RECLAMATION

Managing Water in the West

Trashrack Cleaning Alternatives for Parker Dam Powerplant Forebay Inlet Trashrack Structure

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Executive Summary

Five types of trashrack cleaning systems were identified and evaluated for potential use to clean the forebay inlet trashrack structure at Parker Dam. Two system types were identified as most appropriate and likely to be successful and cost-effective for this application: a hydraulic backhoe-style raking machine traveling on deck-mounted rails that cleans the trashracks with an upward scraping motion, and a cable-style raking machine traveling on an overhead monorail that cleans the trashracks by pushing debris downward and then gripping it for removal from the water. Peer-reviewed construction cost estimates for one backhoe-style system and two cable-style systems were generated. Differences in estimated construction cost for all three systems were negligible, with all costing $3.7 million, assuming award within one year. Contract award in two or three years would raise estimated construction costs to $3.9 and $4.1 million, respectively. The cost similarity of the options suggests that system selection should consider other factors.

Background

Parker Dam (Figure 1), constructed from 1934-1938, is a concrete thick-arch dam impounding Lake Havasu on the Colorado River below Havasu City, Arizona. The dam has a hydraulic height of 80 ft. Parker Powerplant (completed 1942) is located near the right abutment with rated generation capacity of 120 MW, provided by four Francis-type turbines. Flows to the powerplant pass through a forebay inlet trashrack structure into an excavated forebay channel, and then through penstock intakes equipped with individual trashracks. None of the existing trashracks have provisions for regular cleaning.

Figure 1. — Parker Dam and Powerplant.

Quagga Mussel Effects at Parker Dam

The spread of non-native mussels in the Colorado River system is rapidly changing debris handling needs at hydraulic structures and water intakes. Parker Dam has been heavily infested by quagga mussels since 2007 (see http://www.usbr.gov/lc/region/programs/quagga/parker.html). Quagga mussels can cause simple blockage of water intakes and trashracks as they attach to these structures. In addition, mussels are filter feeders, consuming phytoplankton, zooplankton, and algae, which increases water clarity. This leads to increased aquatic weed growth. As a result of expected increases in weed growth in Lake Havasu and upstream waters, a need is anticipated in the near future for automated cleaning of the trashrack structure at the entrance to the Parker Powerplant Forebay.

Figure 2 shows aquatic debris that has recently accumulated upstream from water intakes on the Central Arizona Project (CAP). Similar thick mats of aquatic weeds, algae, and aquatic grasses are expected at Parker Dam in the future. Large rafts of debris are now present in the Bill Williams River arm, but have not yet moved down to Parker Dam.

Figure 2. — Example accumulations of aquatic plants at CAP water intakes.

Trashrack Cleaning Alternatives

Study Objective

To address the future debris problem, this report evaluates alternative trashrack cleaning systems that could be installed at the forebay inlet trashrack structure. We believe the most effective debris removal can be accomplished at this location, where flow velocities are relatively low in comparison to the penstock intakes. Also, velocities at the forebay inlet trashracks will probably be low enough to allow some colonization of those racks. A rack cleaning solution for

the forebay inlet would hopefully address the need for both plant debris removal and some cleaning of mussels from the racks.

Study Approach

For this study, generic trashrack cleaning system types were identified and the characteristics of each type were evaluated with respect to the site-specific needs. Two types of trashrack cleaning systems were identified as feasible alternatives, and appraisal-level cost estimates (Appendix II) for specific designs were developed. Manufacturers of trashrack cleaning equipment were consulted, and their input was used in the development of the cost estimates. Appendix III contains the detailed information obtained from the manufacturers.

Existing Trashrack Structure Description

Figures 3 and 4 show photos of the existing trashrack structure. Drawings included in Appendix IV show the details of the trashrack structure, trashracks, and associated guides and other metalwork.

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The trashrack structure is linear, 236-ft long (end pier to end pier), containing 12 bays. Each bay contains a middle metal guide and two trashrack stacks. The existing guides included a guide slot for a future rake (although no rake was ever provided). The trashracks are installed on a 0.5:1 slope (26° from vertical), with 6 racks stacked into a 62-ft long unit along the slope. The individual trashracks are each nominally about 10.25 ft long and 8.19 ft wide, except the top rack section is about 9.67 ft long. Individual trashrack sections are not pinned together, but lugs at the top of each rack section do minimize the misalignment of the stacked trashracks trash bars. There does remain the possibility for out-of-plane offsets at rack junctions. There is also a ½" gap between the trash bars at the trashrack panel junctions. Trashrack bars are ¾" thick on 6-1/16" centers, and project 3-¼" in front of the support angles and 3-½" in front of the spacer bars. A system that can provide some cleaning of the space between bars is desirable, to help control mussel colonization of the racks.

The total vertical depth of the structure is 55 ft from the deck down to the forebay invert, with a normal maximum water depth of 50 ft. Reservoir water levels fluctuate only about 5 ft throughout most years, with typical water depths being 45 to 50 ft. Maximum powerplant releases are about 18,000 ft^3/s, so typical average flow velocities approaching the forebay trashrack structure are about 2 ft/s or less. Flow is observed to concentrate somewhat toward the center of the structure, so trashrack bays near the two ends experience lower velocities and central bays experience velocities higher than the average, but flow conditions are not excessively turbulent at any location. For comparison, the average flow velocity is about 5.5 ft/s at the penstock entrance trashracks.

We anticipate cleaning needs for aquatic weeds to be intermittent. Manual initiation and control of cleaning cycles is anticipated to be the preferred mode of operation, although automatic controls may add value, since frequent periodic cleaning may help to control mussel colonization of the trashracks. A system that can dump raked debris directly into a truck for immediate disposal or off-site transport would be desirable.

Figure 3. — Deck of forebay inlet trashrack structure with existing embedded rails for future trashrack cleaning equipment. Flow is left to right.

Figure 4. — Upstream view of trashracks at inlet to Parker Dam Forebay.

Trashrack Cleaning System Alternatives

Five types of trashrack cleaning systems were identified as potentially applicable to the Parker Dam Forebay Inlet Trashrack Structure. Table 1 shows these five alternative system types and indicates the capabilities of each system type and the degree to which they meet important design requirements of the site. Each of these system types is described in more detail in Appendix I. Alternatives A and B in the table were selected for development of appraisal-level cost estimates. The backhoe style rake with extended reach away from the structure (A) probably offers the most flexibility for dealing with a variety of potential debris, while the cable style rake mounted on an overhead monorail (B) offers the advantage of a simpler installation (no reliance on deck rails) and minimal space consumed on the structure deck.

Table 1. — Design characteristics summary.

Design / Criteria	A Backhoe Style Rake On Deck Rails	B Cable Style Rake and Gripper on Overhead Monorail	C Cable Style Rake On Deck Rails	D Hydraulic Rake (Hand Rake Style) On Support Structure	E Flex-Rakes
Existing Concrete Structure Acceptable	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Trashracks 26 Degrees Off Vertical OK	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Extended Reach	**Yes**	No	No	No	No
All Parts Park Above Water	**Yes**	**Yes**	**Yes**	**Yes**	No
All Electrical Parts Above Deck	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Single Rake Operation	**Yes**	**Yes**	**Yes**	**Yes**	No
Traversing Rake	**Yes**	**Yes**	**Yes**	**Yes**	No
Conveyor Free Operation	**Yes**	**Yes**	Maybe	No	No
Trashrack or Stoplog Retrieval Capability	**Yes**	No	**Yes (with optional equipment)**	No	No
American-made	Not 100%	Not 100%	Not 100%	Not 100%	**Yes**
Sole-source contracting issues	Probable	Probable	Probable	Probable	Probable

Appraisal-Level Cost Estimates

In consultation with the client, two of the rake types were chosen for development of appraisal-level quantity and construction cost estimates. The rake options selected were the backhoe style rake on rails (A) and the overhead monorail cable-style rake (B). The appraisal-level estimates developed for this study are for the purpose of comparing the rake options to each other and to facilitate planning decisions. These estimates also do not include potential costs for replacing any trashrack sections that might be in such poor condition that they would impact rake performance. The racks that are submerged continuously are reported to be in very good condition, but some top rack sections may be in poorer condition. A detailed assessment of the condition of the top trashrack sections should be performed during the detailed design of any trashrack cleaning system.

Since the appraisal-level costs are intended to be used primarily for comparison of the alternatives, electrical power availability and electrical installation costs were not included in any of the estimates. However, it should be noted that the power requirements for the two rake types are different. Depending on the manufacturer of the backhoe type rake, the motor size required may be in the range of 30-55 kW (40-75 hp). The overhead monorail cable style rake hoist motor will be in the range of 5.5-7.5 kW (7.5-10 hp). Both systems would require 480 V, 3 phase, 60 Hz electrical service.

To assist our development of cost estimates, three manufacturers were invited to provide cost estimates for consideration. These estimates generally were for the furnishing and delivery of equipment only, without installation. The Kunz estimate was stated to include installation, but provided no details. Using the provided estimates and experience from working with these specific companies and others on similar installations at other Reclamation facilities, the manufacturer's estimates were increased to account for installation costs, prime contractor costs, and other items not included by the manufacturers themselves. Costs of furnishing, delivering, and installing equipment were then increased to account for mobilization (5%), cost escalation prior to notice to proceed (4%/yr), contingencies related to design (15%) and construction (25%), and non-contract costs (33%) to obtain a final construction cost estimate.

Table 2 summarizes the cost estimate information obtained from the manufacturers and provides the approved, appraisal-level construction cost estimates for three alternative systems. For the fourth system shown, the Lakeside-MUHR Hydronic unit, an unsolicited manufacturer-provided estimate was received as this report was being completed, after the other construction cost estimates had already been finalized. That estimate is included here as additional information for client consideration, but has not been reviewed or developed to the same level of detail as the other construction cost estimates.

The table shows that the estimated construction costs of all three systems are the same *at the appraisal-design level*. Cost escalation prior to award was estimated for 1, 2, and 3 year periods, with final construction cost estimates of $3.7, $3.9, and $4.1 million. Appendix II provides the approved quantities and construction cost estimate worksheets, and Appendix III provides the information received from each manufacturer.

Two manufacturers, Lakeside-MUHR and Brackett Green, provided estimates of equipment delivery time. Lakeside-MUHR estimated 28-30 weeks for the Catronic cable-style system and 30-36 weeks for the Hydronic backhoe-style system; Brackett Green estimated 32-34 weeks for the Brackett Bosker cable-style system.

Table 2. — Cost estimate summary.

Type	Alternative	Manufacturer Cost Estimate				USBR-Approved Construction Cost Estimate (Award in 1, 2, or 3 years)[a]
		Includes		Form of estimate provided	Manufacturer Cost Estimate	
		Furnish Equipment	Install			
B	Brackett Bosker Super Duty Raking Machine	X		Estimate worksheet and drawing	$934,700	$3,700,000
						$3,900,000
						$4,100,000
A	Kunz TRCM H1000	X	X	E-mail message	$1,200,000	$3,700,000
						$3,900,000
						$4,100,000
B	Lakeside-MUHR Catronic SH-4525	X		Estimate worksheet and drawing	$1,120,000	$3,700,000
						$3,900,000
						$4,100,000
A	Lakeside-MUHR Hydronic M-4000[b]	X		Estimate worksheet and drawing	$1,650,000	—

Notes:

a) See Appendix II for detailed construction cost estimates.

b) This unsolicited manufacturer's estimate was received after construction cost estimates had been generated for all other alternatives. It is provided for client consideration, but was not fully developed as an approved construction cost estimate.

Appendix I. Alternative Trash Cleaning System Types, Descriptions, Advantages, and Disadvantages

Design A: Backhoe Style Rake on Deck Rails

This trash rake can be designed to be operated both manually by an operator and automatically without an operator. The rake looks like a rail mounted backhoe (Figure 5). The rake traverses the trashrack structure to allow cleaning the entire structure one bay at a time. The unit can pivot around a vertical axis to allow the rake to dump debris directly in a trash rail car, truck, or trailer either traveling along with the rake as it cleans or parked at one end of the structure.

Trash rake operation in Automatic Mode: At the startup signal, the trash rake travels to the first trashrack cleaning point and stops. The rake arm pivots out over the water and the arm is extended to the programmed cleaning level using hydraulics. The rake head gripper is then brought toward the structure until it contacts the rack. An adjustable pressure force is maintained between the gripper scraping bar and the racks as the rake head is raised along the rack face, cleaning the rack with an upward scraping motion. At the programmed high position, the gripper closes around the collected debris, securing it for removal. The rake then raises the debris, pivots to position the rake head over the deck, and dumps the debris into a designated dumping container. This dumping procedure may require traveling to a dumping area at the end of the structure if a trash rail car, trailer or truck does not travel with the rake as it cleans. The cleaning cycle is then repeated until each trashrack section has been cleaned. Once all the trashracks have been cleaned, the rake will return to the designated parking position.

Although several manufacturers exist, evaluation of advantages and disadvantages of this type of system is based on the KÜNZ TRCM H1000. A similar installation is at the Broadwater Power Station, Tosten Dam in Montana.

Advantages:

a. Rake can be operated automatically (automatic startup can be with a periodic clock or timer controls, pushbutton, and/or differential level controls) and manually to clean all the trashrack bays with one raking unit.
b. This unit can be purchased and assembled on site like a crane or backhoe.
c. Rake can clean both inclined and vertically mounted trashracks. The existing trashracks are 26° off of vertical.
d. Requires no conveyors. Can dump the raked debris directly into a truck or trailer moving along with the rake, or will transport the debris to where a parked trailer or dumpster is located.
e. Minimal equipment interference since there is no conveyor, the rake can be parked out of the way, and the dumpster is movable.
f. The rake can accommodate the trashrack bar spacing and depth.

g. The rake head is provided with replaceable scraper bar(s) and utilizes hydraulic controls to apply pressure against the trashrack during the cleaning process.

h. The rake, when operated in manual mode, can pick up floating debris in front of the intake. A similar model trash rake at the Broadwater Power Station (see Figure 5) was able to reach approximately 75 ft horizontally.

i. Can be provided with controls (selector switch) to allow selective cleaning of just the upper portion of the trashracks or the complete depth of trashracks.

j. The area immediately above the existing trashracks will remain accessible and uncluttered.

k. The rake head can be supplied with several optional attachments (i.e. - clamp shelf gripper, log gripper, cleaning rake).

l. The rake can be used to remove other equipment such as the trashracks or stoplogs for servicing with an optional attachment.

m. All of the rake equipment is stored out of the water.

Disadvantages:

a. May not be an American Made/Sole Source: Many parts are made in Austria while some parts are made in North Carolina. Although several manufacturers may be able to shop-build a similar machine, the KÜNZ TRCM H1000 may present some "sole source" concerns. The similar Lakeside/MUHR Hydronic system is also mostly German-manufactured.

b. New trash rake track rails will probably need to be furnished (old rails were specified around 1936) and the new rails will need to be specific to this trash rake's requirements.

c. Downstream travel rail will need to project above the deck to allow holding down the rake while operating. This will reduce the available roadway width on the trashrack structure.

d. Existing trashrack structure deck loading and carrying capability will need to be evaluated. Wheel loads are transmitted to the deck-mounted rails.

e. The rake head is not usually provided with teeth that project between the trashrack bars.

f. The existing intermediate metal guides projecting upstream of the trashracks may make it more difficult to position the rake head against the trashracks during manual operation, especially near the bottom. The operator's cab may limit visual operation.

Example Application – Power Station Broadwater

Technical Data:

Width of rake	10 ft
Screen bar pitch	12 inch
Rack inclination	87 ^{o}
Depth of cleaning	60 ft
Hoisting capacity	40 kN
Power input	30 kW

Künz America Inc., Raleigh NC 27617, Phone 919-783-8427

Customer	State of Montana
Location	Power Station Broadwater / USA
Rake Model	TRCM-H1000

Figure 5. — Künz TRCM H1000 (Backhoe Type Rake)

Design B: Cable-Style Rake and Gripper Head on Overhead Monorail

This trash rake is normally designed to operate automatically without an operator by lowering a hydraulically controlled debris gripper suspended from cables. The debris gripper travels down the trashrack face, then back up with debris held in the gripper. The trash rake can also be operated manually by pendant control. The trash rake is provided with an overhead monorail track with support columns/frames that are mounted on the trashrack structure (see Figures 6 and 7). The trash rake trolley travels along the monorail track to clean the entire structure, one trashrack section at a time. The rake transports the raked debris and dumps the debris directly into a truck, trailer or trash bin parked at one end of the structure.

Trash rake operation in Automatic Mode: At the startup signal, the trash rake trolley travels to the first trashrack cleaning point and stops. The hoist then lowers the gripper (with gripper jaws in the opened position), engaging the trashracks near the top section of the trashracks and descends to the bottom of the trashrack. As the gripper is lowered, debris is collecting within its jaws. Once the bottom limit is reached, hydraulic cylinders close the gripper jaws, securing the debris for removal. The hoist then raises the gripper and debris up to the trolley. The trolley motor is started and the trolley is moved to the designated dump area where it stops and dumps the debris. The cleaning cycle is then repeated until each trashrack section has been cleaned. Once all the trashracks have been cleaned, the rake will return to the designated park position.

Although several manufacturers exist, evaluation of advantages and disadvantages of this type of system is based on the Brackett Green USA, Inc., Brackett Bosker Super Duty Raking Machine. A similar installation is at the Headgate Rock Dam, AZ.

Advantages:

a. Rake can be operated automatically (automatic startup can be with a periodic clock or timer controls, pushbutton, and/or differential level controls) and manually to clean all the trashrack bays with one raking unit.
b. Two rakes can be operated on the same overhead beam (track), if desired. Both straight and curved overhead tracks can be supplied.
c. Requires no conveyors. Rake transports the raked debris to a debris dumping location (dumpster or parked trailer) at the end of the structure.
d. Minimal equipment interference since there is no conveyor. Even the movable dumpster may be out of the way if a curved overhead beam (track) is provided as part of the design at the end of the structure.

e. The recommended trashrack angle for operation of the Brackett Bosker Raking Machine is from 8° to 35° off of vertical. The existing trashracks are 26° off of vertical.

f. The super duty model raking machine is rated for a safe working load of 2,200 pounds (debris load). The trash rake manufacturer has other models that range from a safe working load of 550 lbs (Light Duty) up to a safe working load of 6,600 lbs (Ultra Duty).

g. The rake can accommodate the trashrack bar spacing and depth.

h. The rake head (gripper) has teeth that project within the trashrack to dislodge debris from the rack.

i. Locations for the monorail support columns are compatible with the trashrack structure. Maximum allowable span between support columns is 40 ft, and existing trashrack piers are spaced on 19.5 ft centers.

j. The area immediately above the existing trashracks will remain accessible and uncluttered.

k. Rake can be provided with controls (selector switch) to allow selective cleaning of just the upper portion of the trashracks or the complete depth of trashracks.

l. All of the rake equipment is stored out of the water.

