SUMMARY OF THE REASONABLE FORESEEABLE DEVELOPMENT SCENARIO FOR OIL AND GAS

INTRODUCTION

The reasonable foreseeable development (RFD) scenario is an estimate of the oil and gas activity expected because of resumed oil and gas leasing in the Dillon FO. The scenario is hypothetical in that drilling may occur anywhere in the planning area where an oil and gas lease is issued that allows surface occupancy. Probably, actual drilling proposals that result from leasing, if any, will differ in location from the RFD scenario proposals. It is also possible that leasing could result in either more or less drilling proposals than presented in the RFD scenario.

The RFD scenario attempts to portray the most reasonable and likely number of wells expected from a leasing decision on the Dillon FO. It is derived from knowledge of the USGS plays, Energy Information Administration (EIA) price forecasts, the oil and gas occurrence and development potential classifications for the Dillon FO, and historical activity.

Development potential is a ranking system which is created so the potential cumulative impacts of an oil and gas leasing decision on a designated area can be evaluated. Bureau of Land Management petroleum geologists rank the development potential of the planning area based on the probability, at this point in time, of oil and gas exploration, production, and associated infrastructure occurring in the future. It is important to understand that development potential is a dynamic ranking system, which changes with time as new data and ideas become available. While the geology does not change, the perception of the geology can change.

DRILLING ACTIVITY FORECAST

In order for the BLM to analyze the effects of oil and gas leasing and subsequent possible exploration and development, we had to complete the best possible analysis of how many wells industry might drill in the next 10 to 15 years. The BLM has developed an RFD scenario using historical oil and gas development information from the United States Geological Survey, BLM files, and other technical sources.

BLM has mapped the potential of occurrence of oil and gas under Madison and Beaverhead Counties and the potential for industry to develop those possible resources. The classification of the development potential is depicted on Map 83 in the RMP. From these maps and other information, including leasing history and past and present economics, the BLM forecasts how many wells might be drilled in all of the two counties on all mineral ownerships.

Based on our analysis, we estimate that six wildcat wells could be drilled in the area in the next 10 to 15 years. (A "wildcat well" is an exploratory well drilled in an area with no existing production.) Of these six wells, we estimate that four would be dry holes. (If no economically producible oil or gas is discovered, a well is called a "dry hole" or "noncommercial discovery.") Dry holes would be plugged and abandoned with surface reclamation occurring shortly afterward. For analysis purposes, we believe that two of the wells could likely have gas discoveries (however there is also a lower chance of oil production). One producer would be on either BLM minerals or lands administered by the Forest Service. The other would be on privately owned minerals. Each of those wells would probably prompt additional step-out wells. (A "step-out well" is a well drilled adjacent to or near a proven well to establish the limits of the oil or gas reservoir.) For analysis purposes, we estimate that a total of four step-out wells would be drilled, two for each discovery.

The general areas where exploration might occur in the two counties are depicted on Map 83 in the RMP. We forecast that the six projected wildcat wells would be drilled somewhere within the boundaries of these four areas. Area # 1 is referred to as "Big Hole Basin." This area consists of the Big Hole Tertiary graben basin. This basin is floored by Middle Eocene volcanic rock. These rocks are unconformably overlain by late Eocene to Miocene devitrified volcaniclastic and lacustrine rocks associated with locally derived clastic rocks. In the Big Hole Basin this sequence is overlain by Miocene and younger predominately coarse siliclasitic sediments. Basin fill is up to 15,000 feet thick in the Big Hole Basin. Anticipated reservoir rocks are sandstones of Oligocene to Miocene age. Source rocks are late Eocene to Oligocene in age. Natural gas has been encountered in wells drilled in the Basin. A 14,000 foot gas discovery is predicted in this area. An additional two wells are expected on 640 acre spacing. This forecast is based on the existing geologic perception of the area and is our best projection of reasonably foreseeable development.

