# Tyrone
# Stockpile Interior Area
# Cost Estimate Summary Report

*Prepared for*

**Freeport McMoRan, Tyrone Inc.**
**P.O. Box 571**
**Tyrone, New Mexico 88065**

*Prepared by*

**Telesto Solutions, Inc.**
**2950 East Harmony Road, Suite 200**
**Fort Collins, CO 80528**

**July 15, 2010**

TELESTO
SOLUTIONS • INCORPORATED

# TABLE OF CONTENTS



# LIST OF TABLES



# LIST OF DRAWINGS



# LIST OF APPENDICES

# 1.0 INTRODUCTION

## 1.1 Purpose & Summary

The cost estimate presented herein is one part of the justification that Freeport McMoRan Tyrone, Inc. (Tyrone) is assembling for the surface water containment zone interior slope reclamation waiver. Although the reclamation waiver request is for interior slopes, costs are provided for both interior sloped and flat areas (which will be reclaimed within the waiver area). It should be noted that the areas under consideration herein are located between the current and proposed waiver areas.

The purpose of this document is to present the estimate along with a concise explanation of the underlying assumptions and references to the supporting documentation. This work was completed in coordination with MWH who developed the reclamation designs and the quantity take-offs. Telesto developed the unit costs and compiled the cost estimate.

This document is organized as follows:

- Section 2 describes the assumptions specific to the earthwork reclamation areas.
- Section 3 describes the assumptions specific to the water management.
- A summary of the cost estimate is included in Table 1.
- Unit cost bases for fuel, labor and equipment are summarized in Table 2.
- Miscellaneous unit cost bases are provided in Table 3.
- Equipment production factors are provided in Table 4.
- Interior area plan view is shown on Drawing 1 and cross sections are shown on Drawings 2 and 3.
- A summary of cost calculations is provided in Appendix A.
- Supporting documentation is presented in Appendix B.
- Engineering take-offs produced by MWH are presented in Appendix C.
- The spreadsheets containing the cost estimates are provided electronically in Appendix D.

# 2.0 EARTHWORK COST ESTIMATE

The earthwork reclamation cost estimate has been developed based on a template created by the New Mexico Energy, Minerals and Natural Resources Department, Mining and Minerals Division (MMD), using September, 2009 topography. The original MMD cost estimating spreadsheet templates were modified slightly to provide flexibility for evaluating each type of facility independently. The four original linked spreadsheets were combined for each facility type, thus eliminating the possibility of the sheets referencing the wrong spreadsheet file. The formulas and organization of the individual sheets remained unchanged with a few minor exceptions: 1) truck trip time and dozer production rate data that were previously entered manually from the Caterpillar Handbook charts (Caterpillar, 2004 and 2008) were replaced with equivalent formulas derived from the Caterpillar Handbook charts, 2) "Other items" specific to a particular facility were retained with each associated facility (e.g., ditch construction for a particular facility).

## 2.1 Cost Estimate Assumptions

Several working assumptions that are used in the cost estimates include:

- **Labor Rates**: Labor rates were developed based on the New Mexico Department of Labor (DOL) Type H (Heavy Engineering) labor rates (Table 2). These rates include the base, fringe benefit and apprenticeship contribution rates. The following were added to the labor rates to obtain the total per hour labor rate: FICA, Medicare, Federal un-employment, State un-employment and Workman's Compensation Insurance (Table 2).
- **Equipment Rates**: The equipment rates were taken from EquipmentWatch Custom Cost Evaluator (Penton Media, Inc. Version: 4.0.4A, 2010).
- **Fuel Costs**: The off-road diesel fuel cost is based on a quote obtained from Porter Oil Co., Inc. located in Bayard, New Mexico.
- **Revegetation Unit Costs**: The revegetation unit cost (Table 2) is based on a quote obtained from Rocky Mountain Reclamation.
- **Rip Rap Production**: The rip rap unit cost is based on a bid received by the Tyrone Mine for on-site rip rap production.
- **Indirect Costs**: Total indirect costs of 39.6% were applied to the direct costs. The indirect costs are comprised of: Mobilization and Demobilization (1.1%),

Contingencies (2.0%), Engineering Redesign Fee (4.5%), Contractor Profit and Overhead (25.0%), Project Management Fee (5.0%), State Procurement Cost (2.0%). Contractor Profit and Overhead includes: Profit and Office Overhead (10%) and Project Overhead (15%). Project Overhead usually consists of the following except when it is a direct item: salaried and administrative personnel, field office, shop and facilities, temporary utilities, fees and insurance except those applicable to labor and equipment, MSHA and site specific training, performance and payment bonds, quality assurance/quality control, safety, surveying, construction equipment general (salaried pickups, buses, ambulance, etc.).

- **Operations and Maintenance Costs**: Assumed to be equivalent to 15.39% of the indirect costs. This is based on the Tyrone Mine Closure/Closeout Plan Update (Golder, 2007) operations and maintenance (O&M) costs divided by the total earthwork costs. O&M includes: erosion control, wildlife monitoring, and road maintenance.
- **Revegetation Maintenance**: Calculated as 5% of the direct revegetation costs for a 12 year period and is included with the indirect costs. Borrow area revegetation is included in the Tyrone Mine Closure/Closeout Plan Update (Golder, 2007) and is therefore not included in this cost estimate.
- **Haul Distances**: Haul distances are calculated along a preferred route assumed to originate at the approximate centroid of the cover borrow source and terminate at the approximate centroid of the reclamation area. A maximum of three segments are used for each haul route.
- **Borrow Areas**: Borrow areas will be left in a condition such that they can be directly revegetated and will require no cover to be hauled from other sources.
- **Dozer Push Distances**: Dozer push distances represent the distance from the centroid of the cut block to the centroid of the fill block.
- **Miscellaneous Unit Costs**: Miscellaneous unit costs were taken from several sources including R.S. Means Heavy Construction Cost Data Edition 24 (R.S. Means, 2010). All costs taken from R.S. Means and were adjusted using the location factor for Las Cruces. Miscellaneous unit costs are summarized in Table 3.
- **Equipment Production Factors**: Productions factors for each type of equipment are presented in Table 4.
- **Material Swell**: Swell of stockpile, tailing and cover material added to volume is shown on Table 4.
- **Pullback Operations**: All pullback operations will be completed using a Hitachi 5300-3 hydraulic shovel and Komatsu 530M mechanical rear dump truck.

## 2.2 Reclamation Areas

The conceptual designs and associated earthwork cost estimate are based on an overall outslope gradient of 3.5:1 (horizontal:vertical), approximate 25-foot wide terrace benches, and maximum 200-foot inter-bench slope lengths to allow for flexibility in the final design of the terrace benches and associated surface water conveyance channels. With these designs, the inter-bench slope is 3:1.

Surfaces targeted for reclamation under this plan include all top surfaces and outslopes that are located inside the surface water containment zone (SWCZ) that are between the current and proposed waiver areas. The SWCZ is defined as the area adjacent to the open pits where surface water cannot feasibly flow out to the perimeter of the Mine/Stockpile Unit due to existing topographic or regrade constraints, according to the drainage plans compiled by MWH.

The areas located *inside* the SWCZ include:

- 1A and 1B Leach Stockpiles (outslopes)
- 2A Leach Stockpile (outslope)
- 6B Leach and 6C Leach Stockpiles (outslopes)
- 3B Waste Stockpile (outslope)
- 4A Leach, 2B Leach, 2C Leach, and 7B Waste Stockpiles (outslopes)
- 5A Overburden Stockpile (outslope)
- Copper Mountain Pit (outslope).

The main activities that will occur in reclaiming the stockpiles include:

- Regrading outslopes.
- Hauling and grading cover material.
- Ripping and revegetation of covered areas.
- Completing surface water channels to route storm water to the pits.

The major assumptions for this cost estimate for areas *inside* the SWCZ include:

- **Engineering:** overall outslope gradient of 3.5:1, approximate 25-foot wide terrace benches, maximum 200-foot inter-bench slope lengths, 5.0% max cross-bench slope, and 2.0% longitudinal bench slope.
- **Cover:** 36" cover thickness –outslopes.
- **Pullback:** Trucks and loaders with dozer assist perform required pullback of stockpile material.
- **Cover Placement:** Trucks and loaders with dozer assist perform all cover loading and distribution. The economic optimum number of trucks per loader is used for each haul route.
- **Ripping:** Ripping (scarifying) of the final surface is performed at the same time as the revegetation and is included in the revegetation quote.
- **Dust Suppression/Road Maintenance**: Full time water truck and motor grader during reclamation.
- **Channels:** All surface water will be routed to the pits and will not be diverted.

## 2.3 Earthwork Cost Summary

The interior area earthwork reclamation costs are exhibited in Table 1. Detailed calculations and a summary of material quantities and other engineering take-offs including supporting figures are provided in Appendix A through D of this cost estimate.

# 3.0 WATER MANAGEMENT COST ESTIMATE

The water management cost estimate includes 100 years of O&M. The cost estimate summary is presented in Table 1.

## 3.1 Cost Estimate Methods and Assumptions

Water management costs were estimated by:

- Establishing the quantity of water to be managed
- Identifying collection and conveyance system infrastructure requirements
- Estimating infrastructure replacement frequency
- Estimating costs of infrastructure construction, O&M, and removal.

The water management cost estimate is divided into six components: (1) ponds, (2) pumps, (3) pipelines, (4) electrical infrastructure, (5) water quality monitoring, and (6) channels. Each component includes any infrastructure required during post-reclamation. Costs are included for construction, equipment replacement and removal (as needed).

It is assumed that captured surface water will meet applicable standards and will not require treatment. Therefore, water treatment costs are not included in this estimate. However, costs are included for post-reclamation water quality monitoring.

Unit costs were taken from several sources including R.S. Means (2010). Miscellaneous unit costs are summarized in Table 3.

## 3.2 Quantity of Water to be Managed

The sources and quantities of water used in the cost estimate were determined by estimating the average annual storm water runoff from all reclaimed areas.

The average annual storm water runoff from reclaimed areas was determined using the SCS Curve Number Method (USDA, 2004a). A 100-year stochastic daily precipitation data set was developed using the stochastic weather generator CLIGEN (USDA, 2004b). This data set was created by first developing a synthetic 100-year data set for Ft. Bayard, New Mexico, and then scaling the data for Tyrone so that the mean annual precipitation was equal to the 16.0 inches reported in Golder (2007). Areas for each facility were determined using the predicted earthwork revegetation areas. Using a Curve Number of 80 (WMC, 2007) for reclaimed areas, runoff is approximately 4% of the average annual precipitation.

## 3.3 Water Collection and Conveyance

The following sections present the methods and assumptions used in developing costs for component construction, annual maintenance, periodic replacement and removal. For purposes of this estimate, it was assumed that vegetation would be established and storm water would not require treatment. Cost calculation summaries for ponds, pumps, pipelines, and electrical infrastructure are presented in Appendix A. Engineering takeoffs can be found in Appendix C.

### 3.3.1 Ponds

Assumptions and methods for this portion of the cost estimate include:

- The necessary surface impoundment (ponds) infrastructure will be built during reclamation.
- Membrane lined ponds have a life expectancy of 30 years.
- New and replacement costs were taken from R.S. Means (2010). Miscellaneous unit costs are summarized in Table 3.
- Annual O&M cost for ponds is two percent of the total replacement cost.

Ponds were sized to accommodate the 100-year, 24-hour storm event. Runoff from reclaimed areas was determined using the SCS Curve Number Method (USDA, 2004a) and a 100-year, 24-hour rainfall depth of 3.7 inches (WMC, 2007). Areas for each facility were determined using the predicted earthwork revegetation areas. It was

assumed that the ponds must accommodate the entire runoff from a single 100-yr, 24-hour event and that each pond had a maximum depth of 20 feet (Appendix A).

### 3.3.2 Pumps

Assumptions and methods for this portion of the cost estimate include:

- Pump infrastructure will be built during reclamation.
- Pumps have a life expectancy of 20 years.
- Electricity costs $0.06/kWh.
- Pumps will remain in operation during the post-reclamation period.
- New and replacement costs for pumps with capacities greater than 450 gpm were taken from R.S. Means (2010). Miscellaneous unit costs are summarized in Table 3.
- Pipe head loss calculations assume that only a single pump operates when multiple pumps are present.
- Calculations of annual pumping time assume that only a single pump operates when multiple pumps are present (additional pumps are for contingency use only).
- The Chezy head loss coefficient for all pipelines is 150.
- The average pump/motor efficiency is 70 percent.
- Pump station removal costs are $5,000 per installation.
- Annual O&M cost for pumps is five percent of their total replacement cost.

### 3.3.3 Pipelines

Assumptions and methods for this portion of the cost estimate include:

- Pipeline infrastructure will be built during reclamation.
- Pipeline lengths takeoffs provided by MWH.
- Pipeline diameters were calculated to be sufficiently large to accommodate flow velocities of three feet per second or less.
- HDPE Pipeline life expectancy is 100 years but replaced prior to end-of-life, at 85 years.
- Pipelines will remain in operation during the post-reclamation period.
- New, removal, and replacement costs for pipelines were taken from R.S. Means (2010). Miscellaneous unit costs are summarized in Table 3.
- Annual O&M cost for pipelines is one percent of the total replacement cost.

### 3.3.4 Channels

Assumptions and methods for this portion of the cost estimate include:

- Channels will be constructed during reclamation.
- Channels are trapezoidal with 20-foot bottom width, three feet deep, 3:1 side slope, one foot of riprap over half a foot of gravel.
- Channel lengths were provided by MWH, and convey storm water to the ponds.
- Riprap and channel excavation and grading are included with the miscellaneous unit costs (Table 3).
- Annual O&M cost for channels is 15.39% of the total construction cost. This is consistent with the earthwork cost estimate.

### 3.3.5 Electrical Infrastructure

Assumptions and methods for this portion of the cost estimate include:

- Electrical infrastructure will be built during reclamation.
- Electric power lines follow pipeline corridors.
- Power poles will be 30-feet high and spaced at a distance of 100 feet.
- Electrical infrastructure will remain in operation during the post-reclamation period.
- New and replacement costs for electrical power lines were taken from R.S. Means (2010). Miscellaneous unit costs are summarized in Table 3.
- All power lines are high voltage and require a 13-26 kV transformer.
- Each electrical substation and pump control setup costs $5,000.
- Annual O&M cost for electrical systems is one percent of the total replacement cost.

## 3.4 Water Monitoring

Post-closure monitoring of surface and groundwater is generally required in the New Mexico Energy and Natural Resources Department, Mining and Minerals Division permits and New Mexico Environmental Department supplemental discharge permit. For the first 12 years, sampling and analysis will be completed on a quarterly basis, decreasing to semi-annually for years 13 through 20 and then to annually for years 21 through year 100. The change in number of samples collected and analyzed is accounted for in the long-term O&M cost estimate. Sampling locations, schedule, and cost calculation summaries are presented in Appendix A.

Assumptions for post-reclamation sampling include:

- No labor cost is assigned to the sampling effort. It is assumed that the sampling will be a routine duty for site personnel and does not need an additional cost.
- Analytical costs are estimated based on laboratory pricing guide (Energy Laboratories Inc., 2009). Costs include packaging, handling, shipping, quality assurance/quality control, and lab result report preparation.

## 3.5 Water Management Cost Summary

The cost estimate presented herein reflects the cost to construct, operate, and maintain the Tyrone incremental interior area water management system during the post-reclamation period. Annual costs estimated for each subsystem were summed to generate a total cost estimate for operational year 1 through year 100. Summaries of the current dollar costs are presented in Table 1.

# 4.0 REFERENCES


Caterpillar. 2004. Caterpillar Performance Handbook, Edition 35. Caterpillar Inc. Peoria, Illinois. October, 2004.

Caterpillar. 2008. Caterpillar Performance Handbook, Edition 38. Caterpillar Inc. Peoria, Illinois. January, 2008.

Energy Laboratories, Inc. 2009. Published price list for analytical work (www.energylab.com).

Golder Associates, Inc. 2007. Tyrone Mine Closure/Closeout Plan Update. October 11, 2007.

Penton Media, Inc. 2010. EquipmentWatch Custom Cost Evaluator. Version 4.0.4A. January 28, 2010.

R.S. Means. 2010. Heavy Construction Cost Data. 24th Annual Edition. R.S. Means Company, Inc.

United States Department of Agriculture (USDA). 2004a. National Engineering Handbook, Part 360, Chapter 10. Natural Resource Conservation Service. July 2004.

United States Department of Agriculture (USDA). 2004b. Cligen Weather Generator v522564. October, 26, 2004.

Water Management Consultants, Inc. (WMC). 2007. Phelps Dodge Tyrone, Inc. Tailings Impoundments 1, 1A, and 1X Reclamation Hydrologic & Hydraulic Analysis Report. June 29, 2007.

# TABLES

## Table 1 Cost Estimate Summary

| Item | Subtotal, Direct Costs | Subtotal, Indirect Costs 39.6% | Total Current Dollar Cost |
|---|---|---|---|
| **EARTHWORK** | | | |
| 1A and 1B Leach Outslope | $1,500,266 | $594,105 | $2,094,371 |
| 2A Leach Outslope | $5,313,500 | $2,104,146 | $7,417,646 |
| 3B sp Outslope | $2,304,194 | $912,461 | $3,216,655 |
| 4A, 2B, 2C, 7B Leach Outslope | $10,188,894 | $4,034,802 | $14,223,696 |
| 5A Outslope | $1,055,905 | $418,138 | $1,474,043 |
| Copper Mountain Outslope | $1,226,921 | $485,861 | $1,712,782 |
| 6B, 6C Leach Outslope | $7,695,549 | $3,047,437 | $10,742,986 |
| **Total Capital Earthwork** | **$29,285,229** | **$11,596,951** | **$40,882,179** |
| **Total Earthwork Operations and Maintenance** | **$4,506,997** | **$1,784,771** | **$6,291,767** |
| **Total Earthwork** | **$33,792,225** | **$13,381,721** | **$47,173,946** |
| **Water Management** | | | |
| **Ponds** | | | |
| Capital Costs | $456,413 | $180,740 | $637,153 |
| Replacement Costs | $1,369,239 | $542,219 | $1,911,458 |
| Operations & Maintenance | $912,826 | $361,479 | $1,274,305 |
| **Total Ponds** | **$2,738,479** | **$1,084,437** | **$3,822,916** |
| **Pumps** | | | |
| Capital Costs | $184,326 | $72,993 | $257,319 |
| Replacement Costs | $585,816 | $231,983 | $817,799 |
| Operations & Maintenance | $1,929,497 | $764,081 | $2,693,577 |
| **Total Pumps** | **$2,699,639** | **$1,069,057** | **$3,768,695** |
| **Pipelines** | | | |
| Capital Costs | $580,214 | $229,765 | $809,979 |
| Cost Removal and Replacement | $684,887 | $271,215 | $956,102 |
| Operations & Maintenance | $1,265,101 | $500,980 | $1,766,082 |
| **Total Pipelines** | **$2,530,203** | **$1,001,960** | **$3,532,163** |
| **Electrical Infrastructure** | | | |
| Capital Costs | $876,300 | $347,015 | $1,223,315 |
| Cost Removal and Replacement | $0 | $0 | $0 |
| Operations & Maintenance | $876,300 | $347,015 | $1,223,315 |
| **Total Electrical Infrastructure** | **$1,752,601** | **$694,030** | **$2,446,631** |
| **Environmental Sampling** | **$193,400** | **$0** | **$193,400** |
| **Channels** | | | |
| Construction | $1,837,503 | $727,651 | $2,565,154 |
| Maintenance | $282,792 | $111,986 | $394,777 |
| **Total Channels** | **$2,120,295** | **$839,637** | **$2,959,932** |
| **Total Capital Water Management** | **$3,934,757** | **$1,558,164** | **$5,492,921** |
| **Total Replacement and Maintenance** | **$8,099,858** | **$3,130,958** | **$11,230,816** |
| **Total Water Management** | **$12,034,616** | **$4,689,121** | **$16,723,737** |
| **Total** | **$45,826,841** | **$18,070,842** | **$63,897,683** |

## Table 2 Fuel, Labor, and Equipment Unit Costs

| Parameter | Value | Comment |
|---|---|---|
| Revegetation | $1,112.50/acre | Rocky Mountain Reclamation Quote 1/14/10 |
| Fuel | $2.49/gal | Porter Oil Fuel Quote 1/14/10 |
| Dozer Operator | $33.81/hr | Based on NM DOL Rates |
| Motor Grader (Rough) | $33.81/hr | Based on NM DOL Rates |
| Mechanic | $33.10/hr | Based on NM DOL Rates |
| Truck Operator | $24.65/hr | Based on NM DOL Rates |
| Loader Operator | $33.96/hr | Based on NM DOL Rates |
| Caterpillar D11R | $413.67/hr | Standard Crawler Dozer |
| Caterpillar D9R | $176.15/hr | Standard Crawler Dozer |
| Caterpillar D6R | $70.29/hr | Standard Crawler Dozer |
| Caterpillar 777F | $282.72/hr | Mechanical Drive Rear Dump |
| Komatsu 530M | $311.95/hr | Mechanical Drive Rear Dump |
| Caterpillar 992G | $345.66/hr | 4-WD Articulated Loader |
| Caterpillar 16M | $148.02/hr | Articulated Frame Motor Grader |
| Off-Highway Water Tanker Truck | $160.04/hr | 10,000 Gallon |
| Hitachi EX3500-3 | $774.19/hr | Crawler Mounted Hydraulic Excavator |

Description Notes: Labor rates are based on New Mexico Department of Labor Type H labor rates effective January 1, 2010. Equipment hourly rates were obtained from EquipmentWatch (Penton Media, Inc. 2010). Equipment rates were adjusted using a fuel cost of $2.49/gal, mechanics wage of $33.10/hr, sales tax of 7.5%, and annual use hours were increased to reflect a 60 minute work hour. The 50 minute work hour is accounted for in the equipment production calculation.

## Table 3 Miscellaneous Unit Costs

| Activity | Base No Overhead and Profit[1] Unit Cost $/unit | Units | Scaled Cost Las Cruces 83.5%[2] | Means Line Item | Means Page | Reference |
|---|---|---|---|---|---|---|
| Wood Electrical Utility Poles | 733 | ea | 612 | 337116.33 6600 | 348 | 30' high, excludes excavation, backfill and cast-in-place concrete, R-3 crew |
| Electrical Cross Arms | 283 | ea | 236 | 337116.33 7600 | 348 | 4' long, includes hardware and insulators, 1 Electrical Crew |
| Utility Pole Installation a.) | 1,160 | ea | 969 | 337116.20 0105 | 347 | Digging holes in rock-R-5 Crew |
| Utility Pole Installation b.) | 2,291 | ea | 1913 | 337116.20 0250 | 347 | Erect wood poles and backfill holes in rock |
| Utility Pole Installation c.) | 89.2 | mi | 74 | 337116.20 0260 | 347 | Disposal of pole and hardware surplus material |
| Utility Pole Installation d.) | 926 | ea | 773 | 337116.20 0510 | 348 | Guys, anchors and hardware for pole in rock |
| Cross Arm Installation a.) | 128 | ea | 107 | 337116.20 0310 | 347 | Material handling and spotting |
| Cross Arm Installation b.) | 939 | ea | 784 | 337116.20 0320 | 347 | Install cross arms |
| Cross Arm Installation c.) | 46.55 | mi | 39 | 337116.20 0330 | 347 | Disposal of cross arms and hardware surplus material |
| Electrical Wiring Installation a.) | 536 | wire mi | 448 | 337139.13 0110 | 351 | Material handling and spotting-conductors, primary circuits |
| Electrical Wiring Installation b.) | 10,325 | wire mi | 8621 | 337139.13 0150 | 351 | Conductors, per wire, 210-636 kcmil |
| Potential Transformers | 4,533 | ea | 3785 | 337126.26 4100 | 351 | 13 to 26 kV |
| Riprap and Gravel Haul | 9.39 | cy | 7.84 | G1030 150 7600 | 441 | Load & Haul rock, 5-cy loader, 12 20-cy trailers, 3-mile RT |
| Riprap and Gravel Backfill | 1.46 | cy | 1.22 | 312323.14 5200<br>312323.23 5040 | 227, 251 | Gravel Backfill, 300 hp dozer & compactors, 150' haul, 6" lifts, 4 passes |
| Riprap Production | 15.98 | cy | - | - | - | Riprap Production 2007 August Production - McCain Springs Quarry, escalated to 2009 costs. |
| Pipe Removal | 2.95 | lf | 2 | 024113.38-1800 | 25 | Site Demo, pipe removal, sewer/water no exc., plastic pipe, 10"-18" diameter |
| Pipe Disposal | 6.44 | cy | 5 | 02220.875-5500 | - | Site demolition, disposal on site updated from $6.44 in 2008 |
| Excavation of Soil | 5.11 | cy | 4 | G1030120 1600 | 432 | 3/4 C.Y. backhoe, three 8 C.Y. dump trucks, 1 mi round trip. This value removes the profit for equipment (10%) and the profit/overhead for labor of the operator of a shovel (49.7%). |
| Reservoir Liners HDPE | 1.9 | sf | 2 | 334713.53 1200 | 338 | Membrane lining, 2X60 mil thick |
| Utility Pump | 22,075 | ea | 18433 | 221123.10 3190 | 170 | Single stage, double suction 75 HP, 2500 gpm pump |
| Water Supply Piping | 52.05 | lf | 43 | 331113.35 0700 | 319 | Butt fusion joints, SDR 21, HDPE 40' lengths not including excavation or backfill, 16" diameter |
| Riprap or Gravel | 15.98 | cy | - | - | - | 2007 August Production - McCain Springs Quarry, escalated to 2009 costs. |
| Spillway Grading (stockpiles) | 7.53 | ft | - | - | - | Excavate and waste material on slopes with D11R, 175-foot downslope excavation, 200-foot lateral waste push. Finish grade with D6R, 175-foot typical push distance, unit volume per LF. Uses dozer sheet adjustment factors. |
| Bench Grading | 1.44 | ft | - | - | - | Excavate and waste material on slopes with D11R, 175 ft downslope excavation. Finish grade benches using D9R. Three passes per bench, 1 MPH operating speed. Grading benches 15 ft wide, 4.33 cy cut-to-fill/ft of bench. |
| Terrace Channel | 1.58 | ft | - | - | - | Excavate and waste material with D11R, 175-foot excavation, 200-foot lateral waste push. Finish grade with D6R, 175-foot typical push distance, unit volume per LF. Uses dozer sheet adjustment factors. |
| Outslope Channel | 8.59 | ft | - | - | - | Excavate and waste material with D11R, 175-foot excavation, 200-foot lateral waste push. Finish grade with D6R, 175-foot typical push distance, unit volume per LF. Uses dozer adjustment factors. |
| Rip Rap or Gravel Haul | 9.39 | cy | 7.84 | G1030 150 7600 | 441 | Load & Haul rock, 5-cy loader, 12 20-cy trailers, 3-mile RT. |
| Rip Rap or Gravel Backfill | 1.46 | cy | 1.22 | 312323.14 5200<br>312323.23 5040 | 227, 251 | Gravel Backfill, 300 hp dozer & compactors, 150' haul, 6” lifts, 4 passes. |

1) Overhead and Profit are not included in the direct costs.
2) City Cost Index Las Cruces-Total 83.5% R.S. Means Heavy Construction Cost Data 24th Annual Edition 2010 pg. 534.
3) R.S. Means Heavy Construction Cost Data 24th Annual Edition 2010.
.

## Table 4 Equipment Production Factors

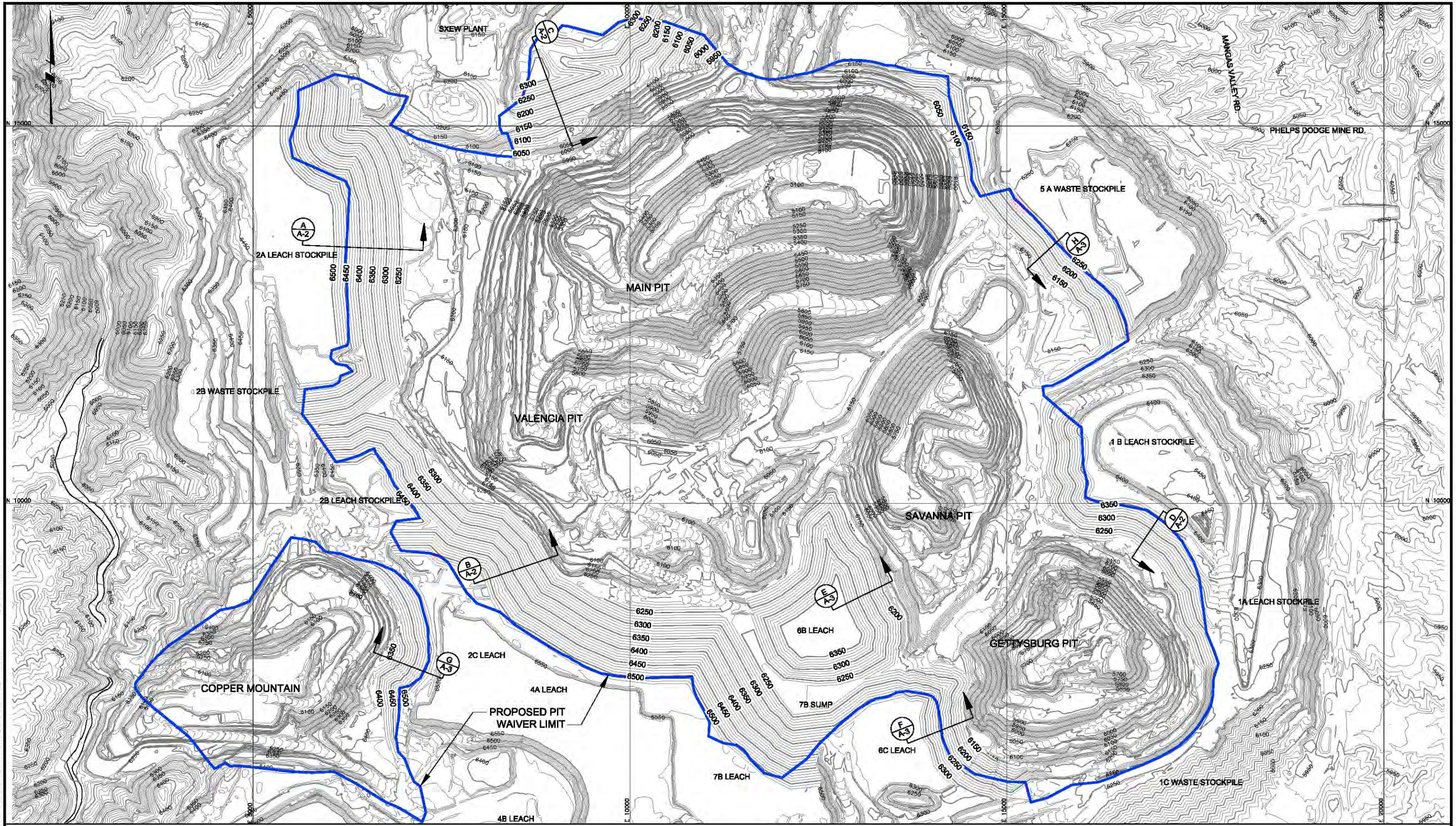
| Parameter | Value | Comment/Reference |
|---|---|---|
| Swell Factor<br>Stockpiles | 15% Pushdown<br>15% Load cover<br>15% Haul cover | - |
| **Grading (D11R, D9R, D6R)** | | |
| Operator Factor | 0.75 Stockpile | (CPH 38, 1-46) |
| Material Factor | 1.2 - Stockpile<br>1.2 - Cover | (CPH 38, 1-46) |
| Work Hour | 50 min Stockpile | - |
| Grade Factor - Outslopes | 1.6 - Stockpile | (CPH 38, 1-46)<br>1.6 – 3H:1V Slopes |
| Soil Weight | 3300 lb/cy Stockpile<br>2900 lb/cy Gila Conglomerate | - |
| Production Method/<br>Blade Factor | 1.2 – Slot | (CPH 38, 1-46) |
| Visibility Factor | 1.0 | Clear<br>(CPH 38, 1-46) |
| Elevation Factor | 1.0 | (CPH 38, 27-5) |
| Direct Drive Transmission | 1.0 | - |
| **Material Handling** | | |
| Material Handling<br>Multiplier | 1.5 - Stockpile | Non-standard factor |
| **Loader (992G)** | | |
| Rated Bucket Capacity (cy) | 16.00 | (CPH 38, 12-59) |
| Loader Cycle Time | 0.65 | Use D11R dozer assist while loading (CPH 38, 12-80)<br>Avg 0.6-0.7 |
| Bucket Fill Factor | 0.875 | (CPH 38, 12-80) Avg 0.85-0.90<br>Loose Material 1” and over |
| Work Hour (min/hr) | 50 | - |
| **Shovel (Hitachi EX3500-3 / CAT 5230B FS) [(1)]** | | |
| Rated Bucket Capacity (cy) | 23.5 | (CPH 35, 4-233) |
| Loader Cycle Time | 0.45 | (CPH 35, 4-236, 5230B FS) |
| Bucket Fill Factor | 1.025 | (CPH 35, 4-236)<br>Avg Rock-Earth Mix 100-105% |
| Work Hour (min/hr) | 50 | - |
| **Trucks (777F)** | | |
| Struck Capacity (cy) | 54.8 | (CPH 38, 9-5) |
| Heaped Capacity(cy) | 78.8 | (CPH 38, 9-5) |
| Rolling Resistance (%) | 4.0% | (CPH 38, 27-1) |
| Truck Exchange Time (min) | 0.7 | (CPH 38, 9-12) Avg. 0.6-0.8 |
| Dump/Maneuver Time (min) | 1.1 | (CPH 38, 9-12) Avg 1.0-1.2 |
| Work Hour (min/hr) | 50 | - |
| **Trucks (Komatsu 530M / CAT 785C) [(2)]** | | |
| Struck Capacity 530M (cy) | 74 | Equipment Watch Spec Sheet |
| Heaped Capacity 530M (cy) | 102 | (CPH 38, 9-6) |
| Rolling Resistance (%) | 4.0% | (CPH 38, 27-1) |
| Truck Exchange Time (min) | 0.7 | (CPH 38, 9-12) Avg. 0.6-0.8 |
| Dump/Maneuver Time (min) | 1.1 | (CPH 38, 9-12) Avg 1.0-1.2 |
| Work Hour (min/hr) | 50 | - |

CPH = Caterpillar Performance Handbook Edition 35 or 38 (Caterpillar, 2004 and 2008).

[(1)] Performance information is unavailable for the Hitachi EX3500-3; therefore, performance information for the Caterpillar 5230B FS has been used.

[(2)] Performance information is unavailable for the Komatsu 530M, therefore, performance information for the Caterpillar 785C has been used.

# DRAWINGS




**PLAN**

SCALE
600 0 600 1200 FEET
CONTOUR INTERVAL = 10 FEET

| ISSUE REV | DESCRIPTION | C.C.L. TECH | T.E.L. ENG | 07/10 DATE |
|---|---|---|---|---|
| A | ISSUED FOR REVIEW | | | |

**DISCLAIMER:**
THIS DRAWING WAS DEVELOPED THROUGH THE APPLICATION OF PROFESSIONAL ENGINEERING SKILL AND PROPRIETARY METHODOLOGIES, PROCESSES AND KNOW HOW OF MWH AS AUTHOR ALL PURSUANT TO THE TERMS OF A CONTRACTUAL SCOPE OF WORK COVERING ITS PREPARATION. THIS DRAWING MAY NOT BE USED OR MODIFIED OTHER THAN IN STRICT ACCORDANCE WITH THE TERMS OF THE GOVERNING CONTRACT AND SCOPE OF WORK OR OTHERWISE ABSENT THE INVOLVEMENT AND CONSENT OF THE AUTHOR. ANY ALTERATION OR ADAPTATION OF THIS DRAWING SHALL BE CONSISTENT WITH THE AUTHOR'S CONTRACTUAL AND PROPRIETARY RIGHTS AND BE AT USER'S SOLE RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY OF MWH.

**DRAWING REFERENCE(S):**

| | | |
|---|---|---|
| DESIGNED BY | T. LEIDICH | 07/06/10 |
| DRAWN BY | C. LEE | 07/06/10 |
| CHECKED BY | T. LEIDICH | 07/06/10 |
| APPROVED BY | | |
| PROJECT MANAGER | T. LEIDICH | 07/06/10 |
| CLIENT APPROVAL | | |
| CLIENT REFERENCE NO. | | |

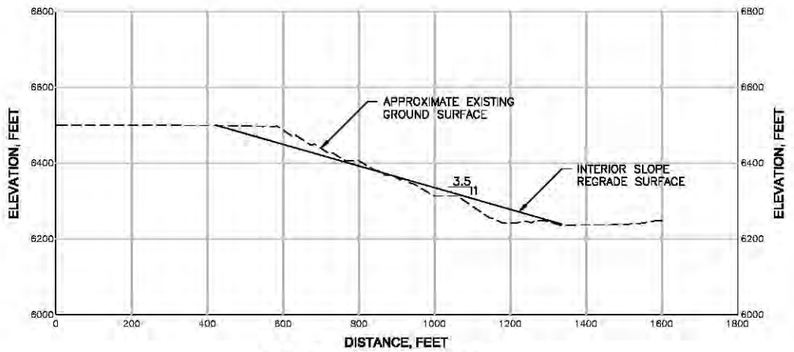
FREEPORT-McMoRAN COPPER & GOLD INC.

PROJECT LOCATION: TYRONE MINE SITE
PROJECT: INTERIOR SLOPE REGRADE
TITLE: PLAN VIEW-INTERIOR SLOPE REGRADE FOR PIT WAIVER ANALYSIS

MWH

DRAWING: A-1 REVISION: A
FILE NAME: 1008011D007

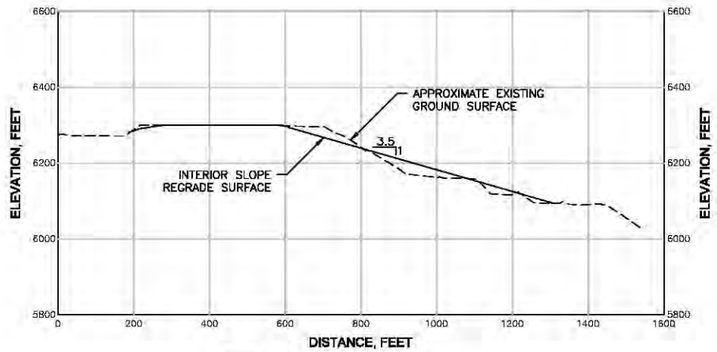
M:\Client\A-H\Freeport McMoRan\1008011 - G & K TYRONE BOND\013- Sheet Set\INTERIOR SLOPES\1008011D007 7/6/2010 10:54:33 AM




A / A-1 **2A INTERIOR SLOPE**

(LOOKING NORTH)

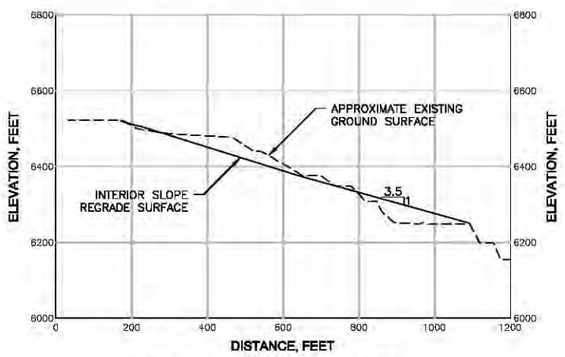
SCALE 200 0 200 400 FEET




C / A-1 **3B INTERIOR SLOPE**

(LOOKING NORTHWEST)

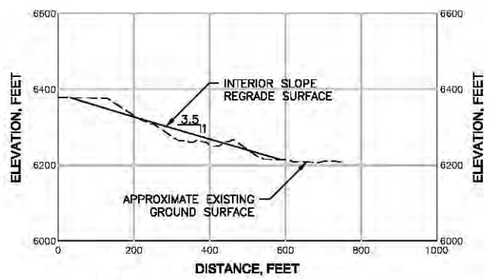
SCALE 200 0 200 400 FEET




B / A-1 **2C, 4A INTERIOR SLOPE**

(LOOKING NORTHWEST)

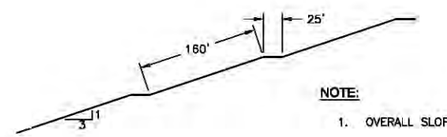
SCALE 200 0 200 400 FEET




D / A-1 **1A INTERIOR SLOPE**

(LOOKING SOUTHEAST)

SCALE 200 0 200 400 FEET




**NOTE:**

1. OVERALL SLOPE 3.5H:1V

**SLOPE CONFIGURATION**

(TYPICAL)

SCALE 100 0 100 200 FEET

| REV | DESCRIPTION | TECH | ENG | DATE |
|---|---|---|---|---|
| A | ISSUED FOR REVIEW | C.C.L. | T.E.L. | 07/10 |



**DRAWING REFERENCE(S):**

| | | |
|---|---|---|
| DESIGNED BY | T. LEIDICH | 07/08/10 |
| DRAWN BY | C. LEE | 07/08/10 |
| CHECKED BY | T. LEIDICH | 07/08/10 |
| APPROVED BY | | |
| PROJECT MANAGER | T. LEIDICH | 07/08/10 |
| CLIENT APPROVAL | | |
| CLIENT REFERENCE NO. | | |

FREEPORT-McMoRAN COPPER & GOLD INC.

PROJECT LOCATION: TYRONE MINE SITE

PROJECT: INTERIOR SLOPE REGRADE

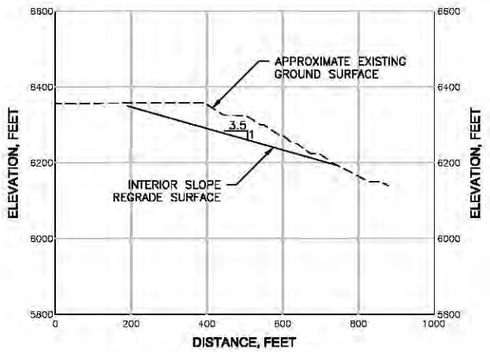
TITLE: CROSS SECTIONS - INTERIOR SLOPE REGRADE FOR PIT WAIVER ANALYSIS

MWH

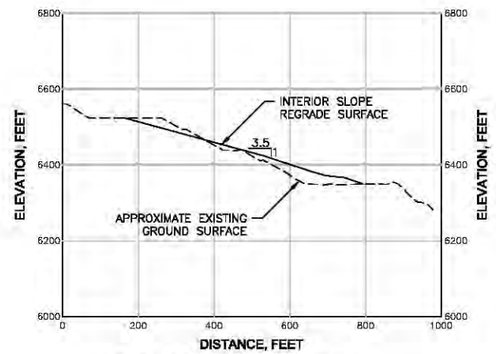
DRAWING: A-2 REVISION: A

FILE NAME: 1008011D008

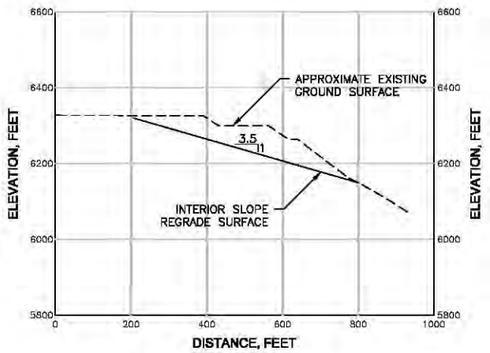
M:\Drafts - A - H\Freeport McMoRan\1008011 - G & K TYRONE BOND\03 - Sheet Set\INTERIOR SLOPES\1008011D008 7/8/2010 11:02:59 AM



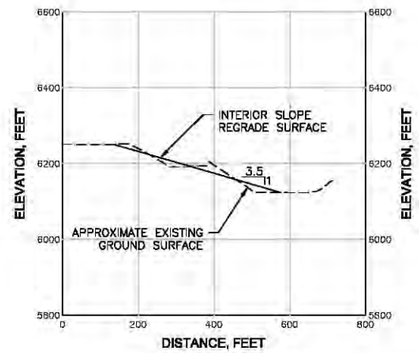

E / A-1 **6B INTERIOR SLOPE**
(LOOKING NORTHWEST)
SCALE 200 0 200 400 FEET



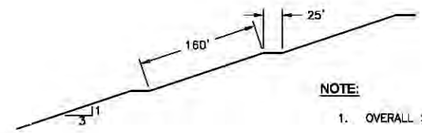

G / A-1 **COPPER MOUNTAIN**
(LOOKING NORTHEAST)
SCALE 200 0 200 400 FEET




F / A-1 **6B INTERIOR SLOPE**
(LOOKING NORTHWEST)
SCALE 200 0 200 400 FEET




H / A-1 **5A INTERIOR SLOPE**
(LOOKING SOUTHEAST)
SCALE 200 0 200 400 FEET




**NOTE:**
1. OVERALL SLOPE 3.5H:1V

**SLOPE CONFIGURATION**
(TYPICAL)
SCALE 100 0 100 200 FEET

| REV | DESCRIPTION | TECH | ENG | DATE |
|---|---|---|---|---|
| A | ISSUED FOR REVIEW | C.C.L. | T.E.L. | 07/10 |



DRAWING REFERENCE(S):

| | | | |
|---|---|---|---|
| DESIGNED BY | T. LEIDICH | 07/08/10 | |
| DRAWN BY | C. LEE | 07/08/10 | |
| CHECKED BY | T. LEIDICH | 07/08/10 | |
| APPROVED BY | | | |
| PROJECT MANAGER | T. LEIDICH | 07/08/10 | |
| CLIENT APPROVAL | | | |
| CLIENT REFERENCE NO. | | | |

FREEPORT-McMoRAN COPPER & GOLD INC.

PROJECT LOCATION: TYRONE MINE SITE
PROJECT: INTERIOR SLOPE REGRADE
TITLE: CROSS SECTIONS - INTERIOR SLOPE REGRADE FOR PIT WAIVER ANALYSIS

MWH

DRAWING: A-3
REVISION: A
FILE NAME: 1008011D010

M:\Climate - A - H\Freeport McMoRan\1008011 - C & K TYRONE BOND\03 - Sheet Set\INTERIOR SLOPES\1008011D010 7/8/2010 11:03:46 AM

# APPENDIX A
## COST CALCULATION SUMMARY

Total Cost Calculation — Tyrone
New Mexico Mining and Minerals Division
***General Information*** — 7/21/2010

| | | |
|---|---|---|
| Applicant | | |
| Disturbed Surface Area (acres) | 618.3 | |
| Type of Operation | Existing/Surface/Copper | |
| **Recommended MMD Bond** | | |
| *Current value before escalation and discounting* | **$47,173,946** | **Interior Reclamation** |

Demo cost are addressed elsewhere.

**This page intentionally left blank.**

| Item | Description | Location 1 | Location 2 | Total Haul/Push Distance (ft) | Grade (%) | Equipment |
|---|---|---|---|---|---|---|
| ***Stockpile Areas*** | | | | | | |
| 1101 | Regrade Outslopes | 1A and 1B Leach | - | 350 | see dozer | D11R |
| 1104 | Regrade Outslopes | 2A Leach | - | 600 | see dozer | D11R |
| 1107 | Regrade Outslopes | 3B sp | - | 400 | see dozer | D11R |
| 1110 | Regrade Outslopes | 4A, 2B, 2C, 7C Leach | - | 500 | see dozer | D11R |
| 1113 | Regrade Outslopes | 5A | - | 325 | see dozer | D11R |
| 1116 | Regrade Outslopes | Copper Mtn | - | 380 | see dozer | D11R |
| 1119 | Regrade Outslopes | 6B, 6C Leach Bench knock down | - | 100 | see dozer | D11R |
| 1137 | Dozer Assist | borrow area 1A and 1B Leach | 1A and 1B Leach Outslope | - | see dozer | D11R |
| 1140 | Dozer Assist | borrow area 2A Leach | 2A Leach Outslope | - | see dozer | D11R |
| 1143 | Dozer Assist | borrow area 3B sp | 3B sp Outslope | - | see dozer | D11R |
| 1145 | Dozer Assist | borrow area 4A, 2B, 2C, 7C Leach | 4A, 2B, 2C, 7C Leach Outslope | - | see dozer | D11R |
| 1148 | Dozer Assist | borrow area 5A | 5A Outslope | - | see dozer | D11R |
| 1150 | Dozer Assist | borrow area Copper Mtn | Copper Mtn Outslope | - | see dozer | D11R |
| 1151 | Dozer Assist | borrow area 6B, 6C Leach | 6B, 6C Leach Outslope | - | see dozer | D11R |
| 1152 | Dozer Assist | 6B, 6C Outslope | 6B, 6C Leach truck/shovel pullback | - | see dozer | D11R |
| 1201 | Load cover soil | borrow area 1A and 1B Leach | 1A and 1B Leach Outslope | | | 992G |
| 1204 | Load cover soil | borrow area 2A Leach | 2A Leach Outslope | | | 992G |
| 1207 | Load cover soil | borrow area 3B sp | 3B sp Outslope | | | 992G |
| 1209 | Load cover soil | borrow area 4A, 2B, 2C, 7C Leach | 4A, 2B, 2C, 7C Leach Outslope | | | 992G |
| 1212 | Load cover soil | borrow area 5A | 5A Outslope | | | 992G |
| 1214 | Load cover soil | borrow area Copper Mtn | Copper Mtn Outslope | | | 992G |
| 1215 | Load cover soil | borrow area 6B, 6C Leach | 6B, 6C Leach Outslope | | | 992G |
| 1216 | Load soil | 6B, 6C Outslope | 6B, 6C Leach truck/shovel pullback | | | EX3500 |
| 1251 | Haul cover soil | borrow area 1A and 1B Leach | 1A and 1B Leach Outslope | 5,400 | see Trucks | 777F |
| 1254 | Haul soil | borrow area 2A Leach | 2A Leach Outslope | 12,600 | see Trucks | 777F |
| 1257 | Haul cover soil | borrow area 3B sp | 3B sp Outslope | 12,900 | see Trucks | 777F |
| 1259 | Haul cover soil | borrow area 4A, 2B, 2C, 7C Leach | 4A, 2B, 2C, 7C Leach Outslope | 8,700 | see Trucks | 777F |
| 1262 | Haul cover soil | borrow area 5A | 5A Outslope | 3,000 | see Trucks | 777F |
| 1264 | Haul cover soil | borrow area Copper Mtn | Copper Mtn Outslope | 14,100 | see Trucks | 777F |
| 1265 | Haul cover soil | borrow area 6B, 6C Leach | 6B, 6C Leach Outslope | 11,300 | see Trucks | 777F |
| 1266 | Haul soil | 6B, 6C Outslope | 6B, 6C Leach truck/shovel pullback | 1,000 | see Trucks | 530M |
| 1601 | Grade cover soil | 1A and 1B Leach Outslope | - | | | D11R |
| 1603 | Grade cover soil | 2A Leach Outslope | - | | | D11R |
| 1605 | Grade cover soil | 3B sp Outslope | - | | | D11R |
| 1606 | Grade cover soil | 4A, 2B, 2C, 7C Leach Outslope | - | | | D11R |
| 1608 | Grade cover soil | 5A Outslope | - | | | D11R |
| 1609 | Grade cover soil | Copper Mtn Outslope | - | | | D11R |
| 1610 | Grade cover soil | 6B, 6C Leach Outslope | - | | | D11R |
| **Other** | | | | | | |
| 1801 | Off-Hwy Water Tanker Truck | | | | | 10,000 gal |
| 1802 | Motor Grader | | | | | 16M |

| Item | Description | Location 1 | Location 2 | Area (ac) | Cover Depth (in) | Bank Volume (bcy) | Swell Factor (%) | Over-size Factor (%) | Loose Volume (lcy) |
|---|---|---|---|---|---|---|---|---|---|
| ***Stockpile Areas*** | | | | | | | | | |
| 1101 | Regrade Outslopes | 1A and 1B Leach | Outslopes | | | 600,000 | 15% | | 690,000 |
| 1104 | Regrade Outslopes | 2A Leach | Outslopes | | | 1,900,000 | 15% | | 2,185,000 |
| 1107 | Regrade Outslopes | 3B sp | Outslopes | | | 600,000 | 15% | | 690,000 |
| 1110 | Regrade Outslopes | 4A, 2B, 2C, 7C Leach | Outslopes | | | 4,300,000 | 15% | | 4,945,000 |
| 1113 | Regrade Outslopes | 5A | Outslopes | | | 400,000 | 15% | | 460,000 |
| 1116 | Regrade Outslopes | Copper Mtn | Outslopes | | | 206,000 | 15% | | 236,900 |
| 1119 | Regrade Outslopes | 6B, 6C Leach Bench knock down | Outslopes | | | 364,736 | 15% | | 419,446 |
| 1140 | Dozer Assist | borrow area 2A Leach | 2A Leach Outslope | | | 546,900 | 15% | | 628,935 |
| 1143 | Dozer Assist | borrow area 3B sp | 3B sp Outslope | | | 304,920 | 15% | | 350,658 |
| 1145 | Dozer Assist | borrow area 4A, 2B, 2C, 7C Leach | 4A, 2B, 2C, 7C Leach Outslope | | | 1,127,700 | 15% | | 1,296,855 |
| 1148 | Dozer Assist | borrow area 5A | 5A Outslope | | | 193,600 | 15% | | 222,640 |
| 1150 | Dozer Assist | borrow area Copper Mtn | Copper Mtn Outslope | | | 209,600 | 15% | | 241,040 |
| 1151 | Dozer Assist | borrow area 6B, 6C Leach | 6B, 6C Leach Outslope | | | 367,800 | 15% | | 422,970 |
| 1152 | Dozer Assist | 6B, 6C Outslope | 6B, 6C Leach truck/shovel pullback | | | 4,060,000 | 15% | | 4,669,000 |
| 1201 | Load cover soil | borrow area 1A and 1B Leach | 1A and 1B Leach Outslope | 50.0 | 36 | 242,000 | 15% | | 278,300 |
| 1204 | Load cover soil | borrow area 2A Leach | 2A Leach Outslope | 113.0 | 36 | 546,900 | 15% | | 628,935 |
| 1207 | Load cover soil | borrow area 3B sp | 3B sp Outslope | 63.0 | 36 | 304,920 | 15% | | 350,658 |
| 1209 | Load cover soil | borrow area 4A, 2B, 2C, 7C Leach | 4A, 2B, 2C, 7C Leach Outslope | 233.0 | 36 | 1,127,700 | 15% | | 1,296,855 |
| 1212 | Load cover soil | borrow area 5A | 5A Outslope | 40.0 | 36 | 193,600 | 15% | | 222,640 |
| 1214 | Load cover soil | borrow area Copper Mtn | Copper Mtn Outslope | 43.3 | 36 | 209,600 | 15% | | 241,040 |
| 1215 | Load cover soil | borrow area 6B, 6C Leach | 6B, 6C Leach Outslope | 76.0 | 36 | 367,800 | 15% | | 422,970 |
| 1216 | Load soil | 6B, 6C Outslope | 6B, 6C Leach truck/shovel pullback | | | 4,060,000 | 15% | | 4,669,000 |
| 1251 | Haul cover soil | borrow area 1A and 1B Leach | 1A and 1B Leach Outslope | | | 242,000 | 15% | | 278,300 |
| 1254 | Haul soil | borrow area 2A Leach | 2A Leach Outslope | | | 546,900 | 15% | | 628,935 |
| 1257 | Haul cover soil | borrow area 3B sp | 3B sp Outslope | | | 304,920 | 15% | | 350,658 |
| 1259 | Haul cover soil | borrow area 4A, 2B, 2C, 7C Leach | 4A, 2B, 2C, 7C Leach Outslope | | | 1,127,700 | 15% | | 1,296,855 |
| 1262 | Haul cover soil | borrow area 5A | 5A Outslope | | | 193,600 | 15% | | 222,640 |
| 1264 | Haul cover soil | borrow area Copper Mtn | Copper Mtn Outslope | | | 209,600 | 15% | | 241,040 |
| 1265 | Haul cover soil | borrow area 6B, 6C Leach | 6B, 6C Leach Outslope | | | 367,800 | 15% | | 422,970 |
| 1266 | Haul soil | 6B, 6C Outslope | 6B, 6C Leach truck/shovel pullback | | | 4,060,000 | 15% | | 4,669,000 |
| 1601 | Grade cover soil | 1A and 1B Leach Outslope | - | | | 242,000 | 15% | | 278,300 |
| 1603 | Grade cover soil | 2A Leach Outslope | - | | | 546,900 | 15% | | 628,935 |
| 1605 | Grade cover soil | 3B sp Outslope | - | | | 304,920 | 15% | | 350,658 |
| 1606 | Grade cover soil | 4A, 2B, 2C, 7C Leach Outslope | - | | | 1,127,700 | 15% | | 1,296,855 |
| 1608 | Grade cover soil | 5A Outslope | - | | | 193,600 | 15% | | 222,640 |
| 1609 | Grade cover soil | Copper Mtn Outslope | - | | | 209,600 | 15% | | 241,040 |
| 1610 | Grade cover soil | 6B, 6C Leach Outslope | - | | | 367,800 | 15% | | 422,970 |