<u>Disadvantages:</u>

a. Not American Made / Sole Source: The parent company is not American and the Brackett Bosker Raking Machine may present some "sole source" concerns. While the carriage is made in the Netherlands, the monorail and other parts are made in Texas.

b. Length of trashrack structure may require that two rakes be provided to keep up with future debris loads or to reduce the time it takes to complete one cleaning cycle of the trashrack structure.

c. When the selector switch is positioned for full depth cleaning, the rake is required to force the debris to the bottom of the trashracks before closing the gripper jaws.

d. With matted, floating debris, the rake head may not be able to push the debris down to the selected cleaning depth. A slack rope limit switch will cease the lowering motion. The gripper may then be closed, raised and the debris taken to the dump area.

e. High winds may affect the gripper position as it is being lowered (prior to contacting the trashrack).

Design B: Overhead Monorail / Cable Deployed Debris Gripper Sketches

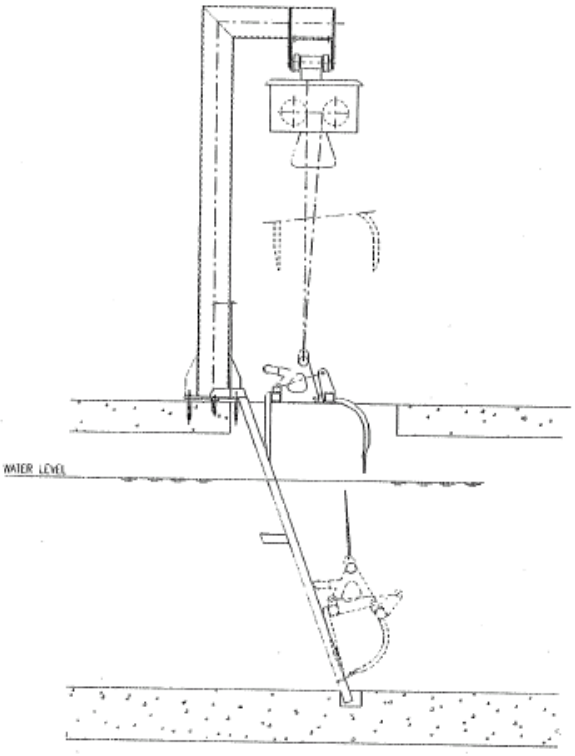

Figure 6. — Typical Brackett Bosker Raking Machine sectional view.

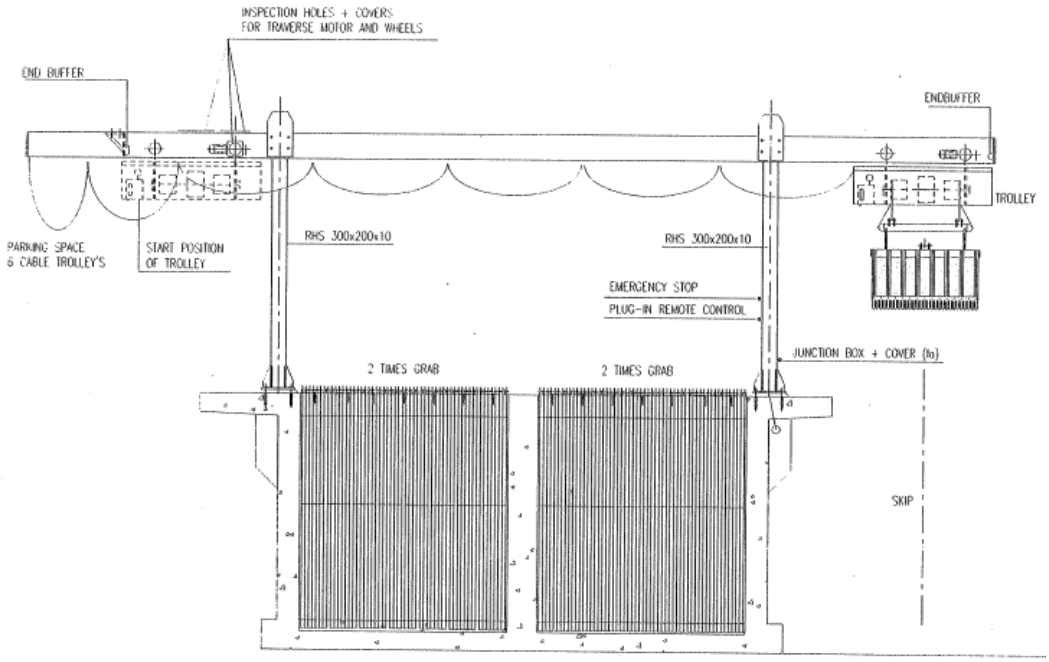

Figure 7. — Typical Brackett Bosker Raking Machine longitudinal view

Design C: Cable Style Rake on Rails

This trash rake can be designed to be operated both manually by an operator and automatically without an operator. The trash raking machine rides on deck mounted rails to traverse the structure to allow cleaning all of the trashracks, one section at a time. Cleaning is accomplished by lowering and controlling the debris gripper with cables (see Figure 8). Debris can be raked up into a trash rail car or bin that moves with the rake or into a debris conveyance (conveyor) system. Optional features can be provided as part of the trash rake (such as a jib crane hoist with grab rake, or stoplog lifter) to increase the functionality of the system. Because the trashracks end below the piers and the existing guides extend above the piers, a trashrack extension may be required above the existing trashracks to allow the debris to be raked high enough to mate with the trash rake body so it can be dumped into the conveyor(s), car or bin. Due to the length of the trashrack structure, two or more conveyors would be required. The debris is moved by the conveyors to a dumping location. An additional conveyor may be required if the debris needs to be elevated to dump into a trash bin, truck, or trailer.

Trash Rake Operation in Automatic Mode: At the startup signal, the trash rake travels to the first trashrack cleaning point and stops. The hoist then lowers the gripper (with gripper jaws in the opened position), engaging the trashracks near the top section of the trashracks and descends to the bottom of the trashrack. As the gripper is lowered, debris is collected within its jaws. Upon reaching the bottom limit, hydraulic cylinders close the gripper jaws, securing the debris for removal. The hoist then raises the gripper and debris up to the trolley. The trolley motor is started and the trolley is moved to the designated dump area where it stops and dumps the debris. The cleaning cycle is then repeated until each trashrack section has been cleaned. Once all the trashracks have been cleaned, the rake will return to the designated park position.

Although several manufacturers exist, evaluation of advantages and disadvantages of this type of system is based on the Lakeside Equipment Corporation/Muhr, Catronic Series Type SV Trash Rake. A similar installation is at Imperial Dam, AZ.

Advantages:

a. Rake can be operated automatically (automatic startup can be with a periodic clock or timer controls, pushbutton, and/or differential level controls) and manually to clean all the trashrack bays with one raking unit.
b. Requires no conveyors if rake provided with a trash rail car or bin that travels with the rake.
c. Minimal equipment interference if there is no conveyor, the rake can be parked out of the way, and the dumpster is movable.

d. The raking machine cable winch can be rated for a safe working load of 10 tons.

e. The rake can accommodate the trashrack bar spacing, angle and depth.

f. The rake head (gripper) has teeth that project within the trashrack to dislodge debris from the rack.

g. Rake can be provided with controls (selector switch) to allow selective cleaning of just the upper portion of the trashracks or the complete depth of trashracks.

h. The rake can be provided with optional features that allow removal of large debris or used to remove other equipment such as the trashracks or stoplogs for servicing.

i. All of the rake equipment is stored out of the water.

Disadvantages:

a. Not American Made / Sole Source: The main raking machine is made in Germany. Rails, superstructure, and control systems are mostly American-made.

b. When the selector switch is positioned for full depth cleaning, the rake is required to force the debris to the bottom of the trashracks before closing the gripper jaws.

c. With matted, floating debris, the rake head may not be able to push the debris down to the lowered setting. A slack rope limit switch will cease the lowering motion. The gripper may then be closed, raised and the debris taken to the dump area.

d. New trash rake track rails will probably need to be furnished (old rails were specified around 1936) and the new rails will need to be specific to this trash rake's needs.

e. Existing trashrack structure deck loading and carrying capability will need to be evaluated. Wheel loads are transmitted to the deck mounted rails.

f. The trash rake and conveyor(s) may have problems with large objects like large logs. The conveyor(s) may jam under some loading conditions.

g. A trashrack extension is required to allow raking the debris up and into the trash rail car, bin or conveyor.

h. If required, the conveyor system will reduce the available roadway width on the trashrack structure. The blockage is increased over the other options since the conveyor is positioned between the rake's rails.

i. Limited Access: The slab area immediately above the trashracks will be occupied with the trashrack extension and possibly a conveyor system. This will make access to the trashracks or a stalled rake difficult.

Design C: Cable Style Rake on Rails Photos

Traversing Type SV

Traversing Type SV with Jib Hoist

Figure 8. — Lakeside Equipment Corporation/Muhr, Catronic Series Type SV Trash Rake.

Design D: Hydraulic Rake (Hand Rake Style) with Support Structure

This hydraulically operated rake imitates the action and design of hand raking (see Figure 9). The debris is raked up the trashrack by the hydraulic rake and is dumped either onto the deck for manual removal, or into a debris conveyance system. This type of trash rake is designed to operate both automatically and manually. Manual operation is by pendant control. The rake carriage traverses the trashrack structure on a support rail system to allow cleaning the entire structure, one bay at a time. A trashrack extension will be required above the existing trashracks to allow the debris to be raked high enough so that it can be dumped into the conveyor(s). Due to the length of the trashrack structure, two or more conveyors would be required. The debris is moved by the conveyors to a dumping location. An additional conveyor may be required if the debris needs to be elevated to dump into a trash bin, truck, or trailer.

Trash Rake Operation in Automatic Mode: At the startup signal, both the rake and the conveyor are started. The trash rake then travels to the first trashrack cleaning point and stops. The rake arm is pivoted upstream and the arm extended using hydraulics. The arm then rotates back towards the trashracks until the rake head contacts the rack. An adjustable pressure force is maintained between the rake head scraping bar and the racks as the rake cleans the rack in an upwards motion. At the top of the trashrack extension the rake pulls the debris into a conveyor. The cleaning cycle is then repeated until each trashrack section has been cleaned. After all of the trashracks have been cleaned, the rake will return to the designated parking position. The conveyor(s) will continue to operate for a preset time period to ensure that all the debris has been transported out of the conveyor before shutting off.

Although several manufacturers exist, evaluation of advantages and disadvantages of this type of system is based on the Atlas Polar Company, Ltd. Hydrorake System - Model DT8300 (double boom rake). The closest similar installation is at New Waddell, AZ.

Advantages:

a. Rake can be operated automatically (automatic startup can be with a periodic clock or timer controls, pushbutton, and/or differential level controls) and manually to clean all the trashrack bays with one raking unit.
b. Multiple rakes can be operated on the same support rail system, if desired.
c. The recommended trashrack angle for operation of the Atlas Polar rake is from 3° to 30° off of vertical. The existing trashracks are 26° off of vertical.
d. The rake is rated for a safe working load of 4,000 pounds (debris load).

e. The rake's support rail system will be installed to not interfere with the installation or removal of the existing trashracks.

f. Locations for the supports are compatible with the trashrack structure (the existing trashrack piers are spaced on 19.5 ft centers).

g. Rake can be provided with controls (selector switch) to allow selective cleaning of just the upper portion of the trashracks or the complete depth of trashracks.

h. All of the rake equipment is stored out of the water.

i. The rake can accommodate the trashrack bar spacing and depth.

j. Several installations exist at Reclamation sites.

Disadvantages:

a. Not American Made / Sole Source: The manufacturer is not American and the Atlas Polar Hydrorake Systems, Ltd. DT8300 may present some "sole source" concerns. Shop-made units may be available from other companies.

b. The trash rake and conveyor(s) may have problems with large objects like large logs. The conveyor(s) may jam under some loading conditions.

c. The rake head is not usually provided with teeth that project between the trashrack bars.

d. The existing intermediate metal guides projecting upstream of the trashracks may make manual operation more difficult to position the rake head against the trashracks, especially near the bottom.

e. A trashrack extension and conveyor system is required to automatically transfer the debris to a dumpster or trailer parked at one end of the structure. The conveyor will reduce the available roadway width on the trashrack structure.

f. Limited Access: The slab area immediately above the trashracks will be occupied with the trashrack extension and the conveyor system. This will make access to the trashracks or a stalled rake difficult. Construction of metal walkways over the water or over the conveyor system to access the Hydrorake equipment must be considered.

Design D: Hydraulic Rake (Hand Rake Style) With Support Structure Photos

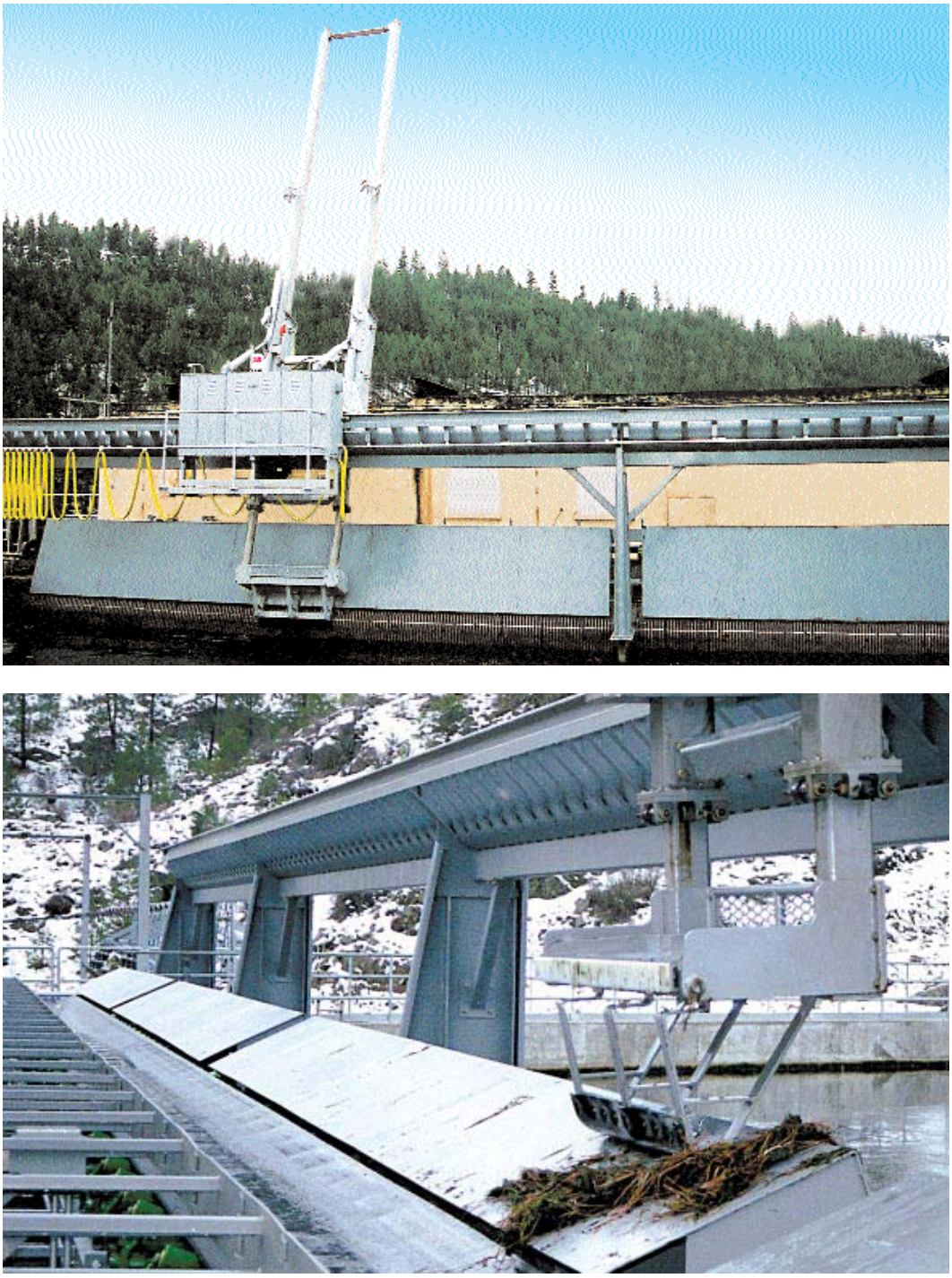

Figure 9. — Atlas Polar Company, Ltd., Model DT8300 Hydrorake.

Design E: Flex-Rake

The Flex-Rake type trash rake is manufactured by the Duperon Corporation and has side chains (Flex-Link) with scraper bars between the chains to provide a slow, continuous cleaning of the trashracks, see Figure 10. Because of the design of the Flex-Link chains, no sprockets, bearings, or tracks are required underwater. One rake would be required for each trashrack bay. Operation of the rakes are usually continuous provided with ON or OFF controls, but can also be automated. The debris is raked up the trashracks by the rake and is dumped onto a debris conveyance system. A trashrack extension would be required above the existing trashracks to allow the debris to be raked high enough so it can be dumped into the conveyor(s). Due to the length of the trashrack structure, two or more conveyors would be required. The debris is moved by the conveyors to a dumping location. An additional conveyor may be required if the debris needs to be elevated to dump into a trash bin, truck, or trailer.

Advantages:

b. The ideal angle for Flex-Rake operation is 20° to 30°. The existing trashracks are 26° off vertical.

c. The rakes can accommodate the trashrack bar spacing.

d. The scrapers are UHMW, and are usually serrated and configured to the trashrack bars.

e. Each of the rakes can lift up to 1,000 lbs of debris.

f. The Flex-Rake is normally designed to run continuously and slowly, so a control PLC would not be necessary. However, the rakes can be provided with additional controls that allow automatic operation of the rakes using cycle timers, differential level control, and remote start/stop.

g. All underwater parts are non-corrosive.

h. The Flex-Rake is American made.

Disadvantages:

a. Sole Source: The Duperon Corporation, Flex-Rake may present some "sole source" concerns. Similar shop-made units may be available from other companies.

b. A trashrack extension and conveyor system is required to automatically transfer the debris to a dumpster or trailer parked at one end of the structure. The conveyor would reduce the available roadway width on the trashrack structure.

c. Limited Access: The slab area immediately above the trashracks will be occupied with the trashrack extension and the conveyor system. This will

make access to the existing trashracks and the Flex-Rake equipment difficult.

d. Twenty four (24) individual trash rakes will be required to clean the trashracks.

e. Operation of the rakes is such that the floating debris (debris mats) would first need to be pulled down and around the bottom before it is raked up the rack.

f. Stringy material can get wrapped around the horizontal bars of the rake and make it difficult to dump the debris into the conveyor.