Area #2 includes the Beaverhead River basin around the town of Dillon, the Retort Mountain area, the Armstead thrust area and the Blacktail salient area. It is referred to as "Dillon". The center of the northern part of the area in, T. 8 and 9 S., R. 9, 10, and 11 W., appears to be complicated by imbricate thrust faults. The best hydrocarbon shows in the area occur here. The well in sec. 9, T. 9 S., R. 9, W., American Quasar 9-1 May-Federal drilled to 4,351 feet and reported Cambrian at 3,444 feet. A subsequent examination of the samples showed an age date of upper Mississippian Chester at 2,800 feet to total depth, Heath-Otter equivalents. The drill stem test at 2,569 feet to 2,654 feet, which recovered a small amount of free gas, appears to be in Pennsylvanian Amsden rocks. Another test at 2,675-2,750 recovered gas-cut mud. Seven-inch casing was set at 2,826 feet and a completion attempt in a number of Amsden zones failed to recover commercial gas. Several older, shallower wells were drilled 3 to 5 miles northeast. One reported an oil show. These wells were 100 feet, 1,800 feet and 2,500 feet deep. It is not known what interval may have had the oil show. When BLM geologists mapped this general area they determined that there was a large area of "MODERATE" development potential based in part on the presence of adequate sediments with source and reservoir potential and the existing drilling results. A dry hole well is predicted near Jim Brown Mountain at about 5,000 feet depth in Permian or Pennsylvanian rocks on BLM minerals. This well would be drilled and abandoned. One other wildcat resulting in another dry hole is projected for Area 2.

Area #3 includes the Tendoy overthrust area and a foreland zone east of the thrust sheet and also a Cretaceous foreland basin at the south end of the Tendoy Mountains. It is referred to as "Lima". A well with a good show of sweet gas in Mississippian rocks, has been drilled in this Cretaceous basin and a gas field could be expected to be developed on 640 acre spacing in the area. The northern and north central portions of this area have had recent strong leasing interest. This is the general area that has potential for oil production. Two wildcats are expected; one dry hole and one discovery well. The result is predicted to be a three well gas field covering about 2,000 acres. Drilling depth is about 13,500 feet and much of this field will be on Forest and/or BLM minerals. This forecast is based on the existing geologic perception of the area and is our best projection of reasonably foreseeable development.

Area #4 consists of the Gravelly Range and the Snowcrest Trough to the south and east of the Gravelly Range. This area is referred to as the"Gravelly." One 11,000-foot exploratory well is projected to be drilled on National Forest System land in this area and found to be a dry hole. This well would be drilled and abandoned. The Gravelly Range is a west dipping sequence of rocks from Precambrian Archean age up into the Cretaceous Montana Group age. In the south and central portions of the Gravelly Range total thickness of post Precambrian sediments is about 12,000 feet. The interval from the top of the Permian to the Precambrian is about 5,000 feet. The primary targets for oil and gas exploration are probably in this interval. The dipping sediments of Cambrian through Cretaceous age are repeated by thrust faulting. Structural traps are probable beneath the thrust. The possibility exists of testing an upper Paleozoic trap on the hanging wall block and a Creta-

ceous Colorado Group through Cambrian structure in the foot wall block of about 11,000 feet. One dry well tested the southern part of this subpart of Area #4. In 1970 Union Texas Petroleum drilled the #1 Metzel-Federal, in the NW1/4NW1/4 Sec. 5, T. 13S., R. 2 W., to a total depth of 4,125 feet into the Cambrian Park Shale. Possible source beds were identified in the well, although they may be too shallow and thermally immature to have generated and expelled hydrocarbons. Possible reservoirs were also noted.

The other part of Area #4 lies south and west of the Gravelly Range. This is the Permian to upper Mississippian Snowcrest depositional trough. It is bounded on the south and east by the Snowcrest Thrust Fault. This area has been classified as having both moderate occurrence and development potential except for an area around an igneous intrusion in T. 11 S., R. 5W. It contains good source beds of Permian through upper Mississippian ages.

