Appendix 9
GIS Methodology

Following are further descriptions of how Federal lands were assigned into the nine categories referred to in Table 2-8 and a detailed description of the GIS methodology used.

Based upon guidance from BLM and FS offices, Table A9-1 shows the NLA/LUP jurisdictions within the Inventory area.

Table A9-2 shows how agency jurisdictions were used to categorize lands for this Inventory.

While GIS files were available to define most of the access categories, for the NLA/LUP category, they had to be created. To accomplish this, an administrative boundary (such as a National Forest) was extracted

Table A9-1. Jurisdictions Classified as NLA/LUP

Jurisdiction	Comments
Anchorage, AK, BLM Field Office	
Ashley NF	Northern unit only
Battle Mountain, NV, BLM Field Office	Shoshone-Eureka and Caliente areas only
Bitterroot NF	
Bridger-Teton NF	Areas east of of Highway 189
Corps of Engineers	Black Warrior Basin
Custer NF	
Deerlodge NF	
Department of Defense	Selected areas in the Denver Basin
Dixie NF	
Ely, NV, BLM Field Office	Schell and Caliente areas only
Fairbanks BLM Field Office	Northeast and Southern NPRA only
Finger Lakes NF	
Fish Lake NF	
Flathead NF	
Gallatin NF	
Helena NF	
Kootenai NF	
Lewistown, MT, BLM Field Office	Western portion only
Lolo NF	
Milwaukee BLM Field Office	All Federal subsurface interests
San Juan NF	
Santa Fe NF	
Sawtooth NF	
Ten Thousand Islands FWS	
Uinta NF	Unmapped western portions only
Wasatch-Cache NF	Western portion only
White River, CO, BLM Field Office	Roan Plateau area only

Table A9-2. Federal Land Categorization

Federal Land Management		Categorization	Level
Bureau of Land Management	BLM	Subject to stipulations	
Bureau of Reclamation	BOR	Subject to stipulations	
Department of Agriculture*	USDA	No Leasing (Administrative), general category (NLA)*	2
Department of Defense**	DOD	No Leasing (Administrative), general category (NLA)**	2
Federal Split Estate	SPLIT	Subject to stipulations	
Fish and Wildlife Service	FWS	No Leasing (Administrative), general category (NLA)	2
USDA Forest Service	FS	Subject to stipulations	
Miscellaneous Federal Land Managers (DOE, DOJ, DHS, etc.)		On Advisement from Office	
National Park Service	NPS	No Leasing (Statutory/Executive Order), (NLS)	1
Federal Land Use Designations			
Inventoried Roadless Areas	IRA	Subject to stipulations	
National Conservation Areas	NCA	No Leasing (Statutory/Executive Order), (NLS)	1
National Monuments	NM	No Leasing (Statutory/Executive Order), (NLS)	1
National Recreation Areas	NRA	No Leasing (Statutory/Executive Order), (NLS)	1
National Wildlife Refuges	NWR	No Leasing (Statutory/Executive Order), (NLS)	1
Special Designated Areas	SDA	No Leasing (Statutory/Executive Order), (NLS)	1
Wilderness Areas	WILD	No Leasing (Statutory/Executive Order), (NLS)	1
Wilderness Reinventory Areas	WRA	Subject to stipulations	
Incorporated Towns and Cities	ITC	No Leasing (Statutory/Executive Order), (NLS)	1
Wilderness Study Areas	WSA	No Leasing (Statutory/Executive Order), (NLS)	1

* *Ft. Keo Agricultural Experimental Station, MT, only*

** *Except for the Naval Petroleum Reserve, Casper Field Office, which is subject to stipulations*

from the surface ownership data and the resultant polygon was then attributed as NLA/LUP as appropriate. For example in Figure A9-1, the Wasatch-Cache National Forest boundary in the Wyoming Thrust Belt is shown in green. The grey represents the area within the forest that is undergoing land use planning, which is categorized as NLA/LUP in the Inventory.

A9.1 Stipulation Exceptions

Exceptions (also including waivers and modifications) to stipulations are sometimes granted. For example, a crucial elk winter range timing limitation exception may be granted if seasonal conditions (e.g., an early spring and snowmelt) are such that the elk have moved out of and are not using the general areas during a particular year. Because proper records of exceptions to lease stipulations are not available to address this issue specifically, BLM and FS field personnel were asked to determine, based on their experience, which lease stipulations were granted exceptions for drilling and how often. The field personnel were asked to surmise the long-term (measured in decades that energy development would take place) relative to the hypothetical situation where

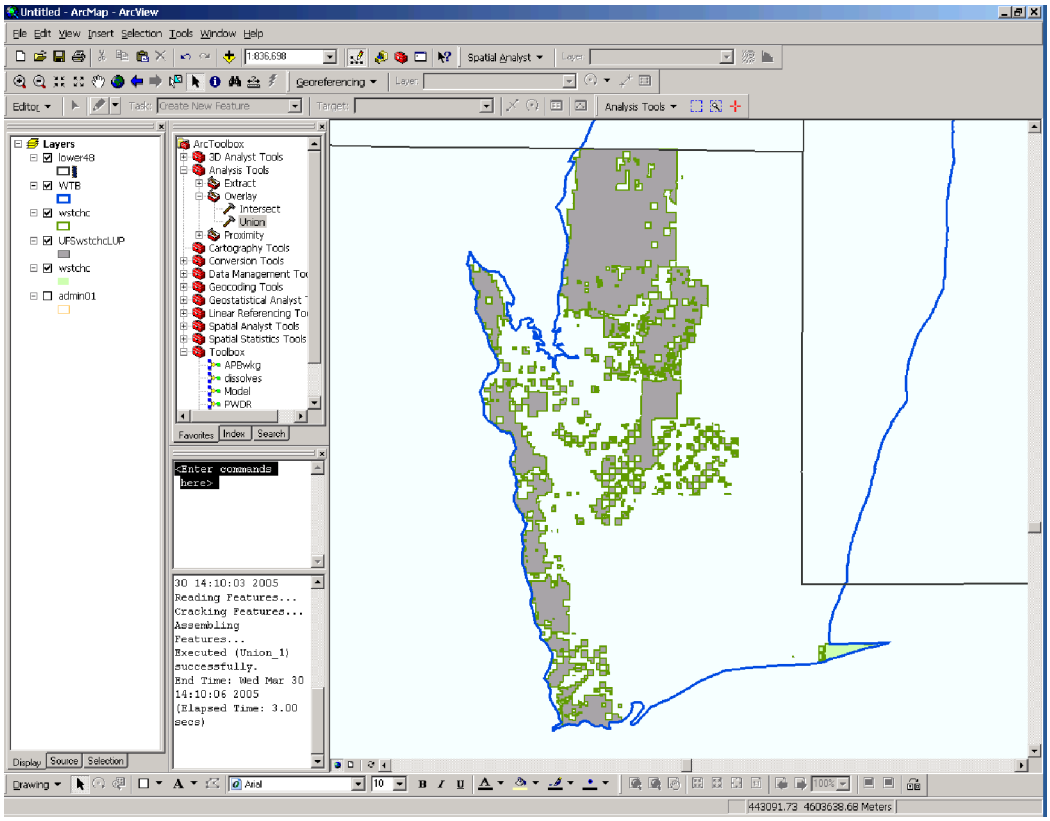

Figure A9-1. Creation of NLA/LUP Polygons

virtually all drilling permit requests in the affected habitat asked for exceptions. The personnel then provided an estimate of the portion of request for which exceptions would be granted. The exception factors thus determined are shown by jurisdiction in Table A9-3.