Design E: Flex-Rake Sketches

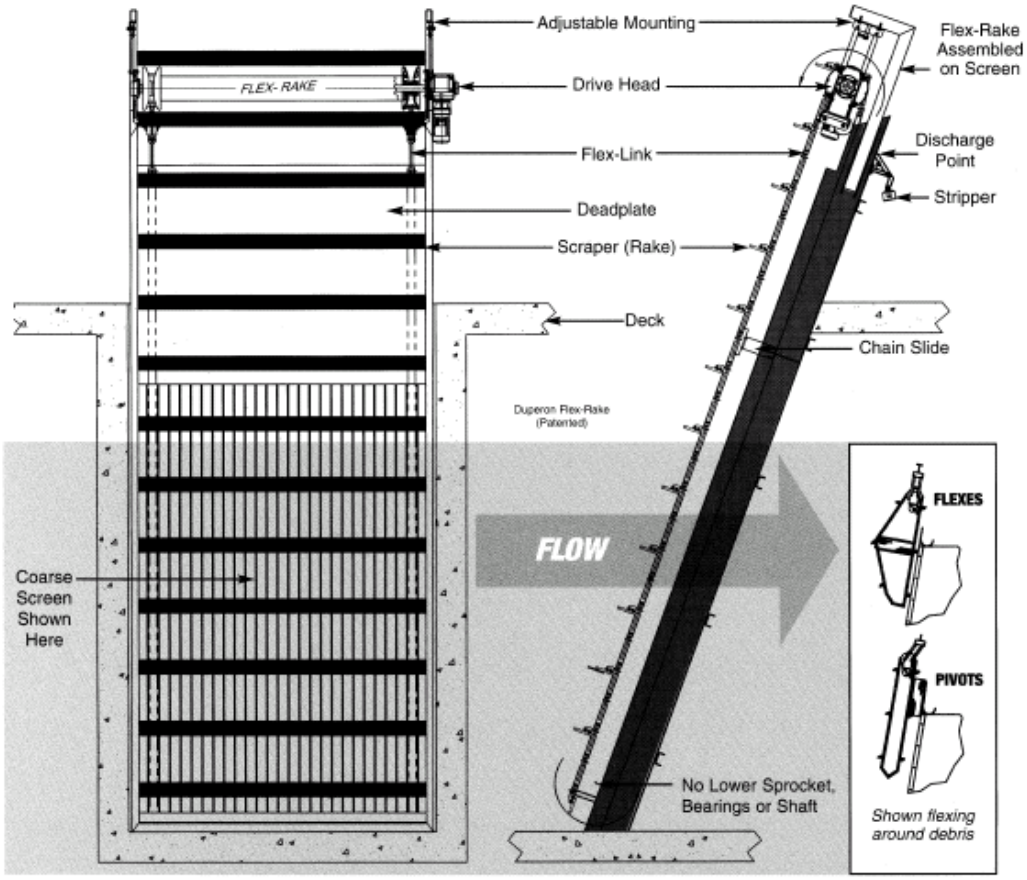

Figure 10. — Duperon Corporation Flex-Rake.

Appendix II. Approved Appraisal-Level Quantities Worksheets and Cost Estimates

BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

SHEET _ 1 _ OF _ 1 _

FEATURE: Parker Powerplant - Trashrack Structure Trash Rake Study Gripper Style Rake Assuming award in 1 year	**PROJECT:** Parker Dam Power **WOID:** L316C **ESTIMATE LEVEL:** Appraisal **REGION:** LC **UNIT PRICE LEVEL:** Oct-2008 **FILE:** C:\Estimating\Parker Dam\Powerplant Trashrack Intake Debris Removal\Appraisal Study - 12-2008\[Parker Trashrack Cleaning Alternatives Appr Study Ests - 12-2008.xls]Gripper Type-BrackettBosker-3YR

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Furnish and install gripper style trash rake sys	86-68410		LS		$1,800,000.00
		Assume: Brackett Bosker Raking Machine, super duty with L type column supports with track, festoon, and control panel.					
		- Rake capacity, working load = 2200 lbs					
		- Hoist motor size = 7.5 Hp					
		- Weight of trolley = 2800 lbs					
		- Weight of gripper = 2200 lbs					
		- Number of support columns = 15					
		- Est. height of support column = 20 ft					
		- Est. total steel wt of columns = 22,500 lbs					
		- Length of straight track = 274 ft					
		- Est. total steel wt of track = 32,800 lbs					
		NOTE: Assumes structural members are steel. No Stainless Steel nor any other specialty metal alloy is assumed					
		Subtotal 1					**$1,800,000.00**
		Mobilization	5%				$90,000.00
		Subtotal 1 with Mobilization					**$1,890,000.00**
		Escalation to Notice to Proceed (NTP), from (12/2008) to (12/2009), at 4%/yr for 12 months					$60,000.00
		Subtotal 2 = Subtotal 1 with Mobilization + Escalation to NTP					**$1,950,000.00**
		Escalation During Construction not applicable as contract duration is minimal,					
		Subtotal 3 = Subtotal 2 + Escalation During Construction					**$1,950,000.00**
		Design Contingencies	15%				$350,000.00
		Allowance for Procurement Strategies (APS)	0%				
		Type of solicitation assumed is full and open competition sealed bid					
		CONTRACT COST					**$2,300,000.00**
		Construction Contingencies	25%				$500,000.00
		FIELD COST					**$2,800,000.00**
		Non-Contract Costs	33%				$900,000.00
		CONSTRUCTION COST					**$3,700,000.00**
		Notes: Non-Contract Costs are included in this cost estimate to obtain a Construction Cost. The Non-Contract Costs shown are distributive only. Project specific lands and rights and contracts for relocation of property by others are not included. Reference documents RM D&S Cost Estimate (FAC 09-01) and RM D&S CCE and PCE (FAC 09-02).					

QUANTITIES		PRICES	
BY	**CHECKED**	**BY**	**CHECKED**
Rick Christensen	Ryan Stephen	Craig A. Grush, P.E.	Math: DW 12-08-08
DATE PREPARED	**PEER REVIEW / DATE**	**DATE PREPARED**	**PEER REVIEW / DATE**
11/7/2008 (Rev. 11/18/08)	Wayne Delzer	12/08/08	DD 12-8-08

BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

SHEET _1_ OF _1_

FEATURE:	PROJECT:
Parker Powerplant - Trashrack Structure Trash Rake Study Gripper Style Rake Assuming award in 2 years	Parker Dam Power WOID: L316C — ESTIMATE LEVEL: Appraisal REGION: LC — UNIT PRICE LEVEL: Oct-2008 FILE: C:\Estimating\Parker Dam\Powerplant Trashrack Intake Debris Removal\Appraisal Study - 12-2008\[Parker Trashrack Cleaning Alternatives Appr Study Ests - 12-2008.xls]Gripper Type-BrackettBosker-3YR

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Furnish and install gripper style trash rake sys	86-68410		LS		$1,800,000.00
		Assume: Brackett Bosker Raking Machine, super duty with L type column supports with track, festoon, and control panel.					
		- Rake capacity, working load = 2200 lbs					
		- Hoist motor size = 7.5 Hp					
		- Weight of trolley = 2800 lbs					
		- Weight of gripper = 2200 lbs					
		- Number of support columns = 15					
		- Est. height of support column = 20 ft					
		- Est. total steel wt of columns = 22,500 lbs					
		- Length of straight track = 274 ft					
		- Est. total steel wt of track = 32,800 lbs					
		NOTE: Assumes structural members are steel. No Stainless Steel nor any other specialty metal alloy is assumed					
		Subtotal 1					**$1,800,000.00**
		Mobilization	5%				$90,000.00
		Subtotal 1 with Mobilization					**$1,890,000.00**
		Escalation to Notice to Proceed (NTP), from (12/2008) to (12/2010), at 4%/yr for 24 months					$110,000.00
		Subtotal 2 = Subtotal 1 with Mobilization + Escalation to NTP					**$2,000,000.00**
		Escalation During Construction not applicable as contract duration is minimal,					
		Subtotal 3 = Subtotal 2 + Escalation During Construction					**$2,000,000.00**
		Design Contingencies	15%				$400,000.00
		Allowance for Procurement Strategies (APS)	0%				
		Type of solicitation assumed is full and open competition sealed bid					
		CONTRACT COST					**$2,400,000.00**
		Construction Contingencies	25%				$500,000.00
		FIELD COST					**$2,900,000.00**
		Non-Contract Costs	33%				$1,000,000.00
		CONSTRUCTION COST					**$3,900,000.00**
		Notes: Non-Contract Costs are included in this cost estimate to obtain a Construction Cost. The Non-Contract Costs shown are distributive only. Project specific lands and rights and contracts for relocation of property by others are not included. Reference documents RM D&S Cost Estimate (FAC 09-01) and RM D&S CCE and PCE (FAC 09-02).					

QUANTITIES		PRICES	
BY Rick Christensen	CHECKED Ryan Stephen	BY Craig A. Grush, P.E.	CHECKED M-th! 12-08-08
DATE PREPARED 11/7/2008 (Rev. 11/18/08)	PEER REVIEW / DATE Wayne Delzer	DATE PREPARED 12/08/08	PEER REVIEW / DATE 12-8-08

BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

SHEET _ 1 _ OF _ 1 _

FEATURE: Parker Powerplant - Trashrack Structure Trash Rake Study Gripper Style Rake Assuming award in 3 years	**PROJECT:** Parker Dam Power **WOID:** L316C — **ESTIMATE LEVEL:** Appraisal **REGION:** LC — **UNIT PRICE LEVEL:** Oct-2008 **FILE:** C:\Estimating\Parker Dam\Powerplant Trashrack Intake Debris Removal\Appraisal Study - 12-2008\[Parker Trashrack Cleaning Alternatives Appr Study Ests - 12-2008.xls]Gripper Type-BrackettBosker-3YR

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Furnish and install gripper style trash rake sys	86-68410		LS		$1,800,000.00
		Assume: Brackett Bosker Raking Machine, super duty with L type column supports with track, festoon, and control panel.					
		- Rake capacity, working load = 2200 lbs					
		- Hoist motor size = 7.5 Hp					
		- Weight of trolley = 2800 lbs					
		- Weight of gripper = 2200 lbs					
		- Number of support columns = 15					
		- Est. height of support column = 20 ft					
		- Est. total steel wt of columns = 22,500 lbs					
		- Length of straight track = 274 ft					
		- Est. total steel wt of track = 32,800 lbs					
		NOTE: Assumes structural members are steel. No Stainless Steel nor any other specialty metal alloy is assumed					
		Subtotal 1					**$1,800,000.00**
		Mobilization	5%				$90,000.00
		Subtotal 1 with Mobilization					**$1,890,000.00**
		Escalation to Notice to Proceed (NTP), from (12/2008) to (12/2011), at 4%/yr for 36 months					$210,000.00
		Subtotal 2 = Subtotal 1 with Mobilization + Escalation to NTP					**$2,100,000.00**
		Escalation During Construction not applicable as contract duration is minimal,					
		Subtotal 3 = Subtotal 2 + Escalation During Construction					**$2,100,000.00**
		Design Contingencies	15%				$300,000.00
		Allowance for Procurement Strategies (APS)	0%				
		Type of solicitation assumed is full and open competition sealed bid					
		CONTRACT COST					**$2,400,000.00**
		Construction Contingencies	25%				$700,000.00
		FIELD COST					**$3,100,000.00**
		Non-Contract Costs	33%				$1,000,000.00
		CONSTRUCTION COST					**$4,100,000.00**
		Notes: Non-Contract Costs are included in this cost estimate to obtain a Construction Cost. The Non-Contract Costs shown are distributive only. Project specific lands and rights and contracts for relocation of property by others are not included. Reference documents RM D&S Cost Estimate (FAC 09-01) and RM D&S CCE and PCE (FAC 09-02).					

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Rick Christensen	Ryan Stephen	Craig A. Grush, P.E.	Math! DC 12-08 TOB
DATE PREPARED	**PEER REVIEW / DATE**	**DATE PREPARED**	**PEER REVIEW / DATE**
11/7/2008 (Rev. 11/18/08)	Wayne Delzer	12/08/08	DCL 12-8-08

BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

SHEET _ 1 _ OF _ 1 _

FEATURE: Parker Powerplant - Trashrack Structure Trash Rake Study Backhoe Style Rake with Rails Assuming award in 1 year	**PROJECT:** Parker Dam Power
	WOID: L316C — **ESTIMATE LEVEL:** Appraisal
	REGION: LC — **UNIT PRICE LEVEL:** Oct-2008
	FILE: C:\Estimating\Parker Dam\Powerplant Trashrack Intake Debris Removal\Appraisal Study - 12-2008\[Parker Trashrack Cleaning Alternatives Appr Study Ests - 12-2008.xls]Gripper Type-BrackettBosker-3YR

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Furnish and install backhoe style trash rake sys	86-68410		LS		$1,700,000.00
		Assume: Kunz Hydraulic Boom Operated Trash Rake Cleaner, TRCM - H1000 with travel rails, power cable/reel, and control panel, 30 kW					
		- Rake capacity, working load = 9000 lbs at racks					
		- 74 ft horizontal reach, 270 degree rotation					
		- Approx. 55 ft depth					
		- Length of each trash rake travel rails = 294 ft					
		(two trash rake travel rails per installation)					
	2	Remove the existing trash rake rails to make room			LS		$100,000.00
		for the new rake's rails (two rails, 294 ft length each, total metalwork wt approx. = 10,100 lbs, concrete/grout removal and replacement around rails approximately 8 yd3)					
		(assumes existing trash car rails to not be removed)					
		(see dwgs 231-D-262 and -328)					
		NOTE: Assumes structural members are steel. No Stainless Steel nor any other specialty metal alloy is assumed					
		Subtotal 1					**$1,800,000.00**
		Mobilization	5%				$90,000.00
		Subtotal 1 with Mobilization					**$1,890,000.00**
		Escalation to Notice to Proceed (NTP), from (12/2008) to (12/2009), at 4%/yr for 12 months					$60,000.00
		Subtotal 2 = Subtotal 1 with Mobilization + Escalation to NTP					**$1,950,000.00**
		Escalation During Construction not applicable as contract duration is short					
		Subtotal 3 = Subtotal 2 + Escalation During Construction					**$1,950,000.00**
		Design Contingencies	15%				$350,000.00
		Allowance for Procurement Strategies (APS)	0%				
		Type of solicitation assumed is full and open competition sealed bid					
		CONTRACT COST					**$2,300,000.00**
		Construction Contingencies	25%				$500,000.00
		FIELD COST					**$2,800,000.00**
		Non-Contract Costs	33%				$900,000.00
		CONSTRUCTION COST					**$3,700,000.00**
		Notes: Non-Contract Costs are included in this cost estimate to obtain a Construction Cost. The Non-Contract Costs shown are distributive only. Project specific lands and rights and contracts for relocation of property by others are not included. Reference documents RM D&S Cost Estimate (FAC 09-01) and RM D&S CCE and PCE (FAC 09-02).					

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Rick Christensen	Ryan Stephen	Craig A. Grush, P.E.	Mth: DW 12.08.08
DATE PREPARED	**PEER REVIEW / DATE**	**DATE PREPARED**	**PEER REVIEW / DATE**
11/17/08	Wayne Delzer	12/08/08	DCD 12-8-08

BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

SHEET _1_ OF _1_

FEATURE: Parker Powerplant - Trashrack Structure Trash Rake Study Backhoe Style Rake with Rails Assuming award in 2 years	**PROJECT:** Parker Dam Power **WOID:** L316C — **ESTIMATE LEVEL:** Appraisal **REGION:** LC — **UNIT PRICE LEVEL:** Oct-2008 **FILE:** C:\Estimating\Parker Dam\Powerplant Trashrack Intake Debris Removal\Appraisal Study - 12-2008\[Parker Trashrack Cleaning Alternatives Appr Study Ests - 12-2008.xls]Gripper Type-BrackettBosker-3YR

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Furnish and install backhoe style trash rake syste	86-68410		LS		$1,700,000.00
		Assume: Kunz Hydraulic Boom Operated Trash Rake Cleaner, TRCM - H1000 with travel rails, power cable/reel, and control panel, 30 kW					
		- Rake capacity, working load = 9000 lbs at racks					
		- 74 ft horizontal reach, 270 degree rotation					
		- Approx. 55 ft depth					
		- Length of each trash rake travel rails = 294 ft					
		(two trash rake travel rails per installation)					
	2	Remove the existing trash rake rails to make room			LS		$100,000.00
		for the new rake's rails (two rails, 294 ft length each, total metalwork wt approx. = 10,100 lbs, concrete/grout removal and replacement around rails approximately 8 yd3)					
		(assumes existing trash car rails to not be removed)					
		(see dwgs 231-D-262 and -328)					
		NOTE: Assumes structural members are steel. No Stainless Steel nor any other specialty metal alloy is assumed					
		Subtotal 1					**$1,800,000.00**
		Mobilization	5%				$90,000.00
		Subtotal 1 with Mobilization					**$1,890,000.00**
		Escalation to Notice to Proceed (NTP), from (12/2008) to (12/2010), at 4%/yr for 24 months					$110,000.00
		Subtotal 2 = Subtotal 1 with Mobilization + Escalation to NTP					**$2,000,000.00**
		Escalation During Construction not applicable as contract duration is short					
		Subtotal 3 = Subtotal 2 + Escalation During Construction					**$2,000,000.00**
		Design Contingencies	15%				$400,000.00
		Allowance for Procurement Strategies (APS)	0%				
		Type of solicitation assumed is full and open competition sealed bid					
		CONTRACT COST					**$2,400,000.00**
		Construction Contingencies	25%				$500,000.00
		FIELD COST					**$2,900,000.00**
		Non-Contract Costs	33%				$1,000,000.00
		CONSTRUCTION COST					**$3,900,000.00**
		Notes: Non-Contract Costs are included in this cost estimate to obtain a Construction Cost. The Non-Contract Costs shown are distributive only. Project specific lands and rights and contracts for relocation of property by others are not included. Reference documents RM D&S Cost Estimate (FAC 09-01) and RM D&S CCE and PCE (FAC 09-02).					

