Surface Compliance of Coal Bed Natural Gas (CBNG) Development in North Central Wyoming

Benjamin E. Kniola
Julian Serafin Gil
November, 4 2005

Abstract

A study was done on the reclamation effort of Coal Bed Natural Gas (CBNG) activities in the Powder River Basin of north central Wyoming. Facilities of several different operators across the Basin were inspected to monitor for compliance with conditions of approval (COAs) and the use of Best Management Practices (BMPs). Observations were made as to what has been done and where improvements could be made. It was found that most wells and facilities in the Basin were out of compliance. Most non-compliance issues were related to a lack of seeding and excessive weeds. A list of suggestions was established for how improvements could be made to reduce the amount of non-compliance issues. These include seeding practices, weed management, stronger penalties for lack of reclamation, and a need for more monitoring and compliance work to be done. Compliance is a key component of Oil & Gas development. It ensures the welfare of stakeholders (e.g. environment, surface owners, operators and public) in the energy development process.

Introduction

The Bureau of Land Management's (BLM), Buffalo Field Office (BFO) manages the Federal lands and minerals in three counties in North central Wyoming; Sheridan, Johnson and Campbell. Approximately 60% of the oil and gas mineral rights in these counties are owned by the Federal Government (Figure 1), while most surface ownership is private (Figure 2).

The Powder River Basin Oil & Gas Environmental Impact Statement (EIS) analyzed the drilling of 51,000 CBNG wells and 3,200 conventional wells by the year 2012. Since 2000, the BFO has permitted 7847 CBNG wells. The EIS also established a

wide variety of Conditions of Approval (COAs) to be applied during the permitting of oil and gas wells. Coal bed natural gas development is the priority for the BFO and the majority of its staff is engaged in the various aspects of CBNG development, inspection, and enforcement.

During the summer of 2005 (June 21st through September 21st), two Environmental Careers Organization (ECO) associates, under contract with the BLM – BFO, conducted environmental compliance and monitoring inspections of oil and gas development project sites. The associates targeted surface disturbances and other environmental impacts associated with the development of CBNG production sites, especially issues concerning the effectiveness of re-vegetation and reclamation practices. Additionally, they verified if projects were constructed according to an operator's approved Plan of Development (POD) and followed the COAs.

Materials and Methods

The first two weeks of the internship involved intensive training on identification of local native vegetation and invasive noxious weeds; detection of environmental impact parameters in project areas; review of the EIS; and, interpretation of engineered drawings. CBNG PODs were then assigned to be inspected. In general, three or more PODs were allocated per Natural Resources Specialist/Physical Scientist's (NRS/PS) assigned inspection area. A review of the POD book was subsequently made, which involved finding the status of wells and their location within the project area; reviewing programmatic and site specific COAs, the Surface Use Plan, and the Water Management Plan; and becoming familiar with project maps, as well as contacting any landowners that required permission before entering their property.

The POD was then inspected for intermediate reclamation of the well locations, water containment structures, and access and pipelines corridors. Other environmental parameters documented in the field included infrastructure correlation with project maps, excess surface disturbances, erosion concerns, miscellaneous debris, and verification/use of site specific COAs. A clinometer was used to calculate grade on cut and fill slopes, water containment structures, embankments and roads. A tape measure and measuring wheel were used to measure road widths, pad size and pipeline corridors. Notes were made in the field, pictures were taken and the findings were brought back to the NRS/PS responsible for monitoring the surface compliance of that area. If problems were found a phone call, a Written Order, or an Incident of Non-Compliance (INC) was given to the operator based on the severity of the issue. Observations were recorded, and notes were made as to what issues were commonly found.

Findings

A total of 628 inspections were completed, including both wells and facilities. 530 of those wells and facilities were found to be out of compliance (Figure 3). A total of 43 enforcement actions were sent to operators; 34 Written Orders and 9 Incident of Non-Compliance letters. Full compliance in regards to wells (Figure 4) and/or facilities (Figure 5) was the case with 7 of 20 operators inspected, and only 1 of these operators was compliant with both wells (Figure 4) and facilities (Figure 5). On average all operators that were inspected were 84% out of compliance (Figure 6).

The inspections of 42 PODs out of the 373 PODs, or 11%, that have been approved since 2000 were completed. There are 46 operators active in the Powder River Basin, but only 20 operators had PODs inspected between June 21st and September 21st.

Just 6 of the inspected operators had 50% or more of their PODs inspected, and 3 were 100% inspected (Figure 7). However, 10 operators had less than 20% of their PODs inspected (Figure 7). All but 3 of the large operators, with more than 6 PODs, had inspections completed on at least 1 of their PODs.

Written Orders were written for almost every environmental problem found during field inspections. The majority of non-compliance issues addressed by Written Orders are related to the lack of completing reclamation obligations. Well locations and associated infrastructures that have not been seeded or need to be seeded again comprise 40.2% of the environmental problems found. (Figure 9)

Another major area of non-compliance has been an abundance of weeds, both noxious weeds and weeds of concern. Several species of weeds were found but the most common were Russian thistle (*Salsola*), Canada thistle (*Cirsium arvense*), Cheatgras (*Bromus tectorum*) and Kochia (*Kochia Scoparia*) (Figure 8). Weeds were commonly found at water containment structures, road and pipeline corridors, and production facilities. Most water containment structures have Canada thistle growing on the shoreline, on the embankment, in the drainage leaving the outlet and/or in the area around the outfall. The well pads, pipelines and roads have also had an abundant growth of weeds. Locations and associated infrastructures inspected that have these weed issues make up 31.6% of problems found. (Figure 9)

Erosion concerns, mostly due to lack of vegetation was 2.1% of problems found. Roads have been another issue that has come up; 1.7% of problems found are roads that have erosion issues, are of an unapproved type, or are different on the ground from what is shown on current inspector maps. Debris on well sites, including wire spools, pipes,

drilling rods, fencing materials and wire, have been found on several sites (10.4% of all problems). Surface re-contouring of well locations, pipelines and roads, as well as spreading topsoil piles has been another issue that was found (10.0% of all problems). Issues related to incorrect or outdated maps were found to be a problem 2.9% of the time. Sign placement (0.6%), status of well (0.1%), and wildlife issues (0.4%) were the least reported problems encountered in the field. (Figure 9)