Lease stipulations, particularly timing limitations, can overlap. Where exception factors overlap, the cumulative effect is calculated by multiplying the overlapping factors (from Table A9-3). This calculation implicitly assumes that exceptions for multiple stipulations would likely not be obtained for a given area. For example, cumulative effects of excepted stipulations for the Wyoming Thrust Belt study area are determined as shown in Table A9-4. The application of these exception factors is described below in Section A9.3.

A9.2 Treatment of NSO Areas

Directional drilling (or "extended reach drilling") is technology that can be employed to reach subsurface targets not located directly underneath the drilling rig. In this Inventory resources beyond a certain EDZ are assumed to not be technically recoverable (Figure A9-2). While it is true that directional drilling horizontally out to distances of 5 or 6 miles is possible in production settings such as Alaska, this type of drilling is not the general case in the lower 48 and is impracticable for exploration.

Directional drilling for exploratory purposes occurs in some areas but is much more limited in scope. As in the case of stipulation exceptions, BLM and FS field personnel were interviewed to determine the

Table A9-3. Stipulation Exception Factors by FS and BLM Office

Jurisdiction	Study Area	Exception Factors									
		Big Game Winter Range	Indiana Bat	Steep slopes	Raptors	Scenic Landscapes	Designated Non-motor Sites	Calving and Fawning	Visual Resources Management	Designated Historic Sites	
Allegheny NF	APB		10%								
Arapaho Roosevelt NF	DEN				10%						
Big Cypress NP	FLP										
Black Hills NF	DEN					60%	40%			25%	
Bridger-Teton NF	WTB	10%		10%				10%			
Buffalo, WY, BLM Field Office	PDR				25%						
Caribou-Targhee NF	WTB	10%									
Carson NF	SJB	10%									
Casper, WY, BLM Field Office	PDR, DEN	25%			25%						
Chugach NF	SAK										
Dakota Prairie Grasslands	WIL										
Ely, NV, BLM Field Office	EGB										
Fillmore, UT, BLM Field Office	EGB	60%			75%						
Glenwood Springs, CO, BLM Field Office	UPB										
Glenwood Springs, CO, BLM Field Office	SWW	20%			30%						
Grand Junction, CO, BLM Field Office	UPB, PDX	70%		15%							
Idaho Falls, ID, BLM Field Office	WTB	10%									
Kemmerer, WY, BLM Field Office	WTB	10%			10%						
Kemmerer, WY, BLM Field Office	SWW	20%			30%						
Lakeview, OR, BLM Field Office	EOW	10%					20%				
Lander, WY, BLM Field Office	SWW	20%			30%						
Little Snake, CO, BLM Field Office	SWW	20%			30%						
Los Padres, NF	VEN			30%					40%		
Malta, MT, BLM Field Office	WIL	10%									
Manti La Sal NF	UPB, PDX, EGB			50%				80%			
Medicine Bow-Routt NF Thunder Basin NG	SWW, PDR, UPB, DEN	20%			30%						
Miles City, MT, BLM Field Office	PDR	50%			50%						
Miles City, MT, BLM Field Office	WIL	5%									
Milwaukee, WI, BLM Field Office	APB		10%								
Missoula, MT, BLM Field Office	MTB	20%		15%	20%						
Moab, UT, BLM Field Office	UPB, PDX	70%									
Monongahela NF	APB		10%								
Nebraska NF	DEN										
North Dakota, BLM Field Office	WIL										
Pinedale, WY, BLM Field Office	SWW	20%			30%						
Pocatello, ID, BLM Field Office	EGB	20%									
Pocatello, ID, BLM Field Office	WTB	20%									
Rawlins, WY, BLM Field Office	SWW, DEN	20%			30%						
Rock Springs, WY, BLM Field Office	SWW	20%			30%						
Royal Gorge, CO, BLM Field Office	DEN			15%					20%		
San Juan, CO, BLM Field Office	PDX, SJB	50%			50%						
St. George, UT, BLM Field Office	EGB	10%			75%						
Uncompahgre, CO, BLM Field Office	UPB	10%			10%						
Uncompahgre, CO, BLM Field Office	PDX	50%			50%						
White River, CO, BLM Field Office	UPB	80%			25%						
White River NF	UPB, SWW							50%			

	Exception Factors																
	Spotted owl, Lynx (T&E)	Sharp-tailed Grouse and Sage Grouse Display Grounds	Sage Grouse	Birds	Recreation Sites	Riparian/flood Areas	Sedimentation (roads)	Bald Eagle Winter Roost	City of Rifle Watershed	Sensitive Resources	Antelope Fawning	Soils, Watershed	Marshes	Inventoried Roadless Areas	Bighorn Sheep	Golden Eagle	Mangrove Forests
				10%													
													5%				5%
			25%														
							10%										
														10%			
		5%													5%	5%	
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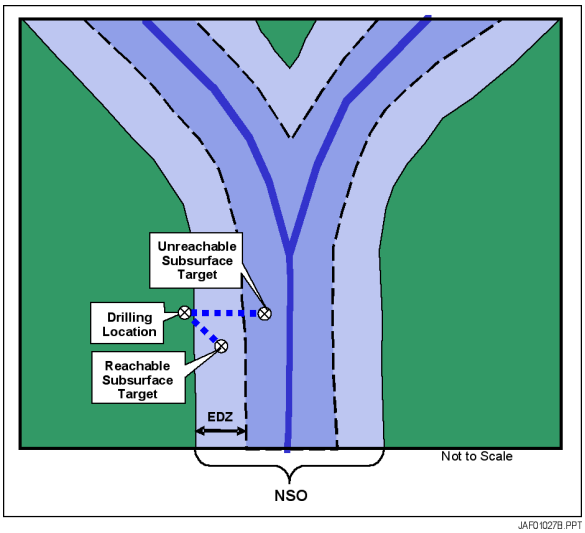

Figure A9-2. Extended Drilling Zone Conceptual Diagram

Table A9-4. Exception Factors Example for Overlapping Stipulations (WTB Study Area)

Stipulation	Exception Factor (EF)
Big Game	10%
Sage Grouse	10%
Raptors	10%
Big Game and Sage Grouse	1%
Big Game/Raptors	1%
Sage Grouse/Raptors	1%
Big Game, Sage Grouse and Raptors	0.10%

practicable width of the EDZ. The width of the EDZ is partially a function of the depth to the drilling objective—generally the deeper the objective, the larger the EDZ. The EDZ distances supplied by the offices and used in this Inventory are shown in Table A9-5.