QUANTITIES		PRICES	
BY	**CHECKED**	**BY**	**CHECKED**
Rick Christensen	Ryan Stephen	Craig A. Gush, P.E.	Mtk: dcd 12-08-08
DATE PREPARED	**PEER REVIEW / DATE**	**DATE PREPARED**	**PEER REVIEW / DATE**
11/17/08	Wayne Delzer	12/08/08	dcd 12-8-08

BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

SHEET _ 1 _ OF _ 1 _

FEATURE:	PROJECT:
Parker Powerplant - Trashrack Structure Trash Rake Study Backhoe Style Rake with Rails Assuming award in 3 years	Parker Dam Power
	WOID: L316C — ESTIMATE LEVEL: Appraisal
	REGION: LC — UNIT PRICE LEVEL: Oct-2008
	FILE: C:\Estimating\Parker Dam\Powerplant Trashrack Intake Debris Removal\Appraisal Study - 12-2008\[Parker Trashrack Cleaning Alternatives Appr Study Ests - 12-2008.xls]Gripper Type-BrackettBosker-3YR

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Furnish and install backhoe style trash rake syste	86-68410		LS		$1,700,000.00
		Assume: Kunz Hydraulic Boom Operated Trash Rake Cleaner, TRCM - H1000 with travel rails, power cable/reel, and control panel, 30 kW					
		- Rake capacity, working load = 9000 lbs at racks					
		- 74 ft horizontal reach, 270 degree rotation					
		- Approx. 55 ft depth					
		- Length of each trash rake travel rails = 294 ft					
		(two trash rake travel rails per installation)					
	2	Remove the existing trash rake rails to make room for the new rake's rails (two rails, 294 ft length each, total metalwork wt approx. = 10,100 lbs, concrete/grout removal and replacement around rails approximately 8 yd3) (assumes existing trash car rails to not be removed) (see dwgs 231-D-262 and -328)			LS		$100,000.00
		NOTE: Assumes structural members are steel. No Stainless Steel nor any other specialty metal alloy is assumed					
		Subtotal 1					**$1,800,000.00**
		Mobilization	5%				$90,000.00
		Subtotal 1 with Mobilization					**$1,890,000.00**
		Escalation to Notice to Proceed (NTP), from (12/2008) to (12/2011), at 4%/yr for 36 months					$210,000.00
		Subtotal 2 = Subtotal 1 with Mobilization + Escalation to NTP					**$2,100,000.00**
		Escalation During Construction not applicable as contract duration is short					
		Subtotal 3 = Subtotal 2 + Escalation During Construction					**$2,100,000.00**
		Design Contingencies	15%				$300,000.00
		Allowance for Procurement Strategies (APS)	0%				
		Type of solicitation assumed is full and open competition sealed bid					
		CONTRACT COST					**$2,400,000.00**
		Construction Contingencies	25%				$700,000.00
		FIELD COST					**$3,100,000.00**
		Non-Contract Costs	33%				$1,000,000.00
		CONSTRUCTION COST					**$4,100,000.00**
		Notes: Non-Contract Costs are included in this cost estimate to obtain a Construction Cost. The Non-Contract Costs shown are distributive only. Project specific lands and rights and contracts for relocation of property by others are not included. Reference documents RM D&S Cost Estimate (FAC 09-01) and RM D&S CCE and PCE (FAC 09-02).					

QUANTITIES		PRICES	
BY Rick Christensen	CHECKED Ryan Stephen	BY Craig A. Grush, P.E.	CHECKED Math : DW 12-08-08
DATE PREPARED 11/17/08	PEER REVIEW / DATE Wayne Delzer	DATE PREPARED 12/08/08	PEER REVIEW / DATE DCD 12-8-08

BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

SHEET _1_ OF _1_

FEATURE:	PROJECT:	
Parker Powerplant - Trashrack Structure Trash Rake Study Monorail Style Rake Assuming award in 1 year	Parker Dam Power	
	WOID: L316C	ESTIMATE LEVEL: Appraisal
	REGION: LC	UNIT PRICE LEVEL: Oct-2008
	FILE: C:\Estimating\Parker Dam\Powerplant Trashrack Intake Debris Removal\Appraisal Study - 12-2008\[Parker Trashrack Cleaning Alternatives Appr Study Ests - 12-2008.xls]Gripper Type-BrackettBosker-3YR	

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Furnish and install monorail trash rake system:	86-68410		LS		$1,800,000.00
		Assume: Lakeside Equipment Corp					
		Cantronic SH Monorail Trashrake Model SH-4525					
		NOTE: Assumes structural members are steel. No Stainless Steel nor any other specialty metal alloy is assumed					
		Subtotal 1					**$1,800,000.00**
		Mobilization	5%				$90,000.00
		Subtotal 1 with Mobilization					**$1,890,000.00**
		Escalation to Notice to Proceed (NTP), from (12/2008) to (12/2009), at 4%/yr for 12 months					$60,000.00
		Subtotal 2 = Subtotal 1 with Mobilization + Escalation to NTP					**$1,950,000.00**
		Escalation During Construction not applicable as contract duration is short					
		Subtotal 3 = Subtotal 2 + Escalation During Construction					**$1,950,000.00**
		Design Contingencies	15%				$350,000.00
		Allowance for Procurement Strategies (APS)	0%				
		Type of solicitation assumed is full and open competition sealed bid					
		CONTRACT COST					**$2,300,000.00**
		Construction Contingencies	25%				$500,000.00
		FIELD COST					**$2,800,000.00**
		Non-Contract Costs	33%				$900,000.00
		CONSTRUCTION COST					**$3,700,000.00**
		Notes: Non-Contract Costs are included in this cost estimate to obtain a Construction Cost. The Non-Contract Costs shown are distributive only. Project specific lands and rights and contracts for relocation of property by others are not included. Reference documents RM D&S Cost Estimate (FAC 09-01) and RM D&S CCE and PCE (FAC 09-02).					

QUANTITIES		PRICES	
BY	**CHECKED**	**BY**	**CHECKED**
Rick Christensen	Ryan Stephen	Craig A. Grush, P.E.	12-08-08
DATE PREPARED	**PEER REVIEW / DATE**	**DATE PREPARED**	**PEER REVIEW / DATE**
11/17/08	Wayne Delzer	12/08/08	12-8-08

BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

SHEET _1_ OF _1_

FEATURE: Parker Powerplant - Trashrack Structure Trash Rake Study Monorail Style Rake Assuming award in 2 years	**PROJECT:** Parker Dam Power **WOID:** L316C — **ESTIMATE LEVEL:** Appraisal **REGION:** LC — **UNIT PRICE LEVEL:** Oct-2008 **FILE:** C:\Estimating\Parker Dam\Powerplant Trashrack Intake Debris Removal\Appraisal Study - 12-2008\[Parker Trashrack Cleaning Alternatives Appr Study Ests - 12-2008.xls]Gripper Type-BrackettBosker-3YR

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Furnish and install monorail trash rake system:	86-68410		LS		$1,800,000.00
		Assume: Lakeside Equipment Corp					
		Cantronic SH Monorail Trashrake Model SH-4525					
		NOTE: Assumes structural members are steel. No Stainless Steel nor any other specialty metal alloy is assumed					
		Subtotal 1					**$1,800,000.00**
		Mobilization	5%				$90,000.00
		Subtotal 1 with Mobilization					**$1,890,000.00**
		Escalation to Notice to Proceed (NTP), from (12/2008) to (12/2010), at 4%/yr for 24 months					$110,000.00
		Subtotal 2 = Subtotal 1 with Mobilization + Escalation to NTP					**$2,000,000.00**
		Escalation During Construction not applicable as contract duration is short					
		Subtotal 3 = Subtotal 2 + Escalation During Construction					**$2,000,000.00**
		Design Contingencies	15%				$400,000.00
		Allowance for Procurement Strategies (APS)	0%				
		Type of solicitation assumed is full and open competition sealed bid					
		CONTRACT COST					**$2,400,000.00**
		Construction Contingencies	25%				$500,000.00
		FIELD COST					**$2,900,000.00**
		Non-Contract Costs	33%				$1,000,000.00
		CONSTRUCTION COST					**$3,900,000.00**
		Notes: Non-Contract Costs are included in this cost estimate to obtain a Construction Cost. The Non-Contract Costs shown are distributive only. Project specific lands and rights and contracts for relocation of property by others are not included. Reference documents RM D&S Cost Estimate (FAC 09-01) and RM D&S CCE and PCE (FAC 09-02).					

QUANTITIES		PRICES	
BY	**CHECKED**	**BY**	**CHECKED**
Rick Christensen	Ryan Stephen	Craig A. Grush, P.E.	Math! DW 12-01-08
DATE PREPARED	**PEER REVIEW / DATE**	**DATE PREPARED**	**PEER REVIEW / DATE**
11/17/08	Wayne Delzer	12/08/08	DCP 12-8-08

BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

SHEET _ 1 _ OF _ 1 _

FEATURE:	PROJECT:	
Parker Powerplant - Trashrack Structure Trash Rake Study Monorail Style Rake Assuming award in 3 years	Parker Dam Power	
	WOID: L316C	ESTIMATE LEVEL: Appraisal
	REGION: LC	UNIT PRICE LEVEL: Oct-2008
	FILE: C:\Estimating\Parker Dam\Powerplant Trashrack Intake Debris Removal\Appraisal Study - 12-2008\[Parker Trashrack Cleaning Alternatives Appr Study Ests - 12-2008.xls]Gripper Type-BrackettBosker-3YR	

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Furnish and install monorail trash rake system:	86-68410		LS		$1,800,000.00
		Assume: Lakeside Equipment Corp					
		Cantronic SH Monorail Trashrake Model SH-4525					
		NOTE: Assumes structural members are steel. No Stainless Steel nor any other specialty metal alloy is assumed					
		Subtotal 1					**$1,800,000.00**
		Mobilization	5%				$90,000.00
		Subtotal 1 with Mobilization					**$1,890,000.00**
		Escalation to Notice to Proceed (NTP), from (12/2008) to (12/2011), at 4%/yr for 36 months					$210,000.00
		Subtotal 2 = Subtotal 1 with Mobilization + Escalation to NTP					**$2,100,000.00**
		Escalation During Construction not applicable as contract duration is short					
		Subtotal 3 = Subtotal 2 + Escalation During Construction					**$2,100,000.00**
		Design Contingencies	15%				$300,000.00
		Allowance for Procurement Strategies (APS)	0%				
		Type of solicitation assumed is full and open competition sealed bid					
		CONTRACT COST					**$2,400,000.00**
		Construction Contingencies	25%				$700,000.00
		FIELD COST					**$3,100,000.00**
		Non-Contract Costs	33%				$1,000,000.00
		CONSTRUCTION COST					**$4,100,000.00**
		Notes: Non-Contract Costs are included in this cost estimate to obtain a Construction Cost. The Non-Contract Costs shown are distributive only. Project specific lands and rights and contracts for relocation of property by others are not included. Reference documents RM D&S Cost Estimate (FAC 09-01) and RM D&S CCE and PCE (FAC 09-02).					

QUANTITIES		PRICES	
BY Rick Christensen	CHECKED Ryan Stephen	BY Craig A. Grush, P.E.	CHECKED Math! DW 12-08-08
DATE PREPARED 11/17/08	PEER REVIEW / DATE Wayne Delzer	DATE PREPARED 12/08/08	PEER REVIEW / DATE DCD 12-8-08

Appendix III. Manufacturer-Provided Design Information and Cost Estimates

1335 Regents Park Dr., Ste 260, Houston, TX. 77058
PH: (281) 480-7955 -- FAX: (281) 480-8225

TO:	U. S. Bureau of Reclamation	DATE:	December 5, 2008
Attn:		EMAIL:	Forwarded by Claire Madson
CC:	EWT		
Attn:	Mr. Claire Madson	EMAIL:	Via Email
FROM:	Trent T. Gathright	NO. OF PAGES:	Four (4) Plus Attachments

SUBJECT: BUDGET PROPOSAL REQUEST

CUSTOMER REFERENCE INFORMATION: Email of 4th November 2008
CUSTOMER/SITE REFERENCE: Parker Dam
EQUIPMENT RECOMMENDED: Brackett Bosker® Raking Machine
BG-USA FILE REFERENCE NUMBER: BI08-218

We, Eimco Water Technologies, LLC, are pleased to provide the following Budget Proposal based on the above customer reference information and the following conditions/considerations: F.O.B. shipping point, freight pre-paid and added.

I. EQUIPMENT INCLUDED IN BUDGET PRICE BY (X)

X	Brackett Bosker® Raking Machine & Controls	X	Factory Coating
X	Controls	X	Factory Testing
X	Anchor Bolts	X	Shipment Loading
X	O & M Manuals	X	Freight to Site (Separate)
X	Warranty	X	Field Service (Separate)

II. ITEMS NORMALLY SUPPLIED BY OTHERS

Unloading at Site / Field Touch-up
Installation / Erection / Mounting
Civil Works / Grouting / Anchor Installation
Conduit / Wiring / Cables & Glands
Access Ladders / Handrails / Flooring
Site Protection / Storage
State, Federal, Local Taxes or Use Taxes

B U D G E T

This Budgetary Proposal constitutes a non-binding estimate of price(s) for certain goods and/or services that may be provided by EWT, LLC from time to time, but shall not be construed as an offer by EWT, LLC to provide such goods and/or services.

III. TYPICAL DELIVERY AND SHIPMENT

A. DELIVERY

The Equipment can be typically delivered in 32-34 weeks based on:

		WEEKS
A.	General Drawings for Review	8-10
B.	Review by Client/User	4
C.	Details, Fabrication, Shipment	20-22
	TOTAL	32-34

B. OVERALL SIZE / WEIGHT

A.	Approximate Size	See Specifications.
B.	Approximate Weight	Ultra Duty, (6,600 lb) Brackett Bosker® Raking Machine, with track, columns, trolley and gripper: approx. 82,600 lbs. total

IV. VALIDITY AND PAYMENT

A. VALIDITY

This Budget Proposal should be considered as valid for approximately three (3) months based on normal industry circumstances. After such time, please check with us for changes such as material/labor rates continued validity.

B. NORMAL PAYMENT TERMS

The budget prices are based on our normal payment terms, which are as follows:

10% - Of the contract value on submission of equipment/foundation drawings.

30% - Of the contract value at a point 3/5ths of the contract period when major raw materials will have been received from our Suppliers.

60% - Of the contract value on delivery to agreed point or as made ready for delivery if delayed by Purchaser.

This Budgetary Proposal constitutes a non-binding estimate of price(s) for certain goods and/or services that may be provided by EWT, LLC from time to time, but shall not be construed as an offer by EWT, LLC to provide such goods and/or services.

V. NORMAL TERMS AND CONDITIONS

The following budget prices are based on our standard terms and conditions, available on request.

VI. BUDGET PRICES

A. One (1) Brackett Bosker Raking Machine with One (1) Ultra Duty (6,600 Lb. capacity) trolley/gripper for straight track operation, one (1) set Manual/Automatic Controls, approximately 272 ft. of straight track, (236 ft. raking, 20 ft. for discharge and 16 ft. cable festoon at one end), with fifteen (15) "L" support columns with anchors, and cable festoon system. (Maintenance platform not included but available as option)

Total Budget Price: $ 905,300.00 USD Total

(Nine hundred five thousand three hundred dollars)

B. Freight to the site of the above equipment to be determined later. We suggest including the following:

Total Budget Price: $ 21,000.00 USD

(Twenty one thousand dollars)

C. Field Service

We recommend including for one (1) field service trip and a total of five (5) days. If additional days are requested, our Field Service Technicians are available for $1,000.00 USD/Day plus all travel, living and per diem at cost.

Total Budget Price: $ 8,400.00 USD

(Eight thousand four hundred dollars)

VII. INFORMATION ATTACHED

X	Typical Specification Reference	Brackett Bosker® Raking Machine, Controls
X	Drawings	Reference Drawings Only
	Other Attachments	

This Budgetary Proposal constitutes a non-binding estimate of price(s) for certain goods and/or services that may be provided by EWT, LLC from time to time, but shall not be construed as an offer by EWT, LLC to provide such goods and/or services.

If you have any further questions, please contact the undersigned directly.

Best Regards,
Eimco Water Technologies, LLC

Trent T. Gathright
Group Product Manager
Screen Products

This Budgetary Proposal constitutes a non-binding estimate of price(s) for certain goods and/or services that may be provided by EWT, LLC from time to time, but shall not be construed as an offer by EWT, LLC to provide such goods and/or services.

Tony Wahl - FW: Parker Dam info

From: "Bob Manwaring" <bob.manwaring@wastetechinc.com>
To: "Tony Wahl" <twahl@do.usbr.gov>
Date: 11/17/2008 2:57 PM
Subject: FW: Parker Dam info

Hi Tony

Here are details of the FTP site and directions to log on with your password to access the information on the Kuenz hydraulic boom which I have placed on the file.

A budget price for the Model 1000 to cover the machine, rails, control panel and controls, site service, spares, and delivery to site with installation is the sum of $ 1.2 million.

Any questions please contact me @ 847/367-5150.

With Best Wishes.

Bob

Robert T. Manwaring
Director of Sales and Business Management
Waste Tech
A Division of Kusters Zima Corporation

TEL: 847/367-5150 (Office)
847/772-2569 (Mobile)
E-MAIL: <bob.manwaring@wastetechinc.com>

From: Tim Stanley
Sent: Monday, November 17, 2008 10:53 AM
To: Bob Manwaring
Subject: RE: Parker Dam info

Bob,

Tony's logon is as follows:

UserID: twahl

Password: nBu7YY9

Please remember the password is case sensitive. You will find his folder as TonyWahl. Tony will be placed directly in this folder.

Attached is the Using FTP document.

1022 E. DEVON AVE. ■ P.O. BOX 8448 ■ BARTLETT, IL 60103 ■ PHONE (630) 837-5640 ■ FAX (630) 837-5647

3-Dec-08

Budget Price Sheet

To: **US Dept. of the Interior, Bureau of Reclamation**
P.O. Box 25007
Denver, Colorado 80115-0007

From: **Jim McKee**

Attn: **Tony Wahl, M.S., P.E.**

Project: Parker Dam, Arizona
Dept. of the Interior, Bureau of Reclamation

Lakeside/Muhr Catronic SH Monorail Trashrake	**Unit Price:**	**$1,120,000**
Model SH-4525	**Quantity:**	**1**
	Total Cost:	**$1,120,000**

Items Included In Pricing

Trolley assembly with:
- Wheel sets
- Motor with brake,
- Buffers,
- Protective cover

Hoist with double drum:
- Motor with brake
- Overload protection
- Limit switches
- Two (2) galvanized wire ropes

Rake head and gripper with:
- Hydraulic cylinders
- Cable suspensions

Hydraulic power pack with:
- Pump
- Solenoid and pressure relief valves
- Pressure gauge
- Filter
- Hydraulic hose drum

Cables and festooning
Monorail structure (10 columns)
PLC based control system

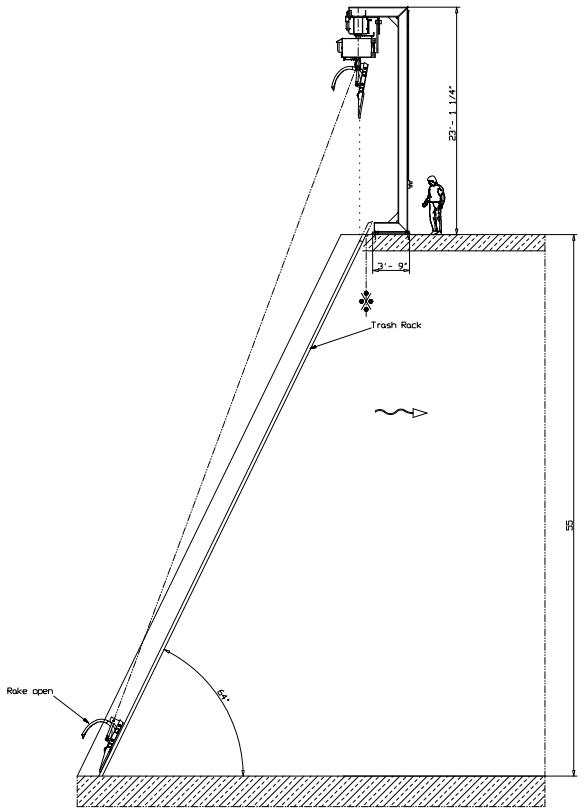
FOB:	Jobsite	Approvals:	8 to 10 weeks
Warranty:	1 year	Delivery:	28 to 30 weeks
Start-up service:	3 days in 1 trip	Full Freight allowed to job site	

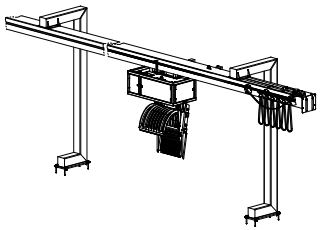
Items Not Included In Proposal

Bar rack	Erection of equipment	Waste containers
Gates	Electrical wiring	

James McKee
e-mail: jm@lakeside-equipment.com

Side view
Scale 1:50





Company: Lakeside							
Project title: Parker Dam							
Title of drawing: Propoeal SH4525 01							
9	-	-	-		Date	Name	Gen. Gr. Tx. Num:
8	-	-	-	Draft	08-09-01	RL	
7	-	-	-	Checked			
6	-	-	-	Gen.	-	-	
5	-	-	-	Scale:			Drawing number:
4	-	-	-	1:50			V10.000.124-01
3	-	-	-				
2	-	-	-				
1	-	-	-				
Date	Revisions		Gen	Drawing dimension: A0		Approved:	Approved by: Proj.:

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Gesellschaft fuer Planung, Maschinen- und Anlagenbau
Erhard Muhr mbH · Grafenau 27 · D-83395 Freilassing
Tel.: 08654/9672-0 Fax: 08654/9672-24 www.muhr.com

Bulletin #2704 February 2007

Monorail Trash Rake

Powerful Cleaning Mechanism

Lakeside/Muhr offers a quality line of cable-operated raking mechanisms with more than 20 years of experience. The Monorail System is designed specifically for wastewater treatment plants, stormwater facilities and water in-take structures. It combines screening and transporting into one unit with an overhead monorail, traversing trolley, hydraullically operated grabber rake and control system. The materials of construction are available in galvanized and stainless steel.