INC letters were sent to operators for not complying with the approved Surface Use Plan, COAs and/or the Code of Federal Regulations. Of the INC letters that were sent 65% of incidents were for signage, 10% for roads, 20% for construction, and 5% for previous orders not followed. Signage issues were mostly a missing or incorrect sign. Road issues were mostly related to the unapproved type of road; i.e. Crown and Ditch road versus two-track road, or if the road was in the wrong location. Construction issues were for incorrect pad size or constructing a pad that was not approved. (Figure 10)

Discussion & Recomendations

The environmental problems reported during field inspections are the result of surface disturbances associated with oil and gas development in the Basin. The most common environmental issues encountered during field inspections include: widespread growth of invasive and noxious weeds on well locations, access roads and utility corridors; minimal perennial vegetation growth on well locations and associated infrastructure; disturbed areas not re-contoured to natural topography; miscellaneous garbage, debris, and construction materials left on well locations and associated infrastructure; and new surface disturbances associated with existing CBM infrastructure not authorized by the authorized BLM Officer. The data collected will help the Buffalo

Field Office assess the effectiveness of the COAs, and determine if there are alternative ways to achieve energy development with fewer disturbances. In completing this monitoring project several ideas were formulated on how improvements could be made. Following is a list of suggestions that may help eliminate continued non-compliance.

Widespread growth of noxious weeds and weeds of concern are a major environmental problem documented during field inspections. A recent analysis pertaining to invasive species and CBNG development in the Basin suggests that surface disturbance associated with CBNG development may facilitate the establishment of non-native plants, such as Russian thistle (*Salsola*), Canada thistle (*Cirsium arvense*), Cheatgras (*Bromus tectorum*) and Kochia (*Kochia Scoparia*) (Bergquist 2005). Weeds that are a problem but not listed as noxious, are not in any management plan by operators and generally do not get taken care of. Weeds such as Kochia and Russian thistle seem to be more of a problem than previously believed to be, especially in years with average or above average precipitation. These are annuals but often are so abundant that something should be done to control the future spread of these weeds. There may be a need to formulate a standard COA that not only dictates the control of these weeds, but also explains the greater impact of their establishment on disturbed surfaces.

COAs often state that reservoirs and outfalls have to be monitored once a month during the first year of operation. Experiences in the field, however, revealed that both monitoring and weed control at these facilities do not take place often or at all after the first year of operation. Weeds are regularly observed both at reservoirs and outfall structures during POD inspections. Perhaps requiring operators to conduct monitoring and control beyond the first year of operation will alleviate this issue.

The lack of seeding is the environmental problem most often observed during field inspections. Exposed surfaces were found frequently throughout POD project areas, including well sites, road and pipeline corridors, reservoirs and outfalls. The cause of this problem is possibly related to an operator's overall environmental performance or behavior. Some companies are much more proactive about accomplishing reclamation objectives than others. However, the lack of seeding might also have to do with factors outside of reclamation that eventually trickle down to an operator inadequately achieving its environmental responsibilities. Such factors might include: supply/demand for energy services and reclamation contractors in the region or inexperienced regulatory personnel.

To address seeding of disturbed locations, or lack thereof, a reactive/end-of-pipe approach should be considered. Implementing an administrative and operational procedure, where the operator notifies the BLM of seeding dates, techniques and seed mix used, as well as provides financial and visual evidence of seeding activity, could help improve the execution of this important stage in the reclamation process. This method will also help keep better records for future field-based evaluations of effective vegetation growth and reclamation success. This procedure will make the operator feel more inclined to actually do the seeding by the required date, since they will have to have a documented date of seeding on file.

A common response from operators to the lack of seeding issue is that it has been too dry for the seeds to germinate. While this area of Wyoming and most of the west has been in drought conditions for the past seven years, several areas have been seeded with adequate germination during these drought conditions. A possible solution, to this response from operators, could be the use of produced water to irrigate newly seeded

areas, if the produced water is suitable for irrigation. Produced water that is not suitable for irrigation could be treated, and a viable solution, but could be costly. Irrigation systems would not be necessary, but taking a water truck and watering the area at night might help keep enough moisture in the soil to cause seeds to germinate. Once roots establish and the vegetation is growing the irrigation could be discontinued. This approach, if used, would have to be managed very closely to prevent unsuitable water from being used and causing damage to soils or excess watering that may augment erosion.

The use of telemetry as a production monitoring tool has significantly reduced an operator's time spent monitoring and visiting well locations. CBNG wells rarely visited by operating personnel seldom show evidence of vehicle disturbance on the site's surface. Moreover, if these locations have been reseeded in the past, at the time of inspection, they often look well vegetated and reclaimed. Conversely, heavy traffic areas at a location show poor vegetation growth and/or an eroded soil surface. This observation suggests that perhaps both limiting vehicle access to the immediate areas surrounding a well site and the widespread use of telemetry could possibly allow rapid vegetation growth and reclamation success, and be an effective monitoring solution.

Livestock and some wildlife are also impediments to intermediate reclamation. In various occasions it was observed that livestock such as cattle (*Bos taurus*), sheep (*Ovis aries*), and domestic bison (*Bison bison*), as well as wildlife such as Mule Deer (*Odocoileus hemionus*) and Pronghorn Antelope (*Antelocapra americana*) were either eating new vegetation or disturbing recently seeded surfaces, thereby restraining vegetation growth. Additionally, cattle appear to be attracted to erosion blankets,

disturbing the blanket to the point where it is no longer effective. In heavily grazed areas alternatives to erosion blankets should be considered. Restricting livestock from areas being reclaimed, possibly to another pasture for one or two growing seasons, could increase the possibility of successful reclamation. Maybe fencing around seeded areas for one or two growing seasons or until vegetation has grown successfully could also help maximize reclamation efforts in the presence of cattle.

This report is based on inspections of only 42 PODs and there are currently 373 PODs approved in the Powder River Basin. It should be taken into account that not all operators received the same amount of inspections. The selection of PODs to be inspected was random in nature since it was not systematic nor did it follow specific selection criteria. Nonetheless, the data collected is a good representation of what is found in the Powder River Basin. It could be predicted that if current conditions remained the same, on average 84% of all wells, facilities and infrastructure will have some sort of non-compliance issue.