The effect of the inclusion of the EDZs in the analysis is to remove an area of land from the perimeters of NSO polygons. The width of this area removed via GIS processing is determined by Federal jurisdiction (Table A9-5) as determined by each field office. The area removed then defaults to the resource access category that would otherwise apply in the absence of the NSO stipulation. The net effect is that the underlying resource is no longer considered inaccessible even though the surface above it cannot be occupied by drilling equipment.

Table A9-5. Extended Drilling Zones by Jurisdiction

Jurisdiction	Study Area	EDZ (miles)
Alabama NF	BWB	0.25
Albuquerque, NM, BLM Field Office	SJB	0.25
Allegheny NF	APB	0.13
Anchorage, AK, BLM Field Office	SAK	0.00
Angeles NF	VEN	0.50
Arapaho Roosevelt NF	DEN	0.25
Arizona Strip, AZ, BLM Field Office	EGB	0.25
Ashley NF	UPB, SWW	0.25
Bakersfield, CA, BLM Field Office	VEN	0.50
Battle Mountain, NV, BLM Field Office	EGB	0.25
Beaverhead-Deerlodge NF	MTB	0.50
Big Cypress NP	FLP	0.25
Bighorn NF	PDR	0.00
Billings, MT, BLM Field Office	PDR	0.00
Bitterroot NF	MTB	N/A (NLA/LUP)
Black Hills NF	PDR, DEN	0.25
Bridger-Teton NF	WTB, SWW	0.50
Buffalo, WY, BLM Field Office	PDR	0.25
Burley, ID, BLM Field Office	EGB	0.25
Butte, MT, BLM Field Office	MTB	0.25
Caribou-Targhee NF	WTB	0.50
Caribou NF	EGB, WTB	0.25
Carson NF	SJB	0.25
Casper, WY, BLM Field Office	PDR, DEN	0.25
Cedar City, UT, BLM Field Office	PDX	0.00
Cedar City, UT, BLM Field Office	EGB	0.50
Chugach NF	SAK	0.25
Cibola NF	SJB	0.25
Custer NF	PDR, WIL	N/A (NLA/LUP)
Dakota Prairie NG	WIL	0.00
Daniel Boone NF	APB	0.00
Deschutes NF	EOW	0.25
Dillon, MT, BLM Field Office	MTB	0.25
Dixie NF	EGB, PDX	N/A (NLA/LUP)
Elko, NV, BLM Field Office	EGB	0.25
Ely, NV, BLM Field Office	EGB	0.25
Fairbanks, AK, BLM Field Office–AK NPR-A NE	NAK	3.00
Fairbanks, AK, BLM Field Office–AK NPR-A NW	NAK	1.00
Fairbanks, AK, BLM Field Office–AK NPR-A S	NAK	N/A (NLA/LUP)
Fairbanks, AK, BLM Field Office–AK Utility Corridor	NAK	1.00
Fairbanks, AK, BLM Field Office–ANWR	NAK	N/A (NLA/LUP)
Farmington, NM, BLM Field Office	SJB	0.25
Fillmore, UT, BLM Field Office	EGB	0.25
Fillmore, UT, BLM Field Office	UPB	0.00
Finger Lakes NF	APB	0.25
Fishlake NF	EGB, UPB, PDX	N/A (NLA/LUP)
Flathead NF	MTB	N/A (NLA/LUP)
Gallatin NF	MTB	N/A (NLA/LUP)
George Washinton NF	APB	0.25
Glenallen, AK, BLM Field Office	SAK	0.00
Glenwood Springs, CO, BLM Field Office	UPB, SWW	0.25
Grand Junction, CO, BLM Field Office	UPB, PDX	0.25
Grand Mesa Uncompahgre/ Gunnison NF	UPB	0.25
Grand Mesa Uncompahgre/ Gunnison NF	PDX	0.00
Gunnison, CO, BLM Field Office	UPB	0.25
Helena NF	MTB	0.25
Humboldt NF	EGB	0.25
Idaho Falls, ID, BLM Field Office	WTB, EGB	0.50
Jackson, MS, BLM Field Office	FLP, BWB, APB	0.50
Jefferson NF	APB	0.25
Kanab, UT, BLM Field Office	PDX	0.00
Kemmerer, WY, BLM Field Office	WTB	0.50
Kemmerer, WY, BLM Field Office	SWW	0.25
Kootenai NF	MTB	N/A (NLA/LUP)
Lakeview, OR, BLM Field Office	EOW	0.25
Lander, WY, BLM Field Office	SWW	0.25
Las Vegas, NF, BLM Field Office	EGB	0.50
Lewis and Clark NF	MTB, eastern portions	0.25
Lewistown, MT, BLM Field Office	MTB	0.25
Little Snake, CO, BLM Field Office	UPB, SWW	0.25
Lolo NF	MTB	N/A (NLA/LUP)
Los Padres NF	VEN	0.50
Malta, MT, BLM Field Office	WIL	0.50
Manti La Sal NF	UPB, EGB	0.50
Manti La Sal NF	PDX	0.25
Medicine Bow-Routt NF Thunder Basin NG	SWW, PDR, UPB, DEN	0.25
Miles City, MT, BLM Field Office	PDR	0.25
Miles City, MT, BLM Field Office	WIL	0.00

Table A9-5. Extended Drilling Zones by Jurisdiction (concluded)

Jurisdiction	Study Area	EDZ (miles)
Milwaukee, WI, BLM Field Office	APB	N/A (NLA/LUP)
Mississippi NF	BWB	0.13
Missoula, MT, BLM Field Office	MTB	0.50
Moab, UT, BLM Field Office	UPB, PDX	0.25
Monongahela NF	APB	0.25
Monticello, UT, BLM Field Office	PDX	0.25
Nebraska, Oglala, Buffalo Gap NF	PDR	0.13
Nebraska, Oglala, Buffalo Gap NF	DEN	0.00
Newcastle, WY, BLM Field Office	PDR	0.00
Newcastle, WY, BLM Field Office	DEN	0.25
North Dakota, BLM Field Office	WIL	0.00
Northern, AK, BLM Field Office	YKF, NAK	1.00
Ochoco NF	EOW	0.25
Palm Springs/South Coast, CA BLM Field Office	VEN	0.50
Las Vegas, NF, BLM Field Office	EGB	0.50
Lewis and Clark NF	MTB, eastern portions	0.25
Lewistown, MT, BLM Field Office	MTB	0.25
Little Snake, CO, BLM Field Office	UPB, SWW	0.25
Lolo NF	MTB	N/A (NLA/LUP)
Los Padres NF	VEN	0.50
Malta, MT, BLM Field Office	WIL	0.50
Manti La Sal NF	UPB, EGB	0.50
Manti La Sal NF	PDX	0.25
Medicine Bow-Routt NF Thunder Basin NG	SWW, PDR, UPB, DEN	0.25
Miles City, MT, BLM Field Office	PDR	0.25
Miles City, MT, BLM Field Office	WIL	0.00
Milwaukee, WI, BLM Field Office	APB	N/A (NLA/LUP)
Mississippi NF	BWB	0.13
Missoula, MT, BLM Field Office	MTB	0.50
Moab, UT, BLM Field Office	UPB, PDX	0.25
Monongahela NF	APB	0.25
Monticello, UT, BLM Field Office	PDX	0.25
Nebraska, Oglala, Buffalo Gap NF	PDR	0.13
Nebraska, Oglala, Buffalo Gap NF	DEN	0.00
Newcastle, WY, BLM Field Office	PDR	0.00
Newcastle, WY, BLM Field Office	DEN	0.25
North Dakota, BLM Field Office	WIL	0.00
Northern, AK, BLM Field Office	YKF, NAK	1.00
Ochoco NF	EOW	0.25