This forecast is somewhat different than that adopted by the Forest Service for their oil and gas leasing EIS for the Beaverhead National Forest. It is noted that the forecast for the Beaverhead EIS only covered lands administered by the US Forest Service. Also, that document projected all wells as if they would occur on National Forest System lands. The BLM forecast examined all of Beaverhead and Madison Counties. The BLM forecast was completed several years after completion of the forecast for the Beaverhead EIS. During that time the economic outlook for the oil and gas industry has changed along with the completion of a dry hole in the area. The BLM is not able to forecast the exact locations for wells that might be drilled in the future. This is a matter that future Federal oil and gas lessees will decide for themselves based on their own more detailed analysis of the geologic and geophysical data that they will collect before drilling. Nor does the BLM have any control on the location of wells drilled on private lands if the minerals are not owned by the Federal government. The location of new wells will also be strongly influenced by lease stipulations developed in this plan amendment. Location of wells on the Beaverhead National Forest would be controlled in large part by the stipulations that were developed in their oil and gas leasing EIS. The Dillon RMP/EIS does not address leasing decisions on National Forest System lands. It must be understood that drilling may occur outside of the four areas described above. Possible environmental effects will also be analyzed in those areas. By looking at what could happen if wells were drilled in the indicated areas, the BLM can predict and extrapolate possible environmental effects throughout the study area, especially where sensitive resources are located and development potential is either “LOW” or “MODERATE.”

In addition to the four areas noted above, the reader will note that there is an area of moderate development potential located on the map of the project area along the trend of the Madison River valley. The BLM is not postulating any drilling in this area for the life of this planning document. Two wells have been drilled within the boundaries of the Madison River graben. No oil or gas shows were noted in either well. Gravity measurements indicate a valley fill thickness of up to 12,000 feet at a point about two miles from either well. The part of the graben with the greatest thickness is shown on internal BLM reports as being on the Hebgen Lake Quadrangle commencing about 1 -1/4 miles south of the Ennis Quadrangle boundary and continuing southeastward for a distance of about 7 -1/2 miles. In this area valley fill is estimated from gravity data to be 15,000 feet or more. From this depocenter, the Tertiary thickness decreases northward. About three miles east of Ennis, the Tertiary thickness is about 7,500 feet. The potential for hydrocarbons, probably gas, may be theorized for the Tertiary sediments at the greater depths than encountered in the two wells. Their bottom-hole temperatures were l44° F and l4l° F, respectively. Calculated geothermal gradients for these wells of 1.12° F/100 ft. to 1.55° F/100 ft. indicates that depths of approximately 12,900 feet to 17,900 feet would be needed to approach 200° F (the approximate top of the “oil window” temperature which allows for the early generation of hydrocarbons from organic sources). This approximation suggests that most of the sediments in the Madison River Valley are immature for thermogenic hydrocarbon generation because they are shallower than these depths, and that the potential for gas is therefore focused on biogenic methane gas at cooler temperatures at shallower depths.

SURFACE ACTIVITY DESCRIPTION

This part of the Reasonable Foreseeable Development Scenario includes information to characterize the type of disturbance projected. The first section predicts the number of acres of ground surface disturbance resulting from exploration and field production activities, regardless of surface ownership. The calculation of acres disturbed relies upon assumptions derived from past exploration activity in the Dillon Field Office (DFO) and existing production from overthrust belt fields. All calculations assume a maximum acreage figure for analysis purposes if past activities show a range (e.g., 3.5 acres would be used if the range is 2.5-3.5 acres). This assumption was made in order to portray what the largest amount of disturbance could be expected to be. Reclaimed lands are also included in these calculations. Although no production exists in the DFO, there have been 44 test wells. The area is still considered a wildcat area with no commercial discoveries. Therefore, in order to model a production scenario, many assumptions are necessary. These assumptions include location, productive capability, reservoir parameters and hydrocarbon type and are based on information from representative oil and gas fields in Montana (Blackleaf and Kevin Sunburst). Even though the drilling activity forecast predicts two gas fields it is pos-

sible that the Lima area could also result in an oil field. Assumptions for both gas and oil fields are included here to make sure this possibility is factored into the analysis of impacts. Other critical factors that need to be considered when evaluating potential impacts of oil and gas activity are shown after the disturbance calculations and field assumptions. These factors include the duration of activity, and the type and quantity of equipment, personnel and other resources used and the frequency of such use.

The drilling activity forecast predicts a total of 6 exploration wells and 4 development wells. The area that would be disturbed totals 35 acres for well pads, 170 acres for access roads and 318 acres for pipelines for a total of 523 acres disturbed as a result of projected well drilling and field development.