Based on these findings, there is a need for compliance work to be done. There has been such a push to get Applications for Permit to Drill (APDs) approved, that compliance has been put low on the priority list. Compliance is a key component of Oil & Gas development. It ensures the welfare of stakeholders (e.g. environment, surface owners, operators and public) in the energy development process. More time should be allocated for the NRS/PS to complete this work or new technician positions should be created. If compliance work is done regularly, the operators will be more careful as to what they or their contractors are doing, and do things correctly. However, if new technician positions are created, the NRS/PS should still be involved in the compliance

process, because that is the best way to monitor and improve current procedures and COAs.

Figure 1:

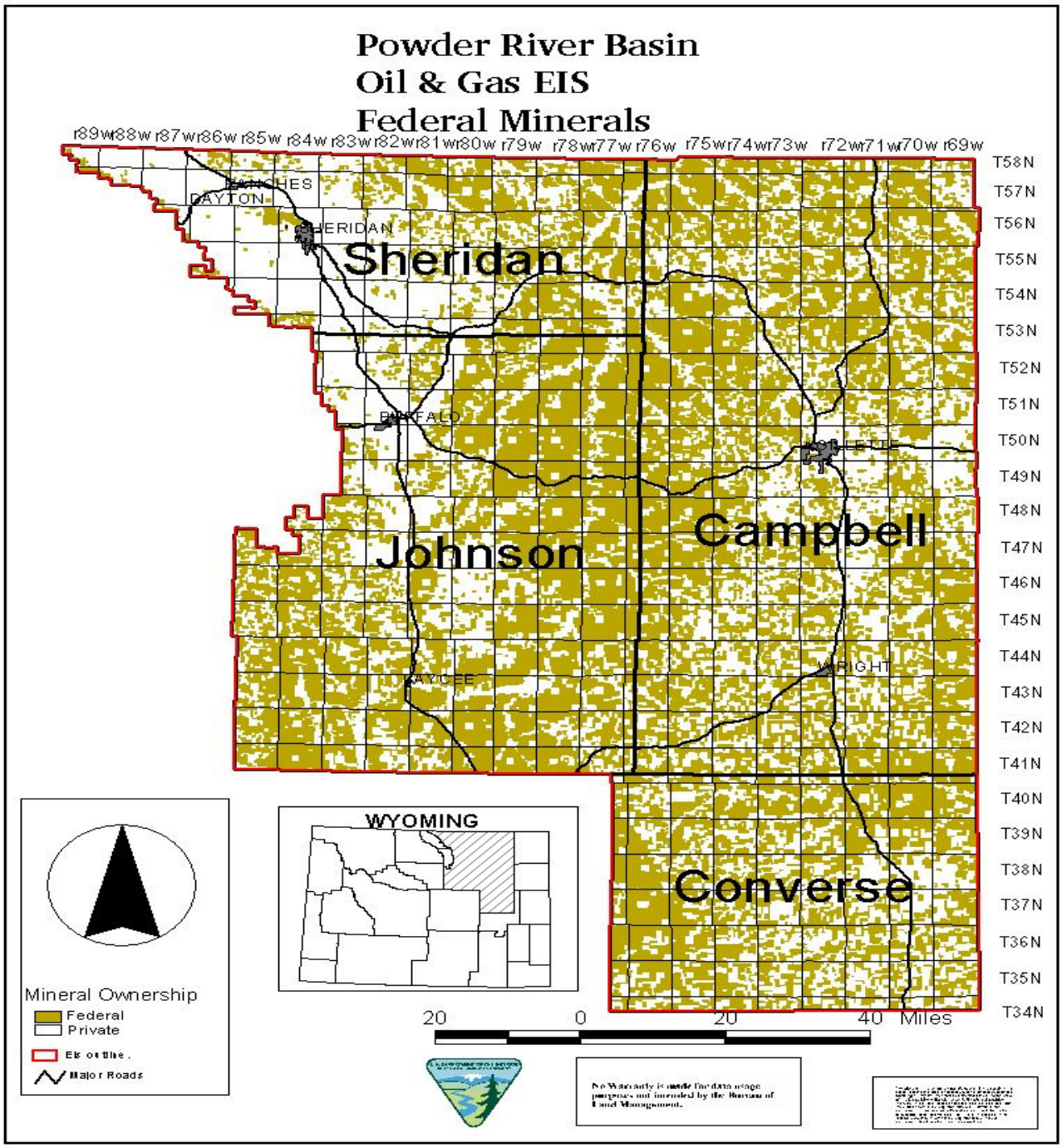

Powder River Basin
Oil & Gas EIS
Federal Minerals
r89w r88w r87w r86w r85w r84w r83w r82w r81w r80w r79w r78w r77w r76w r75w r74w r73w r72w r71w r70w r69w
T58N
T57N
T56N
T55N
T54N
T53N
T52N
T51N
T50N
T49N
T48N
T47N
T46N
T45N
T44N
T43N
T42N
T41N
T40N
T39N
T38N
T37N
T36N
T35N
T34N
BIG HORN
DAYTON
SHERIDAN
Sheridan
BUFFALO
GILLETTE
Campbell
Johnson
KAYCEE
WRIGHT
Converse
WYOMING
Mineral Ownership
Federal
Private
Major Roads
20 0 20 40 Miles

Figure 2:

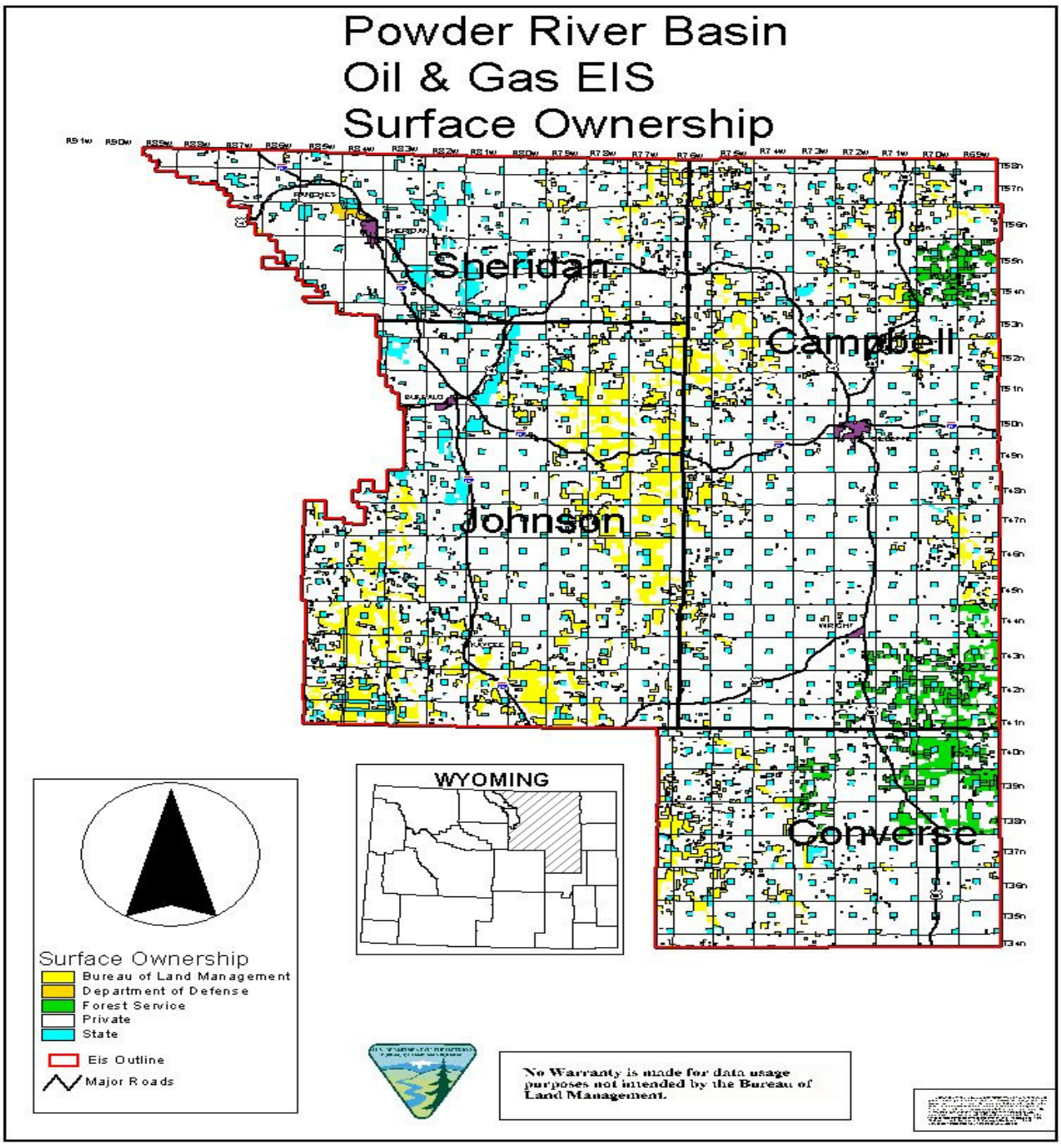

Powder River Basin
Oil & Gas EIS
Surface Ownership
Sheridan
Campbell
Johnson
Converse
WYOMING
Surface Ownership
Bureau of Land Management
Department of Defense
Forest Service
Private
State
Eis Outline
Major Roads
No Warranty is made for data usage purposes not intended by the Bureau of Land Management.

Figure 3: Compiance Totals (Wells & Facilities)

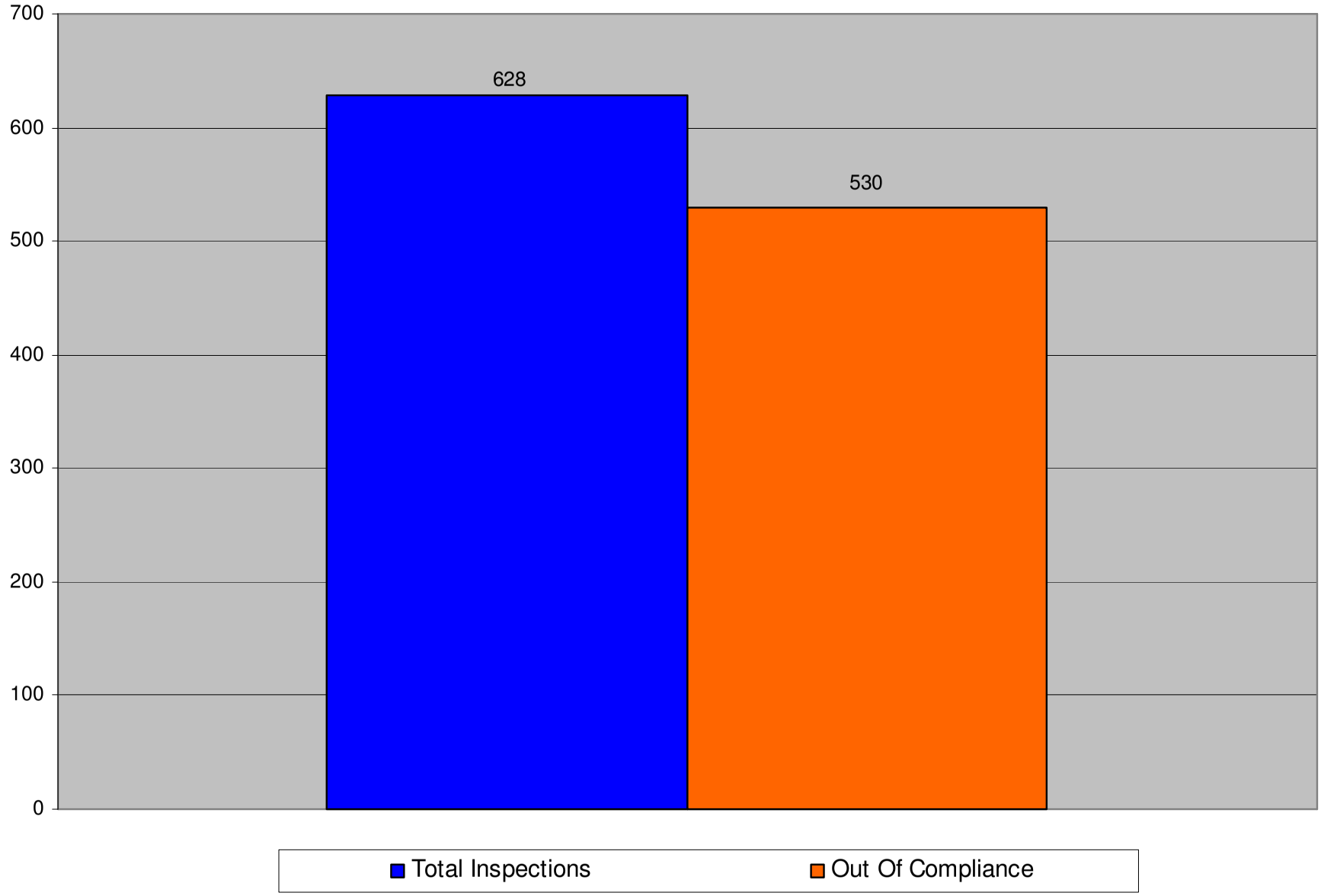


Figure 4: Compliance (Wells)

