Appendix A

Coal Mine Reclamation Employment Estimates for Seven Western U.S. Mine Sites

From: Jim Kuipers, PE, Kuipers & Associates, July 30, 2019

1. Introduction

As requested, this memo describes the reclamation tasks and financial assurance (e.g. "bonding") cost estimates for seven western U.S. coal mines that use open cut strip mining methods at sites located in Colorado, Montana, Wyoming and North Dakota. Based on the financial assurance cost estimates, this memo also contains estimates of the range of potential labor employment that would occur during reclamation of each mine.

2. Methodology

The following sections provide the technical basis for the reclamation and closure tasks and financial assurance cost estimates, and employment estimates, as described herein.

2.1 Coal Mine Reclamation Tasks and Financial Assurance Cost Estimates

As noted in a recent U.S. Government Accountability Office report to Congress[1], under the Surface Mining Control and Reclamation Act (SMCRA), operators of coal mines in the United States are required to reclaim mined lands. To help ensure that reclamation occurs, SMCRA requires an operator to submit financial assurance (e.g., a bond) in an amount sufficient to ensure that adequate funds will be available for the regulatory authority—either the Department of the Interior's Office of Surface Mining Reclamation and Enforcement (OSMRE) or an approved state regulatory authority—to complete required reclamation if the operator does not do so.

SMCRA requires a mine operator to obtain a permit before starting to mine. The permit process requires operators to submit plans describing the extent of proposed mining operations and how and on what timeline the mine sites will be reclaimed. In general, an operator must reclaim the land to a post-mining land use that OSMRE or the state

1 COAL MINE RECLAMATION, Federal and State Agencies Face Challenges in Managing Billions in Financial Assurances, United States Government Accountability Office, March 2018 https://www.gao.gov/assets/700/690476.pdf

regulatory authority deems at least equal to the pre-mining land use. In reclaiming the mine site, operators must specifically comply as follows:

- Operators are generally required to return mine sites to their approximate original contour unless the operator receives a variance from the regulatory authority. To return to this contour, the surface configuration achieved by backfilling and grading of the mined area must closely resemble the general surface configuration of the land before mining and blend into and complement the drainage pattern of the surrounding terrain, with all highwalls and spoil piles eliminated.

- Operators are required to demonstrate successful revegetation of the mine site for 5 years (in locations that receive more than 26 inches of rain annually) or 10 years (in drier areas). States have requirements for what vegetation may be planted depending on the approved postmining land use.

- SMCRA requires that financial assurances be sufficient to ensure reclamation compliant with water quality standards, including those established by the Environmental Protection Agency or the states under the Clean Water Act. SMCRA's implementing regulations also contain additional water protection requirements. For example, the regulations require that all surface mining and reclamation activities be conducted to minimize disturbance of the hydrologic balance within the permit and adjacent areas and to prevent material damage to the hydrologic balance outside the permit area.

OSMRE's Handbook for Calculation of Reclamation Bond Amounts[2] is considered the authoritative guidance on coal mine reclamation cost estimation for the purpose of establishing financial assurance amounts. The tasks described for coal mine reclamation in the handbook are the same regardless of whether the mine operator or the government were to do the work. The specific tasks are summarized as follows:

1. Structure Demolition and Disposal Tasks. With the exception of structures approved for retention as part of the postmining land use, the regulations require the reclamation of all haul and access roads and the removal and disposal of all mining-related buildings, crushers, coal storage bunkers and silos, conveyor systems, fences, foundations, power lines, rail spurs, utilities, storage facilities for equipment and supplies, and other similar structures within the permit area.

2. Earthmoving Tasks. For most surface mining operations, earthmoving is the major reclamation cost. Necessary earthmoving activities most commonly include backfilling, grading, placement of cover materials (especially on coal refuse disposal sites), and topsoil redistribution. Backfilling consists of the mass

2 https://www.osmre.gov/LRG/docs/directive882.pdf

transport of spoil to eliminate spoil piles, pits, and highwalls. Grading commonly includes:

a. Removing diversions and siltation structures,
b. Reshaping road cut-and-fill slopes,
c. Reconstructing stream channels,
d. Recontouring all disturbed areas to restore appropriate drainage patterns and facilitate the postmining land use,
e. Preparing the site for topsoil redistribution, and
f. Ripping or scarifying the regraded overburden necessary to ensure topsoil adhesion.

3. Revegetation Tasks. The initial revegetation process generally consists of seedbed preparation, including such tasks as soil sampling, application of soil amendments (fertilizer, lime, etc.), seeding, planting, and mulching. Weather and site conditions may result in complete or partial failure of an initial revegetation effort. The cost estimate must also include reseeding and replanting expenses associated with vegetative failures, including all disturbed lands within the permit area not yet released.

