

**POWERTECH (USA) INC.**

May 13, 2013

Matt Hicks  
Senior Hydrologist  
Groundwater Quality Program  
South Dakota Department of Environment and Natural Resources  
523 East Capitol Avenue - Joe Foss Building  
Pierre, SD 57501-3182

**Re: Dewey-Burdock Project Groundwater Discharge Permit Application  
January, February and March 2013 Analytical Results for Alluvial Compliance Wells  
and Revised October 2012 Metals Concentrations for Compliance Well DC-1**

Dear Mr. Hicks:

Analytical results for samples collected from alluvial compliance wells at the Dewey-Burdock Project site in January, February and March 2013 are enclosed along with summary tables presenting all sampling to date for each well. A revised report for the sample collected from DC-1 (R12100062-007) in October 2012 is also provided. Metals concentrations for this sample were previously reported based on an incorrect dilution factor.

Please do not hesitate to contact me or Richard Blubaugh, Vice President Environmental Health and Safety Resources, at (303) 790-7528 with questions.

Sincerely,

John Mays, P.E.  
Vice President Engineering

Encl. Data Summary Tables through March 2013  
Laboratory Data Packages **R12100062** (DC1, DC2, DC2 DUP, DC4, BC1, BC2, BC3);  
**R13010064** (DC2, DC4, BC1, BC1 DUP, BC2, BC3); **R13010096** (DC1); **R13010097** (DC3);  
**R13020119** (DC1, DC2, DC4, DC4 DUP, BC1, BC2, BC3); **R13020120** (DC3); **R13030030**  
(DC2); **R13030085** (DC3); and **R13030086** (DC1, DC4, BC1, BC2, BC3, BC3 DUP)  
CD Copy

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cc: Richard Blubaugh, Powertech (USA) Inc.  
Mark Hollenbeck, Powertech (USA) Inc.  
Jack Fritz, WWC Engineering  
Mike Cepak, SD DENR  
Ronald Burrows, NRC  
Valois Shea, EPA  
Marian Atkins, BLM  
Max Main, Bennett, Main & Gubbrud, P.C.



DATA SUMMARY TABLES  
THROUGH  
MARCH 2013



**POWERTECH (USA) INC.**

Powertech (USA) Inc. Dewey-Burdock Project Alluvial Compliance Well Sampling Results		Well DC-1	Well DC-1	Well DC-1	Well DC-1	Well DC-1	Well DC-1	Well DC-1	Well DC-1	Well DC-1	Human Health Standards ARSD 74:54:01:04
Sample Collection Date		7/24/2012	8/21/2012	9/11/2012	10/3/2012	11/6/2012	12/11/2012	1/8/2013	2/12/2013	3/5/2013	
Well Location, Elevation and Construction Details											
Northing (State Plane SD S NAD 27) <sup>1</sup>	feet	447093.13									
Easting (State Plane SD S NAD 27) <sup>1</sup>	feet	1013760.44									
Latitude (NAD 83) <sup>2</sup>	degrees	43.499431056									
Longitude (NAD 83) <sup>2</sup>	degrees	104.052110489									
Top of Casing Elevation (NGVD 29) <sup>1</sup>	feet AMSL	3645.45									
Casing and Screen Diameter	inches	2									
Screen Length	feet	10									
Well Stickup Above Ground Surface	feet	2.73									
Total Well Depth (Below Top of Casing)	feet	27.60									
Dedicated Tubing Intake (Below Top of Casing)	feet	no tubing installed (well bailed)									
Field Measurements											
Water Level Below Top of Casing	feet	22.86	23.00	23.06	23.16	23.27	23.29	23.29	23.36	23.31	
Water Level Elevation (NGVD 29)	feet AMSL	3622.59	3622.45	3622.39	3622.29	3622.18	3622.16	3622.16	3622.09	3622.14	
Well Volume	gal	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	
Volume Purged Prior to Sample Collection	gal	2.75	2.5	2.5	2.25	2.25	2.5	2.2	2.07	2.1	
Field pH	s.u.	7.04	7.05	6.93	7.00	6.9	7.1	7.1	7.3	7.1	
Field Temperature	°C	14.8	10.0	11.4	11.3	11.2	10.3	11.1	10.8	10.1	
Field Conductivity	mS/cm	5.7	6.3	7.61	6.97	7.64	7.37	7.58	6.70	7.21	
Clarity	observed	sl. cloudy	cloudy	cloudy	cloudy	murky	murky	murky	murky	murky	
Color	observed	tan-yellow	tan	tan	tan	tan	gray-tan	ylw-brwn	tan	tan-yellow	
Odor	observed	none	none	none	none	none	none	none	none	none	
Physical Properties											
Lab pH	s.u.	7.23	7.25	7.17	7.14	6.90	7.12	7.10	7.13	6.99	6.5 - 8.5
Total Dissolved Solids	mg/L	6400	5690	6090	6250	6730	6120	5780	5580	6600	1000
Lab Conductivity	umhos/cm	6080	5940	6350	6260	6680	6480	6520	6650	6860	
Common Elements and Ions											
Alkalinity, Total as CaCO <sub>3</sub>	mg/L	404	366	392	390	430	392	368	380	388	
Bicarbonate as HCO <sub>3</sub>	mg/L	492	446	478	475	524	478	449	463	473	
Calcium, Ca	mg/L	424	438	442	430	425	355	419	405	424	
Carbonate as CO <sub>3</sub>	mg/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
Chloride, Cl	mg/L	92	73	85	86	95	87	101	102	102	250
Magnesium, Mg	mg/L	348	353	400	369	364	347	348	349	394	
Nitrate, NO <sub>3</sub> <sup>-</sup> (as Nitrogen)	mg/L	5.5	7.5	7.7	9.1	6.2	9.5	12.6	12.1	9.4	10
Potassium, K	mg/L	15	13	14	18	10	9	12	11	14	
Sodium, Na	mg/L	1030	896	1210	1120	987	894	1290	1110	1160	
Sulfate, SO <sub>4</sub>	mg/L	4010	3520	3970	4040	4110	3920	3890	4030	4190	500
Trace and Minor Elements											
Dissolved Arsenic, As	mg/L	0.001	< 0.001	0.001	0.001	< 0.001	< 0.001	< 0.001	0.001	0.001	0.01
Dissolved Barium, Ba	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	2
Dissolved Boron, B	mg/L	1.2	1.3	1.4	1.4	1.50	1.32	1.12	1.42	1.40	
Dissolved Cadmium, Cd	mg/L	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	0.002	< 0.001	0.001	0.005
Dissolved Chromium, Cr	mg/L	< 0.005	< 0.005	0.010	0.007	< 0.005	< 0.005	< 0.005	< 0.005	0.007	0.1
Dissolved Copper, Cu	mg/L	0.038	< 0.005	0.009	0.011	< 0.005	< 0.005	< 0.005	0.007	0.009	1.0
Dissolved Fluoride, F	mg/L	1.1	1.2	1.1	1.3	0.9	1.0	1.1	1.1	0.8	4
Dissolved Iron, Fe	mg/L	0.04	< 0.03	< 0.03	0.04	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	
Dissolved Lead, Pb	mg/L	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.015
Dissolved Manganese, Mn	mg/L	0.456	0.330	0.757	0.398	0.154	0.150	0.576	0.474	0.484	
Total Mercury, Hg	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.002
Dissolved Molybdenum, Mo	mg/L	0.003	0.003	0.002	0.002	0.003	0.002	0.001	0.002	0.002	
Dissolved Nickel, Ni	mg/L	0.047	0.032	0.086	0.05	0.027	0.020	0.075	0.061	0.070	
Dissolved Selenium, Se	mg/L	0.034	0.032	0.060	0.040	0.028	0.031	0.050	0.050	0.054	0.05
Dissolved Silver, Ag	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.1
Dissolved Uranium, U	mg/L	0.0225	0.0243	0.0184	0.0189	0.0210	0.0228	0.0135	0.0164	0.0148	0.03
Dissolved Vanadium, V	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01	
Dissolved Zinc, Zn	mg/L	0.14	0.05	0.11	0.08	0.08	0.05	0.18	0.10	0.14	
Radiological Parameters											
Dissolved Gross Alpha	pCi/L	29.2	13.3	-0.4	-10	9.6	4.5	41.4	1.0	15.9	15
Precision (±)	pCi/L	13.3	17.7	17.8	16.3	15.8	13.9	13.7	12.8	14.2	
MDC	pCi/L	20.0	28.8	30.0	28.3	25.8	23.1	19.0	21.5	22.6	
Dissolved Gross Beta	pCi/L	2.0	-9	5.7	20.0	-9	4.2	-5	-8.0	9.2	4 mrem/year <sup>3</sup>
Precision (±)	pCi/L	10.3	25.2	28.8	17.5	15.9	17.7	15.5	16.7	16.3	
MDC	pCi/L	17.2	42.5	48.1	28.8	27.0	29.6	26.1	28.3	27.0	
Dissolved Radium 228	pCi/L	1.1	0.3	0.4	2.5	1.5	1.9	0.7	1.0	1.2	5 <sup>4</sup>
Precision (±)	pCi/L	0.7	0.7	0.6	1.2	1.4	1	0.9	1.1	1.3	
MDC	pCi/L	1.1	1.1	0.9	1.8	2.3	1.5	1.4	1.9	2.0	
Dissolved Radium 226	pCi/L	1.1	0.8	0.9	1.5	0.06	0.5	0.4	0.4	1.3	5 <sup>4</sup>
Precision (±)	pCi/L	0.2	0.2	0.2	0.2	0.09	0.2	0.2	0.2	0.3	
MDC	pCi/L	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	
Total Radon 222	pCi/L	1830	1440	1810	1920	1050	989	416	848	1650	300
Precision (±)	pCi/L	149	130	127	132	123	147	123	198	175	
MDC	pCi/L	210	187	173	180	184	224	198	313	258	

Highlighted value exceeds ARSD 74:54:01:04 Human Health Standard.

Note 1: Coordinates and elevation surveyed by Andersen Engineers, August 2012.

Note 2: Surveyed coordinates converted to latitude and longitude using CORPSCON 6.0.1 downloaded from <http://www.agc.army.mil/corpscon/>.

Note 3: A screening level of 50 pCi/L is used to estimate whether the ambient gross beta concentration is less than the Human Health Standard of 4 mrem/yr.

Note 4: Health standard is for radium 228 + radium 226.

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**POWERTECH (USA) INC.**

Powertech (USA) Inc. Dewey-Burdock Project Alluvial Compliance Well Sampling Results		Well DC-2	Well DC-2	Well DC-2	Well DC-2	Well DC-2	Well DC-2	Well DC-2	Well DC-2	Well DC-2	Human Health Standards ARSD 74:54:01:04
Sample Collection Date		7/23/2012	8/20/2012	9/10/2012	10/2/2012	11/5/2012	12/10/2012	1/7/2013	2/11/2013	3/4/2013	
Well Location, Elevation and Construction Details											
Northing (State Plane SD S NAD 27) <sup>1</sup>	feet	444788.27									
Easting (State Plane SD S NAD 27) <sup>1</sup>	feet	1014726.19									
Latitude (NAD 83) <sup>2</sup>	degrees	43.493232021									
Longitude (NAD 83) <sup>2</sup>	degrees	104.048085721									
Top of Casing Elevation (NGVD 29) <sup>3</sup>	feet AMSL	3616.28									
Casing and Screen Diameter	inches	2									
Screen Length	feet	20									
Well Stickup Above Ground Surface	feet	2.84									
Total Well Depth (Below Top of Casing)	feet	32.94									
Dedicated Tubing Intake (Below Top of Casing)	feet	23									
Field Measurements											
Water Level Below Top of Casing	feet	13.12	14.32	14.42	14.49	14.33	14.28	14.22	14.00	13.97	
Water Level Elevation (NGVD 29)	feet AMSL	3603.16	3601.96	3601.86	3601.79	3601.95	3602.00	3602.06	3602.28	3602.31	
Well Volume	gal	3.2	3.0	3.0	3.0	3.0	3.0	3.1	3.1	3.1	
Volume Purged Prior to Sample Collection	gal	10.5	9	9	9	9	9	9	9.3	9.3	
Field pH	s.u.	7.24	7.32	7.22	7.20	7.4	7.4	7.4	7.40	7.5	
Field Temperature	°C	11.9	12.1	12.5	12.5	12.2	10.9	10.6	10.1	9.1	
Field Conductivity	mS/cm	4.9	4.7	5.63	5.45	5.48	5.68	5.69	5.67	5.68	
Clarity	observed	clear	clear	clear	clear	clear	clear	clear	clear	clear	
Color	observed	clear	clear	clear	clear	clear	clear	clear	clear	clear	
Odor	observed	none	none	none	none	none	none	none	none	none	
Physical Properties											
Lab pH	s.u.	7.17	7.13	7.19	7.09	7.24	6.99	7.06	7.14	7.20	6.5 - 8.5
Total Dissolved Solids	mg/L	4640	4560	4610	4630	4620	4550	4540	4690	4700	1000
Lab Conductivity	umhos/cm	5010	5710	5540	5530	5670	5470	6250	5780	5730	
Common Elements and Ions											
Alkalinity, Total as CaCO <sub>3</sub>	mg/L	264	260	264	264	266	262	262	266	266	
Bicarbonate as HCO <sub>3</sub>	mg/L	322	317	322	322	324	319	319	324	324	
Calcium, Ca	mg/L	524	524	516	518	481	521	550	483	500	
Carbonate as CO <sub>3</sub>	mg/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
Chloride, Cl	mg/L	854	756	753	824	827	813	788	863	885	250
Magnesium, Mg	mg/L	145	144	147	147	142	149	153	139	156	
Nitrate, NO <sub>3</sub> (as Nitrogen)	mg/L	< 0.1	0.2	0.3	0.2	< 0.1	< 0.1	< 0.1	< 0.1	0.6	10
Potassium, K	mg/L	7	7	7	7	8	6	7	6	8	
Sodium, Na	mg/L	799	715	714	768	676	704	775	808	715	
Sulfate, SO <sub>4</sub>	mg/L	2140	1920	1890	2080	1980	1960	1950	1970	2030	500
Trace and Minor Elements											
Dissolved Arsenic, As	mg/L	< 0.001	< 0.001	0.002	0.001	0.001	< 0.001	0.001	< 0.001	0.001	0.01
Dissolved Barium, Ba	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	2
Dissolved Boron, B	mg/L	0.2	0.3	0.3	0.2	0.36	0.32	0.4	0.30	0.29	
Dissolved Cadmium, Cd	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005
Dissolved Chromium, Cr	mg/L	< 0.005	< 0.005	0.005	< 0.005	< 0.005	0.010	< 0.005	< 0.005	< 0.005	0.1
Dissolved Copper, Cu	mg/L	< 0.005	< 0.005	< 0.005	0.006	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	1.0
Dissolved Fluoride, F	mg/L	0.7	0.6	0.6	0.7	0.5	0.6	0.7	0.6	0.6	4
Dissolved Iron, Fe	mg/L	0.48	0.36	0.42	0.80	2.79	4.73	4.08	0.92	0.71	
Dissolved Lead, Pb	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.015
Dissolved Manganese, Mn	mg/L	3.88	3.41	3.13	3.05	2.95	3.07	3.28	2.96	3.20	
Total Mercury, Hg	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.002
Dissolved Molybdenum, Mo	mg/L	0.005	0.005	0.004	0.005	0.004	0.026	0.003	0.004	0.004	
Dissolved Nickel, Ni	mg/L	< 0.005	< 0.005	0.010	0.022	0.013	< 0.005	< 0.005	0.010	< 0.005	
Dissolved Selenium, Se	mg/L	0.002	0.001	0.003	0.004	< 0.001	0.002	0.003	< 0.001	0.002	0.05
Dissolved Silver, Ag	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.1
Dissolved Uranium, U	mg/L	0.0089	0.0081	0.0091	0.0087	0.0088	0.0089	0.0079	0.0086	0.0111	0.03
Dissolved Vanadium, V	mg/L	< 0.01	0.09	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	
Dissolved Zinc, Zn	mg/L	0.04	0.04	< 0.01	0.01	0.04	0.02	< 0.01	< 0.01	< 0.01	
Radiological Parameters											
Dissolved Gross Alpha	pCi/L	-10	-5	9.9	20.7	3.1	7.5	2.6	-5	7.3	15
Precision (±)	pCi/L	9.4	13.3	17.7	15.6	9.2	11.1	11.4	7.3	8.4	
MDC	pCi/L	16.6	22.9	29.0	24.7	15.2	18.0	19.0	12.9	13.4	
Dissolved Gross Beta	pCi/L	-1	-10	2.2	-2	-10	3.1	-4	5.4	18.0	4 mrem/year <sup>3</sup>
Precision (±)	pCi/L	8.3	21.4	22.0	21.9	11.6	13.0	13.3	11.7	17.4	
MDC	pCi/L	14.0	36.3	36.9	36.8	19.7	21.7	22.5	19.5	28.7	
Dissolved Radium 228	pCi/L	0.5	0.7	0.6	0.8	0.9	1.4	1.3	0.8	0.4	5 <sup>4</sup>
Precision (±)	pCi/L	0.6	0.7	0.6	0.7	0.8	1	0.7	1.1	0.7	
MDC	pCi/L	1.0	1.1	0.9	1.1	1.2	1.5	1.1	1.7	1.2	
Dissolved Radium 226	pCi/L	0.4	0.4	0.3	0.7	0.2	0.6	0.3	0.2	0.6	5 <sup>4</sup>
Precision (±)	pCi/L	0.2	0.1	0.1	0.1	0.08	0.2	0.2	0.1	0.2	
MDC	pCi/L	0.2	0.1	0.1	0.09	0.09	0.3	0.2	0.2	0.1	
Total Radon 222	pCi/L	1990	1850	2150	2040	2000	2000	1960	1990	2140	300
Precision (±)	pCi/L	167	159	152	154	158	156	167	209	164	
MDC	pCi/L	237	226	208	215	222	220	238	306	230	

Highlighted value exceeds ARSD 74:54:01:04 Human Health Standard.

Note 1: Coordinates and elevation surveyed by Andersen Engineers, August 2012.

Note 2: Surveyed coordinates converted to latitude and longitude using CORPSCON 6.0.1 downloaded from <http://www.agc.army.mil/corpscon/>.

Note 3: A screening level of 50 pCi/L is used to estimate whether the ambient gross beta concentration is less than the Human Health Standard of 4 mrem/yr.

Note 4: Health standard is for radium 228 + radium 226.

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**POWERTECH (USA) INC.**

Powertech (USA) Inc. Dewey-Burdock Project Alluvial Compliance Well Sampling Results		Well DC-3	Well DC-3	Well DC-3	Well DC-3	Well DC-3	Well DC-3	Well DC-3	Well DC-3	Well DC-3	Human Health Standards ARSD 74:54:01:04
Sample Collection Date		7/23/2012	8/20/2012	9/10/2012	10/2/2012	11/6/2012	12/11/2012	1/8/2013	2/12/2013	3/5/2013	
Well Location, Elevation and Construction Details											
Northing (State Plane SD S NAD 27) <sup>1</sup>	feet	444037.97									
Easting (State Plane SD S NAD 27) <sup>1</sup>	feet	1016403.16									
Latitude (NAD 83) <sup>2</sup>	degrees	43.491380990									
Longitude (NAD 83) <sup>2</sup>	degrees	104.041645784									
Top of Casing Elevation (NGVD 29) <sup>1</sup>	feet AMSL	3623.30									
Casing and Screen Diameter	inches	2									
Screen Length	feet	10									
Well Stickup Above Ground Surface	feet	2.26									
Total Well Depth (Below Top of Casing)	feet	25.10									
Dedicated Tubing Intake (Below Top of Casing)	feet	no tubing installed (dry well)									
Field Measurements											
Water Level Below Top of Casing	feet	Dry	Dry	Dry	24.70	24.35	24.35	24.30	24.27	24.43	
Water Level Elevation (NGVD 29)	feet AMSL	Dry	Dry	Dry	3598.60	3598.95	3598.95	3599.00	3599.03	3598.87	
Well Volume	gal	Dry	Dry	Dry	Insufficient Volume to Sample	Purged Approx. 1 c. Sample Vol. Approx. 1/2 c.	Purged Approx. 1 c. Sample Vol. Approx. 1/2 c.	Purged Approx. 1 c. Sample Vol. Approx. 1/2 c.	Purged Approx. 1 c. Sample Vol. Approx. 1/2 c.	Purged Approx. 1 1/2 c. Sample Vol. Approx. < 1/2 c.	
Volume Purged Prior to Sample Collection	gal	---	---	---							
Field pH	s.u.	---	---	---							
Field Temperature	°C	---	---	---							
Field Conductivity	ms/cm	---	---	---							
Clarity	observed	---	---	---							
Color	observed	---	---	---							
Odor	observed	---	---	---							
Physical Properties											
Lab pH	s.u.	---	---	---	---	---	---	---	---	---	6.5 - 8.5
Total Dissolved Solids	mg/L	---	---	---	---	11300	10900	11400	11100	11300	1000
Lab Conductivity	umhos/cm	---	---	---	---	---	---	---	---	---	
Common Elements and Ions											
Alkalinity, Total as CaCO <sub>3</sub>	mg/L	---	---	---	---	---	---	---	---	---	
Bicarbonate as HCO <sub>3</sub>	mg/L	---	---	---	---	---	---	---	---	---	
Calcium, Ca	mg/L	---	---	---	---	404	475	442	456	422	
Carbonate as CO <sub>3</sub>	mg/L	---	---	---	---	---	---	---	---	---	
Chloride, Cl	mg/L	---	---	---	---	1320	1400	1360	1480	1450	250
Magnesium, Mg	mg/L	---	---	---	---	701	771	770	768	715	
Nitrate, NO <sub>3</sub> (as Nitrogen)	mg/L	---	---	---	---	1.7	3.2	3.6	5.8	7.9	10
Potassium, K	mg/L	---	---	---	---	55	50	46	40	36	
Sodium, Na	mg/L	---	---	---	---	1780	1590	1940	1870	1640	
Sulfate, SO <sub>4</sub>	mg/L	---	---	---	---	6330	5940	6060	6150	6080	500
Trace and Minor Elements											
Dissolved Arsenic, As	mg/L	---	---	---	---	---	---	---	---	---	0.01
Dissolved Barium, Ba	mg/L	---	---	---	---	---	---	---	---	---	2
Dissolved Boron, B	mg/L	---	---	---	---	---	---	---	---	---	
Dissolved Cadmium, Cd	mg/L	---	---	---	---	---	---	---	---	---	0.005
Dissolved Chromium, Cr	mg/L	---	---	---	---	---	---	---	---	---	0.1
Dissolved Copper, Cu	mg/L	---	---	---	---	---	---	---	---	---	1.0
Dissolved Fluoride, F	mg/L	---	---	---	---	< 0.1	3.1	4.4	3.0	3.4	4
Dissolved Iron, Fe	mg/L	---	---	---	---	---	---	---	---	---	
Dissolved Lead, Pb	mg/L	---	---	---	---	---	---	---	---	---	0.015
Dissolved Manganese, Mn	mg/L	---	---	---	---	---	---	---	---	---	
Total Mercury, Hg	mg/L	---	---	---	---	---	---	---	---	---	0.002
Dissolved Molybdenum, Mo	mg/L	---	---	---	---	---	---	---	---	---	
Dissolved Nickel, Ni	mg/L	---	---	---	---	---	---	---	---	---	
Dissolved Selenium, Se	mg/L	---	---	---	---	---	---	---	---	---	0.05
Dissolved Silver, Ag	mg/L	---	---	---	---	---	---	---	---	---	0.1
Dissolved Uranium, U	mg/L	---	---	---	---	---	---	---	---	---	0.03
Dissolved Vanadium, V	mg/L	---	---	---	---	---	---	---	---	---	
Dissolved Zinc, Zn	mg/L	---	---	---	---	---	---	---	---	---	
Radiological Parameters											
Dissolved Gross Alpha	pCi/L	---	---	---	---	---	---	---	---	---	15
Precision (±)	pCi/L	---	---	---	---	---	---	---	---	---	
MDC	pCi/L	---	---	---	---	---	---	---	---	---	
Dissolved Gross Beta	pCi/L	---	---	---	---	---	---	---	---	---	4 mrem/year <sup>3</sup>
Precision (±)	pCi/L	---	---	---	---	---	---	---	---	---	
MDC	pCi/L	---	---	---	---	---	---	---	---	---	
Dissolved Radium 228	pCi/L	---	---	---	---	---	---	---	---	---	5 <sup>4</sup>
Precision (±)	pCi/L	---	---	---	---	---	---	---	---	---	
MDC	pCi/L	---	---	---	---	---	---	---	---	---	
Dissolved Radium 226	pCi/L	---	---	---	---	---	---	---	---	---	5 <sup>4</sup>
Precision (±)	pCi/L	---	---	---	---	---	---	---	---	---	
MDC	pCi/L	---	---	---	---	---	---	---	---	---	
Total Radon 222	pCi/L	---	---	---	---	---	---	---	---	---	300
Precision (±)	pCi/L	---	---	---	---	---	---	---	---	---	
MDC	pCi/L	---	---	---	---	---	---	---	---	---	

Highlighted value exceeds ARSD 74:54:01:04 Human Health Standard.

Note 1: Coordinates and elevation surveyed by Andersen Engineers, August 2012.

Note 2: Surveyed coordinates converted to latitude and longitude using CORPSCON 6.0.1 downloaded from <http://www.agc.army.mil/corpscon/>.

Note 3: A screening level of 50 pCi/L is used to estimate whether the ambient gross beta concentration is less than the Human Health Standard of 4 mrem/yr.

Note 4: Health standard is for radium 228 + radium 226.