Jurisdiction	Study Area	EDZ (miles)
Palm Springs/South Coast, CA BLM Field Office	VEN	0.50
Pike-San Isabel NF	DEN	0.25
Pinedale, WY, BLM Field Office	SWW	0.25
Pinedale, WY, BLM Field Office	WTB	N/A (NLA/LUP)
Pocatello, ID, BLM Field Office	WTB	0.50
Pocatello, ID, BLM Field Office	EGB	0.25
Price, UT, BLM Field Office	UPB	0.25
Price, UT, BLM Field Office	PDX	0.00
Prineville, OR, BLM Field Office	EOW	0.25
Rawlins, WY, BLM Field Office	SWW, DEN	0.25
Richfield, UT, BLM Field Office	UPB, EGB	0.25
Richfield, UT, BLM Field Office	PDX	0.00
Ridgecrest, CA, BLM Field Office	VEN	N/A (NLA/LUP)
Rock Springs, WY, BLM Field Office	SWW	0.25
Royal Gorge, CO, BLM Field Office	DEN	0.25
Salt Lake, UT, BLM Field Office	UPB, EGB	0.25
Salt Lake, UT, BLM Field Office	WTB	0.00
San Juan, CO, BLM Field Office	SJB	0.00
San Juan, CO, BLM Field Office	PDX	0.50
San Juan NF	PDX, SJB	N/A (NLA/LUP)
Santa Fe NF	SJB	0.25
Sawtooth NF	EGB	0.25
South Dakota BLM Field Office	PDR, DEN, WIL	0.25
Spokane, WA, BLM Field Office	EOW	0.50
St. George, UT, BLM Field Office	PDX, EGB	0.00
Taos, NM, BLM Field Office	SJB	0.00
Tennessee Valley Authority	BWB	0.50
Tennessee Valley Authority	APB	0.00
Tongass NF	SAK	0.25
Uinta NF	UPB, EGB	0.25
Umatilla NF	EOW	0.13
Uncompahgre, CO, BLM Field Office	UPB	0.25
Uncompahgre, CO, BLM Field Office	PDX	0.50
Vale, OR, BLM Field Office	EOW	0.25
Vernal, UT, BLM Field Office	UPB	0.00
Wasatch-Cache NF	WTB, EGB, SWW	0.50
Wayne NF	APB	0.13
White River, CO, BLM Field Office	UPB, SWW	0.25
White River NF	UPB, SWW	0.25

Figure A9-3 shows an actual example from the Wyoming Thrust Belt. Areas shown in light blue represent a 1/2-mile extended drilling zone removed from the NSO areas for the resource categorization. Areas shown in blue represent the resource Net NSO. The black area depicts an area of no leasing; as such the EDZ was not applied to these lands as a rig cannot be sited in no-lease areas.

A9.3 Analytical Modeling of Federal Lands and Resources

The analytical goal of the Inventory is to calculate the area of Federal lands (including non-Federal lands overlying federally owned oil and gas estate [split estate]) in each access category in the hierarchy and the volume of oil and gas resources underlying the Federal lands in each access category, while at the same time accounting for stipulation exceptions and the accessibility of the EDZ.

One of the primary objectives for the development of the categorization is to achieve geographic independence for a given parcel of land subject to overlapping stipulations (hence, the use of the categorization hierarchy where that parcel of land would be subject to only one category).

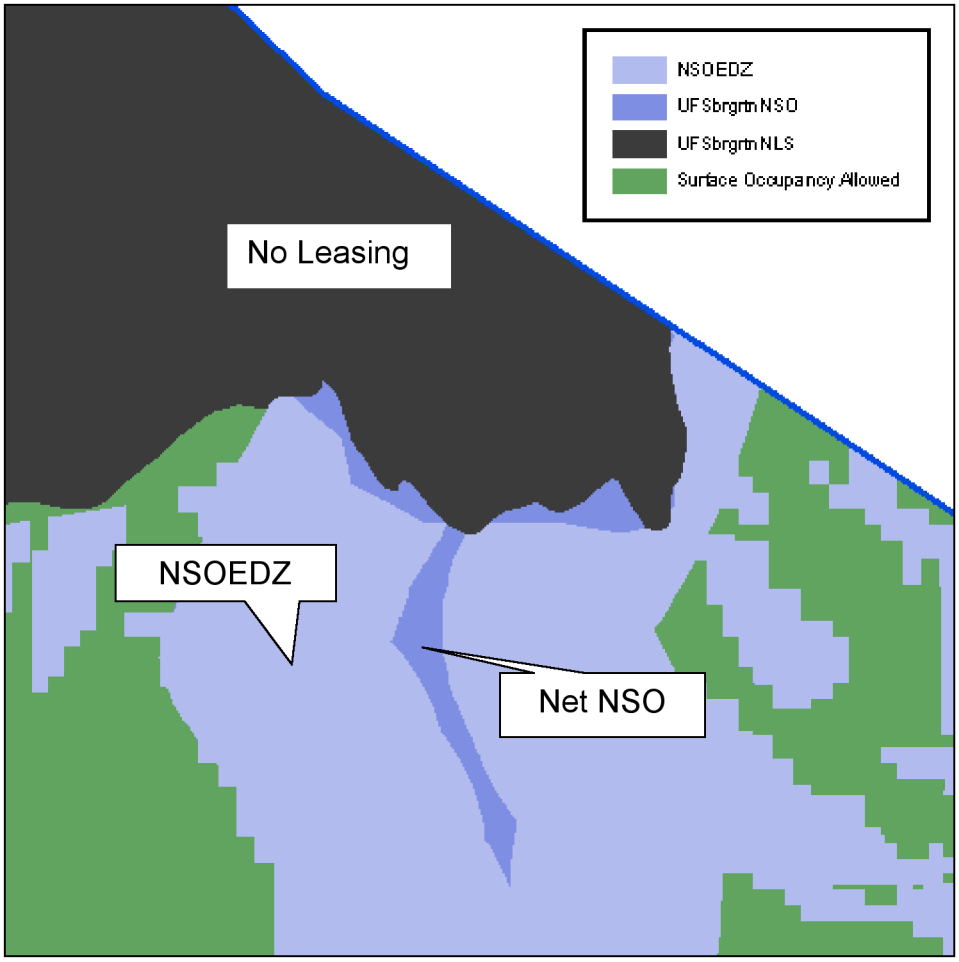

Figure A9-3. Removal of the Extended Drilling Zone from NSO Areas

The following discussion illustrates the application of the land access categorization for an area of multiple stipulations from the Kemmerer, WY, BLM FO in the Wyoming Thrust Belt, where sage grouse leks and nesting habitat and big game winter range define an access category. These types of stipulations are among the most common found in the study areas.

