

Bechtel Associates Professional Corporation  
Ann Arbor, Michigan

APPENDIX D  
SPEC 7220-C-208

TECHNICAL SPECIFICATION  
FOR  
PLANT FOUNDATION EXCAVATION AND  
COOLING POND DIKES  
FOR THE  
CONSUMERS POWER COMPANY  
MIDLAND PLANT, UNITS 1 AND 2  
MIDLAND, MICHIGAN

Consisting of:

1. Specific Conditions
2. G 321C

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SPECIFIC CONDITIONS  
FOR  
PLANT FOUNDATION EXCAVATION AND  
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FOR THE  
CONSUMERS POWER COMPANY  
MIDLAND PLANT, UNITS 1 AND 2  
MIDLAND, MICHIGAN

1.0 Introduction

Earthwork operations at the Midland job site were initially started in 1969 and stopped in 1970. Work under these Specific Conditions are essentially a continuation of the initial work, updated to reflect work completed to date.

1.1 Work Included

The work consists of, but is not limited to, furnishing all plant, labor, technical services, supervision, materials and equipment and performing all operations necessary and required to perform the following:

- 1.1.1 Project reactivation work to inspect, prepare, and/or remove earthwork placed under original earthwork subcontract.
- 1.1.2 Seal off water wells within the "Work Limits" shown on the Drawings.
- 1.1.3 Dismantle and remove all remaining structures within the areas defined by the "Work Limits" on the Drawings. Remove foundations of structures in areas of required excavation and any other foundation at or extending above elevation 615.



- 1.1.4 Clear all remaining areas within the "Work Limits" not previously cleared. Also clear and grub any remaining areas of the Cooling Pond and Baffle Dike foundations and the Borrow Area. Most of the remaining clearing and/or grubbing work to be done is along the southerly portion of the cooling pond, as shown on the drawings. Stripping below elevation 615 is not required except as specified above. | 2
- 1.1.5 Relocate ponds associated with brine wells as shown on the drawings, as and when required.
- 1.1.6 Excavate, dewater and prepare the foundations for the Cooling Pond Dikes, Baffle Dikes, and Railroad Embankment.
- 1.1.7 Excavate the Cooling Pond Area to provide a maximum bottom elevation of 614 (unless shown otherwise on the Drawings). | 2
- 1.1.8 Dewater and maintain in the dewatered state the trenches and foundations of the Cooling Pond dike sections, and all other earthwork operations.
- 1.1.9 Construct embankment for the Cooling Pond Dike, Baffle Dike, and Railroad Embankment and in the Plant Area. This includes the supply of any materials from an external source required to perform the work in accordance with the specification.
- 1.1.10 Complete installation of outlet structure, including the necessary concrete, reinforcement, miscellaneous metalwork, and rip rap work.
- 1.1.11 Provide and maintain all haul and access roads necessary or required to perform the work.
- 1.1.12 Provide construction schedules as required.
- 1.1.13 Excavate for and construct diversion channels, drainage ditches, drop structures, and ditch drops; and protect channel surfaces as shown on the Drawings.

- 1.1.14 Provide slope protection for ditches as shown on drawings.
- 1.1.15 Backfilling around the structures in the Plant Area, and place the Plant Area fill.
- 1.1.16 Construct a construction temporary laydown area, including diversion of the existing Bullock Creek, and placing embankment materials.
- 1.1.17 Provide a quality assurance program for various work items described in paragraph 16.0 of this specification.

1.2 Work Not Included

The following work will be done by and at the expense of others:

- 1.2.1 Supply and placement of ballast, ties and rails for the railroad.
- 1.2.2 Removal or relocation of all telephone and power lines.
- 1.2.3 Relocation of brine lines shown on the Drawings.
- 1.2.4 Excavation of test pits and drilling holes to provide additional information regarding the subsurface. This work will be carried out by and at the expense of others prior to or concurrently with the construction required under this Contract.
- 1.2.5 Compaction testing, except that testing to qualify alternate equipment shall be the responsibility of the Subcontractor.

2.0 CODES AND STANDARDS

2.1 Abbreviations of Codes and Standards used shall have meanings as defined below.

- AASHO - American Association of State Highway Officials
- ACI - American Concrete Institute
- AISC - American Institute of Steel Construction
- API - American Petroleum Institute
- ASTM - American Society for Testing and Materials
- MDSHSS - Michigan Department State Highway Standard Specification
- USBR - United States Bureau of Reclamation
- OSHA - Office of Safety and Health Administration

2.2 All work shall conform to requirements of the building codes, safety orders for the State of Michigan and City and County of Midland, and all applicable paragraphs of OSHA Standards.

2.3 All referenced specifications, codes and standards shall be the revision in effect on the date of the Contract.

2.4 Unless otherwise specified, reference to such standards and codes is solely for technical information.

2.5 Discrepancies in and between applicable codes, standards, the Contract, and/or design drawings shall be brought to the immediate attention of the Contractor.

3.0 MOBILIZATION

The Subcontractor shall mobilize and transport its construction plant and equipment, including materials and supplies, construct such temporary buildings and facilities as are necessary and required and assemble such plant and equipment at the site, all in adequate time for satisfactory performance of all work under the Contract. Mobilization will not be paid for separately.

4.0 RIVER POLLUTION AND FIRE PREVENTION

4.1 River Pollution

The Subcontractor shall perform the work in strict conformity with all applicable laws, rules, and regulations relating to pollution of any stream or river, including crossings thereof. The Subcontractor shall, at its expense, provide suitable facilities to prevent the introduction of any substances or materials into any stream, river, lake or other body of water which may pollute the water or constitute substances or materials deleterious to fish and wild life. All temporary facilities provided by the Subcontractor shall, at completion of the work, be removed by and at the expense of the Subcontractor. The Subcontractor shall be responsible for all costs and/or corrective measures required as a result of pollution or other damages incurred to adjacent properties and streams resulting from the Subcontractor's operations. The Subcontractor shall cooperate with the Water Resources Commission of the Department of Natural Resources for the State of Michigan, and shall keep itself informed as to said Departments' and Commissions' requirements regarding the work as approved or required. All costs in connection with said requirements shall be borne by the Subcontractor. The Subcontractor shall submit with his bid proposal his proposed plan to prevent pollution of the adjacent river and streams.

4.2 FIRE PREVENTION

The Subcontractor shall not permit unauthorized fires either within or adjacent to the limits of the project and it shall be liable for all damage from fire due directly or indirectly to its own activities, or to those of its employees or of its subcontractors or their employees. The Subcontractor shall conform to all Federal, State, and local laws and regulations pertaining to burning, fireprevention and control within or adjacent to the project. A copy of each required permit shall be furnished to the Contractor.

The Subcontractor's forces or equipment may be required to fight fires in the vicinity, regardless of cause. The Contractor will not assume any responsibility for payment for fighting fire when such is ordered by Governmental Authority.

5.0 CARE OF WATER

5.1 Foundation Dewatering

5.1.1 All excavations and foundation surfaces shall be dewatered during construction as and if necessary.

5.1.2 During placing and compacting embankment material, the water table at any point shall be maintained at least 4 feet below the surface of the embankment being placed or compacted provided that during placing and compacting the first 4 feet of embankment the water table shall be maintained below the elevation of the foundation upon which the embankment is being placed or compacted.

5.1.3 All local runoff from adjoining areas shall be intercepted and disposed of to prevent interference with construction of or damage to excavations and structures. See paragraph 4.1 above.

5.1.4 All seepage, including springs encountered in the dike foundation areas shall be dewatered as necessary or required for placement of embankment materials as specified.

5.2 Measurement and Payment

5.2.1 Foundation Dewatering, Embankment Foundations

Foundation dewatering shall be considered as an incidental operation to excavation, embankment, or other earthwork operation. No separate payment for this item will be made. All dewatering costs, if any, shall be included in the appropriate earthwork operation.



6.0 CLEARING, GRUBBING AND REMOVAL OF STRUCTURES

6.1 Definitions

6.1.1 Clearing

Clearing is felling, cutting up and disposing of all trees and brush together with the down timber, snags, floatable material and rubbish contained within the area to be cleared.

6.1.2 Grubbing

Grubbing is removing all stumps, roots larger than 1-1/2 inches in diameter, and matted roots from the embankment foundation and the surface of the borrow areas.

6.1.3 Brush

Brush is that natural vegetation with main stems 2 inches or less in diameter, as measured at ground level.

6.1.4 Trees

Trees are the natural vegetation not falling within the limits of brush as defined in Paragraph 6.1.3.

6.1.5 Fencing

Fencing is all fences including posts, wires, fabric and gates.

6.1.6 Structures

Structures are buildings or portions thereof, water and feed troughs.

6.1.7 Salvage

Salvage is waste material resulting from the operations under the contract which, as determined by the Subcontractor, is marketable.

6.2 Clearing Requirements

The remaining areas not previously cleared within the "Work Limits" shall be cleared only provided that areas specified in Paragraph 6.3 shall be cleared and grubbed.

Clearing shall be carried out in a manner such that damage to structures, both existing and under construction, is prevented. Trees, stumps and brush shall be cut parallel to the slope of the ground and as close as convenient to the surface.

6.3 Clearing and Grubbing Requirements

6.3.1 The areas listed below shall be cleared and grubbed:

The remaining foundations of the cooling pond and baffle dikes, including an area 5 feet beyond the top of cut slopes and the toe of fill slopes; surface of the required excavation areas and surface of all storage and stockpile areas.

6.3.2 Where the material to be grubbed can be removed by subsequent required excavation which is to be wasted, grubbing will not be required.

6.3.3 All field tiles located during foundation excavation shall be removed from the dike foundations.

6.4 Fencing Removal

All fencing existing within the areas to be cleared shall be removed and disposed of when authorized by the Contractor.

6.5 Removal of Structures

Structures located in the county farm area and also an existing building in the plant area shall be utilized as temporary office facilities by the contractor. The contractor will notify the subcontractor as to the approximate date of their removal.

Within the county farm area the three car garage which presently houses Dow equipment will be removed by others. All material from the main structure except the walls and the brick will be removed by the Eagle Boys' Village; They will remove furnaces, windows, roof trusses wiring, plumbing fixtures, etc. The balance of demolition and disposal shall be the responsibility of the subcontractor. △

All other remaining structures within the "Work Limits" shall be demolished and disposed of. Foundations of structures in areas of required excavation shall be removed as noted in 1.1.3

6.6 Disposal of Material

6.6.1 General

Logs, stumps, roots, brush, trees, rotten wood, lumber, fencing fabric and other materials resulting from the clearing and grubbing operations shall be disposed of by removal from the area to be cleared. Material so removed shall be disposed of in the disposal areas shown on the Drawings.

6.6.2 Removal

The Subcontractor will be permitted to remove salvage materials for whatever purposes it sees fit with exceptions as noted in 6.5. No material shall be removed until approval for the removal of the material has been given by the Contractor. | △

The Subcontractor will be permitted to stockpile salvage materials at approved locations within the area to be cleared, provided that said materials are removed from the area before final acceptance.

6.6.3 Burying

Upon approval, materials may be buried at approved locations. All floatable and organic material disposed of within the pond area shall be buried with a minimum of three foot cover over all such material, unless otherwise approved by the Contractor.

6.7 Measurement and Payment

6.7.1 Clearing; Clearing and Grubbing

All work performed to 1) clear and 2) to clear and grub will be paid for at the appropriate lump sum item described below:

6.7.1.1 For all areas within the limits of work shown on the drawings, but excluding Area A, where only clearing work is required, such work will be paid under:

Item 1A Clearing only, except Area A.

6.7.1.2 For Area A, where only clearing work is required, such work will be paid under:

Item 1B Clearing only, Area A.

6.7.1.3 For all areas within the limits of work shown on the drawings, but excluding Area A, where both clearing and grubbing is required, such work will be paid under:

Item 2A Clearing and Grubbing, except Area A.

6.7.1.4 For Area A, where both clearing and grubbing is required, such work will be paid under:

Item 2B Clearing and Grubbing of Area A.

6.7.2 Removal of Structures and Fencing

All work performed to remove any existing structures, footings, and fencing will be paid for at the lump sum item listed below:

Item 3 Removal of Structures and Fencing.

Any monies realized by the Subcontractor through salvage of the structures, etc., will not be deducted from payment of item 3.



## 7.0 SEALING WELLS AND EXPLORATORY HOLES

### 7.1 General

All known wells and well characteristics are listed in the attached Table 7-1 which, by reference herein, forms a part of the specification. Indicated on aforementioned Table 7-1, are eight wells to be sealed by the Subcontractor prior to performing any excavation. In addition to the listed wells, any other wells or found exploratory holes located within the construction area shall also be sealed. All listed wells to be sealed will be field located by the Contractor.

Some of the wells have exposed casing; the remainder are either buried beneath 4 to 5 feet of soil or beneath several feet of water at the bottom of ceramic or concrete sumps. In the case of the buried wells, the Subcontractor will be required to perform hand excavation and minor plumbing to expose the casing and prepare the wells for sealing operations. The buried wells are usually constructed with a horizontal pipe attached to the top of the well casing and buried between the well and the basement of the house. Well casings in sumps shall be dewatered to expose the casing. In most cases, minor plumbing to attach extension pipes for easier access or to stop artesian flow is required. All inserted pipes, pump attachments and pipe fittings installed with each well shall be removed by and at the expense of the Subcontractor.

### 7.2 Well Depths and Diameters

The depth of Well No. 57 is unknown. Remaining wells range in depth from 100 to 170 feet.

The well casing diameters are 2 and 4 inches.

### 7.3 Wells with Check Valves

7.3.1 Those wells with a check valve attached directly to a single casing shall be filled with grout from the check valve to the top of the casing or

to the top of the required extension. In most wells a check valve, commonly the Bremer type, is used to connect the well screen to the bottom of the well casing as well as to function as a check valve to hold the water level up in the casing when no pumping is in progress. These valves are so constructed that when there is no upward flow past the valve, a rubber gasketed free-moving plug effectively seals the well. These check valves are generally installed in the 2-inch diameter wells. The placement of the grout directly upon the valve in a non-flow well will form a positive well seal. Grout shall conform to materials described in paragraph 7.8 of these revised specifications. The grout shall be placed by introducing grout down a pipe inserted in the well. The bottom of the grout pipe shall be left at the placement depth until grout is seen to emerge from the top of the well casing. Upon removal of the grout pipe, the well casing shall be topped up with grout. After filling, the grout level in the well must remain static thus indicating that it has been effectively plugged.

- 7.3.2 For those wells with a check valve attached to a supply line separate from a second outer casing, the well shall be considered as without check valve and shall be pressure grouted similar to the provisions of paragraph 7.4 below.

#### 7.4 Wells Without Check Valves

After the probing operation of a water well has indicated that no check valve is present, or that the check valve is attached only to the separate supply line, the top of the well casing shall be prepared for pressure grouting. The top shall be constructed with provision for either a) inserting a one (1) inch diameter pipe, or b) attaching to the existing supply line; in either case, the pipe shall extend down to within five (5) feet of the well bottom. The top shall include a small valved pipe for inspection purposes. Sealing of the well shall be done by pressure grouting about the center pipe and effectively plugging both the outer casing area and also the supply line.

#### 7.5 Wells with Obstructions

These wells shall be filled from the depth described herein and approved by the Contractor to the top of the casing or the top of the required extension. Prior to grout placement, a check of all wells shall be made for possible obstruction to free movement of grout down to the check valve or well screen depending on the type of installation. The purpose of this check is to assure that the wells have not been accidentally or intentionally plugged at a shallow depth. It is not anticipated that wells will be plugged, but if they are plugged at depth within 50 feet of the ground surface or the finally excavated level, whichever is deeper, the plugs shall be removed or penetrated without damaging the well casing. For each plug encountered, the Contractor will decide whether it shall be removed or left in place to form the bottom of the specified grout well seal.