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**POWERTECH (USA) INC.**

Powertech (USA) Inc. Dewey-Burdock Project Alluvial Compliance Well Sampling Results		Well DC-4	Well DC-4	Well DC-4	Well DC-4	Well DC-4	Well DC-4	Well DC-4	Well DC-4	Well DC-4	Human Health Standards ARSD 74:54:01:04
Sample Collection Date		7/24/2012	8/20/2012	9/10/2012	10/2/2012	11/5/2012	12/10/2012	1/7/2013	2/11/2013	3/5/2013	
Well Location, Elevation and Construction Details											
Northing (State Plane SD S NAD 27) <sup>1</sup>	feet	443942.11									
Easting (State Plane SD S NAD 27) <sup>1</sup>	feet	1018562.17									
Latitude (NAD 83) <sup>2</sup>	degrees	43.491382328									
Longitude (NAD 83) <sup>2</sup>	degrees	104.033501308									
Top of Casing Elevation (NGVD 29) <sup>1</sup>	feet AMSL	3618.34									
Casing and Screen Diameter	inches	2									
Screen Length	feet	10									
Well Stickup Above Ground Surface	feet	2.15									
Total Well Depth (Below Top of Casing)	feet	25.09									
Dedicated Tubing Intake (Below Top of Casing)	feet	22									
Field Measurements											
Water Level Below Top of Casing	feet	19.92	19.98	19.99	19.98	19.95	19.98	19.96	19.97	19.92	
Water Level Elevation (NGVD 29)	feet AMSL	3598.42	3598.36	3598.35	3598.36	3598.39	3598.36	3598.38	3598.37	3598.42	
Well Volume	gal	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	
Volume Purged Prior to Sample Collection	gal	4	3	4	3	3	3	3	2.52	2.52	
Field pH	s.u.	7.44	7.43	7.48	7.50	7.4	7.6	7.5	7.6	7.6	
Field Temperature	°C	11.8	12.2	12.5	13.0	12.4	11.1	11.3	10.3	10.4	
Field Conductivity	mS/cm	8.9	8.3	10.52	10.37	10.77	10.70	10.76	10.79	10.58	
Clarity	observed	clear	clear	clear	clear	clear	clear	clear	clear	clear	
Color	observed	clear	clear	clear	clear	clear	clear	clear	clear	clear	
Odor	observed	none	none	none	none	none	none	none	none	none	
Physical Properties											
Lab pH	s.u.	7.42	7.44	7.47	7.42	7.36	7.29	7.35	7.47	7.36	6.5 - 8.5
Total Dissolved Solids	mg/L	10600	11400	10600	11400	10700	10800	11300	11100	11400	1000
Lab Conductivity	umhos/cm	9270	10400	10400	10300	11200	10200	11700	11100	10800	
Common Elements and Ions											
Alkalinity, Total as CaCO <sub>3</sub>	mg/L	334	346	348	358	346	346	340	344	358	
Bicarbonate as HCO <sub>3</sub>	mg/L	407	422	424	436	422	422	414	419	436	
Calcium, Ca	mg/L	388	389	398	414	380	394	430	353	402	
Carbonate as CO <sub>3</sub>	mg/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
Chloride, Cl	mg/L	116	114	117	123	128	129	131	136	138	250
Magnesium, Mg	mg/L	620	604	630	651	635	661	715	644	708	
Nitrate, NO <sub>3</sub> <sup>-</sup> (as Nitrogen)	mg/L	1.7	1.6	1.7	1.8	1.8	1.7	1.8	1.9	1.9	10
Potassium, K	mg/L	10	10	11	11	11	10	12	9	11	
Sodium, Na	mg/L	2080	1820	1820	2010	1780	1820	2080	2220	2000	
Sulfate, SO <sub>4</sub>	mg/L	7450	6920	7330	7570	7230	7470	7450	7970	7650	500
Trace and Minor Elements											
Dissolved Arsenic, As	mg/L	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.01
Dissolved Barium, Ba	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	2
Dissolved Boron, B	mg/L	1.8	2.0	2.3	2.4	2.28	2.27	2.5	2.10	2.26	
Dissolved Cadmium, Cd	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005
Dissolved Chromium, Cr	mg/L	< 0.005	< 0.005	0.008	0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.009	0.1
Dissolved Copper, Cu	mg/L	< 0.005	< 0.005	0.008	0.012	< 0.005	0.011	< 0.005	0.008	0.009	1.0
Dissolved Fluoride, F	mg/L	2.9	2.5	2.6	2.7	2.2	2.2	2.2	1.8	1.6	4
Dissolved Iron, Fe	mg/L	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	
Dissolved Lead, Pb	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.015
Dissolved Manganese, Mn	mg/L	0.013	0.004	0.002	0.002	0.002	0.002	0.001	< 0.001	0.001	
Total Mercury, Hg	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.002
Dissolved Molybdenum, Mo	mg/L	0.003	0.002	0.003	0.003	0.002	0.009	< 0.001	0.003	0.003	
Dissolved Nickel, Ni	mg/L	< 0.005	< 0.005	0.008	0.016	0.009	< 0.005	< 0.005	0.007	0.007	
Dissolved Selenium, Se	mg/L	0.032	0.034	0.042	0.037	0.036	0.036	0.035	0.038	0.040	0.05
Dissolved Silver, Ag	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.1
Dissolved Uranium, U	mg/L	0.0157	0.0159	0.0171	0.0153	0.0160	0.0158	0.0149	0.0160	0.0160	0.03
Dissolved Vanadium, V	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	
Dissolved Zinc, Zn	mg/L	0.02	0.02	< 0.01	0.02	< 0.01	0.02	< 0.01	0.02	0.02	
Radiological Parameters											
Dissolved Gross Alpha	pCi/L	-5	16.5	-10	29.6	-2	13.3	17.7	-20	3.7	15
Precision (±)	pCi/L	18.5	22.4	21.1	24.0	20.5	21.4	21.7	26.5	22.9	
MDC	pCi/L	31.8	36.2	36.6	37.8	34.8	34.9	35.2	46.2	38.3	
Dissolved Gross Beta	pCi/L	-9	-20	-100	-10	-10	-7	-20	-20	8.7	4 mrem/year <sup>3</sup>
Precision (±)	pCi/L	24.4	29.4	44.4	31.0	26.9	27.0	25.0	26.8	27.3	
MDC	pCi/L	41.2	49.8	77.7	52.3	45.6	45.5	42.6	45.7	45.6	
Dissolved Radium 228	pCi/L	-0.5	0.04	0.4	0.6	1.9	0.4	2.4	0.6	0.02	5 <sup>4</sup>
Precision (±)	pCi/L	0.7	0.7	0.6	0.7	1.1	0.9	0.8	1.2	0.9	
MDC	pCi/L	1.2	1.2	0.9	1.1	1.7	1.6	1.1	2.0	1.6	
Dissolved Radium 226	pCi/L	0.4	0.2	0.2	0.2	-0.06	0.2	0.05	0.007	0.3	5 <sup>4</sup>
Precision (±)	pCi/L	0.2	0.1	0.1	0.1	0.06	0.2	0.1	0.1	0.2	
MDC	pCi/L	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	
Total Radon 222	pCi/L	4820	4530	4140	3990	4570	4710	4620	4620	5160	300
Precision (±)	pCi/L	180	188	173	175	184	184	194	241	214	
MDC	pCi/L	208	225	207	212	220	218	236	310	258	

Highlighted value exceeds ARSD 74:54:01:04 Human Health Standard.

Note 1: Coordinates and elevation surveyed by Andersen Engineers, August 2012.

Note 2: Surveyed coordinates converted to latitude and longitude using CORPSCON 6.0.1 downloaded from <http://www.agc.army.mil/corpscon/>.

Note 3: A screening level of 50 pCi/L is used to estimate whether the ambient gross beta concentration is less than the Human Health Standard of 4 mrem/yr.

Note 4: Health standard is for radium 228 + radium 226.

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**POWERTECH (USA) INC.**

Powertech (USA) Inc. Dewey-Burdock Project Alluvial Compliance Well Sampling Results		Well BC-1	Well BC-1	Well BC-1	Well BC-1	Well BC-1	Well BC-1	Well BC-1	Well BC-1	Well BC-1	Human Health Standards ARSD 74:54:01:04
Sample Collection Date		7/23/2012	8/20/2012	9/10/2012	10/2/2012	11/5/2012	12/10/2012	1/7/2013	2/11/2013	3/5/2013	
Well Location, Elevation and Construction Details											
Northing (State Plane SD S NAD 27) <sup>1</sup>	feet	436026.65									
Easting (State Plane SD S NAD 27) <sup>1</sup>	feet	1029474.73									
Latitude (NAD 83) <sup>2</sup>	degrees	43.471011532									
Longitude (NAD 83) <sup>2</sup>	degrees	103.991102852									
Top of Casing Elevation (NGVD 29) <sup>1</sup>	feet AMSL	3639.84									
Casing and Screen Diameter	Inches	2									
Screen Length	feet	15									
Well Stickup Above Ground Surface	feet	2.50									
Total Well Depth (Below Top of Casing)	feet	32.08									
Dedicated Tubing Intake (Below Top of Casing)	feet	24									
Field Measurements											
Water Level Below Top of Casing	feet	15.23	15.60	15.87	16.01	15.96	15.86	15.72	15.59	15.45	
Water Level Elevation (NGVD 29)	feet AMSL	3624.61	3624.24	3623.97	3623.83	3623.88	3623.98	3624.12	3624.25	3624.39	
Well Volume	gal	2.7	2.7	2.6	2.6	2.6	2.6	2.7	2.7	2.7	
Volume Purged Prior to Sample Collection	gal	11	9	9	9	7.8	8.25	8.25	8.1	8.25	
Field pH	s.u.	7.05	7.03	7.18	7.10	7.1	7.3	7.2	7.30	7.3	
Field Temperature	°C	11.9	12.7	12.2	12.4	12.2	11.0	11.5	10.6	10.6	
Field Conductivity	mS/cm	3.5	3.3	3.64	3.75	3.79	3.77	3.76	3.73	3.68	
Clarity	observed	clear	clear	clear	clear	clear	clear	clear	clear	clear	
Color	observed	clear	clear	clear	clear	clear	clear	clear	clear	clear	
Odor	observed	none	none	none	none	none	none	none	none	none	
Physical Properties											
Lab pH	s.u.	7.08	7.09	7.17	7.15	7.20	7.10	7.06	7.25	7.09	6.5 - 8.5
Total Dissolved Solids	mg/L	3640	3720	3660	3480	3670	3660	3800	3730	3740	1000
Lab Conductivity	umhos/cm	3200	3630	3610	3550	3580	3500	4050	3740	3710	
Common Elements and Ions											
Alkalinity, Total as CaCO <sub>3</sub>	mg/L	288	290	300	292	294	294	294	292	300	
Bicarbonate as HCO <sub>3</sub>	mg/L	351	354	366	356	358	358	358	356	366	
Calcium, Ca	mg/L	515	525	513	517	505	442	516	464	500	
Carbonate as CO <sub>3</sub>	mg/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
Chloride, Cl	mg/L	28	25	25	26	26	25	25	27	26	250
Magnesium, Mg	mg/L	236	238	234	240	234	225	251	230	243	
Nitrate, NO <sub>3</sub> <sup>-</sup> (as Nitrogen)	mg/L	< 0.1	0.2	0.3	< 0.1	0.2	0.2	0.2	0.2	0.3	10
Potassium, K	mg/L	13	12	13	13	12	10	12	11	11	
Sodium, Na	mg/L	206	175	185	197	194	174	194	198	190	
Sulfate, SO <sub>4</sub>	mg/L	2360	2170	2160	2300	2230	2220	2190	2210	2290	500
Trace and Minor Elements											
Dissolved Arsenic, As	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.01
Dissolved Barium, Ba	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	2
Dissolved Boron, B	mg/L	0.65	0.66	0.72	0.73	0.71	0.72	0.77	0.70	0.67	
Dissolved Cadmium, Cd	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005
Dissolved Chromium, Cr	mg/L	< 0.005	0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.007	0.1
Dissolved Copper, Cu	mg/L	< 0.005	< 0.005	< 0.005	0.006	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	1.0
Dissolved Fluoride, F	mg/L	0.6	0.6	0.6	0.7	0.6	0.6	0.7	0.6	0.5	4
Dissolved Iron, Fe	mg/L	0.06	< 0.03	0.08	0.06	0.13	0.17	0.08	0.05	< 0.03	
Dissolved Lead, Pb	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.015
Dissolved Manganese, Mn	mg/L	0.110	0.061	0.057	0.056	0.049	0.042	0.034	0.040	0.031	
Total Mercury, Hg	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.002
Dissolved Molybdenum, Mo	mg/L	0.005	0.005	0.005	0.006	0.012	0.006	0.004	0.006	0.006	
Dissolved Nickel, Ni	mg/L	< 0.005	< 0.005	0.013	0.022	0.005	< 0.005	< 0.005	0.006	0.009	
Dissolved Selenium, Se	mg/L	0.001	0.001	0.002	0.003	0.003	0.001	< 0.001	< 0.001	0.008	0.05
Dissolved Silver, Ag	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.1
Dissolved Uranium, U	mg/L	0.0757	0.0842	0.0854	0.0802	0.0822	0.0818	0.0877	0.111	0.0891	0.03
Dissolved Vanadium, V	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	
Dissolved Zinc, Zn	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01	0.02	
Radiological Parameters											
Dissolved Gross Alpha	pCi/L	65.9	71.1	78.7	68.9	50.1	78.0	69.6	108	72.1	15
Precision (±)	pCi/L	9.1	10.8	10.8	10.8	10.7	11.3	10	13.0	10.2	
MDC	pCi/L	10.5	12.8	12.7	12.9	14.0	13.1	11.6	15.9	12.3	
Dissolved Gross Beta	pCi/L	4.4	-4	0.3	7.8	19.8	27.0	15.7	22.8	17.4	4 mrem/year <sup>3</sup>
Precision (±)	pCi/L	6.2	10.6	11.0	10.4	10.6	11.8	10.9	10.3	9.7	
MDC	pCi/L	10.2	17.7	18.3	17.0	17.0	18.8	17.7	16.3	15.5	
Dissolved Radium 228	pCi/L	0.5	0.7	1.1	4.3	1.7	0.7	1.5	0.8	-0.5	5 <sup>4</sup>
Precision (±)	pCi/L	0.7	0.7	0.6	0.9	1	0.9	0.7	1.0	1.1	
MDC	pCi/L	1.1	1.1	0.9	1.1	1.5	1.5	1.1	1.7	1.8	
Dissolved Radium 226	pCi/L	0.4	0.1	0.3	0.8	0.1	0.3	0.2	0.1	0.2	5 <sup>4</sup>
Precision (±)	pCi/L	0.2	0.1	0.1	0.1	0.08	0.2	0.1	0.1	0.2	
MDC	pCi/L	0.2	0.1	0.1	0.09	0.1	0.2	0.2	0.2	0.2	
Total Radon 222	pCi/L	1870	1870	1730	1700	1900	2020	2110	2100	2040	300
Precision (±)	pCi/L	169	156	143	146	153	153	165	208	180	
MDC	pCi/L	242	221	202	208	216	214	232	302	259	

Highlighted value exceeds ARSD 74:54:01:04 Human Health Standard.

Note 1: Coordinates and elevation surveyed by Andersen Engineers, August 2012.

Note 2: Surveyed coordinates converted to latitude and longitude using CORPSCON 6.0.1 downloaded from <http://www.agc.army.mil/corpscon/>.

Note 3: A screening level of 50 pCi/L is used to estimate whether the ambient gross beta concentration is less than the Human Health Standard of 4 mrem/yr.

Note 4: Health standard is for radium 228 + radium 226.

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**POWERTECH (USA) INC.**

Powertech (USA) Inc. Dewey-Burdock Project Alluvial Compliance Well Sampling Results		Well BC-2	Well BC-2	Well BC-2	Well BC-2	Well BC-2	Well BC-2	Well BC-2	Well BC-2	Well BC-2	Human Health Standards ARSD 74:54:01:04
Sample Collection Date		7/23/2012	8/20/2012	9/10/2012	10/2/2012	11/5/2012	12/10/2012	1/7/2013	2/11/2013	3/5/2013	
Well Location, Elevation and Construction Details											
Northing (State Plane SD S NAD 27) <sup>1</sup>	feet	434253.95									
Easting (State Plane SD S NAD 27) <sup>1</sup>	feet	1030548.07									
Latitude (NAD 83) <sup>2</sup>	degrees	43.466282015									
Longitude (NAD 83) <sup>2</sup>	degrees	103.986769497									
Top of Casing Elevation (NGVD 29) <sup>1</sup>	feet AMSL	3636.33									
Casing and Screen Diameter	inches	2									
Screen Length	feet	10									
Well Stickup Above Ground Surface	feet	2.43									
Total Well Depth (Below Top of Casing)	feet	28.03									
Dedicated Tubing Intake (Below Top of Casing)	feet	23									
Field Measurements											
Water Level Below Top of Casing	feet	5.91	6.29	6.47	6.23	5.60	5.27	5.12	4.95	4.81	
Water Level Elevation (NGVD 29)	feet AMSL	3630.42	3630.04	3629.86	3630.1	3630.73	3631.06	3631.21	3631.38	3631.52	
Well Volume	gal	3.6	3.5	3.5	3.6	3.7	3.7	3.7	3.77	3.8	
Volume Purged Prior to Sample Collection	gal	10.8	10.5	10.5	12	15	11.25	11.25	11.31	11.40	
Field pH	s.u.	7.12	7.10	7.19	7.10	7.3	7.3	7.2	7.3	7.3	
Field Temperature	°C	10.3	10.1	10.3	10.1	9.9	9.1	9.40	9.2	9.0	
Field Conductivity	mS/cm	3.7	3.6	3.87	4.06	4.07	4.03	4.03	3.99	3.92	
Clarity	observed	clear	clear	clear	clear	clear	clear	clear	clear	clear	
Color	observed	clear	clear	clear	clear	clear	clear	clear	clear	clear	
Odor	observed	none	none	none	none	none	none	none	none	none	
Physical Properties											
Lab pH	s.u.	7.07	7.11	7.22	7.25	7.20	7.10	7.08	7.19	7.07	6.5 - 8.5
Total Dissolved Solids	mg/L	3840	3910	3870	3880	3910	3790	3880	3900	3900	1000
Lab Conductivity	umhos/cm	3430	3860	3850	3810	3870	3700	4200	3910	3920	
Common Elements and Ions											
Alkalinity, Total as CaCO <sub>3</sub>	mg/L	230	234	234	232	230	234	230	230	232	
Bicarbonate as HCO <sub>3</sub>	mg/L	280	285	285	283	280	285	280	280	283	
Calcium, Ca	mg/L	544	516	521	525	515	469	540	449	520	
Carbonate as CO <sub>3</sub>	mg/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
Chloride, Cl	mg/L	21	21	21	23	22	22	22	23	22	250
Magnesium, Mg	mg/L	200	218	220	216	223	212	230	212	220	
Nitrate, NO <sub>3</sub> (as Nitrogen)	mg/L	< 0.1	0.2	0.2	< 0.1	0.2	0.2	0.2	0.3	0.3	10
Potassium, K	mg/L	12	13	13	13	12	11	13	11	12	
Sodium, Na	mg/L	278	258	278	290	294	256	282	291	272	
Sulfate, SO <sub>4</sub>	mg/L	2350	2390	2400	2520	2380	2340	2360	2360	2530	500
Trace and Minor Elements											
Dissolved Arsenic, As	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.01
Dissolved Barium, Ba	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	2
Dissolved Boron, B	mg/L	0.44	0.46	0.51	0.51	0.51	0.50	0.5	0.47	0.52	
Dissolved Cadmium, Cd	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005
Dissolved Chromium, Cr	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.1
Dissolved Copper, Cu	mg/L	0.006	< 0.005	< 0.005	0.006	< 0.005	0.008	< 0.005	< 0.005	< 0.005	1.0
Dissolved Fluoride, F	mg/L	0.8	0.7	0.7	0.8	0.7	0.7	0.8	0.7	0.6	4
Dissolved Iron, Fe	mg/L	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	
Dissolved Lead, Pb	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.015
Dissolved Manganese, Mn	mg/L	0.042	0.045	0.039	0.040	0.040	0.038	0.040	0.044	0.038	
Total Mercury, Hg	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.002
Dissolved Molybdenum, Mo	mg/L	0.012	0.012	0.013	0.013	0.013	0.014	0.012	0.014	0.014	
Dissolved Nickel, Ni	mg/L	< 0.005	< 0.005	0.011	0.022	0.006	< 0.005	< 0.005	0.007	0.006	
Dissolved Selenium, Se	mg/L	< 0.001	< 0.001	0.002	0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	0.05
Dissolved Silver, Ag	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.1
Dissolved Uranium, U	mg/L	0.0228	0.0240	0.0241	0.0230	0.0256	0.0230	0.0259	0.0297	0.0246	0.03
Dissolved Vanadium, V	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	
Dissolved Zinc, Zn	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01	
Radiological Parameters											
Dissolved Gross Alpha	pCi/L	20.0	3.5	1.8	25.9	12.6	23.4	25.2	25.8	32.5	15
Precision (±)	pCi/L	7.8	9.7	7.0	9.3	8.6	9.3	8.6	8.9	8.9	
MDC	pCi/L	11.5	16.1	11.6	13.5	13.4	13.7	12.4	13.1	12.7	
Dissolved Gross Beta	pCi/L	4.5	0.5	-10	-10	9.2	7.8	-2	7.3	12.0	4 mrem/year <sup>3</sup>
Precision (±)	pCi/L	6.5	11.6	11.8	11.2	10.2	11.5	9.4	9.2	8.8	
MDC	pCi/L	10.7	19.5	20.1	19.1	16.8	19.1	15.8	15.1	14.3	
Dissolved Radium 228	pCi/L	0.1	-0.1	0.3	-0.1	0.5	0.7	0.8	0.7	0.5	5 <sup>4</sup>
Precision (±)	pCi/L	0.6	0.6	0.6	0.6	1.2	0.9	0.7	1.1	1.1	
MDC	pCi/L	1	1.1	0.9	1	2.1	1.4	1.0	1.7	1.9	
Dissolved Radium 226	pCi/L	0.07	0.3	0.3	0.5	0.02	0.2	0.2	0.08	0.4	5 <sup>4</sup>
Precision (±)	pCi/L	0.1	0.1	0.1	0.1	0.07	0.1	0.1	0.1	0.2	
MDC	pCi/L	0.2	0.1	0.1	0.08	0.1	0.2	0.2	0.2	0.2	
Total Radon 222	pCi/L	2860	2460	2480	2260	2530	2710	2670	2830	2800	300
Precision (±)	pCi/L	180	162	151	152	159	160	170	215	188	
MDC	pCi/L	240	219	200	206	214	212	229	300	256	

Highlighted value exceeds ARSD 74:54:01:04 Human Health Standard.

Note 1: Coordinates and elevation surveyed by Andersen Engineers, August 2012.

Note 2: Surveyed coordinates converted to latitude and longitude using CORPSCON 6.0.1 downloaded from <http://www.agc.army.mil/corpscon/>.

Note 3: A screening level of 50 pCi/L is used to estimate whether the ambient gross beta concentration is less than the Human Health Standard of 4 mrem/yr.

Note 4: Health standard is for radium 228 + radium 226.

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**POWERTECH (USA) INC.**

Powertech (USA) Inc. Dewey-Burdock Project Alluvial Compliance Well Sampling Results		Well BC-3	Well BC-3	Well BC-3	Well BC-3	Well BC-3	Well BC-3	Well BC-3	Well BC-3	Well BC-3	Human Health Standards ARSD 74:54:01:04
Sample Collection Date		7/23/2012	8/20/2012	9/10/2012	10/2/2012	11/5/2012	12/10/2012	1/7/2013	2/11/2013	3/5/2013	
Well Location, Elevation and Construction Details											
Northing (State Plane SD S NAD 27) <sup>1</sup>	feet	438165.90									
Easting (State Plane SD S NAD 27) <sup>1</sup>	feet	1029035.98									
Latitude (NAD 83) <sup>2</sup>	degrees	43.476822344									
Longitude (NAD 83) <sup>2</sup>	degrees	103.993109146									
Top of Casing Elevation (NGVD 29) <sup>1</sup>	feet AMSL	3654.95									
Casing and Screen Diameter	inches	2									
Screen Length	feet	15									
Well Stickup Above Ground Surface	feet	2.29									
Total Well Depth (Below Top of Casing)	feet	27.56									
Dedicated Tubing Intake (Below Top of Casing)	feet	20									
Field Measurements											
Water Level Below Top of Casing	feet	12.25	12.73	13.05	12.96	11.99	11.51	11.23	10.90	10.77	
Water Level Elevation (NGVD 29)	feet AMSL	3642.7	3642.22	3641.9	3641.99	3642.96	3643.44	3643.72	3644.05	3644.18	
Well Volume	gal	2.5	2.4	2.4	2.4	2.5	2.6	2.7	2.7	2.7	
Volume Purged Prior to Sample Collection	gal	7.5	7.5	7.5	7.5	7.5	8.25	8.25	8.16	8.25	
Field pH	s.u.	7.16	7.12	7.33	7.10	7.2	7.2	7.2	7.2	7.4	
Field Temperature	°C	10.3	10.8	10.8	10.9	10.6	9.7	10.3	9.1	8.8	
Field Conductivity	mS/cm	3.1	3.0	3.20	3.35	3.33	3.34	3.32	3.29	3.26	
Clarity	observed	clear	clear	clear	clear	clear	clear	clear	clear	clear	
Color	observed	clear	clear	clear	clear	clear	clear	clear	clear	clear	
Odor	observed	none	none	none	none	none	none	none	none	none	
Physical Properties											
Lab pH	s.u.	7.15	7.17	7.22	7.16	7.21	7.12	7.11	7.17	7.13	6.5 - 8.5
Total Dissolved Solids	mg/L	3160	3130	3140	3180	3170	3160	3100	3180	3160	1000
Lab Conductivity	umhos/cm	2870	3200	3200	3140	3110	3070	3550	3250	3200	
Common Elements and Ions											
Alkalinity, Total as CaCO <sub>3</sub>	mg/L	254	256	256	248	248	250	246	248	242	
Bicarbonate as HCO <sub>3</sub>	mg/L	310	312	312	302	302	305	300	302	295	
Calcium, Ca	mg/L	532	531	535	525	520	488	552	475	541	
Carbonate as CO <sub>3</sub>	mg/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
Chloride, Cl	mg/L	20	19	19	20	19	19	19	20	19	250
Magnesium, Mg	mg/L	150	148	152	150	150	144	159	139	151	
Nitrate, NO <sub>3</sub> (as Nitrogen)	mg/L	0.3	0.3	0.3	0.2	0.3	0.2	0.2	0.2	0.2	10
Potassium, K	mg/L	11	11	12	11	11	10	11	10	12	
Sodium, Na	mg/L	174	158	157	164	172	153	160	157	163	
Sulfate, SO <sub>4</sub>	mg/L	2010	1850	1820	1980	1860	1910	1890	1870	1830	500
Trace and Minor Elements											
Dissolved Arsenic, As	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.01
Dissolved Barium, Ba	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	2
Dissolved Boron, B	mg/L	0.44	0.45	0.49	0.51	0.52	0.50	0.54	0.47	0.49	
Dissolved Cadmium, Cd	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005
Dissolved Chromium, Cr	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.007	0.1
Dissolved Copper, Cu	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	1.0
Dissolved Fluoride, F	mg/L	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.6	0.5	4
Dissolved Iron, Fe	mg/L	0.05	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.06	0.05	0.20	
Dissolved Lead, Pb	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.015
Dissolved Manganese, Mn	mg/L	0.498	0.461	0.447	0.436	0.456	0.451	0.528	0.557	0.594	
Total Mercury, Hg	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.002
Dissolved Molybdenum, Mo	mg/L	0.006	0.006	0.007	0.007	0.006	0.008	0.005	0.006	0.007	
Dissolved Nickel, Ni	mg/L	< 0.005	< 0.005	0.012	0.022	0.006	< 0.005	< 0.005	< 0.005	0.010	
Dissolved Selenium, Se	mg/L	0.002	0.003	0.005	0.004	0.003	0.003	< 0.001	0.002	0.003	0.05
Dissolved Silver, Ag	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.1
Dissolved Uranium, U	mg/L	0.0208	0.0214	0.0226	0.0206	0.0212	0.0201	0.0197	0.0251	0.0204	0.03
Dissolved Vanadium, V	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	
Dissolved Zinc, Zn	mg/L	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02	
Radiological Parameters											
Dissolved Gross Alpha	pCi/L	29.9	10.3	11.4	28.6	14.2	26.4	25.9	19.3	22.4	15
Precision (±)	pCi/L	7.0	7.1	6.0	7.6	8.6	7.7	6.8	6.3	8.5	
MDC	pCi/L	9.5	11.1	9.2	10.2	13.4	10.7	9.4	9.0	12.9	
Dissolved Gross Beta	pCi/L	4.7	2.0	-1	4.1	8.6	5.0	0.6	6.4	12.0	4 mrem/year <sup>3</sup>
Precision (±)	pCi/L	5.6	9.4	10	9.1	8.6	9.2	7.7	7.6	8.0	
MDC	pCi/L	9.2	15.8	16.8	15.0	14.2	15.3	12.9	12.5	13.1	
Dissolved Radium 228	pCi/L	-0.1	-0.1	0.8	1.9	2.0	-0.4	1.5	1.2	1.7	5 <sup>4</sup>
Precision (±)	pCi/L	0.6	0.7	0.6	0.8	0.8	0.7	0.7	1.0	1.2	
MDC	pCi/L	1	1.1	0.9	1.2	1.2	1.2	1.1	1.7	1.9	
Dissolved Radium 226	pCi/L	0.08	0.1	0.1	0.4	0.09	0.07	0.3	0.3	0.2	5 <sup>4</sup>
Precision (±)	pCi/L	0.1	0.1	0.09	0.1	0.06	0.1	0.1	0.1	0.2	
MDC	pCi/L	0.2	0.1	0.1	0.09	0.09	0.2	0.2	0.2	0.2	
Total Radon 222	pCi/L	1700	1710	1720	1490	1860	1690	1750	1970	1630	300
Precision (±)	pCi/L	169	155	144	144	154	150	162	207	177	
MDC	pCi/L	245	223	204	209	218	216	233	304	262	

Highlighted value exceeds ARSD 74:54:01:04 Human Health Standard.