Figure A9-4 shows a selected point where the stipulations overlap and the resultant categorization is "Timing Limitation Stipulations >6 to ≤9". A query at that point brings up a dialog box which lists the stipulations in effect. Table A9-6 contains the corresponding stipulation data extracted from a corresponding master stipulations list.

Figure A9-5 shows the land categorization as determined by the stipulations listed in the relevant land use plan. Note that the core nesting habitat of the sage grouse (shown in blue), is designated a "no surface occupancy" area. The remaining area is under various timing limitations (colored in shades of red), controlled surface use (gold) or standard lease terms (green).

Note that in the Inventory, with regard to NSO areas, lands and resources are treated differently due to the application of EDZs. Figure A9-6 shows the effect where the EDZ is applied to NSO areas to determine the resource categorization. Note that the application of the EDZ in this example renders the resources under the sage grouse nest area accessible. While the acreage

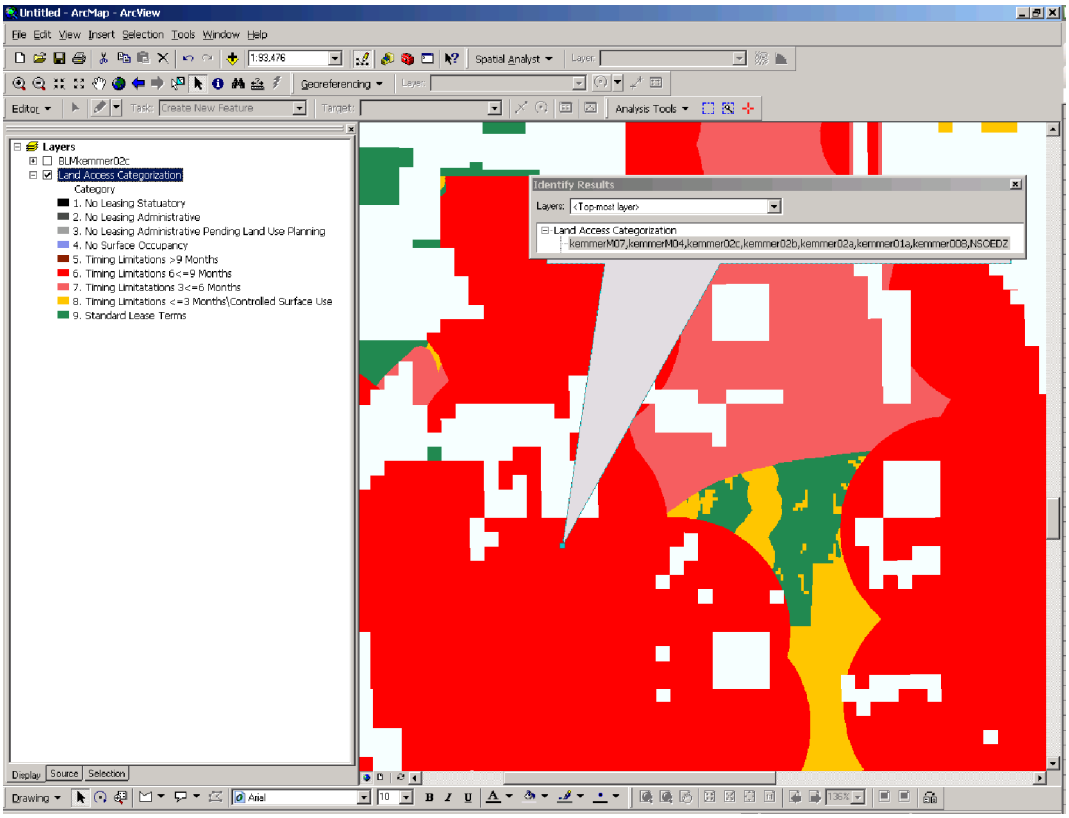

Figure A9-4. Display of Overlapping Timing Limitations (WTB Study Area)

Table A9-6. Sample Master Stipulations List for a Selected Area

Agency	STIPID	Description	LUP Source	Category	TLS months	Exception Factor	EDZ (mi)	Study Area	
								WTB	GGRB
BLM	kemmer003	Green River formation paleontologic survey	p. 11	CSU				X	X
BLM	kemmer007	Slopes >25%	p. 55	CSU				X	X
BLM	kemmer011	Big game winter range	p. 55	TLS	_AB0123	10%		X	X
BLM	kemmer013	Sage and sharp-tailed grouse nesting habitat	p. 55	TLS	123456	10%		X	X
BLM	kemmer015	Wildlife habit protection-grouse leks and other important habitat	p. 55	NSO			WTB - 0.5, GGRB - 0.25	X	X
BLM	kemmer030	Sage and sharp-tailed grouse strutting grounds	WY SO	CSU				X	X
BLM	kemmer032	Big game winter range	WY SO	CSU				X	X

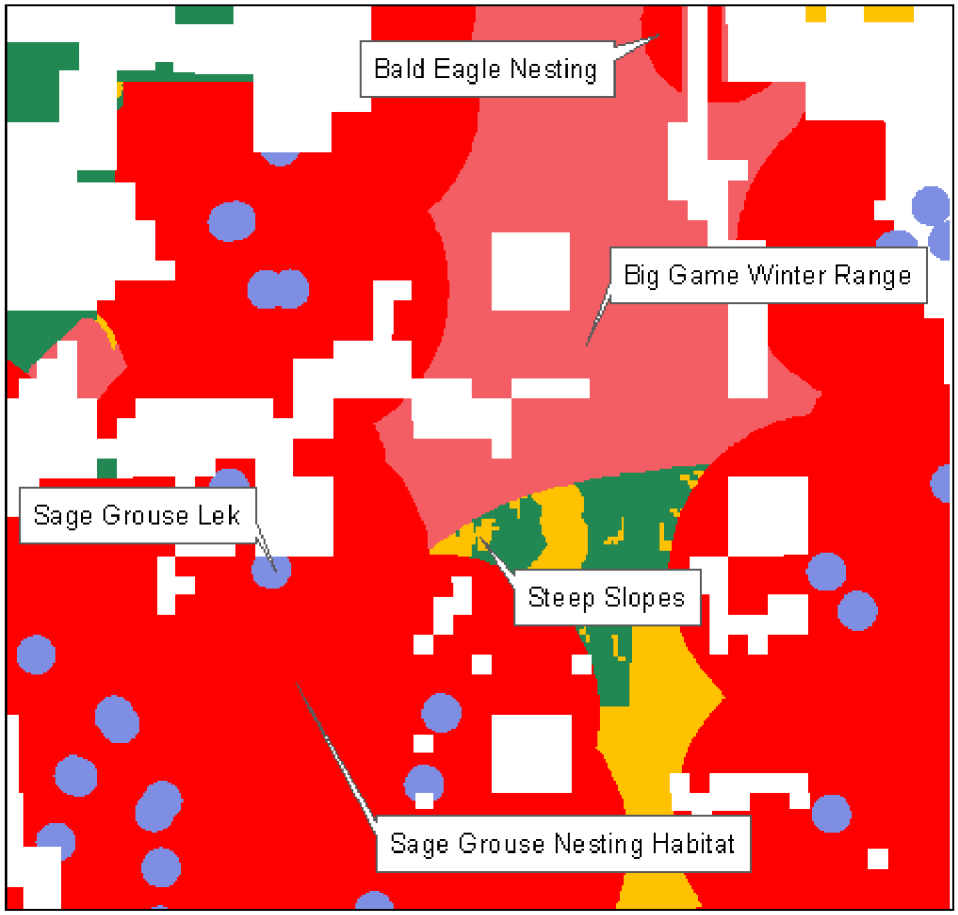

Figure A9-5. Display of Federal Land Access Categorization (WTB Study Area)

figures for each access category faithfully reflect the management prescriptions contained in the land use plans, the oil and gas volumes are calculated using this adjustment. The net result is that more oil and gas resources are accessible than would be assumed if NSO stipulations were taken at face value.

In addition, to account for stipulation exceptions, the GIS model determined the effects due to the presence or absence of the stipulations by selectively removing excepted stipulations in the computer. This is illustrated by Figure A9-7, which shows an example for the Wyoming Thrust Belt where the sage grouse nesting habitat stipulation has been removed. Note that in the case of an excepted stipulation, the analysis defaults to the underlying stipulation or standard lease terms, as appropriate.

For example, if sage grouse nesting stipulations are excepted 10 percent of the time (as shown on Table A9-6), then, for an area represented by the sage grouse polygon (where sage grouse stipulations do not overlap other excepted stipulations), 90 percent of the resources is categorized according to the stipulation and 10 percent is categorized according to the underlying stipulation category next in the hierarchy. This calculation is performed accordingly

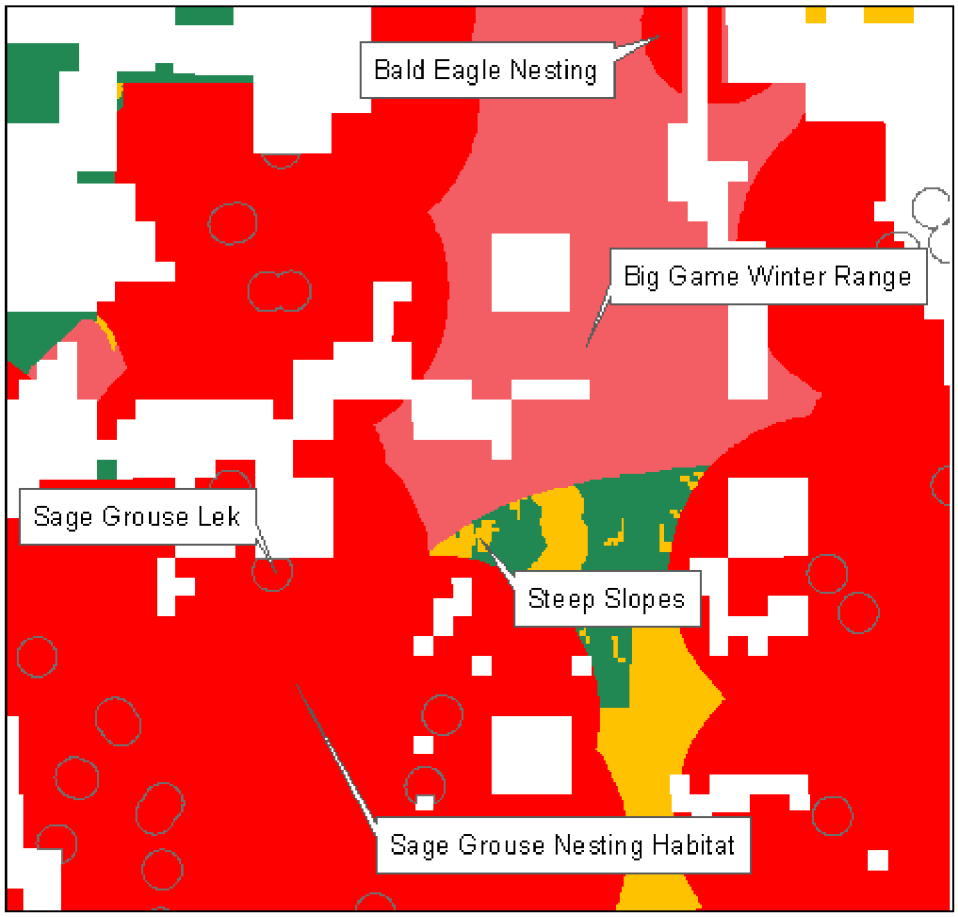

Figure A9-6. Display of Resource Access Categorization with Extended Drilling Zone Applied (WTB Study Area)

Figure A9-7. Display of Federal Land Access Categorization with Extended Drilling Zone Applied and with Sage Grouse Nesting Habitat Stipulation Excepted (WTB Study Area)

for all of the exception factors within a given office jurisdiction (see Table A9-3) or where combinations of these exceptions exist (see Table A9-4).

Access categorization of the Federal lands and resources was determined in aggregate based upon discrete examination of individual GIS polygons using the following equation:

$$FLorRs = \sum((1-EF) * FLorRs_{(EDZ)} + (EF * FLorRs_{(EDZ\ w/\ Excepted)}))$$

Where FlorRs = Federal Lands or Resources
EF = Exception Factor
(e.g., see Table A9-4)

$FLorRs_{(EDZ)}$ = FLorRs determined using the Extended Drilling Zone

$FLorRs_{(EDZ\ w/\ Excepted)}$ = FLorRs determined using the EDZ plus removal of stipulations for which exceptions are granted

This equation accounts for the occurrence of the extended drilling zone and stipulation exceptions. For excepted stipulations the model defaults to the underlying stipulation category in the hierarchy.

This process results in the generation of numerous individual GIS polygons for each

study area. These data are then summed and reported by access category and Federal management agency. For oil and gas resources, categorization is provided by specific resource type (presented on spreadsheets on the accompanying DVD).

A9.4 Quality Control of Modeling Results

A rigorous quality control (QC) check was instituted for the Phase III model. During processing a typical study area will generate more than one million discrete GIS polygons, each with unique characteristics in terms of land status, oil and gas resources, stipulations and exception factors. Complex study areas generate two to three million polygons each. As such, imprecision in GIS mapping data that are insignificant for individual polygons can be amplified in the aggregate. Such imprecision is a direct function of the quality of the data received from the various sources contributing to the Inventory.