It is assumed that 6 wells would prove to be commercially productive. For production the access roads and rights of way would be stabilized by seeding the cut and fill slopes and surfacing the top of the road bed. A small portion of the road rights of way would be returned to a pre-disturbance condition. A major portion of the well pads (up to two thirds) would be rehabilitated. The gas/oil gathering lines would be constructed along existing or new access roads resulting in no additional disturbance. Gas trunk lines would be completely rehabilitated. The following table displays the estimated amount of disturbance (in acres) expected from drilling and production activity predicted in the drilling activity forecast. It is based on the previously discussed assumptions and successful reclamation after construction operations are completed or oil and gas operations cease.

Estimation of Surface Disturbance Assumptions
The maximum area cleared per well pad would be **3.5 acres** (about 380 ft. x 400 ft.) and 2.3 acres would be stabilized in about 2 years. The maximum area cleared per access road per well would be **17 acres** (about 40 ft. x 18480 ft.) and 9 acres would be stabilized in about 2 years. All field gathering pipelines (2-4 inch diameter) will follow existing or new access roads and no additional disturbance would result. The maximum area cleared for trunk lines to transport gas from two different fields to the existing transmission line near Dillon, Montana would be **318 acres** (about 25 ft. x 554,400 ft.) and the entire area of disturbance would be stabilized in about 2 years. All perennial stream crossings would use horizontal drilling to avoid disturbance to the stream, its bed and banks. Dry and abandoned wells would be reclaimed.

	Unsuccessful Wildcat Wells		***Commercially Productive Wells***	
	Pre-Site Reclamation	***Post-Site Reclamation***	***Pre-Site Reclamation***	***Post-Site* Reclamation***
Well Site	14	0	21	7.2
Access Roads	68	0	102	48
Pipelines	0	0	318	0
TOTAL ACRES DISTURBED	82	0	441	55.2

*The figures in this column represent the total area committed to production facilities and permanent access roads after the unused portions have been succeessfully rehabilitated.

Gas Field Assumptions
Gas fields would be discovered in the Lima and Big Hole Basin areas. Fields would be roughly 3 square miles in surface area. Full development would require 3 wells (one discovery and two step out wells). 3-D seismic would be run to refine step out well locations. Gas would be transported by pipeline an order to be marketed. From Lima it would be transported north to Dillon for approximately 45 miles. From the Big Hole Basin it would be transported approximately 60 miles to the south and east to Dillon. Compressor stations would be necessary along the pipeline route, with one of those stations being within one mile of the main line in order to boost the pipeline gas to the pressure of the main line. Wells would be drilled 10,000 to 15,000 feet deep. One well would be drilled from each well pad. Only one development well would be drilled at a time. Wells would take approximately 300 days to drill. Condensate, gas, and water separation would occur at the wellsites. Water disposal would be into a lined pit at the surface or water would be injected into the subsurface through a dry hole converted into a water disposal well. Condensate would be shipped by truck (1 truck every 4 days). The field is expected to produce for 25 years. Well servicing, repair, and maintenance would continue throughout the life of the field. Well servicing operations would take 5 days per well and occur 6 times/well over the 25 year life of the field. A well tender would make one trip per day.

Oil Field Assumptions
An oil field is possible at the Lima area. Field would be roughly 1-1/2 square miles in surface area. Full field development would require 3 wells (one discovery and two step out wells) , 3-D seismic would be run to refine step out well locations. Oil would be transported by truck to the appropriate refining facility. Wells would be 10,000 to 15,000 feet deep. One well would be drilled from each well pad. Only one development well would be drilled at a time. The wells would take approximately 300 days to drill. Oil, gas, and water separation would occur at the wellsites. Water disposal would be into a lined pit at the surface or water would be injected into the subsurface through a dry hole converted into a water disposal well. Gas would be used on lease to separate oil and water and to heat oil. Gas not used on lease would be sold or vented/flared to the atmosphere. If sufficient gas quantities are produced this gas may also be captured and sold. For this analysis all unused gas is assumed to be reinjected for pressure maintenance The field is expected to produce for 25 years. Well servicing, repair, and maintenance continue throughout the life of the field. Well servicing operations would take 5 days per well and occur 6 times/well over the 25 year life of the field. A well tender would make one trip per day.