Note 1: Coordinates and elevation surveyed by Andersen Engineers, August 2012.

Note 2: Surveyed coordinates converted to latitude and longitude using CORPSCON 5.0.1 downloaded from <http://www.agc.army.mil/corpscon/>.

Note 3: A screening level of 50 pCi/L is used to estimate whether the ambient gross beta concentration is less than the Human Health Standard of 4 mrem/yr.

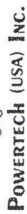
Note 4: Health standard is for radium 228 + radium 226.

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Note 1: A screening level of 50 pCi/L is used to estimate whether the ambient gross beta concentration is less than the highlighted value exceeds ARSD 74-5401:04 Human Health Standard.

Note 2: Health standard is for radium 228 + radium 226.

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**Holm, Eric**

---

**From:** Holm, Eric  
**Sent:** Tuesday, June 04, 2013 7:56 AM  
**To:** 'John Mays'  
**Cc:** Holm, Eric  
**Subject:** RE: Draft of Revised Plate 6.7.1

We reviewed the draft map of the Burdock area and could find no other changes. I also reviewed Plate 6.7-1 sheet 1 of 2 of the Dewey area and could find no other changes. Go ahead and send a final version of Plate 6.7-1.

---

**From:** John Mays [<mailto:jmays@powertechuranium.com>]  
**Sent:** Friday, May 31, 2013 2:29 PM  
**To:** Holm, Eric  
**Subject:** Draft of Revised Plate 6.7.1

Eric,

Please see the attach revised plate 6.7-1. Would like to discuss and will follow with full version.

John



**POWERTECH (USA) INC.**

**John M. Mays**

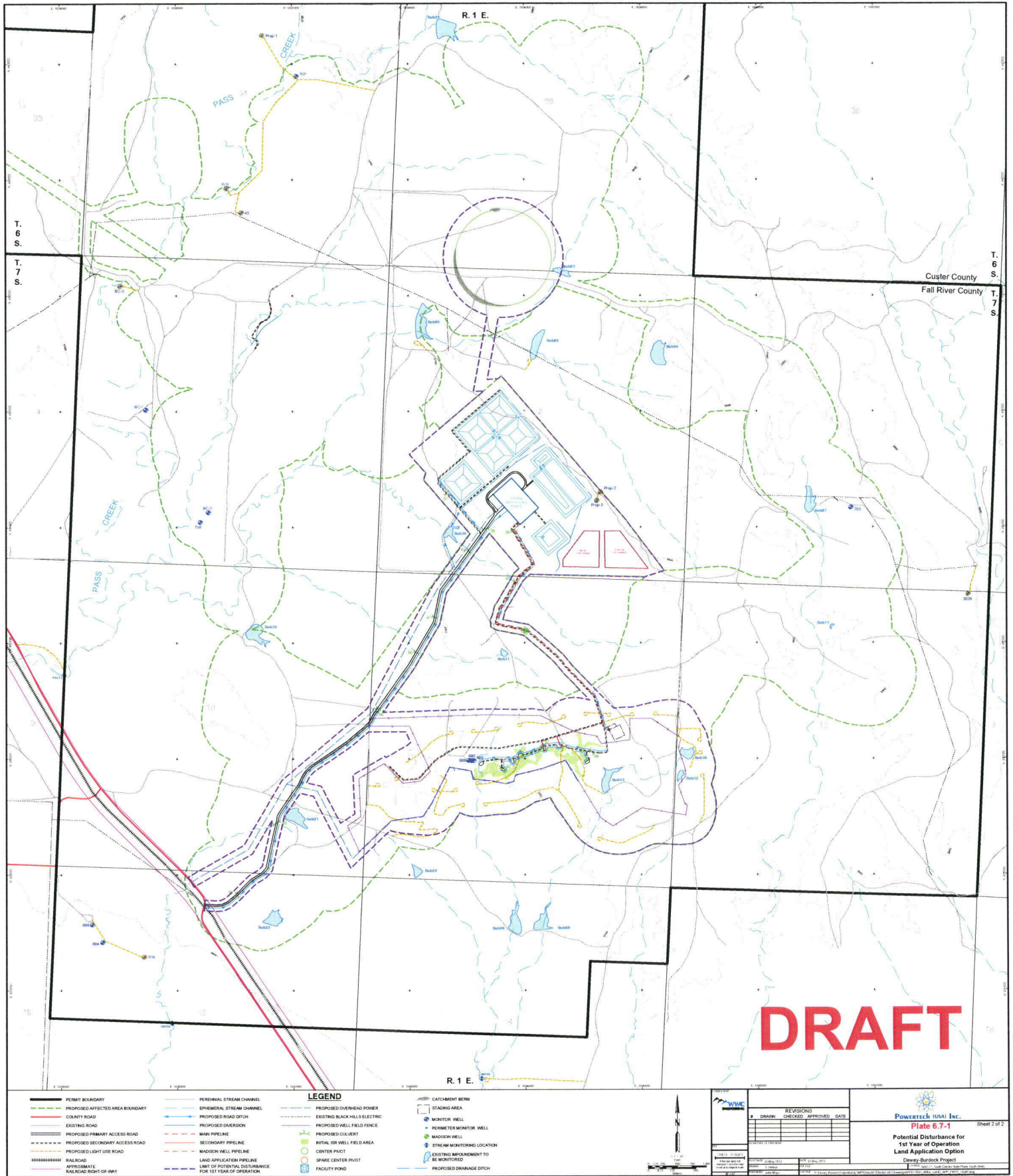
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**Holm, Eric**

---

**From:** Holm, Eric  
**Sent:** Tuesday, May 21, 2013 8:00 AM  
**To:** 'Sean M. Hetrick'  
**Cc:** Holm, Eric  
**Subject:** RE: Regarding Powertech Dewey-Burdock AutoCAD-to-ArcGIS issue

Thanks. A CD with all of the maps will be fine.

---

**From:** Sean M. Hetrick [<mailto:shetrick@powertechuranium.com>]  
**Sent:** Monday, May 20, 2013 5:24 PM  
**To:** Holm, Eric  
**Subject:** Regarding Powertech Dewey-Burdock AutoCAD-to-ArcGIS issue

This is a follow-up to a voice mail I just left for you.

After some work with the "CATCHMENT\_PONDS.dwg" AutoCAD file I was able to determine why ArcGIS was having a problem. It turns out that ArcGIS doesn't understand what an AutoCAD "Multileader" object is, and there just happen to be 8 of those objects in that catchment file. I exploded them, converting them to simple line work, and ArcGIS has no problems working with that file, even at 31 megabytes.

Since we are revising plates 6.7-1 and 6.7-2 to remove the land application pivots that aren't applicable, Jack Fritz at WWC suggested I send you another CD with those revised plates and another copy of the catchment file with the leader issue resolved. I think this will minimize the chance of errors being introduced during a conversion process and also provide you with the most unadulterated raw data in the format that WWC originally developed. This will also give you maximum flexibility in extracting the data as best suits your needs.

Again, just a quick heads-up. Thanks.



**POWERTECH (USA) INC.**

**Sean M. Hetrick**

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## Holm, Eric

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**From:** Sean M. Hetrick <shetrick@powertechuranium.com>  
**Sent:** Monday, May 20, 2013 2:28 PM  
**To:** Holm, Eric; 'Jack Fritz'  
**Subject:** RE: Catchment Basin Drawings

I should be able to help you with this file. I am able to open it find in AutoCAD Map 3D, but Jack tells me that you may be using ArcGIS. I'm not having any luck importing any of the data using ArcGIS, but I may be able to export what you need directly from AutoCAD.

Is the difficulty related to ArcGIS, or are you not able to open the file in AutoCAD?

It may be easier to arrive at a solution for you over the phone rather than through email, but that's your call. You can contact me at the number below, or I will be happy to call you if you'd like.

Please let me know how you would like to proceed. Thank you.

Sean M. Hetrick  
Information Systems and CADD Administrator  
5575 DTC Parkway, Suite 140  
Greenwood Village, Colorado, USA 80111-3012  
(303) 790-7528 x110  
(303) 790-3885 FAX  
[shetrick@powertechuranium.com](mailto:shetrick@powertechuranium.com)  
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-----Original Message-----

**From:** Holm, Eric [<mailto:Eric.Holm@state.sd.us>]  
**Sent:** Thursday, May 16, 2013 3:43 PM  
**To:** 'Jack Fritz'  
**Cc:** Holm, Eric  
**Subject:** Catchment Basin Drawings

On the April 9, 2013 AutoCAD Drawings CD, I cannot open the Catchment\_Ponds.dwg file. I think the file is too big (31 MB) since it appears to contain Plates 5.4-1 and 5.4-2. Would it be possible to create separate dwg files for each plates?

Eric Holm  
Natural Resources Engineer III  
Minerals and Mining Program  
Phone (605) 773-4201

Email [eric.holm@state.sd.us](mailto:eric.holm@state.sd.us)

## Holm, Eric

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**From:** Holm, Eric  
**Sent:** Monday, May 20, 2013 10:51 AM  
**To:** 'Jack Fritz'  
**Cc:** John Mays; Hetrick, Sean  
**Subject:** RE: Plates 6.7-1 and 6.7-2

The end of the week would be fine. No hurry.

-----Original Message-----

From: Jack Fritz [<mailto:jfritz@wwcengineering.com>]  
Sent: Monday, May 20, 2013 10:39 AM  
To: Holm, Eric  
Cc: John Mays; Hetrick, Sean  
Subject: Re: Plates 6.7-1 and 6.7-2

Hi Eric,

Sorry I was out of the office for a couple of days last week. Powertech is working on the response to this request and on your May 17 email regarding Plates 5.4-1 and 5.4-2. Would the end of this week be soon enough to send revised Plates 6.7-1 and 6.7-2 and a CD with revised AutoCAD drawing files for Plates 5.4-1 and 5.4-2?

Sincerely,

Jack

Holm, Eric wrote:

> I had a question on Plates 6.7-1 and 6.7-2 that shows the potential disturbance for the first year of operation. In the draft bond calculation, Powertech mentions that only pivots D-14 and D-15 in the Dewey area and pivots B-9 and B-10 in the Burdock area will be used. However, on Plates 6.7-1 and 6.7-2, it shows the entire land application area being used in the first year of operation. Which is correct? If Powertech plans on only using pivots D-14, D-15, B-9, and B-10 in the first year, please change plates 6.7-1 and 6.7-2 to show only those pivots in the affected area.

>

> -----Original Message-----

> From: Holm, Eric  
> Sent: Thursday, May 16, 2013 4:43 PM  
> To: 'Jack Fritz'  
> Cc: Holm, Eric  
> Subject: Catchment Basin Drawings

>

> On the April 9, 2013 AutoCAD Drawings CD, I cannot open the Catchment\_Ponds.dwg file. I think the file is too big (31 MB) since it appears to contain Plates 5.4-1 and 5.4-2. Would it be possible to create separate dwg files for each plates?

>

>

> Eric Holm  
> Natural Resources Engineer III  
> Minerals and Mining Program  
> Phone (605) 773-4201

> Email [eric.holm@state.sd.us](mailto:eric.holm@state.sd.us)

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>  
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>



**Cepak, Mike**

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**From:** Cepak, Mike  
**Sent:** Monday, April 15, 2013 3:35 PM  
**To:** John Mays  
**Cc:** Cepak, Mike  
**Subject:** DENR Bond Calculation  
**Attachments:** Powertech LSM 1st year disturbance bond estimate (DENR rev).xlsx

John,

Working off your spreadsheets, the DENR's calculation is attached.

Mike

## Cepak, Mike

---

**From:** Cepak, Mike  
**Sent:** Monday, April 15, 2013 11:52 AM  
**To:** John Mays; Richard Blubaugh; Jack Fritz (jfritz@wwcengineering.com)  
**Cc:** Cepak, Mike  
**Subject:** FW: South Dakota DENR Recommendation on Powertech Large Scale Mine Permit  
**Attachments:** Powertech Recommendation.doc; Powertech Mine Permit Conditions 2013.docx

Please find attached the SD DENR's recommendation and recommended conditions for the Powertech large scale mine permit.

Nearly all of your suggested comments to the conditions were accepted, some were further modified by other programs in the department.

I set the reclamation bond amount (condition 1 under "Reclamation Bond) at \$395,000. This calculation was based on Powertech's (WWC's) bond estimate provided late last Friday. The WWC bond estimate was very thorough so I used it as the basis for my recalculation. I did not include any roads on BLM lands, or the roads around the process ponds (covered under the NRC bond?) – this cut off about 17,800 feet of roads that were in the WWC estimate. I included all the diversions from the WWC estimate, except for one at the Burdock Central Processing Plant (covered under NRC bond?). Our calculation (\$395,000) included 41% in overhead and contingency costs.

The recommendation and conditions are being mailed out today to interested persons, interveners, review agencies, and the county commissions. It will also be posted on in the public notice section of the DENR website.

If you have any questions, feel free to contact me.

Mike Cepak  
Engineering Manager I  
Minerals and Mining Program  
SD DENR  
Ph: (605) 773-5418

## Cepak, Mike

---

**From:** Cepak, Mike  
**Sent:** Friday, April 12, 2013 5:04 PM  
**To:** 'Jack Fritz'  
**Cc:** Cepak, Mike  
**Subject:** RE: Draft LSM reclamation estimate

Thanks, this is very helpful to me. I will use most of the road numbers, except I will subtract off roads in the BLM areas and around the ponds.

We can have a conference call on Monday.

Mike Cepak

-----Original Message-----

From: Jack Fritz [<mailto:jfritz@wwcengineering.com>]  
Sent: Friday, April 12, 2013 4:35 PM  
To: Cepak, Mike  
Cc: Holm, Eric; Mays, John; Blubaugh, Richard  
Subject: Draft LSM reclamation estimate

Mike,

As requested, attached please find a draft reclamation estimate for the Dewey-Burdock Project for the first year following permit issuance. John Mays would like to schedule a conference call with you Monday morning, if possible, to discuss.

Sincerely,

Jack Fritz  
307-672-0761



## Cepak, Mike

---

**From:** Jack Fritz <jfritz@wwcengineering.com>  
**Sent:** Friday, April 12, 2013 4:35 PM  
**To:** Cepak, Mike  
**Cc:** Holm, Eric; Mays, John; Blubaugh, Richard  
**Subject:** Draft LSM reclamation estimate  
**Attachments:** LSM 1st year disturbance financial assurance estimate.xlsx

Mike,

As requested, attached please find a draft reclamation estimate for the Dewey-Burdock Project for the first year following permit issuance. John Mays would like to schedule a conference call with you Monday morning, if possible, to discuss.

Sincerely,

Jack Fritz  
307-672-0761

## Holm, Eric

---

**From:** John Mays <jmays@powertechuranium.com>  
**Sent:** Monday, March 18, 2013 3:56 PM  
**To:** Holm, Eric; 'Jack Fritz'  
**Cc:** 'Blubaugh, Richard'; Cepak, Mike  
**Subject:** RE: Reclamation Bonding

Eric,

We will include it in our response.

Thanks.

John

John M. Mays  
Vice President of Engineering  
5575 DTC Parkway, Suite 140  
Greenwood Village, Colorado, USA 80111-3012  
(303) 790-7528 x106  
(303) 790-3885 FAX  
[jmays@powertechuranium.com](mailto:jmays@powertechuranium.com)  
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-----Original Message-----

From: Holm, Eric [<mailto:Eric.Holm@state.sd.us>]  
Sent: Monday, March 18, 2013 8:03 AM  
To: 'Jack Fritz'  
Cc: Blubaugh, Richard; Mays, John; Cepak, Mike; Holm, Eric  
Subject: Reclamation Bonding

We have another technical comment. Please submit a map showing all disturbance that will be covered under the first phase of the reclamation bond. Also, please submit an electronic version of the map in dwg format.



Dewey-Burdock Project LSM Permit Application  
Reclamation Cost Estimate for First Year Following Permit Issuance

**Summary**

**Major Assumptions:**

- 1) Land application pivots and piping will not be used during first year after permit issuance.
- 2) Only two pivots will be constructed at each of the Dewey and Burdock areas during the first year of construction, which is conservatively more than will be required to dispose of wastewater during the first year of operation (2nd year following permit issuance).
- 3) Land application pivots will be salvaged at no net cost or salvage value except for concrete base removal and disposal.
- 4) Land application piping will be left in place, since it will be unused.
- 5) Culverts will be salvaged at no net cost or salvage value.

Item		Estimated Cost
Land application equipment reclamation	\$	5,600.00
Land application area reclamation	\$	-
Catchment berm reclamation	\$	82,800.00
Diversion reclamation	\$	95,700.00
Sediment control structure removal	\$	10,600.00
Access road reclamation	\$	153,900.00
Shallow monitor well plugging	\$	2,900.00
Subtotal	\$	351,500.00
Contingency at 15%	\$	52,725.00
<b>Total financial assurance estimate</b>	<b>\$</b>	<b>404,225.00</b>

Dewey-Burdock Project LSM Permit Application  
Reclamation Cost Estimate for First Year Following Permit Issuance

**Unit Costs**

Item	Units	Unit Cost	Source
Concrete foundation demolition	sq-ft	5.31	Guideline 12, Appendix K
Concrete footer demolition	ft	20.65	Guideline 12, Appendix K
Replace spoil	cy	\$1.08	Guideline 12, Appendix C, 500' haul with scrapers
Replace topsoil	cy	\$1.08	Guideline 12, Appendix C, 500' haul with scrapers
Final grading	acre	\$75.25	Guideline 12, Appendix G, motor grader
Access road gravel removal	acre	\$75.25	Guideline 12, Appendix G, motor grader
Access road gravel disposal	cy	\$0.00	Assumes provided to county at no net cost
Scarification of access roads	acre	\$69.02	Guideline 12, Appendix P, motor grader
Revegetation	acre	\$1,500.00	LSM Appendix 6.7-A
Remove wellhead protector	ea	\$100.00	Estimate
Plug monitor wells	ft	\$4.00	Guideline 12, Appendix L, scattered wells (<25 wells)
Remove rock check dam	ea	\$2,635.92	Guideline 12, Appendix N, conservatively assumes that cost will equal that to remove a surface water monitoring station using dump truck and front-end loader
Remove reinforced silt fence	ea	\$2,635.92	Guideline 12, Appendix N, conservatively assumes that cost will equal that to remove a surface water monitoring station using dump truck and front-end loader

Note: Guideline 12 is Wyoming Department of Environmental Quality/Land Quality Division Guideline No. 12, Standardized Reclamation Performance Bond Format and Cost Calculation Methods, revised October 2012, available on the Internet as of 11 April 2013:

[http://deq.state.wy.us/lqd/downloads/Guidelines/Guideline\\_12\\_\(10\\_2012\).pdf](http://deq.state.wy.us/lqd/downloads/Guidelines/Guideline_12_(10_2012).pdf). This reference document was used since it represents current costs for similar reclamation activities in a neighboring state.



Dewey-Burdock Project LSM Permit Application  
Reclamation Cost Estimate for First Year Following Permit Issuance

## Land Application Systems

### Assumptions:

- 1) Only the pivots above catchments D-14, D-15, B-9 and B-10 will be constructed (50 acres per land application area).
- 2) The estimated pipeline length to the initial pivots is 5,600 feet.
- 3) Land application pivots and piping will not be used during the first year after permit issuance.
- 4) Land application pivots will be salvaged at no net cost or salvage value except for concrete base removal and disposal.
- 5) Land application piping will be left in place, since it will be unused.
- 6) Outlet pipes and valves in catchment berms will be salvaged at no net cost or salvage value.
- 7) No grading will be required in the initial pivot areas.
- 8) Native vegetation will be present.

### Quantity Calculations

Item	Value
Center pivots and piping	
Number of land application pivots	3
Length of land application piping (ft)	5,600
Concrete pads	
Length (ft)	12
Width (ft)	9
Area (sq-ft)	108
Thickness (in)	8
Volume per pad (cy)	2.7
Total area of all pads (sq-ft)	324
Total volume of all pads (cy)	8.0
Pivot base footing	
Length (ft)	30
Width (ft)	1.5
Thickness (ft)	3
Volume per footing (cy)	5.0
Total length of all footings (ft)	90
Total volume of all footings (cy)	15.0
Concrete volume to landfill (incl. 30% swell) (cy)	29.9
Volume per truck load (cy)	20
Number of truckloads	2
Distance to landfill (mi)	16.0
Transportation unit cost (\$/mi)	\$4.60
Landfill disposal unit cost (\$/ton), estimated	\$45.00
Bulk density of demolished concrete (lb/cf)	100
Transportation cost	\$147.20
Landfill disposal cost	\$1,816.43
Area of disturbance, Dewey (ac)	0
Area of disturbance, Burdock (ac)	0
Total area of disturbance (ac)	0

Dewey-Burdock Project LSM Permit Application  
Reclamation Cost Estimate for First Year Following Permit Issuance

**Land Application Systems (Cont'd)**

**Cost Estimate for Land Application Equipment Reclamation**

Cost Item	No. Units	Unit	Unit Cost	Est. Cost
Remove and salvage pivots	21	ea	\$0.00	\$0.00
Leave unused piping in place	5,600	ft	\$0.00	\$0.00
Concrete pad demolition	324	sq-ft	\$5.31	\$1,720.44
Concrete footer demolition	90	ft	\$20.65	\$1,858.50
Concrete disposal	1	ls	\$1,963.63	\$1,963.63
<b>Total</b>				\$5,542.57
<b>For estimate</b>				<b>\$5,600.00</b>

**Cost Estimate for Land Application Area Reclamation**

Cost Item	No. Units	Unit	Unit Cost	Est. Cost
Final grading	0	ac	\$75.25	\$0.00
Revegetation	0	ac	\$1,500.00	\$0.00
<b>Total</b>				\$0.00
<b>For estimate</b>				<b>\$0.00</b>

DRAFT



Dewey-Burdock Project LSM Permit Application  
Reclamation Cost Estimate for First Year Following Permit Issuance

**Catchment Berms**

**Assumptions:**

- 1) Only catchments D-14, D-15, B-9 and B-10 will be constructed.
- 2) Topsoil from catchment berm disturbance area (footprint plus 20' buffer) and borrow area will be stripped and stockpiled.
- 3) The topsoil will be stripped from the existing grade before the berms are constructed. The volume of fill to replace the stripped topsoil is equivalent to the topsoil volume plus 10 percent to account for side slopes.
- 4) The total berm fill will be equivalent to fill above existing grade plus the fill to replace stripped topsoil.
- 5) The average borrow depth will be 3 feet.
- 6) Berm volumes above existing grade were calculated using Carlson Civil with AutoCAD.
- 7) The assumed topsoil stripping extents are 20' outside of the berm footprints.
- 8) The assumed topsoil stripping depth is 0.8 foot in Dewey and 1.2 feet in Burdock (see response to completeness comment #25).
- 9) Topsoil volume includes topsoil stockpiled from the berm and borrow areas.
- 10) Topsoil stockpile areas were calculated assuming an average stockpile height of 5 feet.
- 11) Revegetation area includes the berm disturbance area, borrow area and stockpile area.

**Quantity Calculations**

Catchment	Berm Footprint (ac)	Berm Disturbance Area (incl. 20' buffer) (ac)	Berm Fill (cy)	Borrow Area (ac)	Topsoil Volume (cy)	Topsoil Stockpile Area (ac)	Revegetation Area (ac)
<b>Dewey Area</b>							
D-14	0.44	0.84	2,525	0.5	1,757	0.2	1.6
D-15	1.68	2.95	11,507	2.4	6,876	0.9	6.2
<b>Burdock Area</b>							
B-9	0.23	0.53	1,506	0.3	1,628	0.2	1.0
B-10	2.01	3.56	13,883	2.9	12,446	1.5	8.0
<b>Total</b>			29,421		22,707		16.8

**Cost Estimate**

Cost Item	No. Units	Unit	Unit Cost	Est. Cost
Replace spoil	29,421	cy	\$1.08	\$31,774.83
Replace topsoil	22,707	cy	\$1.08	\$24,524.00
Final grading	16.8	acres	\$75.25	\$1,262.22
Revegetation	16.8	acres	\$1,500.00	\$25,160.57
<b>Total</b>				\$82,721.63
<b>For estimate</b>				<b>\$82,800.00</b>

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Dewey-Burdock Project LSM Permit Application  
Reclamation Cost Estimate for First Year Following Permit Issuance

**Diversions**

**Assumptions:**

- 1) Topsoil from pond and facility diversions will be stockpiled in the facilities topsoil stockpiles (no additional revegetation area).
- 2) Topsoil stockpile areas were obtained from diversion designs (where applicable).
- 3) Gross cut volume was calculated using Carlson Civil with AutoCAD.
- 4) Topsoil stripped from diversion footprint was subtracted from total cut volume to calculate unclassified excavation (i.e., spoil).
- 5) The assumed topsoil stripping extents are 20' outside of the diversion footprint.
- 6) The assumed topsoil stripping depth is 0.8 foot in Dewey and 1.2 feet in Burdock (see response to completeness comment #25).