Total Cost Calculation
New Mexico Mining and Minerals Division
***Productivity and Hours Required for Dozer Use---Earthmoving***

Tyrone
Worksheet #5
07/21/10

| Task Description | Location 1 | Location 2 | Equipment | Material Handling Multiplier (cy) | Productivity (cy/hr) | Total Task Time (hours) | PERFORMANCE FACTORS Material | Grade | Soil Weight (lb/cy) | Production Method/ Blade | Maximum Push Distance (feet) | Normal Production (cy/hr) | Operator | Work Hour (min/hr) | Visibility | Elevation | Direct Drive Trans. | Grade (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Stockpile Areas*** | | | | | | | | | | | | | | | | | | |
| Regrade Outslopes | 1A and 1B Leach | Outslopes | D11R | 1,035,000 | 912 | 1,135 | 1.2 | 1.60 | 3,300 | 1.20 | 350 | 909 | 0.75 | 50 | 1.00 | 1.00 | 1.00 | -30 |
| Regrade Outslopes | 2A Leach | Outslopes | D11R | 3,277,500 | 549 | 5,975 | 1.2 | 1.60 | 3,300 | 1.20 | 600 | 547 | 0.75 | 50 | 1.00 | 1.00 | 1.00 | -30 |
| Regrade Outslopes | 3B sp | Outslopes | D11R | 1,035,000 | 804 | 1,287 | 1.2 | 1.60 | 3,300 | 1.20 | 400 | 801 | 0.75 | 50 | 1.00 | 1.00 | 1.00 | -30 |
| Regrade Outslopes | 4A, 2B, 2C, 7C Leach | Outslopes | D11R | 7,417,500 | 651 | 11,386 | 1.2 | 1.60 | 3,300 | 1.20 | 500 | 649 | 0.75 | 50 | 1.00 | 1.00 | 1.00 | -30 |
| Regrade Outslopes | 5A | Outslopes | D11R | 690,000 | 978 | 706 | 1.2 | 1.60 | 3,300 | 1.20 | 325 | 974 | 0.75 | 50 | 1.00 | 1.00 | 1.00 | -30 |
| Regrade Outslopes | Copper Mtn | Outslopes | D11R | 355,350 | 844 | 421 | 1.2 | 1.60 | 3,300 | 1.20 | 380 | 841 | 0.75 | 50 | 1.00 | 1.00 | 1.00 | -30 |
| Regrade Outslopes | 6B, 6C Leach Bench knock down | Outslopes | D11R | 629,170 | 2,973 | 212 | 1.2 | 1.60 | 3,300 | 1.20 | 100 | 2962 | 0.75 | 50 | 1.00 | 1.00 | 1.00 | -30 |
| Dozer Assist | borrow area 1A and 1B Leach | 1A and 1B Leach Outslope | D11R | N/A | N/A | 258 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Dozer Assist | borrow area 2A Leach | 2A Leach Outslope | D11R | N/A | N/A | 584 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Dozer Assist | borrow area 3B sp | 3B sp Outslope | D11R | N/A | N/A | 326 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Dozer Assist | borrow area 4A, 2B, 2C, 7C Leach | 4A, 2B, 2C, 7C Leach Outslope | D11R | N/A | N/A | 1,204 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Dozer Assist | borrow area 5A | 5A Outslope | D11R | N/A | N/A | 207 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Dozer Assist | borrow area Copper Mtn | Copper Mtn Outslope | D11R | N/A | N/A | 224 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Dozer Assist | borrow area 6B, 6C Leach | 6B, 6C Leach Outslope | D11R | N/A | N/A | 393 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Dozer Assist | 6B, 6C Outslope | 6B, 6C Leach truck/shovel pullback | D11R | N/A | N/A | 1,745 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

Total Cost Calculation
New Mexico Mining and Minerals Division
***Productivity and Hours Required for Dozer Use---Grading***

Tyrone
Worksheet #6
07/21/10

| Task Description | Location 1 | Location 2 | Equipment | Volume (cy) | Productivity (cy/hr) | Task Time (hours) | PERFORMANCE FACTORS: Material | Grade | Soil Weight (lb/cy) | Production Method/ Blade | Work Hour (min/hr) | Visibility | Elevation | Direct Drive Trans. | Grade (%) | Operator | Maximum Push Distance (feet) | Normal Production (cy/hr) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Stockpile Areas*** | | | | | | | | | | | | | | | | | | |
| Grade cover soil | 1A and 1B Leach Outslope | - | D11R | 278,300 | 1,759.2 | 158.2 | 1.2 | 1.6 | 2,900 | 1.20 | 50 | 1.00 | 1.00 | 1.00 | -30.0 | 0.75 | 200 | 1540 |
| Grade cover soil | 2A Leach Outslope | - | D11R | 628,935 | 1,759.2 | 357.5 | 1.2 | 1.6 | 2,900 | 1.20 | 50 | 1.00 | 1.00 | 1.00 | -30.0 | 0.75 | 200 | 1540 |
| Grade cover soil | 3B sp Outslope | - | D11R | 350,658 | 1,759.2 | 199.3 | 1.2 | 1.6 | 2,900 | 1.20 | 50 | 1.00 | 1.00 | 1.00 | -30.0 | 0.75 | 200 | 1540 |
| Grade cover soil | 4A, 2B, 2C, 7C Leach Outslope | - | D11R | 1,296,855 | 1,759.2 | 737.2 | 1.2 | 1.6 | 2,900 | 1.20 | 50 | 1.00 | 1.00 | 1.00 | -30.0 | 0.75 | 200 | 1540 |
| Grade cover soil | 5A Outslope | - | D11R | 222,640 | 1,759.2 | 126.6 | 1.2 | 1.6 | 2,900 | 1.20 | 50 | 1.00 | 1.00 | 1.00 | -30.0 | 0.75 | 200 | 1540 |
| Grade cover soil | Copper Mtn Outslope | - | D11R | 241,040 | 1,759.2 | 137.0 | 1.2 | 1.6 | 2,900 | 1.20 | 50 | 1.00 | 1.00 | 1.00 | -30.0 | 0.75 | 200 | 1540 |
| Grade cover soil | 6B, 6C Leach Outslope | - | D11R | 422,970 | 1,759.2 | 240.4 | 1.2 | 1.6 | 2,900 | 1.20 | 50 | 1.00 | 1.00 | 1.00 | -30.0 | 0.75 | 200 | 1540 |

**This page intentionally left blank.**

**This page intentionally left blank.**

Total Cost Calculation
New Mexico Mining and Minerals Division
***Productivity and Hours Required for Truck Use***

Tyrone
Worksheet #9
07/21/10

Truck-Loader Matching

Truck Loading Height (empty), Cat 777D - 14'5" 18.92 feet
Loader Dump Clearance, Cat 992G - 15'3" 33.00 feet
Truck Loading Height (empty), Cat 785C
Loader Dump Clearance, Cat 5230

| Task Description | Location 1 | Location 2 | Equipment | Volume (cy) | Truck Cycle Time (min) | Optimum No. of Trucks | Productivity (cy/hr) | Task Time (hrs) | PERFORMANCE FACTORS Struck Capacity (cy) | Heaped Capacity (cy) | Loader Cycles per Truck | Total Haul Distance (feet) | **Haul Distance Segment 1 (feet) | **Haul Distance Segment 2 (feet) | **Haul Distance Segment 3 (feet) | **Haul Grade Segment 1 (%) | **Haul Grade Segment 2 (%) | **Haul Grade Segment 3 (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Stockpile Areas*** | | | | | | | | | | | | | | | | | | |
| Haul cover soil | borrow area 1A and 1B Leach | 1A and 1B Leach Outslope | 777F | 278,300 | 13.1 | 4 | 1,072 | 260 | 54.8 | 78.8 | 5 | 5,400 | 3,500 | 1,900 | - | 2.0% | 10.0% | - |
| Haul soil | borrow area 2A Leach | 2A Leach Outslope | 777F | 628,935 | 19.3 | 6 | 1,089 | 584 | 54.8 | 78.8 | 5 | 12,600 | 7,000 | 2,500 | 3,100 | 0.00% | 10.0% | 0.00% |
| Haul cover soil | borrow area 3B sp | 3B sp Outslope | 777F | 350,658 | 23.4 | 7 | 1,048 | 335 | 54.8 | 78.8 | 5 | 12,900 | 3,000 | 3,500 | 6,400 | -10.00% | -7.00% | 7.00% |
| Haul cover soil | borrow area 4A, 2B, 2C, 7C Leach | 4A, 2B, 2C, 7C Leach Outslope | 777F | 1,296,855 | 14.8 | 4 | 943 | 1,375 | 54.8 | 78.8 | 5 | 8,700 | 7,000 | 1,700 | - | 0.00% | 10.00% | - |
| Haul cover soil | borrow area 5A | 5A Outslope | 777F | 222,640 | 11.8 | 3 | 889 | 250 | 54.8 | 78.8 | 5 | 3,000 | 3,000 | - | - | 10.00% | - | - |
| Haul cover soil | borrow area Copper Mtn | Copper Mtn Outslope | 777F | 241,040 | 24.1 | 7 | 1,015 | 238 | 54.8 | 78.8 | 5 | 14,100 | 7,000 | 7,100 | - | 0.00% | 7.00% | - |
| Haul cover soil | borrow area 6B, 6C Leach | 6B, 6C Leach Outslope | 777F | 422,970 | 20.0 | 6 | 1,050 | 403 | 54.8 | 78.8 | 5 | 11,300 | 7,000 | 3,800 | 500 | 0.00% | 10.00% | 0.00% |
| Haul soil | 6B, 6C Outslope | 6B, 6C Leach truck/shovel pullback | 530M | 4,669,000 | 6.1 | 3 | 2,385 | 1,958 | 74.0 | 102.0 | 4 | 1,000 | 1,000 | - | - | 10.00% | - | - |

Total Cost Calculation
New Mexico Mining and Minerals Division
***Productivity and Hours Required for Truck Use***

Truck-Loader Matching
Truck Loading Height (empty), Cat 777D - 14'5"
Loader Dump Clearance, Cat 992G - 15'3"
Truck Loading Height (empty), Cat 785C
Loader Dump Clearance, Cat 5230

| Task Description | Location 1 | Location 2 | Rolling Resistance (%) | Haul Distance Segment 1 (meters) | Haul Distance Segment 2 (meters) | Haul Distance Segment 3 (meters) | Haul Effective Grade Segment 1 (%) | Haul Effective Grade Segment 2 (%) | Haul Effective Grade Segment 3 (%) | Return Effective Grade Segment 1 (%) | Return Effective Grade Segment 2 (%) | Return Effective Grade Segment 3 (%) | Haul Time (min) | Return Time (min) | Loading Time (min) | Load/ Maneuver Time (min) | Dump/ Maneuver Time (min) | Work Hour (min/hr) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Stockpile Areas*** | | | | | | | | | | | | | | | | | | |
| Haul cover soil | borrow area 1A and 1B Leach | 1A and 1B Leach Outslope | 4.0% | 1,067 | 579 | 0 | 6% | 14% | 0% | 2% | 0% | 0% | 6.6 | 1.4 | 3.3 | 0.7 | 1.1 | 50 |
| Haul soil | borrow area 2A Leach | 2A Leach Outslope | 4.0% | 2,134 | 762 | 945 | 4% | 14% | 4% | 4% | 0% | 4% | 10.6 | 3.6 | 3.3 | 0.7 | 1.1 | 50 |
| Haul cover soil | borrow area 3B sp | 3B sp Outslope | 4.0% | 914 | 1,067 | 1,951 | 0% | 0% | 11% | 14% | 11% | 0% | 11.9 | 6.5 | 3.3 | 0.7 | 1.1 | 50 |
| Haul cover soil | borrow area 4A, 2B, 2C, 7C Leach | 4A, 2B, 2C, 7C Leach Outslope | 4.0% | 2,134 | 518 | 0 | 4% | 14% | 0% | 4% | 0% | 0% | 7.3 | 2.5 | 3.3 | 0.7 | 1.1 | 50 |
| Haul cover soil | borrow area 5A | 5A Outslope | 4.0% | 914 | 0 | 0 | 14% | 0% | 0% | 0% | 0% | 0% | 5.9 | 0.8 | 3.3 | 0.7 | 1.1 | 50 |
| Haul cover soil | borrow area Copper Mtn | Copper Mtn Outslope | 4.0% | 2,134 | 2,164 | 0 | 4% | 11% | 0% | 4% | 0% | 0% | 15.1 | 4.0 | 3.3 | 0.7 | 1.1 | 50 |
| Haul cover soil | borrow area 6B, 6C Leach | 6B, 6C Leach Outslope | 4.0% | 2,134 | 1,158 | 152 | 4% | 14% | 4% | 4% | 0% | 4% | 11.7 | 3.2 | 3.3 | 0.7 | 1.1 | 50 |
| Haul soil | 6B, 6C Outslope | 6B, 6C Leach truck/shovel pullback | 4.0% | 305 | 0 | 0 | 14% | 0% | 0% | 0% | 0% | 0% | 2.1 | 0.3 | 1.8 | 0.7 | 1.1 | 50 |

Total Cost Calculation
New Mexico Mining and Minerals Division
***Productivity and Hours Required for Truck Use***

Truck-Loader Matching
Truck Loading Height (empty), Cat 777D - 14'5"
Loader Dump Clearance, Cat 992G - 15'3"
Truck Loading Height (empty), Cat 785C
Loader Dump Clearance, Cat 5230

| Task Description | Location 1 | Location 2 | Travel Time Loaded Segment 1 (min/m) | Travel Time Loaded Segment 2 (min/m) | Travel Time Loaded Segment 3 (min/m) | Travel Time Empty Segment 1 (min/m) | Travel Time Empty Segment 2 (min/m) | Travel Time Empty Segment 3 (min/m) |
|---|---|---|---|---|---|---|---|---|
| ***Stockpile Areas*** | | | | | | | | |
| Haul cover soil | borrow area 1A and 1B Leach | 1A and 1B Leach Outslope | 0.00269 | 0.00649 | 0.00090 | 0.00081 | 0.00090 | 0.00090 |
| Haul soil | borrow area 2A Leach | 2A Leach Outslope | 0.00185 | 0.00649 | 0.00185 | 0.00094 | 0.00090 | 0.00094 |
| Haul cover soil | borrow area 3B sp | 3B sp Outslope | 0.00090 | 0.00090 | 0.00516 | 0.00260 | 0.00219 | 0.00090 |
| Haul cover soil | borrow area 4A, 2B, 2C, 7C Leach | 4A, 2B, 2C, 7C Leach Outslope | 0.00185 | 0.00649 | 0.00090 | 0.00094 | 0.00090 | 0.00090 |
| Haul cover soil | borrow area 5A | 5A Outslope | 0.00649 | 0.00090 | 0.00090 | 0.00090 | 0.00090 | 0.00090 |
| Haul cover soil | borrow area Copper Mtn | Copper Mtn Outslope | 0.00185 | 0.00516 | 0.00090 | 0.00094 | 0.00090 | 0.00090 |
| Haul cover soil | borrow area 6B, 6C Leach | 6B, 6C Leach Outslope | 0.00185 | 0.00649 | 0.00185 | 0.00094 | 0.00090 | 0.00094 |
| Haul soil | 6B, 6C Outslope | 6B, 6C Leach truck/shovel pullback | 0.00697 | 0.00110 | 0.00110 | 0.00110 | 0.00110 | 0.00110 |

Total Cost Calculation
New Mexico Mining and Minerals Division
**Productivity for Front End Loader**

Tyrone
Worksheet #10
7/21/2010

| Task Description | Location 1 | Location 2 | Equipment | Volume (cy) | Net Bucket Capacity (cy) | Loader Cycle Time (min) | Productivity (cy/hr) | Task Time (hours) | PERFORMANCE FACTORS Rated Bucket Capacity (cy) | Bucket Fill Factor | Work Hour (min/hr) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Stockpile Areas** | | | | | | | | | | | |
| Load cover soil | borrow area 1A and 1B L | 1A and 1B Leach Outslope | 992G | 278,300 | 14.0 | 0.65 | 1,077 | 258 | 16.00 | 0.875 | 50 |
| Load cover soil | borrow area 2A Leach | 2A Leach Outslope | 992G | 628,935 | 14.0 | 0.65 | 1,077 | 584 | 16.00 | 0.875 | 50 |
| Load cover soil | borrow area 3B sp | 3B sp Outslope | 992G | 350,658 | 14.0 | 0.65 | 1,077 | 326 | 16.00 | 0.875 | 50 |
| Load cover soil | borrow area 4A, 2B, 2C, 7 | 4A, 2B, 2C, 7C Leach Outslope | 992G | 1,296,855 | 14.0 | 0.65 | 1,077 | 1,204 | 16.00 | 0.875 | 50 |
| Load cover soil | borrow area 5A | 5A Outslope | 992G | 222,640 | 14.0 | 0.65 | 1,077 | 207 | 16.00 | 0.875 | 50 |
| Load cover soil | borrow area Copper Mtn | Copper Mtn Outslope | 992G | 241,040 | 14.0 | 0.65 | 1,077 | 224 | 16.00 | 0.875 | 50 |
| Load cover soil | borrow area 6B, 6C Leac | 6B, 6C Leach Outslope | 992G | 422,970 | 14.0 | 0.65 | 1,077 | 393 | 16.00 | 0.875 | 50 |
| Load soil | 6B, 6C Outslope | 6B, 6C Leach truck/shovel pullba | EX3500 | 4,669,000 | 24.1 | 0.45 | 2,676 | 1,745 | 23.50 | 1.025 | 50 |

**This page intentionally left blank.**

# This page intentionally left blank.

| Equipment Type | Task | Location 1 | Location 2 | Owning and Operating Cost ($/hr) | Labor Cost ($/hr) | Number of Units (Equipment) | Time Req'd (hrs) | Total Cost ($) | Total Production | Prod. Unit | Unit Cost ($/unit) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Stockpile Areas*** | | | | | | | | | | | |
| **Dozers-Earthmoving** | | | | | | | | | | | |
| D11R | Regrade Outslopes | 1A and 1B Leach | Outslopes | 413.67 | 33.81 | 1 | 1,135 | 507,854 | 600,000 | cy | 0.85 |
| D11R | Regrade Outslopes | 2A Leach | Outslopes | 413.67 | 33.81 | 1 | 5,975 | 2,673,798 | 1,900,000 | cy | 1.41 |
| D11R | Regrade Outslopes | 3B sp | Outslopes | 413.67 | 33.81 | 1 | 1,287 | 576,019 | 600,000 | cy | 0.96 |
| D11R | Regrade Outslopes | 4A, 2B, 2C, 7C Leach | Outslopes | 413.67 | 33.81 | 1 | 11,386 | 5,095,182 | 4,300,000 | cy | 1.18 |
| D11R | Regrade Outslopes | 5A | Outslopes | 413.67 | 33.81 | 1 | 706 | 315,712 | 400,000 | cy | 0.79 |
| D11R | Regrade Outslopes | Copper Mtn | Outslopes | 413.67 | 33.81 | 1 | 421 | 188,426 | 206,000 | cy | 0.91 |
| D11R | Regrade Outslopes | 6B, 6C Leach Bench knock down | Outslopes | 413.67 | 33.81 | 1 | 212 | 94,711 | 364,736 | cy | 0.26 |
| D11R | Dozer Assist | borrow area 1A and 1B Leach | 1A and 1B Leach Outslope | 413.67 | 33.81 | 1 | 258 | 115,639 | 242,000 | cy | 0.48 |
| D11R | Dozer Assist | borrow area 2A Leach | 2A Leach Outslope | 413.67 | 33.81 | 1 | 584 | 261,334 | 546,900 | cy | 0.48 |
| D11R | Dozer Assist | borrow area 3B sp | 3B sp Outslope | 413.67 | 33.81 | 1 | 326 | 145,705 | 304,920 | cy | 0.48 |
| D11R | Dozer Assist | borrow area 4A, 2B, 2C, 7C Leach | 4A, 2B, 2C, 7C Leach Outslope | 413.67 | 33.81 | 1 | 1,204 | 538,867 | 1,127,700 | cy | 0.48 |
| D11R | Dozer Assist | borrow area 5A | 5A Outslope | 413.67 | 33.81 | 1 | 207 | 92,511 | 193,600 | cy | 0.48 |
| D11R | Dozer Assist | borrow area Copper Mtn | Copper Mtn Outslope | 413.67 | 33.81 | 1 | 224 | 100,157 | 209,600 | cy | 0.48 |
| D11R | Dozer Assist | borrow area 6B, 6C Leach | 6B, 6C Leach Outslope | 413.67 | 33.81 | 1 | 393 | 175,752 | 367,800 | cy | 0.48 |
| D11R | Dozer Assist | 6B, 6C Outslope | 6B, 6C Leach truck/shovel pullback | 413.67 | 33.81 | 2 | 1,745 | 1,561,277 | 4,060,000 | cy | 0.38 |
| **Dozers-Grading** | | | | | | | | | | | |
| D11R | Grade cover soil | 1A and 1B Leach Outslope | - | 413.67 | 33.81 | 1 | 158.2 | 70,788 | 278,300.0 | cy | 0.25 |
| D11R | Grade cover soil | 2A Leach Outslope | - | 413.67 | 33.81 | 1 | 357.5 | 159,976 | 628,935.2 | cy | 0.25 |
| D11R | Grade cover soil | 3B sp Outslope | - | 413.67 | 33.81 | 1 | 199.3 | 89,193 | 350,658.0 | cy | 0.25 |
| D11R | Grade cover soil | 4A, 2B, 2C, 7C Leach Outslope | - | 413.67 | 33.81 | 1 | 737.2 | 329,868 | 1,296,854.6 | cy | 0.25 |
| D11R | Grade cover soil | 5A Outslope | - | 413.67 | 33.81 | 1 | 126.6 | 56,631 | 222,640.0 | cy | 0.25 |
| D11R | Grade cover soil | Copper Mtn Outslope | - | 413.67 | 33.81 | 1 | 137.0 | 61,311 | 241,040.1 | cy | 0.25 |
| D11R | Grade cover soil | 6B, 6C Leach Outslope | - | 413.67 | 33.81 | 1 | 240.4 | 107,587 | 422,970.4 | cy | 0.25 |
| **Loaders** | | | | | | | | | | | |
| 992G | Load cover soil | borrow area 1A and 1B Leach | 1A and 1B Leach Outslope | 345.66 | 33.96 | 1 | 260 | 98,588 | 278,300 | cy | 0.35 |
| 992G | Load cover soil | borrow area 2A Leach | 2A Leach Outslope | 345.66 | 33.96 | 1 | 584 | 221,703 | 628,935 | cy | 0.35 |
| 992G | Load cover soil | borrow area 3B sp | 3B sp Outslope | 345.66 | 33.96 | 1 | 335 | 126,996 | 350,658 | cy | 0.36 |
| 992G | Load cover soil | borrow area 4A, 2B, 2C, 7C Leach | 4A, 2B, 2C, 7C Leach Outslope | 345.66 | 33.96 | 1 | 1,375 | 522,009 | 1,296,855 | cy | 0.40 |
| 992G | Load cover soil | borrow area 5A | 5A Outslope | 345.66 | 33.96 | 1 | 250 | 95,025 | 222,640 | cy | 0.43 |
| 992G | Load cover soil | borrow area Copper Mtn | Copper Mtn Outslope | 345.66 | 33.96 | 1 | 238 | 90,162 | 241,040 | cy | 0.37 |
| 992G | Load cover soil | borrow area 6B, 6C Leach | 6B, 6C Leach Outslope | 345.66 | 33.96 | 1 | 403 | 152,917 | 422,970 | cy | 0.36 |
| EX3500 | Load soil | 6B, 6C Outslope | 6B, 6C Leach truck/shovel pullback | 774.19 | 33.96 | 1 | 1,958 | 1,582,367 | 4,669,000 | cy | 0.34 |
| **Trucks** | | | | | | | | | | | |
| 777F | Haul cover soil | borrow area 1A and 1B Leach | 1A and 1B Leach Outslope | 282.72 | 24.65 | 4 | 1,039 | 319,299 | 278,300 | cy | 1.15 |
| 777F | Haul soil | borrow area 2A Leach | 2A Leach Outslope | 282.72 | 24.65 | 6 | 3,504 | 1,077,058 | 628,935 | cy | 1.71 |
| 777F | Haul cover soil | borrow area 3B sp | 3B sp Outslope | 282.72 | 24.65 | 7 | 2,342 | 719,787 | 350,658 | cy | 2.05 |
| 777F | Haul cover soil | borrow area 4A, 2B, 2C, 7C Leach | 4A, 2B, 2C, 7C Leach Outslope | 282.72 | 24.65 | 4 | 5,500 | 1,690,647 | 1,296,855 | cy | 1.30 |
| 777F | Haul cover soil | borrow area 5A | 5A Outslope | 282.72 | 24.65 | 3 | 751 | 230,821 | 222,640 | cy | 1.04 |
| 777F | Haul cover soil | borrow area Copper Mtn | Copper Mtn Outslope | 282.72 | 24.65 | 7 | 1,663 | 511,021 | 241,040 | cy | 2.12 |
| 777F | Haul cover soil | borrow area 6B, 6C Leach | 6B, 6C Leach Outslope | 282.72 | 24.65 | 6 | 2,417 | 742,886 | 422,970 | cy | 1.76 |
| 530M | Haul soil | 6B, 6C Outslope | 6B, 6C Leach truck/shovel pullback | 311.95 | 24.65 | 3 | 5,874 | 1,977,186 | 4,669,000 | cy | 0.42 |
| **Water Truck and Grader** | | | | | | | | | | | |
| Off-Hwy Water Tanker Truck | | 1A and 1B Leach Outslope | | 160.04 | 24.65 | - | 260 | 47,965 | | | --- |
| Off-Hwy Water Tanker Truck | | 2A Leach Outslope | | 160.04 | 24.65 | - | 584 | 107,863 | | | |
| Off-Hwy Water Tanker Truck | | 3B sp Outslope | | 160.04 | 24.65 | - | 335 | 61,786 | | | |
| Off-Hwy Water Tanker Truck | | 4A, 2B, 2C, 7C Leach Outslope | | 160.04 | 24.65 | - | 1,375 | 253,968 | | | |
| Off-Hwy Water Tanker Truck | | 5A Outslope | | 160.04 | 24.65 | - | 250 | 46,232 | | | |
| Off-Hwy Water Tanker Truck | | Copper Mtn Outslope | | 160.04 | 24.65 | - | 238 | 43,866 | | | |
| Off-Hwy Water Tanker Truck | | 6B, 6C Leach Outslope | | 160.04 | 24.65 | - | 403 | 74,397 | | | |
| Off-Hwy Water Tanker Truck | | 6B, 6C Leach truck/shovel pullback | | 160.04 | 24.65 | - | 1,958 | 361,633 | | | |
| Motor Grader | | 1A and 1B Leach Outslope | | 148.02 | 33.81 | - | 259.7 | 47,222 | | | |
| Motor Grader | | 2A Leach Outslope | | 148.02 | 33.81 | - | 584.0 | 106,192 | | | |
| Motor Grader | | 3B sp Outslope | | 148.02 | 33.81 | - | 334.5 | 60,829 | | | |
| Motor Grader | | 4A, 2B, 2C, 7C Leach Outslope | | 148.02 | 33.81 | - | 1,375.1 | 250,033 | | | |
| Motor Grader | | 5A Outslope | | 148.02 | 33.81 | - | 250.3 | 45,515 | | | |
| Motor Grader | | Copper Mtn Outslope | | 148.02 | 33.81 | - | 237.5 | 43,186 | | | |
| Motor Grader | | 6B, 6C Leach Outslope | | 148.02 | 33.81 | - | 402.8 | 73,244 | | | |
| Motor Grader | | 6B, 6C Leach truck/shovel pullback | | 148.02 | 33.81 | - | 1,958.0 | 356,030 | | | |

| | | |
|---|---|---|
| 1A and 1B Leach Outslope | | 1,207,355 |
| 2A Leach Outslope | | 4,607,925 |
| 3B sp Outslope | | 1,780,316 |
| 4A, 2B, 2C, 7C Leach Outslope | | 8,680,574 |
| 5A Outslope | | 882,447 |
| Copper Mtn Outslope | | 1,038,129 |
| 6B, 6C Leach Outslope | | 1,326,783 |
| 6B, 6C Leach truck/shovel pullback | | 5,838,493 |
| 6B, 6C Leach Bench knock down | | 94,711 |
| **Total Cost** | | **$25,456,734** |
| Q/A Check -> | $ | 25,456,734 |

| **EQUIPMENT** Equipment Description | Fuel Consumption (gal/hr) | Fuel Cost ($/hr) | Owning and Operating Cost (w/out fuel) ($/hr) | Fuel-Adjusted Own/Op Cost ($/hr) | | Reference |
|---|---|---|---|---|---|---|
| Cat D11R Bulldozer w/universal blade | 29.75 | $74.05 | $339.62 | $413.67 | | 1 |
| Cat D9R Bulldozer w/semi universal blade | 14.35 | $35.72 | $140.43 | $176.15 | | 1 |
| Cat D6R Series II Bulldozer | 6.44 | $16.02 | $54.27 | $70.29 | | 1 |
| Cat 777F Truck | 18.76 | $46.69 | $236.03 | $282.72 | | 1 |
| Cat 992G Loader | 25.31 | $63.00 | $282.66 | $345.66 | $447.48 | 1 |
| Cat 16M Motor Grader | 9.51 | $23.66 | $124.36 | $148.02 | $209.96 | 1 |
| Off-Hwy Water Tanker Truck, 10,000-gal. | 15.35 | $38.19 | $121.85 | $160.04 | $104.10 | 1 |
| Komatsu 530M | 27.54 | $68.55 | $243.40 | $311.95 | | 1 |
| Hitachi EX3500-3 | 71.90 | $178.95 | $595.24 | $774.19 | | 1 |

1. Equipment Watch Version 4.0.4A (http://www.equipmentwatch.com). See attachments for rate development.

**FUEL**

| | | |
|---|---|---|
| Oil Broker Quote | $2.5 per gallon | 2 |

2. Porter Oil, Bayard, NM (January 14, 2010).

**LABOR**

| Labor Description | NMDOL Type A Operator Group | NMDOL Type A Operator Classification | Nominal Total Rate ($/hr) | |
|---|---|---|---|---|
| Cat D11R Bulldozer w/universal blade | Equipment Operator IV | Bulldozer (mult. Units) | 33.814 | 3 |
| Cat D9R Bulldozer w/semi universal blade | Equipment Operator IV | Bulldozer (mult. Units) | 33.814 | 3 |
| Cat D6R Series II Bulldozer | Equipment Operator IV | Bulldozer (mult. Units) | 33.814 | 3 |
| Haul Truck | Equipment Operator III | Teamster | 24.65 | 3 |
| Loader | Equipment Operator VI | Loader (over 10 cy) | 33.962 | 3 |
| Cat 16H Motor Grader | Equipment Operator IV | Motor Grader | 33.814 | 3 |
| Off-Hwy Water Tanker Truck, 10,000-gal. | Equipment Operator III | Teamster | 24.65 | 3 |
| Light Duty Truck, 4x4, 1 ton, 195 HP (Mechanic) | Equipment Operator VI | Mechanic | $33.10 | 3 |

3. Labor rates based on NM Department of Labor Type H (Heavy Engineering) labor rates. See attachments for rate development.

Data Sources:

Equipment Watch
https:www.equipmentwatch.com

Total Cost Calculation — Tyrone
New Mexico Mining and Minerals Division — 7 Worksheet #14
***Revegetation Costs*** — 07/21/10

**Description:**

Plow; apply fertilizer, seed mix, and mulch; and crimp mulch

| Unit or Disturbance | (acres) | Unit Cost ($/acre) | Subtotal Cost ($) | Area Reference |
|---|---|---|---|---|
| ***Stockpile Areas*** | | | | |
| 1A and 1B Leach Outslope | 50 | 1,112.50 | 55,625 | Rocky Mountain Reclamation, Larmie WY (January, 2010). Quote includes cost for scarifying (ripping) surface. |
| 2A Leach Outslope | 113 | 1,112.50 | 125,708 | Rocky Mountain Reclamation, Larmie WY (January, 2010). Quote includes cost for scarifying (ripping) surface. |
| 3B sp Outslope | 63 | 1,112.50 | 70,088 | Rocky Mountain Reclamation, Larmie WY (January, 2010). Quote includes cost for scarifying (ripping) surface. |
| 4A, 2B, 2C, 7C Leach Outslope | 233 | 1,112.50 | 259,208 | Rocky Mountain Reclamation, Larmie WY (January, 2010). Quote includes cost for scarifying (ripping) surface. |
| 5A Outslope | 40.0 | 1,112.50 | 44,500 | Rocky Mountain Reclamation, Larmie WY (January, 2010). Quote includes cost for scarifying (ripping) surface. |
| Copper Mtn Outslope | 43.3 | 1,112.50 | 48,178 | Rocky Mountain Reclamation, Larmie WY (January, 2010). Quote includes cost for scarifying (ripping) surface. |
| 6B, 6C Leach Outslope | 76.0 | 1,112.50 | 84,541 | Rocky Mountain Reclamation, Larmie WY (January, 2010). Quote includes cost for scarifying (ripping) surface. |

| | |
|---|---|
| 1A and 1B Leach Outslope | 55,625 |
| 2A Leach Outslope | 125,708 |
| 3B sp Outslope | 70,088 |
| 4A, 2B, 2C, 7C Leach Outslope | 259,208 |
| 5A Outslope | 44,500 |
| Copper Mtn Outslope | 48,178 |
| 6B, 6C Leach Outslope | 84,541 |
| **Total Cost** | **$687,847** |
| Q/A check-> | $687,847 |

Total Cost Calculation — Tyrone
New Mexico Mining and Minerals Division — Worksheet #15
***Other Reclamation Activity Costs*** — 07/21/10

| ***Stockpiles Area*** | Activity | Quantity | Unit | Unit Cost ($/unit) | Current Item Cost ($) | Reference | Means Line Item | Means Pa | Description |
|---|---|---|---|---|---|---|---|---|---|
| **Spillways** | | | | | | | | | |
| 1A and 1B Leach Outslope | Spillway Grading | 400 | ft | 7.53 | 3,012 | Estimate | | | See Note 3 for unit cost |
| 2A Leach Outslope | Spillway Grading | 1,500 | ft | 7.53 | 11,295 | Estimate | | | See Note 3 for unit cost |
| 4A, 2B, 2C, 7C Leach Outslope | Spillway Grading | 2,900 | ft | 7.53 | 21,837 | Estimate | | | See Note 3 for unit cost |
| 5A Outslope | Spillway Grading | 200 | ft | 7.53 | 1,506 | Estimate | | | See Note 3 for unit cost |
| Copper Mtn Outslope | Spillway Grading | 410 | ft | 7.53 | 3,087 | Estimate | | | See Note 3 for unit cost |
| 6B, 6C Leach Outslope | Spillway Grading | 1,000 | ft | 7.53 | 7,530 | Estimate | | | See Note 3 for unit cost |
| 1A and 1B Leach Outslope | Spillway Riprap and Gravel (Processed), Haul | 1,900 | cy | 7.84 | 14,897 | Means | G1030 150 7600 | 441 | Load & Haul rock, 5-cy loader, 12 20-cy trailers, 3-mile RT |
| 2A Leach Outslope | Spillway Riprap and Gravel (Processed), Haul | 7,200 | cy | 7.84 | 56,453 | Means | G1030 150 7600 | 441 | Load & Haul rock, 5-cy loader, 12 20-cy trailers, 3-mile RT |
| 4A, 2B, 2C, 7C Leach Outslope | Spillway Riprap and Gravel (Processed), Haul | 13,900 | cy | 7.84 | 108,985 | Means | G1030 150 7600 | 441 | Load & Haul rock, 5-cy loader, 12 20-cy trailers, 3-mile RT |
| 5A Outslope | Spillway Riprap and Gravel (Processed), Haul | 900 | cy | 7.84 | 7,057 | Means | G1030 150 7600 | 441 | Load & Haul rock, 5-cy loader, 12 20-cy trailers, 3-mile RT |
| Copper Mtn Outslope | Spillway Riprap and Gravel (Processed), Haul | 2,000 | cy | 7.84 | 15,681 | Means | G1030 150 7600 | 441 | Load & Haul rock, 5-cy loader, 12 20-cy trailers, 3-mile RT |
| 6B, 6C Leach Outslope | Spillway Riprap and Gravel (Processed), Haul | 4,800 | cy | 7.84 | 37,635 | Means | G1030 150 7600 | 441 | Load & Haul rock, 5-cy loader, 12 20-cy trailers, 3-mile RT |
| 1A and 1B Leach Outslope | Spillway Riprap and Gravel (processed), Backfill | 1,900 | cy | 1.22 | 2,316 | Means | 312323.14 5200 | 227, 251 | Gravel backfill…see note 2 for full description |
| 2A Leach Outslope | Spillway Riprap and Gravel (processed), Backfill | 7,200 | cy | 1.22 | 8,778 | Means | 312323.23 5040 | 227, 251 | Gravel backfill…see note 2 for full description |
| 4A, 2B, 2C, 7C Leach Outslope | Spillway Riprap and Gravel (processed), Backfill | 13,900 | cy | 1.22 | 16,945 | Means | 312323.23 5040 | 227, 251 | Gravel backfill…see note 2 for full description |
| 5A Outslope | Spillway Riprap and Gravel (processed), Backfill | 900 | cy | 1.22 | 1,097 | Means | 312323.23 5040 | 227, 251 | Gravel backfill…see note 2 for full description |
| Copper Mtn Outslope | Spillway Riprap and Gravel (processed), Backfill | 2,000 | cy | 1.22 | 2,438 | Means | 312323.14 5200 | 227, 251 | Gravel backfill…see note 2 for full description |
| 6B, 6C Leach Outslope | Spillway Riprap and Gravel (processed), Backfill | 4,800 | cy | 1.22 | 5,852 | Means | 312323.23 5040 | 227, 251 | Gravel backfill…see note 2 for full description |
| 1A and 1B Leach Outslope | Bench Grading | 11,800 | ft | 1.44 | 16,992 | See Note 4 | | | Grading benches 15 ft wide, 4.22 cy cut-to-fill/ft of bench |
| 2A Leach Outslope | Bench Grading | 24,000 | ft | 1.44 | 34,560 | See Note 4 | | | Grading benches 15 ft wide, 4.22 cy cut-to-fill/ft of bench |
| 3B sp Outslope | Bench Grading | 10,800 | ft | 1.44 | 15,552 | See Note 4 | | | Grading benches 15 ft wide, 4.22 cy cut-to-fill/ft of bench |
| 4A, 2B, 2C, 7C Leach Outslope | Bench Grading | 41,800 | ft | 1.44 | 60,192 | See Note 4 | | | Grading benches 15 ft wide, 4.22 cy cut-to-fill/ft of bench |
| 5A Outslope | Bench Grading | 6,000 | ft | 1.44 | 8,640 | See Note 4 | | | Grading benches 15 ft wide, 4.22 cy cut-to-fill/ft of bench |
| Copper Mtn Outslope | Bench Grading | 4,460 | ft | 1.44 | 6,422 | See Note 4 | | | Grading benches 15 ft wide, 4.22 cy cut-to-fill/ft of bench |
| 6B, 6C Leach Outslope | Bench Grading | 13,200 | ft | 1.44 | 19,008 | See Note 4 | | | Grading benches 15 ft wide, 4.22 cy cut-to-fill/ft of bench |
| **Channel Excavation** | | | | | | | | | |
| 1A and 1B Leach Outslope | Outslope Terrace Channels | 11,800 | feet | 1.58 | 18,644 | | | | Excavation…see note 1 for full description |
| 2A Leach Outslope | Outslope Terrace Channels | 24,000 | feet | 1.58 | 37,920 | | | | Excavation…see note 1 for full description |
| 3B sp Outslope | Outslope Terrace Channels | 10,800 | feet | 1.58 | 17,064 | | | | Excavation…see note 1 for full description |
| 4A, 2B, 2C, 7C Leach Outslope | Outslope Terrace Channels | 41,800 | feet | 1.58 | 66,044 | | | | Excavation…see note 1 for full description |
| 5A Outslope | Outslope Terrace Channels | 6,000 | feet | 1.58 | 9,480 | | | | Excavation…see note 1 for full description |
| Copper Mtn Outslope | Outslope Terrace Channels | 4,460 | feet | 1.58 | 7,047 | | | | Excavation…see note 1 for full description |
| 6B, 6C Leach Outslope | Outslope Terrace Channels | 13,200 | feet | 1.58 | 20,856 | | | | Excavation…see note 1 for full description |
| 3B sp Outslope | Top Channels | 4,200 | feet | 8.59 | 36,078 | | | | Excavation…see note 1 for full description |
| 4A, 2B, 2C, 7C Leach Outslope | Top Channels | 2,800 | feet | 8.59 | 24,052 | | | | Excavation…see note 1 for full description |
| **Riprap & Gravel** | | | | | | | | | |
| 1A and 1B Leach Outslope | Outslope Channel Gravel, Haul | 4,700 | cy | 7.84 | 36,851 | Means | G1030 150 7600 | 441 | Load & Haul rock, 5-cy loader, 12 20-cy trailers, 3-mile RT |
| 2A Leach Outslope | Outslope Channel Gravel, Haul | 9,600 | cy | 7.84 | 75,270 | Means | G1030 150 7600 | 441 | Load & Haul rock, 5-cy loader, 12 20-cy trailers, 3-mile RT |
| 3B sp Outslope | Outslope Channel Gravel, Haul | 4,300 | cy | 7.84 | 33,715 | Means | G1030 150 7600 | 441 | Load & Haul rock, 5-cy loader, 12 20-cy trailers, 3-mile RT |
| 4A, 2B, 2C, 7C Leach Outslope | Outslope Channel Gravel, Haul | 16,700 | cy | 7.84 | 130,939 | Means | G1030 150 7600 | 441 | Load & Haul rock, 5-cy loader, 12 20-cy trailers, 3-mile RT |
| 5A Outslope | Outslope Channel Gravel, Haul | 2,400 | cy | 7.84 | 18,818 | Means | G1030 150 7600 | 441 | Load & Haul rock, 5-cy loader, 12 20-cy trailers, 3-mile RT |
| Copper Mtn Outslope | Outslope Channel Gravel, Haul | 1,800 | cy | 7.84 | 14,113 | Means | G1030 150 7600 | 441 | Load & Haul rock, 5-cy loader, 12 20-cy trailers, 3-mile RT |
| 6B, 6C Leach Outslope | Outslope Channel Gravel, Haul | 5,300 | cy | 7.84 | 41,555 | Means | G1030 150 7600 | 441 | Load & Haul rock, 5-cy loader, 12 20-cy trailers, 3-mile RT |
| 3B sp Outslope | Top Channel Riprap (processed), Haul | 6,200 | cy | 7.84 | 48,612 | Means | G1030 150 7600 | 441 | Load & Haul rock, 5-cy loader, 12 20-cy trailers, 3-mile RT |
| 4A, 2B, 2C, 7C Leach Outslope | Top Channel Riprap (processed), Haul | 4,100 | cy | 7.84 | 32,147 | Means | G1030 150 7600 | 441 | Load & Haul rock, 5-cy loader, 12 20-cy trailers, 3-mile RT |
| 3B sp Outslope | Top Channel Gravel, Haul | 3,200 | cy | 7.84 | 25,090 | Means | G1030 150 7600 | 441 | Load & Haul rock, 5-cy loader, 12 20-cy trailers, 3-mile RT |
| 4A, 2B, 2C, 7C Leach Outslope | Top Channel Gravel, Haul | 2,100 | cy | 7.84 | 16,465 | Means | G1030 150 7600 | 441 | Load & Haul rock, 5-cy loader, 12 20-cy trailers, 3-mile RT |
| 1A and 1B Leach Outslope | Outslope Channel Gravel, Backfill | 4,700 | cy | 1.22 | 5,730 | Means | 312323.14 5200 | 227, 251 | Gravel backfill…see note 2 for full description |
| 2A Leach Outslope | Outslope Channel Gravel, Backfill | 9,600 | cy | 1.22 | 11,703 | Means | 312323.23 5040 | 227, 251 | Gravel backfill…see note 2 for full description |
| 3B sp Outslope | Outslope Channel Gravel, Backfill | 4,300 | cy | 1.22 | 5,242 | Means | 312323.23 5040 | 227, 251 | Gravel backfill…see note 2 for full description |
| 4A, 2B, 2C, 7C Leach Outslope | Outslope Channel Gravel, Backfill | 16,700 | cy | 1.22 | 20,359 | Means | 312323.23 5040 | 227, 251 | Gravel backfill…see note 2 for full description |
| 5A Outslope | Outslope Channel Gravel, Backfill | 2,400 | cy | 1.22 | 2,926 | Means | 312323.23 5040 | 227, 251 | Gravel backfill…see note 2 for full description |
| Copper Mtn Outslope | Outslope Channel Gravel, Backfill | 1,800 | cy | 1.22 | 2,194 | Means | 312323.23 5040 | 227, 251 | Gravel backfill…see note 2 for full description |
| 6B, 6C Leach Outslope | Outslope Channel Gravel, Backfill | 5,300 | cy | 1.22 | 6,461 | Means | 312323.23 5040 | 227, 251 | Gravel backfill…see note 2 for full description |
| 3B sp Outslope | Top Channel Riprap, (processed) Backfill | 6,200 | cy | 1.22 | 7,558 | Means | 312323.23 5040 | 227, 251 | Gravel backfill…see note 2 for full description |
| 4A, 2B, 2C, 7C Leach Outslope | Top Channel Riprap, (processed) Backfill | 4,100 | cy | 1.22 | 4,998 | Means | 312323.23 5040 | 227, 251 | Gravel backfill…see note 2 for full description |
| 3B sp Outslope | Top Channel Gravel, Backfill | 3,200 | cy | 1.22 | 3,901 | Means | 312323.23 5040 | 227, 251 | Gravel backfill…see note 2 for full description |
| 4A, 2B, 2C, 7C Leach Outslope | Top Channel Gravel, Backfill | 2,100 | cy | 1.22 | 2,560 | Means | 312323.23 5040 | 227, 251 | Gravel backfill…see note 2 for full description |
| 1A and 1B Leach Outslope | Riprap production (processed) | 6,600 | cy | 15.98 | 105,468 | 2007 August Production - McCain Springs Quarry, escalated to 2009 costs. | | | |
| 2A Leach Outslope | Riprap production (processed) | 16,800 | cy | 15.98 | 268,464 | 2007 August Production - McCain Springs Quarry, escalated to 2009 costs. | | | |
| 3B sp Outslope | Riprap production (processed) | 13,700 | cy | 15.98 | 218,926 | 2007 August Production - McCain Springs Quarry, escalated to 2009 costs. | | | |
| 4A, 2B, 2C, 7C Leach Outslope | Riprap production (processed) | 36,800 | cy | 15.98 | 588,064 | 2007 August Production - McCain Springs Quarry, escalated to 2009 costs. | | | |
| 5A Outslope | Riprap production (processed) | 3,300 | cy | 15.98 | 52,734 | 2007 August Production - McCain Springs Quarry, escalated to 2009 costs. | | | |
| Copper Mtn Outslope | Riprap production (processed) | 3,800 | cy | 15.98 | 60,724 | 2007 August Production - McCain Springs Quarry, escalated to 2009 costs. | | | |
| 6B, 6C Leach Outslope | Riprap production (processed) | 10,100 | cy | 15.98 | 161,398 | 2007 August Production - McCain Springs Quarry, escalated to 2009 costs. | | | |

| | |
|---|---|
| 1A and 1B Leach Outslope | 203,910 |
| 2A Leach Outslope | 504,443 |
| 3B sp Outslope | 411,739 |
| 4A, 2B, 2C, 7C Leach Outslo | 1,093,588 |
| 5A Outslope | 102,257 |
| Copper Mtn Outslope | 111,708 |
| 6B, 6C Leach Outslope | 300,295 |
| **Total** | **$2,727,940** |
| Q/A check-> | $2,727,940 |

Description Notes:

1) Excavate and waste material with D11R, 175-foot excavation, 200-foot lateral waste push. Finish grade with D6R, 175-foot typical push distance, unit volume per LF. Uses dozer sheet adjustment factors.
2) Gravel Backfill, 300 hp dozer & compactors, 150' haul, 6" lifts, 4 passes
3) Excavate and waste material on slopes with D11R, 175-foot downslope excavation, 200-foot lateral waste push. Finish grade with D6R, 175-foot typical push distance, unit volume per LF. Uses dozer sheet adjustment factors.
4) Excavate and waste material on slopes with D11R, 175 ft downslope excavation. Finish grade benches using D9R. Three passes per bench, 1 MPH operating speed.
5) D7R LGP, 198.2 cy/lf of material, 200-foot push. Uses dozer sheet adjustment factors.

Data Sources: RS Means Heavy Construction Cost Data (24th Annual Edition 2010)

Location adjustment: New Mexico 880 Las Cruces 83.5%

## *Tyrone Mine Interior Reclamation*

| | | | Current Value |
|---|---|---|---|
| | Facility and Structure Removal[1] | | $0 |
| | Earthmoving | | $25,456,734 |
| Task Description | Revegetation | 160% | $1,100,555 |
| | Other | | $2,727,940 |
| | **Subtotal, Direct Costs** | | **$29,285,229** |
| **OPERATIONS AND MAINTENANCE** | Includes: Road Maintenance, Wildlife Monitoring and Erosion Control | 15.39% | **$4,506,997** |
| **INDIRECT COSTS** | Mobilization and Demobilization (0%-10%) | 1.1% | $371,714 |
| | Contingencies (3%-5%) | 2.0% | $675,845 |
| | Engineering Redesign Fee (2.5%-6%) | 4.5% | $1,520,650 |
| | Contractor Profit and Overhead (15%-30%)[2] | 25.0% | $8,448,056 |
| | Project Management Fee (2%-7%) | 5.0% | $1,689,611 |
| | State Procurement Cost | 2.0% | $675,845 |
| | Indirect Percentage Sum = | 39.6% | |
| | **Subtotal, Indirect Costs** | | **$13,381,721** |
| **GROSS RECEIPTS TAX** | Grant County (unincorporated areas) (applied to sum of indirect and direct costs) | 0.0% | **$0** |
| **TOTAL COST** | | | **$47,173,946** |

Data Sources:
US Office of Surface Mining, 2000. *Calculation of Reclamation Bond Amounts* .

Notes:

1) The portion of the financial assurance amount for Facility and Structure Removal is to be evaluated through the MMD permit revision process for establishing a closeout plan under the New Mexico Mining Act.