Operation is initiated on a liquid level control system or timer. Once activated, the trolley/grabber rake assembly traverses along the overhead monorail to a pre-determined start-point at the bar screen. When the trolley unit has reached the start point, the cable hoist lowers the grabber rake to the top of the screen with the teeth penetrating the bars. As the rake proceeds downward, debris is brought to the bottom of the screen and captured when the rake head closes. The grab rake, with secured screenings, is raised above the operating deck and transported to the collection container for disposal. This process is repeated for the remainder of the screen, or sets of screens.

The Monorail Trash Rake efficiently cleans bar screens without multiple rakes or conveyors, providing uncluttered screen decks. Overhead monorail tracks with curved sections are also available where there is limited space or access.

Lakeside Equipment Corporation

Monorail Features

The Monorail Trash Rake offers the following benefits:

- No moving parts are permanently submerged
- Maintenance performed in parked position, away from bar screen
- Ideal for retrofit applications
- Reliable, quiet operation
- Low energy
- Automatic, semi-automatic and manual control

Model	SH-2020	SH-4525
Working Load	2,200 lbs	4,800 lbs
Weight of Gripper	2,200 lbs	4,800 lbs
Hoist Motor Size	10.0 hp	15.0 hp
Trolley Motor Size	2 x 0.75 hp	2 x 1.0 hp
Hydraulic Motor Size	2.0 hp	2.0 hp
Lowering Speed	60 ft/min	80 ft/min
Lifting Speed	60 ft/min	40 ft/min
Width of Gripper	6 ft	8 ft
Min. Bar Spacing	1/2 in	1/2 in

Treatment equipment and systems solutions from Lakeside

Lakeside offers a wide range of equipment and systems for virtually all stages of wastewater treatment from influent through final discharge. Each process and equipment item that we supply is manufactured with one goal in mind . . . to reliably improve the quality of our water resources in the most cost-effective way possible.

We've been doing just that since 1928.

Aeration
newair® Diffuser
CLR Process
E.A. Aerotor
Magna Rotors
Rotor Covers
Level Control Weirs

Submersible Products
Mixers
Propeller Pumps
Grinder Pumps

Clarification
Spiraflo Clarifier
Spiravac Clarifier
Tertiary Treatment using Series Clarification
Full-Surface Skimming

Trickling Filters

Trash & Screen Rakes

RAPTOR® Screening Products
Fine Screen
Micro Strainer
Rotating Drum Screen
Wash Press
Septage Acceptance Plant

Other Screening Products
Water Intake Screens
CSO Screens

Packaged Headworks Systems
RAPTOR® Complete Plant
H-PAC

Grit Collection
SpiraGrit
Aeroductor
RAPTOR® Grit Washer
Inline Grit Collector
Model L Grit Classifier

Screw Pumps
Open Screw Pumps
Enclosed Screw Pumps

Lakeside Equipment Corporation

1022 E. Devon, P.O. Box 8448
Bartlett, IL 60103
630/837-5640, FAX: 630/837-5647
E-mail: sales@lakeside-equipment.com
http://www.lakeside-equipment.com

Lakeside Equipment Corporation

1022 E. DEVON AVE. ■ P.O. BOX 8448 ■ BARTLETT, IL 60103 ■ PHONE (630) 837-5640 ■ FAX (630) 837-5647

12-Dec-08

Budget Price Sheet

To: **US Dept. of the Interior, Bureau of Reclamation**
P.O. Box 25007
Denver, Colorado 80115-0007

From: **Jim McKee**

Attn: **Tony Wahl, M.S., P.E.**

Project: Parker Dam, Arizona
Dept. of the Interior, Bureau of Reclamation

Lakeside/Muhr Hydronic M Series Trashrake Model M-4000	**Unit Price:**	**$1,650,000**
	Quantity:	**1**
	Total Cost:	**$1,650,000**

Items Included In Pricing

Articulating boom mechanism with hydraulic cylinders
Rake head with hydraulic gripper:
Traversing under-carriage with rotating assembly and ring gear
- Rack wheels
- 2 drive motors with brakes
- 4 rubber buffers

Operators cab with climate control
- Knockout windows and front wiper
- Adjustable seat
- Operator interface
- Joy sticks, operating switches and indicator lamps
- Exterior cab searchlights

Hydraulic power pack with:
- Pump
- Solenoid and pressure relief valves
- Pressure gauge
- Filter

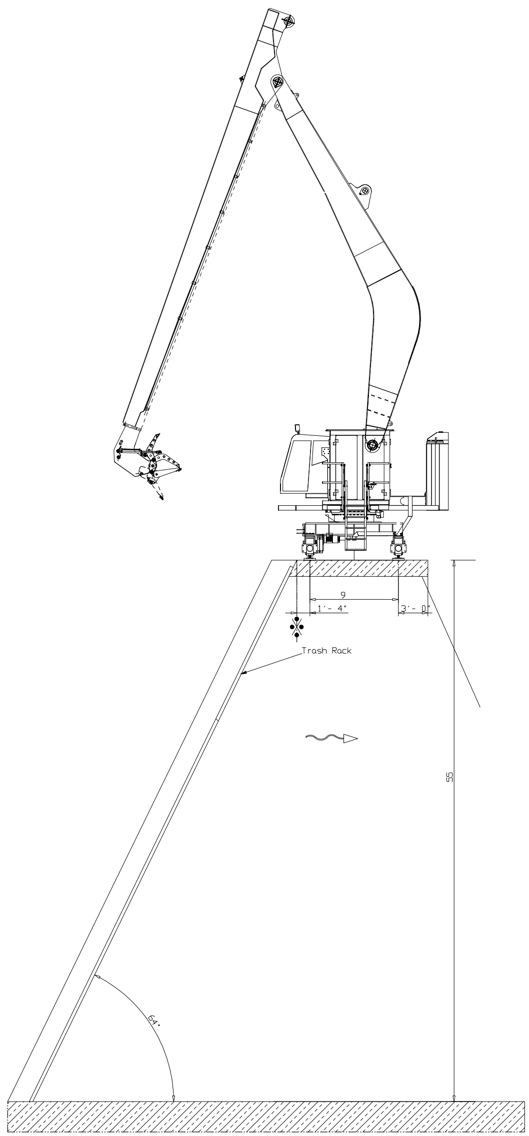
Power cable and cable drum
Rails with mounting hardware and anchorage
PLC based control system (automatic and manual control)
Safety devices

FOB:	Jobsite	Approvals:	10 to 12 weeks
Warranty:	1 year	Delivery:	30 to 36 weeks
Start-up service:	3 days in 1 trip	Full Freight allowed to job site	

Items Not Included In Proposal

Bar rack	Erection of equipment	Waste containers
Gates	Electrical wiring	

James McKee
e-mail: jm@lakeside-equipment.com



MUHR
Gesellschaft fuer Planung, Maschinen- und Muehlenbau
Erhard Muhr mbH - Grafenstr.27 - D-83098 Brannenburg
Tel: 08034/9072-0 Fax: 08034/9072-24 www.muhr.com

Employer:
Lakeside

Project title:
Parker Dam

Title of drawing:
Proposal Hydronic M4000 01

Index	Revisions	Date	Name		Date	Name
H	.	.	.			
G	.	.	.	Drawn	08-12-11	HJ
F	.	.	.	Checked	.	.
E	.	.	.	Seen	.	.
D	.	.	.			
C	.	.	.			
B	.	.	.			
A	.	.	.			

Com.-Nr. Fa. Muhr: .

Scale: 1:50

Drawing number: V10.000.125-01

Drawing dimension: A0 | Superseded: | Superseded by: | Orig.:

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Appendix IV. Existing Structure Drawings

Forebay Plan, Elevation and Sections	231-D-231
Trashrack Structure, Plan, Elevation, and Sections	231-D-262
Trashrack Metalwork Installation	231-D-270
Rack Sections	231-D-813
Guide Sections	231-D-272
Details	231-D-273
Electrical Infrastructure	231-D-314
Deck Expansion Joints	231-D-266
Deck Rails	231-D-328

PLAN

Scale of feet

TABLE OF COORDINATES

POINT	LATITUDE	DEPARTURE
L	2,033,804.92	7,108,955.88
M	33,578.49	109,106.42
N	33,503.19	108,919.23
P	33,513.41	108,955.82
R	33,327.00	109,071.50
S	33,015.19	109,044.22

TUNNEL CURVE DATA

P.C. = Sta. 1+85.15
P.T. = Sta. 2+04.00
Δ = 45°
R. = 24.0'
C. = 18.85'
T. = 9.94'

DETAIL "G"

SECTION A-A

SECTION B-B

SECTION C-C

SECTION D-D

SECTION E-E

SECTION F-F

SECTION H-H

SECTION J-J

This drawing supersedes Dwg. 231-D-79

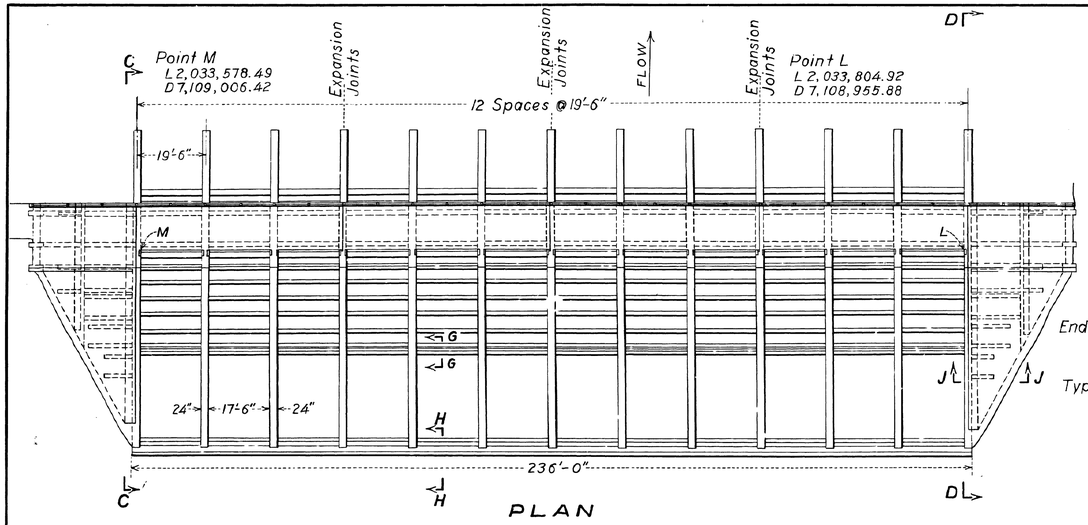
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
PARKER DAM PROJECT

PARKER POWER PLANT FOREBAY PLAN, ELEVATION AND SECTIONS

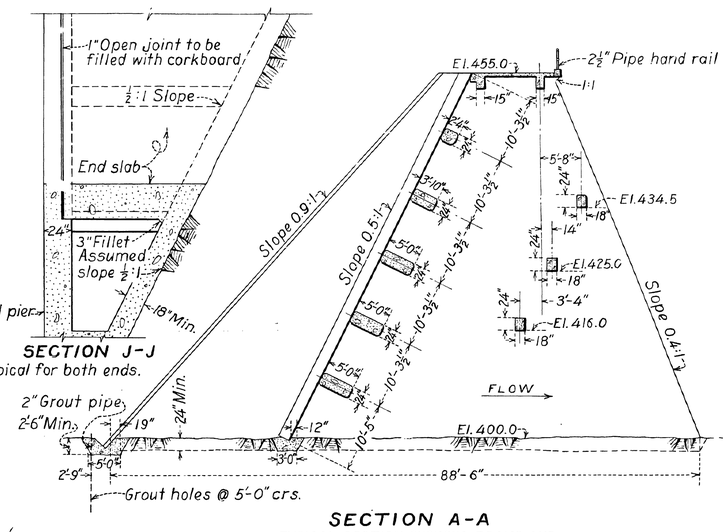
DRAWN W.E.S.	SUBMITTED J.J. Hammond
TRACED H.E.M.	RECOMMENDED G.H. Steele
CHECKED Jno. A.M.T.	APPROVED J.L. Savage
DENVER, COLO. JAN. 9, 1936.	231-D-231

REV. 11-27-36 · REV. 7-13-36 · 4-26-38 C.K.H. APPR. · 8-15-36 · 10-14-36

Job No. 231-

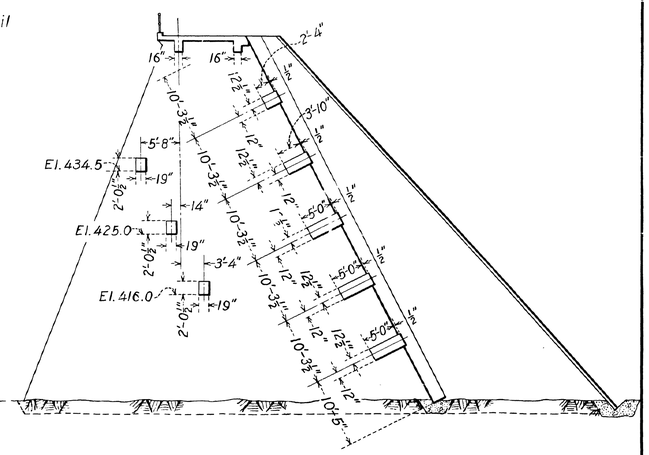


PLAN

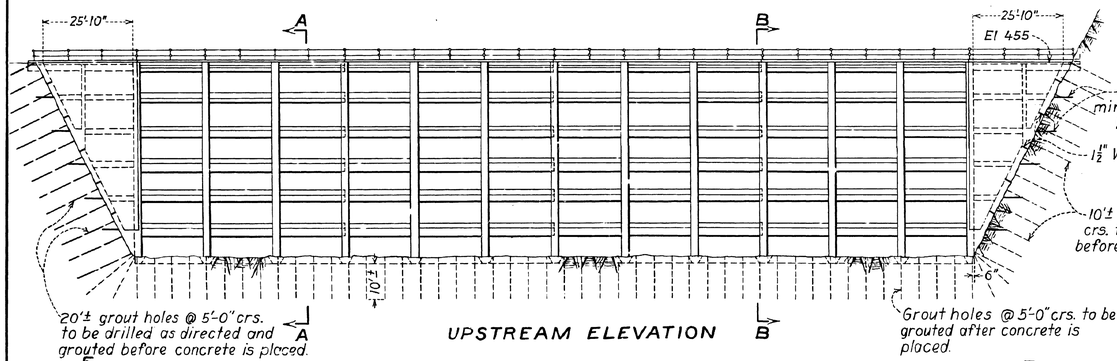


SECTION J-J
Typical for both ends.

