions for these areas would be determined on a site-specific basis during onsites with the BLM and the Tribe.

4.2.8.3 Alternative C – Surface Gas Lines

Potential impacts to water resources under Alternative C would be similar in nature, but slightly less in extent than those described above under the Proposed Action. As all gas lines would be surface-laid under Alternative C, total surface disturbance in the RBU Project Area would be approximately 32 percent less than under the Proposed Action. Correspondingly, impacts to water quality and floodplain areas related to increased erosion, sedimentation, and changes to surface water runoff in the RBU Project Area would be proportionately less under Alternative C.

4.2.8.4 Recommended Mitigation Measures

No additional mitigation measures are recommended for Alternatives A, B, and C.

4.2.9 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

This section considers the socioeconomic impacts of implementing the Proposed Action and alternatives in terms of Tribal, State, and local government revenue as well as Tribal employment and employment within the regional economy.

Oil and gas development within the RBU Project Area has been occurring since the 1950s. During the past 10 years, approximately 173 wells have been developed in the RBU Project Area, which is an average of slightly more than 17 wells per year. If given approval, XTO could increase activity from its current level to the level described under the Proposed Action (an average of approximately 62 wells per year). Because drilling and production activity is ongoing within the RBU Project Area, some of the economic impacts described in this section would be a continuation of impacts rather than an addition of impacts. For example, implementation of the Proposed Action could result in a sustained level of employment and reinforced support for the oil and gas field services sectors, which is well established in both Uintah and Duchesne Counties.

4.2.9.1 Alternative A- No Action

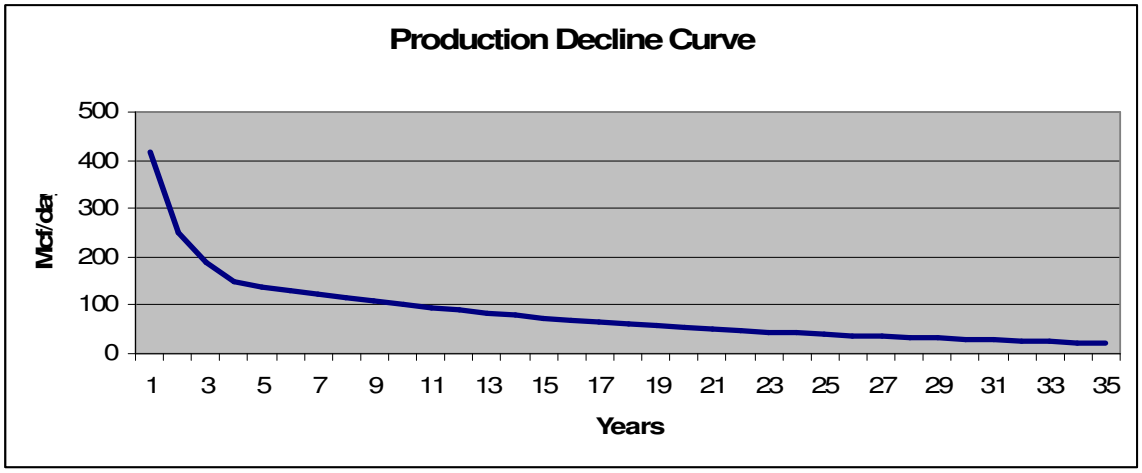
Under the No Action Alternative, XTO would drill 128 wells that were previously approved under EA No. 1997-49. Oil and gas extraction would likely continue at the present rate of development, which would sustain the current level of employment and reinforce support for an already established oil and gas field service sector in the local study area. Although Uintah and Duchesne Counties, the Ute Tribe, and the State of Utah would benefit from taxes and royalties generated by natural gas production in the RBU Project Area, the economic benefits would be substantially less than those that could potentially be generated by implementing the Proposed Action.

Under the Proposed Action, XTO would drill approximately 484 wells, or 74 percent more than under the No Action Alternative. For the purposes of analysis, it is assumed that total employment and the amount of taxes and royalties generated by production would be reduced in proportion to reductions in the amount of proposed development.

4.2.9.2 Alternative B- Proposed Action

For the Proposed Action, it is assumed that XTO would construct approximately 484 natural gas wells over an 8 year period. Average daily and annual production estimates for an individual well within the RBU Project Area were provided by XTO and are used as the basis for this economic analysis. As shown in **Figure 4-1**, production rates are greatest within the first three years of well development.