2) Profit and Office Overhead 10%, Project Overhead 15%
Project Overhead usually consists of the following except when it is a direct item:
Salaried and Admin Personal
Field Office, Shop and Facilities
Temporary Utilities
Fees and Insurance except those applicable to labor and equipment
MSHA and Site Specific Training.
Performance and Payment Bonds
QA/QC
Safety
Surveying
Construction Equipment General (salaried pickups, buses, ambulance, etc.)

| | | | 1A and 1B Leach Outslope | 2A Leach Outslope | 3B sp Outslope | 4A, 2B, 2C, 7C Leach Outslope | 5A Outslope | Copper Mtn Outslope | 6B, 6C Leach Outslope | Totals |
|---|---|---|---|---|---|---|---|---|---|---|
| **DIRECT COSTS** | | | | | | | | | | |
| | Facility and Structure Removal[1] | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | Earthmoving | | $1,207,355 | $4,607,925 | $1,780,316 | $8,680,574 | $882,447 | $1,038,129 | $7,259,988 | **$25,456,734** |
| | Revegetation | 160.0% | $89,000 | $201,133 | $112,140 | $414,733 | $71,200 | $77,084 | $135,265 | **$1,100,555** |
| | Other | | $203,910 | $504,443 | $411,739 | $1,093,588 | $102,257 | $111,708 | $300,295 | **$2,727,940** |
| | **Subtotal, Direct Costs** | | **$1,500,266** | **$5,313,500** | **$2,304,194** | **$10,188,894** | **$1,055,905** | **$1,226,921** | **$7,695,549** | **$29,285,229** |
| **OPERATIONS AND MAINTENANCE** | Includes: Road Maintenance, Wildlife Monitori and Erosion Control | 15.4% | **$230,891** | **$817,748** | **$354,615** | **$1,568,071** | **$162,504** | **$188,823** | **$1,184,345** | **$4,506,997** |
| **INDIRECT COSTS** | Mobilization and Demobilization (0%-10%) | 1.1% | $19,043 | $67,444 | $29,247 | $129,327 | $13,402 | $15,573 | $97,679 | **$371,714** |
| | Contingencies (3%-5%) | 2.0% | $34,623 | $122,625 | $53,176 | $235,139 | $24,368 | $28,315 | $177,598 | **$675,845** |
| | Engineering Redesign Fee (2.5%-6%) | 4.5% | $77,902 | $275,906 | $119,646 | $529,063 | $54,828 | $63,708 | $399,595 | **$1,520,650** |
| | Contractor Profit and Overhead (15%-30%) | 25.0% | $432,789 | $1,532,812 | $664,702 | $2,939,241 | $304,602 | $353,936 | $2,219,973 | **$8,448,056** |
| | Project Management Fee (2%-7%) | 5.0% | $86,558 | $306,562 | $132,940 | $587,848 | $60,920 | $70,787 | $443,995 | **$1,689,611** |
| | State Procurement Cost | 2.0% | $34,623 | $122,625 | $53,176 | $235,139 | $24,368 | $28,315 | $177,598 | **$675,845** |
| | Indirect Percentage Sum = | 39.6% | | | | | | | | |
| | **Subtotal, Indirect Costs** | | **$685,538** | **$2,427,974** | **$1,052,889** | **$4,655,758** | **$482,490** | **$560,635** | **$3,516,438** | **$13,381,721** |
| **GROSS RECEIPTS TAX** | Grant County (unincorporated areas) (applied to sum of indirect and direct costs) | 0.0% | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** |
| **TOTAL COST PER STOCKPILE** | | | **$2,416,694** | **$8,559,222** | **$3,711,698** | **$16,412,723** | **$1,700,898** | **$1,976,379** | **$12,396,332** | **$47,173,946** |
| **TOTAL COST** | | | **$47,173,946** | | | | | | | |

| Facility | 1A and 1B Leach Outslope | 2A Leach Outslope | 3B sp Outslope | 4A, 2B, 2C, 7C Leach Outslope | 5A Outslope | Copper Mtn Outslope | 6B, 6C Leach Outslope |
|---|---|---|---|---|---|---|---|
| **WITHOUT OPERATIONS AND MAINTENANCE** | | | | | | | |
| **Pre Reclamation Acres** | 45.7 | 83.7 | 60.0 | 177.3 | 32.4 | 32.0 | 31.2 |
| **Item** | Capital Cost | Capital Cost | Capital Cost | Capital Cost | Capital Cost | Capital Cost | Capital Cost |
| **Cover Material** | $976,504 | $2,700,041 | $1,681,198 | $5,005,207 | $791,163 | $1,186,185 | $1,852,189 |
| **Truck/Shovel** | $0 | $0 | $0 | $0 | $0 | $0 | $8,150,537 |
| **Top/Outslope Adjustment** | $708,964 | $3,732,622 | $804,123 | $7,112,874 | $440,734 | $263,043 | $132,217 |
| **Seed & Mulch** | $124,244 | $280,781 | $156,547 | $578,967 | $99,395 | $107,610 | $188,831 |
| **Channels, Conduits & Berms** | $284,659 | $704,202 | $574,787 | $1,526,649 | $142,751 | $155,944 | $419,212 |
| **Other** | 0 | $0 | $0 | $0 | $0 | $0 | $0 |
| **Capital Cost Totals** | $2,094,371 | $7,417,646 | $3,216,655 | $14,223,696 | $1,474,043 | $1,712,782 | $10,742,986 |
| **Capital Cost/Acre** | **$45,829** | $88,622 | **$53,611** | **$80,224** | **$45,495** | **$53,524** | **$344,326** |
| | | **$88,622** | | | | | |
| Capital Cost/Acre Cover | $21,368 | $32,259 | $28,020 | $28,230 | $24,419 | $37,068 | $59,365 |
| Capital Cost/Acre Truck Shovel | $0 | $0 | $0 | $0 | $0 | $0 | $261,235 |
| Capital Cost/Acre Top/Outslope Adjustment | $15,513 | $44,595 | $13,402 | $40,118 | $13,603 | $8,220 | $4,238 |
| **Capital Cost/Acre Earthwork Total** | $36,881 | $76,854 | $41,422 | $68,348 | $38,022 | $45,288 | $324,838 |
| Capital Cost/Acre Reveg | $2,719 | $3,355 | $2,609 | $3,265 | $3,068 | $3,363 | $6,052 |
| Capital Cost/Acre Other | $6,229 | $8,413 | $9,580 | $8,611 | $4,406 | $4,873 | $13,436 |
| **WITH OPERATIONS AND MAINTENANCE** | | | | | | | |
| **Operations and Maintenance** | $322,324 | $1,141,576 | $495,043 | $2,189,027 | $226,855 | $263,597 | $1,653,346 |
| **Total Cost** | $2,416,694 | $8,559,222 | $3,711,698 | $16,412,723 | $1,700,898 | $1,976,379 | $12,396,332 |
| **Total Cost/Acre** | **$52,882** | $102,261 | **$61,862** | **$92,570** | **$52,497** | **$61,762** | **$397,318** |
| | | **$102,261** | | | | | |

**Water Management Cost Summary**

| Item | Subtotal Direct Costs | Subtotal, Indirect Costs | Total Current Cost |
|---|---|---|---|
| | | **39.6%** | |
| **Ponds** | | | |
| Capital Costs | $456,413 | $180,740 | $637,153 |
| Replacement Costs | $1,369,239 | $542,219 | $1,911,458 |
| Operations & Maintenance | $912,826 | $361,479 | $1,274,305 |
| **Total Ponds** | **$2,738,479** | **$1,084,437** | **$3,822,916** |
| **Pumps** | | | |
| Capital Costs | $184,326 | $72,993 | $257,319 |
| Replacement Costs | $585,816 | $231,983 | $817,799 |
| Operations & Maintenance | $1,929,497 | $764,081 | $2,693,577 |
| **Total Pumps** | **$2,699,639** | **$1,069,057** | **$3,768,695** |
| **Pipelines** | | | |
| Capital Costs | $580,214 | $229,765 | $809,979 |
| Cost Removal and Replacement | $684,887 | $271,215 | $956,102 |
| Operations & Maintenance | $1,265,101 | $500,980 | $1,766,082 |
| **Total Pipelines** | **$2,530,203** | **$1,001,960** | **$3,532,163** |
| **Electrical Infrastructure** | | | |
| Capital Costs | $876,300 | $347,015 | $1,223,315 |
| Cost Removal and Replacement | $0 | $0 | $0 |
| Operations & Maintenance | $876,300 | $347,015 | $1,223,315 |
| **Total Electrical Infrastructure** | **$1,752,601** | **$694,030** | **$2,446,631** |
| **Environmental Sampling** | **$193,400** | **$0** | **$193,400** |
| **Channels** | | | |
| Construction | $1,837,503 | $727,651 | $2,565,154 |
| Maintenance | $282,792 | $111,986 | $394,777 |
| **Total Channels** | **$2,120,295** | **$839,637** | **$2,959,932** |
| **Total Capital** | **$3,934,757** | **$1,558,164** | **$5,492,921** |
| **Total Replacement and Maintenance** | **$8,099,858** | **$3,130,958** | **$11,230,816** |
| **Total** | **$12,034,616** | **$4,689,121** | **$16,723,737** |

| | Capital Costs | Cost Removal and Replacement | Operations & Maintenance | Subtotal, Direct Costs | Subtotal, Indirect Costs 39.6% | Total MMD Bond Amounts |
|---|---|---|---|---|---|---|
| 2A Leach Flat, 2A Leach Interior Slope | $342,939 | $318,631 | $578,442 | $1,240,012 | $486,042 | **$1,726,054** |
| 4A, 2B, 2C, 7B Interior Slope | $707,122 | $657,001 | $1,192,716 | $2,556,839 | $1,002,193 | **$3,559,032** |
| 1A and 1B Leach Interior Slope, Lube Shop Area | $501,557 | $288,035 | $519,344 | $1,308,936 | $509,829 | **$1,818,765** |
| Lube Shop Area Flat, 5A Interior Slope | $401,245 | $230,428 | $415,475 | $1,047,149 | $407,863 | **$1,455,012** |
| Copper Mountain Interior Slopes | $582,564 | $363,919 | $912,834 | $1,859,317 | $720,972 | **$2,580,289** |
| 6B, 6C, Interior Slopes 6B Flats | $1,218,830 | $523,388 | $1,288,774 | $3,030,992 | $1,184,956 | **$4,215,948** |
| 3B sp Outslope | $180,501 | $258,540 | $552,331 | $991,371 | $377,266 | **$1,368,636** |
| Totals | **$3,934,757** | **$2,639,942** | **$5,459,916** | **$12,034,616** | **$4,689,121** | **$16,723,737** |

**Variables**

| | | | |
|---|---|---|---|
| RSMeans NM Discount Rate | 0.84 | HDPE Pipeline Life Expectancy (yr) | 100 |
| Membrane Lined Pond Life Expectanc | 30 | Annual Pipeline Maintenance to Capital Factor | 1.00% |
| Annual Pond Maintenance to Capital F | 2.00% | Power Pole Spacing (ft) | 100 |
| Pump / Motor Efficiency | 0.70 | Substation Electric Panel Cost | $5,000 |
| Electric Rate ($/kWh) | 0.06 | Annual Electrical Infrastructure Maintenance to Capital Factor | 1.00% |
| Pump / Substation Removal Cost | $5,000 | Excavate and waste material with D11R, 175-foot excavation, 200-foot lateral waste push. Finish grade with D6R, 175-foot typical push distance, unit volume per LF. Uses dozer sheet adjustment factors. See attachment Channel Linear Foot Cost. ($/ft) | $8.59 |
| Annual Pump Maintenance to Capital I | 5.00% | Riprap Production 2007 August Production - McCain Springs Quarry, escalated to 2009 costs. | $15.98 |
| Pump Replacement Age (yr) | 20 | 100 year Channel Maintenance to Capital Cost | 15.39% |
| Chezy Head Loss Coefficient | 150 | | |

**Ponds**

| | Location | Post Closure Purpose | Construction Type | Capacity (gallons) | Capacity (cy) | Pond Area (acres) | Age at Reclamation (yr) | First Replacement Year (yr) | Second Replacement Year (yr) | Third Replacement Year (yr) | Number of Replacements | Cost New and Replacement ($) | Adjusted Cost New and Replacement ($) | **Actual Cost New and Replacement ($)** | **Cost Maintenance Years 1-12 ($/yr)** | **Cost Maintenance Years 13-100 ($/yr)** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Interior Pond | capture for discharge | lined | 0 | 0 | 3.40 | 0 | 30 | 60 | 90 | 3 | $281,262 | $234,854 | $939,415 | $4,697 | $4,697 |
| 2 | Interior Pond | capture for discharge | lined | 0 | 0 | 1.56 | 0 | 30 | 60 | 90 | 3 | $129,480 | $108,116 | $432,462 | $2,162 | $2,162 |
| 3 | Interior Pond | capture for discharge | lined | 0 | 0 | 0.32 | 0 | 30 | 60 | 90 | 3 | $26,825 | $22,399 | $89,596 | $448 | $448 |
| 4 | Interior Pond | capture for discharge | lined | 0 | 0 | 0.85 | 0 | 30 | 60 | 90 | 3 | $70,006 | $58,455 | $233,819 | $1,169 | $1,169 |
| 5 | Interior Pond | capture for discharge | lined | 0 | 0 | 0.47 | 0 | 30 | 60 | 90 | 3 | $39,030 | $32,590 | $130,359 | $652 | $652 |
| | | | | | | | | | | | | | | | **$9,128** | **$9,128** |
| | | | | | | | | | | | | | | **$1,825,652** | **$109,539** | **$803,287** |
| | | | | | | | | | | | | | | | **Total Present Cost** | **$2,738,479** |

**Pumps**

| | From | To | Number | Type | Age at Reclamation (yr) | First Replacement Year (yr) | Second Replacement Year (yr) | Third Replacement Year (yr) | Fourth Replacement Year (yr) | Fifth Replacement Year (yr) | Number of Replacements | Pump Cost New ($/ea) | Pump Cost Replacement ($/ea) | Operational Pumping Rate (ea. pump) (gpm) | Starting Elevation (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Interior Pond | Discharge Point | 2 | Booster | 0 | 20 | 40 | 60 | 80 | 100 | 5 | $18,433 | $5,000 | 1500 | 0 |
| 2 | Interior Pond | Discharge Point | 2 | Booster | 0 | 20 | 40 | 60 | 80 | 100 | 5 | $18,433 | $5,000 | 1500 | 0 |
| 3 | Interior Pond | Discharge Point | 2 | Booster | 0 | 20 | 40 | 60 | 80 | 100 | 5 | $18,433 | $5,000 | 1500 | 0 |
| 4 | Interior Pond | Discharge Point | 2 | Booster | 0 | 20 | 40 | 60 | 80 | 100 | 5 | $18,433 | $5,000 | 1500 | 0 |
| 5 | Interior Pond | Discharge Point | 2 | Booster | 0 | 20 | 40 | 60 | 80 | 100 | 5 | $18,433 | $5,000 | 1500 | 0 |
| | | | | | 0 | | | | | | | | | | |

**Pumps (Continued)**

| | | | | | | | | | **Years 1 - 12** | | | **Years 13 - 100** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Maximum Elevation (ft) | Head Loss (ft) | Head on Pump (ft) | HP | Operational Kilowatts (kW) | Capture Area (ac) | Average Pumping Rate (gal/yr) Year 1 - 12 | Average Pumping Rate (gal/yr) Year 13 - 100 | Operating Time (hr/yr) | Annual Electrical Usage (kWh/yr) | Annual Operational Cost ($) | Operating Time (hr/yr) | Annual Electrical Usage (kWh/yr) | **Annual Operational Cost ($)** | **Pump Actual Cost New and Replacement ($)** | **Cost Maintenance Years 1-12 ($/yr)** | **Cost Maintenance Years 13-100 ($/yr)** |
| | 150 | 4.21 | 154.21 | 83.4 | 62.2 | 400.1 | 6,953,338 | 6,953,338 | 77.3 | 4,807.5 | 288.5 | 77.3 | 4,807.5 | 288.5 | $154,028 | $2,343 | $2,343 |
| | 80 | 2.10 | 82.10 | 44.4 | 33.1 | 164.5 | 2,858,846 | 2,858,846 | 31.8 | 1,052.4 | 63.1 | 31.8 | 1,052.4 | 63.1 | $154,028 | $2,343 | $2,343 |
| | 50 | 4.91 | 54.91 | 29.7 | 22.2 | 43.3 | 752,511 | 752,511 | 8.4 | 185.3 | 11.1 | 8.4 | 185.3 | 11.1 | $154,028 | $2,343 | $2,343 |
| | 100 | 6.31 | 106.31 | 57.5 | 42.9 | 113.3 | 1,969,041 | 1,969,041 | 21.9 | 938.6 | 56.3 | 21.9 | 938.6 | 56.3 | $154,028 | $2,343 | $2,343 |
| | 120 | 1.19 | 121.19 | 65.6 | 48.9 | 63.0 | 1,094,877 | 1,094,877 | 12.2 | 594.9 | 35.7 | 12.2 | 594.9 | 35.7 | $154,028 | $2,343 | $2,343 |
| | | $H_f = \frac{10.44 Q^{1.85}}{C^{1.85} D_i^{4.865}}$ | | $P_{hp} = \frac{Q \ h}{3,960}$ | | | | | 139.3 | **$7,579** | | 151.4 | **$7,579** | | **$770,142** | **$11,716** | **$11,716** |
| | | | | | | | | | | **$90,944** | | | **$666,922** | | **$770,142** | **$140,596** | **$1,031,036** |
| | | | | | | | | | | | | | | | | **Total Present Cost** | **$2,699,639** |

**Pipelines**

| | From | To | Material | Length (ft) | Inside Diameter (in) | Life Expectancy (yr) | Reclamation Replacement Year (yr) | Cost New and Replacement ($/ft) | Cost Removal ($/ft) | Adjusted Cost New and Replacement ($) | Adjusted Cost New and Replacement ($) | **Cost Maintenance Years 1-12 ($/yr)** | **Cost Maintenance Years 13-100 ($/yr)** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Interior Pond | Discharge Point | HDPE | 3,000 | 15 | 100 | 85 | $52.05 | $9.39 | $284,292 | $284,292 | $2,842.92 | $2,842.92 |
| 2 | Interior Pond | Discharge Point | HDPE | 1,500 | 15 | 100 | 85 | $52.05 | $9.39 | $142,146 | $142,146 | $1,421.46 | $1,421.46 |
| 3 | Interior Pond | Discharge Point | HDPE | 3,500 | 15 | 100 | 85 | $52.05 | $9.39 | $331,675 | $331,675 | $3,316.75 | $3,316.75 |
| 4 | Interior Pond | Discharge Point | HDPE | 4,500 | 15 | 100 | 85 | $52.05 | $9.39 | $426,439 | $426,439 | $4,264.39 | $4,264.39 |
| 5 | Interior Pond | Discharge Point | HDPE | 850 | 15 | 100 | 85 | $52.05 | $9.39 | $80,550 | $80,550 | $805.50 | $805.50 |
| | | | | | | | | | | | | **$12,651** | **$12,651** |
| | | | | | | | | | | | **$1,265,101** | **$151,812** | **$1,113,289** |
| | | | | | | | | | | | | **Total** | **$2,530,203** |

**Electrical Infrastructure**

| | From | To | Line (ft) | Number of Poles | Cost Removal | Cost Pole | Cost Pole Crossarm | Cost Pole Installation | Cost Crossarm Installation | Cost Wiring Installation | Number Transformer Stations | Cost Transformer | Cost Electrical Panel | Adjusted Cost New ($) | **Adjusted Cost Removal ($)** | **Actual Cost New and Replacement ($)** | **Cost Maintenance Years 1-12 ($/yr)** | **Cost Maintenance Years 13-100 ($/yr)** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Interior Pond | Discharge Point | 3,000 | 31 | | $22,723 | $8,773 | $138,452 | $34,517 | $6,171 | 2 | $9,065 | $10,000 | $193,450 | 0 | $193,450 | $1,935 | $1,935 |
| 2 | Interior Pond | Discharge Point | 1,500 | 16 | | $11,728 | $4,528 | $71,459 | $17,815 | $3,086 | 2 | $9,065 | $10,000 | $108,264 | $0 | $108,264 | $1,083 | $1,083 |
| 3 | Interior Pond | Discharge Point | 3,500 | 36 | | $26,388 | $10,188 | $160,783 | $40,084 | $7,200 | 2 | $9,065 | $10,000 | $221,846 | $0 | $221,846 | $2,218 | $2,218 |
| 4 | Interior Pond | Discharge Point | 4,500 | 46 | | $33,718 | $13,018 | $205,445 | $51,219 | $9,257 | 2 | $9,065 | $10,000 | $278,637 | $0 | $278,637 | $2,786 | $2,786 |
| 5 | Interior Pond | Discharge Point | 850 | 10 | | $7,330 | $2,830 | $44,662 | $11,135 | $1,748 | 2 | $9,065 | $10,000 | $74,103 | $0 | $74,103 | $741 | $741 |
| | | | | | | | | | | | | | | | | | **$8,763** | **$8,763** |
| | | | | | | | | | | | | | | | **$0** | **$876,300** | **$105,156** | **$771,144** |
| | | | | | | | | | | | | | | | | | **Total Present Cost** | **$1,752,601** |

**Channels**

| | From | To | Description | Length (ft) | Excavation ($/ft) | Rip rap & Gravel (cy) | Riprap & Gravel Haul ($/cy) | Riprap & Gravel Backfill ($/cy) | Riprap & Gravel Production ($/cy) | **Total Cost ($)** | **Total Maintenance Cost (Years 1-100)** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **See MWH Takeoffs** | | | | | | | | |
| 1 | #1 - 2A Leach Flat, 2A Leach Interior Slope, 4A, 2B, 2C,7B Interior Slope | Interior Pond | | 7,000 | 9 | 15750 | $7.84 | $1.22 | $15.98 | $454,506 | $69,948 |
| 2 | #2 - 1A and 1B Leach Interior Slope, 5A Interior Slope, Lube Shop Area Flat | Interior Pond | | 9,000 | 9 | 20250 | $7.84 | $1.22 | $15.98 | $584,365 | $89,934 |
| 3 | #3 - Copper Mountain Interior Slope | Interior Pond | | 2,300 | 9 | 5175 | $7.84 | $1.22 | $15.98 | $149,338 | $22,983 |
| 4 | #4 - 6B Top, 6B, 6C Interior Slope | Interior Pond | | 10,000 | 9 | 22500 | $7.84 | $1.22 | $15.98 | $649,294 | $99,926 |
| 5 | #5 - 3B sp Outslope | Interior Pond | | 0 | 9 | 0 | $7.84 | $1.22 | $15.98 | $0 | $0 |
| | | | | | | | | | | | **$2,828** |
| | | | | | | | | | | **$1,837,503** | **$282,792** |
| | | | | | | | | | | **Total** | **$2,120,295** |

**Sample Collection, Analysis, and Reporting Cost**

| Pond Water Quality Sampling | Total Cost Per Pond |
|---|---|
| Quarterly Sampling Cost | $ 1,070 |
| Semi-Annual Sampling Cost | $ 530 |
| Annual Sampling Cost | $ 270 |

**Sampling Schedule and Cost**

| Year | Interior Ponds | | | Total Pond Locations | Quarterly Cost | Semi-Annual Cost | Annual Cost | Total Yearly Cost |
|---|---|---|---|---|---|---|---|---|
| | Quarterly | Semi-Annual | Annual | | | | | |
| 1 | 5 | | | 5 | $ 5,350 | $ - | $ - | $ 5,350 |
| 2 | 5 | | | 5 | $ 5,350 | $ - | $ - | $ 5,350 |
| 3 | 5 | | | 5 | $ 5,350 | $ - | $ - | $ 5,350 |
| 4 | 5 | | | 5 | $ 5,350 | $ - | $ - | $ 5,350 |
| 5 | 5 | | | 5 | $ 5,350 | $ - | $ - | $ 5,350 |
| 6 | 5 | | | 5 | $ 5,350 | $ - | $ - | $ 5,350 |
| 7 | 5 | | | 5 | $ 5,350 | $ - | $ - | $ 5,350 |
| 8 | 5 | | | 5 | $ 5,350 | $ - | $ - | $ 5,350 |
| 9 | 5 | | | 5 | $ 5,350 | $ - | $ - | $ 5,350 |
| 10 | 5 | | | 5 | $ 5,350 | $ - | $ - | $ 5,350 |
| 11 | 5 | | | 5 | $ 5,350 | $ - | $ - | $ 5,350 |
| 12 | 5 | | | 5 | $ 5,350 | $ - | $ - | $ 5,350 |
| 13 | | 5 | | 5 | $ - | $2,650 | $ - | $ 2,650 |
| … | | 5 | | 5 | $ - | $2,650 | $ - | $ 2,650 |
| 20 | | 5 | | 5 | $ - | $2,650 | $ - | $ 2,650 |
| … | | | 5 | 5 | $ - | $ - | $1,350 | $ 1,350 |
| 100 | | | 5 | 5 | $ - | $ - | $1,350 | $ 1,350 |
| | | | | | | | Total | $193,400 |

## Environmental Sampling, Analysis and Reporting[1]

| | | Shipping and Analysis | | | | | Reporting | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Basis Type | Samples per Year | Number of Shipping Coolers per Sample | Shipping Cost per Cooler | Shipping Cost | Analysis Cost per Sample [2] | Analysis and Shipping Cost | Report Work per Sample (Hours) | Report Work Hourly Rate | Review Work per Sample (Hours) | Review Work Hourly Rate | Reporting Cost | Total Sample Cost |
| Quarterly Sampling | 4 | 0.10 | $ 50 | $ 20 | $ 225 | $ 920 | 0.500 | $ 60 | 0.100 | $ 70 | $ 150 | $ 1,070 |
| Semi-Annual Sampling | 2 | 0.10 | $ 50 | $ 10 | $ 225 | $ 460 | 0.500 | $ 60 | 0.100 | $ 70 | $ 70 | $ 530 |
| Annual Sampling | 1 | 0.10 | $ 50 | $ 5 | $ 225 | $ 230 | 0.500 | $ 60 | 0.100 | $ 70 | $ 40 | $ 270 |

[1] Sampling labor, vehicle and equipment are assumed to be included in the routine duty for site personnel.

[2] 23 Constituents. Energy Laboratories, Inc, 2009. Published price list (www.energylab.com).

***Operations & Maintenance***

Indirect Costs Multiplie 1.396

| PONDS | Years 1-12 | Years 13-100 | PUMPS | Years 1-12 | Years 13-100 | PIPELINES |
|---|---|---|---|---|---|---|
| | 9,128 | 9,128 | | 19,295 | 19,295 | |

| Year | Capital Annual Current Cost | O&M Annual Current Cost ($) | Year | Capital Annual Current, Replacement, Cost | O&M Annual Current Cost ($) | Year | Capital Annual Current Cost | Removal Annual Current Cost |
|---|---|---|---|---|---|---|---|---|
| 2010 | 456,413 | 9,128 | 2010 | 184326.25 | 19,295 | 2010 | 580,214 | |
| 2011 | | 9,128 | 2011 | | 19,295 | 2011 | | |
| 2012 | | 9,128 | 2012 | | 19,295 | 2012 | | |
| 2013 | | 9,128 | 2013 | | 19,295 | 2013 | | |
| 2014 | | 9,128 | 2014 | | 19,295 | 2014 | | |
| 2015 | | 9,128 | 2015 | | 19,295 | 2015 | | |
| 2016 | | 9,128 | 2016 | | 19,295 | 2016 | | |
| 2017 | | 9,128 | 2017 | | 19,295 | 2017 | | |
| 2018 | | 9,128 | 2018 | | 19,295 | 2018 | | |
| 2019 | | 9,128 | 2019 | | 19,295 | 2019 | | |
| 2020 | | 9,128 | 2020 | | 19,295 | 2020 | | |
| 2021 | | 9,128 | 2021 | | 19,295 | 2021 | | |
| 2022 | | 9,128 | 2022 | | 19,295 | 2022 | | |
| 2023 | | 9,128 | 2023 | | 19,295 | 2023 | | |
| 2024 | | 9,128 | 2024 | | 19,295 | 2024 | | |
| 2025 | | 9,128 | 2025 | | 19,295 | 2025 | | |
| 2026 | | 9,128 | 2026 | | 19,295 | 2026 | | |
| 2027 | | 9,128 | 2027 | | 19,295 | 2027 | | |
| 2028 | | 9,128 | 2028 | | 19,295 | 2028 | | |
| 2029 | | 9,128 | 2029 | 117163.13 | 19,295 | 2029 | | |
| 2030 | | 9,128 | 2030 | | 19,295 | 2030 | | |
| 2031 | | 9,128 | 2031 | | 19,295 | 2031 | | |
| 2032 | | 9,128 | 2032 | | 19,295 | 2032 | | |
| 2033 | | 9,128 | 2033 | | 19,295 | 2033 | | |
| 2034 | | 9,128 | 2034 | | 19,295 | 2034 | | |
| 2035 | | 9,128 | 2035 | | 19,295 | 2035 | | |
| 2036 | | 9,128 | 2036 | | 19,295 | 2036 | | |
| 2037 | | 9,128 | 2037 | | 19,295 | 2037 | | |
| 2038 | | 9,128 | 2038 | | 19,295 | 2038 | | |
| 2039 | 456,413 | 9,128 | 2039 | | 19,295 | 2039 | | |
| 2040 | | 9,128 | 2040 | | 19,295 | 2040 | | |
| 2041 | | 9,128 | 2041 | | 19,295 | 2041 | | |
| 2042 | | 9,128 | 2042 | | 19,295 | 2042 | | |
| 2043 | | 9,128 | 2043 | | 19,295 | 2043 | | |
| 2044 | | 9,128 | 2044 | | 19,295 | 2044 | | |
| 2045 | | 9,128 | 2045 | | 19,295 | 2045 | | |
| 2046 | | 9,128 | 2046 | | 19,295 | 2046 | | |
| 2047 | | 9,128 | 2047 | | 19,295 | 2047 | | |
| 2048 | | 9,128 | 2048 | | 19,295 | 2048 | | |
| 2049 | | 9,128 | 2049 | 117163.13 | 19,295 | 2049 | | |
| 2050 | | 9,128 | 2050 | | 19,295 | 2050 | | |
| 2051 | | 9,128 | 2051 | | 19,295 | 2051 | | |
| 2052 | | 9,128 | 2052 | | 19,295 | 2052 | | |
| 2053 | | 9,128 | 2053 | | 19,295 | 2053 | | |
| 2054 | | 9,128 | 2054 | | 19,295 | 2054 | | |
| 2055 | | 9,128 | 2055 | | 19,295 | 2055 | | |
| 2056 | | 9,128 | 2056 | | 19,295 | 2056 | | |
| 2057 | | 9,128 | 2057 | | 19,295 | 2057 | | |
| 2058 | | 9,128 | 2058 | | 19,295 | 2058 | | |
| 2059 | | 9,128 | 2059 | | 19,295 | 2059 | | |
| 2060 | | 9,128 | 2060 | | 19,295 | 2060 | | |
| 2061 | | 9,128 | 2061 | | 19,295 | 2061 | | |
| 2062 | | 9,128 | 2062 | | 19,295 | 2062 | | |
| 2063 | | 9,128 | 2063 | | 19,295 | 2063 | | |
| 2064 | | 9,128 | 2064 | | 19,295 | 2064 | | |
| 2065 | | 9,128 | 2065 | | 19,295 | 2065 | | |
| 2066 | | 9,128 | 2066 | | 19,295 | 2066 | | |
| 2067 | | 9,128 | 2067 | | 19,295 | 2067 | | |
| 2068 | | 9,128 | 2068 | | 19,295 | 2068 | | |
| 2069 | 456,413 | 9,128 | 2069 | 117163.13 | 19,295 | 2069 | | |
| 2070 | | 9,128 | 2070 | | 19,295 | 2070 | | |
| 2071 | | 9,128 | 2071 | | 19,295 | 2071 | | |
| 2072 | | 9,128 | 2072 | | 19,295 | 2072 | | |
| 2073 | | 9,128 | 2073 | | 19,295 | 2073 | | |
| 2074 | | 9,128 | 2074 | | 19,295 | 2074 | | |
| 2075 | | 9,128 | 2075 | | 19,295 | 2075 | | |
| 2076 | | 9,128 | 2076 | | 19,295 | 2076 | | |
| 2077 | | 9,128 | 2077 | | 19,295 | 2077 | | |
| 2078 | | 9,128 | 2078 | | 19,295 | 2078 | | |

***Operations & Maintenance***

Indirect Costs Multiplie 1.396

| PONDS | Years 1-12 | PUMPS | Years 1-12 | PIPELINES | | |
|---|---|---|---|---|---|---|
| | 9,128 | | 19,295 | | | |
| | Years 13-100 | | Years 13-100 | | | |
| | 9,128 | | 19,295 | | | |

| Year | Capital Annual Current Cost | O&M Annual Current Cost ($) | Year | Capital Annual Current, Replacement, Cost | O&M Annual Current Cost ($) | Year | Capital Annual Current Cost | Removal Annual Current Cost |
|---|---|---|---|---|---|---|---|---|
| 2079 | | 9,128 | 2079 | | 19,295 | 2079 | | |
| 2080 | | 9,128 | 2080 | | 19,295 | 2080 | | |
| 2081 | | 9,128 | 2081 | | 19,295 | 2081 | | |
| 2082 | | 9,128 | 2082 | | 19,295 | 2082 | | |
| 2083 | | 9,128 | 2083 | | 19,295 | 2083 | | |
| 2084 | | 9,128 | 2084 | | 19,295 | 2084 | | |
| 2085 | | 9,128 | 2085 | | 19,295 | 2085 | | |
| 2086 | | 9,128 | 2086 | | 19,295 | 2086 | | |
| 2087 | | 9,128 | 2087 | | 19,295 | 2087 | | |
| 2088 | | 9,128 | 2088 | | 19,295 | 2088 | | |
| 2089 | | 9,128 | 2089 | 117163.13 | 19,295 | 2089 | | |
| 2090 | | 9,128 | 2090 | | 19,295 | 2090 | | |
| 2091 | | 9,128 | 2091 | | 19,295 | 2091 | | |
| 2092 | | 9,128 | 2092 | | 19,295 | 2092 | | |
| 2093 | | 9,128 | 2093 | | 19,295 | 2093 | | |
| 2094 | | 9,128 | 2094 | | 19,295 | 2094 | 580,214 | 104,673 |
| 2095 | | 9,128 | 2095 | | 19,295 | 2095 | | |
| 2096 | | 9,128 | 2096 | | 19,295 | 2096 | | |
| 2097 | | 9,128 | 2097 | | 19,295 | 2097 | | |
| 2098 | | 9,128 | 2098 | | 19,295 | 2098 | | |
| 2099 | 456,413 | 9,128 | 2099 | | 19,295 | 2099 | | |
| 2100 | | 9,128 | 2100 | | 19,295 | 2100 | | |
| 2101 | | 9,128 | 2101 | | 19,295 | 2101 | | |
| 2102 | | 9,128 | 2102 | | 19,295 | 2102 | | |
| 2103 | | 9,128 | 2103 | | 19,295 | 2103 | | |
| 2104 | | 9,128 | 2104 | | 19,295 | 2104 | | |
| 2105 | | 9,128 | 2105 | | 19,295 | 2105 | | |
| 2106 | | 9,128 | 2106 | | 19,295 | 2106 | | |
| 2107 | | 9,128 | 2107 | | 19,295 | 2107 | | |
| 2108 | | 9,128 | 2108 | | 19,295 | 2108 | | |
| 2109 | | 9,128 | 2109 | 117163.13 | 19,295 | 2109 | | |
| 2110 | | --- | 2110 | | --- | 2110 | | |
| 2111 | | --- | 2111 | | --- | 2111 | | |
| 2112 | | --- | 2112 | | --- | 2112 | | |
| 2113 | | --- | 2113 | | --- | 2113 | | |
| 2114 | | --- | 2114 | | --- | 2114 | | |
| 2115 | | --- | 2115 | | --- | 2115 | | |
| : Cost | 1,825,652 | 912,826 | | 770,142 | 1,929,497 | | 1,160,429 | 104,673 |
| directs | 2,548,611 | 1,274,305 | | 1,075,118 | 2,693,577 | | 1,619,959 | 146,123 |

2010 Current Cost **$16,723,737**

| Years 1-12 | ELECTRICAL INFRASTRUCTURE | | | ENVIRONMENTAL SAMPLING | | CHANNELS | | |
|---|---|---|---|---|---|---|---|---|
| 12,651 | | | Years 1-12 | | Years 1-12 | | | Years 1-100 |
| Years 13-100 | | | 8,763 | | $5,350.00 | | | $2,827.92 |
| 12,651 | | | Years 13-100 | | Years 13-20 | | | |
| | | | 8,763 | | $2,650.00 | | | |
| | | | | | Years 21-100 | | | |
| Maintenance Annual Current Cost ($) | Year | Capital Annual Current Cost | Maintenance Annual Current Cost ($) | Year | $1,350.00 Annual Current Cost ($) | Year | Capital Annual Current Cost | Annual Current Cost ($) |
| 12,651 | 2010 | 876,300 | 8,763 | 2010 | 5,350.00 | 2010 | 1,837,503 | 2,827.92 |
| 12,651 | 2011 | | 8,763 | 2011 | 5,350.00 | 2011 | | 2,827.92 |
| 12,651 | 2012 | | 8,763 | 2012 | 5,350.00 | 2012 | | 2,827.92 |
| 12,651 | 2013 | | 8,763 | 2013 | 5,350.00 | 2013 | | 2,827.92 |
| 12,651 | 2014 | | 8,763 | 2014 | 5,350.00 | 2014 | | 2,827.92 |
| 12,651 | 2015 | | 8,763 | 2015 | 5,350.00 | 2015 | | 2,827.92 |
| 12,651 | 2016 | | 8,763 | 2016 | 5,350.00 | 2016 | | 2,827.92 |
| 12,651 | 2017 | | 8,763 | 2017 | 5,350.00 | 2017 | | 2,827.92 |
| 12,651 | 2018 | | 8,763 | 2018 | 5,350.00 | 2018 | | 2,827.92 |
| 12,651 | 2019 | | 8,763 | 2019 | 5,350.00 | 2019 | | 2,827.92 |
| 12,651 | 2020 | | 8,763 | 2020 | 5,350.00 | 2020 | | 2,827.92 |
| 12,651 | 2021 | | 8,763 | 2021 | 5,350.00 | 2021 | | 2,827.92 |
| 12,651 | 2022 | | 8,763 | 2022 | 2,650.00 | 2022 | | 2,827.92 |
| 12,651 | 2023 | | 8,763 | 2023 | 2,650.00 | 2023 | | 2,827.92 |
| 12,651 | 2024 | | 8,763 | 2024 | 2,650.00 | 2024 | | 2,827.92 |
| 12,651 | 2025 | | 8,763 | 2025 | 2,650.00 | 2025 | | 2,827.92 |
| 12,651 | 2026 | | 8,763 | 2026 | 2,650.00 | 2026 | | 2,827.92 |
| 12,651 | 2027 | | 8,763 | 2027 | 2,650.00 | 2027 | | 2,827.92 |
| 12,651 | 2028 | | 8,763 | 2028 | 2,650.00 | 2028 | | 2,827.92 |
| 12,651 | 2029 | | 8,763 | 2029 | 2,650.00 | 2029 | | 2,827.92 |
| 12,651 | 2030 | | 8,763 | 2030 | 1,350.00 | 2030 | | 2,827.92 |
| 12,651 | 2031 | | 8,763 | 2031 | 1,350.00 | 2031 | | 2,827.92 |
| 12,651 | 2032 | | 8,763 | 2032 | 1,350.00 | 2032 | | 2,827.92 |
| 12,651 | 2033 | | 8,763 | 2033 | 1,350.00 | 2033 | | 2,827.92 |
| 12,651 | 2034 | | 8,763 | 2034 | 1,350.00 | 2034 | | 2,827.92 |
| 12,651 | 2035 | | 8,763 | 2035 | 1,350.00 | 2035 | | 2,827.92 |
| 12,651 | 2036 | | 8,763 | 2036 | 1,350.00 | 2036 | | 2,827.92 |
| 12,651 | 2037 | | 8,763 | 2037 | 1,350.00 | 2037 | | 2,827.92 |
| 12,651 | 2038 | | 8,763 | 2038 | 1,350.00 | 2038 | | 2,827.92 |
| 12,651 | 2039 | | 8,763 | 2039 | 1,350.00 | 2039 | | 2,827.92 |
| 12,651 | 2040 | | 8,763 | 2040 | 1,350.00 | 2040 | | 2,827.92 |
| 12,651 | 2041 | | 8,763 | 2041 | 1,350.00 | 2041 | | 2,827.92 |
| 12,651 | 2042 | | 8,763 | 2042 | 1,350.00 | 2042 | | 2,827.92 |
| 12,651 | 2043 | | 8,763 | 2043 | 1,350.00 | 2043 | | 2,827.92 |
| 12,651 | 2044 | | 8,763 | 2044 | 1,350.00 | 2044 | | 2,827.92 |
| 12,651 | 2045 | | 8,763 | 2045 | 1,350.00 | 2045 | | 2,827.92 |
| 12,651 | 2046 | | 8,763 | 2046 | 1,350.00 | 2046 | | 2,827.92 |
| 12,651 | 2047 | | 8,763 | 2047 | 1,350.00 | 2047 | | 2,827.92 |
| 12,651 | 2048 | | 8,763 | 2048 | 1,350.00 | 2048 | | 2,827.92 |
| 12,651 | 2049 | | 8,763 | 2049 | 1,350.00 | 2049 | | 2,827.92 |
| 12,651 | 2050 | | 8,763 | 2050 | 1,350.00 | 2050 | | 2,827.92 |
| 12,651 | 2051 | | 8,763 | 2051 | 1,350.00 | 2051 | | 2,827.92 |
| 12,651 | 2052 | | 8,763 | 2052 | 1,350.00 | 2052 | | 2,827.92 |
| 12,651 | 2053 | | 8,763 | 2053 | 1,350.00 | 2053 | | 2,827.92 |
| 12,651 | 2054 | | 8,763 | 2054 | 1,350.00 | 2054 | | 2,827.92 |
| 12,651 | 2055 | | 8,763 | 2055 | 1,350.00 | 2055 | | 2,827.92 |
| 12,651 | 2056 | | 8,763 | 2056 | 1,350.00 | 2056 | | 2,827.92 |
| 12,651 | 2057 | | 8,763 | 2057 | 1,350.00 | 2057 | | 2,827.92 |
| 12,651 | 2058 | | 8,763 | 2058 | 1,350.00 | 2058 | | 2,827.92 |
| 12,651 | 2059 | | 8,763 | 2059 | 1,350.00 | 2059 | | 2,827.92 |
| 12,651 | 2060 | | 8,763 | 2060 | 1,350.00 | 2060 | | 2,827.92 |
| 12,651 | 2061 | | 8,763 | 2061 | 1,350.00 | 2061 | | 2,827.92 |
| 12,651 | 2062 | | 8,763 | 2062 | 1,350.00 | 2062 | | 2,827.92 |
| 12,651 | 2063 | | 8,763 | 2063 | 1,350.00 | 2063 | | 2,827.92 |
| 12,651 | 2064 | | 8,763 | 2064 | 1,350.00 | 2064 | | 2,827.92 |
| 12,651 | 2065 | | 8,763 | 2065 | 1,350.00 | 2065 | | 2,827.92 |
| 12,651 | 2066 | | 8,763 | 2066 | 1,350.00 | 2066 | | 2,827.92 |
| 12,651 | 2067 | | 8,763 | 2067 | 1,350.00 | 2067 | | 2,827.92 |
| 12,651 | 2068 | | 8,763 | 2068 | 1,350.00 | 2068 | | 2,827.92 |
| 12,651 | 2069 | | 8,763 | 2069 | 1,350.00 | 2069 | | 2,827.92 |
| 12,651 | 2070 | | 8,763 | 2070 | 1,350.00 | 2070 | | 2,827.92 |
| 12,651 | 2071 | | 8,763 | 2071 | 1,350.00 | 2071 | | 2,827.92 |
| 12,651 | 2072 | | 8,763 | 2072 | 1,350.00 | 2072 | | 2,827.92 |
| 12,651 | 2073 | | 8,763 | 2073 | 1,350.00 | 2073 | | 2,827.92 |
| 12,651 | 2074 | | 8,763 | 2074 | 1,350.00 | 2074 | | 2,827.92 |
| 12,651 | 2075 | | 8,763 | 2075 | 1,350.00 | 2075 | | 2,827.92 |
| 12,651 | 2076 | | 8,763 | 2076 | 1,350.00 | 2076 | | 2,827.92 |
| 12,651 | 2077 | | 8,763 | 2077 | 1,350.00 | 2077 | | 2,827.92 |
| 12,651 | 2078 | | 8,763 | 2078 | 1,350.00 | 2078 | | 2,827.92 |

| Years 1-12 | | ELECTRICAL INFRASTRUCTURE | | ENVIRONMENTAL SAMPLING | | CHANNELS | |
|---|---|---|---|---|---|---|---|
| 12,651 | | | Years 1-12 | | Years 1-12 | | Years 1-100 |
| Years 13-100 | | | 8,763 | | $5,350.00 | | $2,827.92 |
| 12,651 | | | Years 13-100 | | Years 13-20 | | |
| | | | 8,763 | | $2,650.00 | | |
| | | | | | Years 21-100 | | |
| Maintenance Annual Current Cost ($) | Year | Capital Annual Current Cost | Maintenance Annual Current Cost ($) | Year | $1,350.00 Annual Current Cost ($) | Year | Capital Annual Current Cost / Annual Current Cost ($) |
| 12,651 | 2079 | | 8,763 | 2079 | 1,350.00 | 2079 | 2,827.92 |
| 12,651 | 2080 | | 8,763 | 2080 | 1,350.00 | 2080 | 2,827.92 |
| 12,651 | 2081 | | 8,763 | 2081 | 1,350.00 | 2081 | 2,827.92 |
| 12,651 | 2082 | | 8,763 | 2082 | 1,350.00 | 2082 | 2,827.92 |
| 12,651 | 2083 | | 8,763 | 2083 | 1,350.00 | 2083 | 2,827.92 |
| 12,651 | 2084 | | 8,763 | 2084 | 1,350.00 | 2084 | 2,827.92 |
| 12,651 | 2085 | | 8,763 | 2085 | 1,350.00 | 2085 | 2,827.92 |
| 12,651 | 2086 | | 8,763 | 2086 | 1,350.00 | 2086 | 2,827.92 |
| 12,651 | 2087 | | 8,763 | 2087 | 1,350.00 | 2087 | 2,827.92 |
| 12,651 | 2088 | | 8,763 | 2088 | 1,350.00 | 2088 | 2,827.92 |
| 12,651 | 2089 | | 8,763 | 2089 | 1,350.00 | 2089 | 2,827.92 |
| 12,651 | 2090 | | 8,763 | 2090 | 1,350.00 | 2090 | 2,827.92 |
| 12,651 | 2091 | | 8,763 | 2091 | 1,350.00 | 2091 | 2,827.92 |
| 12,651 | 2092 | | 8,763 | 2092 | 1,350.00 | 2092 | 2,827.92 |
| 12,651 | 2093 | | 8,763 | 2093 | 1,350.00 | 2093 | 2,827.92 |
| 12,651 | 2094 | | 8,763 | 2094 | 1,350.00 | 2094 | 2,827.92 |
| 12,651 | 2095 | | 8,763 | 2095 | 1,350.00 | 2095 | 2,827.92 |
| 12,651 | 2096 | | 8,763 | 2096 | 1,350.00 | 2096 | 2,827.92 |
| 12,651 | 2097 | | 8,763 | 2097 | 1,350.00 | 2097 | 2,827.92 |
| 12,651 | 2098 | | 8,763 | 2098 | 1,350.00 | 2098 | 2,827.92 |
| 12,651 | 2099 | | 8,763 | 2099 | 1,350.00 | 2099 | 2,827.92 |
| 12,651 | 2100 | | 8,763 | 2100 | 1,350.00 | 2100 | 2,827.92 |
| 12,651 | 2101 | | 8,763 | 2101 | 1,350.00 | 2101 | 2,827.92 |
| 12,651 | 2102 | | 8,763 | 2102 | 1,350.00 | 2102 | 2,827.92 |
| 12,651 | 2103 | | 8,763 | 2103 | 1,350.00 | 2103 | 2,827.92 |
| 12,651 | 2104 | | 8,763 | 2104 | 1,350.00 | 2104 | 2,827.92 |
| 12,651 | 2105 | | 8,763 | 2105 | 1,350.00 | 2105 | 2,827.92 |
| 12,651 | 2106 | | 8,763 | 2106 | 1,350.00 | 2106 | 2,827.92 |
| 12,651 | 2107 | | 8,763 | 2107 | 1,350.00 | 2107 | 2,827.92 |
| 12,651 | 2108 | | 8,763 | 2108 | 1,350.00 | 2108 | 2,827.92 |
| 12,651 | 2109 | | 8,763 | 2109 | 1,350.00 | 2109 | 2,827.92 |
| --- | 2110 | | --- | 2110 | --- | 2110 | --- |
| --- | 2111 | | --- | 2111 | --- | 2111 | --- |
| --- | 2112 | | --- | 2112 | --- | 2112 | --- |
| --- | 2113 | | --- | 2113 | --- | 2113 | --- |
| --- | 2114 | | --- | 2114 | --- | 2114 | --- |
| --- | 2115 | | --- | 2115 | --- | 2115 | --- |
| 1,265,101 | | 876,300 | 876,300 | | 193,400 | 1,837,503 | 282,792 |
| 1,766,082 | | 1,223,315 | 1,223,315 | | 193,400 | 2,565,154 | 394,777 |

**Water Treatment Unit Costs**

| Activity | Base No Overhead and Profit[2] Unit Cost $/unit | Units | Scaled Cost Las Cruces 83.5% [1] | Means Line Item | Means Page | Reference |
|---|---|---|---|---|---|---|
| Wood Electrical Utility Poles | 733 | ea | 612 | 337116.33 6600 | 348 | 30' high, excludes excavation, backfill and cast-in-place concrete, R-3 crew |
| Electrical Cross Arms | 283 | ea | 236 | 337116.33 7600 | 348 | 4' long, includes hardware and insulators, 1 Elec Crew |
| Utility Pole Installation a.) | 1,160 | ea | 969 | 337116.20 0105 | 347 | Digging holes in rock-R-5 Crew |
| Utility Pole Installation b.) | 2,291 | ea | 1913 | 0250 | 347 | Erect wood poles and backfill holes in rock |
| Utility Pole Installation c.) | 89.2 | mi | 74 | 0260 | 347 | Disposal of pole and hardware surplus material |
| Utility Pole Installation d.) | 926 | ea | 773 | 337116.20 0510 | 348 | Guys, anchors and hardware for pole in rock |
| Cross Arm Installation a.) | 128 | ea | 107 | 337116.20 0310 | 347 | Material handling and spotting |
| Cross Arm Installation b.) | 939 | ea | 784 | 337116.20 0320 | 347 | Install crossarms |
| Cross Arm Installation c.) | 46.55 | mi | 39 | 337116.20 0330 | 347 | Disposal of crossarms and hardware surplus material |
| Electrical Wiring Installation a.) | 536 | wire mi | 448 | 337139.13 0110 | 351 | Material handling and spotting-conductors, primary circuits |
| Electrical Wiring Installation b.) | 10,325 | wire mi | 8621 | 337139.13 0150 | 351 | Conductors, per wire, 210-636 kcmil |
| Potential Transformers | 4,533 | ea | 3785 | 337126.26 4100 | 351 | 13 to 26 kV |
| Riprap and Gravel Haul | 9.39 | cy | 7.84 | G1030 150 7600 | 441 | Load & Haul rock, 5-cy loader, 12 20-cy trailers, 3-mile RT |
| Riprap and Gravel Backfill | 1.46 | cy | 1.22 | 312323.14 5200<br>312323.23 5040 | 227, 251 | Gravel Backfill, 300 hp dozer & compactors, 150' haul, 6" lifts, 4 passes |
| Pipe Removal | 2.95 | lf | 2 | 024113.38-1800 | 25 | Site Demo, pipe removal, sewer/water no exc., plastic pipe, 10"-18" diam |
| Pipe Disposal | 6.44 | cy | 5 | 02220.875-5500 | - | Site demolition, disposal on site updated from $6.44 in 2008 |
| Excavation of Soil | 5.11 | cy | 4 | G1030120 1600 | 432 | 3/4 C.Y. backhoe, three 8 C.Y. dump trucks, 1 mi round trip. This value removes the profit for equipment (10%) and the profit/overhead for labor of the operator of a shovel (49.7%). |
| Reservoir Liners HDPE | 1.9 | sf | 2 | 334713.53 1200 | 338 | Membrane lining, 2X60 mil thick |
| Utility Pump | 22,075 | ea | 18433 | 221123.10 3190 | 170 | Single stage, double suction 75 HP, 2500 gpm pump |
| Water Supply Piping | 52.05 | lf | 43 | 331113.35 0700 | 319 | Butt fusion joints, SDR 21, HDPE 40' lengths not including excavation or backfill, 16" diam |

Description Notes:

1) Overhead and Profit are added in with the indirect costs.

2) City Cost Index Las Cruces-Total 83.5% RSMeans Heavy Construction Cost Data 24rd Annual Edition 2010 pg. 534.

3) RSMeans Heavy Construction Cost Data 24rd Annual Edition 2010.

# APPENDIX B
## SUPPORTING DOCUMENTATION

# Appendix B-1
# Labor Rates

# Labor Rate Detail

| Labor | Equipment | Zone | Group | Base rate | Zone Pay | Fringes | Apprentice Rate | Subtotal | FICA 6.200% | Medicare 1.450% | Fed Unempl. | State Unempl. | Workmens Comp | Total per Hour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Power Equipment Operator | Front End Loaders | | VI | $22.26 | | $6.77 | $0.34 | $29.37 | $1.82 | $0.43 | $0.03 | $0.20 | $2.119 | **$33.962** |
| Power Equipment Operator | Dozer | | IV | $22.11 | | $6.77 | $0.34 | $29.22 | $1.81 | $0.42 | $0.03 | $0.20 | $2.132 | **$33.814** |
| Power Equipment Operator | Scrapers | | IV | $22.11 | | $6.77 | $0.34 | $29.22 | $1.81 | $0.42 | $0.03 | $0.20 | $2.132 | **$33.814** |
| Power Equipment Operator | Motor Grader (Rough) | | IV | $22.11 | | $6.77 | $0.34 | $29.22 | $1.81 | $0.42 | $0.03 | $0.20 | $2.132 | **$33.814** |
| Power Equipment Operator | Excavator | | VIII | $22.46 | | $6.77 | $0.34 | $29.57 | $1.83 | $0.43 | $0.03 | $0.20 | $2.107 | **$34.165** |
| Power Equipment Operator | Mechanic | | VI | $22.26 | | $6.77 | $0.34 | $29.37 | $1.82 | $0.43 | $0.03 | $0.20 | $1.261 | **$33.104** |
| Teamster | Haul Trucks | | III | $15.45 | | $4.94 | $0.26 | $20.65 | $1.28 | $0.30 | $0.03 | $0.20 | $2.193 | **$24.650** |
| Teamster | Oiler | | II | $21.51 | | $6.77 | $0.34 | $28.62 | $1.77 | $0.41 | $0.03 | $0.20 | $2.193 | **$33.229** |

| | Federal Unemployment - 0.8% on the first $7,000 | New Mexico Unemployment - 2% on the first $20,800 |
|---|---|---|
| $ Max | $7,000 | $20,800 |
| Unemployment Tax | 0.80% | 2.00% new employees' first 4 yrs |
| Unemployment Taxes Paid | $56.00 | $416.00 |
| Hours per Yr | 2,085 (365 * 5/7 * 8 = 2085.71) | 2,085 |
| Unemployment rate per Hour | $0.03 | $0.20 |

| Class | Class Code | Workmens Comp (WC) Rate / $100 | Base Rate W/ Fringes & Apprentice | Base rate / $100 * Base Wage per Hour = WC/Hour $/hr | $10 /$100 of Total Payroll (Surcharge) [1] $/hr | 0.031 cents /$100 of Total Payroll (Terrorist Premium) [1] $/hr | Total Workmans Comp / $100 $/hr |
|---|---|---|---|---|---|---|---|
| **Operators** | | | | | | | |
| Front End Loaders | 6217 | $6.380 | $29.370 | $1.874 | $0.187 | $0.058 | $2.119 |
| Excavator | 6217 | $6.380 | $29.220 | $1.864 | $0.186 | $0.056 | $2.107 |
| All Others | 6217 | $6.380 | $29.570 | $1.887 | $0.189 | $0.057 | $2.132 |
| **Teamster** | 7228 | $9.400 | $20.650 | $1.941 | $0.194 | $0.058 | $2.193 |
| **Mechanic** | 8380 | $3.800 | $29.370 | $1.116 | $0.112 | $0.033 | $1.261 |

[1] based on WC hours

**References 1/1/2010**

| | |
|---|---|
| Base Rate, Fringes, Apprentice Rate | http://www.wia.state.nm.us/Tax/2010Rates.pdf |
| FICA, Medicare | http://www.ssa.gov/OACT/ProgData/taxRates.html |
| New Mexico Unemployment Tax | http://www.dws.state.nm.us/dws-newstax.html |
| Federal Unemployment Tax | http://workforcesecurity.doleta.gov/unemploy/uitaxtopic.asp |
| Workmans Comp | Vendor Quote 1/23/2009, John L. Anna Co West Insurance 823 So. Perry St. #260 Castle Rock, CO 80104 |

# TYPE "H" - HEAVY ENGINEERING

***Effective January 1, 2010***

| Trade Classification | Base Rate | Fringe Rate | Apprenticeship |
|---|---|---|---|
| Asbestos Worker - Heat & Frost Insulator | 27.35 | 10.23 | 0.20 |
| Boilermaker | 18.50 | 3.31 | 0.56 |
| Bricklayer/Blocklayer/StoneMason | 20.78 | 4.73 | 0.54 |
| Carpenter/Lather | 20.86 | 6.00 | 0.35 |
| Millwright/Piledriver | 26.38 | 5.96 | 0.40 |
| Cement Mason | 21.83 | 6.98 | 0.40 |
| **Electricians** | | | |
| **Outside Classifications** | | | |
| Groundman | 21.14 | 10.23 | 0.25 |
| Equipment Operator | 23.96 | 10.23 | 0.25 |
| Lineman/Tech | 24.55 | 10.23 | 0.25 |
| Cable Splicer | 25.73 | 10.23 | 0.25 |
| **Inside Classifications** | | | |
| Wireman/Tech | 26.85 | 8.36 | 0.54 |
| Cable Splicer | 28.58 | 8.36 | 0.54 |
| **Sound Classifications** | | | |
| Installer | 0.00 | 0.00 | 0.00 |
| Technician | 0.00 | 0.00 | 0.00 |
| Soundman | 0.00 | 0.00 | 0.00 |
| Glazier | 0.00 | 0.00 | 0.00 |
| Ironworker | 31.04 | 9.40 | 0.42 |
| Painter (Brush/Roller/Spray) | 16.00 | 3.78 | 0.00 |
| Plumber/Pipefitter | 28.30 | 11.00 | 0.32 |
| Roofer | 19.56 | 11.34 | 0.23 |
| SheetmetalWorker | 27.56 | 14.20 | 0.42 |
| **Operators** | | | |
| Group I | 21.31 | 6.77 | 0.34 |
| Group II | 21.51 | 6.77 | 0.34 |
| Group III | 22.09 | 6.77 | 0.34 |
| Group IV | 22.11 | 6.77 | 0.34 |
| Group V | 22.11 | 6.77 | 0.34 |
| Group VI | 22.26 | 6.77 | 0.34 |
| Group VII | 22.31 | 6.77 | 0.34 |
| Group VIII | 22.46 | 6.77 | 0.34 |
| Group IX | 22.96 | 6.77 | 0.34 |
| Group X | 23.76 | 6.77 | 0.34 |

# TYPE "H" - HEAVY ENGINEERING

***Effective January 1, 2010***

| Trade Classification | Base Rate | Fringe Rate | Apprenticeship |
|---|---|---|---|
| **Laborers** | | | |
| Group I | 14.95 | 4.27 | $0.26 |
| Group II | 15.25 | 4.27 | $0.26 |
| Group III | 15.55 | 4.27 | $0.26 |
| Group IV | 16.12 | 4.27 | $0.26 |
| Group V | 16.37 | 4.27 | $0.26 |
| Group VI | 15.10 | 4.27 | $0.26 |
| Group VII | 15.04 | 4.27 | $0.26 |
| Group VIII | 15.50 | 4.27 | $0.26 |
| Group IX | 15.70 | 4.27 | $0.26 |
| Group X | 16.37 | 4.27 | $0.26 |
| **Truck Drivers** | | | |
| Group I | 15.05 | 4.94 | $0.26 |
| Group II | 15.25 | 4.94 | $0.26 |
| Group III | 15.45 | 4.94 | $0.26 |
| Group IV | 15.65 | 4.94 | $0.26 |

**NOTE: SUBSISTENCE AND INCENTIVE PAY DO NOT APPLY TO TYPE "H" CONSTRUCTION.**

# Appendix B-2
# Equipment Rates
# (Equipment Watch)
# and Fuel Quote

EQUIPMENT WATCH

www.equipmentwatch.com

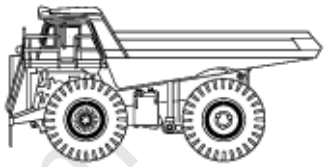
# Custom Cost Evaluator

February 8, 2010

## Caterpillar 777F

Mechanical Drive Rear Dumps

Size Class:
**90 - 104 MTons**
Weight:
**154,753 lbs.**



## Configuration for 777F

| | | | |
|---|---|---|---|
| Power Mode | **Diesel** | Rated Payload | **90.9 MT** |
| Body Capacity (Struck - Heaped) | **78.0 cy** | Net Horsepower | **938.0** |

## Hourly Ownership Costs

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Depreciation | $73.22/hr | $74.97/hr | +2.39% |
| Cost of Facilities Capital (CFC) | $30.58/hr | $27.91/hr | -8.73% |
| Overhead | $30.54/hr | $27.64/hr | -9.5% |
| Overhaul Labor | $23.02/hr | $14.90/hr | -35.27% |
| Overhaul Parts | $28.04/hr | $25.38/hr | -9.49% |
| **Total Hourly Ownership Cost:** | **$185.40/hr** | **$170.80/hr** | **-7.87%** |

**User Defined Adjustments:** Annual Use Hours (1,850 hrs -> 2,044 hrs ) Sales Tax (5.4% -> 7.5%)

## Hourly Operating Costs

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Field Labor | $14.14/hr | $9.15/hr | -35.29% |
| Field Parts | $17.31/hr | $15.66/hr | -9.53% |
| Ground Engaging Component (GEC) | $0.00/hr | $0.00/hr | - |
| Tires | $23.12/hr | $23.12/hr | - |
| Electrical/Fuel | $41.27/hr | $46.69/hr | +13.13% |
| Lube | $17.30/hr | $17.30/hr | - |
| **Total Hourly Operating Cost:** | **$113.14/hr** | **$111.92/hr** | **-1.08%** |

**User Defined Adjustments:** Diesel Cost ($2.20/gal -> $2.49/gal) Mechanics Wage ($46.29 -> $33.10)

## Total

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Hourly Ownership Cost | $185.40/hr | $170.80/hr | **-7.87%** |
| Hourly Operating Cost | $113.14/hr | $111.92/hr | **-1.08%** |
| **Total Hourly Cost** | **$298.54/hr** | **$282.72/hr** | **-5.3%** |

Revised Date: 2nd Half 2009

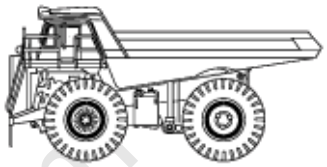
www.equipmentwatch.com

# Custom Cost Evaluator

February 8, 2010

## Komatsu 530M (disc. 2000)

Mechanical Drive Rear Dumps



Size Class:
**Rated Tonnage Capacity: 140 - 169 MTons**
Weight:
**220,440 lbs.**

## Configuration for 530M

| | | | |
|---|---|---|---|
| Power Mode | **Diesel** | Rated Payload | **150.0 MT** |
| Body Capacity (Struck - Heaped) | **71.0 - 102.0 cy** | Net Horsepower | **1,377.0** |

## Hourly Ownership Costs

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Depreciation | $68.35/hr | $69.99/hr | +2.4% |
| Cost of Facilities Capital (CFC) | $31.21/hr | $28.90/hr | -7.4% |
| Overhead | $16.16/hr | $14.87/hr | -7.98% |
| Overhaul Labor | $28.15/hr | $18.53/hr | -34.17% |
| Overhaul Parts | $35.77/hr | $32.92/hr | -7.97% |
| **Total Hourly Ownership Cost:** | **$179.64/hr** | **$165.21/hr** | **-8.03%** |

**User Defined Adjustments:** Annual Use Hours (1,850 hrs -> 2,010 hrs ) Sales Tax (5.4% -> 7.5%)

## Hourly Operating Costs

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Field Labor | $16.26/hr | $10.70/hr | -34.19% |
| Field Parts | $16.38/hr | $15.08/hr | -7.94% |
| Ground Engaging Component (GEC) | $0.00/hr | $0.00/hr | - |
| Tires | $32.81/hr | $32.81/hr | - |
| Electrical/Fuel | $60.59/hr | $68.55/hr | +13.14% |
| Lube | $19.60/hr | $19.60/hr | - |
| **Total Hourly Operating Cost:** | **$145.64/hr** | **$146.74/hr** | **+0.76%** |

**User Defined Adjustments:** Annual Field Parts ($25,250.85 -> $25,250.85) Diesel Cost ($2.20/gal -> $2.49/gal) Mechanics Wage ($46.29 -> $33.10)

## Total

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Hourly Ownership Cost | $179.64/hr | $165.21/hr | **-8.03%** |
| Hourly Operating Cost | $145.64/hr | $146.74/hr | **+0.76%** |
| **Total Hourly Cost** | **$325.28/hr** | **$311.95/hr** | **-4.1%** |

Revised Date: 2nd Half 2009

EQUIPMENT WATCH

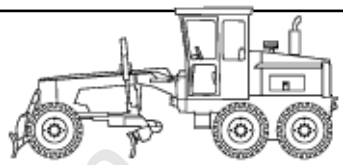
www.equipmentwatch.com

# Custom Cost Evaluator

February 8, 2010

## Caterpillar 16M

Articulated Frame Graders



Size Class:
**250 HP & Over**
Weight:
**57,452 lbs.**

## Configuration for 16M

| | | | |
|---|---|---|---|
| Power Mode | **Diesel** | Operator Protection | **EROPS** |
| Moldboard Size | **16'** | Net Horsepower | **297.0** |

## Hourly Ownership Costs

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Depreciation | $35.22/hr | $36.14/hr | +2.61% |
| Cost of Facilities Capital (CFC) | $18.45/hr | $15.22/hr | -17.51% |
| Overhead | $22.90/hr | $18.66/hr | -18.52% |
| Overhaul Labor | $5.95/hr | $3.47/hr | -41.68% |
| Overhaul Parts | $19.90/hr | $16.22/hr | -18.49% |
| **Total Hourly Ownership Cost:** | **$102.42/hr** | **$89.71/hr** | **-12.41%** |

**User Defined Adjustments:** Annual Use Hours (1,400 hrs -> 1,718 hrs ) Sales Tax (5.4% -> 7.5%)

## Hourly Operating Costs

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Field Labor | $4.96/hr | $2.89/hr | -41.73% |
| Field Parts | $19.30/hr | $15.73/hr | -18.5% |
| Ground Engaging Component (GEC) | $1.61/hr | $1.31/hr | -18.63% |
| Tires | $8.14/hr | $8.14/hr | - |
| Electrical/Fuel | $20.91/hr | $23.66/hr | +13.15% |
| Lube | $6.58/hr | $6.58/hr | - |
| **Total Hourly Operating Cost:** | **$61.50/hr** | **$58.31/hr** | **-5.19%** |

**User Defined Adjustments:** Diesel Cost ($2.20/gal -> $2.49/gal) Mechanics Wage ($46.29 -> $33.10)

## Total

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Hourly Ownership Cost | $102.42/hr | $89.71/hr | **-12.41%** |
| Hourly Operating Cost | $61.50/hr | $58.31/hr | **-5.19%** |
| **Total Hourly Cost** | **$163.92/hr** | **$148.02/hr** | **-9.7%** |

Revised Date: 2nd Half 2009

EQUIPMENT WATCH

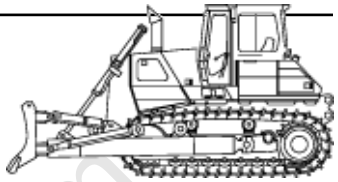
www.equipmentwatch.com

# Custom Cost Evaluator

February 8, 2010

## Caterpillar D11R (disc. 2007)

Standard Crawler Dozers



Size Class:
**Net Hp: 520 HP & Over**
Weight:
**202,847 lbs.**

## Configuration for D11R

| | | | |
|---|---|---|---|
| Power Mode | **Diesel** | Dozer Type | **U Blade** |
| Operator Protection | **EROPS** | Net Horsepower | **850.0** |

Equipment Notes: Includes dozer blade and operator protection as listed.

## Hourly Ownership Costs

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Depreciation | $87.05/hr | $89.16/hr | +2.42% |
| Cost of Facilities Capital (CFC) | $41.74/hr | $35.20/hr | -15.67% |
| Overhead | $42.43/hr | $35.38/hr | -16.62% |
| Overhaul Labor | $13.56/hr | $8.08/hr | -40.41% |
| Overhaul Parts | $80.91/hr | $67.46/hr | -16.62% |
| **Total Hourly Ownership Cost:** | **$265.69/hr** | **$235.28/hr** | **-11.45%** |

**User Defined Adjustments:** Annual Use Hours (1,400 hrs -> 1,679 hrs ) Sales Tax (5.4% -> 7.5%)

## Hourly Operating Costs

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Field Labor | $15.87/hr | $9.46/hr | -40.39% |
| Field Parts | $78.80/hr | $65.71/hr | -16.61% |
| Ground Engaging Component (GEC) | $12.40/hr | $10.34/hr | -16.61% |
| Tires | $0.00/hr | $0.00/hr | - |
| Electrical/Fuel | $65.45/hr | $74.05/hr | +13.14% |
| Lube | $18.83/hr | $18.83/hr | - |
| **Total Hourly Operating Cost:** | **$191.35/hr** | **$178.39/hr** | **-6.77%** |

**User Defined Adjustments:** Diesel Cost ($2.20/gal -> $2.49/gal) Mechanics Wage ($46.29 -> $33.10)

## Total

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Hourly Ownership Cost | $265.69/hr | $235.28/hr | **-11.45%** |
| Hourly Operating Cost | $191.35/hr | $178.39/hr | **-6.77%** |
| **Total Hourly Cost** | **$457.04/hr** | **$413.67/hr** | **-9.49%** |

Revised Date: 2nd Half 2009

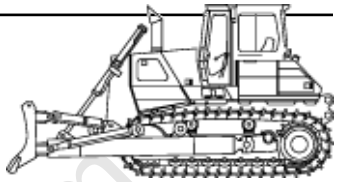
www.equipmentwatch.com

# Custom Cost Evaluator

February 8, 2010

## Caterpillar D9R (disc. 2005)

Standard Crawler Dozers



Size Class:
**Net Hp: 360 - 519 HP**
Weight:
**90,234 lbs.**

## Configuration for D9R

| | | | |
|---|---|---|---|
| Power Mode | **Diesel** | Dozer Type | **Semi-U** |
| Operator Protection | **EROPS** | Net Horsepower | **410.0** |

Equipment Notes: Includes dozer blade and operator protection as listed.

## Hourly Ownership Costs

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Depreciation | $31.18/hr | $31.94/hr | +2.44% |
| Cost of Facilities Capital (CFC) | $15.15/hr | $12.78/hr | -15.64% |
| Overhead | $17.16/hr | $14.31/hr | -16.61% |
| Overhaul Labor | $13.56/hr | $8.08/hr | -40.41% |
| Overhaul Parts | $31.89/hr | $26.59/hr | -16.62% |
| **Total Hourly Ownership Cost:** | **$108.94/hr** | **$93.70/hr** | **-13.99%** |

**User Defined Adjustments:** Annual Use Hours (1,400 hrs -> 1,679 hrs ) Sales Tax (5.4% -> 7.5%)

## Hourly Operating Costs

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Field Labor | $15.87/hr | $9.46/hr | -40.39% |
| Field Parts | $31.06/hr | $25.90/hr | -16.61% |
| Ground Engaging Component (GEC) | $4.50/hr | $3.75/hr | -16.67% |
| Tires | $0.00/hr | $0.00/hr | - |
| Electrical/Fuel | $31.57/hr | $35.72/hr | +13.15% |
| Lube | $7.62/hr | $7.62/hr | - |
| **Total Hourly Operating Cost:** | **$90.62/hr** | **$82.45/hr** | **-9.02%** |

**User Defined Adjustments:** Diesel Cost ($2.20/gal -> $2.49/gal) Mechanics Wage ($46.29 -> $33.10)

## Total

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Hourly Ownership Cost | $108.94/hr | $93.70/hr | **-13.99%** |
| Hourly Operating Cost | $90.62/hr | $82.45/hr | **-9.02%** |
| **Total Hourly Cost** | **$199.56/hr** | **$176.15/hr** | **-11.73%** |

Revised Date: 2nd Half 2009

EQUIPMENT WATCH

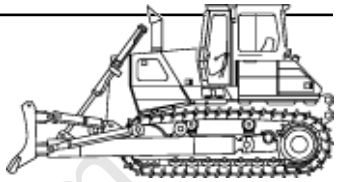
www.equipmentwatch.com

# Custom Cost Evaluator

February 8, 2010

## Caterpillar D6R SERIES II (disc. 2005)

Standard Crawler Dozers



Size Class:
**Net Hp: 160 - 189 HP**
Weight:
**40,400 lbs.**

## Configuration for D6R SERIES II

| | | | |
|---|---|---|---|
| Power Mode | **Diesel** | Dozer Type | **Semi-U** |
| Operator Protection | **EROPS** | Net Horsepower | **165.0** |

Equipment Notes: Includes dozer blade and operator protection as listed.

## Hourly Ownership Costs

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Depreciation | $12.71/hr | $13.07/hr | +2.83% |
| Cost of Facilities Capital (CFC) | $6.79/hr | $5.53/hr | -18.56% |
| Overhead | $5.87/hr | $4.72/hr | -19.59% |
| Overhaul Labor | $7.75/hr | $4.46/hr | -42.45% |
| Overhaul Parts | $10.70/hr | $8.61/hr | -19.53% |
| **Total Hourly Ownership Cost:** | **$43.82/hr** | **$36.39/hr** | **-16.96%** |

**User Defined Adjustments:** Annual Use Hours (1,285 hrs -> 1,597 hrs ) Sales Tax (5.4% -> 7.5%) Overhaul Parts ($13,752.15 -> $13,752.15)

## Hourly Operating Costs

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Field Labor | $9.55/hr | $5.49/hr | -42.51% |
| Field Parts | $10.37/hr | $8.34/hr | -19.58% |
| Ground Engaging Component (GEC) | $1.50/hr | $1.21/hr | -19.33% |
| Tires | $0.00/hr | $0.00/hr | - |
| Electrical/Fuel | $14.16/hr | $16.02/hr | +13.14% |
| Lube | $2.84/hr | $2.84/hr | - |
| **Total Hourly Operating Cost:** | **$38.42/hr** | **$33.90/hr** | **-11.76%** |

**User Defined Adjustments:** Diesel Cost ($2.20/gal -> $2.49/gal) Mechanics Wage ($46.29 -> $33.10)

## Total

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Hourly Ownership Cost | $43.82/hr | $36.39/hr | **-16.96%** |
| Hourly Operating Cost | $38.42/hr | $33.90/hr | **-11.76%** |
| **Total Hourly Cost** | **$82.24/hr** | **$70.29/hr** | **-14.53%** |

Revised Date: 2nd Half 2009

www.equipmentwatch.com

# Custom Cost Evaluator

February 8, 2010

## Caterpillar 992G (disc. 2008)

4-Wd Articulated Wheel Loaders

Size Class:
**Net Hp: 500 - 999 HP**
Weight:
**210,424 lbs.**

## Configuration for 992G

| | | | |
|---|---|---|---|
| Power Mode | **Diesel** | Bucket Capacity-Heaped | **16.00 cy** |
| Net Horsepower | **791.0** | Operator Protection | **EROPS** |

Equipment Notes: Includes General Purpose bucket and ROPS, unless otherwise noted.
Configuration Notes: with EROPS

## Hourly Ownership Costs

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Depreciation | $95.23/hr | $97.82/hr | +2.72% |
| Cost of Facilities Capital (CFC) | $45.18/hr | $37.80/hr | -16.33% |
| Overhead | $49.70/hr | $41.02/hr | -17.46% |
| Overhaul Labor | $8.01/hr | $4.73/hr | -40.95% |
| Overhaul Parts | $26.87/hr | $22.18/hr | -17.45% |
| **Total Hourly Ownership Cost:** | **$224.99/hr** | **$203.55/hr** | **-9.53%** |

**User Defined Adjustments:** Annual Use Hours (1,445 hrs -> 1,751 hrs ) Sales Tax (5.4% -> 7.5%)

## Hourly Operating Costs

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Field Labor | $9.77/hr | $5.77/hr | -40.94% |
| Field Parts | $29.65/hr | $24.47/hr | -17.47% |
| Ground Engaging Component (GEC) | $3.87/hr | $3.19/hr | -17.57% |
| Tires | $29.10/hr | $29.10/hr | - |
| Electrical/Fuel | $55.69/hr | $63.00/hr | +13.13% |
| Lube | $16.58/hr | $16.58/hr | - |
| **Total Hourly Operating Cost:** | **$144.66/hr** | **$142.11/hr** | **-1.76%** |

**User Defined Adjustments:** Annual Field Parts ($36,463.28 -> $36,463.29) Annual Misc. Supply Parts ($6,381.07 -> $6,381.07) Diesel Cost ($2.20/gal -> $2.49/gal) Mechanics Wage ($46.29 -> $33.10)

## Total

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Hourly Ownership Cost | $224.99/hr | $203.55/hr | **-9.53%** |
| Hourly Operating Cost | $144.66/hr | $142.11/hr | **-1.76%** |
| **Total Hourly Cost** | **$369.65/hr** | **$345.66/hr** | **-6.49%** |

Revised Date: 2nd Half 2009

EQUIPMENT WATCH

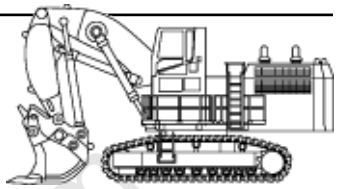
www.equipmentwatch.com

# Custom Cost Evaluator

February 8, 2010

## Hitachi EX3500-3 (disc. 2001)

Hydraulic Shovels



Size Class:
**Operating Weight: 150.1 MTons & Over**
Weight:
**736,000 lbs.**

## Configuration for EX3500-3

| | | | |
|---|---|---|---|
| Power Mode | **Diesel** | Bucket Capacity - Heaped | **23.5 cy** |
| Operating Weight | **334.0 MT** | Net Horsepower | **1,634.0** |

Equipment Notes: Bucket included in rate, unless otherwise noted.

## Hourly Ownership Costs

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Depreciation | $150.10/hr | $153.56/hr | +2.31% |
| Cost of Facilities Capital (CFC) | $71.18/hr | $65.04/hr | -8.63% |
| Overhead | $34.77/hr | $31.56/hr | -9.23% |
| Overhaul Labor | $24.02/hr | $15.59/hr | -35.1% |
| Overhaul Parts | $128.99/hr | $117.09/hr | -9.23% |
| **Total Hourly Ownership Cost:** | **$409.06/hr** | **$382.84/hr** | **-6.41%** |

**User Defined Adjustments:** Annual Use Hours (1,850 hrs -> 2,038 hrs ) Sales Tax (5.4% -> 7.5%) Overhaul Parts ($238,637.22 -> $238,637.23)

## Hourly Operating Costs

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Field Labor | $31.90/hr | $20.71/hr | -35.08% |
| Field Parts | $141.24/hr | $128.21/hr | -9.23% |
| Ground Engaging Component (GEC) | $18.91/hr | $17.17/hr | -9.2% |
| Tires | $0.00/hr | $0.00/hr | - |
| Electrical/Fuel | $158.17/hr | $178.95/hr | +13.14% |
| Lube | $46.31/hr | $46.31/hr | - |
| **Total Hourly Operating Cost:** | **$396.53/hr** | **$391.35/hr** | **-1.31%** |

**User Defined Adjustments:** Diesel Cost ($2.20/gal -> $2.49/gal) Mechanics Wage ($46.29 -> $33.10)

## Total

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Hourly Ownership Cost | $409.06/hr | $382.84/hr | **-6.41%** |
| Hourly Operating Cost | $396.53/hr | $391.35/hr | **-1.31%** |
| **Total Hourly Cost** | **$805.59/hr** | **$774.19/hr** | **-3.9%** |

Revised Date: 2nd Half 2009

www.equipmentwatch.com

# Custom Cost Evaluator

February 8, 2010

## Off-Highway Water Tanker Trucks

Miscellaneous Models

## Configuration for Off-Highway Water Tanker Trucks

| | | | |
|---|---|---|---|
| Power Mode | **Diesel** | Tank Capacity | **10,000 gal** |
| Horsepower | **450.0** | | |

Equipment Notes: Rates include off-highway prime mover complete with a semi-trailer water tanker, hydraulic drive centrifugal pump and rear spraybar.

## Hourly Ownership Costs

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Depreciation | $37.27/hr | $38.25/hr | +2.63% |
| Cost of Facilities Capital (CFC) | $15.32/hr | $13.03/hr | -14.95% |
| Overhead | $11.85/hr | $9.92/hr | -16.29% |
| Overhaul Labor | $10.18/hr | $6.09/hr | -40.18% |
| Overhaul Parts | $8.97/hr | $7.51/hr | -16.28% |
| **Total Hourly Ownership Cost:** | **$83.59/hr** | **$74.80/hr** | **-10.52%** |

**User Defined Adjustments:** Annual Use Hours (1,500 hrs -> 1,793 hrs ) Sales Tax (5.4% -> 7.5%)

## Hourly Operating Costs

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Field Labor | $24.69/hr | $14.77/hr | -40.18% |
| Field Parts | $17.32/hr | $14.49/hr | -16.34% |
| Ground Engaging Component (GEC) | $0.00/hr | $0.00/hr | - |
| Tires | $10.41/hr | $10.41/hr | - |
| Electrical/Fuel | $33.76/hr | $38.19/hr | +13.12% |
| Lube | $7.38/hr | $7.38/hr | - |
| **Total Hourly Operating Cost:** | **$93.56/hr** | **$85.24/hr** | **-8.89%** |

**User Defined Adjustments:** Diesel Cost ($2.20/gal -> $2.49/gal) Mechanics Wage ($46.29 -> $33.10)

## Total

| | Standard Value | User Adjusted Value | Variance |
|---|---|---|---|
| Hourly Ownership Cost | $83.59/hr | $74.80/hr | **-10.52%** |
| Hourly Operating Cost | $93.56/hr | $85.24/hr | **-8.89%** |
| **Total Hourly Cost** | **$177.15/hr** | **$160.04/hr** | **-9.66%** |

Revised Date: 2nd Half 2009

| | Water Truck | 16M | 992G | 777F | D11R | D9R | D6R | 530M | EX-3500-3 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| Hours per year | 2085 | 2085 | 2085 | 2085 | 2085 | 2085 | 2085 | 2085 | 2085 |
| | | | | | | | | | |
| Annual overhaul hours | 330 | 180 | 250 | 920 | 410 | 410 | 215 | 1125 | 960 |
| | | | | | | | | | |
| Subtotal | 1755 | 1905 | 1835 | 1165 | 1675 | 1675 | 1870 | 960 | 1125 |
| | | | | | | | | | |
| 50 minute hour | 293 | 318 | 306 | 194 | 279 | 279 | 312 | 160 | 188 |
| | | | | | | | | | |
| Equipment Watch Annual Use Hours | 1500 | 1400 | 1445 | 1850 | 1400 | 1400 | 1285 | 1850 | 1850 |
| | | | | | | | | | |
| **Adjusted Annual Use Hours** | **1793** | **1718** | **1751** | **2044** | **1679** | **1679** | **1597** | **2010** | **2038** |

January 14, 2010

Re:  Fuel cost estimate update for FMI Tyrone Mines/ Little Rock Reclamation

Ms. April Tischer
Telestro Solutions, Inc.
8670 Wolff Court, Suite 205
Westminister, Co.

Ms. Tischer,

As requested:

Off-road low sulphur diesel delivered to Tyrone, New Mexico

Via tank transport truck with approximately 7,500 gallon capacity:
El Paso refinery rack cost plus $.25 per gallon.
e.g. Today's rack @$2.239 = $2.489 delivered.

Via bob-tail tank truck gallons with 1500 to 2100 gallons capacity:
Established monthly purchase order price for FMI, Chino Mines.
e.g.  January price delivered was $2.60/gallon.
This price is usually good for the entire month.

Prices stated are not static and subject to change as market volatility dictates.

If you have any questions please feel free to call me.

Sincerely,

J.P. Jones
Porter Oil Co., Inc.
P.O. Box 100
Bayard, N.M. 88023
575-537-3376 (ph)
575-537-3469 (fax)
jpjones@porteroil.com

# Appendix B-3
# Unit Costs
# (RS Means)

$169.95 per copy (in United States)
Price is subject to change without prior notice.

0160

# RSMeans Heavy Construction Cost Data

## 24TH ANNUAL EDITION

# 2010

**RSMeans**
A division of Reed Construction Data
*Construction Publishers & Consultants*
*63 Smiths Lane*
*Kingston, MA 02364-3008*
***(781) 422-5000***



Printed in the United States of America
ISSN 0893-5602
ISBN 978-0-87629-997-5



**Senior Editor**
Eugene R. Spencer

**Contributing Editors**
Christopher Babbitt
Ted Baker
Barbara Balboni
Robert A. Bastoni
John H. Chiang, PE
Gary W. Christensen
David G. Drain, PE
Cheryl Elsmore
Robert J. Kuchta
Robert C. McNichols
Melville J. Mossman, PE
Jeannene D. Murphy
Stephen C. Plotner
Marshall J. Stetson
Phillip R. Waier, PE

**Book Design**
Norman R. Forgit

**President & CEO**
Iain Melville

**Vice President, Product & Development**
Richard Remington

**Vice President of Operations**
David C. Walsh

**Vice President of Sales**
Thomas Kesler

**Director, Cost Products**
Daimon Bridge

**Marketing Director**
John M. Shea

**Engineering Manager**
Bob Mewis, CCC

**Cover Design**
Paul Robertson
Wayne Engebretson

**Production Manager**
Michael Kokernak

**Production Coordinator**
Jill Goodman

**Production**
Paula Reale-Camelio
Sheryl A. Rose
Jonathan Forgit
Debbie Panarelli
Mary Lou Geary

**Technical Support**
A.K. Dash
Tom Dion
Roger Hancock
Gary L. Hoitt
Genevieve Medeiros
Kathryn S. Rodriguez
Sharon Proulx

This book is printed on recycled paper,
using soy-based printing ink. This book is recyclable.

PRINTED WITH SOY INK

## 02 41 13 – Selective Site Demolition

| | 02 41 13.34 Selective Demolition, Utility Materials | Crew | Daily Output | Labor-Hours | Unit | 2010 Bare Costs Material | Labor | Equipment | Total | Total Incl O&P |
|---|---|---|---|---|---|---|---|---|---|---|
| 0010 | **SELECTIVE DEMOLITION, UTILITY MATERIALS** R024119-10 | | | | | | | | | |
| 0015 | Excludes excavation | | | | | | | | | |
| 0020 | See other utility items in Div. 02 41 13.33 | | | | | | | | | |
| 0100 | Fire Hydrant extensions | B-20 | 14 | 1.714 | Ea. | | 63.50 | | 63.50 | 97.50 |
| 0200 | Precast Utility boxes up to 8' x 14' x 7' | B-13 | 2 | 28 | | | 1,000 | 375 | 1,375 | 1,925 |
| 0300 | Handholes and meter pits | B-6 | 2 | 12 | | | 430 | 169 | 599 | 840 |
| 0400 | Utility valves 4"-12" | B-20 | 4 | 6 | | | 222 | | 222 | 340 |
| 0500 | 14"-24" | B-21 | 2 | 14 | | | 530 | 69 | 599 | 890 |
| | **02 41 13.36 Selective Demolition, Utility Valves and Accessories** | | | | | | | | | |
| 0010 | **SELECTIVE DEMOLITION, UTILITY VALVES & ACCESSORIES** | | | | | | | | | |
| 0015 | Excludes excavation | | | | | | | | | |
| 0100 | Utility valves 4"-12" diam. | B-20 | 4 | 6 | Ea. | | 222 | | 222 | 340 |
| 0200 | 14"-24" diam. | B-21 | 2 | 14 | | | 530 | 69 | 599 | 890 |
| 0300 | Crosses 4"-12" | B-20 | 8 | 3 | | | 111 | | 111 | 171 |
| 0400 | 14"-24" | B-21 | 4 | 7 | | | 266 | 34.50 | 300.50 | 450 |
| 0500 | Utility cut-in valves 4"-12" diam. | B-20 | 20 | 1.200 | | | 44.50 | | 44.50 | 68.50 |
| 0600 | Curb boxes | " | 20 | 1.200 | | | 44.50 | | 44.50 | 68.50 |
| | **02 41 13.38 Selective Demo., Water & Sewer Piping & Fittings** | | | | | | | | | |
| 0010 | **SELECTIVE DEMOLITION, WATER & SEWER PIPING AND FITTINGS** | | | | | | | | | |
| 0015 | Excludes excavation | | | | | | | | | |
| 0020 | See other utility items in Div. 02 41 13.33 | | | | | | | | | |
| 0090 | Concrete pipe 4"-10" dia | B-6 | 250 | .096 | L.F. | | 3.44 | 1.35 | 4.79 | 6.75 |
| 0100 | 42"-48" diameter | B-13B | 96 | .583 | | | 21 | 12.60 | 33.60 | 46 |
| 0200 | 60"-84" diameter | " | 80 | .700 | | | 25 | 15.10 | 40.10 | 54.50 |
| 0300 | 96" diameter | B-13C | 80 | .700 | | | 25 | 21.50 | 46.50 | 62 |
| 0400 | 108"-144" diameter | " | 64 | .875 | | | 31.50 | 27 | 58.50 | 78 |
| 0450 | Concrete fittings 12" diameter | B-6 | 24 | 1 | Ea. | | 36 | 14.10 | 50.10 | 70 |
| 0480 | Concrete end pieces 12" diameter | | 200 | .120 | L.F. | | 4.30 | 1.69 | 5.99 | 8.40 |
| 0485 | 15" diameter | | 150 | .160 | | | 5.75 | 2.25 | 8 | 11.25 |
| 0490 | 18" diameter | | 150 | .160 | | | 5.75 | 2.25 | 8 | 11.25 |
| 0500 | 24" -36" diameter | | 100 | .240 | | | 8.60 | 3.38 | 11.98 | 16.80 |
| 0600 | Concrete fittings 24"-36" diameter | | 12 | 2 | Ea. | | 71.50 | 28 | 99.50 | 140 |
| 0700 | 48"-84" diameter | B-13B | 12 | 4.667 | | | 167 | 101 | 268 | 365 |
| 0800 | 96" diameter | " | 8 | 7 | | | 250 | 151 | 401 | 545 |
| 0900 | 108"-144" diameter | B-13C | 4 | 14 | | | 500 | 435 | 935 | 1,250 |
| 1000 | Ductile iron pipe 4" diameter | B-21B | 200 | .200 | L.F. | | 7.15 | 3.28 | 10.43 | 14.55 |
| 1100 | 6"-12" diameter | | 175 | .229 | | | 8.15 | 3.75 | 11.90 | 16.60 |
| 1200 | 14"-24" diameter | | 120 | .333 | | | 11.90 | 5.45 | 17.35 | 24.50 |
| 1300 | Ductile iron fittings 4"-12" diameter | | 24 | 1.667 | Ea. | | 59.50 | 27.50 | 87 | 121 |
| 1400 | 14"-16" diameter | | 18 | 2.222 | | | 79.50 | 36.50 | 116 | 162 |
| 1500 | 18"-24" diameter | | 12 | 3.333 | | | 119 | 54.50 | 173.50 | 242 |
| 1600 | Plastic pipe 3/4"-4" diameter | B-20 | 700 | .034 | L.F. | | 1.27 | | 1.27 | 1.95 |
| 1700 | 6"-8" diameter | | 500 | .048 | | | 1.77 | | 1.77 | 2.73 |
| 1800 | 10"-18" diameter | | 300 | .080 | | | 2.95 | | 2.95 | 4.55 |
| 1900 | 20"-36" diameter | | 200 | .120 | | | 4.43 | | 4.43 | 6.85 |
| 1910 | 42"-48" diameter | | 180 | .133 | | | 4.92 | | 4.92 | 7.60 |
| 1920 | 54"-60" diameter | | 160 | .150 | | | 5.55 | | 5.55 | 8.55 |
| 2000 | Plastic fittings 4"- 8" diameter | B-6 | 75 | .320 | Ea. | | 11.45 | 4.51 | 15.96 | 22.50 |
| 2100 | 10"-14" diameter | | 50 | .480 | | | 17.20 | 6.75 | 23.95 | 33.50 |
| 2200 | 16"-24" diameter | | 20 | 1.200 | | | 43 | 16.90 | 59.90 | 84 |
| 2210 | 30"-36" diameter | | 15 | 1.600 | | | 57.50 | 22.50 | 80 | 113 |
| 2220 | 42 "- 48" diameter | | 12 | 2 | | | 71.50 | 28 | 99.50 | 140 |

# 22 11 Facility Water Distribution

## 22 11 19 – Domestic Water Piping Specialties

| | 22 11 19.42 Backflow Preventers | Crew | Daily Output | Labor-Hours | Unit | 2010 Bare Costs Material | Labor | Equipment | Total | Total Incl O&P |
|---|---|---|---|---|---|---|---|---|---|---|
| 5080 | 3" pipe size | Q-1 | 4.50 | 3.556 | Ea. | 3,700 | 167 | | 3,867 | 4,325 |
| 5100 | 4" pipe size | | 3 | 5.333 | | 4,650 | 250 | | 4,900 | 5,475 |
| 5120 | 6" pipe size | Q-2 | 3 | 8 | | 6,725 | 390 | | 7,115 | 7,975 |
| 5200 | Flanged, iron, valves are gate | | | | | | | | | |
| 5210 | 2-1/2" pipe size | Q-1 | 5 | 3.200 | Ea. | 2,475 | 150 | | 2,625 | 2,950 |
| 5220 | 3" pipe size | | 4.50 | 3.556 | | 2,575 | 167 | | 2,742 | 3,075 |
| 5230 | 4" pipe size | | 3 | 5.333 | | 3,500 | 250 | | 3,750 | 4,225 |
| 5240 | 6" pipe size | Q-2 | 3 | 8 | | 4,925 | 390 | | 5,315 | 6,000 |
| 5250 | 8" pipe size | | 2 | 12 | | 8,825 | 585 | | 9,410 | 10,600 |
| 5260 | 10" pipe size | | 1 | 24 | | 12,500 | 1,175 | | 13,675 | 15,500 |
| 5600 | Flanged, iron, valves are OS&Y | | | | | | | | | |
| 5660 | 2-1/2" pipe size | Q-1 | 5 | 3.200 | Ea. | 1,925 | 150 | | 2,075 | 2,350 |
| 5680 | 3" pipe size | | 4.50 | 3.556 | | 2,950 | 167 | | 3,117 | 3,500 |
| 5700 | 4" pipe size | | 3 | 5.333 | | 3,800 | 250 | | 4,050 | 4,550 |
| 5720 | 6" pipe size | Q-2 | 3 | 8 | | 5,375 | 390 | | 5,765 | 6,475 |
| 5740 | 8" pipe size | | 2 | 12 | | 9,450 | 585 | | 10,035 | 11,300 |
| 5760 | 10" pipe size | | 1 | 24 | | 12,700 | 1,175 | | 13,875 | 15,700 |

### 22 11 19.64 Hydrants

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0010 | **HYDRANTS** | | | | | | | | | |
| 0050 | Wall type, moderate climate, bronze, encased | | | | | | | | | |
| 0200 | 3/4" IPS connection | 1 Plum | 16 | .500 | Ea. | 600 | 26 | | 626 | 700 |
| 0300 | 1" IPS connection | " | 14 | .571 | | 690 | 29.50 | | 719.50 | 805 |
| 0500 | Anti-siphon type, 3/4" connection | | | | | 520 | | | 520 | 570 |
| 1000 | Non-freeze, bronze, exposed | | | | | | | | | |
| 1100 | 3/4" IPS connection, 4" to 9" thick wall | 1 Plum | 14 | .571 | Ea. | 405 | 29.50 | | 434.50 | 490 |
| 1120 | 10" to 14" thick wall | " | 12 | .667 | | 520 | 34.50 | | 554.50 | 620 |
| 1280 | For anti-siphon type, add | | | | | 106 | | | 106 | 117 |
| 2000 | Non-freeze bronze, encased, anti-siphon type | | | | | | | | | |
| 2100 | 3/4" IPS connection, 5" to 9" thick wall | 1 Plum | 14 | .571 | Ea. | 1,025 | 29.50 | | 1,054.50 | 1,175 |
| 2140 | 15" to 19" thick wall | " | 12 | .667 | " | 1,100 | 34.50 | | 1,134.50 | 1,275 |
| 3000 | Ground box type, bronze frame, 3/4" IPS connection | | | | | | | | | |
| 3080 | Non-freeze, all bronze, polished face, set flush | | | | | | | | | |
| 3100 | 2 feet depth of bury | 1 Plum | 8 | 1 | Ea. | 765 | 52 | | 817 | 925 |
| 3180 | 6 feet depth of bury | | 7 | 1.143 | | 1,000 | 59.50 | | 1,059.50 | 1,200 |
| 3220 | 8 feet depth of bury | | 5 | 1.600 | | 1,125 | 83.50 | | 1,208.50 | 1,350 |
| 3400 | For 1" IPS connection, add | | | | | 15% | 10% | | | |
| 3550 | For 2" connection, add | | | | | 445% | 24% | | | |
| 3600 | For tapped drain port in box, add | | | | | 69.50 | | | 69.50 | 76 |
| 5000 | Moderate climate, all bronze, polished face | | | | | | | | | |
| 5020 | and scoriated cover, set flush | | | | | | | | | |
| 5100 | 3/4" IPS connection | 1 Plum | 16 | .500 | Ea. | 530 | 26 | | 556 | 625 |
| 5120 | 1" IPS connection | " | 14 | .571 | | 655 | 29.50 | | 684.50 | 765 |
| 5200 | For tapped drain port in box, add | | | | | 69.50 | | | 69.50 | 76 |

## 22 11 23 – Domestic Water Pumps

### 22 11 23.10 General Utility Pumps

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0010 | **GENERAL UTILITY PUMPS** | | | | | | | | | |
| 2000 | Single stage | | | | | | | | | |
| 3000 | Double suction, | | | | | | | | | |
| 3190 | 75 HP, to 2500 GPM | Q-3 | .28 | 114 | Ea. | 16,400 | 5,675 | | 22,075 | 26,500 |
| 3220 | 100 HP, to 3000 GPM | | .26 | 123 | | 20,600 | 6,100 | | 26,700 | 31,800 |
| 3240 | 150 HP, to 4000 GPM | | .24 | 133 | | 31,700 | 6,600 | | 38,300 | 44,800 |

| | 31 23 23.13 Backfill | Crew | Daily Output | Labor-Hours | Unit | 2010 Bare Costs Material | Labor | Equipment | Total | Total Incl O&P |
|---|---|---|---|---|---|---|---|---|---|---|
| 1100 | Vibrating plate, add | A-1E | 90 | .089 | E.C.Y. | | 2.94 | .48 | 3.42 | 5.05 |
| 3000 | For flowable fill, see Div. 03 31 05.35 | | | | | | | | | |
| | **31 23 23.14 Backfill, Structural** | | | | | | | | | |
| 0010 | **BACKFILL, STRUCTURAL** | | | | | | | | | |
| 0011 | Dozer or F.E. loader | | | | | | | | | |
| 0020 | From existing stockpile, no compaction | | | | | | | | | |
| 2000 | 80 H.P., 50' haul, sand & gravel | B-10L | 1100 | .011 | L.C.Y. | | .43 | .40 | .83 | 1.09 |
| 2010 | Sandy clay & loam | | 1070 | .011 | | | .44 | .41 | .85 | 1.12 |
| 2020 | Common earth | | 975 | .012 | | | .49 | .45 | .94 | 1.23 |
| 2040 | Clay | | 850 | .014 | | | .56 | .51 | 1.07 | 1.42 |
| 2200 | 150' haul, sand & gravel | | 550 | .022 | | | .87 | .79 | 1.66 | 2.18 |
| 2210 | Sandy clay & loam | | 535 | .022 | | | .89 | .82 | 1.71 | 2.24 |
| 2220 | Common earth | | 490 | .024 | | | .97 | .89 | 1.86 | 2.45 |
| 2240 | Clay | | 425 | .028 | | | 1.12 | 1.03 | 2.15 | 2.82 |
| 2400 | 300' haul, sand & gravel | | 370 | .032 | | | 1.29 | 1.18 | 2.47 | 3.24 |
| 2410 | Sandy clay & loam | | 360 | .033 | | | 1.32 | 1.21 | 2.53 | 3.33 |
| 2420 | Common earth | | 330 | .036 | | | 1.44 | 1.32 | 2.76 | 3.64 |
| 2440 | Clay | | 290 | .041 | | | 1.64 | 1.51 | 3.15 | 4.14 |
| 3000 | 105 H.P., 50' haul, sand & gravel | B-10W | 1350 | .009 | | | .35 | .49 | .84 | 1.07 |
| 3010 | Sandy clay & loam | | 1325 | .009 | | | .36 | .50 | .86 | 1.09 |
| 3020 | Common earth | | 1225 | .010 | | | .39 | .54 | .93 | 1.18 |
| 3040 | Clay | | 1100 | .011 | | | .43 | .60 | 1.03 | 1.31 |
| 3200 | 150' haul, sand & gravel | | 670 | .018 | | | .71 | .99 | 1.70 | 2.15 |
| 3210 | Sandy clay & loam | | 655 | .018 | | | .73 | 1.01 | 1.74 | 2.21 |
| 3220 | Common earth | | 610 | .020 | | | .78 | 1.08 | 1.86 | 2.37 |
| 3240 | Clay | | 550 | .022 | | | .87 | 1.20 | 2.07 | 2.63 |
| 3300 | 300' haul, sand & gravel | | 465 | .026 | | | 1.02 | 1.42 | 2.44 | 3.11 |
| 3310 | Sandy clay & loam | | 455 | .026 | | | 1.05 | 1.45 | 2.50 | 3.18 |
| 3320 | Common earth | | 415 | .029 | | | 1.15 | 1.59 | 2.74 | 3.48 |
| 3340 | Clay | | 370 | .032 | | | 1.29 | 1.78 | 3.07 | 3.90 |
| 4000 | 200 H.P., 50' haul, sand & gravel | B-10B | 2500 | .005 | | | .19 | .48 | .67 | .81 |
| 4010 | Sandy clay & loam | | 2435 | .005 | | | .20 | .49 | .69 | .84 |
| 4020 | Common earth | | 2200 | .005 | | | .22 | .54 | .76 | .93 |
| 4040 | Clay | | 1950 | .006 | | | .24 | .61 | .85 | 1.04 |
| 4200 | 150' haul, sand & gravel | | 1225 | .010 | | | .39 | .97 | 1.36 | 1.66 |
| 4210 | Sandy clay & loam | | 1200 | .010 | | | .40 | .99 | 1.39 | 1.69 |
| 4220 | Common earth | | 1100 | .011 | | | .43 | 1.08 | 1.51 | 1.84 |
| 4240 | Clay | | 975 | .012 | | | .49 | 1.22 | 1.71 | 2.09 |
| 4400 | 300' haul, sand & gravel | | 805 | .015 | | | .59 | 1.48 | 2.07 | 2.52 |
| 4410 | Sandy clay & loam | | 790 | .015 | | | .60 | 1.51 | 2.11 | 2.57 |
| 4420 | Common earth | | 735 | .016 | | | .65 | 1.62 | 2.27 | 2.76 |
| 4440 | Clay | | 660 | .018 | | | .72 | 1.81 | 2.53 | 3.08 |
| 5000 | 300 H.P., 50' haul, sand & gravel | B-10M | 3170 | .004 | | | .15 | .50 | .65 | .78 |
| 5010 | Sandy clay & loam | | 3110 | .004 | | | .15 | .51 | .66 | .79 |
| 5020 | Common earth | | 2900 | .004 | | | .16 | .55 | .71 | .85 |
| 5040 | Clay | | 2700 | .004 | | | .18 | .59 | .77 | .92 |
| 5200 | 150' haul, sand & gravel | | 2200 | .005 | | | .22 | .72 | .94 | 1.13 |
| 5210 | Sandy clay & loam | | 2150 | .006 | | | .22 | .74 | .96 | 1.14 |
| 5220 | Common earth | | 1950 | .006 | | | .24 | .82 | 1.06 | 1.27 |
| 5240 | Clay | | 1700 | .007 | | | .28 | .94 | 1.22 | 1.45 |
| 5400 | 300' haul, sand & gravel | | 1500 | .008 | | | .32 | 1.06 | 1.38 | 1.65 |
| 5410 | Sandy clay & loam | | 1470 | .008 | | | .32 | 1.08 | 1.40 | 1.68 |

| | 31 23 23.20 Hauling | Crew | Daily Output | Labor-Hours | Unit | 2010 Bare Costs Material | Labor | Equipment | Total | Total Incl O&P |
|---|---|---|---|---|---|---|---|---|---|---|
| 9680 | cycle 20 miles | B-34I | 144 | .056 | L.C.Y. | | 1.84 | 5.80 | 7.64 | 9.20 |
| 9682 | cycle 30 miles | | 108 | .074 | | | 2.46 | 7.75 | 10.21 | 12.30 |
| 9684 | cycle 40 miles | | 90 | .089 | | | 2.95 | 9.30 | 12.25 | 14.75 |
| 9686 | cycle 50 miles | | 72 | .111 | | | 3.68 | 11.65 | 15.33 | 18.40 |
| 9694 | 45 MPH ave, cycle 8 miles | | 216 | .037 | | | 1.23 | 3.88 | 5.11 | 6.15 |
| 9696 | cycle 10 miles | | 198 | .040 | | | 1.34 | 4.23 | 5.57 | 6.70 |
| 9698 | cycle 20 miles | | 144 | .056 | | | 1.84 | 5.80 | 7.64 | 9.20 |
| 9700 | cycle 30 miles | | 126 | .063 | | | 2.10 | 6.65 | 8.75 | 10.50 |
| 9702 | cycle 40 miles | | 108 | .074 | | | 2.46 | 7.75 | 10.21 | 12.30 |
| 9704 | cycle 50 miles | | 90 | .089 | | | 2.95 | 9.30 | 12.25 | 14.75 |
| 9706 | 50 MPH ave, cycle 10 miles | | 198 | .040 | | | 1.34 | 4.23 | 5.57 | 6.70 |
| 9708 | cycle 20 miles | | 162 | .049 | | | 1.64 | 5.20 | 6.84 | 8.20 |
| 9710 | cycle 30 miles | | 126 | .063 | | | 2.10 | 6.65 | 8.75 | 10.50 |
| 9712 | cycle 40 miles | | 108 | .074 | | | 2.46 | 7.75 | 10.21 | 12.30 |
| 9714 | cycle 50 miles | | 90 | .089 | | | 2.95 | 9.30 | 12.25 | 14.75 |
| | **31 23 23.23 Compaction** | | | | | | | | | |
| 0010 | **COMPACTION** | | | | | | | | | |
| 5000 | Riding, vibrating roller, 6" lifts, 2 passes | B-10Y | 3000 | .004 | E.C.Y. | | .16 | .17 | .33 | .43 |
| 5020 | 3 passes | | 2300 | .005 | | | .21 | .22 | .43 | .56 |
| 5040 | 4 passes | | 1900 | .006 | | | .25 | .27 | .52 | .68 |
| 5050 | 8" lifts, 2 passes | | 4100 | .003 | | | .12 | .13 | .25 | .32 |
| 5060 | 12" lifts, 2 passes | | 5200 | .002 | | | .09 | .10 | .19 | .25 |
| 5080 | 3 passes | | 3500 | .003 | | | .14 | .15 | .29 | .37 |
| 5100 | 4 passes | | 2600 | .005 | | | .18 | .20 | .38 | .50 |
| 5600 | Sheepsfoot or wobbly wheel roller, 6" lifts, 2 passes | B-10G | 2400 | .005 | | | .20 | .52 | .72 | .87 |
| 5620 | 3 passes | | 1735 | .007 | | | .27 | .72 | .99 | 1.20 |
| 5640 | 4 passes | | 1300 | .009 | | | .37 | .96 | 1.33 | 1.60 |
| 5680 | 12" lifts, 2 passes | | 5200 | .002 | | | .09 | .24 | .33 | .40 |
| 5700 | 3 passes | | 3500 | .003 | | | .14 | .36 | .50 | .60 |
| 5720 | 4 passes | | 2600 | .005 | | | .18 | .48 | .66 | .81 |
| 6000 | Towed sheepsfoot or wobbly wheel roller, 6" lifts, 2 passes | B-10D | 10000 | .001 | | | .05 | .17 | .22 | .25 |
| 6020 | 3 passes | | 2000 | .006 | | | .24 | .84 | 1.08 | 1.28 |
| 6030 | 4 passes | | 1500 | .008 | | | .32 | 1.12 | 1.44 | 1.71 |
| 6050 | 12" lifts, 2 passes | | 6000 | .002 | | | .08 | .28 | .36 | .43 |
| 6060 | 3 passes | | 4000 | .003 | | | .12 | .42 | .54 | .64 |
| 6070 | 4 passes | | 3000 | .004 | | | .16 | .56 | .72 | .86 |
| 6200 | Vibrating roller, 6" lifts, 2 passes | B-10C | 2600 | .005 | | | .18 | .63 | .81 | .97 |
| 6210 | 3 passes | | 1735 | .007 | | | .27 | .94 | 1.21 | 1.44 |
| 6220 | 4 passes | | 1300 | .009 | | | .37 | 1.25 | 1.62 | 1.93 |
| 6250 | 12" lifts, 2 passes | | 5200 | .002 | | | .09 | .31 | .40 | .48 |
| 6260 | 3 passes | | 3465 | .003 | | | .14 | .47 | .61 | .73 |
| 6270 | 4 passes | | 2600 | .005 | | | .18 | .63 | .81 | .97 |
| 7000 | Walk behind, vibrating plate 18" wide, 6" lifts, 2 passes | A-1D | 200 | .040 | | | 1.32 | .17 | 1.49 | 2.23 |
| 7020 | 3 passes | | 185 | .043 | | | 1.43 | .19 | 1.62 | 2.41 |
| 7040 | 4 passes | | 140 | .057 | | | 1.89 | .24 | 2.13 | 3.19 |
| 7200 | 12" lifts, 2 passes | A-1E | 560 | .014 | | | .47 | .08 | .55 | .82 |
| 7220 | 3 passes | | 375 | .021 | | | .71 | .12 | .83 | 1.22 |
| 7240 | 4 passes | | 280 | .029 | | | .95 | .16 | 1.11 | 1.63 |
| 7500 | Vibrating roller 24" wide, 6" lifts, 2 passes | B-10A | 420 | .029 | | | 1.13 | .36 | 1.49 | 2.10 |
| 7520 | 3 passes | | 280 | .043 | | | 1.70 | .53 | 2.23 | 3.16 |
| 7540 | 4 passes | | 210 | .057 | | | 2.27 | .71 | 2.98 | 4.20 |
| 7600 | 12" lifts, 2 passes | | 840 | .014 | | | .57 | .18 | .75 | 1.06 |

| | 33 11 13.25 Water Supply, Polyvinyl Chloride Pipe | Crew | Daily Output | Labor-Hours | Unit | 2010 Bare Costs Material | Labor | Equipment | Total | Total Incl O&P |
|---|---|---|---|---|---|---|---|---|---|---|
| 8220 | 6" diameter | B-20 | 90 | .267 | Ea. | 92 | 9.85 | | 101.85 | 116 |
| 8240 | 8" diameter | | 50 | .480 | | 173 | 17.75 | | 190.75 | 218 |
| 8260 | 10" diameter | | 50 | .480 | | 273 | 17.75 | | 290.75 | 330 |
| 8280 | 12" diameter | | 30 | .800 | | 365 | 29.50 | | 394.50 | 445 |
| 8300 | Reducing tee 6" x 4" | | 100 | .240 | | 120 | 8.85 | | 128.85 | 146 |
| 8320 | 8" x 6" | | 90 | .267 | | 290 | 9.85 | | 299.85 | 335 |
| 8330 | 10" x 6" | | 90 | .267 | | 335 | 9.85 | | 344.85 | 385 |
| 8340 | 10" x 8" | | 90 | .267 | | 360 | 9.85 | | 369.85 | 410 |
| 8350 | 12" x 6" | | 90 | .267 | | 450 | 9.85 | | 459.85 | 510 |
| 8360 | 12" x 8" | | 90 | .267 | | 500 | 9.85 | | 509.85 | 565 |
| 8400 | Tapped service tee (threaded type) 6" x 6" x 3/4" | | 100 | .240 | | 78 | 8.85 | | 86.85 | 99.50 |
| 8430 | 6" x 6" x 1" | | 90 | .267 | | 78 | 9.85 | | 87.85 | 101 |
| 8440 | 6" x 6" x 1 1/2" | | 90 | .267 | | 78 | 9.85 | | 87.85 | 101 |
| 8450 | 6" x 6" x 2" | | 90 | .267 | | 78 | 9.85 | | 87.85 | 101 |
| 8460 | 8" x 8" x 3/4" | | 90 | .267 | | 123 | 9.85 | | 132.85 | 151 |
| 8470 | 8" x 8" x 1" | | 90 | .267 | | 123 | 9.85 | | 132.85 | 151 |
| 8480 | 8" x 8" x 1 1/2" | | 90 | .267 | | 123 | 9.85 | | 132.85 | 151 |
| 8490 | 8" x 8" x 2" | | 90 | .267 | | 123 | 9.85 | | 132.85 | 151 |
| 8500 | Repair coupling 4" | | 100 | .240 | | 108 | 8.85 | | 116.85 | 133 |
| 8520 | 6" diameter | | 90 | .267 | | 131 | 9.85 | | 140.85 | 159 |
| 8540 | 8" diameter | | 50 | .480 | | 155 | 17.75 | | 172.75 | 198 |
| 8560 | 10" diameter | | 50 | .480 | | 198 | 17.75 | | 215.75 | 246 |
| 8580 | 12" diameter | | 50 | .480 | | 234 | 17.75 | | 251.75 | 285 |
| 8600 | Plug end 4" | | 100 | .240 | | 38 | 8.85 | | 46.85 | 55.50 |
| 8620 | 6" diameter | | 90 | .267 | | 73.50 | 9.85 | | 83.35 | 96 |
| 8640 | 8" diameter | | 50 | .480 | | 79 | 17.75 | | 96.75 | 115 |
| 8660 | 10" diameter | | 50 | .480 | | 126 | 17.75 | | 143.75 | 167 |
| 8680 | 12" diameter | | 50 | .480 | | 156 | 17.75 | | 173.75 | 200 |
| 8700 | PVC pipe, joint restraint | | | | | | | | | |
| 8710 | 4" diameter | B-20A | 32 | 1 | Ea. | 38.50 | 40.50 | | 79 | 104 |
| 8720 | 6" diameter | | 25.60 | 1.250 | | 46.50 | 50.50 | | 97 | 128 |
| 8730 | 8" diameter | | 21.33 | 1.500 | | 67 | 60.50 | | 127.50 | 166 |
| 8740 | 10" diameter | | 18.28 | 1.751 | | 124 | 71 | | 195 | 243 |
| 8750 | 12" diameter | | 16.84 | 1.900 | | 131 | 77 | | 208 | 261 |
| 8760 | 14" diameter | | 16 | 2 | | 206 | 81 | | 287 | 350 |
| 8770 | 16" diameter | | 11.64 | 2.749 | | 263 | 111 | | 374 | 460 |
| 8780 | 18" diameter | | 11.03 | 2.901 | | 325 | 117 | | 442 | 540 |
| 8785 | 20" diameter | | 9.14 | 3.501 | | 405 | 142 | | 547 | 660 |
| 8790 | 24" diameter | | 7.53 | 4.250 | | 470 | 172 | | 642 | 775 |

| | 33 11 13.35 Water Supply, HDPE | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0010 | **WATER SUPPLY, HDPE** | | | | | | | | | |
| 0011 | Butt fusion joints, SDR 21,40' lengths not including excavation or backfill | | | | | | | | | |
| 0100 | 4" diameter | B-22A | 400 | .095 | L.F. | 3.65 | 3.54 | .97 | 8.16 | 10.55 |
| 0200 | 6" diameter | | 380 | .100 | | 10.70 | 3.73 | 1.02 | 15.45 | 18.55 |
| 0300 | 8" diameter | | 320 | .119 | | 12.35 | 4.43 | 1.21 | 17.99 | 21.50 |
| 0400 | 10" diameter | | 300 | .127 | | 19.10 | 4.73 | 1.29 | 25.12 | 29.50 |
| 0500 | 12" diameter | | 260 | .146 | | 27 | 5.45 | 1.49 | 33.94 | 39.50 |
| 0600 | 14" diameter | | 220 | .173 | | 32.50 | 6.45 | 1.76 | 40.71 | 48 |
| 0700 | 16" diameter | | 180 | .211 | | 42 | 7.90 | 2.15 | 52.05 | 61 |
| 0800 | 18" diameter | | 140 | .271 | | 53.50 | 10.15 | 2.77 | 66.42 | 77.50 |
| 0900 | 24" diameter | | 100 | .380 | | 95.50 | 14.20 | 3.88 | 113.58 | 131 |
| 1000 | Fittings | | | | | | | | | |

# 33 47 Ponds and Reservoirs

## 33 47 13 – Pond and Reservoir Liners

| 33 47 13.53 Reservoir Liners HDPE | | Crew | Daily Output | Labor-Hours | Unit | 2010 Bare Costs Material | Labor | Equipment | Total | Total Incl O&P |
|---|---|---|---|---|---|---|---|---|---|---|
| 0010 | **RESERVOIR LINERS HDPE** | | | | | | | | | |
| 0011 | Membrane lining | | | | | | | | | |
| 1100 | 30 mil thick | 3 Skwk | 1850 | .013 | S.F. | .27 | .55 | | .82 | 1.15 |
| 1200 | 60 mil thick | | 1600 | .015 | " | .31 | .64 | | .95 | 1.32 |
| 1220 | 60 mil thick | | 1.60 | 15 | M.S.F. | 310 | 640 | | 950 | 1,325 |
| 1300 | 120 mil thick | | 1440 | .017 | S.F. | .38 | .71 | | 1.09 | 1.51 |

# 33 49 Storm Drainage Structures

## 33 49 13 – Storm Drainage Manholes, Frames, and Covers

### 33 49 13.10 Storm Drainage Manholes, Frames and Covers

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0010 | **STORM DRAINAGE MANHOLES, FRAMES & COVERS** | | | | | | | | | |
| 0020 | Excludes footing, excavation, backfill (See line items for frame & cover) | | | | | | | | | |
| 0050 | Brick, 4' inside diameter, 4' deep | D-1 | 1 | 16 | Ea. | 440 | 605 | | 1,045 | 1,400 |
| 0100 | 6' deep | | .70 | 22.857 | | 625 | 860 | | 1,485 | 1,975 |
| 0150 | 8' deep | | .50 | 32 | | 800 | 1,200 | | 2,000 | 2,700 |
| 0200 | For depths over 8', add | | 4 | 4 | V.L.F. | 167 | 151 | | 318 | 410 |
| 0400 | Concrete blocks (radial), 4' I.D., 4' deep | | 1.50 | 10.667 | Ea. | 365 | 400 | | 765 | 1,000 |
| 0500 | 6' deep | | 1 | 16 | | 490 | 605 | | 1,095 | 1,450 |
| 0600 | 8' deep | | .70 | 22.857 | | 615 | 860 | | 1,475 | 1,975 |
| 0700 | For depths over 8', add | | 5.50 | 2.909 | V.L.F. | 64.50 | 110 | | 174.50 | 236 |
| 0800 | Concrete, cast in place, 4' x 4', 8" thick, 4' deep | C-14H | 2 | 24 | Ea. | 475 | 985 | 15.10 | 1,475.10 | 2,075 |
| 0900 | 6' deep | | 1.50 | 32 | | 690 | 1,325 | 20 | 2,035 | 2,800 |
| 1000 | 8' deep | | 1 | 48 | | 990 | 1,975 | 30 | 2,995 | 4,150 |
| 1100 | For depths over 8', add | | 8 | 6 | V.L.F. | 108 | 246 | 3.78 | 357.78 | 505 |
| 1110 | Precast, 4' I.D., 4' deep | B-22 | 4.10 | 7.317 | Ea. | 450 | 281 | 50.50 | 781.50 | 980 |
| 1120 | 6' deep | | 3 | 10 | | 800 | 385 | 69 | 1,254 | 1,550 |
| 1130 | 8' deep | | 2 | 15 | | 925 | 575 | 104 | 1,604 | 2,025 |
| 1140 | For depths over 8', add | | 16 | 1.875 | V.L.F. | 75 | 72 | 12.95 | 159.95 | 207 |
| 1150 | 5' I.D., 4' deep | B-6 | 3 | 8 | Ea. | 1,100 | 287 | 113 | 1,500 | 1,750 |
| 1160 | 6' deep | | 2 | 12 | | 1,200 | 430 | 169 | 1,799 | 2,175 |
| 1170 | 8' deep | | 1.50 | 16 | | 1,300 | 575 | 225 | 2,100 | 2,550 |
| 1180 | For depths over 8', add | | 12 | 2 | V.L.F. | 184 | 71.50 | 28 | 283.50 | 340 |
| 1190 | 6' I.D., 4' deep | | 2 | 12 | Ea. | 1,825 | 430 | 169 | 2,424 | 2,850 |
| 1200 | 6' deep | | 1.50 | 16 | | 1,975 | 575 | 225 | 2,775 | 3,300 |
| 1210 | 8' deep | | 1 | 24 | | 2,700 | 860 | 340 | 3,900 | 4,650 |
| 1220 | For depths over 8', add | | 8 | 3 | V.L.F. | 310 | 107 | 42 | 459 | 550 |
| 1250 | Slab tops, precast, 8" thick | | | | | | | | | |
| 1300 | 4' diameter manhole | B-6 | 8 | 3 | Ea. | 195 | 107 | 42 | 344 | 425 |
| 1400 | 5' diameter manhole | | 7.50 | 3.200 | | 400 | 115 | 45 | 560 | 665 |
| 1500 | 6' diameter manhole | | 7 | 3.429 | | 555 | 123 | 48.50 | 726.50 | 850 |
| 3800 | Steps, heavyweight cast iron, 7" x 9" | 1 Bric | 40 | .200 | | 13.10 | 8.35 | | 21.45 | 27 |
| 3900 | 8" x 9" | | 40 | .200 | | 19.60 | 8.35 | | 27.95 | 34 |
| 3928 | 12" x 10-1/2" | | 40 | .200 | | 22.50 | 8.35 | | 30.85 | 37 |
| 4000 | Standard sizes, galvanized steel | | 40 | .200 | | 18.90 | 8.35 | | 27.25 | 33.50 |
| 4100 | Aluminum | | 40 | .200 | | 25.50 | 8.35 | | 33.85 | 41 |

# 33 63 Steam Energy Distribution

## 33 63 13 – Underground Steam and Condensate Distribution Piping

| | 33 63 13.10 Calcium Silicate Insulated System | Crew | Daily Output | Labor-Hours | Unit | 2010 Bare Costs Material | Labor | Equipment | Total | Total Incl O&P |
|---|---|---|---|---|---|---|---|---|---|---|
| 7480 | 2-1/2" diameter pipe size | Q-17 | 31 | .516 | L.F. | 60.50 | 24 | 1.89 | 86.39 | 105 |
| 7490 | 3" diameter pipe size | | 27 | .593 | | 71 | 27.50 | 2.17 | 100.67 | 122 |
| 7500 | 4" diameter pipe size | | 21 | .762 | | 92.50 | 35.50 | 2.79 | 130.79 | 159 |
| 7510 | 5" diameter pipe size | | 17 | .941 | | 128 | 44 | 3.44 | 175.44 | 210 |
| 7520 | 6" diameter pipe size | Q-18 | 22 | 1.091 | | 141 | 53 | 2.66 | 196.66 | 237 |
| 7530 | 8" diameter pipe size | | 18 | 1.333 | | 211 | 64.50 | 3.25 | 278.75 | 335 |
| 7540 | 10" diameter pipe size | | 15 | 1.600 | | 251 | 77.50 | 3.90 | 332.40 | 395 |
| 7550 | 12" diameter pipe size | | 13 | 1.846 | | 310 | 89.50 | 4.50 | 404 | 480 |
| 7590 | For 2" thick insulation, add | | | | | 13% | | | | |
| 7640 | For 2-1/2" thick insulation, add | | | | | 18% | | | | |
| 7680 | For 3" thick insulation, add | | | | | 24% | | | | |

# 33 71 Electrical Utility Transmission and Distribution

## 33 71 13 – Electrical Utility Towers

### 33 71 13.23 Line Towers and Fixtures

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0010 | **LINE TOWERS & FIXTURES** | | | | | | | | | |
| 0100 | Excavation and backfill, earth | R-5 | 135.38 | .650 | C.Y. | | 28 | 10.85 | 38.85 | 53.50 |
| 0105 | Rock | | 21.46 | 4.101 | " | | 175 | 68.50 | 243.50 | 340 |
| 0200 | Steel footings (grillage) in earth | | 3.91 | 22.506 | Ton | 1,775 | 960 | 375 | 3,110 | 3,825 |
| 0205 | In rock | | 3.20 | 27.500 | " | 1,775 | 1,175 | 460 | 3,410 | 4,200 |
| 0290 | See also Div. 33 05 23.19 | | | | | | | | | |
| 0300 | Rock anchors | R-5 | 5.87 | 14.991 | Ea. | 465 | 640 | 251 | 1,356 | 1,750 |
| 0400 | Concrete foundations | " | 12.85 | 6.848 | C.Y. | 123 | 293 | 115 | 531 | 700 |
| 0490 | See also Div. 03 30 53.40 | | | | | | | | | |
| 0500 | Towers-material handling and spotting | R-7 | 22.56 | 2.128 | Ton | | 73.50 | 9 | 82.50 | 122 |
| 0540 | Steel tower erection | R-5 | 7.65 | 11.503 | | 1,725 | 490 | 192 | 2,407 | 2,825 |
| 0550 | Lace and box | | 7.10 | 12.394 | | 1,725 | 530 | 207 | 2,462 | 2,900 |
| 0560 | Painting total structure | | 1.47 | 59.864 | Ea. | 375 | 2,550 | 1,000 | 3,925 | 5,325 |
| 0570 | Disposal of surplus material | R-7 | 20.87 | 2.300 | Mile | | 79.50 | 9.70 | 89.20 | 132 |
| 0600 | Special towers-material handling and spotting | " | 12.31 | 3.899 | Ton | | 135 | 16.45 | 151.45 | 223 |
| 0640 | Special steel structure erection | R-6 | 6.52 | 13.497 | | 2,125 | 575 | 495 | 3,195 | 3,725 |
| 0650 | Special steel lace and box | " | 6.29 | 13.990 | | 2,125 | 600 | 515 | 3,240 | 3,775 |
| 0670 | Disposal of surplus material | R-7 | 7.87 | 6.099 | Mile | | 211 | 25.50 | 236.50 | 350 |

### 33 71 13.80 Transmission Line Right of Way

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0010 | **TRANSMISSION LINE RIGHT OF WAY** | | | | | | | | | |
| 0100 | Clearing right of way | B-87 | 6.67 | 5.997 | Acre | | 246 | 390 | 636 | 800 |
| 0200 | Restoration & seeding | B-10D | 4 | 3 | " | 1,050 | 119 | 420 | 1,589 | 1,800 |

## 33 71 16 – Electrical Utility Poles

### 33 71 16.20 Line Poles and Fixtures

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0010 | **LINE POLES & FIXTURES** | | | | | | | | | |
| 0100 | Digging holes in earth, average | R-5 | 25.14 | 3.500 | Ea. | | 150 | 58.50 | 208.50 | 289 |
| 0105 | In rock, average | " | 4.51 | 19.512 | | | 835 | 325 | 1,160 | 1,600 |
| 0200 | Wood poles, material handling and spotting | R-7 | 6.49 | 7.396 | | | 256 | 31 | 287 | 425 |
| 0220 | Erect wood poles & backfill holes, in earth | R-5 | 6.77 | 12.999 | | 1,400 | 555 | 217 | 2,172 | 2,625 |
| 0250 | In rock | " | 5.87 | 14.991 | | 1,400 | 640 | 251 | 2,291 | 2,775 |
| 0260 | Disposal of pole & hardware surplus material | R-7 | 20.87 | 2.300 | Mile | | 79.50 | 9.70 | 89.20 | 132 |
| 0300 | Crossarms for wood pole structure | | | | | | | | | |
| 0310 | Material handling and spotting | R-7 | 14.55 | 3.299 | Ea. | | 114 | 13.90 | 127.90 | 189 |
| 0320 | Install crossarms | R-5 | 11 | 8 | " | 465 | 340 | 134 | 939 | 1,175 |
| 0330 | Disposal of crossarms & hardware surplus material | R-7 | 40 | 1.200 | Mile | | 41.50 | 5.05 | 46.55 | 68.50 |

# 33 71 Electrical Utility Transmission and Distribution

## 33 71 16 – Electrical Utility Poles

| | 33 71 16.20 Line Poles and Fixtures | Crew | Daily Output | Labor-Hours | Unit | 2010 Bare Costs Material | Labor | Equipment | Total | Total Incl O&P |
|---|---|---|---|---|---|---|---|---|---|---|
| 0400 | Formed plate pole structure | | | | | | | | | |
| 0410 | Material handling and spotting | R-7 | 2.40 | 20 | Ea. | | 690 | 84.50 | 774.50 | 1,150 |
| 0420 | Erect steel plate pole | R-5 | 1.95 | 45.128 | | 8,775 | 1,925 | 755 | 11,455 | 13,400 |
| 0500 | Guys, anchors and hardware for pole, in earth | | 7.04 | 12.500 | | 530 | 535 | 209 | 1,274 | 1,625 |
| 0510 | In rock | | 17.96 | 4.900 | | 635 | 209 | 82 | 926 | 1,100 |
| 0900 | Foundations for line poles | | | | | | | | | |
| 0920 | Excavation, in earth | R-5 | 135.38 | .650 | C.Y. | | 28 | 10.85 | 38.85 | 53.50 |
| 0940 | In rock | | 20 | 4.400 | | | 188 | 73.50 | 261.50 | 365 |
| 0960 | Concrete foundations | | 11 | 8 | | 123 | 340 | 134 | 597 | 795 |

### 33 71 16.33 Wood Electrical Utility Poles

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0010 | **WOOD ELECTRICAL UTILITY POLES** | | | | | | | | | |
| 0011 | Excludes excavation, backfill and cast-in-place concrete | | | | | | | | | |
| 6200 | Electric & tel sitework, 20' high, treated wd, see Div. 26 56 13.10 | R-3 | 3.10 | 6.452 | Ea. | 266 | 310 | 44.50 | 620.50 | 805 |
| 6400 | 25' high | | 2.90 | 6.897 | | 281 | 335 | 47.50 | 663.50 | 860 |
| 6600 | 30' high | | 2.60 | 7.692 | | 310 | 370 | 53 | 733 | 955 |
| 6800 | 35' high | | 2.40 | 8.333 | | 405 | 400 | 57.50 | 862.50 | 1,100 |
| 7000 | 40' high | | 2.30 | 8.696 | | 495 | 420 | 60 | 975 | 1,225 |
| 7200 | 45' high | | 1.70 | 11.765 | | 605 | 570 | 81.50 | 1,256.50 | 1,600 |
| 7400 | Cross arms with hardware & insulators | | | | | | | | | |
| 7600 | 4' long | 1 Elec | 2.50 | 3.200 | Ea. | 126 | 157 | | 283 | 370 |
| 7800 | 5' long | | 2.40 | 3.333 | | 146 | 163 | | 309 | 405 |
| 8000 | 6' long | | 2.20 | 3.636 | | 169 | 178 | | 347 | 450 |

## 33 71 19 – Electrical Underground Ducts and Manholes

### 33 71 19.15 Underground Ducts and Manholes

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0010 | **UNDERGROUND DUCTS AND MANHOLES** | | | | | | | | | |
| 0011 | Not incl. excavation, backfill and concrete, in slab or duct bank | | | | | | | | | |
| 1000 | Direct burial | | | | | | | | | |
| 1010 | PVC, schedule 40, w/coupling, 1/2" diameter | 1 Elec | 340 | .024 | L.F. | .47 | 1.15 | | 1.62 | 2.23 |
| 1020 | 3/4" diameter | | 290 | .028 | | .62 | 1.35 | | 1.97 | 2.69 |
| 1030 | 1" diameter | | 260 | .031 | | .93 | 1.51 | | 2.44 | 3.26 |
| 1040 | 1-1/2" diameter | | 210 | .038 | | 1.52 | 1.87 | | 3.39 | 4.45 |
| 1050 | 2" diameter | | 180 | .044 | | 1.99 | 2.18 | | 4.17 | 5.45 |
| 1060 | 3" diameter | 2 Elec | 240 | .067 | | 3.79 | 3.27 | | 7.06 | 9.05 |
| 1070 | 4" diameter | | 160 | .100 | | 5.35 | 4.90 | | 10.25 | 13.15 |
| 1080 | 5" diameter | | 120 | .133 | | 7.75 | 6.55 | | 14.30 | 18.20 |
| 1090 | 6" diameter | | 90 | .178 | | 10.25 | 8.70 | | 18.95 | 24 |
| 1110 | Elbows, 1/2" diameter | 1 Elec | 48 | .167 | Ea. | 1.40 | 8.15 | | 9.55 | 13.70 |
| 1120 | 3/4" diameter | | 38 | .211 | | 1.57 | 10.30 | | 11.87 | 17.10 |
| 1130 | 1" diameter | | 32 | .250 | | 2.47 | 12.25 | | 14.72 | 21 |
| 1140 | 1-1/2" diameter | | 21 | .381 | | 4.70 | 18.65 | | 23.35 | 33 |
| 1150 | 2" diameter | | 16 | .500 | | 6.80 | 24.50 | | 31.30 | 44 |
| 1160 | 3" diameter | | 12 | .667 | | 19.90 | 32.50 | | 52.40 | 70.50 |
| 1170 | 4" diameter | | 9 | .889 | | 34 | 43.50 | | 77.50 | 103 |
| 1180 | 5" diameter | | 8 | 1 | | 60 | 49 | | 109 | 139 |
| 1190 | 6" diameter | | 5 | 1.600 | | 102 | 78.50 | | 180.50 | 229 |
| 1210 | Adapters, 1/2" diameter | | 52 | .154 | | .47 | 7.55 | | 8.02 | 11.70 |
| 1220 | 3/4" diameter | | 43 | .186 | | .84 | 9.10 | | 9.94 | 14.45 |
| 1230 | 1" diameter | | 39 | .205 | | 1.06 | 10.05 | | 11.11 | 16.10 |
| 1240 | 1-1/2" diameter | | 35 | .229 | | 1.64 | 11.20 | | 12.84 | 18.45 |
| 1250 | 2" diameter | | 26 | .308 | | 2.36 | 15.10 | | 17.46 | 25 |
| 1260 | 3" diameter | | 20 | .400 | | 5.90 | 19.60 | | 25.50 | 35.50 |
| 1270 | 4" diameter | | 14 | .571 | | 10.25 | 28 | | 38.25 | 53 |

## 33 71 26 – Transmission and Distribution Equipment

| | 33 71 26.13 Capacitor Banks | Crew | Daily Output | Labor-Hours | Unit | 2010 Bare Costs Material | Labor | Equipment | Total | Total Incl O&P |
|---|---|---|---|---|---|---|---|---|---|---|
| 0010 | **CAPACITOR BANKS** | | | | | | | | | |
| 0300 | Station capacitors | | | | | | | | | |
| 0350 | Synchronous, 13 to 26 kV | R-11 | 3.11 | 18.006 | MVAR | 6,350 | 830 | 276 | 7,456 | 8,525 |
| 0360 | 46 kV | | 3.33 | 16.817 | | 8,100 | 775 | 258 | 9,133 | 10,300 |
| 0370 | 69 kV | | 3.81 | 14.698 | | 7,950 | 680 | 225 | 8,855 | 10,000 |
| 0380 | 161 kV | | 6.51 | 8.602 | | 7,450 | 395 | 132 | 7,977 | 8,925 |
| 0390 | 500 kV | | 10.37 | 5.400 | | 6,475 | 249 | 82.50 | 6,806.50 | 7,575 |
| 0450 | Static, 13 to 26 kV | | 3.11 | 18.006 | | 5,375 | 830 | 276 | 6,481 | 7,475 |
| 0460 | 46 kV | | 3.01 | 18.605 | | 6,800 | 860 | 285 | 7,945 | 9,075 |
| 0470 | 69 kV | | 3.81 | 14.698 | | 6,600 | 680 | 225 | 7,505 | 8,525 |
| 0480 | 161 kV | | 6.51 | 8.602 | | 6,125 | 395 | 132 | 6,652 | 7,500 |
| 0490 | 500 kV | | 10.37 | 5.400 | | 5,600 | 249 | 82.50 | 5,931.50 | 6,600 |
| 1600 | Voltage regulators, 13 to 26 kV | | .75 | 74.667 | Ea. | 240,500 | 3,450 | 1,150 | 245,100 | 271,500 |
| | **33 71 26.23 Current Transformers** | | | | | | | | | |
| 0010 | **CURRENT TRANSFORMERS** | | | | | | | | | |
| 4050 | Current transformers, 13 to 26 kV | R-11 | 14 | 4 | Ea. | 2,950 | 185 | 61.50 | 3,196.50 | 3,600 |
| 4060 | 46 kV | | 9.33 | 6.002 | | 8,650 | 277 | 92 | 9,019 | 10,000 |
| 4070 | 69 kV | | 7 | 8 | | 8,950 | 370 | 123 | 9,443 | 10,500 |
| 4080 | 161 kV | | 1.87 | 29.947 | | 29,000 | 1,375 | 460 | 30,835 | 34,500 |
| | **33 71 26.26 Potential Transformers** | | | | | | | | | |
| 0010 | **POTENTIAL TRANSFORMERS** | | | | | | | | | |
| 4100 | Potential transformers, 13 to 26 kV | R-11 | 11.20 | 5 | Ea. | 4,225 | 231 | 76.50 | 4,532.50 | 5,075 |
| 4110 | 46 kV | | 8 | 7 | | 8,700 | 325 | 107 | 9,132 | 10,200 |
| 4120 | 69 kV | | 6.22 | 9.003 | | 9,225 | 415 | 138 | 9,778 | 10,900 |
| 4130 | 161 kV | | 2.24 | 25 | | 19,900 | 1,150 | 385 | 21,435 | 24,000 |
| 4140 | 500 kV | | 1.40 | 40 | | 59,500 | 1,850 | 615 | 61,965 | 69,000 |

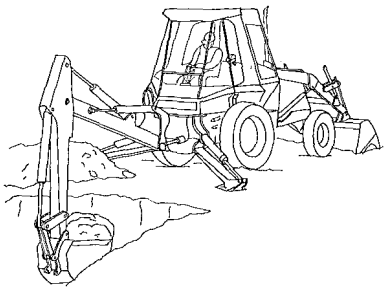
## 33 71 39 – High-Voltage Wiring

### 33 71 39.13 Overhead High-Voltage Wiring

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0010 | **OVERHEAD HIGH-VOLTAGE WIRING** | | | | | | | | | |
| 0100 | Conductors, primary circuits | | | | | | | | | |
| 0110 | Material handling and spotting | R-5 | 9.78 | 8.998 | W.Mile | | 385 | 151 | 536 | 740 |
| 0120 | For river crossing, add | | 11 | 8 | | | 340 | 134 | 474 | 655 |
| 0150 | Conductors, per wire, 210 to 636 kcmil | | 1.96 | 44.898 | | 7,650 | 1,925 | 750 | 10,325 | 12,100 |
| 0160 | 795 to 954 kcmil | | 1.87 | 47.059 | | 11,500 | 2,000 | 785 | 14,285 | 16,500 |
| 0170 | 1000 to 1600 kcmil | | 1.47 | 59.864 | | 18,200 | 2,550 | 1,000 | 21,750 | 24,900 |
| 0180 | Over 1600 kcmil | | 1.35 | 65.185 | | 24,400 | 2,775 | 1,100 | 28,275 | 32,200 |
| 0200 | For river crossing, add, 210 to 636 kcmil | | 1.24 | 70.968 | | | 3,025 | 1,175 | 4,200 | 5,850 |
| 0220 | 795 to 954 kcmil | | 1.09 | 80.734 | | | 3,450 | 1,350 | 4,800 | 6,650 |
| 0230 | 1000 to 1600 kcmil | | .97 | 90.722 | | | 3,875 | 1,525 | 5,400 | 7,475 |
| 0240 | Over 1600 kcmil | | .87 | 101 | | | 4,325 | 1,700 | 6,025 | 8,325 |
| 0300 | Joints and dead ends | R-8 | 6 | 8 | Ea. | 1,375 | 345 | 57 | 1,777 | 2,075 |
| 0400 | Sagging | R-5 | 7.33 | 12.001 | W.Mile | | 515 | 201 | 716 | 990 |
| 0500 | Clipping, per structure, 69 kV | R-10 | 9.60 | 5 | Ea. | | 231 | 62 | 293 | 415 |
| 0510 | 161 kV | | 5.33 | 9.006 | | | 415 | 112 | 527 | 745 |
| 0520 | 345 to 500 kV | | 2.53 | 18.972 | | | 875 | 235 | 1,110 | 1,550 |
| 0600 | Make and install jumpers, per structure, 69 kV | R-8 | 3.20 | 15 | | 370 | 650 | 107 | 1,127 | 1,500 |
| 0620 | 161 kV | | 1.20 | 40 | | 740 | 1,725 | 285 | 2,750 | 3,725 |
| 0640 | 345 to 500 kV | | .32 | 150 | | 1,250 | 6,500 | 1,075 | 8,825 | 12,300 |
| 0700 | Spacers | R-10 | 68.57 | .700 | | 74 | 32.50 | 8.70 | 115.20 | 139 |
| 0720 | For river crossings, add | " | 60 | .800 | | | 37 | 9.95 | 46.95 | 66 |
| 0800 | Installing pulling line (500 kV only) | R-9 | 1.45 | 44.138 | W.Mile | 650 | 1,775 | 236 | 2,661 | 3,650 |

# G10 Site Preparation

## G1030 Site Earthwork



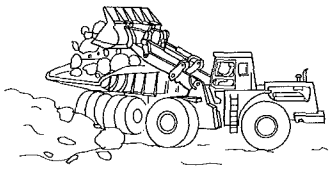
The Excavation of Common Earth System balances the productivity of the excavating equipment to the hauling equipment. It is assumed that the hauling equipment will encounter light traffic and will move up no considerable grades on the haul route. No mobilization cost is included. All costs given in these systems include a swell factor of 25% for hauling.

The Expanded System Listing shows Excavation systems using backhoes ranging from 1/2 Cubic Yard capacity to 3-1/2 Cubic Yards. Power shovels indicated range from 1/2 Cubic Yard to 3 Cubic Yards. Dragline bucket rigs range from 1/2 Cubic Yard to 3 Cubic Yards. Truck capacities range from 8 Cubic Yards to 20 Cubic Yards. Each system lists the number of trucks involved and the distance (round trip) that each must travel.

| System Components | QUANTITY | UNIT | COST PER C.Y. EQUIP. | LABOR | TOTAL |
|---|---|---|---|---|---|
| **SYSTEM G1030 120 1000** | | | | | |
| **EXCAVATE COMMON EARTH, 1/2 CY BACKHOE, TWO 8 CY DUMP TRUCKS, 1 MRT** | | | | | |
| Excavating, bulk hyd. backhoe wheel mtd., 1/2 C.Y. | 1.000 | B.C.Y. | .84 | 1.86 | 2.70 |
| Hauling, 8 CY truck,cycle 0.5 mile, 20 MPH, 15 min. wait/Ld./Uld. | 1.280 | L.C.Y. | 2.44 | 2.23 | 4.67 |
| Spotter at earth fill dump or in cut | .020 | Hr. | | .82 | .82 |
| TOTAL | | | 3.28 | 4.91 | 8.19 |

| G1030 120 | Excavate Common Earth | COST PER C.Y. EQUIP. | LABOR | TOTAL |
|---|---|---|---|---|
| 1000 | Excavate common earth, 1/2 C.Y. backhoe,two 8 C.Y. dump trucks, 1MRT | 3.28 | 4.91 | 8.19 |
| 1200 | Three 8 C.Y. dump trucks, 3 mile round trip | 6.80 | 8.20 | 15 |
| 1400 | Two 12 C.Y. dump trucks, 4 mile round trip | 7.40 | 6.35 | 13.75 |
| 1600 | 3/4 C.Y. backhoe, three 8 C.Y. dump trucks, 1 mile round trip | 3.42 | 4.03 | 7.45 |
| 1700 | Five 8 C.Y. dump trucks, 3 mile round trip | 6.80 | 7.60 | 14.40 |
| 1800 | Two 12 C.Y. dump trucks, 2 mile round trip | 6.30 | 4.89 | 11.19 |
| 1900 | Two 16 C.Y. dump trailers, 3 mile round trip | 5.90 | 4.13 | 10.03 |
| 2000 | Two 20 C.Y. dump trailers, 4 mile round trip | 5.65 | 4.10 | 9.75 |
| 2200 | 1-1/2 C.Y. backhoe, eight 8 C.Y. dump trucks, 3 mile round trip | 6.70 | 6.70 | 13.40 |
| 2300 | Four 12 C.Y. dump trucks, 2 mile round trip | 6 | 4.15 | 10.15 |
| 2400 | Six 12 C.Y. dump trucks, 4 mile round trip | 7.25 | 4.77 | 12.02 |
| 2500 | Three 16 C.Y. dump trailers, 2 mile round trip | 4.85 | 3.08 | 7.93 |
| 2600 | Two 20 C.Y. dump trailers, 1 mile round trip | 3.85 | 2.54 | 6.39 |
| 2700 | Three 20 C.Y. dump trailer, 3 mile round trip | 5.10 | 3.15 | 8.25 |
| 2800 | 2-1/2 C.Y. excavator, six 12 C.Y. dump trucks, 1 mile round trip | 4.41 | 2.80 | 7.21 |
| 2900 | Eight 12 C.Y. dump trucks, 3 mile round trip | 6.30 | 3.90 | 10.2 |
| 3000 | Four 16 C.Y. dump trailers, 1 mile round trip | 4.33 | 2.53 | 6.8 |
| 3100 | Six 16 C.Y. dump trailers, 3 mile round trip | 5.80 | 3.44 | 9.2 |
| 3200 | Six 20 C.Y. dump trailers, 4 mile round trip | 5.40 | 3.19 | 8.5 |
| 3400 | 3-1/2 C.Y. backhoe, six 16 C.Y. dump trailers, 1 mile round trip | 4.48 | 2.43 | 6.9 |
| 3600 | Ten 16 C.Y. dump trailers, 4 mile round trip | 6.40 | 3.42 | 9.8 |
| 3800 | Eight 20 C.Y. dump trailers, 3 mile round trip | 5.10 | 2.72 | 7.8 |
| 4000 | 1/2 C.Y. pwr. shovel, four 8 C.Y. dump trucks, 2 mile round trip | 5.85 | 6.10 | 11.9 |
| 4100 | Two 12 C.Y. dump trucks, 1 mile round trip | 4.82 | 3.81 | 8.6 |
| 4200 | Four 12 C.Y. dump trucks, 4 mile round trip | 7.45 | 5.05 | 12.5 |
| 4300 | Two 16 C.Y. dump trailers, 2 mile round trip | 5.05 | 3.72 | 8.7 |
| 4400 | Two 20 C.Y. dump trailers, 4 mile round trip | 5.85 | 4.27 | 10.1 |
| 4800 | 3/4 C.Y. pwr. shovel, six 8 C.Y. dump trucks, 2 mile round trip | 5.75 | 5.90 | 11.6 |
| 4900 | Three 12 C.Y. dump trucks, 1 mile round trip | 4.73 | 3.26 | 7.9 |
| 5000 | Five 12 C.Y. dump trucks, 4 mile round trip | 7.55 | 4.86 | 12.4 |
| 5100 | Three 16 C.Y. dump trailers, 3 mile round trip | 6.15 | 3.94 | 10.1 |
| 5200 | Three 20 C.Y. dump trailers, 4 mile round trip | 5.75 | 3.68 | 9. |
| 5400 | 1-1/2 C.Y. pwr. shovel, six 12 C.Y. dump trucks, 1 mile round trip | 4.37 | 2.79 | 7. |
| 5500 | Ten 12 C.Y. dump trucks, 4 mile round trip | 7.15 | 4.39 | 11. |

## G1030 Site Earthwork



The Loading and Hauling of Rock System balances the productivity of loading equipment to hauling equipment. It is assumed that the hauling equipment will encounter light traffic and will move up no considerable grades on the haul route.

The Expanded System Listing shows Loading and Hauling systems that use either a track or wheel front-end loader. Track loaders indicated range from 1-1/2 Cubic Yards capacity to 4-1/2 Cubic Yards capacity. Wheel loaders range from 1-1/2 Cubic Yards to 5 Cubic Yards. Trucks for hauling range from 8 Cubic Yards capacity to 20 Cubic Yards capacity. Each system lists the number of trucks involved and the distance (round trip) that each must travel.

| System Components | QUANTITY | UNIT | COST PER C.Y. EQUIP. | LABOR | TOTAL |
|---|---|---|---|---|---|
| SYSTEM G1030 150 1000 | | | | | |
| LOAD & HAUL ROCK, 1-1/2 C.Y. TRACK LOADER, SIX 8 C.Y. TRUCKS, 1 MRT | | | | | |
| Excavating bulk, F.E. loader, track mtd., 1.5 C.Y. | 1.000 | B.C.Y. | .83 | 1.24 | 2.07 |
| 8 CY truck, cycle 2 miles | 1.650 | L.C.Y. | 5.36 | 4.90 | 10.26 |
| Spotter at earth fill dump or in cut | .010 | Hr. | | .71 | .71 |
| TOTAL | | | 6.19 | 6.85 | 13.04 |

| G1030 150 | Load & Haul Rock | COST PER C.Y. EQUIP. | LABOR | TOTAL |
|---|---|---|---|---|
| 1000 | Load & haul rock, 1-1/2 C.Y. track loader, six 8 C.Y.trucks, 1 MRT | 6.20 | 6.85 | 13.05 |
| 1200 | Nine 8 C.Y. dump trucks, 3 mile round trip | 8.45 | 9 | 17.45 |
| 1400 | Six 12 C.Y. dump trucks, 4 mile round trip | 9.25 | 6.65 | 15.90 |
| 1600 | Three 16 C.Y. dump trucks, 2 mile round trip | 6.15 | 4.52 | 10.67 |
| 2000 | 2-1/2 C.Y. track loader, twelve 8 C.Y. dump trucks, 3 mile round trip | 8.85 | 8.50 | 17.35 |
| 2200 | Five 12 C.Y. dump trucks, 1 mile round trip | 6 | 3.84 | 9.84 |
| 2400 | Eight 12 C.Y. dump trucks, 4 mile round trip | 9.65 | 6.15 | 15.80 |
| 2600 | Four 16 C.Y. dump trailers, 2 mile round trip | 6.60 | 4.07 | 10.67 |
| 3000 | 3-1/2 C.Y. track loader, eight 12 C.Y. dump trucks, 2 mile round trip | 7.90 | 4.82 | 12.72 |
| 3200 | Five 16 C.Y. dump trucks, 1 mile round trip | 5.75 | 3.27 | 9.02 |
| 3400 | Seven 16 C.Y. dump trailers, 3 mile round trip | 7.70 | 4.49 | 12.19 |
| 3600 | Seven 20 C.Y. dump trailers, 4 mile round trip | 7.20 | 4.16 | 11.36 |
| 4000 | 4-1/2 C.Y. track loader, nine 12 C.Y. dump trucks, 1 mile round trip | 6 | 3.48 | 9.48 |
| 4200 | Eight 16 C.Y. dump trailers, 2 mile round trip | 6.50 | 3.53 | 10.03 |
| 4400 | Eleven 16 C.Y. dump trailers, 4 mile round trip | 8.30 | 4.48 | 12.78 |
| 4600 | Seven 20 C.Y. dump trailers, 2 mile round trip | 5.65 | 3.07 | 8.72 |
| 5000 | 1-1/2 C.Y. wheel loader, nine 8 C.Y. dump trucks, 2 mile round trip | 6.65 | 7.20 | 13.85 |
| 5200 | Four 12 C.Y. dump trucks, 1 mile round trip | 5.45 | 4.11 | 9.56 |
| 5400 | Seven 12 C.Y. dump trucks, 4 mile round trip | 9.05 | 6.35 | 15.40 |
| 5600 | Five 16 C.Y. dump trailers, 4 mile round trip | 7.75 | 5.10 | 12.85 |
| 6000 | 3 C.Y. wheel loader, eight 12 C.Y. dump trucks, 2 mile round trip | 7.05 | 4.62 | 11.67 |
| 6200 | Five 16 C.Y. dump trailers, 1 mile round trip | 4.93 | 3.07 | 8 |
| 6400 | Seven 16 C.Y. dump trailers, 3 mile round trip | 5.95 | 3.81 | 9.76 |
| 6600 | Seven 20 C.Y. dump trailers, 4 mile round trip | 6.35 | 3.95 | 10.30 |
| 7000 | 5 C.Y. wheel loader, twelve 12 C.Y. dump trucks, 1 mile round trip | 5.40 | 3.25 | 8.65 |
| 7200 | Nine 16 C.Y. dump trailers, 1 mile round trip | 5.20 | 2.97 | 8.17 |
| 7400 | Eight 20 C.Y. dump trailers, 1 mile round trip | 4.44 | 2.53 | 6.97 |
| 7600 | Twelve 20 C.Y. dump trailers, 3 mile round trip | 6.05 | 3.34 | 9.39 |

# Location Factors

| STATE/ZIP | CITY | MAT. | INST. | TOTAL |
|---|---|---|---|---|
| **MICHIGAN (CONT'D)** | | | | |
| 496 | Traverse City | 92.2 | 79.8 | 86.8 |
| 497 | Gaylord | 93.4 | 74.2 | 84.9 |
| 498-499 | Iron mountain | 95.5 | 88.8 | 92.5 |
| **MINNESOTA** | | | | |
| 550-551 | Saint Paul | 99.3 | 123.4 | 109.9 |
| 553-555 | Minneapolis | 99.7 | 126.3 | 111.5 |
| 556-558 | Duluth | 98.6 | 114.6 | 105.6 |
| **MINNESOTA (CONT'd)** | | | | |
| 559 | Rochester | 98.5 | 107.8 | 102.6 |
| 560 | Mankato | 96.2 | 105.5 | 100.3 |
| 561 | Windom | 94.8 | 77.8 | 87.3 |
| 562 | Willmar | 94.4 | 84.4 | 90.0 |
| 563 | St. Cloud | 96.2 | 124.2 | 108.6 |
| 564 | Brainerd | 96.1 | 107.4 | 101.1 |
| 565 | Detroit Lakes | 97.9 | 97.7 | 97.8 |
| 566 | Bemidji | 97.2 | 100.1 | 98.5 |
| 567 | Thief River Falls | 96.7 | 96.4 | 96.6 |
| **MISSISSIPPI** | | | | |
| 386 | Clarksdale | 95.8 | 57.8 | 79.0 |
| 387 | Greenville | 99.6 | 67.9 | 85.6 |
| 388 | Tupelo | 97.3 | 60.4 | 81.0 |
| 389 | Greenwood | 97.1 | 57.3 | 79.5 |
| 390-392 | Jackson | 97.8 | 67.0 | 84.2 |
| 393 | Meridian | 96.1 | 68.6 | 84.0 |
| 394 | Laurel | 97.1 | 60.9 | 81.2 |
| 395 | Biloxi | 97.9 | 62.2 | 82.1 |
| 396 | Mccomb | 95.5 | 56.8 | 78.4 |
| 397 | Columbus | 97.0 | 59.2 | 80.4 |
| **MISSOURI** | | | | |
| 630-631 | St. Louis | 98.6 | 107.2 | 102.4 |
| 633 | Bowling Green | 97.0 | 86.6 | 92.4 |
| 634 | Hannibal | 95.8 | 76.8 | 87.4 |
| 635 | Kirksville | 98.9 | 70.7 | 86.5 |
| 636 | Flat River | 98.0 | 87.4 | 93.3 |
| 637 | Cape Girardeau | 98.4 | 83.8 | 92.0 |
| 638 | Sikeston | 96.0 | 74.2 | 86.4 |
| 639 | Poplar Bluff | 95.4 | 74.7 | 86.3 |
| 640-641 | Kansas City | 98.7 | 108.2 | 102.9 |
| 644-645 | St. Joseph | 98.0 | 87.2 | 93.3 |
| 646 | Chillicothe | 94.7 | 66.1 | 82.1 |
| 647 | Harrisonville | 94.2 | 94.8 | 94.5 |
| 648 | Joplin | 96.8 | 65.2 | 82.9 |
| 650-651 | Jefferson City | 95.6 | 85.0 | 90.9 |
| 652 | Columbia | 96.8 | 88.2 | 93.0 |
| 653 | Sedalia | 95.7 | 78.8 | 88.2 |
| 654-655 | Rolla | 94.0 | 75.8 | 86.0 |
| 656-658 | Springfield | 97.7 | 77.8 | 88.9 |
| **MONTANA** | | | | |
| 590-591 | Billings | 102.0 | 72.9 | 89.2 |
| 592 | Wolf Point | 101.5 | 68.6 | 87.0 |
| 593 | Miles City | 99.0 | 70.4 | 86.4 |
| 594 | Great Falls | 103.4 | 72.2 | 89.6 |
| 595 | Havre | 100.3 | 71.3 | 87.5 |
| 596 | Helena | 101.9 | 70.6 | 88.1 |
| 597 | Butte | 102.0 | 72.3 | 88.9 |
| 598 | Missoula | 99.2 | 72.7 | 87.5 |
| 599 | Kalispell | 97.8 | 70.9 | 86.0 |
| **NEBRASKA** | | | | |
| 680-681 | Omaha | 99.8 | 75.6 | 89.2 |
| 683-685 | Lincoln | 97.8 | 74.1 | 87.3 |
| 686 | Columbus | 95.8 | 73.4 | 85.9 |
| 687 | Norfolk | 97.5 | 77.1 | 88.5 |
| 688 | Grand Island | 97.9 | 79.2 | 89.6 |
| 689 | Hastings | 96.8 | 81.5 | 90.0 |
| 690 | Mccook | 96.5 | 72.2 | 85.8 |
| 691 | North Platte | 97.2 | 81.6 | 90.4 |
| 692 | Valentine | 98.5 | 70.6 | 86.2 |
| 693 | Alliance | 98.7 | 68.7 | 85.5 |
| **NEVADA** | | | | |
| 889-891 | Las Vegas | 101.0 | 113.8 | 106.7 |
| 893 | Ely | 99.6 | 69.1 | 86.1 |
| 894-895 | Reno | 100.0 | 90.5 | 95.8 |
| 897 | Carson City | 99.9 | 89.5 | 95.3 |
| 898 | Elko | 98.2 | 74.4 | 87.7 |
| **NEW HAMPSHIRE** | | | | |
| 030 | Nashua | 99.9 | 87.0 | 94.2 |
| 031 | Manchester | 100.4 | 87.0 | 94.5 |

| STATE/ZIP | CITY | MAT. | INST. | TOTAL |
|---|---|---|---|---|
| **NEW HAMPSHIRE (CONT'D)** | | | | |
| 032-033 | Concord | 98.5 | 83.3 | 91.8 |
| 034 | Keene | 96.3 | 51.3 | 76.4 |
| 035 | Littleton | 96.1 | 58.2 | 79.3 |
| 036 | Charleston | 95.8 | 48.8 | 75.0 |
| 037 | Claremont | 94.7 | 48.8 | 74.5 |
| 038 | Portsmouth | 97.3 | 90.9 | 94.4 |
| **NEW JERSEY** | | | | |
| 070-071 | Newark | 101.9 | 124.3 | 111.8 |
| 072 | Elizabeth | 100.1 | 123.8 | 110.6 |
| 073 | Jersey City | 99.0 | 124.7 | 110.3 |
| 074-075 | Paterson | 100.9 | 124.3 | 111.2 |
| 076 | Hackensack | 98.8 | 124.8 | 110.3 |
| 077 | Long Branch | 98.5 | 122.4 | 109.1 |
| 078 | Dover | 99.1 | 124.3 | 110.2 |
| 079 | Summit | 99.0 | 123.8 | 110.0 |
| 080,083 | Vineland | 97.1 | 122.2 | 108.2 |
| 081 | Camden | 99.0 | 122.9 | 109.5 |
| 082,084 | Atlantic City | 97.6 | 122.2 | 108.5 |
| 085-086 | Trenton | 99.0 | 123.4 | 109.8 |
| 087 | Point Pleasant | 99.2 | 122.2 | 109.3 |
| 088-089 | New Brunswick | 99.7 | 123.6 | 110.2 |
| **NEW MEXICO** | | | | |
| 870-872 | Albuquerque | 99.8 | 74.8 | 88.8 |
| 873 | Gallup | 100.0 | 74.8 | 88.9 |
| 874 | Farmington | 100.4 | 74.8 | 89.1 |
| 875 | Santa Fe | 101.8 | 74.8 | 89.9 |
| 877 | Las Vegas | 98.2 | 74.6 | 87.8 |
| 878 | Socorro | 97.8 | 74.8 | 87.6 |
| 879 | Truth/Consequences | 97.9 | 68.9 | 85.1 |
| 880 | Las Cruces | 96.8 | 66.7 | 83.5 |
| 881 | Clovis | 98.5 | 72.7 | 87.1 |
| 882 | Roswell | 100.4 | 72.8 | 88.2 |
| 883 | Carrizozo | 100.8 | 74.8 | 89.3 |
| 884 | Tucumcari | 99.3 | 72.7 | 87.6 |
| **NEW YORK** | | | | |
| 100-102 | New York | 107.0 | 166.3 | 133.2 |
| 103 | Staten Island | 103.1 | 162.5 | 129.3 |
| 104 | Bronx | 100.8 | 162.5 | 128.0 |
| 105 | Mount Vernon | 100.6 | 136.0 | 116.2 |
| 106 | White Plains | 100.7 | 136.0 | 116.3 |
| 107 | Yonkers | 105.7 | 136.1 | 119.2 |
| 108 | New Rochelle | 100.9 | 136.0 | 116.4 |
| 109 | Suffern | 100.7 | 126.7 | 112.2 |
| 110 | Queens | 101.8 | 162.4 | 128.6 |
| 111 | Long Island City | 103.5 | 162.4 | 129.5 |
| 112 | Brooklyn | 103.9 | 162.4 | 129.7 |
| 113 | Flushing | 103.4 | 162.4 | 129.4 |
| 114 | Jamaica | 101.5 | 162.4 | 128.4 |
| 115,117,118 | Hicksville | 101.6 | 146.4 | 121.4 |
| 116 | Far Rockaway | 103.6 | 162.4 | 129.5 |
| 119 | Riverhead | 102.4 | 145.9 | 121.6 |
| 120-122 | Albany | 97.7 | 97.6 | 97.7 |
| 123 | Schenectady | 98.2 | 97.3 | 97.8 |
| 124 | Kingston | 101.2 | 117.9 | 108.6 |
| 125-126 | Poughkeepsie | 100.3 | 134.3 | 115.3 |
| 127 | Monticello | 99.6 | 122.5 | 109.7 |
| 128 | Glens Falls | 92.2 | 90.5 | 91.5 |
| 129 | Plattsburgh | 97.1 | 87.3 | 92.8 |
| 130-132 | Syracuse | 99.3 | 93.0 | 96.5 |
| 133-135 | Utica | 97.2 | 88.9 | 93.5 |
| 136 | Watertown | 99.1 | 91.9 | 95.9 |
| 137-139 | Binghamton | 98.8 | 89.5 | 94.7 |
| 140-142 | Buffalo | 100.3 | 102.8 | 101.4 |
| 143 | Niagara Falls | 97.7 | 100.8 | 99.1 |
| 144-146 | Rochester | 99.8 | 97.4 | 98.7 |
| 147 | Jamestown | 96.6 | 86.9 | 92.3 |
| 148-149 | Elmira | 96.3 | 87.8 | 92.6 |
| **NORTH CAROLINA** | | | | |
| 270,272-274 | Greensboro | 99.2 | 49.2 | 77.1 |
| 271 | Winston-Salem | 99.1 | 47.8 | 76.5 |
| 275-276 | Raleigh | 100.3 | 49.4 | 77.8 |
| 277 | Durham | 100.3 | 49.7 | 78.0 |
| 278 | Rocky Mount | 96.3 | 40.3 | 71.6 |
| 279 | Elizabeth City | 97.3 | 41.6 | 72.7 |
| 280 | Gastonia | 98.2 | 47.2 | 75.7 |
| 281-282 | Charlotte | 99.8 | 49.7 | 77.7 |
| 283 | Fayetteville | 100.0 | 50.1 | 78.0 |
| 284 | Wilmington | 96.9 | 47.6 | 75.1 |
| 285 | Kinston | 94.6 | 41.6 | 71.2 |

# Installing Contractor's Overhead & Profit

Below are the **average** installing contractor's percentage mark-ups applied to base labor rates to arrive at typical billing rates.

**Column A:** Labor rates are based on union wages averaged for 30 major U.S. cities. Base rates including fringe benefits are listed hourly and daily. These figures are the sum of the wage rate and employer-paid fringe benefits such as vacation pay, employer-paid health and welfare costs, pension costs, plus appropriate training and industry advancement funds costs.

**Column B:** Workers' Compensation rates are the national average of state rates established for each trade.

**Column C:** Column C lists average fixed overhead figures for all trades. Included are Federal and State Unemployment costs set at 6.2%; Social Security Taxes (FICA) set at 7.65%; Builder's Risk Insurance costs set at 0.44%; and Public Liability costs set at 2.02%. All the percentages except those for Social Security Taxes vary from state to state as well as from company to company.

**Columns D and E:** Percentages in Columns D and E are based on the presumption that the installing contractor has annual billing of $4,000,000 and up. Overhead percentages may increase with smaller annual billing. The overhead percentages for any given contractor may vary greatly and depend on a number of factors, such as the contractor's annual volume, engineering and logistical support costs, and staff requirements. The figures for overhead and profit will also vary depending on the type of job, the job location, and the prevailing economic conditions. All factors should be examined very carefully for each job.