#### 7.6 Artesian Flow Control

Should any of the proposed wells to be sealed flow under artesian pressure, the flow shall be stopped by attachment of a surface pipe prior to grout placement in the well so that the grout will not be diluted by the upward movement of the water.

The attachment of these pipes will generally require pipe cutting and re-threading. The check valves shall be closed when flow is stopped, thus allowing the grout to effectively seal the well against upward movement of artesian water.

#### 7.7 Exploratory Holes

Exploratory holes which were (a) drilled to sufficient depth to intercept ground water aquifers in the pond area or (b) drilled into the artesian aquifer found at depths varying from 177 to 230 feet in the plant area, shall be sealed by pressure grouting. Exploratory holes are listed on the attached Table 7-2 which by reference herein, forms a part of the specification. In addition, other exploratory holes which show signs of possible leakage or artesian ground water shall be checked, and, if required, shall also be pressure grouted.

In order to pressure grout the exploratory holes an outer casing must be grouted into the top 20 feet of the hole. This casing must be installed to withstand an internal pressure of 30 psi. After the casing has been installed and the grout set, a one (1) inch diameter pipe shall be inserted down the original exploratory hole to within five (5) feet of the top of the artesian aquifer. The grout pipe shall be sealed into the top of the surface casing to withstand a 30 psi maximum pressure. In addition, a small valved inspection pipe shall be welded to the top of the surface casing.

Table 7-2 lists the depth to the top of the aquifer and other known data.

Table 7-3 lists those holes which should be checked by the Contractor, and if observed to be flowing, shall also be sealed by the Subcontractor by pressure grouting methods.

## 7.8 Grout Design

The grout shall be composed of cement, water, and aluminum powder. The cement shall conform to the requirement of ASTM Designation C 150-68, Type III. The grout shall be proportioned, mixed and placed in accordance with the instructions of the manufacturer of the aluminum powder to be used. The ratio by volume of water to cement shall not exceed 0.75; however, the Contractor may change the grout mix to suit field conditions.

## 7.9 Pressure Grouting

### 7.9.1 General

The intent of pressure grouting 1) all wells without check valves, 2) wells with check valves on the separate supply line, and 3) various other exploratory holes, is to seal those wells or holes where they penetrate aquifers. This sealing shall be done by either injecting neat cement grout under pressure or by pressurizing a previously grout filled well casing or exploratory hole. The exact method of pressure grouting will be





subject to the Contractor's approval and subsequent to each well or hole pressure grouting, they will be pressure tested to insure that sealing has been achieved.

#### 7.9.2 Mix Design

The grout shall consist of cement, water, and aluminum powder in accordance with paragraph 7.8. Subject to the Contractor's approval, accelerators to speed grout curing can be added during the final stages of grouting.

#### 7.9.3 Grout Placement

The grout shall be placed in accordance with the methods described below and subject to adjustment to fit field conditions as approved by the Contractor: (note all mix ratios are water: cement by volume).

Two general methods appear applicable to the pressure grouting program. The first, termed "pressure injection" is where grout is injected under pressure at all times. This method should prove most effective in sealing the flowing artesian wells. The second, termed "secondary pressurization" is accomplished by first filling the hole with grout and then applying pressure to the filled hole or casing. Following are simplified descriptions of the two methods:

##### 7.9.3.1 Pressure Injection

- a. Insert pipe (nominal diameter one (1) inch) through specially constructed top of well or surface casing within five (5) feet of the top of aquifer.

Seal pipe at top of well or surface casing.

- b. Mix grout at W:C ratio of 0.75:1 and inject under sufficient pressure (nominally 20 psi) to fill well casing or exploratory hole. Injection should continue until grout of essentially the same W:C ratio is observed flowing from the inspection pipe at top of the casing. The inspection pipe valve shall then be closed and an additional 10 psi



applied to the filled well. Accelerators can be added to the mix at the time grout is observed at the inspection pipe. After the grout has set, the hole or well shall be pressure tested to a 30 psi pressure for ten (10) minutes to insure that the hole is sealed.

#### 7.9.3.2 Secondary Pressurization

- a. Insert pipe (nominal diameter is one (1) inch) through specially constructed top of well or surface casing down to within five (5) feet of the top of aquifer.

Seal the pipe at top of well or surface casing.

- b. Mix grout at W:C ratio of 0.75:1 and fill the hole or casing. Attach grout equipment to the pipe and complete grouting operation by applying 20 psi to system. The entire system should remain pressurized, if possible, until the grout has set. Accelerators can be added during the final stages with the approval of the Contractor. After the grout has set, the hole or well shall be pressure tested to a 30 psi pressure for ten (10) minutes to insure that the hole is sealed.

#### 7.9.4 Records

The Subcontractor shall submit to the Contractor daily records of all pressure grouting work. This record should note the depth of well, quantity of grout used, and note the satisfactory testing results at each well.

### 7.10 Measurement and Payment

#### 7.10.1 Measurement

Sealing of wells and exploratory holes will be measured as the number of wells sealed to the satisfaction of the Contractor. No additional compensation will be made for varying size or quantity of grout used to seal the well or hole.

7.10.2 Payment

Sealing of wells and holes will be paid for at the contract price stated in the Price Schedule for the items listed below:

- Item 4 Sealing Wells (with Check Valves)
- Item 5 Sealing Wells (without Check Valves, Pressure Grouted)
- Item 6 Sealing Exploratory Holes (Pressure Grouted)

8.0 EXCAVATION

8.1 General

The Subcontractor shall perform all required excavation regardless of the character of the materials encountered, all dewatering and cleanup work required to prepare the excavated areas for placement of embankment and, if required by the Contractor, remove slide material. The required excavation shall be made to the excavation paylines, grades and elevations shown or to a sufficient depth to obtain an acceptable foundation.

All necessary precautions shall be taken to preserve in a sound and undisturbed condition all material below and beyond the limits of required excavation. If, as determined by the Contractor, materials below and beyond the required excavation limits were disturbed, due to excavation methods employed, such material shall be removed and replaced with suitable compacted material as required by the Contractor by and at the expense of the Subcontractor.

All excavation operations within 1000 feet of the west and south property lines shall be limited to normal daylight hours.

8.2 Definitions

8.2.1 Required Excavation

Required excavation is all open cut excavation shown on the Drawings including but not limited to the excavation required for:

- 1) Deepening the Cooling Pond (designated for borrow) so that the level of the bottom is not higher than elevation 614, nor lower than elevation 612 in the excavation areas (unless shown otherwise on the drawings), and not higher than elevation 615 in disposal areas.
- 2) Dike and railroad embankment foundations including an inspection trench excavated in the dike foundation to a minimum depth 8 feet below the original ground level, and the removal of loose sand with uniform grading of the particles from the Cooling Pond dikes;
- 3) Diversion channels, drop structures, and drainage ditches; and
- 4) Emergency Cooling Pond area

#### 8.2.2 Borrow Excavation

Borrow excavation is the excavation of material suitable for use in the embankment. All borrow shall be obtained from the required excavation unless otherwise approved by the Contractor. All borrow excavation outside the limits of the required excavation shall be carried out by and at the expense of Subcontractor.

#### 8.2.3 Stripping

Stripping is removing from the surface, all soil which contains organic material or any other material which is unsuitable.

#### 8.2.4 Acceptable Foundation

The determination of acceptable foundation will be made by the Contractor.

#### 8.2.5 Suitable Material

The suitability of all material will be determined by the Contractor.

### 8.3 Classification of Excavation

Excavation will not be classified for payment

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8.4 Blasting

No blasting of rock or tree stumps will be permitted.

8.5 Safety of Excavations

The Subcontractor shall have sole responsibility for the safety of all excavations performed under the Contract.

8.6 Borrow Excavation

8.6.1 General

The part of the Cooling Pond which is required, by this specification, to be excavated, is designated as borrow area. This borrow area



and the materials therein will be made available in place and as is, without cost to the Subcontractor. The location and approximate extent of the borrow areas are shown on the Drawings. The Subcontractor may request the use of borrow areas other than that shown. The Subcontractor shall not use such areas until approved by the Contractor. All borrow areas shall be stripped only to the extent necessary to obtain sufficient quantity of suitable borrow material. Unless otherwise shown on the Drawings, excavation in the borrow areas shall be made so that the finally excavated slopes are not steeper than 5 horizontal to 1 vertical. The Subcontractor shall dress all borrow areas from which material has been removed, and those areas otherwise disturbed by the Subcontractor, to present a satisfactory appearance.

#### 8.7 Stripping

Stripped material from the dike foundation shall be used as top soil in Zone 6 on the downstream slope of the dike as shown on the Drawings. The Subcontractor may, for his convenience, stockpile any of the stripped materials for later use in Zone 6 in areas approved by the Contractor. Stripped material not suitable or not required for use in the embankment shall be disposed of and/or wasted by the Subcontractor.

#### 8.8 Acceptable Foundation

8.8.1 Where the foundation elevation is fixed by structural requirements indicated by specific elevations, additional excavation may be required if the material encountered at the indicated elevation is not acceptable.

#### 8.8.2 Cooling Pond Dikes

##### 8.8.2.1 Foundation Areas in the Inspection Trench

Acceptable foundation for the Inspection Trench is firm undisturbed sandy, silty clays or sandy silts with some clay.



8.8.2.2 Foundation Areas Other than the  
Inspection Trench

Acceptable foundation for foundation areas other than the Inspection Trench is firm in-place material with the organic material removed from the surface. Loose uniform sand which is saturated or will become permanently saturated when the Cooling Pond is in operation will not be acceptable foundation. Existing hard smooth pavement surfaces will not be acceptable and must be ripped up and removed before any embankment material is placed thereon.

8.8.3 Baffle Dikes and Railroad Embankment

Acceptable foundation for the Baffle Dikes and Railroad Embankment is firm in-place material with the organic material removed.

8.9 Drainage

Excavation of temporary drainage ditches as necessary during the execution of the work shall be provided by and at the expense of the Subcontractor.

8.10 Shoring

Shoring as necessary or required shall be done in accordance with the applicable laws and regulations of the State of Michigan, and also with all applicable OSHA requirements.

8.11 Excess Material

Excess material from the excavation, not required for backfill, shall be wasted in designated disposal areas.

## 8.12 Disposal of Excavated Material

### 8.12.1 General

Suitable materials removed from required excavation, existing stockpiled material from river excavation and borrow areas shall be placed in the embankment or used as backfill as shown on the Drawings and as specified. Excess and/or unsuitable material from required excavation may be wasted in designated disposal area.

### 8.12.2 Stockpiling

When the excavation progresses at a rate faster than placement in the embankment is being accomplished or prior to start of embankment construction, or if convenient for the execution of the work, excavated materials shall be stockpiled at approved locations until required for placement in embankment. Stockpiling of topsoil shall be done in accordance with Paragraph 8.7

### 8.12.3 Wasting

Material specified to be wasted shall be wasted in the disposal areas indicated on the Drawings. The disposal areas are within the Cooling Pond Area. The material shall be wasted only in those places where the ground level is such that after the material has been placed, the level at the final surface is not higher than elevation 615. The surfaces of the disposal area shall be left in a satisfactory condition, sloped to drain, and compacted with 2 passes of a 50-ton rubber tired roller or approved alternate. No waste material shall be dumped within the Cooling Pond Area so that the final rolled surface has a slope steeper than 5 horizontal to 1 vertical.

8.13 Measurement and Payment

8.13.1 Required Excavation

8.13.1.1 Measurement

Required excavation will be measured in place to the nearest cubic yard, as the number of cubic yards of material satisfactorily excavated and disposed of.

8.13.1.2 Payment

Required excavation will be paid for at the applicable contract price stated in the Price Schedule for the items listed below.

Item 7 Excavation; Cooling Pond Area

Item 8 Excavation; Cooling Pond Dike Foundation, Baffle Dike Foundation and Railroad Embankment Foundation

Item 9 Excavation; Diversion Channels, Drainage Ditches, and Drop Structures

8.13.2 Stripping

Stripping will not be paid for separately.

8.13.3 Borrow Excavation

Borrow excavation will not be paid for separately.

8.13.4 Stockpiling

Stockpiling and moving material from stockpile to points of disposal will not be paid for separately.

8.13.5 Wasting

Wasting will not be paid for separately.

8.13.6 Shoring

Shoring will not be paid for separately.

8.13.7 Compacting Waste Areas

Compacting waste areas will not be paid for separately.

8.13.8 Overhaul

Overhaul of borrow will not be paid for separately.

8.13.9 Drainage and Dewatering

Drainage and dewatering will not be paid for separately.



9.0 SLURRY TRENCH

9.1 General

In some locations it is anticipated that pervious layers consisting mostly of sand will extend below the water table. In certain instances where this occurs an impervious cutoff to reduce seepage through the foundations shall be constructed by the slurry trench method. The necessity for and limits of the slurry trench will be determined by the Contractor following an assessment of the foundation conditions revealed during construction. The trench shall have a minimum 4 foot width with substantially vertical walls. The top of the slurry trench shall be at least one foot above the water table. The trench shall extend from the surface of excavated foundation, or the surface of construction fills placed by the Subcontractor for construction purposes, through the sand or other pervious deposits to penetrate a minimum of 2 feet into satisfactory impervious foundation, such as firm undisturbed sandy silty clays or sandy silts with some clay.

9.2 Surface Preparation

The Subcontractor shall, at its expense, perform any required surface preparation, including temporary filling, grading, clearing and dewatering.

9.3 Excavation

Excavation of the trench shall be done with a dragline or other equipment approved by Contractor. The excavation shall be carried to the final depth at the point where excavation is started, and the entire depth of cut shall be carried along the trench centerline. The depth of the trench shall be terminated when the excavation penetrates a minimum of 2 feet into impervious foundation. The stability of the trench walls shall be maintained during excavation by introducing bentonite slurry.

The stability of the trench throughout construction shall be the responsibility of the Subcontractor.

## 9.4 Slurry

### 9.4.1 General

The slurry shall consist of a stable colloidal suspension of bentonite in water.

### 9.4.2 Slurry Properties

The slurry properties will be determined by tests described in the API Recommended Practice 13B, dated November 1962, 1st Edition, "Standard Procedure for Testing Drilling Fluids," including Supplement No. 1, dated March 1966. Such tests will be made by the Contractor without charge to the Subcontractor.

9.4.2.1 At the introduction of the slurry into the trench:

- 1) The slurry shall contain a minimum of 20 pounds of bentonite per barrel of slurry equivalent to a density of approximately 65 pounds per cubic foot;
- 2) The viscosity shall not be less than 15 centipoises at 20 C; and
- 3) The water loss shall not be greater than 25 cubic centimeters in 30 minutes.

9.4.2.2 At any time in the slurry trench:

- 1) The slurry density shall be no greater than 85 pounds per cubic foot unless otherwise approved by the Contractor; and
- 2) The viscosity shall be no greater than 30 centipoises at 20 C.

9.4.2.3 At the time the backfill is introduced into the slurry trench:

- 1) The slurry shall have a density no greater than 80 pounds per

cubic foot unless otherwise approved by the Contractor; and

- 2) The water loss shall not be greater than 30 cubic centimeters in 30 minutes.

#### 9.4.3 Bentonite

The bentonite shall be an approved powdered sodium bentonite and shall conform to the requirements of API Standard 13A, dated March 1965, 3rd edition, "Specification for Oil-Well Drilling - Fluid Materials, (Tentative)". The properties of the slurry may be altered to suit construction conditions by admixtures used for the control of oil field drilling muds, as approved by the Contractor. Under no condition will peptizing or bulking agents be allowed.