Figure 4-1. Production Decline for an Individual Well within the RBU Project Area



For the purposes of analysis, estimated annual average field production and estimated total field production were calculated by taking the production of an individual well (see **Figure 4-1**) and multiplying by the number of wells projected to be drilled during each year of the development phase (see **Table 2-1**). **Table 4-21** shows estimated annual field production and total field production over the LOP.

Table 4-21. Estimated Annual and Total Field Production under the Proposed Action

Year	2008 (Mcf)	2009 (Mcf)	2010 (Mcf)	2011 (Mcf)	2012 (Mcf)	2013 (Mcf)	2014 (Mcf)	2015 (Mcf)	Total (Mcf)
1	7,003,713								7,003,713
2	4,212,537	9,135,277							13,347,814
3	3,159,402	5,494,613	14,159,680						22,813,695
4	2,488,994	4,120,960	8,516,651	8,678,513					23,805,117
5	2,311,373	3,246,514	6,387,487	5,219,883	10,048,805				27,214,061
6	2,172,691	3,014,834	5,032,096	3,914,912	6,044,075	9,744,296			29,922,903
7	2,042,330	2,833,945	4,672,992	3,084,188	4,533,056	5,860,921	9,287,532		32,314,963
8	1,919,790	2,663,908	4,392,615	2,864,092	3,571,165	4,395,690	5,586,190	6,394,694	31,788,145
9	1,804,602	2,504,074	4,129,058	2,692,248	3,316,317	3,462,948	4,189,642	3,846,229	25,945,119
10	1,696,326	2,353,829	3,881,315	2,530,713	3,117,340	3,215,823	3,300,622	2,884,672	22,980,639
11	1,594,547	2,212,600	3,648,435	2,378,870	2,930,299	3,022,875	3,065,081	2,272,560	21,125,266
12	1,498,874	2,079,844	3,429,529	2,236,137	2,754,482	2,841,502	2,881,178	2,110,384	19,831,930
13	1,408,941	1,955,053	3,223,759	2,101,970	2,589,212	2,671,012	2,708,307	1,983,762	18,642,015
14	1,324,405	1,837,750	3,030,332	1,975,852	2,433,860	2,510,751	2,545,809	1,864,736	17,523,493
15	1,244,942	1,727,485	2,848,512	1,857,300	2,287,829	2,360,106	2,393,059	1,752,852	16,472,085
16	1,170,244	1,623,837	2,677,602	1,745,862	2,150,558	2,218,500	2,249,476	1,647,680	15,483,760

Year	2008 (Mcf)	2009 (Mcf)	2010 (Mcf)	2011 (Mcf)	2012 (Mcf)	2013 (Mcf)	2014 (Mcf)	2015 (Mcf)	Total (Mcf)
17	1,100,030	1,526,405	2,516,947	1,641,111	2,021,525	2,085,389	2,114,508	1,548,820	14,554,735
18	1,034,027	1,434,821	2,365,927	1,542,645	1,900,234	1,960,266	1,987,637	1,455,891	13,681,449
19	971,987	1,348,731	2,223,973	1,450,085	1,786,221	1,842,651	1,868,379	1,368,537	12,860,563
20	913,667	1,267,809	2,090,533	1,363,080	1,679,045	1,732,093	1,756,277	1,286,425	12,088,929
21	858,847	1,191,739	1,965,104	1,281,294	1,578,304	1,628,165	1,650,901	1,209,240	11,363,594
22	807,316	1,120,235	1,847,196	1,204,419	1,483,604	1,530,476	1,551,845	1,136,686	10,681,776
23	758,877	1,053,020	1,736,364	1,132,152	1,394,590	1,438,646	1,458,735	1,068,483	10,040,869
24	713,345	989,840	1,632,182	1,064,223	1,310,913	1,352,330	1,371,210	1,004,375	9,438,417
25	670,544	930,450	1,534,252	1,000,369	1,232,258	1,271,188	1,288,939	944,112	8,872,113
26	630,311	874,622	1,442,198	940,348	1,158,322	1,194,917	1,211,602	887,466	8,339,786
27	592,493	822,145	1,355,665	883,928	1,088,824	1,123,222	1,138,905	834,217	7,839,398
28	556,943	772,817	1,274,324	830,891	1,023,495	1,055,829	1,070,571	784,164	7,369,035
29	523,527	726,448	1,197,866	781,037	962,085	992,480	1,006,337	737,114	6,926,894
30	492,115	682,861	1,125,994	734,176	904,359	932,931	945,958	692,888	6,511,281
31	462,588	641,889	1,058,435	690,125	850,098	876,954	889,199	651,315	6,120,604
32	434,832	603,375	994,928	648,718	799,092	824,338	835,847	612,236	5,753,367
33	408,743	567,173	935,231	609,795	751,147	774,877	785,697	575,501	5,408,165
34	384,219	533,143	879,118	573,206	706,078	728,385	738,555	540,972	5,083,676
35	361,165	501,155	826,372	538,814	663,713	684,682	694,242	508,513	4,778,656
36		471,085	776,790	506,486	623,890	643,600	652,587	478,003	4,152,441
37			730,182	476,097	586,458	604,984	613,431	449,322	3,460,475
38				447,531	551,270	568,686	576,626	422,363	2,566,475
39					518,194	534,565	542,029	397,021	1,991,809
40						502,491	509,507	373,200	1,385,199
41							478,937	350,808	829,745
42								329,760	329,760
Total									**528,643,924**