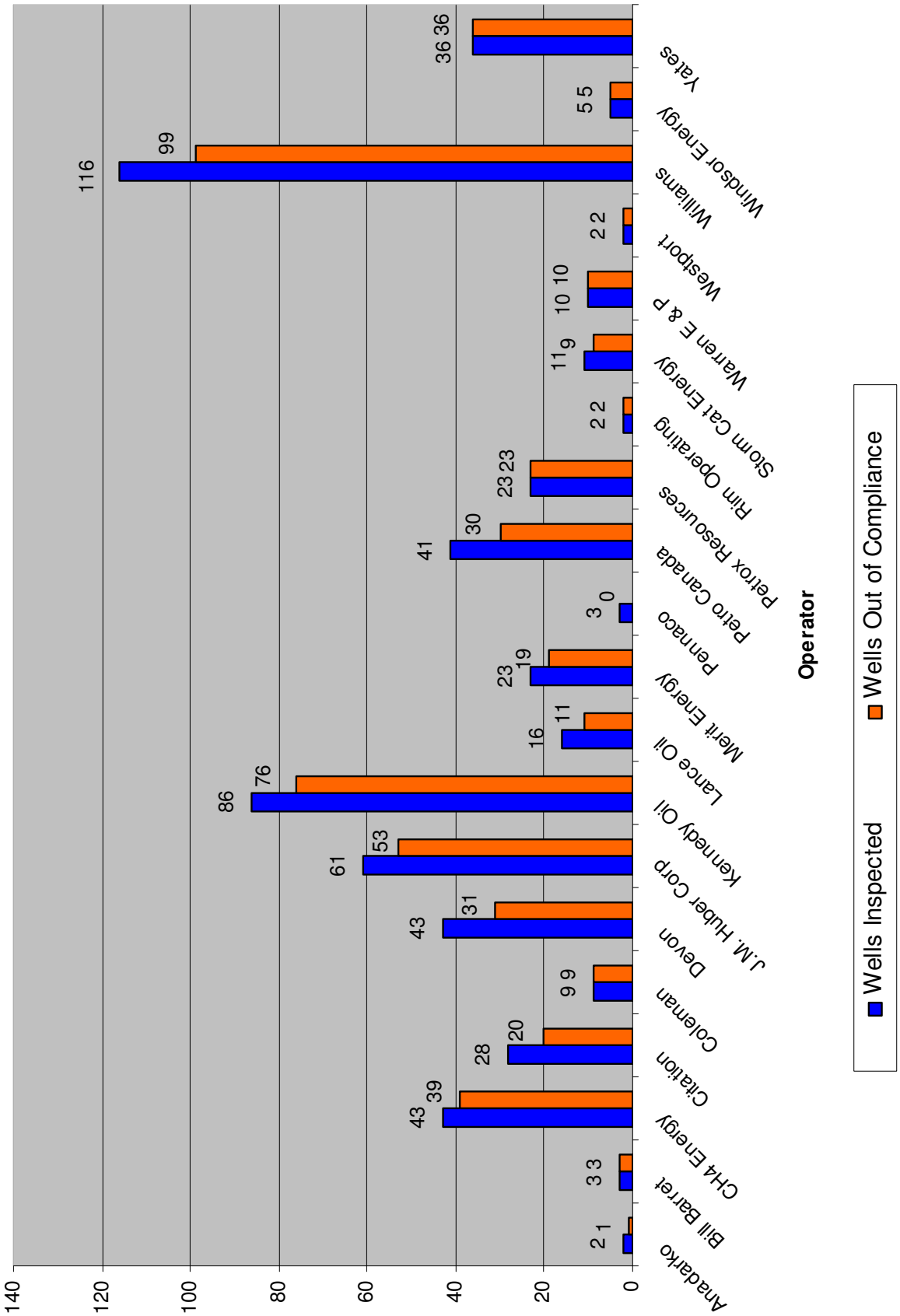


Figure 5: Compliance (Facilities)