#### 9.4.4 Water

Water will be available from the Tittabawassee River without charge to the Subcontractor, provided that the Subcontractor shall, at its expense, provide pumps, pipes and other equipment required to convey the water to the site of work and to assure that the quality of the water is satisfactory for use with slurry. Upon completion of the work, the Subcontractor shall, at its expense, remove all pumps, pipes and any other equipment and leave the site with a satisfactory appearance.

#### 9.4.5 Mixing and Placing Slurry

Slurry plant shall include a mixer capable of producing a colloidal suspension of bentonite and water along with the necessary air agitation, and additional pumps to assure thorough mixing. Slurry shall be transported to the trench by a temporary pipeline or by other methods approved by the Contractor.

#### 9.4.6 Cleaning of Slurry

Equipment shall be provided by the Subcontractor

to remove slurry from near the bottom of the trench so that it can be treated by shakers and/or cyclones to remove excess sands and silts. The coarse material so removed may be used as a part of the backfill or disposed of. The slurry with the coarse material removed and which meets the requirements of this specification shall be discharged back to the trench. This Operation shall be on a continuous basis to assure cleanliness of the slurry at all times.

#### 9.4.7 Level of Slurry

At any time the level of the slurry shall not drop below one foot above the level of the water table. The Subcontractor shall be responsible for the stability of the trench walls above and below the water table. The Subcontractor shall also be responsible for the stability of the excavation should the level of the slurry drop below the water table.

#### 9.4.8 Excess Slurry

At completion of the backfill operations the excess slurry shall be disposed of as approved by the Contractor.

### 9.5 Backfill

#### 9.5.1 General

The backfill for the slurry trench shall consist of a combination of excavated material and imported material, or entirely of imported material. The backfill material shall be mixed and blended thoroughly prior to placing in the trench. The Subcontractor shall assure that all backfill material has been thoroughly blended with additional bentonite slurry prior to introducing the backfill into the trench. This additional slurry shall be sluiced or pumped into the blending area and thoroughly mixed with the backfill material in a proportion of a minimum 2 percent of bentonite to backfill, based on dry weights. All clods of

earth, clay, bentonite, silt or other cemented matter shall be broken up and blended. The backfill shall be free of all vegetation or other deleterious materials. Before introducing the backfill into the trench, the backfill shall have the consistency of wet concrete with about a 6-inch slump as determined by the Contractor. The Subcontractor shall waste any material which, as determined by the Contractor, is unsuitable.

9.5.2 Gradation

The gradation of the backfill shall be as follows:

<u>U. S. Standard</u> <u>Series Sieves</u>	<u>Percent Passing</u> <u>by Weight</u>
3 inch	80-100
3/4 inch	40-100
No. 4	30- 70
No. 30	20- 50
No. 200	10- 25

9.5.3 Imported Material

In order to obtain backfill material which will meet the specific gradation, it will be necessary to import some material. The Subcontractor, at its expense, shall make all necessary arrangements for supply of such material. The Subcontractor may import the material from any source subject to approval as to suitability of the material.

9.5.4 Initial Backfill


After the backfill has been blended and prepared to the required characteristics and gradation, it shall be placed in the trench with a clamshell bucket. The first lifts shall be placed by lowering buckets of material to the bottom of the trench. Subsequent lifts shall be built up, using the clamshell bucket, until the backfill is above the top of the trench and has been formed without encroaching on unexcavated trench material. Free dropping of any backfill material will not be permitted.



9.5.5 Remaining Backfill

The remaining backfill shall be placed by bulldozing at the starting point and progressing continuously from the beginning to the end of the trench in the same direction as the excavation.

9.5.6 Trench Surcharge

Immediately after the trench has been satisfactorily backfilled, the Subcontractor shall mound over the trench a surcharge of slurry trench backfill material to provide a minimum surcharge thickness of 5 feet. This surcharge shall extend over the flared top of the trench. This surcharge shall be left untouched and no embankment material shall be placed over the slurry trench until a minimum of 7 days have elapsed. Prior to placement of Zone 1 material the mound shall be flattened to an extent so that a minimum surcharge of one foot remains. Zone 1 material placed over the slurry trench shall be placed and compacted in accordance with the requirements specified in Section 12, "Dike and Railroad Embankment Construction." 

9.5.7 Excess Backfill

All materials excavated from the trench and not used as backfill, or materials to be wasted, or unused backfill, shall be wasted as specified in Paragraph 8.12. The operation shall be done so as to leave no areas undrained and an appearance satisfactory to the Contractor. The Subcontractor shall, as approved by the Contractor, bury any material mixed with bentonite to prevent its exposure to the reservoir.

9.6 Records

The Contractor will keep records of gradation of backfill, profile and gradation of impervious foundation at the bottom of the trench; composition, viscosity and density of the slurry and other data which are necessary for control of the work. The Subcontractor shall, at its expense, provide all necessary facilities, information and non-technical assistance required in keeping such records.

9.7 Additional Probing

In addition to the probings made approximately every 10 feet along the trench centerline for the purpose of measurement for payment as specified in Paragraph 9.8, the Contractor may require additional probing. Such probing will be to determine more accurately the foundation condition prior to backfilling. The Subcontractor shall furnish all labor and equipment and all non-technical assistance and perform all operations to aid the Contractor in performing additional probing.

9.8 Measurement and Payment

9.8.1 Slurry Trench

9.8.1.1 Measurement

The slurry trench will be measured to the nearest square foot as the number of square feet of slurry trench excavated and backfilled. Such measurement will be made as projected onto a vertical plane along the centerline of the trench. Measurement will be based on surveys and probings of the bottom of the trench. Probings will be made at approximately 10 foot intervals. The Subcontractor shall provide all necessary equipment, facilities, labor and non-technical personnel, and perform all operations required to make the probings which shall be made in the presence of the Contractor.

9.8.1.2 Payment

The slurry trench will be paid for at the contract price stated in the Price Schedule for the item listed below.

Item 10 Slurry Trench

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9.8.1.3 Estimated Length of Slurry Trench

Subcontractor's attention is invited to the fact that the estimated quantity given in the Price Schedule is based on the slurry trench having a total estimated length of 500 feet.

9.8.1.4 Item 10 includes ground surface preparation excavation, pumping and conveyance and if necessary treatment of water, furnishing, mixing, placing and cleaning bentonite slurry, disposal of excess slurry, stockpiling excavated material, importing additional material for backfill, blending backfill materials, blending backfill material with additional bentonite slurry, placing backfill material, placing and removal of trench surcharge, disposal of excess backfill, soundings, and all related work necessary to construct the slurry trench.

9.8.2 Excess Slurry

Disposal of excess slurry will not be paid for separately.

9.8.3 Additional Probing

9.8.3.1 Measurement

Additional probing as necessary and required will be measured to the nearest ¼ hour as the number of hours such probing, ordered by the Contractor, is satisfactorily performed.

9.8.3.2 Payment

Additional probing will be paid for at the contract price stated in the Price Schedule for the item listed below.

Item 11 Additional Probing

10.0 FOUNDATION PREPARATION

10.1 General

Foundation preparation shall be performed upon acceptable foundation. No embankment fill shall be placed on any foundation until the Contractor has approved the foundation. Request for such approval shall be made immediately prior to placement of material. Foundations shall be cut to firm undisturbed material and shall be free of all loose material.

Immediately before placing embankment material on the foundation of the dikes and railroad embankment the foundation shall be scarified and moisture-conditioned as necessary and then rolled with 4 passes of a 50-ton rubber tired roller. An alternative roller approved by the Contractor may be used in which case additional passes may be required.

10.2 Foundation Dewatering

All foundation areas shall be dewatered prior to placement of embankment material thereon.

10.3 Measurement and Payment

10.3.1 Foundation Preparation, Dikes and Railroad Embankment

10.3.1.1 Measurement

Foundation preparation will be measured to the nearest square yard as the number of square yards of foundation preparation satisfactorily performed. Such measurement will be made as a projection on to a horizontal plane.

10.3.1.2 Payment

Foundation preparation will be paid for at the contract price stated in the Price Schedule for the item listed below.

Item 12 Foundation Preparation, Dikes and Railroad Embankment

10.3.2 Proof Rolling Plant Area

10.3.2.1 Measurement

Proof rolling in the Plant Area will be measured to the nearest square yard as the number of square yards of proof rolling satisfactorily performed. Such measurement will be made as a projection on to a horizontal plane.

10.3.2.2 Payment

Proof rolling in the Plant Areas will be paid for at the contract price stated in the Price Schedule for the item listed below.

Item 13 Proof Rolling, Plant Area

10.3.3 Basis of Payment

Pay items 12 and 13 shall be based on the Subcontractor making 4 passes using a 50 ton rubber tired roller. No additional payment will be made if an alternate roller is used which required more than 4 passes to achieve compactive results equivalent to the 50-ton roller specified.

10.3.4 Basis of Payment

Additional excavation authorized by the Contractor to carry the foundation down to acceptable foundation, will be measured and paid for as required excavation in accordance with Section 8, "Excavation".



11.0 EXISTING EARTHWORK - RECONDITION

11.1 General

A period of approximately two years has elapsed since the initial earthwork construction, resulting in considerable bank erosion to dikes and drainage ditches. Construction backfills have also deteriorated. Weeds and brush have grown, necessitating removal prior to continuation of new construction. Some backfill work is required as identified on the construction drawings.

11.2 Inspection, Testing and Removal

The Contractor will inspect and perform all tests to determine the extent of earthwork removal for all earthwork construction previously performed under the initial earthwork contract, without cost to the Sub-contractor.

11.3 Cooling Dikes

Prior to placement of new fill, the outer slopes will be excavated to a maximum depth of two feet perpendicular to the dike slope and reconstructed to lines and grades as shown on the drawings. Sufficient crown fill shall be removed to expose the construction zones. Particular care shall be taken in the preparation of existing fill for the addition of Zone 3 material (sand drain) see Section 12.5.4. △

11.4 Construction Backfill

In the plant area, excavate all previous fill to a depth as determined by the Contractor. All unsuitable material shall be removed and replaced with select material and compacted in accordance with applicable provisions of Section 12.0 "Dike and Railroad Embankment Construction."

11.5 Railroad Abutments

Remove existing fill as determined by the Contractor and replace with select material compacted in accordance with Section 12.0 "Dike and Railroad Embankment Construction".

11.6 Emergency Cooling Pond Area

In the emergency cooling pond area, backfill as required to provide a minimum 100 foot wide berm as shown on the drawings. Backfill material to be placed in accordance with Section 13.0 "Plant Area and Berm Backfill".

11.7 Outlet Structure Area

Regrade existing slopes and complete ditch to river. Rip rap material shall be placed in accordance with Section 12.5.6 "Zone 5 and Zone 5A".

11.8 Cutoff or Inspection Trenches

Existing cutoff or inspection trenches shall be thoroughly cleaned and stripped. Existing stockpiled stripped material shall be disposed of.

11.9 Channel Excavation Spoil

The Subcontractor shall remove all remaining spoil material excavated during the channel widening work done in the initial earthwork subcontract. Such material is located immediately adjacent to the west bank of the Tittabawassee River as shown on the contract drawings. All material above the existing ground at the outset at project work in 1969 shall be removed. If the material is satisfactory as determined by the Contractor, such material shall be placed in the construction laydown area; otherwise this material shall be wasted in a designated disposal area within the cooling pond area.

11.10 Embankment Resumption

After all unsuitable material has been excavated from the existing fills, the Subcontractor shall disc the top 6 inches of the remaining embankments to assure proper bond between the existing and new embankments.

11.11 Measurement and Payment

11.11.1 Measurement for the various reconditioning operations described in Section 11.0 will be made to the nearest cubic yard satisfactorily excavated and disposed of; measured in place before excavation.

11.11.2 Reconditioning work will be paid for at the applicable price stated in the Price Schedule for the items listed below.

Item 14 A - Recondition Cooling Dikes and Railroad Abutment Backfill.

Item 14 B - Recondition Plant Area Backfill.

Item 14 C - Regrade and Complete Work in Outlet Ditch.

Item 14 D - Recondition Cutoff and Inspection Trenches.

Item 14 E - Complete Excavation of Channel Spoil.

11.11.3 Scarifying

No additional payment will be made for scarifying work.

11.11.4 Riprap

Riprap required for completing the outlet structure and ditch will be paid for under Item 22.

11.11.5 Emergency Cooling Pond Area Backfill

Backfill for the emergency cooling pond area will be paid for under Item 15B.

12.0 DIKE AND RAILROAD EMBANKMENT CONSTRUCTION

12.1 Definitions

12.1.1 Embankment

Embankment is all required earth placed and, unless otherwise specified, compacted within the limits of the Cooling Pond Dike, Baffle Dike, and Railroad Embankment or as shown on the Drawings. Embankment shall also include those materials which are placed in diversion channels and drainage ditches as shown on the Drawings to act as protection against erosion.

12.1.2 Suitability of Material

The Contractor will determine the suitability of all materials.

12.2 Lines and Grades

The embankments shall be constructed to the lines, grades and cross sections shown on the Drawings. The Subcontractor shall furnish and supply all equipment, materials and labor required to set out the work. Survey markers and grade stakes shall be set out in accordance with the lines and grades shown on the Drawings. The Subcontractor may be required by the Contractor to remove and dispose of any embankment fill placed outside the prescribed slope lines. Such removal and disposal shall be by and at the expense of the Subcontractor.

12.3 Materials

12.3.1 General

The Subcontractor's attention is invited to Table 12-1 for a listing of the various zones



of the embankment, their description, and the source of materials for the various zones. Table 12-1 is included at the end of this Section, 12. Unless otherwise approved in writing, materials for the various zones of embankment shall be obtained from the borrow areas and sources shown on the Drawings. Approval of a borrow area or other source does not mean that all material within that area is suitable for embankment construction. If, for any reason, the Subcontractor places unsuitable material, or material not previously approved by the Contractor, in the embankment or within any zone of the embankment, all such unsuitable material shall be removed and disposed of and replaced with suitable material, all by and at the expense of the Subcontractor. The criteria by which the Contractor will be guided in his determination of the suitability of materials in final position or condition in the embankment are set forth in Paragraph 12.6 and on Table 12-1 included at the end of this Section 12. These criteria apply to material characteristics as placed in complete portions of the embankment. Any or all of the tests specified which are applicable to materials in the borrow areas or other sources, or in the embankment, may be used by the Contractor in determining the suitability of materials.

12.3.2 Riprap - Zone 5

There is currently stockpiled at the jobsite an unknown quantity of Zone 5 material, the location of which is shown on the drawings.

The Subcontractor shall use the existing Zone 5 material in areas specified on the drawings until the supply is exhausted. No new Zone 5 material shall be purchased, and Zone 5A material will then be substituted for Zone 5 areas.

Existing Zone 5 material will be made available in an "as - is" condition at no cost to the Subcontractor.



12.3.2.1 Riprap- Zone 5A

The riprap shall be obtained from a source approved by the Contractor. The rock shall be sound and free of cracks or seams. Neither the breadth nor the width of any piece of riprap shall be less than one third of its length.

Loading, hauling and placing of riprap shall be conducted in a manner which will minimize breakage. The sands and fines content of the riprap shall be limited to those resulting from handling during hauling and placing of material.

12.3.3 Organic and Deleterious Materials

Materials containing brush, roots, peat, sod or other organic, perishable or deleterious materials shall not be placed in the embankment Zones 1 through 5.

12.3.4 Gravel-Zones 4 and 4A

Gravel shall be located and placed as shown on the drawings. Zone 4A material shall identify gravel surface course material placed on the dike crests; all areas other than the dike crest requiring gravel materials, shall be designated Zone 4. Zone 4 and 4A materials shall conform to gradation requirements given in Table 12-1.