4. Other Direct Reclamation Tasks. Depending upon site conditions and applicable requirements of the reclamation and operation plans, other necessary reclamation activities may include:

a. Pumping and treating impounded waters.
b. Replacing wetlands.
c. Sealing underground mine entries and openings.
d. Plugging auger holes.
e. Sealing monitoring wells and other drilled holes.
f. Constructing rock drains.
g. Disposing of toxic, hazardous, and other solid (noncoal) waste in accordance with state and federal laws and local ordinances.
h. Maintaining roads during reclamation including grading, surfacing, ditches and culverts, and snow removal.
i. Maintaining ponds.
j. Water sampling and monitoring to the extent required to comply with any necessary Federal, State, or local permits.
k. Evaluating and rehabilitating structures to be retained as part of the postmining land use (ponds, roads, diversions, etc.).

The permittee may also be required to address subsidence-related material damage to surface lands and protected structures and to replace certain water supplies impacted by mining operations. And, if an unanticipated discharge of pollutants requiring long-term treatment develops, the regulatory authority must adjust the bond or require the permittee to post equivalent financial assurance to cover all foreseeable abatement and future treatment costs.

The financial assurance cost estimates are performed using standard fundamental engineering cost estimation methods that incorporate the costs of equipment, labor, fuel, supplies and supervision. These are typically identified as “direct costs” whereas “indirect costs” refer to: mobilization and demobilization; engineering, procurement and construction management; contingency; contractor overhead and profit, and; agency administration and overhead. Indirect costs are typically estimated as a percentage of direct costs. The total amount of financial assurance is determined by combining the direct and indirect costs.

2.2. Labor Estimates from Financial Assurance Estimates

As a general engineering cost estimation rule of thumb for heavy construction activities such as mine reclamation, the labor cost as a percentage of total direct costs is typically assumed to be 20%. The actual labor cost can vary from 10% to greater than 50% depending on the size and complexity of the reclamation activities. Large mines, such as most open cut coal mines, typically have lower labor costs as a percentage of total costs due to the efficiency of scale resulting from the use of very large heavy equipment. Financial assurance cost estimates are typically based on conceptual level plans with limited technical design information. Consistent with the recommended practice of the Association for the Advancement of Cost Engineering[3], financial assurance estimates are generally consistent with pre-design screening level estimates with an accuracy on the low side of from -15% to -30%, and +20% to +50% on the high side. Additionally, while the cost estimates follow a similar engineering cost estimation approach, because there is no standard cost estimation model, the actual details of each estimate vary significantly.

The majority of financial assurance estimates identify labor hours specifically associated with the operation of specific equipment. The estimates do not specifically identify labor associated with “owner costs” for equipment that are included in the estimate and include such tasks as equipment maintenance and servicing. The estimates in most cases do not identify labor associated with tasks such as equipment removal, building demolition, and revegetation. Finally, the estimates do not specify labor associated with indirect cost areas such as mobilization and demobilization, and contractor overhead such as construction supervision, or white-collar jobs associated with indirect cost areas such as engineering, procurement and construction management.

3. Reclamation Tasks and Financial Assurance Cost Estimates for Seven Western U.S. Open Cut Coal Mines

The following sections summarize the information contained in reclamation financial assurance cost estimates for the following seven western U.S. coal mines, all of which use open cut mining methods.

3 Recommended Practice No. 18-R-97, Cost Estimate Classification System, The Association for the Advancement of Cost Engineering, February 2, 2005.

- East Decker, Montana
- Absaloka, Montana (Crow Nation)
- Rosebud, Montana
- Colowyo, Colorado
- Eagle Butte, Wyoming
- North Antelope Rochelle, Wyoming
- Freedom, North Dakota

The East Decker, MT mine information is provided in more detail with more discussion in order to help better explain the reclamation process and the labor involved in that process. The sections essentially constitute seven case studies demonstrating the differences in approach to reclamation, cost estimation, and labor estimates.

3.1 East Decker Mine, Montana

The East Decker Mine is located in Montana and owned by Lighthouse Resources Inc. The 2008 Reclamation Bond Estimate together with the corresponding Reclamation Plan for the mine site are contained in Appendix A. The estimated direct cost for reclamation is $43.7M. Table 1 shows the East Decker Mine reclamation financial assurance cost estimate broken down by activity and equipment, quantity, equipment cost, labor cost, materials and supplies cost, and total cost. The activities are further discussed in the following sections.