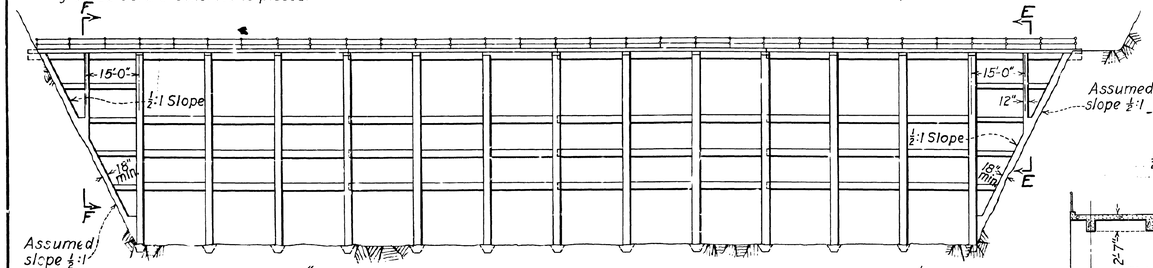
SECTION A-A
TYPICAL SECTION SHOWING BEAMS AND SLABS WITH FIXED ENDS



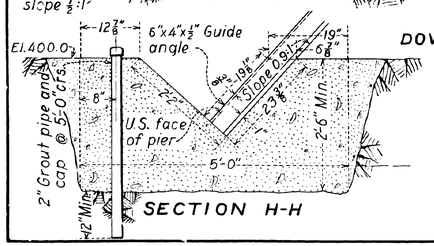
SECTION B-B
TYPICAL SECTION SHOWING RECESSES FOR EXPANSION END OF BEAMS AND SLAB



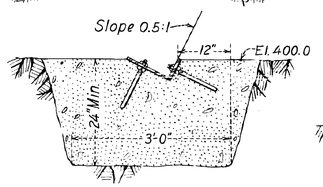
UPSTREAM ELEVATION



DOWNSTREAM ELEVATION

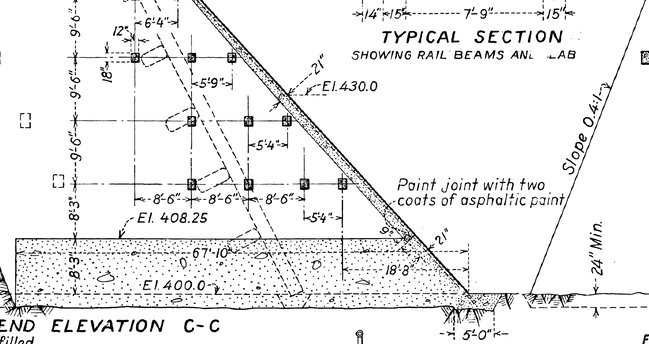


SECTION H-H

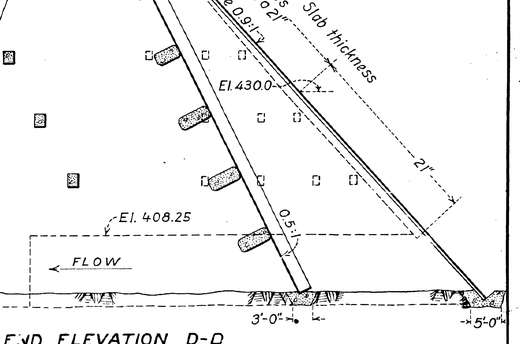


SECTION G-G

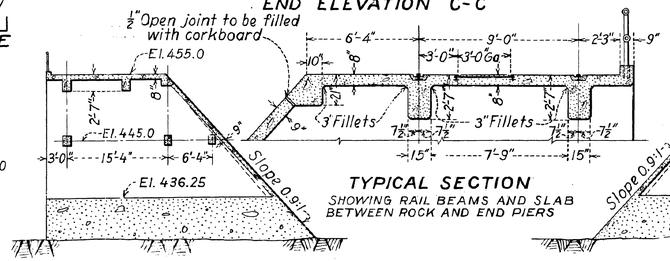
0 10 20 30 40 50
Scale of feet



END ELEVATION C-C



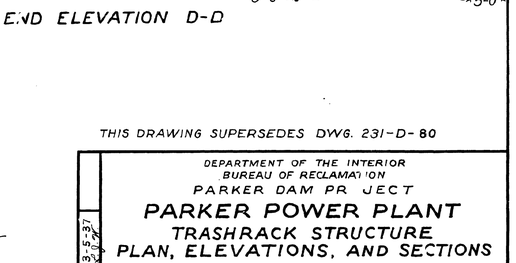
END ELEVATION D-D



TYPICAL SECTION
SHOWING RAIL BEAMS AND SLAB BETWEEN ROCK AND END PIERS

SECTION E-E

TYPICAL SECTION
SHOWING RAIL BEAMS AND SLAB



SECTION F-F

THIS DRAWING SUPERSEDES DWG. 231-D-80

DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
PARKER DAM PROJECT

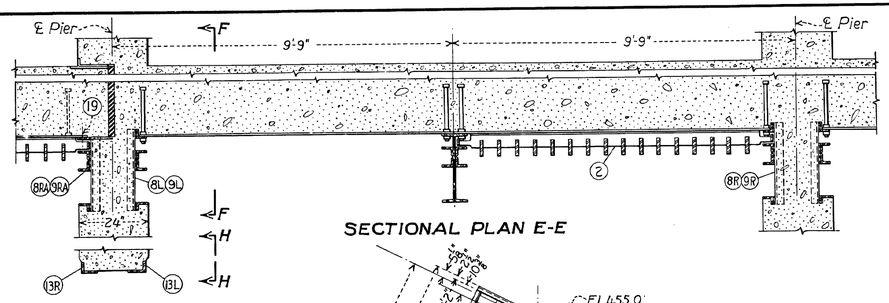
PARKER POWER PLANT
TRASHRACK STRUCTURE
PLAN, ELEVATIONS, AND SECTIONS

REV. 2-9-37 3-5-37

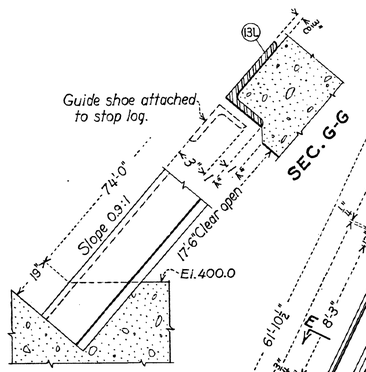
DRAWN J.K.A. SUBMITTED J.J. Hammond
TRACED J.L. RECOMMENDED R.F. Greene
CHECKED H.E.M. APPROVED J.L. Savage

DENVER, COLO. MAY 28, 1936 231-D-262

Corrected 2-13-37

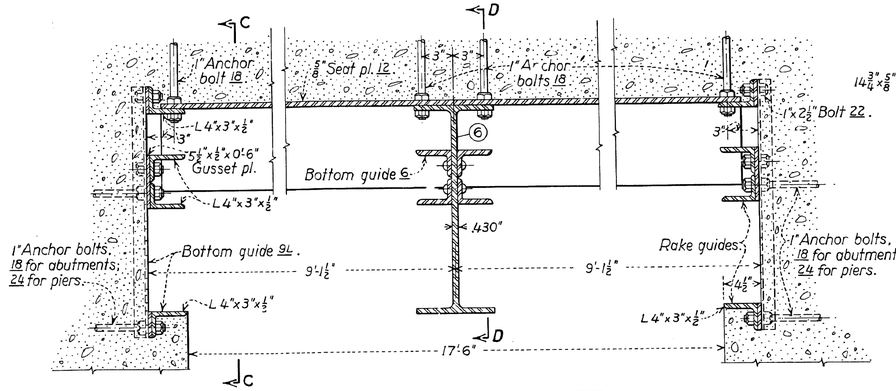


SECTIONAL PLAN E-E

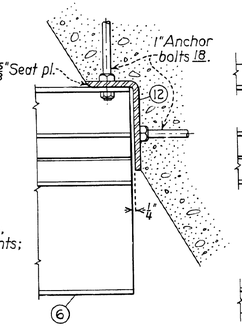


VIEW H-H

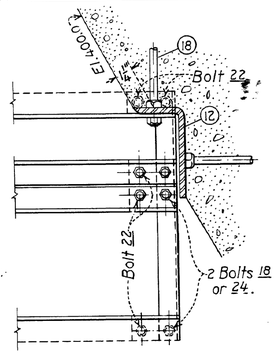
SECTION F-F



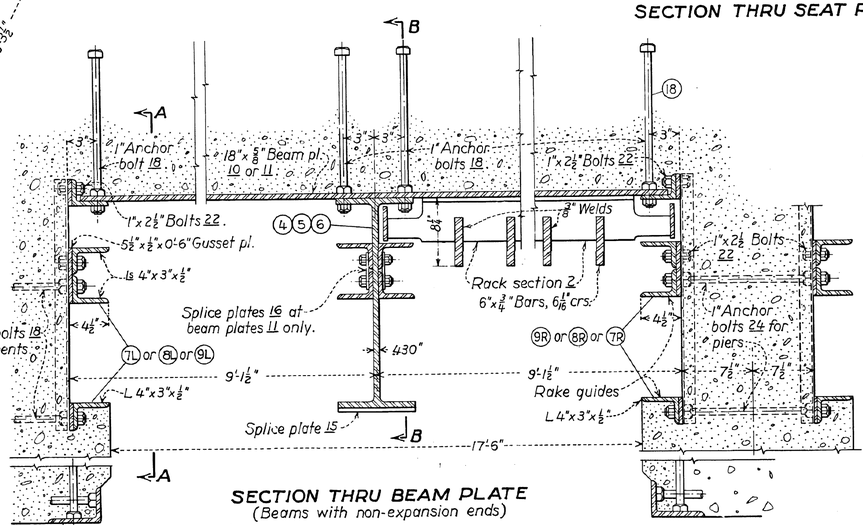
SECTION THRU SEAT PLATE



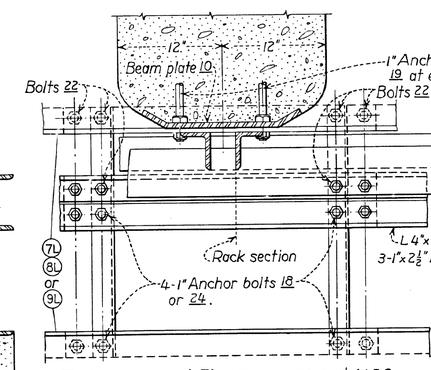
SECTION D-D
INTERMEDIATE GUIDE ANCHORAGE TO SEAT PLATE



SECTION C-C
END GUIDE ANCHORAGE TO SEAT PLATE

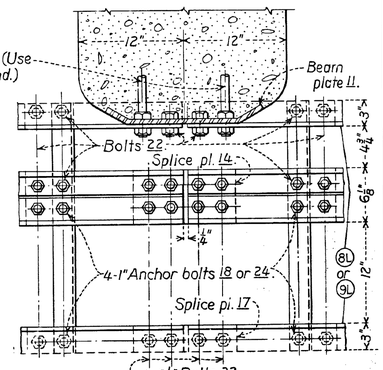


SECTION THRU BEAM PLATE
(Beams with non-expansion ends)



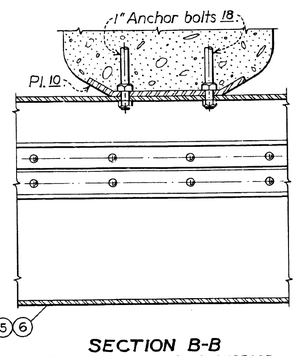
Typical section at Els. 409.0, 427.4 and 445.8

SECTION A-A
END GUIDE ANCHORAGE TO BEAM PLATE

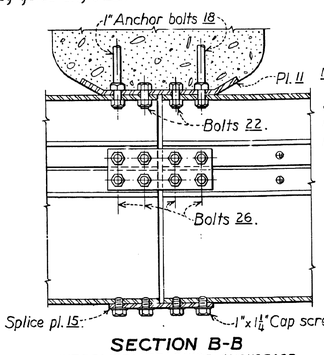


Typical section at El. 418.2 and 436.6

SECTION A-A
END GUIDE ANCHORAGE AND SPLICE AT BEAM PLATE

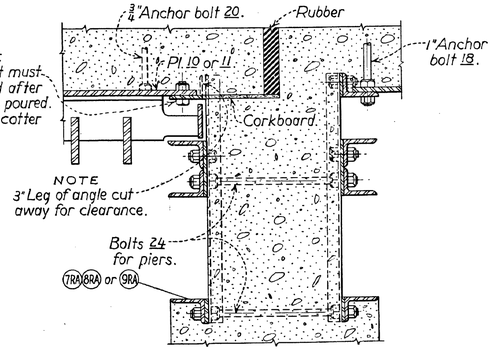


SECTION B-B
INTERMEDIATE GUIDE ANCHORAGE TO BEAM PLATE
TYPICAL AT ELEVATIONS 409.0, 427.4, 445.8 AND 455.0



SECTION B-B
INTERMEDIATE GUIDE ANCHORAGE AND SPLICE AT BEAM PLATE
TYPICAL AT ELEVATIONS 418.2 AND 436.6

NOTE
19 This bolt must be removed after concrete is poured. Do not use cotter pin.



SECTIONAL PLAN - EXPANSION END
(Beams with expansion end)

LIST OF DRAWINGS

RACK SECTIONS	231-D-813
GUIDE SECTIONS	231-D-272
DETAILS AND LIST OF PARTS	231-D-273
TRASHRACK STRUCTURE	231-D-231

THIS DRAWING SUPERSEDES 231-D-84

DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
PARKER DAM PROJECT

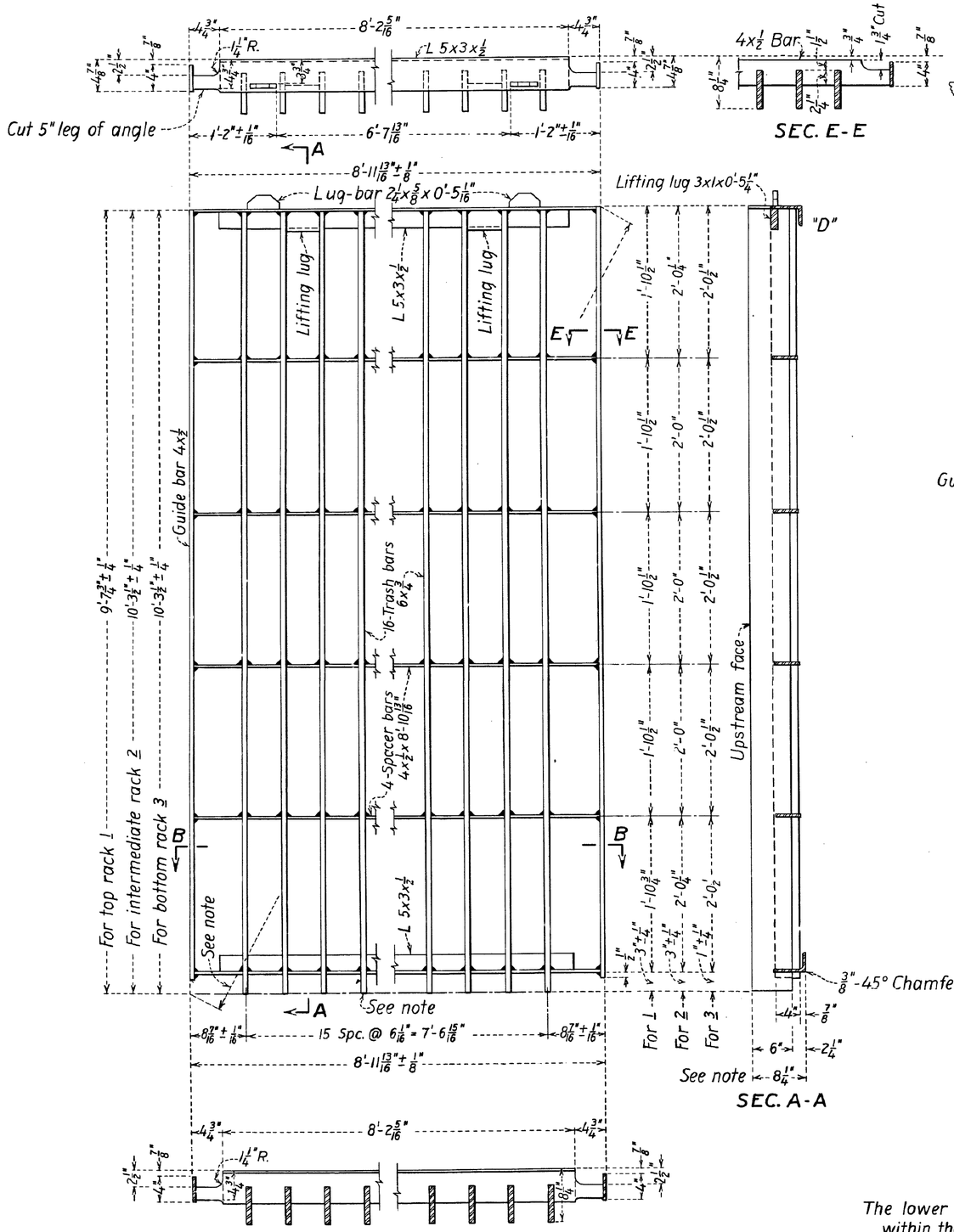
PARKER POWER PLANT
TRASHRACK METALWORK INSTALLATION

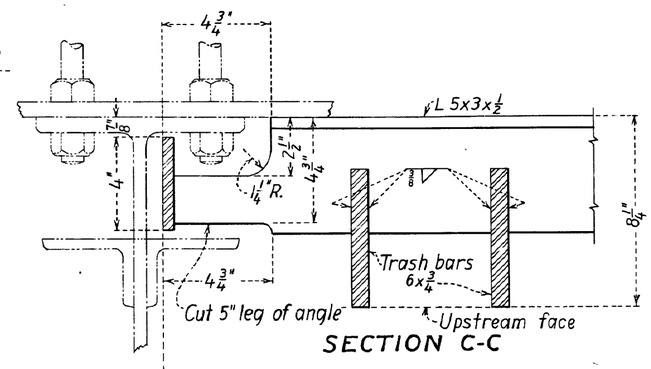
REV. 2-7-40 PJK
REV. 8-28-36 EB
REV. 9-17-36 EB
REV. 3-3-37 SG

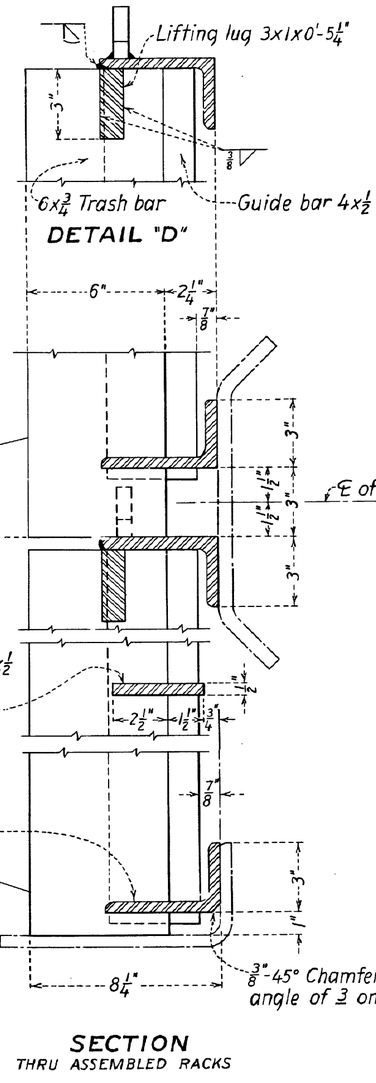
DRAWN: M.A.S. SUBMITTED:
TRACED: MEB-EAJ RECOMMENDED:
CHECKED: S.B. APPROVED:

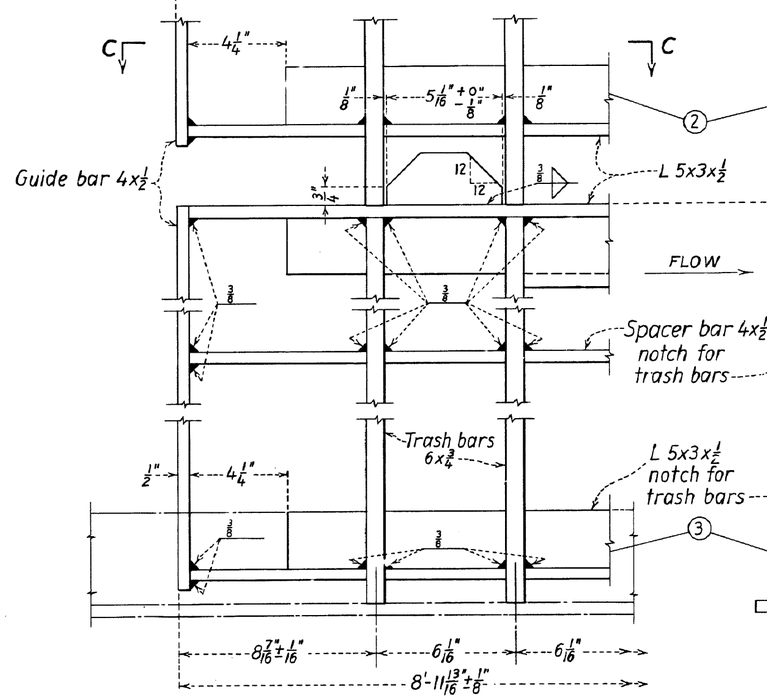
DENVER, COLORADO JUNE 30, 1936.
SHEET 1 OF 4.