## 12.4 Testing of Embankment Materials

### 12.4.1 General

The Contractor will take all samples and perform all tests of the embankment materials for control of the placement operations. The Contractor will conduct density and other tests on the compacted embankment and the related laboratory testing to determine the relative degree of compaction and other properties. In addition, concurrent with construction, the Contractor will take samples of the materials from the borrow areas and the embankment and test these samples for moisture content and gradation. Testing by the Contractor will be done as frequently as the Contractor deems necessary, without cost to the Subcontractor, provided that the Subcontractor shall, at its expense, furnish labor and materials to assist in obtaining the samples for testing. Tests performed by the Contractor will be in accordance with the following procedures.

### 12.4.2 Moisture Content

ASTM Designation D 2216. Other methods such as a nuclear density device in accordance with ASTM D 3017 and using manufacturer's instructions, for rapid moisture determination may be used, provided that the results are compatible with those obtained by the specified procedure. Compatibility of the methods will be determined by the Contractor.

### 12.4.3 Gradation

ASTM Designation D 422 or C136, whichever is applicable for the soil being tested.

### 12.4.4 Density of Soil in Place

ASTM Designation D 1556. The size of the density hole or pit shall be selected in accordance with the following criteria.

- 1) For soils with little or no gravel: hole size shall be in accordance with ASTM D 1556. (Volume of hole determined by 6 inch minimum size sand cone.)
- 2) For soils containing appreciable gravel: 10 to 12 inch diameter, 12 to 14 inch depth, conical hole. (Volume of hole determined by 12 inch maximum size sand cone.)



A nuclear density device may be used in accordance with ASTM D 2922 and manufacturer's instructions, provided that the results are compatible with those obtained by the specified procedure.



The density of material is defined as the weight of the material per unit of volume of the material in place.

#### 12.4.5 Laboratory Maximum Density and Optimum Moisture Content

##### 12.4.5.1 Cohesive Soils

The maximum dry density and optimum moisture content of cohesive material will be determined in the laboratory in accordance with ASTM Designation D 1557 Method D.



##### 12.4.5.2 Cohesionless Soils

The maximum density of cohesionless soils will be determined in accordance with the applicable requirements of ASTM Designation D 2049.

#### 12.4.6 Specific Gravity

ASTM Designation D854.

12.4.7 Atterberg Limits

ASTM Designation D 423 and Designation D-424.

12.4.8 Strength

12.4.8.1 Shear Strength

Strength tests for cohesionless soils will be performed generally in accordance with Chapter XI, "Triaxial Compression Tests on Cohesionless Soil," of "Soil Testing for Engineers" by T. William Lambe. Tests will be made on soil samples taken from the placed embankment soil.

12.4.9 Permeability

ASTM Designation D 2434.

12.5 Placement

12.5.1 General

All soil work is to be performed under the direction of a qualified onsite geotechnical soils engineer.

No embankment materials shall be placed on any foundation until the foundation has been approved by the Contractor. The ultimate location of such material shall be subject to approval. The gradation and distribution of materials throughout each zone of the compacted embankments shall be such that the embankments will be free from lenses, pockets, streaks, and layers of material differing substantially in texture or gradation from surrounding material of the same zone.

Excavation in the borrow area shall be carried out in such a manner that the material placed in the embankment for compaction shall not contain large solid lumps or clods of material which



will not break down and compact satisfactorily when rolled as specified. Material shall be placed so that when compacted it forms a homogeneous mass and any voids between stones or large soil lumps are completely filled with compacted material.

No embankment shall be placed upon a frozen surface nor shall any ice or frozen earth be incorporated in the embankment. Embankment construction for which moisture conditioning is required shall be suspended when the ambient temperature is 32°F and falling, unless otherwise approved by the Contractor.

Unless otherwise specified, all embankment zones being placed shall be raised simultaneously with the top surface of the embankment to form an approximately horizontal plane extending transversely to the final slopes and longitudinally to the abutments.

At any particular section along the axis of the dike, during construction, a temporary differential elevation of 20 feet will be permitted within the embankment provided the bonding surface has a slope not exceeding 3 horizontal to 1 vertical. Such bonding surface shall extend across the various zones of the embankment to form a plane.

At any particular section perpendicular to the axis of the dike the temporary differential elevation between any two adjoining zones due to construction operations shall not exceed 12 inches.


The embankments shall be maintained at all times in such condition that the surfaces will readily drain. In any areas where materials become soft or yielding due to becoming wet or saturated such materials shall be removed, disposed of, and replaced with suitable material all by and at the expense of the Subcontractor. The entire surface of any section of the dike embankment shall be maintained in such condition, as determined by the Contractor, that construction equipment can travel on any part of all sections. Ruts in the surface of any layer shall be filled and leveled satisfactorily before compacting.

The Subcontractor shall exercise extreme care in placing and compacting embankment fill in the proximity of all structures. The Subcontractor shall also carefully place all Zone 1 and Zone 2 material to preclude any contamination of the sand drain.







12.5.2 Zone 1 and Zone 1A

Zone 1 and Zone 1A material shall be placed in the embankment fill as shown on the Drawings or as required and compacted as specified. The uncompacted lift thickness shall be determined by field personnel after evaluation of the proposed compaction equipment. However, in no case shall the uncompacted lift thickness exceed 8 inches for heavy self-propelled equipment and 4 inches for hand-operated equipment. | 

12.5.3 Zone 2

Zone 2 material shall be placed in the embankment fill as shown on the Drawings or as required and compacted as specified. The uncompacted lift thickness of Zone 2 material shall be determined by field personnel after evaluation of the proposed compaction equipment. However, in no case shall the uncompacted lift thickness exceed 8 inches for heavy self-propelled equipment and 4 inches for hand-operated equipment. | 

12.5.4 Zone 3

Zone 3 material shall be placed in the embankment as shown on the Drawings or as required. The uncompacted lift thicknesses shall be determined by field personnel after evaluation of the proposed compaction equipment. However, in no case shall the uncompacted lift thickness exceed 8 inches for heavy self-propelled equipment and 4 inches for hand-operated equipment. Approved placement methods shall be used which will prevent segregation of the materials and prevent mixing with other materials. Approval of the placing method will be on the basis of demonstrated ability to place Zone 3 materials without segregation. The surface of the adjacent fill shall be sloped throughout the construction operations so that water will readily drain away from Zone 3 toward the outer slopes of the embankment. The Subcontractor shall take particular care to prevent water from draining into Zone 3. Construction equipment shall cross Zone 3 only at specifically approved locations and elevations and the number of crossings shall be periodically changed as required. Provision shall be made to protect Zone 3 material from contamination at each crossing, and any contaminated Zone 3 material shall be removed and replaced with | 



satisfactory material all be and at the expense of the Subcontractor. A vibratory roller or other suitable equipment may be substituted for the rubber tired roller to achieve the required compaction of Zone 3 material only.

12.5.5 Zone 4, Zone 4A, Zone 4A

Zone 4 and 4A material shall be placed as embankment fill and riprap bedding in the embankment as shown on the Drawings or as required. In areas of Zone 4, no special compaction is required; however, construction equipment shall be routed in such a manner that some compaction is achieved. In areas of Zone 4A, material shall be placed in layers not more than seven inches in uncompacted thickness, and shall be rolled as directed by the Contractor.

In areas of Zone 4A not accessible to roller equipment operation, the material shall be compacted in accordance with Paragraph 12.8.3.1 of these specifications with the lift thickness determined by field personnel after evaluation of the proposed compaction equipment. However, in no case shall the uncompacted lift thickness exceed 7 inches.

Placing shall be carried out so that the material does not segregate. If segregation does occur, the material shall be removed and replaced with suitable material all by and at the expense of the Subcontractor.

Zone 4 material shall be placed only on the outside of the pond dikes (over the sand drain). Zone 4Z shall be used only on the baffle dike, on the inside of the pond dikes, and on those outside areas of the dike where it will not contaminate the discharge face of the Zone 3 sand drain material.

12.5.6 Zone 5 and Zone 5A

Zone 5 and 5A material shall be placed in the embankment fill as shown on the drawings or as required. Zone 5 material shall identify riprap protection material generally placed along selected portions of the outside slope of the cooling pond (the east and northeast sides) and along selected portions of the inside slope of the cooling pond in areas of a short fetch. All other areas requiring riprap protection shall be designated Zone 5A.

Zone 5 and 5A material shall be placed in such a manner as to produce a reasonably well graded mass of rock with the minimum practical percentage of voids. The larger pieces shall be uniformly distributed throughout the rock mass and the smaller pieces shall fill the voids between the larger pieces. Hand placing may be required to a limited extent, but only as necessary to obtain the results specified



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A tolerance of plus 6 inches or minus 3 inches from the slope lines, elevations and grades shown, will be allowed in the finished surfaces of the Zone 5 and Zone 5A materials. Zone 5 and 5A materials shall conform to gradation requirements given in Table 12-1.

Where Zone 5 or 5A material is placed as slope protection at drops in the drainage ditches, as shown on the drawings, it shall be grouted after it has been placed in its final position. The zone shall be grouted over its entire thickness. Prior to grouting, the rock particles shall be flushed with water and the material shall be thoroughly wetted. Care shall be exercised to ensure that all voids are satisfactorily filled with grout.

#### 12.5.7 Zone 6

Zone 6 materials shall be placed as downstream slope protection for the embankment fill as shown on the Drawings or as required. The method of placement will be at the Subcontractors option and subject to approval by the Contractor. Approval will be based on demonstrated ability to place Zone 6 material satisfactorily.

#### 12.5.8 Spreading

Immediately after dumping embankment material on any zone having a specified maximum uncompacted lift thickness, that material shall be spread by bulldozer, grader, or other approved means in approximately horizontal layers over the previously compacted fill. Unless otherwise required, the uncompacted thickness of the layers prior to compaction shall not exceed those specified.

#### 12.5.9 Loosening Surface of Materials

If the compacted surface of any layer of material is determined by the Contractor



to be too smooth to bond properly with the succeeding layer, it shall be loosened by harrowing or by other approved methods, and, if required by the Contractor, it shall be sprinkled or otherwise moisture conditioned before the succeeding lift is placed thereon. In addition, any surface crust formed on a layer of fill material that has been dumped and spread shall be broken up by harrowing and, if required by the Contractor, moisture conditioned to the full depth of the layer prior to rolling. Harrowing shall be done with a disc or a spring-toothed harrow or other approved equipment. If one pass of the equipment does not accomplish the breaking up and blending of the material, additional passes of the equipment may be required.

12.5.10 Removal of Stones, Roots and Debris


Any oversize material transported to the embankment for use in Zones 1 through 4 shall be removed to Zone 5 or 5A provided that it falls within the specified requirements for Zone 5 or 5A. Roots and other debris shall be removed from the embankment and disposed of in the disposal areas as specified.


12.6 Moisture Control


12.6.1 Zone 1, Zone 1A, and Zone 2

Insofar as practicable, Zone 1, Zone 1A and Zone 2 material which require moisture control, shall be moisture-conditioned in the borrow areas. Moisture conditioning is the operations required to decrease the moisture content of material, which as required by the specification is too wet or to increase the moisture content of materials, which, as required by the specification



is too dry. The moisture content during compaction should be within  $\pm 2\%$  of the optimum moisture content provided that in Zone 2 the wet limit for compaction of the material shall be that moisture content at which the rubber tires of the specified rubber tired rollers rut the surface of the fill by more than 6 inches. | 

For Zone 2 material placed in the Bullock Cree area and other areas as specified by the Bechtel representative, the water content during compaction shall be not more than 2 percentage points below optimum moisture content and not more than 5 percentage points above optimum moisture content. If the moisture content exceeds 2 percent above optimum the fill shall be placed with a compaction effort equal to at least 95 percent of the maximum dry density as described in Section 12.4.5.1, or 85 percent relative density as determined by ASTM A-2049, whichever is applicable. If the material in the borrow area does not contain the required moisture content, it shall be moistened by sprinkling from a truck equipped with a sprinkler. The sprinkler truck shall be capable of uniformly distributing the water over the entire area to be used. When required by the Contractor, material in the borrow area shall be processed with plows, discs, dozers, motor graders or other approved equipment to distribute the moisture uniformly throughout the material to be used, or for the purpose of aerating material containing excessive moisture. If moisture conditioning is done in the borrow area, care shall be exercised to moisten the material uniformly and excessive runoff or accumulation of water shall be avoided in depressions. | 

Tests done in accordance with Paragraph 12.4.2 will indicate the degree of moistening or aerating necessary to comply with Paragraph 12.6.1. After placement of loose material on the embankment fill, the moisture content may be further adjusted as necessary to bring such material within the moisture content limits required for compaction. If the material placed is too wet for compaction, | 

it shall be aerated as specified and dried until the moisture content of the entire layer is uniform and reduced to within the required. If the material placed is too dry for suitable compaction, it shall be sprinkled and disked, harrowed or otherwise mixed until the moisture content of the entire layer is uniform and within the specified limits. Such sprinkling shall be by sprinkler truck which shall be equipped with pressure spray bars and valves to give a uniform and even application of water to the areas being covered and a positive control of the rate of application at all times. Rolling of any section of embankment containing material too wet or too dry.

The above paragraphs give recommended instructions and are a guide to controlling moisture content prior to and during compaction. The verification of the adequacy of this control is to be at the time of density testing. Therefore the moisture requirement of  $\pm 2\%$  of optimum moisture is to be implemented at the time of density testing. Density tests shall be performed immediately after compaction or as directed by the onsite geotechnical soils engineer.

to obtain the required compaction shall be delayed until the moisture content of the material is brought to within the required limits or the material shall be removed and replaced with suitable material by and at the expense of the Subcontractor.

12.6.2 Zone 3, Zone 4, Zone 4A, Zone 5, Zone 5A and Zone 6

Moisture conditioning of material for Zones 3, 4, 4A, 5, 5A and 6 is not required.

12.7 Compaction Equipment

12.7.1 General

All compaction equipment shall conform to the following specifications. The Subcontractor shall maintain such equipment in first class operating condition at all times and, where required by the Contractor, shall immediately make any adjustment necessary to obtain the required compaction. When rollers are operated one behind the other in the same track, all rollers operated in this manner shall have the same general dimensions, weights, and operating characteristics. Equipment used to pull rollers shall have sufficient power to satisfactorily pull the rollers when they are ballasted to the specified weights. The Subcontractor may use compaction equipment other than that specified, provided that the Subcontractor shall, at its expense, demonstrate that such substituted equipment will achieve equal or better degrees of compaction and other characteristics than those achieved by the equipment specified, all as determined by the Contractor.

12.7.2 Rubber-Tired Rollers

Rubber-tired rollers shall have a minimum of 4 wheels equipped with pneumatic tires which

shall be of such size and ply that tire pressures can be maintained between 80 and 100 pounds per square inch for a 25,000 pound wheel load during rolling operations. Unless otherwise required, rolling shall be done with tires inflated to 100 psi. The roller wheels shall be located abreast in a rigid steel frame, each wheel loaded by an individual weight box so that each will carry an equal load when traversing uneven ground. The spacing of the wheels shall be such that the distance between the nearest edges of adjacent tires shall be not greater than one-half of the tire width of a single tire at the operating pressure for a 25,000 pound wheel load. The weight boxes shall be suitable for ballast loading such that the load per wheel may be varied as required from 18,000 to 25,000 pounds. The roller shall be towed at speeds not to exceed 10 miles per hour.

An alternate roller approved by the Contractor may be used in which case additional passes may be required.

### 12.7.3 Power Tampers

Power tampers shall be operator-held type of a size capable of performing the required compaction and shall be subject to approval. Approval will be on the basis of demonstrated ability of the tampers to accomplish adequate compaction as determined by the Contractor.