For all study areas, the quality of the model output is high. For QC purposes, input oil and gas resource volumes and land areas were compared to outputs. A comparison of the study areas inputs and outputs revealed percentage differences ranging from zero to a maximum of 0.62 percent, with the vast majority well below 0.1 percent.

The model's land output data differs by 0.1 percent from the input data on an aggregate basis. For oil and gas resources, model output data differs by 0.1 percent from the input data on an aggregate basis.

A9.5 Extrapolated Areas

The EPCA study areas, which were examined comprehensively, comprise 18 oil and natural gas resource basins. Where additional oil and natural gas resources occur outside the comprehensively studied areas extrapolations were made and were split into three regions, Alaska, Western U.S. and Eastern U.S., using the Mississippi River and the border of Louisiana as the boundary for the continental U.S., for the purpose of reporting the results. Figure A9-8 depicts the extrapolated resource areas relative to the EPCA study areas.

The USGS National Oil and Gas Assessment (NOGA)[1] was used as the base for the undiscovered resources for the extrapolation effort, and excludes areas where the resource was not quantitatively assessed. The oil and natural gas resources in USGS provinces not comprehensively studied during the Inventory were then unioned with the Federal land status layer created by the National Atlas.[2] A list of all the provinces and resources that were included in the extrapolation analysis can be found in Table A9-7.[3] The undiscovered resources with an extrapolation area were distributed to access categories based on the distribution of access categorizations within the comprehensively studied basins for a given land status type.

[1] The USGS National Oil and Gas Assessment. http://energy.cr.usgs.gov/oilgas/noga/

[2] The National Atlas of the United States. http://www.nationalatlas.gov/

[3] Differences in this table compared to Table 2-8 are the result of resources associated with state waters and overlap with comprehensively studied basins.

Table A9-7. Resources Associated with Extrapolated USGS 1995 NOGA and EPCA-Updated Basins

USGS Province Name	Extrapolation Region	Total Oil (MMBbl)	Total Natural Gas (Bcf)	Latest Assessment Update
(1) Northern Alaska	Alaska	33.3	11,333.0	2007
(2) Central Alaska	Alaska	61.2	2,387.4	1995
(1) Northern Alaska	Comprehensively Studied	22,152.5	118,462.8	2006
(13) Ventura Basin	Comprehensively Studied	739.4	1,194.8	1995
(19) Eastern Great Basin	Comprehensively Studied	1,666.8	264.5	1995
(2) Central Alaska - Yukon Flats	Comprehensively Studied	299.3	5,462.6	2004
(20) Uinta-Piceance Basin	Comprehensively Studied	154.3	21,658.3	2002
(21) Paradox Basin	Comprehensively Studied	394.3	1,004.6	1995
(22) San Juan Basin	Comprehensively Studied	271.9	50,808.1	2002
(27) Montana Thrust Belt	Comprehensively Studied	348.5	8,638.0	2002
(3) Southern Alaska	Comprehensively Studied	622.1	1,334.3	1995
(31) Williston Basin	Comprehensively Studied	591.5	1,223.9	1995
(33) Powder River Basin	Comprehensively Studied	1,622.1	18,742.9	2007
(36) Wyoming Thrust Belt	Comprehensively Studied	81.4	574.2	2003
(37) Southwestern Wyoming	Comprehensively Studied	2,724.0	84,930.0	2002
(39) Denver Basin	Comprehensively Studied	154.6	1,885.7	2003
(5) Eastern Oregon-Washington	Comprehensively Studied	9.8	2,429.1	2006
(50) Florida Peninsula	Comprehensively Studied	286.3	1,023.9	2001
(65) Black Warrior Basin	Comprehensively Studied	13.5	8,164.7	2002
(67) Appalachian Basin	Comprehensively Studied	891.3	67,694.1	2002
(48/49) East Texas Basin and LA-MS Salt Basins	East	19.9	410.1	1995
(51) Superior Basin	East	47.5	335.8	1995
(52) Iowa Shelf	East	-	-	1995
(53) Cambridge Arch-Central Kansas Uplift	East	69.4	142.0	1995
(54/59) Salina/Sedgwick Basin	East	33.1	136.3	1995
(55) Nemaha Uplift	East	101.5	324.0	1995
(56) Forest City Basin	East	7.7	470.9	1995
(57) Ozark Uplift	East	-	-	1995
(58) Anadarko Basin	East	505.1	11,111.6	1995
(60) Cherokee Platform	East	77.1	2,077.2	1995
(61) Southern Oklahoma	East	210.9	740.0	1995
(62) Arkoma Basin	East	78.3	4,637.6	1995
(63) Michigan Basin	East	871.9	8,662.2	2004
(64) Illinois Basin	East	36.9	3,812.0	1995
(66) Cincinnati Arch	East	17.2	1,405.5	1995
(68) Blue Ridge Thrust Belt	East	-	23.2	1995
(69) Piedmont	East	-	348.2	1995
(70) Atlantic Coastal Plain	East	-	-	1995
(71) Adirondack Uplift	East	-	-	1995
(72) New England	East	-	-	1995
(10) San Joaquin Basin	West	478.6	1,650.1	2004
(11) Central Coastal	West	357.1	107.4	1995
(12) Santa Maria Basin	West	132.0	74.0	1995
(14) Los Angeles Basin	West	405.3	1,127.2	1995
(15) San Diego Oceanside	West	-	-	1995
(16) Salton Trough	West	-	-	1995
(17) Idaho-Snake River Downwarp	West	0.9	11.2	1995
(18) Western Great Basin	West	0.6	4.4	1995
(23) Albuquerque-Santa Fe Rift	West	46.1	258.8	1995

Table A9-7. Resources Associated with Extrapolated USGS 1995 NOGA and EPCA-Updated Basins (continued)

USGS Province Name	Extrapolation Region	Total Oil (MMBbl)	Total Natural Gas (Bcf)	Latest Assessment Update
(24) Northern Arizona	West	57.0	133.5	1995
(25) Southern Arizona-Southwestern New Mexico	West	38.0	193.3	1995
(26) South-Central New Mexico	West	-	-	1995
(28) North-Central Montana	West	175.7	41,829.3	1995
(29) Southwest Montana Basin	West	24.8	291.4	1995
(30) Hanna Basin	West	109.9	298.0	2005
(32) Sioux Arch	West	-	-	1995
(34) Big Horn Basin	West	397.4	1,013.0	1995
(35) Wind River Basin	West	493.9	2,198.8	2005
(38) Park Basin	West	29.9	549.5	1995
(39) Denver Basin	West	-	984.1	2002
(4) Western Oregon-Washington	West	20.8	1,316.7	1995
(40) Las Animas Arch	West	117.0	525.9	1995
(41) Raton Basin	West	28.1	2,353.0	2004
(42) Pedernal Uplift	West	-	-	1995
(43) Palo Duro Basin	West	6.5	4.1	1995
(44) Permian Basin	West	2,256.7	11,861.3	1995
(45) Bend Arch-Fort Worth Basin	West	1,260.6	26,713.3	2003
(46) Marathon Thrust Belt	West	113.5	191.3	1995
(47) Western Gulf	West	3,878.4	39,933.7	1995
(48/49) East Texas Basin and LA-MS Salt Basins	West	33.8	535.1	1995
(6) Klamath-Sierra Nevada	West	-	-	1995
(7) Northern Coastal	West	21.1	811.9	1995
(8) Sonoma-Livermore Basin	West	3.7	25.8	1995
(9) Sacramento Basin	West	5.9	2,128.4	1995
Hawaii	West	-	-	NA
	Total	45,688.1	580,977.7	

