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Washington Facility Environmental Report

Supplement

UNOCAL 76

MOLYCORP

Prepared by

Radiological Services, Inc.

July 14, 2000

Washington Facility Environmental Report (April 1997)
Errata Sheets
revised July 2000

After the submittal of the "Washington Facility Environmental Report ", (April 1997) (ER), Molycorp made three major changes to the decommissioning approach for the Washington site. This report serves as a supplement to the ER and makes required revisions to ensure that the report is consistent with the current decommissioning strategy. The three major changes were:

- The proposal to remove thoriated slag exceeding 10 pCi/g total thorium (approximately 3300 yd^3) from the Molycorp York facility and to place the material into a temporary thorium storage structure located at the Washington facility, has been revised. The slag material from the York facility is now planned to be dispositioned offsite at an NRC-approved disposal facility.

- The cleanup criteria proposed for the Washington facility has been changed from 30 pCi/g to 10 pCi/g total thorium as described in the "Washington, PA Facility, Decommissioning Plan, Part 1 Revision," (June 1999).

- A single, onsite engineered cell location (referred to as the "Onsite Option") has been proposed to replace the three cell location options (referred to as Option 1, 2 and 3) originally evaluated in the "Washington Facility Environmental Report ", (April 1997). Option 2 (Open Storage Area Option) is no longer considered viable. The onsite engineered cell location proposed is a consolidation of the Option 1 (Hill Option) and Option 3 (Railroad Area Option) locations due to the need to accommodate larger volumes of material resulting from the decrease in cleanup criteria from 30 pCi/g to 10 pCi/g total thorium. The location and design of the onsite engineered cell are described in detail in the "Washington, PA Facility, Decommissioning Plan, Part 2 Revision," (July 2000).

While much of the ER contains site-specific information that characterizes the Washington facility and remains relevant, errata is provided to supplement the report to incorporate the three modifications discussed above and to achieve parity with the revised proposed plans contained in the "Washington, PA Facility, Decommissioning Plans, Parts 1 and 2 Revisions" (referred to as Part 1 DP and Part 2 DP).

Revisions that add text are typed in italics. Revisions that delete text are indicated by ~~strikeout~~. The sentence or paragraph containing the revised text is included as necessary to allow the context of the revision to be understood.

Washington Facility Environmental Report (April 1997)
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CHAPTER 1.0 INTRODUCTION

Page 1-1, Paragraph 1

Delete the first two sentences to remove references to the Molycorp York facility.

Revise the third sentence to read: "Based upon ~~these Decommissioning Plans~~ *the "Washington, PA Facility, Decommissioning Plan, Part 2 Revision," (July 2000) the United States Nuclear Regulatory Commission (NRC)* has determined that the construction of an onsite cell ~~decommissioning of these facilities~~ *at the Washington facility* may constitute a major federal action as defined by the National Environmental Policy Act (NEPA). ~~(10 Code of Federal Regulations (CFR) Part 51).~~ ..."

Page 1-1, Paragraph 2

Revise the first sentence to read: "This ER evaluates potential radiological and non-radiological impacts associated with the alternative plans which could be implemented for decommissioning the ~~facilities~~ *Washington facility.* ..."

Page 1-1, Paragraph 3, "Background"

Delete the fourth sentence as follows: "~~Decommissioning, as defined in 10 CFR 40.4, means to safely reduce residual radioactivity to a level that permits release of the property for unrestricted use and termination of the license.~~"

Page 1-2, Paragraph 2

Delete entire paragraph to remove reference to York and variance to NRC requirements.

Pages 1-2 through 1-4, Section 1.1.1 "York Facility Site History and Background"

Delete the entire text section and figures to remove reference to York facility.

Page 1-7, Table 1-1: Quantity of Thoriated Slag Located at the Washington, PA Facility

Replace Table 1-1: "Quantity of Thoriated Slag Located at the Washington Facility" with *Table 2.2 in Part 2 DP "Estimated Volume of Contaminated Soil at the Washington Site"*

Page 1-8, Paragraph 2

Revise first sentence to read: "Molycorp has requested from the NRC that ~~thoriated soil from York with a concentration greater than 10 pCi/g and~~ the thoriated slag from Washington with a concentration greater than ~~30 pCi/g~~ *10 pCi/g* be consolidated and placed in a permanent storage cell to be located within the Washington property."

Page 1-8, Paragraph 3:

Revise first sentence to read: "This ER is a presentation and evaluation of potential environmental impacts for each of the evaluated alternatives for decommissioning ~~both the York and~~ *the* Washington ~~facilities~~ *facility.*"

Page 1-9, Paragraph 3

Revise the first sentence to read: "This ER has been prepared for submittal to the NRC to aid in the selection of the appropriate decommissioning alternative to be implemented at the Washington facility for thoriated soil and slag from ~~both the York and~~ *the* Washington ~~facilities~~ *facility.*"

CHAPTER 2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

Page 2-1, Paragraph 1

Delete the entire paragraph as it discusses temporary storage of the York material at the Washington facility.

Pages 2-1 through 2-12, Section 2.1 "On-site Management Alternatives"

Delete Section 2.1 in its entirety as it discusses the previously proposed three locations for an onsite engineered cell. *Replace with Section 3.0 in the Part 2 DP, "Onsite Cell Design."*

Page 2-12, Paragraph 3

Revise second and third sentences to read: "Radioactive contamination at the Washington facility would be reduced to less than ~~30 pCi/g~~ *10 pCi/g* ~~which would require Molycorp to maintain their source material license and place restrictions upon future uses of the site~~ *which would allow the site to be released for unrestricted use.* The Washington facility has approximately ~~62,000 yd^3~~ *142,700 yd^3* (approximately ~~92,070~~ *211,900* tons, assuming a unit weight of 110 pounds per cubic foot) of thoriated material for management"

Page 2-13, Paragraph 1

Delete second sentence related to the York facility material.

Page 2-13, Paragraph 2

To be consistent with Section 3.0 of the Part 2 DP, revise the last sentence to read: "~~Options 1, 2, and 3 were~~ *The Onsite Option was* considered the most feasible ~~options~~ *option* ...",

CHAPTER 3.0 AFFECTED ENVIRONMENT

Page 3-1, Paragraph 2

Revise the third sentence to read: "The thoriated material which would be managed is located within the plant area, in the open storage area, in rolloff bins, *and* in a slag pile ~~and in a proposed temporary storage structure that would be used to store thoriated soil from York~~."

Page 3-24, Paragraph 1

Revise the first paragraph to read: "Construction of ~~all storage cell options~~ *The onsite engineered cell for the Onsite Option* ~~include~~ *includes* excavation of the material in the open storage area. This activity will be visible to the residents and motorists along Caldwell Avenue and the motorists traveling along Interstate 70 (I-70). It will also be visible to the residents east of the facility. ~~All of the cell construction activities for Option 2 will occur in the open storage area, therefore visibility is limited to the residents and motorists already mentioned."~~

Page 3-24, Paragraph 2

Revise the second paragraph to read: "In addition to the *excavation* activities in the open storage area, the construction activities for ~~Option 1~~ *the Onsite Option* include excavation and construction on top of the hill. This will be visible to the residents south and west of the area. The activities for ~~Option 3~~ *the Onsite Option* will *also* include excavation and construction along the abandoned railroad and this will be visible to the residents and motorists along Caldwell Avenue."

CHAPTER 4.0 ENVIRONMENTAL CONSEQUENCES AND RECOMMENDED MONITORING AND MITIGATION

Page 4-1, Paragraph 4

Revise the fourth paragraph to read: "~~Approximately 0.16 km^2 (4 acres) of land for Options 1 and 2, and 0.21 km^2 (5.25 acres) of land for Option 3~~ *Approximately 0.36 km^2 (9 acres) of land for the Onsite Option* would be disturbed during remedial activities. All of this land is well within Molycorp's property boundaries. ~~This disturbance of land would not affect land use for Option 2 (open storage area) because that section of property is already zoned as heavy industrial and would continue to be devoted to heavy industrial use while in Molycorp's possession. Option 1 (hill area) and 3 (abandoned railroad) are currently zoned as light residential.~~ The direct impacts on land use would be confined to the Molycorp property."

Page 4-2, Paragraphs 1, 3, and 4

Revise the first paragraph to read: "The quantity of off-site fill materials needed to complete remediation ~~varies depending upon which on-site management option is selected. Option 1 will require an estimated 39,700 yd^3 of off-site materials. Option 2 will require an estimated 76,100 yd^3 of off-site materials. Option 3 will require an estimated 8,700 yd^3 off-site soil materials.~~ *for the Onsite Option is approximately 50,000 yd^3*. Numerous local sources of off-site fill material are available for use. ..."

Revise the third paragraph to read: "~~Any of the three storage cell options would~~ *The Onsite Option will* result in restricted land use of the storage cell area defined by the NRC. Therefore the land would have restricted potential for future economically productive use. Molycorp would ~~retain their Source Material License for the facility,~~ maintain the property, and ensure compliance with NRC regulations, including maintenance of security fences and warning signs. ~~If either Option 1 (Hill Area) or Option 3 (abandoned railroad) are~~ *If the Onsite Option is* implemented, the removal of the thoriated material may allow the open storage area land to be put to economically productive use. The economic return would depend on how the land was used (commercial or future industrial development). Because some of this area is located within the 100-yr floodplain, commercial or industrial development may be restricted."

Revise the fourth paragraph to read: " ~~Removal of thoriated materials with a thorium concentration greater than 30 pCi/g would also require retention of the Source Materials License for the Washington facility and a continuance of restricted use of the affected areas~~. The direct impacts on land use would be confined to the Molycorp property and would not conflict with current facility usage.

Page 4-3, Paragraph 4

Delete the following sentences: ~~"The off-site disposal alternative for thoriated material above 30 pCi/g would result in restricted land use as defined by the NRC. Molycorp would retain their Source Material License for the facility monitor and maintain the property, and ensure compliance with NRC and PADEP regulations including maintenance of security fences and warning signs. ...~~"

Page 4-4, Paragraphs 2, 3, and 4

Revise the second paragraph to read: "The projected labor force (not including design and construction management/oversight) for the ~~onsite management options~~ *Onsite Option* is 15 to 30 persons over a 2 to 3 year period..."

Revise the third paragraph to read: "Construction of ~~any of the three on-site options~~ *the Onsite Option* is not expected to increase Molycorp's use of natural gas, or electricity...Local solid waste management capacity is ample and would not be affected by additional demand from the construction of ~~any of the storage cell options~~ *the Onsite Option* ..."

Revise the fourth paragraph to read: "The volume of the off-site borrow material needed for the ~~on-site management cell options~~ *Onsite Option* ~~varies due to differences in design~~ *is estimated to be 50,000 yd*^{3}. ~~Table 4-1 presents a summary of the off-site borrow material needed~~. Additional traffic impacts to the area would be the result of workers commuting to the Molycorp facility..."

Page 4-4a, Table 4-1: Summary of Off-Site Borrow Material

Delete Table 4-1 in its entirety as it summarizes borrow material needed for Options 1, 2 and 3 which have been replaced by the Onsite Option.

Page 4-5, Paragraph 2

Revise the second paragraph to read: "The impact to traffic patterns is anticipated to be minimal due to the low increase in daily traffic associated with the construction of the ~~on-site options~~ *Onsite Option* ..."

Page 4-6, Paragraph 4

Revise the fourth paragraph to read: "The Pennsylvania Historic and Museum Commission has confirmed that there are no historic structures located within the area of thoriated slag removal or the area of the *Onsite Option* ~~any of the on-site storage options~~.

Page 4-8, Paragraphs 2 and 4

Delete the entire second paragraph as follows: "~~Additional consideration will be given to Option 2…Options 1 and 3 are not located within the 100 year floodplain and no additional activities are anticipated to build up these areas~~."

Revise the fourth paragraph to read: "Construction of ~~any of the storage cell options~~ *the Onsite Option* is not anticipated to significantly alter watershed drainage areas. …"

Pages 4-9 through 4-11, Section 4.3.2 "Groundwater"

Delete Section 4.3.2.on Groundwater through the third paragraph on page 4-11 that discusses "Alternative 1, Option 3-Abandoned Railroad Area", and replace with Section 4.4 in the Part 2 DP.

Page 4-12, Paragraphs 3 and 4

Revise the third paragraph to read: "Air Quality. Implementation of ~~any of the on-site options would~~ *the Onsite Option* would increase traffic on-site by 50 vehicles per day, maximum. …"

Revise the fourth paragraph to read: "Air Quality Modeling…~~Decommissioning on-site options 1, 2, and 3 involve~~ *The Onsite Option involves* excavating and loading of thoriated material, transporting to a storage cell, unloading and spreading of material. ~~Each of these operations are similar however, the location of the storage cell, and thus the location of the unloading and spreading material differs."~~

Page 4-13, Paragraph and 5

Revise the fifth paragraph to read: "Each source was modeled…The maximum and minimum distance for this polar array was chosen to correspond to the maximum and minimum source-receptor distance for each of the three on-site options *previously evaluated using the onsite alternative assumptions proposed in the 1997 ER. Because the revised Onsite Option is a consolidation of the former option 1 (Hill Area) and option 3 (abandoned railroad area), it is assumed that the results for options 1 and 3 are applicable to the Onsite Option…"*

Page 4-14, Paragraph 2

Revise the second paragraph to read: "Modeling results are presented in Appendix L…These findings were common to all three on-site remediation options *previously* under consideration-*and therefore apply to the newly proposed Onsite Option* Only the maximum distance varied among the *previous* three options. Consequently this analysis

applies to the newly proposed Onsite Option ~~all three remediation options under consideration."~~

Page 4-15, Paragraphs 1 and 5

Revise the first paragraph to read: "Visibility. Excavation of the thoriated slag in the open area and ~~construction of any of the three on-site storage cell options~~ *implementation of the Onsite Option* will be visible to traffic traveling along west on I-70 and by traffic on Caldwell Avenue. Construction of ~~storage cell Option 1 on top of the hill~~ *the Onsite Option cell* will also be visible to residents of The Circle (residential street). ~~Construction of the storage cell Option 3 in the railroad area~~ *The Onsite Option cell* will also be visible to residents along Weirich Avenue."

Revise the fifth paragraph to read: "Visibility. Following remediation, the ~~selected on-site storage option~~ *area surrounding the Onsite Option engineered cell* will be vegetated with trees planted around the perimeter. ~~Each of the options~~ *The Onsite Option* will result in permanent changes to the existing topography."

Page 4-16, Paragraph 1

Delete the first paragraph: "~~Option 1 in the hill area will increase the height of the hill by approximately 29 feet and will appear as a natural hill top. Option 2, the open storage area will, at its maximum height, be 1072 ft msl or approximately 8 feet below the level of I-70. This will be an obvious change in the existing ground surface which will not appear as natural in regards to other topographic features. The railroad area option, Option 3, will for the most part blend into the existing topography. Maintenance of upstream ditches or channels will be critical to maintenance of slope stability in Option 3 and will be performed at recommended intervals.~~"

Page 4-17, Paragraph 2

Revise the second paragraph to read: "~~Decommissioning alternactive 3,~~ *The* off-site management *alternative* includes only the excavating and loading of material. ..."

Pages 4-18 through 4-26, Risk Assessment

Replace Section 4.5 "Risk Assessment" through the third paragraph on page 4-26, with the revised Section 4.5 contained in Appendix A.

Page 4-27, Paragraphs 2 and 3

Revise the second paragraph to read: "...Confirmation surveys will be performed to ensure that all thoriated slag with a radiation concentration greater than ~~30 pCi/g~~ *10 pCi/g* has been removed."

Delete the third paragraph.: ~~"Long-term monitoring of any of the on-site management options will include inspection of the leachate collection system and periodic removal and management of the leachate which drains from the encapsulated soils. ..."~~

CHAPTER 5.0 COSTS AND BENEFITS ASSOCIATED WITH DECOMMISSIONING

Replace Section 5.0 in its entirety with the revised Section 5.0 contained in Appendix B.

CHAPTER 6.0 ENVIRONMENTAL AND ECONOMIC IMPACT SUMMARY

Replace Section 6.0 in its entirety with the revised Section 6.0 contained in Appendix C.

Appendix A

Risk Assessment

4.5 Risk Assessment

A risk assessment was conducted as part of the economic and regulatory evaluation of alternatives for decommissioning the Washington PA Facility. This section provides a summary of the detailed assessment reported in Appendix N. Alternatives considered in the risk assessment are:

1) On-site storage in an engineered storage cell - the On-site alternative,

2) Off-site disposal at an NRC approved facility - the Off-site alternative, and

3) the No Action alternative.

The risk assessment compares radiation exposure risks from the three decommissioning alternatives. As described in the Part 2 DP, site characterization results indicate that the site contains approximately 124,500 cubic yards (cy) of soil with thorium in concentrations above the limit for unrestricted release (10 pCi/g). The decommissioning alternatives involve two different means of disposal of this material. In the off-site alternative, the entire the entire volume is shipped to an NRC approved off-site disposal facility. In the on-site alternative, Molycorp proposes to ship approximately 15 % of the soil, estimated to be above the limit for on-site disposal, to an NRC approved off-site facility and to dispose of the remaining material in an engineered cell located on the facility (see below for a characterization of the volumes).