## 12.8 Compaction Requirements

### 12.8.1 Rolling

After material has been placed and spread on the fill and the moisture content and condition of the fill is satisfactory, the material shall immediately be compacted. All roller passes shall be made parallel to the axes of the dikes or embankment unless otherwise approved



by the Contractor. The rolling requirements for each zone of the dikes and embankment are as follows:

<u>Zone</u>	<u>Type of Compaction Equipment</u>	<u>Minimum Number of Passes per Lift</u>
1	50-ton Rubber Tired Roller	4
1A	50-ton Rubber Tired Roller	4
2	50-ton Rubber Tired Roller	4
3	50-ton Rubber Tired Roller or Vibr. Roller	4
4	Construction Equipment routed over the zone or additional rolling as directed by Contractor	
4A	50-ton Rubber Tired Roller as directed by Contractor.	-
5	Not Required	-
5A	Not Required	-
6	Not Required	-

A pass shall consist of the entire coverage of the area with at least one trip of the equipment specified. In order to effect complete coverage of the area being rolled, each trip of the roller shall overlap the adjacent trip by not less than 2 feet. Dumping, spreading, sprinkling, disking, or harrowing, and compacting may be performed at the same time at different points along the section where there is sufficient area to permit these operations to proceed simultaneously.

#### 1 2.8.2 Additional Rolling

If, as determined by the Contractor, the desired compaction of any portion of embankment is not obtained by the minimum passes specified, additional passes shall be made over the surface area of such designated portions of the embankment until the desired degree of compaction has been attained. However, where lift thickness is greater than specified, or moisture content at time of rolling is improper or specified rolling has not been performed, such rolling shall be by and at the expense of the Subcontractor.



12.8.3 Fill Not Accessible to Specified Rollers

12.8.3.1 General

Unless otherwise specified, all embankment fill not accessible to roller compaction shall be compacted by power or hand tampers, or by rolling, or other approved means to the same degree required for like materials compacted by roller. Fill containing both sides of a wall, pipe or structure shall be kept at approximately the same elevation and compacted equally on the sides until placement has reached the required elevation.

12.9 Slides

In the event of slides in any part of any of the embankment prior to final acceptance, the Subcontractor shall remove material from the slide area as required, and shall rebuild that portion of the embankment. In case it is determined by the Contractor that the slide was caused through the fault or negligence of the Subcontractor, the removal and disposal of the material and the rebuilding of the embankment shall be performed by and at the expense of the Subcontractor. Otherwise, such work will be paid for under the applicable items of excavation and embankment.

12.10 Winter Protection of the Embankment

The Subcontractor shall take whatever precautions are necessary to protect the partially completed embankments for the winter period. Subcontractor will also perform any necessary reconditioning resulting from lack of winter protection.

12.11 Measurement and Payment

12.11.1 Embankment

12.11.1.1 Measurement

Embankment will be measured in place to the nearest cubic yard of embankment material of the various zones, satisfactorily placed and compacted in the dikes and the railroad embankment. Such measurement will be made between the foundation lines as determined by survey in the field and the neat fill lines, grades and slopes shown. No allowance will be made for settlement of the foundation or of the embankment during construction.

12.11.1.2 Payment

Embankment will be paid for at the applicable contract price stated in the Price Schedule for the items listed below; provided that embankment placed around walls, pipes, structures and elsewhere requiring the use of special compactors for compaction will not be paid for separately.

- Item 15A Embankment, Zone 1
- Item 16 Embankment, Zone 1A
- Item 17A Embankment, Zone 2
- Item 18A Embankment, Zone 3
- Item 19 Embankment, Zone 4
- Item 20 Embankment, Zone 4A
- Item 21 Embankment, Zone 5
- Item 22 Embankment, Zone 5A
- Item 23 Embankment, Zone 6

Payment for Item 21 shall reflect savings for use of Contractor-furnished materials located on-site; such materials are available to the Subcontractor in an "as-is" condition.

12.11.2 Additional Rolling for Compaction

12.11.2.1 Measurement

Additional rolling for compaction will be measured to the nearest 1/4 hour as the number of hours such additional rolling is satisfactorily performed.

12.11.2.2 Payment

Additional rolling for compaction will be paid for at the contract price stated in the Price Schedule for the item listed below.

Item 24 Additional Rolling

Rolling for compaction of Zone 4A material, if required by Contractor, will be paid for at the contract price stated in the Price Schedule for Item 24. No payment will be made for additional rolling required of alternate rollers to meet the same compactive effort of the 50-ton roller.

12.11.3 Winter Protection

Winter protection will not be paid for separately, nor will any payment be made for costs to recondition the materials as a result of the Subcontractor's failure to provide adequate winter protection.

13.0 PLANT AREA BACKFILL AND BERM BACKFILL

13.1 General

This section covers only embankment materials placed in the plant area, (as defined on the contract drawings) and also backfill material required to provide a minimum 100 foot wide berm adjacent to the emergency cooling pond area. All work under this section shall be subject to the Quality Assurance provisions as required by Section 16.0 "Quality Assurance Program Requirements".

13.2 Definition

The term backfill as used in this section shall include all types of embankment zone materials required in the plant area and the berm, except that the following materials shall be considered structural backfill: 1) backfill materials to be placed within three feet of any plant area structure, or 2) backfill areas inaccessible to motorized rollers. Structural backfill will not be placed by the Subcontractor.



13.3 Materials

Materials shall conform to the applicable paragraphs of Section 12.3.



13.4 Testing

Testing of all materials placed in the plant area and the berm will be performed in accordance with the tests listed in Section 12.4.

13.5 Placement

Material placement procedures shall conform to Section 12.5. Attention shall be given to not exceed the lift thickness specified for the various zones of materials.

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13.6 Moisture Control

Moisture control of the plant area and berm material shall conform to Section 12.6.

13.7 Compaction Requirements

13.7.1 Cohesive Soils

All cohesive backfill in the plant area and the berm shall be compacted to not less than 95 percent of maximum density as determined by ASTM D 1557, Method D.

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13.7.2 Cohesionless Soils

All cohesionless backfill under structures shall be compacted to not less than 85% relative density. All other backfill in the plant area and the berm shall be compacted to not less than 80% relative density as determined by ASTM D 2049, with the exception that Zone 4, 4A, 4Z, 5, 5A, and 6 materials need no special compaction effort other than what is described in Section 12.8.1.

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13.8 Slides and Winter Protection

All provisions for slides and winter protection shall be similar to requirements in Sections 12.9 and 12.10

13.9 Measurement & Payment

13.9.1 Measurement

Embankment will be measured in place to the nearest cubic yard of embankment material of the various zones, satisfactorily placed and compacted in the plant area and the berm. Such measurement will be made between the foundation lines as determined by survey in the field and the neat fill lines, grades and slopes shown. No allowance will be made for settlement of the foundation or of the embankment during construction.

13.9.2 Payment

Embankment will be paid for at the applicable contract price stated in the Price Schedule for the items listed below.



Item 15B - Embankment, Zone 1

Item 17B - Embankment, Zone 2

Item 18B - Embankment, Zone 3

13.9.3 Zones 4, 4A, 5, 5A, and 6 placed in the plant area will be paid for under the appropriate item as listed in 12.11.1.2. No other payment will be made.

13.9.4 Pay items 15B, 17B, and 18B will be full payment for placing and compacting the material. No payment for additional compactive work to meet unanticipated problems for slides and winter protection will be made.

## 14.0 GROUT

The Zone 5 and 5A riprap shall be grouted where used in the drainage ditches as shown on the Drawings. Grout shall consist of a mixture of 1 part Portland Cement, 2½ parts of sand, and water. The cement and sand shall first be combined in the proper proportions, and then thoroughly mixed with a quantity of water sufficient to permit gravity flow into the interstices with limited spading and brooming.

Cement, sand and water shall conform to the requirements of Paragraphs 14.1.1 through 14.1.3

The grout shall be mixed in a mechanical mixer and used within 1/2 hour after mixing commences.

## 14.1 Materials

Materials shall conform to the applicable requirements of MDSHSS to the degree referenced below and as modified herein.

### 14.1.1 Cement

ASTM Designation C-150 Type IIA



### 14.1.2 Aggregate

Coarse aggregate shall conform to MDSHSS (1970 edition) Paragraph 8.02, Class 6A; fine aggregates shall conform to MDSHSS Paragraph 8.02, Class 2NS.

### 14.1.3 Water

Water used in mixing concrete shall be free of injurious amounts of oil, acid, alkali, organic material or other deleterious substances as determined by current AASHO Designation: T-26.

14.2 Measurement

Measurement for payment for grout will be made by the mixer to the nearest cubic yard as the number of cubic yards supplied and placed to the satisfaction of the Contractor.

14.2.1 Payment

Payment for grout will be made at the contract price stated in the Price Schedule for the item listed below.

Item 25 Grout

15.0 SEEDING

15.1 General

At completion of placement of Zone 6 material the slope surfaces shall be seeded. Seeding consists of cultivating, watering, furnishing and applying fertilizer, furnishing and broadcasting seed, and covering the surface with a mulch.

15.2 Materials

Materials shall conform to the following specifications:

15.2.1 Seed

A mixture containing 20 percent Perennial Rye Grass, 30 percent Red Fescue and 50 percent of Kentucky Blue Grass. The seed shall be at least 95 percent pure and have a minimum of 85 percent germination.

15.2.2 Fertilizer

Fertilizer shall be Complete Analysis Fertilizer with a 1:1:1 ratio.

15.2.3 Mulch

Mulch shall be Excelsior Woodfibre Mat as manufactured by the American Excelsior Corporation, or equivalent.

15.3 Procedure

15.3.1 Cultivating

Areas to be seeded shall be cultivated to a depth of approximately 6 inches.

15.3.2 Watering

After cultivation the areas to be seeded shall be uniformly watered. Water shall be applied in a fine mist spray to prevent erosion. Application rate shall be as determined by the Contractor.

15.3.3 Seeding

Immediately after watering, seed shall be uniformly broadcast over the area to be seeded. Such broadcast shall be at the rate of four pounds of seed mixture to each 1000 square feet of actual area.

15.3.4 Fertilizing

Immediately after broadcasting seed, fertilizer shall be applied to the seeded areas. Such application shall be at the rate of 2 pounds of actual nitrogen (slow release) for each 1000 square feet of actual seeded area.

15.3.5 Mulch

The mulch shall be applied at thickness in accordance with the appropriate manufacturer's recommendations.

15.3.6 Alternative Procedure to Sections 15.3.2 through 15.3.5

The seeding and mulching will be accomplished by a two step operation. The first is to broadcast 4 pounds of seed (mixture as specified in Section 15.2.1) per 1000 sq. ft. The second step is the hydraulic application of mulch (30 lb. of Conwed, or equal per 1000 sq. ft.), fertilizer (10 lb. of 18:6:4 ratio per 1000 sq. ft.), and binder (1 gal. of Terra-Tack, or equal per 1000 sq. ft.).



15.4 Measurement and Payment

15.4.1 Measurement

Measurement for payment for seeding will be made at the contract unit price per 1000 square feet, and shall be full payment for all operations to seed, fertilize, water, etc., performed in conjunction with the seeding work. Topsoil used in preparation for such seeding will be paid for under Item 23.


15.4.2 Payment


Payment for seeding will be paid for at the contract price stated in the Price Schedule for the item listed below:

Item 26 Seeding



16.0 QUALITY ASSURANCE PROGRAM REQUIREMENTS

The Subcontractor will be required to provide a Quality Assurance Program to cover Section's 13.5 (Placement), 13.6 (Moisture Control), and 13.7 (Compaction Requirements) of these specifications. The program will cover the following elements. 

- |                              |                       |
|------------------------------|-----------------------|
| 1. Organization              | 6. Document Control   |
| 2. Quality Assurance Program | 7. Nonconformance     |
| 3. Instructions & Procedures | 8. Corrective Actions |
| 4. Inspection                | 9. Audits (Internal)  |
| 5. Quality Assurance Records |                       |
- 

16.1 ORGANIZATION

The authority and responsibilities of persons performing activities affecting the quality of the work shall be clearly established.

16.2 QUALITY ASSURANCE PROGRAM

The Subcontractor's Quality Assurance Program shall be described in a Quality Assurance Plan which incorporates descriptions of existing techniques and procedures that apply to the program elements.


16.3 INSTRUCTIONS, PROCEDURES AND DRAWINGS

Activities affecting quality shall be described by documented instructions, procedures or drawings and shall be accomplished therewith.

16.4 INSPECTION

In-process inspection of activities affecting quality shall be planned and documented to assure conformance with drawings, specifications and work instructions.

16.5 QUALITY ASSURANCE RECORDS

Records shall be maintained to furnish documentary evidence of activities affecting quality. The records shall include procedures and equipment used in performing quality requirements and results of inspections performed. 

16.6 Document Control

Measures shall be established to control the issuance of documents, such as instructions, procedures, and drawings, including changes there to, which prescribe all activities affecting quality.

16.7 Nonconforming Materials, Parts, or Components

Measures shall be established to control materials, parts, or components which do not conform to requirements in order to prevent their inadvertent use or installation.

16.8 Corrective Actions

Measures shall be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected.

16.9 Audits (Internal)

A comprehensive system of planned and periodic audits shall be carried out to verify compliance with all aspects of the quality assurance program, and to determine the effectiveness of the program.

16.10 No separate payment for this program will be made.



17.0 MISCELLANEOUS STRUCTURAL WORK AND OTHER DRAINAGE ITEMS

17.1 General

Various structures, including the inlet, outlet, and gate shaft of the pond outlet facility, drop structures, headwalls, and culverts, are included in the contract work as incidental items to the earthwork. A large part of these items were completed during the original construction work. This section covers all items shown on the contract drawings as remaining work to be completed.

17.2 Concrete Work

17.2.1 Materials

Cement shall conform to ASTM Designation C-150, Type II. Aggregates shall conform to ASTM C 33-71a. Water shall be free of injurious amounts of impurities as determined by current AASHTO Designation: T-26. Air entraining admixture conforming to ASTM Designation C-260; entrained air content shall be 3 to 6%. Reinforcing steel in all concrete work shall conform to ASTM Designation A-615, Grade 60. Preformed expansion joint fill shall be in accordance with ASTM Designation D 1751.



17.2.2 Concrete

Portland cement concrete shall be designed, batched, mixed and furnished to the jobsite in accordance with ASTM C-94 and ACI 301. Concrete shall be a 1 1/2 in. or 3/4 in. mix, and shall have a minimum compressive strength of 3000 psi in 90 days.



17.2.3 Concrete Submittals to be Furnished by Subcontractor.

The Subcontractor shall, at its expense, submit the following:

- 17.2.3.1 Proposed concrete mix designs
- 17.2.3.2 Mill test reports.
- 17.2.3.3 Material samples as requested by the Contractor.
- 17.2.3.4 Concrete samples for compressive strength tests (Testing by Contractor).
- 17.2.3.5 Delivery tickets.

17.2.4 Concrete Construction Methods

All concrete shall be placed in accordance with the applicable provisions of ACI 301, ACI 318 and ASTM C-94.



17.3 Miscellaneous Metal Work

- 17.3.1 The work includes, but is not limited to furnishing, fabricating, and installing the following miscellaneous metalwork.
  - 17.3.1.1 Stoplog guides, galvanized.
  - 17.3.1.2 Hatch cover and frames, galvanized.
  - 17.3.1.3 Pipe handrailing, galvanized.
  - 17.3.1.4 Pipe, galvanized.
  - 17.3.1.5 Ladders, galvanized.

17.3.2 Materials

Materials shall conform to the following specifications.

17.3.2.1 Structural Steel

ASTM Designation A 36.

17.3.2.2 Pipe for Handrails and Sleeves

ASTM Designation A 120, Schedule 40,  
galvanized.

#### 17.3.2.3 Fasteners

Anchors, inserts, plugs and like items required for the installation of miscellaneous metal items shall be approved standard commercial products of types and sizes best suited for the intended purpose.