Table 1 - East Decker Mine, MT - Financial Assurance Estimate

Activity	Quantity		Equipment			Labor			Materials/Supplies		Total Cost
	Units	No Units	Hours	Rate ($/hr)	Total	Hours	Rate ($/hr)	Total	Cost/ Unit	Total	
Highwall Blasting	bcy	10,188,000	2,970	$139	$412,572	3,300	$30.00	$99,009	$0.12	$1,252,718	$1,764,299
Truck-Shovel Grading											
Front End Loader	cy	30,406,000	26,091	$259	$6,753,350	28,990	$30.00	$869,700			$7,623,050
Haul Truck			104,364	$149	$15,542,318	115,960	$25.00	$2,899,000			$18,441,318
Track Dozer			13,046	$198	$2,588,307	14,495	$30.00	$434,850			$3,023,157
Grader			13,046	$99	$1,292,161	14,495	$30.00	$434,850			$1,727,011
Water Truck			13,046	$99	$1,296,811	14,495	$25.00	$362,375			$1,659,186
Sub-Total			169,593	$162	$27,472,947	188,435	$26.54	$5,000,775			$32,473,722
Road Ripping and Scarifying											
Track Dozer	l-ft	35,300	588	$199	$116,729	654	$29.99	$19,611			$136,340
Grader	acres	1,644	1,096	$99	$108,559	1,096	$30.00	$32,880			$141,439
Sub-Total			1,684	$134	$225,288	1,750	$29.99	$52,491			$277,779
Topsoil Placement											
Front End Loader	lcy	3,940,046	5,122	$259	$1,325,770	5,691	$30.00	$170,733			$1,496,503
Haul Truck			14,246	$149	$2,121,574	15,829	$25.00	$395,722			$2,517,296
Track Dozer			3,073	$198	$609,742	3,415	$30.00	$102,440			$712,182
Grader			2,561	$99	$253,668	2,846	$30.00	$85,367			$339,035
Water Truck			2,561	$99	$254,581	2,846	$25.00	$71,139			$325,720
Sub-Total			27,563	$166	$4,565,335	30,627	$26.95	$825,401			$5,390,736
Topsoil Scarifying											
Grader	acres	2,087	696	$99	$68,906	696	$30.00	$20,870			$89,776
Revegetation	acres	1,429							$372.98	$532,985	$532,985
Demolition	lot	1									$3,159,107
Total			202,506		$32,745,048	224,808	$26.68	$5,998,546		$1,785,703	$43,688,404

Highwall Blasting

According to the Reclamation Plan, all highwalls will be reduced and the steepest slope of the reduced highwalls will be no greater than 18° degrees (3:1) from the horizontal. This will be accomplished by grading from beyond the top of the highwall and backfilling the final cut so as to establish a broad
smooth grassy slope. The slope will be blended to undisturbed ground in such a way that there is a smooth transition with the surrounding landscape.

The cost estimate for highwall blasting is based on the bank cubic yards (bcy) and the cost to drill and blast including labor costs. The cost of $1.764M (4% of total direct costs) is based on highwall blasting of two pits, while the estimate notes for a third pit "Scoria/No Drill & Blast." The estimate assumes 3,300 labor hours at a rate of $30/hr or $99,000 total for labor, or 6% of the total task costs.

Grading

According to the Reclamation Plan, all final grading on the area of land affected will be to the approximate original contour of the land. Final slopes will be graded to prevent slope failure, will not exceed the angle of repose, and will achieve a minimum long-term static safety factor of 1.3. Cut and
fill terraces will be used only in those situations expressly identified in and in compliance with ARM 17.24.502. The postmining graded slopes will approximate the pre-mining natural slopes in the area. The steeper slopes will provide appropriate area for the inclusion of dry washes, as well as a variety of other habitat features, e.g. knobs, scarps, snow catchment areas, and rock ledges. The disturbed area will be blended with surrounding and undisturbed ground to provide a smooth transition in topography

The cost estimate for grading is based on bank cubic yards and truck-shovel grading utilizing a front end loader, four haul trucks, a track dozer, grader, and water truck. The cost of $32.473M (74% of total direct costs) assumes 188,435 labor hours at a weighted average rate of $25.54/hr or $5.000M total for labor, or 15% of the total task costs.

Road Ripping and Scarifying

The estimate includes costs for road ripping and scarifying prior to revegetation. The cost estimate for road ripping and scarifying is based on linear feet for dozer ripping and acres for grader scarifying. The cost of $0.278M (0.6% of total direct costs) assumes 1,750 labor hours at a rate of $30.00/hr or $52,491 total for labor, or 19% of the total task costs.

Topsoil Placement and Scarifying

According to the Reclamation Plan, the depth of soil laydown ("AB" and "C" material) is predetermined for the individual pits. Soil replacement will take place in a two-lift sequence with sufficient control

of the operation to achieve the approved thicknesses. The average replacement soil depth will be approximately 25 inches, with the top 6 inches being the surface lift material.

The cost estimate for topsoil placement and grading is based on loose cubic yards and truck-shovel grading utilizing a front end loader, three haul trucks, a track dozer, grader, and water truck. The cost of $5.391M (12% of total direct costs) assumes 30,627 labor hours at a weighted average rate of $26.95/hr or $0.825M total for labor, or 15% of the total task costs. Topsoil scarifying was estimated at $89,776 (0.2% of total direct costs) assumes 696 labor hours at a rate of $30.00/hr or $20,870 total for labor, or 23% of the total task costs.