**Quantity Calculations**

Diversion	Distur- bance Area (acres)	Topsoil Depth (ft)	Topsoil Volume (cy)	Gross Cut Volume (cy)	Topsoil Removed from Diversion (cy)	Unclass. Excavation (Spoil) Volume (cy)	Topsoil Stockpile Area (ac)	Reveg. Area (ac)
<b>Dewey Area</b>								
Div_2_LA	2.73	0.8	3,524	13,966	1,789	12,177	0.3	3.1
Div_3_LA	2.96	0.8	3,820	20,975	2,035	18,940	0.2	3.2
Div_4_LA	1.94	0.8	2,504	1,561	842	719	0	2.0
Div_5_LA	2.51	0.8	3,240	2,801	1,688	1,113	0	2.6
<b>Burdock Area</b>								
Div_1_LA	1.86	1.2	3,601	5,423	1,556	3,867	0.2	2.1
CPP_FAC	2.44	1.2	4,724	10,474	2,703	7,771	0	2.5
<b>Total</b>	<b>14.44</b>		<b>21,412</b>			<b>44,587</b>		<b>15.5</b>

**Cost Estimate**

Cost Item	No. Units	Unit	Unit Cost	Est. Cost
Replace spoil	44,587	cy	\$1.08	\$48,153.76
Replace topsoil	21,412	cy	\$1.08	\$23,125.13
Final grading	15.5	acres	\$75.25	\$1,166.38
Revegetation	15.5	acres	\$1,500.00	\$23,250.00
<b>Total</b>				<b>\$95,695.27</b>
<b>For estimate</b>				<b>\$95,700.00</b>

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Dewey-Burdock Project LSM Permit Application  
Reclamation Cost Estimate for First Year Following Permit Issuance

**Sediment Control Measures**

**Assumptions:**

- 1) Sediment control structures are shown on Plate 5.3-7 (land application option).
- 2) For the 1st year of construction disturbance, one wire-bound rock check dam will be required at Dewey and two single-fence rock check dams and one reinforced silt fence will be required at Burdock.
- 3) A disturbance area of 50' x 100' was estimated for each structure.

**Quantity Calculations**

Item	Value
Number of wire-bound rock check dams	1
Number of single-fence rock check dams	2
Number of reinforced silt fences	1
Disturbance area per sediment control measure (ac)	0.11

**Cost Estimate**

Cost Item	No. Units	Unit	Unit Cost	Est. Cost
Remove rock check dams	3	ea	\$2,635.92	\$7,907.76
Remove reinforced silt fences	1	ea	\$2,635.92	\$2,635.92
Revegetation	0.5	ac	\$1,500.00	\$750.00
<b>Total</b>				\$10,543.68
<b>For estimate</b>				<b>\$10,600.00</b>

DRAFT

Dewey-Burdock Project LSM Permit Application  
Reclamation Cost Estimate for First Year Following Permit Issuance

**Access Roads**

**Assumptions:**

- 1) Average top width of primary access roads will be 30 feet (LSM application p. 5-76). Average primary access road disturbance width (including shoulders and ditches) will be 45 feet.
- 2) Average top width of secondary access roads will be 20 feet (LSM application p. 5-76). Average secondary access road disturbance width will be 30 feet.
- 3) Light use roads will be unconstructed, two-track trails. Due to limited use during the first year after permit issuance, it is assumed that no scarification or revegetation will be required for light use roads.
- 4) Gravel thickness will be 12 inches on primary access roads and 6 inches on secondary.
- 5) Gravel volume will be based upon top width.
- 6) Gravel will be windrowed and made available to counties at no net salvage value.
- 6) Scarification, topsoil distribution and reseeding will be based upon average disturbance width.
- 7) The assumed topsoil stripping depth is 0.8 foot in the Dewey area and 1.2 feet in Burdock area (see response to completeness comment #25).
- 8) The average topsoil stockpile height will be 10 feet.

**Quantity Calculations**

Item	Value
Dewey Area - Primary Access Roads	
Length (ft)	5,743
Top width (ft)	30
Disturbance width (ft)	45
Gravel thickness (ft)	1.0
Area of gravel removed (ac)	4.0
Volume of gravel removed (cy)	6,381
Scarification area (ac)	5.9
Topsoil replacement depth (ft)	0.8
Topsoil replacement volume (cy)	7,657
Topsoil stockpile area (ac)	0.9
Revegetation area (ac)	6.9
Dewey Area - Secondary Access Roads	
Length (ft)	15,386
Top width (ft)	20
Disturbance width (ft)	30
Gravel thickness (ft)	0.5
Area of gravel removed (ac)	7.1
Volume of gravel removed (cy)	5,699
Scarification area (ac)	10.6
Topsoil replacement depth (ft)	0.8
Topsoil replacement volume (cy)	13,676
Topsoil stockpile area (ac)	1.7
Revegetation area (ac)	12.3



Dewey-Burdock Project LSM Permit Application  
Reclamation Cost Estimate for First Year Following Permit Issuance

**Access Roads (Cont'd)**

Item	Value
Burdock Area - Primary Access Roads	
Length (ft)	10,637
Top width (ft)	30
Disturbance width (ft)	45
Gravel thickness (ft)	1.0
Area of gravel removed (ac)	7.3
Volume of gravel removed (cy)	11,819
Scarification area (ac)	11.0
Topsoil replacement depth (ft)	1.2
Topsoil replacement volume (cy)	21,274
Topsoil stockpile area (ac)	2.6
Revegetation area (ac)	13.6
Burdock Area - Secondary Access Roads	
Length (ft)	18,653
Top width (ft)	20
Disturbance width (ft)	30
Gravel thickness (ft)	0.5
Area of gravel removed (ac)	8.6
Volume of gravel removed (cy)	6,909
Scarification area (ac)	12.8
Topsoil replacement depth (ft)	1.2
Topsoil replacement volume (cy)	24,871
Topsoil stockpile area (ac)	3.1
Revegetation area (ac)	15.9

**Cost Estimate**

Cost Item	No. Units	Unit	Unit Cost	Est. Cost
Access road gravel removal	26.9	acres	\$75.25	\$2,024.94
Access road gravel disposal	30,807.0	cy	\$0.00	\$0.00
Scarification of access roads	40.4	acres	\$69.02	\$2,785.95
Final grading	40.4	acres	\$75.25	\$3,037.42
Replace topsoil	67,478	cy	\$1.08	\$72,876.72
Revegetation	48.7	acres	\$1,500.00	\$73,094.13
<b>Total</b>				\$153,819.16
<b>For estimate</b>				<b>\$153,900.00</b>

DRAFT

Dewey-Burdock Project LSM Permit Application  
Reclamation Cost Estimate for First Year Following Permit Issuance

**Monitor Wells**

**Assumptions:**

- 1) Average well depth for interior monitor wells will be 26' (same as compliance wells).
- 2) Number of compliance wells associated with land application = 7 (actual).
- 3) Number of interior wells associated with land application = 7 (planned).
- 4) Wells will be filled with bentonite chips following wellhead protector removal, and well casing will be cut off below ground.

**Quantity Calculations**

Item	Value
Number of compliance wells	7
Number of interior wells	7
Total number of wells	14
Average well depth (ft)	26

**Cost Estimate**

Cost Item	No. Units	Unit	Unit Cost	Est. Cost
Remove wellhead protector	14	ea	\$100.00	\$1,400.00
Plug monitor wells	364	ft	\$4.00	\$1,456.00
<b>Total</b>				\$2,856.00
<b>For estimate</b>				<b>\$2,900.00</b>



Dewey-Burdock Project LSM Permit Application  
Reclamation Cost Estimate for First Year Following Permit Issuance - DENR Calculation

**Summary**

**Major Assumptions:**

- 1) Land application pivots and piping will not be used during first year after permit issuance.
- 2) Only two pivots will be constructed at each of the Dewey and Burdock areas during the first year of construction, which is conservatively more than will be required to dispose of wastewater during the first year of operation (2nd year following permit issuance).
- 3) Land application pivots will be salvaged at no net cost or salvage value except for concrete base removal and disposal.
- 4) Land application piping will be left in place, since it will be unused.
- 5) Culverts will be salvaged at no net cost or salvage value.
- 6) Reclamation work on BLM land is not included in this estimate.

Item		Estimated Cost
Land application equipment reclamation	\$	5,600.00
Land application area reclamation	\$	-
Catchment berm reclamation	\$	82,800.00
Diversion reclamation	\$	78,300.00
Sediment control structure removal	\$	10,600.00
Access road reclamation	\$	99,900.00
Shallow monitor well plugging	\$	2,900.00
Subtotal	\$	280,100.00
Mobilization (5%)	\$	14,005.00
Performance Bond (1%)	\$	2,801.00
Contractor Overhead (8%)	\$	22,408.00
State Excise Tax (2%)	\$	5,602.00
Contractor Profit (10%)	\$	28,010.00
Contingency (10%)	\$	28,010.00
Insp., Adm., & Maint. (5%)	\$	14,005.00
<b>Total estimate</b>	<b>\$</b>	<b>394,941.00</b>
<b>Round to</b>	<b>\$</b>	<b>395,000.00</b>

CONSTRUCTION COST INDEX (CCI) FOR JANUARY 2013 = 9437.27

FORMULA FOR COMPUTING FUTURE CONSTRUCTION COST:

$$\text{FUTURE COSTS} = (\text{FUTURE CCI} / \text{ORIGINAL CCI}) * \text{ORIGINAL CONSTRUCTION COSTS}$$

CURRENT CCI	9437.27
ORIGINAL CCI	9437.27
ORIG. CONSTRUCTION COST	\$395,000
FUTURE COST	\$395,000

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Dewey-Burdock Project LSM Permit Application  
Reclamation Cost Estimate for First Year Following Permit Issuance

**Unit Costs**

Item	Units	Unit Cost	Source
Concrete foundation demolition	sq-ft	5.31	Guideline 12, Appendix K
Concrete footer demolition	ft	20.65	Guideline 12, Appendix K
Replace spoil	cy	\$1.08	Guideline 12, Appendix C, 500' haul with scrapers
Replace topsoil	cy	\$1.08	Guideline 12, Appendix C, 500' haul with scrapers
Final grading	acre	\$75.25	Guideline 12, Appendix G, motor grader
Access road gravel removal	acre	\$75.25	Guideline 12, Appendix G, motor grader
Access road gravel disposal	cy	\$0.00	Assumes provided to county at no net cost
Scarification of access roads	acre	\$69.02	Guideline 12, Appendix P, motor grader
Revegetation	acre	\$1,500.00	LSM Appendix 6.7-A
Remove wellhead protector	ea	\$100.00	Estimate
Plug monitor wells	ft	\$4.00	Guideline 12, Appendix L, scattered wells (<25 wells)
Remove rock check dam	ea	\$2,635.92	Guideline 12, Appendix N, conservatively assumes that cost will equal that to remove a surface water monitoring station using dump truck and front-end loader
Remove reinforced silt fence	ea	\$2,635.92	Guideline 12, Appendix N, conservatively assumes that cost will equal that to remove a surface water monitoring station using dump truck and front-end loader

Note: Guideline 12 is Wyoming Department of Environmental Quality/Land Quality Division Guideline No. 12, Standardized Reclamation Performance Bond Format and Cost Calculation Methods, revised October 2012, available on the Internet as of 11 April 2013:

[http://deq.state.wy.us/lqd/downloads/Guidelines/Guideline\\_12\\_\(10\\_2012\).pdf](http://deq.state.wy.us/lqd/downloads/Guidelines/Guideline_12_(10_2012).pdf). This reference document was used since it represents current costs for similar reclamation activities in a neighboring state.



Dewey-Burdock Project LSM Permit Application  
Reclamation Cost Estimate for First Year Following Permit Issuance

**Land Application Systems**

**Assumptions:**

- 1) Only the pivots above catchments D-14, D-15, B-9 and B-10 will be constructed (50 acres per land application area).
- 2) The estimated pipeline length to the initial pivots is 5,600 feet.
- 3) Land application pivots and piping will not be used during the first year after permit issuance.
- 4) Land application pivots will be salvaged at no net cost or salvage value except for concrete base removal and disposal.
- 5) Land application piping will be left in place, since it will be unused.
- 6) Outlet pipes and valves in catchment berms will be salvaged at no net cost or salvage value.
- 7) No grading will be required in the initial pivot areas.
- 8) Native vegetation will be present.

**Quantity Calculations**

Item	Value
Center pivots and piping	
Number of land application pivots	3
Length of land application piping (ft)	5,600
Concrete pads	
Length (ft)	12
Width (ft)	9
Area (sq-ft)	108
Thickness (in)	8
Volume per pad (cy)	2.7
Total area of all pads (sq-ft)	324
Total volume of all pads (cy)	8.0
Pivot base footing	
Length (ft)	30
Width (ft)	1.5
Thickness (ft)	3
Volume per footing (cy)	5.0
Total length of all footings (ft)	90
Total volume of all footings (cy)	15.0
Concrete volume to landfill (incl. 30% swell) (cy)	29.9
Volume per truck load (cy)	20
Number of truckloads	2
Distance to landfill (mi)	16.0
Transportation unit cost (\$/mi)	\$4.60
Landfill disposal unit cost (\$/ton), estimated	\$45.00
Bulk density of demolished concrete (lb/cf)	100
Transportation cost	\$147.20
Landfill disposal cost	\$1,816.43
Area of disturbance, Dewey (ac)	0
Area of disturbance, Burdock (ac)	0
Total area of disturbance (ac)	0

Dewey-Burdock Project LSM Permit Application  
Reclamation Cost Estimate for First Year Following Permit Issuance

**Land Application Systems (Cont'd)**

**Cost Estimate for Land Application Equipment Reclamation**

Cost Item	No. Units	Unit	Unit Cost	Est. Cost
Remove and salvage pivots	21	ea	\$0.00	\$0.00
Leave unused piping in place	5,600	ft	\$0.00	\$0.00
Concrete pad demolition	324	sq-ft	\$5.31	\$1,720.44
Concrete footer demolition	90	ft	\$20.65	\$1,858.50
Concrete disposal	1	ls	\$1,963.63	\$1,963.63
<b>Total</b>				\$5,542.57
<b>For estimate</b>				<b>\$5,600.00</b>

**Cost Estimate for Land Application Area Reclamation**

Cost Item	No. Units	Unit	Unit Cost	Est. Cost
Final grading	0	ac	\$75.25	\$0.00
Revegetation	0	ac	\$1,500.00	\$0.00
<b>Total</b>				\$0.00
<b>For estimate</b>				<b>\$0.00</b>

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Dewey-Burdock Project LSM Permit Application  
Reclamation Cost Estimate for First Year Following Permit Issuance

**Catchment Berms**

**Assumptions:**

- 1) Only catchments D-14, D-15, B-9 and B-10 will be constructed.
- 2) Topsoil from catchment berm disturbance area (footprint plus 20' buffer) and borrow area will be stripped and stockpiled.
- 3) The topsoil will be stripped from the existing grade before the berms are constructed. The volume of fill to replace the stripped topsoil is equivalent to the topsoil volume plus 10 percent to account for side slopes.
- 4) The total berm fill will be equivalent to fill above existing grade plus the fill to replace stripped topsoil.
- 5) The average borrow depth will be 3 feet.
- 6) Berm volumes above existing grade were calculated using Carlson Civil with AutoCAD.
- 7) The assumed topsoil stripping extents are 20' outside of the berm footprints.
- 8) The assumed topsoil stripping depth is 0.8 foot in Dewey and 1.2 feet in Burdock (see response to completeness comment #25).
- 9) Topsoil volume includes topsoil stockpiled from the berm and borrow areas.
- 10) Topsoil stockpile areas were calculated assuming an average stockpile height of 5 feet.
- 11) Revegetation area includes the berm disturbance area, borrow area and stockpile area.

**Quantity Calculations**

Catchment	Berm Footprint (ac)	Berm Disturbance Area (incl. 20' buffer) (ac)	Berm Fill (cy)	Borrow Area (ac)	Topsoil Volume (cy)	Topsoil Stockpile Area (ac)	Revegetation Area (ac)
<b>Dewey Area</b>							
D-14	0.44	0.84	2,525	0.5	1,757	0.2	1.6
D-15	1.68	2.95	11,507	2.4	6,876	0.9	6.2
<b>Burdock Area</b>							
B-9	0.23	0.53	1,506	0.3	1,628	0.2	1.0
B-10	2.01	3.56	13,883	2.9	12,446	1.5	8.0
<b>Total</b>			29,421		22,707		16.8

**Cost Estimate**

Cost Item	No. Units	Unit	Unit Cost	Est. Cost
Replace spoil	29,421	cy	\$1.08	\$31,774.83
Replace topsoil	22,707	cy	\$1.08	\$24,524.00
Final grading	16.8	acres	\$75.25	\$1,262.22
Revegetation	16.8	acres	\$1,500.00	\$25,160.57
<b>Total</b>				\$82,721.63
<b>For estimate</b>				<b>\$82,800.00</b>

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Dewey-Burdock Project LSM Permit Application  
Reclamation Cost Estimate for First Year Following Permit Issuance

**Diversions**

**Assumptions:**

- 1) Topsoil from pond and facility diversions will be stockpiled in the facilities topsoil stockpiles (no additional revegetation area).
- 2) Topsoil stockpile areas were obtained from diversion designs (where applicable).
- 3) Gross cut volume was calculated using Carlson Civil with AutoCAD.
- 4) Topsoil stripped from diversion footprint was subtracted from total cut volume to calculate unclassified excavation (i.e., spoil).
- 5) The assumed topsoil stripping extents are 20' outside of the diversion footprint.
- 6) The assumed topsoil stripping depth is 0.8 foot in Dewey and 1.2 feet in Burdock (see response to completeness comment #25).
- 7) CPP\_FAC diversion was not included in the DENR calculation (NCR)

**Quantity Calculations**

Diversion	Distur- bance Area (acres)	Topsoil Depth (ft)	Topsoil Volume (cy)	Gross Cut Volume (cy)	Topsoil Removed from Diversion (cy)	Unclass. Excavation (Spoil) Volume (cy)	Topsoil Stockpile Area (ac)	Reveg. Area (ac)
<b>Dewey Area</b>								
Div_2_LA	2.73	0.8	3,524	13,966	1,789	12,177	0.3	3.1
Div_3_LA	2.96	0.8	3,820	20,975	2,035	18,940	0.2	3.2
Div_4_LA	1.94	0.8	2,504	1,561	842	719	0	2.0
Div_5_LA	2.51	0.8	3,240	2,801	1,688	1,113	0	2.6
<b>Burdock Area</b>								
Div_1_LA	1.86	1.2	3,601	5,423	1,556	3,867	0.2	2.1
CPP_FAC	0.00	1.2	0	0	0	0	0	0.0
<b>Total</b>	<b>12.00</b>		<b>16,688</b>			<b>36,815</b>		<b>13.0</b>

**Cost Estimate**

Cost Item	No. Units	Unit	Unit Cost	Est. Cost
Replace spoil	36,815	cy	\$1.08	\$39,760.62
Replace topsoil	16,688	cy	\$1.08	\$18,023.39
Final grading	13.0	acres	\$75.25	\$978.25
Revegetation	13.0	acres	\$1,500.00	\$19,500.00
<b>Total</b>				<b>\$78,262.26</b>
<b>For estimate</b>				<b>\$78,300.00</b>

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Dewey-Burdock Project LSM Permit Application  
Reclamation Cost Estimate for First Year Following Permit Issuance

**Sediment Control Measures**

**Assumptions:**

- 1) Sediment control structures are shown on Plate 5.3-7 (land application option).
- 2) For the 1st year of construction disturbance, one wire-bound rock check dam will be required at Dewey and two single-fence rock check dams and one reinforced silt fence will be required at Burdock.
- 3) A disturbance area of 50' x 100' was estimated for each structure.

**Quantity Calculations**

Item	Value
Number of wire-bound rock check dams	1
Number of single-fence rock check dams	2
Number of reinforced silt fences	1
Disturbance area per sediment control measure (ac)	0.11

**Cost Estimate**

Cost Item	No. Units	Unit	Unit Cost	Est. Cost
Remove rock check dams	3	ea	\$2,635.92	\$7,907.76
Remove reinforced silt fences	1	ea	\$2,635.92	\$2,635.92
Revegetation	0.5	ac	\$1,500.00	\$750.00
<b>Total</b>				\$10,543.68
<b>For estimate</b>				<b>\$10,600.00</b>

Dewey-Burdock Project LSM Permit Application  
Reclamation Cost Estimate for First Year Following Permit Issuance

## Access Roads

### Assumptions:

- 1) Average top width of primary access roads will be 30 feet (LSM application p. 5-76). Average primary access road disturbance width (including shoulders and ditches) will be 45 feet.
- 2) Average top width of secondary access roads will be 20 feet (LSM application p. 5-76). Average secondary access road disturbance width will be 30 feet.
- 3) Light use roads will be unconstructed, two-track trails. Due to limited use during the first year after permit issuance, it is assumed that no scarification or revegetation will be required for light use roads.
- 4) Gravel thickness will be 12 inches on primary access roads and 6 inches on secondary.
- 5) Gravel volume will be based upon top width.
- 6) Gravel will be windrowed and made available to counties at no net salvage value.
- 6) Scarification, topsoil distribution and reseeding will be based upon average disturbance width.
- 7) The assumed topsoil stripping depth is 0.8 foot in the Dewey area and 1.2 feet in Burdock area (see response to completeness comment #25).
- 8) The average topsoil stockpile height will be 10 feet.
- 9) Roads on BLM Lands and secondary road around ponds (NRC) not included in DENR calculation. This includes 4900' on Burdock access road, 6150' of Burdock secondary roads, and 6750' of Dewey secondary roads.

### Quantity Calculations

Item	Value
Dewey Area - Primary Access Roads	
Length (ft)	5,743
Top width (ft)	30
Disturbance width (ft)	45
Gravel thickness (ft)	1.0
Area of gravel removed (ac)	4.0
Volume of gravel removed (cy)	6,381
Scarification area (ac)	5.9
Topsoil replacement depth (ft)	0.8
Topsoil replacement volume (cy)	7,657
Topsoil stockpile area (ac)	0.9
Revegetation area (ac)	6.9
Dewey Area - Secondary Access Roads	
Length (ft)	8,636
Top width (ft)	20
Disturbance width (ft)	30
Gravel thickness (ft)	0.5
Area of gravel removed (ac)	4.0
Volume of gravel removed (cy)	3,199
Scarification area (ac)	5.9
Topsoil replacement depth (ft)	0.8
Topsoil replacement volume (cy)	7,676
Topsoil stockpile area (ac)	1.0
Revegetation area (ac)	6.9



Dewey-Burdock Project LSM Permit Application  
Reclamation Cost Estimate for First Year Following Permit Issuance

**Access Roads (Cont'd)**

Item	Value
Burdock Area - Primary Access Roads	
Length (ft)	5,737
Top width (ft)	30
Disturbance width (ft)	45
Gravel thickness (ft)	1.0
Area of gravel removed (ac)	4.0
Volume of gravel removed (cy)	6,374
Scarification area (ac)	5.9
Topsoil replacement depth (ft)	1.2
Topsoil replacement volume (cy)	11,474
Topsoil stockpile area (ac)	1.4
Revegetation area (ac)	7.3
Burdock Area - Secondary Access Roads	
Length (ft)	12,503
Top width (ft)	20
Disturbance width (ft)	30
Gravel thickness (ft)	0.5
Area of gravel removed (ac)	5.7
Volume of gravel removed (cy)	4,631
Scarification area (ac)	8.6
Topsoil replacement depth (ft)	1.2
Topsoil replacement volume (cy)	16,671
Topsoil stockpile area (ac)	2.1
Revegetation area (ac)	10.7

**Cost Estimate**

Cost Item	No. Units	Unit	Unit Cost	Est. Cost
Access road gravel removal	17.6	acres	\$75.25	\$1,325.31
Access road gravel disposal	20,584.8	cy	\$0.00	\$0.00
Scarification of access roads	26.4	acres	\$69.02	\$1,823.37
Final grading	26.4	acres	\$75.25	\$1,987.96
Replace topsoil	43,478	cy	\$1.08	\$46,956.72
Revegetation	31.8	acres	\$1,500.00	\$47,711.90
<b>Total</b>				\$99,805.26
<b>For estimate</b>				<b>\$99,900.00</b>

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April 12, 2013

Dewey-Burdock Project LSM Permit Application  
Reclamation Cost Estimate for First Year Following Permit Issuance

**Monitor Wells**

**Assumptions:**

- 1) Average well depth for interior monitor wells will be 26' (same as compliance wells).
- 2) Number of compliance wells associated with land application = 7 (actual).
- 3) Number of interior wells associated with land application = 7 (planned).
- 4) Wells will be filled with bentonite chips following wellhead protector removal, and well casing will be cut off below ground.

**Quantity Calculations**

Item	Value
Number of compliance wells	7
Number of interior wells	7
Total number of wells	14
Average well depth (ft)	26

**Cost Estimate**

Cost Item	No. Units	Unit	Unit Cost	Est. Cost
Remove wellhead protector	14	ea	\$100.00	\$1,400.00
Plug monitor wells	364	ft	\$4.00	\$1,456.00
<b>Total</b>				<b>\$2,856.00</b>
<b>For estimate</b>				<b>\$2,900.00</b>



**DEPARTMENT OF ENVIRONMENTAL QUALITY  
LAND QUALITY DIVISION**



**GUIDELINE NO. 12**

**STANDARDIZED RECLAMATION  
PERFORMANCE BOND FORMAT AND COST  
CALCULATION METHODS**

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## INTRODUCTION

This document is a Guideline only. Its contents are not to be interpreted by the applicant/permittee or Wyoming Department of Environmental Quality (WDEQ) staff as mandatory. This Guideline intends to assist applicants/permittees in understanding and attaining the requirements of the Wyoming Environmental Quality Act (ACT) and Land Quality Division (LQD) Rules and Regulations addressing bonding topics.

This Guideline was developed as a joint project of the Wyoming Mining Association (WMA) Reclamation Subcommittee and the LQD. The LQD has and intends to selectively and periodically publish updated versions of the Cost Calculation Methods as contained in the various Appendices.

## APPLICABLE WEQA STATUTES AND LQD RULES AND REGULATIONS

This is a general summary of items from the ACT.

WS §35-11-417:

Outlines some general provisions applying to initial bond and renewal bond values.  
This statute outlines the concept of Partial Bond Release.

WS §35-11-418:

Outlines acceptable bond vehicles.

WS §35-11-423:

Outlines procedures for bond release for coal and other mineral permittees.