231-D-270









① TOP RACK
STRUCTURAL STEEL-24 REQUIRED

② INTERMEDIATE RACK
STRUCTURAL STEEL-96 REQUIRED

③ BOTTOM RACK
STRUCTURAL STEEL-24 REQUIRED

NOTES

The lower ends of all trash bars shall lie in the same plane within the limits of ±1/16" and shall be cut square and regular without rough or torn surfaces.

Tolerances in the overall length of any rack shall apply to the rack as a unit, the tolerance for the difference in the lengths of the two sides of any one rack shall be 1/16".

Racks shall be square, with an allowable variation of not more than 1/4" between the overall diagonal dimensions.

REFERENCE DRAWINGS

TRASHRACK METALWORK INSTALLATION	231-D-270
WELDING SYMBOLS	X-D-2589
TRASHRACK STRUCTURE	231-D-231

THIS DRAWING SUPERSEDES 231-D-271

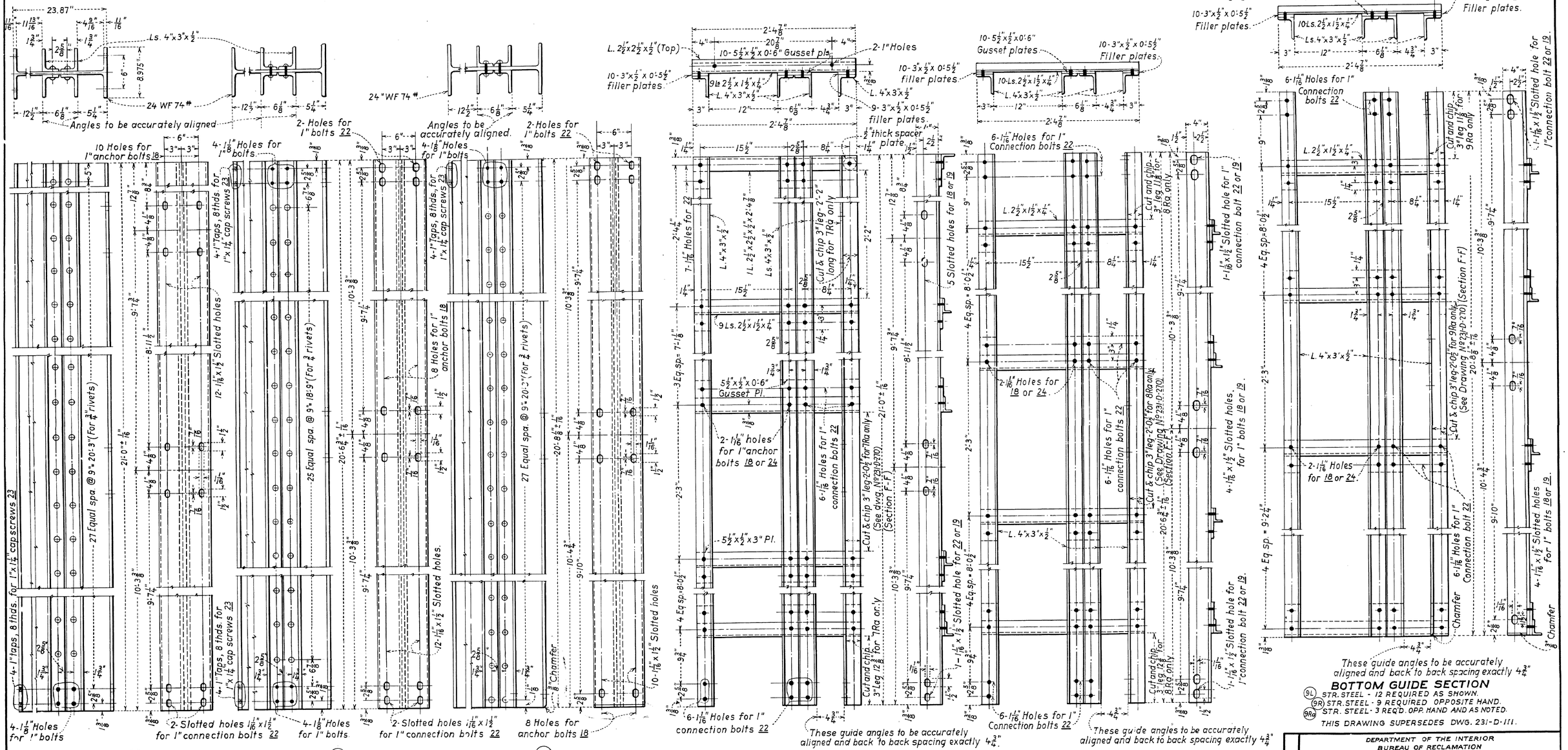
Material purchased on specification No. 1453-D

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
PARKER DAM POWER PROJECT

PARKER POWER PLANT
TRASHRACK METALWORK
RACK SECTIONS

DRAWN W.D. SUBMITTED F.C. Bratty
TRACED L.J.F. - R.E.J. RECOMMENDED L.N. McClellan
CHECKED P.I.K. ROT APPROVED J.L. Savage
DENVER COLORADO, FEB. 16, 1940.

231-D-813



4-1⅛" Holes for 1" bolts

2- Slotted holes 1 1/16"x½" for 1" connection bolts 22

4-1⅛" Holes for 1" bolts

2- Slotted holes 1 1/16"x½" for 1" connection bolts 22

8 Holes for anchor bolts 18

6-1 1/16" Holes for 1" connection bolts 22

These guide angles to be accurately aligned and back to back spacing exactly 4¾"

6-1 1/16" Holes for 1" Connection bolts 22

These guide angles to be accurately aligned and back to back spacing exactly 4¾"

These guide angles to be accurately aligned and back to back spacing exactly 4¾"

(4) TOP GUIDE SECTION

STRUCTURAL STEEL - 12 REQUIRED.

(5) INTERMEDIATE GUIDE SECTION

STRUCTURAL STEEL - 12 REQUIRED.

(6) BOTTOM GUIDE SECTION

STRUCTURAL STEEL - 12 REQUIRED.

TOP GUIDE SECTION

(7L) STR. STEEL - 12 REQUIRED AS SHOWN.
(7R) STR. STEEL - 9 REQUIRED OPPOSITE HAND.
(7Ra) STR. STEEL - 3 REQ'D. OPPOSITE HAND AND AS NOTED.

INTERMEDIATE GUIDE SECTION

(8L) STR. STEEL - 12 REQUIRED AS SHOWN
(8R) STR. STEEL - 9 REQUIRED OPPOSITE HAND.
(8Ra) STR. STEEL - 3 REQ'D. OPP. HAND AND AS NOTED.

BOTTOM GUIDE SECTION

(9L) STR. STEEL - 12 REQUIRED AS SHOWN.
(9R) STR. STEEL - 9 REQUIRED OPPOSITE HAND.
(9Ra) STR. STEEL - 3 REQ'D. OPP. HAND AND AS NOTED.

THIS DRAWING SUPERSEDES DWG. 231-D-111.

GENERAL NOTES

Paint as per specifications.
Guides $7^{L}_{R,Ra}$, $8^{L}_{R,Ra}$, $9^{L}_{R,Ra}$ to be completely assembled in field and squared in forms before concrete is poured.

DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
PARKER DAM PROJECT

PARKER POWER PLANT
TRASHRACK METALWORK GUIDE SECTIONS

REV. 11-6-36 S.B.

DRAWN: M.A.S. SUBMITTED: C.H. Young
TRACED: S.N.R. L.R.H. RECOMMENDED: F.A. Banzhaf
CHECKED: E.B. Rice APPROVED: A.J. Wallen

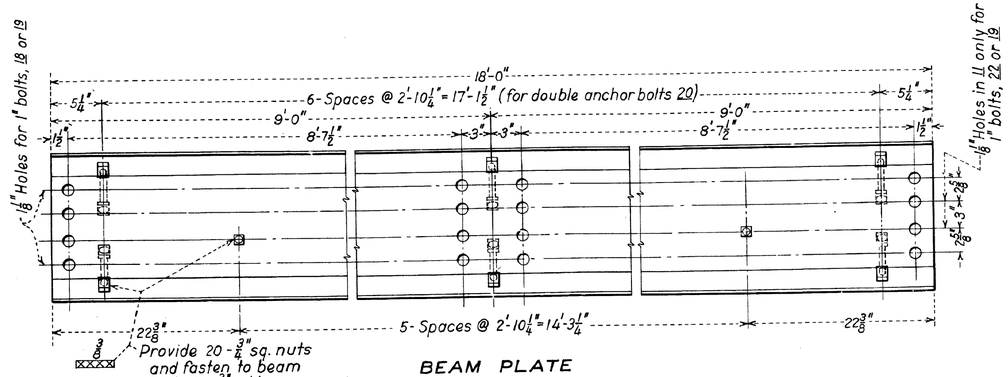
DENVER, COLORADO, JUNE 30, 1936
SHEET 3 OF 4

231-D-272

21"x36"

Job No 23174-3
Comp. 6-24-36 - L.R.H.

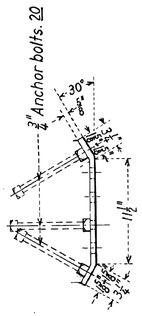
(K)

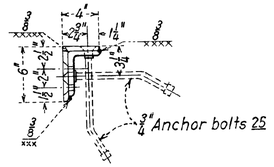


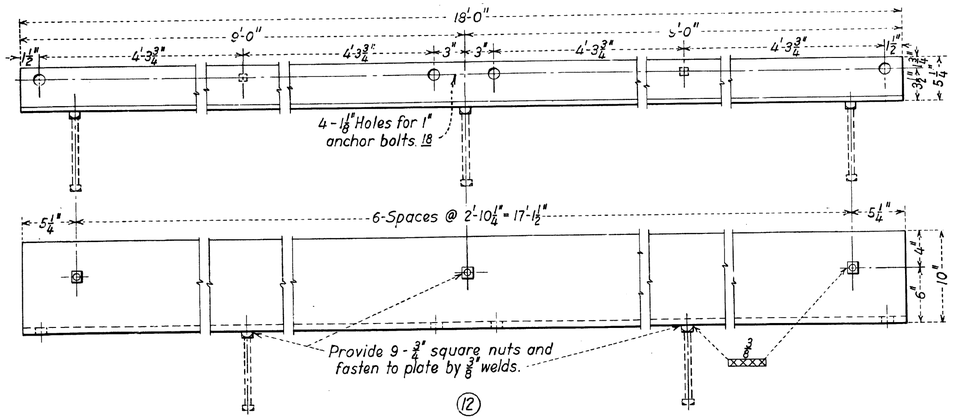
BEAM PLATE

(10) STRUCTURAL STEEL – 48 REQUIRED

(11) STRUCTURAL STEEL – 24 REQUIRED

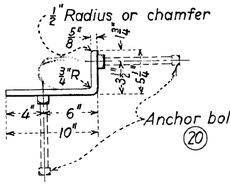


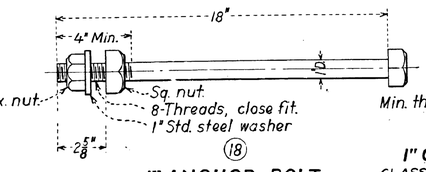




SEAT PLATE

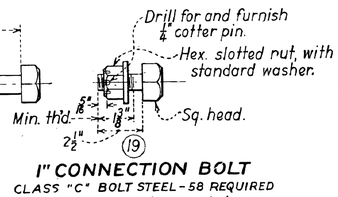
STRUCTURAL STEEL – 12 REQUIRED





1" ANCHOR BOLT

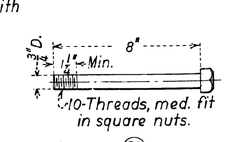
CLASS "C" BOLT STEEL – 700 REQUIRED



1" CONNECTION BOLT

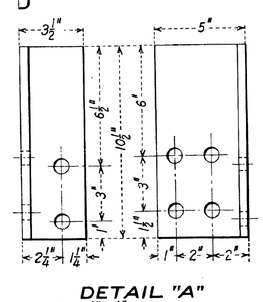
CLASS "C" BOLT STEEL – 58 REQUIRED

(Used with beam plates at expansion joints only)



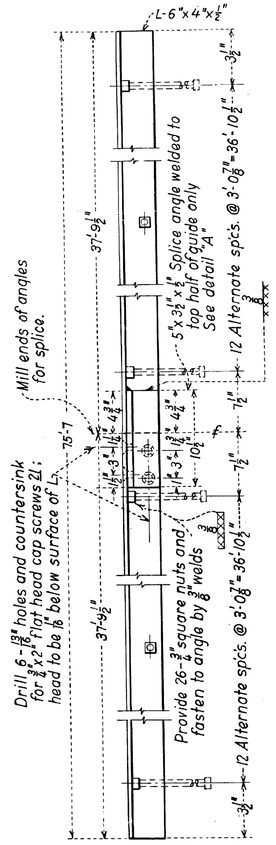
¾" ANCHOR BOLT

CLASS "C" BOLT STEEL – 1560 REQUIRED



DETAIL "A"

5" x 3½" x ½" SPLICE ANGLE

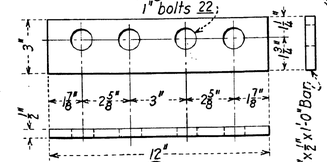


STOP LOG GUIDE ANGLE

STRUCTURAL STEEL

(13R) 12 REQUIRED – AS SHOWN

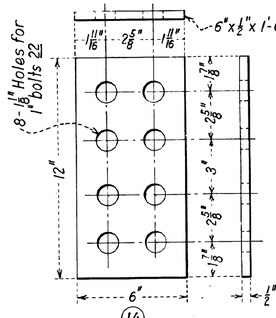
(13L) 12 REQUIRED – OPP. HAND



(17)

SPLICE BAR

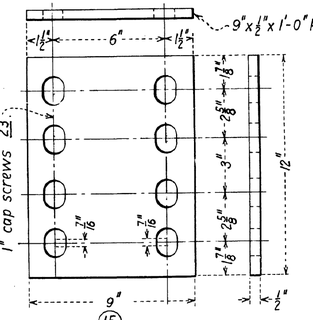
STR. STEEL – 48 REQUIRED



(14)

SPLICE PLATE

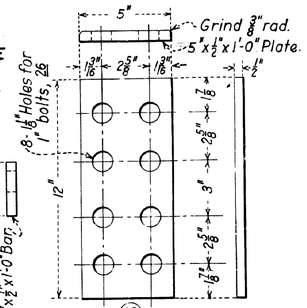
STR. STEEL – 48 REQUIRED



(15)

SPLICE PLATE

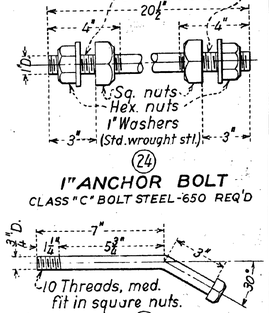
STR. STEEL – 24 REQUIRED



(16)

SPLICE PLATE

STR. STEEL – 48 REQUIRED



(24)

1" ANCHOR BOLT

CLASS "C" BOLT STEEL – 650 REQ'D

(25)

¾" ANCHOR BOLT

CLASS "C" BOLT STEEL – 630 REQ'D

THIS DRAWING SUPERSEDES DWG. 231-D-112

LIST OF PARTS (COMPLETE)

PART NO	DESCRIPTION	MATERIAL	REQ'D	DWG. NO.
1	Top rack section	Structural steel	24	231-D-271
2	Intermediate rack section	" "	96	"
3	Bottom rack section	" "	24	"
4	Top guide section	" "	12	231-D-272
5	Intermediate guide section	" "	12	"
6	Bottom guide section	" "	12	"
7R	Top guide section	" "	9	"
7Ra	Top guide section	" "	3	"
7L	Top guide section	" "	12	"
8R	Intermediate guide section	" "	9	"
8Ra	Intermediate guide section	" "	3	"
8L	Intermediate guide section	" "	12	"
9R	Bottom guide section	" "	9	"
9Ra	Bottom guide section	" "	3	"
9L	Bottom guide section	" "	12	"
10	Beam plate	" "	48	231-D-273
11	Beam plate	" "	24	"
12	Seat plate	" "	12	"
13R	Stop log guide angle	" "	12	"
13L	Stop log guide angle	" "	12	"
14	Splice plate	" "	48	"
15	Splice plate	" "	24	"
16	Splice plate	" "	48	"
17	Splice bar	" "	48	"
18	1" Anchor bolt - see detail	Bolt steel, Class "C"	700	"
19	1" Connection bolt - see detail.	" "	58	"
20	¾" Anchor bolt - see detail	" "	1560	"
21	¾" x 2 Fl.hd. cap screw, hex. nut, lock wash.	" "	150	No detail
22	1" x 2⅝" Bolt, hex. hd. nut and washer	" "	5150	"
23	1" x 1¼" Hex. hd. cap screw, lock washer	" "	200	"
24	1" Anchor bolt, see detail	" "	650	231-D-273
25	¾" Anchor bolt, see detail	" "	630	"
26	1" x 4" Bolt, hex. hd. and nut and washer	" "	200	No detail

NOTES

After assembly in the field, the ¾" flat head cap screws 21 are to be welded over and the weld chipped flush with the face of the angle.

Paint as per specifications.

Welding symbols as given on Dwg. X-D-1357

Quantities as listed include up to 5% excess for bolts.

DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
PARKER DAM PROJECT

PARKER POWER PLANT

TRASHRACK METALWORK

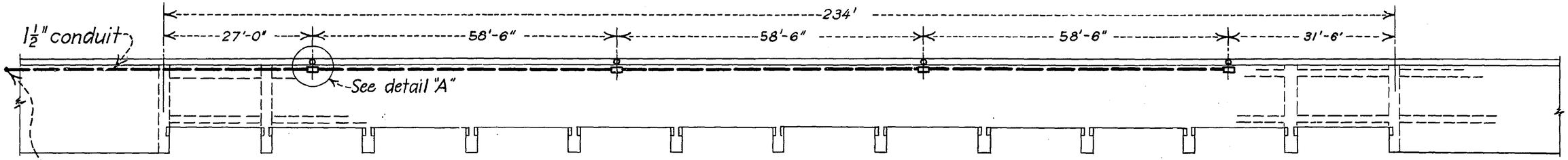
PLATES-GUIDE ANGLES-ANCHOR BOLTS-LIST OF PARTS

REV.	DRAWN	TRACED	CHECKED
8-28-36	M.A.S.	W.G.S - C.A.G.	E.B.
9-17-36			
11-6-36			

SUBMITTED: C.A.Dewing
RECOMMENDED: J.L. Savage
APPROVED: A.F. Walter

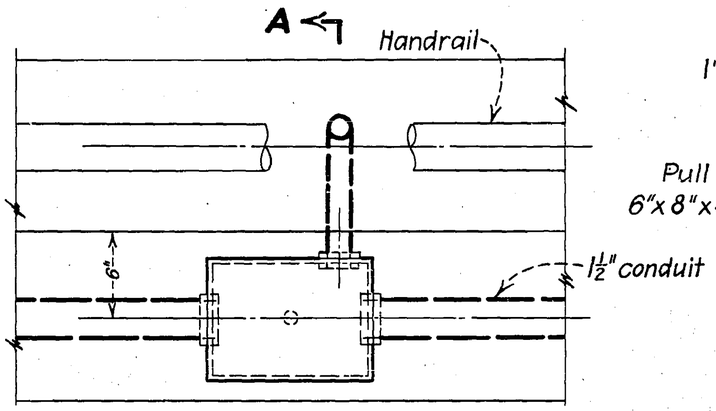
DENVER, COLORADO, JUNE 30, 1936
SHEET 4 OF 4

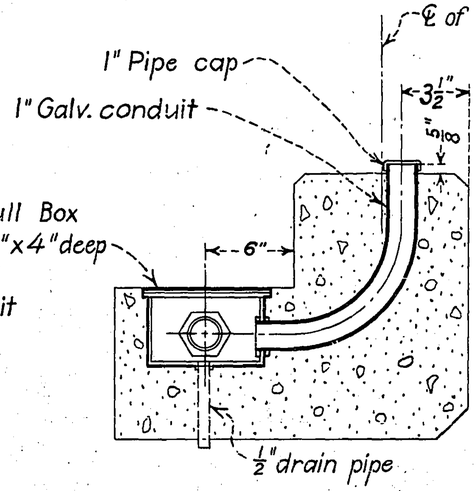
231-D-273



PLAN

Plug receptacles on downstream side of curb. Handrail not shown





DETAIL "A"

Bill of Material.....231-BM-314.