Estimated annual production values presented in the table above were used to calculate the estimated value of production in the RBU Project Area. The estimated value of natural gas was derived by multiplying the annual gas field production by forecasted wellhead prices in the lower 48 states. All values are expressed in 2006 U.S. dollars. The estimated value of production under the Proposed Action would be an annual average of about $82.9 million and about $3.5 billion cumulatively (undiscounted).

Tribal and Public Revenues

Taxes, royalties, and other revenues generated by natural gas development in the RBU Project Area are directly tied to the value of gas produced, which varies with both the amount of production and price. As discussed in **Section 3.2.9**, revenues generated by natural gas development are important revenue sources for the Ute Tribe, Uintah County, and the State of Utah. **Table 4-22** includes a detailed summary of the estimated revenues that would be generated if the Proposed Action were selected. An explanation of each of these revenues is included after the table.

As discussed in **Section 3.2.9.3**, the RBU Project Area contains some split-estate. For confidentiality reasons, the mineral rights beneath Tribal lands have not been fully disclosed.

Based on sub-surface mineral ownership patterns, and for the purposes of analysis in this EA, it is assumed that of the wells proposed on Tribal land; approximately four percent would be on Tribal minerals, five percent on State minerals, and 91 percent on Federal minerals.

Public Revenues

Mineral Lease Royalties

Federal mineral lease royalties are collected from oil and gas extraction operations located on Federally-held minerals at a rate of 12.5 percent. Federal mineral leasing regulations require that 50 percent of royalties collected from mineral lease royalties are returned to the state of origin. Within the State of Utah, close to 80 percent of States revenue is returned to impacted counties through the Permanent Community Impact Fund (PCIF) or through county special service districts. As shown in **Table 4-22**, annual average mineral lease royalties on Federal lands would be approximately $9.1 million. Cumulative mineral lease royalties on Federal lands would be approximately $380.4 million.

Mineral lease royalties on State lands are also collected at a rate of approximately 12.5 percent. According to **Table 4-22**, annual average mineral lease royalties on State lands would be approximately $497,680 and cumulative mineral lease royalties on State lands would be approximately $20.9 million.

Table 4-22. Estimated Annual, Average, and Total Public and Tribal Revenues from the Proposed Action

Production Estimates and Values			Public and Tribal Revenues										
			Federal Mineral Royalty and State of Utah Appropriations (Dollars)					State Royalties and Revenues (Dollars)			Tribal Royalties and Revenues (Dollars)		
Year	Annual Field Production (mcf)	Total Production Value (Dollars)[1]	Total Federal Mineral Royalty	State of Utah (50% of Federal Mineral Royalty)	UDOT for Special Service Districts (40% of State Allocation)	PCIF (32.5% of State Allocation)	Department of Community and Cultural for Special Service Districts (5% of State Allocation)	SITLA Mineral Royalties	State Severance Tax	State Conservation Tax	Tribal Mineral Royalty	Tribal Severance Tax
1	7,003,713	46,154,466	5,040,068	2,520,034	1,008,014	819,011	40,951	276,927	1,846,179	92,309	332,312	110,771
2	13,347,814	87,962,095	9,605,461	4,802,730	1,921,092	1,560,887	78,044	527,773	3,518,484	175,924	633,327	211,109
3	22,813,695	150,342,253	16,417,374	8,208,687	3,283,475	2,667,823	133,391	902,054	6,013,690	300,685	1,082,464	360,821
4	23,805,117	156,875,724	17,130,829	8,565,415	3,426,166	2,783,760	139,188	941,254	6,275,029	313,751	1,129,505	376,502
5	27,214,061	179,340,663	19,584,000	9,792,000	3,916,800	3,182,400	159,120	1,076,044	7,173,627	358,681	1,291,253	430,418
6	29,922,903	197,191,932	21,533,359	10,766,680	4,306,672	3,499,171	174,959	1,183,152	7,887,677	394,384	1,419,782	473,261
7	32,314,963	212,955,609	23,254,753	11,627,376	4,650,951	3,778,897	188,945	1,277,734	8,518,224	425,911	1,533,280	511,093
8	31,788,145	209,483,876	22,875,639	11,437,820	4,575,128	3,717,291	185,865	1,256,903	8,379,355	418,968	1,508,284	502,761
9	25,945,119	170,978,332	18,670,834	9,335,417	3,734,167	3,034,010	151,701	1,025,870	6,839,133	341,957	1,231,044	410,348
10	22,980,639	151,442,413	16,537,511	8,268,756	3,307,502	2,687,346	134,367	908,654	6,057,697	302,885	1,090,385	363,462
11	21,125,266	139,215,506	15,202,333	7,601,167	3,040,467	2,470,379	123,519	835,293	5,568,620	278,431	1,002,352	334,117
12	19,831,930	130,692,416	14,271,612	7,135,806	2,854,322	2,319,137	115,957	784,154	5,227,697	261,385	940,985	313,662
13	18,642,015	122,850,876	13,415,316	6,707,658	2,683,063	2,179,989	108,999	737,105	4,914,035	245,702	884,526	294,842
14	17,523,493	115,479,820	12,610,396	6,305,198	2,522,079	2,049,189	102,459	692,879	4,619,193	230,960	831,455	277,152
15	16,472,085	108,551,039	11,853,773	5,926,887	2,370,755	1,926,238	96,312	651,306	4,342,042	217,102	781,567	260,522
16	15,483,760	102,037,976	11,142,547	5,571,273	2,228,509	1,810,664	90,533	612,228	4,081,519	204,076	734,673	244,891
17	14,554,735	95,915,702	10,473,995	5,236,997	2,094,799	1,702,024	85,101	575,494	3,836,628	191,831	690,593	230,198
18	13,681,449	90,160,748	9,845,554	4,922,777	1,969,111	1,599,902	79,995	540,964	3,606,430	180,321	649,157	216,386
19	12,860,563	84,751,109	9,254,821	4,627,411	1,850,964	1,503,908	75,195	508,507	3,390,044	169,502	610,208	203,403
20	12,088,929	79,666,039	8,699,531	4,349,766	1,739,906	1,413,674	70,684	477,996	3,186,642	159,332	573,595	191,198
21	11,363,594	74,886,081	8,177,560	4,088,780	1,635,512	1,328,854	66,443	449,316	2,995,443	149,772	539,180	179,727
22	10,681,776	70,392,902	7,686,905	3,843,452	1,537,381	1,249,122	62,456	422,357	2,815,716	140,786	506,829	168,943
23	10,040,869	66,169,323	7,225,690	3,612,845	1,445,138	1,174,175	58,709	397,016	2,646,773	132,339	476,419	158,806
24	9,438,417	62,199,168	6,792,149	3,396,075	1,358,430	1,103,724	55,186	373,195	2,487,967	124,398	447,834	149,278

Table 4-22. Estimated Annual, Average, and Total Public and Tribal Revenues from the Proposed Action

Production Estimates and Values			Public and Tribal Revenues										
			Federal Mineral Royalty and State of Utah Appropriations (Dollars)					State Royalties and Revenues (Dollars)			Tribal Royalties and Revenues (Dollars)	
Year	Annual Field Production (mcf)	Total Production Value (Dollars)[1]	Total Federal Mineral Royalty	State of Utah (50% of Federal Mineral Royalty)	UDOT for Special Service Districts (40% of State Allocation)	PCIF (32.5% of State Allocation)	Department of Community and Cultural for Special Service Districts (5% of State Allocation)	SITLA Mineral Royalties	State Severance Tax	State Conservation Tax	Tribal Mineral Royalty	Tribal Severance Tax
25	8,872,113	58,467,222	6,384,621	3,192,310	1,276,924	1,037,501	51,875	350,803	2,338,689	116,934	420,964	140,321
26	8,339,786	54,959,189	6,001,543	3,000,772	1,200,309	975,251	48,763	329,755	2,198,368	109,918	395,706	131,902
27	7,839,398	51,661,633	5,641,450	2,820,725	1,128,290	916,736	45,837	309,970	2,066,465	103,323	371,964	123,988
28	7,369,035	48,561,938	5,302,964	2,651,482	1,060,593	861,732	43,087	291,372	1,942,478	97,124	349,646	116,549
29	6,926,894	45,648,231	4,984,787	2,492,393	996,957	810,028	40,501	273,889	1,825,929	91,296	328,667	109,556
30	6,511,281	42,909,341	4,685,700	2,342,850	937,140	761,426	38,071	257,456	1,716,374	85,819	308,947	102,982
31	6,120,604	40,334,779	4,404,558	2,202,279	880,912	715,741	35,787	242,009	1,613,391	80,670	290,410	96,803
32	5,753,367	37,914,685	4,140,284	2,070,142	828,057	672,796	33,640	227,488	1,516,587	75,829	272,986	90,995
33	5,408,165	35,639,806	3,891,867	1,945,933	778,373	632,428	31,621	213,839	1,425,592	71,280	256,607	85,536
34	5,083,676	33,501,425	3,658,356	1,829,178	731,671	594,483	29,724	201,009	1,340,057	67,003	241,210	80,403
35	4,778,656	31,491,342	3,438,855	1,719,427	687,771	558,814	27,941	188,948	1,259,654	62,983	226,738	75,579
36	4,152,441	27,364,588	2,988,213	1,494,106	597,643	485,585	24,279	164,188	1,094,584	54,729	197,025	65,675
37	3,460,475	22,804,527	2,490,254	1,245,127	498,051	404,666	20,233	136,827	912,181	45,609	164,193	54,731
38	2,566,475	16,913,073	1,846,908	923,454	369,382	300,122	15,006	101,478	676,523	33,826	121,774	40,591
39	1,991,809	13,126,019	1,433,361	716,681	286,672	232,921	11,646	78,756	525,041	26,252	94,507	31,502
40	1,385,199	9,128,458	996,828	498,414	199,366	161,984	8,099	54,771	365,138	18,257	65,725	21,908
41	829,745	5,468,019	597,108	298,554	119,422	97,030	4,852	32,808	218,721	10,936	39,370	13,123
42	329,760	2,173,116	237,304	118,652	47,461	38,562	1,928	13,039	86,925	4,346	15,646	5,215
Total	**528,643,924**	**3,483,763,462**	**380,426,970**	**190,213,485**	**76,085,394**	**61,819,383**	**3,090,969**	**20,902,581**	**139,350,538**	**6,967,527**	**25,083,097**	**8,361,032**
Average Annual	**12,586,760**	**82,946,749**	**9,057,785**	**4,528,893**	**1,811,557**	**1,471,890**	**73,595**	**497,680**	**3,317,870**	**165,893**	**597,217**	**199,072**

[1]Total production value is based on annual field production multiplied by the average wellhead price of natural gas from the Energy Information Administration (EIA) between 2005 and 2009. EIA forecasts are in 2006 dollars.
Source: EIA 2006.

State Severance Tax

Utah Severance Tax (Utah Code 59-05) is paid to the Utah Tax Commission and promptly remitted to the State treasurer. With the exception of taxes collected on certain Indian lands, severance monies collected are credited to the General Fund, where it is subject to appropriation by the legislative process.

As discussed in **Section 3.9.2.1**, within Utah, natural gas severance tax rates are administered on a sliding scale basis. The rate is three percent of the value up to, and including, the first $1.50 per mcf and five percent of the value in excess of the first $1.50. There are several exemptions and stipulations for taxable value per the State Tax Commission's regulations. For example, the first $50,000 of annual production per well is tax exempt.

Despite the State's sliding rate structure for severance taxes, this analysis assumes that the effective State severance tax rate on XTO would be four percent.

In the Supreme Court case Cotton Petroleum Corporation v. New Mexico (490 U.S. 163), the court upheld the legality of imposing State severance taxes on production of oil and gas resources on Tribal lands by non-Indian lessees. Therefore, XTO would pay State and Tribal severance tax for development occurring on Tribal minerals within the RBU Project Area.

As shown in **Table 4-22**, XTO would pay an annual average of approximately $3.3 million in State severance taxes over the 42-year production LOP and $139.3 million cumulatively.

Conservation Fees

A conservation tax is collected by the Utah State Tax Commission at a rate of two-tenths of one percent (0.002) of the value of oil and gas produced, sold, or transported from any oil and gas field in Utah. Revenue generated from the conservation tax is paid to the Utah State Tax Commission and deposited into the State's general tax fund.

As shown in **Table 4-22**, on average, the State would collect approximately $165,893 annually in conservation fees over the LOP. Over the 42-year production life, XTO would pay approximately $6.9 million.