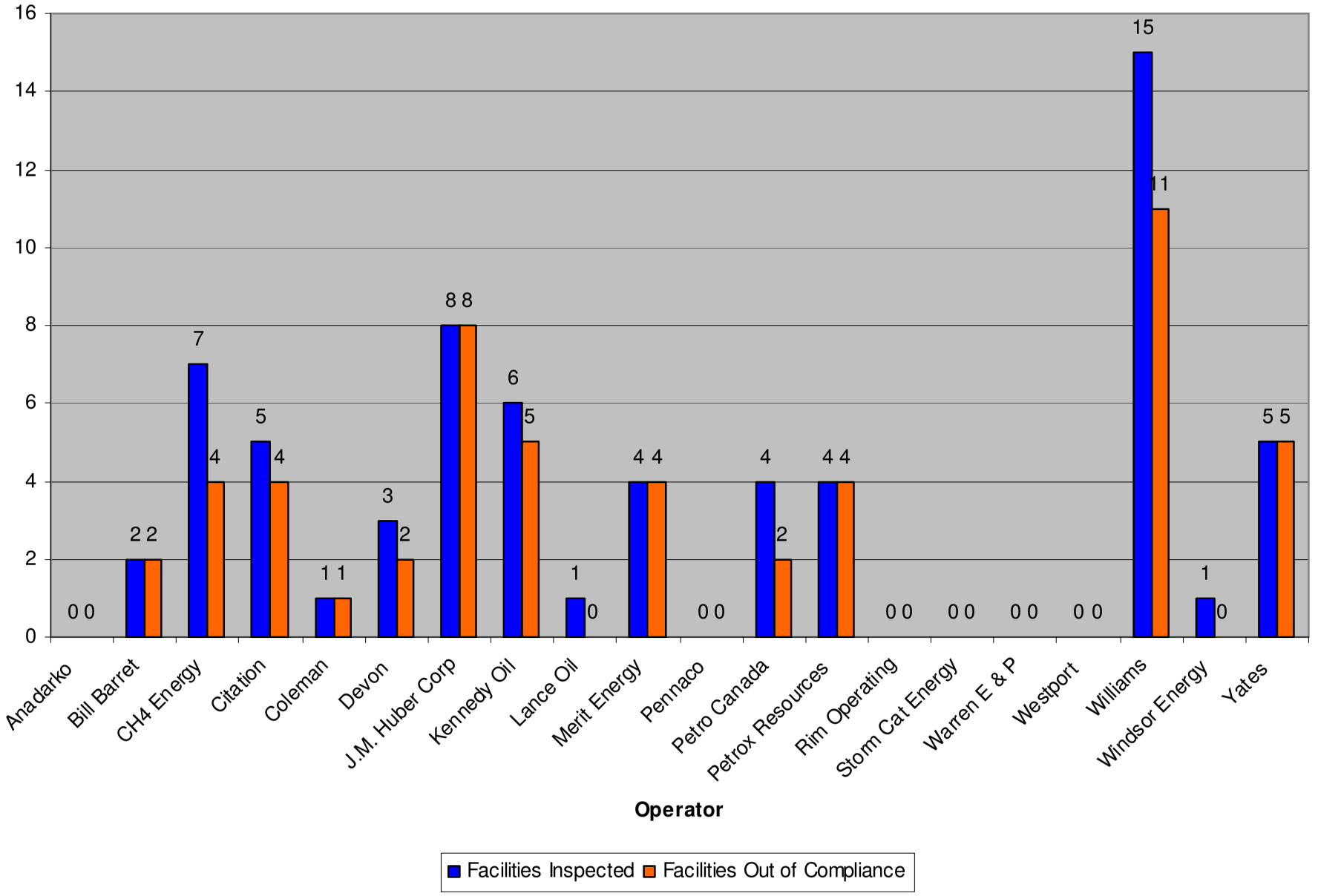


Figure 6: Percent Out of Compliance (Of Inspected Wells & Facilities)