A framework for comparison of the alternatives has been established in the Part 2 DP, including a series of dose estimates for the proposed alternatives. These were prepared in accordance with regulatory requirements in 10CFR20 Subpart E and NRC Guidance. They include estimates of dose to workers and the public during decommissioning and to members of the public after decommissioning is completed. Dose estimates are also performed for the other alternatives in similar fashion as applicable.

The assessment considers dose to workers from the following activities as applicable to each alternative:

- direct exposure to materials during on-site excavation, transport and cell loading
- inhalation dose from fugitive dust generated during on-site handling of contaminated soil
- direct exposure of train crews during transport to an off-site disposal facility

Dose to the public is evaluated for:

- direct exposure to on-site activities during decommissioning
- inhalation of fugitive dust from on-site decommissioning activities
- dose to people along the transportation corridor during transport of materials to an off-site disposal facility
- post-decommissioning dose to a resident who could occupy the site or its immediate vicinity

4.5.1 Methodology

Simple models of the radiation sources and receptor behavior are used in the analysis. For occupational doses, the estimates are a function of worker exposure time and average dose rate. Worker exposure time is computed from estimated average production rates for excavation and transport of materials. Dose rates are calculated assuming uniform-average concentrations of thorium and uranium. However, the dose estimates are considered to be realistic but conservative using currently available descriptions of decommissioning activities. Characterization of the principal sources and approach to the analysis follows:

1. Decommissioning phase - higher activity material. This material contains radionuclide concentrations that may be above the limit for placement in the cell and has an estimated volume of 16,200 cy (before swell). This includes 6400 cy of thoriated slag-soil mixture stored in an above ground pile at the site and material below grade that requires excavation. The average concentrations for this volume are conservatively assumed to be equal to the average concentrations in the thorium pile. These are 1068 pCi/g total thorium and 534 pCi/g total uranium (see Part 2 DP, Section 2.2, "Site Characterization). The total uranium concentration is conservatively assumed to be 50% of the total thorium concentration. This source description is used for calculation of dose to workers from excavation and transport of the higher activity material. For the transportation analysis, the volume is increased to 17,700 cy to account for swelling from the excavation and handling, vs the in-ground volume.

2. Decommissioning phase - remainder of material. This material includes the remaining volume of in-ground material above 10 pCi/g total thorium, estimated to be 105,300 cy (before swell) plus a smaller quantity of material stored in roll-off boxes on the site for a total volume of 108,300 cy. The average concentration of this volume is 73 pCi/g total thorium and 37 pCi/g total uranium. This source description is used for calculation of dose to workers for excavation and transport of the remainder of material and for estimation of the dose to members of the public. For analysis of transport and cell filling, the volume is increased to 125,000 cy to account for swelling.

3. Post – decommissioning phase – institutional controls in place. Analysis of the On-site Option considers direct exposure to an individual from the material stored in the cell and use of groundwater from a well drilled in the vicinity of the site. The material stored in the on-site cell comprises 125,000 cy, the cell design capacity (including allowance for contingency and swelling of excavated soil). The volume is assumed to contain an average concentration of 100 pCi/g total thorium, 12 pCi/g total uranium and 10 pCi/g Ra-226 (see Part 2 DP, Section 2.2, Site Characterization). For the Offsite alternative, the entire site will be released for unrestricted use in accordance with the criteria in the SDMP Action Plan. This is the same criteria applied for the unrestricted use of property under the On-Site alternative and therefore the only difference in dose between the two options is the dose from the Onsite cell. For the no action alternative, the source term is assumed to be the in-ground thorium-bearing slag/soil with average concentrations of 73 and 36 pCi/g of total thorium and total uranium respectively. For both of the groundwater dose assessments (proposed alternative and no action alternative), it is assumed that a well is drilled near the site

for irrigation and domestic water supply. The groundwater concentration inputs to RESRAD for the water dependent pathway analysis are the same as those used in the Part 2 DP dose assessment (see Part 2 DP Section 4.2.2).

Other assumptions and methods used in the analysis include:

- occupational and public doses are limited to exposure from normal operations
- non-radiological risks are assumed to be minimal from this relatively small scale project and are not evaluated
- dose from the present time to beginning of decommissioning is not evaluated - it is the same for all the alternatives
- analysis of post – decommissioning doses includes calculation to 1000 years after completion of decommissioning activities
- direct radiation doses for the decommissioning phase and from post-decommissioning phase with institutional controls in place are calculated using the Microshield™ computer code.
- collective doses are estimated for comparison of occupational dose
- individual doses to members of the public are estimated for comparison of the alternatives

4.5.2 Results

Results of the analysis are summarized in Table 4.1 The table provides a comparison of the estimated doses for the three alternatives. It is seen that there are no significant differences regarding the dose impact between the On Site and Off Site alternatives. However, as shown in Section 5.0, there is a significant difference in cost. Of the two, the Off Site alternative has a slightly higher dose impact, due to the larger transportation dose associated with transport of a much larger waste volume to an off site disposal facility. Due to the difficulty in establishing a basis for estimating collective dose to the public from the post-decommissioning period, a direct comparison of the No Action alternative is not achieved in this analysis. However, it can be seen that over a period of 1000 years, the estimated collective dose to members of the public represented by the resident farmer would be at least 1000 times higher than the individual dose of 742 mrem/yr assuming one resident.

Table 4.1

Comparison of Alternatives

Dose Component	Alternative		
	On Site	**Off Site**	**No Action**
Occupational Dose (person-rem)	7.1	7.3	N/A
Public dose from transportation (person-rem)	0.6	1.2	N/A
Maximum individual dose to a member of the public (mrem) (1)	17.9	20.7	742

(1) Table 4.1 Note. Doses to individuals are the dose to an individual in one year. The dose from the On Site and Off site alternatives is the total dose, which was experienced in a less than one year during decommissioning.

Appendix B

Costs and Benefits Associated with Decommissioning

5.0 COSTS AND BENEFITS ASSOCIATED WITH DECOMMISSIONING

This section presents an analysis of the costs and benefits of each of the three alternatives considered. It should be noted that the costs are in addition to any sums already spent by Molycop on decommissioning at the Washington, Pennsylvania facility. The main focus of the analysis is on quantifiable, monetary values; i.e. capital costs (e.g. construction, material labor) and operation and maintenance (O&M) costs (e.g. periodic inspections, monitoring). Other significant qualitative costs and benefits are identified

Capital and O&M costs for each alternative are discussed below, the exception being the no action alternative for which no costs are projected. Capital costs include mainly the material, equipment, and labor costs. The majority of these costs are from *R.S. Means Heavy Construction Cost Data, 13th Annual Edition* (R.S. Means, 1999) and copies of the referenced pages are provided in Appendix O. However, some of the costs included are from vendor quotes for similar services or from the previous cost estimate in the 1997 EIS. All costs presented include the cost of equipment and labor. Because most of the cost items for the alternatives are the same, the unit costs are presented in Table 5-1, with buildup and sources identified. The specific costs for each alternative are described in greater detail in the following subsections. Activities associated with the capital costs will be performed over a relatively short time (less than 18 months), therefore, all capital costs are assumed at present value in 2000 dollars utilizing no discount rate.

5.1 On-Site Management Alternative

The capital costs for the on-site storage cell alternative includes facility preparation for the area of the cell, cell construction and closure, thoriated water excavation and placement, and facility refurbishing in the area of the thoriated material excavation and other disturbed areas. Also included are railcar loading, transportation, tipping fees for the small quantity of material that will be sent off-site. A contingency of 20% has been added to account for miscellaneous equipment and material costs, miscellaneous services (e.g., surveying), periodic progress reviews and other miscellaneous expenses. The itemized costs are presented in Table 5-2. This report assumes that the off-site commercial disposal facility to be utilized will be Envirocare in Clive, Utah in order to estimate the order of magnitude costs for transportation and off-site disposal.

The O&M costs are presented in Table 5-3. This cost was developed to support the Financial Assurance requirements for the proposed release of the cell for restricted use in accordance with 10 CFR 20.1403 and are provided as first year annual cost These cost are the same as were provided in the Part 2 DP for Financial Assurance.

5.2 Off-site Management Alternative

The capital costs for the off-site management alternative include facility preparation, thoriated material excavation, railcar loading, transportation, tipping fees and facility refurbishing in the area of the thoriated material excavation and other disturbed areas. A contingency of 20% has been added to account for miscellaneous equipment and material costs, miscellaneous services (e.g., surveying), periodic progress reviews and other miscellaneous expenses. The itemized costs are presented in Table 5-2. No O&M costs have been assumed for this alternative. This report assumes that the off-site commercial

disposal facility to be utilized will be Envirocare in Clive, Utah in order to estimate the order of magnitude costs for transportation and off-site disposal. Note that 125,00 cy of the material assumed to be shipped contain less than exempt quantities of source material (0.05 wt%). Therefore, the tipping fee is reduced to $100/cy.

5.3 No Action Alternative

There is no cost associated with the no Action alternative. It is assume that that the site is released for unrestricted use at some time in the future .

TABLE 5-1 Cost Bases for decommissioning Alternative Cost Estimates

Description	UNIT COSTS Unit Rate	UOM	Unit Rate Origin	Assumptions
Mobilization / Site Prep				
Enviromental, silt fence	0.8	/lf	Means 022 704 1100	
Enviromental, hay bale, install & remove	6.5	/lf	Means 022 704 1250	
Dewatering- Sump Drain	14,135	Lump Sum	estimated	
Signage	1,609	Lump Sum	estimated	
Police detail for road crossing	64,336	Lump Sum	estimated	
	$ 153,015.00	Lump Sum	weighted average for item	
Clearing and Grubbing				
Clearing Site (Heavy)	5,560	/ac	Means 021 104 0300	
Grub Stump/Removal (Heavy)	4,795	/ac	Means 021 104 0350	
Stump/Tree Disposal Fee	20,000	Lump sum	estimated	
	$ 13,212.30	/ac	weighted average for item	
Excavation				
Excavation- Earth; Large Structure, (Backhoe/Truck) Haul 1,000'	2.1	/cy	Means 022 238 0300	from site to offsite
Excavation, hauling, 20 yd truck, 1 mile	2..5	/cy	Means 022 266 1150	from site to offsite
Excavation, soil classification	1.4	/cy	estimated	
Excavation, truck loading	0.4	/cy	Means 022 238 0020	from offsite to site
Excavation, hauling, 20 yd truck, 1 mile	2.5	/cy	Means 022 266 1150	from offsite to site
Excavation, truck loading	0.4	/cy	Means 022 238 0020	from site to offsite
Excavation- Rock; Rippable, Genl Site, Haul 1 mi	2.4	/cy	Means 022 278 2500	assume 25% of total quantity
Excavation (User Defined)	3.0	/cy	estimated	
	$ 9.90	/cy	weighted average	
Backfill				
Backfill/Spread, Open Area	1.2	/cy	Means 022 262 0010	
Backfill/Compact, Open Area	0.5	/cy	Means 022 226 5620	
Backfill/Spread, adder for steep slopes	0.2	/cy	estimated	adder to base rate
Backfill/Compact, adder for steep slopes	0.1	/cy	estimated	adder to base rate
Total	$ 2.10	/cy		
Dust Control				
Road dust control	110,940	/ea	estimated	chemical truck / driver
Truck wash down station	13,045	/ea	estimated	
	$ 123,985.00	/ea	weighted average for item	
Roads				
Surfacing, Crushed Stone; 6"	8	/sy	Means 022 308 0100	
Paving, Prepare Subgrade (for Road)	1	/sy	Means 022 304 0100	
Paving- Base; Crushed Stone, 18"	20	/sy	Means 022 308 0304	
Guard Rail- Corrugated Steel (Galv)	12	/lf	Means 028 404 0010	
Guard Rail-Corrugated Steel (Galv)	70	/ea	Means 028 404 0200	
Pre-work to old rail bed	17,180	/ls	estimated	
	$ 75.30	/lf	weighted average for item	

TABLE 5-1 Cost Bases for decommissioning Alternative Cost Estimates

Description	UNIT COSTS Unit Rate	UOM	Unit Rate Origin	Assumptions
Bridges				
Bridge, Perm	250	/sf	S&W experience	
Bridge, Temp	51	/sf	S&W experience	
	$ 175,345.80	/ea	weighted average for item	
Overburden Removal				
Excavation- Earth; Large Structure, (Backhoe/Truck) Haul 1,000'	4.1	/cy	Means 022 238 0300	
Excavation, hauling, 20 yd truck, 1 mile	2.4	/cy	Means 022 266 1150	
Excavation, truck loading	0.4	/cy	Means 022 238 0020	
Total	$ 6.90	/cy		
Thoriated Material Removal				
Excavation- Earth; Large Structure, (Backhoe/Truck) Haul 1,000'	$ 4.10	/cy	Means 022 238 0300	
Radiological Surveys	$ 390.00	/h	Estimate	
Hauling, On-Site				
Excavation, hauling, 20 yd truck, 1 mile	2.4	/cy	Means 022 266 1150	
Excavation, truck loading	0.4	/cy	Means 022 238 0020	
Total	$ 2.80	/cy		
Thoriated Material Placement and Comp				
Backfill/Spread, Open Area	2.0	/cy	Means 022 208 3320	
Backfill/Compact, Open Area	0.5	/day	Means 022 226 5620	
Total	$ 2.50	/cy		
Storm Water Retention Pond				
Backfill- Crushed Stone	20	/cy	estimated	
Backfill- rip rap - culvert protection	49	/cy	estimated	
Concrete Structures (Complete)	480	/cy	estimated	
Pipe- Corrugated Metal; Below Ground, 24" Dia	40	/lf	Means 027 164 2140	
Pipe- Corrugated Metal; Below Ground, 12" Dia	23	/lf	Means 027 164 2080	
Pipe-trash screen	505	/ea	estimated	
	$ 76,369.90	Lump sum	weighted average for item	
Hydroseeding	$ 0.40	/sy	Means 029 308 3800	
Material Placement				
Backfill/Spread, Open Area	1.2	/cy	Means 022 262 0010	
Backfill/Compact, Open Area	0.5	/cy	Means 022 226 5620	
Backfill/Spread, adder for steep slopes	0.3	/cy	estimated	
Backfill/Compact, adder for steep slopes	0.1	/cy	estimated	
Total	$ 2.10	/cy		
Fences, gates				
Fence Gate, Double Swing;	$ 1,237.80	/ea	Means 028 308 5070	

TABLE 5-1 Cost Bases for decommissioning Alternative Cost Estimates

Description	UNIT COSTS Unit Rate	UOM	Unit Rate Origin	Assumptions
ChainLink, 24' wide				
Fence; ChainLink, 9ga, 8', set in concrete, barbed wire	$ 15.30	/lf	Means 028 308 0300	
Backfill Site Refurbishment				
Backfill/Spread, Open Area	2.0	/cy	Means 022 208 3320	
Backfill/Compact, Open Area	0.9	/cy	Means 022 226 8700	
Total	$ 2.85	/cy	weighted average for item	
Offsite Soils				
Clay	$ 15.00	/cy	estimated	
Crushed Stone	$ 23.90	/cy	1997 estimate	
Sand	$ 12.00	/cy	estimated	
Topsoil	$ 14.20	/cy	1997 estimate	
Clean Soil	$ 10.50	/cy	1997 estimate	
Other Items				
Groundwater Monitoring Wells	$ 1,166.67	/ea	Vendor quote	
Railroad, 100# (on Wood Ties)	$ 92.90	/lf	Means 024 524 0820	
Railroad, Turnout	$ 21,156.60	/ea	Means 024 520 2300	
Railroad, Car Bumper	$ 2,938.20	/ea	Means 024 520 0010	
Railroad Switcher	$ 2,000.00	/day	1997 estimate	
Railroad, transportation to Utah	$ 3.70	/cf	Vendor quote	
Tipping Fee (High Activity Waste)	$ 15.00	/cf	Vendor quote	
Tipping Fee (Low Activity Waste)	$ 3.70	/cf	Industry Average	
Load Railroad Cars	$ 2.31	/cy	Estimated	