Sales and Use Taxes

Sales and use taxes on purchases of taxable goods in the region would also be collected in Uintah County. Some purchases made by XTO, plus retail purchases by contractors and the holders of secondary jobs, would generate sales tax revenues. Sales taxes are an important revenue source for Utah local government. There is insufficient information available to estimate the amount of sales and use taxes that would be generated by the Proposed Action.

Tribal Revenues

Tribal Mineral Royalties

Tribal royalty rates can vary from approximately 12.5 percent to 25 percent. For calculation purposes, an average royalty rate of 18 percent was used. As shown in **Table 4-22**, if the

Proposed Action were implemented, the Ute Tribe would collect an annual average of $597,217, and a cumulative amount of $25 million, over the production LOP.

Tribal Severance Tax

Severance taxes are also paid to the Ute Tribe for all oil and gas, produced, sold, or transported from Tribal minerals at rate of approximately six percent. Within the RBU Project Area, the Tribe would collect an annual average of $199,072 over the production LOP, which equals approximately $8.3 million cumulatively.

Surface-Use Agreements

In cases where mineral and surface ownership are held in split estate, mineral developers (XTO) and the surface land owner (Ute Tribe) may enter into a surface use agreement. The specific details of a surface use agreement are negotiable.

In general, the compensation agreed upon through surface use agreements exceeds the direct and indirect financial losses that occur from surface disturbance. Some agreements may specify that the land owner would collect an overriding royalty interest (ORI) payment, in which case a certain percentage of oil and gas revenue would be paid to the Tribe. In other cases, the Tribe may collect surface use and damage payments on a per acre or annual basis. Because surface use agreements are confidential, no attempt has been made to calculate what revenues would be created for the Tribe.

Employment

Uintah and Duchesne County

For the Proposed Action, an IMPLAN (Impact Analysis for Planning) economic model was used to estimate the impacts that could occur in Uintah and Duchesne Counties as a result of implementing this project. The IMPLAN software automatically integrates economic data from both counties into a single economic unit known as a study area. The benefit of this approach is that the interaction between counties is captured in the economic analyses. The limitation is that it is that impacts cannot be apportioned to individual counties within the study area. Based on the location of this project, the level of impact to Uintah County would be larger than the impacts to Duchesne County. Nonetheless, by including Duchesne County, the majority of the impacts that would occur from oil and gas development in the RBU Project Area are taken into consideration.

Employment estimates for construction, drilling, completion, and production activities which provide the basis of the analysis were provided by XTO. Many of the personnel employed in different phases of the project would not be full-time, but would be employed for short periods of time as needed. For the modeling exercise, the employment estimates for each phase were converted into full-time equivalent employment by dividing by 2,080 (average hours worked by one employee in a year) or 260 (average days worked by one employee in a year), as appropriate.

Employment numbers for each phase are also presented as annual averages. As was shown in **Table 2-1**, the number of wells drilled each year could vary during the development phase. Therefore, employment would be the highest during peak-development. **Table 4-23** shows the average full-time equivalent employment required for each phase of the project.

Table 4-23. Average Annual Equivalent Full-Time Employment

Project Phase	Full-Time Equivalent Employment[1]
Development	
Pre-Construction	7
Construction	35
Drilling	133
Completion	84
Total	**259**
Production	
Total Production[2]	45

[1]Full-time equivalent employment includes both direct employment by XTO and employment by XTO contractors.
[2]Production employment includes employment associated with production activities as well as with workovers.

Employment numbers presented in **Table 4-24** were used to estimate the direct effects of the Proposed Action. However, the direct effect is just the beginning of the economic impacts. For example, if the Proposed Action were implemented, XTO would need materials, supplies, and services from other businesses in order to produce oil and gas. These suppliers would also need to purchase materials and supplies needed by their businesses. The sum of these increases in spending for materials, equipment, and supplies from businesses to other businesses is the indirect effect. Finally, wages and salaries paid to workers in the oil and gas industry and their supplier industries generate household expenditures for items such as housing, food, and utilities. This is the induced effect. As personal income rises, households spend more on housing, food, transportation, clothing, entertainment, and other items, which stimulates the local economy. **Table 4-11** shows total estimated employment impacts from implementation of the Proposed Action.

Table 4-24. Estimated Average Annual Employment during the Development and Production Phase

Project Phase	Employment	
Development	Direct Employment	259
	Indirect Employment	60
	Induced Employment	103
	Total	**422**
Production	Direct Employment	45
	Indirect Employment	8
	Induced Employment	19
	Total	**72**

As was shown in **Table 3-17**, in 2006, total employment across all non-agricultural sources of employment in the study area was approximately 19,877. Based on employment projections shown in **Table 4-24**, during the development phase, total employment would increase by approximately 2.1 percent.

Study area information contained within the IMPLAN data shows that the total value of all employment sectors within the study area is approximately 2.7 billion dollars annually. The addition of 422 jobs during the development phase would add 50.5 million dollars into the study area annually, which is approximately two percent.

Ute Tribe

Projected employment effects due to the Proposed Action have not been quantified in this analysis due to the lack of available data. However, it should be noted that the Ute Tribe passed a "Contracting Preference Ordinance" in 1992 which "is intended to facilitate and enhance economic opportunities for businesses owned and operated by members of the Ute Indian Tribe by establishing a procedure by which enterprises doing business with the Tribe on the Reservation may locate and contract and subcontract with member-owned businesses." More specifically, the Ordinance would generally obligate XTO by contract, lease, or other agreement to employ, to the greatest extent possible, Tribal members and to contact and subcontract with Tribally owned businesses. The Ordinance requires any employer conducting work on the Reservation to give preference in awarding contracts and subcontracts to Indian-owned businesses that have been certified by the Ute Employment Commission. Indian preference means that qualified Indian-owned businesses and individuals would be hired before qualified non-Indian individuals and businesses.

In addition, as required by the Tribe, XTO would post a notice of staking at the BIA office for five days during which time Tribal members could apply for jobs in the RBU Project Area. If qualified, Tribal members would be given preference over non-members.

Population and Housing

As shown in **Table 4-24**, average annual employment (direct, indirect, and induced) during the development phase would be approximately 422 full-time equivalents. However, it should be noted that employment could be approximately 33 percent (561 full-time equivalents) higher during peak development. Actual employment would fluctuate with drilling patterns throughout the development phase. In order to conduct an impact analysis that is representative of the various phases of oil and gas development, population and housing demand were calculated during the peak year of development *and* the average year of development.

Total population increase due to implementation of the Proposed Action was estimated by calculating a population to employment ratio. Based on data from Utah's DEA as presented in **Section 3.2.9.1**, every one employee in the study area represents 1.5 individuals in the general population. Therefore, an employment increase of 422 full time equivalents during an average year of well development implies an annual population increase of 621 individuals in the study area. Likewise, adding 561 jobs to the economy during a peak development year would create an estimated population increase of 826 individuals. Based on a 2008 population of 16,196 in the study area, the population increase from the Proposed Action represents 1.3 to 1.8 percent of the current population.

The above analysis can be extended further to forecast the increase in housing demand as a direct result of a population increase in the study area. Data in **Section 3.2.9.1** show an average of 2.9 persons per household in Uintah and Duchesne Counties. Based on a population increase of between 621 and 826 individuals per year, there would be a demand for between 212 and 282 housing units in the study area. **Table 4-25** below summarizes the demographic impacts to the study area from the Proposed Action.

Table 4-25. Demographic Impacts to the Study Area from the Proposed Action

	Annual Peak Development	Average Development
Employment Increase	561	422
Population Increase	826	621
Demand for Housing Units	282	212

According to DEA projections, from 2008 to 2015 (the 8-year development phase), the average annual increase in housing units would be 2.3 percent. Numerically, this equates to approximately 341 new housing units a year. The Proposed Action would increase annual demand for housing units over forecasted levels by approximately 212 to 282 housing units, or 1.3 to 1.7 percent.

It should be noted that housing demand due to oil and gas development is likely implicit in the State's projection models. A proportion of the 341 housing units in the study area are likely a result of forecasted oil and gas development. However, in order to provide the most conservative analysis, it was assumed that the Proposed Action would create an additive impact to the State's forecasted housing units.

As previously discussed, for this analysis, employment estimates were converted into full-time equivalent employment. However, it should be recognized that many personnel would not be employed full-time, but would be employed for short periods of time, as needed. Short-term employment, as well as a fluctuating pattern of economic activity during the development phase, would lead to a demand for temporary housing (e.g., motel rooms and RV spaces).

Current housing stock in both Duchesne and Uintah Counties totals approximately 15,570. The annual demand for housing generated from the Proposed Action represents between 1.4 and 1.8 percent of the current housing stock. The ability of the current housing market to meet the increased demand for housing depends on a multitude of factors including housing vacancy rates, new residential construction rates. According to the 2000 U.S. Census, the combined vacancy rate in Uintah and Duchesne Counties was 20 percent. For comparison purposes, the State of Utah and the nation as a whole had residential vacancy rates of 8.8 and 9.0 percent, respectively (U.S. Census Bureau 2000f). Therefore, at the time the housing vacancy rate in the study area was considerably higher than the State and the nation.

Sixty-six percent of vacant housing units in the study area in 2000 were for seasonal, recreational or occasional use. This proportion is significantly higher than the vacant temporary housing in the State and the nation (37 and 46 percent, respectively) (U.S. Census Bureau 2000h). This characteristic of the vacant housing units in the study area likely reflects the transient nature of oil and gas workers. Census data also reveal that 35 percent of vacant housing units in 2000 were mobile homes and another 23 percent were boats, RVs, vans, etc. (U.S. Census Bureau 2000g). These housing unit types are often ideal for oil and gas employees. Therefore, the housing demand created by the Proposed Action could partially be filled by existing vacant units. The vacant housing units together with new construction and motel rooms would likely fulfill the demand for housing created by the Proposed Action.

While census data is the best available source of data, it should be noted, that oil and gas development has dramatically increased in the Uinta Basin since the 2000 census; therefore, housing information including vacancy rates may be inaccurate. Contrary to what census data shows, empirical observations by Uintah County officials suggest that there is a shortage for both short- and long-term housing. In recent years, demand has significantly increased, predominately

due to increased oil and gas activity within the Uinta Basin. An informal poll of local motel and restaurant owners indicates that as many as 85 to 90 percent of their current users are oil and gas affiliated with occupancy rates being nearly 100 percent. To address the issue, Uintah County is in the process of conducting a formal study on the availability of both short- and long-term housing and impacts that changes in the housing market have had on local residents as well as temporary employees (Hoyt 2006).

Social Impacts

As discussed in the preceding section, implementation of the Proposed Action would lead to an increase in transient workforce and population within Uintah and Duchesne Counties.

Research provides empirical support that increases in population can have a disruptive effect on the social well-being of some segments of the local population within a rural community. Negative social consequences could include: a collapse of informal social structures; conflict and tension between advocates and opponents of growth; the absence of social integration; changes in neighboring ties; decreases in community satisfaction, and deteriorating quality of life.

On a more specific level, rural communities impacted by boom periods have observed increases in school drop out rates, juvenile delinquency, criminal activity, domestic/family violence, and drug and alcohol problems, which can in turn affect police and social services (Smith et al 2001).

A 2001 study which focused on patterns of population change in four rural communities that have experience extremely rapid growth due to energy-related development in the past, showed that social disruptive effects may not be permanent. As stated in the study, the disruptive effects associated with boom growth dissipate in the years after the boom phase has ended, with no evidence of lasting disruption. Vernal, which is the largest community with multi-county study area, was one of the communities evaluated in the study (Smith et. al 2001).

Environmental Justice

Information contained in **Table 3-20** show that the members of the Ute Tribe located on the Uintah and Ouray Indian Reservation constitute both a minority and low income population.

In the memorandum that accompanied Executive Order 12898, the President specifically recognized the importance of procedures under NEPA for identifying and addressing environmental justice concerns. The memorandum particularly emphasizes the importance of NEPA's public participation process, direction "each agency shall provide opportunities for community input in the NEPA process."

As discussed in **Section 6.2** and **Section 6.3**, Native American Tribes with cultural ties to the Uinta Basin, including the Ute Tribe, were consulted during the scoping process for this EA. In addition, public scoping was conducted in compliance with CEQ regulations.

Although Tribal lands are included in the RBU Project Area, there are no Tribal members living on, or adjacent to, these lands. Minority and low-income populations within the Tribal communities of Fort Duchesne, White Rocks, and Randlett would not be disproportionately adversely affected by implementation of the Proposed Action.

The economic effects of development in RBU Project Area would be positive for the Ute Tribe. Tribal severance tax would benefit individuals needing Tribal services, such as housing,

educational assistance, loans, and social services. Tribal minerals revenue also benefits Tribal households because the Tribe makes per capita payments to enrolled members.

In addition, the Ute Contracting Preference Ordinance requires that employers give preference to qualified Tribal contractors and subcontractors before employing non-Indians.

In terms of health and safety, it should be realized that natural gas development and production are inherently hazardous activities. As such, Tribal employees are likely to be exposed to the occupational hazards associated with construction, drilling, completion, and production activities in proportion to their positions of employment.

4.2.9.3 Alternative C- Surface Gas Lines

Socioeconomic impacts under Alternative C would be identical to those described under Alternative B.

4.2.9.4 Recommended Mitigation Measures

No mitigation measures are necessary for socioeconomic resources under Alternatives A, B, or C.