#### 17.3.2.4 Zinc-Coating Repair Material

Galvanox or ZRC.

#### 17.3.3 Fabrication

17.3.3.1 Detailing and fabrication of steel items shall conform to AISC Steel Construction Manual.

17.3.3.2 Connections shall be bolted or welded as shown or as specified.

17.3.3.3 Pieces shall be well-formed to the shapes and sizes shown. Shearing and punching shall produce clean, true lines and surfaces. All ragged edges, welds, protruding bolts or other fasteners, which might cause injury to personnel, shall be removed or otherwise protected.

#### 17.3.4 Galvanizing

17.3.4.1 Galvanizing shall be done after fabrication in accordance with the specifications cited below.

Items fabricated from rolled, pressed and forged steel shapes, plates and strip, ASTM Designation A 123.



Iron and steel hardware, ASTM Designation  
A 153.

Iron or steel sheets, coils and cut lengths,  
ASTM Designation A 525, with not less than  
1.25 ounces of zinc coating per square foot of  
flat area.

### 17.3.5 Welding

#### 17.3.5.1 General

Welding shall be done by the manual-shielded,  
metal-arc or submerged-arc process. Welding  
electrodes used for manual welding shall be  
an approved low hydrogen type unless other-  
wise approved. Unless modified herein, weld-  
ing, welding procedure qualification and  
welder and operator qualification shall comply  
with the applicable requirements of the AWS  
"Structural Welding Code",

D1.1. In addition to conformance with the  
referenced code, manual welding shall meet the  
following requirements:

- (1) Each weld shall be reasonably uniform in  
width and size throughout its entire  
length. Each layer shall be smooth, free  
of slag, cracks, pinholes and undercut,  
and shall be completely fused to the adja-  
cent weld beads and base metal. The  
cover pass shall be free of coarse ripples,  
irregular surface, non-uniform bead pattern,  
high crown, deep ridges or valleys between  
beads, and shall blend smoothly and grad-  
ually into the surface of the base metal.
- (2) Butt welds shall be slightly convex, of  
uniform height and shall have full penetra-  
tion.
- (3) Fillet welds shall be of the size indicated,  
with full throat and with each leg of equal  
length.
- (4) Repair, chipping, or grinding of welds shall  
be so done as not to gouge, groove or reduce  
the base metal thickness.

### 17.3.6 Installation

Miscellaneous metal items shall be accurately positioned and securely fastened in place. Items which are to be placed in the forms prior to placing of concrete shall be so fastened in place as to prevent displacement during concrete placing operations. Movable parts shall operate satisfactorily. Field connections shall be made by bolts unless field welding is specifically approved. Damaged zinc coatings shall be coated with zinc coating repair material. The surface preparation for and the application of the zinc coating repair material shall be done in accordance with the manufacturer's specifications.

## 17.4 Culverts

### 17.4.1 General

A corrugated metal pipe culvert shall be installed under the Miller Road Ramp. Coated perforated corrugated metal pipe shall be installed under the drop structures.

### 17.4.2 Materials

Culvert pipe and fittings shall be furnished in accordance with AASHO Designation M36. 6" CMP shall be perforated in accordance with AASHO Designation M 36-70. Coating shall be as specified for Type C, AASHO Designation M 190-70. △

### 17.4.3 Installation

#### 17.4.3.1 General

The installation of culverts shall include furnishing all materials and equipment and the construction or installation of all cofferdams and other facilities which may be necessary to perform the trenching and backfill, and the subsequent removal of such

cofferdams and facilities, except where they are required or permitted to remain in place. The locations shown for culverts are approximate only, the exact location and alignment shall be as required. A minimum of 9 inches of cover to finished subgrade will be required over all culverts. As determined by the Contractor, any culvert which, after Installation, is not in true alignment or shows undue settlement, or which is damaged or deformed shall be taken up and re-installed or replaced as required, by and at the expense of the Subcontractor.

#### 17.4.3.2 Trenching

Trenches for culverts shall be excavated to the lines and grades established by the Contractor. When excavating for culverts and unyielding material is encountered, the material shall be removed below the bottom of the culvert to a minimum depth of one foot. The resulting trench below the bottom of the culvert shall be backfilled with backfill material as specified. Where culverts are to be installed in roadway fill, the fill shall first be constructed to a height above the top of the culvert equal to half the diameter of the culvert or to finished subgrade, whichever is less, and for a distance each side of the culvert location of not less than 5 times the diameter of the culvert, after which a trench shall be excavated, symmetrical about the centerline of the culvert, with a minimum width equal to one and a half times the diameter of the culvert and with sides as nearly vertical as conditions will permit, and the culvert placed. The trench shall then be backfilled to the top with backfill material as specified. When a firm foundation is not encountered, due to soft, spongy or other unsuitable material, such material shall be removed to the limits required and the resulting excavation backfilled with backfill material as specified. Material from the trenching operations shall be disposed of as required. The suitability of material shall be as determined by the Contractor.

#### 17.4.3.3 Placing Culvert

The bottom of the trenches, in which culverts are to be placed, shall be graded and prepared to provide a firm and uniform bearing throughout the entire length of the pipe. Corrugated metal materials shall be so handled as to prevent deformation and damage to the zinc coating. Separate sections of corrugated metal pipe shall be laid in the trench with outside laps circumferential joints upgrade and with longitudinal laps positioned other than in the invert. Sections of corrugated metal pipe shall be firmly fastened together by means of the specified couplings.

17.5 Deleted

17.6 Excavation and Backfill

Excavation and backfill around the structures and culvert pipe shall be in accordance with applicable provisions of Section 8.0 "Excavation" and Section 12.0 "Dike and Railroad Embankment construction".

17.7 Measurement and Payment

17.7.1 Concrete

17.7.1.1 Measurement

Concrete will be measured to the nearest cubic yard as the number of cubic yards of concrete satisfactorily furnished and placed within the lines and elevations shown or as required. The volume of any opening, recess, spaces occupied by ducts, embedded pipe, woodwork and metalwork, the measurement of which is greater than one square foot in cross section or 5 cubic feet in volume will be deducted.

- 17.7.1.2 Concrete will be paid for at the applicable contract price stated in the Price Schedule for the items listed below. Provided, that concrete which is wasted or rejected or used in finishing operations, replacing damaged or defective concrete, backfilling of unauthorized excavation, backfilling additional excavation required as a result of unsatisfactory operations by the Subcontractor, or concrete which has been used by the Subcontractor solely to facilitate its operations will not be paid for and provided further that concrete which, as determined by the Contractor, is wasted through no fault of the Subcontractor will be paid for at the applicable contract price.

Item 27 Concrete Work

17.7.2 Reinforcement Steel

17.7.2.1 Measurement

Reinforcement steel will be measured to the nearest pound as the number of pounds of reinforcement steel satisfactorily furnished and installed.

17.7.2.2 Payment

Reinforcement steel will be paid for at the contract price stated in the Price Schedule for the item listed below.



Item 28 Reinforcement Steel

17.7.3 Preformed Expansion Joint Filler

Preformed expansion joint filler will not be paid for separately.

17.7.4 Deleted

17.7.5 Formwork

Formwork will not be paid for separately.

17.7.6 Miscellaneous Metalwork

17.7.7.1 Measurement

Miscellaneous metal work will be measured to the nearest pound as the number of pounds of such metalwork detailed, furnished, fabricated and installed. Such weight will be determined using certified shipping weights, certified fabricators weights, and/or computed weights.

17.7.6.2 Payment

Miscellaneous metalwork will be paid for at the contract price stated in the Price Schedule for the item listed below:

Item 29 - Miscellaneous Metalwork.

17.7.7 Culverts

17.6.7.1 Measurement

Culverts will be measured to the nearest foot from end to end along the centerline of the installed culvert as the number of linear feet of culvert satisfactorily furnished and installed.

17.7.7.2 Payment

Culverts will be paid for at the contract price stated in the Price Schedule for the items listed below.

Item 30 - Corrugated Metal Pipe Culvert,  
15 inch. diameter.

Item 31 - Corrugated Metal Pipe Culvert,  
perforated and bituminous coated  
6 inch. diameter.

17.7.8 Excavation and Backfill

Excavation and backfill will not be paid under this section, but rather in accordance with the appropriate pay items

## 18.0 TEMPORARY CONSTRUCTION LAYDOWN AREAS

### 18.1 General

A temporary construction laydown area will be provided along the west side of the plant area. Permanent earthwork items in this area may be deferred until the laydown area is removed at a later date.

### 18.2 Material

Material for this area shall be either,

1) material obtained from excavating for the Bullock Creek diversion, 2) spoil material from the channel widening excavation presently located along the river's edge, or 3) Zone 2 material as described in Section 12.3.

### 18.3 Testing

Testing of all materials placed in the laydown area will be performed in accordance with the tests listed in Section 12.4.

### 18.4 Placement and Moisture Control

Material placement of laydown area backfill will be in accordance with Sections 12.5.1 and 12.5.3, except that no proof rolling is required. Moisture control of the material shall be in accordance with Section 12.6. Prior to placement of backfill, the laydown area shall be cleared and grubbed.

### 18.5 Compaction Requirements

Backfill in the laydown area will be to the required densities shown on the drawing. Such densities will be determined by the modified ASTM 1557, Method D described in Section 12.4.5.1.

### 18.6 Channel Excavation

Immediately adjacent to the laydown area a new channel alignment of Bullock Creek shall be excavated by the Subcontractor. All channel excavation work shall be within 3 inches plus or minus of the design invert elevations. Such materials obtained from channel excavation shall be placed as fill for the laydown area.

18.7 Channel Stabilization

Portions of the new channel shall be stabilized using a soil cement mixture composed of 8 per cent of Portland Cement, type II mixed with the natural soil. The natural soil shall have a minimum of 8 per cent passing and a maximum of 30 per cent passing the #200 sieve. Unsuitable material, roots, vegetation, etc. shall be removed. Approximately 6 gallons of water per square yard shall be added to the mixture; this amount may be revised as required by the Contractor.

The soil, cement, and water shall be mixed using an approved mixing machine. Details of the Sub-contractor's proposed method to place the soil cement shall be submitted to the Contractor prior to beginning this work. .Δ

18.8 Measurement and Payment

18.8.1 Backfill Measurement

18.8.1.1 Backfill in the construction laydown area will be measured to the nearest cubic yard of material placed and compacted. Such measurement will be based on the existing grades as determined by a survey preceding backfill operations, and the neat fill lines, grades, and slopes shown. No allowance will be made for settlement or shrinkage of the embankment during construction.

18.8.1.2 Payment

Backfill will be paid for at the applicable contract price stated in the Price Schedule for the item listed below.

Item 32 Construction Laydown  
Area Backfill

18.8.2 Channel Excavation

18.8.2.1 Measurement

Required excavation will be measured in place to the nearest cubic yard, as the number of yards satisfactorily excavated and disposed of in the laydown area. 184

18.8.2.2 Payment

Required excavation will be paid for at the applicable contract price stated in the Price Schedule for the items listed below.

Item 33 Construction Laydown  
Area Channel Excavation

18.8.3 Remaining Excavation

All other excavation required to provide backfill material will be paid at the appropriate item number 7 or 14 E .

18.8.4 Channel Stabilization

18.8.4.1 Measurement

Stabilization work will be measured by the number of square yards completed and accepted.

18.8.4.2 Payment

Stabilization work will be paid for at the applicable contract price stated in the Price Schedule for the item listed below.

Item 34 Channel Stabilization

18.8.5 Clearing and Grubbing

18.8.5.1 Measurement

All work performed to clear and grub the laydown area will be paid for as a lump sum item.

18.8.5.2 Payment

Clearing and grubbing work in the laydown area will be paid at the contract price stated in the Price Schedule for the item listed below.

Item 35 Construction Laydown Area  
Clearing and Grubbing



<u>Zone</u>	<u>Description</u>	<u>Source</u>	<u>Gradation</u>	
1. Impervious Fill	Sandy silty clays or sandy silts with some clay.	Designated borrow area and all required excavation.	Not less than 20% passing No. 200 sieve. <span style="float: right;">△</span>	
			<u>U.S. Std. Series Sieve Sizes</u>	<u>Percent Passing (by dry weight)</u>
1A. Impervious Fill	Native broadly graded sandy glacial till.	Designated borrow area and all required excavation.	No. 4	40-100
			No. 30	30-100
			No. 100	25-80
			No. 200	20-70
			<u>Size in millimeters</u>	
			0.01	10-40
			0.002	0-20
2. Random Fill	Any material free of humus, organic or other deleterious material.	Designated borrow area and all required excavation.	No restrictions	
3. Sand Drain	Clean sand graded as specified.	Obtained by Subcontractor from source approved by Contractor.	3/8 inch	100
			No. 8	55-100
			No. 30	20-55
			No. 100	0-10
			No. 200	0-3
4. Gravel*	Crushed Stone	Obtained by Subcontractor from source approved by Contractor.	3 inch	100
			1 1/2 inch	80-100
			3/4 inch	60-90
			3/8 inch	35-60
			No. 4	10-45
			No. 10	0-20
			No. 16	0-5"

\* Washing may be required to control fines.

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<u>Zone</u>	<u>Description</u>	<u>Source</u>	<u>Gradation</u>	
4A. Gravel	A washed 100% crushed limestone graded as specified.	Obtained by Subcontractor from source approved by Contractor.	1 inch	100
			3/4 inch	90-100
			1/2 inch	75-90
			3/8 inch	60-85
			No. 200	7-15
4Z.** Gravel	Crushed stone	Obtained by Subcontractor from source approved by Contractor.	3 inch	100
			1 1/2 inch	80-100
			3/4 inch	60-90
			No. 4	35-60: <sup>A</sup>
			No. 10	10-45
			No. 16	0- 5
			No. 50	0- 3
			No. 200	0- 2

\*\* No washing will be required provided fines do not exceed above gradation requirements for two percent (2%) passing No. 200 U.S. standard sieve size and up to three percent (3%) passing No. 50.

5. Riprap	Sound durable rock free of cracks	Stockpiled on jobsite	Average size of particles: 8 inches to 12 inches. Maximum size of any particle: 18 inches. No more than 20% (by weight) of the material with particle sizes smaller than 6 inches.	
1A. Riprap	Sound durable rock free of cracks.	Obtained by Subcontractor from source approved by Contractor.	Average size of particles: 8 inches to 12 inches. Maximum size of any particle: 18 inches. No more than 20% (by weight) of the material with particle sizes smaller than <sup>A</sup> 6 inches. At least 40% (by weight) of the material shall have particle sizes of 10 inches (100#) or larger.	
6. Topsoil and Seeding	Humus and organic material.	Stripping from dike foundation, borrow areas, and plant area.	Not applicable.	

NOTE: The materials to be placed in Zones 1A, 3, 4, 4A and 4Z shall not be of uniform size nor skip-graded, but shall be well graded from coarse to fine sizes within the specified gradation limits.