Revegetation

According to the Reclamation Plan, DCC will establish on all lands disturbed by its coal mining operation a diverse, effective and permanent vegetative cover of the same seasonal variety and utility as that
native to the area. The reestablished vegetation will meet applicable state and federal laws and regulations governing seeds, poisonous and noxious plants and introduced species. The revegetation practices used at DCC are designed to create the desired primary postmining land use of Agriculture Rangeland for livestock grazing and Wildlife Grazing and Habitat.

The cost estimate for revegetation is based on an average estimated cost of $373 per acre which includes the cost of equipment, labor and supplies, and soil analysis. The cost is based actual previous costs for the previous three-years of revegetation. The cost of $532,985 (1.2% of total direct costs) does not identify specific information on labor costs.

Demolition

The estimate includes costs for demolition of offices, shops, warehouses, and numerous other miscellaneous facilities at the site. The cost is based on building dimensions and unit costs per linear or square feet. The cost of $3.159M (7% of total direct costs) does not identify specific information on labor costs.

Summary

The total disturbed area is approximately 2,087 acres and the direct costs to perform the required reclamation activities or tasks as indicated in Table 1 total $43.7M or $20,934 per acre. Of that amount, based on equipment hours, $6.0M, or 13.7% of the total cost, goes towards labor. If the labor costs for revegetation and demolition are assumed to be 20% of their respective costs, or $0.738M additional, then the total labor cost would be $6.7M, or 15.4% of the total cost.

3.2 Absaloka, Montana (Crow Nation)

The Absaloka Mine is located in Montana on the Crow Nation and owned by Westmoreland Mining. The 2017 Reclamation Bond Estimate is contained in Appendix B. The estimated direct cost for reclamation is $19.7M. Table 2 shows the Absaloka Mine financial assurance cost estimate broken down by activity and equipment, quantity, equipment cost, labor cost, materials and supplies cost, and total cost. The activities are further discussed in the following sections.

Table 2 - Absaloka Mine, MT - Financial Assurance Estimate

Activity	Quantity		Equipment			Labor			Materials/Supplies		Total Cost
	Units	No Units	Hours	Rate ($/hr)	Total	Hours	Rate ($/hr)	Total	Cost/ Unit	Total	
Highwall Blasting	bcy	1,734,391							$0.186	$322,625	$322,625
Earthmoving											
Dozer			15,337	$393	$6,026,203	15,337	$42.37	$649,821			$6,676,024
Ripping			2,308	$393	$906,923	2,308	$42.37	$97,796			$1,004,719
Scraper			16,304	$345	$5,631,156	16,304	$44.20	$720,635			$6,351,791
Blade			4,076	$124	$505,878	4,076	$42.37	$172,700			$678,578
Water Truck			4,076	$165	$670,881	4,076	$41.88	$170,703			$841,584
Sub-Total			42,101	$326	$13,741,041	42,101	$43.03	$1,811,655			$15,552,696
Revegetation	acres	1,918									$817,311
Demolition	lot	1									$2,411,165
Monitoring	lot	1									$590,724
Total					$27,482,082			$3,623,310		$322,625	$19,694,521

Highwall Blasting

The cost estimate of $322,625 (2% of total direct costs) for highwall blasting is based on the bank cubic yards (bcy) and the cost to drill and blast including labor costs. The cost estimate includes labor costs totaling $14.60/hole out of a total of $199.41/hole, or 7% of the total task costs.

Earthmoving

The cost estimate combines all earthmoving activities for pit reclamation, facilities, haul roads and topsoil placement. The estimate is based on loose cubic yards and using a dozer and scraper for earthmoving, a dozer for ripping, a blade (grader), and water truck.

The cost of $15.553M (79% of total direct costs) assumes 42,101 labor hours at a weighted average rate of $43.03/hr or $1.811M total for labor, or 12% of the total task costs.

Revegetation

The cost estimate for revegetation is based on various levels of operations: seeding (contingency seeding previous reclaimed areas); highwall reduction area (cultivate and seed); and scarify, cultivate and seed. The costs include equipment and labor, plant materials, and soil replacement contingency. The cost of $817,311 (4% of total direct costs) does not identify specific information on labor costs.

Demolition

The estimate includes costs for demolition of offices, shops, warehouses, and numerous other miscellaneous facilities at the site. The cost is based on building dimensions and unit costs per linear or square feet. The cost of $2.411M (12% of total direct costs) does not identify specific information on labor costs.

Monitoring

The estimate also includes costs of $590,724 for “long-term” monitoring. The estimate includes up to 10 years of costs for spoil, vegetation, wildlife, groundwater and surface water sampling. The estimate is based for costs for technicians of $71.00/hr and labor costs of about 14% of total task costs.

Summary

The total of the direct costs to perform the required reclamation activities or tasks as indicated in Table 2 totals $19.7M. The information provided does not allow for a project wide estimate of labor hours or costs.