WS §35-11-411(d):

Authorizes the WDEQ Director to establish the bond amount based upon information submitted in the annual report, an inspection and other materials.

These items in LQD Rules and Regulations apply to bonding.

Coal Rules and Regulations, Chapter 1, Section 2(k) and Noncoal Rules and Regulations, Chapter 1, Section 2(i) defines bond.

Coal Rules and Regulations, Chapter 2, Section 3(b)(xxi) requires that shared structures be cross-referenced in the bonds of applicable coal permittees.

Coal Rules and Regulations, Chapter 4, Section 2(d)(ix) establishes a minimum ten (10) year bond period for coal permittees.

Coal Rules and Regulations, Chapter 11 and Noncoal Rules and Regulations, Chapter 6 outlines definitions and procedures for the self-bond program.

Coal Rules and Regulations, Chapter 12 applies exclusively to coal permittees. Section 2(a) defines the Area and Incremental Bonds. Section 2(b) elaborates further bond data requirements. Section 2(d) explains the liability areas and periods for the Area and

Incremental Bonds. Section 2(e) distinguishes among and establishes procedures for bond adjustments versus bond reductions versus partial bond releases. Sections 2(f) through (h) address requirements for specific bond vehicles.

Coal Rules and Regulations, Chapter 14, Section 4 and Noncoal Rules and Regulations, Chapter 8, Section 3 require a bond for exploration by drilling.

Coal Rules and Regulations, Chapter 15 outlines procedures for partial or complete release of coal permittee bonds.

Noncoal Rules and Regulations, Chapter 9, Section 2 discusses bond requirements for conversion of a non-coal Small Mine Permit to a Regular Mine Permit.

Coal Rules and Regulations, Chapter 20 and Noncoal Rules and Regulations, Chapter 12 details information on Letters of Credit used as a bond vehicle.

## **I. COST EXPLANATION FOR ITEMS USED IN STANDARDIZED RECLAMATION BOND COSTS**

Equipment sizes (loaders, trucks, scrapers, motor graders, etc.) were selected and agreed upon by the WMA Committee and LQD based on the usual types of equipment contractors normally have available for use. Costs for other equipment may be calculated by using methodologies as shown in this package.

Owning and operating costs were determined, except where noted, by using EquipmentWatch (formerly DataQuest). The owning and operating costs are no longer regionally adjusted to 90% since actual costs in Wyoming no longer reflect that.

Costs for the electric shovel and the trucks associated with the shovel were determined from the InfoMine USA, Inc.; Mine and Mill Equipment Costs Estimators Guide (2012). There was no adjustment factors used for these costs since they are based on actual costs at mining operations in the United States.

A standard efficiency factor of 0.83 is incorporated into all production calculations. The factor accounts for a fifty-minute work hour as recommended by many cost references.

Labor and benefit costs were obtained from the 2012 State Building Construction Prevailing Wages (February 2012).

Supervision costs were determined by adding \$5.00 per hour to labor costs and also include the same percentage add-on for benefits that the labor costs had. In most cases, only a portion of a supervisor's costs is applied to each task. Theoretically, this allows one supervisor the flexibility to oversee many jobs or pieces of equipment at the same time.

The supervisor's transportation is also divided among tasks. For example, where one-half of a supervisor's time is allotted, the same amount of time is used in calculating his transportation costs.

Where only a portion of support equipment are used in a calculation (i.e., one-half water truck), it is assumed that the equipment in question services more than one area.



Table D-1. Operating Costs and Adjusted Costs (\$/Hour w/o Operator) For Equipment in This Standardized Bond Format

Equipment Type	Equipment Name	100% Equipment Watch Book Cost (\$)	Date
Dozer	Caterpillar D9T (SU)	208.41	10/2012
Blade	Caterpillar 16M	145.14	10/2012
Scraper	Caterpillar 657G P-P	404.36	10/2012
Truck (95 ton)	Caterpillar 777F	304.76	10/2012
Loader (13.5 CY)	Caterpillar 992K	365.69	10/2012
Loader (5.25 CY)	Caterpillar 980H	115.78	10/2012
Dozer	Caterpillar D10T (SU)	271.57	10/2012
Dozer	Caterpillar D11R (U)	394.11	10/2012
Dozer	Caterpillar D11R-CD	368.43	10/2012
Backhoe Loader	Caterpillar 430E(4WD)	36.24	10/2012
Water Truck	14,000 Gallon	214.14	10/2012
Dump Truck	10-12 CY	77.78	10/2012
Pickup Truck	Crew 4x4 1T (Gas)	32.91	10/2012
Pickup Truck	Crew 4x4 1T (Diesel)	27.47	10/2012
Tractor	New Holland 545D 4WD 63 H.P.	16.08	10/2012
Towed Mower	Flail 7 ft	2.43	10/2012
Rubber Tired Dozer	Caterpillar 854G	275.09	10/2012
Scraper	Caterpillar 637G P-P	326.53	10/2012
Scraper	Caterpillar 651E	250.63	
Scraper	Caterpillar 627G P-P	242.66	
Blade	Caterpillar 140M	73.43	
Dozer	Caterpillar D6T-XL SU	92.13	

Caterpillar 24H blade: \$67.49/hr. to lease and \$150.24/hr. operating cost (from InfoMine USA, Inc.) for a total of \$217.73/hr. This blade is used in the truck/shovel appendices (D & D1) only.

Table D-1a. Purchase Price, Lease Cost, and Operating Costs for 58 CY Electric Shovel and 793C Trucks

Operators that use the truck/shovel appendix must show a regrading plan that is suitable for a large shovel/truck operation. Many backfill operations are not suited for this type operation because the cuts are not thick enough to allow the shovel optimum digging depths, highwall reduction with dozers takes up a large percentage of the required backfill, and there is insufficient backfill to justify this large shovel/truck fleet.

Operators using the shovel/truck appendix should submit suitable cut and fill isopachs that support the choice of this backfill method.

This method is not to be used for topsoil movement from native areas or from stockpiles. Topsoil movement from stockpiles should have the shovel production rate reduced to 85% (see page 7, item 8.).

The \$15,183,000.00 purchase price of the 58 CY shovel must be added to the bond costs. There is no profit or other contingency items added to this cost so it can be added to the bond cost after all the line items and add-ons have been totaled. No salvage value is allowed at the end of the project.

58 CY Electric Shovel

Purchase Price \$21,500,000 (InfoMine)

Productivity - 58 CY x 1 pass/35 sec. x 3,600 sec./hr. x 0.968 bucket fill factor = 5,774

5,774 CY/hr. x 0.8696 BCY/LCY (15% swell of BCY) = 5,021 BCY/hr.

5,021 BCY/hr. x 0.8333 (operating efficiency) = 4,184 BCY/hr.

58 CY Shovel Hourly Costs (WME)

Overhaul Parts	Overhaul Labor	Maint. Parts	Maint. Labor	Power	Lube	Wear Parts	Total
\$66.25	\$84.28	\$99.37	\$126.42	\$72.44	\$61.43	\$24.24	\$534.43

(Note: if mine uses an 80 CY shovel the purchase price will be \$23,000,000 & \$534.87/hr. w/o ownership cost)

Caterpillar 793D Trucks (240 Ton)

Purchase Price \$4,082,000 (InfoMine)

Monthly Lease (@600 hr./month) \$91,700.00

Hourly Lease Cost \$152.83

[Cat 797F Trucks (380T) @ \$236.48/hr. to lease & \$596.60/hr. operating cost = \$833.08/hr.]

793 Truck Hourly Costs (WME)

Overhaul Parts	Overhaul Labor	Maint. Parts	Maint. Labor	Fuel	Lube	Tires	Total
\$12.96	\$14.14	\$24.07	\$26.25	\$135.13	\$32.78	\$88.25	\$333.58



Table D-2. Abbreviations Used in This Standardized Bond Format

CPH -	Caterpillar Performance Handbook (Edition No. specified where appropriate)
EQW -	Equipment Watch Guide (date of data indicated)
WYDOT-WDD -	Wyoming Department of Transportation - Wage Determination Decision (2012 Version)
IM -	InfoMine, USA, Inc. (2012 Estimating Guide)
BCY -	Bank Cubic Yard
LCY -	Loose Cubic Yard
MPH -	Miles Per Hour
BHB -	Black Hills Bentonite Corporation
AML -	DEQ Abandoned Mine Land Reclamation Program

## II. STANDARDIZED RECLAMATION BOND FORMAT

Individual items may be expanded as necessary or noted as not applicable based upon the specific reclamation practices approved in each permit.

This guideline refers to “area bond” and “incremental bond” which are terms that are associated with bond estimates for coal mines. In general terms, the area bond is the pit backfill cost and the incremental bond is the cost of completing the reclamation after backfilling is completed. These terms are not applicable for non-coal mines, but the costs are estimated in the same manner.

### A. Area Bond

The Area Bond covers the costs of backfilling and rough grading (and special reconstruction techniques when specifically approved) according to procedures and postmining topography approved in the current term permit.

#### 1. Introduction

Present a general discussion of assumptions, including time frames, backup calculations, procedures, methods, etc. for summarizing or documenting the basis for all calculations. The reclamation cost estimate should be based upon completing the reclamation of the site in a timely and efficient manner consistent with the approved reclamation plan. The time frame for completion must be clearly stated in order to support the calculations.

#### 2. Backfill

Describe equipment, procedures, volumes, and costs for bringing all pits to an interim/bond topography with reference to a quality, current map of the project site. **The interim/bond topography must come as close as possible to the approved final topography, acknowledging that the current mine site differs from the final configuration.**



The operator should submit a map showing the interim/bond topography that will be constructed if the mine were to cease operations during the next Annual Report period. Cut and fill isopachs may also need to be submitted to adequately show the backfill work.

LQD realizes that the interim/bond topography will not exactly match the approved PMT because the mine life will not be the same. The operator must do more than simply regrade the highwalls and spoil piles to 5(H):1(V) slopes, topsoil and seed. There has to be some diversity built into the slopes and adequate, non-erosive through drainage. LQD will not accept long, straight slopes that match the dragline or truck/shovel highwall from the current pit.

Appendices A through F detail equipment fleets and costs for this reclamation activity.

Operators should clearly show cut and fill areas and the associated haul distances and grades on a map.

This section should clearly list overburden Drilling and Blasting cost at \$0.259/BCY when applicable. If the operator intends to cast blast some material then that should be calculated at \$0.400/BCY. Drill and blast costs in small mines and quarries are considerably higher and the cost should be figured at \$0.859/BCY, or on a case by case basis depending on the location, topography, rock type, etc.

### 3. Rough Grade Backfill

Describe procedures and costs for shaping interim/bond topography with reference to a quality map. NOTE: Depending upon permit approved backfill practices, rough grading may not be a necessary line item bond cost.

Appendices G and M detail equipment and costs for this reclamation activity.

### 4. Final Grade Backfill

Describe equipment, procedures, and costs for specific site tasks (e.g., drainage reconstruction or permit-specific postmining features).

Appendix G details equipment and costs for this reclamation activity.

## B. Incremental Bond

### 1. Introduction

The Incremental Bond covers all other costs beyond those detailed in the Area Bond.

Present a general discussion of assumptions, including time frames, backup calculations, procedures, methods, etc. for summarizing or documenting the basis for all calculations. The reclamation cost estimate should be based upon completing the reclamation of the site in a timely and efficient manner consistent with the approved reclamation plan. The time frame for completion must be clearly stated in order to support the calculations.

2. Native Topsoil Removal From Borrow and/or Backslope Areas

If applicable, describe equipment, volumes, haul routes, and costs with reference to a quality, current map of the project site.

Appendices A, B, C, E, F and G detail potential equipment and costs for this reclamation activity.

3. Native Overburden Removal From Borrow and/or Backslope Areas

If applicable, describe equipment, haul routes, volumes, and costs with reference to a quality, current map of the project site.

Appendices A through G detail potential equipment and costs for this reclamation activity.

4. Miscellaneous Overburden Redistribution

Describe equipment, haul routes, volumes, and costs (with reference to a quality map) for backfilling structures, such as:

- scoria or shale pit(s)
- diversion ditches
- access/haul road cut or fill
- railroad cuts/embankments
- sediment ponds
- sewage lagoons
- culverts
- other

Appendices A through G (excluding D) detail potential equipment and costs for this reclamation activity.

5. Demolition

Equipment, procedures, and costs for demolition and disposal of each individual structure should be described in terms of size, type of construction, etc. so that appropriate demolition costs can be estimated, such as:

- fences
- power lines, transformers
- hard-surfaced roads
- bridges
- abandoned equipment (i.e., draglines, shovels, drills and pieces of same)
- culverts
- railroads (rails, ties, ballast, scales, etc.)
- facility buildings (shops, warehouse, offices, etc.)
- mineral handling facilities (truck dumps, conveyors, silos, scales, etc.)
- support facilities (ready line, fuel tanks, water tanks, equipment yards, explosive storage sites, electrical substations)

Appendices H through K contain costs for these reclamation and demolition practices. LQD accepts no salvage value for any facilities, equipment, or other infrastructure.

6. Removal of Monitoring Structures and Other Miscellaneous Items

Describe the procedures, equipment, and costs required to properly abandon or remove and disposal of items, such as:

- groundwater monitor wells
- all other operator-owned wells within the permit area
- surface water monitoring stations
- all other experimental study sites within the permit area
- meteorological/air quality monitoring sites

Appendices L through O detail equipment and costs for these reclamation practices.

7. Scarification or Ripping of All Compacted Surfaces

Describe equipment, procedures, and costs (preferably on a per acre basis) with reference to a quality, current map of the project site.

Appendices I1 and P detail costs for this reclamation practice.

8. Topsoil Redistribution on All Disturbed Areas

Describe equipment, procedures, and costs with reference to a quality, current map of the project site. The map should show haul distances and grades.

Appendices B and C detail equipment and costs for this reclamation activity. Topsoil haul from stockpiles with shovel or loader and trucks should be at 85% of the productivity from the appendices.

9. Revegetation of All Disturbed Areas

Describe equipment, practices, and costs (preferably on a per acre basis), including:

- seedbed preparation
- mulch (purchase and application)
- seed (purchase and application)
- fertilizer (if required, purchase and application)
- post-seeding maintenance over the minimum bonding period (e.g., weed control, mowing, interseeding). Operators suggest that a ten percent line item should cover this issue for the entire bonding period.



Appendix Q outlines a cost calculation process for this reclamation activity. The costs must be calculated using the specific seed mixes and practices from the approved term permit.

10. Reclamation Status and Bond Liability Status of All Lands Within the Permit Area

a. Land Status Categories

The bond calculation should describe the status of all lands within the permit area. Each land status category should be clearly identified on a quality map and cross-referenced to specific reclamation cost for each category. The LQD also prefers a tabular summary of the acreage for each category.

**LANDS THAT HAVE BEEN TOPSOILED AND SEEDED BUT HAVE NO BOND RELEASE MUST BE BONDED FOR RETOPSOILING, SCARIFICATION, AND REVEGETATION.** [see Section 10.b.(2)(b)i)e) on page 10]

The following is a summary of generic land status categories. Section 10.(2) below details the information and calculations necessary for each of these categories.

- (1) Native lands undisturbed at the time of this specific bond calculation and which will remain undisturbed under this bond calculation (e.g., no borrow areas necessary).
- (2) Lands disturbed and requiring backfilling, regrading and revegetation at the time of this specific bond calculation.
  - (a) Lands requiring assessment of Area Bond costs
  - (b) Lands requiring assessment of full or Incremental Bond costs
  - (c) Lands requiring assessment of partial Incremental Bond costs
    - i) Lands permanently reclaimed prior to December 31, 1982
    - ii) Lands permanently reclaimed after December 31, 1982
      - a) Lands with no approved Partial or Full Bond Release
      - b) Lands with approved 60 percent Partial Release of the Incremental Bond
      - c) Lands with approved larger percent Partial Release of the Incremental Bond

d) Lands with approved Full Release of Area and Incremental Bonds

b. Line Item Bond Costs

- (1) The bond covers lands currently disturbed by mining and associated activities and those lands to be disturbed in the next 12-month period.
- (2) The bond should include costs for the Area Bond (through backfill, rough and final grading) for all open pits, impoundments, sediment ponds, diversions, etc.
  - (a) Section II.A of this Guideline and its associated appendices detail procedures and costs for the Area Bond. The bond calculation should detail costs for the operations listed in Section II.A Parts 2, 3 and 4.
  - (b) Section II.B of this Guideline and its associated appendices detail general categories and procedures for the Incremental Bond. Overall, the bond calculation should detail costs for the operations listed in Section II B Parts 2 through 9.
    - i) The bond calculation should assess the full suite of Incremental Bond tasks and costs for all disturbed lands which have not formally approved partial or full release of the Incremental Bond.

Historic LQD policy, LQD Coal Rules and Regulations Chapter 15 and WS§35-11-417(e) establish three (3) distinct categories of Partial Bond Release for permanently reclaimed lands.

(a) Lands Permanently Reclaimed Prior to December 31, 1982

Prior to this date and prior to approval of the Wyoming State Coal Program, the LQD granted defacto Partial Bond Release for permanently reclaimed lands.

The LQD did not specifically approve or otherwise record this Partial Bond Release category, so there is generally no written approval letter.

The bond should specifically identify this Partial Bond Release category if it exists.

The bond should include a carry-over cost assessment for interseeding an appropriate, permit-approved seed mixture on these lands. These carry-over costs should include seed purchase and seed implantation.

(b) 60 Percent Partial Bond Release

LQD Coal Rules and Regulations Chapter 15, Section 5(a)(i) allows for release of 60 percent of the Incremental Bond when the permittee has completed backfilling, regrading, topsoil replacement, and drainage control according to the approved term permit procedures.

This category of Partial Bond Release requires formal, written approval by the DEQ Director. If this release category exists for your specific permit, the bond calculation should include the date of the Director's approval letter.

The bond calculation should specifically identify this category and show the appropriate units on a quality map.

The bond calculation should specifically tabulate the residual 40 percent Incremental Bond costs (preferably on a per acre basis) as the appropriate carry-over cost assessment. As noted above, the Incremental Bond includes all term permit approved Reclamation Plan practices beyond rough grading of the backfill. The tabulation of the 40 percent Incremental Bond carry-over costs should detail all approved reclamation practices.

(c) Larger Percentage of Partial Bond Release

LQD Coal Rules and Regulations Chapter 15, Section 5(a)(ii)(A) allows more than 60 percent release of the Incremental Bond as determined by the LQD Administrator and DEQ Director.

WS §35-11-423(d) mandates development of specific rules and regulations for release of coal bonds. These rules are controlling not withstanding other provisions of WS§35-11-417 and §35-11-423 to the contrary.

LQD Coal Rules and Regulations, Chapter 15 is that formulation.

Coal Chapter 15 governs partial and 100 percent release of the Incremental Bond. For partial release, the amount remaining cannot be less than the cost of reseeding.

This category of Partial Bond Release requires formal, written approval by the DEQ Director. If this release category exists for your specific



permit, the bond calculation should identify the date of the Director's approval letter.

The bond calculation should specifically tabulate the residual percentage Incremental Bond costs (preferably on a per acre basis) as the appropriate carry-over cost assessment. As previously noted, the Incremental Bond includes all term permit approved Reclamation Plan practices beyond rough grading of the backfill. The tabulation of the percentage Incremental Bond carry-over costs should detail all approved reclamation practices.

NOTE: The percentages of partial release of the Incremental Bond vary for Noncoal Permittees. A Noncoal Permittee seeking partial release should consult with the LQD.

(d) Full Bond Release of the Area and Incremental Bonds

This category includes all land permanently reclaimed and formally released under provisions of the 1973 ACT and LQD RR Chapter 15.

Full Bond Release requires formal, written approval by the DEQ Director. If this category exists for your specific permit, the bond calculation should list the date of the DEQ Director's Full Bond Release decision.

(e) Lands Permanently Reclaimed After December 31, 1982

This category includes all land permanently reclaimed that has no bond release.

These reclaimed lands must be bonded to scarify, retopsoil, and reseed. There are no provisions made for where the topsoil would come from. It is assumed that topsoil would be spread at the same average depth on these lands as it is on the rest of the areas requiring topsoil. Topsoil haul distance and grade used would be the weighted average used for the rest of the reclamation. Scarification and reseeding costs would be the same per acre as those used on other lands requiring reclamation.

NOTE: The LQD continues development of a DRAFT Guideline on Full and Partial Bond Release Procedures. Please consult with the LQD concerning the status of that Guideline, should you consider bond release for permanently reclaimed lands.

11. Coal Drilling

Describe the approximate number, depth, diameter, and location (show on inclusive map, if possible) of all holes drilled into or through coal during the current and next annual report

period. A tabular format with reference to map locations may be an efficient presentation. This description should distinguish between coal drill holes which will be or have been removed by the pit advance within the annual report period versus those coal drill holes which will not be mined out in a report cycle. The operator may distinguish between abandonment/plugging procedures for the coal drill holes mined out in the report cycle versus the longer term abandoned holes. Each category should have a total line item cost entry in the bond. The LQD prefers that all coal drill hole reclamation costs be estimated according to Appendices L and M.

## 12. Miscellaneous Items

The following tasks are mostly for the surface coal mine bonds. Miscellaneous bond costs for other mines, which are typically much smaller than coal mines, will be different. Mobilization, de-mobilization, and profit will likely be higher for small, remote projects, and other tasks will also vary. LQD feels that the miscellaneous costs on other mines should range from 25% on projects in excess of \$500,000.00, to 35% on projects of \$250,000.00, and 45% on projects of \$50,000 and less. See Appendix S, page 46.

Each individual operator should identify these items as a line item or include each in some specific bond category. Otherwise, the LQD will enter the item as an addition to total dollar value of the Area and Incremental Bonds.

- a. COSTS FOR AN INDEPENDENT FIRM TO DESIGN THE FINAL RECLAMATION PROJECT: LQD and WMA agreed on a flat \$200,000 for project design regardless of project size.
- b. CONTRACTOR PROFIT, OVERHEAD, MOBILIZATION AND DEMOBILIZATION COSTS: The Dataquest Cost Reference Guides used to construct the appendices do not include these costs. If an operator uses these appendices in bond calculations, there is still a need for this distinct line item cost in the bond. Assorted references place these items from 8 to 15 percent of the total bond cost. Presently LQD is using 10 percent.
- c. PRECONSTRUCTION INVESTIGATION AND STABILIZATION: This item addresses all field work necessary to document and mitigate dangerous and/or quickly deteriorating conditions, such as slumping highwalls or drainage problems. Any assessment under this item will be based upon the LQD's knowledge of specific site conditions and the length of time between cessation/forfeiture and initiation of the final reclamation project. When necessary, reference sources place this cost at 1 to 2 percent. LQD is using 1 percent.
- d. COSTS FOR AN INDEPENDENT FIRM TO MANAGE THE FINAL RECLAMATION PROJECT: LQD and the WMA agreed that the Office of Surface Mining's sliding scale would be used for this item. A copy of that is attached as Appendix R.



- e. COSTS FOR ON SITE MONITORING PROGRAMS FOR TEN YEARS AFTER COMPLETION OF THE FINAL RECLAMATION PROJECT (INCLUDES SUCH ITEMS AS UTILITIES AND GROUNDWATER SAMPLING): Costs of this item will vary depending upon specific permit commitments. The LQD uses a range of 1/2 to 2 percent. Usually LQD uses 0.5 percent.
- f. COSTS FOR SITE SECURITY DURING THE FINAL RECLAMATION PROJECT AND LIABILITY INSURANCE COST DURING THE FINAL RECLAMATION PROJECT AND OVER THE FULL BONDING PERIOD: LQD and the WMA agreed that \$200,000 per year of project life would be adequate.
- g. LONG-TERM ADMINISTRATION AND ACCOUNTING COSTS: LQD and the WMA agreed to a range of \$250,000 to \$400,000 based on the project size.
- h. ANY OTHER SITE-SPECIFIC PERMIT COMMITMENTS SHOULD ALSO BE INCLUDED HERE: Costs will vary according to specific permit commitments.

The LQD has historically used the following sources to establish the range of percentages list in the Miscellaneous Items.

- \* Means Heavy Construction Cost Data (current edition), published by R. S. Means Company, Inc., Kingston, MA
- \* Means Site Work Cost Data (current edition), published by R. S. Means Company, Inc., Kingston, MA
- \* Building Construction Cost Data (current edition), published by R. S. Means Company, Inc., Kingston, MA
- \* Handbook for Calculation of Reclamation Bond Costs, 1987, Department of Interior, Office of Surface Mining Reclamation and Enforcement, Washington, D.C.
- \* Wyoming DEQ Abandoned Mine Land Program contracting and reclamation practices and cumulative experience

### 13. Unknown Costs

The items under L) represent the usual contingency items applied to bonds. If these items are included as line items in the bond, the only remaining category could be unknown as per WS §35-11-417(c)(ii). References place this cost at 2 to 5 percent of the total bond cost. Under normal circumstances LQD is using 4 percent.

### 14. References

List sources of information, procedures, costs, etc. which were used in the bond calculations.



## 15. Maps

This Guideline requests that the various tasks, operations, disturbed areas, reclamation areas, etc., be illustrated on or referenced to a **QUALITY, CURRENT MAP**. Several of the tasks may be illustrated on the same map. All maps presented in support of the bond calculations must be clear and legible contour maps or recent (with date) aerial photographs. **The preferred scale is 1"=500'**, unless it is necessary to directly compare (e.g., overlay) a bond map to an existing permit map. In this case the scales should be identical. Each map should be of a reasonable size, generally no larger than 48" on a side.

Each map must have a complete title block, including:

- Map title
- Name and address of permittee
- Permit number and term designation
- Annual report period
- Scale, north arrow, contour interval, date of photography or date of preparation

All maps must show and clearly label:

- Legal subdivisions with section, township, and range lines
- Permit area boundary and term boundary

## III. APPENDICES

The following appendices are intended for use in this standardized bond calculation package. Any references to specific equipment should not be interpreted as a recommendation of any kind by any person, company or agency for the use of specific brand-name equipment.

Appendix A  
Calculations for Moving Materials With a Caterpillar 992K Loader and Caterpillar 777F Truck Fleet

**NOTE: THESE COSTS ARE FOR EXCAVATION ONLY. MATERIAL REQUIRING BLASTING SHOULD HAVE AN ADDITIONAL \$0.259/BCY ADDED FOR DRILLING AND BLASTING COSTS.**

Material Movement By Loader-Truck Combination

1) Caterpillar 992K Loader	13.2 BCY	CPH 40
2) Caterpillar 777F Trucks (85 ton)	66.0 BCY	CPH 40
3) Material Density	2,850.0 LB/BCY	CPH 40
4) Operating Efficiency Factor (50 Min/Hr)	0.83	CPH 40
5) Rolling Resistance Factor	4.00 %	CPH 40
6) 777F Truck Operating Costs	\$304.76 Per Hour	100% of E-W
7) 992K Loader Operating Costs	\$365.69 Per Hour	100% of E-W
8) Labor Costs	\$45.31 Per Hour	WYDOT-WDD
9) 1/2 of 1 - 14,000 Gal. Water Trucks + 1 Operator	\$129.73 Per Hour	1/2 of 100% E-W
10) 1 - 16M Blade for Road Work + 1 Operator	\$190.45 Per Hour	100% E-W + Operator
11) 1 - D9T for Misc. Work + 1 Operator	\$253.72 Per Hour	100% E-W + Operator
12) Supervision Labor Costs	\$25.16 Per Hour	1/2 of WYDOT-WDD
13) Supervisor Transportation	<u>\$13.74 Per Hour</u>	1/2 of 100% E-W
14) Total Fleet Hourly Costs (Except Trucks)	\$1,023.80	

TO USE TABLE: Locate your approximate grade by reference to case number. Determine cost per BCY by using distance column that approximates your distance. No calculations are necessary.

Case #1: Level Ground		Loaded (0% grade + 4% rolling = 4% total resistance)						Empty (0% grade + 4% total resistance)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Loader Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	3.50	0.70	0.47	1.10	0.36	6.13	9.8	66	539	942	1.75	\$1.737
1000	3.50	0.70	0.78	1.10	0.56	6.64	9.0	66	495	942	1.90	\$1.793
1500	3.50	0.70	1.06	1.10	0.74	7.10	8.5	66	467	942	2.02	\$1.838
2000	3.50	0.70	1.34	1.10	0.90	7.54	8.0	66	440	942	2.15	\$1.886
2500	3.50	0.70	1.60	1.10	1.06	7.96	7.5	66	412	942	2.29	\$1.938
3000	3.50	0.70	1.86	1.10	1.22	8.38	7.2	66	396	942	2.38	\$1.971
3500	3.50	0.70	2.11	1.10	1.39	8.80	6.8	66	374	942	2.52	\$2.023
4000	3.50	0.70	2.37	1.10	1.55	9.22	6.5	66	357	942	2.64	\$2.068
4500	3.50	0.70	2.63	1.10	1.71	9.64	6.2	66	341	942	2.77	\$2.116
5000	3.50	0.70	2.89	1.10	1.88	10.07	6.0	66	330	942	2.86	\$2.150
5500	3.50	0.70	3.15	1.10	2.04	10.49	5.7	66	313	942	3.00	\$2.202
6000	3.50	0.70	3.41	1.10	2.21	10.92	5.5	66	302	942	3.12	\$2.246
6500	3.50	0.70	3.66	1.10	2.37	11.33	5.3	66	291	942	3.24	\$2.291
7000	3.50	0.70	3.92	1.10	2.53	11.75	5.1	66	280	942	3.36	\$2.336

Operating Costs = (((# Trucks x (Truck costs + Labor costs)) + Total Fleet costs)/Loader Productivity)

Appendix A (Continued)  
Calculations for Moving Materials With a Caterpillar 992K Loader and Caterpillar 777F Truck Fleet

Material Movement By Loader-Truck Combination

Case #2: 5% Assisting Grade			Loaded (-5% grade + 4% rolling = -1% total)					Empty (5% grade + 4% rolling = 9% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Loader Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	3.50	0.70	0.38	1.10	0.41	6.09	9.9	66	544	942	1.73	\$1.730
1000	3.50	0.70	0.58	1.10	0.68	6.56	9.1	66	500	942	1.88	\$1.786
1500	3.50	0.70	0.74	1.10	0.94	6.98	8.6	66	473	942	1.99	\$1.826
2000	3.50	0.70	0.89	1.10	1.18	7.37	8.1	66	445	942	2.12	\$1.875
2500	3.50	0.70	1.05	1.10	1.43	7.78	7.7	66	423	942	2.23	\$1.916
3000	3.50	0.70	1.20	1.10	1.68	8.18	7.3	66	401	942	2.35	\$1.960
3500	3.50	0.70	1.35	1.10	1.92	8.57	7.0	66	385	942	2.45	\$1.997
4000	3.50	0.70	1.50	1.10	2.17	8.97	6.7	66	368	942	2.56	\$2.038
4500	3.50	0.70	1.66	1.10	2.42	9.38	6.4	66	352	942	2.68	\$2.083
5000	3.50	0.70	1.81	1.10	2.66	9.77	6.1	66	335	942	2.81	\$2.131
5500	3.50	0.70	1.96	1.10	2.91	10.17	5.9	66	324	942	2.91	\$2.168
6000	3.50	0.70	2.11	1.10	3.16	10.57	5.7	66	313	942	3.01	\$2.205
6500	3.50	0.70	2.27	1.10	3.40	10.97	5.5	66	302	942	3.12	\$2.246
7000	3.50	0.70	2.42	1.10	3.65	11.37	5.3	66	291	942	3.24	\$2.291

Case #3: 10% Assisting Grade			Loaded (-10% grade + 4% rolling = -6% total)					Empty (10% grade + 4% rolling = 14% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Loader Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	3.50	0.70	0.35	1.10	0.49	6.14	9.8	66	539	942	1.75	\$1.737
1000	3.50	0.70	0.52	1.10	0.90	6.72	8.9	66	489	942	1.93	\$1.804
1500	3.50	0.70	0.67	1.10	1.31	7.28	8.2	66	451	942	2.09	\$1.864
2000	3.50	0.70	0.82	1.10	1.72	7.84	7.7	66	423	942	2.23	\$1.916
2500	3.50	0.70	0.97	1.10	2.13	8.40	7.1	66	390	942	2.42	\$1.986
3000	3.50	0.70	1.13	1.10	2.54	8.97	6.7	66	368	942	2.56	\$2.038
3500	3.50	0.70	1.28	1.10	2.94	9.52	6.3	66	346	942	2.72	\$2.098
4000	3.50	0.70	1.43	1.10	3.35	10.08	6.0	66	330	942	2.85	\$2.146
4500	3.50	0.70	1.59	1.10	3.76	10.65	5.6	66	308	942	3.06	\$2.224
5000	3.50	0.70	1.74	1.10	4.17	11.21	5.4	66	297	942	3.17	\$2.265
5500	3.50	0.70	1.89	1.10	4.58	11.77	5.1	66	280	942	3.36	\$2.336
6000	3.50	0.70	2.04	1.10	4.99	12.33	4.9	66	269	942	3.50	\$2.388
6500	3.50	0.70	2.20	1.10	5.40	12.90	4.7	66	258	942	3.65	\$2.443
7000	3.50	0.70	2.35	1.10	5.80	13.45	4.5	66	247	942	3.81	\$2.503



Calculations for Moving Materials With a Caterpillar 992K Loader and Caterpillar 777F Truck Fleet

Material Movement by Loader-Truck Combination

Case #4: 5% Resisting Grade			Loaded (5% grade + 4% rolling = 9% total)					Empty (-5% grade + 4% rolling = -1% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Loader Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	3.50	0.70	0.66	1.10	0.33	6.29	9.5	66	522	942	1.80	\$1.756
1000	3.50	0.70	1.23	1.10	0.50	7.03	8.5	66	467	942	2.02	\$1.838
1500	3.50	0.70	1.81	1.10	0.65	7.76	7.7	66	423	942	2.23	\$1.916
2000	3.50	0.70	2.38	1.10	0.81	8.49	7.1	66	390	942	2.42	\$1.986
2500	3.50	0.70	2.95	1.10	0.96	9.21	6.5	66	357	942	2.64	\$2.068
3000	3.50	0.70	3.53	1.10	1.11	9.94	6.0	66	330	942	2.85	\$2.146
3500	3.50	0.70	4.10	1.10	1.26	10.66	5.6	66	308	942	3.06	\$2.224
4000	3.50	0.70	4.68	1.10	1.42	11.40	5.3	66	291	942	3.24	\$2.291
4500	3.50	0.70	5.25	1.10	1.57	12.12	5.0	66	275	942	3.43	\$2.362
5000	3.50	0.70	5.82	1.10	1.72	12.84	4.7	66	258	942	3.65	\$2.443
5500	3.50	0.70	6.40	1.10	1.87	13.57	4.4	66	242	942	3.89	\$2.533
6000	3.50	0.70	6.97	1.10	2.03	14.30	4.2	66	231	942	4.08	\$2.603
6500	3.50	0.70	7.54	1.10	2.18	15.02	4.0	66	220	942	4.28	\$2.677
7000	3.50	0.70	8.12	1.10	2.33	15.75	3.8	66	209	942	4.51	\$2.763

Case #5: 10% Resisting Grade			Loaded (10% grade + 4% rolling = 14% total)					Empty (-10% grade + 4% rolling = -6% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Loader Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	3.50	0.70	0.94	1.10	0.33	6.57	9.1	66	500	942	1.88	\$1.786
1000	3.50	0.70	1.83	1.10	0.49	7.62	7.9	66	434	942	2.17	\$1.893
1500	3.50	0.70	2.72	1.10	0.64	8.66	6.9	66	379	942	2.49	\$2.012
2000	3.50	0.70	3.60	1.10	0.79	9.69	6.2	66	341	942	2.76	\$2.113
2500	3.50	0.70	4.49	1.10	0.94	10.73	5.6	66	308	942	3.06	\$2.224
3000	3.50	0.70	5.38	1.10	1.10	11.78	5.1	66	280	942	3.36	\$2.336
3500	3.50	0.70	6.26	1.10	1.25	12.81	4.7	66	258	942	3.65	\$2.443
4000	3.50	0.70	7.15	1.10	1.40	13.85	4.3	66	236	942	3.99	\$2.570
4500	3.50	0.70	8.04	1.10	1.55	14.89	4.0	66	220	942	4.28	\$2.677
5000	3.50	0.70	8.94	1.10	1.71	15.94	3.8	66	209	942	4.51	\$2.763
5500	3.50	0.70	9.81	1.10	1.86	16.97	3.5	66	192	942	4.91	\$2.912
6000	3.50	0.70	10.70	1.10	2.01	18.01	3.3	66	181	942	5.20	\$3.019
6500	3.50	0.70	11.59	1.10	2.16	19.05	3.1	66	170	942	5.54	\$3.146
7000	3.50	0.70	12.48	1.10	2.32	20.10	3.0	66	165	942	5.71	\$3.209

Appendix B  
Calculations for Moving Materials With a Caterpillar 657G Push-Pull Scraper Fleet

**NOTE: DRILLING AND BLASTING COSTS ARE NOT INCLUDED IN THESE CALCULATIONS. THE LQD DOES NOT CONSIDER DRILLING AND BLASTING COSTS NECESSARY WHEN USING APPENDIX B.**

Material Movement By Scrapers

1) Caterpillar 657G Push-Pull Scraper		
2) Material Density	2,850. LB/BCY	CPH 40
3) Payload	104,000. LB	CPH 40
	35.0 BCY	
4) Maximum Vehicle Speed Loaded	33.0 MPH	CPH 40
5) Operating Efficiency Factor (50 Min./Hr.)	0.83	CPH 40
6) 657G PP Operating Costs	\$404.36 Per Hour	100% E-W
7) Labor Costs	\$45.31 Per Hour	WYDOT-WDD
8) Supervision Labor Costs	\$6.29 Per Hour	1/8 of WYDOT-WDD
9) Supervisor Transportation	\$3.43 Per Hour	1/8 of 100% E-W
10) 1/8 of 1 - 14,000 Gal. Water Trucks + 1 Operator	\$32.43 Per Hour	1/8 of 100%E-W
11) 1/8 of 1 - 16M Blade for Road Work + 1 Operator	\$23.81 Per Hour	1/8 of 100% E-W
12) - D9T for Ripping Ovb. and Misc. Work + 1 Operator	<u>\$126.86 Per Hour</u>	- of 100% E-W
13) Total Hourly Costs	\$642.49	

TO USE TABLE: Locate your approximate grade by reference to case number. Determine cost per BCY by using distance column that approximates your distance. No calculations are necessary.

Case #1: Level Ground		Loaded (0% grade + 4% rolling = 4% total)				Empty (0% grade + 4% rolling = 4% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.10	0.42	0.60	0.36	2.48	24.2	35.0	0.83	706	\$0.910
1000	1.10	0.68	0.60	0.57	2.95	20.3	35.0	0.83	593	\$1.084
1500	1.10	0.92	0.60	0.75	3.37	17.8	35.0	0.83	519	\$1.238
2000	1.10	1.15	0.60	0.92	3.77	15.9	35.0	0.83	464	\$1.385
2500	1.10	1.37	0.60	1.09	4.16	14.4	35.0	0.83	421	\$1.526
3000	1.10	1.59	0.60	1.26	4.55	13.2	35.0	0.83	385	\$1.669
3500	1.10	1.81	0.60	1.44	4.95	12.1	35.0	0.83	354	\$1.815
4000	1.10	2.02	0.60	1.61	5.33	11.3	35.0	0.83	328	\$1.959
4500	1.10	2.22	0.60	1.78	5.70	10.5	35.0	0.83	307	\$2.093
5000	1.10	2.43	0.60	1.95	6.08	9.9	35.0	0.83	288	\$2.231
5500	1.10	2.64	0.60	2.13	6.47	9.3	35.0	0.83	270	\$2.380
6000	1.10	2.85	0.60	2.30	6.85	8.8	35.0	0.83	255	\$2.520
6500	1.10	3.05	0.60	2.47	7.22	8.3	35.0	0.83	242	\$2.655
7000	1.10	3.26	0.60	2.64	7.60	7.9	35.0	0.83	230	\$2.793

Appendix B (Continued)  
Calculations for Moving Materials With a Caterpillar 657G Push-Pull Scraper Fleet

Material Movement By Scrapers

Case #2: 5% Assisting Grade		Loaded (-5% grade + 4% rolling = -1% total)					Empty (5% grade + 4% rolling = 9% total)			
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.10	0.36	0.60	0.42	2.48	24.2	35.0	0.83	706	\$0.910
1000	1.10	0.54	0.60	0.71	2.95	20.3	35.0	0.83	593	\$1.084
1500	1.10	0.71	0.60	0.98	3.39	17.7	35.0	0.83	516	\$1.245
2000	1.10	0.87	0.60	1.25	3.82	15.7	35.0	0.83	458	\$1.403
2500	1.10	1.03	0.60	1.51	4.24	14.2	35.0	0.83	413	\$1.556
3000	1.10	1.19	0.60	1.78	4.67	12.8	35.0	0.83	375	\$1.713
3500	1.10	1.36	0.60	2.05	5.11	11.7	35.0	0.83	342	\$1.879
4000	1.10	1.52	0.60	2.32	5.54	10.8	35.0	0.83	316	\$2.033
4500	1.10	1.68	0.60	2.59	5.97	10.1	35.0	0.83	293	\$2.193
5000	1.10	1.85	0.60	2.86	6.41	9.4	35.0	0.83	273	\$2.353
5500	1.10	2.01	0.60	3.12	6.83	8.8	35.0	0.83	256	\$2.510
6000	1.10	2.17	0.60	3.39	7.26	8.3	35.0	0.83	241	\$2.666
6500	1.10	2.33	0.60	3.66	7.69	7.8	35.0	0.83	228	\$2.818
7000	1.10	2.50	0.60	3.93	8.13	7.4	35.0	0.83	215	\$2.988

Case #3: 10% Assisting Grade		Loaded (-10% grade + 4% rolling = -6% total)					Empty (10% grade + 4% rolling = 14% total)			
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.10	0.34	0.60	0.51	2.55	23.5	35.0	0.83	686	\$0.937
1000	1.10	0.51	0.60	0.96	3.17	18.9	35.0	0.83	552	\$1.164
1500	1.10	0.67	0.60	1.41	3.78	15.9	35.0	0.83	463	\$1.388
2000	1.10	0.83	0.60	1.85	4.38	13.7	35.0	0.83	400	\$1.606
2500	1.10	0.99	0.60	2.30	4.99	12.0	35.0	0.83	351	\$1.831
3000	1.10	1.16	0.60	2.74	5.60	10.7	35.0	0.83	313	\$2.053
3500	1.10	1.32	0.60	3.19	6.21	9.7	35.0	0.83	282	\$2.278
4000	1.10	1.48	0.60	3.63	6.81	8.8	35.0	0.83	257	\$2.500
4500	1.10	1.64	0.60	4.08	7.42	8.1	35.0	0.83	236	\$2.722
5000	1.10	1.81	0.60	4.52	8.03	7.5	35.0	0.83	218	\$2.947
5500	1.10	1.97	0.60	4.97	8.64	6.9	35.0	0.83	203	\$3.165
6000	1.10	2.13	0.60	5.41	9.24	6.5	35.0	0.83	189	\$3.400
6500	1.10	2.30	0.60	5.86	9.86	6.1	35.0	0.83	177	\$3.630
7000	1.10	2.46	0.60	6.30	10.46	5.7	35.0	0.83	167	\$3.847



Appendix B (Continued)  
Calculations for Moving Materials With a Caterpillar 657G Push-Pull Scraper Fleet

Material Movement By Scrapers

Case #4: 5% Resisting Grade		Loaded (5% grade + 4% rolling = 9% total)				Empty (-5% grade + 4% rolling = -1% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.10	0.55	0.60	0.33	2.58	23.3	35.0	0.83	678	\$0.948
1000	1.10	1.01	0.60	0.50	3.21	18.7	35.0	0.83	545	\$1.179
1500	1.10	1.46	0.60	0.66	3.82	15.7	35.0	0.83	458	\$1.403
2000	1.10	1.92	0.60	0.83	4.45	13.5	35.0	0.83	393	\$1.635
2500	1.10	2.38	0.60	0.99	5.07	11.8	35.0	0.83	345	\$1.862
3000	1.10	2.83	0.60	1.15	5.68	10.6	35.0	0.83	308	\$2.086
3500	1.10	3.29	0.60	1.31	6.30	9.5	35.0	0.83	278	\$2.311
4000	1.10	3.75	0.60	1.48	6.93	8.7	35.0	0.83	253	\$2.540
4500	1.10	4.21	0.60	1.64	7.55	7.9	35.0	0.83	232	\$2.769
5000	1.10	4.66	0.60	1.80	8.16	7.4	35.0	0.83	214	\$3.002
5500	1.10	5.12	0.60	1.96	8.78	6.8	35.0	0.83	199	\$3.229
6000	1.10	5.58	0.60	2.13	9.41	6.4	35.0	0.83	186	\$3.454
6500	1.10	6.04	0.60	2.29	10.03	6.0	35.0	0.83	174	\$3.693
7000	1.10	6.49	0.60	2.45	10.64	5.6	35.0	0.83	164	\$3.918

Case #5: 10% Resisting Grade		Loaded (10% grade + 4% rolling = 14% total)				Empty (-10% grade + 4% rolling = -6% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.10	0.75	0.60	0.32	2.77	21.7	35.0	0.83	632	\$1.017
1000	1.10	1.43	0.60	0.49	3.62	16.6	35.0	0.83	483	\$1.330
1500	1.10	2.12	0.60	0.65	4.47	13.4	35.0	0.83	391	\$1.643
2000	1.10	2.81	0.60	0.81	5.32	11.3	35.0	0.83	329	\$1.953
2500	1.10	3.49	0.60	0.98	6.17	9.7	35.0	0.83	284	\$2.262
3000	1.10	4.18	0.60	1.14	7.02	8.5	35.0	0.83	249	\$2.580
3500	1.10	4.87	0.60	1.30	7.87	7.6	35.0	0.83	222	\$2.894
4000	1.10	5.56	0.60	1.46	8.72	6.9	35.0	0.83	201	\$3.197
4500	1.10	6.24	0.60	1.63	9.57	6.3	35.0	0.83	183	\$3.511
5000	1.10	6.93	0.60	1.79	10.42	5.8	35.0	0.83	168	\$3.824
5500	1.10	7.62	0.60	1.95	11.27	5.3	35.0	0.83	155	\$4.145
6000	1.10	8.31	0.60	2.12	12.13	4.9	35.0	0.83	144	\$4.462
6500	1.10	8.99	0.60	2.28	12.97	4.6	35.0	0.83	135	\$4.759
7000	1.10	9.68	0.60	2.44	13.82	4.3	35.0	0.83	127	\$5.060

Appendix C  
Calculations for Moving Materials With a Caterpillar 637G Push-Pull Scraper Fleet

**NOTE: DRILLING AND BLASTING COSTS ARE NOT INCLUDED IN THESE CALCULATIONS. THE LQD DOES NOT CONSIDER DRILLING AND BLASTING COSTS NECESSARY WHEN USING APPENDIX C.**

Material Movement By Scrapers

1) Caterpillar 637E Push-Pull Scraper		
2) Material Density	2,850. LB/BCY	CPH 40
3) Payload	75,000. LB	CPH 40
	25.0 BCY	
4) Maximum Vehicle Speed Loaded	33.0 MPH	CPH 40
5) Operating Efficiency Factor (50 Min./Hr.)	0.83	CPH 40
6) 637G PP Operating Costs	\$326.53 Per Hour	100% E-W
7) Labor Costs	\$45.31 Per Hour	WYDOT-WDD
8) Supervision Labor Costs	\$6.29 Per Hour	1/8 of WYDOT-WDD
9) Supervisor Transportation	\$3.43 Per Hour	1/8 of 100% E-W
10) 1/8 of 1 - 14,000 Gal. Water Trucks + 1 Operator	\$32.43 Per Hour	1/8 of 100% E-W
11) 1/8 of 1 - 16M Blade for Road Work + 1 Operator	\$23.81 Per Hour	1/8 of 100% E-W
12) - D9T for Ripping Ovb. and Misc. Work + 1 Operator	<u>\$126.86</u> Per Hour	- of 100% E-W
13) Total Hourly Costs	\$564.66	

TO USE TABLE: Locate your approximate grade by reference to case number. Determine cost per BCY by using distance column that approximates your distance. No calculations are necessary.

Case #1: Level Ground		Loaded (0% grade + 4% rolling = 4% total)				Empty (0% grade + 4% rolling = 4% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.0	0.42	0.60	0.36	2.38	25.2	25.0	0.83	523	\$1.080
1000	1.0	0.68	0.60	0.57	2.85	21.1	25.0	0.83	438	\$1.289
1500	1.0	0.92	0.60	0.75	3.27	18.4	25.0	0.83	382	\$1.478
2000	1.0	1.15	0.60	0.92	3.67	16.3	25.0	0.83	338	\$1.671
2500	1.0	1.37	0.60	1.09	4.06	14.8	25.0	0.83	307	\$1.839
3000	1.0	1.59	0.60	1.26	4.45	13.5	25.0	0.83	280	\$2.017
3500	1.0	1.81	0.60	1.44	4.85	12.4	25.0	0.83	257	\$2.197
4000	1.0	2.02	0.60	1.61	5.23	11.5	25.0	0.83	239	\$2.363
4500	1.0	2.22	0.60	1.78	5.60	10.7	25.0	0.83	222	\$2.544
5000	1.0	2.43	0.60	1.95	5.98	10.0	25.0	0.83	208	\$2.715
5500	1.0	2.64	0.60	2.13	6.37	9.4	25.0	0.83	195	\$2.896
6000	1.0	2.85	0.60	2.30	6.75	8.9	25.0	0.83	185	\$3.052
6500	1.0	3.05	0.60	2.47	7.12	8.4	25.0	0.83	174	\$3.245
7000	1.0	3.26	0.60	2.64	7.50	8.0	25.0	0.83	166	\$3.402

Appendix C (Continued)  
Calculations for Moving Materials With a Caterpillar 637G Push-Pull Scraper Fleet

Material Movement By Scrapers

Case #2: 5% Assisting Grade										
Loaded (-5% grade + 4% rolling = -1% total)						Empty (5% grade + 4% rolling = 9% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.0	0.36	0.60	0.42	2.38	25.2	25.0	0.83	523	\$1.080
1000	1.0	0.54	0.60	0.71	2.85	21.0	25.0	0.83	436	\$1.295
1500	1.0	0.71	0.60	0.98	3.29	18.2	25.0	0.83	378	\$1.494
2000	1.0	0.87	0.60	1.25	3.72	16.1	25.0	0.83	334	\$1.691
2500	1.0	1.03	0.60	1.51	4.14	14.5	25.0	0.83	301	\$1.876
3000	1.0	1.19	0.60	1.78	4.57	13.1	25.0	0.83	272	\$2.076
3500	1.0	1.36	0.60	2.05	5.01	12.0	25.0	0.83	249	\$2.268
4000	1.0	1.52	0.60	2.32	5.44	11.0	25.0	0.83	228	\$2.477
4500	1.0	1.68	0.60	2.59	5.87	10.2	25.0	0.83	212	\$2.664
5000	1.0	1.85	0.60	2.86	6.31	9.5	25.0	0.83	197	\$2.866
5500	1.0	2.01	0.60	3.12	6.73	8.9	25.0	0.83	185	\$3.052
6000	1.0	2.17	0.60	3.39	7.16	8.4	25.0	0.83	174	\$3.245
6500	1.0	2.33	0.60	3.66	7.59	7.9	25.0	0.83	164	\$3.443
7000	1.0	2.50	0.60	3.93	8.03	7.5	25.0	0.83	156	\$3.620

Case #3: 10% Assisting Grade										
Loaded (-10% grade + 4% rolling = -6% total)						Empty (10% grade + 4% rolling = 14% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.0	0.34	0.60	0.51	2.45	24.5	25.0	0.83	508	\$1.112
1000	1.0	0.51	0.60	0.96	3.07	19.5	25.0	0.83	405	\$1.394
1500	1.0	0.67	0.60	1.41	3.68	16.3	25.0	0.83	338	\$1.671
2000	1.0	0.83	0.60	1.85	4.28	14.0	25.0	0.83	291	\$1.940
2500	1.0	0.99	0.60	2.30	4.89	12.3	25.0	0.83	255	\$2.214
3000	1.0	1.16	0.60	2.74	5.50	10.9	25.0	0.83	226	\$2.499
3500	1.0	1.32	0.60	3.19	6.11	9.8	25.0	0.83	203	\$2.782
4000	1.0	1.48	0.60	3.63	6.71	8.9	25.0	0.83	185	\$3.052
4500	1.0	1.64	0.60	4.08	7.32	8.2	25.0	0.83	170	\$3.322
5000	1.0	1.81	0.60	4.52	7.93	7.6	25.0	0.83	158	\$3.574
5500	1.0	1.97	0.60	4.97	8.54	7.0	25.0	0.83	145	\$3.894
6000	1.0	2.13	0.60	5.41	9.14	6.5	25.0	0.83	135	\$4.183
6500	1.0	2.30	0.60	5.86	9.76	6.2	25.0	0.83	129	\$4.377
7000	1.0	2.46	0.60	6.30	10.36	5.8	25.0	0.83	120	\$4.706

Appendix C (Continued)  
Calculations for Moving Materials With a Caterpillar 637G Push-Pull Scraper Fleet



Material Movement By Scrapers

Case #4: 5% Resisting Grade		Loaded (5% grade + 4% rolling = 9% total)				Empty (-5% grade + 4% rolling = -1% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.0	0.55	0.60	0.33	2.48	24.2	25.0	0.83	502	\$1.125
1000	1.0	1.01	0.60	0.50	3.11	19.3	25.0	0.83	400	\$1.412
1500	1.0	1.46	0.60	0.66	3.72	16.1	25.0	0.83	334	\$1.691
2000	1.0	1.92	0.60	0.83	4.35	13.8	25.0	0.83	286	\$1.974
2500	1.0	2.38	0.60	0.99	4.97	12.1	25.0	0.83	251	\$2.250
3000	1.0	2.83	0.60	1.15	5.58	10.8	25.0	0.83	224	\$2.521
3500	1.0	3.29	0.60	1.31	6.20	9.7	25.0	0.83	201	\$2.809
4000	1.0	3.75	0.60	1.48	6.83	8.8	25.0	0.83	183	\$3.086
4500	1.0	4.21	0.60	1.64	7.45	8.1	25.0	0.83	168	\$3.361
5000	1.0	4.66	0.60	1.80	8.06	7.4	25.0	0.83	154	\$3.667
5500	1.0	5.12	0.60	1.96	8.68	6.9	25.0	0.83	143	\$3.949
6000	1.0	5.58	0.60	2.13	9.31	6.4	25.0	0.83	133	\$4.246
6500	1.0	6.04	0.60	2.29	9.93	6.0	25.0	0.83	125	\$4.517
7000	1.0	6.49	0.60	2.45	10.54	5.7	25.0	0.83	118	\$4.785

Case #5: 10% Resisting Grade		Loaded (10% grade + 4% rolling = 14% total)				Empty (-10% grade + 4% rolling = -6% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.0	0.75	0.60	0.32	2.67	22.5	25.0	0.83	467	\$1.209
1000	1.0	1.43	0.60	0.49	3.52	17.0	25.0	0.83	353	\$1.600
1500	1.0	2.12	0.60	0.65	4.37	13.7	25.0	0.83	284	\$1.988
2000	1.0	2.81	0.60	0.81	5.22	11.5	25.0	0.83	238	\$2.373
2500	1.0	3.49	0.60	0.98	6.07	9.9	25.0	0.83	205	\$2.754
3000	1.0	4.18	0.60	1.14	6.92	8.7	25.0	0.83	181	\$3.120
3500	1.0	4.87	0.60	1.30	7.77	7.7	25.0	0.83	160	\$3.529
4000	1.0	5.56	0.60	1.46	8.62	7.0	25.0	0.83	145	\$3.894
4500	1.0	6.24	0.60	1.63	9.47	6.3	25.0	0.83	131	\$4.310
5000	1.0	6.93	0.60	1.79	10.32	5.8	25.0	0.83	120	\$4.706
5500	1.0	7.62	0.60	1.95	11.17	5.4	25.0	0.83	112	\$5.042
6000	1.0	8.31	0.60	2.12	12.03	4.9	25.0	0.83	102	\$5.536
6500	1.0	8.99	0.60	2.28	12.87	4.7	25.0	0.83	98	\$5.762
7000	1.0	9.68	0.60	2.44	13.72	4.4	25.0	0.83	91	\$6.205

Appendix D  
Calculations for Moving Materials With a 58 CY Electric Cable Shovel and Caterpillar 240T (793F) Trucks

**NOTE: THESE COSTS ARE FOR EXCAVATION ONLY. MATERIAL REQUIRING BLASTING SHOULD HAVE AN ADDITIONAL \$0.259/BCY ADDED FOR DRILLING AND BLASTING COSTS.**

Material Movement By Shovel-Truck Combination

1) 58 CY Shovel	58.0 LCY Heaped	
2) Caterpillar 793F - 240-Ton End Dumps	193.0 LCY/156.8 BCY	
3) Material Density	2,850.0 LB/BCY	CPH 40
4) Operating Efficiency Factor	0.83	CPH 40
5) Rolling Resistance Factor	4.00 %	CPH 40
6) 58 CY Shovel Operating Costs (No Ownership Cost)	\$534.43	IM
7) 793F Lease + Operating Costs	\$486.41	IM
8) Labor Costs	\$45.31 Per Hour	WYDOT-WDD
9) - of 1 - 14,000 Gal. Water Truck + 1 Operator	\$129.73 Per Hour	- of 100% E-W + Operator
10) 1 - 24H Blade + 1 Operator	\$263.04 Per Hour	IM
11) 1 - D9T + 1 Operator	\$253.72 Per Hour	100% E-W + Operator
12) 1 834G Rubber Tired Dozer + 1 Operator	\$320.40 Per Hour	100% E-W + Operator
13) Supervision Labor Costs	\$25.16 Per Hour	- of WYDOT-WDD
14) Supervisor Transportation	\$13.74 Per Hour	- of 100% E-W
15) Total Fleet Hourly Costs (Except Trucks)	\$1,585.53 Per Hour	

**TO USE TABLE:** Locate your approximate grade by reference to case number. Determine cost per BCY by using distance column that approximates your distance. No calculations are necessary.

Case #1: Level Ground			Loaded (0% grade + 4% rolling = 4% total resistance)					Empty (0% grade + 4% = 4% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Shovel Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	1.70	0.60	0.25	1.20	0.2	3.95	15.2	156.8	1985	4184	2.11	\$0.647
1000	1.70	0.60	0.5	1.20	0.35	4.35	13.8	156.8	1802	4184	2.32	\$0.674
1500	1.70	0.60	0.75	1.20	0.6	4.85	12.4	156.8	1620	4184	2.58	\$0.707
2000	1.70	0.60	1.0	1.20	0.7	5.20	11.5	156.8	1502	4184	2.79	\$0.734
2500	1.70	0.60	1.3	1.20	0.8	5.60	10.7	156.8	1398	4184	2.99	\$0.759
3000	1.70	0.60	1.5	1.20	1.0	6.0	10.0	156.8	1306	4184	3.20	\$0.786
3500	1.70	0.60	1.7	1.20	1.2	6.4	9.4	156.8	1228	4184	3.41	\$0.812
4000	1.70	0.60	2.0	1.20	1.4	6.9	8.7	156.8	1136	4184	3.68	\$0.847
4500	1.70	0.60	2.2	1.20	1.5	7.2	8.3	156.8	1084	4184	3.86	\$0.870
5000	1.70	0.60	2.5	1.20	1.7	7.7	7.8	156.8	1019	4184	4.11	\$0.901
5500	1.70	0.60	2.7	1.20	1.9	8.10	7.4	156.8	967	4184	4.33	\$0.929
6000	1.70	0.60	3.0	1.20	2.1	8.60	7.0	156.8	914	4184	4.58	\$0.961
6500	1.70	0.60	3.2	1.20	2.3	9.0	6.7	156.8	875	4184	4.78	\$0.986
7000	1.70	0.60	3.5	1.20	2.5	9.5	6.3	156.8	823	4184	5.08	\$1.025

Operating Costs = (((# Trucks x (Truck costs + Labor costs)) + Total Fleet costs)/Shovel Productivity)

Appendix D (Continued)  
Calculations for Moving Materials With a 58 CY Electric Cable Shovel and Caterpillar 240T (793F) Trucks

Material Movement By Shovel-Truck Combination

Case #2: 5% Resisting Grade			Loaded (5% grade + 4% rolling = 9% total resistance)					Empty (-5% grade + 4% rolling = -1% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Shovel Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	1.70	0.60	0.5	1.20	0.2	4.2	14.3	156.8	1866	4184	2.24	\$0.664
1000	1.70	0.60	1.2	1.20	0.3	5.0	12.0	156.8	1567	4184	2.67	\$0.718
1500	1.70	0.60	1.8	1.20	0.5	5.8	10.3	156.8	1351	4184	3.10	\$0.773
2000	1.70	0.60	2.2	1.20	0.6	6.3	9.52	156.8	1244	4184	3.36	\$0.806
2500	1.70	0.60	2.7	1.20	0.8	7.0	8.57	156.8	1120	4184	3.74	\$0.854
3000	1.70	0.60	3.3	1.20	1.0	7.8	7.69	156.8	1005	4184	4.16	\$0.908
3500	1.70	0.60	3.8	1.20	1.1	8.4	7.14	156.8	933	4184	4.48	\$0.948
4000	1.70	0.60	4.4	1.20	1.2	9.1	6.59	156.8	861	4184	4.86	\$0.997
4500	1.70	0.60	5.0	1.20	1.3	9.8	6.12	156.8	800	4184	5.23	\$1.044
5000	1.70	0.60	5.6	1.20	1.5	10.6	5.66	156.8	739	4184	5.66	\$1.098
5500	1.70	0.60	6.1	1.20	1.7	11.3	5.31	156.8	694	4184	6.03	\$1.145
6000	1.70	0.60	6.9	1.20	1.9	12.3	4.88	156.8	637	4184	6.57	\$1.214
6500	1.70	0.60	7.3	1.20	2.0	12.8	4.69	156.8	612	4184	6.84	\$1.248
7000	1.70	0.60	7.8	1.20	2.2	13.5	4.44	156.8	581	4184	7.20	\$1.294

Case #3: 5% Assisting Grade			Loaded (-5% grade + 4% rolling = -1% total resistance)					Empty (5% grade + 4% = 9% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Shovel Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	1.70	0.60	0.3	1.20	0.4	4.2	14.29	156.8	1866	4184	2.24	\$0.664
1000	1.70	0.60	0.4	1.20	0.5	4.4	13.64	156.8	1781	4184	2.35	\$0.678
1500	1.70	0.60	0.5	1.20	0.7	4.7	12.77	156.8	1667	4184	2.51	\$0.700
2000	1.70	0.60	0.7	1.20	0.9	5.1	11.76	156.8	1537	4184	2.72	\$0.725
2500	1.70	0.60	0.9	1.20	1.2	5.6	10.71	156.8	1399	4184	2.99	\$0.759
3000	1.70	0.60	1.0	1.20	1.4	5.9	10.17	156.8	1328	4184	3.15	\$0.779
3500	1.70	0.60	1.1	1.20	1.6	6.2	9.68	156.8	1264	4184	3.31	\$0.800
4000	1.70	0.60	1.2	1.20	1.8	6.5	9.23	156.8	1206	4184	3.47	\$0.820
4500	1.70	0.60	1.4	1.20	2.1	7.0	8.57	156.8	1120	4184	3.74	\$0.854
5000	1.70	0.60	1.6	1.20	2.3	7.4	8.11	156.8	1059	4184	3.95	\$0.881
5500	1.70	0.60	1.8	1.20	2.6	7.9	7.59	156.8	992	4184	4.22	\$0.915
6000	1.70	0.60	1.9	1.20	2.8	8.2	7.32	156.8	956	4184	4.38	\$0.936
6500	1.70	0.60	2.1	1.20	2.9	8.5	7.06	156.8	922	4184	4.54	\$0.956
7000	1.70	0.60	2.3	1.20	3.1	8.9	6.74	156.8	881	4184	4.75	\$0.983



Appendix D1  
Calculations for Moving Materials With an 80 CY Electric Cable Shovel and Caterpillar 380T (797F) Trucks

NOTE: THESE COSTS ARE FOR EXCAVATION ONLY. MATERIAL REQUIRING BLASTING SHOULD HAVE AN ADDITIONAL \$0.259/BCY ADDED FOR DRILLING AND BLASTING COSTS.

Material Movement By Shovel-Truck Combination

1) 80 CY Shovel	80.0 LCY Heaped	
2) Caterpillar 797F - 360-Ton End Dumps	316.3 LCY/275.8 BCY	
3) Material Density	2,850.0 LB/BCY	CPH 40
4) Operating Efficiency Factor	0.83	CPH 40
5) Rolling Resistance Factor	4.00 %	CPH 40
6) 80 CY Shovel Operating Costs (No Ownership Cost)	\$534.87	IM
7) 797F Lease + Operating Costs	\$833.08	IM
8) Labor Costs	\$45.31 Per Hour	WYDOT-WDD
9) - of 1 - 14,000 Gal. Water Truck + 1 Operator	\$129.73 Per Hour	- of 100% E-W + Operator
10) 1 - 24H Blade + 1 Operator	\$263.04 Per Hour	IM
11) 1 - D9T + 1 Operator	\$253.72 Per Hour	100% E-W + Operator
12) 1 834G Rubber Tired Dozer + 1 Operator	\$320.40 Per Hour	100% E-W + Operator
13) Supervision Labor Costs	\$25.16 Per Hour	- of WYDOT-WDD
14) Supervisor Transportation	\$13.74 Per Hour	- of 100% E-W
15) Total Fleet Hourly Costs (Except Trucks)	\$1,585.97 Per Hour	

TO USE TABLE: Locate your approximate grade by reference to case number. Determine cost per BCY by using distance column that approximates your distance. No calculations are necessary.

Case #1: Level Ground			Loaded (0% grade + 4% rolling = 4% total resistance)					Empty (0% grade + 4% = 4% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Shovel Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	2.00	0.60	0.4	1.20	0.2	4.4	13.64	275.8	3133	5865	1.87	\$0.551
1000	2.00	0.60	0.5	1.20	0.3	4.7	12.77	275.8	2933	5865	2.00	\$0.570
1500	2.00	0.60	0.8	1.20	0.5	5.1	11.76	275.8	2703	5865	2.17	\$0.596
2000	2.00	0.60	1.1	1.20	0.6	5.5	10.9	275.8	2506	5865	2.34	\$0.621
2500	2.00	0.60	1.4	1.20	0.7	5.9	10.17	275.8	2336	5865	2.51	\$0.647
3000	2.00	0.60	1.6	1.20	0.8	6.2	9.68	275.8	2223	5865	2.64	\$0.666
3500	2.00	0.60	1.8	1.20	1.0	6.6	9.09	275.8	2089	5865	2.81	\$0.692
4000	2.00	0.60	2.1	1.20	1.2	7.1	8.45	275.8	1941	5865	3.02	\$0.723
4500	2.00	0.60	2.4	1.20	1.3	7.5	8.0	275.8	1838	5865	3.19	\$0.749
5000	2.00	0.60	2.6	1.20	1.4	7.8	7.69	275.8	1767	5865	3.32	\$0.768
5500	2.00	0.60	2.8	1.20	1.5	8.1	7.41	275.8	1702	5865	3.45	\$0.788
6000	2.00	0.60	3.2	1.20	1.7	8.9	6.9	275.8	1584	5865	3.70	\$0.825
6500	2.00	0.60	3.4	1.20	1.9	9.1	6.59	275.8	1515	5865	3.87	\$0.851
7000	2.00	0.60	3.8	1.20	2.0	9.6	6.25	275.8	1436	5865	4.08	\$0.882

Operating Costs = (((# Trucks x (Truck costs + Labor costs)) + Total Fleet costs)/Shovel Productivity)

Appendix D1 (Continued)  
Calculations for Moving Materials With an 80 CY Electric Cable Shovel and Caterpillar 360T (797F) Trucks

Material Movement By Shovel-Truck Combination

Case #2: 5% Resisting Grade			Loaded (5% grade + 4% rolling = 9% total resistance)					Empty (-5% grade + 4% rolling = -1% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Shovel Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	2.00	0.60	0.5	1.20	0.2	4.5	13.33	275.8	3063	5865	1.91	\$0.557
1000	2.00	0.60	1.0	1.20	0.3	5.1	11.76	275.8	2703	5865	2.17	\$0.596
1500	2.00	0.60	1.5	1.20	0.4	5.7	10.53	275.8	2418	5865	2.43	\$0.635
2000	2.00	0.60	2.2	1.20	0.5	6.5	9.23	275.8	2121	5865	2.77	\$0.686
2500	2.00	0.60	3.0	1.20	0.6	7.4	8.11	275.8	1863	5865	3.15	\$0.743
3000	2.00	0.60	3.3	1.20	0.8	7.9	7.59	275.8	1745	5865	3.36	\$0.774
3500	2.00	0.60	4.0	1.20	0.9	8.7	6.90	275.8	1584	5865	3.70	\$0.825
4000	2.00	0.60	4.5	1.20	1.1	9.4	6.38	275.8	1466	5865	4.00	\$0.870
4500	2.00	0.60	5.0	1.20	1.3	10.1	5.94	275.8	1365	5865	4.30	\$0.915
5000	2.00	0.60	5.5	1.20	1.4	10.7	5.61	275.8	1288	5865	4.55	\$0.952
5500	2.00	0.60	6.2	1.20	1.6	11.6	5.17	275.8	1188	5865	4.94	\$1.011
6000	2.00	0.60	6.8	1.20	1.7	12.3	4.88	275.8	1121	5865	5.23	\$1.054
6500	2.00	0.60	7.2	1.20	1.8	12.8	4.69	275.8	1077	5865	5.45	\$1.087
7000	2.00	0.60	7.8	1.20	2.0	13.6	4.41	275.8	1014	5865	5.79	\$1.138

Case #3: 5% Assisting Grade			Loaded (-5% grade + 4% rolling = -1% total resistance)					Empty (5% grade + 4% = 9% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Shovel Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	2.00	0.60	0.2	1.20	0.3	4.3	13.95	275.8	3206	5865	1.83	\$0.545
1000	2.00	0.60	0.3	1.20	0.5	4.6	13.04	275.8	2997	5865	1.96	\$0.564
1500	2.00	0.60	0.4	1.20	0.8	5.0	12.00	275.8	2757	5865	2.13	\$0.590
2000	2.00	0.60	0.6	1.20	1.0	5.4	11.11	275.8	2553	5865	2.30	\$0.615
2500	2.00	0.60	0.7	1.20	1.2	5.7	10.53	275.8	2418	5865	2.43	\$0.635
3000	2.00	0.60	0.9	1.20	1.4	6.1	9.84	275.8	2260	5865	2.60	\$0.660
3500	2.00	0.60	1.0	1.20	1.7	6.5	9.23	275.8	2121	5865	2.77	\$0.686
4000	2.00	0.60	1.1	1.20	1.9	6.8	8.82	275.8	2027	5865	2.89	\$0.704
4500	2.00	0.60	1.3	1.20	2.2	7.3	8.22	275.8	1888	5865	3.11	\$0.737
5000	2.00	0.60	1.4	1.20	2.5	7.7	7.79	275.8	1790	5865	3.28	\$0.762
5500	2.00	0.60	1.6	1.20	2.6	8.0	7.50	275.8	1723	5865	3.40	\$0.780
6000	2.00	0.60	1.7	1.20	2.8	8.3	7.23	275.8	1661	5865	3.53	\$0.800
6500	2.00	0.60	1.8	1.20	3.0	8.6	6.98	275.8	1603	5865	3.66	\$0.819
7000	2.00	0.60	2.0	1.20	3.2	9.0	6.67	275.8	1532	5865	3.83	\$0.845

Appendix E

Calculations for Moving Material With a Caterpillar D9T Dozer

These costs are for dozing only. Material requiring drilling and blasting should have an additional \$0.259/BCY added for D&B. If cast blasting will be used the D&B cost should be \$0.400/BCY.

Material Movement By Dozing

1) Caterpillar D9T Dozer With U Blade		
2) Operating Costs	\$208.41 Per Hour	100% of E-W
3) Labor Costs	\$45.31 Per Hour	WYDOT-WDD
4) Supervisor Labor Costs	\$6.29 Per Hour	1/8 of WYDOT-WDD
5) Supervisor Transportation	<u>\$3.43 Per Hour</u>	1/8 of 100% E-W
6) Total Hourly Costs	\$263.44 Per Hour	

TO USE TABLE: Locate your approximate grade by referencing "Grade" column. Determine cost per LCY by using the distance that best approximates your distance.

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors <sup>1</sup>				Grade (0%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	2200	1.0	1.0	0.90	0.83	1.00	1649	\$0.160
100	1300	1.0	1.0	0.90	0.83	1.00	975	\$0.270
150	1000	1.0	1.0	0.90	0.83	1.00	750	\$0.351
200	750	1.0	1.0	0.90	0.83	1.00	562	\$0.469
250	570	1.0	1.0	0.90	0.83	1.00	427	\$0.617
300	480	1.0	1.0	0.90	0.83	1.00	360	\$0.732
350	390	1.0	1.0	0.90	0.83	1.00	292	\$0.902
400	330	1.0	1.0	0.90	0.83	1.00	247	\$1.067
450	290	1.0	1.0	0.90	0.83	1.00	217	\$1.214
500	250	1.0	1.0	0.90	0.83	1.00	187	\$1.409

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors <sup>1</sup>				Grade (-10%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	2200	1.0	1.0	0.90	0.83	1.20	1979	\$0.133
100	1300	1.0	1.0	0.90	0.83	1.20	1170	\$0.225
150	1000	1.0	1.0	0.90	0.83	1.20	900	\$0.293
200	750	1.0	1.0	0.90	0.83	1.20	675	\$0.390
250	570	1.0	1.0	0.90	0.83	1.20	513	\$0.514
300	480	1.0	1.0	0.90	0.83	1.20	432	\$0.610
350	390	1.0	1.0	0.90	0.83	1.20	351	\$0.751
400	330	1.0	1.0	0.90	0.83	1.20	297	\$0.887
450	290	1.0	1.0	0.90	0.83	1.20	261	\$1.009
500	250	1.0	1.0	0.90	0.83	1.20	225	\$1.171

<sup>1</sup> Job Correction Factors:

Operator	Excellent	= 1.00
Material	Good	= 1.00
Visibility	Fair	= 0.90
Efficiency	50 min/hr	= 0.83



Appendix E (Continued)  
Calculations for Moving Material With a Caterpillar D9T Dozer

These costs are for dozing only. Material requiring drilling and blasting should have an additional \$0.259BCY added for D&B. If cast blasting will be used the D&B cost should be \$0.400/BCY.

Material Movement By Dozing

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors <sup>1</sup>				Grade (-20%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	2200	1.0	1.0	0.90	0.83	1.40	2309	\$0.114
100	1300	1.0	1.0	0.90	0.83	1.40	1365	\$0.193
150	1000	1.0	1.0	0.90	0.83	1.40	1050	\$0.251
200	750	1.0	1.0	0.90	0.83	1.40	787	\$0.335
250	570	1.0	1.0	0.90	0.83	1.40	599	\$0.440
300	480	1.0	1.0	0.90	0.83	1.40	504	\$0.523
350	390	1.0	1.0	0.90	0.83	1.40	409	\$0.644
400	330	1.0	1.0	0.90	0.83	1.40	346	\$0.761
450	290	1.0	1.0	0.90	0.83	1.40	304	\$0.867
500	250	1.0	1.0	0.90	0.83	1.40	262	\$1.006

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors <sup>1</sup>				Grade (10%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	2200	1.0	1.0	0.90	0.83	0.75	1237	\$0.213
100	1300	1.0	1.0	0.90	0.83	0.75	731	\$0.360
150	1000	1.0	1.0	0.90	0.83	0.75	562	\$0.469
200	750	1.0	1.0	0.90	0.83	0.75	422	\$0.624
250	570	1.0	1.0	0.90	0.83	0.75	321	\$0.821
300	480	1.0	1.0	0.90	0.83	0.75	270	\$0.976
350	390	1.0	1.0	0.90	0.83	0.75	219	\$1.203
400	330	1.0	1.0	0.90	0.83	0.75	186	\$1.416
450	290	1.0	1.0	0.90	0.83	0.75	163	\$1.616
500	250	1.0	1.0	0.90	0.83	0.75	141	\$1.868

<sup>1</sup> Job Correction Factors:

Operator	Excellent	= 1.00
Material	Good	= 1.00
Visibility	Fair	= 0.90
Efficiency	50 min/hr	= 0.83

Appendix F

Calculations For Moving Material With a Caterpillar D11R Dozer

These costs are for dozing only. Material requiring drilling and blasting should have an additional \$0.259BCY added for D&B. If cast blasting will be used the D&B cost should be \$0.400/BCY.

Material Movement By Dozing With D11R

1) Caterpillar D11R Dozer With U Blade		
2) Operating Costs	\$394.11 Per Hour	100% E-W
3) Labor Costs	\$45.31 Per Hour	WYDOT-WDD
4) Supervisor Labor Costs	\$6.29 Per Hour	1/8 of WYDOT-WDD
5) Supervisor Transportation	<u>\$3.43 Per Hour</u>	1/8 of 100% E-W
6) Total Hourly Costs	\$449.14 Per Hour	

TO USE TABLE: Locate your approximate grade by referencing "Grade" column. Determine cost per LCY by using the distance that best approximates your distance.

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors <sup>1</sup>				Grade (0%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	4500	1.0	1.0	0.90	0.83	1.00	3374	\$0.133
100	3000	1.0	1.0	0.90	0.83	1.00	2249	\$0.200
150	2000	1.0	1.0	0.90	0.83	1.00	1499	\$0.300
200	1550	1.0	1.0	0.90	0.83	1.00	1162	\$0.387
250	1250	1.0	1.0	0.90	0.83	1.00	937	\$0.480
300	1080	1.0	1.0	0.90	0.83	1.00	810	\$0.555
350	900	1.0	1.0	0.90	0.83	1.00	675	\$0.665
400	800	1.0	1.0	0.90	0.83	1.00	600	\$0.749
450	720	1.0	1.0	0.90	0.83	1.00	540	\$0.832
500	650	1.0	1.0	0.90	0.83	1.00	487	\$0.922

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors <sup>1</sup>				Grade (-10%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	4500	1.0	1.0	0.90	0.83	1.20	4048	\$0.111
100	3000	1.0	1.0	0.90	0.83	1.20	2699	\$0.166
150	2000	1.0	1.0	0.90	0.83	1.20	1799	\$0.250
200	1550	1.0	1.0	0.90	0.83	1.20	1394	\$0.322
250	1250	1.0	1.0	0.90	0.83	1.20	1125	\$0.399
300	1080	1.0	1.0	0.90	0.83	1.20	972	\$0.462
350	900	1.0	1.0	0.90	0.83	1.20	810	\$0.555
400	800	1.0	1.0	0.90	0.83	1.20	720	\$0.624
450	720	1.0	1.0	0.90	0.83	1.20	648	\$0.693
500	650	1.0	1.0	0.90	0.83	1.20	585	\$0.768

<sup>1</sup> Job Correction Factors:

Operator	Excellent	= 1.00
Material	Good	= 1.00
Visibility	Fair	= 0.90
Efficiency	50 min/hr	= 0.83

Appendix F (Continued)  
Calculations For Moving Material With a Caterpillar D11R Dozer

These costs are for dozing only. Material requiring drilling and blasting should have an additional \$0.259/BCY added for D&B. If cast blasting will be used the D&B cost should be \$0.400/BCY.

Material Movement By Dozing With D11R

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors <sup>1</sup>				Grade (-20%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	4500	1.0	1.0	0.90	0.83	1.40	4723	\$0.095
100	3000	1.0	1.0	0.90	0.83	1.40	3149	\$0.143
150	2000	1.0	1.0	0.90	0.83	1.40	2099	\$0.214
200	1550	1.0	1.0	0.90	0.83	1.40	1627	\$0.276
250	1250	1.0	1.0	0.90	0.83	1.40	1312	\$0.342
300	1080	1.0	1.0	0.90	0.83	1.40	1134	\$0.396
350	900	1.0	1.0	0.90	0.83	1.40	945	\$0.475
400	800	1.0	1.0	0.90	0.83	1.40	840	\$0.535
450	720	1.0	1.0	0.90	0.83	1.40	756	\$0.594
500	650	1.0	1.0	0.90	0.83	1.40	682	\$0.659

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors <sup>1</sup>				Grade (10%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	4500	1.0	1.0	0.90	0.83	0.75	2530	\$0.178
100	3000	1.0	1.0	0.90	0.83	0.75	1687	\$0.266
150	2000	1.0	1.0	0.90	0.83	0.75	1125	\$0.399
200	1550	1.0	1.0	0.90	0.83	0.75	872	\$0.515
250	1250	1.0	1.0	0.90	0.83	0.75	703	\$0.639
300	1080	1.0	1.0	0.90	0.83	0.75	607	\$0.740
350	900	1.0	1.0	0.90	0.83	0.75	506	\$0.888
400	800	1.0	1.0	0.90	0.83	0.75	450	\$0.998
450	720	1.0	1.0	0.90	0.83	0.75	405	\$1.109
500	650	1.0	1.0	0.90	0.83	0.75	365	\$1.231

<sup>1</sup> Job Correction Factors:

Operator	Excellent	= 1.00
Material	Good	= 1.00
Visibility	Fair	= 0.90
Efficiency	50 min/hr	= 0.83



Appendix F1

Calculations For Moving Material With a Caterpillar D11R Carry Dozer

These costs are for dozing only. Material requiring drilling and blasting should have an additional \$0.259/BCY added for D&B. If cast blasting will be used the D&B cost should be \$0.400/BCY.

Material Movement By Dozing With D11R

1) Caterpillar D11R Carry Dozer		
2) Operating Costs	\$368.43 Per Hour	100% E-W
3) Labor Costs	\$45.31 Per Hour	WYDOT-WDD
4) Supervisor Labor Costs	\$6.29 Per Hour	1/8 of WYDOT-WDD
5) Supervisor Transportation	<u>\$3.43 Per Hour</u>	1/8 of 100% E-W
6) Total Hourly Costs	\$423.46 Per Hour	

TO USE TABLE: Locate your approximate grade by referencing "Grade" column. Determine cost per LCY by using the distance that best approximates your distance.

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors <sup>1</sup>				Grade (0%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	4300	1.0	1.0	0.90	0.83	1.00	3224	\$0.131
100	3000	1.0	1.0	0.90	0.83	1.00	2249	\$0.188
150	2200	1.0	1.0	0.90	0.83	1.00	1649	\$0.257
200	1700	1.0	1.0	0.90	0.83	1.00	1274	\$0.332
250	1350	1.0	1.0	0.90	0.83	1.00	1012	\$0.418
300	1180	1.0	1.0	0.90	0.83	1.00	885	\$0.479
350	1000	1.0	1.0	0.90	0.83	1.00	750	\$0.565
400	900	1.0	1.0	0.90	0.83	1.00	675	\$0.627
450	800	1.0	1.0	0.90	0.83	1.00	600	\$0.706
500	750	1.0	1.0	0.90	0.83	1.00	562	\$0.754

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors <sup>1</sup>				Grade (-10%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	4300	1.0	1.0	0.90	0.83	1.20	3868	\$0.110
100	3000	1.0	1.0	0.90	0.83	1.20	2699	\$0.157
150	2200	1.0	1.0	0.90	0.83	1.20	1979	\$0.214
200	1700	1.0	1.0	0.90	0.83	1.20	1529	\$0.277
250	1350	1.0	1.0	0.90	0.83	1.20	1215	\$0.349
300	1180	1.0	1.0	0.90	0.83	1.20	1062	\$0.399
350	1000	1.0	1.0	0.90	0.83	1.20	900	\$0.471
400	900	1.0	1.0	0.90	0.83	1.20	809	\$0.523
450	800	1.0	1.0	0.90	0.83	1.20	720	\$0.588
500	750	1.0	1.0	0.90	0.83	1.20	675	\$0.627

<sup>1</sup> Job Correction Factors:

Operator	Excellent	= 1.00
Material	Good	= 1.00
Visibility	Fair	= 0.90
Efficiency	50 min/hr	= 0.83

Appendix F1 (Continued)

Calculations For Moving Material With a Caterpillar D11R Carry Dozer

These costs are for dozing only. Material requiring drilling and blasting should have an additional \$0.259/BCY added for D&B. If cast blasting will be used the D&B cost should be \$0.400/BCY.

Material Movement By Dozing With D11R

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors <sup>1</sup>				Grade (-20%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	4300	1.0	1.0	0.90	0.83	1.40	4513	\$0.094
100	3000	1.0	1.0	0.90	0.83	1.40	3149	\$0.135
150	2200	1.0	1.0	0.90	0.83	1.40	2309	\$0.183
200	1700	1.0	1.0	0.90	0.83	1.40	1784	\$0.237
250	1350	1.0	1.0	0.90	0.83	1.40	1417	\$0.299
300	1180	1.0	1.0	0.90	0.83	1.40	1239	\$0.342
350	1000	1.0	1.0	0.90	0.83	1.40	1050	\$0.403
400	900	1.0	1.0	0.90	0.83	1.40	945	\$0.448
450	800	1.0	1.0	0.90	0.83	1.40	840	\$0.504
500	750	1.0	1.0	0.90	0.83	1.40	787	\$0.538

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors <sup>1</sup>				Grade (10%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	4300	1.0	1.0	0.90	0.83	0.75	2418	\$0.175
100	3000	1.0	1.0	0.90	0.83	0.75	1687	\$0.251
150	2200	1.0	1.0	0.90	0.83	0.75	1237	\$0.342
200	1700	1.0	1.0	0.90	0.83	0.75	956	\$0.443
250	1350	1.0	1.0	0.90	0.83	0.75	759	\$0.558
300	1180	1.0	1.0	0.90	0.83	0.75	663	\$0.639
350	1000	1.0	1.0	0.90	0.83	0.75	562	\$0.754
400	900	1.0	1.0	0.90	0.83	0.75	506	\$0.837
450	800	1.0	1.0	0.90	0.83	0.75	450	\$0.941
500	750	1.0	1.0	0.90	0.83	0.75	422	\$1.004

<sup>1</sup> Job Correction Factors:

Operator	Excellent	= 1.00
Material	Good	= 1.00
Visibility	Fair	= 0.90
Efficiency	50 min/hr	= 0.83

Appendix G  
Calculations for Final Grading With a Caterpillar 16M Motor Grader

Final Grading

INPUT, UNIT AS INDICATED		COMMENT/ SOURCE
Caterpillar 16M Motor Grader		
Speed in Miles Per Hour (Second Gear)	3.3 Miles/Hour	CPH 40
Width of Grading Per Pass	8 Feet	CPH 40
Feet Per Mile	5,280 Feet	
Square Feet Per Acre	43,560 Sq. Ft.	
Operating Efficiency Factor 50 Min./Hr.	0.83	CPH 40
Operating Costs	\$145.14 Per Hour	100% of E-W
Labor Costs	\$45.31 Per Hour	WYDOT-WDD
Supervision Labor Costs	\$6.29 Per Hour	1/8 of WYDOT-WDD
Supervisor Transportation	\$3.43 Per Hour	1/8 of 100% of E-W
Total Hourly Costs	\$200.17	
Grading Rate		
$(3.3 \text{ Miles/Hour}) \times (5,280 \text{ Ft./Mile}) \times (8 \text{ Ft./Pass})$	139,392 Ft <sup>2</sup> /Hour	
$(139,392 \text{ Ft}^2/\text{Hour}) / (43,560 \text{ Ft}^2/\text{Acre})$	3.2 Acres/Hour	
$(3.2 \text{ Acres/Hour}) \times (0.83 \text{ Efficiency Factor})$	2.66 Acres/Hour	
Operating Costs		
$(\$200.17/\text{Hour}) / (2.66 \text{ Acres/Hour})$	\$75.25 Per Acre	



Appendix H  
Cost Estimates for Handling Wire Fencing and Electrical Power Lines

FENCING		SOURCES
Construction 4-Strand Barbed	Overall Average - \$1.99/LF	Wyoming Highway Department Weighted Average Bid Prices, 2011
Removal	Overall Average - \$0.32/LF	Wyoming Highway Department, Average Bid Prices, 2011
	Power Line Removal	
Distribution Lines:	No Charge	From: Tri-County Electric
Transmission Lines:	No Charge	From: Tri-County Electric

Note: Cost estimates for power line removal are based on phone contact with Tri-County Electric. Distribution lines are owned by Tri-County Electric and would be removed upon request at no charge by Tri-County Electric. Transmission lines (lines which go from the main metering point to various electrical substations and are not owned by Tri-County Electric) would be removed by Tri-County Electric at no cost for their salvage value.

Appendix I  
Cost Estimate for Ripping Asphalt Using a Caterpillar D9T Dozer

Asphalt Ripping (3"-4" Mat)

	INPUT, UNIT AS INDICATED	COMMENT/ SOURCE
Caterpillar D9T Dozer With 3 Shank Ripper		
Speed in Miles Per Hour	1 Mile/Hour	CPH 40
Width of Ripping Pass	3 Feet	CPH 40
Feet Per Mile	5,280 Feet	
Square Feet Per Acre	43,560 Sq. Ft.	
Operating Efficiency Factor 50 Min./Hr.	0.83	CPH 40
Operating Costs	\$208.41 Per Hour	100% of E-W
Labor Costs	\$45.31 Per Hour	WYDOT-WDD
Supervision Labor Costs	\$6.29 Per Hour	1/8 of WYDOT-WDD
Supervisor Transportation	\$3.43 Per Hour	1/8 of 100% of E-W
Total Hourly Costs	\$263.44	
Ripper Productivity		
(1.0 Mile/Hour)x(5,280 Ft./Mile)x(3 Ft./Pass)	15,840 Ft <sup>2</sup> /Hour	
(15,840 Ft <sup>2</sup> /Hour)/(43,560 Ft <sup>2</sup> /Acre)	0.36 Acres/Hour	
(0.36 Acres/Hour)x(0.83 Efficiency Factor)	0.299 Acres/Hour	
Operating Costs		
(\$263.44/Hour)/(0.299 Acres/Hour)	\$881.07 Per Acre	

Appendix I1  
Cost Estimate for Ripping Overburden Using a Caterpillar D10T Dozer

Overburden Ripping

INPUT, UNIT AS INDICATED		COMMENT/ SOURCE
Caterpillar D10T Dozer With Single Shank Ripper		
Speed in Miles Per Hour	1 Mile/Hour	CPH 40
Width of Ripping Pass	3 Feet	CPH 40
Feet Per Mile	5,280 Feet	
Square Feet Per Acre	43,560 Sq. Ft.	
Operating Efficiency Factor 50 Min./Hr. (adjusted) <sup>1</sup>	0.75	CPH 40
Rip Depth	2 Feet	CPH 40
Operating Costs	\$271.57 Per Hour	100% of E-W
Labor Costs	\$45.31 Per Hour	WYDOT-WDD
Supervision Labor Costs	\$6.29 Per Hour	1/8 of WYDOT-WDD
Supervisor Transportation	\$3.43 Per Hour	1/8 of 100% of E-W
Total Hourly Costs	\$326.60	
Ripper Productivity		
(1.0 Mile/Hour)x(5,280 Ft./Mile)x(3 Ft./Pass)	15,840 Ft <sup>2</sup> /Hour	
(15,840 Ft <sup>2</sup> /Hour)/(43,560 Ft <sup>2</sup> /Acre)	0.36 Acre/Hour	
(0.36 Acre/Hour)x(0.75 Efficiency Factor)	0.27 Acre/Hour	
Operating Costs		
(\$326.60/Hour)/(0.27 Acre/Hour)	\$1,209.63 Per Acre	

Note: A 75 percent Efficiency Factor was used to account for slowing, raising ripper, maneuvering and turn time.



Appendix J  
Cost Estimate for Culvert Removal

Culvert Removal

		INPUT, UNIT AS INDICATED	COMMENT/ SOURCE
Average Length of CMP Section		20 Feet	
Assumed Culvert Diameter		48 Inches	
Time to Cut One Band		10 Minutes	
Time to Load One 20' Section (2 People)		20 Minutes	
Average Haul, Dump and Return Time		30 Minutes	
Number of Sections of CMP Per Load		2	
Operating Efficiency Factor 50 Min./Hr.		0.83	
Labor		\$45.31 Per Hour	WYDOT-WDD
Dump Truck (10-12 yd <sup>3</sup> )		\$77.78 Per Hour	100% of E-W
Caterpillar 980G Front-End Loader		\$115.78 Per Hour	100% of E-W
Cost to Remove One 20' Section of CMP			
Labor Cost x Time to Cut One Band		\$7.55	
+ ((Labor Cost x 2) + FEL Cost) x Time to Load 1 Section		\$68.73	
+ (Labor Cost + Truck Cost) x Haul Time		\$61.55	
Cost to Remove One 20' Section of CMP (not including dirt removal)		\$137.83	

Note: Culverts may be smashed and buried in place when feasible.

Appendix K  
Cost Estimates for Demolition and Removal of Railroad Spurs and Facilities Buildings

<b>TASK</b>	<b>COST PER UNIT (\$)</b>	<b>REGIONAL COST ADJUSTMENT<sup>1</sup></b>	<b>ADJUSTED COST PER UNIT (\$)</b>
Track Removal	8.76/lin. ft.	95.8%	8.39/lin. ft.
Ballast Removal	4.33/cy	95.8%	4.15/cy
Building Demolition and Disposal <sup>1, 2, 3</sup>			
Mixture of Types	0.29/ft <sup>3</sup>	95.8%	0.278/ft <sup>3</sup>
Explosive Demolition, Concrete or Steel	0.29/ft <sup>3</sup>	95.8%	0.278/ft <sup>3</sup>
Disposal (Average)	9.92/cy	95.8%	9.50/cy
City Landfill Dump Charges	\$82.00/ton	95.8%	\$78.56/ton
Concrete Footings and Foundations			
6" Thick With Rebar	5.54sq. ft.	95.8%	5.31/sq. ft.
Footings - 2' Thick, 3' Wide	20.65/lin. ft.	95.8%	19.78/lin. ft.
Concrete Disposal On-Site	8.61/cy	95.8%	8.25/cy

Note: Operators may also provide a verifiable cost estimate from a qualified contractor for these demolition tasks. This estimate may be used for one to three consecutive years, assuming few substantial changes in mine facilities.

<sup>1</sup> Costs From: 2013 Means Heavy Construction Cost Data & Building Construction Cost Data

<sup>2</sup> Based on Total Volume of Building, does not include disposal cost

<sup>3</sup> Based on Concrete Structures Volume Only, does not include disposal cost



**Appendix L**  
**Abandonment of Drill Holes and Wells**

<b>Drill Hole Abandonment Costs<sup>2, 3</sup></b>	<b>Cost</b>	<b>Unit</b>
Shallow dry holes ( $\leq 50$ feet deep)	\$10.00	Hole
Shallow wet holes ( $\leq 50$ feet deep)	\$50.00	Hole
Delineation holes (w/in 500' of the pit highwall)	\$50.00	Hole
Dry Exploration holes	\$2.00	Ft.
Wet Exploration holes ( $\leq 25$ holes)	\$4.00	Ft.
Wet Exploration holes ( $> 25$ holes)	\$3.00	Ft.
Artesian or Gassy Holes	\$10.00	Ft.
<b>Well Abandonment Costs</b>		
Monitor, production, and injection wells w/in an active ISR facility	\$2.50	Ft.
Scattered wells ( $\leq 25$ wells)	\$4.00	Ft.
Scattered wells ( $> 25$ wells)	\$3.00	Ft.
Artesian or Gassy Wells	\$10.00	Ft.
<b>Incidental Costs</b>		
Small site grading and seeding ( $\leq 1,000$ ft <sup>2</sup> )	\$50.00	Site
Large site / access road grading and seeding <sup>4</sup>	\$3,000.00	Ac.
Capping using a pre-cast concrete cap	\$10.00	Each
Location fee	\$10.00	Hole
Remove pump, wiring, and drop pipe	\$0.40	Ft.
Removal and disposal of top few feet casing	\$30.00	Well
Monitoring well concrete pedestal disposal	\$100.00	Each
Mobilization <sup>1</sup>	\$1,000.00	Prj.

**Notes**

<sup>1</sup> Mobilization cost maybe adjusted upward due to the remoteness of the activity / project.

<sup>2</sup> Costs in the table do not include directional drilling. The applicant should contact the appropriate WYDEQ/LQD District office to reach agreement on an appropriate abandonment cost.

<sup>3</sup> Costs assume a diameter of 5½ inches or less. For larger diameter holes the applicant should contact the appropriate WYDEQ/LQD District office to reach agreement on an appropriate abandonment cost.

<sup>4</sup> Cost does not include reclamation of major cut and fill road construction. Calculation of these costs should be performed independently on a volumetric basis.

<sup>5</sup> For Drilling Notifications and Coal Notifications a Contingency Fee of 22% shall be applied to the Reclamation Bond estimate.

<sup>6</sup> Once subsurface reclamation is complete, the bonding level maybe reduced to the grading and seeding cost plus mobilization and contingency. If the revegetation is observed the first growing season, the surface reclamation bond can be reduced by 60% and held at this level until final bond release.



Appendix M  
Cost Estimate for Rough Grading Backfill Using  
Caterpillar D9R Dozer or Caterpillar 854G

ITEMS	CATERPILLAR D9R DOZER	CATERPILLAR 854G RUBBER TIRED DOZER	COMMENT/SOURCE
Speed in Miles Per Hour (First Gear)	2.0 Miles/Hour	4.0 Miles/Hour	CPH 40
Width of Dozer Pass	14 Feet	14 Feet	CPH 40
Feet Per Mile	5,280 Feet	5,280 Feet	
Square Feet Per Acre	43,560 Sq. Ft.	43,560 Sq. Ft.	
Operating Efficiency Factor 50 Min./Hr.	0.83	0.83	CPH 40
Operating Costs	\$208.41 Per Hour	\$275.09 Per Hour	100% of E-W
Labor Costs	\$45.31 Per Hour	\$45.31 Per Hour	WYDOT-WDD
Supervision Labor Costs	\$6.29 Per Hour	\$6.29 Per Hour	1/8 of WYDOT-WDD
Supervisor Transportation	\$3.43 Per Hour	\$3.43 Per Hour	1/8 of 100% of E-W
Total Hourly Costs	\$263.44	\$330.12	
SCARIFICATION RATE			
(2.0 Miles/Hour)x(5,280 Ft./Mile)x(14 Ft./Pass) <sup>1</sup> (4.0 Miles/Hour)x(5,280 Ft./Mile)x(14 Ft./Pass) <sup>2</sup>	147,840 Ft <sup>2</sup> /Hour	295,680 Ft <sup>2</sup> /Hour	
(147,890 Ft <sup>2</sup> /Hour)/(43,560 Ft <sup>2</sup> /Acre) <sup>1</sup> (295,680 Ft <sup>2</sup> /Hour)/(43,560 Ft <sup>2</sup> /Acre) <sup>2</sup>	3.39 Acres/Hour	6.79 Acres/Hour	
(3.39 Acres/Hour)x(0.83 Efficiency Factor) <sup>1</sup> (6.79 Acres/Hour)x(0.83 Efficiency Factor) <sup>2</sup>	2.82 Acres/Hour	5.66 Acres/Hour	
OPERATING COSTS			
(\$263.44/Hour)/(2.82 Acres/Hour) <sup>1</sup> (\$330.12/Hour)/(5.66 Acres/Hour) <sup>2</sup>	\$93.42 Per Acre	\$58.33 Per Acre	

<sup>1</sup> Caterpillar D9T Dozer

<sup>2</sup> Caterpillar 854G Rubber Tired Dozer

Appendix N  
Cost Estimates for Demolition and Removal of One "Standard" Surface Water Monitoring Station

	INPUT, UNIT AS INDICATED	COMMENT/ SOURCE
Assumed Time to Remove One Station	8 Hours	
Labor	\$45.31 Per Hour	WYDOT-WDD
Dump Truck (10-12 yd <sup>3</sup> )	\$77.78 Per Hour	100% of E-W
Caterpillar 980H Front-End Loader	\$115.78 Per Hour	100% of E-W
Cost to Remove One Surface Water Station = (Labor Cost x Time to Remove Station)	\$362.48	
+ (Labor Cost + Truck Cost) x Time to Remove Station	\$984.72	
+ (Labor Cost + Loader Cost) x Time to Remove Station	\$1,288.72	
Cost to Remove One Surface Water Station =	\$2,635.92	

Appendix O  
Cost Estimates for Demolition and Removal of One  
"Standard" Meteorological or Air Quality Monitoring Site

	INPUT, UNIT AS INDICATED	COMMENT/ SOURCE
Assumed Time to Remove One Station	4 Hours	
Labor	\$45.31 Per Hour	WYDOT-WDD
Dump Truck (10-12 yd <sup>3</sup> )	\$77.78 Per Hour	100% of E-W
Caterpillar 430D (4WD) Backhoe Loader	\$36.24 Per Hour	100% of E-W
Cost to Remove One Meteorological or Air Quality Station = (Labor Cost x Time to Remove Station)	\$181.24	
+ (Labor Cost + Truck Cost) x Time to Remove Station	\$492.36	
+ (Labor Cost + Loader Cost) x Time to Remove Station	\$326.20	
Cost to Remove One Meteorological or Air Quality Station =	\$999.80	



Appendix P  
Cost Estimate for Scarification of Compacted Surfaces

INPUT, UNIT AS INDICATED		COMMENT/ SOURCE
CATERPILLAR 16M MOTOR GRADER		
Speed in Miles Per Hour (First Gear)	2.4 Miles/Hour	CPH 40
Width of Scarifying Pass	12 Feet	CPH 40
Feet Per Mile	5,280 Feet	
Square Feet Per Acre	43,560 Sq. Ft.	
Operating Efficiency Factor 50 Min./Hr.	0.83	CPH 40
Operating Costs	\$145.14 Per Hour	100% of E-W
Labor Costs	\$45.31 Per Hour	WYDOT-WDD
Supervision Labor Costs	\$6.29 Per Hour	1/8 of WYDOT-WDD
Supervisor Transportation	\$3.43 Per Hour	1/8 of 100% of E-W
Total Hourly Costs	\$200.17	
SCARIFICATION RATE		
(2.4 Miles/Hour)x(5,280 Ft./Mile)x(12 Ft./Pass)	152,064 Ft <sup>2</sup> /Hour	
(152,064 Ft <sup>2</sup> /Hour)/(43,560 Ft <sup>2</sup> /Acre)	3.49 Acres/Hour	
(3.49 Acres/Hour)x(0.83 Efficiency Factor)	2.90 Acres/Hour	
OPERATING COSTS		
(\$200.17/Hour)/(2.90 Acres/Hour)	\$69.02 Per Acre	



## Appendix Q Revegetation Tasks and Costs

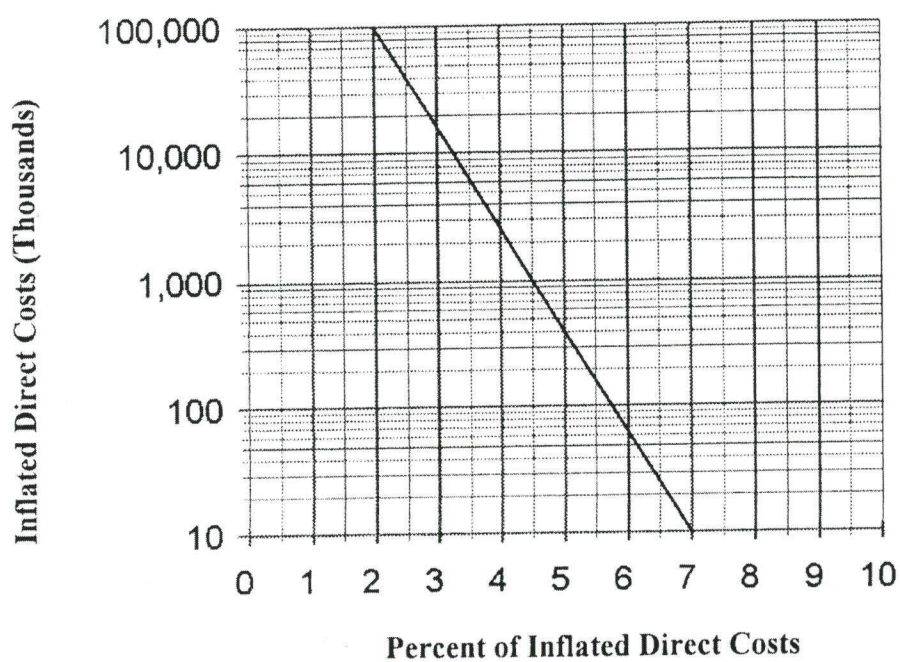
The permittee should fill in the cost per acre for each mine-specific Revegetation Activity as listed in the approved permit document. If a permittee does not use a specific Revegetation Activity, there should be no cost entry. The permittee should add these costs together to obtain a total cost per acre for revegetation. A flat estimate per acre for revegetation costs is not acceptable. The LQD may request verification of submitted revegetation costs (WS • 35-11-417(c)(i)).

General Revegetation Activity	Calculate According To Specific Permit Commitments
<b>1) Seedbed Preparation</b>	
Ripping	\$
Chisel Plowing	\$
Disking	\$
Harrowing or Cultipacking	\$
<b>2) Drill Seed Stubble Mulch Mix</b>	
Seed Costs	\$
Drill Seeding	\$
Mowing Prior to Planting Permanent Seed Mix	\$
<b>3) Seeding Permanent Mixes: Detail for each seed mix, if different seed mixes will be applied. The costs/acre for each individual mix should then be proportioned on the basis of acreage per parcels to derive a single weighted average cost/acre.</b>	
Drill Seeding	\$
Broadcast Seeding	\$
Seed Costs	\$
<b>4) Mulching</b>	
Mulch Purchase	\$
Hydromulch Application	\$
Straw Mulch Placement and Crimping	\$
<b>5) Fertilizer</b>	
Fertilizer Purchase by Defined Composition	\$
Application	\$
<b>6) Fencing</b>	
Construction	\$
Removal	\$
<b>Subtotal</b>	\$
<b>7) Maintenance Operations at 10% of Total Revegetation Costs: This cost addresses standard husbandry practices applied over the minimum 10-year bonding period, such as remedial seeding, mowing, selective weed treatment, etc. The 10 percent figure is derived from historical operator experience for the Powder River Basin.</b>	\$
<b>Total Revegetation Cost Per Acre</b>	\$

Appendix R  
Reclamation Management Costs

**Project Management Fee**

Graph 2



Graphical extension of  
Reference lines 010 000 016 0050 and 0300  
From Means 1998 *Building Construction Cost Data*,  
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Appendix S

Non-Coal Miscellaneous Costs