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TABLE F-1  
MIDLAND NUCLEAR PLANT, UNITS 1 AND 2  
WATER WELL SEALING INFORMATION

Well No.	Coordinates	Description Well Locations	Diameter of Casing (Inches)	Approx. Ground Surface Elev.	Approx. Piezo Head (ft.)	Approx. Piezo Elev.	Approx. Flow (gpm)	Approx. Depth (ft.)	Water Sample (a)	No Breach Check Valve	No Casing Visible	Well No. to Be Sealed	Wells Req'd Plugging (X-yes)	
1	58,319 W7,682	3253 Stewart; 18.5' N. 36.5' E. of N.W. cor. house.	2	+628			No	131	(Midland Co.)		X†	1	Yes	X
2	58,717 W7,672	3254 Stewart; Well Probably loc. ±303. of S.W. cor. hse.	2	+633.4			No	120-120	(Midland Co.)		X†	2	*(Sealed)	
3	510,937 E4,197	Midland Co. Well buried beneath feed bin.	2	+619.7			No	250-260	(Midland Co.)	X	X	3	*(Sealed)	
4	510,756 E5,734	Midland Co. Well loc. in shed W. of barn.	2†	+607			No	40	(Midland Co.)		NA	4	No	NA*
5	58,606 E1,717	3784 Stewart; 24' E. 4' S. of S.W. cor. of house	2†	+614.9			No†	130-180	(PS&S)		†	5	*(Sealed)	
6	57,759 E3,189	Well loc. ±60' N.E. of bldg.	4	+610.8			No	140	(Midland Co.)	X		6	Yes	OK
7	57,809 E3,155	Well buried ±15' N.E. of bldg.	4	+610.8			No	140	(Midland Co.)	X	X	7	Yes	X
8	59,050 E3,950	Well beneath shed ±80' N.E. garage.	4	+607			No (orig. flowed)	85-100			Well in sump	8	*(Sealed)	
9	59,518 W1,275	Well buried ±4' S. of chimney.	2	+619.7			Yes	112			X	9	*(Sealed)	
10	59,754, W1,227	Well buried 14' N., 9' W. of S.W. cor. house.	2	+622			No	82			X	10	*(Sealed)	
11	59,867 W1,314	Loren Sasse; Casing loc: ±30' N. of barn.	2	+623.8			No	80				11	*(Sealed)	

PS&S - Not applicable, well not to be sealed.  
 (a) Water samples taken by Midland Co. Health Dept., R. A. Schnable for PS&S & B. G. Hicks (BCH) for this report. Analyses are available for (2) & (3) in the Geology Files and Midland Co. will send those indicated when completed.  
 (b) Height above ground surface that water will rise in pipe attached to top of well casing.  
 \*(Sealed) - Well sealed under previous contract 7220-C-10.

TABLE 7-1  
MIRHAUD NUCLEAR PLANT, UNITS 1 AND 2  
WATER WELL SEALING INFORMATION

Well No.	Coordinates	Description Well Locations	Diameter of Casing (inches)	Approx. Ground Surface Elev.	Approx. Piezo Head (ft.)	Approx. Piezo Elev.	Approx. Flow (gpm)	Approx. Depth (ft.)	Water Sample(s)	No Breker Check Valve	No Casing Visible	Well No. Sealed	Well Reqs. Flushing (X-yes)
12	89,889 W1,175	Well csg. reported @ bot. of creek nr. road.	7	+623			No	80			X	12	-(Sealed)
13	811,027 W1,314	Well buried; Loc. = approx. only.	2	+625			No	111-120			X	13	-(Sealed)
14	89,543 W1,003	Two wells loc. bet. house and garage.	2	+620	3.5	623.5	Yes	82 & 120	i			14	-(Sealed)
15	88,595 W2,725	3357 Stewart Rd. 6' N. 33' W of N.E. cor. of house	2	+623.8			No	107			X	15	-(Sealed)
16	88,368 W2,528	House zone, approx. loc. of well.	2	+625			No	110			X	16	-(Sealed)
17	88,356 W2,270	Well loc. 430 N. of house.	2	+623.3			?	4130				17	-(Sealed)
18	88,377 W1,766	Well in small shed @ N. of house.	2	+621.4			?	120-130				18	-(Sealed)
19	88,395 W1,294	Well loc. 2' N. & 26' W. of N.E. cor. of house.	2	+617.3			Yes	90-100				19	-(Sealed)
20	88,364 W1,176	Coordn. are N.E. cor. of house. (Possibly no well here.)	27	+619			?	Unknown				20	-(Sealed)
21	88,677 W962	Well in creek in shed E. of house.	2	+620.5			No	4100			X	21	Yes
22	88,824 W380	Well csg. (flowing) loc. 250' E. of house foundation.	2	+622.3			Yes (6.5)	114				22	-(Sealed)

(1) Two wells located @ 21 ft. apart; one flowing freely, the other piped into pressure system.  
-(Sealed) = Well sealed under previous contract 7220-C-10.

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TABLE 7-1  
MIDLAND NUCLEAR PLANT, UNITS 1 AND 2  
WATER WELL SEALING INFORMATION

Well No.	Coordinates	Description Well Location	Diameter of Casing (inches)	Approx. Ground Surface Elev.	Approx. Piezo Head (b) (ft.)	Approx. Piezo Elev.	Approx. Flow (gpm)	Approx. Depth (ft.)	Water Sample(s)	No Bromaz Check Valve	No Casing Visible	Well No.	To Be Sealed	Well Reqs. Plugging (7-Yes)
23(2)	88,392 845	Well loc. $\pm 10'$ S. of S.W. cor. of house.	2	$\pm 616$			No	127			X	23	Yes	X
24	88,407 8270	Approx. location: 15.5' S. 37' W. S.E. cor. of house.	2	$\pm 615.5$			No	18	(Midland Co.)			24	*(Sealed)	
25	88,565 8361	3644 Stewart; 35.5' S. 17' E. S.E. cor. of house.	2	$\pm 613.7$			No	$\pm 100$				25	*(Sealed)	
26	88,707 8333	Well loc. $\pm 40'$ E. of N.E. cor. barn.	2	$\pm 613$			Yes	$\pm 100$				26	*(Sealed)	
27	88,270 8487	Well loc. $\pm 25'$ N. of house ruins	2	$\pm 614.8$			Yes (2)	$\pm 88$				27	*(Sealed)	
28	86,316 81,065	Well southerly exposed 2" casing.	2	$\pm 609$	10	619	Yes (2.6)	Unknown	(PSAR)4(BCR)			28	*(Sealed)	
29	87,327 81,321	Well buried; pump in basement.	2	$\pm 619.7$			No	$\pm 130$				29	*(Sealed)	
30	88,013, 81,227	Well in manhole near S.W. cor. house.	2	$\pm 616$			Yes	93				30	*(Sealed)	
31	87,731 81,011	Well in creek near S.E. cor. house.	2	$\pm 619$			Yes (3.4)	124	(PSAR)			31	*(Sealed)	
32	88,177 81,180	Well buried $\pm 20'$ W. of exposed pipe.	2	$\pm 616.8$			Yes (1.6)	105				32	*(Sealed)	
33(3)	88,183 81,156 (concrete) $\pm 50'$	Well loc. in Manhole from Sasse Road.	2	$\pm 617.5$			Yes	124				33	*(Sealed)	
34(4)	86,028 83,105	Well buried @ S.E. cor. of house.	2	$\pm 609.3$			No	60-90			X	34	Yes	X

(2) Well supplies house at 3620 Stewart Rd. (Arnold Decker) and house located immediately west.

(3) Possibly another well located  $\pm 4'$  west of manhole.

(4) Casing to  $\pm 60'$  well drilled to 80-90', no screen installed.

\*(Sealed) = Well sealed under previous contract 7220-C-10.



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TABLE 7-1

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Revision 1TABLE 7-1  
MEDLAND NUCLEAR PLANT, UNITS 1 AND 2  
WATER WELL SEALING INFORMATION

Well No.	Coordinates	Description Well Location	iameter of casing (inches)	Approx. Ground Surface Elev.	Approx. Piezo Head (b) (ft.)	Approx. Piezo Elev.	Approx. Flow (gpm)	Approx. Depth (ft.)	Water Sample(s)	No. Brener Check Valve	No. Casing Visible	Well No. To Be Sealed	Wells Req'd Plumbing (X-Yes)
35	56,035 W2,483	Well loc. W. of private rd. ±50' S. of house foundation	2	+609.5			Yes (when drilled)	±130			X	35	X
36	56,196 W1,873	Well buried ±40 S., ±20' W. of N.W. cor. house.	2	+613.4			Yes	234			X	36	X
37	56,111 W1,867	Csg. exposed ±50' N., ±20' W. of N.W. cor. house.	2	+613.5	6	619.5	Yes(0.6)	110	(MCH)			37	X
38(3)	55,049 W4,6	Dow Chem. Co.: Bldg. 655 ("AR28" Well) 35.06' S. & 35.35' E. of N.W. corner of bldg.	4	+611.5			Yes	±170	(PMAR)			38	X
39	511,376 W2,146	3412 Gordonville Rd.: 11' S., 18' W. of S.E. cor. of house.	2	OFF map			?	109			NA	39	NA
40	510,998 W2,392	Well loc. in shed behind house.	2	+635.8			?	140				40	X
41(6)	510,927 W2,567	House gone, approx. loc. of well.	27	+635.5			?	±140				41	X
42	511,028 W2,820	House gone, app. ex. loc. of well.	27	+628.3			No	±150				42	X
43	511,026 W3,018	Approx. loc.: 33' N. 22' E. of S.W. cor. of house.	?	+628.5			?	103				43	X
44	510,987 W3,226	Approx. location: 39' N., 44' W. of S.E. cor. of house.	27	+627			?	91				44	X

(3) May use for construction supply well.  
 (6) Possibly another well loc. 50-100 ft. N.W. of No. 41, no casing exposed.  
 X(Sealed) = Well sealed under previous contract 7220-C-10.

MIDLAND NUCLEAR PLANT, UNITS 1 AND 2  
WATER WELL SEALING INFORMATION

TABLE 7-1

Well No.	Coordinates	Description Well Locations	Diameter of Casing (inches)	Approx. Ground Surface Elev. (ft.)	Approx. Piezo Head (ft.)	Approx. Piezo Elev. (ft.)	Approx. Flow (gpm)	Approx. Depth (ft.)	Water Sample(s)	No. Braker Check Valve	No. Casing Visible	Well No.	To Be Sealed	Wellie Req'd (5-year)
45	S11,360 W3,140	9' S., 5' E of S.W. corner of house.	7	Off map			?	Unknown			NA	45	No	NA*
46	S11,041 W3,580	Well buried ±5' S., 30' W. of S.E. cor. house.	27	+629.5			?	100	(BGR)		X	46	*(Sealed)	
47	S11,018 W3,686	Well buried ±35' S. and ±4' W. of tree loc. bet. 3253 & 3275 Gordonville Rd.	27	+629.5			?	100			X	47	*(Sealed)	
48	S11,174 E1,127	(Not to be sealed)	?	+630			?	105			NA	48	No	NA*
49	S11,223 E180	(Not to be sealed)	?	+627			?	±120			NA	49	No	NA*
50	S11,278 W2,499	(Not to be sealed)	4	Off map			?	32			NA	50	No	NA*
51	S6025 E2254	Well loc. ±50' S.E. of house foundation.	2				No	Unknown				51	*(Sealed)	NA*
52	S8360 W1445		?				?	Unknown				52	*(Sealed)	NA*
53		Well loc. in swampy ground 75-100' W. of house ruins.	?	+605 (flow from well has caused swamp)	605		Yes(±10)	±300			X	53	*(Sealed)	NA*
54	Near intersection of Miller & Seese Rds.	Wash well for Dow brins well No. 29 (Monroe).	4				?	--	(PSAR)		NA	54	No	NA*
55(8)	S8675 W1195	Buried near S.E. cor. of house.	?				?	±100			X	55	*(Sealed)	NA*
56(8)	S8600 W2035	Approx. Loc.: Immediately south of house.	?				?	±130			X	56	*(Sealed)	NA*
57(8) (9)	S10965 E795	Approx. loc.: ±25' E. of house.	?				?	Unknown	(PSAR)		X	57	Yes	X

(8) Could not contact owner by instructions from Mr. W. Neagher, Dow Chemical Co., Midland.  
(9) May be another well (abandoned) located near foundation of old house (near Gordonville Road).  
\*(Sealed) = Well sealed under previous contract 7220-C-10.

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TABLE 7-2

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TABLE 7-2  
MIDLAND NUCLEAR POWER PLANT  
EXPLORATORY HOLES  
IN PLANT AND POND AREAS TO BE GROUTED

Hole No. Drilled By Date	Plant Area	Approx. Coord.	Remarks & Present Status	Approx. Surface	Grd. Elev.	Hole Depth (Ft.)	Bottom Elev.	Grd. Water Depth or Piezometric Head	Top of Main Artesian Aquifer Depth (Ft.) Elev.	Depth (Ft.)	Elev.	Possible Minor Aquifers Description On Log	Construction Requirement Re Cut or Fill @ Hole Location	Grd. Surface Change @ Hole Location
MCA Mich. Drig. Co. Feb. 1968		S4580, E272	Maness No. 1; Top of casing at ground face	605		418	187	None shown on log but unless sealed prob. + 10' piezo. head.	177 428	165-167 170-171 171-171	440-438 435-434 434-433.5	"white quartz sand" "quartz sand" "sand"	Cut to el. 600	Cut ± 5'
M-1 Mich. Drig Co. Feb. 1958		S4865, E102	(Sealed) Casing extended + 6' above grd. surface	609		200	409	Log indicates 178' but 6' csg. extension indicates + 6' piezo head	178 421	None indicated on log			Cut to el. 591	Cut ± 18'
D-1 Dames & Moore June 1968		S4785, E140	(Plugged-Impossible to grout)	608		370	238	Artesian; Flow @ 1-2- gpm; piezo head prob. @ ± 7 ft.	230 378	33	575	"occas. pockets of gray silty sand"	Cut to el. 582	Cut ± 26'
D-3 Dames & Moore June 1968		S4785, E360	Log does not indicate casing left installed	604		202	402	2 ft. (depth)	Not encountered	None indicated on log			Cut to el. 582'	Cut ± 22'
D-4		S4875, E250	"	605		98.5	-	4.5 ft'	"	83-85	522-520	"gray silty sand"	Cut to el. 580'	Cut ± 25'
D-5 Dames & Moore June 1968		S4950, E77	(Sealed) Log does not indicate casing left installed	612		151	461		Not encountered	No distinctive permeable units indicated			Cut to el. 602	Cut ± 10'
D-6 Dames & Moore June 1968		S4950, E426	Log does not indicate casing left installed	604		150	454	None encountered	Not encountered	14 40 52	590 564 552	"sand pockets" "sand pockets" "silty sand @ 52'-58'	Cut to el. 602	Cut ± 2'
D-8		S4670, E399	"	603.4		63.5	539.9	"	"	3-8 8-17 17-31	600.4 595.4 595.4-586.4 586.4-567.4	"brownish-gray fine to medium sand" "gray fine to medium sand" "gray fine sand"	Fill to el. 613	Fill ± 7'

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TABLE 7-2  
MIDLAND NUCLEAR POWER PLANT  
EXPLORATORY HOLES

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Hole No. Drilled By Date	Approx. Coord. Plant Area	Remarks & Present Status	Approx. Surface	Grd. Elev.	Hole Depth (Ft.)	Bottom Elev.	Grd. Water Depth or Piezometric Head	Top of Main Artesian Aquifer Depth (Ft.) Elev.	Possible Minor Aquifers		Construction Requirement Re Cut or Fill @ Hole Location	Grd. Surface Change @ Hole Locatio	
									Depth (Ft.)	Elev.			
D-10	S4702, E290	"	602.5		80.5	522.0	7	"	3-29	599.5- 573.5	"brownish- gray silty fine sand"	Cut to el. 582	Cut ± 18'
N-3	S4870, E910	(Sealed)	603.1		100	503.1	75'	"	65.0- 65.25 74.5- 75.5	538.15- 537.90 528.63- 527.65	"occasional lenses of fine sand "layer of very moist gray sand" "layer of wet gray sand, slight clay content"	Fill to el. 634 Cut to el. 584	Fill ± 31' Cut ± 13'
N-5	S4865, E500	(Sealed)	603.4		100	503.4	51'	"	None indicated on log				
POSD AREA 145	S8130, W2880	"	621.6		60	561.6	"	"	37-39 45	585-583 577	"gray fine sand" "occasional sand seams"	Cut to el. 615	Cut ± 6'

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7220-C-210

TABLE 7-3

Sheet 1 of 1

Revision 1

TABLE 7-3

## NEILAND NUCLEAR POWER PLANT

EXPLORATORY HOLES  
TO BE CHECKED

Hole No. Drilled By Date	Approx. Coord. Plant Area	Remarks & Present Status	Approx. Surface	Grd. Elev.	Hole Depth (Ft.)	Bottom Elev.	Grd. Water Depth or Piezometric Head	Top of Main Artesian Aquifer Depth (Ft.) Elev.	Possible Minor Aquifers		Construction Requirement Re Cut or Fill @ Hole Location	Grd. Surface Change @ Hole Location	
									Depth (Ft.)	Elev.			Description On Log
D-731 Dunn & Moore June 1957	34455, 255	Log does not indicate 60' casing left installed			150	454	8 ft. (depth)	Not encountered	40	564	"occas. thin layers of water bearing sand"	Fill to el. 634	Fill ± 3'
									89	515	"occas. seams of sand"		
									97	507	"layer of sand"		



This schedule of drawing and data requirements is to be fulfilled before rendering final invoices. See below for drawings required and dates due. Failure of Vendor to comply with drawing and data requirements may result in order cancellation in the case of initial drawings, or final payment being withheld in the case of final drawings. Drawings are to be forwarded to:

BECHTEL CORPORATION • P. O. Box 2167; Midland, Michigan 48646

Attention: E. E. Felton

IN ADDITION, FORWARD WITH SHIPMENT, ONE SET OF ANY DRAWINGS NECESSARY FOR FIELD INSTALLATION. FORWARD COPY OF LETTER OF TRANSMITTAL TO: BECHTEL ASSOCIATES PROFESSIONAL CORPORATION PROCUREMENT DEPT. P.O. Box 1000 ANN ARBOR, MICHIGAN 48106. ATTENTION: EXPEDITOR NAMED ON PAGE 1 OF PURCHASE ORDER.