Notes:

cy = cubic yard
lf = linear foot
sy = square yard
ea = each
ac = acre

TABLE 5-2 Cost Estimates for Decommissioning Alternatives

				Onsite Option		Offsite Disposal		No Action	
		Unit Rate	UOM	Quantity	Total Costs	Quantity	Total Costs	Quantity	Total Costs
SITE PREPARATION									
Mobilization / Site Prep		$153,015.00	Lump Sum	1	$153,015	0.3412	$52,209	Not applicable	
Clearing and Grubbing		$13,212.30	/ac	7	$92,486	Not applicable		Not applicable	
Sub Total - SITE PREPARATION		$255,500.80	Lump Sum		$245,501		$52,209		
CELL CONSTRUCTION									
Excavation	(1)	$9.90	/cy	110,000	$1,084,879	Not applicable		Not applicable	
Backfill	(1)	$2.10	/cy	65,000	$136,500	Not applicable		Not applicable	
Sub Total -CELL CONSTRUCTION					$1,221,379				
ACCESS ROAD AND BRIDGES									
Roads		$75.30	/lf	3,140	$236,414	Not applicable		Not applicable	
Bridges		$175,345.80	/ea	2	$350,692	Not applicable		Not applicable	
Sub Total - ACCESS ROAD AND BRIDGES					$587,106				
REMOVAL & ONSITE DISPOSAL									
Overburden Removal		$6.90	/cy	52,000	$358,800	52,000	$358,800	Not applicable	
Thoriated Material Removal	(2)	$4.10	/cy	124,500	$510,450	124,500	$510,450	Not applicable	
Radiological Surveys		$390.00	/h	1,000	$390,000	1,000	$390,000	Not applicable	
Hauling, On-Site	(2)	$2.80	/cy	142,700	$399,560	142,700	$399,560	Not applicable	
Thoriated Material Placement and Comp	(2)	$2.50	/cy	125,000	$312,500	Not applicable		Not applicable	
Dust Control		$123,985.00	Lump Sum	1	$123,985	1	$123,985	Not applicable	
Sub Total - REMOVAL & ONSITE DISPOSAL					$2,095,295		$1,782,795		-
RETENTION POND CONSTRUCTION									
Storm Water Rentention Pond		$76,369.90	Lump Sum	1	$76,370	Not applicable		Not applicable	
Sub Total - RETENTION POND					$76,370				
CAP CONSTRUCTION									
Clay		$2.10	/cy	14,900	$31,290	Not applicable		Not applicable	
Rock / Aggregate "Biotic" layer		$2.10	/cy	7,440	$15,624	Not applicable		Not applicable	
Sand		$2.10	/cy	3,720	$7,812	Not applicable		Not applicable	
Topsoil		$2.10	/cy	3,720	$7,812	Not applicable		Not applicable	
Cover Soil		$2.10	/cy	11,200	$23,520	Not applicable		Not applicable	
Fences, gates		$1,237.80	Ea	1	$1,238	Not applicable		Not applicable	
Fences		$15.30	/lf	2,640	$40,392	Not applicable		Not applicable	
Rip Rap		$2.10	/cy	5,600	$11,760	Not applicable		Not applicable	
Hydroseeding		$0.40	/sy	33,000	$13,200	Not applicable		Not applicable	
Groundwater Monitoring Wells		$1,166.67	Ea	6	$7,000	Not applicable		Not applicable	

TABLE 5-2 Cost Estimates for Decommissioning Alternatives

		Unit Rate	UOM	Onsite Option Quantity	Onsite Option Total Costs	Offsite Disposal Quantity	Offsite Disposal Total Costs	No Action Quantity	No Action Total Costs
Sub Total - CAP CONSTRUCTION					$159,648		-		-
SITE REFURBISHING									
Backfill	(3)	$2.85	/cy	82,000	$233,700	127,000	$361,950	Not applicable	
Sub Total - SITE REFURBISHING					$233,700		$361,950		-
OFFSITE SOILS									
Clay		$15.00	/cy	14,900	$223,500	Not applicable		Not applicable	
Rock / Aggregate "Biotic" layer		$23.90	/cy	13,040	$311,656	Not applicable		Not applicable	
Sand		$12.00	/cy	3,720	$44,640	Not applicable		Not applicable	
Topsoil		$14.20	/cy	3,720	$52,824	Not applicable		Not applicable	
Cover Soil		$10.50	/cy	11,200	$117,600	Not applicable		Not applicable	
Clean Fill		$10.50	/cy	82,000	$861,000	127,000	$1,333,500	Not applicable	
Sub Total - OFFSITE SOILS					$1,611,220		$1,333,500		-
OFF-SITE DISPOSAL									
Railroad, 100# rail (on Wood Ties)		$92.90	/lf	500	$46,450	500	$46,450	Not applicable	
Railroad, Turnout		$21,156.00	Ea	1	$21,156	1	$21,156	Not applicable	
Railroad, Car Bumper		$2,938.00	Ea	1	$2,938	1	$2,938	Not applicable	
Railroad Switcher		$2,000.00	/day	25	$50,000	225	$450,000	Not applicable	
Railroad, transportation to Utah	(2)	$3.70	/cf	477,900	$1,768,230	3,852,900	$14,255,730	Not applicable	
Tipping Fee (High Activity waste)	(2)	$15.00	/cf	477,900	$7,168,500	477,900	$ 7,168,500	Not applicable	
Tipping Fee (Low Activity waste)	(2)	$3.70	/cf	Not applicable		3,375,000	$12,487,500	Not applicable	
Load Railroad Cars	(2)	$2.31	/cy	17,700	$40,887	142,700	$329,637	Not applicable	
Sub Total - OFF-SITE DISPOSAL					$9,098,161		$34,761,911		
Total Direct Costs					$15,328,380		$38,292,365		-
Labor Productivity		13%			$194,351		$116,995		
Overtime Allowance		10%			$149,501		$89,996		
Sub Total					$15,672,232		$38,499,356		-
Bonds					Excluded				
Taxes					Excluded				
Freight - on mat'l & eqt.		4%			$88,951		$56,760		
Warranty		0%			$39,246		$205,577		-
Sub Total					$15,800,429		$38,761,693		-
Escalation – Materials		3%			$66,713		$42,580		
Escalation- Labor		5%			$74,750		$44,998		-

TABLE 5-2 Cost Estimates for Decommissioning Alternatives

			Onsite Option		Offsite Disposal		No Action	
	Unit Rate	UOM	Quantity	Total Costs	Quantity	Total Costs	Quantity	Total Costs
Escalation – Construction Equipment.	4%			$75,431		$35,833		-
Sub Total				$16,017,323		$38,885,104		
Overhead / Fee (not including tipping fee)	5%			$442,441		$961,455		-
Total Construction Costs				$16,459,764		$39,846,559		-
Contingency	20%			$3,291,953		$ 7,969,312		-
Sub Total				$19,751,717		$47,815,871		-
Other costs								
Administrative Costs (not including disposal costs)	2%			$180,553		$142,436	Not applicable	
Engineering Oversight (not including disposal costs)	4%			$361,106		$284,872	Not applicable	
Permits and Legal (not including disposal costs)	2%			$180,553		$142,436	Not applicable	
Financial Assurance (see Table 5-3)				$2,067,500	Not applicable		Not applicable	
NRC Oversight / EIS				$1,000,000		$250,000	Not applicable	
Final Status Survey of Sites And Cell				$1,500,000		$1,200,000	Not applicable	
Engineering			5%	$987,586	1%	$478,159	Not applicable	
Total				**$26,029,014**		**$ 50,313,773**		

Notes:

(1) A total of 110,000 cy will be excavated to prepare the storage pile site of which 65,000 cy will be used to construct the berm and haul road. Excavation Includes hauling to offsite area, classification of soils, and rehauling back to cell area.

(2) Material consists of 9,400 cy above ground (3,000 cy in roll-offs and 6,400 cy in a stock pile) and 115,100 cy in-ground. The in-ground material will swell upon removal (calculations assumes 15% swell). This results in a total of 142,700 cy of material for disposal. 17,700 cy (after swell) is considered high activity.

(3) The excess material removed from the storage pile area (45,000 cy) will be used to backfill the site.

(4) cf = cubic foot
cy = cubic yard
lf = linear foot
sf = square foot
sy = square yard

Table 5.3

Summary of Costs for Maintenance of Physical Controls and Monitoring

Item Description	O&M			
	Activity	**Activity period**	**Cost per period ($)** (20)	**First Year Annual Cost ($)**
Cell Cover (1)	mowing and routine maintenance, erosion repair	annual	11,029	11,029
Perimeter Fencing (2)	Inspection and maintenance	annual	1,320	1,320
	replacement	25 years	70,000	2,143(3)
Security Inspection(4)	Inspection	Quarterly	500(5)	2,000
Groundwater Monitoring (6)	sample collection and analysis	annual after year 2	3,400	3,400
Groundwater Monitoring(7)	Sample collection and analysis	Quarterly First 2 years	3,400	N/A(8)
Groundwater Monitoring Well Replacement (9)	Replacement	20 years	7,000	282(10)
Direct Radiation Thermoluminescent Dosimeters (11)	replacement and readout	quarterly	130	520
	replacement of TLD enclosures	5 years	1,200	225(12)
Haul Road (13)	grade and fill	annual	4,856	4,856

Bridge Maintenance[14]	Inspection and report	2 years	7,200	3,494[15]
	Cleaning/ hydroblasting joints	annual	1,447	1,447
	Sandblasting, painting, scaffolding, repairing railings and spalls	5 years	18,540	3,493[16]
Bridge Replacement[17]	Replacement	50 years	185,000	2,144[18]
Management Fee[19]	Management of controls and monitoring	annual	5,000	5,000
TOTAL				**41,353**

(1) Cost estimate provided by Bruce McCampbell, Stone & Webster, 6/5/00. Cost data is from Means Building Construction Cost Data, 1997. Cell maintenance includes grass and brush mowing, hauling fill, placing and spreading fill, seeding, fertilizing, etc. Cell cover initial installation costs are assigned to cell construction and are not part of institutional control maintenance costs.

(2) The fencing initial installation cost is considered to be part of cell construction and is not part of institutional control maintenance costs. Replacement costs are based on 3500 feet of standard eight-foot galvanized chain link fencing with concrete-mounted posts, vehicle access gate and warning signs. The 25 year fence replacement cost is based upon the assumption of $20/ft (personal communication, Bruce McCampbell, SEWC, 2/17/00). The basis for the 25 year replacement period is that this is the assumed life of fencing used in cost estimates for several sites reviewed. See Summary Report "Details of the Institutional Controls and Financial Assurances Applied or Planned at Various Hazardous and Radioactive Material Sites in the United States", Radiological Services, Inc., Nov. 28, 1999. Annual fencing maintenance costs of $1320 assume eight hours four times per year for walk-down inspection and minor repairs @ $35/hr plus $200 per year for materials.

(3) Annual payment of $2,143 with NRC-specified rate of return (2.0% per annum) will generate sufficient funds for $70,000 outlay every 25 years. In accordance with the NRC's Draft Regulatory Guide DG-4006 at Section 4.2.3, the amount of financial assurance funding will be determined by multiplying the first year annual cost by 50.

(4) Security inspections will include walking the perimeter fencing and inspecting the cell cap and six (6) groundwater monitoring wells for any evidence of trespassers, intruders, vandalism, burrowing animals, erosion, etc.

(5) Cost estimate of $500 per inspection provided by Tom Maher, Civil & Environmental Consultants, Inc. ("CEC"), 6/6/00. CEC will prepare a written report for each inspection.

(6) The installation of the six (6) groundwater monitoring wells is considered to be part of the cell construction cost and is not part of institutional control maintenance costs. It is assumed that water samples will be collected annually from each well and analyzed for thorium, uranium and radium by chemical separation and alpha spectroscopy. Sample collection and analysis costs are estimated as $500 for collection (one person-day), $200 for containers, supplies, handling and shipping and $2,700 for laboratory analysis ($150 for each U, Th, Ra analysis). Analytical costs were provided by RSA, Inc., 2/21/00.

(7) For the first two (2) years following completion of the on-site storage cell, groundwater samples will be collected quarterly from each well.

(8) The total of the first two (2) years of quarterly groundwater monitoring ($27,200) is not included in the calculation of the first year annual cost because it is an extraordinary expense that will be incurred only for the first two (2) years of the operation and maintenance of the institutional controls. Instead, Molycorp will prepay this amount to the contractor which will be performing the quarterly groundwater monitoring during the first two (2) years.

(9) All six monitoring wells are assumed to require replacement every 20 years (Personal communication, Jack Robertson, 6/5/00). The cost of replacing 6 monitoring wells is assumed to be $7,000 (cost estimate from TERRA Testing, Inc., 2/28/00).

(10) Annual payment of $282 with NRC-specified rate of return (2.0% per annum) will generate sufficient funds for $7,000 outlay every 20 years. In accordance with the NRC's Draft Regulatory Guide DG-4006 at Section 4.2.3, the amount of financial assurance funding will be determined by multiplying the first year annual cost by 50.

(11) Monitoring of direct radiation exposure consists of four (4) environmental thermoluminescent dosimeters ("TLDs"). The installation cost is included in the cell construction cost and is not part of institutional control maintenance costs. Tamper proof TLD enclosures are $300 each with replacement assumed every five years. The labor cost for TLD change out is assumed to be 2 hours @ $35/hr. Analysis and reporting cost is $15 per TLD (telecon with Jeff Gunther, Teledyne Labs, Inc., 2/18/00).

(12) Annual payment of $225 with NRC-specified rate of return (2.0% per annum) will general sufficient funds for $1,200 outlay every 5 years. In accordance with the NRC's Draft Regulatory Guide DG-4006 at Section 4.2.3, the amount of financial assurance funding will be determined by multiplying the first year annual cost by 50.

(13) Cost estimate provided by Bruce McCampbell, Stone & Webster, 6/5/00. Cost data is from Means Building Construction Cost Data, 1997. Gravel road maintenance includes gravel hauling, delivery, placing, spreading, and grading, clearing drainage ditches, and snow removal.

(14) Cost estimate provided by Bruce McCampbell, Stone & Webster, 6/5/00. Cost data is from Means Building Construction Cost Data, 1997. Bridge maintenance includes structural inspection and appraisal report, sandblasting and painting girder ends, scaffolding, rolling tower, cleaning expansion joints, repairing railings, concrete spall repairs, and hydroblasting joints and cracks.

(15) Annual payment of $3,494 with NRC-specified rate of return (2% per annum) will generate sufficient funds for $7,200 outlay every 2 years. In accordance with the NRC's Draft Regulatory Guide DG-4006 at Section 4.2.3, the amount of financial assurance funding will be determined by multiplying the first year annual cost by 50.

(16) Annual payment of $3,493 with NRC-specified rate of return (2% per annum) will generate sufficient funds for $18,540 outlay every 5 years. In accordance with the NRC's Draft Regulatory Guide DG-4006 at Section 4.2.3, the amount of financial assurance funding will be determined by multiplying the first year annual cost by 50.

(17) Bridge replacement is assumed to occur every 50 years.

(18) Annual payment of $2,144 with NRC-specified rate of return (2% per annum) will generate sufficient funds for $185,000 outlay every 50 years. In accordance with the NRC's Draft Regulatory Guide DG-4006 at Section 4.2.3, the amount of financial assurance funding will be determined by multiplying the first year annual cost by 50.

(19) Annual site management fee of $5,000 to be paid to Site Maintenance Corporation for the operation and maintenance of the institutional controls. The management fee will cover the cost of the preparation of the annual report and the periodic filing of a "Notice of Prior Recordation" of the restrictive covenant and deed restriction in the Washington County land records as well as incidental expenses (e.g., photocopy and postage costs). Although included within the calculation of first year annual cost, this fee shall be paid to Site Maintenance Corporation only in the event of a default by Molycorp under the Agreement with Site Maintenance Corporation. The fee shall be paid from the fund established by the Trust Agreement.

(20) Period dependent costs (O&M and replacement) are present day (year 2000 costs) with no escalation or inflation multipliers.