**Column F:** Column F lists the total of Columns B, C, D, and E.

**Column G:** Column G is Column A (hourly base labor rate) multiplied by the percentage in Column F (O&P percentage).

**Column H:** Column H is the total of Column A (hourly base labor rate) plus Column G (Total O&P).

**Column I:** Column I is Column H multiplied by eight hours.

| | | A | | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Base Rate Incl. Fringes | | Workers' Comp. Ins. | Average Fixed Overhead | Overhead | Profit | Total Overhead & Profit | | Rate with O & P | |
| Abbr. | Trade | Hourly | Daily | | | | | % | Amount | Hourly | Daily |
| Skwk | Skilled Workers Average (35 trades) | $42.60 | $340.80 | 14.4% | 16.3% | 13.0% | 10% | 53.7% | $22.90 | $65.50 | $524.00 |
| | Helpers Average (5 trades) | 31.60 | 252.80 | 16.0 | | 11.0 | | 53.3 | 16.85 | 48.45 | 387.60 |
| | Foreman Average, Inside ($.50 over trade) | 43.10 | 344.80 | 14.4 | | 13.0 | | 53.7 | 23.15 | 66.25 | 530.00 |
| | Foreman Average, Outside ($2.00 over trade) | 44.60 | 356.80 | 14.4 | | 13.0 | | 53.7 | 23.95 | 68.55 | 548.40 |
| Clab | Common Building Laborers | 33.10 | 264.80 | 16.9 | | 11.0 | | 54.2 | 17.95 | 51.05 | 408.40 |
| Asbe | Asbestos/Insulation Workers/Pipe Coverers | 45.55 | 364.40 | 13.1 | | 16.0 | | 55.4 | 25.25 | 70.80 | 566.40 |
| Boil | Boilermakers | 52.25 | 418.00 | 10.6 | | 16.0 | | 52.9 | 27.65 | 79.90 | 639.20 |
| Bric | Bricklayers | 41.75 | 334.00 | 13.5 | | 11.0 | | 50.8 | 21.20 | 62.95 | 503.60 |
| Brhe | Bricklayer Helpers | 33.65 | 269.20 | 13.5 | | 11.0 | | 50.8 | 17.10 | 50.75 | 406.00 |
| Carp | Carpenters | 41.55 | 332.40 | 16.9 | | 11.0 | | 54.2 | 22.50 | 64.05 | 512.40 |
| Cefi | Cement Finishers | 39.70 | 317.60 | 8.7 | | 11.0 | | 46.0 | 18.25 | 57.95 | 463.60 |
| Elec | Electricians | 49.00 | 392.00 | 6.4 | | 16.0 | | 48.7 | 23.85 | 72.85 | 582.80 |
| Elev | Elevator Constructors | 61.70 | 493.60 | 6.3 | | 16.0 | | 48.6 | 30.00 | 91.70 | 733.60 |
| Eqhv | Equipment Operators, Crane or Shovel | 44.40 | 355.20 | 9.4 | | 14.0 | | 49.7 | 22.05 | 66.45 | 531.60 |
| Eqmd | Equipment Operators, Medium Equipment | 42.95 | 343.60 | 9.4 | | 14.0 | | 49.7 | 21.35 | 64.30 | 514.40 |
| Eqlt | Equipment Operators, Light Equipment | 41.30 | 330.40 | 9.4 | | 14.0 | | 49.7 | 20.55 | 61.85 | 494.80 |
| Eqol | Equipment Operators, Oilers | 38.30 | 306.40 | 9.4 | | 14.0 | | 49.7 | 19.05 | 57.35 | 458.80 |
| Eqmm | Equipment Operators, Master Mechanics | 44.60 | 356.80 | 9.4 | | 14.0 | | 49.7 | 22.15 | 66.75 | 534.00 |
| Glaz | Glaziers | 40.20 | 321.60 | 13.3 | | 11.0 | | 50.6 | 20.35 | 60.55 | 484.40 |
| Lath | Lathers | 36.95 | 295.60 | 9.8 | | 11.0 | | 47.1 | 17.40 | 54.35 | 434.80 |
| Marb | Marble Setters | 39.90 | 319.20 | 13.5 | | 11.0 | | 50.8 | 20.25 | 60.15 | 481.20 |
| Mill | Millwrights | 42.95 | 343.60 | 8.7 | | 11.0 | | 46.0 | 19.75 | 62.70 | 501.60 |
| Mstz | Mosaic & Terrazzo Workers | 39.00 | 312.00 | 8.8 | | 11.0 | | 46.1 | 18.00 | 57.00 | 456.00 |
| Pord | Painters, Ordinary | 36.35 | 290.80 | 11.5 | | 11.0 | | 48.8 | 17.75 | 54.10 | 432.80 |
| Psst | Painters, Structural Steel | 37.40 | 299.20 | 41.6 | | 11.0 | | 78.9 | 29.50 | 66.90 | 535.20 |
| Pape | Paper Hangers | 36.55 | 292.40 | 11.5 | | 11.0 | | 48.8 | 17.85 | 54.40 | 435.20 |
| Pile | Pile Drivers | 40.30 | 322.40 | 18.5 | | 16.0 | | 60.8 | 24.50 | 64.80 | 518.40 |
| Plas | Plasterers | 37.30 | 298.40 | 11.9 | | 11.0 | | 49.2 | 18.35 | 55.65 | 445.20 |
| Plah | Plasterer Helpers | 33.90 | 271.20 | 11.9 | | 11.0 | | 49.2 | 16.70 | 50.60 | 404.80 |
| Plum | Plumbers | 52.05 | 416.40 | 7.6 | | 16.0 | | 49.9 | 25.95 | 78.00 | 624.00 |
| Rodm | Rodmen (Reinforcing) | 46.80 | 374.40 | 20.8 | | 14.0 | | 61.1 | 28.60 | 75.40 | 603.20 |
| Rofc | Roofers, Composition | 35.40 | 283.20 | 28.9 | | 11.0 | | 66.2 | 23.45 | 58.85 | 470.80 |
| Rots | Roofers, Tile & Slate | 35.60 | 284.80 | 28.9 | | 11.0 | | 66.2 | 23.55 | 59.15 | 473.20 |
| Rohe | Roofers, Helpers (Composition) | 26.20 | 209.60 | 28.9 | | 11.0 | | 66.2 | 17.35 | 43.55 | 348.40 |
| Shee | Sheet Metal Workers | 49.10 | 392.80 | 9.1 | | 16.0 | | 51.4 | 25.25 | 74.35 | 594.80 |
| Spri | Sprinkler Installers | 50.40 | 403.20 | 7.4 | | 16.0 | | 49.7 | 25.05 | 75.45 | 603.60 |
| Stpi | Steamfitters or Pipefitters | 51.90 | 415.20 | 7.6 | | 16.0 | | 49.9 | 25.90 | 77.80 | 622.40 |
| Ston | Stone Masons | 42.15 | 337.20 | 13.5 | | 11.0 | | 50.8 | 21.40 | 63.55 | 508.40 |
| Sswk | Structural Steel Workers | 46.90 | 375.20 | 35.5 | | 14.0 | | 75.8 | 35.55 | 82.45 | 659.60 |
| Tilf | Tile Layers | 39.35 | 314.80 | 8.8 | | 11.0 | | 46.1 | 18.15 | 57.50 | 460.00 |
| Tilh | Tile Layers Helpers | 31.20 | 249.60 | 8.8 | | 11.0 | | 46.1 | 14.40 | 45.60 | 364.80 |
| Trlt | Truck Drivers, Light | 32.25 | 258.00 | 15.2 | | 11.0 | | 52.5 | 16.95 | 49.20 | 393.60 |
| Trhv | Truck Drivers, Heavy | 33.15 | 265.20 | 15.2 | | 11.0 | | 52.5 | 17.40 | 50.55 | 404.40 |
| Sswl | Welders, Structural Steel | 46.90 | 375.20 | 35.5 | | 14.0 | | 75.8 | 35.55 | 82.45 | 659.60 |
| Wrck | *Wrecking | 33.10 | 264.80 | 30.3 | | 11.0 | | 67.6 | 22.40 | 55.50 | 444.00 |

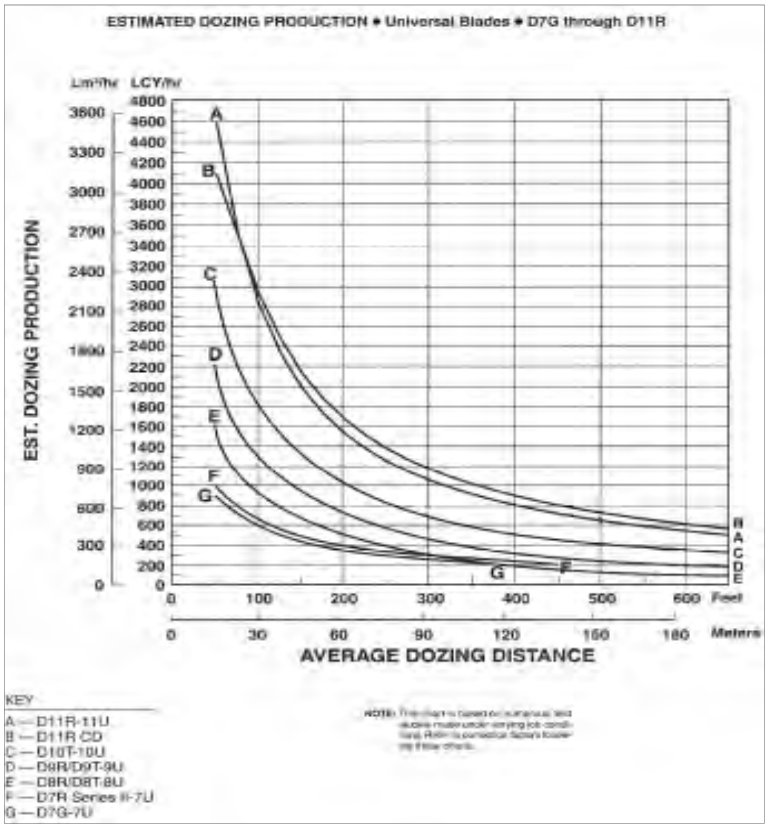
*Not included in averages

# Appendix B-4
# Equipment Productivity
# Curve Fits

## D11R

Dozer production data (based on Caterpillar Handbook)

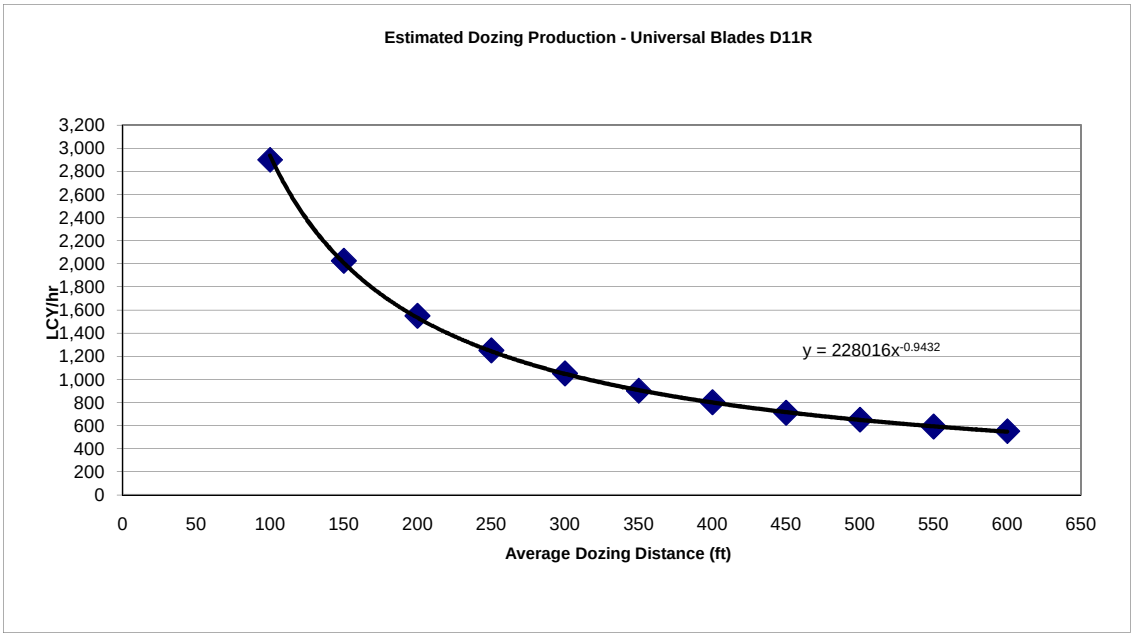
| Maximum Push Distance (feet) | Normal Production (cy/hr) |
|---|---|
| 50 | 4600 |
| 100 | 2,900 |
| 150 | 2,025 |
| 200 | 1,550 |
| 250 | 1,250 |
| 300 | 1,050 |
| 350 | 900 |
| 400 | 800 |
| 450 | 710 |
| 500 | 650 |
| 550 | 590 |
| 600 | 550 |




Fitted curve - based on data above and additional data points

y = 228016 x ^ (-0.9432)

| Maximum Push Distance (feet) | Normal Production (cy/hr) |
|---|---|
| 75 | 3885 |
| 100 | 2962 |
| 125 | 2400 |
| 150 | 2021 |
| 175 | 1747 |
| 200 | 1540 |
| 225 | 1378 |
| 250 | 1248 |
| 275 | 1141 |
| 300 | 1051 |
| 325 | 974 |
| 350 | 909 |
| 375 | 851 |
| 400 | 801 |
| 425 | 757 |
| 450 | 717 |
| 475 | 681 |
| 500 | 649 |
| 525 | 620 |
| 550 | 593 |
| 575 | 569 |
| 600 | 547 |

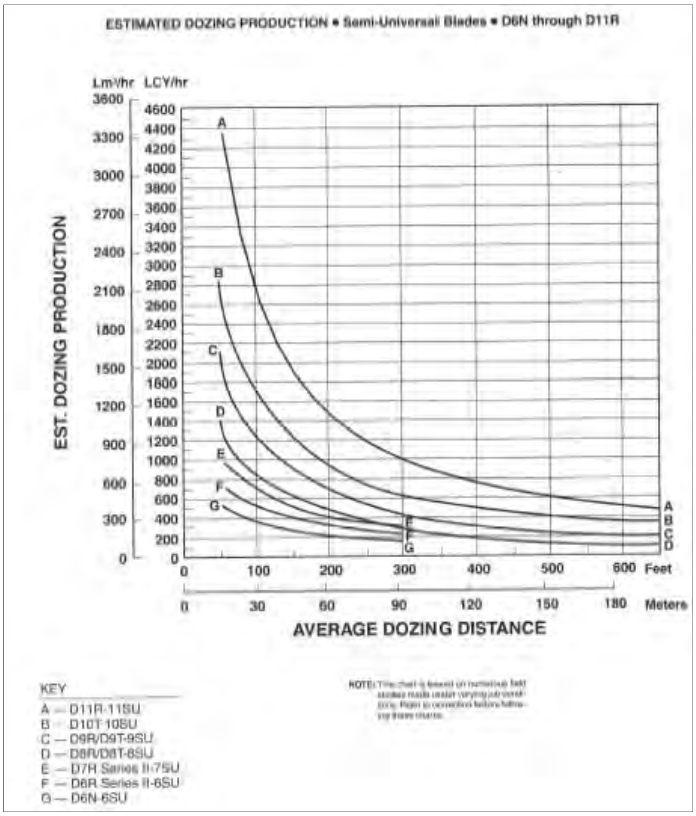



Caterpillar Performance Handbook Edition 38 D11R page1-43

**D9R**

Dozer production data (based on Caterpillar Handbook)

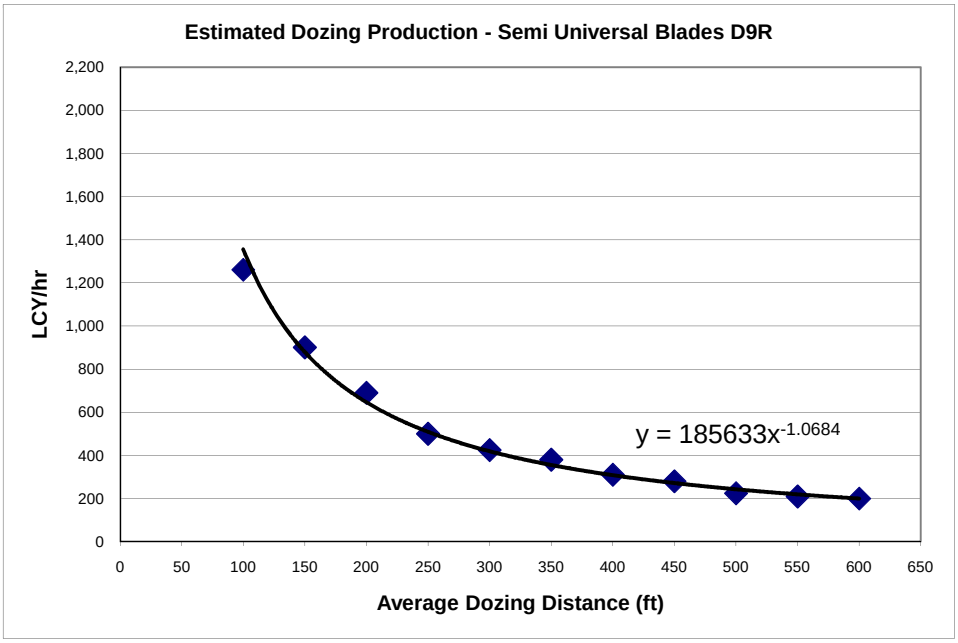
| Maximum Push Distance (feet) | Normal Production (cy/hr) |
|---|---|
| 50 | 2100 |
| 100 | 1,260 |
| 150 | 900 |
| 200 | 690 |
| 250 | 500 |
| 300 | 425 |
| 350 | 380 |
| 400 | 310 |
| 450 | 280 |
| 500 | 225 |
| 550 | 210 |
| 600 | 200 |




Fitted curve - based on data above and additional data points

y = 185633x ^ (-1.0684)

| Maximum Push Distance (feet) | Normal Production (cy/hr) |
|---|---|
| 75 | 1842 |
| 100 | 1355 |
| 125 | 1067 |
| 150 | 878 |
| 175 | 745 |
| 200 | 646 |
| 225 | 570 |
| 250 | 509 |
| 275 | 460 |
| 300 | 419 |
| 325 | 385 |
| 350 | 355 |
| 375 | 330 |
| 400 | 308 |
| 425 | 289 |
| 450 | 272 |
| 475 | 256 |
| 500 | 243 |
| 525 | 230 |
| 550 | 219 |
| 575 | 209 |
| 600 | 200 |



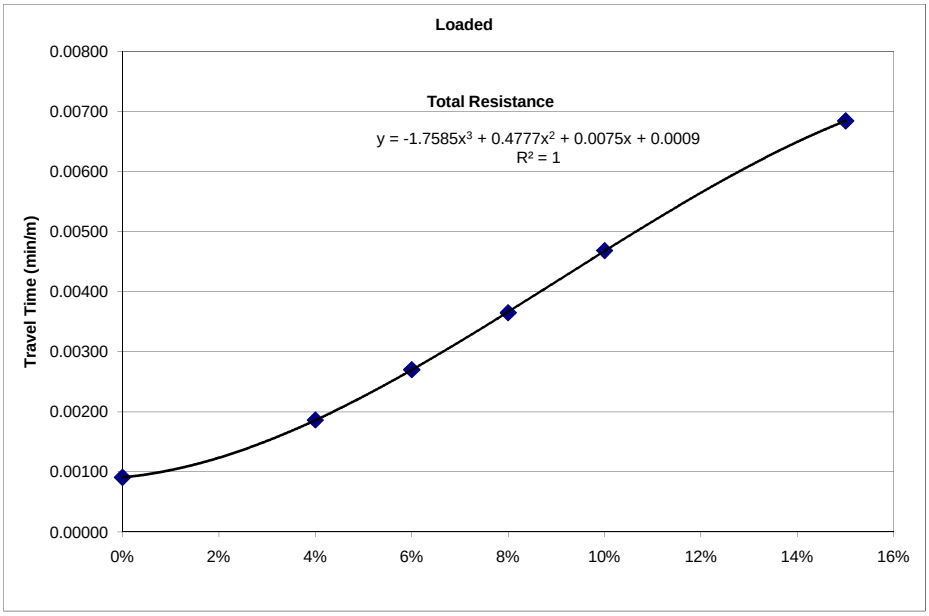

Caterpillar Performance Handbook Edition 38 D11R page1-44

**777F**

Loaded

| % | x (min) | y | Slope (min/m) |
|---|---|---|---|
| 0 | 0 | 0.0 | |
| | 2 | 2200.0 | 0.00091 |
| 4 | 0 | 0.0 | |
| | 4.1 | 2200.0 | 0.00186 |
| 6 | 0 | 0.0 | |
| | 5.2 | 1925.0 | 0.00270 |
| 8 | 0 | 0.0 | |
| | 5.2 | 1425.0 | 0.00365 |
| 10 | 0 | 0.0 | |
| | 5.2 | 1110.0 | 0.00468 |
| 15 | 0 | 0.0 | |
| | 5.2 | 760.0 | 0.00684 |

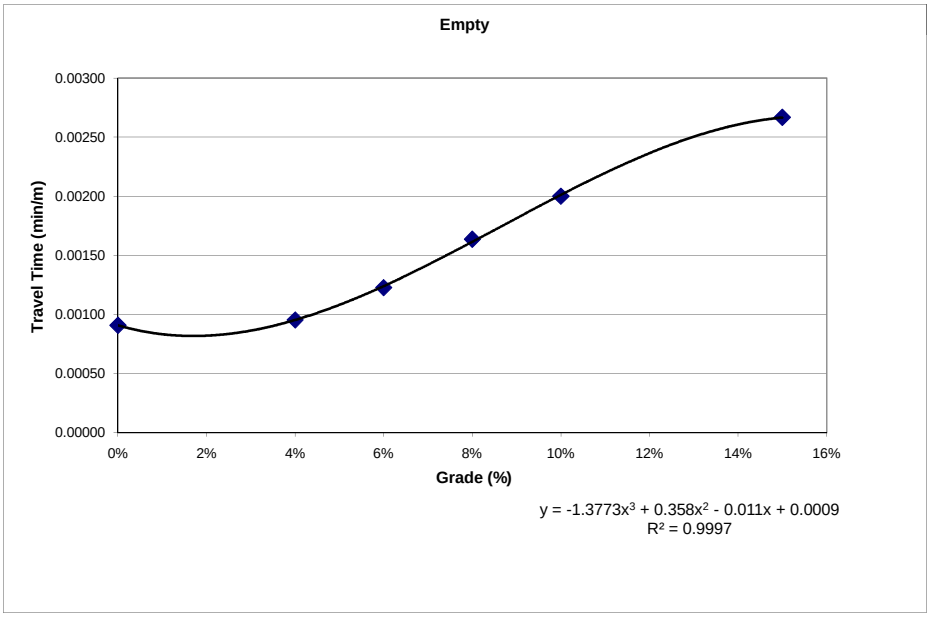
| | | |
|---|---|---|
| 0% | 0.00091 | 0.00090 |
| 4% | 0.00186 | 0.00185 |
| 6% | 0.00270 | 0.00269 |
| 8% | 0.00365 | 0.00366 |
| 10% | 0.00468 | 0.00467 |
| 15% | 0.00684 | 0.00684 |




Empty

| % | x (min) | y (m) | Slope |
|---|---|---|---|
| 0 | 0 | 0.0 | |
| | 2 | 2200.0 | 0.0009 |
| 4 | 0 | 0.0 | |
| | 2.1 | 2200.0 | 0.0010 |
| 6 | 0 | 0.0 | |
| | 2.7 | 2200.0 | 0.0012 |
| 8 | 0 | 0.0 | |
| | 3.6 | 2200.0 | 0.0016 |
| 10 | 0 | 0.0 | |
| | 4.4 | 2200.0 | 0.0020 |
| 15 | 0 | 0.0 | |
| | 5.2 | 1950.0 | 0.0027 |

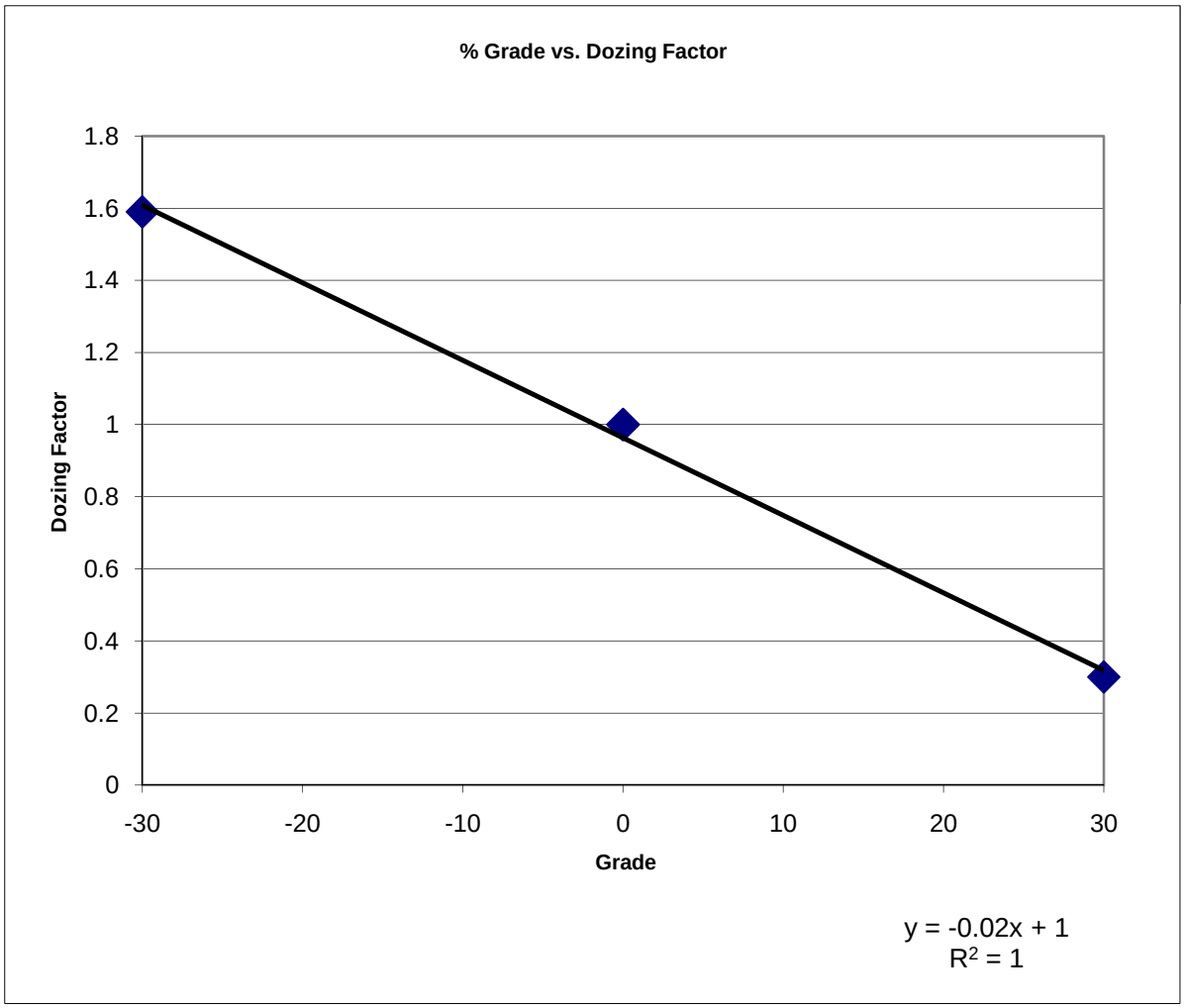
| | | |
|---|---|---|
| 0% | 0.00091 | 0.00090 |
| 4% | 0.00095 | 0.00094 |
| 6% | 0.00123 | 0.00123 |
| 8% | 0.00164 | 0.00161 |
| 10% | 0.00200 | 0.00200 |
| 15% | 0.00267 | 0.00266 |




Caterpillar Performance Handbook Edition 38 9-5, 9-33

**Grade vs. Dozing Factor**

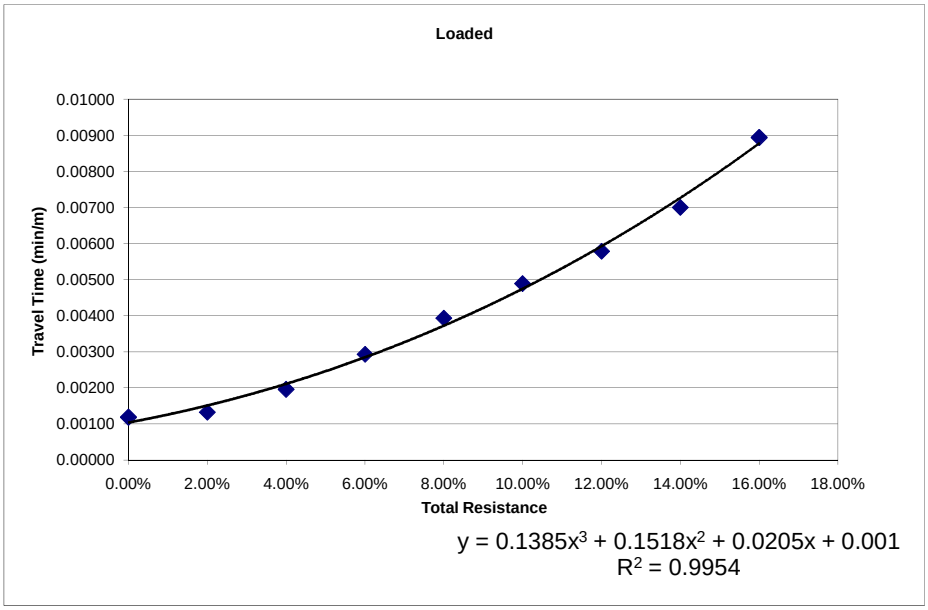
| Grade % | Dozing Factor |
|---|---|
| 0 | 1 |
| -30 | 1.59 |
| 30 | 0.3 |



Loaded

| % | x (min) | y | Slope (min/m) |
|---|---|---|---|
| 0 | 0 | 0.0 | |
| | 2.6 | 2200.0 | 0.0012 |
| 2 | 0 | 0.0 | |
| | 2.9 | 2200.0 | 0.0013 |
| 4 | 0 | 0.0 | |
| | 4.3 | 2200.0 | 0.0020 |
| 6 | 0 | 0.0 | |
| | 5.5 | 1880.0 | 0.0029 |
| 8 | 0 | 0.0 | |
| | 5.5 | 1400.0 | 0.0039 |
| 10 | 0 | 0.0 | |
| | 5.5 | 1125.0 | 0.0049 |
| 12 | 0 | 0.0 | |
| | 5.5 | 950.0 | 0.0058 |
| 14 | 0 | 0.0 | |
| | 5.5 | 785.0 | 0.0070 |
| 16 | 0 | 0 | |
| | 5.5 | 615.0 | 0.0089 |

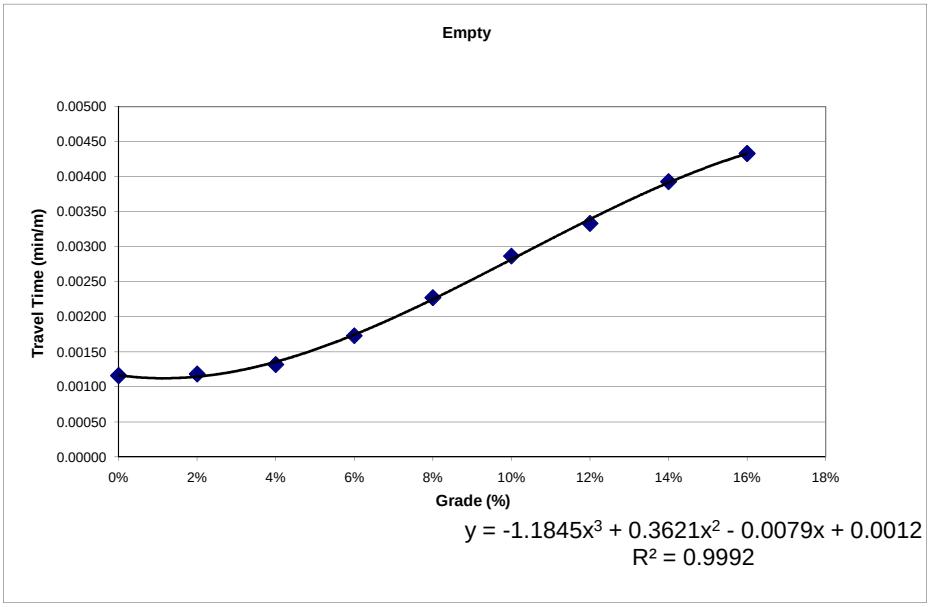
| | | |
|---|---|---|
| 0.00% | 0.00118 | 0.00100 |
| 2.00% | 0.00132 | 0.00147 |
| 4.00% | 0.00195 | 0.00207 |
| 6.00% | 0.00293 | 0.00281 |
| 8.00% | 0.00393 | 0.00368 |
| 10.00% | 0.00489 | 0.00471 |
| 12.00% | 0.0058 | 0.00589 |
| 14.00% | 0.0070 | 0.00723 |
| 16.00% | 0.0089431 | 0.00873 |




Empty

| % | x (min) | y (m) | Slope |
|---|---|---|---|
| 0 | 0 | 0.0 | |
| | 2.55 | 2200.0 | 0.0012 |
| 2 | 0 | 0.0 | |
| | 2.6 | 2200.0 | 0.0012 |
| 4 | 0 | 0.0 | |
| | 2.9 | 2200.0 | 0.0013 |
| 6 | 0 | 0.0 | |
| | 3.8 | 2200.0 | 0.0017 |
| 8 | 0 | 0.0 | |
| | 5 | 2200.0 | 0.0023 |
| 10 | 0 | 0.0 | |
| | 5.5 | 1920.0 | 0.0029 |
| 12 | 0 | 0.0 | |
| | 5.5 | 1650.0 | 0.0033 |
| 14 | 0 | 0.0 | |
| | 5.5 | 1400.0 | 0.0039 |
| 16 | 0 | 0.0 | |
| | 5.5 | 1270.0 | 0.0043 |

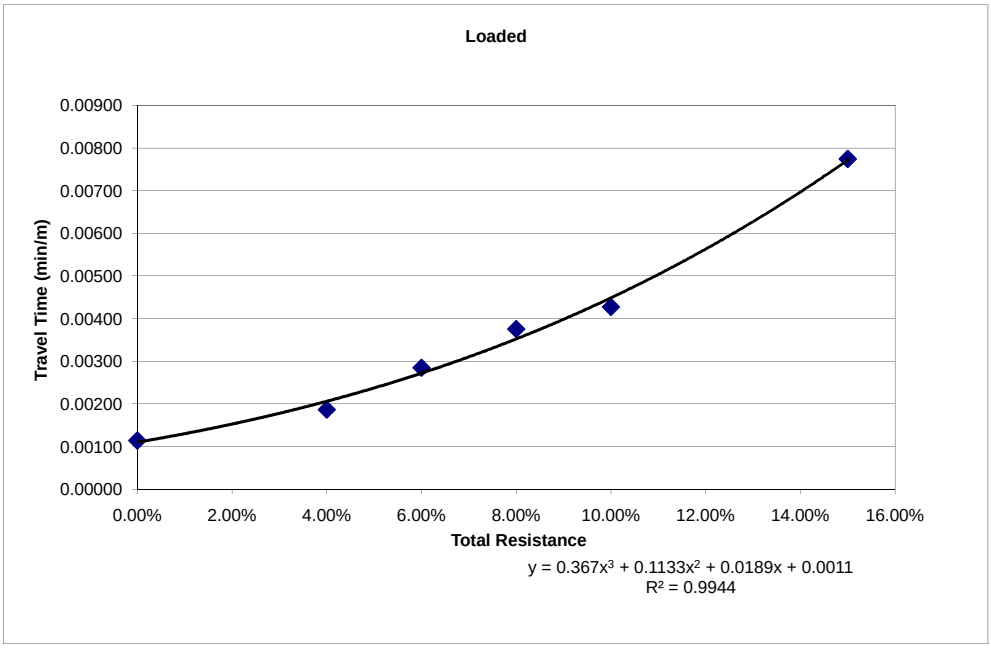
| grade | min/m | min/m |
|---|---|---|
| 0% | 0.00116 | 0.001200 |
| 2% | 0.00118 | 0.001177 |
| 4% | 0.00132 | 0.001388 |
| 6% | 0.00173 | 0.001774 |
| 8% | 0.00227 | 0.002279 |
| 10% | 0.00286 | 0.002847 |
| 12% | 0.00333 | 0.003419 |
| 14% | 0.00393 | 0.003941 |
| 16% | 0.00433 | 0.004354 |



Loaded

| % | x (min) | y | Slope (min/m) |
|---|---|---|---|
| 0 | 0 | 0.0 | |
| | 2.5 | 2200.0 | 0.0011 |
| 4 | 0 | 0.0 | |
| | 4.1 | 2200.0 | 0.0019 |
| 6 | 0 | 0.0 | |
| | 6.25 | 2200.0 | 0.0028 |
| 8 | 0 | 0.0 | |
| | 8.25 | 2200.0 | 0.0038 |
| 10 | 0 | 0.0 | |
| | 9.4 | 2200.0 | 0.0043 |
| 15 | 0 | 0.0 | |
| | 12 | 1550.0 | 0.0077 |

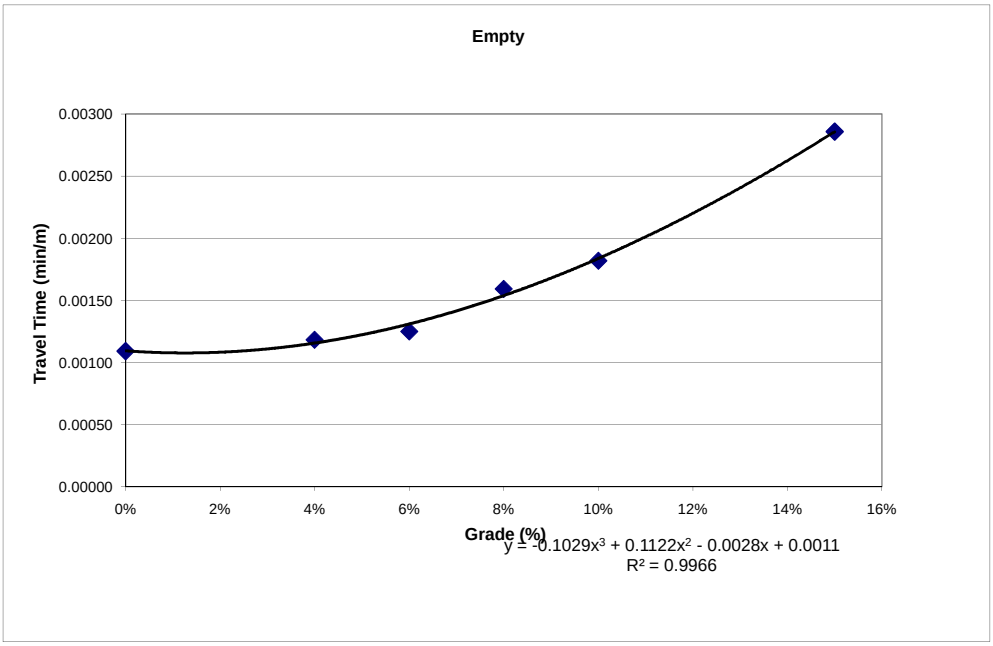
| | | |
|---|---|---|
| 0.00% | 0.00114 | 0.00110 |
| 4.00% | 0.00186 | 0.00206 |
| 6.00% | 0.00284 | 0.00272 |
| 8.00% | 0.00375 | 0.00353 |
| 10.00% | 0.00427 | 0.00449 |
| 15.00% | 0.0077 | 0.00772 |




Empty

| % | x (min) | y (m) | Slope |
|---|---|---|---|
| 0 | 0 | 0.0 | |
| | 2.4 | 2200.0 | 0.0011 |
| 4 | 0 | 0.0 | |
| | 2.6 | 2200.0 | 0.0012 |
| 6 | 0 | 0.0 | |
| | 2.75 | 2200.0 | 0.0013 |
| 8 | 0 | 0.0 | |
| | 3.5 | 2200.0 | 0.0016 |
| 10 | 0 | 0.0 | |
| | 4 | 2200.0 | 0.0018 |
| 15 | 0 | 0.0 | |
| | 6 | 2100.0 | 0.0029 |

| | | |
|---|---|---|
| 0% | 0.00109 | 0.00110 |
| 4% | 0.00118 | 0.00116 |
| 6% | 0.00125 | 0.00131 |
| 8% | 0.00159 | 0.00154 |
| 10% | 0.00182 | 0.00184 |
| 15% | 0.00286 | 0.00286 |



# Appendix B-5
# Production Calculation
# QA Documentation

# EQUATIONS COMMON TO TAILINGS AND STOCKPILES

**Sheet #4 Earthwrk:**

$$Bank\ Volume\ (bcy) = Area\ (acre) * Cover\ Depth\ (in) * \frac{43560(ft^2/acre)}{12(in/ft) * 27(ft^3/cy)}$$

$$Loose\ Volume\ (lcy) = Bank\ Volume\ (cy) * [1 + Swell\ Factor]$$

**Sheet #5 Dozer:**

$$Dozer\ Material\ Handling\ Multiplier = Loose\ Volume\ (lcy) * 1.5$$

$$Normal\ Production\ (cy/hr) = 228016 * Maximum\ Push\ Distance\ (ft)^{-.9432}$$
$$(Curve\ Fit\ Cat\ Handbook\ Ed\ 37.\ 1-43)$$

$$Productivity\ (cy) = Normal\ Production\ (cy/hr) * Operator * Material * \frac{Work\ Hour\ (\min/hr)}{60\ (\min/hr)}$$

$$Total\ Task\ Time\ (hr) = \frac{Material\ Handling\ Multiplier(cy)}{Productivity\ (cy/hr)}$$

$$Grade\ (Dozing\ Factor) = -0.02 * Cut\ to\ Fill\ Haul\ Grade + 1$$
$$(Curve\ Fit\ Cat\ Handbook\ Ed\ 37.1-46)$$

**Sheet #13 Earth Sum:**

$$Total\ Cost\ (\$) = [Owning\ \&\ Operating\ Cost\ (\$/hr) + Labor\ Cost\ (\$/hr)] * TimeRequired\ (hr)$$

$$Unit\ Cost\ (\$/unit) = \frac{Total\ Cost\ (\$)}{Total\ Production\ (unit)}$$

$$Total\ Cost\ (\$) = \sum Total\ Cost\ (\$)$$

**Sheet #14 Reveg:**

$$Subtotal\ Cost\ (\$) = Area\ (acres) * Unit\ Cost\ (\$/acre)$$

$$Total\ Reveg\ Cost\ (\$) = \sum\ Subtotal\ Cost\ (\$)$$

$$Tailing\ Pipeline\ Corridor\ Area\ (acres) = \frac{Corridor\ Length\ (ft) * Corridor\ Width\ (ft)}{43560\ (ft^2/acre)}$$

**Sheet #15 Other:**

$$Unit\ Cost\ (\$/unit) = Unadjusted\ Cost\ (\$/unit) * \frac{Location\ Adjustment\ (\%)}{100}$$

$$Current\ Item\ Cost\ (\$) = Quantity\ (units) * Unit\ Cost\ (\$/unit)$$

$$Total\ (\$) = \sum Current\ Item\ Cost\ (\$)$$

$$Tailings\ Spillway\ Cut\ Volume\ (cy) = \frac{Length\ (ft) * Cross\ Section\ (ft^2)}{27(ft^3/cy)}$$

**Sheet #16 & 17 BondSum:**

$$SubTotal\ Direct\ Cost\ (\$) = Total\ Earthmoving\ (\$) + Total\ Reveg\ (\$) + Total\ Other\ (\$)$$

$$Indirect\ Costs\ \&\ GrossReceipts\ Tax(\$) = SubTotal\ Direct\ Cost\ (\$) * \frac{Various\ Costs\ (\%)}{100}$$

$$Total\ Bond\ Amount\ (\$) = Sum\ Direct\ Cost\ (\$) + Indirect\ Cost\ (\$) + Gross\ Receipts\ Tax\ (\$)$$

# EQUATIONS FOR STOCKPILES:

## Sheet #6 Grading:

$$Productivity\ (acre/hr) = Speed\ (mi/hr) * \frac{5280\ (ft/mi) * Effective\ Blade\ Width\ (ft)}{43560\ (ft^2/acre)} * \frac{Work\ Hour\ (\min/hr)}{60\ (\min/hr)}$$
$$* Operator * Material * Grade\ Factor * \frac{2300(lbs/cy)}{Soil\ Weight\ (lbs/cy)} * Prod.\ Method * Visibility * Elev.* Drive\ Trans.$$

$$Normal\ Production\ (cy/hr) = 228016 * Maximum\ Push\ Distance\ (ft)^{-.9432}$$
(*Curve Fit Cat Handbook Ed* 37. 1 – 43)

$$Productivity\ (cy/hr) = Normal\ Production\ (cy/hr) * \frac{Work\ Hour\ (\min/hr)}{60\ (\min/hr)} * Operator * Material * Grade\ Factor$$
$$* \frac{2300\ (lbs/cy)}{Soil\ Weight\ (lbs/cy)} * Production\ Method * Visibility * Elevation * DriveTrans$$

$$Task\ Time(hr) = \frac{Area\ or\ Volume}{Productivity}$$

## Sheet #9 Trucks:

$$Total\ Haul\ \text{Distance}\ (ft) = \sum Segment\ Haul\ \text{Distance}\ (ft)$$

$$Haul\ \text{Distance}\ Segment\ (m) = Haul\ \text{Distance}\ (ft) * 0.3048\ (m/ft)$$

$$Haul\ Effective\ Grade\ (\%) = \left(Haul\ Grade\ (\%) + Rolling\text{Resistance}\ (\%)\right)\ (unless < 0\ then\ 0)$$

$$\text{Return}\ Effective\ Grade\ (\%) = \left(Rolling\text{Resistance}\ (\%) - Haul\ Grade\ (\%)\right)\ (unless < 0\ then\ 0)$$

$$777F\ Segment\ Travel\ Time\ Loaded\ (\text{min}/m) =$$
$$-1.7585 * Haul\ Effective\ Grade\ Segment\ (\%)^{3} + 0.4777 * Haul\ Effective\ Grade\ Segement\ (\%)^{2}$$
$$+ 0.0075 * Haul\ Effective\ Grade\ Segment\ (\%) + 0.0009$$

$$777F\ Segment\ Travel\ Time\ Empty\ (\text{min}/m) =$$
$$-1.3773 * \text{Return}\ Effective\ Grade\ Segment\ (\%)^{3} + 0.358 * \text{Return}\ Effective\ Grade\ Segement\ (\%)^{2}$$
$$- 0.011 * \text{Return}\ Effective\ Grade\ Segement\ (\%) + 0.0009$$

(*Curve Fit Cat Handbook Ed* 38. $9-5,9-33$)

$$530M\ Segment\ Travel\ Time\ Loaded\ (\text{min}/m) =$$
$$0.367 * Haul\ Effective\ Grade\ Segment\ (\%)^{3} + 0.1133 * Haul\ Effective\ Grade\ Segement\ (\%)^{2}$$
$$+ 0.0189 * Haul\ Effective\ Grade\ Segment\ (\%) + 0.0011$$

$$530M\ Segment\ Travel\ Time\ Empty\ (\text{min}/m) =$$
$$-0.1029 * \text{Return}\ Effective\ Grade\ Segment\ (\%)^{3} + 0.1122 * \text{Return}\ Effective\ Grade\ Segment\ (\%)^{2}$$
$$- 0.0028 * \text{Return}\ Effective\ Grade\ Segement\ (\%) + 0.0011$$

(*Curve Fit Cat Handbook Ed* 37. $9-38$)

$$Loader\ (cycles/truck) = Minimum\left[\frac{Struck\ Capacity\ (cy)}{Loader\ Net\ Bucket\ Capacity\ (cy)}, \frac{Heaped\ Capacity\ (cy)}{Loader\ Net\ Bucket\ Capacity\ (cy)}\right]$$

$$Haul\ Time\ (\text{min}) = \sum\left(Segment\ Travel\ Time\ Loaded\ (\text{min}/m) * Segment\ Haul\ Dist\ (m)\right)$$

$$\text{Return}\ Time\ (\text{min}) = \sum\left(Segment\ Travel\ Time\ Empty\ (\text{min}/m) * Segment\ Haul\ Dist\ (m)\right)$$

$$Loading\ Time\ (\text{min}) = Loader\ Cycle\ Time\ (\text{min}) * Loader\ (cycles/truck)$$

$$Task\ Time\ (hr) = Maximum\left[\frac{Volume\ (cy)}{\text{Productivity}\ (cy/hr)}, Loader\ Task\ Time\ (hr)\right]$$

$$Truck\ Cycle\ Time\ (\text{min}) =$$
$$Haul\ Time\ (\text{min}) + \text{Return}\ Time\ (\text{min}) + Loading\ Time\ (\text{min})$$
$$+ Load\ /\ Manuever\ Time\ (\text{min}) + Dump\ Manumver\ Time\ (\text{min})$$

$$\text{Productivity}\ (cy/hr) =$$
$$Work\ Hour\ (\text{min}/hr) * Loader\ (cycles/truck) * Loader\ Net\ Bucket\ Cap\ (cy) * \frac{Optimum\ Number\ of\ Trucks}{Truck\ Cycle\ Time\ (\text{min})}$$

### Sheet #10 Loader:

$$Net\ Bucket\ Capcity\ (cy) = \frac{Rated\ Bucket\ Capcity\ (cy)}{Bucket\ Fill\ Factor}$$

$$\text{Productivity}\ (cy/hr) = \frac{Net\ Bucket\ Capcity\ (cy) * Work\ Hour\ (\text{min}/hr)}{Loader\ Cycle\ Time\ (\text{min})}$$

$$Task\ Time\ (hr) = \frac{Volume\ (cy)}{\text{Productivity}\ (cy/hr)}$$

## OPTIMIZATION EQUATIONS:

### Productivity Sheet:

$$Productivity\ (cy/hr) =$$
$$Work\ Hour\ (\text{min}/hr) * Loader\ (cycle/truck) * Loader\ Net\ Buckter\ Cap\ (cy) * \frac{Variying\ Number\ of\ Trucks}{Truck\ Cycle\ Time\ (\text{min})}$$

### Time Sheet:

$$Time\ (hr) = Maximum\left(\frac{Volume\ (cy)}{Productivity\ (cy/hr)}, Laoder\ Task\ Time\ (hr)\right)$$

### Truck Cost Sheet:

$$Truck\ Cost\ (\$) =$$
$$Time\ (hr) * Varying\ Number\ of\ Trucks * \left(Owning\ \&\ Operating\ Cost\ (\$/hr) + Labor\ Cost\ (\$/hr)\right)$$

### Loader Cost Sheet:

$$Loader\ Cost\ \ for\ Varying\ Number\ of\ Trucks\ (\$) =$$
$$Time\ (hr) * \left(Owning\ \&\ Operating\ Cost\ (\$/hr) + Labor\ Cost\ (\$/hr)\right)$$

**Total Cost Sheet:**

$$Total\ Cost\ Varying\ Number\ of\ Trucks\ (\$) = Truck\ Cost\ (\$) + Loader\ Cost\ (\$)$$

$$Minimum\ Cost = Minimum\ (Total\ Cost\ \ for\ Varying\ Number\ of\ Trucks(\$))$$

**Optimum Number of Trucks:**

$$Number\ of\ Trucks =$$
$$Number\ of\ Trucks$$
$$when\ \left(Minimum\ Cost\ (\$) >= Total\ Cost\ \ for\ Varying\ Number\ of\ Trucks\right)$$
$$else\ 0$$

$$Optimum\ Number\ of\ Trucks = \sum Number\ of\ Trucks$$

# Appendix B-6
# Caterpillar Performance Handbook
# References

# CATERPILLAR® PERFORMANCE HANDBOOK

a CAT® publication by Caterpillar Inc., Peoria, Illinois, U.S.A.

OCTOBER 2004

Performance information in this booklet is intended for estimating purposes only. Because of the many variables peculiar to individual jobs (including material characteristics, operator efficiency, underfoot conditions, altitude, etc.), neither Caterpillar Inc. nor its dealers warrant that the machines described will perform as estimated.

Materials and specifications are subject to change without notice.

Printed in U.S.A.



SEBD0345

## Working Weights Bucket & Payload

| Model | Boom | | Stick Length | | Working Weights Buckets & Payload | |
|---|---|---|---|---|---|---|
| **5110B ME** | 7.6 m | **24'11"** | 3.4 m<br>4.1 m | **11'1"**<br>**13'5"** | 21 940 kg<br>19 920 kg | **48,350 lb**<br>**43,900 lb** |
| **5110B L** | 9.2 m | **30'2"** | 3.6 m<br>4.5 m<br>5.5 m | **11'10"**<br>**14'9"**<br>**18'1"** | 17 995 kg<br>16 030 kg<br>13 710 kg | **39,660 lb**<br>**35,320 lb**<br>**30,220 lb** |
| **5130B ME** | 8.0 m | **26'3"** | 3.8 m<br>5.2 m | **12'6"**<br>**17'1"** | 30 540 kg<br>25 850 kg | **67,310 lb**<br>**56,970 lb** |
| **5230B ME** | 9.5 m | **31'2"** | 4.5 m | **14'9"** | 51 000 kg | **112,450 lb** |

## Bucket Selection — ME

| Model | Bucket Type | Bucket Bite Width | | Bucket Tip Radius | | Heaped Capacity | | Bucket Weight With Teeth | |
|---|---|---|---|---|---|---|---|---|---|
| | | mm | in | mm | in | $m^3$ | $yd^3$ | kg | lb |
| **5110B ME** | Rock | 2682 | **105.0"** | 2812 | **110.0"** | 7.6 | **9.9** | 7450 | **16,420** |
| | Rock | 2356 | **93.0"** | 2797 | **110.0"** | 6.2 | **8.1** | 6680 | **14,730** |
| | Coal | 3128 | **123.0"** | 2803 | **110.0"** | 10.4 | **13.6** | 7010 | **15,450** |
| **5110B L** | Rock | 2356 | **93.0"** | 2474 | **98.0"** | 4.6 | **6.0** | 5730 | **12,630** |
| | Medium Duty | 2540 | **100.0"** | 2550 | **100.0"** | 6.0 | **7.8** | 5280 | **11,640** |
| | Medium Duty | 2210 | **87.0"** | 2550 | **100.0"** | 5.0 | **6.5** | 4750 | **10,470** |
| | Medium Duty | 1905 | **75.0"** | 2550 | **100.0"** | 4.2 | **5.5** | 4350 | **9590** |
| **5130B ME** | High Density | 2840 | **111.8"** | 3065 | **120.0"** | 8.6 | **11.2** | 9750 | **21,500** |
| | Rock | 2840 | **111.8"** | 3053 | **120.0"** | 10.6 | **13.9** | 10 630 | **23,440** |
| | Excavation | 3290 | **129.4"** | 3074 | **121.0"** | 10.2 | **13.3** | 8740 | **19,260** |
| | Coal | 3500 | **138.0"** | 3244 | **127.0"** | 13.8 | **18.0** | 8920 | **19,670** |
| | Coal | 3680 | **145.0"** | 3225 | **127.0"** | 18.6 | **24.0** | 9360 | **20,630** |
| **5230B ME** | Rock | 3940 | **156.0"** | 3350 | **132.0"** | 16.0 | **20.9** | 17 085 | **37,665** |
| | Light Material | 3940 | **156.0"** | 3250 | **128.0"** | 18.0 | **23.5** | 18 810 | **41,465** |
| | Coal | 4350 | **171.0"** | 3664 | **144.0"** | 27.6 | **36.1** | 16 700 | **36,815** |

## ESTIMATING FRONT SHOVEL CYCLE TIME

The loading cycle of the front shovel is composed of four segments:

1. Load bucket
2. Swing loaded
3. Dump bucket
4. Swing empty

Total shovel cycle time is dependent on machine size and job conditions. As conditions become more severe (tougher loading, more obstacles, etc.), the shovel slows down accordingly.

The following table breaks down what experience has shown to be typical Caterpillar Front Shovel cycle times with above average job conditions and an operator of average ability.

These times would decrease as job conditions or operator ability improved and would become slower as conditions become less favorable. For example:

Tough material . . . . . .Longer bucket fill and dump time.
Greater swing angle . . . . . .Longer swing times.
Operator ability . . . . . .Affects total cycle time.
Loading from the top down . . . . . .May improve swing time.



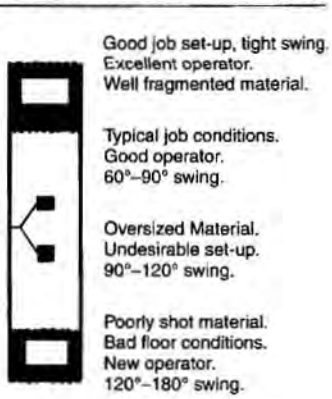
### Cycle Time Estimating

| MODEL | | 5110B ME | 5130B ME | 5230B ME |
|---|---|---|---|---|
| Bucket Size | ($m^3$)<br>($yd^3$) | 7.6<br>**9.9** | 10.6<br>**13.9** | 16.0<br>**20.9** |
| Soil Type | | ← | Hard Clay | → |
| Digging Depth | (m)<br>(ft) | — | 4.0<br>**13** | 5.0<br>**16** |
| Load Bucket | (min) | 0.11 | 0.12 | 0.12 |
| Swing Loaded | (min) | 0.10 | 0.13 | 0.14 |
| Dump Bucket | (min) | 0.04 | 0.04 | 0.04 |
| Swing Empty | (min) | 0.10 | 0.13 | 0.14 |
| Total Cycle Time | (min) | 0.35 | 0.42 | 0.44 |

| MODEL | | 5090B FS | 5130B FS | 5230B FS |
|---|---|---|---|---|
| Bucket Size | ($m^3$)<br>($yd^3$) | 5.2<br>**6.8** | 11.0<br>**14.4** | 17.0<br>**22.2** |
| Soil Type | | ← | Shot Rock | → |
| Swing Angle | | ← | 90° | → |
| Load Area | | ← | No Obstructions | → |
| Operator Ability | | ← | Average | → |
| Load Bucket | (min) | 0.18 | 0.18 | 0.20 |
| Swing Loaded | (min) | 0.08 | 0.13 | 0.14 |
| Dump Bucket | (min) | 0.05 | 0.04 | 0.05 |
| Swing Empty | (min) | 0.10 | 0.10 | 0.10 |
| Total Cycle Time | (min) | 0.41 | 0.45 | 0.49 |

| CYCLE TIME ESTIMATING CHART | | | | |
|---|---|---|---|---|
| CYCLE TIME (Min) | MACHINE AND BUCKET | | | CYCLE TIME (Sec) |
| | 5090B FS | 5130B FS | 5230B FS | |
| | | | | |
| | | | | 10 |
| 0.25 | | | | 15 |
| 0.30 | | | | 20 |
| 0.35 | | | | |
| 0.40 | | | | 25 |
| 0.45 | | | | |
| 0.50 | | | | 30 |
| 0.60 | | | | 35 |
| | | | | 40 |
| 0.75 | | | | 45 |
| | | | | 50 |
| | | | | 55 |
| 1.00 | | | | 60 |

**CYCLE TIME vs JOB CONDITION DESCRIPTION**




**BOTTOM DUMP BUCKET FILL FACTORS**

| Material | Fill Factor* |
|---|---|
| Bank Clay; Earth | 100%-105% |
| Rock-Earth Mixture | 100%-105% |
| Rock — Poorly Blasted | 85%-95% |
| Rock — Well Blasted | 95%-105% |
| Shale, Sandstone — Standing Bank | 85%-100% |

*Percent of heaped bucket capacity.

| CYCLE TIME ESTIMATING CHART | | | | |
|---|---|---|---|---|
| CYCLE TIME (Min) | MACHINE SIZE CLASS | | | CYCLE TIME (Sec) |
| | 5110B ME | 5130B ME | 5230B ME | |
| 0.17 | | | | 10 |
| 0.25 | | | | 15 |
| 0.33 | | | | 20 |
| 0.42 | | | | 25 |
| 0.50 | | | | 30 |
| 0.58 | | | | 35 |
| 0.67 | | | | 40 |
| 0.75 | | | | 45 |
| 0.83 | | | | 50 |
| 0.92 | | | | 55 |
| 1.00 | | | | 60 |

# CATERPILLAR® PERFORMANCE HANDBOOK

a Cat® publication by Caterpillar Inc., Peoria, Illinois, U.S.A.

JANUARY 2008

Performance information in this booklet is intended for estimating purposes only. Because of the many variables peculiar to individual jobs (including material characteristics, operator efficiency, underfoot conditions, altitude, etc.), neither Caterpillar Inc. nor its dealers warrant that the machines described will perform as estimated.

**NOTE: Always refer to the appropriate Operation and Maintenance Manual for specific product information.**

Materials and specifications are subject to change without notice.



Printed in U.S.A.



SEBD0348

## TRAVEL SPEED

| POWER SHIFT MODEL | D3K All Models | | D4K All Models | | D5K All Models | | D5N XL/LGP | | D5N LGP* PS DD | | D6K All Models | | D6N FTC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FORWARD | km/h | mph | km/h | mph | km/h | mph | km/h | mph | km/h | mph | km/h | mph | km/h | mph |
| 1 | — | — | — | — | — | — | 3.1 | **1.9** | 2.8 | **1.7** | — | — | 3.3 | **2.0** |
| 2 | — | — | — | — | — | — | 5.4 | **3.3** | 5.0 | **3.1** | — | — | 5.7 | **3.5** |
| 3 | — | — | — | — | — | — | 9.1 | **5.6** | 8.7 | **5.4** | — | — | 10.0 | **6.2** |
| REVERSE | | | | | | | | | | | | | | |
| 1 | — | — | — | — | — | — | 3.8 | **2.3** | | | — | — | 4.0 | **2.5** |
| 2 | — | — | — | — | — | — | 6.7 | **4.1** | ** | | — | — | 7.2 | **4.4** |
| 3 | — | — | — | — | — | — | 11.3 | **6.9** | | | — | — | 12.3 | **7.6** |
| HYDROSTATIC | | | | | | | | | | | | | | |
| FORWARD | 9.0 | **5.6** | 9.0 | **5.6** | 9.0 | **5.6** | — | — | — | — | 0-10.0 | **0-6.2** | — | — |
| REVERSE | 10.0 | **6.2** | 10.0 | **6.2** | 10.0 | **6.2** | — | — | — | — | 0-10.0 | **0-6.2** | — | — |

| POWER SHIFT MODEL | D6N D/S | | D6G/ D6G Series II | | D6T | | D7G/ D7G Series II | | D7R Series II (FTC) | | Differential Steer D7R Series II | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FORWARD | km/h | mph | km/h | mph | km/h | mph | km/h | mph | km/h | mph | km/h | mph |
| 1 | 3.4 | **2.1** | 4.0 | **2.5** | 3.8 | **2.3** | 3.7 | **2.3** | 3.7 | **2.3** | 3.5 | **2.2** |
| 2 | 5.9 | **3.7** | 6.9 | **4.3** | 6.6 | **4.1** | 6.4 | **4.0** | 6.4 | **4.0** | 6.2 | **3.8** |
| 3 | 9.9 | **6.2** | 10.8 | **6.7** | 11.4 | **7.1** | 10.0 | **6.2** | 11.1 | **6.9** | 10.7 | **6.7** |
| REVERSE | | | | | | | | | | | | |
| 1 | 3.8 | **2.4** | 4.8 | **3.0** | 4.8 | **3.0** | 4.5 | **2.8** | 4.8 | **3.0** | 4.6 | **2.9** |
| 2 | 7.2 | **4.5** | 8.4 | **5.2** | 8.4 | **5.2** | 7.9 | **4.9** | 8.3 | **5.1** | 8.0 | **5.0** |
| 3 | 11.7 | **7.3** | 12.9 | **8.0** | 14.6 | **9.0** | 11.9 | **7.4** | 14.3 | **8.9** | 13.8 | **8.6** |

| POWER SHIFT MODEL | Differential Steer D8R | | D8T | | D9R | | D9T | | D10T | | D11R/CD | | D11R/CD High Altitude | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FORWARD | km/h | mph | km/h | mph | km/h | mph | km/h | mph | km/h | mph | km/h | mph | km/h | mph |
| 1 | 3.5 | **2.2** | 3.4 | **2.1** | 3.8 | **2.4** | 3.9 | **2.4** | 4.0 | **2.5** | 3.9 | **2.4** | 4.0 | **2.5** |
| 2 | 6.2 | **3.9** | 6.1 | **3.8** | 6.8 | **4.2** | 6.8 | **4.2** | 7.2 | **4.5** | 6.8 | **4.2** | 7.0 | **4.4** |
| 3 | 10.8 | **6.7** | 10.6 | **6.6** | 11.9 | **7.4** | 11.7 | **7.3** | 12.7 | **7.9** | 11.8 | **7.3** | 12.0 | **7.5** |
| REVERSE | | | | | | | | | | | | | | |
| 1 | 4.7 | **2.9** | 4.5 | **2.8** | 4.7 | **2.9** | 4.7 | **2.9** | 5.2 | **3.2** | 4.7 | **2.9** | 4.8 | **3.0** |
| 2 | 8.1 | **5.0** | 8.0 | **5.0** | 8.4 | **5.2** | 8.4 | **5.2** | 9.0 | **5.6** | 8.2 | **5.1** | 8.3 | **5.2** |
| 3 | 13.9 | **8.6** | 14.2 | **8.8** | 14.7 | **9.1** | 14.3 | **8.9** | 15.8 | **9.8** | 14.0 | **8.7** | 14.9 | **9.0** |

*Power Shift direct drive transmission available for Japan domestic market only.
**Not available at time of printing.

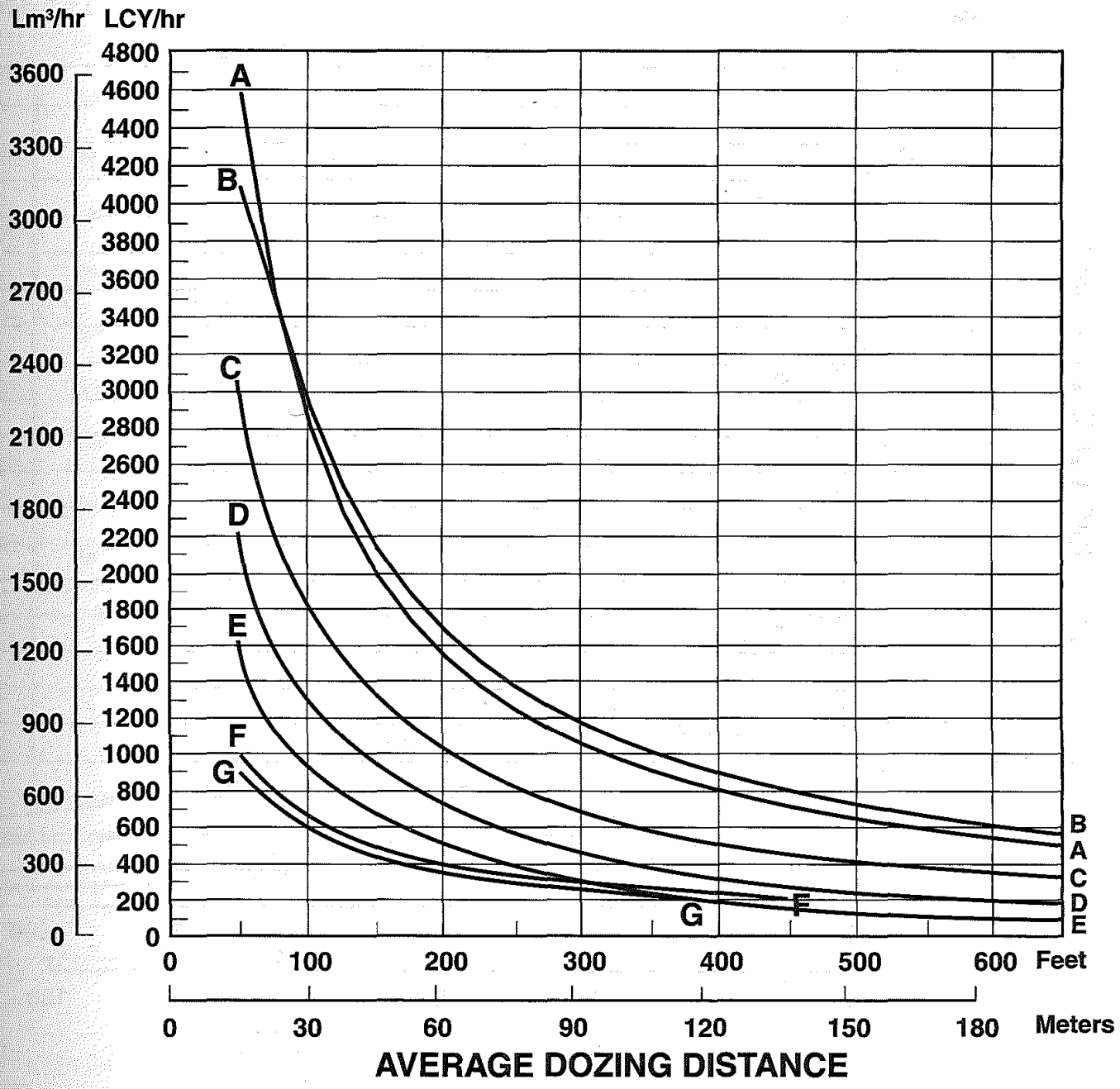
| | D8R/D8T | | | | | | D9R/D9T | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **MODEL** | **8A** | | **8SU** | | **8U** | | **9SU** | | **9U** | |
| Type | **Angling** | | **Semi-U** | | **Universal** | | **Semi-U** | | **Universal** | |
| Blade Capacities* | 4.7 $m^3$ | **6.1 $yd^3$** | 8.7 $m^3$ | **11.4 $yd^3$** | 11.7 $m^3$ | **15.3 $yd^3$** | 13.5 $m^3$ | **17.7 $yd^3$** | 16.4 $m^3$ | **21.4 $yd^3$** |
| Weight, Shipping** (Dozer) | 5459 kg | **12,009 lb** | 4789 kg | **10,557 lb** | 5352 kg | **11,800 lb** | 6543 kg | **14,425 lb** | 7134 kg | **15,727 lb** |
| Tractor and Dozer Dimensions: | | | | | | | | | | |
| **A** Length (Blade Straight) | 6.57 m | **21'7"** | 6.39 m | **21'0"** | 6.79 m | **22'3"** | 6.84 m | **22'5"** | 7.18 m | **23'7"** |
| Length (Blade Angled) | 7.62 m | **25'0"** | — | | — | | — | | — | |
| Width (Blade Angled) | 4.52 m | **14'10"** | — | | — | | — | | — | |
| Width (with C-Frame only) | 3.38 m | **11'1"** | — | | — | | — | | — | |
| Blade Dimensions: | | | | | | | | | | |
| **B** Width (including std. end bits) | 4.99 m | **16'4"** | 3.94 m | **12'11"** | 4.26 m | **14'0"** | 4.31 m | **14'2"** | 4.65 m | **15'3"** |
| **C** Height | 1174 mm | **3'10.2"** | 1690 mm | **5'6.5"** | 1740 mm | **5'8.5"** | 1934 mm | **6'4.1"** | 1934 mm | **6'4.1"** |
| **D** Max. Digging Depth | 628 mm | **2'0.7"** | 575 mm | **22.6"** | 575 mm | **22.6"** | 606 mm | **1'11.9"** | 606 mm | **1'11.9"** |
| **E** Ground Clearance @ Full Lift | 1308 mm | **4'3.5"** | 1225 mm | **48.2"** | 1225 mm | **48.2"** | 1422 mm | **4'8"** | 1422 mm | **4'8"** |
| **G** Max. Pitch Adjustment | **—** | | **+3.0° to 2.9°** | | **+3.0° to 2.9°** | | **+3.4° to 2.9°** | | **+3.4° to 2.9°** | |
| Blade Angle (either side) | **25°** | | — | | — | | — | | — | |
| **H** Max. Hydraulic Tilt | 729 mm | **2'4.7"◀** | 883 mm | **34.8"** | 954 mm | **37.5"** | 940 mm | **3'1"** | 1014 mm | **3'3.9"** |
| **J** Hydraulic Tilt (Manual Brace Centered) | **—** | | 596 mm | **23"** | 644 mm | **25"** | 570 mm | **1'10.4"** | 616 mm | **2'0.3"** |
| **K** Push Arm Trunnion Width (to Ball Centers) | 2.98 m | **9'9"** | 2.98 m | **9'9"** | 2.98 m | **9'9"** | 3.17 m | **10'3"** | 3.17 m | **10'3"** |
| Maximum Track Width Permitted | 712 mm | **2'4"** | 711 mm | **2'4"** | 711 mm | **2'4"** | 762 mm | **2'6"** | 762 mm | **2'6"** |
| Dual Tilt Option | | | | | | | | | | |
| **G** Dual Pitch Adj. | **—** | | **±4.6°** | | **±4.6°** | | **+4.8° to 5.2°** | | **+4.8° to 4.9°** | |
| **H** Dual Max. Hyd. Tilt | **—** | | 879 mm | **34.5"** | 950 mm | **37.3"** | 1139 mm | **3'8.8"** | 1231 mm | **4'0.5"** |

* Blade capacities as determined by SAE J1265.
Notice that the capacity of the U-blade is the volume carried by a straight blade of the same dimensions plus the volume included in the "cup" of the U-blade. It is intended for **relative comparisons of dozer sizes,** and not for predicting capacities or productivities in actual field conditions.
** Shipping Weight — Total Bulldozer Arrangement includes: Blade, push arms or C-frame, braces, cylinders, lines, trunnions and lift cylinder mountings.
◀ Attachment includes two cylinders.

| MODEL | D10T | | | | D11R | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 10SU | | 10U | | 11SU | | 11U | | 11 CD | |
| Type | Semi-U | | Universal | | Semi-U | | Universal | | Universal | |
| Blade Capacities* | 18.5 $m^3$ | **24.2 $yd^3$** | 22.0 $m^3$ | **28.7 $yd^3$** | 27.2 $m^3$ | **35.5 $yd^3$** | 34.4 $m^3$ | **45.0 $yd^3$** | 43.6 $m^3$ | **57.0 $yd^3$** |
| Weight, Shipping** | | | | | | | | | | |
| Standard Dozer | 10 229 kg | **22,550 lb** | 10 784 kg | **23,775 lb** | 14 813 kg | **32,658 lb** | 17 296 kg | **38,131 lb** | 22 070 kg | **48,660 lb** |
| Abrasion Dozer | 11 069 kg | **24,403 lb** | 12 413 kg | **27,366 lb** | 16 192 kg | **35,698 lb** | 18 823 kg | **41,498 lb** | — | |
| Tractor and Dozer Dimensions: | | | | | | | | | | |
| A Length | 7.76 m | **25'5"** | 8.01 m | **26'3"** | 8.38 m | **27'6"** | 8.83 m | **28'11"** | 8.34 m | **26'8"** |
| Width | 4.86 m | **15'11"** | 5.26 m | **17'3"** | 5.60 m | **18'4"** | 6.35 m | **20'10"** | 6.71 m | **22'0"** |
| Blade Dimensions: | | | | | | | | | | |
| B Width (including std. end bits) | 4.86 m | **15'11"** | 5.26 m | **17'3"** | 5.60 m | **18'4"** | 6.35 m | **20'10"** | 6.71 m | **22'0"** |
| C Height | 2.12 m | **6'11"** | 2.12 m | **6'11"** | 2.37 m | **7'9"** | 2.37 m | **7'9"** | 3.26 m | **10'8"** |
| D Max. Digging Depth | 674 mm | **2'2.5"** | 674 mm | **2'2.5"** | 766 mm | **2'6.2"** | 766 mm | **2'6.2"** | 766 mm | **2'6.2"** |
| E Ground Clearance @ Full Lift | 1497 mm | **4'10.9"** | 1497 mm | **4'10.9"** | 1533 mm | **5'0.4"** | 1533 mm | **5'0.4"** | 1533 mm | **5'0.4"** |
| G Max. Pitch Adjustment | **+1.7° to 2.3°** | | **+1.7° to 2.3°** | | **+2.1° to 2.2°** | | **+2.1° to 2.2°** | | — | |
| H Max. Hydraulic Tilt | 993 mm | **3'3.1"** | 1074 mm | **3'6.3"** | 1184 mm | **3'10.6"** | 1344 mm | **4'4.9"** | 1344 mm | **4'4.9"** |
| J Hydraulic Tilt (Manual Brace Centered) | 722 mm | **2'4.4"** | 782 mm | **2'6.8"** | 886 mm | **2'10.9"** | 1006 mm | **3'3.6"** | — | |
| K Push Arm Trunnion Width (to Ball Centers) | 3.60 m | **11'10"** | 3.60 m | **11'10"** | 4.18 m | **13'9"** | 4.18 m | **13'9"** | 4.18 m | **13'9"** |
| Maximum Track Width Permitted | 762 mm | **2'6"** | 762 mm | **2'6"** | 914 mm | **3'0"** | 914 mm | **3'0"** | 914 mm | **3'0"** |
| Dual Tilt Option | | | | | **+7.5° to 7.6° or** | | **+7.5° to 7.6° or** | | | |
| G Dual Pitch Adj. | **+5.2° to 5.5°** | | **+5.2° to 5.5°** | | **+0° to 13°** | | **+0° to 13°** | | **+47.8° to 10.4°** | |
| H Dual Max. Hyd. Tilt | 1441 mm | **4'8.7"** | 1560 mm | **5'1.4"** | 1706 mm | **5'7.2"** | 1938 mm | **6'4.3"** | — | |

*Blade capacities as determined by SAE J1265.
Notice that the capacity of the U-blade is the volume carried by a straight blade of the same dimensions plus the volume included in the "cup" of the U-blade. It is intended for **relative comparisons of dozer sizes,** and not for predicting capacities or productivities in actual field conditions.
**Shipping Weight — Total Bulldozer Arrangement includes: Blade, push arms or C-frame, braces, cylinders, lines, trunnions and lift cylinder mountings.

## ESTIMATED DOZING PRODUCTION ● Universal Blades ● D7G through D11R

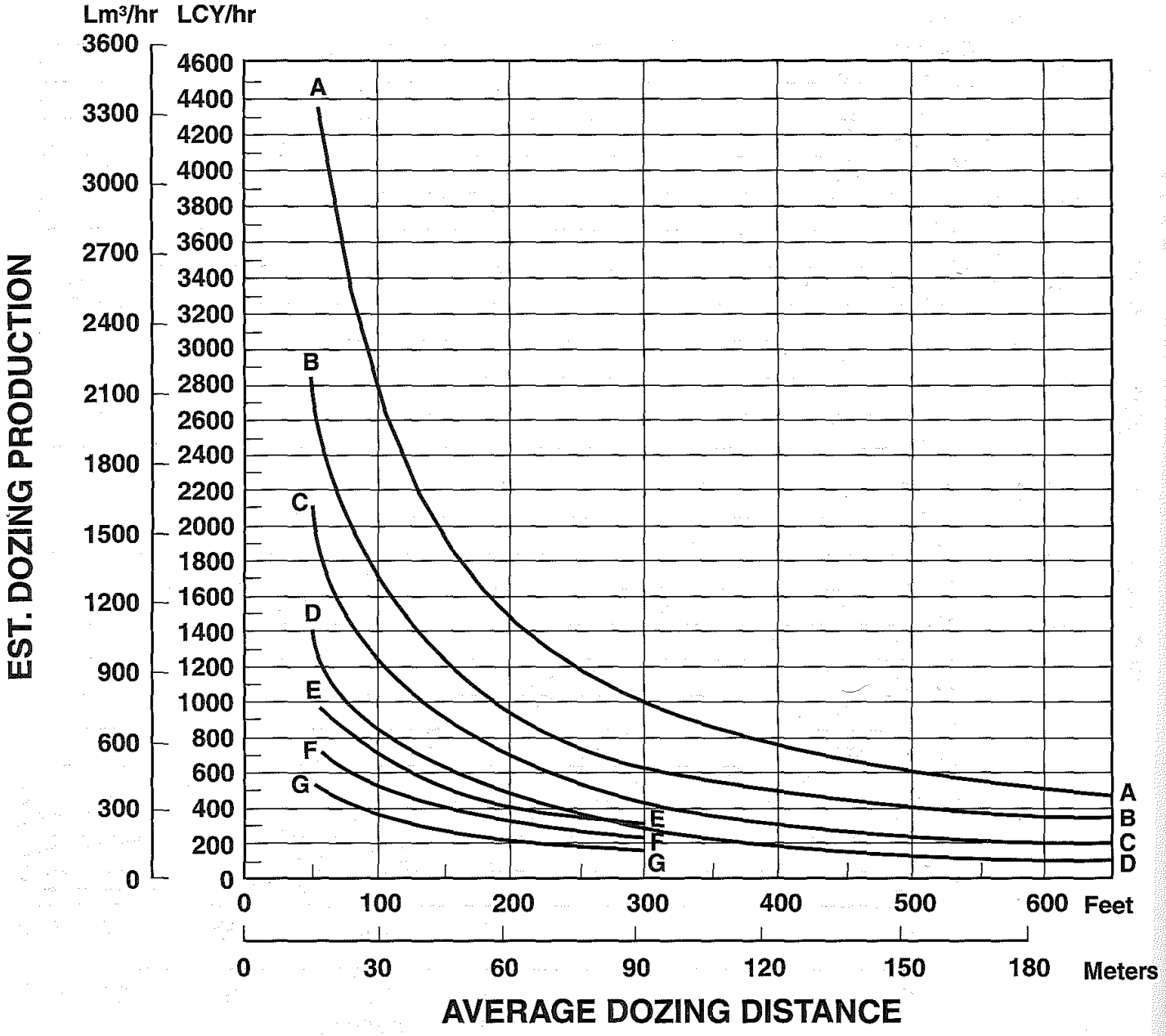



KEY

A — D11R-11U
B — D11R CD
C — D10T-10U
D — D9R/D9T-9U
E — D8R/D8T-8U
F — D7R Series II-7U
G — D7G-7U

**NOTE:** This chart is based on numerous field studies made under varying job conditions. Refer to correction factors following these charts.

## ESTIMATED DOZING PRODUCTION ● Semi-Universal Blades ● D6N through D11R




KEY

A — D11R-11SU
B — D10T-10SU
C — D9R/D9T-9SU
D — D8R/D8T-8SU
E — D7R Series II-7SU
F — D6T

**NOTE:** This chart is based on numerous field studies made under varying job conditions. Refer to correction factors following these charts.

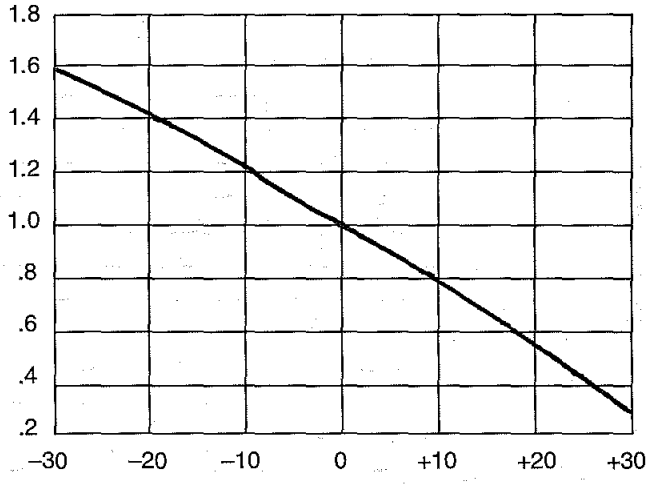
## JOB CONDITION CORRECTION FACTORS

| | TRACK-TYPE TRACTOR | WHEEL-TYPE TRACTOR |
|---|---|---|
| **OPERATOR** — | | |
| Excellent | 1.00 | 1.00 |
| Average | 0.75 | 0.60 |
| Poor | 0.60 | 0.50 |
| **MATERIAL** — | | |
| Loose stockpile | 1.20 | 1.20 |
| Hard to cut; frozen — | | |
| with tilt cylinder | 0.80 | 0.75 |
| without tilt cylinder | 0.70 | — |
| Hard to drift; "dead" (dry, non-cohesive material) or very sticky material | 0.80 | 0.80 |
| Rock, ripped or blasted | 0.60-0.80 | — |
| **SLOT DOZING** | 1.20 | 1.20 |
| **SIDE BY SIDE DOZING** | 1.15-1.25 | 1.15-1.25 |
| **VISIBILITY** — | | |
| Dust, rain, snow, fog or darkness | 0.80 | 0.70 |
| **JOB EFFICIENCY** — | | |
| 50 min/hr | 0.83 | 0.83 |
| 40 min/hr | 0.67 | 0.67 |
| **BULLDOZER*** | | |
| Adjust based on SAE capacity relative to the base blade used in the Estimated Dozing Production graphs. | | |
| **GRADES** — See following graph. | | |

***NOTE:** Angling blades and cushion blades are not considered production dozing tools. Depending on job conditions, the A-blade and C-blade will average 50-75% of straight blade production.

**% Grade vs. Dozing Factor**

(–) Downhill
(+) Uphill




## ESTIMATING DOZER PRODUCTION OFF-THE-JOB

*Example problem:*

Determine average hourly production of a D8T/8SU (with tilt cylinder) moving hard-packed clay an average distance of 45 m (150 feet) down a 15% grade, using a slot dozing technique.

Estimated material weight is 1600 kg/Lm³ (2650 lb/LCY). Operator is average. Job efficiency is estimated at 50 min/hr.

Uncorrected Maximum Production — 458 Lm³/h (600 LCY/hr) (example only)

Applicable Correction Factors:

Hard-packed clay is "hard to cut" material –0.80
Grade correction (from graph) .....–1.30
Slot dozing .....–1.20
Average operator .....–0.75
Job efficiency (50 min/hr) .....–0.83
Weight correction .....(2300/2650)–0.87

Production = Maximum Production × Correction Factors
= (600 LCY/hr) (0.80) (1.30) (1.20) (0.75) (0.83) (0.87)
= 405.5 LCY/hr

To obtain production in metric units, the same procedure is used substituting maximum uncorrected production in Lm³.

= 458 Lm³/h × Factors
= 309.6 Lm³/h

| TRACTOR/RIPPER | D11R | D11R | D11R |
|---|---|---|---|
| **Ripper Type** | **CD Single Shank** | **CD Multishank** | **Multishank** |
| Dimensions: | | | |
| **Ripper to Track** | | | |
| Ripper length behind track, shank vertical, ripper up (A) | | | |
| **A** With Pushblock | **N/A** | **N/A** | **N/A** |
| **B** Without Pushblock | 2.04 m **6'8"** | 1.92 m **6'4"** | 1.92 m **6'4"** |
| Ripper length behind track, shank vertical, ripper down (A) | | | |
| **C** With Pushblock | **N/A** | **N/A** | **N/A** |
| **D** Without Pushblock | 2.48 m **8'2"** | 1.92 m **6'4"** | 1.92 m **6'4"** |
| Tip to track distance, shank vertical (A) | | | |
| **E** Ripper Up | 622 mm **2'0.5"** | 651 mm **2'1.6"** | 651 mm **2'1.6"** |
| **F** Ripper Down | 1041 mm **3'5"** | 1030 mm **3'4.6"** | 1030 mm **3'4.6"** |
| **Ripper Shank*** | | | |
| **G** Maximum digging depth | 1612 mm **5'3.5"** | 1070 mm **3'6.1"** | 1070 mm **3'6.1"** |
| **H** Dig adjustment per hole | 280 mm **11"** | 280 mm **11"** | 280 mm **11"** |
| **I** Total dig adjustment | 840 mm **2'9.1"** | 280 mm **11"** | 280 mm **11"** |
| Pitch Adjustment, ripper down: | | | |
| **J** Forward | **15°** | **15°** | **15°** |
| **K** Backward | **18.3°** | **18.5°** | **18.5°** |
| **L** Maximum reach at ground line | 1.73 m **5'8"** | 1.57 m **5'2"** | 1.57 m **5'2"** |
| **M** Maximum ground clearance under tooth (shank pinned in bottom hole) | 1115 mm **3'7.9"** | 1137 mm **3'8.8"** | 1137 mm **3'8.8"** |
| **N** Maximum ramp angle, ripper up (shank pinned in bottom hole) | **33.9°** | **37.1°** | **37.1°** |
| Shank Section | 110 × 450 mm **4.3" × 17.7"** | 100 × 400 mm **3.9" × 15.7"** | 100 × 400 mm **3.9" × 15.7"** |
| **Ripper Beam** | | | |
| **O** Overall width | **N/A** | 3.33 m **10'11"** | 3.33 m **10'11"** |
| **P** Height | **N/A** | 560 mm **1'10"** | 560 mm **1'10"** |
| **Q** Length | **N/A** | 560 mm **1'10"** | 560 mm **1'10"** |
| Clearance under beam, shank vertical | | | |
| **R** Ripper Up | **N/A** | 2.06 m **6'9"** | 2.06 m **6'9"** |
| **S** Ripper Down | **N/A** | 282 mm **11.1"** | 282 mm **11.1"** |
| Number of Pockets | **1** | **3** | **3** |
| **T** Pocket Spacing | **N/A** | 1500 mm **5'9"** | 1500 mm **5'9"** |
| **U** Shank Gauge | **N/A** | 2.99 m **9'10"** | 2.99 m **9'10"** |
| **V** Track Clearance with standard shoe | 141 mm **5.6"** | 166 mm **5.6"** | 166 mm **5.6"** |
| **W** Width across widest part of lift cylinders | 1.9 m **6'3"** | 1.9 m **6'3"** | 1.9 m **6'3"** |
| Installed Weights: | | | |
| Ripper with standard shank | 12 971 kg **28,536 lb** | 12 389 kg **27,256 lb** | 9545 kg **21,000 lb** |
| Each additional tooth group | **N/A** | **N/A** | **N/A** |
| **Ripper Forces:**** | | | |
| Penetration Force, shank vertical | 295 807 N **66,494 lb** | 274 917 N **61,804 lb** | 225 680 N **50,715 lb** |
| Pryout Force, shank vertical | 625 577 N **140,579 lb** | 549 834 N **123,608 lb** | 451 360 N **101,430 lb** |

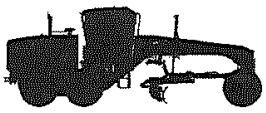
*Hydraulic pin puller is standard with deep ripping shank. Deep Ripping Arrangement maximum digging depth is 2.18 m **(7'2")**.
**Forces are for a ripper on a tractor equipped with an EROPS, U-Dozer and performance track. Forces will vary slightly with other vehicle configurations.

| MODEL | 140M | | 160M | |
|---|---|---|---|---|
| Base Power — Net | 136 kW | **183 hp** | 159 kW | **213 hp** |
| VHP Range — Net | 136-148 kW | **183-198 hp** | 159-170 kW | **213-228 hp** |
| VHP Plus Range — Net | 136-163 kW | **183-218 hp** | 159-185 kW | **213-248 hp** |
| Operating Weight* | 15 130 kg | **33,356 lb** | 15 903 kg | **35,060 lb** |
| Engine Model | **C7 ACERT VHP** | | **C9 ACERT VHP** | |
| Rated Engine RPM | **2000** | | **2000** | |
| No. of Cylinders | **6** | | **6** | |
| Displacement | 7.2 L | **439 in³** | 8.8 L | **537 in³** |
| Max. Torque Rise | 1079 N·m | **796 lb-ft** | 1237 N·m | **912 lb-ft** |
| No. of Speeds Forward/Reverse | **8/6** | | **8/6** | |
| Top Speed: Forward | 46.6 km/h | **29 mph** | 47.4 km/h | **29.5 mph** |
| Reverse | 36.8 km/h | **22.9 mph** | 37.4 km/h | **23.3 mph** |
| Std. Tires — Front and Rear | **14.00 24 10PR (G-2)** | | **14.00 24 10PR (G-2)** | |
| Front Axle Steering: | | | | |
| Oscillation Angle | **32°** | | **32°** | |
| Wheel Lean Angle | **18.0°** | | **18.0°** | |
| Steering Angle | **47.5°** | | **47.5°** | |
| Articulation Angle | **20°** | | **20°** | |
| Minimum Turning Radius** | 7.75 m | **25'6"** | 7.75 m | **25'6"** |
| No. Circle Support Shoes | **6** | | **6** | |
| Hydraulics: | | | | |
| Pump Type | **Variable Piston** | | **Variable Piston** | |
| Max. Pump Flow | 210 L/min | **55.7 gpm** | 210 L/min | **55.7 gpm** |
| Tank Capacity | 60 L | **15.9 U.S. gal** | 60 L | **15.9 U.S. gal** |
| Implement Pressure: Max. | 24 150 kPa | **3500 psi** | 24 150 kPa | **3500 psi** |
| Min. | 3100 kPa | **450 psi** | 3100 kPa | **450 psi** |
| Interior Sound Level/SAE J919 | **70 dB (A)** | | **70 dB(A)** | |
| Electrical: | | | | |
| System Size | **24V** | | **24V** | |
| Std. Battery CCA @ 0° F | **880** | | **880** | |
| Std. Alternator | **80** | | **80** | |
| GENERAL DIMENSIONS: | | | | |
| Height (to top of ROPS) | 3293 mm | **130"** | 3293 mm | **130"** |
| Overall Length | 8713 mm | **343"** | 8713 mm | **343"** |
| With Ripper and Pushplate | 10 144 mm | **399"** | 10 144 mm | **399"** |
| Wheelbase | 6121 mm | **241"** | 6121 mm | **241"** |
| Blade Base | 2552 mm | **101"** | 2552 mm | **101"** |
| Overal Width (at top of front tires) | 2493 mm | **98"** | 2493 mm | **98"** |
| Standard Blade: Length | 3658 mm | **12'0"** | 3658 mm | **12'0"** |
| Height | 610 mm | **24"** | 610 mm | **24"** |
| Thickness | 22 mm | **0.87"** | 22 mm | **0.87"** |
| Lift Above Ground | 480 mm | **18.9"** | 452 mm | **17.8"** |
| Max. Shoulder Reach:*** | | | | |
| Frame Straight — left | 1790 mm | **70.5"** | 2090 mm | **82.3"** |
| Frame Straight — right | 1978 mm | **77.9"** | 2278 mm | **89.7"** |
| Fuel Tank Capacity | 416 L | **110 U.S. gal** | 416 L | **110 U.S. gal** |

*Operating Weight — based on standard machine configuration with full fuel tank, coolant, lubricants and operator.
**Minimum Turning Radius — combining the use of articulated frame steering, front wheel steer and unlocked differential.
***Applicable for the standard blade with hydraulic sideshift and tip control. Maximum shoulder reach is obtainable to the right.

# Motor Graders Global Versions

## Specifications



| MODEL | 14M | | 16M | | 24M | |
|---|---|---|---|---|---|---|
| Base Power — Net | 193 kW | **259 hp** | 221 kW | **297 hp** | 397 kW | **533 hp** |
| VHP Range — Net | 193-204 kW | **259-274 hp** | 221-233 kW | **297-312 hp** | | — |
| VHP Plus Range — Net | 193-219 kW | **259-294 hp** | 221-248 kW | **297-332 hp** | | — |
| Operating Weight* | 21 379 kg | **47,133 lb** | 26 060 kg | **57,452 lb** | 62 456 kg | **137,692 lb** |
| Engine Model | **C11** | | **C13 ACERT VHP** | | **C18 ACERT** | |
| Rated Engine RPM | **1800** | | **2000** | | **1800** | |
| No. of Cylinders | **6** | | **6** | | **6** | |
| Displacement | 11.1 L | **677 in³** | 12.5 L | **763 in³** | 18.1 L | **1104.5 in³** |
| Max. Torque Rise | 1422 N·m | **1049 lb-ft** | 1710 N·m | **1261 lb-ft** | 2389 N·m | **1762 lb-ft** |
| No. of Speeds Forward/Reverse | **8/6** | | **8/6** | | **6/3** | |
| Top Speed: Forward | 49.8 km/h | **31 mph** | 53.9 km/h | **33.5 mph** | 43 km/h | **26.7 mph** |
| Reverse | 39.4 km/h | **24.5 mph** | 42.6 km/h | **26.5 mph** | 41.2 km/h | **25.6 mph** |
| Std. Tires — Front and Rear | **16.00-24 (16 PR) (G-2)** | | **18.00-25 12PR (G-2)** | | — | |
| Front Axle Steering: | | | | | | |
| Oscillation Angle | **32°** | | **32°** | | **32°** | |
| Wheel Lean Angle | **17.1°** | | **18.2°** | | **18.0°** | |
| Steering Angle | **47.5°** | | **47.5°** | | **47.5°** | |
| Articulation Angle | **20°** | | **20°** | | **20°** | |
| Minimum Turning Radius** | 7.9 m | **25'11"** | 8.9 m | **29'3"** | 12.4 m | **40'9"** |
| No. Circle Support Shoes | **6** | | **6** | | **6** | |
| Hydraulics: | | | | | | |
| Pump Type | **Variable Piston** | | **Variable Piston** | | **Variable Piston** | |
| Max. Pump Flow | 280 L/min | **74 gpm** | 280 L/min | **74 gpm** | 550 L/min | **145 gpm** |
| Tank Capacity | 60 L | **15.9 U.S. gal** | 60 L | **15.9 U.S. gal** | 264 L | **70 U.S. gal** |
| Implement Pressure: Max. | 24 150 kPa | **3500 psi** | 24 150 kPa | **3500 psi** | 24 150 kPa | **3500 psi** |
| Min. | 3100 kPa | **450 psi** | 3100 kPa | **450 psi** | 3100 kPa | **450 psi** |
| Interior Sound Level/SAE J919 | **70 dB(A)** | | **72 dB(A)** | | **74 dB(A)** | |
| Electrical: | | | | | | |
| System Size | **24V** | | **24V** | | **24V** | |
| Std. Battery CCA @ 0° F | **1125** | | **1400** | | **1500** | |
| Std. Alternator | **80** | | **150** | | **150** | |
| GENERAL DIMENSIONS: | | | | | | |
| Height (to top of ROPS) | 3535 mm | **139.2"** | 3703 mm | **145.8"** | 4352 mm | **171.3"** |
| Overall Length | 9412 mm | **370.6"** | 9963 mm | **392.2"** | 14 194 mm | **558.8"** |
| With Ripper and Pushplate | 10 896 mm | **429"** | 11 672 mm | **459.5"** | 16 102 mm | **633.9"** |
| Wheelbase | 6559 mm | **258"** | 6985 mm | **275"** | 10 278 mm | **404.6"** |
| Blade Base | 2842 mm | **112"** | 3069 mm | **120.8"** | 4048 mm | **159.4"** |
| Overal Width (at top of front tires) | 2791 mm | **109.9"** | 3096 mm | **121.9"** | 4280 mm | **168.5"** |
| Standard Blade: Length | 4287 mm | **14'0"** | 4877 mm | **16'0"** | 7315 mm | **24'0"** |
| Height | 686 mm | **27"** | 787 mm | **31"** | 1076 mm | **42"** |
| Thickness | 25 mm | **1"** | 25 mm | **1"** | 50 mm | **2"** |
| Lift Above Ground | 419 mm | **16.5"** | 395 mm | **15.6"** | 634 mm | **25"** |
| Max. Shoulder Reach:*** | | | | | | |
| Frame Straight — left | 2169 mm | **85.4"** | 2282 mm | **90"** | 3222 mm | **126.9"** |
| Frame Straight — right | 2279 mm | **89.7"** | 2587 mm | **101.9"** | 3228 mm | **127.1"** |
| Fuel Tank Capacity | 492 L | **130 U.S. gal** | 511 L | **135 U.S. gal** | 1326 L | **350 U.S. gal** |

*Operating Weight — based on standard machine configuration with full fuel tank, coolant, lubricants and operator. 24M includes ripper.
**Minimum Turning Radius — combining the use of articulated frame steering, front wheel steer and unlocked differential.
***Applicable for the standard blade with hydraulic sideshift and tip control. Maximum shoulder reach is obtainable to the right.

## PRODUCTION

The motor grader is used in a variety of applications in a variety of industries. Therefore, there are many ways to measure its operating capacity, or production. One method expresses a motor grader's production in relation to the area covered by the moldboard.

### Formula:

$$A = S \times (L_e - L_o) \times 1000 \times E \quad \text{(Metric)}$$
$$A = S \times (L_e - L_o) \times 5280 \times E \quad \text{(English)}$$

where A: Hourly operating area ($m^2$/h or $ft^2$/h)
S: Operating speed (km/h or mph)
$L_e$: Effective blade length (m or ft)
$L_o$: Width of overlap (m or ft)
E: Job efficiency

### Operating Speeds:

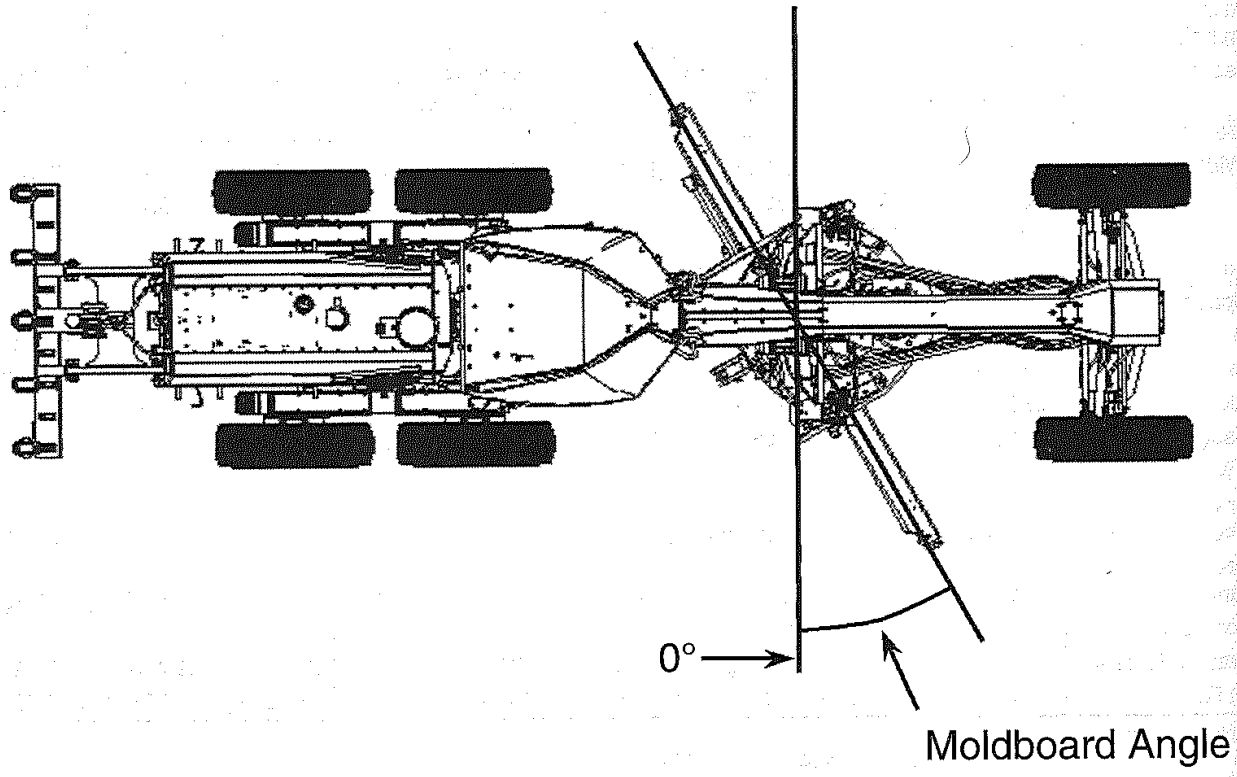
Typical operating speeds by application

| | | |
|---|---|---|
| Finish Grading: | 0-4 km/h | (0-2.5 mph) |
| Heavy Blading: | 0-9 km/h | (0-6 mph) |
| Ditch Repair: | 0-5 km/h | (0-3 mph) |
| Ripping: | 0-5 km/h | (0-3 mph) |
| Road Maintenance: | 5-16 km/h | (3-9.5 mph) |
| Haul Road Maintenance: | 5-16 km/h | (3-9.5 mph) |
| Snow Plowing: | 7-21 km/h | (4-13 mph) |
| Snow Winging: | 15-28 km/h | (9-17 mph) |

### Effective Blade Length:

Since the moldboard is usually angled when moving material, an effective blade length must be computed to account for this angle. This is the actual width of material swept by the moldboard.

**NOTE:** Angles are measured as shown below. The effective length becomes shorter as the angle increases.



| Moldboard Length, m (ft) | Effective Length, m (ft) 30 degree blade angle | Effective Length, m (ft) 45 degree blade angle |
|---|---|---|
| 3.658 (12) | 3.17 **(10.4)** | 2.59 **(8.5)** |
| 3.962 (13) | 3.43 **(11.3)** | 2.80 **(9.2)** |
| 4.267 (14) | 3.70 **(12.1)** | 3.02 **(9.9)** |
| 4.877 (16) | 4.22 **(13.9)** | 3.45 **(11.3)** |
| 7.315 (24) | 6.33 **(20.8)** | 5.17 **(17.0)** |

For other blade lengths and carry angles:
Effective length = COS [Radians (Blade L)] × Blade Length

### Width of Overlap:

The width of overlap is generally 0.6 m (2.0 ft). This overlap accounts for the need to keep the tires out of the windrow on the return pass.

### Job Efficiency:

Job efficiencies vary based on job conditions, operator skill, etc.

A good estimation for efficiency is approximately 0.70 to 0.85, but actual operating conditions should be used to determine the best value.

*Example problem:*

A 140M motor grader with a 3.66 m (12 ft) moldboard is performing road maintenance on a township road. The machine is working at an average speed of 13 km/h (8 mph) with a moldboard carry angle of 60 degrees. What is the motor grader's production based on coverage area?

**Note:** Due to the long passes involved in road maintenance — fewer turnarounds — a higher job efficiency of 0.90 is chosen.

### Solution:

From the table, the effective blade length is 3.17 m (10.4 ft).

*Metric*

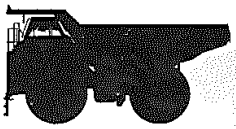
Production, A = 13 km/h × (3.17 m − 0.6 m) × 1000 × 0.90
= **30 069 m²/hr (3.07 hectares/hr)**

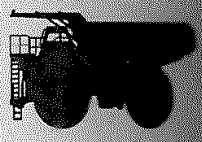
*English*

Production, A = 8 mph × (10.4 ft − 2.0 ft) × 5280 × 0.90
= **319,334 ft²/hr (7.33 acres/hr)**

| MODEL | 777F | |
|---|---|---|
| Body Type | Dual Slope Lined | |
| Gross Machine Weight | 163 293 kg | **360,000 lb** |
| Chassis Weight* | 50 790 kg | **111,971 lb** |
| Body System Weight | 22 187 kg | **48,914 lb** |
| Target Payload** | 90 316 kg | **199,115 lb** |
| Capacity: | | |
| Struck (SAE) | 41.9 $m^3$ | **54.8 $yd^3$** |
| Heaped (2:1) (SAE) | 60.2 $m^3$ | **78.8 $yd^3$** |
| Distribution Empty: | | |
| Front | **45%** | |
| Rear | **55%** | |
| Distribution Loaded: | | |
| Front | **33%** | |
| Rear | **67%** | |
| Engine Model | **C32 ACERT** | |
| Number of Cylinders | **12** | |
| Bore | 145 mm | **5.7"** |
| Stroke | 162 mm | **6.4"** |
| Displacement | 32.1 L | **1959 $in^3$** |
| Net Power | 700 kW | **938 hp** |
| Gross Power | 758 kW | **1016 hp** |
| Standard Tires | **27.00R49 (E4)** | |
| Machine Clearance Turning Circle | 28.4 m | **83'0"** |
| Fuel Tank Refill Capacity | 1137 L | **300 U.S. gal** |
| Top Speed (Loaded) | 64.5 km/h | **40.1 mph** |
| **GENERAL DIMENSIONS (Empty):** | | |
| Height to Canopy Rock Guard Rail | 5.19 m | **17'0"** |
| Wheelbase | 4.56 m | **15'0"** |
| Overall Length (Operating) | 10.53 m | **34'6"** |
| Overall Length (Shipping) | 9.78 m | **32'1"** |
| Loading Height (Empty) | 4.43 m | **14'7"** |
| Height at Full Dump | 10.36 m | **34'0"** |
| Body Length (Target Length) | 6.39 m | **20'11"** |
| Width (Operating) | 6.49 m | **21'4"** |
| Width (Shipping)*** | 3.51 m | **11'5"** |
| Front Tire Tread | 4.05 m | **13'3"** |

*Weights include lubricants, coolants, 100% fuel and a debris allowance (4% of chassis).
**Refer to Caterpillar's 10/10/20 Payload Policy for Quarry & Construction Trucks.
***Disassembled.





| MODEL | 785C | | 789C | | 793D Standard (MA1) | |
|---|---|---|---|---|---|---|
| Body Type | Dual Slope | | Dual Slope | | MSD II | |
| Target Gross Machine Weight § | 249 433 kg | **550,000 lb** | 317 460 kg | **700,000 lb** | 383 673 kg | 846,000 lb |
| Basic Machine Weight* | 57 176 kg | **126,074 lb** | 67 344 kg | **148,425 lb** | 51 934 kg | 114,522 lb |
| Attachments** | 22 955 kg | **50,616 lb** | 30 668 kg | **67,592 lb** | 68 528 kg | 151,076 lb |
| Body Weight without Liners*** | 22 181 kg | **48,887 lb** | 27 094 kg | **59,715 lb** | 32 650 kg | 71,981 lb |
| Full Liner | 7433 kg | **16,382 lb** | 9392 kg | **20,701 lb** | — | |
| Standard Sideboard | 1263 kg | **2785 lb** | 1292 kg | **2848 lb** | — | |
| Operating Machine Weight | 111 008 kg | **244,744 lb** | 135 790 kg | **299,281 lb** | 153 112 kg | 337,550 lb |
| Debris (2% of Operating Machine Weight) | 1569 kg | **3461 lb** | 1905 kg | **4198 lb** | 2334 kg | 5145 lb |
| Empty Operating Weight | 112 577 kg | **248,205 lb** | 137 695 kg | **303,479 lb** | 155 446 kg | 342,695 lb |
| Target Payload § | 137 m tons | **151 tons** | 180 m tons | **198 tons** | 228 m tons | 252 tons |
| Capacity: | | | | | | |
| Heaped (2:1) (SAE) Base Body | 78 $m^3$ | **102 $yd^3$** | 105 $m^3$ | **137 $yd^3$** | 140 $m^3$ | 196 $yd^3$ |
| Heaped (2:1) (SAE) with Std. Sideboards | 91 $m^3$ | **119 $yd^3$** | 120 $m^3$ | **157 $yd^3$** | — | |
| Distribution Empty: | | | | | | |
| Front | **47%** | | **46.9%** | | **46.9%** | |
| Rear | **53%** | | **53.1%** | | **53.1%** | |
| Distribution Loaded: | | | | | | |
| Front | **33%** | | **33.6%** | | **33.3%** | |
| Rear | **67%** | | **66.4%** | | **66.7%** | |
| Engine Model | **3512B EUI** | | **3516B EUI** | | **3516B HD EUI** | |
| Number of Cylinders | **12** | | **16** | | **16** | |
| Bore | 170 mm | **6.7"** | 170 mm | **6.7"** | 170 mm | 6.7" |
| Stroke | 190 mm | **7.5"** | 190 mm | **7.5"** | 215 mm | 8.5" |
| Displacement | 51.8 L | **3158 $in^3$** | 69 L | **4210 $in^3$** | 78 L | 4760 $in^3$ |
| Net Power | 1005 kW | **1348 hp** | 1320 kW | **1771 hp** | 1743 kW | 2337 hp |
| Gross Power | 1082 kW | **1450 hp** | 1417 kW | **1900 hp** | 1801 kW | 2415 hp |
| Standard Tires | **33.00R51** | | **37.00R57** | | **40.00R57** | |
| Machine Clearance Turning Circle | 30.6 m | **100'5"** | 30.2 m | **99'2"** | 32.7 m | 107'3" |
| Fuel Tank Refill Capacity | 1893 L | **500 U.S. gal** | 3222 L | **851 U.S. gal** | 4353 L | 1150 U.S. gal |
| Top Speed (Loaded) | 54.1 km/h | **33.6 mph** | 52.6 km/h | **32.7 mph** | 54.2 km/h | 33.7 mph |
| **GENERAL DIMENSIONS (Empty):** | | | | | | |
| Height to Canopy Rock Guard Rail | 5.77 m | **18'11"** | 6.15 m | **20'2"** | 6.60 m | 21'8" |
| Wheelbase | 5.18 m | **17'0"** | 5.70 m | **18'8"** | 5.91 m | 19'5" |
| Overall Length (Base Body) | 10.62 m | **34'10"** | 11.63 m | **38'2"** | 13.05 m | 42'9" |
| Loading Height (Base Body) | 4.97 m | **16'4"** | 5.21 m | **17'1"** | 5.87 m | 19'4" |
| Height at Full Dump | 11.21 m | **36'9"** | 11.90 m | **39'1"** | 13.25 m | 43'6" |
| Body Length (Target Length) | 7.65 m | **25'1"** | 8.15 m | **26'9"** | 8.99 m | 29'6" |
| Width (Operating) | 6.64 m | **21'4"** | 7.67 m | **25'2"** | 8.28 m | 27'2" |
| Width (Shipping)*** | 3.91 m | **12'10"** | 3.84 m | **12'7"** | 4.09 m | 13'5" |
| Front Tire Tread | 4.85 m | **15'11"** | 5.43 m | **17'10"** | 5.61 m | 18'5" |

*See Weight Definitions and Relations on 9-9. Note: No mandatory or optional attachments or fuel.

**Typical selection of mandatory and optional attachments.

***Data provided is for a representative body and liner package. Several dual slope, flat floor, and mine specific design (MSD) bodies and liner packages are available. All weights, capacities, and dimensions are dependent on the machine configuration (body type, attachments, tires, and optional equipment selected).

§ Reference Caterpillar's latest 10/10/20 Payload Policy for information on gross machine operating weight and target payload.

## USE OF BRAKE PERFORMANCE CURVES

The speed that can be maintained when the machine is descending a grade with retarder applied can be determined from the retarder curves in this section when gross machine weight and total effective grade are known.

Select appropriate grade distance chart that covers total downhill haul; don't break haul into individual segments.

To determine brake performance: Read from gross weight down to the percent effective grade. (Effective grade equals actual % grade *minus* 1% for each 10 kg/metric ton (20 lb./U.S. ton) of rolling resistance.) From this weight-effective grade point, read horizontally to the curve with the highest obtainable speed range, then down to maximum descent speed brakes can safely handle without exceeding cooling capacity. When braking, engine RPM should be maintained at the highest possible level without overspeeding. If cooling oil overheats, reduce ground speed to allow transmission to shift to next lower speed range.

## USE OF RIMPULL-SPEED-GRADEABILITY CURVES

(See Wheel Tractor Scraper Section)

**Total Effective Grade** (or Total Resistance) is grade assistance *minus* rolling resistance.

10 kg/metric ton (20 lb/U.S. ton) = 1% adverse grade.

*Example —*

With a favorable grade of 20% and rolling resistance of 50 kg/metric ton (100 lb/U.S. ton), find Total Effective Grade.

(50 kg/metric ton) = 50 ÷ 10 = 5% Effective Grade
(from Rolling Resistance)
100 lb/ton = 100 ÷ 20 = 5% Effective Grade
20% (grade) – 5% (resistance) =
15% Total Effective Grade

## TYPICAL FIXED TIMES FOR HAULING UNITS

Wait time, delays and operator efficiency all impact cycle time. Minimizing truck exchange time can have a significant effect on productivity.

Fixed time for hauling units include:
1. Truck load time (various with loading tool)
2. Truck maneuver in load area (Truck exchange) (Typically 0.6-0.8 min.)
3. Maneuver and dump time at dump point (Typically 1.0-1.2 min.)

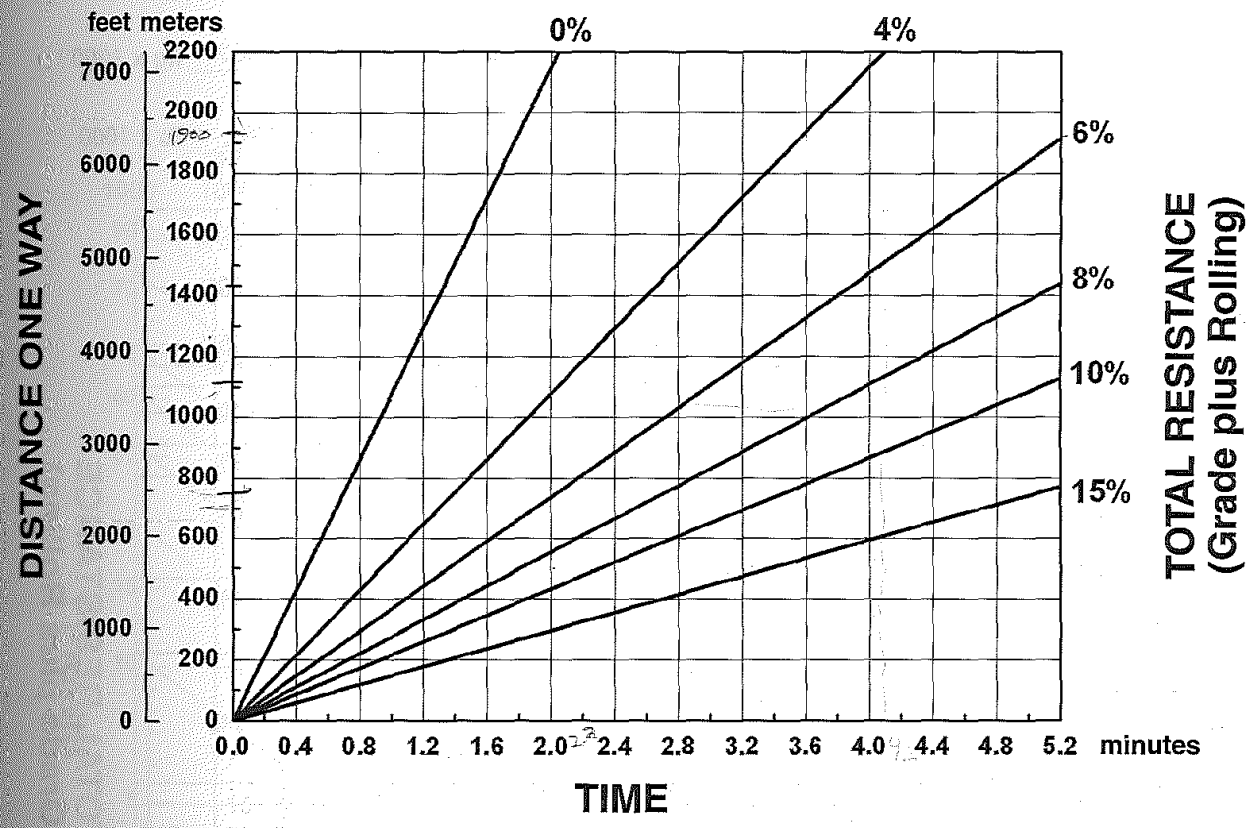
Total cycle time is the combination of:
1. The above fixed time
2. Hauling time (Loaded)
3. Return time (Empty)

*Example — assume load tool spots hauler with full bucket*

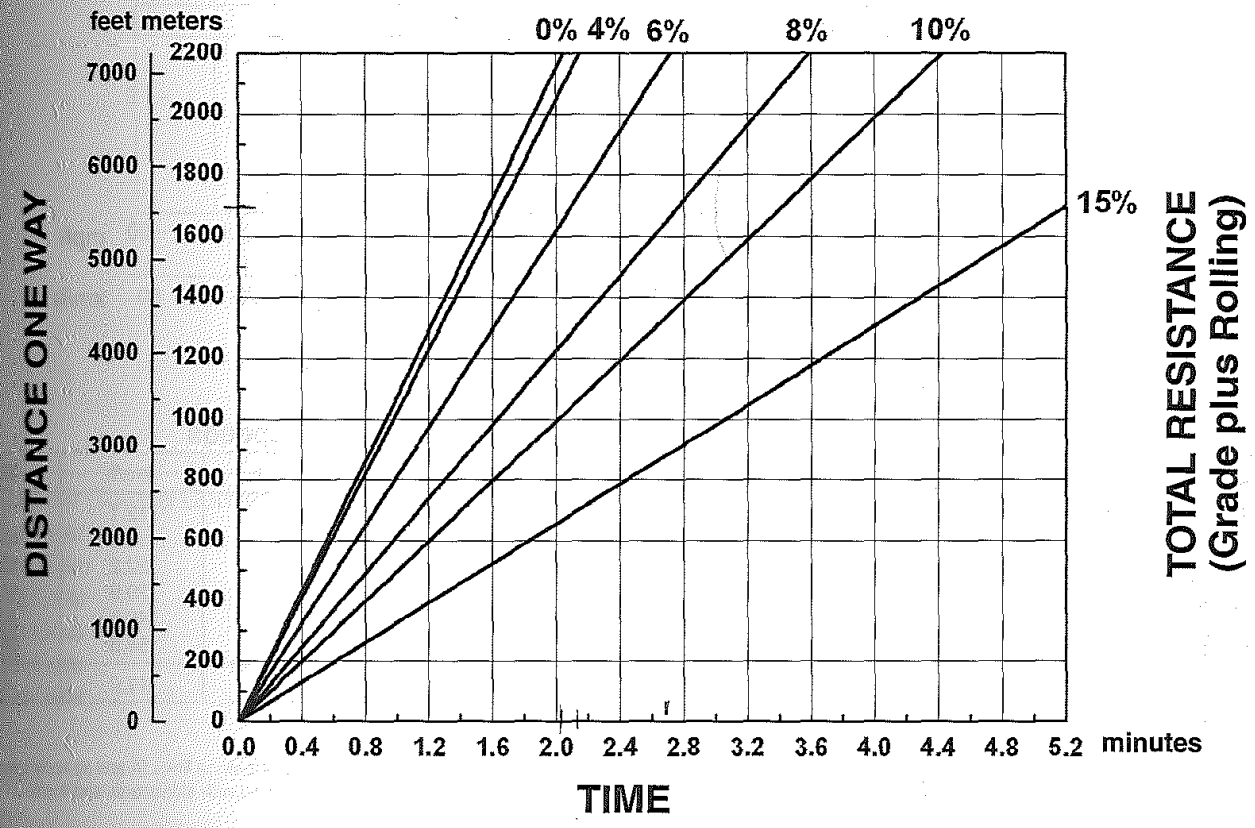
| | | 988F | 5130B |
|---|---|---|---|
| cycle times | | .60 | .45 |
| First pass | (dump time) | .10 min. | .05 min. |
| 2 passes | (full cycle) | .70 | .50 |
| 3 passes | " | 1.30 | .95 |
| 4 passes | " | 1.90 | 1.40 |
| 5 passes | " | 2.50 | 1.85 |
| 6 passes | " | 3.10 | 2.30 |
| 7 passes | " | 3.70 | 2.75 |
| 8 passes | " | 4.30 | 3.20 |
| 9 passes | " | 4.90 | 3.65 |
| 10 passes | " | 5.40 | 4.10 |

**NOTE:** Other sizes of loading tools will have different cycle times. See Wheel Loader section for **average** cycle times for truck loading.

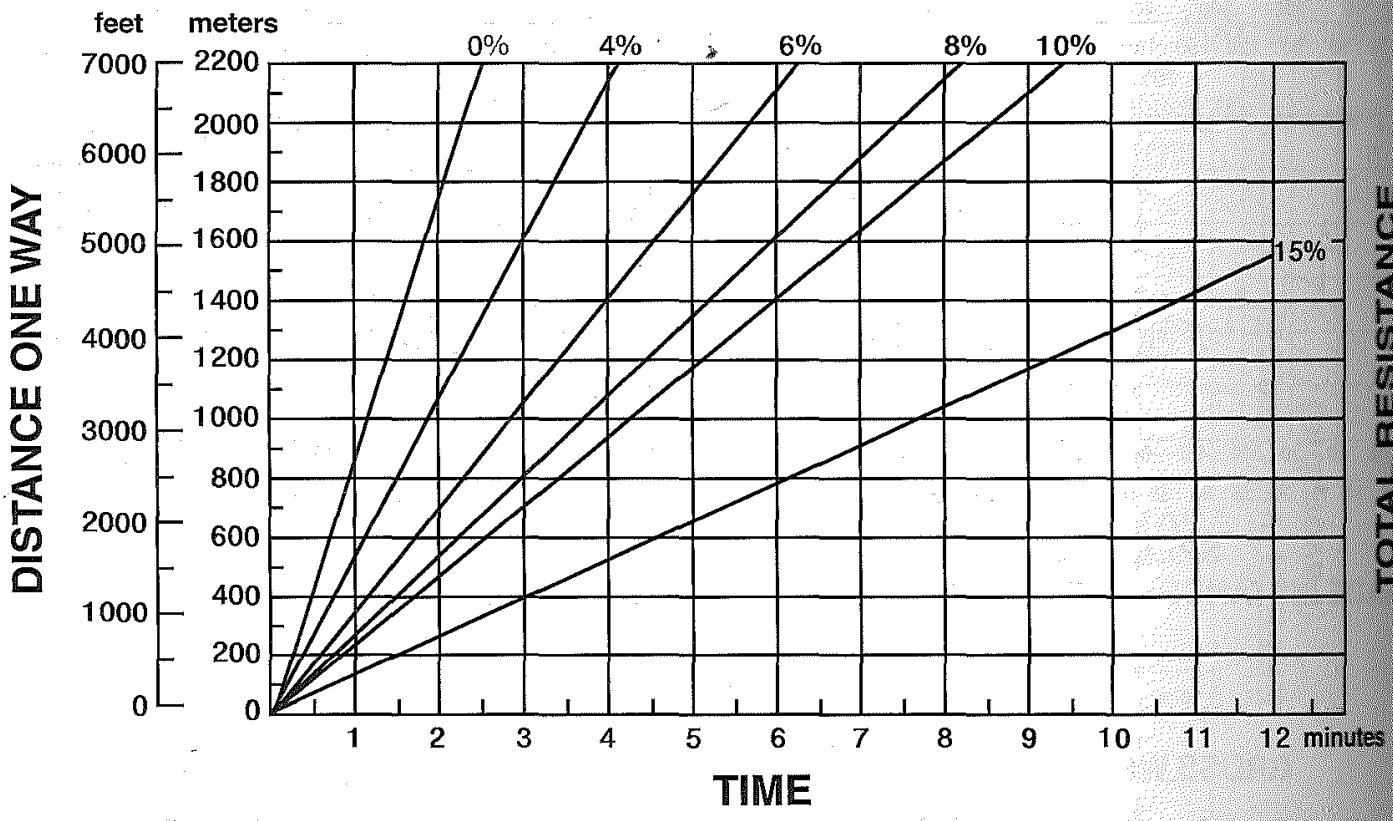
LOADED



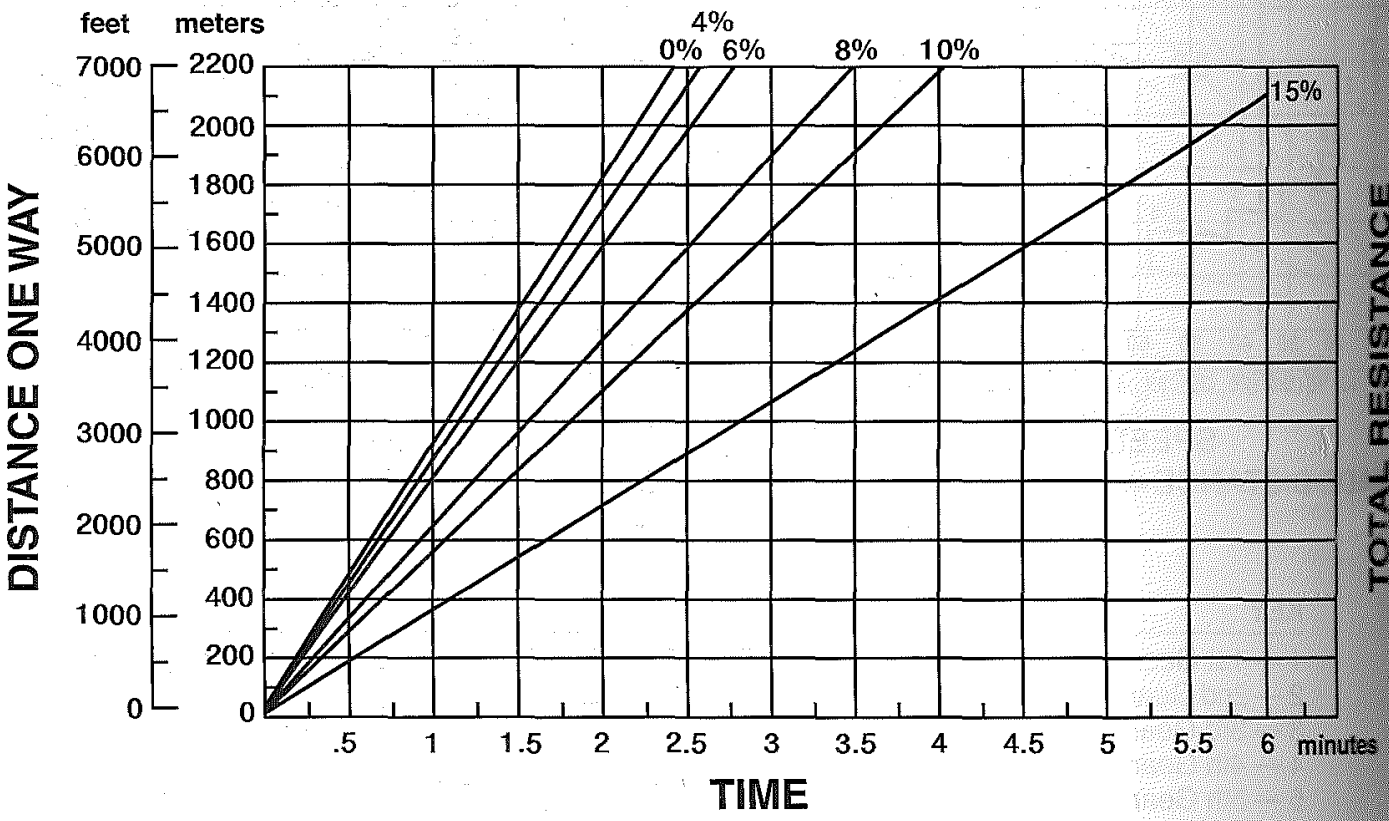

EMPTY



## LOADED




## EMPTY



| Rock Buckets | | | Standard Spade Edge | | Large Standard Spade Edge | | Heavy Duty Quarry | | High Abrasion | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Teeth & Segments | | Teeth & Segments | | Teeth & Segments | | Teeth | |
| | | | Std. | Hi-Lift | Std. | Hi-Lift | Std. | Hi-Lift | Std. | Hi-Lift |
| Rated bucket capacity (§) | | $m^3$ | 11.5 | 11.5 | 12.2 | 12.2 | 11.5 | 11.5 | 11.5 | 11.5 |
| | | $yd^3$ | **15.0** | **15.0** | **16.0** | **16.0** | **15.0** | **15.0** | **15.0** | **15.0** |
| Struck capacity (§) | | $m^3$ | 9.45 | 9.45 | 10.1 | 10.1 | 9.45 | 9.45 | 9.45 | 9.45 |
| | | $yd^3$ | **12.36** | **12.36** | **13.2** | **13.2** | **12.4** | **12.4** | **12.36** | **12.36** |
| Bucket width (§) | | mm | 4824 | 4824 | 4824 | 4824 | 4824 | 4824 | 4840 | 4840 |
| | | ft/in | **15'10"** | **15'10"** | **15'10"** | **15'10"** | **15'10"** | **15'10"** | **15'11"** | **15'11"** |
| Dump clearance at full lift and 45° discharge (§) | With teeth | mm | 4626 | 5250 | 4626 | 5250 | 4557 | 5182 | 4602 | 5227 |
| | | ft/in | **15'2"** | **17'3"** | **15'2"** | **17'3"** | **14'11"** | **17'0"** | **15'1"** | **17'2"** |
| | Bare | mm | 4993 | 5607 | 4993 | 5607 | 4993 | 5607 | 4993 | 5607 |
| | | ft/in | **16'5"** | **18'5"** | **16'5"** | **18'5"** | **16'5"** | **18'5"** | **16'5"** | **18'5"** |
| Reach at full lift and 45° discharge (§) | With teeth | mm | 2315 | 2304 | 2315 | 2304 | 2364 | 2354 | 2391 | 2381 |
| | | ft/in | **7'7"** | **7'7"** | **7'7"** | **7'7"** | **7'9"** | **7'9"** | **7'10"** | **7'10"** |
| | Bare | mm | 1732 | 1720 | 1732 | 1720 | 1732 | 1720 | 1732 | 1720 |
| | | ft/in | **5'8"** | **5'8"** | **5'8"** | **5'8"** | **5'8"** | **5'8"** | **5'8"** | **5'8"** |
| Reach with boom – horizontal and bucket level | With teeth | mm | 5110 | 5590 | 5110 | 5590 | 5192 | 5673 | 5181 | 5661 |
| | | ft/in | **16'9"** | **18'4"** | **16'9"** | **18'4"** | **17'0"** | **18'7"** | **17'0"** | **18'7"** |
| | Bare | mm | 4177 | 4657 | 4177 | 4657 | 4177 | 4657 | 4177 | 4657 |
| | | ft/in | **13'8"** | **15'3"** | **13'8"** | **15'3"** | **13'8"** | **15'3"** | **13'8"** | **15'3"** |
| Digging depth (§) | | mm | 165 | 161 | 165 | 161 | 180 | 177 | 155 | 152 |
| | | in | **6** | **6** | **6** | **6** | **7** | **7** | **6** | **6** |
| Overall length (§) | With teeth | mm | 15 585 | 16 175 | 15 585 | 16 175 | 15 604 | 16 194 | 15 636 | 16 226 |
| | | ft/in | **51'2"** | **53'1"** | **51'2"** | **53'1"** | **51'2"** | **53'2"** | **51'4"** | **53'3"** |
| | Bare | mm | 15 143 | 15 733 | 15 143 | 15 733 | 15 143 | 15 733 | 15 143 | 15 733 |
| | | ft/in | **49'8"** | **51'7"** | **49'8"** | **51'7"** | **49'8"** | **51'7"** | **49'8"** | **51'7"** |
| Overall height with bucket at full raise (§) | | mm | 9415 | 10 035 | 9415 | 10 035 | 9415 | 10 035 | 9415 | 10 035 |
| | | ft/in | **30'11"** | **32'11"** | **30'11"** | **32'11"** | **30'11"** | **32'11"** | **30'11"** | **32'11"** |
| Loader clearance circle with bucket in carry position (§) | With teeth | m | 22.27 | 22.88 | 22.27 | 22.88 | 22.27 | 22.88 | 22.31 | 22.92 |
| | | ft/in | **73'1"** | **75'1"** | **73'1"** | **75'1"** | **73'1"** | **75'1"** | **73'2"** | **75'2"** |
| | Bare | m | 21.88 | 22.46 | 21.88 | 22.46 | 21.88 | 22.46 | 21.94 | 22.51 |
| | | ft/in | **71'9"** | **73'8"** | **71'9"** | **73'8"** | **71'9"** | **73'8"** | **72'** | **73'10"** |
| Static tipping load, straight† | | kg | 60 292 | 58 693 | 60 091 | 58 488 | 59 226 | 57 552 | 58 164 | 56 620 |
| | | lb | **132,921** | **129,396** | **132,478** | **128,944** | **130,571** | **126,880** | **128,230** | **124,826** |
| Static tipping load, full 40° turn† | | kg | 52 541 | 50 720 | 52 303 | 50 477 | 51 424 | 49 534 | 50 442 | 48 673 |
| | | lb | **115,833** | **111,818** | **115,308** | **111,283** | **113,370** | **109,204** | **111,205** | **107,306** |
| Static tipping load, full 43° turn† | | kg | 51 392 | 49 538 | 51 149 | 49 289 | 50 267 | 48 346 | 49 297 | 47 494 |
| | | lb | **113,300** | **109,213** | **112,764** | **108,664** | **110,820** | **106,585** | **108,681** | **104,706** |
| Breakout force†† (§) | | kN | 615 | 602 | 612 | 599 | 595 | 583 | 591 | 578 |
| | | lb | **138,360** | **135,421** | **137,692** | **134,753** | **133,783** | **130,957** | **132,804** | **129,921** |
| Operating weight† (§) | | kg | 94 927 | 98 596 | 95 447 | 99 116 | 96 304 | 99 973 | 96 607 | 100 277 |
| | | lb | **209,278** | **217,367** | **210,424** | **218,513** | **212,314** | **220,403** | **212,982** | **221,073** |

†Static tipping load and operating weight shown are based on standard machine configuration with 45/65-45, 46 PR (L-5) tires, full fuel tank, cooolant, lubricants and operator.

††Measured 102 mm **(4")** behind tip of cutting edge with bucket hinge pin as pivot point in accordance with SAE J732 JUN92.

NOTE: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers (SAE). SAE Standards J732 JUN92 and J742 FEB85 govern loader ratings, denoted in the text by (§). Dimensions are also measured to the tip of the bucket teeth to provide accurate clearance data. SAE Standards specifies the cutting edge.

| | Change in Operating Weight | | Change in Articulated Static Tipping Load | | | |
|---|---|---|---|---|---|---|
| | Standard (for four tires) | | Standard | | High Lift | |
| | kg | lb | kg | lb | kg | lb |
| 45/65-45, 46 ply L-5 Firestone | 0 | **0** | 0 | **0** | 0 | **0** |
| 45/65-45, 46 ply L-5 General | + 427 | **+ 940** | + 284 | **+ 625** | +256 | **+ 564** |
| 45/65-45, 46 ply L-5 Goodyear | – 162 | **– 356** | – 108 | **– 238** | – 97 | **– 214** |
| 45/65 R45 1-Star L-4 (XLDD1) Michelin | –1942 | **–4272** | –1290 | **–2838** | –882 | **–1942** |
| 45/65 R45 1-Star L-5 (XLDD2) Michelin | – 681 | **–1500** | – 452 | **– 994** | –409 | **– 900** |
| 45/65 R45 1-Star L-5 (XMINED2) Michelin | + 752 | **+1656** | + 523 | **+1151** | +451 | **+ 994** |
| 45/65-45, 50PR L-5 Firestone | – 278 | **– 612** | – 167 | **– 367** | –167 | **– 367** |
| 45/65-45, 50PR L-5 Firestone | + 441 | **+ 972** | + 265 | **+ 583** | +265 | **+ 583** |

| | *Minutes added (+) or Subtracted (–) From Basic Cycle* |
|---|---|
| *Machine* | |
| — Material handler | –.05 |
| *Materials* | |
| — Mixed | +.02 |
| — Up to 3 mm (1/8 in) | +.02 |
| — 3 mm (1/8 in) to 20 mm (3/4 in) | –.02 |
| — 20 mm (3/4 in) to 150 mm (6 in) | .00 |
| — 150 mm (6 in) and over | +.03 and Up |
| — Bank or broken | +.04 and Up |
| *Pile* | |
| — Conveyor or Dozer piled 3 m (10 ft) and up | .00 |
| — Conveyor or Dozer piled 3 m (10 ft) or less | +.01 |
| — Dumped by truck | +.02 |
| *Miscellaneous* | |
| — Common ownership of trucks and loaders | Up to –.04 |
| — Independently owned trucks | Up to +.04 |
| — Constant operation | Up to –.04 |
| — Inconsistent operation | Up to +.04 |
| — Small target | Up to +.04 |
| — Fragile target | Up to +.05 |

Using actual job conditions and the above factors, total cycle time can be estimated. Convert total cycle time to cycles per hour.

$$\textit{Cycles per hour at 100\% Efficiency} = \frac{\textit{60 min}}{\textit{Total Cycle Time in Minutes}}$$

Job efficiency is an important factor in machine selection. Efficiency is the actual number of minutes worked during an hour. Job efficiency accounts for bathroom breaks and other work interruptions.

$$\text{Cycles per hour at 50 minutes per hour (83\% efficiency)} = \text{Cycles per hour at 100\% efficiency} \times \frac{\text{50 min actual work time}}{\text{60 min hour}}$$

*TRUCK LOADING*

*Average* loader cycle times

| | |
|---|---|
| 914G-962H | 0.45-0.5 min |
| 966H-980H | 0.50-0.55 min |
| 988H-990H | 0.55-0.6 min |
| 992G-994F | 0.60-0.7 min |

### 3. Required Payload Per Cycle

Required payload per cycle is determined by dividing required hourly production by the number of cycles per hour.

### 4. Bucket Selection

After required payload per cycle has been calculated, the payload should be divided by the loose cubic yard (meter) material weight to determine number of loose cubic yards (meters) required per cycle.

The bulk of material handled does not weigh 1800 kg/m³ (3000 lb/yd³), so a reasonable knowledge of material weight is necessary for accurate production estimates. The Tables Section has average weight for certain materials when actual weights are not known.

The percentage of rated capacity a bucket will carry in various materials is estimated below. The bucket size required to handle the required volume per cycle is found with the aid of the percentage of rated bucket capacity called "Bucket Fill Factor."

The bucket size needed is determined by dividing loose cubic meters (or yards) required per cycle by the bucket fill factor.

$$\textit{Bucket size} = \frac{\textit{Volume Required/Cycle}}{\textit{Bucket Fill Factor}}$$

*BUCKET FILL FACTORS*

The following indicates the approximate amount of material as a percent of rated bucket capacity which will actually be delivered per bucket per cycle. This is known as "Bucket Fill Factor."

| Loose Material | Fill Factor |
|---|---|
| Mixed moist aggregates | 95-100% |
| Uniform aggregates up to 3 mm (1/8 in) | 95-100% |
| 3 mm (1/8 in) to 9 mm (3/8 in) | 90-95% |
| 12 mm (1/2 in) to 20 mm (3/4 in) | 85-90% |
| 24 mm (1.0 in) and over | 85-90% |

*Blasted Rock*

| | |
|---|---|
| Well blasted | 80-95% |
| Average | 75-90 |
| Poor | 60-75 |

*Other*

| | |
|---|---|
| Rock dirt mixtures | 100-120% |
| Moist loam | 100-110 |
| Soil, boulders, roots | 80-100 |
| Cemented materials | 85-95 |

NOTE: Fill factors on wheel loaders are affected by bucket penetration, breakout force, rackback angle, bucket profile and ground engaging tools such as bucket teeth or bolt-on replaceable cutting edges.

*Example:*

12 mm (1/2 in) material and 3 $m^3$ (4 $yd^3$) bucket.
.90 × 3 $m^3$ = 2.75 Loose $m^3$ delivered per cycle.
.90 × 4 $yd^3$ = 3.6 Loose $yd^3$ delivered per cycle.

NOTE: Check the static tipping load on the specific machine to determine if bucket load is in fact a safe operating load.

*Bucket Selection*

$$\textit{Tons Required/Cycle} = \frac{\textit{Tons Required/Hour}}{\textit{CyclesHour}}$$

$$\textit{Kg (Pounds) Required/Cycle} = \textit{Tons Required/Cycle} \times \textit{907 kg (2000 lb)}$$

$$\textit{Volume Required/Cycle} = \frac{\textit{kg (Pounds) Cycle}}{\textit{Material Weight kg/m}^3\textit{ (lb/yd}^3\textit{)}}$$

Always select a machine with a greater capacity than the calculated required operating capacity. For most applications, payload above recommended and excessive counterweight can hinder machine performance and reduce dynamic stability and machine life.

For optimum performance in fast cycling situations such as truck loading, operating loads should not exceed the recommended capacity. To provide extra stability, calcium chloride ($CaCl_2$) ballast may be desired when operating at recommended operating load, see SAE Loader rating pages in this section. For specific stability data and optional tire sizes, see the "Performance Data" pages in this section.

When selecting special application buckets, such as multi-purpose and side dump the additional bucket weight must be deducted from recommended capacity.

Specific circumstances may involve other conditions which would also affect loader capacity. Because of the greatly varied applications and conditions, your Caterpillar dealer should be contacted for guidance.

*Example problem:*

*JOB CONDITIONS*

| | |
|---|---|
| Application | Truck loading |
| Production Required | 450 metric ton (496 Tons) per hour |
| Material | 9 mm (3/8") gravel in 6 m (20 ft) high stockpile |
| Density | 1660 kg/$m^3$ (2800 lb/$yd^3$) |

Trucks are 6-9 $m^3$ (8-12 $yd^3$) capacity and are owned by three contractors. Loading is constant. Hard level surface for loader maneuvering.

1. *PRODUCTION REQUIRED:* Given

2. *CYCLE TIME:* Assume loader size between 914G and 962H for initial choice of basic cycle.
(Refer to Cycle Time Factors in this section)

| | |
|---|---|
| Independent trucks | .04 min |
| Basic Cycle | .50 min |
| Material | –.02 min |
| Independent trucks | +.04 min |
| Constant operation | –.02 min |
| Total Cycle | .50 min |

**NOTE:** Load and carry times not required in total cycle.

$$\text{Cycles/hr at 83\% efficiency} = 120 \text{ cycles/hr} \times \frac{\text{50 min actual work time}}{\text{60 min per hr}}$$

$$= 100 \text{ cycles/hr}$$

3. *VOLUME REQUIRED PER CYCLE*
(Density in tons)
Density in this example was given. When not given, refer to Tables Section to obtain an estimated density for the material being handled.

$$\textit{Metric:}\ \frac{1660 \text{ kg/m}^3}{1000 \text{ kg/ton}} = 1.66 \text{ ton/m}^3$$

$$\textit{English:}\ \frac{2800 \text{ lb/yd}^3}{2000 \text{ lb/ton}} = 1.4 \text{ tons/yd}^3$$

12

## SWELL — VOIDS — LOAD FACTORS

| SWELL (%) | VOIDS (%) | LOAD FACTOR |
|---|---|---|
| 5 | 4.8 | .952 |
| 10 | 9.1 | .909 |
| 15 | 13.0 | .870 |
| 20 | 16.7 | .833 |
| 25 | 20.0 | .800 |
| 30 | 23.1 | .769 |
| 35 | 25.9 | .741 |
| 40 | 28.6 | .714 |
| 45 | 31.0 | .690 |
| 50 | 33.3 | .667 |
| 55 | 35.5 | .645 |
| 60 | 37.5 | .625 |
| 65 | 39.4 | .606 |
| 70 | 41.2 | .588 |
| 75 | 42.9 | .571 |
| 80 | 44.4 | .556 |
| 85 | 45.9 | .541 |
| 90 | 47.4 | .526 |
| 95 | 48.7 | .513 |
| 100 | 50.0 | .500 |

## BUCKET FILL FACTORS

| Loose Material | Fill Factor |
|---|---|
| Mixed Moist Aggregates | 95-100% |
| Uniform Aggregates up to 3 mm (1/8") | 95-100 |
| 3 mm-9 mm (1/8"-3/8") | 90-95 |
| 12 mm-20 mm (1/2"-3/4") | 85-90 |
| 24 mm (1") and over | 85-90 |
| **Blasted Rock** | |
| Well Blasted | 80-95% |
| Average Blasted | 75-90 |
| Poorly Blasted | 60-75 |
| **Other** | |
| Rock Dirt Mixtures | 100-120% |
| Moist Loam | 100-110 |
| Soil, Boulders, Roots | 80-100 |
| Cemented Materials | 85-95 |

**NOTE:** Loader bucket fill factors are affected by bucket penetration, breakout force, rackback angle, bucket profile and ground engaging tools such as bucket teeth or bolt-on replaceable cutting edges.

**NOTE:** For bucket fill factors for hydraulic excavators, see bucket payloads in the hydraulic excavator section.

## TYPICAL ROLLING RESISTANCE FACTORS

Various tire sizes and inflation pressures will greatly reduce or increase the rolling resistance. The values in this table are approximate, particularly for the track and track + tire machines. These values can be used for estimating purposes when specific performance information on particular equipment and given soil conditions is not available. See Mining and Earthmoving Section for more detail.

| UNDERFOOTING | ROLLING RESISTANCE, PERCENT* | | | |
|---|---|---|---|---|
| | Tires | | Track | Track |
| | Bias | Radial | ** | +Tires |
| A very hard, smooth roadway, concrete, cold asphalt or dirt surface, no penetration or flexing | 1.5%* | 1.2% | 0% | 1.0% |
| A hard, smooth, stabilized surfaced roadway without penetration under load, watered, maintained | 2.0% | 1.7% | 0% | 1.2% |
| A firm, smooth, rolling roadway with dirt or light surfacing, flexing slightly under load or undulating, maintained fairly regularly, watered | 3.0% | 2.5% | 0% | 1.8% |
| A dirt roadway, rutted or flexing under load, little maintenance, no water, 25 mm (1") tire penetration or flexing | 4.0% | 4.0% | 0% | 2.4% |
| A dirt roadway, rutted or flexing under load, little maintenance, no water, 50 mm (2") tire penetration or flexing | 5.0% | 5.0% | 0% | 3.0% |
| Rutted dirt roadway, soft under travel, no maintenance, no stabilization, 100 mm (4") tire penetration or flexing | 8.0% | 8.0% | 0% | 4.8% |
| Loose sand or gravel | 10.0% | 10.0% | 2% | 7.0% |
| Rutted dirt roadway, soft under travel, no maintenance, no stabilization, 200 mm (8") tire penetration and flexing | 14.0% | 14.0% | 5% | 10.0% |
| Very soft, muddy, rutted roadway, 300 mm (12") tire penetration, no flexing | 20.0% | 20.0% | 8% | 15.0% |

*Percent of combined machine weight.

**Assumes drag load has been subtracted to give Drawbar Pull for good to moderate conditions. Some resistance added for very soft conditions.

## ANGLE OF REPOSE OF VARIOUS MATERIALS

| MATERIAL | ANGLE BETWEEN HORIZONTAL AND SLOPE OF HEAPED PILE | |
|---|---|---|
| | Ratio | Degrees |
| Coal, industrial | 1.4:1—1.3:1 | 35-38 |
| Common earth, Dry | 2.8:1—1.0:1 | 20-45 |
| Moist | 2.1:1—1.0:1 | 25-45 |
| Wet | 2.1:1—1.7:1 | 25-30 |
| Gravel, Round to angular | 1.7:1—0.9:1 | 30-50 |
| Sand & clay | 2.8:1—1.4:1 | 20-35 |
| Sand, Dry | 2.8:1—1.7:1 | 20-30 |
| Moist | 1.8:1—1.0:1 | 30-45 |
| Wet | 2.8:1—1.0:1 | 20-45 |

# ALTITUDE DERATION

## PERCENT FLYWHEEL HORSEPOWER AVAILABLE AT SPECIFIED ALTITUDES

| MODEL | 0-760 m (0-2500') | 760-1500 m (2500-5000') | 1500-2300 m (5000-7500') | 2300-3000 m (7500-10,000') | 3000-3800 m (10,000-12,500') | 3800-4600 m (12,500-15,000') |
|---|---|---|---|---|---|---|
| D3K XL | 100 | 100 | 100 | 100 | 88 | 85 |
| D3K LGP | 100 | 100 | 100 | 100 | 88 | 85 |
| D4K XL | 100 | 100 | 100 | 100 | 88 | 85 |
| D4K LGP | 100 | 100 | 100 | 100 | 88 | 85 |
| D5K XL | 100 | 100 | 100 | 100 | 88 | 85 |
| D5K LGP | 100 | 100 | 100 | 100 | 88 | 85 |
| D5N XL & LGP | 100 | 100 | 100 | 100 | 100 | 100 |
| D6K XL & LGP | 100 | 100 | 100 | 100 | N/A | N/A |
| D6N XL & LGP | 100 | 100 | 100 | 100 | N/A | N/A |
| D6N XL & LGP** | 100 | 100 | 100 | 100 | 100 | 100 |
| D6G | 100 | 100 | 100 | 100 | 94 | 87 |
| D6R Series III (All) | 100 | 100 | 100 | 100 | 92 | 84 |
| D7G | 100* | 100* | 100* | 94 | 86 | 80 |
| D7R Series II (All) | 100 | 100 | 100 | 100 | 100 | 96 |
| D8R | 100 | 100 | 100 | 93 | 85 | 77 |
| D8T | 100 | 100 | 100 | 100 | 100 | 93 |
| D9R | 100 | 100 | 100 | 93 | 85 | 77 |
| D9T | 100 | 100 | 100 | 100 | 100 | 93 |
| D10T | 100 | 100 | 100 | 100 | 97 | 89 |
| D11R/D11R CD | 100 | 100 | 100 | 93 | 85 | 77 |
| 120H STD | 100 | 100 | 100 | 100 | 100 | 100 |
| 120M | 100 | 100 | 100 | 100 | 95 | 88 |
| 135H STD | 100 | 100 | 100 | 100 | 100 | 98 |
| 12H STD | 100 | 89 | 83 | 77 | 71 | 65 |
| 12M | 100 | 100 | 100 | 100 | 95 | 88 |
| 140H STD | 100 | 100 | 100 | 100 | 97 | 89 |
| 140M | 100 | 100 | 100 | 100 | ** | ** |
| 160H STD | 100 | 100 | 100 | 97 | 89 | 82 |
| 160M | 100 | 100 | 100 | 100 | ** | ** |
| 14M | 100 | 100 | 100 | 100 | 100 | ** |
| 16M | 100 | 100 | 100 | 100 | 100 | 100 |
| 24M | 100 | 100 | 100 | 100 | ** | ** |

*Refer to "Captive Vehicle Engine Fuel Specifications" microfiche at your local dealer.
**Information not available at time of printing.

# Appendix B-7
# Third Party On-site Rip-Rap Production

**M3 Engineering & Technology Corp.**

**To:** Chuck Johnson

**Cc:** Tom Shelley, Daniel Roth

**From:** Frank Van de Wille

**Date:** September 21, 2007

**Subject:** August Production – McCain Springs Quarry

M3 Engineering & Technologies is hereby transmitting the August 2007 production numbers for the McCain Springs Quarry.

The plant was approved for production on August 14th, 2007. T.G. McCauley operated the plant 7 days per week during this period. The plant was shutdown due to a belt on August 19th.

A total of 17,497 CY was pushed through the plant during this period. Output of the plant was as follows:

| Size/Product | Quantity (CY) | Percent of Throughput |
|---|---|---|
| 1" minus | 7,305 | 42% |
| 1"-3" | 2,781 | 16% |
| 3"-6" | 2,753 | 16% |
| 6"-12" | 2,358 | 14% |
| +12" | 1,745 | 10% |
| | | |

Cost per Cubic Yard of rock produced excluding drill & blast was $14.32/CY. Estimated drill & blast cost are $1.00/CY.

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

Encl. August Riprap Costs
Drill & Blast Cost

Frank Van de Wille
M3 Engineering
602-909-2205
fvandewille@cox.net

M3 Engineering & Technology

PROJECT NO. _____

PROJECT _____

SHEET NO. _____ OF _____ BY _____

DRAWING NO. _____

SUBJECT: August Riprap Cost DATE: 9/2017

TOTAL PLANT THROUGHPUT: 17,497 CY (Aug. 15-Aug 31)

TOTAL PRODUCTION:

| | | |
|---|---|---|
| 1" minus | 7305 | +2 % |
| 1"-3" | 3781 | 16 % |
| 3"-6" | 2,753 | 16 % |
| 6"-12" | 2,358 | 14 % |
| +12" | 1745 | 10% |

TOTAL COST FOR MONTH: 137,981$

TOTAL ROCK (RIPRAP) PRODUCED: 9,637 CY

COST FOR CY: $\frac{137,981\$}{9,637\ CY} = 14.32\ \$/CY$

COST EXCLUDE DRILL & BLAST

PROJECT NO. _____

**M3 Engineering & Technology**

PROJECT _____
SHEET NO. _____ OF _____ BY _____
DRAWING NO. _____

SUBJECT: DRILL BLAST COST DATE: 9/5/7.

46,222 CY/BLAST (BASED ON 13X15 SPACING W/ 50' DEPTH)

BLAST COST : 15,127 17 ON 7/10/7.

DRILL COST : 177 hr @ 178 $/hr = 31,506.

TOTAL COST: 46,633 17 $

DRILL BLAST COST ≅ 1$/CY.

# U.S. Bureau of Labor Statistics

## Databases, Tables & Calculators by Subject

# CPI Inflation Calculator

**Inflation Calculator**

$ 15.32

**in** 2007

**has the same buying power as**

**$15.98**

**in** 2009

Calculate

About this calculator

### About the CPI Inflation Calculator

The CPI inflation calculator uses the average Consumer Price Index for a given calendar year. This data represents changes in prices of all goods and services purchased for consumption by urban households. This index value has been calculated every year since 1913. For the current year, the latest monthly index value is used.

**U.S. Bureau of Labor Statistics** 2 Massachusetts Avenue, NE Washington, DC 20212-0001

www.bls.gov | Telephone: (202) 691-5200 | Do you have a Data question?

# Appendix B-8
# Spillway, Channel, and Bench
# Linear Foot Cost

## *Spillways*

| Task Description | Equipment | Productivity (cy/hr) | Material | Grade | Soil Weight (lb/cy) | Production Method/ Blade | Maximum Push Distance (feet) | Normal Production (cy/hr) | Operator | Work Hour (min/hr) | Visibility | Elevation | Direct Drive Trans. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Excavate | D11R | 1,973 | 1.2 | 1.80 | 3,300 | 1.20 | 175 | 1747 | 0.75 | 50 | 1.00 | 1.00 | 1.00 |
| Waste | D11R | 805 | 1.2 | 1.00 | 3,300 | 1.00 | 200 | 1540 | 0.75 | 50 | 1.00 | 1.00 | 1.00 |
| Finish Grade | D6R | 165 | 1.2 | 1.80 | 3,300 | 1.00 | 175 | 175 | 0.75 | 50 | 1.00 | 1.00 | 1.00 |

| Spillway Volume: | | | | Dozer Cost | | Spillway Cost | |
|---|---|---|---|---|---|---|---|
| | Excavate | 7.3 | CY/LF | | | | |
| | Waste | 7.3 | CY/LF | | | | |
| | Finish | 2.9 | CY/LF | | | | |
| | Excavate | 0.0037005 | HRS/LF | 447.48 | $/HR | 1.66 | $/LF |
| | Waste | 0.009066 | HRS/LF | 447.48 | $/HR | 4.06 | $/LF |
| | Finish Grade | 0.01743 | HRS/LF | 104.1 | $/HR | 1.81 | $/LF |
| | | | | | | **7.53** | **$/LF** |

Volumes based on cross-section area for excavation and waste
Volume assumes unit volume/linear foot of spillway perimeter (39 Feet * 1 Foot/27)

***Outslope Bench Grading Unit Cost Development***

| Task Description | Equipment | Productivity (cy/hr) | Material | Grade | Soil Weight (lb/cy) | Production Method/ Blade | Maximum Push Distance (feet) | Normal Production (cy/hr) | Operator | Work Hour (min/hr) | Visibility | Elevation | Direct Drive Trans. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Excavate | D11R | 1552.6 | 1.2 | 1.7 | 3300.0 | 1.0 | 175.0 | 1747 | 0.75 | 50.0 | 1.0 | 1.0 | 1.0 |

| | | Productivity (lf/hr) | Time (hrs/lf) | # passes | Material | Grade | Task Weight (lb/cy) | Blade | Width (feet) | Soil Speed (miles/hr) | Method/ Operator | Blade Hour (min/hr) | Visibility | Elevation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Finish Grade | D9R | 920.0 | 0.0011 | 3 | 1.2 | 1.0 | 3300.0 | 1.0 | 15.25 | 1.0 | 0.75 | 50.0 | 1.0 | 1.0 |

Notes:
1. Bench width: Stockpiles 15 ft

| Bench Volume (excavate): | 4.22 cy/lf | Dozer Cost ($/hr) | Bench Cost ($/lf) |
|---|---|---|---|
| Excavate | 0.0027 hrs/lf | 447.48 | 1.22 |
| Finish Grade | 0.0011 hrs/lf | $209.96 | 0.23 |
| Excavate + Finish Grade | | | **1.44** |
| Finish Grade Only | | | **0.23** |

## *Terrace Channels*

| Task Description | Equipment | Productivity (cy/hr) | Material | Grade | Soil Weight (lb/cy) | Production Method/ Blade | Maximum Push Distance (feet) | Normal Production (cy/hr) | Operator | Work Hour (min/hr) | Visibility | Elevation | Direct Drive Trans. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Excavate | D11R | 1,754 | 1.2 | 1.60 | 3,300 | 1.20 | 175 | 1747 | 0.75 | 50 | 1.00 | 1.00 | 1.00 |
| Waste | D11R | 805 | 1.2 | 1.00 | 3,300 | 1.00 | 200 | 1540 | 0.75 | 50 | 1.00 | 1.00 | 1.00 |
| Finish Grade | D6R | 146 | 1.2 | 1.60 | 3,300 | 1.00 | 175 | 175 | 0.75 | 50 | 1.00 | 1.00 | 1.00 |

Volume: Excavate 1.0 CY/LF
Waste 1.0 CY/LF
Finish 1.0 CY/LF

| | | | Dozer Cost | | Outslope Channel Cost | |
|---|---|---|---|---|---|---|
| Excavate | 0.0005931 | HRS/LF | 447.48 | $/HR | 0.27 | $/LF |
| Waste | 0.0012916 | HRS/LF | 447.48 | $/HR | 0.58 | $/LF |
| Finish Grade | 0.0071056 | HRS/LF | 104.1 | $/HR | 0.74 | $/LF |
| | | | | | **1.58** | **$/LF** |

Volumes based on cross-section area for excavation and waste
Volume assumes unit volume/linear foot of perimeter (39 Feet * 1 Foot/27)
Finish grading based on 1mph at 3 passes

## *Channels*

| Task Description | Equipment | Productivity (cy/hr) | Material | Grade | Soil Weight (lb/cy) | Production Method/ Blade | Maximum Push Distance (feet) | Normal Production (cy/hr) | Operator | Work Hour (min/hr) | Visibility | Elevation | Direct Drive Trans. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Excavate | D11R | 1,096 | 1.2 | 1.00 | 3,300 | 1.20 | 175 | 1747 | 0.75 | 50 | 1.00 | 1.00 | 1.00 |
| Waste | D11R | 805 | 1.2 | 1.00 | 3,300 | 1.00 | 200 | 1540 | 0.75 | 50 | 1.00 | 1.00 | 1.00 |
| Finish Grade | D6R | 91 | 1.2 | 1.00 | 3,300 | 1.00 | 175 | 175 | 0.75 | 50 | 1.00 | 1.00 | 1.00 |

Volume: Excavate 5.5 CY/LF
Waste 5.5 CY/LF
Finish 2.9 CY/LF

| | | | Dozer Cost | | Top Channel Cost | |
|---|---|---|---|---|---|---|
| Excavate | 0.0050368 | HRS/LF | 447.48 | $/HR | 2.25 | $/LF |
| Waste | 0.0068554 | HRS/LF | 447.48 | $/HR | 3.07 | $/LF |
| Finish Grade | 0.0313739 | HRS/LF | 104.1 | $/HR | 3.27 | $/LF |
| | | | | | **8.59** | **$/LF** |

Volumes based on cross-section area for excavation and waste
Volume assumes unit volume/linear foot of perimeter (39 Feet * 1 Foot/27)
Finish grading based on 1mph at 3 passes

# APPENDIX C
## ENGINEERING TAKE-OFFS
## By MWH

TYRONE MINE STOCKPILE CONCEPTUAL RECLAMATION PLAN
Quantities

| Area | | Task | Length (ft) | Volume (cy) | Area (ac) | Dozer Work Distance (ft) | Dozer Work Slope (%) | Haul Leg 1 Distance (ft) | Haul Leg 1 Grade (%) | Haul Leg 2 Distance (ft) | Haul Leg 2 Grade (%) | Haul Leg 3 Distance (ft) | Haul Leg 3 Grade (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1A and 1B Leach | Interior Slope | Truck/Shovel Pull Back | | | | | | | | | | | |
| | | Dozer Rough Grade | | 600,000 | | 350 | 30 | | | | | | |
| | | Truck/Shovel Bench Regrade | | | | | | | | | | | |
| | | Terrace Bench Construction | 11,800 | | | | | | | | | | |
| | | Cover Placement (Haul) | | 242,000 | 50 | | | 3,500 | 2 | 1,900 | 10 | | |
| | | Cover Placement (Placement) | | 242,000 | 50 | 200 | -30 | | | | | | |
| | | Terrace Channel Construction | 11,800 | | | | | | | | | | |
| | | Terrace Gravel Placement | | 4,700 | | | | | | | | | |
| | | Down Drain Construction | 400 | | | | | | | | | | |
| | | Down Drain Riprap Placement | | 1,600 | | | | | | | | | |
| | | Down Drain Bedding Layer | | 300 | | | | | | | | | |
| | | Drainage Construction | n/a | | | | | | | | | | |
| | | Drainage Riprap Placement | | n/a | | | | | | | | | |
| | | Drainage Bedding Layer | | n/a | | | | | | | | | |
| | | Revegetation | | | 50 | | | | | | | | |
| | | Infrastructure Relocation | n/a | | | | | | | | | | |
| 2A Leach | Interior Slope | Truck/Shovel Pull Back | n/a | | | | | | | | | | |
| | | Dozer Rough Grade | | 1,900,000 | | 600 | -30 | | | | | | |
| | | Truck/Shovel Bench Regrade | | n/a | | | | | | | | | |
| | | Terrace Bench Construction | 24,000 | | | | | | | | | | |
| | | Cover Placement (Haul) | | 546,900 | 113 | | | 7,000 | 0 | 2,500 | 10 | 3,100 | 0 |
| | | Cover Placement (Placement) | | 546,900 | 113 | 200 | -30 | | | | | | |
| | | Terrace Channel Construction | 24,000 | | | | | | | | | | |
| | | Terrace Gravel Placement | | 9,600 | | | | | | | | | |
| | | Down Drain Construction | 1,500 | | | | | | | | | | |
| | | Down Drain Riprap Placement | | 6,100 | | | | | | | | | |
| | | Down Drain Bedding Layer | | 1,100 | | | | | | | | | |
| | | Drainage Construction | n/a | | | | | | | | | | |
| | | Drainage Riprap Placement | | n/a | | | | | | | | | |
| | | Drainage Bedding Layer | | n/a | | | | | | | | | |
| | | Revegetation | | | 113 | | | | | | | | |
| | | Infrastructure Relocation | n/a | | | | | | | | | | |
| 3B | Interior Slope | Truck/Shovel Pull Back | | | | | | | | | | | |
| | | Dozer Rough Grade | | 600,000 | | 400 | -30 | | | | | | |
| | | Truck/Shovel Bench Regrade | | | | | | | | | | | |
| | | Terrace Bench Construction | 10,800 | | | | | | | | | | |
| | | Cover Placement (Haul) | | 304,920 | 63 | | | 3,000 | -10 | 3,500 | -7 | 6,400 | 7 |
| | | Cover Placement (Placement) | | 304,920 | 63 | 200 | -30 | | | | | | |
| | | Terrace Channel Construction | 10,800 | | | | | | | | | | |
| | | Terrace Gravel Placement | | 4,300 | | | | | | | | | |
| | | Down Drain Construction | | | | | | | | | | | |
| | | Down Drain Riprap Placement | | - | | | | | | | | | |
| | | Down Drain Bedding Layer | | - | | | | | | | | | |
| | | Drainage Construction | 4,200 | | | | | | | | | | |
| | | Drainage Riprap placement | | 6,200 | | | | | | | | | |
| | | Drainage Bedding Layer | | 3,200 | | | | | | | | | |
| | | Revegetation | | | 63 | | | | | | | | |
| | | Infrastructure Relocation | | | | | | | | | | | |
| 4A, 2B, 2C 7C Leach | Interior Slope | Truck/Shovel Pull Back | NA | | | | | | | | | | |
| | | Dozer Rough Grade | | 4,300,000 | | 500 | -30 | | | | | | |
| | | Truck/Shovel Bench Regrade | NA | - | | | | | | | | | |
| | | Terrace Bench Construction | 41,800 | | | | | | | | | | |
| | | Cover Placement (Haul) | | 1,127,700 | 233 | | | 7,000 | 0 | 1,700 | 10 | | |
| | | Cover Placement (Placement) | | 1,127,700 | 233 | 200 | -30 | | | | | | |
| | | Terrace Channel Construction | 41,800 | | | | | | | | | | |
| | | Terrace Gravel Placement | | 16,700 | | | | | | | | | |
| | | Down Drain Construction | 2,900 | | | | | | | | | | |
| | | Down Drain Riprap Placement | | 11,900 | | | | | | | | | |
| | | Down Drain Bedding Layer | | 2,000 | | | | | | | | | |
| | | Drainage Construction | 2,800 | | | | | | | | | | |
| | | Drainage Riprap placement | | 4,100 | | | | | | | | | |
| | | Drainage Bedding Layer | | 2,100 | | | | | | | | | |
| | | Revegetation | | | 233 | | | | | | | | |
| | | Infrastructure Relocation | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5A Waste | Interior Slope | Truck/Shovel Pull Back | n/a | | | | | | | | | | |
| | | Dozer Rough Grade | | 400,000 | | 325 | -30 | | | | | | |
| | | Truck/Shovel Bench Regrade | n/a | | | | | | | | | | |
| | | Terrace Bench Construction | 6,000 | | | | | | | | | | |
| | | Cover Placement (Haul) | | 193,600 | 40 | | | 3,000 | 10 | | | | |
| | | Cover Placement (Placement) | | 193,600 | 40 | 200 | -30 | | | | | | |
| | | Terrace Channel Construction | 6,000 | | | | | | | | | | |
| | | Terrace Gravel Placement | | 2,400 | | | | | | | | | |
| | | Down Drain Construction | 200 | | | | | | | | | | |
| | | Down Drain Riprap Placement | | 800 | | | | | | | | | |
| | | Down Drain Bedding Layer | | 100 | | | | | | | | | |
| | | Drainage Construction | | | | | | | | | | | |
| | | Drainage Riprap placement | | - | | | | | | | | | |
| | | Drainage Bedding Layer | | - | | | | | | | | | |
| | | Revegetation | | | 40 | | | | | | | | |
| | | Infrastructure Relocation | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Copper Mountain | Interior Slope | Truck/Shovel Pull Back | n/a | | | | | | | | | | |
| | | Dozer Rough Grade | | 206,000 | | 380 | -30 | | | | | | |
| | | Truck/Shovel Bench Regrade | n/a | | | | | | | | | | |
| | | Terrace Bench Construction | 4,460 | | | | | | | | | | |
| | | Cover Placement (Haul) | | 209,600 | 43 | 200 | -30 | 7,000 | 0 | 7,100 | 7 | | |
| | | Cover Placement (Placement) | | 209,600 | 43 | | | | | | | | |
| | | Terrace Channel Construction | 4,460 | | | | | | | | | | |
| | | Terrace Gravel Placement | | 1,800 | | | | | | | | | |
| | | Down Drain Construction | 410 | | | | | | | | | | |
| | | Down Drain Riprap Placement | | 1,700 | | | | | | | | | |
| | | Down Drain Bedding Layer | | 300 | | | | | | | | | |
| | | Drainage Construction | | | | | | | | | | | |
| | | Drainage Riprap placement | | - | | | | | | | | | |
| | | Drainage Bedding Layer | | - | | | | | | | | | |
| | | Revegetation | | | 43 | | | | | | | | |
| | | Infrastructure Relocation | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6B 6C Leach | Interior Slope | Truck/Shovel Pull Back | | 4,060,000 | | | | 1,000 | 10 | | | | |
| | | Dozer Rough Grade | | | | | | | | | | | |
| | | Truck/Shovel Bench Regrade | | 364,736 | 76 | 100 | -30 | | | | | | |
| | | Terrace Bench Construction | 13,200 | | | | | | | | | | |
| | | Cover Placement (Haul) | | 367,800 | 76 | | | 7,000 | 0 | 3,800 | 10 | 500 | 0 |
| | | Cover Placement (Placement) | | 367,800 | 76 | 200 | -30 | | | | | | |
| | | Terrace Channel Construction | 13,200 | | | | | | | | | | |
| | | Terrace Gravel Placement | | 5,300 | | | | | | | | | |
| | | Down Drain Construction | 1,000 | | | | | | | | | | |
| | | Down Drain Riprap Placement | | 4,100 | | | | | | | | | |
| | | Down Drain Bedding Layer | | 700 | | | | | | | | | |
| | | Drainage Construction | NA | | | | | | | | | | |
| | | Drainage Riprap placement | | | | | | | | | | | |
| | | Drainage Bedding Layer | | | | | | | | | | | |
| | | Revegetation | | | 76 | | | | | | | | |
| | | Infrastructure Relocation | | | | | | | | | | | |

| Additional Waiver Area Designation | Description | Pre-Reclamation Area (acres) |
|---|---|---|
| 1A and 1B Leach | Interior Slope | 45.7 |
| 2A Leach | Interior Slope | 83.7 |
| 3B | Interior Slope | 60.0 |
| 4A, 2B, 2C,7C | Interior Slope | 177.3 |
| 5A | Interior Slope | 32.4 |
| Copper Mountain | Interior Slope | 32.0 |
| 6B, 6C | Interior Slope | 31.2 |

**Table: Engineering Take-off Summary**

| Locations | Channel Length (ft) | Pipe (ft) | Pump Head (ft) | Reclaimed Area (acres) |
|---|---|---|---|---|
| | | | | |
| #1 - 2A Leach Flat, 2A Leach Interior Slope, 4A, 2B, 2C,7B Interior Slope | 7000 | 3000 | 150 | 400 |
| | | | | |
| | | | | |
| #2 - 1A and 1B Leach Interior Slope, 5A Interior Slope, Lube Shop Area Fla | 9000 | 1500 | 80 | 165 |
| | | | | |
| | | | | |
| #3 - Copper Mountain Interior Slope | 2300 | 3500 | 50 | 43.3 |
| | | | | |
| #4 - 6B Top, 6B, 6C Interior Slope | 10000 | 4500 | 100 | 113 |
| | | | | |
| | | | | |
| #5 - 3B sp Outslope | 0 | 850 | 120 | 63 |

| Location | Reclaimed Area (acres) |
|---|---|
| | |
| 1A and 1B Leach Interior Slope | 50 |
| 2A Leach Flat | 54 |
| 2A Leach Interior Slope | 113 |
| 6B Top | 37 |
| 3B sp Outslope | 63 |
| 4A, 2B, 2C,7B Interior Slope | 233 |
| Lube Shop Area Flat | 75 |
| 5A Interior Slope | 40.0 |
| Copper Mountain Interior Slope | 43.3 |
| 6B, 6C Interior Slope | 76.0 |

# APPENDIX D
# COST ESTIMATE (ELECTRONIC)