3.3 Rosebud, Montana

The Rosebud Mine is located in Montana and owned by Westmoreland Mining. The 2007 Reclamation and Performance Bond Estimate is contained in Appendix C. The combined, Area A – E, estimated direct cost for reclamation is $152.8M. Table 3 shows the Rosebud Mine Area A financial assurance cost estimate broken down by activity and equipment, quantity, equipment cost, labor cost, materials and supplies cost, and total cost. Table 4 shows the Rosebud Mine Area A - D financial assurance cost estimate broken down by activity. The activities are further discussed in the following sections.

Highwall Blasting

The cost estimate for highwall blasting is based on the bank cubic yards (bcy) and the cost to drill and blast including labor costs. The Area A (Table 3) cost of $1.156M (4% of

total direct costs) is based on a unit cost of $0.24/bcy and does not allow for discernment of labor costs. The total highwall blasting cost of $9.369M (Table 4) is approximately 6% of total direct costs.

Table 3 – Rosebud Mine, MT – Area A Financial Assurance Estimate

Activity	Quantity		Equipment			Labor			Materials/Supplies		Total Cost
	Units	No Units	Hours	Rate ($/hr)	Total	Hours	Rate ($/hr)	Total	Cost/ Unit	Total	
Highwall Blasting	bcy	4,816,883							$0.24	$1,156,052	$1,156,052
Regrading											
Regrade Fleet			21,277	$357.71	$7,610,931						$7,610,931
Scraper Fleet			9,479	$280.64	$2,660,159						$2,660,159
Loader Truck Fleet			29,106	$238.04	$6,928,350						$6,928,350
Sub-Total			59,862	$287.32	$17,199,440						$17,199,440
Road Removal			10,036	$239.46	$2,403,176						$2,403,176
Pond and Trap Removal			1,345	$259.21	$348,631						$348,631
Spoil Finish Regrade and Scarification	acres	1,031	1,308	$197.71	$258,606						$258,606
Soil Distribution	acres	1,031	9,859	$234.41	$2,311,002						$2,311,002
Revegetation	acres	972	1,701	$287.00	$488,187						$488,187
Facilities	lot	1									$2,002,793
Monitoring	lot	1									$422,878
Total			84,111	$273.56	$23,009,042					$1,156,052	$26,590,765

Table 4 – Rosebud Mine, MT – Total Financial Assurance Estimate

Activity	Area Costs					Total Cost
	Area A	Area B	Area C	Area D	Area E	
Highwall Blasting	$1,156,052	$5,757,013	$2,161,553	$294,462		$9,369,080
Regrading						
Regrade Fleet	$7,610,931	$28,422,250	$9,004,493			
Scraper Fleet	$2,660,159	$4,699,656	$3,087,089			
Loader Truck Fleet	$6,928,350	$19,524,728	$7,177,675			
Sub-Total	$17,199,440	$52,646,634	$19,269,257	$8,964,152		$98,079,483
Road Removal	$2,403,176	$616,447	$1,001,533	$653,630	$47,353	$4,722,139
Pond and Trap Removal	$348,631	$123,466	$665,244	$237,401	$94,945	$1,469,687
Spoil Finish Regrade and Scarification	$258,606	$771,272	$806,333	$471,097	$22,178	$2,329,486
Soil Distribution	$2,311,002	$6,654,097	$9,180,926	$5,603,352	$267,367	$24,016,744
Revegetation	$488,187	$1,979,231	$2,709,986	$755,074	$271,422	$6,203,900
Facilities	$2,002,793	$1,019,775	$948,089	$502,818	$14,720	$4,488,195
Monitoring	$422,878	$718,267	$110,372	$477,169	$349,868	$2,078,554
Total	$26,590,765	$70,286,202	$36,853,293	$17,959,155	$1,067,853	$152,757,268

Grading

The cost estimate for grading is based on bank cubic yards and truck-shovel grading utilizing a regrade fleet, scraper fleet, and loader truck fleet. The Area A (Table 3) cost of $17.199M (65% of total direct costs) is based on equipment costs that include labor, but

do not allow for discernment of labor costs. The total grading cost of $98.079M (Table 4) is approximately 64% of total direct costs.

Road Ripping and Scarifying

The estimate includes costs for road ripping and scarifying. The Area A (Table 3) cost of $2.403M (9% of total direct costs) is based on equipment costs that include labor, but do not allow for discernment of labor costs. The total road ripping and scarifying cost of $4.722M (Table 4) is approximately 3% of total direct costs.

Pond and Trap Removal

The estimate includes costs for pond and trap removal. The Area A (Table 3) cost of $0.349M (1.3% of total direct costs) is based on equipment costs that include labor, but do not allow for discernment of labor costs. The total pond and trap removal cost of $1.470M (Table 4) is approximately 1.0% of total direct costs.

Spoil Finish Regrade and Scarification

The estimate includes costs for spoil finish regrade and scarification. The Area A (Table 3) cost of $0.259M (1.0% of total direct costs) is based on equipment costs that include labor, but do not allow for discernment of labor costs. The total spoil finish regrade and scarification cost of $2.329M (Table 4) is approximately 1.5% of total direct costs.

Topsoil Placement

The cost estimate includes costs for soil distribution. The Area A (Table 3) cost of $2.311M (9% of total direct costs) is based on equipment costs that include labor, but do not allow for discernment of labor costs. The total soil distribution cost of $24.017M (Table 4) is approximately 16% of total direct costs.

Revegetation

The cost estimate for revegetation in Area A (Table 3) of $0.488M (2% of total direct costs) is based on equipment costs that include labor, but do not allow for discernment of labor costs. The total revegetation cost of $6.204M (Table 4) is approximately 4% of total direct costs.

Demolition

The estimate includes costs for demolition of offices, shops, warehouses, and numerous other miscellaneous facilities at the site. The cost is based on building dimensions and unit costs per linear or square feet. The cost estimate for facilities in Area A (Table 3) of $2.003M (8% of total direct costs) does not allow for discernment of labor costs. The total facilities demolition cost of $4.488M (Table 4) is approximately 3% of total direct costs.

Monitoring

The estimate also includes costs for monitoring. The estimate includes up to 10 years of costs for spoil, vegetation, wildlife, groundwater and surface water sampling. The total monitoring cost of $2.078M (Table 4) is approximately 1.4% of total direct costs.

Summary

The total of the direct costs to perform the required reclamation activities or tasks as indicated in Table 4 totals $152.8M. The information provided does not allow for a project wide estimate of labor hours or costs.

3.4 Eagle Butte, Wyoming

The Eagle Butte Mine is located in Wyoming and owned by Contura Coal West, LLC. The 2017 Reclamation Bond Estimate is contained in Appendix D. The estimated direct cost for reclamation is $107.4M. Table 5 shows the Eagle Butte Mine financial assurance cost estimate broken down by activity. The activities are further discussed in the following sections.

This estimate of reclamation costs for Eagle Butte Mine was prepared according to the Wyoming Department of Environmental Quality, Land Quality Division Guideline No. 12, Standardized Reclamation Performance Bond Format and Cost Calculation Methods dated February 2017. This estimate is in the suggested format of Guideline 12. The methodology is based on unit costs and does not allow for discernment of either equipment or labor costs without referring to the guidelines.

Table 5 – Eagle Butte Mine, WY – Financial Assurance Estimate

Activity	Quantity		Equipment			Labor			Materials/Supplies		Total Cost
	Units	No Units	Hours	Rate ($/hr)	Total	Hours	Rate ($/hr)	Total	Cost/ Unit	Total	
Overburden Removal and Backfill											
Earthmoving	lcy	49,292,000									$68,488,600
Purchase of 80 CY Shovel	lot	1									$24,529,400
Scarification	acres	4,078									$204,716
Soil Distribution	lcy	9,037,257									$5,503,371
Revegetation	acres	4,078							$650.00	$2,650,700	$2,650,700
Demolition	lot	1									$3,899,372
Reclamation Carryover	lot	1									$2,145,283
Total											$107,421,442

Overburden Removal and Backfill

The cost estimate for native overburden removal and backfill is based on unit costs for loose cubic yards using dozers, truck/shovel, and scraper methods. The cost of $68.489M

is approximately 64% of total direct costs. Additionally, the method used requires the financial assurance estimate include the cost of purchase of an 80 cubic yard shovel, the cost of which is estimated at $24.529M which is approximately 23% of the total direct costs. Combined, these costs equal approximately 87% of the total direct costs in the Eagle Butte Mine financial assurance cost estimate.

Scarification

The estimate includes costs for scarifying. The scarifying cost of $0.205M is approximately 0.2% of total direct costs.

Soil Distribution

The cost estimate includes costs for soil distribution. The soil distribution cost of $5.503M is approximately 5% of total direct costs.

Revegetation

The cost estimate includes costs for revegetation. The method uses a cost of $650/acre resulting in a cost of $2.651M which is approximately 2% of total direct costs.

Demolition

The estimate includes costs for demolition. The demolition cost of $3.899M is approximately 4% of total direct costs.

Reclamation Carryover

As required by Guideline 12, lands that have been topsoiled and seeded but have no bond release are bonded for retopsoiling, scarification, and revegetation. This also applies to land that has topsoil placed but not permanently seeded. The total reclamation carryover cost of $2.145M is approximately 2% of total direct costs.

Summary

The total of the direct costs to perform the required reclamation activities or tasks as indicated in Table 5 totals $107.4M. The information provided does not allow for a project wide estimate of labor hours or costs.

3.5 North Antelope Rochelle, Wyoming

The North Antelope Rochelle Mine is located in Wyoming and owned by Peabody Energy. The 2018 Reclamation Bond Estimate is contained in Appendix E. The estimated direct cost for reclamation is $299.1M. Table 6 shows the North Antelope Rochelle Mine financial assurance cost estimate broken down by activity. The activities are further discussed

in the following sections.