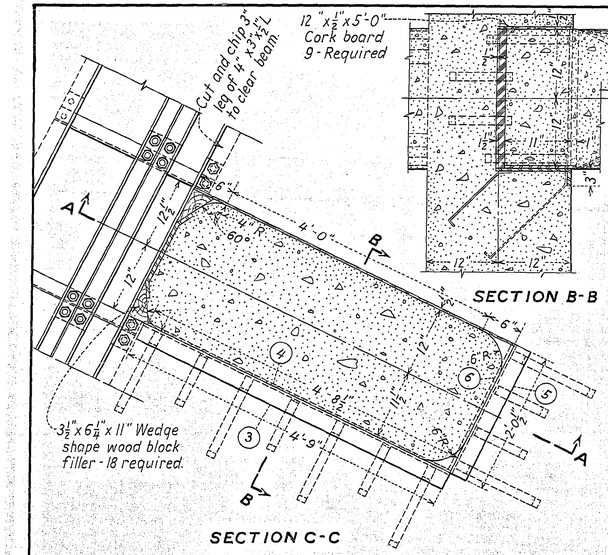
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
PARKER DAM PROJECT
PARKER POWER PLANT
TRASHRACK STRUCTURE
ELECTRICAL INSTALLATION

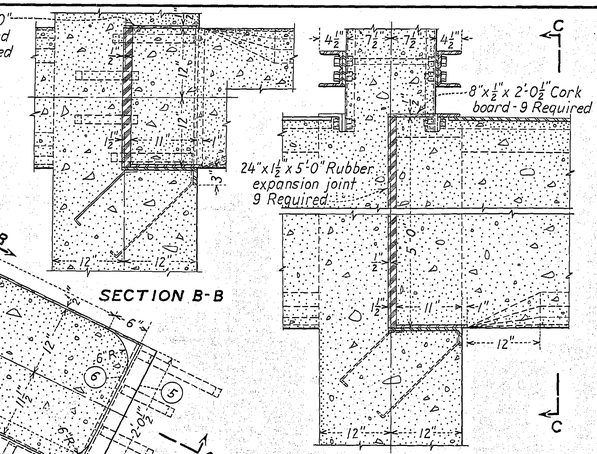
DRAWN R.D.P.	SUBMITTED A. Bruce Reid
TRACED W.M.B.	RECOMMENDED J. M. Gaffaney
CHECKED J.R.W.	APPROVED J. L. Savage

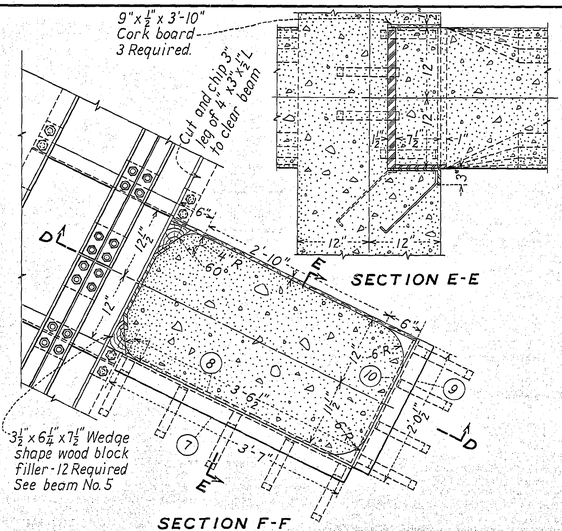
DENVER, COLO. OCT. 13, 1936 | 231-D-314

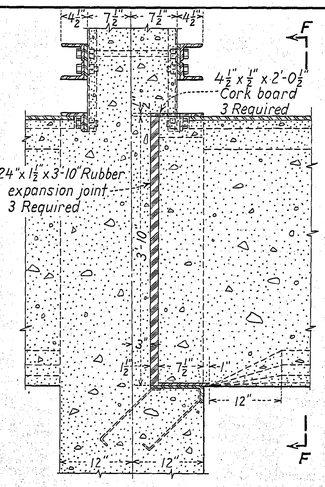
10½" x 15"

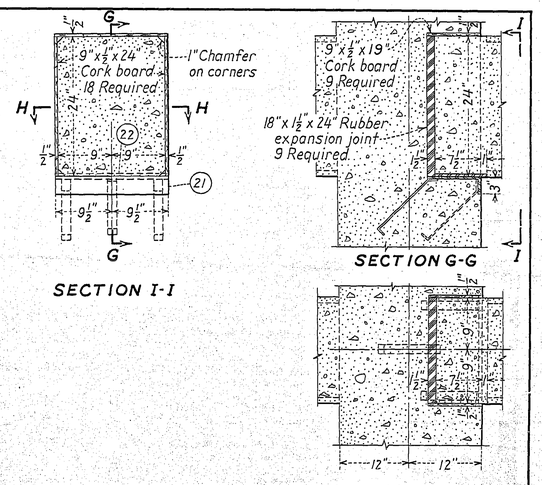
Job No. 231-8-1









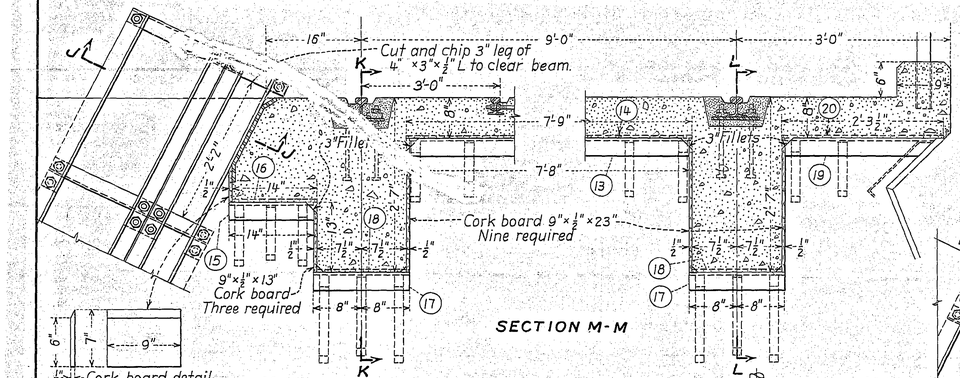


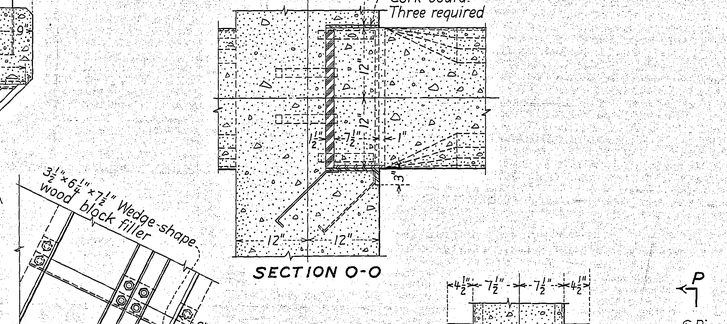
EXPANSION END DETAILS OF BEAMS No. 1, 2 AND 3

NOTE
Anchor bolts for beam plates not shown in these details.

EXPANSION END DETAILS OF BEAM No. 4

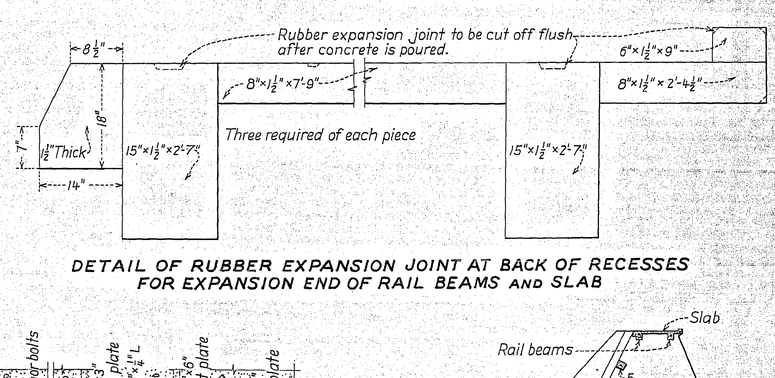
EXPANSION END DETAILS OF STRUTS No. 6, 7 AND 8

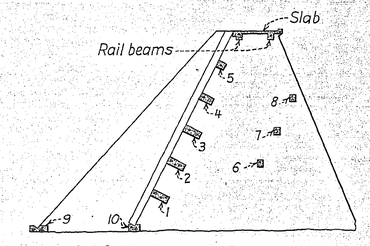




EXPANSION END DETAILS OF RAIL BEAMS AND SLAB

EXPANSION END DETAILS OF BEAM No. 5





DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
PARKER DAM PROJECT

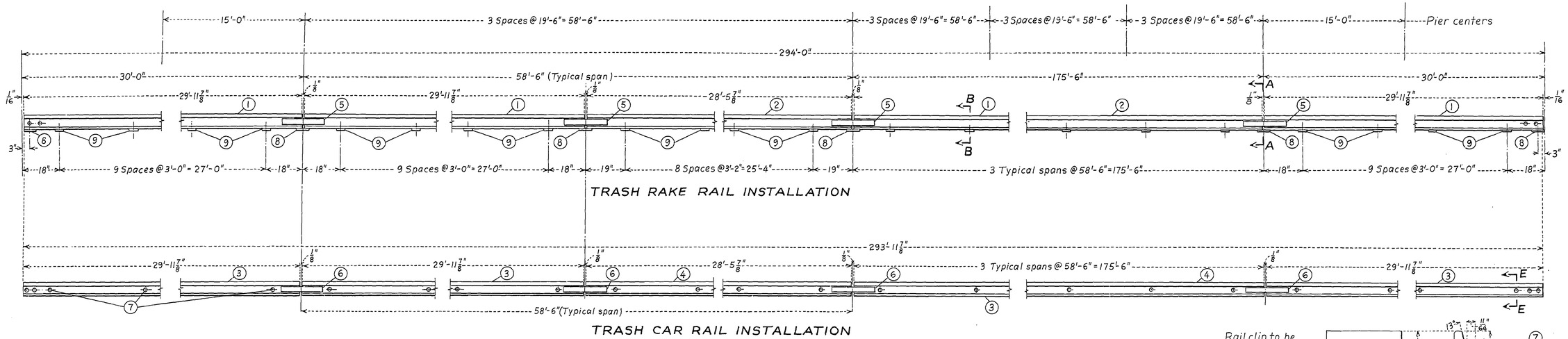
PARKER POWER PLANT
TRASHRACK STRUCTURE EXPANSION JOINT DETAILS

DRAWN J.K.A.	SUBMITTED	J.J. Hammond	
TRACED W.A.S. - G.A.M.	RECOMMENDED	[illegible]	
CHECKED H.E.W.	APPROVED	J.L. Savage	
DENVER COLO. MAY 28, 1936			231-D-266

TR 6-10-36

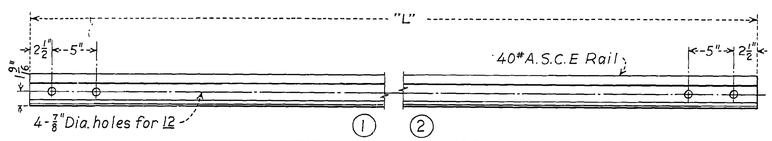
Job No. 231-4-3

21"x 36"



TRASH RAKE RAIL INSTALLATION

TRASH CAR RAIL INSTALLATION

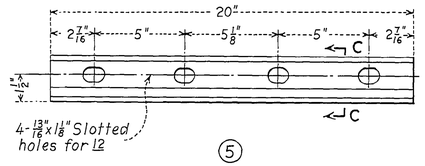


① ②

TRASH RAKE RAIL

STEEL

1/2 TWELVE REQUIRED "L" = 29'-11 7/8"
1/2 EIGHT REQUIRED "L" = 28'-5 7/8"



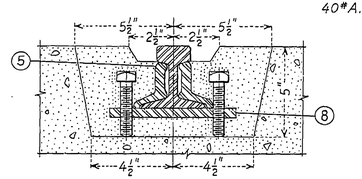
⑤

SPLICE BAR

STEEL - 36 REQUIRED

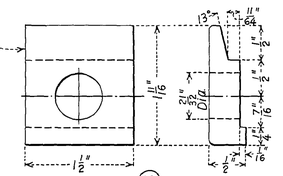
Splice bar section to be standard for 40#A.S.C.E.rail

SECTION C-C



SECTION A-A

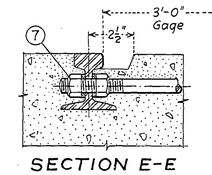
Rail clip to be standard for 40#A.S.C.E. rail



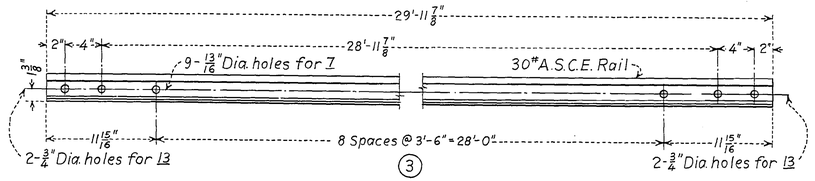
⑩

RAIL CLIP

STEEL - 404 REQUIRED



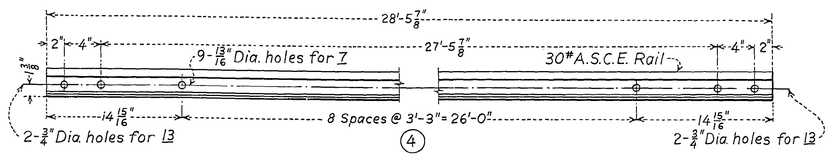
SECTION E-E



③

TRASH CAR RAIL

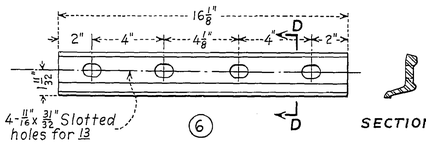
STEEL - TWELVE REQUIRED



④

TRASH CAR RAIL

STEEL - EIGHT REQUIRED



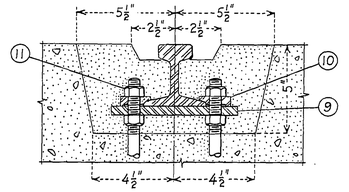
⑥

SPLICE BAR

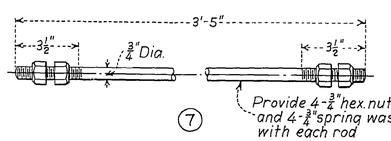
STEEL - 36 REQUIRED

Splice bar section to be standard for 30#A.S.C.E.rail

SECTION D-D



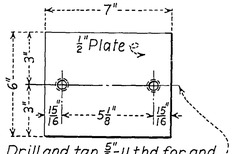
SECTION B-B



⑦

TIE RODS

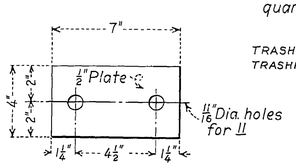
CLASS "C" BOLT STEEL - 90 REQUIRED



⑧

JOINT BEARING PLATE

STRUCT. STEEL - 22 REQUIRED



⑨

BEARING PLATE

STRUCT. STEEL - 192 REQUIRED

LIST OF PARTS

PART NO.	DESCRIPTION	MATERIAL	NO. REQ'D.
1	Trash rake rail	Steel	12
2	Trash rake rail	Steel	8
3	Trash car rail	Steel	12
4	Trash car rail	Steel	8
5	Splice bar	Steel	36
6	Splice bar	Steel	36
7	Tie rods	Class "C" bolt steel	90
8	Joint bearing plate	Structural steel	22
9	Bearing plate	Structural steel	192
10	Rail clip	Steel	404
11	5/8 x 8" Sq. hd. machine bolts with 2- hex. nuts	Class "C" bolt steel	404
12	3/4 x 3" Hex. hd. machine bolts and hex. nuts	Class "C" bolt steel	76
13	5/8" x 2 3/4" Hex. hd. machine bolts and hex. nuts	Class "C" bolt steel	76

NOTE

All bolts and rail clips as listed are about 5% in excess of quantity required.

REFERENCE DRAWINGS

TRASHRACK STRUCTURE - PLAN - ELEVATIONS.....231-D-262
TRASHRACK STRUCTURE - EXPANSION JOINT.....231-D-266

DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
PARKER DAM PROJECT

PARKER POWER PLANT
TRASHRACK STRUCTURE
TRAVELING TRASH RAKE TRACK RAIL

DRAWN Z.M.M. SUBMITTED Roy F. Weston
TRACED A.E.L. RECOMMENDED C.H. Dey
CHECKED E.B. APPROVED W. H. Holden

DENVER, COLORADO, NOV. 16, 1936 | 231-D-328

Job No. 231-4-3

Appendix V. Contact Information for Study Participants and Representatives of Equipment Manufacturers

Name	Description	Phone	E-mail
Tony Wahl	Hydraulics laboratory	303-445-2155	TWAHL@do.usbr.gov
Rick Christensen	Mechanical equipment	303-445-2858	RCHRISTENSEN@do.usbr.gov
Craig Grush	Cost estimating	303-445-3081	CGRUSH@do.usbr.gov
Joe Kubitschek	Peer review	303-445-2148	JKUBITSCHEK@do.usbr.gov
Ron Ellis	J.L. Hermon & Assoc. (Brackett Green rep)	303-771-4045	RELLIS@JLHermon.com
Bob Manwaring	WasteTech Inc. (rep for Kunz)	847-367-5150	BOB.MANWARING@wastetechinc.com
Jim McKee	Lakeside Equipment (Lakeside-MUHR)	630-837-5640	JM@lakeside-equipment.com
Josh Queen	Gobel-Sampson (Lakeside-MUHR rep in Denver area)	303-770-6418	JQUEEN@goblesampson.com