Appendix C

Environmental and Economic Impact Summary

TABLE 6-1

Summary of Anticipated Environmental and Economic Impacts
Due to Implementation of Decommissioning Options

		Onsite Disposal Option	**Offsite Disposal**
Land Use	Remediation	Assumes change to current zoning is performed	No conflict with current land use and zoning
	Postremediation	Dedication of approximately 7 acres for storage cell, restricted access and land use	Restricted access and land use
Socioeconomic Resources	Remediation	Minor increase in jobs, payroll, and taxes (<1%)	Minor increase in jobs, payroll, and taxes (<1%)
	Postremediation	No significant impact to socioeconomic resources	Potential impact based on use of current storage area
Cultural Resources	Remediation	No adverse impacts to cultural resources	No adverse impacts to cultural resources
	Postremediation	No adverse impacts to cultural resources	No adverse impacts to cultural resources
Surface Water	Remediation	Excavation within the 100 yr. Flood plain. Erosion and sediment controls utilized	Excavation within the 100 yr. Flood plain. Erosion and sediment controls utilized
	Postremediation	No impact to surface water quality, minor increase in surface water quantity	No impact to surface water quantity or quality
Groundwater	Remediation	No groundwater effects outside the limits of excavation and construction	No groundwater effects outside the limits of excavation
	Postremediation	Infiltration of precipitation prohibited by impermeable cap layers. Semi-annual monitoring and analysis of groundwater monitoring wells	Semi-annual groundwater monitoring well analysis using existing wells
Air Quality	Remediation	No significant impact to air quality during remediation	No significant impact to air quality during remediation
	Postremediation	No change to existing conditions	No change to existing conditions

		Onsite Disposal Option	**Offsite Disposal**
Visibility	Remediation	Construction activities visible from I-70, The Circle, Caldwell Avenue and Weirich Avenue	Construction activities visible form I-70 and Caldwell Road
	Postremediation	Change in landscape will blend into surrounding topography	Minimal change to existing topographic configuration (pile removed)
Noise Sound Pressure Level	Remediation	No significant impact to sound pressure level	No significant impact to sound pressure level
	Postremediation	No change to existing sound pressure level	No change to existing sound pressure level
Human Health	Remediation	ALARA procedures implemented to minimize impact	ALARA procedures implemented to minimize impact
	Postremediation	Less exposure following remediation	Less exposure following remediation
Terrestrial Ecology	Remediation	No impact to terrestrial ecology	No impact to terrestrial ecology
	Postremediation	No impact to terrestrial ecology	No impact to terrestrial ecology
Aquatic Ecology	Remediation	No impact to aquatic ecology	No impact to aquatic ecology
	Postremediation	No impact to aquatic ecology	No impact to aquatic ecology
Estimated Cost		$26,029,000	$50,313,800

Appendix D

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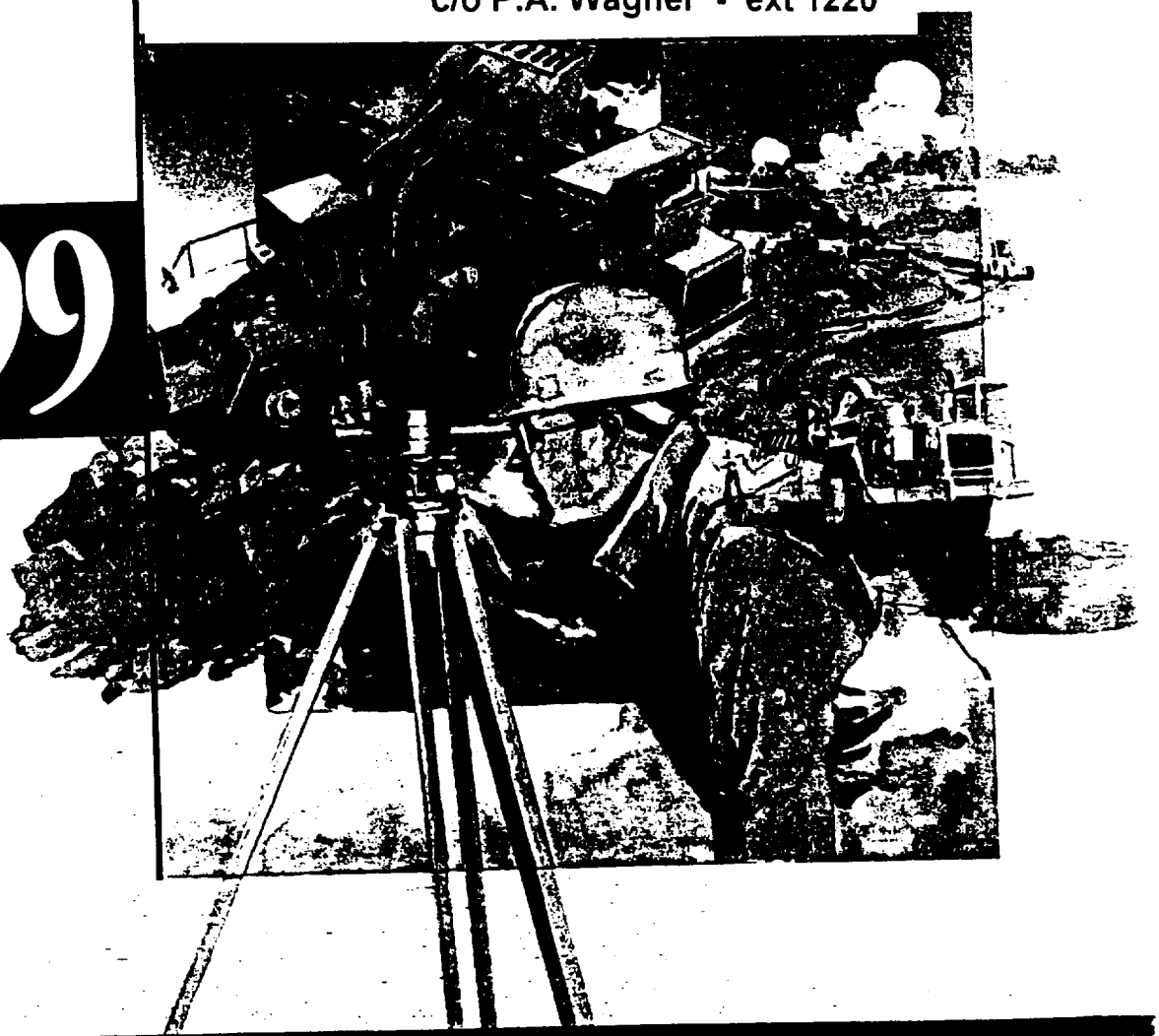

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020 750 | Concrete Removal

		CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1999 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P	
758 5160	8" thick	A-1	175	.046	S.F.		.98	.39	1.37	1.97	758
5400	Alternate pricing method, stone, 4" thick		60	.133	C.F.		2.86	1.14	4	5.75	
5420	8" thick		85	.094	"		2.02	.81	2.83	4.07	
880 0010	REMOVAL OF UNDERGROUND STORAGE TANKS (R020-880)										880
0011	Petroleum storage tanks, non-leaking										
0100	Excavate & load onto trailer										
0110	3000 gal. to 5000 gal. tank	B-14	4	12	Ea.		273	54.50	327.50	485	
0120	6000 gal to 8000 gal tank	B-3A	3	13.333			305	238	543	735	
0130	9000 gal to 12000 gal tank	"	2	20			455	355	810	1,100	
0190	Known leaking tank add				%				100%	100%	
0200	Remove sludge, water and remaining product from bottom										
0201	of tank with vacuum truck										
0300	3000 gal to 5000 gal tank	A-13	5	1.600	Ea.		43.50	105	148.50	181	
0310	6000 gal to 8000 gal tank		4	2			54.50	131	185.50	227	
0320	9000 gal to 12000 gal tank		3	2.667			72.50	175	247.50	300	
0390	Dispose of sludge off-site, average				Gal.					4	
0400	Insert solid carbon dioxide "dry ice" to produce inert gas										
0401	For cleaning/transporting tanks (1.5 lbs./100 gal. cap)	1 Clab	500	.016	Lb.	1.20	.34		1.54	1.86	
1020	Haul tank to certified salvage dump, 100 miles round trip										
1023	3000 gal. to 5000 gal. tank				Ea.				550	630	
1026	6000 gal. to 8000 gal. tank								650	750	
1029	9,000 gal. to 12,000 gal. tank								875	1,000	
1100	Disposal of contaminated soil to landfill										
1110	Minimum				C.Y.					100	
1111	Maximum				"					300	
1120	Disposal of contaminated soil to										
1121	bituminous concrete batch plant										
1130	Minimum				C.Y.					50	
1131	Maximum				"					100	
2010	Decontamination of soil on site incl poly tarp on top/bottom										
2011	Soil containment berm, and chemical treatment										
2020	Minimum	B-11C	100	.160	C.Y.	5.60	3.99	2.19	11.78	14.70	
2021	Maximum	"	100	.160		7.25	3.99	2.19	13.43	16.55	
2050	Disposal of decontaminated soil, minimum									60	
2055	Maximum									125	

021 100 | Site Clearing

		CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1999 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P	
04 0010	CLEAR AND GRUB Cut & chip light, trees to 6" diam.	B-7	1	48	Acre		1,100	1,175	2,275	3,025	104
0150	Grub stumps and remove	B-30	2	12			290	800	1,090	1,325	
0200	Cut & chip medium, trees to 12" diam.	B-7	.70	68.571			1,575	1,700	3,275	4,300	
0250	Grub stumps and remove	B-30	1	24			580	1,600	2,180	2,625	
0300	Cut & chip heavy, trees to 24" diam.	B-7	.30	160			3,675	3,950	7,625	10,100	
0350	Grub stumps and remove	B-30	.50	48			1,150	3,200	4,350	5,300	
0400	If burning is allowed, reduce cut & chip									40%	
3000	Chipping stumps, to 18" deep, 12" diam.	B-86	20	.400	Ea.		11.35	8.10	19.45	26.50	
3040	18" diameter		16	.500			14.20	10.15	24.35	32.50	
3080	24" diameter		14	.571			16.25	11.60	27.85	37.50	

022 100 | Grading

		CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1999 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P	
0010	**GRADING** Site excav. & fill, see div 022-200										104
0020	Fine grading, see div 025-122										

022 200 | Excav./Backfill/Compact.

		CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P	
0010	**BACKFILL** By hand, no compaction, light soil (R022-220)	1 Clab	14	.571	C.Y.		12.25		12.25	19.30	204
0100	Heavy soil		11	.727			15.60		15.60	24.50	
0300	Compaction in 6" layers, hand tamp, add to above		20.60	.388			8.35		8.35	13.10	
0400	Roller compaction operator walking, add	B-10A	100	.120			3.13	.93	4.06	5.85	
0500	Air tamp, add	B-9C	190	.211			4.60	.95	5.55	8.30	
0600	Vibrating plate, add	A-1	60	.133			2.86	1.14	4	5.75	
0800	Compaction in 12" layers, hand tamp, add to above	1 Clab	34	.235			5.05		5.05	7.95	
0900	Roller compaction operator walking, add	B-10A	150	.080			2.09	.62	2.71	3.88	
1000	Air tamp, add	B-9	285	.140			3.07	.63	3.70	5.55	
1100	Vibrating plate, add	A-1	90	.089			1.91	.76	2.67	3.84	
3000	For flowable fill, see div. 033-126										
0010	**BACKFILL, STRUCTURAL** Dozer or F.E. loader										208
0020	From existing stockpile, no compaction										
2000	75 H.P., 50' haul, sand & gravel	B-10L	1,100	.011	C.Y.		.28	.28	.56	.75	
2020	Common earth		975	.012			.32	.32	.64	.84	
2040	Clay		850	.014			.37	.36	.73	.97	
2200	150' haul, sand & gravel		550	.022			.57	.56	1.13	1.49	
2220	Common earth		490	.024			.64	.63	1.27	1.67	
2240	Clay		425	.028			.74	.72	1.46	1.93	
2400	300' haul, sand & gravel		370	.032			.85	.83	1.68	2.21	
2420	Common earth		330	.036			.95	.93	1.88	2.49	
2440	Clay		290	.041			1.08	1.06	2.14	2.83	
3000	105 H.P., 50' haul, sand & gravel	B-10W	1,350	.009			.23	.31	.54	.70	
3020	Common earth		1,225	.010			.26	.34	.60	.76	
3040	Clay		1,100	.011			.28	.38	.66	.86	
3200	150' haul, sand & gravel		670	.018			.47	.62	1.09	1.41	
3220	Common earth		610	.020			.51	.68	1.19	1.54	
3240	Clay		550	.022			.57	.76	1.33	1.70	
3300	300' haul, sand & gravel		465	.026			.67	.90	1.57	2.02	
3320	Common earth		415	.029			.75	1.01	1.76	2.27	
3340	Clay		370	.032			.85	1.13	1.98	2.54	
4000	200 H.P., 50' haul, sand & gravel	B-10B	2,500	.005			.13	.34	.47	.56	
4020	Common earth		2,200	.005			.14	.38	.52	.64	
4040	Clay		1,950	.006			.16	.43	.59	.72	
4200	150' haul, sand & gravel		1,225	.010			.26	.68	.94	1.14	
4220	Common earth		1,100	.011			.28	.76	1.04	1.28	
4240	Clay		975	.012			.32	.86	1.18	1.44	
4400	300' haul, sand & gravel		805	.015			.39	1.04	1.43	1.75	
4420	Common earth		735	.016			.43	1.14	1.57	1.91	
4440	Clay		660	.018			.47	1.27	1.74	2.13	
5000	300 H.P., 50' haul, sand & gravel	B-10M	3,170	.004			.10	.36	.46	.54	
5020	Common earth		2,900	.004			.11	.39	.50	.60	
5040	Clay		2,700	.004			.12	.42	.54	.64	
5200	150' haul, sand & gravel		2,200	.005			.14	.51	.65	.79	
5220	Common earth		1,950	.006			.16	.58	.74	.89	
5240	Clay		1,700	.007			.18	.67	.85	1.01	
5400	300' haul, sand & gravel		1,500	.008			.21	.75	.96	1.15	
5420	Common earth		1,350	.009			.23	.84	1.07	1.28	
5440	Clay		1,225	.010			.26	.92	1.18	1.41	
6000	For compaction, see div. 022-226										
6010	For trench backfill, see div. 022-254 & 258										

022 200 | Excav./Backfill/Compact.

			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1999 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P	
216	0010	BORROW, LOADING AND/OR SPREADING										216
	4000	Common earth, shovel, 1 C.Y. bucket	B-12N	840	.019	C.Y.	5.05	.51	.76	6.32	7.15	
	4010	1-1/2 C.Y. bucket	B-12O	1,135	.014		5.05	.38	.76	6.19	6.95	
	4020	3 C.Y. bucket	B-12T	1,800	.009		5.05	.24	.68	5.97	6.65	
	4030	Front end loader, wheel mounted										
	4050	3/4 C.Y. bucket	B-10R	550	.022	C.Y.	5.05	.57	.44	6.06	6.90	
	4060	1-1/2 C.Y. bucket	B-10S	970	.012		5.05	.32	.33	5.70	6.40	
	4070	3 C.Y. bucket	B-10T	1,575	.008		5.05	.20	.29	5.54	6.15	
	4080	5 C.Y. bucket	B-10U	2,600	.005		5.05	.12	.36	5.53	6.10	
	5000	Select granular fill, shovel, 1 C.Y. bucket	B-12N	925	.017		7.50	.46	.69	8.65	9.70	
	5010	1-1/2 C.Y. bucket	B-12O	1,250	.013		7.50	.34	.69	8.53	9.55	
	5020	3 C.Y. bucket	B-12T	1,980	.008		7.50	.22	.62	8.34	9.25	
	5030	Front end loader, wheel mounted										
	5050	3/4 C.Y. bucket	B-10R	800	.015	C.Y.	7.50	.39	.31	8.20	9.20	
	5060	1-1/2 C.Y. bucket	B-10S	1,065	.011		7.50	.29	.30	8.09	9.05	
	5070	3 C.Y. bucket	B-10T	1,735	.007		7.50	.18	.26	7.94	8.80	
	5080	5 C.Y. bucket	B-10U	2,850	.004		7.50	.11	.33	7.94	8.80	
	6000	Clay, till, or blasted rock, shovel, 1 C.Y. bucket	B-12N	715	.022		3.75	.60	.89	5.24	6	
	6010	1-1/2 C.Y. bucket	B-12O	965	.017		3.75	.44	.90	5.09	5.80	
	6020	3 C.Y. bucket	B-12T	1,530	.010		3.75	.28	.80	4.83	5.45	
	6030	Front end loader, wheel mounted										
	6035	3/4 C.Y. bucket	B-10R	465	.026	C.Y.	3.75	.67	.53	4.95	5.75	
	6040	1-1/2 C.Y. bucket	B-10S	825	.015		3.75	.38	.39	4.52	5.15	
	6045	3 C.Y. bucket	B-10T	1,340	.009		3.75	.23	.34	4.32	4.86	
	6050	5 C.Y. bucket	B-10U	2,200	.005		3.75	.14	.42	4.31	4.81	
	6060	Front end loader, track mounted										
	6065	1-1/2 C.Y. bucket	B-10N	715	.017	C.Y.	3.75	.44	.49	4.68	5.35	
	6070	3 C.Y. bucket	B-10P	1,190	.010		3.75	.26	.73	4.74	5.35	
	6075	5 C.Y. bucket	B-10Q	1,835	.007		3.75	.17	.62	4.54	5.05	
	7000	Topsoil or loam from stockpile, shovel, 1 C.Y. bucket	B-12N	840	.019		14.15	.51	.76	15.42	17.20	
	7010	1-1/2 C.Y. bucket	B-12O	1,135	.014		14.15	.38	.76	15.29	17	
	7020	3 C.Y. bucket	B-12T	1,800	.009		14.15	.24	.68	15.07	16.70	
	7030	Front end loader, wheel mounted										
	7050	3/4 C.Y. bucket	B-10R	550	.022	C.Y.	14.15	.57	.44	15.16	16.95	
	7060	1-1/2 C.Y. bucket	B-10S	970	.012		14.15	.32	.33	14.80	16.45	
	7070	3 C.Y. bucket	B-10T	1,575	.008		14.15	.20	.29	14.64	16.20	
	7080	5 C.Y. bucket	B-10U	2,600	.005		14.15	.12	.36	14.63	16.15	
	8900	For larger hauling units, deduct from above								30%		
	9000	Hauling only, excavated or borrow material, see div. 022-266										
	9200	For flowable fill, see section 033-126										
226	0010	COMPACTION R022-220										226
	5000	Riding, vibrating roller, 6" lifts, 2 passes	B-10Y	3,000	.004	C.Y.		.10	.12	.22	.29	
	5020	3 passes		2,300	.005			.14	.15	.29	.38	
	5040	4 passes		1,900	.006			.16	.19	.35	.45	
	5060	12" lifts, 2 passes		5,200	.002			.06	.07	.13	.16	
	5080	3 passes		3,500	.003			.09	.10	.19	.25	
	5100	4 passes		2,600	.005			.12	.14	.26	.33	
	5600	Sheepsfoot or wobbly wheel roller, 6" lifts, 2 passes	B-10G	2,400	.005			.13	.23	.36	.46	
	5620	3 passes		1,735	.007			.18	.32	.50	.63	
	5640	4 passes		1,300	.009			.24	.43	.67	.84	
	5680	12" lifts, 2 passes		5,200	.002			.06	.11	.17	.21	
	5700	3 passes		3,500	.003			.09	.16	.25	.32	
	5720	4 passes		2,600	.005			.12	.21	.33	.42	
	6000	Towed sheepsfoot or wobbly wheel roller, 6" lifts, 2 passes	B-10D	10,000	.001			.03	.10	.13	.16	
	6020	3 passes		2,000	.006			.16	.48	.64	.77	
	6030	4 passes		1,500	.008			.21	.64	.85	1.03	

022 200 | Excav./Backfill/Compact.

			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1999 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P	
234	2800	Boulders under 1/2 C.Y., loaded on truck, no hauling	B-10O	80	.150	C.Y.		3.91	6.40	10.31	13	234
	2900	Boulders, drilled, blasted	B-47	100	.240		1.60	5.75	6.20	13.55	17.50	
	3100	Jackhammer operators with foreman compressor, air tools	B-9	1	40	Day		875	180	1,055	1,575	
	3300	Track drill, compressor, operator and foreman	B-47	1	24	"		575	620	1,195	1,575	
	3500	Blasting caps				Ea.	3			3	3.30	
	3900	Blasting mats, rent, for first day					90			90	99	
	4000	Per added day					30			30	33	
	4200	Preblast survey for 6 room house, individual lot, minimum	A-6	2.40	6.667			171		171	260	
	4300	Maximum	"	1.35	11.852			305		305	460	
	4500	City block within zone of influence, minimum	A-8	25,200	.001	S.F.		.03		.03	.05	
	4600	Maximum	"	15,100	.002	"		.05		.05	.08	
	5000	Excavate and load boulders, less than 0.5 C.Y.	B-10T	80	.150	C.Y.		3.91	5.65	9.56	12.20	
	5020	0.5 C.Y. to 1 C.Y.	B-10U	100	.120			3.13	9.25	12.38	15	
	5200	Excavate and load blasted rock, 3 C.Y. power shovel	B-12T	1,530	.010			.28	.80	1.08	1.30	
	5400	Haul boulders, 25 Ton off-highway dump, 1 mile round trip	B-34E	330	.024			.54	2.12	2.66	3.15	
	5420	2 mile round trip		275	.029			.64	2.54	3.18	3.78	
	5440	3 mile round trip		225	.036			.79	3.11	3.90	4.62	
	5460	4 mile round trip		200	.040			.88	3.50	4.38	5.20	
	5600	Bury boulders on site, less than 0.5 C.Y., 300 H.P. dozer										
	5620	150' haul	B-10M	310	.039	C.Y.		1.01	3.65	4.66	5.55	
	5640	300' haul		210	.057			1.49	5.40	6.89	8.20	
	5800	0.5 to 1 C.Y., 300 H.P. dozer, 150' haul		300	.040			1.04	3.77	4.81	5.75	
	5820	300' haul		200	.060			1.56	5.65	7.21	8.60	
238	0010	**EXCAVATING, BULK BANK MEASURE** Common earth piled (R022-240)										238
	0020	For loading onto trucks, add								15%	15%	
	0050	For mobilization and demobilization, see division 022-274 (R022-250)										
	0100	For hauling, see division 022-266										
	0200	Backhoe, hydraulic, crawler mtd., 1 C.Y. cap. = 75 C.Y./hr.	B-12A	600	.027	C.Y.		.71	.91	1.62	2.08	
	0250	1-1/2 C.Y. cap. = 100 C.Y./hr.	B-12B	800	.020			.53	.89	1.42	1.79	
	0260	2 C.Y. cap. = 130 C.Y./hr.	B-12C	1,040	.015			.41	.98	1.39	1.71	
	0300	3 C.Y. cap. = 160 C.Y./hr.	B-12D	1,280	.013			.33	1.68	2.01	2.36	
	0310	Wheel mounted, 1/2 C.Y. cap. = 30 C.Y./hr.	B-12E	240	.067			1.78	1.40	3.18	4.25	
	0360	3/4 C.Y. cap. = 45 C.Y./hr.	B-12F	360	.044			1.19	1.25	2.44	3.18	
	0500	Clamshell, 1/2 C.Y. cap. = 20 C.Y./hr.	B-12G	160	.100			2.67	3.26	5.93	7.65	
	0550	1 C.Y. cap. = 35 C.Y./hr.	B-12H	280	.057			1.53	2.05	3.58	4.57	
	0950	Dragline, 1/2 C.Y. cap. = 30 C.Y./hr.	B-12I	240	.067			1.78	2.19	3.97	5.10	
	1000	3/4 C.Y. cap. = 35 C.Y./hr.	"	280	.057			1.53	1.88	3.41	4.38	
	1050	1-1/2 C.Y. cap. = 65 C.Y./hr.	B-12P	520	.031			.82	1.45	2.27	2.84	
	1100	3 C.Y. cap. = 112 C.Y./hr.	B-12V	900	.018			.47	1.12	1.59	1.96	
	1200	Front end loader, track mtd., 1-1/2 C.Y. cap. = 70 C.Y./hr.	B-10N	560	.021			.56	.63	1.19	1.55	
	1250	2-1/2 C.Y. cap. = 95 C.Y./hr.	B-10O	760	.016			.41	.67	1.08	1.37	
	1300	3 C.Y. cap. = 130 C.Y./hr.	B-10P	1,040	.012			.30	.83	1.13	1.38	
	1350	5 C.Y. cap. = 160 C.Y./hr.	B-10Q	1,280	.009			.24	.89	1.13	1.36	
	1500	Wheel mounted, 3/4 C.Y. cap. = 45 C.Y./hr.	B-10R	360	.033			.87	.68	1.55	2.09	
	1550	1-1/2 C.Y. cap. = 80 C.Y./hr.	B-10S	640	.019			.49	.50	.99	1.30	
	1600	2-1/4 C.Y. cap. = 100 C.Y./hr.	B-10T	800	.015			.39	.56	.95	1.22	
	1601	3 C.Y. cap. = 140 C.Y./hr.	"	1,120	.011			.28	.40	.68	.87	
	1650	5 C.Y. cap. = 185 C.Y./hr.	B-10U	1,480	.008			.21	.63	.84	1.01	
	1800	Hydraulic excavator, truck mtd, 1/2 C.Y. = 30 C.Y./hr.	B-12J	240	.067			1.78	2.65	4.43	5.65	
	1850	48 inch bucket, 1 C.Y. = 45 C.Y./hr.	B-12K	360	.044			1.19	2.24	3.43	4.27	
	3700	Shovel, 1/2 C.Y. capacity = 55 C.Y./hr.	B-12L	440	.036			.97	1.20	2.17	2.80	
	3750	3/4 C.Y. capacity = 85 C.Y./hr.	B-12M	680	.024			.63	.87	1.50	1.92	
	3800	1 C.Y. capacity = 120 C.Y./hr.	B-12N	960	.017			.45	.66	1.11	1.41	
	3850	1-1/2 C.Y. capacity = 160 C.Y./hr.	B-12O	1,280	.013			.33	.68	1.01	1.25	
	3900	3 C.Y. cap. = 250 C.Y./hr.	B-12T	2,000	.008			.21	.61	.82	1.01	

022 200 | Excav./Backfill/Compact.

		CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1999 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P	
58 0860	24" wide trench, 9' deep, light soil	B-54B	4,981	.002	C.Y.		.06	.11	.17	.20	258
0870	Medium soil		4,000	.002			.07	.14	.21	.26	
0880	Heavy soil		3,237	.003			.08	.17	.25	.32	
1000	Backfill by hand including compaction, add										
1050	4" wide trench, 12" deep	A-1	800	.010	L.F.		.21	.09	.30	.43	
1100	18" deep		530	.015			.32	.13	.45	.65	
1150	24" deep		400	.020			.43	.17	.60	.87	
1300	6" wide trench, 12" deep		540	.015			.32	.13	.45	.64	
1350	18" deep		405	.020			.42	.17	.59	.86	
1400	24" deep		270	.030			.64	.25	.89	1.28	
1450	36" deep		180	.044			.95	.38	1.33	1.92	
1600	8" wide trench, 12" deep		400	.020			.43	.17	.60	.87	
1650	18" deep		265	.030			.65	.26	.91	1.30	
1700	24" deep		200	.040			.86	.34	1.20	1.73	
1750	36" deep		135	.059			1.27	.51	1.78	2.56	
2000	Chain trencher, 40 H.P. operator riding										
2050	6" wide trench and backfill, 12" deep	B-54	1,200	.007	L.F.		.18	.18	.36	.47	
2100	18" deep		1,000	.008			.22	.21	.43	.56	
2150	24" deep		975	.008			.22	.22	.44	.58	
2200	36" deep		900	.009			.24	.23	.47	.63	
2250	48" deep		750	.011			.29	.28	.57	.75	
2300	60" deep		650	.012			.33	.32	.65	.87	
2400	8" wide trench and backfill, 12" deep		1,000	.008			.22	.21	.43	.56	
2450	18" deep		950	.008			.23	.22	.45	.59	
2500	24" deep		900	.009			.24	.23	.47	.63	
2550	36" deep		800	.010			.27	.26	.53	.70	
2600	48" deep		650	.012			.33	.32	.65	.87	
2700	12" wide trench and backfill, 12" deep		975	.008			.22	.22	.44	.58	
2750	18" deep		860	.009			.25	.25	.50	.65	
2800	24" deep		800	.010			.27	.26	.53	.70	
2850	36" deep		725	.011			.30	.29	.59	.78	
3000	16" wide trench and backfill, 12" deep		835	.010			.26	.25	.51	.68	
3050	18" deep		750	.011			.29	.28	.57	.75	
3100	24" deep		700	.011			.31	.30	.61	.80	
3200	Compaction with vibratory plate, add								50%	50%	
9100	For clay or till, add up to								150%	150%	
62 0010	FILL Spread dumped material, by dozer, no compaction	B-10B	1,000	.012	C.Y.		.31	.84	1.15	1.40	262
0100	By hand	1 Clab	12	.667			14.30		14.30	22.50	
0150	Spread fill, from stockpile with 2-1/2 C.Y. F.E. loader										
0170	130 H.P., 300' haul	B-10P	600	.020	C.Y.		.52	1.44	1.96	2.39	
0190	With dozer 300 H.P., 300' haul	B-10M	600	.020			.52	1.89	2.41	2.87	
0400	For compaction of embankment, see div. 022-226										
0500	Gravel fill, compacted, under floor slabs, 4" deep	B-37	10,000	.005	S.F.	.15	.11	.02	.28	.36	
0600	6" deep		8,600	.006		.23	.13	.02	.38	.47	
0700	9" deep		7,200	.007		.38	.15	.02	.55	.67	
0800	12" deep		6,000	.008		.52	.18	.03	.73	.89	
1000	Alternate pricing method, 4" deep		120	.400	C.Y.	11.25	9.10	1.27	21.62	28	
1100	6" deep		160	.300		11.25	6.80	.95	19	24	
1200	9" deep		200	.240		11.25	5.45	.76	17.46	22	
1300	12" deep		220	.218		11.25	4.96	.69	16.90	21	
1500	For fill under exterior paving, see division 022-308										
66 0011	HAULING Excavated or borrow material, loose cubic yards (R022-240)										266
0015	no loading included, highway haulers										
0020	6 C.Y. dump truck, 1/4 mile round trip, 5.0 loads/hr.	B-34A	195	.041	C.Y.		.91	1.37	2.78	3.44	
0030	1/2 mile round trip, 4.1 loads/hr.		160	.050			1.11	2.28	3.39	4.19	

022 200 | Excav./Backfill/Compact.

			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1999 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
266	0040	1 mile round trip, 3.3 loads/hr. (R022-240)	B-34A	130	.062	C.Y.		1.36	2.80	4.16	5.15
	0100	2 mile round trip, 2.6 loads/hr.		100	.080			1.77	3.64	5.41	6.70
	0150	3 mile round trip, 2.1 loads/hr.		80	.100			2.21	4.55	6.76	8.40
	0200	4 mile round trip, 1.8 loads/hr.		70	.114			2.53	5.20	7.73	9.55
	0310	12 C.Y. dump truck, 1/4 mile round trip 3.7 loads/hr.	B-34B	288	.028			.61	1.54	2.15	2.63
	0320	1/2 mile round trip, 3.2 loads/hr.		250	.032			.71	1.77	2.48	3.03
	0330	1 mile round trip 2.7, loads/hr.		210	.038			.84	2.11	2.95	3.61
	0400	2 mile round trip, 2.2 loads/hr.		180	.044			.98	2.46	3.44	4.20
	0450	3 mile round trip, 1.9 loads/hr.		170	.047			1.04	2.60	3.64	4.45
	0500	4 mile round trip, 1.6 loads/hr.		125	.064			1.41	3.54	4.95	6.05
	0540	5 mile round trip, 1 load/hr.		78	.103			2.27	5.65	7.92	9.70
	0550	10 mile round trip, 0.60 load/hr.		58	.138			3.05	7.60	10.65	13.05
	0560	20 mile round trip, 0.4 load/hr.		39	.205			4.53	11.35	15.88	19.40
	0600	16.5 C.Y. dump trailer, 1 mile round trip, 2.6 loads/hr.	B-34C	280	.029			.63	2	2.63	3.17
	0700	2 mile round trip, 2.1 loads/hr.		225	.036			.79	2.48	3.27	3.93
	1000	3 mile round trip, 1.8 loads/hr.		193	.041			.92	2.90	3.82	4.59
	1100	4 mile round trip, 1.6 loads/hr.		172	.047			1.03	3.25	4.28	5.15
	1110	5 mile round trip, 1 load/hr.		108	.074			1.64	5.15	6.79	8.20
	1120	10 mile round trip, .60 load/hr.		80	.100			2.21	7	9.21	11.10
	1130	20 mile round trip, .4 load/hr.		54	.148			3.27	10.35	13.62	16.40
	1150	20 C.Y. dump trailer, 1 mile round trip, 2.5 loads/hr.	B-34D	325	.025			.54	1.73	2.27	2.73
	1200	2 mile round trip, 2 loads/hr.		260	.031			.68	2.16	2.84	3.42
	1220	3 mile round trip, 1.7 loads/hr.		221	.036			.80	2.54	3.34	4.02
	1240	4 mile round trip, 1.5 loads/hr.		195	.041			.91	2.88	3.79	4.56
	1245	5 mile round trip, 1.1 load/hr.		143	.056			1.24	3.93	5.17	6.20
	1250	10 mile round trip, .75 load/hr.		110	.073			1.61	5.10	6.71	8.05
	1255	20 mile round trip, .5 load/hr.		78	.103			2.27	7.20	9.47	11.35
	1300	Hauling in medium traffic, add								20%	20%
	1400	Heavy traffic, add								30%	30%
	1600	Grading at dump, or embankment if required, by dozer	B-10B	1,000	.012			.31	.84	1.15	1.40
	1800	Spotter at fill or cut, if required	1 Clab	8	1	Hr.		21.50		21.50	34
	2000	Off highway haulers									
	2010	22 C.Y. rear/bottom dump, 1000' rnd trip, 4.5 loads/hr.	B-34F	645	.012	C.Y.		.27	1.61	1.88	2.19
	2020	1/2 mile round trip, 4.2 loads/hr.		600	.013			.29	1.73	2.02	2.35
	2030	1 mile round trip, 3.9 loads/hr.		555	.014			.32	1.87	2.19	2.55
	2040	2 mile round trip, 3.3 loads/hr.		470	.017			.38	2.21	2.59	3.01
	2050	34 C.Y. rear or bottom dump, 1000' round trip, 4 loads/hr.	B-34G	885	.009			.20	1.58	1.78	2.05
	2060	1/2 mile round trip, 3.8 loads/hr.		840	.010			.21	1.67	1.88	2.15
	2070	1 mile round trip, 3.5 loads/hr.		775	.010			.23	1.81	2.04	2.34
	2080	2 mile round trip, 3.0 loads/hr.		665	.012			.27	2.11	2.38	2.73
	2090	42 C.Y. rear or bottom dump, 1000' round trip, 3.8 loads/hr.	B-34H	1,040	.008			.17	1.54	1.71	1.95
	2100	1/2 mile round trip, 3.6 loads/hr.		980	.008			.18	1.63	1.81	2.07
	2110	1 mile round trip, 3.3 loads/hr.		900	.009			.20	1.78	1.98	2.25
	2120	2 mile round trip, 2.8 loads/hr.		765	.010			.23	2.09	2.32	2.65
	2130	60 C.Y. rear or bottom dump, 1000' round trip, 3.6 loads/hr.	B-34J	1,400	.006			.13	1.60	1.73	1.95
	2140	1/2 mile round trip, 3.4 loads/hr.		1,325	.006			.13	1.69	1.82	2.06
	2150	1 mile round trip, 3.1 loads/hr.		1,200	.007			.15	1.86	2.01	2.28
	2160	2 mile round trip, 2.6 loads/hr.		1,015	.008			.17	2.20	2.37	2.70
	3000	Rough terrain or steep grades, add to above								100%	
	4500	Dust control, light	B-59	1	8	Day		177	530	707	850
	4501	Heavy		.50	16			355	1,050	1,405	1,725
	4600	Haul road maintenance	B-86A	1	8			227	575	802	980
	4700	Highway hauling beyond 20 miles, per loaded mile, minimum				Mile					1
	4750	Maximum									2
270	0010	**HORIZONTAL BORING** Casing only, 100' minimum,									
	0020	not incl. jacking pits or dewatering									

Important: See the Reference Section for critical

022 200 | Excav./Backfill/Compact.

			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1999 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P	
270	0100	Roadwork, 1/2" thick wall, 24" diameter casing	B-42	14	4.571	L.F.	45	110	80	235	315	270
	0200	36" diameter		12	5.333		75	129	93.50	297.50	390	
	0300	48" diameter		12	5.333		105	129	93.50	327.50	425	
	0500	Railroad work, 24" diameter		10	6.400		45	155	112	312	420	
	0600	36" diameter		9.50	6.737		75	163	118	356	475	
	0700	48" diameter		9	7.111		105	172	125	402	530	
	0900	For ledge, add								145	175	
	1000	Small diameter boring, 3", sandy soil	B-82	900	.018		13	.43	.05	13.48	15.05	
	1040	Rocky soil	"	500	.032		13	.78	.10	13.88	15.60	
	1100	Prepare jacking pits, incl. mobilization & demobilization, minimum				Ea.				2,650	3,150	
	1101	Maximum				"				15,000	18,000	
274	0010	**MOBILIZATION OR DEMOBILIZATION** Up to 50 miles (R016-410)										274
	0020	Dozer, loader, backhoe or excavator, 70 H.P.- 250 H.P.	B-34K	6	1.333	Ea.		29.50	152	181.50	213	
	0100	Above 250 H.P		4	2			44	228	272	320	
	0300	Scraper, towed type (incl. tractor), 6 C.Y. capacity		3.75	2.133			47	244	291	340	
	0400	10 C.Y.		3.50	2.286			50.50	261	311.50	365	
	0600	Self-propelled scraper, 15 C.Y.		3.30	2.424			53.50	277	330.50	385	
	0700	24 C.Y.		3	2.667			59	305	364	425	
	0900	Shovel or dragline, 3/4 C.Y.		3.60	2.222			49	254	303	355	
	1000	1-1/2 C.Y.		3	2.667			59	305	364	425	
	1100	Delivery charge for small equipment on flatbed trailer, minimum									40	
	1150	Maximum									100	
	3000	For large pieces of equipment, allow for knockdown, assembly										
	3001	and lead and tail vehicles for highway transport										
278	0010	**RIPPING** Trap rock, soft, 200 HP dozer, ideal conditions	B-10B	710	.017	C.Y.		.44	1.18	1.62	1.98	278
	1500	Adverse conditions	"	660	.018			.47	1.27	1.74	2.13	
	1600	Medium hard, 300 HP dozer, ideal conditons	B-10M	600	.020			.52	1.89	2.41	2.87	
	1700	Adverse conditions	"	540	.022			.58	2.09	2.67	3.19	
	2000	Very hard, 460 HP dozer, ideal conditions	B-10X	300	.040			1.04	4.60	5.64	6.65	
	2100	Adverse conditions	"	270	.044			1.16	5.10	6.26	7.40	
	2200	Shale, soft, 200 HP dozer, ideal conditons	B-10B	850	.014			.37	.99	1.36	1.66	
	2300	Adverse conditions	"	790	.015			.40	1.06	1.46	1.78	
	2310	Grader rear ripper, 180 H.P. ideal conditions	B-11L	740	.022			.54	.78	1.32	1.69	
	2320	Adverse conditions	"	630	.025			.63	.91	1.54	1.98	
	2400	Medium hard, 300 HP dozer, ideal conditons	B-10M	720	.017			.43	1.57	2	2.40	
	2500	Adverse conditions	"	650	.018			.48	1.74	2.22	2.65	
	2510	Grader rear ripper, 180 H.P. ideal conditions	B-11L	625	.026			.64	.92	1.56	2	
	2520	Adverse conditions	"	530	.030			.75	1.09	1.84	2.35	
	2600	Very hard, 460 HP dozer, ideal conditons	B-10X	360	.033			.87	3.83	4.70	5.55	
	2700	Adverse conditions	"	320	.038			.98	4.31	5.29	6.25	
	2800	Till, boulder clay/hardpan, soft, 200 H.P. dozer, ideal conditions	B-10B	1,400	.009			.22	.60	.82	1	
	2810	Adverse conditions	"	1,315	.009			.24	.64	.88	1.07	
	2815	Grader rear ripper, 180 H.P. ideal conditions	B-11L	1,500	.011			.27	.38	.65	.83	
	2816	Adverse conditions	"	1,275	.013			.31	.45	.76	.98	
	2820	Medium hard, 300 H.P. dozer, ideal conditions	B-10M	1,200	.010			.26	.94	1.20	1.44	
	2830	Adverse conditions	"	1,080	.011			.29	1.05	1.34	1.59	
	2835	Grader rear ripper, 180 H.P. ideal conditions	B-11L	1,300	.012			.31	.44	.75	.96	
	2836	Adverse conditions	"	1,100	.015			.36	.52	.88	1.14	
	2840	Very hard, 460 H.P. dozer, ideal conditions	B-10X	600	.020			.52	2.30	2.82	3.33	
	2850	Adverse conditions	"	530	.023			.59	2.60	3.19	3.77	
	3000	Dozing ripped material, 200 HP, 100' haul	B-10B	700	.017			.45	1.20	1.65	2.01	
	3050	300' haul	"	250	.048			1.25	3.36	4.61	5.60	
	3200	300 HP, 100' haul	B-10M	1,150	.010			.27	.98	1.25	1.50	
	3250	300' haul	"	400	.030			.78	2.83	3.61	4.31	

022 200 | Excav./Backfill/Compact.

			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1999 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P	
278	3400	460 HP, 100' haul	B-10X	1,680	.007	C.Y.		.19	.82	1.01	1.19	278
	3450	300' haul	"	600	.020			.52	2.30	2.82	3.33	
286	0010	**LOAM OR TOPSOIL** Remove and stockpile on site										286
	0020	6" deep, 200' haul	B-10B	865	.014	C.Y.		.36	.97	1.33	1.63	
	0100	300' haul		520	.023			.60	1.61	2.21	2.69	
	0150	500' haul		225	.053			1.39	3.73	5.12	6.25	
	0200	Alternate method: 6" deep, 200' haul		5,090	.002	S.Y.		.06	.16	.22	.27	
	0250	500' haul		1,325	.009	"		.24	.63	.87	1.06	
	0400	Spread from pile to rough finish grade, F.E. loader, 1.5 C.Y.	B-10S	200	.060	C.Y.		1.56	1.60	3.16	4.16	
	0500	Up to 200' radius, by hand	1 Clab	14	.571			12.25		12.25	19.30	
	0600	Top dress by hand, 1 C.Y. for 600 S.F.	"	11.50	.696		18.25	14.90		33.15	43.50	
	0700	Furnish and place, truck dumped, screened, 4" deep	B-10S	1,300	.009	S.Y.	2.28	.24	.25	2.77	3.15	
	0800	6" deep	"	820	.015	"	2.92	.38	.39	3.69	4.23	

022 300 | Pavement Base

304	0010	**BASE** Prepare and roll sub-base, small areas to 2500 S.Y.	B-32A	1,500	.016	S.Y.		.42	.66	1.08	1.37	304
	0100	Large areas over 2500 S.Y.	B-32	3,700	.009	"		.23	.45	.68	.84	
308	0010	**BASE COURSE** For roadways and large paved areas										308
	0050	Crushed 3/4" stone base, compacted, 3" deep R025-110	B-36B	5,200	.012	S.Y.	3.07	.31	.63	4.01	4.55	
	0100	6" deep		5,000	.013		6.15	.32	.65	7.12	8	
	0200	9" deep		4,600	.014		9.25	.35	.71	10.31	11.45	
	0300	12" deep		4,200	.015		12.55	.38	.78	13.71	15.30	
	0301	Crushed 1-1/2" stone base, compacted to 4" deep		6,000	.011		3.78	.27	.54	4.59	5.15	
	0302	6" deep		5,400	.012		5.80	.30	.60	6.70	7.45	
	0303	8" deep		4,500	.014		7.55	.36	.73	8.64	9.70	
	0304	12" deep		3,800	.017		11.60	.43	.86	12.89	14.35	
	0350	Bank run gravel, spread and compacted										
	0370	6" deep	B-32	6,000	.005	S.Y.	2.34	.14	.28	2.76	3.10	
	0390	9" deep		4,900	.007		3.44	.17	.34	3.95	4.43	
	0400	12" deep		4,200	.008		4.68	.20	.40	5.28	5.90	
	0500	Bituminous concrete, 4" thick	B-25	4,545	.019		6	.46	.39	6.85	7.75	
	0550	6" thick		3,700	.024		8.80	.56	.48	9.84	11.10	
	0560	8" thick		3,000	.029		11.75	.69	.60	13.04	14.65	
	0570	10" thick		2,545	.035		14.55	.81	.70	16.06	18.05	
	0600	Cold laid asphalt pavement, see div. 025-116										
	0700	Liquid application to gravel base, asphalt emulsion	B-45	6,000	.003	Gal.	1.50	.07	.12	1.69	1.89	
	0800	Prime and seal, cut back asphalt		6,000	.003	"	1.77	.07	.12	1.96	2.19	
	1000	Macadam penetration crushed stone, 2 gal. per S.Y., 4" thick		6,000	.003	S.Y.	3	.07	.12	3.19	3.54	
	1100	6" thick, 3 gal. per S.Y.		4,000	.004		4.50	.10	.19	4.79	5.30	
	1200	8" thick, 4 gal. per S.Y.		3,000	.005		6	.13	.25	6.38	7.10	
	1500	Alternate method to figure base course										
	1510	Crushed stone, 3/4" maximum size, 3" deep	B-36B	800	.080	C.Y.	37.50	2.02	4.08	43.60	48.50	
	1511	6" deep		1,500	.043		37.50	1.08	2.18	40.76	45	
	1512	9" deep		1,650	.039		37.50	.98	1.98	40.46	44.50	
	1513	12" deep		1,800	.036		37.50	.90	1.81	40.21	44.50	
	1520	Crushed stone, 1-1/2" maximum size, 4" deep		670	.096		34.50	2.41	4.87	41.78	47	
	1521	6" deep		750	.085		34.50	2.16	4.35	41.01	46	
	1522	8" deep		765	.084		34.50	2.11	4.27	40.88	46	
	1523	12" deep		785	.082		34.50	2.06	4.16	40.72	45.50	
	1530	Gravel, bank run, 6" deep	B-32A	650	.037		13.80	.96	1.53	16.29	18.30	
	1531	9" deep		720	.033		13.80	.87	1.39	16.06	18	
	1532	12" deep		785	.031		13.80	.80	1.27	15.87	17.75	
	2000	Alternate method to figure base course										
	2005	Bituminous concrete, 4" thick	B-25	1,000	.088	Ton	26.50	2.07	1.79	30.36	34.50	
	2006	6" thick		1,220	.072		26.50	1.70	1.47	29.67	34	

022 | Earthwork

022 400 | Soil Stabilization

			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1999 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P	
412	2100	4% mix, 6" deep	B-74	1,800	.036	S.Y.	2.13	.90	1.81	4.84	5.70	412
	2120	8" deep		1,700	.038		2.88	.95	1.92	5.75	6.75	
	2160	12" deep		1,550	.041		4.31	1.05	2.10	7.46	8.65	
	2200	6% mix, 6" deep		1,800	.036		3.23	.90	1.81	5.94	6.95	
	2220	8" deep		1,700	.038		4.31	.95	1.92	7.18	8.30	
	2260	12" deep		1,550	.041		6.40	1.05	2.10	9.55	11	

022 500 | Vibroflotation

504	0010	VIBROFLOTATION										504
	0900	Vibroflotation compacted sand cylinder, minimum	B-60	750	.075	V.L.F.		1.86	1.34	3.20	4.33	
	0950	Maximum		325	.172			4.29	3.08	7.37	10	
	1100	Vibro replacement compacted stone cylinder, minimum		500	.112			2.79	2	4.79	6.50	
	1150	Maximum		250	.224			5.55	4.01	9.56	13	
	1300	Mobilization and demobilization, minimum		.47	119	Total		2,975	2,125	5,100	6,925	
	1400	Maximum		.14	400	"		9,950	7,150	17,100	23,200	

022 700 | Slope/Erosion Control

702	0010	CUT DRAINAGE DITCH Common earth, 30'w x 1'deep	B-11L	6,000	.003	L.F.		.07	.10	.17	.21	702
	0200	Clay and till		4,200	.004			.09	.14	.23	.30	
	0250	Clean wet drainage ditch, 30' wide		10,000	.002			.04	.06	.10	.12	
704	0010	EROSION CONTROL Jute mesh, 100 S.Y. per roll, 4' wide, stapled	B-80A	2,400	.010	S.Y.	.72	.21	.07	1	1.21	704
	0060	Nylon, 3 dimensional geomatrix, 9 mil thick		700	.034		3.85	.74	.26	4.85	5.70	
	0062	12 mil thick		515	.047		4	1	.35	5.35	6.35	
	0064	18 mil thick		460	.052		5	1.12	.39	6.51	7.70	
	0070	Paper biodegradable mesh	B-1	2,500	.010		.07	.21		.28	.41	
	0080	Paper mulch	B-64	20,000	.001		.05	.02	.01	.08	.11	
	0100	Plastic netting, stapled, 2" x 1" mesh, 20 mil	B-1	2,500	.010		40	.21		.61	.77	
	0120	Revegetation mat, webbed	2 Clab	1,000	.016		2.88	.34		3.22	3.70	
	0200	Polypropylene mesh, stapled, 6.5 oz./S.Y.	B-1	2,500	.010		1	.21		1.21	1.43	
	0300	Tobacco netting, or jute mesh #2, stapled	"	2,500	.010		.07	.21		.28	.41	
	0400	Soil sealant, liquid sprayed from truck	B-81	5,000	.005		.40	.12	.12	.64	.75	
	1000	Silt fence, polypropylene, 3' high, ideal conditions	2 Clab	1,600	.010	L.F.	.35	.21		.56	.73	
	1100	Adverse conditions	"	950	.017	"	.28	.36		.64	.88	
	1130	Cellular confinement, poly, 3-dimen, 8' x 20' panels, 4" deep cell	B-6	1,600	.015	S.F.	.89	.35	.14	1.38	1.67	
	1140	8" deep cells	"	1,200	.020	"	1.60	.47	.18	2.25	2.69	
	1200	Place and remove hay bales	A-2	3	8	Ton	50	172	57.50	279.50	385	
	1250	Hay bales, staked	"	1,800	.013	L.F.	6	.29	.10	6.39	7.15	
706	0010	MEMBRANE LINING SYSTEMS, HDPE, 100,000 S.F. or more										706
	0100	30 mil thick	3 Skwk	1,850	.013	S.F.	.30	.36		.66	.90	
	0200	60 mil thick		1,600	.015		.60	.42		1.02	1.32	
	0300	120 mil thick		1,440	.017		1.20	.47		1.67	2.06	
708	0010	RETAINING WALLS Aluminized steel bin, excavation										708
	0020	and backfill not included, 10' wide										
	0100	4' high, 5.5' deep	B-13	650	.086	S.F.	14.50	2	.85	17.35	20	
	0200	8' high, 5.5' deep		615	.091		16.70	2.12	.89	19.71	22.50	
	0300	10' high, 7.7' deep		580	.097		17.55	2.24	.95	20.74	24	
	0400	12' high, 7.7' deep		530	.106		18.95	2.46	1.04	22.45	26	
	0500	16' high, 7.7' deep		515	.109		20	2.53	1.07	23.60	27	
	1800	Concrete gravity wall with vertical face including excavation & backfill										
	1850	No reinforcing										
	1900	6' high, level embankment	C-17C	36	2.306	L.F.	43	65.50	11.45	119.95	163	
	2000	33° slope embankment		32	2.594		40.50	74	12.85	127.35	175	
	2200	8' high, no surcharge		27	3.074		55.50	87.50	15.25	158.25	216	

Important: See the Reference Section

023 | Tunneling, Piles & Caissons

023 800 | Caissons

			Crew	Daily Output	Labor-Hours	Unit	1999 Bare Costs Mat.	Labor	Equip.	Total	Total Incl O&P
804	2180	9' bell diameter, 48" shaft, 4.48 C.Y. (R023-820)	B-49	3.30	26.667	Ea.	273	670	765	1,708	2,200
	2200	10' bell diameter, 60" shaft, 5.24 C.Y.		2.80	31.429		320	790	900	2,010	2,600
	2220	12' bell diameter, 72" shaft, 8.74 C.Y.		1.60	55		535	1,375	1,575	3,485	4,475
	2240	14' bell diameter, 84" shaft, 13.6 C.Y.		1	88		830	2,200	2,525	5,555	7,200
	2300	Open style, machine drilled, to 50' deep, in soft rocks and									
	2400	medium hard shales, 18" diameter, 0.065 C.Y./L.F.	B-49	50	1.760	V.L.F.	4.82	44	50.50	99.32	131
	2500	24" diameter, 0.116 C.Y./L.F.		30	2.933		8.65	73.50	84	166.15	218
	2600	30" diameter, 0.182 C.Y./L.F.		20	4.400		13.50	110	126	249.50	330
	2700	36" diameter, 0.262 C.Y./L.F.		15	5.867		19.45	147	168	334.45	440
	2800	48" diameter, 0.465 C.Y./L.F.		10	8.800		34.50	221	253	508.50	665
	2900	60" diameter, 0.727 C.Y./L.F.		7	12.571		54	315	360	729	955
	3000	72" diameter, 1.05 C.Y./L.F.		6	14.667		78	370	420	868	1,125
	3100	84" diameter, 1.43 C.Y./L.F.		5	17.600		106	440	505	1,051	1,375
	3200	For bell excavation and concrete, add									
	3220	4' bell diameter, 24" shaft, 0.444 C.Y.	B-49	10.90	8.073	Ea.	27	203	232	462	605
	3240	6' bell diameter, 30" shaft, 1.57 C.Y.		3.10	28.387		96	715	815	1,626	2,125
	3260	8' bell diameter, 36" shaft, 3.72 C.Y.		1.30	67.692		227	1,700	1,950	3,877	5,050
	3280	9' bell diameter, 48" shaft, 4.48 C.Y.		1.10	80		273	2,000	2,300	4,573	6,000
	3300	10' bell diameter, 60" shaft, 5.24 C.Y.		.90	97.778		320	2,450	2,800	5,570	7,300
	3320	12' bell diameter, 72" shaft, 8.74 C.Y.		.60	146		535	3,675	4,200	8,410	11,000
	3340	14' bell diameter, 84" shaft, 13.6 C.Y.		.40	220		830	5,525	6,325	12,680	16,600
	3600	For rock excavation, sockets, add, minimum		120	.733	C.F.		18.40	21	39.40	52
	3650	Average		95	.926			23.50	26.50	50	65.50
	3700	Maximum		48	1.833			46	52.50	98.50	131
	3900	For 50' to 100' deep, add				V.L.F.				7%	7%
	4000	For 100' to 150' deep, add								25%	25%
	4100	For 150' to 200' deep, add								30%	30%
	4200	For casings left in place, add				Lb.	.50			.50	.55
	4300	For other than 50 lb. reinf. per C.Y., add or deduct				"	.50			.50	.55
	4400	For steel "I" beam cores, add	B-49	8.30	10.602	Ton	960	266	305	1,531	1,800
	4500	Load and haul excess excavation, 2 miles	B-34B	178	.045	C.Y.		.99	2.48	3.47	4.25
	4600	For mobilization, 50 mile radius, rig to 36"	B-43	2	24	Ea.		565	890	1,455	1,850
	4650	Rig to 84"	B-48	1.75	32			770	1,125	1,895	2,450
	4700	For low headroom, add								50%	
	4750	For difficult access, add								25%	
	5000	Bottom inspection	1 Skwk	1.20	6.667			187		187	295

024 | Railroad & Marine Work

024 520 | Railroad Trackwork

			Crew	Daily Output	Labor-Hours	Unit	1999 Bare Costs Mat.	Labor	Equip.	Total	Total Incl O&P
524	0010	RAILROAD Car bumpers, standard (R024-520)	B-14	2	24	Ea.	2,000	545	109	2,654	3,175
	0100	Heavy duty		2	24		3,775	545	109	4,429	5,150
	0200	Derails hand throw (sliding)		10	4.800		700	109	22	831	965
	0300	Hand throw with standard timbers, open stand & target		8	6		755	136	27.50	918.50	1,075
	0400	Resurface and realign existing track		200	.240	L.F.		5.45	1.09	6.54	9.75
	0600	For crushed stone ballast, add		500	.096	"	10.90	2.18	.44	13.52	15.90
	0800	Siding, yard spur, level grade									
	0808	Wood ties and ballast, 80 lb. rail	B-14	57	.842	L.F.	50.50	19.15	3.84	73.49	89.50
	0809	80 lb. relay rail		57	.842		38	19.15	3.84	60.99	75.50
	0812	90 lb. rail		57	.842		42	19.15	3.84	64.99	80.50

Important: See the Reference Section for critical [illegible]

024 520 | Railroad Trackwork

		CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1999 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P	
0813	90 lb. relay rail (RO24-520)	B-14	57	.842	L.F.	42	19.15	3.84	64.99	80	524
0820	100 lb. rail		57	.842		60	19.15	3.84	82.99	100	
0822	100 lb. relay rail		57	.842		43	19.15	3.84	65.99	81	
0830	110 lb. rail		57	.842		46	19.15	3.84	68.99	84.50	
0832	110 lb. relay rail		57	.842		45.50	19.15	3.84	68.49	84	
1002	Steel ties in concrete, incl. fasteners & plates										
1003	80 lb. rails	B-14	22	2.182	L.F.	95	49.50	9.95	154.45	193	
1005	80 lb. relay rail		22	2.182		75	49.50	9.95	134.45	171	
1012	90 lb. rail		22	2.182		88	49.50	9.95	147.45	185	
1015	90 lb. relay rail		22	2.182		74	49.50	9.95	133.45	170	
1020	100 lb. rail		22	2.182		95	49.50	9.95	154.45	193	
1025	100 lb. relay rail		22	2.182		74	49.50	9.95	133.45	170	
1030	110 lb. rail		22	2.182		98	49.50	9.95	157.45	196	
1035	110 lb. relay rail		22	2.182		82	49.50	9.95	141.45	178	
1200	Switch timber, for a #8 switch, pressure treated		3.70	12.973	M.B.F.	580	295	59	934	1,175	
1300	Complete set of timbers, 3.7 M.B.F. for #8 switch		1	48	Total	2,500	1,100	219	3,819	4,700	
1400	Ties, concrete, 8'-6" long, 30" O.C.		80	.600	Ea.	89.50	13.65	2.74	105.89	123	
1600	Wood, pressure treated, 6" x 8" x 8'-6", C.L. lots		90	.533		27	12.15	2.43	41.58	51	
1700	L.C.L. lots		90	.533		28	12.15	2.43	42.58	52.50	
1900	Heavy duty, 7" x 9" x 8'-6", C.L. lots		70	.686		29.50	15.60	3.13	48.23	60.50	
2000	L.C.L. lots		70	.686		29	15.60	3.13	47.73	60	
2200	Turnouts, #8, incl. 100 lb. rails, plates, bars, frog, switch pt.										
2300	Timbers and ballast 6" below bottom of tie	B-14	.50	96	Ea.	17,400	2,175	440	20,015	23,000	
2400	Wheel stops, fixed		18	2.667	Pr.	430	60.50	12.15	502.65	585	
2450	Hinged		14	3.429	"	505	78	15.65	598.65	695	

024 820 | Dredging

0010	**DREDGING** Mobilization and demobilization., add to below, minimum	B-8	.53	120	Total		2,900	4,350	7,250	9,225	824
0100	Maximum	"	.10	640	"		15,300	23,000	38,300	48,900	
0300	Barge mounted clamshell excavation into scows,										
0310	Dumped 20 miles at sea, minimum	B-57	310	.155	C.Y.		3.79	3.69	7.48	9.90	
0400	Maximum	"	213	.225	"		5.50	5.35	10.85	14.45	
0500	Barge mounted dragline or clamshell, hopper dumped,										
0510	pumped 1000' to shore dump, minimum	B-57	340	.141	C.Y.		3.46	3.37	6.83	9.05	
0525	All pumping uses 2000 gallons of water per cubic yard										
0600	Maximum	B-57	243	.198	C.Y.		4.84	4.71	9.55	12.65	
1000	Hydraulic method, pumped 1000' to shore dump, minimum		460	.104			2.56	2.49	5.05	6.70	
1100	Maximum		310	.155			3.79	3.69	7.48	9.90	
1400	Into scows dumped 20 miles, minimum		425	.113			2.77	2.69	5.46	7.25	
1500	Maximum		243	.198			4.84	4.71	9.55	12.65	
1600	For inland rivers and canals in South, deduct								30%	30%	

024 840 | Seawall & Bulkheads

0010	**BULKHEADS** Reinforced concrete, include footing and tie-backs										844
0020	Up to 6' high, minimum	C-17C	28	2.964	L.F.	30.50	84.50	14.70	129.70	183	
0060	Maximum		24.25	3.423		49	97.50	17	163.50	226	
0100	12' high, minimum		20	4.150		79.50	118	20.50	218	296	
0160	Maximum		18.50	4.486		91.50	128	22.50	242	325	
0180	Precast bulkhead, complete, including										
0190	vertical and battered piles, face panels, and cap				L.F.				225	260	
0195	Using 16' vertical piles				"				240	275	
0196	Using 20' vertical piles										
0200	Steel sheeting, with 4' x 4' x 8" concrete deadmen, @ 10' O.C.										
0210	12' high, shore driven	B-40	27	2.370	L.F.	53	65.50	71	189.50	245	
0260	Barge driven	B-76	15	4.800	"	79.50	132	135	346.50	455	

027 150 | Sewage Systems

			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1999 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
162 2520	27" diameter	R027 -110	B-21	120	.233	L.F.	22	5.85	1.13	28.98	34.50
2522	30" diameter		B-13	88	.636		28	14.80	6.25	49.05	61
2524	36" diameter		"	72	.778		35	18.10	7.65	60.75	75
2600	Class 5										
2610	12" diameter		B-21	168	.167	L.F.	10	4.17	.81	14.98	18.45
2612	15" diameter			160	.175		13	4.38	.85	18.23	22
2614	18" diameter			152	.184		15	4.61	.89	20.50	24.50
2616	21" diameter			144	.194		20	4.87	.94	25.81	30.50
2618	24" diameter			136	.206		24	5.15	1	30.15	35.50
2620	27" diameter			120	.233		28	5.85	1.13	34.98	41.50
2622	30" diameter		B-13	88	.636		35	14.80	6.25	56.05	68.50
2624	36" diameter		"	72	.778		41	18.10	7.65	66.75	81.50
2800	Add for rubber joints,						12%				
3040	Vitrified plate lined, add to above, 30" to 36" diameter					SFCA	3			3	3.30
3050	42" to 54" diameter, add						3.20			3.20	3.52
3060	60" to 72" diameter, add						3.75			3.75	4.13
3070	Over 72" diameter, add						4			4	4.40
3080	Radius pipe, add to pipe prices, 12" to 60" diameter					L.F.	50%				
3090	Over 60" diameter, add					"	20%				
3500	Reinforced elliptical, 8' lengths, C507 class 3										
3520	14" x 23" inside, round equivalent 18" diameter		B-21	82	.341	L.F.	40	8.55	1.66	50.21	59
3530	24" x 38" inside, round equivalent 30" diameter		B-13	58	.966		50	22.50	9.45	81.95	100
3540	29" x 45" inside, round equivalent 36" diameter			52	1.077		65	25	10.55	100.55	122
3550	38" x 60" inside, round equivalent 48" diameter			38	1.474		100	34.50	14.45	148.95	179
3560	48" x 76" inside, round equivalent 60" diameter			26	2.154		135	50	21	206	250
3570	58" x 91" inside, round equivalent 72" diameter			22	2.545		200	59	25	284	340
3780	Concrete slotted pipe, class 4 mortar joint										
3800	12" diameter		B-21	168	.167	L.F.	10.50	4.17	.81	15.48	19
3840	18" diameter		"	152	.184	"	16.25	4.61	.89	21.75	26
3900	Class 4 O-ring										
3940	12" diameter		B-21	168	.167	L.F.	12	4.17	.81	16.98	20.50
3960	18" diameter		"	152	.184	"	18	4.61	.89	23.50	28
6200	Gasket, conc. pipe joint, 12"					Ea.	2.15			2.15	2.37
6220	24"						3.73			3.73	4.10
6240	36"						5.55			5.55	6.10
6260	48"						7.95			7.95	8.75
6270	60"						11			11	12.10
6280	72"						11.15			11.15	12.25
164 0010	PIPING, STORM DRAINAGE, CORRUGATED METAL										
0020	Not including excavation or backfill										
2000	Corrugated metal pipe, galvanized and coated										
2020	Bituminous coated with paved invert, 20' lengths										
2040	8" diameter, 16 ga.		B-14	330	.145	L.F.	7.10	3.32	.66	11.07	13.75
2060	10" diameter, 16 ga.			260	.185		8.90	4.22	.84	13.94	17.25
2080	12" diameter, 16 ga.			210	.229		11.90	5.22	1.04	18.14	22.50
2100	15" diameter, 16 ga.			200	.240		12.45	5.45	1.09	18.99	23.50
2120	18" diameter, 16 ga.			190	.253		13.30	5.75	1.15	20.20	25
2140	24" diameter, 14 ga.			160	.300		26.50	6.80	1.37	34.67	41
2160	30" diameter, 14 ga.		B-13	120	.467		28.50	10.85	4.58	43.93	53.50
2180	36" diameter, 12 ga.			120	.467		50	10.85	4.58	65.43	77
2200	48" diameter, 12 ga.			100	.560		61.50	13	5.50	80	94.50
2220	60" diameter, 10 ga.		B-13B	75	.747		101	17.35	10.55	128.90	150
2240	72" diameter, 8 ga.		"	45	1.244		135	29	17.60	181.60	213
2250	End sections, 8" diameter, 16 ga.		B-14	20	2.400	Ea.	33	54.50	10.95	98.45	134
2255	10" diameter, 16 ga.			20	2.400		36	54.50	10.95	101.45	137
2260	12" diameter, 16 ga.			18	2.667		38.50	60.50	12.15	111.15	150

028 100 | Irrigation Systems

		CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1999 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P	
104 1470	2"	2 Skwk	2	8	Ea.	214	224		438	590	104
1475	Pressure vacuum breaker, brass, 15-150 PSI										
1480	3/4"	2 Skwk	2	8	Ea.	54	224		278	415	
1490	1"		2	8		81.50	224		305.50	445	
1500	1-1/2"		2	8		161	224		385	530	
1510	2"		2	8		149	224		373	520	

028 200 | Fountains

204 0010	FOUNTAINS/AERATORS										204
0100	Pump w/controls										
0200	Single phase, 100' chord, 1/2 H.P. pump	2 Skwk	4.40	3.636	Ea.	2,025	102		2,127	2,375	
0300	3/4 H.P. pump		4.30	3.721		2,275	104		2,379	2,675	
0400	1 H.P. pump		4.20	3.810		2,300	107		2,407	2,700	
0500	1-1/2 H.P. pump		4.10	3.902		2,425	109		2,534	2,825	
0600	2 H.P. pump		4	4		2,450	112		2,562	2,875	
0700	Three phase, 200' chord, 5 H.P. pump		3.90	4.103		6,500	115		6,615	7,325	
0800	7-1/2 H.P. pump		3.80	4.211		7,675	118		7,793	8,600	
0900	10 H.P. pump		3.70	4.324		7,725	121		7,846	8,700	
1000	15 H.P. pump		3.60	4.444		10,400	125		10,525	11,600	
1100	Nozzles, minimum		8	2		135	56		191	238	
1200	Maximum		8	2		246	56		302	360	
1300	Lights w/mounting kits, 200 watt		18	.889		295	25		320	365	
1400	300 watt		18	.889		330	25		355	400	
1500	500 watt		18	.889		360	25		385	435	
1600	Color blender		12	1.333		280	37.50		317.50	365	

028 300 | Fences & Gates

308 0010	FENCE, CHAIN LINK INDUSTRIAL, schedule 40										308
0020	3 strands barb wire, 2" post @ 10' O.C., set in concrete, 6' H										
0200	9 ga. wire, galv. steel	B-80	240	.133	L.F.	7	3.13	2.25	12.38	15	
0300	Aluminized steel		240	.133		9	3.13	2.25	14.38	17.20	
0500	6 ga. wire, galv. steel		240	.133		11.35	3.13	2.25	16.73	19.80	
0600	Aluminized steel		240	.133		13	3.13	2.25	18.38	21.50	
0800	6 ga. wire, 6' high but omit barbed wire, galv. steel		250	.128		11	3	2.16	16.16	19.10	
0900	Aluminized steel		250	.128		15.40	3	2.16	20.56	24	
0920	8' H, 6 ga. wire, 2-1/2" line post, galv. steel		180	.178		17.95	4.17	3	25.12	29.50	
0940	Aluminized steel		180	.178		22	4.17	3	29.17	34.50	
1400	Gate for 6' high fence, 1-5/8" frame, 3' wide, galv. steel		10	3.200	Ea.	80	75	54	209	264	
1500	Aluminized steel		10	3.200		110	75	54	239	297	
2000	5'-0" high fence, 9 ga., no barbed wire, 2" line post,										
2010	10' O.C., 1-5/8" top rail										
2100	Galvanized steel	B-80	300	.107	L.F.	6	2.50	1.80	10.30	12.45	
2200	Aluminized steel		300	.107		7.25	2.50	1.80	11.55	13.85	
2400	Gate, 4' wide, 5' high, 2" frame, galv. steel		10	3.200	Ea.	100	75	54	229	286	
2500	Aluminized steel		10	3.200		110	75	54	239	297	
3100	Overhead slide gate, chain link, 6' high, to 18' wide		38	.842	L.F.	82.50	19.75	14.20	116.45	137	
3105	8' high		30	1.067		84	25	18	127	151	
3108	10' high		24	1.333		75	31.50	22.50	129	156	
3110	Cantilever type		48	.667		38	15.65	11.25	64.90	78.50	
3120	8' high		24	1.333		55	31.50	22.50	109	134	
3130	10' high		18	1.778		65	41.50	30	136.50	169	
5000	Double swing gates, incl. posts & hardware										
5010	5' high, 12' opening	B-80	3.40	9.412	Opng	263	221	159	643	805	
5020	20' opening		2.80	11.429		340	268	193	801	1,000	
5060	6' high, 12' opening		3.20	10		475	235	169	879	1,075	

028 300 | Fences & Gates

			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1999 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
308	5070	20' opening	B-80	2.60	12.308	Opng.	655	289	208	1,152	1,400
	5080	8' high, 12' opening		2.13	15.002		700	350	253	1,303	1,600
	5090	20' opening		1.45	22.069		935	520	370	1,825	2,225
	5100	10' high, 12' opening		1.31	24.427		800	575	410	1,785	2,225
	5110	20' opening		1.03	31.068		1,200	730	525	2,455	3,025
	5120	12' high, 12' opening		1.05	30.476		1,175	715	515	2,405	2,950
	5130	20' opening		.85	37.647		1,500	885	635	3,020	3,725
	5190	For aluminized steel add					20%				
	6500	Auger fence post hole, 3' deep, medium soil, by hand	1 Clab	30	.267	Ea.		5.70		5.70	9
	6510	By machine	B-80	175	.183			4.29	3.08	7.37	10.05
	6520	Rock, with jackhammer	B-9C	32	1.250			27.50	5.65	33.15	49
	6530	With rock drill	B-47C	65	.246			6	9.75	15.75	19.95
	6580	Line posts, galvanized, 2-1/2" OD, set in conc., 4'	B-80	80	.400		14.10	9.40	6.75	30.25	37.50
	6585	5'		76	.421		16.90	9.90	7.10	33.90	41.50
	6590	6'		74	.432		17	10.15	7.30	34.45	42.50
	6595	7'		72	.444		18.55	10.45	7.50	36.50	45
	6600	8'		69	.464		20.50	10.90	7.80	39.20	48
	6610	H-beam, 1-7/8", 4'		83	.386		15.75	9.05	6.50	31.30	38.50
	6615	5'		81	.395		18	9.25	6.65	33.90	41.50
	6620	6'		78	.410		21	9.60	6.90	37.50	45.50
	6625	7'		75	.427		23	10	7.20	40.20	49
	6630	8'		73	.438		25	10.30	7.40	42.70	51.50
	6635	Vinyl coated, 2-1/2" OD, set in conc., 4'		79	.405		25.50	9.50	6.85	41.85	50
	6640	5'		77	.416		30	9.75	7	46.75	56
	6645	6'		74	.432		35	10.15	7.30	53.45	63
	6650	7'		72	.444		38.50	10.45	7.50	56.45	66.50
	6655	8'		69	.464		42.50	10.90	7.80	61.20	72.50
	6660	End gate post, steel, 3" OD, set in conc., 4'		68	.471		30	11.05	7.95	49	59
	6665	5'		65	.492		38.50	11.55	8.30	58.35	69.50
	6670	6'		63	.508		40.50	11.90	8.55	60.95	72.50
	6675	7'		61	.525		51.50	12.30	8.85	72.65	85.50
	6685	Vinyl, 4'		68	.471		50	11.05	7.95	69	81
	6690	5'		65	.492		55	11.55	8.30	74.85	87.50
	6695	6'		63	.508		65.50	11.90	8.55	85.95	100
	6705	8'		59	.542		78.50	12.70	9.15	100.35	116
	6710	Corner post, galv. steel, 4" OD, set in conc., 4'		65	.492		50.50	11.55	8.30	70.35	82.50
	6715	6'		63	.508		69	11.90	8.55	89.45	104
	6720	7'		61	.525		80.50	12.30	8.85	101.65	117
	6725	8'		65	.492		89	11.55	8.30	108.85	125
	6730	Vinyl, 5'		65	.492		88	11.55	8.30	107.85	124
	6735	6'		63	.508		113	11.90	8.55	133.45	152
	6740	7'		61	.525		124	12.30	8.85	145.15	165
	6745	8'		59	.542		134	12.70	9.15	155.85	178
	6935	Fabric, 9 ga., galv., 1.2 oz. coat, 2" chain link, 4'	B-80A	304	.079	L.F.	2	1.69	.59	4.28	5.50
	6940	5'		285	.084		2.43	1.81	.63	4.87	6.20
	6945	6'		266	.090		4.07	1.94	.67	6.68	8.25
	6950	7'		247	.097		3.33	2.08	.73	6.14	7.75
	6955	8'		228	.105		7	2.26	.79	10.05	12.10
	6960	9 ga., fused, 4'		304	.079		2.15	1.69	.59	4.43	5.65
	6965	5'		285	.084		2.69	1.81	.63	5.13	6.50
	6970	6'		266	.090		3.87	1.94	.67	6.48	8.05
	6975	7'		247	.097		3.77	2.08	.73	6.58	8.20
	6980	8'		228	.105		5.40	2.26	.79	8.45	10.30
	6985	Barbed wire, galv., cost per strand		2,280	.011		.07	.23	.08	.38	.52
	6990	Vinyl coated		2,280	.011		.15	.23	.08	.46	.62
	6995	Extension arms, 3 strands		143	.168	Ea.	5.05	3.60	1.26	9.91	12.60

028 300 | Fences & Gates

		CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1999 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P	
328 0950	No. 2 cedar	B-1	150	.160	L.F.	2.67	3.54		6.21	8.50	328
1240	Stockade fence, no. 1 cedar, 3-1/4" rails, 6' high		160	.150		8.50	3.32		11.82	14.55	
1260	8' high		155	.155		11	3.43		14.43	17.50	
1270	Gate, 3'-6" wide		9	2.667	Ea.	135	59		194	242	
1300	No. 2 cedar, treated wood rails, 6' high		160	.150	L.F.	8.50	3.32		11.82	14.55	
1320	Gate, 3'-6" wide		8	3	Ea.	50	66.50		116.50	159	
1360	Treated pine, treated rails, 6' high		160	.150		8.30	3.32		11.62	14.35	
1400	8' high		150	.160		12.50	3.54		16.04	19.30	
1420	Gate, 3'-6" wide		9	2.667		55	59		114	154	

028 400 | Walk/Road/Parkg Appurt

		CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P	
404 0010	**GUIDE/GUARD RAIL** Corrugated steel, galv. steel posts, 6'-3" O.C. R025-120	B-80	850	.038	L.F.	10	.88	.63	11.51	13.05	404
0100	Double face		570	.056	"	15	1.32	.95	17.27	19.60	
0200	End sections, galvanized, flared		50	.640	Ea.	40	15	10.80	65.80	79.50	
0300	Wrap around end		50	.640		60	15	10.80	85.80	101	
0350	Anchorage units		15	2.133		480	50	36	566	645	
0365	End section, flared	B-80A	78	.308		19.15	6.60	2.30	28.05	34	
0370	End section, wrap-around, corrugated steel	"	78	.308		23	6.60	2.30	31.90	38	
0400	Timber guide rail, 4" x 8" with 6" x 8" wood posts, treated	B-80	960	.033	L.F.	12	.78	.56	13.34	15.05	
0600	Cable guide rail, 3 at 3/4" cables, steel posts, single face		900	.036		4.71	.83	.60	6.14	7.15	
0650	Double face		635	.050		9.90	1.18	.85	11.93	13.65	
0700	Wood posts		950	.034		5.90	.79	.57	7.26	8.35	
0750	Double face		650	.049		10.90	1.15	.83	12.88	14.70	
0760	Breakaway wood posts		195	.164	Ea.	245	3.85	2.77	251.62	279	
0800	Anchorage units, breakaway		15	2.133	"	450	50	36	536	610	
0900	Guide rail, steel box beam, 6" x 6"		120	.267	L.F.	15.50	6.25	4.50	26.25	31.50	
0950	End assembly	B-80A	48	.500	Ea.	420	10.75	3.74	434.49	480	
1100	Median barrier, steel box beam, 6" x 8"	B-80	215	.149	L.F.	19.50	3.49	2.51	25.50	29.50	
1120	Shop curved	B-80A	92	.261	"	25	5.60	1.95	32.55	38.50	
1140	End assembly		48	.500	Ea.	190	10.75	3.74	204.49	230	
1150	Corrugated beam		400	.060	L.F.	13.35	1.29	.45	15.09	17.15	
1200	Impact barrier, UTMCD, barrel type	B-16	30	1.067	Ea.	237	23.50	14.75	275.25	315	
1400	Resilient guide fence and light shield, 6' high	B-2	130	.308	L.F.	17	6.70		23.70	29.50	
1500	Concrete posts, individual, 6'-5", triangular	B-80	110	.291	Ea.	30	6.80	4.90	41.70	49	
1550	Square		110	.291		32.50	6.80	4.90	44.20	52	
1600	Wood guide posts		150	.213		26	5	3.60	34.60	40	
2000	Median barrier, precast concrete, 3'-6" high, 2' wide, single face	B-29	380	.147	L.F.	28	3.42	1.68	33.10	37.50	
2200	Double face	"	340	.165		23.50	3.83	1.87	29.20	34	
2300	Cast in place, steel forms	C-2	170	.282		45.50	7.55		53.05	62	
2320	Slipformed	C-7	352	.205		18.50	4.76	2.54	25.80	30.50	
2400	Speed bumps, thermoplastic, 10-1/2" x 2-1/4" x 48" long	B-2	120	.333	Ea.	80	7.30		87.30	99.50	
3000	Energy absorbing terminal, 10 bay, 3' wide	B-80B	.10	320		23,600	7,325	2,825	33,750	40,500	
3010	7 bay, 2' - 6" wide		.20	160		17,300	3,650	1,425	22,375	26,300	
3020	5 bay, 2' wide		.20	160		13,500	3,650	1,425	18,575	22,100	
3100	Wide hazard protection, foam sandwich, 7 bay, 7' - 6" wide		.14	228		16,700	5,225	2,025	23,950	28,800	
3110	5' wide		.15	213		16,500	4,875	1,875	23,250	27,900	
3120	3' wide		.18	177		15,900	4,075	1,575	21,550	25,600	
5000	For bridge railing, see div. 025-508										
408 0010	**PARKING BARRIERS** Timber with saddles, treated type										408
0100	4" x 4" for cars	B-2	520	.077	L.F.	2.58	1.68		4.26	5.50	
0200	6" x 6" for trucks		520	.077	"	5.55	1.68		7.23	8.75	
0400	Folding with individual padlocks		50	.800	Ea.	340	17.50		357.50	405	
0600	Flexible fixed stanchion, 2' high, 3" diameter		100	.400		17.40	8.75		26.15	33	
1000	Wheel stops, precast concrete incl. dowels, 6" x 10" x 6'-0"		120	.333		25.50	7.30		32.80	40	

029 200 | Soil Preparation

			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1999 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
208	1100	Heavy soil or clay	2 Clab	8	2	C.Y.		43		43	67.50
	1200	1/2 C.Y. backhoe, sandy soil	B-11C	150	.107			2.66	1.46	4.12	5.70
	1300	Heavy soil or clay	"	115	.139			3.47	1.90	5.37	7.45
	2000	Mix planting soil, incl. loam, manure, peat, by hand	2 Clab	60	.267		25	5.70		30.70	36.50
	2100	Skid steer loader	B-62	150	.160		25	3.74	.74	29.48	34
	3000	Pile sod, skid steer loader	"	2,800	.009	S.Y.		.20	.04	.24	.35
	3100	By hand	2 Clab	400	.040			.86		.86	1.35
	4000	Remove sod, F.E. loader	B-10S	2,000	.006			.16	.16	.32	.42
	4100	Sod cutter	B-12K	3,200	.005			.13	.25	.38	.48
	4200	By hand	2 Clab	240	.067			1.43		1.43	2.25

029 300 | Lawns & Grasses

308	0010	**SEEDING** Athletic field mix, 8#/M.S.F., push spreader R029-310	1 Clab	8	1	M.S.F.	20	21.50		41.50	56
	0100	Tractor spreader	B-66	52	.154		20	4.18	3.86	28.04	32.50
	0200	Hydro or air seeding, with mulch & fertil.	B-81	80	.300		22	7.20	7.55	36.75	43.50
	0400	Birdsfoot trefoil, .45#/M.S.F., push spreader	1 Clab	8	1		15.60	21.50		37.10	51
	0500	Tractor spreader	B-66	52	.154		15.60	4.18	3.86	23.64	27.50
	0600	Hydro or air seeding,with mulch & fertil.	B-81	80	.300		30	7.20	7.55	44.75	52.50
	0800	Bluegrass, 4#/M.S.F., common, push spreader	1 Clab	8	1		14	21.50		35.50	49.50
	0900	Tractor spreader	B-66	52	.154		14	4.18	3.86	22.04	26
	1000	Hydro or air seeding, with mulch & fertil.	B-81	80	.300		23	7.20	7.55	37.75	45
	1100	Baron, push spreader	1 Clab	8	1		18.50	21.50		40	54.50
	1200	Tractor spreader	B-66	52	.154		18.50	4.18	3.86	26.54	31
	1300	Hydro or air seeding, with mulch & fertil.	B-81	80	.300		25.50	7.20	7.55	40.25	47.50
	1500	Clover, 0.67#/M.S.F., white, push spreader	1 Clab	8	1		3	21.50		24.50	37.50
	1600	Tractor spreader	B-66	52	.154		3	4.18	3.86	11.04	13.90
	1700	Hydro or air seeding, with mulch and fertil.	B-81	80	.300		16.50	7.20	7.55	31.25	37.50
	1800	Ladino, push spreader	1 Clab	8	1		4.80	21.50		26.30	39.50
	1900	Tractor spreader	B-66	52	.154		4.80	4.18	3.86	12.84	15.90
	2000	Hydro or air seeding, with mulch and fertil.	B-81	80	.300		21	7.20	7.55	35.75	42.50
	2200	Fescue 5.5#/M.S.F., tall, push spreader	1 Clab	8	1		8	21.50		29.50	43
	2300	Tractor spreader	B-66	52	.154		8	4.18	3.86	16.04	19.40
	2400	Hydro or air seeding, with mulch and fertilizer	B-81	80	.300		26.50	7.20	7.55	41.25	48.50
	2500	Chewing, push spreader	1 Clab	8	1		9	21.50	-	30.50	44
	2600	Tractor spreader	B-66	52	.154		9	4.18	3.86	17.04	20.50
	2700	Hydro or air seeding, with mulch and fertil.	B-81	80	.300		29.50	7.20	7.55	44.25	52
	2900	Crown vetch, 4#/M.S.F., push spreader	1 Clab	8	1		35	21.50		56.50	72.50
	3000	Tractor spreader	B-66	52	.154		35	4.18	3.86	43.04	49
	3100	Hydro or air seeding, with mulch and fertilizer	B-81	80	.300		48	7.20	7.55	62.75	72.50
	3300	Rye, 10#/M.S.F., annual, push spreader	1 Clab	8	1		12	21.50		33.50	47
	3400	Tractor spreader	B-66	52	.154		12	4.18	3.86	20.04	24
	3500	Hydro or air seeding, with mulch and fertilizer	B-81	80	.300		26.50	7.20	7.55	41.25	48.50
	3600	Fine textured, push spreader	1 Clab	8	1		14	21.50		35.50	49.50
	3700	Tractor spreader	B-66	52	.154		14	4.18	3.86	22.04	26
	3800	Hydro or air seeding, with mulch and fertilizer	B-81	80	.300		31	7.20	7.55	45.75	53.50
	4000	Shade mix, 6#/M.S.F., push spreader	1 Clab	8	1		10	21.50		31.50	45
	4100	Tractor spreader	B-66	52	.154		10	4.18	3.86	18.04	21.50
	4200	Hydro or air seeding, with mulch and fertilizer	B-81	80	.300		22	7.20	7.55	36.75	43.50
	4400	Slope mix, 6#/M.S.F., push spreader	1 Clab	8	1		10	21.50		31.50	45
	4500	Tractor spreader	B-66	52	.154		10	4.18	3.86	18.04	21.50
	4600	Hydro or air seeding, with mulch and fertilizer	B-81	80	.300		25	7.20	7.55	39.75	47
	4800	Turf mix, 4#/M.S.F., push spreader	1 Clab	8	1		10	21.50		31.50	45
	4900	Tractor spreader	B-66	52	.154		10	4.18	3.86	18.04	21.50
	5000	Hydro or air seeding, with mulch and fertilizer	B-81	80	.300		25	7.20	7.55	39.75	47
	5200	Utility mix, 7#/M.S.F., push spreader	1 Clab	8	1		7.75	21.50		29.25	42.50
	5300	Tractor spreader	B-66	52	.154		7.75	4.18	3.86	15.79	19.15