This estimate of reclamation costs was prepared according to the Wyoming Department of Environmental Quality, Land Quality Division Guideline No. 12, Standardized Reclamation Performance Bond Format and Cost Calculation Methods dated February 2017. The methodology is based on unit costs and does not allow for discernment of either equipment or labor costs without referring to the guidelines.

Table 6 – North Antelope Rochelle Mine, WY – Financial Assurance Estimate

Activity	Quantity		Equipment			Labor			Materials/Supplies		Total Cost
	Units	No Units	Hours	Rate ($/hr)	Total	Hours	Rate ($/hr)	Total	Cost/ Unit	Total	
Overburden, Backfilling and Grading											
Earthmoving	lcy										$204,666,024
Purchase of 80 CY Shovel	lot										$28,000,000
Scarification	acres	30,375									$1,626,581
Soil Distribution	lcy										$36,289,935
Revegetation	acres	30,375							$537.46	$16,325,348	$16,325,350
Demolition	lot	1									$24,675,604
Bond Release	lot	1									-$12,513,767
Total											$299,069,727

Overburden, Backfilling and Grading

The cost estimate for overburden removal, backfilling and grading is based on unit costs for loose cubic yards using dozers, truck/shovel, and scraper methods. The cost of $204.7M is approximately 68% of total direct costs. Additionally, the method used requires the financial assurance estimate include the cost of purchase of an 80 cubic yard shovel, the cost of which is estimated at $28.0M which is approximately 9% of the total direct costs. Combined, these costs equal approximately 77% of the total direct costs in the financial assurance cost estimate.

Scarification

The estimate includes costs for scarifying. The scarifying cost of $1.627M is approximately 0.5% of total direct costs.

Soil Distribution

The cost estimate includes costs for soil distribution. The soil distribution cost of $36.290M is approximately 12% of total direct costs.

Revegetation

The cost estimate includes costs for revegetation. The method uses a cost of $537.46/acre resulting in a cost of $16.325M which is approximately 5% of total direct costs.

Demolition

The estimate includes costs for demolition. The demolition cost of $24.766M is approximately 8% of total direct costs.

Bond Release

The financial assurance estimate also includes the release of funds for areas already topsoiled, scarified, or revegetated. The released amount of $12.514M is approximately 4% of total direct costs.

Summary

The total of the direct costs to perform the required reclamation activities or tasks as indicated in Table 6 totals $299.1M. The information provided does not allow for a project wide estimate of labor hours or costs.

3.6 Freedom, North Dakota

The Freedom Mine is located in North Dakota and owned by The Coteau Properties Company. The 2014 Reclamation Bond Estimate is contained in Appendix F. The estimated direct cost for reclamation is $141.3M. The estimate summary contains four individual line items: Equipment Costs ($132.8M); Revegetation Costs ($3.8M); Misc. Structure Removal Costs ($3.3M) and Miscellaneous Costs ($1.4M). The method used in the estimate did allow for the estimation of total task hours, however it did not allow the discernment of labor costs.

3.7 Colowyo, Colorado

The Colowyo Mine is located in Colorado and owned by Elk Ridge Mining and Reclamation, LLC. The 2016 Reclamation Bond Estimate is contained in Appendix G. The estimated direct cost for reclamation of currently disturbed lands is $70.7M. The estimate summary contains more than 200 individual line items that include address of overburden, backfilling, grading, scarification, soil distribution, revegetation and demolition and include provisions for both current and future mining activities. The method used in the estimate did allow for the estimation of total task hours, however it did not allow the discernment of labor costs. As the aggregation of the individual line items for the primary tasks would require significant expenditure of time without the discernment of labor costs it was not performed as part of this evaluation.

4. Labor Estimates from Financial Assurance Estimates

As previously discussed, as a general engineering cost estimation rule of thumb for heavy construction activities such as mine reclamation, the labor cost as a percentage of total direct costs is typically assumed to be 20%. Large mines, such as most open cut coal mines, typically have lower labor costs as a percentage of total costs due to the efficiency of scale resulting from the use of very large heavy equipment. Of the financial assurance cost estimation examples provided in this report, only the East Decker Mine methodology allowed for an approximation of the total labor requirements, which were estimated at 13.7% of the total project direct costs. Based on an average labor rate of $26.68 used in the estimate, a total of 224, 808 labor hours can be estimated, which is the equivalent of 112.4 full-time employee's (FTEs) based on 2,000 hours per year.

Other estimates, where the information was available, were projected based on higher labor rates ranging from $30.00/hr to as high as $60.00/hr. Additionally, the general accuracy of the financial assurance cost estimates must also be considered.

For the purpose of this evaluation a simplified approach was used that considers the total direct costs multiplied by a base case factor of 15% to determine the total cost of labor, followed by a base case labor rate of $30.00/hr to determine the total labor hours for the reclamation of each mine site. Additionally, a sensitivity analysis was performed that uses a direct cost factor of 10% to estimate the total cost of labor on the low side, and a direct cost factor of 20% to estimate the total cost of labor on the low side, with the labor rate held at $30.00/hr. The base case results are presented in Table 7 and the sensitivity analysis in Table 8.

The base case analysis shows that for the seven mines evaluated the total direct costs range from $19.7M to $299.1M with a combined total direct cost of $834.7M. Based on labor costs being 15% of total direct costs the total labor costs range from $3.0M to $44.9M with a combined total labor cost of $125.2M. Based on an average fully burdened labor rate of $30.00 per hour the employment at each mine that would occur would range from 49 to 748 FTEs with a combined total employment of 2,087 FTEs.

The sensitivity analysis shows a low side case based on labor costs being 10% of total direct costs. The total labor costs range from $2.0M to $29.9M with a combined total labor cost of $83.5M. Based on an average fully burdened labor rate of $30.00 per hour the employment at each mine that would occur would range from 33 to 498 FTEs with a combined total employment of 1,391 FTEs. The sensitivity analysis shows a high side case based on labor costs being 20% of total direct costs. The total labor costs range from $3.9M to $59.8M with a combined total labor cost of $166.9M. Based on an average fully burdened labor rate of $30.00 per hour the employment at each mine that would occur would range from 66 to 997 FTEs with a combined total employment of 2,782 FTEs.

Labor Utilization

The actual utilization of the labor estimated in this evaluation would be based on the reclamation schedule. In the examples presented the primary reclamation tasks such as earthmoving and demolition were scheduled to be completed within two years with top-soiling and revegetation proceeding within one year of those tasks being completed, if not in the same year. With the exception of monitoring, the examples presented expected to be completed with reclamation within 3 years of initiation.

With the exception of revegetation, earthmoving activities would be expected to be conducted year-round. Revegetation activities, which consist of seeding using agricultural type equipment, are typically conducted during the fall months on areas that have been previously backfilled and regraded that same year.

As a result of these labor utilization considerations, it could be expected that the FTE years would be spread fairly evenly over 2-3 years. For example, this could result in full-time employment of approximately 25 labor employees over two years at the Absaloka Mine in MT, and in the case of the North Antelope Rochelle Mine in WY, this could result in full-time employment of approximately 250 labor employees over three years. In addition, it is important to note that technical and management employment would also occur as a result of these reclamation activities resulting in the addition of approximately 10% more employees in “white-collar” positions that are not included in these estimates.

Table 7 – Base Case Labor Estimate from Financial Assurance Estimates

Mine	Estimate Year	Total Direct Costs	Labor Rate $ hr	% Direct Cost as Labor	Base Case - 15% as Labor	
					Total Labor Costs	Employment (FTE years)
East Decker, MT	2008	$43,688,404	$30.00	15%	$6,553,261	109
Absaloka, MT	2017	$19,694,521	$30.00	15%	$2,954,178	49
Rosebud, MT	2007	$152,757,268	$30.00	15%	$22,913,590	382
Eagle Butte, WY	2017	$107,421,442	$30.00	15%	$16,113,216	269
North Antelope Rochelle, WY	2018	$299,069,727	$30.00	15%	$44,860,459	748
Freedom, ND	2014	$141,302,864	$30.00	15%	$21,195,430	353
Colowyo, CO	2016	$70,724,252	$30.00	15%	$10,608,638	177
Total		$834,658,478			$125,198,772	2,087

Table 8 – Labor Estimate Sensitivity Analysis from Financial Assurance Estimates

Mine	Base Case - 15% as Labor		Low Case - 10% as Labor		High Case - 20% as Labor	
	Total Labor Costs	Employment (FTE years)	Total Labor Costs	Employment (FTE years)	Total Labor Costs	Employment (FTE years)
East Decker, MT	$6,553,261	109	$4,368,840	73	$8,737,681	146
Absaloka, MT	$2,954,178	49	$1,969,452	33	$3,938,904	66
Rosebud, MT	$22,913,590	382	$15,275,727	255	$30,551,454	509
Eagle Butte, WY	$16,113,216	269	$10,742,144	179	$21,484,288	358
North Antelope Rochelle, WY	$44,860,459	748	$29,906,973	498	$59,813,945	997
Freedom, ND	$21,195,430	353	$14,130,286	236	$28,260,573	471
Colowyo, CO	$10,608,638	177	$7,072,425	118	$14,144,850	236
Total	$125,198,772	2,087	$83,465,848	1,391	$166,931,696	2,782

APPENDIX B

Case Study Mine Information References

All mine employment and production data comes from the US Dept. of Labor Mine Safety and Health Administration for the fourth quarter of 2019

- US Dept. of Labor Mine Safety and Health Administration (2020, May 1). Mine Quarterly Production Information. Retrieved from: https://www.msha.gov/mine-data-retrieval-system