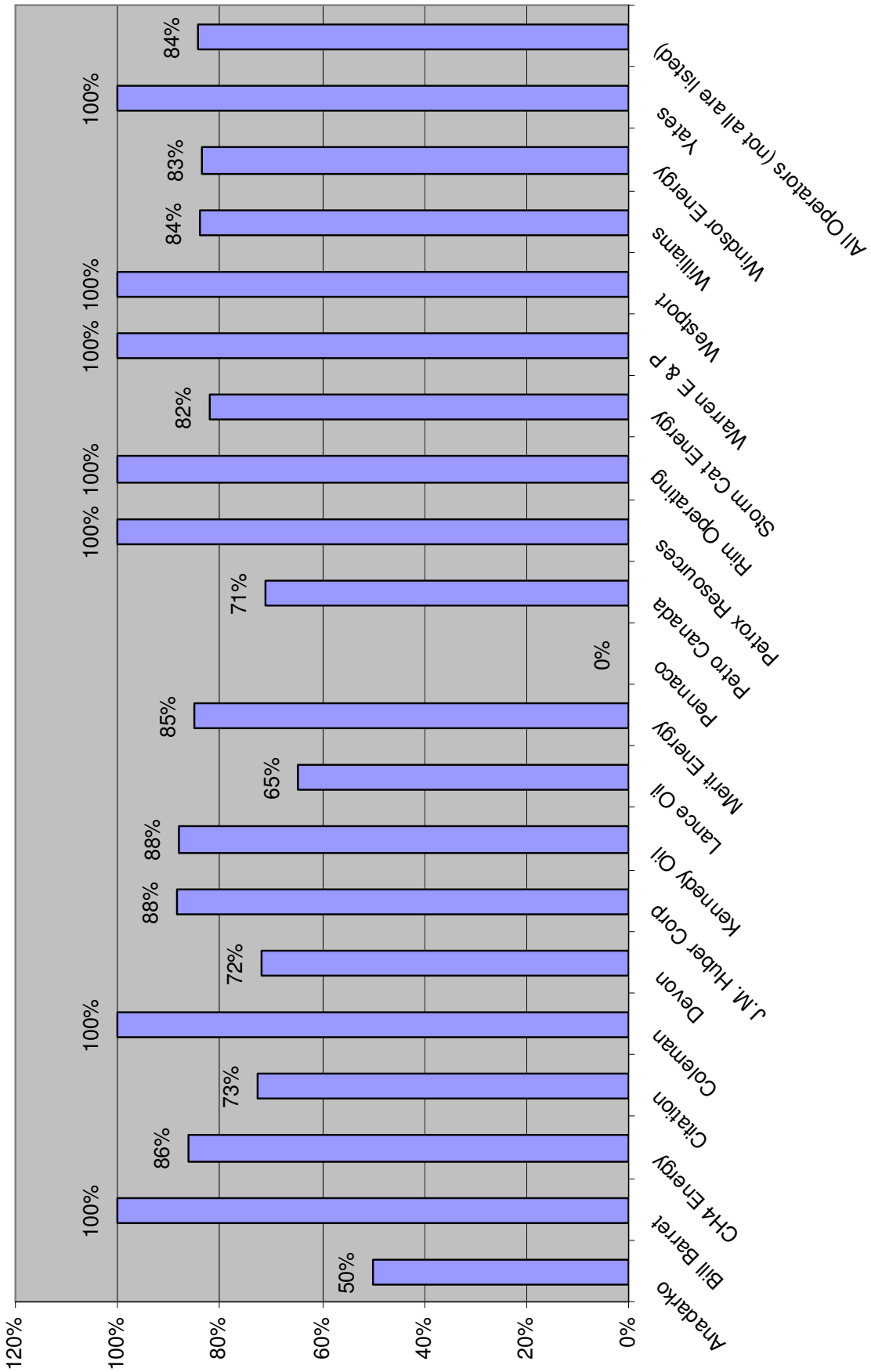


Figure 7: Percent of PODs Inspected vs. PODs Approved

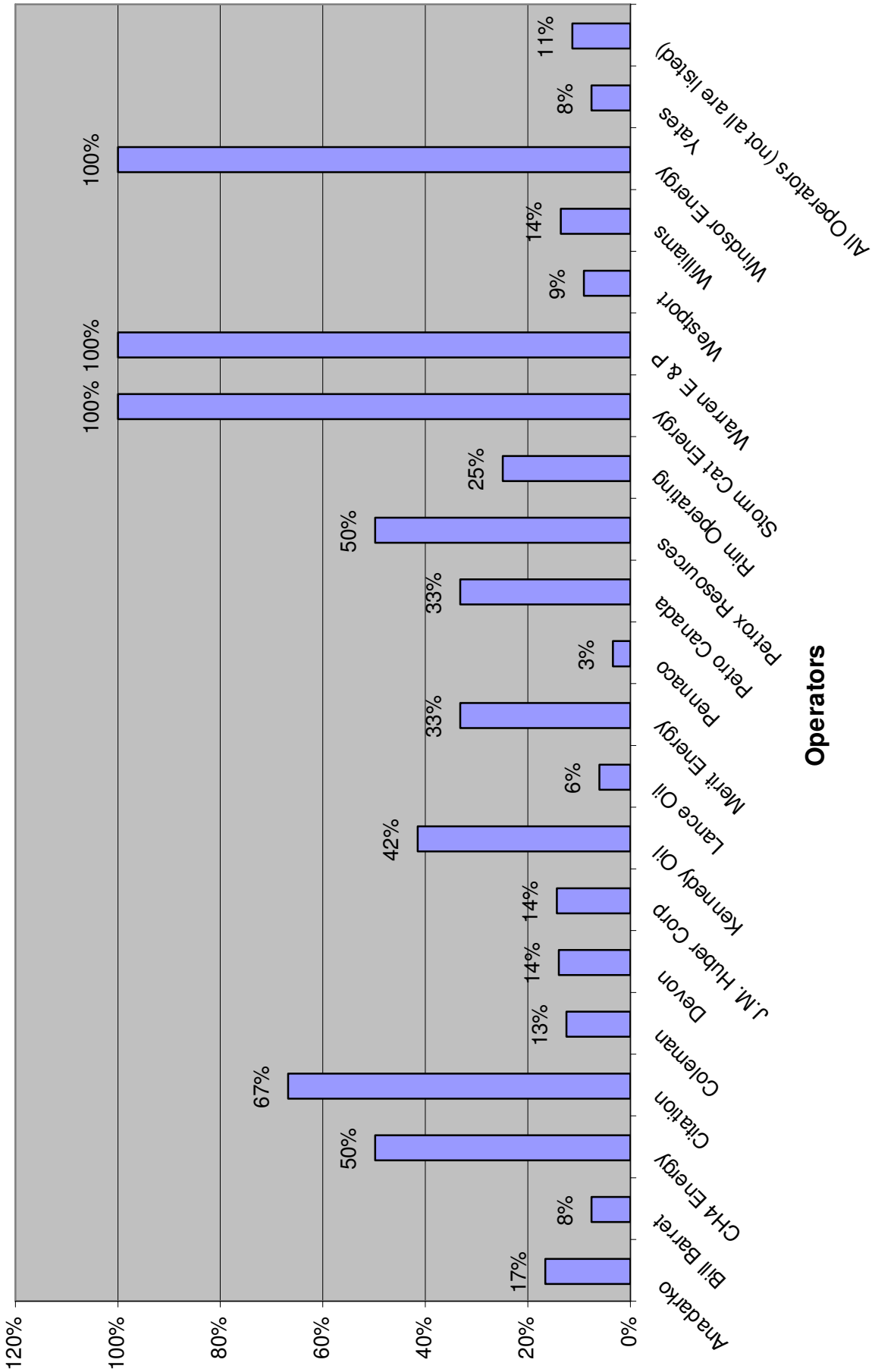


Figure 8:

Common Name	Scientific Name
Canada thistle*	*Cirsium arvense*
Russian thistle[1]	*Salsola*
Kochia[1]	*Kochia Scoparia*
Halogeton[1]	*Halogeton glomeratus*
Saltcedar*	*Tamarix ramosissima*
Bull thistle[1]	*Cirsium vulgare*
Scotch thistle*	*Onopordum acanthium*
Common cocklebur[1]*	*Xanthium strumarium*
Buffalobur[1]	*Solanum rostratum*
Cheatgrass[1]	*Bromus tectorum*

This is a list of weeds that were observed in the inspections completed of Coal Bed Natural Gas well locations. * = noxious weeds; [1] = weeds of concern; [1]* = weed of concern that is tracked as noxious in Campbell and Johnson Counties

Figure 9: Percent of Environmental Problems Found

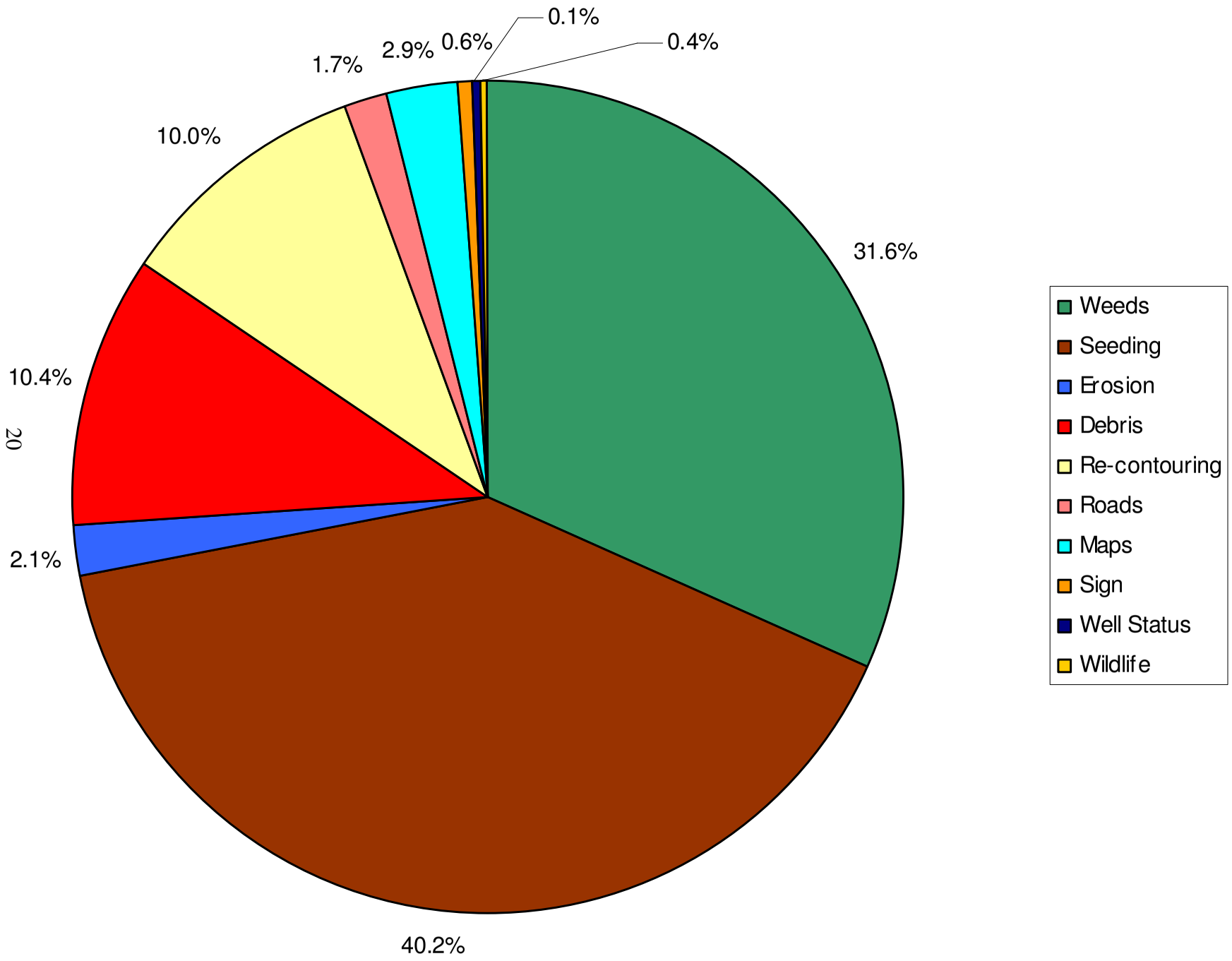
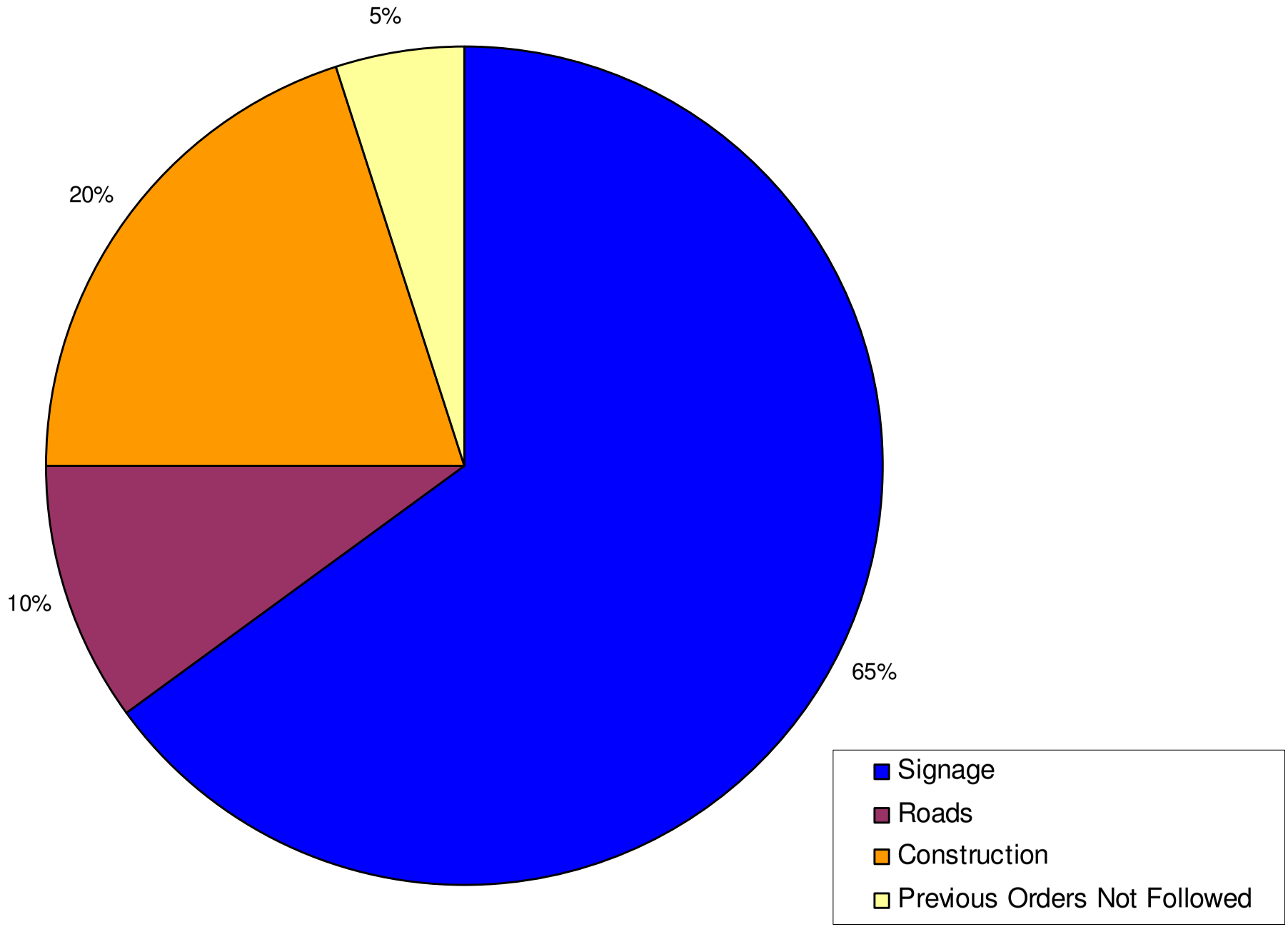


Figure 10: Incidents of Non-Compliance Letters: Percentage of Offenses



References

Bergquist, Erin. 2005. Invasive Species and Coal Bed Methane Development in the Powder River Basin, Wyoming. MS Defense Paper. Natural Resource Ecology Laboratory, Colorado State University, Fort Collins, CO.