Activity	Approximate Time Frame	Number of Workers	Vehicles and Equipment	Number of Trips
Construction of well pad and access road Reserve pit is 125 ft X 200 ft X 12 deep; lined with 8-10 mil reinforced nylon/ plastic. Location fixed by rig location.	1 week	5-6	2 Bulldozers 2 Scrapers Grader Water truck Workers' vehicles	2 (1/wk per dozer) 2 (1/wk per scraper) 1 (1/wk) 35 (5/day) 28 (4/day)
Access Road Culverts added if stream channels must be crossed, but operators usually would lengthen road to avoid drainages to minimize maintenance and to maintain maximum grade of 10% or less. In extreme terrain or remote locations, company may put up camps at drill site. Additional buildings (portable) for sleeping quarters and cooking and eating are used. Camp crew includes cook, assistant cook. Support facilities include septic systems, refrigerated food storage. Camp jobs eliminate some traffic due to shift changes.				

Activity	Approximate Time Frame	Number of Workers	Vehicles and Equipment	Number of Trips
Well Drilling Rig-Size/Type: Triple derrick, jackknife type; Diesel or diesel-electric Weight: rig about 2,000,000 lbs Height: 160 ft (assumes 20 ft substructure) Engine: 1500-2000 horse power from 3 engines Derrick capacity: 1 million lbs Drilling Equipment requires: 40-50 one-way semi-truck loads to move rig to site at 45,000 lbs per load	300 days	5-6, during Drilling phase; 10, during cementing and running casing phases	Rig set-up (semi-trucks) Maintenance (pickup truck) Well-logging truck Semi-truck carrying casing Semi-truck carrying drilling steel Service trucks (mud, bits, special equipment) Water trucks Workers' vehicles Salesmen's vehicles	200 (20/day for 10 days) 300 (1/day) 3 (1/day, 3 separate days) 30 (5/day, 6 separate days 8 (1/day, 8 separate days) 86 (2/wk) 600 (2/day) 1800 (6/day) 86 (2/wk)
Water truck - several trips per day (fresh water required to drill through all fresh water aquifers ranging from 600 ft to 2500 ft below surface, at rate of 10 bbl per ft). About 40,000 bbls of water required to drill remainder of well unless lost circulation problems occur, then more water required. A separate water truck may make 2-3 trips per day to spray fresh water on roads for dust control. Water source well is usually drilled for rank wildcat wells.				

Activity	Approximate Time Frame	Number of Workers	Vehicles and Equipment	Number of Trips
Well Testing and Completion: the drilling rig is typically used to set the casing. A completion rig (smaller in size) is used to complete well for production.	1 week to 1 month	4 during testing; 10-12 for completion, fracturing, and/or acidizing phases	Truck carrying tubing, packers Truck carrying wellhead Truck carrying testing tools Truck carrying perforation tools Pump and bulk trucks	6 (3/day for 2 days) 1 (1 in 1 day) 12 (3/wk) 3 (1/day for 3 days) 10 (5 on 2 separate days)

Activity	Approximate Time Frame	Number of Workers	Vehicles and Equipment	Number of Trips
Placement of Production Facilities	1 week	4-5	Truck carrying meter device Truck carrying pipe, fittings, etc. Truck carrying dehydrator Truck carrying tank Backhoe Workers' vehicles	1 (1/wk) 1 (1/wk) 1 (1/wk) 3 (3/wk) 1 (1/wk) 28 (4/day)

Activity	Approximate Time Frame	Number of Workers	Vehicles and Equipment	Number of Trips
Pipeline Construction-per mile	1 week	5-8	Trencher Dozer Welding Truck Pipeline Truck Workers' vehicles	1 (1/wk) 1 (1/wk) 14 (2/day) 5 (5/wk) 28 (4/day)

Activity	Approximate Time Frame	Number of Workers	Vehicles and Equipment	Number of Trips
Abandonment/ Reclamation	3 weeks	5-6	Workover Rig and associated equipment	24 (3/day for 8 days)
Well plugging, equipment dismantling and removal, and reclamation			Bulldozer, scraper and road grader	3
			Maintenance (pickup truck)	21 (1/day)
			Semi-truck for equipment hauling	3
			Service trucks	4
			Workers' vehicles	126 (6/day)