"–" Denotes no assessed resources

An approach to determine reserves growth associated with extrapolated areas, presented below, was developed with Steering Committee guidance. First, proved reserves associated with extrapolated areas needed to be determined. To do so, total proved reserves by state based upon EIA data were obtained[4] and aggregated by extrapolation region. By region, the proved reserve totals for the comprehensively studied EPCA basins (see Appendix 8) were then subtracted from the proved reserves totals for each region to determine the remaining reserves to be associated with the extrapolation areas.

Subsequently, to determine reserves growth associated with each of the extrapolation areas, a weighted ratio of reserves growth to proved reserves[5] based on individual ECPA study area was established. These ratios were then applied to the proved reserves associated with the extrapolation areas outside the EPCA study areas to determine

[4] The Energy Information Administration. http://www.eia.doe.gov/

[5] Performed on a technical basis and thus includes state waters, a feature important in the Alaska extrapolation area.

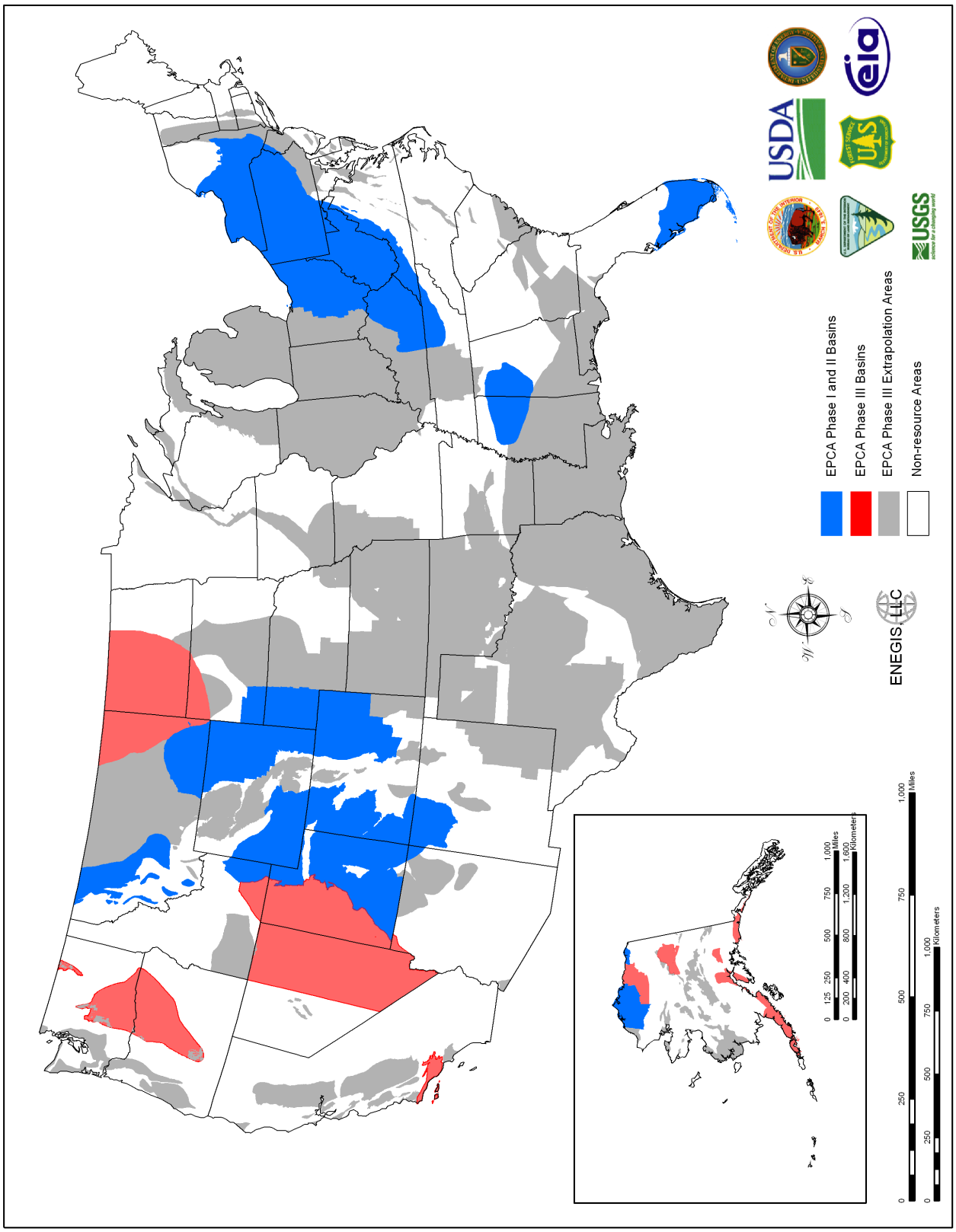

Figure A9-8. Map of EPCA Study Areas and Extrapolated Resource Areas

the reserves growth associated with respective extrapolation areas.

To determine reserves growth associated Federal lands within an extrapolation area, the total reserves growth was multiplied by the portion of Federal resources in the extrapolation area. Subsequently, reserves growth were distributed to access categories relative to the portion of Federal resources within a respective category.

While the above approach is simplistic, given the absence of comprehensive data outside of the EPCA study areas, it does provide an estimate of reserves growth that can be associated with the extrapolation areas. To the extent that reserves growth cannot be associated with proved reserves and resource distribution, it will be in error.

In a similar process, extrapolation of land and oil and gas resources associated with each access categorization was made within each extrapolated area based upon the results for individual Federal land types within correlative EPCA study areas.

Within the EPCA study areas, based on Steering Committee guidance, Federal lands that had less than 5 BCFE of undiscovered resource were also extrapolated using the land and resource access categorization by Federal land type within the study area. A list of the areas and the basins where this occurred can be found in Table A9-8.

Table A9-8. Extrapolated BLM and FS Areas

Unit	EPCA Study Area	Notes
Colville National Forest	EOW	
Elko, NV BLM	EGB	Jarbidge RMP Area only
Fremont National Forest	EOW	
Gifford-Pinchot National Forest	EOW	
Kremmling, CO BLM	SWW	
La Jara, CO BLM	SJB	
Lakeview, OR BLM	EOW	Klamath Falls Resource Area only
Mt. Baker-Snoqualmie National Forest	EOW	
Mt. Hood National Forest	EOW	
Okanogan National Forest	EOW	
Wenatchee National Forest	EOW	
Winema National Forest	EOW	