DATE: 3/27/72  
4/14/72

APPROVALS: [Signatures]

MATL. SUPV. [Signatures]

CHK. DR. [Signatures]

ENG. [Signatures]

DESCRIPTION: I Issued for Subcontract  
O Issued for bids

REV. 1

TYPE OF DRAWINGS AND OTHER REQUIREMENTS	APPROVAL BEFORE FAB (YES/NO)	KIND OF COPIES	NUMBER REQUIRED	
			INITIAL	FINAL
A OUTLINE DIMENSIONS AND FOUNDATION REQUIREMENTS		TRANSPARENCY PRINTS		
B CROSS SECTION WITH PARTS LISTS WITH PRICES		TRANSPARENCY PRINTS		
C SHOP DETAIL DRAWINGS	YES	TRANSPARENCY PRINTS	1 3	1 3
D CERTIFIED PERFORMANCE DATA AND TEST REPORTS		TRANSPARENCY PRINTS		
E WIRING DIAGRAMS		TRANSPARENCY PRINTS		
F CONTROL LOGIC DIAGRAMS		TRANSPARENCY PRINTS		
G WELDING PROCEDURES		TRANSPARENCY PRINTS		
H CODE CERTIFICATES, INSPECTION AND TEST REPORTS		ORIGINAL COPIES		
J INSTRUCTIONS FOR ERECTION OR INSTALLATION, OPERATION AND MAINTENANCE		MANUALS OF EACH TYPE		
K LIST OF RECOMMENDED SPARE PARTS FOR ONE YEAR'S OPERATION, WITH PRICES		LISTS		
L COMPLETED BECHTEL CORPORATION DATA SHEETS		TRANSPARENCY		
M MATERIAL CERTIFICATIONS				
N MANUFACTURERS QUALITY CONTROL, INSPECTION AND TEST PROCEDURES AND REPORTS	YES *		4 Copies	4 Copies
Mill Test Reports	YES		2 copies	2 copies
*Ref. Spec Sect. 13.0 & 16.0				

Vendor's drawings will be reviewed and approved only as to arrangement and conformance to the specifications and related drawings, and approval shall not be construed to relieve or mitigate the Vendor's responsibility for accuracy or adequacy and suitability of materials and/or equipment represented thereon.

Final drawings must be certified and must show adjacent to the title block, Purchaser's equipment title and number, manufacturer's serial number and purchase order number. Initial transparencies must be made from faultless masters. Final transparencies shall be on wash-off Mylar. Additional drawing requirements will be specified in the Technical Specification.

Initial drawings required within 30 days of receipt of firm order. Final drawings required within 30 days of receipt of initial drawings, or within          days of receipt of firm order if no initial drawings are requested. The finalized drawing transmittal requirement dates will be specified in the purchase order and will take precedence over the above.

DRAWINGS AND DATA REQUIREMENTS

G-351-C  
5/13/69



JOB NO. 7220

ATTACHMENT TO REQUISITION NUMBER C-210

REV 196



QUALITY ASSURANCE PROGRAM  
FORM G-321C-SUPPLEMENT A  
ENGINEERING DOCUMENTATION SUMMARY  
(Requiring Bechtel Approval Prior to Fabrication)

7220-C-210  
P. O. No. \_\_\_\_\_

This schedule of documentation is to be fulfilled before rendering final invoices. See below for documentation required and dates due. Failure of Supplier to comply with documentation requirement may result in order cancellation in the case of preliminary drawings or acceptance and/or payment being withheld in the case of final documentation. This Supplier is to use this summary as a guide for the preparation and transmittal of the Supplier Engineering Documentation List.

Documentation Requirement	Reference Specification Paragraph	Date Required			Kind and Number of Copies		Remarks
		Prior To Fab.	Prior To Ship.	Days After Contr. Award	Preliminary	Final	
Quality Assurance Program	16.0			15	4	4	

ATTACHMENT - A

REQUIRED TEST REPORT FORMS

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DECHTEL JOB NO.

INSTRUMENT CALIBRATION AND MAINTENANCE RECORD

Instrument Name \_\_\_\_\_

Model No. \_\_\_\_\_

Mfr. \_\_\_\_\_

S/N \_\_\_\_\_

Property No. \_\_\_\_\_

Assigned To: \_\_\_\_\_

Calibration Cycle \_\_\_\_\_

days

Date Calibrated	Next Calib. Date	Remarks	Returned to	Calib. by

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MIDLAND POWER PLANT



ation \_\_\_\_\_  
 vation \_\_\_\_\_

Inspector \_\_\_\_\_

Shift From \_\_\_\_\_ to \_\_\_\_\_

Weather \_\_\_\_\_

Screen or Sieve Size	Retained	Cum.	% Passing	Spec. % Passing	Retained	Cum.	% Passing	Spec. % Passing
	Wt. gm.	% Ret.		Wt. gm.	%			
	Log # 1-1/2 to 3" Time:				Log # 3/4 to 1-1/2" Time:			
.4"				100				
3"				99-100				
2"				20-55				100
1-1/2"				0-15				99-100
1"				0-5				20-55
3/4"								0-15
1/2"								—
3/8"								0-5
No. 4								
	Log # No. 4 to 3/4" Time:				Log # No. 8 to 3/8" Time:			
1"				100				
3/4"				99-100				
3/8"				20-55				85-100
No. 4				0-10				10-30
No. 8				0-5				0-10
	Sand Sample No. Time:				Sand Sample No. Time:			
4				95-100				95-100
8				80-100				80-100
16				50-85				50-65
30				25-60				25-60
50				10-30				10-30
100				2-10				2-10
200				—				—
F.M.				2.5-3.0				2.5-3.0

Colorimetric Plate No. -1 1 2 3 4 5					Moisture Content %			
Flat & Elongated Size			%		%		%	%
	AVE. _____							
Flat & Elongated Size			%		%		%	%
	AVE. _____							

Remarks: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

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1. Inspection plan number and date of report.
11. Serial number shown on the concrete delivery ticket or truck number if delivery ticket unavailable.
12. Time that the load arrived at the point of placement.
13. Cumulative yardage of concrete manufactured/transported for placement.
14. Result of slump test/tests when performed. See Note 1.
15. Temperature of concrete. See Note 1.
16. Result of air test when performed. See Note 1.
17. Unit weight recorded in pounds per cubic foot. See Note 1.
18. Identity: Identify cylinder test set by a unique number.  
Quantity: Number of concrete test specimens in cylinder set.  
Cure: Record how cylinder set is to be cured; use "F" when field cured, and "L" when laboratory cured.





**BLOCK NO.****ENTRY INFORMATION – QC-C1**

1. Project number.
2. Date of report.
3. To be signed and dated by the Quality Control Engineer signifying the form has been reviewed for completeness and correctness. The form will then be routed to the Quality Control Documentation Coordinator for completion of this block.
4. Control specification number.
5. Drawing number or numbers applicable.
6. Date of tests, Saturday through Friday week.
7. Date of individual compaction test.
8. Test number.
9. Name of person performing test.
10. Test location.
11. Elevation of test.
12. Depth of test below final grade.
13. In place wet density.
14. Moisture content.
15. In place dry density.
16. Soil classification.
17. Maximum laboratory dry density.
18. Percent compaction.
19. Remarks.
20. Signature and date of person preparing this report.
21. Signature and date of the Responsible Engineer signifying that the work is complete and in accord with drawings and specifications.





**BLOCK NO.****ENTRY INFORMATION - Q.C.6**

- 1.\* Project number.
- 2 Date of report.
3. To be signed and dated by the Quality Control Engineer signifying the form has been reviewed for completeness and correctness. The form will then be routed to the Quality Control Documentation Coordinator for completion of this block.
4. Date test performed.
- 5.\* Laboratory Test number.
- 6.\* Heat number(s) of which material is representative.
- 7.\* Grade of steel, i.e., 40, 60 or 75.
- 8.\* Size of bar sample, i.e., 18's, 14's.
9. Result of elongation test.
- 10.\* Minimum percent elongation required by specification.
11. Result of yield test.
- 12.\* Minimum yield strength required by specification.
13. Result of tensile test.
14. Minimum tensile strength required by specification.
15. Result of bend test.
16. Additional information pertaining to test results when required.
17. Signature of the testing laboratory supervisor.

\* Information to be entered by assigned Field Engineer. The Rebar Test Report Form Q.C.6 shall accompany the specimens to the Test Laboratory for completion.



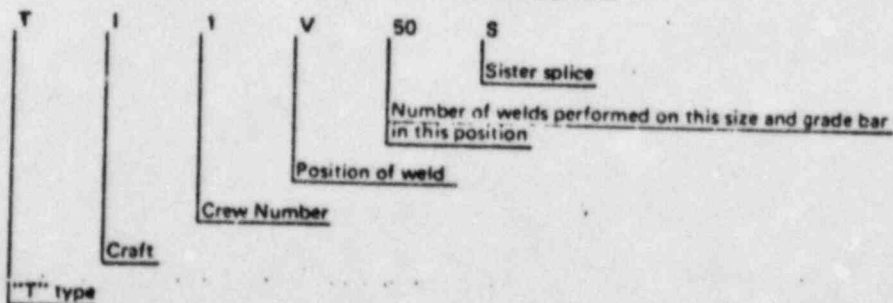
**BLOCK NO.**

**ENTRY INFORMATION - QC-C8**

1. Project number.
2. Date of report.
3. To be signed and dated by the Quality Control Engineer signifying the form has been reviewed for completeness and correctness. The form will then be routed to the Quality Control Documentation Coordinator for completion of this block.
4. Numerical splice number.
5. Type of test splice.  
S = Sister Splice  
P = Production Splice
6. Sleeve Lot Number. This is found on shipping container.
7. Powder Lot Number. This is found on container.
8. Position in which the splice was performed, by an "X" in the appropriate block.
9. Verify minimum pre-heat temperature per specification by a temperature crayon and indicate results:  
S = Satisfactory  
U = Unsatisfactory
10. Inspect both ends of the sleeve and compute void limit as stated in the Specification and indicate results as:  
S = Satisfactory  
U = Unsatisfactory
11. Visually inspect tap hole for slag or generally porous metal and indicate inspection results as:  
S = Satisfactory  
U = Unsatisfactory
12. Visually inspect for centering to confirm that the bar ends are properly centered in the splice sleeves. Indicate results of inspection as:
13. Result of Tensile Test when test has been indicated in Block 5.
14. Nature of failure, (Bar, Sleeve, Pull out).
15. Moving average for this series, position grade and size bar for this operator.
16. Location drawing number on which this splice has been plotted.
17. The remarks column will be used for rejection notations.
18. Bar size, i.e., 18's, 14's.
19. Grade of bar, i.e., 40, 60.
20. Indicate series "T" or "B" by an "X" in the appropriate block.
21. Splice Operator's full name.
22. Splice Operator's employee badge number.
23. Splice operator's unique crew number.
24. The number of the various type welds performed today by this crew by totalling all X's in each column for each type.
25. The total to-date figures posted on the report as total forwarded.
26. The sum of today's total plus the total forwarded for each type and position.
27. Signature of the Crew Foreman.
28. Signature and date of the Field Engineer signifying that the work is complete and in accord with drawings and specifications.
29. Signature of Testing Laboratory Supervisor

Note: The completed report shall become the latest entry of the Cadweld Quality Control Ledger. A form shall be prepared for each bar size, grade and series Cadwelded. If more than one size grade or series Cadweld was performed by any one crew during any one shift it shall require an equal number of forms.

An example of a splice number would be T11V50S, derived from:



**BLOCK NO.**

**ENTRY INFORMATION - QC-C8**

1. Project number
2. Date of report.
3. To be signed and dated by the Quality Control Engineer signifying the form has been reviewed for completeness and correctness. The form will then be routed to the Quality Control Documentation Coordinator for completion of this block.
4. Numerical splice number.
5. Type of splice:  
S - Sister Splice  
P - Production Splice
6. Sleeve Lot Number. This is found on shipping container.
7. Powder Lot Number. This is found on container.
8. Position in which the splice was performed, by an "X" in the appropriate block.
9. Verify minimum pre-heat temperature per specification by a temperature crayon and indicate results:  
S = Satisfactory  
U = Unsatisfactory
10. Inspect both ends of the sleeve and compute void limit as stated in the Specification and indicate results as:  
S = Satisfactory  
U = Unsatisfactory
11. Visually inspect top hole for slag or generally porous metal and indicate inspection results as:  
S = Satisfactory  
U = Unsatisfactory
12. Visually inspect for centering to confirm that the bar ends are properly centered in the splice sleeve. Indicate results of inspection as:
13. Result of Tensile Test when test has been indicated in Block 5.
14. Nature of failure, (Bar, Sleeve, Pull out).
15. Moving average for this series, position grade and size bar for this operator.
16. Location drawing number on which this splice has been plotted.
17. The remarks column will be used for rejection notations.
18. Bar size, i.e., 18's, 14's.
19. Grade of bar, i.e., 40, 60
20. Indicate series "T" or "B" by an "X" in the appropriate block.
21. Splice Operator's full name.
22. Splice Operator's employee badge number.
23. Splice operator's unique crew number.
24. The number of the various type welds performed today by this crew by totaling all X's in each column for each type.
25. The total to-date figures posted on the report as total forwarded.
26. The sum of today's total plus the total forwarded for each type and position.
27. Signature of the Crew Foreman.
28. Signature and date of the Field Engineer signifying that the work is complete and in accord with drawings and specifications.
29. Signature of Testing Laboratory Supervisor.

**Note:** The completed report shall become the latest entry of the Cadweld Quality Control Ledger.  
A form shall be prepared for each bar size, grade and series Cadwelded. If more than one size grade or series Cadweld was performed by any one crew during any one shift it shall require an equal number of forms.

An example of a splice number would be T11V50S, derived from:

