METRO

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Memorandum

Part II of II

DATE: January 2, 1992

TO: Metro Council
Executive Officer
Interested Persons

FROM: Paulette Allen, Clerk of the Council PA

RE: AGENDA ITEM NO. 7.2; RESOLUTION NO. 92-1546

The Council agenda will be printed before the Solid Waste Committee meets on January 7 to consider Resolution No. 92-1546. Solid Waste Committee reports will be distributed in advance to Councilors and available at the January 9 Council meeting.

The resolution RFB will be distributed under separate cover due to the volume of that document.

DIVISION 1 - GENERAL CONSTRUCTION PROVISIONS

INDEX

SECTION 01001

SPECIFICATION STRUCTURE

1. GENERAL

1.1 FORMAT

A. This specification is organized on the format promulgated by the Construction Specification Institute (CSI Format).

B. This format assigns permanent numbers to all Divisions and Sections and so far as possible assigns all products, processes, activities and construction requirements permanent places in the specifications. A number is assigned which will not change from specification to specification.

C. Division, Section and Subsection numbers which are not required are omitted from the Specification.

D. Reference to an Article is a numbered clause in the General Conditions.

1.2 INDEX

All Sections required for a complete Contract appear in the index. Sections not required are omitted.

1.3 ARRANGEMENT

A. The Project manual is organized as follows:

1. Procedural and legal documents in Division O.

2. Specifications in Divisions 1 to 16.

B. No attempt has been made in these specifications or plans to segregate Work covered by any trade or Subcontractor under one specification. Such segregation and establishment of subcontract limits shall be solely a matter of specific agreement between Contractor and his Subcontractors and shall not be based upon an inclusion, segregation or arrangement in or of these specifications. Contractor and Subcontractor in each case is warned that work included in any subcontract may be divided between several general specifications and that each general specification or subhead of the Technical Specifications may include work covered by two or more subcontracts in excess of any one subcontract.

C. Contractor shall be responsible for all work shown or specified, regardless of location in the Contract Documents.

1.4 LANGUAGE

A. These Specifications are written in imperative and abbreviated form.

B. This imperative language of the technical sections is directed at Contractor, unless specifically noted otherwise.

C. Incomplete sentences shall be completed by inserting "shall", "Contractor shall", and "shall be", and similar mandatory phrases by inference in the same manner as they are applied to notes on the drawings. The words "shall be" shall be supplied by inference where a colon (:) is used within sentences or phrases.

D. Except as worded to the contrary, fulfill (perform) all indicated requirements whether stated imperatively or otherwise.

*** * * END OF SECTION * * ***

SECTION 01010

SUMMARY OF WORK

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Coordination: Section 01041

B. Field Engineering Section 01050

C. Construction Schedules: Section 01310

D. Schedule of Values: Section 01370

E. Temporary Electricity: Section 01511

F. Temporary Water: Section 01515

G. Protection and Maintenance of Work and Property: Section 01545

H. Product Requirements/Substitutions: Section 01600

1.2 SCOPE OF WORK

A. The work covers construction work specifically shown on the Contract Drawings and described herein.

B. In general, work under this Contract includes furnishing and installing the final cover system and related appurtenances for Subarea 1 and the northerly portion of the Power Line Corridor. Specifically included, but not limited to, are stripping and stockpiling of existing topsoil and low permeable soil, procurement and placement of subgrade embankment soil, placement of low permeable soil barrier, installation of gas collection wells, trenches piping and vacuum pump station, installation of geomembrane liner and geonet drainage material, placement of Type I sand and topsoil, installation of surface water control facilities such as ditches, sedimentation basins and hydroseeding.

1.3 CONTRACTOR'S DUTIES

A. Except as specifically noted, provide and pay for:

1. Labor, materials and equipment.

2. Tools, construction equipment, machinery and fuel.

3. Water, heat, and utilities required for construction.

4. Protection of existing installations such as wells, road systems and drainage, and vegetation and soil covers, as required for construction.

5. Testing except as provided by the ENGINEER.

6. Field Engineering except as provided by the ENGINEER.

7. Daily Quality Control.

8. Other facilities and services necessary for proper execution and completion of Work.

B. Pay legally required consumer use and other taxes as may be required by law.

C. Give required notices.

D. Comply with codes, ordinances, rules, regulations, orders and other legal requirements of public authorities which bear on performance of work.

E. Promptly submit written notice to Metro and Engineer of observed variance of Contract Documents from legal requirements.

F. Enforce strict discipline and good order among employees. Employ only skilled personnel of good character. Remove from the jobsite individuals who display poor workmanship or superintendence, repeatedly break rules of discipline or safety, or engage in unlawful acts on or around the jobsite.

1.4 CONTRACTOR FURNISHED

A. Labor, materials and equipment required for the project, including all soil and rock materials except clay and topsoil stripped from Subarea 1.

B. Water for construction and fire protection.

C. All gates, barricades, fences, handrails, guardrails, and security required by the Contract or by laws and regulations.

D. Sanitary facilities adequate for all workers and complying with all codes and regulations.

E. Shelter and drying facilities for workers.

F. Guards, marks, shields, protective clothing, rain gear, and other equipment required by law, ordinance, labor contracts, OSHA and other regulations for the maintenance of health and safety.

G. First Aid Kits and equipment required by law and regulations.

1.5 PERMITS AND LICENSES

A. Metro has secured all general permits for the project. Copies of the permits are on file at Metro. All requirements set forth by these permits shall be investigated prior to bidding and are to be strictly enforced by Contractor and his agents.

B. Contractor shall acquire and pay for all specialty permits such as electrical permits, transportation permits, wage and hour regulations permits, and all other permits of a temporary nature relating to the construction of the project.

C. Contractor is invited to review the provisions of the Oregon Mined Land Reclamation (ORS 5.17.750-517.955). The Oregon Department of Geology and Mineral Industries can be contacted to determine if this act is pertinent to Contractor's borrow sources.

1.6 TYPE AND EXTENT OF WORK

A. All work incidental and necessary to the completion of the work described herein and shown on the drawings shall be completed under the bid items listed in the Bid Form and no other compensation will be allowed, except as authorized by formal Change Order.

1.7 WORK UNDER SEPARATE CONTRACTS

A. During the course of this Project, Metro may award separate contracts in connection with other work at the Site. Other Metro Contractors on the Site will be involved in:

1. Procurement and Stockpiling of Soils for the St. Johns Landfill-Construction is currently underway and is anticipated to continue through October, 1992.

2. Monitoring of Groundwater Wells - Periodic monitoring well sampling is currently underway and shall continue through the life of this project.

3. Abandonment of groundwater wells D-8A and C-3 and Extension of well H-1.

B. Contractor shall cooperate with Other Metro Contractors in every way possible. It shall be the responsibility of Contractor to maintain its schedule so as not to delay the progress of the Project or the work of Other Metro Contractors. Cooperation shall include, but not limited to:

1. Sharing access routes, designation of laydown areas, and temporary utility corridors.

2. Maintenance of continuous traffic flow onto the Site. The St. Johns Landfill bridge is currently the only road access to the landfill.

C. Regular Coordination meetings will be held on the Site during the course of this Contract with all contractors involved in work at St. Johns Landfill.

1.8 METRO FURNISHED PRODUCTS

A. Metro will furnish no material except in-place clay and topsoil stripped from Subarea 1. Other furnished materials are specifically called for in other sections of the specifications or the drawings.

1.9 CONSTRUCT WORK IN STAGES

A. In general, construction of work in stages will be required as set out in the plans or specifications to accommodate anticipated schedules and weather considerations. The staging shall be coordinated with Metro and reflected in the contract schedule.

B. Construction of the gas collection wells shall be completed in the SA-1 closure area prior to commencement of earthwork/grading operations. The installation of gas collection wells in SA-2 under this contract shall be completed after the SA-1 wells are completed and prior to the end of the contract period at the Contractors convenience.

1.10 USE OF PREMISES

A. Limitations:

1. Contractor shall confine his apparatus, storage of materials, and construction operations to such limits as may be directed by Metro, and shall not unreasonably encumber the premises with his materials.

2. Contractor shall enforce any instructions of Metro regarding signs, advertising, danger signals, barricades, and shall require all persons employed on the work to comply with all regulations while on the premises.

3. Contractor shall not permit the landfill access bridge structure to be loaded with vehicle weights greater than the allowable loads. Refer to the Allowable Loads in the Appendix.

B. Confine operations at site to areas permitted by:

1. Laws
2. Ordinances
3. Permits
4. Contract Documents
5. Right-of-Way

1.11 CONTRACT DOCUMENTS

A. The precedence for interpretation of the Contract Documents is in accordance with Article 1 of the General Conditions.

B. If apparent conflicts or questions arise, Contractor shall immediately contact the Engineer for interpretation or correction.

C. Contractor with the advice of the Engineer will establish a system for Requests for Information (RFI's) which will be used to seek and receive direction quickly, track and record the action, provide a possible basis for change orders as required, provide documentation for possible claims. Additional information may be found in Article 3 of the General Conditions.

1.12 RECORD DOCUMENTS

A. Record documents in accordance with Section 01720 shall be maintained onsite. Section 01720 describes the record drawings which are required onsite.

*** * * END OF SECTION * * ***

SECTION 01025
MEASUREMENT AND PAYMENT

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Bid Form: Section 00300
B. Payments: Article 9 General Conditions
C. Schedule of Values: Section 01370

1.2 MEASUREMENT OF PAY QUANTITIES

A. General:

1. Contractor shall make all interim measurements, and determine all interim quantities and amounts of completed work done under the Contract. At the time measurements are made for quantity determinations, the Engineer or Metro shall be present to verify such measurements. From quantity figures so ascertained, it will be Contractor's responsibility to prepare a monthly periodical estimate of the work accomplished to date. This estimate and application for payment shall be submitted to the Engineer each month for his review not later than the date established at preconstruction conference. The form of such monthly estimates and application for payment to be subject to the approval of the Engineer. The Engineer will take measurements and determine final quantities for payment with Contractor present to verify such measurements.

2. Some settlement of the subgrade is anticipated during the filling operations. Measurement of pay for fill quantities is by weight so Contractor is paid for materials placed as set out in these contract drawings and specifications. The amount of settlement is a function of the rate of filling and therefore the actual fill quantities may vary from the estimated fill quantities given in the schedule of bid prices. Variation in actual required, versus estimated fill quantities shall not be a basis for a claim to Metro.

B. Description of Methods for Measurement of Quantities:

1. When Items are specified to be measured by an **area** unit (e.g.

square yards, acres), direct in-place horizontal measurement shall be employed by the most practical means as determined by the Engineer. Where survey traverse measurements are used for area computation, horizontal measure will be the basis. No allowance for slopes will be made in computing areas. Contractor's bid price shall be adjusted accordingly.

2. For Items specified to be measured by a **volume** unit (e.g. cubic yards), in-place measurement will be used by the Engineer. For subgrade embankment and existing topsoil removal, in-place survey cross-sections will establish final in-place geometry. The quantity for payment will be the calculated difference between this in-place cross-section and the pre-construction cross-section or a prior applicable measurement. For all other "cubic yard" pay items (such as Topsoil, Type I Sand, Roadway Embankment, Crushed Surfacing, & Quarry Spalls), neat line measure for depth as shown on the Drawings will be used together with in-place horizontal measurement for area, (as defined in B1 above) to calculate in-place volumes.

3. Where Items are to be measured by a **weight** unit (e.g. Tons), material shall be weighed on scales that are accurate within the tolerances required by the State of Oregon. Certification of scale accuracy and its licensing with the State shall be provided to the Engineer upon request. Contractor will be responsible to provide a copy of all certified weight bills to the Engineer at the time of delivery. All trucks are to be numbered or otherwise uniquely marked for identification purposes.

   All weigh bills shall include a reference to the borrow source, the intended use of the material, (i.e. Subgrade Embankment or Type I Sand) the delivery vehicle identification, date and time delivered to the landfill.

   At the option of the Engineer, random checks of truck weight and weigh bill accuracy may be performed by weighing an arriving truck at the Metro scale at the landfill entrance. Where a discrepancy is encountered, Metro may elect to adjust all weigh bills received since a prior check date.

   Specific quantities deductions in weight will be made for excess moisture contained in the following items:

   a. Subgrade Embankment or Type I Sand. The deductions

3. The unit price shall also include all costs required to furnish and bond geotextile above and below the geonet.

ITEMS 9 & 10 GEOMEMBRANE - 40 MIL:

1. The unit price bid per square yard for Geomembrane - 40 mil, smooth or textured as specified, shall include all costs for materials, labor, equipment, and tools required to furnish and install the geomembrane in accordance with the Specifications, and Drawings.
2. All costs including but not limited to, penetrations seaming, pressure testing of seams, destructive testing of seams, repair of test areas, repair of areas with material defects or installation defects shall be included in this unit price.
3. The cost of furnishing and placing bentonite required at penetrations shall be included in these bid items.

ITEM 11 BENTONITE MAT:

1. The unit price bid per square yard shall constitute full compensation for all labor, material and equipment necessary to furnish and install Bentonite Mat in areas without existing interim cover, under ditches, roads and sedimentation basins, as specified, and as shown on the Drawings or Specifications.
2. All costs of overlapping, splicing or anchoring of bentonite mat in accordance with Manufacturers recommendations shall be included in this unit price and no additional compensation or measurement for payment for these items will be made.
3. No measurement or payment will be made for Bentonite Mat placed in areas receiving Type "B" Cover which had existing interim cover.
4. Costs for extra Bentonite Mat are to be included with separately bid items (e.g. Outlet Structure) and will not be included under this bid item.

ITEM 12 LOW PERMEABLE SOIL FOR FINAL COVER TYPE 'A':

1. The unit price bid per square yard shall constitute full compensation for all labor, materials, and equipment required to prepare the surface of the existing low permeable soil, in its existing position, as shown on the Drawings and as directed in these Specifications.

2. The cost of removing existing topsoil above the existing low permeable soil shall be included in a separate bid item.

ITEM 13 LOW PERMEABLE SOIL FOR FINAL COVER TYPE 'B':

1. The unit price bid per square yard shall constitute full compensation for all labor, materials, and equipment required to excavate the existing low permeable soil, haul, temporarily stockpile, place, compact, and prepare the surface of the low permeable material as shown on the Contract Drawings and as directed in these Specifications.
2. When Bentonite Mat or imported low permeable material is used in lieu of existing low permeable material, in areas which had interim cover, due to the Contractor's failure to excavate or protect sufficient quantities of the material, all labor, materials, and equipment required to furnish, deliver and place the Bentonite Mat or imported low permeable material will be incidental to the work. No additional measurement or payment for the Bentonite Mat or imported low permeable soil will be made.

ITEM 14 HYDROSEEDING:

1. The unit price bid per acre for Hydroseeding shall constitute full compensation for all materials, labor and equipment required to hydroseed the areas shown on the Drawings or specified in the Specifications.
2. All costs of furnishing, placing, and maintaining temporary clear plastic sheeting on slopes following hydroseeding, as necessary, shall be included in this bid item.
3. All costs of sampling and testing of existing and imported topsoil to determine fertilizer needs are to be included in this bid item.

ITEM 15 PROCURE AND DELIVER SUBGRADE EMBANKMENT MATERIALS:

1. The unit price per ton, less a weight deduction for excess moisture and scale check differences, shall constitute full compensation for all labor, materials, and equipment required to procure and deliver, dump and spread subgrade embankment materials to locations and grades indicated in the Contract

will be made based on material samples taken at the entrance to the landfill site. No provisions for adding weight will be made for drier materials.

The amount of weight deduction for excess moisture will be made as follows:

a. Compaction curves per ASTM D698 shall be developed by the Geotechnical Engineer for each suitable borrow source of Subgrade Embankment or Type I Sand proposed by Contractor. These tests shall be completed for each borrow area in advance of any materials being brought onto the site from that borrow source.

b. The optimum moisture content per ASTM D698 shall serve as a basis for weight deductions for borrow source materials brought onto the site. No deduction will be made up to plus-two percent (+2%) by weight moisture above optimum moisture content in materials with more than 50 percent gravel or rock. No deduction will be made up to plus-four percent (+4%) by weight moisture above optimum moisture content in of Subgrade Embankment with less than 50 percent gravel or rock.

c. Moisture content shall be determined by the Geotechnical Engineer of representative samples of Subgrade Embankment or Type I Sand brought onto the site each day. Compaction check points (ASTM D698) will be carried out for each material type so that the moisture sample can be matched to the appropriate compaction curve.

d. The moisture content tests shall be by microwave oven method ASTM D4643 or over drying method ASTM D2216. The moisture content results from the nuclear test method shall be periodically calibrated using ASTM D2216 run on split samples.

e. A minimum of 1 moisture content test per 150 trucks or 1 test per 3,000 tons of material will be carried out. Additional, more frequent, moisture content and check point determinations will be carried out as determined by the Geotechnical Engineer. Moisture content test results for each material for each borrow source shall be averaged over a 24 hour period of work.

f. The average moisture content for each material for each borrow source for each day will be compared to the

allowable moisture content in (b) above. The amount over the allowable percentage is the excess percentage (by weight) of moisture. The deduction shall be the excess weight of water calculated by multiplying the excess percentage (decimal) of moisture by the corresponding total weight of each material brought onto the site for that day. The final determination of the excess weight of water deduction shall be made by the Geotechnical Engineer. During construction, all records supporting this determination will be available for inspection by Contractor.

4. For Items specified to be measured by a **length** unit (e.g. lineal or vertical foot), pay length will be measured along the line and grade of the item involved as actually placed and accepted.

5. Where **lump sum** is the specified pay unit, complete payment for the work described to be done, completed and accepted, without further measurement will be used. The Contractor shall furnish a Schedule of Values in accordance with Section 01370 of this Specification if partial payment is desired by Contractor.

C. No measurement will be made for:

1. Work performed or materials placed outside of lines indicated in the plans or established by the Engineer.

2. Materials wasted, used, or disposed of in a manner not called for under the contract.

3. Rejected materials (including material rejected after it has been placed, if the rejection is due to the contractor's failure to comply with the provisions of the contract).

4. Hauling and placement of materials from or to interim stockpiles.

5. Hauling and disposing of rejected materials.

6. Material on hand after completion of the work.

7. Any other work or material when payment is contrary to any provision of the contract.

1.3 ESTIMATED QUANTITIES (UNIT PRICE ITEMS)

A. The estimated quantities shown in the Bid Forms are estimates only, being given only as the basis for the comparison of Bids, and Metro does not warrant, expressly or by implication, that the actual amount of work will correspond therewith. The right to increase or decrease the amount of any class or portion of the work, or to make changes in the work required as may be deemed necessary is reserved by Metro as provided elsewhere in these specifications. The basis of payment will be the actual unit bid items of Work performed and measured in accordance with the contract. All prospective Bidders should note that certain bid items may be included in the Bid Form to establish a unit price should use of those items become necessary during construction. Allowance will not be made for loss of anticipated profits or additional compensation should the use of these items be deemed unnecessary.

1.4 PAYMENT FOR LUMP SUM ITEMS

A. Payment for work items designated by Lump Sum units shall be in accordance with Article 9 of the General Conditions.

1.5 PAYMENT FOR UNIT PRICE ITEMS

A. Payments to be made to the Contractor will be made as set forth in Article 9 of the General Conditions and according to the unit price schedule provided in Section 00300.

1.6 PAYMENT FOR MATERIAL STORED OFF SITE

A. Refer to Article 9 of the General Conditions.

1.7 DESCRIPTION OF BID ITEMS

A. GENERAL:

1. Payment will be made only under those items listed in the Schedule at Bid Prices, Section 00300 All other items required for the work where a specific bid item was not provided shall be considered incidental to the project and all costs are to be included with the listed Schedule of Bid Prices.

2. Where common materials are used in several applications, payment shall be made under each specific bid item unless specifically stated otherwise. For example, Type I Sand may be used as gas well backfill material, bedding for pipes or as the protective material above the final cover geosynthetics. Hence, the cost of furnishing, delivering, placing sand as well backfill material shall be included in the price bid for the well installation.

1.8 DESCRIPTION OF BASE BID ITEMS:

ITEM 1 MOBILIZATION:

1. This item shall consist of preconstruction costs of preparatory work and operations performed by the Contractor, including, but not limited to, those necessary for the movement of his personnel, equipment, supplies and incidentals to the project site; for the establishment of his offices, buildings and other facilities necessary for work on this project; for premiums on bonds and insurance for the project and for work and operations which he must perform or costs he must incur before beginning production work on the various items on the project site. Mobilization costs for all subcontracted work shall be considered to be included.
2. Items which are not to be included in this item include, but are not limited to:
   a. Any portion of the work covered by a specific bid item or incidental work which is to be included in a bid item or items.
   b. Profit, interest on borrowed money, overhead or management costs.
3. The lump sum price bid for "Mobilization," partial payments will be made as follows:
   a. When 5% of the total original contract amount is earned from other bid items, 50% of the amount bid for mobilization, or 5% of the total original contract amount, whichever is the least will be paid.
   b. When 10% of the total original contract amount is earned from other bid items, 100% of the amount bid for mobilization, or 10% of the total original contract amount, whichever is the least, will be paid.
   c. Upon completion of all work on the project, payment of any amount bid for mobilization in excess of 10% of the

total original contract amount will be paid.

ITEM 2 SITE SAFETY AND HEALTH PROGRAM:

1. The lump sum price bid for the Site Safety and Health Program shall constitute complete compensation for the investigation of existing conditions and potential hazards, preparation of all required safety and health program elements and implementation of the approved Program throughout the course of the contractors work on the landfill site.

ITEM 3 EXISTING TOPSOIL REMOVAL:

1. The unit price bid per cubic yard for Existing Topsoil Removal shall be full compensation for removing all existing topsoil above the existing low permeable soil at the Landfill in those areas requiring Type A or B cover placement.
2. This bid item shall specifically include, but not be limited to, all costs of excavating, hauling to temporary stockpile, interim erosion control measures at disturbed areas and stockpile(s), hauling from temporary stockpile and placement at final cover locations, restoration of interim cover in area of stockpile or haul roads if disturbed.
3. Imported Topsoil, bid separately, will supplement Existing Topsoil removal only if existing topsoil quantities are not sufficient to achieve Final Cover requirements. Prior approval by the Engineer will be required to import topsoil.
4. Measurement for payment will be made for existing topsoil removal in its original position based on preconstruction and post removal topographic surveys by the Engineers.

ITEM 4 IMPORTED TOPSOIL:

1. The unit price bid per cubic yard for Imported Topsoil shall be full pay for loading, hauling, stockpiling, placing, spreading, processing and compacting Imported Topsoil as indicated on the Drawings or in the Specifications.
2. All costs of testing to verify that all requirements are satisfied for Imported Topsoil are to be included in this bid item.
3. Contractor shall obtain prior approval from Engineer before supplying Imported Topsoil. The use of Imported Topsoil shall supplement Existing Topsoil, as bid separately.

ITEM 5 PROCURE AND DELIVER TYPE I SAND MATERIALS:

1. The unit price per ton, less a weight deduction for excess moisture and scale check differences, shall constitute full compensation for all labor, materials, and equipment required to procure, deliver and dump Type I Sand materials above the geomembrane/geonet composite as indicated in the Contract Documents.
2. Alternative methods of measurement (other than scales) will be considered by Metro if methods of conveyance to the site other than highway legal trucks are proposed by Contractor.
3. The costs for grading, placing and compacting Type I Sand material are not included in this bid item.
4. The costs for temporary protection of materials prior to and after placement is included in this bid item.
5. All costs for Type I Sand used in other applications (e.g. gas wells, pipe bedding, casing backfill, etc.) shall be included with those other bid items and shall be excluded from this bid item.

ITEM 6 PLACE TYPE I SAND:

1. The unit price per cubic yard shall constitute full compensation for all labor and equipment required for grading and placing Type I Sand materials above the geomembrane/geonet composite in accordance with the Contract Documents.
2. All costs for compaction of Type I Sand are considered incidental to this bid item.
3. The cost of the Type I Sand material has been included in a separate bid item.
4. The cost of placing Type I Sand material in other applications (e.g. gas wells, pipe bedding, casing backfill, etc.) shall be included with those other bid items and shall be excluded from this bid item.

ITEMS 7 & 8 GEONET COMPOSITE:

1. The unit price bid per square yard for Geonet Composite, Type A or B, shall include all costs for materials, labor, equipment, and tools required to furnish and install the Geonet Composite in accordance with these Specifications, and Drawings.
2. All costs associated with furnishing and placing perforated PVC pipe at ditch locations above the geonet composite are to be paid under separate bid items.

Documents.

2. Alternative methods of payment will be considered by Metro if methods of conveyance to the site other than highway legal trucks are proposed by Contractor.
3. The costs for grading and compacting material to subgrade contours are not included.
4. The costs for temporary protection of materials prior to and after placement is included in this bid item.
5. The cost of subgrade embankment used in applications other than for achieving the required grading plan shall be excluded from this bid item and shall be paid under separate bid item as applicable.

ITEM 16: COMPACT SUBGRADE EMBANKMENT:

1. The unit price per cubic yard shall constitute full compensation for all labor and equipment required for grading and compacting subgrade embankment materials to achieve subgrade contours in accordance with the Contract Documents.
2. All costs for rough grading to the subgrade contours, establishing surface drainage and erosion control features (except as separately bid), and compaction are considered incidental to this bid item.
3. The cost of the subgrade embankment material has been included in a separate bid item.
4. The cost of excavation and disposal of refuse necessary to provide a 1 foot minimum thickness of subgrade embankment below Type B low permeable soil shall be included in this bid item.

ITEM 17 ROADWAY EMBANKMENT:

1. The unit price bid per cubic yard shall constitute complete payment for all labor, materials, and equipment necessary to furnish, place and compact Roadway Embankment materials to the lines and grades and sections shown on the Drawings and as directed in these Specifications.

ITEM 18 CRUSHED SURFACING BASE COURSE:

1. The unit price bid per cubic yard shall be complete payment for all labor, materials, and equipment necessary to furnish, place and compact Crushed Surfacing Base Course as indicated on

the Drawings and as directed by the Specifications.

ITEM 19 REMOVE EXISTING CULVERTS:

1. The unit price bid per each shall constitute full compensation for all labor, materials, and equipment required to excavate to, remove, and dispose of each culvert and to backfill and install Bentonite Mat, as directed in these Specifications.

ITEM 20 EXCAVATION FOR SEDIMENTATION BASIN:

1. The unit price bid per cubic yard shall constitute full compensation for Excavation for Sedimentation Basin shown on the Drawings. All labor, materials and equipment shall be included in this unit price with no additional compensation allowed.
2. The cost of all work associated with temporary control of leachate flow at basin excavations shall be included in this bid item. Leachate shall be disposed in the leachate collection system in SA-5.
3. Excavated material shall be disposed on-site at Subarea 4 or as directed by the Engineer. All costs for this disposal, including hauling, shall be included in this bid item.

ITEMS 21 - 22 CORRUGATED METAL PIPE (CMP) CULVERTS:

1. The unit price bid per linear foot for CMP culverts, size as specified, shall constitute full compensation for all labor, materials and equipment required to provide, deliver, and place CMP, bedding, backfill, and CMP Connections to other pipe sections and riser in accordance with the Drawings and Specifications.
2. All labor and equipment required for excavation and compaction shall be included in this bid item.
3. Storm Drain Manholes, Parshall Flume will access manhole and outlet structure are paid under separate bid items.

ITEMS 23 - 25 PERFORATED PVC UNDERDRAIN PIPE:

1. The unit price bid per linear foot, size as specified, shall constitute full compensation for all labor, materials, and equipment required to furnish, deliver, and place either perforated PVC underdrain collection or transfer pipe.

2. The cost to furnish, deliver, and place drain rock, geotextile above the drain rock, fittings, and cleanouts associated with the underdrain collection pipes shall be considered incidental to the work.
3. The cost to excavate for and furnish, deliver, and place bedding material, backfill material, fittings, and bentonite dams associated with the underdrain transfer pipes shall be considered incidental to the work. The cost of excavation and disposal of refuse, where required, shall be included int his bid item.

ITEM 26 OUTLET STRUCTURE:

1. The unit price bid per each Outlet Structure shall constitute full compensation for all labor, materials and equipment required to furnish, deliver and place forty-eight inch diameter CMP riser, overflow structure, galvanized steps, concrete support slab, sand bedding and six-inch perforated CMP drain pipe in accordance with the Drawings and Specifications.
2. The cost of the CMP outlet pipes, Storm Drain, Manholes and Parshall Flume with Access Manhole will be paid under separate bid items for these materials.
3. The cost of installing Type 1 geotextile and the perforated CMP drain pipe, extra bentonite mat and geomembrane layers under the Outlet Structure as detailed on the Drawings shall be included in this Bid Item.

ITEM 27 STORM DRAIN MANHOLE:

1. The unit price bid per each shall constitute full compensation for all labor, materials and equipment required to furnish and install Storm Drain Manholes at the locations shown on the Plans.
2. Excavation, bedding material, backfilling and compaction shall be included in this bid item.
3. All costs for the manhole frame and grate are included.
4. All costs of disposal of refuse excavated shall be included.

ITEMS 28 PARSHALL FLUME WITH ACCESS MANHOLE:

1. The unit price bid per each shall constitute full compensation for all labor, materials and equipment required to furnish, deliver and place Parshall Flume with integral access manhole,

concrete support slabs/flume encasement in accordance with the Drawings and Specifications

2. Excavation, bedding, and backfilling shall be included in this bid item.
3. All costs of disposal of refuse excavated shall be included.

ITEM 29 FENCE:

1. The unit price bid per lineal foot for Fence shall include all costs for materials, equipment, labor and tools necessary to install chain link fencing, including access gates, at sedimentation basins according to the Drawings and Specifications.

ITEM 30 QUARRY SPALLS:

1. The unit price bid per cubic yard for Quarry Spalls shall constitute full compensation for all labor, materials and equipment required to furnish, deliver and place Quarry Spalls at locations designated on the Drawings and Specifications.
2. All costs for the geotextile required under Quarry Spalls shall be included in this bid item.

ITEM 31 EROSION CONTROL MAT:

1. The unit price bid per square yard shall constitute full compensation for all labor, materials and equipment required to finish, deliver and place Erosion Control Mat and staking in accordance with the Drawings and Specifications.

ITEM 32 STRAWBALE SEDIMENTATION BARRIERS:

1. The unit price bid per each shall constitute full compensation for all labor, materials and equipment required to establish and maintain temporary strawbale barriers for sedimentation control.

ITEM 33 SEDIMENT FENCING:

1. The unit price bid per lineal foot shall constitute full compensation for all labor, materials and equipment required to establish and maintain temporary sediment fencing for sedimentation control.

1.9 DESCRIPTION OF ALTERNATE No. 1 BID ITEMS:

ITEMS A1 & A2 GAS EXTRACTION WELLS:

1. The unit price bid per vertical foot for Gas Extraction Well, single completion or double completion, shall be full compensation for all labor, tools, equipment, and materials necessary to drill, furnish materials and install the wells, complete in place. Work will include but not be limited to, drilling, installation of well casing and screened intervals and installation of all well backfill materials as described in the Drawings and Specifications.
2. Costs for Mobilization to and from each well location including all costs for temporary access (e.g. crushed rock, wood timber supports, etc.) if required, are to be included with the unit price bid for this item.
3. Also included, but not limited to, are all costs for drilling safety and methods, soil sampling and borehole logging, abandonment of incomplete wells, decontamination, well records, site restoration and waste soil collection and disposal.
4. Cost, for all well materials (e.g. Type I Sand, PVC pipe) are to be included in the unit price bid for this item. No payment for materials used in well installation will be made under any other bid item.
5. In the event abandonment of an incomplete well is necessary due to unforeseen conditions and not the result of poor contractor workmanship, the cost of abandonment will be paid at the unit price bid for this item. Prior approval by the Engineer will be required.

ITEM A3 HORIZONTAL GAS TRENCHES:

1. The unit price bid per linear foot for Horizontal Gas Trenches shall constitute full compensation for all labor, material, tools, and equipment necessary for installing the gas trench as shown on the plans and as specified.

2. All costs associated with trenching through refuse, solid or perforated HDPE pipe and fittings, bedding, Type 1 Geotextile placement, backfill and compaction are to be included in the unit cost for this item with no additional compensation allowed.
3. The cost of disposal of excavated refuse shall be included in this bid item.
4. All costs necessary to excavate existing low permeable soil in the trench zone, temporarily stockpile and replace a minimum 12" depth as backfill in the upper trench zone shall be included in this bid item. Costs for protection of the low permeable soil from contamination and compaction of the low permeable soil in the trench zone are to be included in this bid item.

ITEMS A4 - A6 WELLHEAD COMPLETIONS:

1. The unit price bid per each shall constitute full compensation for all labor, materials, tools and equipment necessary to furnish and install Wellhead Completions of the type specified.
2. This item shall include all costs for PVC or HDPE piping and fittings, valves, monitoring ports, pipe support at well completion, connections to vertical gas extraction wells or horizontal gas trenches and gas manifold piping, all as shown on the Drawings.
3. The cost of vertical gas extraction wells, horizontal gas trenches, gas manifold piping and adjustable pipe supports is specifically excluded from this bid item and will be paid under those separate bid items.

ITEMS A7 - A9 HDPE-LFG:

1. The unit price bid per linear foot for above-grade HDPE Gas System Piping and Fittings, size as noted, shall include all labor, material, tools, and equipment necessary for its installation.

ITEM A10 HDPE-C (BURIED):

1. The unit price bid per linear foot for buried HDPE Condensate System Piping and Fittings, size as noted, shall include all labor, material, tools, and equipment necessary for its installation.
2. All costs associated with trenching, bedding, backfill and compaction are to be included in the unit cost for this item with no additional compensation allowed.

ITEM A11 PVC-V (BURIED):

1. The unit price bid per lineal foot for buried PVC Vacuum System Piping and Fittings, size as noted, shall constitute full compensation for all labor, material, tool and equipment costs necessary for its installation.
2. All costs associated with trenching, bedding, backfill and compaction are to be included in the unit cost for this item with no additional compensation allowed.

ITEM A12 PVC-D (BURIED):

1. The unit price bid per linear foot for buried PVC Condensate and Vacuum Pump Discharge Piping and Fittings, size as noted, shall include all labor, material, tools, and equipment necessary for its installation.
2. All costs associated with trenching, bedding, backfill and compaction are to be included in the unit cost for this item with no additional compensation allowed.

ITEMS A13 - A15 D.I. CASING:

1. The unit price bid per linear foot for Ductile Iron Casing, size as noted, shall be full compensation for all labor, tools, equipment, and materials necessary to furnish and install the casing pipe at locations shown on the Drawings where gas system piping crosses an access road.
2. All costs for D.I. Casing trenching and backfilling, furnishing and placing (blowing) sand into the annular space to immobilize the condensate or vacuum pipes, furnishing and installing wooden blocking banded to the condensate or vacuum pipe with stainless steel clamps shall be included in this bid item.
3. Specifically excluded shall be the cost of the condensate or vacuum piping to be placed through the D.I. casing and it shall be paid under separate bid item described elsewhere.

ITEMS A16 - A20 PIPE SUPPORTS/GUIDES/ANCHORS/BOLLARDS:

1. The unit price bid per each for Adjustable Pipe Supports, Pipe Guides (G2), Adjustable Pipe Supports with Guides (G1), Pipe Anchors and Bollards shall be full compensation for all labor, materials, tools and equipment necessary for their installation

as shown on the Drawings.

2. Specifically included, but not limited to, are all costs for concrete footings or piers, reinforcing steel, steel pipe, paint, galvanizing, channel, angle iron, pipe clamps, U-bolts and miscellaneous fittings and hardware.
3. The cost of gas piping and associated fittings are to be paid under separate Bid Item.
4. Specifically excluded are all costs for Supports/Guides/Anchors/Bollards which are within the Bid Limits for the Vacuum Pump Stations, Remote Condensate Pump Stations and Wellhead Completions or other bid limits as applicable.

ITEM A21 EXPANSION JOINT:

1. The unit price bid per each shall constitute full compensation for all labor, equipment and materials necessary to furnish and install Expansion Joints of the size specified as indicated in the Drawings and Specifications.

ITEMS A22 & A23 VALVES:

1. The unit price bid per each for Butterfly, Gate or Check Valves; Worm Gear, Lever or Handwheel Operated; size as noted, shall be per valve installed and shall include all labor, tools, and equipment necessary for installation.

ITEM A24 VACUUM VALVE STATIONS:

1. The unit price bid for Vacuum Valve Station will be per each vacuum valve station installed. Payment will be from the HDPE-to-stainless steel flange break as shown on the Drawings and shall include, but not limited to, furnishing and installing the following specific items:

    a) All piping and fittings between the "HDPE-to-stainless steel" flange break at the gas collection manifold and the condensate collection manifold.
    b) Two 1/2 inch stainless steel ball valves as shown on the Plans.
    c) 3/16 or 1/2 inch stainless steel tubing with fittings and valves as shown on the Plans.
    d) One APCO model 65.5 air release valve.

e) One meter box with gravel bedding.

ITEM A25 VACUUM PUMP STATION:

1. Payment for Vacuum Pump Station shall be per each, lump sum, and shall be full compensation for all materials, labor, and equipment required to install the vacuum pump station as per the Drawings and Specifications, including, but not limited to, furnishing and installing the following specific items:

   a) All piping, fittings, supports, guides, and valves within the vacuum pump station and between the vacuum pump station and the condensate collection tank as shown on the Plans.
   b) One Vacuum Reserve Tank System
   c) Two Condensate Discharge Pumps, including concrete slab.
   d) One Condensate Collection Tank, including concrete foundation.
   e) One Vacuum Pump Station Roof Structure, including concrete slab. Cost of enclosure design (if required) shall be included.
   f) All other piping, tubing, electrical tracing, and all other appurtenances as described in these specifications and on the Plans
   g) All costs for electrical equipment and conductors associated with this Pump Station shall be included in this bid item.

ITEM A26 REMOTE CONDENSATE PUMP STATION:

1. Payment for Remote Condensate Pump Station shall be per each, lump sum, and shall be full compensation for all materials, labor, and equipment required to install the remote condensate pump station as per the Drawings and Specifications, including, but not limited to, furnishing and installing the following specific items:

   a) All piping, fittings, supports, guides, and valves between the condensate discharge pumps and the condensate collection tank as shown on the Plans.
   b) Two Condensate Discharge Pumps including concrete slab.

c) One Condensate Collection Tank including foundation.
d) All other piping, tubing, electrical tracing, and all other appurtenances as described in these specifications and on the Plans.
e) All costs for electrical equipment and conductors associated with this Pump Station shall be included in this bid item.

ITEM A27 & A28 CONDENSATE DRIP LEG FITTINGS:

1. The unit price bid per each for Condensate Drip Leg Fittings shall be full compensation for all labor, material, tools, and equipment necessary for fabricating and installing the condensate drip leg fittings as shown on the Drawings.

ITEM A29 CONDENSATE CLEANOUTS:

1. The unit price bid per each for Condensate Cleanouts shall be full compensation for all labor, tools, equipment and materials required for the installation.
2. Specifically included, but not limited to, are all costs for riser pipe, fittings, monitoring port, vault with cover, drain rock and polyfoam board inside vault.

ITEM A30 & A31 ELECTRICAL DUCT BANK:

1. The unit price bid per linear foot for buried Electrical Ductbank, type as specified, shall be full compensation for all labor material, tools, and equipment necessary for installing the ductbank.
2. All costs associated with trenching, bedding, backfill and compaction are to be included in the unit cost for this item with no additional compensation allowed.
3. Specifically included but not limited to, are all costs of furnishing and installing PVC electrical ducts, select backfill or Type I Sand or concrete bedding and handholes including PVC-coated steel elbow fittings.
4. Excluded are all costs of the electrical service, all electrical conductors, Pump Station electrical equipment, etc.

ITEM A32 ELECTRICAL SERVICE:

1. The lump sum price bid for Electrical Service shall constitute

full compensation for all materials, labor and equipment required to provide and install the electrical service for SA-1 Closure Improvements.

2. All costs for electrical service conduits(s), service equipment, service connection(s), metering and service conductors shall be included in this bid item to provide an electrical service, complete, tested, ready to use.

3. Specifically excluded, but not limited to, are all costs for conduit, conductors, electrical equipment located beyond the service equipment mounting rack in the SA-1/Power Line Corridor project area. These costs shall be identified with each of the separate bid items as appropriate.

ITEM A33 TEMPORARY 4" PVC GAS PIPING:

1. The unit bid price per linear foot for Temporary 4" PVC Gas Collection Piping shall be full compensation for all labor, tools, equipment, and materials necessary to furnish the temporary 4" PVC Gas Collection pipe as directed by the Engineer and these Specifications.

ITEM A34 TEMPORARY 2" PVC CONDENSATE DISCHARGE: PIPING

1. The unit bid price per linear foot for 2" PVC Condensate Discharge Piping shall be full compensation for all labor, tools, equipment and materials necessary to furnish and install the temporary condensate piping as directed by the Engineer and these Specifications.

ITEM A35 TEMPORARY CONDENSATE MANHOLE:

1. The unit price per each for the Temporary Condensate Manhole shall be full compensation for all labor, tools, equipment, and materials necessary to furnish and install the temporary condensate manhole as directed by the Engineer and these Specifications.

ITEM A36 TEMPORARY GAS FLARE:

1. The unit price per each Temporary Gas Flare shall be full compensation for all labor, tools, equipment and materials necessary to furnish, install, transport, and reinstall the

Temporary Gas Flare, including foundations, as indicated on the Plans and as directed by the Engineer and these Specifications.

ITEM A37 LABORERS FOR TEMPORARY SYSTEM CONSTRUCTION:

1. The unit price per hour for the Laborers for Temporary System Construction shall be full compensation for help to assist the Owner, as required, with the installation of the Temporary Gas Collection System as directed by these Specifications.

ITEM A38 OPERATOR AND EQUIPMENT FOR TEMPORARY SYSTEM CONSTRUCTION

1. The unit per hour for Operator and Equipment for Temporary System Construction shall be full compensation for all labor, tools, equipment, and materials necessary to transport the Temporary 4" PVC gas collection piping as directed by the Owner and these Specifications.

*** * * END OF SECTION * * ***

SECTION 01041

PROJECT COORDINATION

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Separate Contracts: Article 6 General Conditions
B. Subcontractors: Article 4 General Conditions
C. Work Under Separate Contracts: Section 01010
D. Job Site Administration: Section 01043
E. Field Engineering: Section 01050
F. Preconstruction Conferences: Section 01210
G. Progress Meetings: Section 01220
H. Shop Drawings, Project Data and Samples: Section 01340

1.2 POLICY IN PRACTICE

A. Engineer is Metro's Advisor and Consultant:

1. Inspection and Testing Laboratories are to furnish data and guidance only and may make no decisions involving changes in the Contract.

2. All job located questions or problems shall be handled through the Resident Engineer/Construction Manager.

B. Metro's desires and instructions will be channeled through the Engineer regarding all phases of the Contract.

C. Contract related communication from Contractor shall be handled through the Engineer.

D. Coordination of all Subcontractors is the responsibility of the Contractor.

E. Documents of the Contract are directed to the Contractor and not the Subcontractors involved.

F. The Contractor is solely responsible for construction methods and the results thereof regardless of any advice, information, methodology or scheduling unless such advice, methodology or scheduling is written

into the Contract or given in writing by the Engineer or Metro.

G. Metro is solely responsible for approving and all changes to the Contract Documents. All such changes will be provided in writing via a Contract Change Order.

1.3 COORDINATION OF TRADES AND SUBCONTRACTORS

A. Coordination is the responsibility of the Contractor. He shall assure coordination with suppliers, electrical contractors, mechanical contractors and all trades to the end that:

1. All necessary equipment, work and structures are scheduled, installed and tested in proper sequence.

2. He shall assure that electrical and mechanical equipment, wiring and control equipment, piping and plumbing, grading and landscaping and all problems of supply, installation and scheduling are coordinated and that the relations of all elements are carried out in an orderly manner in accordance with the Contract.

3. Contractor shall coordinate all suppliers of equipment, controls and electrical supplies before submittal of shop drawings.

1.4 COORDINATION OF UTILITIES

A. Contractor shall schedule and supply utilities as required in the Contract.

1.5 PUBLIC AGENCIES

A. Contractor shall coordinate his schedule and activities with Metro, the Engineer and various agencies involved as the necessity arises and as required by the Contract:

1. Power
2. Water
3. Sewer
4. Electrical
5. Other Utilities

6. Police
7. Fire
8. Schools
9. County
10. City
11. State
12. Other Public Agencies

*** * * END OF SECTION * * ***

SECTION 01041

PROJECT COORDINATION

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Separate Contracts: Article 6 General Conditions
B. Subcontractors: Article 4 General Conditions
C. Work Under Separate Contracts: Section 01010
D. Job Site Administration: Section 01043
E. Field Engineering: Section 01050
F. Preconstruction Conferences: Section 01210
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2. He shall assure that electrical and mechanical equipment, wiring and control equipment, piping and plumbing, grading and landscaping and all problems of supply, installation and scheduling are coordinated and that the relations of all elements are carried out in an orderly manner in accordance with the Contract.

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2. Water
3. Sewer
4. Electrical
5. Other Utilities
6. Police
7. Fire
8. Schools
9. County
10. City
11. State
12. Other Public Agencies

*** * * END OF SECTION * * ***

SECTION 01043

JOB SITE ADMINISTRATION

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Supervision: Article 2, General Conditions
B. Summary of Work: Section 01010
C. Project Coordination: Section 01041
D. Temporary Electricity: Section 01511
E. Temporary Water: Section 01515
F. Protection and Maintenance of Work and Property: Section 01545

1.2 REMOVAL OF DEBRIS, CLEANING, ETC.

A. Equipment, walls and floors shall be left clean and free of stains, paint or roofing splashes or other mars or defects.

B. Upon completion, the site of all work or equipment and material storage areas shall be restored to substantially their original condition.

1.3 TESTS

A. Where the Specifications require work to be specifically tested or reviewed, it shall not be tested or covered up without timely notice to the Engineer of its readiness for inspection, unless the Engineer waives such notice.

B. Should any such work be covered up without such notice, approval or consent, it must, if required by the Engineer, be uncovered for examination at the Contractor's expense.

C. Where work is to be tested, all necessary equipment shall be set up and the work given a preliminary test so that any and all defects may be discovered and repaired prior to calling out the Engineer for the "record" test.

1.4 COMMENCEMENT OF WORK ON PUBLIC AND PRIVATE RIGHT-OF-WAY

A. Work shall not be started on any public or private right-of-way until clearance is given the Contractor by the Engineer.

B. It will be the responsibility of the Contractor to comply with any special requirements of any permits or easements acquired by Metro for the project

*** * * END OF SECTION * * ***

SECTION 01050

FIELD ENGINEERING

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Job Site Administration: Section 01043
B. Construction Schedules: Section 01310

1.2 GENERAL REQUIREMENTS

A. The Contractor shall protect and preserve in their original position all stakes, points, or marks set for the work.

B. If any stakes and markings are destroyed or defaced by the Contractor's operations before their use is ended, the full cost of replacing them will be at the Contractor's expense.

C. Working operations shall be suspended at different points for such brief and reasonable time as may be required for giving of lines and grades, taking measurements and making inspections. Such delays shall be considered incidental to the Contract and no additional compensation will be allowed.

D. Any claim by the Contractor for extra compensation by reason of alterations or reconstruction work allegedly due to error in the Engineer's staking, will not be allowed unless the original control points set by the Engineer still exist, or unless other satisfactory substantiating evidence to prove the error is furnished to the Engineer.

E. The Contractor shall transfer lines and grades from the control points given to his own work at his own expense.

1.3 PRECONSTRUCTION SURVEY BY ENGINEER

A. Preconstruction survey will be performed by the Engineer to include the following:

1. Survey Control Points

2. Existing Site Contours

1.4 CONSTRUCTION STAKING BY ENGINEER

A. The Engineer will provide the following construction stakes:

1. Survey Control Points will be established at four (4) locations for the Contractors use. Each point will establish horizontal and vertical control for the project. The four Survey Control Points will be located as follows:
   - Sta #7 (see Sheet 3 of Plans)
   - Sta #8 (see Sheet 3 of Plans)
   - North most BPA tower footing
   - Center BPA Tower footing (south of SA-1 project limits)

2. An AutoCAD file will be provided to the Contractor for the grading plan (Sheet 5 of Plans) to enable the Contractors surveyor to obtain additional detailed control information necessary for the successful completion of the grading plan.

B. Surveys will be performed by the Engineer in conjunction with appropriate unit price bid items which require final volumetric measurement. Refer to Section 01025. The timing of these surveys will vary with Contractors work schedule. The Engineer will provide surveys for the following final quantity measurements:

1. Existing Topsoil Removal

2. Compact Subgrade Embankment

Additional surveys may be performed by Engineer where necessary. Contractor will make measurements as required for interim progress payments.

1.5 CONSTRUCTION STAKING BY CONTRACTOR

A. Contractor will provide and pay for all survey and field engineering services except as provided by the Engineer.

B. Contractor will record changes in location or layout of permanent features or structures on the Project Record Documents.

C. Staking when performed by Contractor shall be done by qualified

licensed surveyors. Prior to the Contractor conducting any survey work, the Contractor shall submit to Metro evidence of the qualifications of the person(s) he will assign to do the survey work for the project. Metro reserves the right to disallow the person(s) selected by the Contractor for surveying if, in Metro's opinion, the person is not qualified to do the work. The Contractor shall selected another surveyor and submit qualifications to Metro until a qualified person is approved by Metro.

D. Control points shall be utilized by the Contractors surveyor to stake out the project. The Engineer will provide the Contractor with a copy of survey field notes, when appropriate.

E. The Contractor shall provide the Engineer with a copy of all field notes including references to control points or other features. Notes shall be submitted tothe Engineer as quickly as possible following the staking, but in no case longer than 2 days after staking is completed. The Contractor shall provide the Engineer with copy of grade sheets, prior to construction work on any specific portion of the project.

*** * * END OF SECTION * * ***

SECTION 01070

ABBREVIATIONS AND SYMBOLS

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Definitions: General Conditions

1.2 ABBREVIATIONS

A. Whenever the following abbreviations are used on the plans, specifications, proposals, and contracts, they shall be construed to mean the words and terms as listed below.

B. Duplicate definitions shall be interpreted in context of use.

A

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AITC	American Institute of Timber Construction
AGA	American Gas Association
AGC	Associated General Contractors of America
AGMA	American Gear Manufacturer Association
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association

AREA American Railway Engineering Association

ASAE American Society of Agricultural Engineers

ASCE American Society of Civil Engineers

ASHRAE American Society of Heating, Refrigeration, and Air Conditioning Engineers

ASME American Society of Mechanical Engineers

ASTM American Society for Testing and Materials

AWPA American Wood Preservers Association

AWS American Welding Society

AWWA American Water Works Association

B

BTU British thermal unit

BTUH British thermal units per hour

C

C Centigrade/Celsius

CBMA Certified Ballast Manufacturers Association

CFM Cubic feet per minute

CFS Cubic feet per second

CY Cubic Yard

H

HDPE High Density Polyethylene

HOA Hand-Off-Auto

HP Horsepower

HR Hour

CPM Critical path method

CRSI Concrete Reinforcing Steel Institute

CMP Corrugated Metal Pipe

D

DFP Douglas Fir Plywood Association

DIPRA Ductile Iron Pipe Research Association

DI Ductile Iron

E

EA Each

EEO Equal Employment Opportunity

EPA Environmental Protection Agency (Federal)

F

F Fahrenheit

FED SPEC Federal Specification

FHWA Federal Highway Administration

FPM Feet per minute

FT, FT^2, FT^3 Foot, square feet, cubic feet

G

GA Gage, Gauge

GAL Gallon

GALV Galvanized

GPD Gallons per day

GPH Gallons per hour

GPM Gallons per minute

L

L Length

LB Pounds

LF Linear feet

LS Lump Sum

HT Height

Hz Hertz

I

ID Inside Diameter

IEEE Institute of Electrical and Electronics Engineers

IN, IN^2, IN^3 Inch, square inches, cubic inches

ISA Instrument Society of America

J

JIC Joint Industry Conference of Hydraulic Manufacturers

K

KV Kilovolt

KVA Kilovolt ampere

KVAR Reactive kilovolt amperes

KW kilowatts

KWH kilowatt hours

NESC National Electric Safety Code

NFPA National Fire Protection Agency

NPC National Plumbing Code

NPT National pipe thread

NRS Non-rising stem

NLMA National Lumber Manufacturers Association

M

M Thousand

MA Milliamperes

MBTUH One thousand British thermal units per hour

MGD Million gallons per day

mgl Milligrams per liter

mil One thousandth of an inch

MIN Minute

MSS Manufacturers Standardization Society of the Valve and Fittings Industry

MV Millivolts

MVA Megavolt amperes

N

NAMM National Association of Metal Manufacturers

NBFU National Bureau of Fire Underwriters

NEC National Electrical Code

NEMA National Electrical Mauf. Ass.

PVC Polyvinyl chloride

PT Pint

Q

R

RPM Revolutions per minute

S

SAE Society of Automotive Engineers

SCBA Self-contained Breathing Apparatus

SCFM Standard cubic feet per minute

O

OD Outside diameter

OSHA Occupational Safety and Health Act

OZ Ounce

P

PCA Portland Cement Association

pcf Pounds per cubic foot

ph Hydrogen ion concentration

PH Phase

PPM Parts per million

PSF Pounds per square foot

PSI Pounds per square inch

PSIG Pounds per square inch gauge

V

V Volt

VLDPE Very Low Density Polyethlene

W

WCLIB West Coast Lumber Inspection Bureau

WWPA Western Wood Products Association

X

Y

Z

SF Square Foot

SMACNA Sheet Metal and Air Conditioning Contractors National Association

SY Square Yard

SQFT Square foot

SQIN Square inch

SQMI Square mile

SSPC Steel Structures Painting Council

T

T Tons

U

UBC Uniform Building Code

UL Underwriter's Laboratory

UPC Uniform Plumbing Code

*** * * END OF SECTION * * ***

SECTION 01090

REFERENCE STANDARDS

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. All Divisions: As referenced

1.2 AUTHORITY

A. Contractor is responsible to conform to all codes and regulations legally in effect at the location of the project.

B. Contractor shall conform to all requirements and regulations of the authority administering such codes and regulations.

1.3 REFERENCE CODES

A. Contractor shall conform to all codes and sections thereof as may be referred to in the specifications.

B. Referenced codes are, by such reference, incorporated into this Contract as if set forth herein in full.

1.4 SPECIFICATIONS INCORPORATED BY REFERENCE

A. Where Federal, AWWA, ASTM, or any other standard specifications are referred to, or included by reference, the latest issue and/or amendment there to published at the date of issue of the Advertisement for Bids shall be incorporated in the Contract by said reference as if set forth herein in full.

*** * * END OF SECTION * * ***

SECTION 01100

HEALTH AND SAFETY PROGRAM

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. General Conditions - Article 10, Safety and Protection of the Work

B. Section 01400 Contractor Quality Control

C. Section 01220 Progress Meetings

D. Section 02222 Excavating, Backfilling and Compacting for Utilities

E. Section 02150 Shoring

F. Appendix - Site Characterization/Health and Safety Hazards (Marine and Environmental Testing, Inc.)

G. OSHA Regulations and Applicable Oregon Occupational Safety and Health Codes

1.2 SUBMITTALS

A. Contractor will submit to Metro a written Health and Safety Plan no later than 14 days after Notice to Proceed. The Plan must be approved before Contractor begins work. Please refer to the special requirements for hazardous waste operations in paragraphs 1.8 through 1.10.

B. Contractor will submit the name and qualifications of the proposed Site Health and Safety Officer as soon as possible but no later than 14 days after Notice to Proceed. This individual must be approved by Metro and appointed before Contractor begins work.

C. Contractor will submit the names and qualifications of first aid trained personnel who will be available for administering first aid on each shift prior to beginning work. Include a list of first aid equipment available. Coordinate with and provide contact information for local health and safety agencies as follows:

1. Emergency Medical Treatment and Evacuation

2. Hospital

3. Fire Department
4. Law Enforcement

D. Contractor will develop a detailed activity hazard analysis on each new phase of work prior to the start of work on that phase. This is in addition to the more preliminary hazard analysis included in the Health and Safety Plan. These hazard analyses will be reviewed with Metro and upon approval become a part of the Health and Safety Plan.

E. Furnish reports of weekly tool box safety training as completed.

1.3 HEALTH AND SAFETY LAWS AND REGULATIONS, AND REQUIREMENTS FOR HAZARDOUS WASTE OPERATIONS

A. The St. Johns Landfill is classified as a sanitary landfill. Most of the work involved in the project falls under OSHA and Oregon OSHA rules pertaining to ordinary construction, and Contractor shall conform to such rules when completing ordinary construction tasks. Some of the tasks involve the possibility of exposure to known and unknown materials that may be considered hazardous substances. These tasks include, but are not limited to,

1. Work around vertical gas collection wells and water monitoring wells.

2. Intentional excavation and work in refuse such as excavation of the horizontal gas trenches and laying gas collection pipe, excavation for manholes, sedimental basin, culverts, flume, etc.

3. Minor excavation of refuse during grading operations

4. Diversion, removal and disposal of leachate.

For this type of work, Contractor shall ensure compliance with all requirements of the Federal Occupational Health and Safety Act of 1970 (OSHA), as amended including, OSHA 29 CFR Part 1910 Hazardous Waste Operations and Emergency response, Final rule, Oregon Administrative Rules (OAR) 437-02-100 et. seq. and with any other applicable Oregon Industrial Health and Safety provisions as they apply to health and safety provisions for hazardous waste operations, and all other applicable federal, state, county, and local laws, ordinances, codes, the requirements set forth herein, and any regulations that may be specified in other parts of this Contract. If any of these requirements are in conflict, the more stringent requirements shall apply. Contractor's failure to thoroughly familiarize himself with the aforementioned health and safety

provisions shall not relieve Contractor of responsibility for full compliance with the obligations and requirements set forth therein. Where "Hazardous Waste Operations" is mentioned in the regulations listed above, it shall be interpreted in this Specification to include any person potentially exposed to hazards including, but not limited to, landfill gas, landfill gas condensate, asbestos or leachate at the St. Johns Landfill. Contractor is cautioned that the aforementioned OSHA and other referenced regulations require, among other items, the following:

1. A site specific Health and Safety Plan. (Note: This plan is to be written in sufficient detail to satisfy all requirements of OSHA 29 CFR Part 1910.120, and must be submitted for review by Metro prior to start of work on this site.)

2. A Site Health and Safety Officer as described in paragraph 1.5 these Specifications.

3. A provision for Personal Protective Equipment, Level "B" which shall include, at a minimum:
   - ▲ Positive pressure, full-facepiece SCBA or positive pressure supplied-air respirator with escape SCBA.
   - ▲ Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one or two-piece chemical splash suit; disposable chemical-resistant one-piece suit).
   - ▲ Inner and outer chemical-resistant gloves.
   - ▲ Chemical-resistant safety boots/shoes.
   - ▲ Hard hat.
   - ▲ Two-way radio.
4. Medical surveillance exams as described in OSHA 29 CFR Part 1910.120, Paragraph (f).

5. Hazardous Waste Operator Training as described in OSHA 29 CFR Part 1910.120, Paragraph (e).

B. The provisions mentioned above are considered minimum requirements for this project.

1.4 PRESENT SITE CHARACTERIZATION

A. The possibility exists of encountering gases, leachates, asbestos and/or other substances that may be potentially hazardous to the health and safety of personnel during work at the St. Johns Landfill. Tables of known substances and gases at the maximum concentration levels found at the landfill site are included in the Appendix and should be considered in preparing the Health and Safety Program. The information in the

Appendix represents only the substances and gases identified to date. Since other substances and gases may be present and may be found during work pursuant to the Contract, Contractor should consider the possibility of encountering other substances or gases in preparing the Health and Safety Program. Contractor is solely and completely responsible for meeting all applicable laws, regulations and requirements of Paragraph 1.3 above for employee health and safety during the work performed under this Contract. Contractor shall provide all personnel working on the project with required orientation and training on the potential hazards anticipated and the appropriate use of safety equipment.

1.5 CONTRACTOR'S RESPONSIBILITY FOR HEALTH AND SAFETY FOR HAZARDOUS WASTE OPERATIONS

A. Contractor shall have sole responsibility for the safety, efficiency, and adequacy of Contractor's plant, appliances, and methods, and for any damage or injury resulting from their failure, or improper maintenance, use, or operation. Contractor shall be solely and completely responsible for the conditions at the site including health and safety for the authorized persons and property in performance of the Work. This requirement shall be continuous, and shall not be limited to normal working hours. The required or implied duty of the Engineer or Metro to review or approve Contractor's performance or any submittal of Contractor shall not be construed as relieving Contractor of full responsibility for worker safety and compliance with applicable laws, regulations and requirements.

B. Contractor shall observe and comply with all applicable laws, regulations and requirements of Paragraph 1.3, above. Such information, interpretation, or representation of laws, regulations, or ordinances referenced in the Contract Documents shall not take precedence over the law, regulation, or ordinance itself, nor relieve Contractor of responsibility for determining the true current construction and content of such laws, regulations, and ordinances.

C. Contractor shall appoint a Site Health and Safety Officer who has experience in industrial hygiene, such as an Industrial Hygienist certified by the American Industrial Hygiene Association or approved equal and who is qualified by experience and training in hazardous waste operations in accordance with the applicable laws, regulations, and requirements of Paragraph 1.3, above. The Site Health and Safety Officer shall be qualified and authorized to monitor, supervise and enforce compliance with the site Health and Safety Program.

D. Contractor, through his Health and Safety Officer shall be solely responsible for the detection of contaminated gases, soils or liquids.

Contractor shall provide for the protection and the health and safety of all workers and other authorized persons at the job-site from exposure to potentially hazardous substances.

E. Contractor shall be responsible for ensuring that all necessary monitoring equipment, protective clothing, and other supplies and equipment up to the appropriate level of protection as defined by the applicable laws, regulations, and requirements of Paragraph 1.3 above are available to implement the plan. No work shall take place in areas where hazardous substances may potentially be present unless the Site Health and Safety Officer is present and monitoring of the site conditions is accomplished.

F. Contractor, through the Site Health and Safety Officer, shall not permit any employee, in the performance of the Contract, to work under conditions which are hazardous to the employee. Should violations of the health and safety requirements be called to the Site Health and Safety Officer's attention by Metro or Engineer or any authorized representative of a regulatory agency, Contractor shall immediately correct the identified conditions.

G. In the event Contractor fails or refuses to promptly comply with any compliance directive, Metro may issue an order to stop all or any part of the work. When compliance with the directive is accomplished an order to resume work will be issued. Contractor shall not be entitled to any extension of time or any claim for damage or to any additionally compensation for either the directive or the work suspension order. Failure of Metro to order discontinuance of any or all of Contractor's operations shall not relieve Contractor of responsibility for safety.

H. Contractor shall maintain in a manner acceptable to Metro an accurate record of, and shall report to Metro and Engineer, all cases of death, occupational diseases, or traumatic injury to employees or the public incident to the performance of work under this Contract. Records to be kept by the Site Health and Safety Officer shall include as a minimum: daily log; all gas analyses; reports of variances in conditions; report of any illnesses, disease, injury, pulmonary disorder or death to any person on the site.

I. The Site Health and Safety Officer shall immediately notify Metro and Engineer of any emergencies as soon as possible following an incident. The site specific Health and Safety plan must also describe the emergency reporting procedures and actions to be taken in the event of an emergency.

1.6 HEALTH AND SAFETY PLAN FOR HAZARDOUS WASTE AND CONVENTIONAL OPERATIONS

A. Contractor shall develop and implement for the duration of the work on or around the existing landfill a Site Health and Safety Plan for hazardous waste and conventional operations for its employees that is in compliance with the laws, regulations and requirements of Paragraph 1.3 above. The plan shall incorporate the requirements of the applicable laws, regulations and requirements as well as the following items for its employees involved in hazardous waste operations. The items include, as a minimum:

- Site Characterization and Health Risk and Hazard Analysis
- Site Control Measures
- Training
- Medical Surveillance
- Engineering controls, work practices and personal protective equipment
- Monitoring Program
- Informational Program/Hazard Communication Program
- Material Handling
- Decontamination Procedures
- Emergency Response
- Illumination
- Sanitation
- Site Excavation
- Contractors and Sub-Contractors
- Standard operating procedures for health and safety
- Names of key personnel and alternatives responsible for site health and safety
- Personal protective equipment program
- Confined space entry procedures
- Spill containment program

B. In the event the Health and Safety Program implemented for the duration of the work on or around the existing landfill is determined by Metro or a regulatory agency to be inadequate to protect the employees and the public, then such plan shall be promptly modified to meet the requirements of Metro or those regulatory agencies.

1.7 MONITORING FOR HAZARDOUS WASTE OPERATIONS

A. As a part of the Health and Safety Program, Contractor shall perform monitoring so that employees are not exposed to levels which exceed established Permissible Exposure Limits or published exposure levels for hazardous substances.

B. Identification of areas of potentially hazardous substances shall be made through observations and through a continuous ongoing monitoring program designed to detect contaminated air, soil, and surface water.

Contractor shall develop a monitoring program in accordance with the requirements outlined in these Contract specifications that will provide Metro with certain information, as specified herein, that is needed to identify these potentially contaminated areas, as well as to provide information necessary to comply with relevant worker health and safety regulations. Contractor shall require all workers to report any observations of potentially hazardous substances or odors. Such observations will be reported to Contractor's On-Site Monitor who shall be qualified and responsible for conducting a regular monitoring program and to the site Health and Safety Officer.

C. Contractor shall develop as part of the Site Health and Safety Plan a monitoring program that will provide for detection of the presence of potentially hazardous substances during excavation operations. The program shall include, at a minimum, the following elements:

- Instruction of workers in observing and reporting potentially hazardous substances such as refuse, oily sheen or color on soils or water, and oily or chemical odors.
- Monitoring of excavated soils using a portable continuous analyzer, such as an HNU photo-ionization detector (PID), or an approved equivalent to detect the presence of non-methane organic vapors which could indicate chemical contamination. Monitoring devices shall be capable of detecting 0.1 ppm benzene and shall be calibrated daily by qualified personnel.
- Periodic monitoring with a combustible gas indicator such as an MSA Model 361, or an approved equivalent with both audible and visual alarms during operations where the soil surface is being disturbed or when work is being performed below ground level. Calibrate the instrument in accordance with manufacturer's instructions prior to use. Set audible alarm at 10 percent LEL (lower explosive limit).
- Development of action levels for worker safety when potential contamination is detected by monitoring equipment.
- Development of an emergency medical care and treatment plan.
- Submittal of copies of all monitoring records to the Engineer on a weekly basis.

D. During construction, Contractor's soil and gas monitoring shall consist of inspection for visual abnormalities, odors and gases using a photo-ionization detector (PID) and a combustible gas meter. The visual and odor inspection will be an ongoing responsibility of all Contractor's employees. In addition, the air quality will be monitored continuously for all trench excavations, suspect soils, and area identified as known refuse soils. The meters shall be calibrated in accordance with manufacturer's instructions.

E. In addition to the minimal requirements outlined herein, Contractor shall fully comply with the laws, regulations, and requirements of Paragraph 1.3 above relating to worker health and safety and the potential presence of contaminated air, soil, and/or water.

1.8 NOTIFICATION AND SUSPENSION

A. In the event Contractor's monitoring program detects the presence of a potentially hazardous substance at concentrations at or above established Permissible Exposure Limits or published exposure levels, Contractor shall immediately notify the Engineer and Metro. Following such notifications by Contractor, Metro may notify the various governmental and regulatory agencies concerned with the presence of potentially hazardous substances. Depending upon the type of the problem identified, Metro may further suspend the work in the vicinity of the material discovery.

B. Following completion of any further testing necessary to determine the nature of the material, Metro will decide the manner in which the substance will be handled or disposed of and the actual procedures to be used in resuming the work.

C. Although the actual procedures used in resuming the work shall depend upon the nature and extent of the potentially hazardous substance, Metro foresees the following alternatives operation as possible:

- Contractor to resume work as before suspension.
- Contractor to move work operations to another portion of the site until measures to eliminate any hazardous conditions can be affected.
- Metro will direct Contractor to dispose of the excavated refuse material at locations determined by Metro or at other appropriate and approved sites.

D. If suspect air, soils and/or liquid is identified by the monitoring program and construction activity is terminated at the suspect location by Metro and Contractor cannot move his operation to another portion of the work, Contractor shall be compensated for idle time of all equipment in actual use at the time of the potentially hazardous substance identification at the potentially hazardous substance location. Contractor shall be compensated for those hours or days the equipment is idled until a determination of the condition is made. Labor that is idled and cannot be diverted to other work will be paid through the one-half shift of the day during which the work is suspended. No compensation will be made for overhead, profit and/or any other general expenses. Contractor shall maintain records in such a manner as to provide the Engineer and Owner with a daily report sheet itemizing the equipment (size, type and identification number) idled

and the charges for equipment rental. Said daily report sheets shall be signed by Contractor or an authorized agent of Contractor. The charges for equipment rental shall not exceed the rates allowed under Force Account Work set forth in the General Conditions.

1.10 CORRECTIVE ACTIONS

Appropriate corrective actions are dependent upon the nature and extent to the contamination identified, and will be determined on a case-by-case basis by Contractor, Metro and the regulatory agency having jurisdiction.

*** END OF SECTION ***

SECTION 01210

PRECONSTRUCTION CONFERENCES

1 GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Summary of Work: Section 01010

B. Measurement and Payment: Section 01025

C. Project Coordination: Section 01041

D. Job Site Administration: Section 01043

E. Progress Meetings: Section 01220

F. Shop Drawings, Project Data and Samples: Section 01340

G. Schedule of Values: Section 01370

H. Product Requirements/Substitutions: Section 01600

1.2 SCHEDULE

A. Metro will schedule a preconstruction meeting after execution of the Contract.

B. Present at the meeting to represent Contractor shall be at least the official in charge of the project, the project superintendent, a representative of each Subcontractors, and other representatives as required.

C. Appropriate representatives of Metro, the Engineer and the Geotechnical Engineer will be present.

D. Proceedings of meeting to be recorded and distributed to interested parties by Metro.

1.3 AGENDA

A. Introduction:

1. Roster - Sign in names, addresses, phone numbers.

2. Introduction of key representatives. Metro will introduce Metro representatives and representatives of regulatory agencies. Contractor will introduce their own representatives and Subcontractors who are present.

B. Construction Schedule

1. Notice to Proceed Date of Record:

2. Schedule of Work
   a. Required Completion Date
   b. Date for Starting Subsequent Contract
   c. Preliminary Schedule
   d. Initial or Zero Progress Construction Schedule
   e. Schedule Updates
   f. Two Week Schedule
   g. Daily Work Plan

3. Working Hours/Overtime/Additional Shifts

4. Contractors Plan of Operation

C. Coordination

1. Soils Procurement Contractor

2. Existing Utilities

3. Existing Conditions of Site and Adjacent Area

4. Bridge Access/Limitations

5. Traffic Control/Haul Roads

6. Site Layout

7. Permits

8. Regulatory Agencies

9. Monitoring well activities

D. Communications

1. Lines of Authority Between Metro, Engineer and Contractor

2. Correspondence Routing

3. Submittals/Shop Drawings

4. Requests for Information/Clarification

E. Contract Administration/Finances

1. Contract, Bonds, Insurance

2. Scope of Work

3. Payments
   a. Process
   b. Formats
   c. Timing

4. Change Order Procedure

5. Schedule of Values

6. Insurance

F. Construction

1. Survey and Layout

2. Contractors Quality Control

3. Metro Construction Quality Assurance Plan

4. Safety and Security

5. Progress Meetings

6. Record Documents

7. Delivery of Permanent Materials
   a. Borrow Sites

b. Measurement and Payment for Sand and Subgrade Embankment Material
c. Inspection and Receiving Reports

8. Housekeeping/Maintenance of Access Roads

9. Clean up and Disposal

10. Final Acceptance

11. Records

G. Environmental Issues

1. Hazardous Materials/Health & Safety Program

2. Leachate Control

3. Site Drainage and Erosion Control

H. Questions

I. Comments and Closing Remarks

*** * * END OF SECTION * * ***

SECTION 01220

PROGRESS MEETINGS

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Summary of Work: Section 01010
B. Project Coordination: Section 01041
C. Construction Schedules: Section 01310
D. Project Record Documents: Section 01720
E. Preconstruction Conferences: Section 01220

1.2 MEETINGS

A. There will be scheduled Progress Meetings every week at mutually agreed time.

B. Special Meetings in addition to the regular Progress Meetings may be held at the discretion of Metro or other involved parties.

C. Location of meetings: As designated during preconstruction conference.

D. Attendance:

1. Engineer and his Subconsultants
2. Metro
3. Contractor
4. Other Contractors (if any)
5. Subcontractors as pertinent to agenda
6. Safety Representative (if any)
7. Representatives of Governmental or other Regulatory Agencies
8. Other invited parties

1.3 MINIMUM MEETING AGENDA

A. Review, approve minutes of previous meeting.

B. Review work progress since last meeting.

C. Review the construction schedule. Contractor will hand out copies of the planned two week schedule at this time.

D. Discuss problems which impeded planned progress such as:

1. Submittals
2. Requests for Information
3. Claims or Changes
4. Material or equipment delivery

E. Discuss quality of work

F. Review field observations

G. Administrative, safety and housekeeping problems

H. Other Current Business

*** * * END OF SECTION * * ***

SECTION 01310

CONSTRUCTION SCHEDULES

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Summary of Work: Section 01010

B. Project Coordination: Section 01041

C. Field Engineering: Section 01050

D. Progress Meetings: Section 01220

E. Shop Drawings, Project Data and Samples: Section 01340

F. Schedule of Values: Section 01370

G. Product Requirements/Substitutions: Section 01600

1.2 PRELIMINARY SCHEDULE

A. The Contractor shall submit within five (5) days after Notice to Proceed, a preliminary project schedule in graphic form (e.g. bar chart) showing proposed schedule of anticipated progress to include all major operations and items and time of anticipated completion of major portions of the work.

B. The preliminary schedule shall be accompanied by a narrative work plan which will include the following information:

1. Manpower levels planned to achieve durations shown in the preliminary schedule.

2. Equipment utilization planned for each activity taking place on site.

3. Identification of work planned for overtime or additional shifts.

4. Identification of planned assets for import delivery including planned borrow sites, numbers and types of trucks forecasted.

5. Plans for wet weather work.

6. Identification of critical work or supply activities.

C. The preliminary schedule will be reviewed within three (3) days by the Engineer and Metro. Comments will be forwarded to Contractor for his consideration and action where appropriate. A revised preliminary schedule shall be resubmitted by the Contractor three (3) days after receiving Engineer and Metro comments, if so required.

1.3 CONSTRUCTION SCHEDULE

A. The Contractor shall submit within twenty (20) days of Notice to Proceed an overall project schedule in both graphic and tabular form.

B. The schedule shall utilize a standard Critical Path Method (CPM) computer program using either the Arrow Diagram Method (ADM) or Precedence Diagram Method (PDM) which will furnish a mathematical analysis and identification of the critical path.

C. Reports to be furnished with the CPM schedule will include:

1. Work Item Number in ascending order

2. Total Float/Early Start in ascending order

3. Early Start in ascending order

4. Late start in ascending order

5. Predecessor report

6. Successor report

D. The graphic schedule will be of a format suitable for use by the Contractor and acceptable to Metro.

E. The work activities in the CPM will provide a complete sequence of construction, as well as submittal and delivery activity.

F. Information shown for each activity on the CPM will include description, responsibility, duration, float, early and late start dates, early and late finish dates, preceding and succeeding activities and relationships, percentage complete or remaining duration.

G. The Construction Schedule will be accompanied by an narrative similar in format to the provided in the Preliminary Schedule reflecting any refinements or changes to the planning process.

H. The Engineer and Metro will review the Construction Schedule and provide comments to the Contractor for appropriate action including potentially revision and resubmittal. Once schedule is determined acceptable by Metro, this schedule will be designated the initial or zero progress schedule.

I. Contractor will update the CPM and submit to Engineer and Metro on a monthly basis. CPM will be accompanied by a narrative report which will include:

1) Description of work completed during the past month.

2) Discussion of problem areas including current and anticipated delay factors.

3) Description of schedule revisions made for this months update.

4) Actions planned to mitigate delays or to facilitate construction progress.

1.4 CONTRACTOR TO SCHEDULE WORK

A. Contractor shall keep the Engineer informed sufficiently in advance of the time and places at which he intends to work in order that the necessary measurements for record and payment may be made with the minimum of inconvenience and delay to both the Engineer and the Contractor.

1.5 TWO WEEK SCHEDULE

A. Provide to the Engineer, on a weekly basis, a two week schedule using bar chart format in sufficient detail to plan and properly coordinate upcoming work.

1.6 SUBMITTALS BY CONTRACTOR

A. Submit Preliminary Schedule prior to starting work.

1. Engineer and Metro will review overall schedule and may return reviewed copy with suggested revisions within 5 days after receipt.

2. If required by the Engineer, contractor shall resubmit a revised preliminary schedule within 3 days after return of reviewed copy.

B. Submit initial CPM Construction Schedule within 20 days after Notice to Proceed.

C. Submit monthly updated CPM Construction Schedule accurately depicting progress to first day of each month and anticipated work schedules.

D. Submit a Two Week Schedule every week. Deliver to Engineer at the weekly Progress Meeting.

E. Submit six copies of schedules to Engineer, both initial submittals and revised or updated schedules.

1.6 DISTRIBUTION BY CONTRACTOR

A. Distribute copies of reviewed schedules to:

1. Job site file

2. Other contractors

3. Subcontractors

4. Other concerned parties

*** * * END OF SECTION * * ***

SECTION 01340

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Project Coordination: Section 01041

B. Job Site Administration: Section 01243

C. Construction Schedules: Section 01310

D. Testing Laboratory Services: Section 01410

E. Project Record Documents: Section 01720

F. Product Requirements/Substitutions: Section 01600

1.2 SUBMITTAL REGISTER AND SCHEDULE

A. Contractor will review the Contract Documents and identify all requirements for submittal of information to the Engineer and Metro. Contractor will arrange the listing of these submittals in order by section and paragraph beginning with the General Conditions, Supplementary Conditions and finally, the Technical Specifications in numerical order by section and paragraph. This document will be identified as the Submittal Schedule and will include the following information about each required submittal.

1. Specification Section and Paragraph

2. Transmittal Number (leave blank until submittal is made)

3. Description

4. Responsibility (Contractor, Sub or Supplier)

5. Schedule Date - Date on which Contractor plans to submit

6. Approval Required - Date approval is required to deliver the material by required date.

7. Material Required - Date material is needed onsite.

8. Submittal Date - Leave blank until submittal is actually made.

9. Review Status - No Exceptions Taken, Make Corrections Noted, Rejected, Revise and Resubmit, Submit Specified Item.

10. Action Date - Date on which Metro actually returned the reviewed submittal to Contractor.

11. Comment - Cross reference on notes as required.

B. The Submittal Schedule will be submitted no later than 10 days after Notice to Proceed and should be coordinated with the information presented in the Construction Schedule.

C. Sufficient lead time should be allowed for review and approval by Metro. Allow 10 days for review and approval. Specifically identify those submittals which will require an expedited review process.

D. The Submittal Schedule upon acceptance by Metro will form the basis for the Submittal Register. Contractor will keep track of submittals as submitted by sequential number. Contractor will update his submittal Schedule with information from the Submittal Register on a monthly basis and furnish a copy to Metro.

1.3 SUBMITTALS

A. All submittals including shop drawings, data and samples shall be submitted attached to a form furnished by the Engineer entitled "Shop Drawing Transmittal". Location by drawing number and paragraph of specification shall be shown on the form for the product or material being submitted. Each transmittal shall be assigned a unique number in sequential order.

B. Shop drawings shall be submitted and reviewed in the following manner:

1. Contractor shall review, stamp with his approval and submit postpaid with such promptness as to cause no delay in his work or in that of any other contractor, the required number of copies of all shop drawings, schedules, data, and samples required for the work of the various trades determined necessary by the Engineer, required in the General Conditions and/or described elsewhere in the Project Specifications.

2. Shop drawings shall establish the actual detail of all manufactured or fabricated items. All shall be drawn to scale and be completely dimensioned.

3. Sheet sizes of shop drawings shall be in multiples of 8 1/2 by 11 inches, preferably not exceeding 22 by 34 inches unless there is a special requirement for larger size sheets.

4. Provide on each drawing a clear space for the Engineer's review and approval stamps and comments.

5. Four (4) copies of shop drawings, manufacturer's literature, brochures, catalog cuts, and other pertinent printed matter or data shall be submitted in addition to the number of copies Contractor wishes returned to him.

6. Shop drawings may be submitted to the Engineer in the form of a reproducible transparency, along with one blackline or blueline print. Mylars are preferred.

7. The Engineer shall review the shop drawings with reasonable promptness and will affix the Shop Drawing Review Stamp with notations thereon indicating "No Exceptions Taken", "Make Corrections Noted", "Revise and Resubmit", "Rejected" or "Submit Specified Item". He will then obtain the prints he requires from the transparency and forward it along with one marked-up copy of the reviewed copies of the other material, in excess of four, to Contractor.

8. When shop drawings and/or other submittals are required to be revised or corrected and resubmitted, Contractor shall make such revisions and/or corrections and resubmit the drawings or other material in the same manner as specified above.

9. Contractor shall obtain and provide such number of prints or copies of drawings as is required for his field distribution.

10. It shall be Contractor's responsibility to clearly note on the shop drawings, and in writing specifically call to the Engineer's attention, any changes and deviations that vary from the Contract Drawings and Specifications. No review of the shop drawings by the Engineer shall relieve Contractor of full responsibility and at his own cost and expense to comply with the Contract Documents.

11. If corrections are required, Contractor shall make the corrections required by the Engineer and file with him the same number of corrected copies as indicated above. Contractor shall direct specific attention in writing or, on resubmitted Shop Drawings to revisions other than the corrections requested on previous submissions. The Engineer will return to Contractor copies of drawings in the same

manner and number as before.

12. Shop Drawings shall give complete information necessary for the fabrication and installation of all component parts of the equipment, structure, facility, etc. In the case of structural drawings, they shall include the location, type, and size and extent of all welds, if any are necessary. Manufacturer's standard details, catalogues, advertising literature, etc., shall not necessarily constitute all of the shop drawings required for any unit or facility. Additional shop details designed for the particular project shall be furnished when required by the Engineer. Shop drawings of electrical equipment shall include complete diagrams of electrical circuitry.

13. The Engineer's review of and placement of shop drawing review stamp on any shop drawing is understood to be an acceptance of the character of the details and not a check of any dimension or quantity and will not relieve Contractor from responsibility for errors of any sort in shop drawings data or schedules, whether or not such errors are found by the Engineer in his review of such details.

14. No changes will be made in any shop drawing after it has been reviewed except by the consent or direction of the Engineer in writing.

C. Samples shall be submitted in the same manner as shop drawings.

1. Samples to be physical examples to illustrate materials, equipment or workmanship, and to establish standards by which completed work is judged.
   a. Office samples: of sufficient size and quantity to clearly illustrate:
      (1) Functional characteristics of product of material, with integrally related parts and attachment devices.
      (2) Full range of color samples.
      (3) After review the Engineer will retain two samples and return the remainder to Contractor.

   b. Field samples and mockups
      (1) Erect at project site location acceptable to Engineer.
      (2) Construct each required sample or mock-up complete, including work of all trades required in finished work.
      (3) Coordinate sampling of natural materials with Field Engineer.

2. If any test sample fails to meet the specification requirement, all previous approvals will be withdrawn and such materials or equipment,

which fail the testing, shall be subject to removal and replacement by Contractor with materials or equipment meeting the specification requirement.

3. Affected finish work shall not be commenced until the Engineer has given written approval for the field samples.

1.4 CONTRACTOR RESPONSIBILITY

A. All submittals shall be attached to a "Shop Drawing Transmittal" form provided by the Engineer.

B. Contractor shall review and approve shop drawings before submittal. Submittal directly from Subcontractor or Suppliers will not be accepted.

C. By approving and submitting Shop Drawings and Samples, Contractor thereby represents that he has determined and verified all field measurements, field construction criteria, materials, catalog numbers and similar data, or will do so, and that he has checked and coordinated each Shop Drawing with the requirements of the Work and of the Contract Documents and that there is no conflict with other submittals that may affect the work of another contractor of Metro.

D. A copy of each approved shop drawing and each approved sample shall be kept in good order by Contractor at the job site and shall be available to the Engineer.

1.5 LIMITATION

A. Two submittals (initial and revised) of each item requiring samples and/or shop drawings will be reviewed by the Engineer in the regular course of the Contract. However, all subsequent reviews of the same item over two will be reviewed at the expense of Contractor unless the right to an additional review without charge was previously approved in writing by the Engineer. Contractor will be billed by Metro at the Engineer's current established rates.

*** * * END OF SECTION * * ***

SECTION 01370

SCHEDULE OF VALUES

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Measurement and Payment: Section 01025
B. Project Coordination: Section 01041
C. Job Site Administration: Section 01043
D. Progress Meetings: Section 01220
E. Construction Schedules: Section 01310

1.2 TIMING

Submit to the Engineer a Schedule of Values for all Lump Sum bid items, at least 15 days prior to submitting first Application for Payment.

1.3 SUPPORT

Upon request by Engineer, support values given with data that will substantiate their accuracy.

1.4 DETAILED BREAKDOWN OF LUMP SUM BID PRICES

A. Except in cases where unit prices form the basis for payment under the Contract, Contractor shall, within 15 days prior to First Application for Payment, submit a complete breakdown of all lump sum bid prices showing the value assigned to each part of the work including an allowance for profit and overhead.

B. Each breakdown shall include, where applicable, separate items for Field Tests and Adjustments and Cleaning Up which shall total at least five percent of each breakdown's total price.

C. The form of the breakdown shall separate labor from materials to arrive at a total for each unit. Breakdown shall be so organized as to facilitate assessment of work and payment of Subcontractors.

D. Breakdown shall be balanced so that progress payments will not create a condition where sufficient funds are not available to complete the work. Contractor shall provide documentation substantiating the cost allocation if the Engineer believes that the costs are unbalanced.

E. Upon acceptance of the breakdown of the lump sum bid prices by the Engineer, it shall be used as a basis for all requests for partial payment.

F. Where Maintenance Manuals are required, no more than 50% of applicable lump sum bid prices shall be paid prior to receipt of a rough draft of the Maintenance Manual and no more than 90% of the final payment shall be made before receipt of the Maintenance Manual complete.

*** * * END OF SECTION * * ***

SECTION 01400

CONTRACTOR'S QUALITY CONTROL

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. General Conditions - Article 7 Control and Quality of work and Material.

B. Technical Specifications pertaining to the work.

1.2 RESPONSIBILITIES

A. Contractor is primarily responsible for quality control and will provide for sufficient supervision and control measures on a daily basis to ensure that the Work is completed in accordance with the Contract Documents.

B. Metro and the Engineer are responsible for quality control assurance, and will monitor the quality of Work. Their activities in no way relieve Contractor of his quality control responsibilities.

1.3 REQUIREMENTS

A. Quality Control Plan - Contractor will prepare and submit a plan of action to establish and maintain a Quality Control Program. The program as a minimum will contain:

1. The quality control organization chart beginning with the responsible corporate officer.

2. The names and qualifications of personnel selected to implement the program onsite.

3. Authority and responsibility of the quality control staff.

4. A breakdown of the schedule of work which includes proposed inspections, tests or other means of controlling the quality of work for each phase.

5. Provides controls for each phase of work by establishing a system of inspections as follows:
   a. Preparatory Inspection - This inspection will be conducted by Contractor prior to starting any new phase of work. Contractor's Quality Control Manager will review the contract

documents to ensure that required materials, equipment and procedures have been submitted and approved, are onsite and checked, that a reasonable, coordinated work plan has been prepared, that all previous work has been completed, inspected and tested as required. Contractor will schedule a preparatory conference with the Engineer and/or Metro Construction Coordinator to discuss the findings and to develop a material understanding on execution of the work and the quality standards which will be used. The hazard analysis will also be presented and discussed at this meeting. The inspection results and minutes of the conference will be documented by Contractor and a copy furnished to the Engineer and Metro Construction Coordinator. Subsequent to the conference, but prior to start of work, all involved working personnel and inspectors will be briefed on the work plan and the quality standards expected.

b. Initial Inspection - This joint inspection by Contractor and the Engineer/Metro Construction Coordinator will be made as soon as a representative portion of the work has been accomplished. This inspection will be repeated if new crew member(s) are assigned to the work or if acceptable standards of workmanship are not being met. Contractor will, as a minimum, document this inspection in the daily Quality Control Report.

c. Followup Inspections - Contractor will perform daily inspections of the work until completion.

6. Establishes a system of Quality Control Deficiency Reports to report deficiencies in the work or materials to determine appropriate correction and to track the execution of the correction.

B. Documentation

1. Daily Quality Control Report - This report will be furnished by Contractor in a suitable format on a daily basis over the signature of the Quality Control Manager or onsite Quality Control Representative. It shall be delivered to the onsite Metro Representative and/or Engineer by 10:00 a.m. on the following work day, and will contain as a minimum:
   a. Weather
   b. Manpower (listed by craft for Contractor and total for each Subcontractor).
   c. A summary of activity for each shift and evaluation of the workmanship.
   d. A record of any inspections which were made
   e. Results of tests.

f. Identification of deficiencies or rejections.
g. Proposed remedial sections.
h. Corrective actions taken.
i. Safety related issues.
j. Permanent materials deliveries and inspections.

2. Preparatory Inspection Meeting Record - This record will be delivered to the onsite Metro Representative and/or Engineer prior to the start of that phase of work but not later than three work days after the meeting. The hazard analysis separately described in Section 01100 can be delivered at the same time.

3. Test Reports - A record of all tests shall be kept by Contractor on the job site. A copy of all test reports done by Contractor shall be provided to the Engineer and/or Metro.

4. Quality Control Deficiency Reports - Contractor will prepare a deficiency report on all deficiencies in the work or in the quality of materials. The report will be logged and numbered and submitted to the Engineer and/or Metro along with the recommended remedy. Contractor will track the action through to completion, submitting a final report of inspection on the work in question.

C. Duties and responsibilities of the Quality Control Manager or a designated representative includes:

1. Have the authority to stop or reject work.

2. Be onsite during normal working hours and will be assigned full time to the project.

3. Establish the Quality Control Plan and execute the Quality Control Program.

4. Review all submittals, including shop drawings and materials submittals. Reject those submittals not in accordance with the Contract Documents, approve and submit those which are in accordance. Maintain a jobsite submittal file.

5. Ensure that line, grade, depth and compaction, density and composition of materials are in accordance with the Contract Documents.

6. Ensure that all work to be inspected includes an opportunity for Metro to check work prior to covering the work.

7. Coordinate required tests and inspections with the Engineer and Metro's Construction Coordinator.

8. Inspect the work of Contractor and all Subcontractors.

9. Submit all required quality control documentation and maintain records.

10. Verify that all permanent materials delivered to the jobsite are in accordance with the Contract Documents. Submit certifications and test reports as required.

11. Accompany the Engineer and/or Metro Construction Coordinator on jobsite inspections as required.

12. Prepare and submit the project punch lists prior to job completion and acceptance.

13. Furnish representative samples for testing as required by the Contract Documents or Metro.

2. INSPECTION

2.1 Contractor will provide continuous inspection over his daily operations, including overtime and additional shifts.

A. Inspections will include but not be limited to:

1. Inspection of borrow materials entering the jobsite.

2. Inspection of placement and compaction of borrow materials including lines and grades shown on the Drawings.

3. Inspection of topsoil, low permeable soil and unsuitable materials as they are stripped and assurance that they end up in appropriate stockpiles.

4. Trenching, installation and backfilling pipes and culverts.

5. Installation of geotextiles and geomembrane.

6. Site drainage and erosion control.

7. Protection of site utilities above and below ground.

8. Installation of gas collection wells, piping and appurtenances.

9. Compliance with provisions of the Health and Safety Program for Hazardous Waste Operations when working below the landfill cover (during trenching or excavation).

10. Protection of existing landfill cover during Contractor operations.

B. Inspection by Contractor for Quality Control (QC) will be supplemented by the Engineer and Metro representatives. Other regulatory agencies may also inspect as required by law and custom. The inspection by any of the above does not relieve Contractor of the requirement to inspect and to produce work in accordance with the plans and specifications. Contractor shall at all times provide safe access and assistance to Metro, the Engineer, and other authorized inspectors for inspection of the work.

3. TESTING

3.1 Metro will provide and pay for the services of an independent testing laboratory. This laboratory will provide testing services which will include:

A. For Imported Borrow Materials:

1. Compaction Curve per Standard Proctor, ASTM D698 - for each borrow source.
2. Moisture Content Test by Microwave Oven method, ASTM D4643 with periodic calibration per ASTM D2216 - a minimum of one test per 200 truckloads or one test per 5,000 tons of material for each borrow source per day.
3. Compaction Check Point Tests per ASTM D698 will be carried out as needed for the moisture test.

B. In Place Density Determination: Nuclear Test ASTM D2922 - with periodic calibration by the Sand Cone Method ASTM D1556. Conduct these tests at a frequency of one test per acre per lift for placement of subgrade embankment and Type B low Permeable Soil materials to subgrade. Metro or the Engineer may reduce this requirement if the manner of performance and visual inspection consistently produces satisfactory results.

3.2 Contractor will be responsible for all other testing which may be required. Contractor will submit the qualifications of an independent test laboratory to provide testing services as required. Services may include but not be limited to the following:

A. Gradation Tests at borrow sites

B. Certify or tests for hazardous materials or contaminants at borrow sites

C. Testing and monitoring for potentially hazardous substances in accordance with the jobsite health and safety plan.

D. Testing and Monitoring of installation of geotextiles and geo membrane in accordance with Specifications.

E. Testing which may be required by other regulatory agencies.

3.3 Contractor will facilitate testing by Metro or the Engineer as follows:

A. Cooperate with the Geotechnical Engineer or laboratory personnel and provide safe access to the work.

B. Provide representative samples of materials to be tested in required quantities. Notify Metro/Engineer in advance of changing material sources to allow testing before use of the material.

C. Furnish labor and facilities as required for access, gathering samples, and storage of test samples.

3.4 The Engineer may conduct additional testing to check on the quality of work, materials or testing. The Engineer will visually inspect, then test and develop compaction curves for material from Contractor's proposed borrow sites which appear to be adequate.

3.5 Metro is concerned that only safe materials, with no hazardous substances or hydrocarbon contaminants, are used in the closure and final cover of the St. Johns Landfill. Contractor is cautioned to provide only clean materials and to test any materials which may be contaminated. Soil previously contaminated with petroleum is acceptable as subgrade embankment material if remediated to level one standards in Oregon Administrative Rule 340-22-305 to 360, and accompanied by verification acceptable to Metro. If Metro suspects that materials are contaminated, the Engineer may test. If the results are negative, Metro will pay for the testing. If materials tested are found to contain hazardous materials, Contractor will pay for the testing, immediately remove the material and properly dispose of it offsite and be solely responsible for any resultant impact on the work or schedule.

4. EXECUTION

The planning, execution and results of Contractor's Quality Control Program are considered incidental to the payment for the work as indicated by the bid items. Failure to comply with the Quality Control Program may result in withholding of all or a portion of the monthly progress payments by Metro at its discretion and Metro may use these withheld funds to contract or pay for this work outside of this Contract.

*** END OF SECTION ***

SECTION 01511

TEMPORARY ELECTRICITY

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Electrical Equipment and Construction: Division 16

1.2 TEMPORARY SYSTEM

A. Contractor to provide an adequate temporary electrical system for the duration of the Contract.

B. Contractor will furnish power and/or light for:

1. All construction requirements.
2. Safe working conditions.
3. Security.
4. Field Office for contractors operations.

C. Power source to be arranged by Contractor.

D. Costs paid by Contractor.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

A. Obtain permits and easements if required.

B. Comply with codes and utility regulations in force.

1.3 USE OF PERMANENT SYSTEM

A. Construct temporary system to prevent interference with orderly work progress.

B. Do not use existing system (if available) without specific written permission.

C. Construct and use any portion of permanent system on the supply side of the permanent meter and use that construction for a portion of the temporary supply.

D. Leave permanent service in condition as good as new.

2. PRODUCTS

2.1 MATERIALS

A. General:
   1. Comply with Division 16 - Electrical.
   2. Materials may be new or used, but must be adequate in capacity for required purposes, and must not create unsafe conditions or violate requirements of applicable codes.

2.2 EQUIPMENT

A. Provide appropriate enclosures for environment in which used, in compliance with NEMA standards.

B. Provide ground fault protection.

C. Provide adequate short circuit duty for capacity of supply transformers in use.

3. EXECUTION

3.1 GENERAL

A. Comply with applicable sections of Division 16 - Electrical.

B. Install work in neat and orderly manner.

C. Make structurally and electrically sound throughout.

D. Maintain to give continuous service and to provide safe working conditions. Provide adequate temporary lighting for all operations which are conducted during the hours of darkness.

E. Modify and extend service as work progress requires.

3.2 INSTALLATION

A. Temporary service and distribution may be overhead or underground.

B. Locate to avoid interference with:

   1. Traffic and work areas.

   2. Storage areas.

3. Work under other contracts.

C. Do not run branch circuits on floor or on ground.

3.3 REMOVAL

A. Completely remove temporary materials and equipment upon completion of construction.

B. Repair damage caused by installation, and restore to specified, or original condition.

*** * * END OF SECTION * * ***

SECTION 01515

TEMPORARY WATER

1. GENERAL

1.1 DESCRIPTION OF SYSTEM

A. Contractor shall make arrangements for and provide all necessary facilities for water supply, for both personal consumption and job-site needs, at his own expense, unless otherwise provided.

1.2 COSTS

A. Pay costs of temporary water services, including costs of installations, maintenance and removal of facilities.

B. Contractor may secure water from any suitable source. If Contractor purchases water from a water utility at a fire hydrant on or near the project, all arrangements shall be made by him at his own expense and payment be made to the utility in accordance with their rate schedule.

2. PRODUCTS

2.1 MATERIALS

A. Materials for temporary water supply may be new or used but must be adequate for purpose required, sanitary and must not violate requirements of applicable codes.

3. EXECUTION

3.1 GENERAL REQUIREMENTS

A. The water utility shall be contacted to determine if sufficient water is available at the particular time before any use.

B. Contractor shall use only those hydrants designated by the agency in charge of water distribution and in strict accordance with its requirements for hydrant use.

C. Contractor shall use hydrant wrenches only in open hydrants. He shall also make certain that the hydrant valve is open "full", since "cracking" the valve causes damage in the valve. An approved auxiliary valve shall be provided on the outlet line for control purposes. Fire hydrant valves must be closed slowly

to avoid a surge in the system which creates undue pressure on the water lines. Contractor shall carefully note the importance of following these directions.

D. If one of Contractor's employees shall knowingly or unknowingly use the wrong wrench on a hydrant and thereby damage the hydrant valve stem, Contractor will be responsible. He shall immediately notify the water utility so that the damage can be repaired as quickly as possible.

E. Upon completing the use of the hydrants, Contractor shall notify the water distribution agency, so that the hydrants may then be inspected for possible damage. Any damage resulting from the use of the hydrants by Contractor will be repaired by the water agency and the cost thereof shall, if necessary, be withheld from the final payment to Contractor.

F. Contractor shall furnish all connectors, wrenches, valves, and small tools that may be necessary to meet the requirements of the water distribution agency pertaining to hydrant use.

G. Violation of these requirements will result in fines and will lay Contractor liable for damage suits because of malfunctioning of damaged fire hydrants, in the event of fire or other emergencies.

3.2 REMOVAL

A. Completely remove temporary materials and equipment upon completion of construction.

*** * * END OF SECTION * * ***

SECTION 01545

PROTECTION OF WORK AND PROPERTY

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Protection of Work, Property and Person: Article 10 General Conditions

B. Access and Haul Roads: Section 01550

C. Temporary Controls: Section 01560

D. Existing Utilities/Facilities - Underground and Overhead: Section 02760

1.2 PUBLIC AND PRIVATE PROPERTY

A. Contractor shall protect and maintain all underground or aboveground utilities and structures affected by the work and all private property crossed by or adjacent to his operation, and any damage shall be repaired and restored by Contractor, at his expense, to the satisfaction of Metro.

B. Contractor will be responsible for all damage to roads, highways, ditches, walls, vegetation, engineered soil covers, bridges, culverts, utilities, lights, or other property, caused by the work, whether such damage be at the site of the work or caused by transporting or hauling to or from the work; and he shall repair or replace, or arrange for the repair or replacement of all such damage to the satisfaction of Metro. Any material damaged by Contractor's operations shall be replaced with new material at Contractor expense.

C. Whenever construction work under this Contract is undertaken on easement or right-of-way all work shall be accomplished so as to cause the least amount of disturbance and a minimum amount of damage. All requirements stipulated by easements shall be met.

D. Contractor shall take adequate precautions to protect adjoining sloughs and wetlands, and to avoid damage thereto, and he shall at his own expense completely repair any damage thereto caused by his operation.

E. Access for fire fighting equipment or personal health emergency vehicles shall be maintained at all times.

1.3 EXISTING UTILITIES/FACILITIES - UNDERGROUND AND OVERHEAD

A. The Contractor shall protect existing utilities/facilities, both overhead and underground as provided in Section 02760.

*** * * END OF SECTION * * ***

SECTION 01550

ACCESS AND HAUL ROADS

1. GENERAL

1.1 ACCESS AND HAUL ROADS

A. Comply with all laws and regulations.

B. All off-site streets and on-site access roads used by Contractor's trucks or any other equipment hauling material to and from the construction area shall be kept reasonably clean and shall be swept and/or flushed periodically to the satisfaction of the R/W jurisdiction involved. Contractor shall provide truck washing facilities if and when hauling operations create nuisance levels of mud on nearby off-site or on-site roads.

C. Unsurfaced roads may require an application of dust oil or shall be sprinkled with water as needed to allay dust.

D. Any damage to roadway surfaces, surfaced or unsurfaced, as a result of Contractor's operation shall be repaired by Contractor at his expense to the satisfaction of the responsible agency.

E. Haul roads on-site at the landfill shall generally be located at the existing road corridors wherever possible. Temporary haul roads proposed to be located elsewhere by Contractor may be allowed by Metro providing that adequate protection is provided for the existing interim cover. If deemed necessary by Metro, removal of temporary haul roads and restoration of existing interim cover may be required.

F. Contractor shall submit to Metro, for review and approval, the proposed on-site hauling plan. This is to be handled as a submittal in accordance with Section 01340 of the Specifications. Plan shall identify ingress/egress routes, temporary access/haul routes (if any), traffic control measures, vehicle flow patterns and rates and anticipated quantities of materials involved. This hauling plan is applicable primarily to transport and placement of procured soil materials (sand and subgrade embankment). Periodic updates and resubmittals are to be provided as needed to keep Metro and Engineer fully informed of planned hauling activities.

1.2 OTHER FORMS OF ACCESS AND CONVEYANCE

A. Contractors are encouraged to consider other forms of access or materials conveyance onto, or close to the site, such as rail, conveyor, barge, large off-

road vehicles, pipelines, etc. Pumping of water/slurry directly onto the landfill shall not be permitted.

B. Contractors shall submit to Metro, for review and approval, any proposed alternative access and conveyance plans. Contractor shall be responsible to obtain all permits, licenses, permission for access or construction onto adjacent properties, permission for crossing the Slough(s) at alternate locations other than the existing bridge, and permission to drain water into, float, construct within, or otherwise disturb the Slough(s). Contractor shall be responsible for restoration, to the condition prior to construction, of all areas affected by the alternative access.

*** * * END OF SECTION * * ***

SECTION 01560

TEMPORARY CONTROLS

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Summary of Work: Section 01010

B. Project Coordination: Section 01041

C. Job Site Administration: Section 01043

D. Protection of Work and Property: Section 01545

E. Access and Haul Roads: Section 01550

1.2 LAWS

A. Requirements of federal, state and local statutes and regulations dealing with temporary controls described in this section shall be strictly adhered to by Contractor.

1.3 AIR POLLUTION CONTROL

A. Contractor shall not discharge smoke, dust or other contaminants into the atmosphere that violate the regulations of the applicable city, county or state authority.

B. All excavations, embankments, stockpiles, haul roads, access roads, plant sites, waste areas, borrow areas, and other work areas shall be maintained free from dust which would cause a hazard or nuisance. Approved temporary methods of stabilization such as sprinkling, chemical treatment, light bituminous treatment or similar methods shall be used to control dust. Sprinkling, to be approved, must be repeated at such intervals as to keep all parts of the disturbed area damp at all times, and sufficient equipment must be on the job to accomplish this. Dust control shall be performed as the work proceeds, wherever and whenever a dust nuisance or hazard occurs.

C. Contractor shall comply with specific requirements of air quality control laws.

D. Contractor shall be responsible for any damage resulting from any dust originating from his operations.

1.4 EROSION CONTROL

A. Contractor shall provide temporary erosion control work as may be required by state or local agencies during the life of the contract. This work is intended to provide prevention, control, and abatement of water pollution/erosion within the limits of the project, and to minimize damage to the work, adjacent property, and adjacent sloughes.

B. Contractor shall coordinate this temporary water pollution/erosion control work with the existing drainage and erosion control measures to the extent practicable to ensure that effective and continuous water pollution/erosion control is maintained during the construction of the Project.

C. Clearing and grubbing operations shall be so scheduled and performed that embankment and grading operations and temporary erosion control features can follow immediately.

D. If the Engineer or applicable regulatory agencies determines that water pollution and/or erosion could occur due to seasonal limitations, the nature of the material, or Contractor's progress, temporary water pollution/erosion control measures shall be taken immediately.

E. Metro may require Contractor's operations to be scheduled so that temporary erosion control features will be installed concurrently with or immediately following grading operations.

F. Compliance with the requirements of this section shall not relieve Contractor from his responsibility to comply with other provisions of the contract.

1.5 NOISE CONTROL

A. Comply with applicable state, city and county requirements as to allowable noise levels during construction at all times.

B. Equip all internal combustion engines in vehicles and construction equipment used at the project site with effective mufflers.

1.6 SANITARY PROVISIONS

A. Contractor shall provide and maintain in a neat and sanitary condition such temporary accommodations for the use of his employees, Metro and Engineer as may be necessary to comply with the requirements and regulations of the agencies or organizations having jurisdiction over sanitary and health conditions. He shall permit no public nuisances.

1.7 PROVISION FOR WATER COURSES

A. Contractor shall provide for the flow of all existing surface water courses, sewers or drains, intercepted or disturbed by Contractor during the progress of the work, and shall replace the same in as good condition as he found them or shall make such final provisions for them as necessary.

B. Contractor shall make provisions to take care of all surplus surface water, mud, silt, or other runoff pumped from excavations or resulting from other operations, and shall be responsible for any damage, of whatever nature, resulting from his failure so to provide. Waters which may come into contact with solid waste and/or leachate waters, shall be handled as leachate water and will be disposed of in the sanitary sewer system as required by permit.

C. No direct payment shall be allowed for the above work. Payment for the cost thereof shall be included in the prices bid for the various items which comprise the improvement.

1.8 TRAFFIC CONTROL

A. Contractor shall not unnecessarily interfere with use of any public traffic facility (sidewalks, streets, pavements, etc.) required for vehicular or pedestrian traffic. If such interference becomes necessary to perform the work in a safe, proper and convenient way, and no satisfactory detour route exists, Contractor shall provide a satisfactory detour, as approved by City of Portland Approvals and Permits, and Metro. The cost of this detour, required permits and the maintenance thereon shall be borne by Contractor.

B. Contractor is responsible to keep all public traffic facilities (sidewalks, streets, pavements, etc.) in the general vicinity of the site clean and clear at all times from debris, soils, etc., resulting from the work of his contract.

C. Contractor shall provide qualified flagmen and/or crossing guards, as necessary, to maintain proper and safe control of vehicular and pedestrian traffic during his construction operations.

D. Contractor shall provide warning lights, barricades, signs, etc., as necessary (beyond what is existing) to maintain such control about the perimeter roads of the site for his work.

*** * * END OF SECTION * * ***

SECTION 01600

PRODUCT REQUIREMENTS/SUBSTITUTIONS

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Royalties and Patents: Article 7 General Conditions
B. Project Coordination: Section 01041
C. Shop Drawings, Project Data, Samples: Section 01340
D. Schedule of Values: Section 01370

1.2 GENERAL PRODUCT REQUIREMENTS

A. Unless otherwise specifically provided, all workmanship, equipment, and materials incorporated in the work covered by the Contract are to be new and of the best available grade of their respective kinds.

B. For products specified only by reference standards, select any product meeting standards, by any manufacturer.

C. For products specified by naming one or more products, but indicating the option of selecting equivalent products by stating "or equivalent" after specified product, Contractor must submit request, as required for substitution, for any product not specifically named.

D. For products specified by naming only one product and manufacturer, there is no option, and no substitution will be allowed.

1.3 SUBSTITUTIONS REVIEW AND APPROVAL PROCEDURE

A. Within thirty (30) days after Notice to Proceed, Engineer will consider formal requests from Contractor for substitution of products in place of those specified. Provide complete list of all products which are proposed for installation as substitutions or product options. Tabulate list by each specification section.

B. Submit detail request for substitution in accordance with requirements for submittal of shop drawings (Section 01340) and the following additional requirements.

1. For construction methods:
   a. Detailed description of proposed method.
   b. Drawings illustrating methods.

2. Itemized comparison of proposed substitution with product or method specification.
3. Data relating to changes in construction schedule.
4. Accurate cost data on proposed substitution in comparison with product or method specified.

C. In making request for substitution, Contractor shall specifically represent:

1. He has personally investigated proposed product or method, and determined that it is equivalent or superior in all respects to that specified.
2. He will provide the same guarantee for substitution as for product or method specified.
3. He will coordinate installation of accepted substitution into work, making such changes as may be required for work to be complete in all respects.
4. He waives all claims for additional costs related to substitution which consequently becomes apparent.
5. Cost data is complete and includes all related costs under his Contract.

D. Substitutions will not be considered if:

1. They are indicated or implied on shop drawings or project data submittals without formal request submitted in accord with Section 01340.
2. Acceptance will require substantial revision of Contract Documents or redesign by the Engineer, without substantial benefit to Metro.
3. Requests are submitted beyond 30 days after Notice to Proceed.

E. The above shall not be construed to mean that any substitution for materials and equipment will be allowed. The Engineer reserves the right to reject and disapprove any request he deems irregular or not in compliance with the Specifications.

*** * * END OF SECTION * * ***

SECTION 01650

TESTING, STARTUP AND OPERATION

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Temporary Electricity: Section 01511
B. Temporary Water: Section 01515
C. Contract Closeout: Section 01700
D. Operation and Maintenance Data: Section 01730
E. Gas Collection System: Section 02680
F. Equipment: Division 11

1.2 RESPONSIBILITY

A. Testing, startup and operation shall not be cause for claims for delay by the Contract and all expenses accruing therefrom, shall be deemed to be incidental to the Contract.

B. The Contractor shall provide all materials, supplies and labor necessary to efficiently complete the testing, startup and operation.

C. All power and utility bills shall be paid by the Contractor up to and including the day of final acceptance of the Contract by Metro. If not paid, these charges shall be treated as claims against the Contractor.

D. If Metro chooses to commence operations prior to final acceptance, Metro will assume payment of all power and utility charges effective the day that operation is assumed by Metro and notice is given in writing.

1.3 SCHEDULE

A. Placing all applicable phases of the project in service shall consist of three parts: testing, start up and operations.

B. Not less than thirty (30) days before anticipated time for beginning the testing, the Contractor will submit to the Engineer for approval, a complete plan for:
   1. Schedules for tests.
   2. Detail schedules of procedures for startup.

3. Complete schedule of events to be accomplished during startup.
4. Schedule operator training as specified.
5. An outline of work remaining under the Contract that will be carried out concurrently with the operation phases.

1.4 TESTING

A. Testing shall consist of individual tests and checks made on equipment intended to provide proof of performance of units and proper operation of unit controls together with such necessary tests whether or not described elsewhere in these Specifications to assure proper alignment, size, condition, capability, strength, proper adjust, lubrication, pressure, hydraulic tests, leakage tests and all other checks deemed necessary by the Engineer to determine that all materials and equipment are of specified quality, properly situated, anchored and in all respects ready for use.

B. All gravity pipe and pressure piping shall be tested as required by these specifications and applicable codes.

C. Tests on individual items of equipment, pipelines, vessels, structures, tanks, controls and other items shall be as described in various sections describing such items.

D. Testing will be done by the Contractor in the presence of an Inspector designated by the Engineer. Records of all official tests will be made by the Inspector.

E. During tests, the Contractor shall correct any defective work discovered or that is not in first class operating condition.

1.5 STARTUP

A. Startup shall consist of testing by a simulated operation, all operational equipment and controls. The purpose of these tests shall be to check that all equipment will function under operating conditions, that all interlocking controls and sequences are properly set and that the facility will function as an operating unit.

B. Checks for leakage of tanks, ponds, piping, valves, gates and all other hydraulic systems and structures will be made.

C. Factory representatives of all major units shall be present for the startup phase. The test shall continue until it is demonstrated that all disfunction of controls and machinery are corrected.

D. The startup shall not begin until all tests required by these Specifications have been completed and approved by the Engineer.

1.6 OPERATION

A. Operation of the facility shall be immediately started after completion of testing and startup and after satisfactory repairs and adjustments have been made and providing supply and disposal facilities furnished by others are available. If these facilities are not available, the plant will be closed down and no further testing or operation by the Contractor will be required. The Contractor, however, will be responsible that all details required by the Contract shall remain in good order until final acceptance of the whole Contract.

B. The facility will be operated by personnel placed on the project by Metro who will perform all duties and operate all equipment.

C. Taking possession and use of the facility shall not be deemed an acceptance of any work not completed in accordance with the Contract Documents.

D. If such prior use increases or causes refinishing of completed work, the Contractor shall be entitled to such extra compensation or extension of time or both, as the Engineer may determine.

*** * * END OF SECTION * * ***

SECTION 01700

CONTRACT CLOSEOUT

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Liquidated Damages: Article 3 General Conditions
B. Payments: Article 9 General Conditions
C. Certification and Final Payment: Article 9 General Condition
D. Project Coordination: Section 01041
E. Protection of Work and Property: Section 01545
F. Project Record Documents: Section 01720
G. Project Record Documents: Section 01720
H. Operation and Maintenance Data: Section 01730
I. Spare Parts and Maintenance Materials: Section 01750

1.2 SUBSTANTIAL COMPLETION

A. Contractor:

1. After testing and startup, submit written certification to Engineer that Project or designated portion of Project is substantially complete.

2. Submit punch list of items to be completed or corrected.

B. Engineer will make an inspection after receipt of Contractor's certification, together with Metro's representative.

C. If it appears to the Engineer and Metro that work is substantially complete:

1. The Engineer may request of and Contractor shall prepare and submit to the Engineer, a list of items to be completed or corrected as determined by the inspection.

2. If the Engineer then considers the work to be substantially complete, the Engineer may, with Metro's approval, issue a Certificate of Substantial Completion, with appropriate conditions, accompanied by a list of the items to be completed and corrected, as verified and amended by Engineer. Omission of any item from the list shall not relieve Contractor from responsibility to complete all the work in accordance with the Contract.

3. Metro occupancy of Project or designated portion of Project:
   a. Metro may use all or part of the work within the time designated in the Certificate of Substantial Completion, upon notice to the insurance company or companies as provided in Article 9 of the General Conditions.

4. Contractor shall complete all the work within the time designated in the Certificate, or if not so designated within a reasonable time.

D. Should the Engineer and Metro consider that work is not substantially complete:

1. Engineer shall notify Contractor, in writing stating reasons and list of items.

2. Contractor shall complete work and send second written notice to Engineer and Metro certifying that Project or designated portion of Project is substantially complete.

E. Warranties: Under Article 7 of the General Conditions guarantee and warranty periods begin with the date of final acceptance. However, in connection with any specific equipment certified by the Engineer as completed and its use or operation thereof for its intended purpose is assumed by Metro, the warranty period for such equipment shall begin with the beginning date of such use or operation.

1.3 FINAL INSPECTION

A. Contractor shall submit written certification that:

1. Contract Documents have been reviewed.

2. Work has been completed in accordance with Contract Documents.

3. Equipment and systems have been tested in presence of Metro's representative and are operational.

4. Project is completed, and ready for final inspection.

B. Engineer will make final inspection within a reasonable time after receipt of certification.

C. Should Engineer consider that work is complete in accordance with requirements of Contract Documents, Engineer shall request Contractor to make project closeout submittals.

D. Should Engineer and Metro consider that work is not complete:

1. Engineer shall notify Contractor, in writing, stating reasons.

2. Contractor shall take immediate steps to remedy the stated deficiencies, and send second written notice to Engineer certifying that work is complete.

3. Engineer will reinspect work.

1.4 REINSPECTION COSTS

In addition to any overtime inspection due under Article 9 of the General Conditions, should Engineer be required to perform second inspections because of failure of work to comply with original certifications of Contractor, Metro will compensate Engineer for additional services as stated in said article and charge Contractor for such fees at the Engineer's currently established billing rate.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: To requirements of Section 01720.

B. Guarantees and bonds required by these specifications: See Article 7 of General Conditions and specific equipment or material specifications.

C. Easement Release: Section 01545 (where applicable).

D. At the close of the Contract Contractor shall:

1. Pay all utility bills.

2. Remove all electrical, sanitary, gas, telephone, water, offices and any other temporary service equipment that may remain.

3. Arrange for transfer of electrical, water and other applicable utility accounts to Metro's name.

E. Deliver evidence of compliance with requirements of governing authorities (where applicable).

1.6 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit final statement of accounting to Engineer.

B. Statement shall reflect all uncompleted adjustments:

1. Additions and deductions resulting from:
   a. Previous Change Orders.
   b. Cash Allowances.
   c. Unit Prices.
   d. Other Adjustments.
   e. Deductions for Liquidated Damages.

2. Unadjusted sum remaining due.

1.7 FINAL APPLICATION FOR PAYMENT

Contractor shall submit final application for payment in accordance with requirements of General Conditions and shall reflect the final adjustment of accounts in Paragraph 1.6.

1.8 FINAL CERTIFICATE FOR PAYMENT

A. Engineer will issue Final Certificate in accordance with provisions of General Conditions.

B. Should final completion be materially delayed through no fault of Contractor, Engineer may issue a Final Certificate for Payment, in accordance with provisions of General Conditions and existing laws.

1.9 POST-CONSTRUCTION INSPECTION

A. Prior to expiration of one year from Date of Substantial Completion or Final Acceptance, Engineer may make visual inspection of Project in company with Metro and Contractor to determine whether correction of work is required, in accordance with warranty/guarantee provisions of General Conditions.

B. For guarantees beyond one year, Engineer will make inspections at request of Metro, after notification to Contractor.

C. Metro will promptly notify Contractor, in writing, of any observed deficiencies.

*** * * END OF SECTION * * ***

SECTION 01720

PROJECT RECORD DOCUMENTS

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Closeout Submittals: Article 9 General Conditions and Section 01700.

B. Project Coordination: Section 01041

C. Shop Drawings, Project Data, and Samples: Section 01340

D. Operation and Maintenance Data: Section 01730

1.2 MAINTENANCE OF RECORD DOCUMENTS

A. Contractor shall maintain at job site, one record copy of:

1. Contract Drawings.

2. Project Specifications.

3. Addenda.

4. Reviewed Shop Drawings.

5. Change Orders.

6. Other Modifications to Contract.

7. Field Test Records.

8. Operational and Maintenance Data Delivered with Mechanical and Electrical Equipment.

9. Certified Weight Tickets

B. Store record documents apart from working documents used for construction.

C. Provide files and shelves for storage of record documents.

D. Maintain record documents in clean, dry, legible condition.

E. Do not use record documents for daily construction purposes.

F. Make record documents available at all times for inspection by Engineer and Metro.

1.3 RECORDING

A. Do not permanently conceal any work until required information has been recorded.

B. Keep record documents current.

C. Contract Drawings: Legibly mark to record actual construction:

1. Horizontal and vertical location of underground utilities and appurtenances and references to permanent surface improvements.

2. Field changes of dimension and detail.

3. Changes made by Change Order.

4. Details not on original Contract Drawings.

D. Specifications and Addenda: Legibly mark up each Section to record:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.

2. Changes made by Change Order.

3. Other matters not originally specified.

E. Shop Drawings: Maintain as record documents; legibly annotate drawings to record changes made after review.

1.4 SUBMITTAL

A. At completion of project, deliver complete set of all record documents to Engineer.

B. Accompany submittal with transmittal letter signed by Contractor or his authorized site representative.

*** * * END OF SECTION * * ***

SECTION 01730

OPERATION AND MAINTENANCE DATA

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Testing, Startup and Operation: Section 01650
B. Material and Equipment: Section 01600
C. Contract Closeout: Section 01700
D. Spare Parts and Maintenance Materials: Section 01750
E. Material and Equipment Specified: All Divisions

1.2 REQUIREMENTS

A. The Contractor shall submit to Engineer two copies of draft operations and maintenance manuals for each major piece of equipment and system component at least 30 days prior to scheduled testing and at least 30 days prior to submitting written notice of substantial completion.

B. Engineer and Metro will review and return one copy with comments. If corrections are required, the Contractor will make corrections and resubmit one corrected copy plus corrected pages for the copy in Metro's possession.

C. Upon approval, the Contractor will furnish six (6) copies of the Operations and Maintenance Manuals. Complete approval of all required manuals will be a condition for final completion and payment.

D. The Operations and Maintenance Manuals will include as a minimum the following:

1. Table of Contents.
2. System Description and Functions of Individual Items of Equipment.
3. As Built Layout. Include locations of all elements and wiring diagram of control circuits.
4. Operations and Maintenance Instructions for each major item of equipment. These instructions will clearly identify the equipment actually provided and information pertaining to other models or variations will be lined out. The instructions

will include information on:

a) Operating conditions
b) Installation instructions
c) Startup procedures
d) Shut down procedures
e) Maintenance instructions
f) Trouble shooting procedures.

5. Maintenance Schedules - Cross reference these schedules to specific paragraphs in the O&M Instructions.
6. Spare Parts and lubricants lists
7. Warranties

E. Specific requirements for the Electrical Operations and Maintenance Manual are included in Division 16.

1.3 MANUAL ASSEMBLY

A. Data shall be bound in first quality, heavy, permanent 3-ring type binders. The Contractor shall submit the binding he proposes to furnish to the Engineer for his approval before assembling all of the material.

B. Manuals shall be assembled and indexed so that information on any piece of equipment can be readily found.

1.4 MAINTENANCE SCHEDULED

A. Maintenance schedules for each item of equipment will include a "summary of maintenance" substantially in the following format:

1. Name of Item: _____

2. Name of Manufacturer: _____

   Address: _____

3. Name Plate Information: _____

4. Nearest Local Representative: _____

   Address: _____

   Telephone No.: _____

5. Maintenance Requirements | Date or Frequency | Remarks

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6. Spare Parts List (to be kept on hand)

7. Type of Lubricant (if required) _____

*** * * END OF SECTION * * ***

SECTION 01750

SPARE PARTS AND MAINTENANCE MATERIALS

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Operation and Maintenance Data: Section 01730

B. Specific Requirements for Individual Items: All Divisions

1.2 SPARE PARTS

A. All equipment shall be furnished with spare parts as recommended by the manufacturer. All bearings, bushings and shaft sleeves shall be "export" packaged.

B. Additional spare parts shall be furnished when specifically listed under any products.

1.3 LUBRICANTS

A. The Contractor shall provide a maintenance schedule in the O&M Manual on which shall be shown, in a list, each item of equipment requiring lubricant, the type and quantity of lubricant required, the frequency of lubrication required and a space for the last date that each piece of equipment was lubricated.

B. The Contractor shall provide a one year's supply of every kind of packing grease or oil required for new equipment.

C. Furnish 1 each all oil cans, grease guns and all other necessary items for proper lubrication.

D. Lubrication charts shall be included in maintenance manual.

*** * * END OF SECTION * * ***

DIVISION 2 - SITEWORK

INDEX

SECTION 02010

SUBSURFACE INVESTIGATION

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Information Available to Bidders: Section 00200
B. Job Site Administration: Section 01043
C. Shoring: Section 02150

1.2 GEOTECHNICAL REPORTS

A. Any data on geotechnical and/or subsurface conditions shown in the Plans or Specifications is not to be taken as an actual representation, but is based on limited information and is at best only an opinion; consequently, such data cannot be considered precise or complete and there is no guarantee as to its completeness, accuracy, or precision.

B. Available reports may be reviewed at the Metro offices. Included, but not limited to are the following reports:

- Cornforth Consultants, October, 1991. Geotechnical Investigation of Subarea 1 Interim Clay Cover.
- Cornforth Consultants, October 1990. Technical Memorandum for Leachate Migration, Perimeter Dike, St. Johns Landfill.
- Cornforth Consultants, October 1990. Geotechnical Investigation for Proposed Motor Blower/Flare Facility, St. Johns Landfill.
- Cornforth Consultants, October 1990. Five Interior Monitoring Wells, As Constructed, St. Johns Landfill.
- Metro Solid Waste Deparment. 1990. Various topographic maps of the St. Johns Landfill site dated 1979 to 1990. Provided by Metro.
- Metro Solid Waste Department. September, 1989. Revised Closure and Financial Assurance Plan for the St. Johns Landfill.

C. These reports were obtained and/or prepared only for use by the Engineer in design and are not a part of the Contract Documents.

* * * END OF SECTION * * *

SECTION 02050

DEMOLITION

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Embankment and Grading: Section 02220

B. Excavating, Backfilling and Compacting for Utilities: Section 02222

C. Existing Utilities/Facilities: Section 02760

1.2 PROTECTION

A. Access roads, monitoring wells, existing landfill cover soil and other work to remain shall be protected throughout the work or repaired by the Contractor if damaged.

1.3 REMOVAL OF EXISTING CULVERTS

A. Existing culverts where designated on the Drawings shall be removed. The method and timing of removal shall be part of the Contractor's erosion control plan and shall provide, at all times, for proper control of all surface water and erosion. Existing culverts may be salvaged and reused if the culvert is in suitable condition as determined by the Engineer. Culverts removed which are not suitable for reuse shall be properly disposed of by the Contractor.

B. For culverts along Road 'E', the excavation shall be backfilled with subgrade embankment material to the original top of existing low permeable soil. Placement and compaction shall be as required for subgrade embankment in these Specifications. Bentonite Mat shall be placed over the backfill and overlap the adjacent existing clay a minimum of two feet. The Bentonite Mat shall be in intimate contact with the existing clay in the overlap.

* * * END OF SECTION * * *

SECTION 02150

SHORING

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Health and Safety Plan: Section 01100

B. Excavating, Backfilling and Compacting for Utilities: Section 02222

1.2 QUALITY ASSURANCE

A. Contractor's sheeting and shoring plans shall be designed by a structural engineer with experience in the work.

2.0 PRODUCTS

2.1 TRENCHES

A. Materials used shall be at the Contractor's option. Alternately, trench excavation sloped as required per OSHA and other agencies may be acceptable in lieu of shoring.

3.0 EXECUTION

3.1 SAFETY REQUIREMENTS

A. Shoring shall be placed in accordance with federal, state and local safety requirements.

B. The Contractors Health and Safety Program shall apply specifically where excavating in refuse. Refer to Section 01100.

3.2 CRIBBING AND SHEETING

A. Unless otherwise provided, the Contractor shall provide all cribbing and sheeting needed to protect the work, adjacent property and improvements, utilities, pavement, etc., and to provide safe working conditions in the trench.

B. Removal of any or all cribbing and sheeting from the trench shall be accomplished in such a manner as to fulfill all of the above requirements and shall also be accomplished in such a manner as to prevent any damage to the work.

C. Damages resulting from improper cribbing or from failure to crib shall be the sole responsibility of the Contractor.

3.3 SPECIAL REQUIREMENT FOR FLEXIBLE PIPE

A. Shoring to be removed, or moveable trench shields or boxes, shall be located at least 2-1/2 pipe diameters away from the pipe if the bottom of the shoring, shield or box extends below the top of flexible pipe, unless a satisfactory means of reconsolidating the bedding or side support material disturbed by shoring removal can be demonstrated.

B. Damages resulting from improper shoring or failure to shore shall be the sole responsibility of the Contractor.

* * * END OF SECTION * * *

SECTION 02220

EMBANKMENT AND GRADING

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Subsurface Conditions: Section 02010
B. Excavating, Backfilling & Compacting for Structures: Section 02221
C. Excavating, Backfilling, and Compacting for Utilities: Section 02222

1.2 APPLICABLE PUBLICATIONS: The following publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

A. American Society for Testing and Materials (ASTM) Publications:

D 698	Standard Proctor
D 4318	Liquid Limit, Plastic Limit and Plasticity Index of Soils
D 1556	Density of Soil In-Place by the Sand-Cone Method
D 1140	Grain Size Distribution (Fines Content)
D 422	Grain Size Distribution (Sieve/Hydrometer Analyses)
D 2922	Density of Soil and Soil-Aggregate in place by Nuclear methods (shallow depth)
D 2217	Wet Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants
D 2487	Classification of Soils for Engineering Purposes

1.3 QUALITY CONTROL

A. Soils and Backfill: Compaction standard ASTM D698 method unless otherwise specifically approved, grainsize distribution ASTM D422 and moisture content determination ASTM D2216.

B. In-place Density Determination: Sandcone method ASTM D1556 or Nuclear method ASTM D2922.

C. Classification of Soils ASTM D2487 and Liquid Limit, Plastic Limit and Plasticity Index of Soil ASTM D4318.

D. Quality control assurance monitoring of subgrade, low permeable soil, backfill, embankment materials and construction will be by the Geotechnical Engineer.

E. Contaminated borrow materials shall not be accepted on the jobsite. If any material is found to contain hazardous material or hydrocarbons, all costs for testing, removal, disposal and impact on the work will be borne by Contractor. Soil which is contaminated with petroleum (Hydrocarbons) will be acceptable for this project only as 'subgrade embankment' if it has been treated to level one standards as defined in Oregon Administrative Rule (OAR) 340-22-305 to 360. Specific written verification of said treatment will be required by Metro prior to acceptance of this contaminated borrow material on the job site.

F. Contractor shall insure that materials containing excessive free water are not brought on the site.

1.4 SUBMITTALS

A. Excavation, Embankment and Grading Plan - Contractor will provide an overall plan for the earthwork required for this project at least seven (7) days prior to the start of excavation and stockpile of top soil and low permeability soil and/or placement of subgrade embankment materials. The plan will include as a minimum:

1. Procedures and equipment

2. Location of haul roads and traffic control

3. Location of stockpiles

4. Plan for site drainage and surface water control

5. Survey control procedures to ensure excavations and embankments are made to the proper line and grade

B. Proposed Borrow Sources - Contractor will submit the name, location and owner of all proposed borrow sources with an estimate of the quantity of suitable materials available. The submittal will include gradation tests for both Type I sand and for Subgrade Embankment materials as well as Certification by Contractor that the proposed borrow sources contain no hazardous contaminants or hydrocarbons. This information shall be submitted at least 14 days prior to required delivery to allow Metro time for their investigation and evaluation of the site. In addition to the above, should the Contractor elect to supply treated petroleum contaminated soil as 'subgrade embankment', specific submittal shall include soil treatment methods used and recent laboratory test to indicate compliance with OAR 340-22-305 to 360.

C. Site Drainage/Leachate Control Plan - Contractor shall prepare a plan for preventing releases of contaminants or leachates into the surrounding waters and for immediate action to mitigate the damage in the event that a release occurs. The purpose is to plan for the intentional excavation into refuse such as for the gas trenches sedimentation basins, condensate tanks or for inadvertent exposure of refuse in grading operations. This plan must be submitted no later then ten (10) days after Notice to Proceed. Contractor will include procedures for working in excavated refuse or in handling leachates in the Health and Safety Plan (Section 01100)

1.5 SCOPE

A. The embankment and grading work includes: Existing topsoil removal, stockpiling and placement; topsoil import and placement, low permeable soil removal, stockpiling and replacement; excavation and grading of roadways, ditches, channels, drains, sedimentation basins; placement and compaction of fill material for landfill subgrade and roadways; preparation of existing subgrade soils, placement, grading and compaction of Type A and Type B low permeable soils; preparation of subgrade surface; placement and grading of Type 1 sand and topsoils.

1.6 DEFINITIONS

A. REFUSE

Refuse is defined as any natural or manmade material making up any part of the contents of the landfill, including waste fills, daily cover materials, and any

soil materials that has been contaminated to any degree by contact with any part of the waste fill.

B. ON-SITE DEBRIS

On-site Debris means all nonuseable natural material produced by clearing, grubbing, or cleanup.

C. LEACHATE

Leachate is defined as any liquid, regardless of quality, that has come in contact with any part of the refuse, and includes all groundwater encountered on site, and any surface water that contacts any part of the landfill not covered by final cover, interim cover or sufficient subgrade embankment or low permeable soil as determined by the Engineer.

D. DEGREE OF COMPACTION

The Degree of Compaction is the percentage of the maximum density obtained by the test procedure presented in ASTM D698, and is abbreviated as a percent of laboratory-determined maximum density.

E. SUBGRADE EMBANKMENT

Subgrade Embankment shall be that material used to construct the final subgrade contours as shown on the plans. Material used for Subgrade Embankment may consist of clay, sand, gravel, pit run rock or a combination of these items meeting the requirements of these Specifications. Soil which is contaminated with petroleum (Hydrocarbons) will be acceptable for this project only as 'subgrade embankment' if it has been treated to level one standards as defined in Oregon Administrative Rule (OAR) 340-22-305 to 360. Specific written verification of said treatment will be required by Metro prior to acceptance of this contaminated borrow material on the job site.

F. TYPE I SAND

Type I Sand shall be that material used to cover and protect the geosynthetic components of the landfill cover as shown on the plans.

G. TOPSOIL

Topsoil consists of suitable on-site topsoils and imported topsoils used in the construction of the final cover system as shown on the plans. Topsoil materials shall be organic, friable and fertile in nature and shall be fully capable of supporting the growth of surface grasses at the St. Johns Landfill.

H. EXISTING LOW PERMEABLE SOIL

Existing Low Permeable Soil consists of on-site clayey soil that was placed as part of the existing interim cover of the landfill as shown on the Drawings.

I. IMPORTED LOW PERMEABILITY SOIL

Imported low permeable soil consists of clay, clayey silt, or silty clay imported onto the landfill site from an outside source.

J. NATIVE SOIL

Where this term is utilized on the Drawings, material furnished shall conform with Subgrade Embankment except that no rock pieces larger than 3" measured in any dimension will be permitted.

K. EXISTING DAILY COVER

Existing Daily cover consists of a minimum of six (6) inches of compacted cover material which was put onto all exposed refuse at the end of each day during active landfill operations.

L. EXISTING INTERIM COVER

Existing Interim Cover consists of approximately 18-inches of compacted Low Permeable Soil and approximately six-inches of existing topsoil material.

1.7 FINAL COVER

A. The barrier layer for the final cover is composed of two parts; a low permeable soil layer and a geomembrane. There are two variations of the barrier layer. These two variations are identified on the Drawings as Final Cover Types 'A' and 'B'.

B. Final Cover Type 'A' is generally located on the steeper side slopes of the landfill. The barrier layer for Type 'A' cover utilizes the existing low permeable soil in its existing position. The existing topsoil overlaying the low permeable soil shall be removed and the surface of the low permeable soil shall be prepared in accordance with the Specifications. Textured geomembrane shall then be placed over the prepared surface of the low permeable soil.

C. Final Cover Type 'B' is generally located on the flatter top slopes of the landfill. The barrier layer for Type 'B' cover also utilizes the existing low permeable soil. However, the existing topsoil and low permeable soil in these areas must be removed so that subgrade embankment material can be placed to achieve final subgrade

contours. After the subgrade embankment material is placed, the removed existing low permeable soil shall be placed and compacted in accordance with the Drawings and Specifications to achieve the geomembrane subgrade contours.

D. In areas where interim cover does not exist, the final cover shall be Type 'B' with the following exceptions;

- o Bentonite Mat shall replace the low permeable soil component. It shall be in intimate contact with and overlap two feet over the top of the adjacent low permeable soil at the transition.

- o The subgrade embankment material shall be placed up to the Geomembrane Subgrade contours shown on the Drawings.

E. In areas to receive Type 'B' cover and where interim cover does exist, but the Contractor fails to recover enough existing low permeable soil to provide full depth and coverage as required by the Drawings and Specifications; the Contractor shall provide Bentonite Mat or imported low permeable material meeting the requirements of the Specifications. Bentonite Mat shall be installed as described above. Imported low permeable material shall be installed in accordance with requirements for placement of existing low permeable soil. All cost associated with providing imported low permeable soil or Bentonite Mat, due to failure to recover sufficient existing low permeable soil, shall be incidental to work and at no additional cost to Metro.

F. In areas to receive Type 'A' cover and where excavation through the existing low permeable soil is required for down slope flumes and horizontal gas collection trenches, the existing low permeable soil shall be excavated, protected, and reused in accordance with the requirements for Type 'B' cover. The cost for this work shall be incidental to the surface preparation of the existing low permeable soil for Type 'A' cover.

2. MATERIALS

2.1 EXISTING TOPSOIL

A. Existing topsoils shall be surface soils obtained above the existing low permeable soil at St. Johns Landfill. Satisfactory existing topsoils shall be free of subsoil, clay lumps, gravel, and other objects over 2" in diameter, and free of large roots, refuse, sticks or other objectionable material.

2.2 IMPORTED TOPSOIL

A. Shall be organic surface soils obtained in a depth of not more than 10" below native ground surface combined with yard debris compost.

B. Imported topsoil shall be 50% yard debris compost. Yard debris compost shall consist of brush, branches, leaves, grass clippings and clean woody yard debris. The yard debris must be ground so that a minimum of 95% of the material passes through a 5/8" screen opening. Compost shall be thoroughly mixed and heated (to 140° F) to ensure destruction of weed seed and plant pathogens. Only mature and stable compost will be acceptable; having temperature less than 20 degrees above ambient temperature and free of viable weed seed, adequate decomposition has occurred and minimal levels of herbicides and pesticides exist. All requirements to be verified by testing provided by the Contractor. The imported topsoil material shall be tested for nutrient composition (nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, N03-N and NH4-N), pH and salinity.

C. Imported topsoil shall be pre-mixed (topsoil and yard debris compost) off-site. Contractor shall provide certification to the Engineer with each delivery stating that imported topsoil complies with above requirements.

2.3 TYPE 1 SAND

A. Satisfactory Type 1 Sand materials shall consist of clean, coarse to fine sand and may consist of river dredged sand, "screenings" and/or pit run sand. Contractor shall provide gradation test results for all proposed borrow sources.

B. River dredged, pit-run, and other sand shall conform to the following gradation limits based on wet sieve analysis, weight basis:

Sieve Size	Percent Passing by Weight
1/2"	100
No. 4	80 - 100
No. 10	50 - 100
No. 40	5 - 80
No. 100	0 - 12
No. 200	0 - 5

C. Screenings sand shall conform to the following gradation limits based on wet sieve analysis, weight basis:

Sieve Size	Percent Passing by Weight
1/2"	100
No. 4	70 - 100
No. 10	40 - 80
No. 40	0 - 30
No. 100	0 - 10
No. 200	0 - 7

D. Each proposed off-site borrow source for Type 1 Sand will be visually inspected and tested for compliance with the Specifications by the Geotechnical Engineer. Materials from off-site borrow sources which do not meet the Specifications, as determined by the Geotechnical Engineer based on visual inspection and test results, shall not be suitable for use as Type 1 Sand.

E. Compaction curves per ASTM D698 will be developed by the Geotechnical Engineer for each suitable borrow source.

F. Materials from borrow sources which have not been visually inspected and tested by the Geotechnical Engineer, or which are not suitable as stipulated in (D) above, shall not be brought onto the landfill site.

G. Since the Geotechnical Engineer cannot inspect all materials coming from the borrow source(s), the inspection and testing program shall not relieve Contractor's responsibility to provide Type 1 Sand to the site which meet all requirements stipulated in the Specifications.

2.4 SUBGRADE EMBANKMENT

A. Shall consist of any soil free of organic matter, contaminants, refuse, and rock pieces larger than 10" in diameter. Subgrade Embankment may consist of clay, sand, gravel, pit run rock, or a combination of the same.

B. Each proposed off-site borrow source for Subgrade Embankment will be visually inspected and tested for compliance with the Specifications by the Geotechnical Engineer. Materials from borrow sources which do not meet the Specifications, as determined by the Geotechnical Engineer based on visual inspection and test results, shall not be suitable for use as Subgrade Embankment.

C. Compaction curves per ASTM D698 will be developed by the Geotechnical Engineer for each suitable borrow source.

D. Materials from borrow sources which have not been visually inspected and tested by the Geotechnical Engineer, or which are not suitable, as stipulated in (B) above, shall not be brought into the landfill site.

E. Since the Geotechnical Engineer cannot inspect all materials coming from the borrow source(s), the inspection and testing program shall not relieve Contractor's responsibility to provide Subgrade Embankment to the site which meet all requirements stipulated in the specifications.

2.5 DRAIN ROCK

A. Shall consist of a clean, well-graded gravel or rock, with not more than 5 percent passing No. 200 sieve, based on wet sieve analysis. Drain Rock shall be well graded and conform with the following gradation limits:

Sieve Size	% Passing (By Weight)
1-1/2" square	100
U.S. No. 200	0 - 5

2.6 QUARRY SPALLS

A. Shall consist of angular, durable basalt or andesite rock with a minimum specific weight of 160 pcf. The rock for quarry spalls shall conform to the following gradation limits:

Size	% Finer (By Weight)
8"	100
3"	40 max.
3/4"	10 max.

2.7 ROADWAY EMBANKMENT

A. Shall consist of a clean, well-graded gravel, having hard, strong, durable pieces, with not more than 5 percent passing No. 200 sieve, based on wet sieve analysis. It shall be well graded and conform with the following gradation limits:

Sieve Size	% Passing (By Weight)
1-1/2" square	100
3/4" square	80-100
3/8" square	50-85
U.S. No. 4	30-65
U.S. No. 8	15-40
U.S. No. 200	0-5

2.8 CRUSHED SURFACING BASE COURSE

A. Shall consist of a clean, well-graded, 3/4-inch minus crushed rock with not more than 5 percent passing the No. 200 sieve, based on wet sieve analysis.

2.9 STRUCTURAL FILL

A. Shall consist of a clean, well-graded 2" minus crushed rock, with not more than 5% passing the No. 200 sieve, based on wet sieve analysis.

2.10 LAVA ROCK BACKFILL

A. Lava Rock Backfill for gas extraction well completions shall consist of crushed, processed, or naturally occurring granular "lava-rock" material.

It shall be essentially free from various types of wood waste or other characteristics of size and shape that it will compact readily and shall meet the following specifications for grading, quality, and density:

Sieve Size	Percent Passing
3/4" Square	100

1/4" Square	0

The density shall range from 55 lb/ft^3 (min.) to 67 lb/ft^3 (max.).

2.11 IMPORTED LOW PERMEABLE SOIL

A. Shall consist of a clay, silty clay, or clayey silt free of organic matter, foreign material, and rock pieces larger than 1" in diameter. The Imported Low Permeable Soil shall have a Plasticity index greater than 10 and shall conform to the following gradation limits:

Sieve Size	Percent Passing (Wet sieve analysis)
No. 4	97 - 100
No. 40	85 - 100
No. 200	75 - 100

3. EXECUTION

3.1 WEATHER CONDITIONS

A. All earthwork described in this section shall be performed during dry weather, typically May through October.

B. The Geotechnical Engineer will monitor wet weather conditions during the Contract Period. If the quality of the work is susceptible to degradation due to deficient construction procedures, or if undue damage to existing installations such as haul roads, vegetation covers, or engineered soil covers is occurring, the Engineer shall recommend to Metro that the work be stopped.

3.2 FINAL COVER

A. The barrier layer of the final cover is composed of a geomembrane underlain by a low permeable soil layer. Two types of final covers will be constructed for this Contract: i) Final Cover Type 'A' will be constructed on the steeper sideslopes of Subarea 1 and the Power Line Corridor. The Type 'A' cover utilizes the existing low permeable soil in its existing position. The in-place low permeable soil will be recompacted under strict compaction control requirements; and ii) Final Cover Type 'B' would be located on the flat-top slopes of Subarea 1 and the flat area of the Powerline Corridor (PLC). The Type 'B' cover utilizes the existing low permeable soil which will be removed from Subarea 1 and stockpiled. Twelve inches, compacted

thickness, of low permeable soil will be placed and compacted under strict conditions of moisture and compaction control.

B. The locations for Type 'A' and Type 'B' cover construction are shown on the Drawings.

3.3 EXISTING TOPSOIL REMOVAL, STOCKPILING AND REPLACEMENT

A. The Contractor shall develop and follow an approved plan for stripping areas of existing on-site topsoil, stockpiling of reusable topsoil, and placing existing reusable topsoil on the prepared slopes of the final cover.

B. Contractor shall remove existing topsoil to a depth sufficient to insure that most of the topsoil has been removed from the surface of the underlying existing low permeable soil. Approximately 6 inches thickness to topsoil will be stripped.

C. Existing grass vegetation may be removed with the underlying topsoil provided it is cut to a height not exceeding 3 inches at the time of topsoil removal, and thoroughly mixed with the underlying topsoil prior to or during the topsoil removal process. Grass clippings resulting from cutting the grass to the specified height, may also be mixed with the underlying topsoil provided the clippings are mulched and evenly spread over the mowed area in a layer not exceeding 1.5 inches thick prior to the topsoil removal process.

D. Topsoil deemed unsuitable for reuse by the Engineer shall be disposed of on site in Subarea 4 unless otherwise approved by the Engineer. Unsuitable topsoil means soil material which appears to be unable to support the required growth of surface grasses. Topsoil suitable for reuse shall be placed in a stockpile at a location approved by the Engineer and/or shown on the Drawings. Stockpiled topsoil shall be kept free of contamination by refuse or other objectionable materials. Temporary covering of the stockpile with plastic to prevent contamination or erosion may be necessary.

3.4 EXCAVATION IN REFUSE

A. The variety of refuse disposed of within the landfill is unknown. Where excavation in refuse is required, the Contractor shall remove and dispose of all materials encountered in the refuse. Excavated refuse shall be disposed of on-site in Subarea 4 unless otherwise approved by the Engineer.

B. When it is necessary to excavate into refuse in order to perform any of the work, the Contractor shall follow an approved Health and Safety

Plan during excavating, handling, and disposing of the refuse, and whenever working in proximity to exposed refuse. **The Contractor is cautioned that the possibility of encountering potentially harmful gases, liquids or wastes exists.**

C. Excavation of refuse may be required to obtain a portion of the grades shown on the grading plan, for installation of horizontal gas wells, condensate tanks, drainage ditches, and sedimentation basin construction. Excavation of refuse for other facilities may also be required.

D. Excavation into refuse may require surface water/leachate diversion and groundwater/leachate removal and disposal. Prior to any dewatering, the Contractor shall submit for approval to the Engineer a plan of the methods, installations and details of the proposed water control system and his intended disposal methods for contaminated groundwater/leachate collected during dewatering. The Contractor shall follow a plan approved by the Engineer for all dewatering. Dewatering activities shall be performed in accordance with the Contractors approved Health and Safety Plan.

3.5 EXCAVATION AND STOCKPILING OF EXISTING LOW PERMEABLE SOIL

A. Existing Low Permeable Soil shall be excavated from areas to receive Type 'B' cover or Subgrade Embankment. The locations of Existing Low Permeable Soil removal and stockpiles are shown on the Contract Drawings.

B. The surface of the Existing Low Permeable Soil shall be free of all topsoil and other extraneous matter, and shall be approved by the Geotechnical Engineer, prior to commencing the removal and stockpiling of Existing Low Permeable Soil for future use.

C. Contractor shall remove the Existing Low Permeable Soil to within two (2) inches of the underlying daily cover/refuse material. Approximately 24 to 42 inches of Existing Low Permeable Soil exists above the refuse in the area shown on the Drawings. This thickness and condition of the Existing Low Permeable Soil varies over the site as shown in the October 1991 report by Parametrix and Cornforth.

D. Contractor shall insure that the Low Permeable Soil remains clean and free from Topsoil, Dredge Sand, refuse, and other extraneous matter throughout the removal, haul, and stockpile operations. Removal of the Existing Low Permeable Soil shall be carefully performed so that refuse or other materials is not picked up and mixed with the Low Permeable Soil Stockpile.

3.6 CONSTRUCTION OF TYPE 'A' COVER

A. The Type A cover shall be constructed by compacting the in-place Existing Low Permeable Soil after the Topsoil has been removed. Prior to compaction, foreign materials and protrusions shall be removed and the surface made uniformly sloping indicated on the Drawings. The surface shall be free from angular rocks, roots, grass and vegetation. Cavities, excavations, and zones containing less than 6-inches of in-place Low Permeable Soil shall be backfilled with material meeting the specification for Imported Low Permeable Soil.

B. Compaction shall be accomplished using a multi-tired pneumatic or heavy pneumatic rubber tire roller greater than 40,000 pounds. A minimum of four passes of the roller encompassing the area of Type 'A' cover construction shall be required. The roller shall provide uniform compaction, work well on a slope, and leave a relatively smooth surface. Vibratory action shall not be used. The specific roller used for compacting the Type 'A' cover shall be approved by the Geotechnical Engineer in advance of the work.

C. General construction traffic shall not be allowed on the compacted Low Permeable Surface except for grading equipment needed to finish the surface prior to placing the Geosynthetic.

D. The surface of the Type A cover shall be finished as stipulated in Paragraph 10.

E. Textured geomembrane shall be placed on the finished Type A low permeable soil surface as stipulated in Section 02272.

3.7 CONSTRUCTION OF TYPE 'B' COVER

A. The Type B cover shall be constructed by placing and compacting twelve inches, compacted thickness, of low permeable soil after the design subgrade on the top slopes of Subarea 1 and the PLC have been prepared. Provide a minimum of 12 inches, compacted thickness, of subgrade embankment below low permeable soil. Excavation of refuse may be required. Prior to geosynthetic placement, foreign materials and protrusions shall be removed and the surface made uniformly sloping as indicated on the Drawings.

B. Low Permeable Soil delivered to Subarea 1, or the PLC, will be visually inspected by the Geotechnical Engineer. Material which is outside the specifications, will not be accepted for placement based on the visual inspection. Unacceptable materials shall be disposed of in Subarea 4 by the Contractor at the Contractor's expense.

C. Contractor shall utilize all stockpiled Low Permeable Soil from Subarea 1, prior to importing Low Permeable Soil from off-site or from other on-site stockpiles.

D. The Low Permeable Soil shall be placed and compacted using the following procedure:

1. The Low Permeable Soil shall consist of clods no greater than 1.5-inches in the largest dimension. If larger clods are present, the Soil shall be repeatedly pulverized using a farm type disc, rototiller, or other appropriate means to meet the size requirement.

2. The moisture content of the soil shall be adjusted to be within a range of 2 percent below optimum to 3 percent above optimum based on ASTM D698 (standard Proctor).

3. Compaction shall be accomplished using a medium weight roller greater than 30,000 pounds with penetrating feet greater than 6-inches long. The roller shall provide uniform compaction. Vibratory action shall not be used. The specific roller used for compacting the Type 'B' cover shall be approved by the Geotechnical Engineer in advance of the work.

4. The Type B cover shall be constructed in two 6-inch finish thickness lifts. The material shall be placed in successive horizontal layers and compacted to the 6-inch thickness as required. Each layer shall be compacted by the Contractor to the specified requirement before the overlying lift is placed.

5. Each layer shall be compacted to not less than 95 percent of the standard Proctor maximum dry density. Placement procedures will be monitored by the Geotechnical Engineer. Compaction will be verified by the Geotechnical Engineer via periodic testing of the lifts.

E. General construction traffic shall not be allowed on the compacted Low Permeable Surface except for grading equipment needed to finish the surface prior to placing the Geosynthetic.

F. The surface of the Type B cover shall be finished as stipulated in Paragraph 3.10.

G. Smooth geomembrane shall be placed on the finished surface of the Type B low permeable soil as stipulated in Section 02272.

3.8 PLACEMENT OF TYPE 1 SAND

A. Type 1 Sand shall be installed over completed sections of the Geonet Composite. During Type 1 Sand installation, the Geonet Composite shall be protected as stipulated in Section 02272.

B. Type 1 Sand shall be placed in a single 18-inch finished thickness lift with minimal compactive effort. Extreme care shall be exercised during placement to prevent damage or major disturbance to the geosynthetic liner system. Compaction shall consist of not more than 3 passes with a smooth-drum or grid type roller, or light to medium grading equipment. Placement method, design and location of temporary haul roads, number of passes, and type and weight of compaction equipment shall be pre-approved by the Engineer.

Type 1 Sand delivered to the site during construction will be visually inspected by the Geotechnical Engineer. Material which is outside the specifications will not be accepted for placement based on the visual inspection. Unacceptable materials shall be disposed of a specified by the Geotechnical Engineer at the Contractor's expense.

All Type 1 Sand material shall be imported from off-site sources. On-site Type 1 Sand that has been stockpiled shall not be used for this work.

C. The surface of the Type 1 Sand shall be uniformly smooth graded to within $\pm$2-inches of the line, grade, and cross-sections shown on the Drawings.

D. No construction traffic shall be allowed over the finished areas. Any damage to the liner system as a result of the Type 1 Sand placement and compaction activities shall be repaired by the Contractor at his expense.

E. Any significantly disturbed portions of the liner system, particularly on the sideslopes shall be corrected by the Contractor at his expense.

F. Topsoil shall be placed on the finished surface of the Type 1 Sand as stipulated in Section 02220.

3.9 PLACEMENT AND COMPACTION OF OTHER FILLS

A. Fills or embankments to achieve subgrade contours within Subarea 1 and the PLC as shown on the Drawings shall consist of Subgrade Embankment materials. The complete fill shall conform to the shape of the typical sections and contours indicated on the Drawings. The material shall be placed in successive horizontal layers of 12 inches in

loose depth and shall be compacted to not less than 90 percent of the standard Proctor maximum dry density. Subgrade Embankment placed near (3 feet ±) wells shall be compacted via powered hand tamper to protect well from damage.

Subgrade Embankment material delivered to the site during construction will be visually inspected by the Geotechnical Engineer. Material which is outside the specifications will not be accepted for placement based on the visual inspection. Unacceptable materials shall be disposed of as specified by the Geotechnical Engineer at the Contractor's expense. The Geotechnical Engineer may also reject materials that contain excessive free water.

All Subgrade Embankment material shall be imported from off-site sources. On-site Subgrade Embankment that has been stockpiled shall not be used for this work.

B. Crushed Rock: Each layer of fill shall be compacted by rolling with compaction equipment approved by the Geotechnical Engineer. Materials shall be compacted in horizontal lifts to not less than 95 percent of the standard Proctor maximum dry density.

C. Roadway Embankment and Crushed Rock Base Course for Access Roads: The roadway materials shall be compacted in horizontal 6-inch (loose measure) lifts. Each lift shall be compacted to not less than 97 percent of the standard Proctor maximum dry density.

D. All fills shall be shaped to line, grade, and cross section, and compacted as specified. Soft or otherwise unsatisfactory material shall be removed and replaced with suitable compacted material up to the required grades as directed by the Engineer.

E. All fills shall be finished as stipulated in Paragraph 3.9.

3.10 FINISHED EXCAVATION, FILLS, EMBANKMENTS AND GROUND SURFACES FOR GEOSYNTHETICS:

A. All surfaces to be covered by geosynthetics, including excavated, filled, and embankment sections and adjacent transition areas, shall be uniformly smooth-graded and compacted to within ±3-inches of the line, grade, and cross-sections shown on the Drawings. The surface in contact with the geosynthetic shall be smooth and free of broken face stones greater than 3/8 inch, smooth stones greater than 1-inch, sticks, roots, sharp objects, or other debris of any kind. The surface shall provide a firm, unyielding foundation for the geosynthetics with no sudden sharp or abrupt changes or breaks in grade, accept as shown on the Drawings. No standing water or excessive moisture will be

allowed. No construction traffic shall be allowed over the exposed subgrade.

B. Ditches or channels shall be cut accurately to the cross sections and grades indicated. Care shall be taken not to excavate or grade ditches or channels below the elevations required. Provide temporary erosion control measures, described elsewhere, as needed to maintain ditch geometry and grade during construction activities prior to placement of the final cover system materials and the permanent erosion control measures.

C. Other surfaces shall be uniformly smooth-graded and compacted reasonably true to line, grade and cross-sections shown on the Drawings.

3.11 PROTECTION:

A. During construction, fills, embankments, and excavations shall be kept shaped and drained. Newly graded areas shall be protected from traffic and erosion, and any local subsidence or washing away that may occur from any cause shall be repaired and grades reestablished to required elevations and slopes. All work shall be conducted in accordance with environmental protection requirements of the contract. Ditches and drains along subgrade shall be maintained in such a manner as to drain effectively at all times. The finished subgrade shall not be disturbed by traffic or other operation and shall be protected and maintained by the Contractor in a satisfactory condition until final cover materials are placed. The storage or stockpiling of materials on the finished subgrade will not be permitted. Final cover materials shall not be laid until the subgrade has been checked and approved by the Contractor and Engineer, and in no case shall final cover materials be placed on a muddy, spongy, or frozen subgrade.

B. Existing structures such as wells, control points, benchmarks, culverts, manholes and utilities poles within and adjacent to the construction area shall be clearly marked and protected from damage.

C. Abandonment of Wells D-8A and C-3 in the Power Line Corridor will be accomplished by others prior to earthwork starting in that area. Other existing wells in Subarea 1 and the powerline corridor are to be protected and remain undisturbed. The wells to be protected in Subarea 1 and the PLC include D-1 A, B. & C, D-2 A & B, G-7 and H-1. Additional wells to be protected will be delineated on the proposed on-site hauling plan. Appropriate protection devices may be required.

D. Extension of Well H-1 in Subarea 1 will be performed by others during placement of Subgrade Embankment material. Contractor shall coordinate this work through Metro and protect this well.

3.12 TOPSOIL PLACEMENT

A. Topsoil for the final cover shall conform to the requirements of this section. On-site existing topsoil that has been removed and stockpiled shall be used first for the final cover. When on-site existing topsoil has been depleted, the Contractor shall supply sufficient imported topsoil as necessary to complete the work.

B. The Contractor shall spread topsoil evenly over the specified areas to the depth shown on the plans or as otherwise ordered by the Engineer.

C. Topsoil shall not be placed when the ground or topsoil is frozen, excessively wet, or in the opinion of the Engineer, in a condition detrimental to the work. After the topsoil has been spread, all large clods, hard lumps, rocks larger than 1 inch in diameter, and litter shall be removed from the surface and disposed of by the Contractor. The topsoil shall then be placed to a uniform, dense state ready for hydroseeding operations.

D. During topsoil placement and up to the time the vegetative cover is established, the Contractor shall protect the work from erosion, traffic, Contractor's activities, and any other cause of damage. The Contractor shall repair or replace any damaged topsoil and vegetative cover at no additional expense to Metro.

* * * END OF SECTION * * *

SECTION 02221

EXCAVATING, BACKFILLING, AND COMPACTING FOR STRUCTURES

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Health and Safety Program: Section 01100
B. Shoring: Section 02150
C. Embankment and Grading: Section 02220
D. Excavation, Backfilling, and Compacting for Utilities: Section 02222
E. Sedimentation Control: Section 02275
F. Storm Drainage Facilities: Section 02720

1.2 CLASSIFICATION

A. All excavation is unclassified and the Contractor shall make his own estimate of the kind and extent of materials which will be encountered in the excavation.

1.3 QUALITY CONTROL

A. Soils and Backfill: Compaction standard ASTM D698 method unless otherwise specifically approved.

B. In-place Density Determination: Sandcone method ASTM D1556 or Nuclear method ASTM D2922.

C. Classification of Soils: ASTM D2487.

D. Quality control monitoring of subgrade backfill and embankment materials and construction at structures will be by the Geotechnical Engineer.

2. PRODUCTS

2.1 CRUSHED ROCK OR GRAVEL

A. All imported rock or gravel to be furnished under this Contract shall comply with Section 02220.

3. EXECUTION

3.1 GENERAL EXCAVATION REQUIREMENTS

A. The Contractor shall exercise care and caution in performing the work so as not to cause any slide or slip beyond the limits of the structure excavation.

B. Surplus excavated material suitable for Subgrade Embankment shall be stockpiled and reused on-site.

C. The excavation shall be dewatered as described in Section 02220 during excavation, construction of structures and placement and compaction of backfill.

D. Design of shoring is responsibility of the Contractor.

E. Excavations shall extend a sufficient distance from walls and footings to allow for placing and removal of forms, installation of services, and for inspection, except where concrete is specified to be placed directly against excavated surfaces.

F. The Contractor is cautioned that any excavation may encounter refuse, leachate, gases, etc. Refer to requirements for Health and Safety Program in Section 01100.

3.2 FOUNDATION PREPARATION

A. Foundation shall be dug to final grade so that subgrade is not disturbed.

B. Should the excavation be carried below the lines and grades specified on the drawings or should the bottom of the excavation be disturbed because of the Contractor's operations and require overexcavation and backfill, the Contractor shall refill such excavated space to the proper elevation with crushed rock at his own expense.

C. When the foundation excavation is complete, the Contractor shall notify the Engineer who will make an inspection and approve the work before any additional work or structure is placed thereon.

D. Contractor shall additionally notify the Engineer on completion of placement of foundation material. The Engineer will then make an inspection, make compaction tests, and the Engineer shall approve the work before any additional work or structure is placed thereon.

3.3 BACKFILLING

A. The Contractor shall provide and place as structural fill and shall bring the site to the grades shown on the Drawings.

B. Structural fill shall not be placed until the subgrade for the structure has been inspected by the Engineer.

C. No structural fill material shall be deposited against concrete structures until the concrete has developed at least 80% of its design strength or until the concrete has been in place for 28 days, whichever occurs first.

D. Structural fill material shall be placed in uniform 6" layers and shall be brought up uniformly.

E. Minimum compaction requirements:

Beneath slabs / footings	Backfill around Structure
Top 9 inches (re:subgrade)-97% Below 9 inches depth - 95%	95%

All compactions are referenced to percent of standard Proctor, maximum dry density.

F. Mechanical or power tampers may be used in compacting the structural fill material; however, no equipment or tamper may be used which by its weight or movement will damage, move or tilt out of alignment any part of the structure above or below the ground surface.

G. Contractor shall be responsible for any such damages and shall make necessary corrections and repairs at his own expense.

H. Unless otherwise specified, backfill around and above pipelines within the excavation line of any structure shall be the same as that specified for structures.

* * * END OF SECTION * * *

SECTION 02222

EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Subsurface Conditions: Section 02010
B. Embankment and Grading: Section 02220
C. Excavating, Backfilling and Compacting for Structures: Section 02221
D. Sedimentation Control: Section 02275
E. Storm Drainage: Section 02720
F. Existing Utilities/Facilities-Underground and Overhead: Section 02760
G. Gas and Condensate Collection System: Section 02680
H. Health and Safety Program: Section 01100

1.2 CLASSIFICATION

A. All excavation is unclassified unless separate bid item is included in bid form.

B. The terms earthwork or excavation include all materials excavated or removed regardless of material characteristics.

C. The Contractor shall make his own estimate of the kind and extent of materials which will be encountered in the excavation.

1.3 QUALITY CONTROL

A. Soils and Backfill: Compaction standard ASTM D698 method unless otherwise specifically approved.

B. In-place Density Determination: Sandcone method ASTM D1556 or Nuclear method ASTM D2922.

C. Classification of Soils: ASTM D2487

2. PRODUCTS

2.1 BEDDING MATERIAL

A. Bedding material, if required by the Drawings or elsewhere in this Specification, shall conform to Section 02220.

B. Unless otherwise specified, all pipe bedding material shall conform with Type I sand. Where gravel bedding is specified, it shall conform with Drain Rock.

2.2 WARNING TAPE

A. Continual, non-metallic warning tape made of inert plastic with large, bold, black letters equivalent to Calpico Underground Marking Tapes. Provide 2" minimum width yellow tape. Tape shall identify utility line (e.g. Buried Electric Line Below or Buried Gas Line Below).

3. EXECUTION

3.1 TRENCHING - GENERAL

A. Material shall be excavated from trenches and piled adjacent to the trench and maintained so that the toe of the slope of the spoil material is at least two (2) feet from the edge of the trench.

B. Contractor shall keep excavations free of water or leachate during pipe laying operations and until trench backfill is placed.

C. Contractor is responsible for shoring in accordance with Section 02150.

D. Contractor is responsible for Health and Safety in accordance with Section 01100. No trench excavation will take place until the Health and Safety Plan is approved.

3.2 TRENCHING FOR PIPES AND CULVERTS

A. Trenches must be of sufficient width to permit proper jointing of the pipe and backfilling of material along the sides of the pipe.

B. Trench width at the surface of the ground shall be kept to the minimum amount necessary to install the pipe in a safe manner, ordinarily accomplished by sloping the trench sides to the angle of repose of the material encountered or alternatively, to allow placement of shoring in the trench.

C. The length of trench excavated in advance of the pipe laying shall be kept to a minimum, and in no case shall it exceed 200 feet unless specifically authorized by the Engineer.

D. Trenches shall be excavated below the barrel of the pipe a sufficient distance to provide for bedding material, if specified.

3.3 PIPE BEDDING

A. Placement of bedding material in the pipe zone shall be as specified in the section regarding the pipeline being constructed or as shown on the Drawings.

B. Pipe bedding, where required, shall be completed before backfilling operations are started.

3.4 BACKFILLING

A. The Contractor shall take all necessary precautions to protect the pipe from any damage, movement or shifting. In general, backfilling shall be performed by pushing native material from the end of the trench into, along and directly over the pipe so that the material will be applied in the form of a rolling slope rather than by side filling which may damage the pipe. Backfilling from the sides of the trench will be permitted after sufficient material has first been carefully placed over the pipe to such a depth as to protect the pipe.

B. Compaction equipment used above the pipe zone shall be of a type that does not damage the pipe.

C. Temporary cribbing, sheeting, or other timbering shall be removed unless specifically authorized in writing.

D. Dewatering shall be continued until the trench is completely backfilled.

E. Where original excavated material is unsuitable for trench backfill, subgrade embankment materials shall be placed. In this use, maximum particle size shall be 2" diameter. The unsuitable material shall be removed to an on-site disposal area in Subarea 4. Imported material shall be used for trench backfill only where original material is unsuitable or specifically called for on the Drawings and upon prior approval by the Engineer.

F. Install warning tape continuously in trench backfill as detailed in the Drawings.

3.5 COMPACTION REQUIREMENTS

A. Trench backfill under roadways (existing or proposed) shall be mechanically compacted to 97% of standard Proctor maximum dry density in the top 3 feet. Below 3 feet, compaction to 95% of standard Proctor maximum dry density shall be achieved.

B. When working in areas outside of proposed traveled roadways or parking areas, backfill compaction shall be achieved throughout the entire depth of the trench to 95% of standard Proctor maximum dry density.

C. The Contractor shall be responsible to provide the proper size and type of compaction equipment and select the proper method of utilizing said equipment to attain the required compaction density. In place compaction tests may be made as determined by the Geotechnical Engineer. Contractor shall remove and recompact material that does not meet specified requirements.

* * * END OF SECTION * * *

SECTION 02272
GEOSYNTHETICS

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Embankment and Grading: Section 02220

B. Shop Drawings: Section 01340

1.2 SCOPE

A. The work includes furnishing and installing Geosynthetic components: Very Low Density Polyethylene (VDLPE) Geomembrane, Bentonite Mat, Geonet Composite, Geotextile, incorporated into the final cover system.

B. The Contractor shall furnish all labor, materials, tools, and equipment to install the Geosynthetic components as indicated on the plans, described in these specifications, and as prescribed by the Geosynthetic Manufacturer for a complete and proper installation.

C. The Contractor shall perform the indicated quality control testing as part of the installation, and shall protect the work and materials until final acceptance by the Engineer.

D. The Engineer will perform Quality Assurance for the project in accordance with the Engineers' Construction Quality Assurance (CQA) Plan. The Contractor shall provide access to all areas of the work and notification of all deliveries, as necessary for proper performance of the CQA Plan by the Engineer or his agent(s). The Engineers' CQA Plan does not specify work for the Contractor; only these Specifications and Drawings stipulate work requirements for the Contractor.

1.3 DESCRIPTION

A. The final cover includes multiple layers of geosynthetic materials over low permeable soils that form a composite barrier. There are two types of final cover, Type 'A' and Type 'B', each having slightly different Geosynthetic components. In general, Type 'A' cover will be placed on the landfill sideslopes while Type 'B' cover will be placed on the flatter topslopes of the landfill as indicated on the plans.

B. The Geosynthetic components for the Type 'A' cover consist of a Geonet Composite Type 'A' and a textured 40 mil VLDPE Geomembrane.

C. The Geosynthetic components for the Type 'B' cover consist of a Geonet Composite Type 'B' and a smooth 40 mil VLDPE Geomembrane.

D. The Geonet Composite underlies the Type I Sand and provides a drainage path for the final cover system. Type 'B' Geonet Composite has geotextile bonded to one side only and the Type 'A' Geonet Composite has geotextile bonded to both sides.

E. The VLDPE Geomembrane underlies the Geonet Composite and provides a barrier to both landfill gas and surface water. Type 'A' cover uses a textured surface geomembrane to provide additional interface friction for the steeper slopes. Type 'B' cover uses a smooth surface geomembrane.

F. Underlying the VLDPE Geomembrane is a low permeable soil layer. Preparation of low permeable soils and other subgrade soil is specified in Section 02220.

G. Bentonite Mat is utilized in place of a low permeable soil layer in areas without interim cover, in the sedimentation ponds, and under some ditches and roads as shown on the Drawings.

H. Geotextile Type 1 shall be placed over all refuse which is exposed during excavation of any type, prior to backfilling with subgrade embankment material. Geotextile Type 1 and 2 shall be bonded to geonet, as described herein, to form the geonet composite. Geotextile Type 3 shall be placed under all quarry spalls used as ditch or splash pad lining.

1.4 QUALIFICATIONS

1.4.1 MANUFACTURERS

The Contractor shall provide Geosynthetics manufactured by Manufacturers with the following minimum qualifications:

A. Bentonite Mat Manufacturer

The Bentonite Mat Manufacturer shall have produced at least 1 million square feet of Bentonite mat meeting the specifications for this project prior to producing materials for this project.

B. VLDPE Manufacturer

The VLDPE Manufacturer shall be listed by the National Sanitation Foundation as having met the current Standard 54 for Flexible Membrane

Liners, and shall have at least 5 continuous years experience in the manufacture of polyethylene geomembrane, and shall have manufactured a minimum of 25 million square feet of 40 mil or thinner polyethylene geomembrane, and shall have manufactured a minimum of 5 million square feet of 40 mil or thinner VLDPE geomembrane prior to producing materials for this project.

C. Geonet Composite

The Geonet Composite Manufacturer shall have produced at least 1 million square feet of Geonet Composite meeting the specifications for this project prior to producing materials for this project.

D. Geotextile

The Geotextile Manufacturer shall have produced at least 1 million square feet of each type Geotextile meeting the specifications for this project prior to producing materials for this project.

1.4.2 INSTALLERS

The Contractor shall provide for Geosynthetics installation by Installers with the following minimum qualifications:

A. Bentonite Mat Installer

The Bentonite Mat Installer shall have successfully installed at least 1 million square feet of bentonite mat.

B. VLDPE Installer

The VLDPE Installer shall have successfully installed at least 25 million square feet of 40 mil or thinner polyethylene geomembrane, and shall have successfully installed a minimum of 5 million square feet of 40 mil or thinner VLDPE geomembrane.

The Supervisor for the VLDPE Installer shall have supervised the installation of at least 5 million square feet of polyethylene geomembrane of which at least 1 million square feet shall have been incorporated into landfill barrier layers that consist of multiple geosynthetic components, and shall have supervised the installation of at least 1 million square feet of 40 mil or thinner VLDPE geomembrane.

1.5 SUBMITTALS

A. Prior to shipping geosynthetic materials to the site, the Contractor shall submit from an approved testing laboratory, certified test results

showing that the residual interface friction angles for each of the Geosynthetic components of the final cover meet the requirements of Paragraph 2.1, Interface Friction Angles.

B. Bentonite Mat

1. Qualifications statement of Manufacturer

2. Qualifications statement of Installer

3. Samples and product description.

4. Manufacturer's certification that material meets project specifications and quality control certificates for each roll produced and delivered to the project.

5. Installation Procedures and Schedules including a plan for protecting the work, and for repairing and replacing damaged work.

C. VLDPE Geomembrane

1. Qualifications statement of Manufacturer

2. Qualifications statement of Installer

3. Resume of Installation Supervisor

4. Samples and product description

5. Manufacturer's certification that material meets project specifications, quality control certificates issued by the resin supplier, quality control certificates for each roll produced, certification that geomembrane and extrudate produced for this project have the same material properties.

6. Installation Procedures and Quality Control program, including a plan for protecting the work, and for repairing and replacing damaged work.

7. Proposed Installation Panel layout identifying seams.

D. Geonet Composite

1. Qualifications statement of Manufacturer.

2. Samples and product description for each type.

3. Manufacturer's certification that product meets project specifications.

4. Installation Procedures including a plan for protecting the work, and for repairing and replacing damaged work.

E. Geotextile

1. Qualifications statement of Manufacturer.

2. Samples and product description for each type.

3. Manufacturer's certification that material meets project specifications.

1.6 QUALITY CONTROL SUBMITTAL AND REPORTS

A. The Geomembrane Installer shall submit to the Engineer, 30 days prior to delivery of VLDPE Geomembrane to the project site, a quality control manual including quality control procedures, tests, inspection personnel, and documentation.

B. The Geomembrane Installer shall submit, on a daily basis, the following reports.

1. Daily progress reports shall be prepared including the following:

Project Name

Date

Weather conditions, including range of wind speed and temperature, cloud cover, and precipitation

Project location

Panels installed (by number) including location. Provide map/plan showing panel numbering and location.

Panels seamed

Field observations

2. Daily Quality control records acceptable to the Engineer shall be prepared detailing the initial weld qualification of equipment and welding crews. Daily quality control records shall be maintained of all field seaming including, but not limited to, the following:

Date

Project location

Weld location, panel number including plan/map.

Sheet temperature

Weld crew identification

Weld samples, if taken

Test Results

General observations

1.7 QUALITY CONTROL TESTING

A. Quality Control Testing of geomembrane seams shall be performed by the Installer and shall include field test seams, non-destructive seam testing, and destructive seam testing.

1.7.1 FIELD TEST SEAMS

A. Field test seams shall be conducted by the Installer on geomembrane liner to verify that seaming conditions are satisfactory. Test seams shall be conducted for each crew at the beginning of each seaming period, at the Engineer's discretion and at least once each 4 hours, for each seaming apparatus used that day.

B. All test seams shall be made at a location selected by the Engineer in the area of the seaming and in contact with the subgrade. The test seam samples shall be 10 feet long for hot shoe welding and 3 feet long for extrusion welding with the seam centered lengthwise. Specimens 1-inch wide shall be cut from each end of the test seam at a location identified by the Engineer. The Installer shall use a tensiometer to test these specimens for shear and peel. If a test seam fails to meet field seam specifications, the seaming apparatus and seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive successful full test seams are achieved.

1.7.2 NON-DESTRUCTIVE SEAM TESTING

A. The Installer shall non-destructively test all field seams over their full length. All test equipment, including but not limited to the following, shall be furnished by the Installer:

1. Vacuum Box Testing

1.1 Equipment for testing single wedge fusion seams and extrusion seams shall be comprised of the following:

a. A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft rubber gasket attached to the bottom, port hole or valve assembly, and a vacuum gauge.

b. A steel vacuum tank and pump assembly equipped with a pressure controller and pipe connections.

c. A rubber pressure/vacuum hose with fittings and connections.

d. A plastic bucket and wide paint brush.

e. A soapy solution.

1.2 The following procedures shall be followed by the Installer:

a. Excess sheet overlap shall be trimmed away.

b. Clean the window, gasket surfaces, and check for leaks.

c. Energize the vacuum pump and reduce the tank pressure to approximately 5 psi.

d. Wet a strip of geomembrane approximately 12 inches by 48 inches (length of box) with the soapy solution.

e. Place the box over the wetted area and compress.

f. Close the bleed valve and open the vacuum valve.

g. Ensure that a leak-tight seal is created.

h. For a period of approximately 15 seconds, examine the geomembrane through the viewing window for the presence of soap bubbles.

i. If no bubbles appear after 15 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3 inches overlap and repeat the process.

j. All areas where soap bubbles appear shall be marked and repaired and then retested.

1.3 The following procedures shall apply to locations where seams cannot be non-destructively tested, as determined by the Inspector:

a. If the seam is accessible to testing equipment prior to final installation, the seam shall be non-destructively tested prior to final installation.

b. If the seam cannot be tested prior to final installation, the seaming operations shall be observed by the Inspector for uniformity and completeness.

2. Air Pressure Testing (For Double Fusion Seam Only)

2.1 The following procedures are applicable to those processes which produce a double seam with an enclosed space. Equipment for testing double fusion seams shall be comprised of the following:

a. An air pump equipped with pressure gauge capable of generating and sustaining a pressure between 25 and 30 psi and mounted on a cushion to protect the geomembrane.

b. A manometer equipped with a sharp hollow needle, or other approved pressure feed device.

2.2 The following procedures shall be followed by the Installer:

a. Seal both ends of the seam to be tested.

b. Insert needle or other approved pressure feed device into the tunnel created by the double wedge fusion weld.

c. Energize the air pump to a pressure between 25 and 30 psi, close valve, and sustain pressure for approximately 5 minutes.

d. If loss of pressure exceeds 4 psi, or pressure does not stabilize, locate faulty area, repair and retest.

e. Relieve pressure at end opposite pressure gauge to check for continuity of air channel.

f. Remove needle or other approved pressure feed device and seal hole with an extrusion weld.

1.7.3 DESTRUCTIVE SEAM TESTING

A. The Installer shall provide the Engineer with a minimum of one destructive test sample per 500 feet of seam length from a location specified by the Engineer. The Installer shall not be informed in advance of the sample location.

1. Sample Procedure

1.1 In order to obtain test results prior to completion of liner installation, samples shall be cut by the Installer as the seaming progresses. Sampling times and locations shall be determined by the Engineer. The Engineer must witness the obtainment of all field test samples and the Installer will mark all samples with their location, roll, and seam number. The Installer shall also record in written form the date, time, location, roll seam number, ambient temperatures, and pass or fail description. A copy of the information must be attached to each sample portion. All holes in the geomembrane resulting from obtaining the seam samples shall be immediately repaired. All patches shall be vacuum tested.

2. Size and Disposition of Samples

2.1 The samples shall be 12 inches wide by 36 inches long and the seam centered lengthwise. The sample shall be cut into three equal length pieces, with one piece given to the Engineer, for destructive testing at an independent laboratory, one piece retained by the Installer for field destructive testing and one piece sent to the Installers laboratory for destructive testing.

3. Testing

3.1 The Installer shall cut ten 1-inch wide replicate specimens from his sample and these shall be tested by the Installer. The Installer shall test five specimens for shear strength using ASTM D3083 and five for peel strength using ASTM D413. The Contractor shall have the required equipment on site in order to perform the above-mentioned tests. To be acceptable, four out of the five replicate test specimens must pass the strength criteria established in Section 3.3E, Paragraph 12. Any specimen that does not meet the strength requirements or fails through the weld or by adhesion at the weldsheet interface shall be considered a failure. Results of all field testing shall be

supplied to the Engineer, in written form, at the end of each working day.

3.2 Destructive testing shall also be performed in the installers laboratory as described in Paragraph 3.1 above. Results of all laboratory testing shall be supplied to the engineer in written form, at the end of the first working day after the sample was cut from a seam.

4. Procedures for Destructive Test Failure

4.1 The following procedures shall apply whenever a sample fails the field destructive test:

a. The Installer shall reconstruct the seam between the failed location and any passed test location.

b. The Installer can retrace the welding path to an intermediate location (at a minimum of 10 feet from the location of the failed test), at the Engineer's discretion, and take a sample for an additional field test. If this test passes, then the seam shall be reconstructed between that location and the original failed location. If the test fails, then the process is repeated.

c. Over the length of seam failure, the Contractor shall either cut out the old seam, reposition the panel and reseam, or add a cap strip, as required by the Engineer.

d. After reseaming or placement of the cap strip, additional destructive field test(s) shall be taken within the reseamed area. The reseamed sample shall be found acceptable if test results are approved by the Engineer. If test results are not acceptable, this process shall be repeated until the reseamed length is judged satisfactory by the Engineer.

4.2 In the event that a sample, including a sample supplied to the Engineer, fails a destructive test, then the above procedures shall be followed, considering laboratory tests exclusively.

2. MATERIALS

2.1 INTERFACE FRICTION ANGLES

A. Geosynthetic components incorporated into Type 'A' final cover shall

have a residual interface friction angle of 22 degrees or greater with adjacent geosynthetic components and with adjacent soils.

B. Geosynthetic components incorporated into Type 'B' final cover shall have a residual interface friction angle of 10 degrees or greater with adjacent geosynthetic components and with adjacent soils.

C. Interface friction angle testing shall be performed in accordance with GRI Test Method GS6 with a minimum of three points for each interface at vertical pressures of 200 psf, 500 psf and 1,000 psf, calculated at deflection equals one inch.

D. The testing shall be performed by GeoServices, Inc., Norcross, Georgia; Westinghouse Environmental Service, Fairfield, Ohio; STS Consultants LTD, Northbrook, Illinois; or another testing laboratory approved by the Engineer.

E. For Interface Friction Angle testing, Existing Low Permeable Soil from the St. Johns Landfill site will be made available to any interested parties by Metro. Materials proposed for Type I Sand and Subgrade Embankment shall be supplied by the Contractor. Additional Interface Friction Angle testing may be required if materials proposed for Type I Sand or Subgrade Embankment change substantially during the project.

2.2 VERY LOW DENSITY POLYETHYLENE (VLDPE) GEOMEMBRANE LINER

A. Smooth VLDPE geomembrane shall be "Hyperlastic" as manufactured by Gundle Lining Systems, Inc. or shall be "Dura-Flex" as manufactured of Poly-America, or approved equal. Smooth VLDPE Geomembrane liners shall conform to the following properties:

TYPICAL PROPERTIES	TEST METHOD	ACCEPTED VALUES
o Thickness (mils)	ASTM D 1593	40 ± 10%
o Tensile Properties. (Typical)		
1. Tensile Strength at Break (Pounds/inch-width)	ASTM D638 Type IV Dumb-bell at 2 ipm	126
2. Elongation at Break (Percent)		900
o Puncture Resistance Pounds (Typical)	FTMS 101 Method 2065	55
o Tear Resistance Initiation Pounds (Typical)	ASTM D1004 Die C	17
o Dimensional Stability. %	ASTM D1204	±3

Change. Each Direction. (Max.)	212°F 1 hr	
o Low Temperature Brittleness. °F (Typical)	ASTM D746M Procedure B	-112
o Resistance to Soil Burial. Percent change in original value. (Typical) Tensile Strength at Break.	ASTM D3083 Type IV Dumb-bell at 2 ipm	
o Environmental Stress Crack. Hours. (Min.)	ASTM D1693 10% Igepal, 50°C	1500
o Density g/cc (range)	ASTM D1505	0.90 - 0.935
o Melt Index g/10 (max)	ASTM D1238 Condition E	1.1
o Carbon Black % (range)	ASTM D1603	2 - 3
o Carbon Black Dispersion	ASTM D3015	A-2

* Note: All values, except when specified as minimum or maximum, are typical test results.

B. Textured VLDPE geomembrane shall be "Hyperlastic" manufactured by Gundle Lining Systems, Inc., or approved equal. Textured VLDPE Geomembrane liner shall conform with the following:

TYPICAL PROPERTIES	TEST METHOD	ACCEPTED VALUE
o Thickness (mils)	ASTM D1593	40 ± 10%
o Tensile strength @ Yield	ASTM D638 Type	
1. Tensile strength @ Yield (Pound/inch width)	IV Dumbbell @ 2 ipm	35
Tensile strength @ Break (Pound/inch width)		55
2. Elongation @ Yield (Percent)		10
Elongation @ Break (Percent)		300
o Puncture Resistance Pounds (Typical)	FTMS 101 Method 2065	38
o Tear Resistance Initiation Pounds (Typical)	ASTM D1004 Die C	16
o Dimensional Stability % Change Each Direction (Max)	ASTM D1204 212 °F 1 hour	±2
o Low Temperature Brittleness Degree °F (Typical)	ASTM D746M	-112
o Environmental Stress Crack Hours (Min)	ASTM D1638 50°C	1500

o Density g/cc (Min)	ASTM D1505	.90
o Melt Index g/10 (Max)	ASTM D1238 Condition E	1.1
o Carbon Black % (Min)	ASTM D1603	2.0
o Carbon Black Dispersion	ASTM D3015	A-2

C. Rolls shall be labeled such that it is possible to relate each roll with manufacturing quality control documentation and raw material documentation.

2.3 GEONET

A. Type 'A' Geonet Composite

Geonet Composite Type 'A' shall consist of an integrally formed polyethylene net structure heat bonded on the top side with Type I geotextile and heat bonded on the bottom side with Type 2 geotextile.

B. Type 'B' Geonet Composite

Geonet Composite Type 'B' shall consist of an integrally formed polyethylene net structure heat bonded on the top side with Type 1 geotextile.

C. Geonet structure shall be Gundnet XL-14 as manufactured by Gundle Lining Systems, Inc., Houston, Texas, or approved equal.

D. The Geonet Composite shall have a minimum transmissivity of 1.1 x 10^{-3} m^2/sec, at a hydraulic gradient of 0.05 and a normal stress of 250 psf, when tested in accordance with ASTM D4716, modified to include the proposed soil/geosynthetic environment as follows;

- Standard base plate
- 2-inches of existing low permeable material
- Smooth geomembrane
- Type 'B' geonet composite
- 2-inches of Type 1 sand
- Standard top plate

The soil materials shall be placed at densities as required by the Specifications. The test shall be performed at GeoSyntec Consultants, Inc. (Norcross, Georgia); Westinghouse Environmental Services (Fairfield, Ohio); STS Consultants LTD. (Northbrook, Illinois), or other qualified testing laboratories approved by the Engineer. Samples of existing low permeable soil will be made available to any interested parties by Metro.

In the event materials proposed for the project change substantially during constructiion, additional transmissivity testing may be required.

E. The geotextile to geonet ply adhesion shall be a minimum of 1.0 pound/inch and an average of 2.0 pound/inch when tested in accordance with ASTM F904 (2"x8" @ 2ipm).

2.4 BENTONITE MAT

A. The Bentonite Mat shall be formulated and manufactured from polypropylene geotextiles and a minimum of one pound per square foot of high swelling sodium bentonite. The maximum permeability of the Bentonite Mat shall be 1×10^{-9} cm/sec at 10-foot water head. The upper and lower geotextiles of the bentonite mat shall be mechanically connected to enhance the shear strength between the upper and lower geotextiles of the mat. The shear strength between the upper and lower geotextile must be sufficient to maintain the integrity of the mat, while hydrated, during interface friction testing as required in these Specifications.

B. The bentonite shall have the following base mineralogical composition:

Type: High swelling granular sodium bentonite

Free Swell: Minimum 16 cc per 2 grams.

Particle Size: 20% max retained on a #20 U.S. seive
10% max passing a #70 U.S. seive

Chemical Composition:	Silica	63.02%	Sodium	2.57%
	Alumina	21.08%	Calcium	0.65%
	Iron (ferric)	3.25%	Crystal water	5.64
	Iron (ferrous)	0.35%	Trace Elements	0.72%
	Magnesium	2.67%		

C. A 6 inch lapline and a 9 inch matchline shall be printed on both edges of the upper geotextile of the bentonite mat (as installed) for minimum overlap quality control.

D. The encapsulating geotextiles shall be polypropylene or Engineer approved equals. The top layer of geotextile (as manufactured) shall be a 6 oz. per square yard nonwoven polypropylene needlepunched fabric. The bottom layer of geotextile shall be a 3.25 oz. per square yard woven slit film polypropylene fabric.

E. The bentonite mat shall be BENTOMAT as manufactured by American Colloid Company, 1500 W. Shure Dr., Arlington Heights, Illinois or an approved equal.

2.5 GEOTEXTILES (Type 1, 2 & 3)

A. The geotextiles shall be nonwoven, needle punched, and consist of long chain staple polymeric fibers or filaments composed of polypropylene or polyester. The fibers and filaments shall be oriented into a stable network whereby they retain their positions relative with each other. The geotextile shall be free of any chemical treatment or coating which reduces permeability, be inert to chemicals commonly found in soil, and shall be mildew, insect, and rodent resistant. The geotextiles shall conform to the following minimum physical properties (in each principal direction):

PHYSICAL PROPERTY	TEST METHOD	TYPE 1	TYPE 2	TYPE 3
Weight, OZ/SY	ASTM D-3776	5.9	4.0	11.5
Tensile Strength, lbs.	ASTM D-4632	155	100	265
Elongation, %	ASTM D-4632	50	50	50
Puncture Strength, lbs.	ASTM D-4833	80	50	155
Mullen Burst, psi	ASTM D-3786	275	190	470
Trapezoidal Tear Strength, lbs.	ASTM D-4533	60	40	130
Coefficient of Permeability, cm/sec	ASTM D-4491	0.20	-	-
Flow Rate, gpm/sq.ft.	ASTM D-4491	110	-	-
Permittivity, 1/sec	ASTM D-4491	1.3	-	-
Apparent Opening Size (AOS), US Std Sieve	ASTM D-4751	70	-	100

* Minimum value in each principal direction.

B. The geotextile shall be furnished in a protective wrapping to protect it from ultraviolet radiation and from damage due to shipping and handling.

3. EXECUTION

3.1 GENERAL

A. No layer of geosynthetic shall be covered until the Engineer has inspected and approved the installation.

3.2 BENTONITE MAT

A. PACKAGING AND PANEL MARKING

1. Each factory fabricated sheet shall be individually packaged for protection during shipment. Each roll of the bentonite mat shall be given prominent, unique, identifying markings indicating the sheet number and roll length.

2. The bentonite mat shall be shipped in rolls and protected with a waterproof outside covering. Folded material shall not be accepted. Any evidence of folding or other damage shall be cause for rejection of the material by the Engineer.

B. STORAGE

1. The bentonite mat storage area shall be prepared and reviewed for acceptability prior to the arrival of any material. The Contractor shall submit a written plan to the Engineer for review describing methods of unloading, storage and installation of the material. The submittal shall delineate the responsibility of the Contractor for the material and its protection from the weather during each phase of the construction process. No material shall be accepted at the site, and no payment shall be made for any of the bentonite mat until this submittal has been reviewed and approved. Under no circumstances shall this review relieve the Contractor from providing adequate protection for the material during all phases of the construction.

2. The bentonite mat shall be stored in either the original watertight shipping containers or in a warehouse with concrete floor and roof. The material shall not be stored in any areas where ponding could occur. At all times, the materials shall be protected from water. If outdoor storage is approved by the Engineer, the bentonite mat rolls must be covered by a carefully secured tarpaulin.

C. HANDLING

1. The bentonite mat rolls must be handled by the use of a heavy duty carpet pole or lifting bar placed through the cardboard core. In no case are the rolls to be unloaded or transported with forklift forks or with slings wrapped around the outside of the roll.

D. INSTALLATION

1. The Contractor shall install Bentonite Mat on prepared subgrade surface as specified in Section 02220. The Bentonite Mat Installer shall certify in writing that each section of prepared subgrade surface is acceptable for installation of Bentonite Mat prior to placing Bentonite Mat on that section.

2. The Contractor shall coordinate placement of the Bentonite Mat with the placement of the VLDPE Geomembrane and other components of the final cover as necessary to protect and

maintain the integrity of installed portions of Bentonite Mat.

3. The Bentonite Mat is extremely sensitive to moisture. The Contractor shall not allow the Bentonite Mat to be exposed to rain and shall protect and cover all installed portions at the end of each work day. Any portion of Bentonite Mat that becomes wet by any cause shall be removed and replaced at the Contractors expense.

4. The Bentonite Mat shall not be placed on snow, frost, or frozen ground.

5. The Bentonite Mat sheets shall be placed with the proper side facing up as marked by the manufacturer, and pulled tight to smooth out wrinkles and irregularities. Seams along the length of the roll shall be oriented up and down slope. Seams at the ends of the roll that traverse the slope shall be minimized.

6. The Bentonite Mat shall be laid with a 6 inch overlap at all seams. Seams at the ends of a roll that traverse a slope steeper than 10 percent shall have a minimum overlap of 24 inches.

7. Seams shall be augmented with granular bentonite to insure seam integrity. Granular bentonite shall be spread evenly from the panel edge to the lapline at a minimum rate of 1/4 pound per lineal foot. Accessory bentonite shall be of the same type as the material within the composite liner itself. Fasteners, anchor pins or adhesives may be used on seams to keep panels in place during backfill operations if necessary.

F. REPAIR

1. Damaged or defective sections of Bentonite Mat shall be patched with the same material. The patch shall be 12 inches larger in all directions than the area to be repaired.

3.3 VLDPE GEOMEMBRANE

A. PACKAGING AND PANEL MARKING

1. Each roll of geomembrane shall be uniquely marked by the manufacturer identifying the roll number, date of manufacture, sheet thickness, and sheet length.

B. SHIPPING

1. Shipping is the responsibility of the Installer. Materials

damaged in shipping shall be replaced at the Contractors expense.

2. The Contractor shall supply to the Engineer that information required in Paragraph 1.4 submittals, section C.5, prior to delivery to the site of each roll of geomembrane and each batch of extrudate.

C. STORAGE

1. The geomembrane rolls shall be stored on a smooth, flat, non-abrasive surface, not on wooden pallets, and stacked no more than two high. The Contractor shall protect the geomembrane rolls at all times from dirt, grease, moisture, heat, and any cause of damage. The Contractor shall replace geomembrane damaged by any means at his expense.

D. HANDLING

1. The Installer is responsible for handling geomembrane during off-loading, storing, moving and installing activities.

E. INSTALLATION

1. Installation shall be performed under the constant direction of Installation Supervisor(s) who shall remain on site at all times during the installation and be in responsible charge for all geomembrane installation, including panel layout, seaming, patching, testing, and all other activities associated with the installation.

2. Prior to placing geomembrane panels, the Installation Supervisor shall certify in writing that the receiving surface is acceptable.

3. Geomembrane deployment shall proceed between ambient temperatures of 45 degrees F to 90 degrees F. Placement can proceed below 45 degrees only after it has been verified by the Engineer that the material can be seamed according to the specification. Geomembrane shall not be placed during any precipitation, in the presence of excessive moisture (e.g., fog, dew) or in the presence of excessive winds.

4. The geomembrane shall be installed to the limits indicated on the Drawings. The geomembrane shall be placed in such a manner to minimize field seaming. The geomembrane shall be installed such that field seams run longitudinally down the

slope. The Contractor shall provide temporary wind anchorage during geomembrane installation. Only geomembrane panels for each day's field seaming shall be spread each day and shall be held in position by sandbags until field seaming is complete. As geomembrane materials are unrolled, the Contractor shall perform further visual inspection of the geomembrane surface. If damage or faults not previously observed are discovered, they shall be clearly marked and the respective sheet roll will be set aside. The Engineer shall be notified of the damage. All faulty areas shall be repaired in an appropriate, workmanlike manner. The geomembrane panels shall be installed by experienced workmen and handled in a good workmanlike manner. All rips, tears, puncture, or other injuries to the lining shall be repaired the same day to the satisfaction of the Engineer and in accordance with procedures as specified herein. All rips and tears with sharp edges shall be rounded prior to patching. All patches shall have rounded edges.

5. All seams, including anchor trench seams, shall be made by extrusion or fusion welding. The Contractor shall use only welding apparatus on which proper control of extrudate or wedge temperature, apparatus pressure, welding speed, width of weld, and sheet preheating temperature can be maintained. The Contractor will verify that the welding apparatus meets these requirements.

6. A determination of sheet surface temperature, peel and shear testing in a tensiometer, and visual inspection of seam surface and cross section shall be performed satisfactorily on a test weld, approximately 6 feet in length, before any seam welding is begun each day. Additional test welds at the Engineer's option may be requested before startup of any welding equipment after it has been shutdown for an extended period, at 4-hour intervals, or if the temperature falls below 45°F.

7. Extrusion welds will be made by overlapping adjacent sheets a minimum of 3 inches and extruding a ribbon of hot fusion-joining resin no less than 1.0 inch in width between the overlapped sheets or over the seams between the over lapped sheets, as required. The slick surface of the VLDPE sheet shall be roughened by an acceptable means before extrudate is placed between overlapping sheet or over the lapped seam. Excessive grinding resulting in grooving of the liner or reducing the liner thickness greater than 10 percent shall not be permitted.

8. Fusion field seams shall be made by overlapping adjacent sheets

a minimum of 3 inches and forming a double welded seam separated by an air space. Welded seams shall be produced by a double hot shoe welder capable of maintaining a recordable temperature determined by onsite conditions and shall not vary more than 10°F from the target temperature.

9. After positive evaluation of the test weld, the welding of the sheet geomembrane shall begin.

10. Welding shall not be performed unless the geomembrane sheet is dry and the sheet temperature is above 45°F (7.2°C) and below 95°F (35°C). If the temperature falls below 45°F, seaming may continue at the direction of the Engineer. Prior to allowing seaming to continue, the Engineer shall consider the need to require more frequent test welding. No welding shall be performed if it is raining or the geomembrane is wet.

11. No Geomembrane shall be covered until all inspection, field test, and repairs are satisfactorily completed. Where the installer's or engineer's laboratory tests indicate a failure for a destructive test the seam shall be repaired as required in Section 1.6.3 Destructive Seam Testing. No repair will be required, based on the engineer's laboratory test, unless the engineer delivers laboratory test data to the installer within two working days after the test patch was cut from the installed geomembrane.

12. The completed joints shall have a minimum bonded seam strength in shear of 90 percent and in peel of 50 percent of the specified parent material tensile strength at yield when tested in accordance with ASTM D 3083 and ASTM D 413, respectively. The joints shall also fail as a film tear bond (FTB).

13. Due to potential build-up of pressure under placed geomembrane from trapped landfill gases, Geonet composite and Type 1 Sand shall be installed within two days after placement of the Geomembrane material unless alternate means of maintaining the integrity of the geomembrane is proposed by the Contractor and approved by the Engineer.

F. REPAIRS

1. All seams and non-seam areas of the geomembrane shall be inspected by the Installer for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. Because light reflected by the geomembrane helps to detect

defects, the surface of the geomembrane shall be clean at the time of inspection. The geomembrane surface shall be brushed, blown, or cleaned with a moist cloth by the Installer if the amount of dust or mud inhibits inspection. The Engineer shall decide if cleaning of the geomembrane is needed to facilitate inspection.

a. Evaluation

1) Each suspect location in seam and non-seam areas shall be non-destructively tested as appropriate in the presence of the Engineer. Each location that fails the non-destructive testing shall be marked by the Engineer, and repaired accordingly.

b. Repair Procedures

1) Defective seams shall be restarted/reseamed as described in these specifications.

2) Small holes shall be repaired by extrusion cap welding. If the hole is larger than 1/4 inch, it shall be patched.

3) Tears shall be repaired by patching. Sharp ends must be rounded prior to patching.

4) Blisters, large holes, undispersed raw materials, and contamination by foreign matter shall be repaired by patches.

5) Surfaces of VLDPE which are to be patched shall be abraded and cleaned no more than 15 minutes prior to the repair. No more than 10 percent of the thickness shall be removed.

6) Patches shall be round or oval in shape, made of the same geomembrane, and extend a minimum of 6 inches beyond the edge of defects. All patches shall be of the same compound and thickness as the geomembrane specified. All patches shall have their top edge beveled with an angle grinder prior to placement on the geomembrane. Patches shall be applied using approved methods only.

7) Wrinkles which may become folds during placement of material above the Geomembrane shall be repaired by cutting away the excess material and repairing as required above. No folding in the Geomembrane is allowed.

3.4 GEONET COMPOSITE

A. PACKAGING, LABELING AND SHIPPING

1. Geonet Composite shall be packaged and shipped in protective wrapping, labeled with appropriate identification including manufacturer, fabric weight, and roll length.

B. STORAGE

1. The Geonet Composite rolls shall be stored in its protective wrapping in a manner that protects the material from dirt, moisture, heat, and any other cause of damage.

C. INSTALLATION

1. The surface to receive Geonet Composite shall be free from dust, dirt, stones, and any other objects or debris. The Geonet Composite shall be installed as shown on the plans with the proper side facing up. When installed on slopes greater than 10 percent, longitudal seams shall be oriented up and down slope.

2. Adjoining sections of Geonet Composite shall have no more than 1/4 inch gap between the edges of the net structure on each piece and shall be fastened every 10 feet of seam with plastic ties approved by the manufacturer and Engineer. All seams shall have the upper geotextile overlapped 6 inches and heat bonded the entire length of seam by a method approved by the manufacturer and the Engineer.

3. The Contractor shall secure and protect installed sections of Geonet Composite by approved methods. The Contractor shall not operate equipment or vehicles of any kind on the Geonet Composite. Any damaged sections of Geonet Composite caused by wind, weather, Contractors activities or any other means, shall be repaired or replaced at no additional cost to Metro.

4. The Contractor shall place Type I Sand over installed sections of Geonet Composite only by a method approved by the Engineer.

F. REPAIR

1. Repairs shall be made by cutting out damaged areas, in rectangular shapes, and replacing with new material. Seaming shall be as required above with a minimum of one tie on each side of the patch.

3.5 GEOTEXTILE

A. LABELING AND SHIPPING

1. Geotextile shall be packaged and shipped in protective wrapping, labeled with appropriate identification including manufacturer, fabric weight, and roll length.

B. STORAGE

1. The Geotextile rolls shall be stored in its protective wrapping in a manner that protects the material from dirt, moisture, heat, and any other cause of damage.

C. INSTALLATION

1. Geotextile shall be placed as shown on the project plans with overlaps a minimum of 12 inches unless otherwise stated. Geotextile shall be laid smooth without excessive wrinkles and held in place by an approved method until covered.

D. REPAIR

1. Torn geotextile shall be covered with a piece of the same material with at least 12 inch overlap all around.

* * * END OF SECTION * * *

SECTION 02275

SEDIMENTATION CONTROL

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Embankment and Grading: Section 02220
B. Excavating, Backfilling and Compacting for Structures: Section 02221
C. Excavating, Backfilling and Compacting for Utilities: Section 02222
D. Storm Drainage: Section 02720
E. Fences: Section 02831

1.2 SCOPE

A. This section covers material and installation requirements for sedimentation control to be installed by the Contractor under of this project. This work may consist of constructing sedimentation ponds, erosion control matting, hydroseeding, temporary or permanent drainage ditches, sedimentation barriers or fences, plastic sheeting with anchors and any additional sedimentation control measures which may be necessary depending on the Contractors methods, time of year, type and location of work activity.

1.3 QUALITY CONTROL

A. Conform to regulatory requirements, specifically City of Portland Bureau of Environmental Services.

B. Contractor shall review the City of Portland Erosion Control requirements, his intended methods, work schedule etc., and provide a system to prevent erosion of embankment slopes or ditches and the resulting siltation of surrounding waters. Sedimentation control measures will be required to assure adequate protection of adjacent slough water quality. All requirements set forth in the City of Portland, Bureau of Environmental Services, Erosion Control handbook, latest printing, shall be satisfied during this contract.

1.4 SCHEDULE

A. Required sedimentation control facilities must be constructed and in operation prior to land clearing and/or other construction to ensure that sediment laden water does not enter the natural drainage system.

B. Sediment facilities shall be maintained in a satisfactory condition until such time that clearing and/or construction is completed and potential for on-site erosion has passed.

C. The implementation, maintenance, replacement and additions to erosion/sedimentation control systems shall be the responsibility of the Contractor.

1.5 SUBMITTALS

A. Temporary measures required to control surface runoff, erosion and sedimentation during construction will be included with the Excavation, Embankment and Grading Plan required in Section 02220. Periodic updates of this portion of the plan may be required.

B. The measures to control surface water and erosion for completed work on this phase of the landfill closure as outlined in the Contract Documents will be submitted in the Sedimentation Control Plan no later than 20 days after Notice to Proceed.

C. Product information for materials required in this section will be submitted and approved prior to purchase.

2. PRODUCTS

2.1 HYDROSEEDING MATERIALS

A. Provide fresh, clean, dry, new-crop seed complying with tolerance for purity and germination established by Official Seed Analysts of North America. Provide grass seed as follows:

1. "Mecklenberger" sheep fescue, 100 pounds (PLS) per acre.

   "Manhattan" perennial ryegrass, 50 pounds (PLS) per acre.

2. The application rates indicated above are given in Pure Live Seed (PLS) rates. PLS rate will be determined by the percent purity times percent germination. For example, a seed mix of 95% purity and 35% germination will equal 33% PLS. Therefore, 3 pounds of the seed mix will be required to equal 1 pound of PLS.

B. All fertilizers shall be of standard commercial manufacturer and grade. Fertilizer shall be furnished in standard, unopened, moisture-proof containers and in dry condition. Granular or pelletized forms shall be free from lumps and caking. Each container shall be marked with the weight and manufacturers guaranteed analysis certifying the percentage of each ingredient.

Fertilizer needs shall be evaluated by the contractor prior to hydroseeding. Once topsoil has been placed, appropriate top soil

analyses shall be performed based on one soil test per 5 acres to be hydroseeded. Analyses shall evaluate nutrient content, salinity, pH, organic content and other appropriate factors. Tests shall include both existing topsoils from the landfill and imported topsoils as specified.

Based on these tests, fertilizer makeup (nitrogen, phosphorous and potash) and rate of application (lbs. per acre) shall be determined to provide optimum growth for the seed mix. Contractor shall submit test results and proposed fertilizer makeup and application rate for Metro/Engineer review prior to performing work.

C. All mulch materials shall be free of noxious weed seeds and plants and shall contain no substance detrimental to plant life. Wood cellulose fibre mulch shall be processed so that the wood fibers will remain uniformly suspended under agitation in water. The mulch shall also blend with seed, fertilizer and other typical additives of a hyroseeding mixture to form a homogeneous slurry.

This processed mulch shall have the ability to cover and hold grass seed in contact with soil. The wood fiber shall also have moisture-absorption and percolation properties to form a blotter-like ground cover. The cellulose fiber shall be colored green to visibly aid uniform application.

Wood cellulose fiber shall be shipped in packages of uniform weight ($\pm$5%) and labeled with the manufacturer's name and air-dry weight.

D. Hydro-Slurry Mix:

1. Seed Mix: 150 pounds (PLS) per acre
2. Fertilizer: As Required, (Paragraph B)
3. Wood Cellulose Fiber, dyed green: 1500 pounds per acre
4. Tackifier: As required

2.2 EROSION CONTROL MATTING/BLANKET

A. Shall be XCEL blanket manufactured by Soil Stabilization Co., or equal.

2.3 SEDIMENT FENCE

A. Conform with Figure 3.3 in the City's "Erosion Control Plan" 1989.

B. Filter fabric material shall conform to Section 02272-2.1.

2.4 STRAWBALE SEDIMENT BARRIER

A. Strawbales shall be standard 40 to 60 pound rectangular bales of cereal grain or seed straw.

2.5 PLASTIC SHEETING

A. Shall be polyethylene and have a minimum thickness of 6 mil.

B. Anchors to be sandbags with stakes, tires or other items suitable in size and weight to adequately hold the plastic sheeting in place during windy, wet weather. Anchors shall not have sharp edges, except stakes through sandbags.

3. EXECUTION

3.1 GENERAL EROSION CONTROL

A. Erosion control provisions shall meet or exceed the requirements of the City of Portland, Bureau of Environmental Services. Refer to City's "Erosion Control Plans Technical Guidance Handbook".

B. When provisions are specified and shown on the Drawings, they are the minimum requirements.

C. Contractor shall not permit sediment laden waters to enter off-site drainage facilities/sloughs.

D. As construction progresses and seasonal conditions dictate, more siltation control facilities may be required. It shall be the responsibility of the Contractor to address new conditions that may be created and to provide additional facilities in a timely manner over and above minimum requirements as may be required.

3.2 SILTATION/SEDIMENTATION PONDS

A. Temporary siltation/sedimentation ponds shall be installed on site to desilt all stormwater or water pumped from excavations.

B. If additional siltation control is required, check dams or silt fences may be placed in streams or ditches receiving stormwater from areas disturbed by construction.

C. Siltation/sedimentation ponds shall be constructed in accordance with the requirements of the agencies having jurisdiction over facilities to receive discharge from siltation/sedimentation ponds.

3.3 PLACING EROSION CONTROL MATTING

A. Seed and fertilizer (Hydroseeding) shall be placed prior to placing of matting.

B. Erosion Control matting shall be unrolled parallel to the flow of water. Where more than 1 strip of matting is required to cover the given area, it shall overlap the adjacent mat a minimum of 4 inches. The ends of matting shall overlap at least 6 inches with the upgrade section on top.

C. The up-slope end of each strip of matting shall be staked and buried in a 6-inch deep trench with the soil firmly tamped against the mat. Three stakes per width of matting (1 stake at each overlap) shall be driven below the finish ground line prior to backfilling of the trench.

D. The Engineer may require that any other edge exposed to more than normal flow of water or strong prevailing winds be staked and buried in a similar manner.

E. Check-slots shall be placed between the ends of strips by placing a tight fold of the matting at least 6 inches vertically into the soil. These shall be tamped and stapled the same as upslope ends. Check-slots must be spaced so that one check-slot or one end occurs within each 50 feet of slope.

F. Edges of matting shall be buried around the edges of catch basins and other structures as herein described. Matting must be spread evenly and smoothly and in contact with the soil at all points.

G. Matting shall be held in place by approved wire staples, pins, spikes or wooden stakes driven vertically into the soil. Matting shall be fastened at intervals not more than 3 feet apart in 3 rows for each strip of matting, with 1 row along each edge and 1 row alternately spaced in the middle. All ends of the matting and check slots shall be fastened at 6-inch intervals across their width. Length of fastening devices shall be sufficient to securely anchor matting against the soil and driven flush with the finished grade.

3.4 HYDROSEEDING

A. Do not use wet seed or seed which is moldy or otherwise damaged in transit or storage (unless soaking seed for quick germination is approved by Metro). Do not use seed from containers opened before delivery to the job site or before hydro-slurry equipment is ready. Retain seed packaging for observation by Engineer.

B. Confirm that final subgrade is achieved, topsoil has been placed and tested (re: fertilizer needs) and is acceptable prior to commencing the hydroseeding operations. Hydroseed all areas covered by topsoil.

C. Mix specified seed, fertilizer, and mulch in water using equipment specifically designed for hydro-slurry application. Continue mixing until uniformly blended into a homogeneous slurry suitable for hydraulic application. The materials shall be applied through a pressure-spray system providing continuous, nonfluctuating applicate rate.

D. Apply slurry uniformly at the specified rates using a sweeping, horizontal motion. Clean hydro-mulch off areas not intended for hydroseeding which are inadvertently sprayed during applications.

E. Unless otherwise specified or approved, this work is to be performed from August 15 to October 1. The work shall be performed only at times when local weather and other conditions are not detrimental to seeding and mulching. The work shall not be undertaken when wind velocities would prevent uniform application of the materials or would drift the materials. Work shall be done in stages along the project as soon as practicable after completion of topsoil placement on areas to be seeded and mulched.

F. Inspection of any area will be made upon completion of hydro seeding. The work in any area will not be measured for payment until a uniform distribution of the materials is accomplished at the specified rate and the grass has started to grow. Areas not receiving a uniform application, or areas where grass fails to thrive, as determined by the Engineer, shall be reseeded, refertilized, or remulched at the Contractor's expense prior to payment.

3.5 STRAWBALE SEDIMENT BARRIER

A. Bales to be keyed into existing ground a minimum of 4 inches. Wood stakes are to be driven through the bales and into ground a minimum of 12 inches.

B. At no time shall more than a one foot depth of sediment be allowed to accumulate behind strawbale sediment barriers. Sediment must be removed or new lines of barriers installed uphill of sediment laden barriers.

3.6 PLASTIC SHEETING WITH ANCHORS

A. Plastic sheeting shall be installed and maintained tightly in place by using staked sandbags or tires on ropes (10' max. grid spacing). Other anchor materials may be used which provide similar hold-down characteristics. All seams shall be taped or weighted down full length and there shall be at least

a 12-inch overlap of all seams. For seams parallel to the slope contour, the uphill sheet shall overlap the downhill sheet.

3.7 PROTECTING GEOSYNTHETICS

A. All stakes, whether for anchoring sand bags, plastic sheeting, strawbales, matting, or other material, shall be installed in such a way as to insure the integrity of the underlying geosynthetics.

* * * END OF SECTION * * *

SECTION 02610

PIPE AND FITTINGS

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Excavating, Backfilling and Compacting for Utilities: Section 02222
B. Storm Drainage: Section 02720
C. Gas and Condensate Collection System: Section 02680

1.2 QUALITY CONTROL

A. Testing by Manufacturer:
   1. Manufacturer shall test all materials as required by these Specifications and the standards referenced.
   2. Manufacturer shall submit to the Engineer two (2) copies of all test results which shall include a certification that materials to be delivered are represented by the samples tested and that such delivered materials meet or exceed the specification requirements.
   3. No material shall be delivered until test results and certifications are in the hands of the Engineer.
   4. Engineer shall have free access to all testing and records pertaining to material to be delivered to the job site.
   5. The Engineer may elect to be present at any or all material testing operations.

B. Joint tests are intended for qualification of joint design and shall be considered to be a qualification test to establish the adequacy of the manufacturer's joint design. The manufacturer shall certify that tests have been performed within the last year with pipes equivalent in size and design and that they have passed the test enumerated in the specifications. Tests may be waived for pipes of different strength class if joint design is the same as the pipe tested.

2. PRODUCT

2.1 FLEXIBLE COUPLINGS

A. Use for connection between plain end pipe of same or different material.

B. Sleeve: Gray iron ASTM A126 Class B or ductile iron ASTM A536. Ends have a smooth inside taper for uniform gasket seating.

C. Followers: Ductile iron ASTM A536.

D. Gaskets: Grade 30 specially compounded rubber of all new materials.

E. Bolts and nuts: High strength low alloy steel with heavy, semi-finished hexagon nuts to AWWA C111 (ANSI-A21.11).

2.2 GALVANIZED CORRUGATED STEEL CULVERT PIPE (CMP)

A. Conform to the requirements of AASHTO Designation M36, Type I and II, 16 gage minimum. Welded seam aluminum coated inside and outside (aluminized) CMP steel pipe is acceptable alternate.

B. Coupling band shall meet the requirements of AASHTO M36 and wide enough to cover at least two annular corrugations. Gasket shall be provided.

C. When specified, pipe ends shall be flared or beveled to serve as structural, hydraulic and/or aesthetic end treatment to corrugated steel culverts.

2.3 HIGH DENSITY POLYETHYLENE (HDPE) PRESSURE PIPE

A. Pipe used for the gas and condensate collection manifold piping system shall be High Density Polyethylene (HDPE) pipe conforming to the following specifications:

1. Pipe sizing shall be in accordance with ASTM F714-83 and ASTM D3035-83.
2. The pipe shall be made from Premium High Density Polyethylene resin qualified as Type III, Category 5, Class C, Grade P34 in ASTM D1248-81.
3. This material shall have a long term hydrostatic strength of 1600 psi when tested and analyzed by ASTM D2837-76 (1981), and listed by the Plastic Pipe Institute as P.E. 3408 resin.
4. The following minimum engineering design specifications are required:

ASTM D-638 Tensile Strength Yield (2in/min), $\geq$3,200 PSI.

ASTM D-638 Elongation at break, 750%.

ASTM D-638 Modulus of Elasticity, 120,000 PSI.

ASTM D-790 Flexural Modulus, 135,000 PSI.

ASTM D-1693 Environmental stress crack resistance (E.S.C.R.) Condition C, >5,000° F, 20 Hrs.

ASTM D-2837 Long Term Strength (L.T.H.S.) @73.4 degrees Fahrenheit, 1600 PSI.

5. In addition to the above, the High Density Polyethylene Material shall have the following general characteristics:

ASTM D-1505 Density with carbon black, 0.955 g/cm 3 (min).

ASTM D-1238 Melt index (E) Condition, $\leq$ 0.14 g/10 min.

ASTM D-1238 Melt index (F) Condition, $\leq$ 11.0 g/10 min.

ASTM D-1525 Vicat softening point, 257 degrees Fahrenheit (min).

ASTM D-746 Brittleness temperature, < -180 degrees Fahrenheit (max).

ASTM C-177 Thermal conductivity, 2.7 BTU, in/ft^2 hrs./degrees Fahrenheit.

ASTM D-696 Thermal expansion, 1.2 x 10-4 in/in/degrees Fahrenheit (max).

ASTM D-2240 Hardness shore "D", 65.

ASTM D-3350 Cell Class, 345434C.

Resin to be N.S.F. listed.

6. The pipe shall contain no recycled compound except that generated on the manufacturer's own plant from resin of the same specification from the same raw supplier.

7. The HDPE pipe shall be homogenous throughout and free from visible cracks, holes, foreign inclusions, or other injurious defects. The pipe shall be uniform in color, opacity, density, and other physical properties. The following information shall be continuously marked on the pipe or spaced at intervals not exceeding 5 feet:
   a. Name and/or trade mark of the pipe manufacturer.
   b. Nominal pipe size.
   c. Standard Dimension Ratio (SDR)
   d. PE 3408
   e. Manufacturer's Standard Reference
   f. A production code from which the date and place of manufacture can be determined.

8. Polyethylene compound shall be protected against ultra violet degradation by carbon black in concentration of not less than 2%. All gas and condensate manifold pipe shall have a minimum working pressure of 160 psi at 73.4 degrees Fahrenheit and a minimum SDR of 11.

9. Flanges shall consist of a polyethylene flange adapter (ribbed face) fused to each length of pipe, with a shop primered convoluted ductile iron back-up ring.

10. Flange bolts shall conform to material requirements of ASTM A307 Grade B with ANSI B18.2.1 standard hex head pattern, ANSI B1.1 coarse thread, Class 2 fit. Nuts shall meet the requirements of ASTM A307, ANSI B18.2.2 standard hex head pattern ANSI B1.1 coarse thread and have a Class 2B fit. Flat washers shall be provided with each nut for protection of flanges. All bolting materials shall be hot-dip galvanized per ASTM A153.

B. Pipe used for the perimeter gas collection trenches shall be as described below:

1. Solid wall and "broken back collar" sections shall be as described in Paragraph A above.

2. Perforated pipe sections shall be corrugated high-density polyethylene pipe, ASTM F405 as manufactured by Advanced Drainage Systems, 1025 Commerce Drive, Madera, California, 93637 or approved equal.

2.4 POLYVINYL CHLORIDE (PVC) PIPE FOR CONDENSATE PUMP DISCHARGE AND VACUUM SYSTEM, VERTICAL GAS EXTRACTION WELLS, WELL HEAD COMPLETIONS

A. PVC condensate pump system, vacuum system, vertical gas well and well head completions piping shall be manufactured from Type 1 Grade 1 PVC material conforming to the requirements of ASTM D1784. All piping shall be solvent weld unless otherwise shown or required for connection to other components. Pipe that is to be threaded shall be Schedule 80.

B. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, or other injurious defects. Any pipe with nicks, scrapes, or gouges deeper than 5% of the nominal wall thickness shall be rejected. It shall be uniform in color, density, and other physical properties.

C. Pipe 8 inches in diameter and smaller shall meet the requirements of ASTM D1785 and shall be Schedule 40, unless otherwise noted or required. Pipe larger than 8 inches shall comply with ASTM D2241 SDR 26 Class 160.

D. Flexible PVC pipe shall be sized with the I.D. to match the O.D. of rigid PVC pipe, have a rigid outer wall reinforcement, a minimum vacuum rating of 25 inches Hg, and shall be as manufactured by Kanaflex Corporation of America, series 101-PS flexible PVC pipe, or equal.

E. Pipe for vertical gas extraction well casing shall be as described above with the exception that the pipe wall will be Schedule 80. Pipe for vertical gas extraction well screens shall be flush threaded, schedule 80 PVC furnished in 5 and 10 foot lengths. The slotted openings shall be 0.040-inch sized.

F. Fittings shall be solvent weld and shall be manufactured of the same material as the pipe. All fittings shall be Schedule 80 when located below grade. Fittings above grade shall be Schedule 40.

G. All fittings shall be rated and warranted to the full pressure of the pipe they are fabricated from. The manufacturer shall be able to demonstrate that fittings have been randomly tested to exceed the following:

- Short-term quick burst at 2.5 times the normal operating pressure rating of the pipe material or greater.

- Long-term 1,000 hour test at 2.0 times the normal operating pressure rating of the pipe material, or greater, without damage.

H. All fittings 8-inches and smaller shall meet the requirements of ASTM D2466-73. Fittings over 8-inches shall be either injection molded or fabricated from PVC material utilizing butt fusion welded or mitered and welded joints. Joints for fabricated fittings for 45° and 90° bends shall be butt fusion welded. All other bends may be thermoplastic welded with a minimum of three full weld passes. Welding rod shall be of the same material as the pipe.

I. All fabricated fittings shall be reinforced with fiberglass, chemically bonded to the fittings, to achieve a shear strength of at least 1,000 psi. Test results shall be available upon request by the Engineer.

J. Flanges shall be 150-pound flat face solvent weld Van Stone type and shall comply with the requirements of ANSI B16.5 Class 150. Flange gaskets shall be full faced 1/8-inch thick EPDM. Solvent cement shall conform to ASTM D2564.

K. Flange bolts shall conform to material requirements of ASTM A307 Grade B with ANSI B18.2.1 standard hex head pattern, ANSI B1.1 coarse thread, Class 2 fit. Nuts shall meet the requirements of ASTM A307, ANSI B18.2.2 standard hex head pattern ANSI B1.1 coarse thread and have a Class 2B fit. Flat washers shall be provided with each nut for protection of flanges. All bolting materials shall be hot-dip galvanized per ASTM A153.

2.5 DUCTILE IRON CASING

A. Conform to AWWA C151 (ANSI A21.51) and shall be Class 52, unless otherwise specified.

B. Joints shall be mechanical joint or push-on joint and shall conform to AWWA C111 (ANSI A21.11).

C. Pipe and fittings shall have a cement mortar lining conforming to AWWA C104 (ANSI A21.4).

2.6 SOLID PVC PIPING (NON-PRESSURE)

A. Solid PVC piping and fittings shall conform to the requirements for ASTM D3034 SDR35.

2.7 PERFORATED PVC PIPING

A. Perforated PVC piping shall meet the requirements of AASHTO M278. At the Contractor's option, an approved equal slotted PVC pipe may be used. Should the Contractor choose this option, he shall submit plans showing pipe dimensions and slot sizes and intervals for approval.

2.8 PERFORATED CMP PIPING

A. Conform to AASHTO M36 requirements for zinc coated (galvanized) or aluminum coated (aluminized) corrugated iron or steel pipe. Provide minimum 0.052-inch thickness for 6 inch diameter and smaller pipe and 0.064-inch thickness for 8-inch diameter and larger pipe.

B. Perforations shall conform to the locations shown in the Drawings.

C. Coupling bands shall conform with AASHTO M36, Type III pipe, unless otherwise approved.

2.9 EXPANSION JOINTS

A. Conform to Section 02680.

3. EXECUTION

3.1 INSTALLATION

A. Install pipe in accordance with specification section for pipeline being installed.

B. Test pressure or vacuum pipes in accordance with the manufacturers recommendations prior to commencing normal service on this project. Where manufacturer does not specify a test similar to the application involved in this project, test pipe at 1.5 times working pressure or vacuum pressure to demonstrate the integrity of the installed pipe.

C. Provide temporary protection, if required, for installed pipes with shallow burials to prevent damage from construction related equipment until the time of work completion.

* * * END OF SECTION * * *

SECTION 02680

GAS AND CONDENSATE COLLECTION

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Vacuum Pump Stations: Section 11301
B. Pipe and Fittings: Sections 02610
C. Remote Condensate Pump Station: Section 11302

1.2 DESCRIPTION

A. This work shall consist of the construction of the road crossing casing pipes for the gas and condensate system, gas and condensate manifold piping, condensate system cleanouts including meter boxes, condensate pump discharge and vacuum service piping, horizontal gas collection trenches, vertical gas extraction wells, wellhead completions, and vacuum valve stations.

B. Temporary Systems work shall consist of providing construction assistance to the Owner for installation of the temporary gas collection and condensate disposal systems. The work shall also consist of providing the pipe and the gas flare with foundation for these temporary systems.

C. All earthwork required, including trench excavation, pipe bedding, and backfill, shall be in accordance with Section 02222 of the Specification. The installation of erosion control measures shall be in accordance with Section 02275 of this Specification.

1.3 QUALITY CONTROL

A. PROOF TESTS

1. The intent of this requirement is to pre-qualify a piping joint system, components of which meet the above requirements, as to the water and air/vacuum tightness capability of that joint system. This proof test shall be understood to apply to the gas and condensate lines which are to be tested for water and air/vacuum tightness prior to acceptance. Material and test equipment for proof testing shall be provided by the manufacturer. When approved by the Engineer, internal hydrostatic testing may be applied by a suitable joint tester. Proof testing will be required for the permanent system only. No proof testing will be required for the temporary system.

B. MATERIAL CERTIFICATION

1. The manufacturer shall furnish appropriate certification, based on the manufacturer's routine quality control tests, that the pipe and pipe fittings meet the requirements of the pertinent ASTM or ANSI Specifications.

2. MATERIALS

2.1 ROAD CROSSING CASING PIPE

A. Conform to Section 02610 for Ductile Iron Casing Pipe.

2.2 HDPE GAS AND CONDENSATE COLLECTION PIPE

A. Conform to Section 02610.

2.3 PVC PIPE FOR CONDENSATE PUMP DISCHARGE AND VACUUM SYSTEM

A. Conform with Section 02610.

2.4 CONDENSATE CLEANOUTS

A. Piping material to conform to Section 02610 except that the clean-out wye shall be shop fabricated with a 5' radius as shown on the Plans.

B. Vaults for the condensate system clean-outs shall be as manufactured by Utility Vault model 2436-R6 pre-cast concrete riser with a 23-2436P cover or approved equal.

2.5 VALVES FOR GAS AND CONDENSATE SYSTEM

A. Valves 4 inches and larger shall be butterfly valves manufactured with PVC wafer style bodies and shall be as manufactured by Asahi America Type 75 or approved equal with PVC body, Polypropylene (PP) or Polyvinylidene fluoride (PVDF) disk and EDPM seat. Valves 8 inches and larger shall be provided with a worm gear operator, position indicator and handwheel for operation. Valves 6 inches and smaller shall be provided with a ratcheting hand lever for operation. Valves shall be rated for full vacuum service.

B. Valves 3 inch and smaller shall be gate valves manufactured with a PVC flanged body type and straight-through flow passage, with EPDM seats and handwheel operator as manufactured by Asahi America or approved equal. Valves shall be rated for full vacuum service.

C. The ball valves shall be stainless steel body, stainless steel ball and stem, with teflon seats.

D. All stainless steel tubing, fittings and valves shall be 316L stainless steel "Swagelock" or approved equal.

E. The vault shall be a "Utility Vault Co." pre-cast concrete vault with two Model No. 2436-R6 risers and a Model No. 23-2436P locking cover, or approved equal. The overall dimensions of the vault shall be 3'-0" x 2'-0" x 1'-6" deep. The vault shall be installed with 1-inch thick "Styrofoam-Blue" brand polyfoam or equal and shall be secured to all interior surfaces of the vault using DOW Chemical PL-300 adhesive or approved equal.

F. The "APCO" Model 65.5 air release valve shall be constructed of stainless steel body, internals, and seats. No substitutions will be accepted for this air release valve.

2.10 EXPANSION JOINTS

A. Expansion joints shall be constructed of high strength silicone rubber with polyester fabric reinforcement as manufactured by Industrial Tube Corporation, 3091 Indian Avenue, Perris, California, 92370, Model IT-6000 -24 or acceptable substitute. Stainless steel Type 302 wire shall be encapsulated within the inner and outer plies and not exposed. Scuff strips shall be added to the outside of the coupling over the wire areas. The coupling shall have an operating temperature range of between -65 degree F through +325 degree F. The coupling shall have the flexibility of 50% contraction and 20% extension and a bend radius of 1.5% of the diameter.

PVC pipe collars shall meet the requirements of Section 02610 of this specification and shall be manufactured by Industrial Tube Corp., 3091 Indian Ave., Perris, Calif. 92370, Model IT-6003 or acceptable substitute. PVC pipe flanges shall meet the requirements of Section 02610 of this specification.

2.11 TEMPORARY SYSTEMS

A. The Contractor shall be responsible for supplying 4" SCH 40 PVC pipe for the temporary gas collection system. The Contractor shall also supply 2" SCH 40 PVC pipe and a 4' dia. x 10' deep temporary condensate manhole as manufactured by Advanced Drainage Systems, or equal, for the temporary condensate disposal system. The Owner/Engineer shall supply all additional materials required for the installation of the temporary systems.

2.6 HORIZONTAL GAS COLLECTION TRENCHES

A. Piping material shall conform to Section 02610.

B. Gravel bedding material shall conform to Section 02222-2.1.

C. Geotextile shall conform to Section 02272.

2.7 VERTICAL GAS EXTRACTION WELLS

A. Well casing material shall conform to Section 02610.

B. Well screen material shall conform to Section 02610.

C. The pack material shall be vesicular scoria or pumice as available through Red Rock, Inc. Goldendale, WA. or other low density granular "lava-rock" material as approved by the Engineer. The pack material shall conform to the specifications for grading, qaulity and density in Section 02220-2.10.

D. The annular seal materials shall be a State of Oregon approved seal to the land surface. The bentonite plug placed above the pack material shall be bentonite chips. The Contractor shall measure and record depth soundings versus depth of drill casing and the number of bags of bentonite used on their State well log.

2.8 WELLHEAD COMPLETIONS

A. Conform with Paragraphs 2.3 and 2.5 of this Section.

2.9 VACUUM VALVE STATIONS

A. Included in each vacuum valve station are the following components:

1. All piping and fittings between the "HDPE-to-stainless steel" flange break at the gas collection manifold and the condensate collection manifold as shown on the Plans.
2. Two 1/2 inch stainless steel ball valves as shown on the Plans.
3. 3/16 inch stainless steel tubing with fittings and valve as shown on the Plans.
4. One "APCO" model 65.5 air release valve. The valve shall be installed "up-side-down" as shown on the Plans in that it will be used as a vacuum release valve rather than an air release valve.
5. One precast concrete vault.

B. The piping shall be 316L stainless steel.

B. The Contractor shall supply a temporary gas flare fabricated as shown on the Plans. The flare shall be provided with a solar powered ignition device, control panel, 12 volt, 650 AMP deep cycle marine battery with lockable case, 40 feet of 3/C#14 Teck cable, and all hardware required for mounting the solar panel, control panel, and battery case remote from the flare.

The ignitor assembly shall be a "MAC Ignitor" as manufactured by MAC Tronic, Ltd., Box 621 Red Deer, Alberta, Canada T4N5G6 (403) 342-1822, or approved equal.

C. The Contractor shall supply foundations for the flare base and guy wires. These foundations shall conform with Division 3 of this specification.

3. EXECUTION

3.1 ROAD CROSSINGS CASING PIPE

A. Road crossing casing pipe shall be installed at locations shown on the Drawings to permit landfill gas collection, condensate collection, condensate discharge and vacuum piping to cross beneath roadways.

B. The landfill gas manifold piping, condensate piping and vacuum piping shall be inserted in the casing pipe using 2-inch by 2-inch by 18-inch long wooden blocking at 5-foot centers as shown on the Plans. Condensate piping, and vacuum piping shall be bundled together with plastic strapping where applicable and inserted into a single casing pipe as shown on the Plans. Casings for the condensate and vacuum piping shall be blown full of sand. Any build-up of the road required to achieve minimum cover over the casing pipe shall be done in accordance with Section 02220 of these Specifications.

3.2 PERMANENT HDPE GAS OR CONDENSATE PIPE INSTALLATION

A. HDPE Pipe which is to be installed underground shall be laid in a manner that the excavation, pipe laying, and back-filling of the pipe trench, as described on the Plans, shall be completed within the same day and before the Contractor leaves the site on that day. Extreme care must be taken to ensure that the landfill geomembrane is not disturbed or damaged in any way. Any repairs made to the cover that are a result of the contractor's negligence while installing the piping will be done at the contractor's expense. Trench excavation and backfill shall be per Section 02222

B. For HDPE pipe which is to be installed aboveground, the ground surface shall be smoothed and ruts filled in 30-inches on each side of

the pipe route prior to pipeline installation. Continuous slope between inverts shown on plans is to be maintained. Maximum deviation from inverts shown to be +/- 0.01 feet. Where necessary to meet slopes or elevations, the contractor shall excavate or backfill areas 30-inches on each side of the pipe route prior to the installation of the pipe.

C. When necessary to cut the HDPE gas or condensate pipe, the pipe shall be cut using a tool or tools specifically designed to leave a smooth, even and square end on the pipe material to be cut. Cut ends shall be reamed to the full inside diameter of the pipe.

D. The individual lengths of pipe and all fittings (unless otherwise noted) shall be jointed together by thermal butt fusion. This pipe shall be fused of the same type, grade, and class of polyethylene compound and supplied by the same raw material supplier.

Butt fusion shall be made only when the pipe materials to be jointed are clean and dry, and only at ambient temperatures of 40 degree Fahrenheit and above, or as approved by the Engineer.

The butt fusion shall be accomplished according to the pipe manufacturer's recommendation.

E. The Contractor shall take care when handling the pipe so as to not damage it by dragging it over sharp and cutting objects. Sections of the pipe with gouges or cuts shall be cut out and the ends of the pipe rejoined.

F. Where shown the Plans, lengths of pipe shall be joined together by the use of flanges rather than thermal fusion. Flange bolts shall be tightened by pulling down on diametrically opposite nuts until proper bolt torque values are achieved. Bolt torques for the HDPE Flanges are given below:

Flange Size (inches)	Torque (foot pounds)
2 to 4	20 to 30
6 to 8	33 to 50
10	53 to 75
12	80 to 110

Contractor shall provide necessary gaskets and bolting to install between adjoining flanges. Flanged connections are required where disconnection of one flange is required for removal, repair or maintenance of equipment.

3.3 CONDENSATE CLEAN-OUTS

A. Conform to Paragraph 3.2.

B. Pre-cast concrete vaults shall be installed in accordance with Section 03485 of this Specification.

3.4 PVC CONDENSATE PUMP DISCHARGE AND VACUUM SYSTEM PIPING INSTALLATION

A. Conform to Paragraphs 3.2 A, B, C, and E.

B. The individual lengths of pipe and all fittings (unless otherwise noted) shall be jointed together by solvent welding. The pipe or fittings bell and spigot shall be clean and dry before jointing operations begin. The bell and spigot shall both be coated with primer followed by the application of cementing material to both the bell and spigot in accordance with the manufacturer's instructions.

C. Care shall be taken to properly align the pipe before the joints are forced home. Where dirt, water or other foreign material comes in contact with the primer or cementing material for the joints, the joint shall be thoroughly cleaned and dried and new primer and cementing material applied before the joint is forced home. The joint shall be maintained in position for the time specified by the manufacturer before any pressure is applied to the pipe.

D. Paint all exposed portions of rigid PVC pipe per Section 09900 of this specification.

3.5 VALVE INSTALLATION

A. All gas and condensate system valves shall be oriented for operator convenience with the operation handle or actuator in the most accessible position. Butterfly valves shall be installed with the shaft axis in the horizontal position.

3.6 HORIZONTAL GAS COLLECTION TRENCHES

A. Horizontal Gas Collection Trenches will be installed surrounding the landfill perimeter in Subarea 1 per the Plans. These trenches are to be installed in refuse, therefore the appropriate safety precautions apply.

B. Installation of gravel bedding material shall conform to the Plans.

C. Installation of the geotextile shall conform to Section 02272, the manufacturer's recommendations, and as shown on the Plans.

3.7 VERTICAL GAS EXTRACTION WELLS

A. Drilling

1. These wells are to be installed in refuse, therefore the appropriate safety precautions apply. All drillers and laborers associated with the drilling operation shall have received health and safety training as defined in the Federal Occupational Safety and Health Act of 1970 (OSHA) as amended including, OSHA 29, CFR Part 1910 Hazardous Waste Operations and Emergency Responses; Interim Final Rule, as they apply to the safety and health provisions for hazardous waste operations and all other applicable federal, state, county, and local laws, ordinances, codes, and the requirements set forth herein, and any other regulations that may be set forth in any other parts of this Contract. If any of these requirements are in conflict, the more stringent requirement shall apply. The Contractor's failure to thoroughly familiarize himself with the aforementioned safety and health provisions shall not relieve the Contractor of the responsibility for full compliance with the obligations and requirements set forth therein. Where "Hazardous Waste Operations" is mentioned in the regulations listed above, it shall be interpreted in this Specification to include any persons potentially exposed to landfill gas, landfill gas condensate, asbetos, or leachate from the St. Johns Landfill.

2. All borings shall be drilled using rotary barrel core type auger drilling equipment. Drilling using cable tool or air rotary methods shall not be allowed. The drilling Contractor shall have successfully completed a minimum of 1,000 linear feet in refuse using the same procedures described above. The Contractor shall provide a rig large enough and capable of reaching the desired depth. A borehole a minimum of 26-inches in diameter is required.

3. Borings shall be drilled to 100% of the depth of refuse. When the boring begins to penetrate the underlying soils, the Contractor shall pullback and discontinue drilling. The Contractor shall fill the boring zone below the refuse with bentonite. Completion of the well shall begin within the refuse zone per the contract documents.

B. Soil Sampling and Borehole Logging

1. Sample drill cuttings shall be collected by the Contractor and placed in bags furnished by the Engineer on a routine basis, at 5-foot intervals, at the change of formation, or at the discretion of the Engineer.

2. Borehole logging will be conducted by the Engineer for the purposes of this project and must also be done by the Contractor for fulfillment of state requirements. The Contractor shall endeavor to provide information on drilling conditions that will assist the Engineer in making determinations of subsurface material character.

C. Alignment

1. Alignment requirements during drilling are that any casing, liner, or drill tools can be run freely through the boring.

D. Abandonment

1. Any well that does not meet the alignment or other requirement, or which is contaminated by the Contractor, or any well on which the Contractor stops work will be considered abandoned. A new well shall be started in the immediate vicinity at a location designated by the Engineer. The Contractor may, at his own expense, remove any ungrouted casing.

E. Gas Extraction Well Installation

1. Depending on the number of completions per boring, the Contractor shall install one or more 4 or 6-inch Schedule 80 PVC casing in each boring as shown on the Plans. Each completion shall have between 20 to 40 feet of 40 slot screen, as shown on the Plans or as determined by the Engineer. Casing threads may be lubricated with Teflon materials only.

2. The well casing will then be lowered into the boring and shall be suspended at the required depth for the remainder of the installation. The casing shall be pulled back a few inches prior to pack rock installation to insure that the completion is not caught in the drill casing. Gloves and coverall worn by the

Contractor while touching the well casing shall be new and clean. The well casing shall be cleaned before installation (unless already cleaned, wrapped and shipped in plastic bags by the manufacturer.)

F. Pack Material/Seal Installation

1. The pack material shall be placed around the completion screen up to approximately 4-foot above the screen. To separate double completions, a 2 foot layer of Type I Sand will be placed above the pack rock. A 2 foot thick bentonite chip plug will be placed above the sand layer and will be covered with additional 2 foot thick layer of Type I Sand. On the shallow completion or on single completion wells, a 2 foot layer of Type I Sand will top the pack material followed by a 2 foot thick bentonite chip plug. The remainder of the borehole will then be backfilled with Type I Sand. The bentonite plug layer shall be hydrated by pouring clean potable water through a separate tremie pipe placed in the annular space of the well.

G. Completion

1. Well casings will be terminated at least a point 12-inches above **final** grade elevations as shown on the Plans. A slip cap will then be installed to prevent contamination of the well until the well will be completed. An HDPE pipe sleeve shall be installed as shown on the Plans. The pipe sleeve shall be backfilled with bentonite chips and hydrated with clean water. Temporary barriers or traffic posts shall be installed at appropriate well locations after the well drilling and construction is completed to protect well from damage.

2. Wells installed in Subarea 2 shall be capped 12-inches above existing grade to prevent contamination of the well. A HDPE pipe sleeve will not be required. Temporary barriers shall be installed to protect wells from damage.

H. Decontamination

1. All drilling equipment, tools, steel casing, and PVC casing associated with the construction of the wells shall be decontaminated using a high-temperature steam cleaner.

2. The Contractor shall clean drilling equipment before mobilizing to the site, once on site before work commences, between each boring, and before demobilizing from the site. The cleaning

performed before mobilization is incidental to the mobilization charge.

3. PVC well casing shall be cleaned prior to installation, and kept clean between the time it is washed and the time it is used in the well.

4. The Contractor shall be responsible for providing all the equipment necessary for the cleaning process. This includes: clean potable water; a source of electricity; and a portable high pressure and temperature washer.

5. Wash water which has been in contact with refuse must be collected and disposed of in the SA-5 leachate system. Other wash water maybe disposed in the sanitary sewer system.

I. Site Restoration

1. At the conclusion of all work activity at a boring, all drilling tools, extra casing, trash, and other materials shall be removed from the site. No work shall begin on subsequent borings until the previous boring site has been cleaned up. All boring and miscellaneous trash materials such as bentonite bags will be properly disposed of.

J. Well Construction Records

1. The Contractor shall keep a daily written log of operations, including size and length of the casing placed, character, depth and thickness of all formations penetrated, causes of delays, and screen location. Duplicate copies of this log shall be furnished to the Engineer at the end of each work day.

One sample of material penetrated from each five feet of depth, at every change in material type, or as specified by the Engineer shall be collected by the Contractor.

K. Waste Soil

1. All soil materials which has been removed from the borings shall be considered refuse and shall be disposed of in an appropriate manner on-site.

3.8 WELL HEAD COMPLETIONS

A. Conform to paragraph 3.4.

B. Pipe supports shall be fabricated and installed as shown on the Plans and shall meet the requirements of Section 05500. Pipe supports shall be spaced at a maximum distance of 7 feet apart.

C. Paint all exposed portions of rigid PVC pipe per Section 09900 of this specification.

3.9 VACUUM VALVE STATION INSTALLATION

A. Each "Vacuum Valve Station" shall be installed per standard pipe fitting methods at the locations indicated in the Plans.

B. Pre-cast concrete vaults shall be installed in accordance with Section 03485 of the Specification.

C. Extreme care must be taken to ensure that the landfill geomembrane is not disturbed or damaged in any way. Any repairs made to the cover that are a result of the contractor's negligence while installing the vacuum valve station will be done at the contractor's expense.

3.10 EXPANSION JOINTS

A. Expansion joints shall be fabricated with a PVC socket flange, PVC pipe collar and two stainless steel band clamps at each end. The distance between rigid PVC pipe ends shall allow the expansion joint to be compressed to half its resting length.

B. Paint exposed portions of PVC flanges per Section 09900 of this specification.

3.11 TEMPORARY SYSTEMS

A. During the Subarea 1 construction, a temporary gas collection system shall be installed to protect the final cover system from damage. This temporary piping will be installed, re-moved, and re-installed to facilitate the work of the Contractor, while meeting the performance criteria listed below. The temporary gas flare shall be installed by the Contractor during the Subarea 1 construction to burn gases collected from the temporary gas collection system. This temporary gas flare may be removed after construction and re-installed by the Contractor at a location selected by the Engineer to better facilitate the burning of gases collected from the permanent gas collection system.

Temporary condensate disposal piping and manhole shall be installed by the Contractor after Subarea-1 construction to provide a temporary means of disposal of condensate from the vacuum pump station and remote condensate pump station installed as part of this contract.

B. The temporary gas collection system, temporary condensate disposal system, and temporary gas flare will be located in the field by the Engineer in accordance with the requirements set forth in this specification.

The Contractor shall make available to the Engineer, laborers, (maximum 2) to assist the Engineer with the installation, removal, and of the re-installation of the temporary systems. The Contractor shall also make available to the Engineer, equipment and operator(s) as required to transport the temporary piping. The Contractor shall submit to the Engineer prior to construction, a detailed Construction Sequencing Plan to allow the Engineer to make preliminary judgements on the installation of the temporary systems to best facilitate the needs of the Engineer and the Contractor. The Contractor shall provide 48 hours written notice identifying exact area's of work to allow determination for temporary pipeline alignment.

C. Generally the performance criteria for the installation of temporary systems shall be (1) to prevent damage to the final cover system as a result of landfill gas "build-up" under the cover. (2) to provide a temporary means of flaring the landfill gas during and after the Subarea 1 construction, and (3) to provide for a temporary means of condensate disposal after Subarea 1 construction. The Contractor/Engineer will follow the performance criteria listed below with regards to the installation of the temporary gas collection system during Subarea 1 construction.

1. Any vertical gas extraction well in Sub-Area 1 displaying over 20" water column positive pressure will require inclusion into the temporary gas collection system. At no time will any of these wells be taken off-line, unless the Contractor provides 48 hours written notice and approval is given by the Engineer. The Engineer will be afforded every opportunity to sustain the temporary gas collection system.

2. The number of wells that must remain on line may vary. The maximum period in which wells may be off line is 6 hours. This decision will be on a case-by-case basis, and the Engineer shall reserve the right to maintain operation of all wells should the potential for damage to the final cover system become evident. Likewise, the Engineer may approve operation of a lesser number of wells. The Contractor therefore must plan his work to accommodate said operation. The Contractor will not receive additional compensation for conditions requiring operation of all wells.

3. Under no circumstances shall the Contractor operate any valves connect or disconnect any portion of the temporary gas collection system, or do any work that might modify the operation of the temporary gas system. The Engineer will be responsible for all gas system operations.

4. The Contractor shall give a 48-hour minimum response time notice to the Engineer's designated representative for any work which the Engineer is to perform.

5. All temporary headers and temporary connections shall allow for the free drainage of condensate to establish low points for drainage of condensate into a condensate collection system. The condensate will be removed by the Engineer.

* * * END OF SECTION * * *

SECTION 02720

STORM DRAINAGE FACILITIES

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Pipe and Fittings: Section 02610
B. Sedimentation Control: Section 02275
C. Excavating, Backfilling, and Compacting for Structures: Section 02221

1.2 SCOPE

A. This section covers the material and installation requirements for storm drainage facilities to be installed under this project. This work shall consist of constructing sedimentation basin, outlet structure, measuring flume, culverts, manholes, drainage swales, underdrain lines, and subsurface drainage lines of the sizes and types designated on the Drawings and described herein.

2. MATERIALS

2.1 PERFORATED CMP SUBSURFACE DRAIN PIPES

A. This section covers perforated CMP subsurface drain pipes to be installed in the sedimentation basin as shown on the Drawings.

B. Perforated CMP piping shall conform to Section 02610.

2.2 UNDERDRAIN PIPE

A. This section covers underdrain collection and transfer lines to be installed in drainage ditches and other areas as shown on the Drawings.

B. Underdrain collection piping shall be perforated PVC piping conforming to Section 02610.

C. Underdrain transfer piping shall be solid PVC pipe conforming to Section 02610.

2.3 AGGREGATE FOR SUBSURFACE DRAINS OR UNDERDRAINS

A. Aggregate to be used for subsurface drains or underdrains shall consist of clean, Drain Rock conforming to Section 02220.

2.4 GEOTEXTILES

A. Geotextiles used in conjunction with subsurface drain lines and drainage swales shall conform with Section 02272 for the type geotextile specified and shown on the Drawings.

2.5 QUARRY SPALLS

A. Quarry Spalls shall conform to Section 02220.

2.6 CULVERTS

A. Culverts shall conform to Section 02610.

2.7 CONCRETE

A. Conform to Section 03300.

2.8 PARSHALL FLUMES WITH ACCESS MANHOLE

A. Parshall Flumes shall be prefabricated of fiberglass reinforced polyester with a minimum wall thickness of 1/4" throughout. Flumes shall be equipped with an integral 12" diameter float well. Inside surfaces shall be white gelcoat, smooth and free from irregularities. The outside surface shall be provided with clips suitable for anchoring to concrete. Flumes shall be equipped with adapter end sections, flexible neoprene boots and stainless steel clamps for connection to CMP. Flumes shall also have integral head gauges. Top of exposed flume shall be covered with a fiber-reinforced plastic cover suitable for the depth of installation specified.

B. Provide fiberglass access manhole integral to the Parshall Flume. Manhole shall conform to ANSI/ASTM D-3753 specifications for fiber-reinforced manholes. Provide 24" diameter cast iron or steel frame and cover. Size of fiberglass manhole shall be 48" diameter, minimum, height as required with suitable reducer capable of supporting H-20 highway loading. Furnish OSHA-approved access ladder, height as required.

C. The Packaged Flume, incorporating the Parshall Flume and access manhole with cover, shall be a standard product of manufacture from Plasti-Fab, Inc., P.O. Box 100 Tualatin, Oregon 97062, (503) 692-5460 or approved equal.

2.9 OVERFLOW STRUCTURE

A. Overflow structures shall consist of 48" diameter CMP riser pipe. Manhole steps shall be placed one foot on center and shall conform to OSHA Standards. Factory-fabricated, welded, CMP inlet and outlet pipe stubs shall be provided at CMP riser pipe to allow field-coupling of the CMP inlet and outlet pipes.

B. Overflow screens shall be fabricated steel in accordance with Section 05500 of these specifications.

2.10 METERBOX

A. Meterboxes for access to underdrain pipe cleanouts shall be a Brooks Meter box with concrete cover; 36 series for 4-inch pipe, 37 series for 6-inch pipe, 38 series for 8-inch pipe; or approved equivalent product.

2.11 ROCK-LINED DRAINAGE SWALES AND SPLASH PADS

A. Splash pads and a portion of the drainage swales which are to be constructed on this project shall be lined with Quarry Spalls as shown on the Drawings. All Quarry Spalls shall be underlain with Type 3 Geotextile.

2.12 GRASS-LINED DRAINAGE SWALES

A. The majority of the drainage swales which are to be constructed on this project shall be surface-lined with Erosion Control Matting/Blanket and hydroseeded as shown on the Drawings and specified elsewhere in this Specification.

2.13 BENTONITE

A. Bentonite for dams associated with underdrain collection pipes shall be Volclay SC-40, as manufactured by American Colloid Company, Skokie, Illinois; Federal's Bentonite, as manufactured by Aurora Industries, Inc., Montgomery, Illinois; or approved equal.

2.14 STORMDRAIN MANHOLE

A. Precast concrete manholes shall conform to the requirements of ASTM C478 except as specifically modified herein.

B. Joints between precast sections used for storm sewers may be rubber gasketed or cement mortar.

C. Base sections shall be made with the base slab integral with the wall in such a manner to achieve a completely watertight structure. Design

of base shall be in accordance with the following table for all manholes up to 25 feet deep using Grade 60 reinforcing steel.

Manhole Inside Diameter	Minimum Base Thickness	Minimum Steel-Sq.In./LF Separate Base	Minimum Steel-Sq.In./LF Both Directions Base Integral With Wall
54"	8"	0.19	0.19

D. Proportion of Portland cement in concrete mixture shall be not less than 564 pounds per cubic yard of concrete.

E. Openings to receive pipes shall be circular, and shall be sized to equal the outside diameter of the pipe to be inserted in the joint plus the manhole wall thickness.

F. Resilient connectors conforming to ASTM C923 may be used at the Contractor's option.

G. Provide flat top, 8" minimum depth, with offset 24" diameter opening.

H. Provide 12" sump below pipe invert.

I. Provide standard manhole steps for maintenance access.

J. Provide cast metal frame and cover, non-locking type, 24" inside diameter minimum, conforming to ASTM A48, Class 30, with "DRAIN" indicated on cover with two-inch raised letters.

3. EXECUTION

3.1 SURVEY LINE AND GRADE

A. The Contractor shall transfer line and grade and control his work.

B. In the case the referenced methods are impractical, the Contractor may control his line and grade by the use of approved surveying instruments operated by qualified personnel.

C. The Contractor shall constantly check line and grade of the pipe and in the event they do not meet specified limits, the work shall be immediately stopped, the Engineer notified, and the cause remedied before proceeding with the work.

3.2 PIPE LAYING

A. Laying of drainage pipe shall be accomplished to line and grade in the trench only after it has been dewatered and the foundation and/or bedding has been prepared. Where applicable, perforations shall be placed downward. Install all pipe in strict compliance with the manufacturers recommendations.

B. Mud, silt, gravel and other foreign material shall be kept out of the pipe and off the jointing surfaces.

3.3 PLACEMENT OF QUARRY SPALLS

A. Quarry Spalls shall be placed in a manner which will produce a reasonably well graded mass of stone with the minimum practical percentage of voids, and shall be constructed to the lines, grades, and thickness shown on the Drawings. Type 3 Geotextile shall be placed under all quarry spalls.

B. Quarry Spalls protection shall be placed to its full course thickness in one operation and in such a manner as to avoid displacing the underlying geotextile material or earth subgrade. Placing of quarry spalls protection in layers will not be permitted. Place quarry spalls starting at the bottom of the slope and working toward the top of the slope.

C. Placing quarry spalls protection by dumping into chutes or by similar methods likely to cause segregation of the various sizes will not be permitted.

D. It shall be the Contractor's responsibility to protect the embankment and excavated slopes from erosion or damage. Contractor shall maintain the quarry spalls protection until accepted and any material displaced by any cause, shall be replaced at the Contractor's expense, to the lines and grades shown on the drawings.

3.4 OVERFLOW STRUCTURES

A. CMP overflow structure shall be embedded in concrete pads which are supported on 3 inches of sand bedding and extra layers of bentonite mat, geotextile and geomembrane as shown on the Drawings.

3.5 PARSHALL FLUMES

A. Excavating, backfilling, and compaction shall be performed in accordance with manufacturers recommendations and Section 02221.

B. Provide 12" thickness concrete support slab with anchor bolts. Size as required by manufacturer.

C. Grout space under the flume full in accordance with manufacturer recommendations.

3.6 STORMDRAIN MANHOLE

A. Foundation
   1. Place base on a well-graded granular bedding course conforming to Paragraph 2.3 of this section, not less than 4 inches in thickness and extending to the limits of the excavation.
   2. Bedding course shall be firmly tamped and made smooth and level to assure uniform contact and support of the manhole.

B. Precast Base Section:
   1. Place on the prepared bedding so as to be fully and uniformly supported in true alignment.
   2. Make sure that all entering pipes can be inserted on proper grade.

C. Pipe Connections:
   1. Provide flexible joint at a distance from the face of the manhole of not more than 1-1/2 times the nominal pipe diameter or 12 inches, whichever is greater, for all rigid pipes entering or leaving any manhole.
   2. Firmly compact bedding under pipe within the area of the manhole excavation.
   3. Openings through which pipes enter the structure are to be watertight.

D. Manhole Cover:
   1. Provide not less than 4 inches or more than 16 inches of grade rings between the top of the slab and the underside of the manhole casting ring for adjustment of the casting to ground surface.

* * * END OF SECTION * * *

SECTION 02760

EXISTING UTILITIES/FACILITIES UNDERGROUND AND OVERHEAD

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Excavating, Backfilling and Compacting for Utilities: Section 02222

1.2 LEGAL REQUIREMENTS - UNDERGROUND FACILITIES

A. The Contractor shall, before commencing excavation in any area, comply with the provisions of any applicable laws relating to or governing the indentification, location, marking, and responsibility for protecting and repairing of underground facilities.

B. Whenever there may be a conflict between the provisions of any law and the provisions of these specifications, the provisions of law shall control.

1.3 DEFINITIONS

A. Utility means any facility or item placed above or below ground for use in connection with the storage or conveyance of water, sewage, leachate, electronic, telephonic or telegraphic communication, cablevision, electric energy, petroleum products, gas, gaseous vapors, hazardous liquids, or other substances and including, but not limited to pipes, sewers, conduits, cables, valves, lines, wires, manholes, and attachments.

1.4 IDENTIFICATION

A. All underground utilities known by Metro to be in the proposed work area are identified on the project plan.

B. The underground utilities identified on the Drawings have not and cannot be precisely located by Metro or its agents or engineers and location is approximate only. Metro, under this Contract, does not warrant the location of underground utilities.

C. NOTICE: Overhead electrical lines may not be completely shown on the Drawings. Electrical transmission lines which are shown on the Drawings are located by point to point, power pole to power pole connections. The transmission cables or wires may be located on

either side of the drawing location depending upon the configuration of the crossarms on the power poles or towers. Line voltage is not shown.

1.5 NOTIFICATION

A. It is the responsibility of the Contractor to give adequate notice to Metro or owners of any utilities known or suspected to be within the area of any proposed excavation or construction activities.

B. The Contractor is responsible to have the locations of underground utilities marked by the utility owners prior to beginning excavation.

C. The Contractor is responsible for determining the extent of any hazard created by electrical power in all areas and shall follow procedures during construction as required by law and regulation. Prior to construction, the Contractor shall meet with utility owners and determine the extent of hazards and remedial measures and shall take whatever precautions may be required.

D. The Contractor's attention is directed to federal, state, and local safety codes relative to limitations of work in proximity to overhead power lines.

1.6 QUALITY CONTROL

A. Contractors shall cooperate with utility owners to aid in locations and maintenance of existing utilities.

1.7 ELECTRICAL TRANSMISSION AND SERVICE LINES

A. Since neither the Engineer nor Metro can anticipate the construction methods or techniques and equipment to be used by the Contractor in performing the work, the extent of the possibility of the Contractor's equipment and personnel coming in contact with electrical transmission lines cannot be fully anticipated, and there is no representation that all electrical transmission lines are shown on the Drawings.

B. The Contractor is charged with the responsibility of observing and investigating the presence of any elctrical transmission lines which might impinge on his work whether overhead or underground and shall consult with and utilize the information given by utility owners and operators to determine the extent of any hazards and remedial measures required, and follow appropriate safety procedures.

1.8 ABOVE GROUND UTILITIES

A. Existing above ground utilities, whether shown on the Drawings or not, shall be maintained, relocated, rerouted, removed and restored as may be necessary by the Contractor in a manner satisfactory to owners and operators of the utilities.

1.9 UNDERGROUND UTILITIES

A. Existing major underground utilities and appurtenant structures within the area of excavation, whether shown on the Drawings or not shall be maintained, relocated, rerouted, removed and restored by the Contractor.

B. Minor underground utility service lines, including but not limited to sanitary sewer services, gas services, water services, drains, leachate force main and electricity or telephone services and culverts shall be maintained, relocated, rerouted, removed and restored by the Contractor with the least possible interference with such services.

1.10 RESTORATION BY UTILITY OWNER

A. The right is reserved by owners of public utilities and franchiese to enter upon any street, road, right-of-way, or easement for the purpose of maintaining their property and for making necessary repairs or adjustments caused by the Contractor's operations.

B. The Contractor shall save Metro harmless of any costs so incurred in restoration of a utility damaged by the Contractor subject to the provisions of any law.

* * * END OF SECTION * * *

SECTION 02831

CHAIN LINK FENCES

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Embankment and Grading: Section 02220
B. Concrete: Division 3

1.2 QUALITY CONTROL

A. Erector shall be a Contractor regularly engaged in installation of similar fencing.

1.3 SUBMITTALS

A. Certification of quality of all fence elements.

B. Shop drawings illustrating locations of all posts, structural details of all fence elements and gate construction.

C. Submit results of ASTM A90 test for zinc coating weight.

2. PRODUCTS

2.1 GENERAL

A. Posts, rails, rods, bars, fittings and hardware shall be hot-dipped, zinc-coated steel per ASTM Specifications A120, A123 and A153, as applicable. Repair of damaged galvanized metal to be by Galvwelding off-site, or by cold galvanized high-zinc content paint.

B. Fence components to be galvanically compatible.

2.2 CHAIN LINK FABRIC

A. Chain link in accordance with ASTM A392, high carbon steel, zinc-coated Class II (2.0 ounces per square foot).

B. No. 9 gauge x 2-inch mesh, hot-dipped after weaving, twisted and barbed at top and bottom selvages.

C. 72-inch height (fabric roll width) or other sizes as indicated on drawings.

2.3 POSTS

A. Terminal Posts: All end, corner and pull posts, 3 inch O.D. standard pipe, 5.79 lbs. per lineal foot (deflection in horizontal fence line of 15 degrees or more requires a terminal post).

B. Intermediate Posts: 2-1/2 inch O.D. pipe, 3.65 pounds per lineal foot.

C. Gate Hinge Posts

1. Single leaves 6 to 13 foot width: 4 inch O.D. pipe, 9.1 pounds per lineal foot.

D. Post Braces: 1-5/8 inch O.D. pipe, 1.17 pounds per lineal foot.

E. All posts shall be provided with tops as required.

F. Provide base plate welded to bottom of post as shown on the drawings. Base plate shall galvanized steel of the size shown. Weld to be fillet all around.

G. Weld rebar to posts as shown on the drawings.

2.4 GATES

A. Outer Frame: 2 inch O.D. pipe (all four sides), 2.72 pounds per lineal foot.

B. Cross of "X" bracing: 1-5/8 inch O.D. pipe, 2.27 pounds per lineal foot.

2.5 ATTACHMENTS

A. Truss Rods: 3/8-inch diameter round rod.

B. Tension Bars (Stretcher Bar): 1/4 inch x 3/4 inch flat, high carbon steel.

C. Tension Wire (Top and Bottom): No. 7 gauge, galvanized coiled spring wire.

D. Fittings and Hardware: All standard fittings required for the complete fence assembly, including gates, shall be malleable cast iron or pressed steel. All ferrous material shall be hot-dipped galvanized.

2.6 CONCRETE

A. Per Division 3 with consistency requirement altered to 6 inch maximum slump.

3. EXECUTION

3.1 CHAIN LINK FENCE INSTALLATION

A. General:
1. Install as illustrated on approved shop drawings by skilled mechanics experienced in erection of chain link fence and gates.

B. Posts:
1. Posts shall be set vertically and spaced at 8-foot centers.
2. Set all posts in concrete footings as detailed on the drawings. Concrete shall be worked thoroughly to remove voids.
3. Install post braces and adjustable truss rods at corners, gates, pull posts or as detailed on approved submittal drawings.
4. Install so posts are plumb when diagonal rod is under tension.
5. Equip posts with tops designed to exclude moisture from posts.

C. Tension Wire:
1. Install top tension wire, top rail not required except at corners and gates.
2. Install bottom tension wire along bottom 2 inches above finish grade.
3. Stretch tension wire prior to fabric stretching and fasten to terminal posts.
4. Secure chain link fabric to tension wire with 11 gauge hog rings spaced 24 inches apart.

D. Chain Link Fabric:
1. Stretch taut and securely fasten to posts.
2. Fasten chain link fabric to all terminal posts by tension bars with heavy one inch by 11 gauge pressed steel bands spaced 14 inches apart.
3. Fasten to line posts with 2 gauge wire clips spaced 14-inches apart.

E. Gates:
1. Weld all joints in gate frames. Welded connections where the spelter coating has been burned shall be thoroughly cleaned by wire brushing and all traces of welding flux and loose or cracked spelter removed. The clean areas shall then be painted with two coats of galvanizing repair paint.

2. Chain link fence shall be fastened to the end bars of the gate frames by stretcher bars and fabric bands, and to the top and bottom bars of the gate frames by tie wires in the same manner as specified for the chain link fence fabric.
3. Gates shall be properly braced to eliminate any possible sagging condition.
4. Hinges shall be of sufficient strength and design to permit easy and trouble-free operation.
5. Provide double swing gates, size as noted, equipped with center plunger rods and catches to secure gates in open and closed positions.
6. Set plunger rod and catch in 12-inch round by 18-inch deep concrete footing.

* * * END OF SECTION * * *

DIVISION 3 - CONCRETE

INDEX

SECTION 03100

CONCRETE FORMWORK

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Concrete Reinforcement: Section 03200
B. Anchors and Inserts: Section 03251
C. Expansion and Contraction Joints: Section 03252
D. Cast In Place Concrete: Section 03300

1.2 QUALITY CONTROL

A. Standards
   1. "Recommended Practice for Concrete Formwork", ACI 347.
   2. "Chapter 26", Uniform Building Code.
   3. U.S. Product Standard PS 1 for Plywood.
   4. Standard Grading and Dressing Rules No. 16 of the West Coast Lumber Inspection Bureau.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. On delivery to job site, place materials in area protected from weather.
B. Store materials above ground on framework or blocking and cover with protective waterproof covering providing for adequate air circulation or ventilation.
C. Handle materials to prevent damage.

2. PRODUCTS

2.1 MATERIALS

A. Plywood: New or in new condition "B-B Plyform Class 1 Exterior" grade plywood, 5/8 inch minimum thickness.
B. Framing, Studding, and Bracing: "Standard" or "Construction" grade West Coast species lumber.
D. Form Coating:
   1. Lacquer, plastic or epoxy coating or non-staining form oil that will not impair the bonding quality for final finish of the painting or protective coating.
   2. Coatings containing mineral oils or other non-drying ingredients will not be permitted.

E. Chamfer Strips: Chamfer strips (for all exposed edges) 3/4 inch, 45^0 bevel wood strips or reusable plastic triangular strips.

3. EXECUTION

3.1 DESIGN OF FORMWORK

A. Design formwork to safely support vertical and lateral loads which might be applied until such loads can be supported by the concrete structure. Carry vertical and lateral loads by formwork system to ground or to in-place construction which has attained adequate strength for that purpose.

B. Design forms and falsework to include assumed values of live load, dead load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structure during construction.

C. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent material.

D. Keep oil or other agents from getting on reinforcing steel, embedded items, or other surfaces requiring bond with concrete.

3.2 CONSTRUCTION OF FORMS

A. Formwork - General:

1. Before concrete is placed in any form, verify horizontal and vertical form position and correct all inaccuracies. Complete all wedging and bracing in advance of placing of concrete.
2. For exposed concrete, forms shall be of new plywood, metal panel, or approved panel materials, smooth, and continuous.
3. For unexposed concrete, forms shall be plywood, metal, boards, or approved material. Boards: nominal one inch minimum thickness, sound and tight, commercial construction lumber, shiplapped or tongue-and-grooved, dressed on at least one side and both edges for tight fit. Plywood, metal, or approved material equal to or better than board surface.

B. Chamfered Corners: All corners chamfered 3/4 inch, unless shown otherwise on drawings. Provide 45-degree triangular moldings in forms for all chamfering required.

C. Coordination: Coordinate the installation of all items to be inserted or embedded in concrete. Support all items to maintain accurate alignment and prevent distortion during concrete placement.

D. Cleaning: All dirt, chips, sawdust, mud, water and other foreign matter shall be removed from within the forms or within the excavated areas before any concrete is deposited therein.

3.3 NOTIFICATION AND INSPECTION

A. Prior to placing of any concrete, and after placement of reinforcing steel in the forms, notify the Engineer at least 24 hours in advance of placing concrete to permit inspection.

3.4 DEFECTIVE WORK

A. Any form movement or deflection during construction or finished surface variations in excess of the tolerances specified will be basis for rejection of cast-in-place product and requirement for replacement of same.

3.5 REMOVAL OF FORMS

A. Do not remove forms and supports until concrete has attained sufficient strength to support anticipated loads.

B. Use methods of form removal which will not cause overstressing of the concrete. Remove supports to permit the concrete to uniformly and gradually take the stress due to its own weight. Do not use high impact methods to remove supports.

3.6 REUSE OF FORMS

A. Any reused form for exposed concrete work shall be reconditioned to "like new" condition. Any reused form shall be cleaned, repaired, and recoated before each reuse.

3.7 BLOCKOUTS

A. Where pipes, conduits or sleeves pass through the walls or slabs, place such pipes or sleeves in the forms before pouring the concrete.

* * * END OF SECTION * * *

SECTION 03200

CONCRETE REINFORCEMENT

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Concrete Framework: Section 03100

1.2 QUALITY CONTROL

A. Manual of Standard Practice for Detailing Reinforced Concrete Structures, ACI 315.
B. Manual of Standard Practice, Concrete Reinforcing Steel Institute.

1.3 SUBMITTALS

A. Placing drawings, bending and cutsheet schedules.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver reinforcement to project site in bundles marked to coordinate with placement drawings.
B. Handle and store to prevent contamination from dirt, oil and other materials which will affect bond.
C. Store a minimum of 6" above ground and in locations where the materials will not be subject to abuse.

2. PRODUCTS

2.1 MATERIALS

A. Reinforcing Bars: Unless specified otherwise, deformed bars meeting requirements of ASTM A615, Grade 60. Supplementary Requirements S1 shall apply.
B. Tie Wire: Steel, black annealed, 16-gauge minimum.
C. Reinforcing Bar Supports: Per CRSI Manual Chapter 3, pregalvanized or plastic-coated.

3. EXECUTION

3.1 INSTALLATION

A. Placement and Tolerances: Conform to CRSI "Manual of Standard Practice".

B. Splices:
   1. Do not splice bars except at locations shown or noted on the drawings or as otherwise approved.
   2. Tie lap slices securely with wire to prevent displacement of splice during placement of concrete.
   3. Perform welded splices in accordance with ACI Building Code (ACI 318).

C. Cleaning: Remove dirt, grease, oil, loose mill scale, excessive rust, and foreign matter that may reduce bond with concrete.

D. Protection During Concreting: Keep reinforcing in proper position during concrete placement.

E. Concrete Cover: Maintain minimum concrete cover over reinforcement as specified in ACI 318 or as noted.

* * * END OF SECTION * * *

SECTION 03251

ANCHORS AND INSERTS

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Concrete Formwork: Section 03100
B. Cast-In-Place Concrete: Section 03300

1.2 QUALITY CONTROL

A. Use only materials compatible with embedded concrete environment.

1.3 SUBMITTALS

A. Shop drawings including catalog cuts for all anchors, inserts and embedded products (wall castings, pipes with seep rings, and special castings).

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver and store all items to be embedded in a manner to prevent damage or contamination.

2. PRODUCTS

2.1 MATERIALS

A. Anchor Bolts: ASTM A307, Steel unless otherwise noted.
B. Threaded or Slotted Inserts: Galvanized malleable iron or stainless steel size and type as specified.

3. EXECUTION

3.1 INSTALLATION

A. Coordinate the location and placement of all items to be embedded in concrete.
B. Coat any embedded aluminum with asphalt paint.

3.2 EMBEDDING

A. Set accurately and hold in position all embedded products during placement until the concrete is set.

3.3 DRILLED IN GROUTED ANCHORS

A. In lieu of embedding anchor bolts and when approved, drill holes in hardened concrete and install the anchor bolts and other items with special mortars. Drill with diamond boring or coring bits. Bonding mortar shall be epoxy grout type. Blow holes clean and dry before installation of embedded items. Before insertion, coat both hole and the item to be embedded with bonding compound. Studs of equal size and length may be substituted for anchor bolts if nut fasteners are used. Drilled in studs or anchors utilizing mechanical expansion locking in any process areas shall not be used.

* * * END OF SECTION * * *

SECTION 03252

EXPANSION AND CONTRACTION JOINTS

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Concrete Formwork: Section 03100
B. Cast-In-Place Concrete: Section 03300

1.2 QUALITY CONTROL

A. Prepare and use in strict accordance with manufacturer's instructions. Discard materials after specified "shelf-life".
B. Deliver products in manufacturer labeled containers with complete preprinted instructions by manufacturer included.
C. Installers experienced in use of products.

1.3 SUBMITTALS

A. Certification on conformance to Specifications.

2. PRODUCTS

2.1 MATERIALS

A. Preformed board shall conform to Federal Specification HH-F-341, Type I, Class B (moderately resilient) unless otherwise noted.
B. Joint Sealant:
   1. Polyurethane material designated for bonding to concrete for sewage treatment plant service, which when cured, develops a high bond between surfaces and provides flexible watertight seal, non-sag, resistant to mild alkalis and acids, oils and meets all requirements for Federal Specifications TT-S-00230, Type II, Class A.
   2. Prior to ordering the sealant, submit to the Engineer for review, sufficient data to show experience record of sealant and general compliance with the Specification requirements.
   3. Joint primer supplied by the same manufacturer supplying the sealant.
C. Backer-Rod: Closed cell polyethylene backer-rod shall be used in sealant joints. The backer-rod shall be resilient and of a diameter at least 1/8 inch larger than the groove and shall be approved by the sealant manufacturer.

3. EXECUTION

3.1 INSTALLATION

A. Joints constructed and located as shown on the drawings.

B. Sealant Surfaces: Clean, free of oil, grease, residue and other foreign materials, prior to application of sealant in accordance with manufacturer's recommendations. Prime all joints with joint primer.

C. Sealant Application:

1. Tape or otherwise protect surfaces adjacent to joints not intended to receive sealants. The backer rod shall be accurately placed in the joint to provide the depth of sealant called for on the drawings.

2. Neatly apply sealants to fill void required to level non-sag surface. Maintain uniform application procedures to continuously apply sealant. Complete joint system without intermediate stops and starts.

3. Sealant shall be applied according to manufacturer's recommendations in a manner so as to avoid entrainment of air in the joint. All sealant shall cure at least 7 days before the structure is filled with water.

4. Secure preformed board to surfaces with fasteners and procedures recommended by manufacturer.

* * * END OF SECTION * * *

SECTION 03300

CAST IN PLACE CONCRETE

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Concrete Formwork: Section 03100
B. Concrete Reinforcement: Section 03200
C. Anchors and Inserts: Section 03251
D. Expansion and Contraction Joints: Section 03252

1.2 QUALITY CONTROL

A. Delivery: Furnish a certificate with each truckload of concrete product delivered to the site, indicating the composition and quality of the mix. Include size and weight of each aggregate, amount of cement, amount of water and amount and kind of any additives included in the concrete, grout fill, or mortar.
B. Standards: All applicable standards of the following:
   1. American Concrete Institute - ACI
   2. Concrete Reinforcing Steel Institute - CRSI
   3. Uniform Building Code - UBC
   4. Other local codes or criteria noted on drawings.
C. Concrete Consistency:
   1. Each truckload of concrete will be tested by the Engineer for slump. Calibrate each mixer or haul unit to be used by measuring slump near the beginning and near the end of the discharge cycle. Mix units determined by the Engineer to be deficient in mixing capability shall not be used in subsequent deliveries. Slump testing procedures per ASTM C143.
   2. Consistency per values below with tolerance of $\pm$ 1 inch.
      a. 2-3 inches slump for structural elements 12 inches and greater in thickness.
      b. 2-4 inches slump for structural elements less than 12 inches in thickness.
D. Concrete Test Cylinders:
   1. A minimum of three test cylinders will be prepared by the Engineer for each location (slab, wall, beam, etc.), for each days placement or each 50 cu. yd., whichever is greater.
   2. Test set of 3 cylinders as follows:
      a. One at 7 days.
      b. Two at 28 days.
   3. Prepare and test cylinders per ASTM C31 and C39.
E. Air Entrained: One test for each mix design.

1.3 SUBMITTALS

A. Concrete mix design (for each concrete type used), including strength tests by independent laboratory, of 3 cylinders proportioned to mix design formula.
B. Certification of quality of all concrete, mortar, and grout mix design ingredients including admixtures with supporting test data, mill quality control results and all information specified and requested by the Engineer.
C. Curing materials and methods proposed with certification statements of materials quality.
D. Certification of quality and type of epoxy bonding materials.
E. Trip tickets for each load of concrete, grout or mortar indicating weights of all materials and additives used in the batch.
F. Location of construction joints not shown on the plans.

1.4 STORAGE OF MATERIALS

A. Maintain in continuously clean environment and in manner required to maintain homogeneity.
B. Cements, grouts, and mortar containerized and kept in dry humidity environment. Engineer shall reject materials which have hardened or show any evidence of initial hydration.

2. PRODUCTS

2.1 CONCRETE

A. ASTM C94 and mix design approved by Engineer.
B. Compression strength and water cement ratio: The minimum compressive strength and cement content of concrete shall be not less than that shown in the tabulation that follows. The Engineer may order the cement content for any class of concrete to be increased over the quantity specified in the tabulation if it is determined that such increase is necessary to attain the required strength. Such increased quantities of cement, if so ordered, shall be furnished by the Contractor at no additional cost to Metro.

Concrete Min. 28-day Compr. Strength (psi)	Type of Work	Max. Size Aggregate (in.)	Min. Cement Pounds Per cu. yd.	Max. W/C Ratio
3,000	Floor slabs, pads anchor blocks, footings	1	564	0.45
Lean	Encasement of dowels for future expansion	--	188 (235 max.)	--

NOTE: Type AX and C concrete shall conform to 3,000 psi concrete above.

C. Cement ASTM C150:
   1. Type I or II.
D. Aggregates:
   1. Conform to ASTM C33.
   2. Maximum wear 50% at 500 revolutions, AASHTO T96.
E. Water:
   1. Clear free from injurious amounts of oil, acid, salt, alkali, organic matter, or other deleterious substances.
F. Admixtures:
   1. Use only those specified in approved mix design.
   2. Air entrain all concrete unless elsewhere excepted, with agent conforming to ASTM C260. Freshwater concrete air content between 4% and 6% by volume.
   3. Apply in strict accordance with manufacturer's printed instructions.
   4. No chloride contents permitted.
   5. Compatible with coatings specified elsewhere.

2.2 GROUT

A. For equipment and column bases and drilled in anchors use nonshrink, nonstaining, premixed grout, Masterflow 713 by Master Builders; or equivalent. Mix in accordance with the manufacturer's directions.
B. For Fill: Driest consistency practical composed of 1 part Portland Cement 3 parts sand (by volume). Aggregate proportions may be varied slightly to give the most workable mix.
C. or placement at base of walls, one part fine aggregate, one part cement. In a thick cream consistency.
D. Cure in accordance with manufacturer's recommendations.

2.3 CURING MATERIALS

A. Polyethylene Sheeting 0.004 inch thick.
B. Waterproof Paper: Polyethylene-coated, Fed. Spec. UU-B-790 Type I, Grades A, B, C, Style 4. Define lap control lines clearly by printed markings.
C. Masonry Sand: ASTM C144 (Maintained continually moist).

2.4 VAPOR BARRIER (UNDER SLABS)

A. Polyethylene sheeting 6 mil (0.006 inch) thickness. Define lap control lines clearly by continuously marking material edges.
B. Glass fiber reinforced waterproof paper coated with polyethylene (both sides). Fed. Sped. UU-B-790 Type I grades A, B, C Style 4. Define lap control lines clearly by printed markings.

3. EXECUTION

3.1 MIXING AND TRANSPORTATION

A. Ready-Mixed Concrete: Conform to ASTM C94 Alternate No. 3.

3.2 PLACING

A. Deliver only in sufficient quantities required for specified time interval use and placement. Discard concrete having initial set before placement. No remixing with water or supplementing with other materials will be permitted once initial set has occurred. Initial set as evidenced by typical hydration characteristics to be determined by Engineer and Contractor quality assurance representative.
B. Place as nearly as possible to final position to avoid segregation of the materials and displacement of reinforcement. Placement shall be completed within 30 minutes after water is first added to the mix. However, at the Engineer's discretion if climatic and temperature conditions are suitable and when the concrete is continually agitated, the time may be extended to 1-1/2 hours.
C. Place no concrete in the absence of the Engineer.
D. Do not change consistency (slump) for a given placement without the Engineer's written permission.
E. Keep open trough and chutes of steel or steel lined, clean and free from coatings of hardened concrete.
F. Do not drop concrete a distance of more than 5 feet unless approved in writing by the Engineer.
G. Layout and sequence of placing of concrete in monolithic structures as shown on the drawings or approved by the Engineer.
H. Within a placement, deposit concrete in horizontal layers not to exceed 18 inches in depth. Place at rate such that: (1) no concrete surface shall obtain initial set

before additional concrete is placed on it and (2) yielding of forms is not so great as to cause the concrete surfaces to exceed the tolerances specified.

I. Unless specified otherwise, place all slabs and finished floors to finish elevation in one continuous operation, except that the Contractor may place a separate finish topping if prior approval is received from the Engineer. Floor slab sectional thicknesses shown are minimum thicknesses. Slopes on floors increase, rather than decrease, slab thicknesses.

J. Where a separate finish topping is placed, increase structural slab thickness by the maximum thickness of the finish topping and maintain finished floor elevation as noted on the drawings.

K. Construction Joints:
   1. Locate construction joints as shown on the drawings or as approved by the Engineer.
   2. Locate construction joints so as not to impair the strength of the structure, and only at locations shown on the drawings or approved by the Engineer.
   3. Construct bulkheads to neatly fit reinforcement and waterstops and prevent concrete leakage.
   4. Provide waterstops or sealants in construction joints where required.
   5. Unless shown otherwise, key all construction joints.
   6. Continue reinforcement through construction joint unless otherwise shown or noted.
   7. Before placing concrete against previously placed concrete, thoroughly roughen and clean by wet sandblasting or green cutting with an air-water jet.
      a. Use air-water cutting at the proper time after the initial set. Use a high pressure air-water jet to expose clean, sound aggregate without undercutting the edges of the larger aggregate. Protect adjacent subgrade when cutting is used on slab edges.
      b. After cutting or sandblasting, rinse the surface until wash water contains no cloudiness. Dispose of wastes from cutting, washing and rinsing so they do not stain or abrade exposed surfaces.
   8. Place concrete continuously to a predetermined construction joint.

L. Care shall be taken in placing concrete through reinforcement so that no segregation of the coarse aggregate occurs. On the bottom of beams and slabs where the congestion of steel near the forms makes placing difficult, a layer of mortar, of the same strength as used in concrete, shall first be deposited in the forms, followed immediately by the concrete. The thickness and use of this mortar layer shall be as approved by the Engineer.

M. Special care shall be taken to prevent splashing forms or reinforcement with concrete. Any hardened concrete or partially hardened concrete on the forms or reinforcements above the level of the concrete already in place shall be removed before proceeding with the work.

N. Cold Weather Placement:
   1. Concrete shall be placed only when the temperature is at least 40°F., and rising, unless permission to pour is obtained from the Engineer.
   2. Material shall be heated and otherwise prepared so that batching and mixing can proceed in full accord with the provisions of this Specification.

3. Suitable means shall be provided for maintaining the concrete at a temperature of at least 50°F for a period of at least the first five (5) days and at a temperature above freezing for the remainder of the specified curing period, except that where high-early-strength cement is used, this period may be reduced to 72 hours. The methods proposed for heating the materials and protecting the concrete shall be approved by the Engineer.
4. Salt, chemicals, or other materials shall not be mixed with the concrete for the purpose of preventing freezing. Accelerating agents shall not be used.

O. Hot Weather Placement:
1. The temperature of fresh concrete at the time of placement during hot weather shall be a maximum of 90°F to prevent an accelerated setting of the concrete.
2. A retarding densifier admixture shall be used when the high expected atmospheric temperature for the day is 85°F or above. Admixture shall be used in accordance with the manufacturer's recommendations.

P. Placing Concrete Against Earth:
1. Unless otherwise called for on the drawings, earth cuts shall not be used as forms for vertical surfaces without the prior approval of the Engineer.
2. Concrete placed on or against earth shall be placed only upon or against firm, damp surfaces free from frost, ice and standing or running water. Concrete shall not be placed upon mud, or upon fills until the required compaction has been obtained.

Q. Placing Concrete Slabs:
1. Smooth subgrade surface irregularity with thin film of masonry sand prior to placing vapor barrier.
2. Place vapor barrier on subgrade in maximum widths commercially available. Longitudinal laps 6 inch minimum. End laps 2 feet minimum.
3. Edge and side laps to be in continuous contact. Place materials to maintain tight lap contact.
4. Repair any tears in the material.
5. Place concrete without displacing vapor barrier.

R. Depositing Concrete in Water:
1. Concrete may be deposited in water only when specifically authorized.
2. Methods and equipment used shall be acceptable to the Engineer.
3. When deposited by the tremie method, the tremie shall be watertight and sufficiently large to permit a free flow of concrete. The discharge end shall be kept submerged continuously in the concrete and the shaft kept full of concrete to a point well above the water surface. Placing shall proceed without interruption until the top of the concrete has been brought to the required height.

3.3 COMPACTING

A. Compact all concrete with high frequency internal vibrators immediately after placing.
B. Use external vibrators for compacting concrete where the concrete is inaccessible for adequate compaction by internal vibrators; construct forms sufficiently rigid to resist displacement or damage from external vibration.

C. Penetrate concrete with a sufficient number of vibrations immediately after it is deposited. Move vibrator throughout the mass so as to thoroughly work the concrete around reinforcement and embedded fixtures and into corners and form recesses. Vibrate the minimum time required to compact the concrete in place and not cause separation of the materials. Concrete shall be compacted to maximum density as determined by tests for yield. Select vibrator size to efficiently accommodate reinforcement clearances.

3.4 CURING AND PROTECTION

A. General:
   1. Maintain at site ready to install, before actual concrete placing begins, all equipment and materials needed for optimum concrete curing and protection; maintain extra vibrators on standby in case of malfunction of any unit.
   2. Protect finished surfaces or edges from stains, abrasions and breakage during the entire construction period.
   3. Protect all concrete from accelerated drying and excessive heat at all times. Close all galleries, conduits and other formed openings through the concrete during the entire curing period and as long thereafter as practicable to prevent drying of concrete by air circulation.
   4. Install slab curing covers immediately after initial set or as soon as free water has disappeared from the surface of the concrete after finishing or surfacing.

B. Water Curing:
   1. Use water curing specified herein for all walls and slabs where watertight construction is required.
   2. Keep concrete continuously wet by covering with an approved material or by a system of perforated pipes or mechanical sprinklers or other approved methods. (Periodic wetting acceptable.)
   3. Keep forms wet at all times to prevent opening of joints and the drying out of the concrete.
   4. Water for curing shall be clean and free from any elements which might cause objectionable staining or discoloration of the concrete.
   5. Cover surfaces completely with sheeting. Where a single sheet does not cover the entire surface, lap ends and edges at least 4 inches and continuously seal with tape or other suitable means recommended by the manufacturer.
   6. Continue waterproof sheet curing for 7 days. Maintain sheeting and edge and end seals intact for entire period. Repair immediately any breaks in the sheeting envelope.

C. Curing Compounds (Use only when specifically approved and for optimum climatic conditions):
   1. Do not use curing compounds unless their use is authorized in writing by the Engineer. Curing compounds unacceptable where concrete is exposed to the direct rays of the sun or accelerated drying conditions.
   2. Curing compounds shall not be used unless their use is face membrane type and shall be applied in accordance with the manufacturer's recommendations. They shall be of such composition and characteristics as will spread readily on moist concrete and deposit a hard, tenacious film without permanently coloring the

concrete surfaces that will be exposed. The resultant film shall adhere to the concrete surface without chemical reaction therewith, and shall not peel. Maintain coverage for 28 days to prevent detrimental loss of water from the concrete.

3. Prior to applying curing compounds to formed surfaces, the surfaces shall be moistened with a spray of water immediately after forms are removed. Moistening shall be continued until the surfaces will not readily absorb more water. The compound shall be applied as soon as the moisture film has disappeared and while the surface is still damp.
4. On unformed surfaces, the compounds shall be applied immediately after finishing and after bleeding water and "shine" has disappeared.
5. Curing compounds shall not be used on surfaces where future bonding, painting or protective coating is required. In cold weather, curing compounds shall not be used on concrete surfaces that are kept at curing temperature by the use of steam.

D. Saturated Sand Curing:
   1. Horizontal construction joints and finished surfaces, cured with sand, shall be kept covered with a minimum thickness of one inch of sand. It shall be kept uniformly distributed and continuously wetted with clean water for a period of 7 days.

3.5 REPAIRING CONCRETE

A. Immediately after removal of forms, break back all form ties and inspect concrete surfaces for defects. Complete repair of defects within 48 hours after removal of forms. No repairs shall be made until the defects have been reviewed and method of repair approved by the Engineer.

B. Remove all defective or damaged concrete, including honeycombed, sand streaked, or fractured material from the area to be repaired. Chip out areas to one inch minimum depth. Edge shall be squared with the surface to eliminate feather edges.

C. Before placing the repair material obtain Engineer inspection. Clean area free of chipping dust, dried mortar, and all other foreign materials.

D. Keep surfaces to be repaired continuously wet for at least three hours prior to placing new concrete or mortar. No free water on the surface when the repair material is placed.

E. Apply a bonding agent to the area to be repaired before placing repair material. Apply the bonding agent per manufacturer's published instructions attached to container.

F. For all repair surfaces permanently exposed to atmosphere use white cement in proportions found by trial to be effective in producing a color that, in the hardened patch, will match the surrounding concrete surface.

G. Make repairs or patch form tie holes by (1) dry-packing, (2) filling with concrete, or (3) plastering with mortar or a combination of all 3 in conformance with the following:
   1. Use the dry-pack method for holes at least one inch deep where the depth is equal to, or greater than the smallest surface dimension of the defect, such as

cone-bolt or form tie holes, and for narrow slots cut for the repair of cracks. Do not use the dry-pack method where lateral restraint cannot be obtained. Place and pack dry-pack mortar in layers having a compacted thickness of approximately 3/8 inch. Solidly compact each layer over its entire surface by use of a hardwood stick and hammer. Do not use metal tools for compacting. Compact surface just flush with adjacent area. Do not use steel finishing tools or water to facilitate finishing.

2. Use concrete replacement for (1) holes extending entirely through concrete sections; (2) for holes larger than one square foot and deeper than four inches in which no reinforcement is encountered; (3) for holes larger than 1/2 of one square foot where reinforcement is exposed. Concrete used for replacement shall be of the same strength and mixture as used in the structure except for color matching as specified above.
3. Use mortar replacement for holes too wide to dry-pack and too shallow for concrete replacement and when approved by the Engineer for other conditions not covered above.

H. Cure all repairs with the same methods as new concrete.

3.6 CONCRETE FINISHES AND TOLERANCE

A. General Finish:

1. Finish concrete surfaces to conform with the following table unless otherwise noted on the drawings.
2. Formed Surfaces — System

Exterior - Exposed and One Foot Below	F4
Exterior - Below Grade	F2
Interior	F4

3. Slabs

Tops of exterior footings in contact with soil or backfill	U2
Exterior - Except as Otherwise Noted	U5
Interior - Walking Surface Except as Otherwise Noted (with hardener)	U4

B. Formed Surfaces: Finishes for formed surfaces shall be as designated below:

1. Finishing for F1 and F2 finishes consists of concrete repairing only, which is to be completed within 48 hours after forms are removed.
2. Finishing for F3 and F4 finishes shall immediately follow concrete repairing and be completed within 96 hours after the forms are removed. Except where forms are left in place for the duration of the curing period, finishing shall be done during the curing period, keeping the interruptions to the curing process as short as possible. Where forms left on prevent finishing during the curing period, finishing shall be completed within 48 hours after forms are removed. All finishes shall receive a minimum of 24 hours of curing after completion of the finish. Curing shall be carefully done so as not to disturb or remove any of the mortar.
3. Finish F1: Rough formed surface with defective concrete repaired and form tie holes and other holes over 1/2 inch deep filled. Forms may be built with a

minimum of refinement and form sheathing may be any material that will not leak mortar or yield beyond specified tolerances when the concrete is vibrated.

4. Finish F2: Smooth, formed concrete surface with all fins, projections and loose material removed and defective concrete and form tie holes and other holes over 1/2 inch deep, repaired and filled. Forms in contact with concrete shall be plywood or steel.

5. Finish F3: Smooth, formed concrete surface with all fins, projections and loose material removed, and defective concrete, form tie holes, air bubble holes, surface pits, holes from defective forms, nailhead holes and similar surface defects, repaired and filled. Forms in contact with concrete shall be plywood or steel. Form construction shall be planned so that if any pattern from the forms is left in the concrete surface it will harmonize with the structure or building. All joints shall be horizontal or vertical.

6. Finish F4: Exceptionally smooth, formed concrete surface with all fins, joint marks, bulges, projections and loose material removed. Sandblast to expose air bubble holes, surface pits and similar minor surface defects. Defective concrete, form tie holes, holes from defective forms, and other holes too large to fill by "sack rubbing" shall be repaired and filled. Finish with sack rubbing as follows.
   a. Thoroughly wet the surface and begin treatment while the concrete is still damp. Use 1 part cement, 2 parts (by volume) of sand which will pass a No. 16 screen, and enough water so that mortar consistency will be that of thick cream. Rub mortar thoroughly over the area with clean burlap or a cork or sponge rubber float to fill all pits, surface holes and air bubble holes. While the mortar in the pits is still plastic, rub the surface with a dry mix of mortar. This dry rub shall remove all excess mortar and place enough dry material in the pits to stiffen and solidify the mortar flush with the surface. No material shall remain on the surface except that within the pits. When the ambient temperature is 85°F or higher, keep the mortar continuously damp by means of a fog spray for 24 hours during the setting period. Take care that the fog spray does not remove any of the mortar. Break finish for any area only at natural breaks in the finished surface.
   b. Rub all surfaces that are to be finish painted with a carborundum stone to provide a smooth texture and to remove any latent material on the surface. Pre-blast walls to remove any residual form oils prior to finishing when walls are to be finish painted.
   c. Form requirements shall be the same as Finish F-3.

C. Unformed Surfaces:

1. Working on unformed surfaces in various finishing operations shall be held to the minimum required to produce the desired finish. Use of any finishing tool in areas where water has accumulated will not be allowed. Work in these areas shall be delayed until the water has been absorbed, has evaporated, or has been removed by draining, mopping, dragging off with a loop of hose, or by other means. In no case, shall cement or mixture of cement and sand be spread on the surface to absorb excess moisture nor shall such materials or water be added to facilitate troweling. Joints and edges, unless specified otherwise, shall be carefully finished with edging tools.

2. Finishes for unformed surfaces shall be as designated below:
   a. Finish U1: Even, uniform finish. Consolidate level and screed concrete to obtain an even, uniform surface. Surplus concrete shall be removed immediately after consolidation by striking it off with a sawing motion of the straight edge or template across wood or metal strips, that have been set as guides. When the surface is curbed use screed strips at approved intervals. For long, narrow stretches of curved surfaces such as on invert paving, a heavy slip form may be used. In the case of extensive flat paving, a paving and finishing machine is preferred.
   b. Finish U2: A wood float finish. Follow treatment specified for finish U1 by floating either by hand, or by power driven equipment. Floating to be started after some stiffening has taken place in the surface concrete and the moisture or "shine" has disappeared. Work the concrete no more than necessary to produce a surface known as "wood float finish" which is uniform in texture and free of screed marks. Do any necessary cutting and filling during the floating operations.
   c. Finish U3: A steel troweled finish. Follow the treatment specified for the finish U2, except leave a small amount of mortar without excess water at the surface to permit effective troweling. Start steel troweling after the moisture film or "shine" has disappeared from the float surface and after the concrete has hardened enough to prevent an excess of fine material and water from being worked to the surface. Trowel with firm pressure that will flatten the sand surface left by the floating and produce a dense, uniform surface free of blemishes, ripples and trowel marks.
   d. Finish U4: A hard, steel troweled finish burnished. Follow the treatment specified for finish U3 with additional steel troweling after the surface has nearly hardened, using firm pressure and troweling until the surface has a burnished appearance.
   e. Finish U5: Broom finish. Follow the treatment specified for finish U3 by roughening the surface immediately after troweling with a fiber bristle broom in a direction perpendicular to the direction of traffic. Broom grooves not more than 1/16 inch deep. After brooming, neatly tool all joints and edges to configuration.

D. Tolerances:
1. Unless otherwise required, allowable tolerances for concrete surfaces shall be in accordance with those shown in the table below. Surface irregularities are classified as either "abrupt" or "gradual". Offsets caused by displaced or misplaced form sheathing, lining, or form section or by defective form lumber shall be considered as abrupt irregularities. All others are classed as gradual irregularities. Gradual irregularities shall be measured with a template consisting of a straight edge for plane surfaces and its equivalent for curved surfaces.
2. The length of the template for testing formed surfaces shall be 5 feet. The length of the template for unformed surfaces shall be 10 feet. Maintain a 5 foot length and 10 foot length steel template on the job site.

3. Maximum allowable irregularities in concrete:

Finish Designation	Irregularity in Inches Gradual	Abrupt
F1	1	1/2
F2	1/2	1/4
F3	1/4	3/16
F4	3/16	3/16
U1 thru U5	1/8	1/8

3.7 UNSATISFACTORY CONCRETE

A. Any concrete placed which fails to meet or exceed the specified strength requirements as determined from molded cylinders or cores, or to meet the density or surface requirements, or which has been frozen during placing or curing, shall be removed and replaced with satisfactory materials at the Contractor's expense.

B. Method of determining unsatisfactory concrete: Visual appearance characteristic of rain or freeze damage to concrete which is apparent to the Engineer.

* * * END OF SECTION * * *

SECTION 03485

PRECAST CONCRETE VAULTS

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Shop Drawings, Product Data and Samples: Section 01340

1.2 DESCRIPTION

A. This section covers furnishing and installation of the precast concrete vaults.

1.3 SUBMITTALS

A. Submit complete shop drawings with detailed specifications and data for materials used, parts, devices and other accessories forming part of the vault.

1.4 ADAPTATION OF PRODUCT

A. Furnish product readily adaptable for installation and operation in the manner shown on the drawings.

2. PRODUCTS

2.1 GENERAL

A. The vaults shall be precast as manufactured by Utility Vault Co., Brooks, or equivalent, with tops modified as shown on the plans.

2.2 DESIGN

A. Conform to ASTM C913.
B. Designed for 16,000 pound wheel load, if vault is located in traffic area.
C. Designed for earth load of 130 pounds per cubic foot.

3. EXECUTION

3.1 INSTALLATION

A. The bottom of the excavation for the vaults shall be fine graded to a plane surface on firm undisturbed subgrade material.

B. Gravel pipe bedding material shall be uniformly spread to a depth of 3 inches minimum over the bottom of the excavated area to provide uniform bearing for the vault.

C. Install vault and accessories in conformance with drawings, specifications and recommendations of vault manufacturer unless otherwise instructed in writing by the Engineer.

D. The vault joints, pipeline, and conduit penetrations through walls as shown on the plans shall be sealed watertight. No leakage will be allowed into the vault.

E. The manhole ring and cover or access doors shall be adjusted to match the finished surface grade.

* * * END OF SECTION * * *

DIVISION 5 - METALS

INDEX

SECTION 05500

METAL FABRICATIONS

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Gas and Condensate Collection System: Section 02680
B. Vacuum Pump Stations: Section 11301
C. Remote Condensate Pump Stations: Section 11302
D. Storm Drainage: Section 02720

1.2 QUALITY CONTROL

A. Welding: By operators qualified by tests as prescribed by the AWS in Standard Qualification Procedure for performance of the type of work required.
B. Comply with OSHA and latest Building Code requirements.

1.3 SUBMITTALS

A. Shop Drawings: All fabricated metals illustrating dimensions, erection details, cuts, copes, connections, holes, threaded fasteners and welds. Base dimensional data on actual field measurements where applicable.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle materials in such a manner as to prevent damage to finished surfaces. Store above grade in clean dry locations. Protect from corrosion. Handle during construction to prevent overstressing any elements.

1.5 DESCRIPTION

A. Pipe supports, pipe anchors, pipe guides and bollards shall be provided and installed at the locations or by the spacing requirements as shown on the Drawings. Contractor shall ensure that all above-grade piping is adequately supported.
B. Provide overflow screens for overflow structures in Sedimentation Basins.

2. PRODUCTS

2.1 FABRICATED STEEL

A. Pipe supports, pipe anchors, pipe guides and bollards shall be fabricated from ASTM A36 structural steel and ASTM A53 Grade B seamless or electric welded pipe, galvanized. U-bolts shall be carbon steel, galvanized, with 4 galvanized hex nuts each and shall be as manufactured by Grinnell Fig. 137 or equivalent. Sizes shall be as indicated on the Drawings.

B. Overflow screens shall be fabricated from ASTM A-36 Structural Steel and shall be galvanized.

C. "Galvanized" shall mean hot-dip galvanized per ASTM A153 and A123.

3. EXECUTION

3.1 INSTALLATION

A. Install pipe supports, pipe anchors, pipe guides and bollards at the locations or by the spacing requirements indicated on the Drawings.

B. All concrete foundations for pipe supports shall be installed in accordance with Section 03300 of this Specification and the Drawings.

* * * END OF SECTION * * *

DIVISION 9 - FINISHES

INDEX

SECTION 09900

PAINTING

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Shop coatings and/or factory finishes on fabricated or manufactured equipment may be specified in other divisions.
B. Vacuum Pump Stations: Section 11301
C. Gas and Condensate System: Section 02680

1.2 EXCLUSION

A. Do not paint stainless steel, nonferrous metals, galvanizing, HDPE multiple coated factory finished baked enamel or porcelain products unless elsewhere noted or specified.

1.3 STANDARDS

A. Acceptable Manufacturers: Ameritone, Sika Corp. Miller, Olympic, Sherwin Williams, Rhodda, Glidden, Tnemec Company, Koppers Company, and Ameron.
B. Alternate Products:
   1. Coating to be same generic type.
   2. Coating thickness and number of coats comparable to guide product.
   3. Documented application, serviceability, performance, physical properties and composition equivalent to the guide product.
C. Volume 2 of Steel Structures Painting Manual, by Steel Structures Painting Council (SSPC).

1.4 QUALITY CONTROL

A. Establish control panel or area for each coat of each paint system on each substrate material:
   1. Panel to be 16 square feet square or as approved for metal equipment.
   2. Continue all operations to test panel area until precise thickness and surface texture is achieved and complies with procedures approved in submittal data.
B. Obtain Engineer's inspection and provide coating thickness measurements:
   1. If panel is satisfactory to Engineer, proceed with painting operation.
   2. If panel is unsatisfactory, remove paint and reapply until test panel is acceptable.

C. Panel to be used as a quality control reference base; and, all areas with appearance quality less than control panel subject to removal and reapplication.
D. Continuously maintain at painting location quality thickness gauges specifically designed for use on each substrate to be coated. Provide standard shims for calibration check of dry film gauges.
E. Deliver to the job site in the original sealed containers with manufacturer's name, product name, type of product, manufacturer's specification or catalog number, federal specification number (if applicable):
   1. Provide complete printed instructions.
   2. Permit adequate time for Engineer to inspect all unopened containers at the site prior to initiating painting.
F. Paint manufacturer's representative to be at site and review typical quality control procedures with Engineer and Contractor prior to and during first day of application of each generic paint type used.
G. Check coating thickness at regular intervals:
   1. Provide 5 measurements at random locations selected by the Engineer for each 100 square feet of each application of each material.
   2. Form to include a graphic depiction of area tested with locations and measured thicknesses noted.
   3. Obtain Engineer review of each coating layer thickness prior to applying subsequent cover coat.

1.5 SUBMITTALS

A. Submit complete product information including systems proposed, constituent ingredients for each coating, color charts, samples of coating material on chips of substrate (steel and concrete) for each prime and finish coat, manufacturer experience and additional information requested by the Engineer.
B. Furnish certification statements with each delivery of materials including statement of compliance with material submittals reviewed by the Engineer.
C. Provide measurements (wet or dry film thickness) on permanent record form for each coating application.
D. Submit samples of tints proposed for identification of coating layers.
E. Submit proportioning statement for inhibitive additives with product submittals.
F. Certification of shop surface preparation.

1.6 STORAGE

A. Maintain all products in locked room and comply with local fire and health regulations.

1.7 DESCRIPTION OF WORK

A. The Contractor shall paint the blowers, condensate knock-outs, air compressor, piping (above ground), valves, fittings, pipe supports, appurtenances, and all shop primed items at the Motor Blower/Flare Facility. In addition, all above ground PVC piping, fittings, valves, pipe supports, and equipment at the Vacuum Pump Stations and Remote Condensate Tank locations shall be painted in accordance with the Plans and these Specifications. All pre-finished machinery, painted in accordance with these specifications, shall be touched up as required. Bollards shall be painted with a High Visibility Yellow paint in accordance with these Specifications. The pipe supports, guides and anchors located above grade on the gas collection manifold piping shall also be painted in accordance with these Specifications.

2. MATERIALS

2.1 ALTERNATE MANUFACTURERS

A. Shall provide information on all materials to indicate their proposed products are equivalent.

2.2 COMPATIBILITY

A. Contractor shall be responsible for the compatibility of all paint products used.

B. All products from single manufacturer where possible.

2.3 MILDEW RESISTANCE

A. Manufacturer to formulate specific fungus or mildew inhibitive additives for all nonepoxy products.

2.4 PAINTING SYSTEMS

A. Steel:
   1. System M-2: Epoxy:
      a. Use: Submerged metal including splash zone.
      b. Surface preparation: 3.1A
      c. Prime (Field or Shop): Tnemec 20-1211, Koppers Pug Primer, Amercoat 71 Primer, 3-4 mils dry.
      d. Second coat: Tnemec Series 104, Koppers Hi-Gard Epoxy, Amercoat 395FD, 5-6 mils dry.
      e. Finish coat: Same as second coat.
   2. System M-3: Epoxy:
      a. Use: Exterior/Interior nonsubmerged metal (color).

b. Surface preparation: 3.1A
c. Prime: Tnemec 20-1211, Amercoat 17, 2.5 to 3 mils dry.
d. Second coat: Tnemec Series 104, Koppers Hi Gard Epoxy, Amercoat 383HS, 5-6 mils dry.
e. Finish coat: Tnemec Series 73 Hi-Build Urethane, Koppers BRS, Amershield, 3-5 mils dry.

3. System M-7: Semi-Gloss Alkyd Enamel:
a. Use: Exterior/Interior building related ferrous metals.
b. Surface preparation: 3.1D at galvanized metals, Miller 1289 Galvanized Wash. Note 3.1C at factory precoated finishes.
c. Prime: Ferrous Metal Primer, Miller 484, 1.5 mils dry.
d. Second coat: Exterior Semi-gloss Alkyd Enamel, Miller 6750, 400 sq.ft/gallon. 1.5 mils dry.
e. Finish coat: Same as second coat.

B. Nonferrous Metals and Plastics:
1. System P-6: Epoxy:
a. Surface preparation: 3.1G.
b. Prime coat: Tnemec Series 66, Koppers 40, Amercoat 178.
c. Finish coat: Tnemec Series 73 Hi-Build Urethane, Koppers BRS, Amershield, 3.5 mils dry.

C. Concrete/Masonry:
1. System C-9: Polymer Modified Cement Coating:
a. Use: Interior concrete floors.
b. Surface preparation: 3.1E. Sandblast/waterblast/mechanically prepare entire surface to be coated.
c. First coat: Sika Top 144 at coverage of 100-150 ft/gallon. 8 to 16 mils dry.
d. Finish coat: Same as first coat at 150-200 ft/gallon. 8 to 16 mils dry.

3. EXECUTION

3.1 SURFACE PREPARATION

A. Ferrous Metal to Receive Coating Systems M-2 or M-3:
1. Near white metal blast cleaning: SSPC-SP10.
2. Round all edges and prominence to duplicate a wheelbrator finished flat plate product.
3. Remove all weld spatter prior to blasting.

B. Factory Applied Bituminous Coating On Cast Iron Or Other Products:
1. Clean and dress any damaged or corroded surface as per 3.1A above.
2. Apply Tnemec Series 66 before prime coat.

C. Precoated Factory Equipment To Be Painted (where specifically required by contract documents):
1. Apply appropriate "tiecoat" and provide paint system over tiecoat equivalent to that specified for general area of use.

2. System to be proposed by Contractor's paint supplier and submitted with required transmittal data to Engineer.

D. If painting galvanized products is required by the contract documents, clean with solvent wipe then treat with Tnemec 32-120 or Koppers 30 Metal Conditioner prior to priming.

E. Concrete:
   1. Light sand blast after form removal to completely remove all form oil and/or release agents prior to concrete finishing. Refer to Division 3 for appropriate finish.
   2. Allow concrete sufficient time to dry after specified moist curing period. (Use no was type curing seals.)
   3. Clean any contaminated surfaces with detergent, rinse and dry immediately prior to prime coating and application of finish coats.
   4. Smoothness equivalent to specified concrete finish tolerance.
   5. Remove all concrete splatter from grouting or other operations.

F. Concrete Masonry Units:
   1. Remove all contaminants with prime detergent, rinse and dry.
   2. Remove projections with a masonry carborundum block.
   3. Remove loose material with stiff bristle broom and compressed air.

G. Smooth Nonferrous Metals and Plastics:
   1. Copper, Aluminum, PVC, fiberglass reinforced plastic.
   2. Solvent wipe (degloss) and light sand blast to roughen and provide "tooth" for primer or paint.

3.2 COMPATIBILITY OF COATINGS

A. Contractor shall be responsible for compatibility of all paint products.

B. Test coatings applied to an existing surface coating by patch test to determine suitability.

C. Allow sufficient time to demonstrate compatibility.

3.3 INSPECTION PRIOR TO APPLICATION OF FIELD PRIMER AND FINISH COATINGS

A. Clean all surfaces immediately prior to coating.

B. Inspect all surfaces for conformance to specified preparation standards.

C. Request and obtain Engineer inspection for each coating surface preparation prior to coating application.

3.4 SURFACE DEFECTS OR FILLERS IN ARCHITECTURAL MATERIALS

A. Fill defects in architectural areas with patching compound specifically designed for the intended application.

B. Sand or otherwise finish patched or filled areas to blend with adjacent surface.

C. Counter sink or nail set fasteners to depth necessary to provide good bond for putty or dowel stock:
   1. Match dowel stock or putty to color of stain on any natural finish areas.
   2. Carefully apply glue to dowels and immediately wipe thoroughly any surplus glue.

3.5 PAINT SMOOTHNESS, COVER AND SHEEN TOLERANCE

A. Finish coating surface smoothness equal to base surface preparation smoothness.
B. Uniform lustre with even appearance free of lap marks.
C. Thickness tolerance $\pm$ 10 percent in any given location, but average not to be less than specified mil coverage.

3.6 PAINT APPLICATION CONDITIONS

A. Clean, dry environment and at temperatures recommended in manufacturer's preprinted instructions.
B. Surface temperature: Minimum of 5°F. above wet bulb temperature.
C. Maximum Humidity: 85 percent.
D. Shield from hot sun with appropriate housing when applying paints.
E. Do not apply coatings in areas where dust is being generated.
F. Do not apply in fog, snow, rain or to wet or damp surfaces.

3.7 APPLICATION

A. Add fungus or mildew inhibitive additives to all nonepoxy products.
B. Apply coatings at specified rates and consistency per selected manufacturer's specific application instructions.
C. Buildup in multiple or single finish coats as specified.
D. Thin only with thinners specifically formulated for use by approved manufacturer.
E. Tint primer, second and finish coats different shades to verify coverage.

3.8 RECOAT DRY TIME

A. Permit adequate cure-drying interval between multiple coats as determined by manufacturer's recommended drying time at specified cure conditions.

3.9 SAFETY AND PROTECTION

A. Provide safe working environment for paint applicators.
B. Provide adequate heat and forced mechanical ventilation for health, safety and drying requirements.
C. Use explosion proof equipment.

D. Provide approved face masks.
E. Protect adjacent surfaces with suitable masking and drop cloths as required.
F. Dispose of paint rags, empty containers, clothes, worn applicators to avoid hazardous situations.
G. Clean up daily.

3.10 FINISH AND COLOR SCHEDULE

A. Painted surfaces shall be colored in accordance with Metro-selected schedules provided during the construction work.
B. Submit for approval prior to any painting, color, manufacturer and color chips of all coatings listed herein in accordance with Section 01340.

* * * END OF SECTION * * *

DIVISION 11 - EQUIPMENT

INDEX

SECTION 11301
VACUUM PUMP STATIONS

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Gas and Condensate Collection: Section 02680

B. Remote Condensate Pump Station: Section 11032

C. Shop Drawings: Section 01340

D. O & M Data: Section 01730

E. Electrical: Division 16

1.2 DESCRIPTION

A. The work shall consist of furnishing all equipment and material, and constructing the Vacuum Pump Station per the Plans. Included in each Vacuum Pump Station are the following components:

1. All piping, valves, fittings, and pipe supports within the walls of the Vacuum Pump Station enclosure and between the Vacuum Pump Station enclosure and the Condensate Collection Tank as shown on the Plans.
2. One Vacuum Reserve Tank System.
3. Two Condensate Discharge Pumps (one spare)
4. One Condensate Collection Tank
5. One Vacuum Pump Station Roof Structure

1.3 SUBMITTALS

A. Shall conform to Section 01340 and 01730.

2. PRODUCTS

2.1 PIPING

A. The piping is to be PVC material as per Section 02610 of these specifications

2.2 VALVES

A. Ball valves for use at the vacuum pump station shall have PVC bodies, socket type union ends, and EPDM seats and seals, as manufactured by ASAHI America "Duo Bloc", or approved equivalent.

B. Check valves for use at the vacuum pump station shall be ball check valves with PVC bodies, union ends and EPDM seals as manufactured by Chemtrol, Inc., or equal.

2.3 VACUUM RESERVE TANK SYSTEM

A. The Vacuum Reserve Tank System shall be provided with the following components:

- (2) ea. oil-free vacuum pumps with 5 hp 230/460 volt, 3 phase, 60 Hz TEFC motors, inlet filter, vacuum regulator and exhaust muffler. The pumps shall be capable of producing, at its extremes, 56 cfm air at 0 inches Hg vacuum, and 26 inches Hg at 0 cfm air. The pumps shall be of spark-proof design suitable for methane gas service.
- (2) ea. Pump inlet check valves
- (2) ea. Pump isolation valves
- (2) ea. Vacuum switches
- (1) ea. Vacuum Gage
- (1) ea. 80 gal. vacuum receiver
- (1) ea. Vacuum relief valve
- (2) ea. Ball float shut-offs on pump inlets
- (1) ea. Duplex NEMA - 3R control panel with HOA switches

The unit shall be a complete package, fully assembled, and tested, including all plumbing, valves, gauges, and electrical connections, shipped ready for installation and start-up from the vendor.

2.4 CONDENSATE DISCHARGE PUMPS

A. The condensate discharge pumps (one spare per location) shall be "jet" pumps as manufactured by Goulds Pumps, Model GH15 with 1 1/2 HP 460V, 3 phase motors with a FT5-12 Jet Assembly Package. The pumps shall be capable of pumping 18 gpm water against a negative suction head of 40-foot water column. The pump casing shall be close grained cast iron, with 20% glass filled "noryl" impeller. The pumps

shall be supplied with a bronze jetbody and foot valve for installation in the condensate collection tank as shown on the Drawings.

2.5 CONDENSATE COLLECTION TANK

A. The condensate collection tank shall be furnished ready for installation in conformance with ASTM Standard Specification D3299 for "Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Chemical-Resistant Tanks" and with National Bureau of Standards Specifications PS 15-19 "Product Standard for Reinforced Plastic Tanks".

B. The Condensate Collection Tank shall have adequate wall thickness, fiberglass mat, and stiffener for an operating vacuum of 25 inches Hg.

C. The Condensate Collection Tank shall meet the classification of Type II, Grade 2 in conformance with ASTM Standard Specification D3299. The resin used to fabricate the Condensate Collection Tank shall be a commercial-grade, vinyl ester resin, corrosion resistant thermoset suitable for corrosive leachate collection systems. The chopped strand mat, the continuous roving, and the surface mat shall be in accordance with ASTM Standard Specification D3299. The woven roving shall be in accordance with ASTM Standard Specification D2150.

D. The Condensate Collection Tank shall be coated with a protective coating resin to resist ultraviolet degradation. The interior shall have a vinyl ester liner, 100 mil thick, and shall be Koppers Atlac 580 or approved equal.

2.6 PUMP STATION ROOF STRUCTURE

A. This section covers the work necessary to furnish and install the Vacuum Pump Station Roof Structure, complete, as shown on the Drawings and specified herein.

B. Materials shall be similar in nature and shall meet the intended service requirements. The roof structure shall be watertight and have corrosion-resistant paint. The roof structure shall carry a 10-year warrantee to obligate the manufacturer to repair or replace any defect in materials or workmanship. Building construction and materials shall be Underwriters Laboratories and Factory Mutual approved, as applicable.

1. Manufacturer. Shall be Freedom Metal Mfr. Inc., Box 990, Sumner, WA. 98390 (206)863-7710 "Double Column Carport".

2. Dimensions. Height to be 7'0" overall dimensions and column locations shall be as shown on the Plans.

3. Roof. The roofing system shall consist of 26 GA. USG V-Beam roofing as a minimum. Rain gutters shall be provided on the front and rear sides of the roof. The roof structure shall be provided with the necessary structural metal members for exposure to Class C conditions, wind loads to 90 MPH, and to meet Uniform Building Code, 1988 requirements. All materials shall have a finish suitable to withstand the elements. Baseplates shall be provided on the support columns to sufficiently anchor the roof structure to the foundation.

4. Finish. Paint all surfaces per manufacturer's standard coating finishes and erection drawings. Provide Metro with color samples for selection prior to painting.

5. Hardware. The manufacturer shall provide all hardware for assembly and securing the roof structure in place. All hardware for securing the building components shall be corrosion-resistant with insulating washers for interface where dissimilar metals are in contact. All concrete anchors for securing the roof structure to the concrete slab shall be stainless steel and shall be anchor bolts with lock washers or inserts shot into the concrete slab.

6. Electrical. See the Plans and Division 16 of these Specifications for electrical and lighting requirements.

7. Foundation. See the Plans and Division 3 of these Specifications for enclosure foundation requirements.

2.7 PIPE SUPPORTS

A. Pipe supports at the Vacuum Pump Station shall be fabricated as shown on the Plans. Materials and construction requirements shall be as per Section 05500 of this Specification.

3. EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. Piping at the Vacuum Pump Station shall be PVC pipe, fabricated and installed as shown on the Plans and shall meet all applicable requirements of Section 02610 of this Specification.

B. Pipe supports shall be installed as shown on the Plans and shall meet all applicable requirements of Section 05500 of this Specification.

C. Valves shall be installed per Section 02680 of the Specification.

D. The Condensate Collection Tank shall be installed to match the elevations shown on the Plans. The Condensate Collection Tank shall be raised 1'-0" from the bottom of the excavation to allow concrete to flow beneath as shown on the Plans. Tank excavation shall be in accordance with Section 02221 of this Specificatin.

E. The Vacuum Pump Station Roof Structure shall be designed by the manufacturer to meet local Building Code, Wind Loadings, 1988 UBC, and environmental conditions encountered at the site. Design drawings and calculations shall be stamped by a registered professional engineer in the State of Oregon and submitted in accordance with the GENERAL CONDITIONS. Design drawings shall include details for anchoring the modular structure to the concrete slab. Manufacturer's installation instructions shall also be provided.

The Vacuum Pump Station Roof Structure shall be erected and finished according to the manufacturer's printed instructions. The structure shall be watertight at all joints and conform to local Building Code and 1988 UBC.

The roof structure shall rest and be secured on the top its foundation as per the Plans. Provide watertight sealing of all joints with 20-year life sealant per the manufacturer's recommendation. Concrete foundation shall be installed in accordance with Section 03300 of this Specification and the Plans.

* * * END OF SECTION * * *

SECTION 11302
REMOTE CONDENSATE PUMP STATIONS

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Gas and Condensate Collection: Section 02680
B. Vacuum Pump Stations: Section 11301
C. Shop Drawings: Section 01340
D. O&M Manual: Section 01730
E. Electrical: Division 16

1.2 DESCRIPTION

A. The work to be performed includes furnishing all equipment and material, and constructing the "Remote Condensate Pump Station" as per the Plans. Included in the condensate pump station are the following components:
   1. All piping, fittings, valves and pipe supports between the condensate pump and the condensate collection tank as shown on the Plans.
   2. Two Condensate Discharge Pumps (one spare) per Condensate Pump Station.
   3. One Condensate Collection Tank per Condensate Pump Station.
   4. One concrete pump foundation per Condensate Pump Station.

B. These items shall be installed at the locations shown on the Plans.

1.3 SUBMITTALS

A. Provide submittals per applicable portions of Section 11301 and 01340.

2. PRODUCTS

2.1 PIPING

A. Conform with Section 02610.

2.2 VALVES

A. Conform with Section 11301.

2.3 CONDENSATE DISCHARGE PUMPS

A. Conform with Section 11301.

2.4 CONDENSATE COLLECTION TANKS

A. Conform with Section 11301.

2.5 PIPE SUPPORTS

A. Conform with Section 11301

3. EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. Conform with applicable portions of Section 11031.

* * * END OF SECTION * * *

DIVISION 16 - ELECTRICAL

INDEX

SECTION 16000

GENERAL ELECTRICAL

1. GENERAL

1.1 CONTRACT DOCUMENTS: The General Conditions and General Requirements listed in the Index to Specifications apply to work under this Section, and to all Sections of Division 16 contained herein.

1.2 CODE COMPLIANCE

A. All work and materials shall comply with latest rules, codes, and regulations including but not limited to the following: OSHA, the National Electric Code, and all other applicable state and local laws and regulations.

B. Code compliance is mandatory. Nothing in these Drawings and Specifications permits work not conforming to applicable codes.

1.3 SAFETY AND INDEMNITY

A. The Contractor shall be solely and completely responsible for conditions of the job site, including safety of all persons and all property during performance of the work. This requirement will apply continuously and not be limited to normal working hours.

B. No act, service, drawing review, or construction observation by Metro or their Consultants is intended to include review of the adequacy of the Contractor safety measures in, on, or near the construction site.

1.4 PERMITS: Include cost in this Contract for all permits and inspections of the work. Permits and inspections shall be obtained by the Contractor when required.

1.5 WARRANTY: Warrant the installation free from defects of workmanship and materials for a period of one year after date of certificate of final payment and promptly remedy any defects developing during this period without charge. Warranty shall not apply to normal burnout of incandescent lamps that result from usage after building has been occupied.

2. PRODUCTS

2.1 STANDARD PRODUCTS: Material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.2 MATERIALS ALLOWED

A. All materials must be new and bear the U.L. label and be manufactured to NEMA and NECA standards, where applicable. Materials that are not covered by U.L. testing standards shall be tested and approved by an independent testing laboratory or governmental agency.

B. Materials not in accordance with the Specification may be rejected either before or after installation.

2.3 ELECTRICAL O&M MANUALS

A. General - The Electrical O&M Manual for this project will generally follow the requirements of Specification 01730 but will include the following:

1. Table of Contents
2. System Descriptions
3. Catalog Data/Operations and Maintenance Instructions organized by specifications section and paragraph for all electrical materials and equipment.
4. As Built Electrical Plans

B. Operations and Maintenance Instructions will be required for the following items:

a. Panelboards (Specification 16470)
b. Packaged Power Supply (Specification 16470)
c. Motor Control (Specification 16480)

C. Operations and Maintenance Instructions will include the following:

1) Installation Instructions
2) Startup Procedures
3) Maintenance Instructions
4) Maintenance Schedule
5) Spare Parts List
6) Warranties

3. EXECUTION

3.1 COORDINATION: The drawings indicate the extent and the general location and arrangement of equipment, conduit, and wiring. The Contractor shall become familiar with all details of the work and verify all dimensions in the field so that the outlets and equipment will be properly located and readily accessible. Lighting fixtures, outlets, and other equipment and materials shall be located to avoid interference with mechanical or structural features; otherwise, lighting fixtures shall be symmetrically located according to the room arrangement when uniform illumination is required, or asymmetrically located to suit conditions fixed by design and shown. Raceways, junction and outlet boxes, and lighting fixtures shall not be supported from sheet metal roof decks. If any conflicts occur necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change.

3.2 CUTTING AND PATCHING

A. Perform all cutting and fitting required for work of this Section in rough construction of the building.

B. All patching of finished construction of building shall be performed under the sections covering these materials.

C. No joists, beams, girders, or columns shall be cut or bored by any Contractor without obtaining written permission from the Engineer.

3.3 CLEANING EQUIPMENT AND PREMISES

A. Thoroughly clean all parts of the apparatus and equipment. Exposed parts which are to be painted shall be thoroughly cleaned of cement, foreign paint, and other unwanted materials.

B. All oil and grease spots shall be removed.

C. Such surfaces shall be carefully wiped and all cracks and corners scraped out.

3.4 TESTS AND DEMONSTRATIONS

A. Test all service entrance equipment, feeders, and branch circuits, etc. for shorts and grounds prior to energizing. Service entrance conductors and feeders shall be meggered to ground. Document all readings and submit to the Engineer for the project records.

B. Test all mechanical equipment connected to insure proper rotation and phasing.

C. Check the horsepower of all motors connected against the size of heater elements in the starters. If they do not match, notify the motor supplier to provide the correct size and type.

D. All systems shall be tested, adjusted, and balanced for proper operation. Metro and/or his official representative shall be instructed in their use and shown all controls and operating procedures. The operation of the systems shall be demonstrated in the presence of Metro and Engineer. Prior to final inspection the Contractor shall instruct personnel designated by Metro in relamping and cleaning lamp fixtures.

E. A letter from the Contractor acknowledging that all above mentioned tests and demonstrations have been done shall be submitted to the Engineer with the final inspection submittal.

3.5 ELECTRICAL POWER SHUTDOWN: The Contractor shall schedule with Metro the shutdown of the electrical power to any facility or portion of facility. The scheduling shall be done a minimum of 24 hours in advance of the proposed shutdown and shall fully address the requirements of Metro for such matters as maximum duration of shutdown and temporary operation of essential services.

* * * END OF SECTION * * *

SECTION 16111

CONDUIT

1. GENERAL

1.1 WORK INCLUDED

A. Rigid metal conduit and fittings.

B. Liquidtight flexible metal conduit and fittings.

C. Non-metallic conduit and fittings.

D. Pressure rated sealing gland fitting

1.2 RELATED WORK

A. Section 02222 - Excavating, Backfilling, and Compacting for Utilities.

B. Section 03300 - Cast in Place Concrete: Protective envelope for underground conduit installations at road crossings.

1.3 REFERENCES

A. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated.

B. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.

C. FS WW-C-566 - Specification for Flexible Metal Conduit.

D. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).

E. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

2. PRODUCTS

2.1 RIGID METAL CONDUIT AND FITTINGS

A. Rigid Steel Conduit: ANSI C80.1.

B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; threaded type, material to match conduit.

2.1 LIQUIDTIGHT FLEXIBLE CONDUIT AND FITTINGS

A. Conduit: Flexible metal conduit with PVC jacket.

B. Fittings and Conduit Bodies: ANSI/NEMA FB 1.

2.2 PLASTIC CONDUIT FITTINGS

A. Conduit: NEMA TC 2; Schedule 40 PVC.

B. Fittings and Conduit Bodies: NEMA TC 3.

2.3 CONDUIT SUPPORTS

A. Conduit Clamps, Straps, and Supports: Steel or malleable iron.

2.4 DUCTBANK HANDHOLES

A. Handholes shall be of high density polyethylene (HDPE). Carson Industries Series 1730, or equal.

2.5 PRESSURE RATED SEALING GLAND FITTING

A. Fittings shall be of stainless steel with teflon sealant. Conax catalog number PL-12-6.

3. EXECUTION

3.1 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

A. Size conduit for conductor type installed 3/4-inch minimum size.

B. Arrange conduit to maintain headroom and present a neat appearance.

C. Route exposed conduit parallel and perpendicular to walls and adjacent piping.

D. Maintain minimum 6 inch clearance between conduit and piping. Maintain 12 inch clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.

E. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.

F. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.

G. Do not fasten conduit with wire or perforated pipe straps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.

H. Support conduit at a maximum of 7 feet on center.

3.2 CONDUIT INSTALLATION

A. Cut conduit square using a saw or pipecutter; de-burr cut ends.

B. Bring conduit to the shoulder of fittings and couplings and fasten securely.

C. Use conduit hubs for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet locations.

D. Install no more than the equivalent of three 90-degree bends between boxes.

E. Use conduit bodies to make sharp changes in direction, as around beams.

F. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 inch size.

G. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.

H. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.

I. Provide No. 12 AWG insulated conductor or suitable pull string in empty conduit, except sleeves and nipples.

J. Maximum Size Conduit in Slabs Above Grade: 3/4 inch.

K. Install pressure rated sealing gland fittings to provide a leak proof installation at the condensate tank entrances.

L. Use PVC-coated rigid steel factory elbows for bends in plastic conduit runs longer than 100 feet, or in plastic conduit runs which have more than two bends regardless of length.

M. Wipe plastic conduit clean and dry before joining. Apply full, even coat of cement to entire area that will be inserted into fitting. Let joint cure for 20 minutes minimum.

3.3 UNDERGROUND DUCTBANK INSTALLATION

A. Install top of duct bank minimum 18 inches below finished grade.

B. Install conduit with minimum grade of 4 inches per 100 feet.

C. Stagger conduit joints in concrete encasement 6 inches minimum vertically.

D. Use suitable separators and chairs installed not greater than 4 feet on centers. Band conduit together with suitable banding devices. Securely anchor conduit to prevent movement during concrete placement.

E. Provide two No. 4 steel reinforcing bars in top of bank under paved areas.

3.4 CONDUIT INSTALLATION OF SCHEDULE

A. Underground Installations More than five feet from foundation wall: Schedule 40 plastic conduit.

B. Installations In or Under Concrete Slab, or Underground Within Five Feet of Foundation Wall: Schedule 40 plastic conduit.

C. In Slab Above Grade: Schedule 40 plastic conduit.

D. Exposed Outdoor Locations: Rigid steel conduit.

E. Wet Interior Locations: Rigid steel conduit.

F. Concealed Dry Interior Locations: Rigid steel conduit.

G. Exposed Dry Interior Locations: Electrical metallic tubing. Rigid steel conduit.

* * * END OF SECTION * * *

SECTION 16120

WIRE AND CABLE

1. GENERAL

1.1 WORK INCLUDED

A. Building wire.

B. Type TC power cables.

C. Control cable.

D. Type KX thermocouple extension wire.

E. Wiring connections, terminations, and splices.

F. Heat trace cable

1.2 REFERENCES

A. NEMA WC 5 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

1.3 SUBMITTALS

A. Submit shop drawings and product data under the provisions of Section 01340.

2. PRODUCTS

2.1 BUILDING WIRE

A. Thermoplastic-insulated Building Wire: NEMA WC 5.

B. Feeders and Branch Circuits Larger Than 6 AWG: Copper, stranded conductor, 600 volt insulation, THHN/THWN.

C. Feeders and Branch Circuits 6 AWG and Smaller: Copper conductor, 600 volt insulation, THHN/THWN. 6 and 8 AWG, stranded conductor; smaller than 8 AWG, solid conductor.

D. Control Circuits: Copper, stranded conductor 600 volt insulation, THW.

2.2 TYPE TC POWER CABLE

A. Conductors: Soft drawn or annealed copper. Three insulated conductors and three bare ground wire.

B. Insulation: Cross-linked polyethylene (XLP) on individual conductors.

C. Jacket: Black, flame-retarding polyvinyl chloride (PVC).

2.3 THERMOCOUPLE EXTENSION WIRE (ANSI TYPE KX)

A. Conductors: No. 14 AWG solid copper.

B. Insulation: Polyvinyl chloride (PVC) on individual conductors and an overall PVC jacket.

C. Wire Braid: Tinned copper.

2.4 SIGNAL CABLE

A. Conductors: Stranded annealed copper.

B. Insulation: Heat-stabilized polyethylene.

C. Jacket: Black, flame-retarding polyvinyl chloride (PVC).

2.5 DUCTBANK CONSTRUCTION SPLICE INSULATION

A. Heat Shrink Sleeves: Cross-lined polyolefin. 3M Cat. No. ITCSN, or equal.

2.6 HEAT TRACE CABLE

A. Heat trace cable: Self-Regulating three watt per foot 120 volt heating cable with tinner-copper braid covering Chromolox SRL3-1CT, or equal.

B. Heat trace cable connection accessories: Chromolox DL series, or equal.

C. Ambient sensing thermostat: Chromolox catalog number RTAS, or equal.

3. EXECUTION

3.1 GENERAL WIRING METHODS

A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.

B. Use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 75 feet.

C. Place an equal number of conductors for each phase of a circuit in same raceway or cable.

D. Splice only in junction or outlet boxes.

E. Neatly train and lace wiring inside boxes, equipment, and panelboards.

F. Make Conductor lengths for parallel circuits equal.

3.2 WIRING INSTALLATION IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires and for pulling cables in ductbanks.

B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

C. Completely and thoroughly swab raceway system before installing conductors.

3.3 WIRING CONNECTIONS AND TERMINATIONS

A. Splice only in accessible junction boxes.

B. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps.

C. Use split bolt connectors for copper wire splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.

D. Thoroughly clean wires before installing lugs and connectors.

E. Make splices, taps and terminations to carry full capacity of conductors without perceptible temperature rise.

F. Terminate spare conductors with electrical tape.

G. Use heat shrink sleeves to insulate splices in ductbank construction.

3.4 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01400.

B. Inspect wire and cable for physical damage and proper connection.

C. Torque test conductor connections and terminations to manufacturer's recommended values.

D. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.

3.5 WIRE AND CABLE INSTALLATION SCHEDULE

A. Concealed Interior Locations: Building wire in raceways.

B. Exposed Interior Locations: Building wire in raceways.

C. Wet or Damp Interior Locations: Building wire in raceway.

D. Exterior Locations: Building wire in raceways. Thermocouple extension wire.

E. Underground Locations: Building wire in raceways.

F. Ductbank Installations: Type TC power cable. Signal cable.

3.6 HEAT TRACE CABLE

A. Furnish and install heat trace cable to protect all above grade piping, tanks, and compressors at pump station VS-1

B. Obtain the services of a factory approved designer to design the heat trace system to prevent freezing at -10°F ambient temperatures.

* * * END OF SECTION * * *

SECTION 16130

BOXES

1. GENERAL

1.1 WORK INCLUDED

A. Wall and ceiling outlet boxes.

B. Pull and junction boxes.

1.2 REFERENCES

A. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

2. PRODUCTS

2.1 OUTLET BOXES

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1; galvanized steel, with 1/2 inch male fixture studs where required.

B. Cast Boxes: Cast feralloy, deep type, gasketed cover, threaded hubs.

2.2 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: ANSI/NEMA OS 1; galvanized steel.

B. Sheet Metal Boxes Larger Than 12 Inches in Any Dimension: Hinged enclosure in accordance with Section 16160.

C. Cast Metal Boxes for Outdoor and Wet Location Installations: NEMA 250; Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron box and cover with ground flange, neoprene gasket, and stainless steel cover screws.

D. Cast Metal Boxes for Underground Installations: NEMA 250; Type 4, outside flanged, recessed cover box for flush mounting, UL listed as raintight. Galvanized cast iron box and plain cover with neoprene gasket and stainless steel cover screws.

3. EXECUTION

3.1 COORDINATION OF BOX LOCATIONS

A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.

B. Electrical box locations shown on Contract Drawings are approximate unless dimensioned. Verify location of floor boxes and outlets prior to rough-in.

C. Locate and install boxes to allow access.

D. Locate and install to maintain headroom and to present a neat appearance.

3.2 OUTLET BOX INSTALLATION

A. Provide knockout closures for unused openings.

B. Support boxes independently of conduit, except for cast boxes that are connected to two rigid metal conduits, both supported within 12 inches of box.

C. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

D. Install boxes in walls without damaging wall insulation.

E. Position outlets to locate luminaires as shown on reflected ceiling plans.

F. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.

* * * END OF SECTION * * *

SECTION 16141

WIRING DEVICES

1. GENERAL

1.1 WORK INCLUDED

A. Wall switches.

B. Receptacles.

C. Device plates and box covers.

1.2 REFERENCES

A. NEMA WD 1 - General-Purpose Wiring Devices.

1.3 SUBMITTALS

A. Submit product data under provisions of Section 01340.

B. Provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

2. PRODUCTS

2.1 WALL SWITCHES

A. Wall Switches for Lighting Circuits and Motor Loads Under 1/2 HP: NEMA WD 1; AC general use snap switch with toggle handle, rated 20 amperes and 120-277 volts AC. Handle: Ivory plastic.

2.2 RECEPTACLES

A. Convenience and Straight-blade Receptacles: NEMA WD 1.

B. Convenience Receptacle Configuration: NEMA WD 1; Type 5-20 R, ivory plastic face.

2.3 WALL PLATES

A. Decorative Cover Plate: Smooth stainless steel.

B. Weatherproof Cover Plate: Gasketed cast metal with hinged gasketed device covers.

3. EXECUTION

3.1 INSTALLATION

A. Install wall switches 48 inches above floor, OFF position down.

B. Install convenience receptacles 24 inches above floor, grounding pole on bottom.

C. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

D. Install devices and wall plates flush and level.

* * * END OF SECTION * * *

SECTION 16160

CABINETS AND ENCLOSURES

1. GENERAL

1.1 WORK INCLUDED

A. Hinged cover enclosures.

B. Cabinets.

C. Terminal blocks and accessories.

D. Wiring ducts.

1.2 REFERENCES

A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

B. ANSI/NEMA ICS 1 - Industrial Control and Systems.

C. ANSI/NEMA ICS 4 - Terminal Blocks for Industrial Control Equipment and Systems.

D. ANSI/NEMA ICS 6 - Enclosures for Industrial Control Equipment and Systems.

1.3 SUBMITTALS

A. Submit product data under provisions of Section 01340.

B. Shop Drawings for Equipment Panels: Include wiring schematic diagram, wiring diagram, outline drawing and construction diagram as described in ANSI/NEMA ICS 1.

2. PRODUCTS

2.1 HINGED COVER ENCLOSURES

A. Construction: NEMA 250; steel.

B. Finish: Manufacturer's standard enamel finish.

C. Covers: Continuous hinge, held closed by flush latch operable by key.

D. Panel for Mounting Terminal Blocks or Electrical Components: 12 gage steel.

E. PLC Enclosure: Hoffman Cat. No. A-604808LP, or equal.

D. Remote Equipment Indication Panel: Hoffman Cat. No. E16PB, or equal.

2.2 TERMINAL BLOCKS AND ACCESSORIES

A. Terminal Blocks: ANSI/NEMA ICS 4; UL listed.

B. Power Terminals: Unit construction type, closed-back type, with tubular pressure screw connectors, rated 600 volts.

C. Signal and Control Terminals: Pass & Symour Cat. No. 37060, or equal.

2.3 FABRICATION

A. Shop assemble enclosures and cabinets housing terminal blocks or electrical components in accordance with ANSI/NEMA ICS 6.

B. Provide conduit hubs on exterior located enclosures and knockouts on interior located enclosures.

C. Provide protective pocket inside front cover with schematic diagram, connection diagram, and layout drawing of control wiring and components within enclosure.

3. EXECUTION

3.1 INSTALLATION

A. Install cabinets and enclosures plumb; anchor securely to wall and structural supports at each corner, minimum.

B. Provide accessory feet for free-standing equipment enclosures.

C. Install trim plumb.

* * * END OF SECTION * * *

SECTION 16190

SUPPORTING DEVICES

1. GENERAL

1.1 WORK INCLUDED

A. Conduit and equipment supports.

B. Fastening hardware.

1.2 RELATED WORK

A. Section 03300, Cast in Place Concrete. Concrete equipment pads.

1.3 COORDINATION

A. Coordinate size, shape and location of concrete pads with Section 03300, Cast in Place Concrete.

1.4 QUALITY ASSURANCE

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

2. PRODUCTS

2.1 MATERIAL

A. Support Channel: Galvanized steel.

B. Hardware: Corrosion resistant.

3. EXECUTION

3.1 INSTALLATION

A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using precast insert system, preset inserts, beam clamps, or spring steel clips.

B. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.

C. Do not use powder-actuated anchors.

D. Do not drill structural steel members.

E. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

F. In wet locations, install free-standing electrical equipment on concrete pads.

G. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide steel channel supports to stand cabinet one inch off wall.

* * * END OF SECTION * * *

SECTION 16195

ELECTRICAL IDENTIFICATION

1. GENERAL

1.1 WORK INCLUDED

A. Nameplates and tape labels.

B. Wire and cable markers.

1.2 SUBMITTALS

A. Submit shop drawings under provisions of Section 01340.

B. Include schedule for nameplates and tape labels.

2. PRODUCTS

2.1 MATERIALS

A. Nameplates: Engraved three-layer laminated plastic, black letters on a white background.

B. Tape Labels: Embossed adhesive tape, with 3/16 inch white letters on black background.

C. Wire and Cable Markers: Cloth markers, split sleeve or tubing type.

3. EXECUTION

3.1 INSTALLATION

A. Degrease and clean surfaces to receive nameplates and tape labels.

B. Install nameplates and tape labels parallel to equipment lines.

C. Secure nameplates to equipment fronts using screws, rivets, or adhesive. Secure nameplate to inside face of recessed panelboard doors in finished locations.

3.2 WIRE IDENTIFICATION

A. Provide wire markers on each conductor in panelboard gutters, pull boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on schematic and interconnection diagrams for control wiring.

3.3 NAMEPLATE ENGRAVING SCHEDULE

A. Provide nameplates to identify all electrical distribution and control equipment, and loads served. Letter Height: 1/8 inch for individual switches and loads served, 1/4 inch for distribution and control equipment identification.

* * * END OF SECTION * * *

SECTION 16420

SERVICE ENTRANCE

1. GENERAL

1.1 WORK INCLUDED

A. Arrangement with Utility Company for permanent electric service, including payment of utility company charges for service.

B. Underground service entrance.

1.2 SYSTEM DESCRIPTION

A. System Voltage: 277/480 volts, three phase, four-wire, 60 Hertz.

1.3 QUALITY ASSURANCE

A. Utility Company: Portland General Electric, Portland, Oregon.

B. Install service entrance in accordance with Utility Company's rules and regulations.

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01340.

B. Submit Utility Company prepared drawings.

2. PRODUCTS

2.1 METERING EQUIPMENT

A. Meter: Furnished by Utility Company.

B. Meter Base: As specified by Utility Company.

C. Current Transformers: Furnished by Utility Company.

D. Current Transformers Enclosure: As specified by Utility Company.

E. Wood Power Poles: As specified by Utility Company.

3. EXECUTION

3.1 INSTALLATION

A. Make arrangements with Utility Company to obtain permanent electric service to the Project. Contact Mr. Jim Van Kleek or William Ferguson at (503) 464-7739.

B. Underground: Install service entrance conduits from Utility Company's terminal pole to service entrance equipment. Utility Company will connect service lateral conductors to service entrance conductors.

* * * END OF SECTION * * *

SECTION 16450

SECONDARY GROUNDING

1. GENERAL

1.1 WORK INCLUDED

A. Power system grounding.

B. Communication system grounding.

C. Electrical equipment and raceway grounding and bonding.

1.2 SYSTEM DESCRIPTION

A. Ground the electrical service system neutral at service entrance equipment to grounding electrodes.

B. Ground each separately-derived system neutral to service grounding electrodes.

C. Provide communications system grounding conductor at point of service entrance and connect to nearest effectively grounded building structural steel member.

D. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.

1.3 SUBMITTALS

A. Submit shop drawings under provisions of Section 01340.

B. Indicate location of system grounding electode connections, and routing of grounding electrode conductor.

2. PRODUCTS

2.1 MATERIALS

A. Ground Rods: Copper-encased steel, 3/4 inch diameter, minimum length 10 feet.

3. EXECUTION

3.1 INSTALLATION

A. Provide a separate, insulated equipment grounding conductor in feeder and branch circuits. Terminate each end on a grounding lug, bus, or bushing.

B. Connect grounding electrode conductors to metal methane and condensate piping using a suitable ground clamp.

C. Supplementary Grounding Electrode: Use driven ground rod on exterior of building. Install ground rod in suitable recessed well; fill with gravel after connection is made.

D. Use minimum 6 AWG copper conductor for communications service grounding conductor. Leave 10 feet slack conductor at terminal cabinet.

E. Provide grounding and bonding at Utility Company's metering equipment and pad-mounted transformer in accordance with Section 16420.

3.2 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

B. Measure ground resistance from system neutral connection at service entrance to convenient ground reference point using suitable ground testing equipment. Resistance shall not exceed 10 ohms.

* * * END OF SECTION * * *

SECTION 16470

PANELBOARDS

1. GENERAL

1.1 WORK INCLUDED

A. Service and distribution panelboards.

B. Lighting and appliance branch circuit panelboards.

1.2 REFERENCES

A. NEMA AB 1 - Molded Case Circuit Breakers.

B. NEMA PB 1 - Panelboards.

C. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

1.3 SUBMITTALS

A. Submit shop drawings for equipment and component devices under provisions of Section 01340.

B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

1.4 SPARE PARTS

A. Keys: Furnish 2 each to Metro.

2. PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - PANEBOARDS AND LOAD CENTERS

A. Square D.

B. General Electric.

C. Westinghouse.

D. Substititutions: Under provisions of Section 01600.

2.1 MAIN AND DISTRIBUTION PANELBOARDS

A. Panelboards: NEMA PB 1; circuit breaker type.

B. Enclosure: NEMA PB 1; Type 1. Cabinet size: 6 inches deep; 20 inches wide.

C. Provide cabinet front with screw cover and hinged door with flush lock. Finish in manufacturer's standard gray enamel.

D. Provide panelboards with copper bus, ratings as scheduled on Drawings. Provide copper ground bus in all panelboards.

E. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 240 volt panelboards; 14,000 amperes rms symmetrical for 480 volt panelboards, or as shown on Drawings.

F. Molded Case Circuit Breakers: NEMA AB 1; provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

2.2 BRANCH CIRCUIT PANELBOARDS

A. Lighting and Appliance Branch Circuit Panelboards: NEMA PB1; circuit breaker type.

B. Enclosure: NEMA PB 1; Type 1.

C. Cabinet Size: 6 inches deep; 20 inches wide.

D. Provide surface cabinet front with concealed trim clamps, concealed hinge and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

E. Provide panelboards with copper bus, ratings as scheduled on Drawings. Provide copper ground bus in all panelboards.

F. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 240 volt panelboards; 14,000 amperes rms symmetrical for 480 volt panelboards, or as shown on Drawings.

G. Molded Case Circuit Breakers: NEMA AB 1; bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits.

H. Power Conditioner: Isatrol Cat. No. I-415, or equal.

3. EXECUTION

3.1 INSTALLATION

A. Install panelboards plumb, in conformance with NEMA PB 1.1.

B. Height: 6 ft.

C. Provide filler plates for unused spaces in panelboards.

D. Provide typed or neatly handwritten circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

E. Install power conditioner inside the panelboard to be protected.

3.2 FIELD QUALITY CONTROL

A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.

B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

* * * END OF SECTION * * *

3. EXECUTION

3.1 INSTALLATION

A. Install package power supply plumb and level.

B. Height: 6 ft.

C. Provide filler plates for unused spaces in panelboards.

D. Provide typed or neatly handwritten circuit directory for each branch circuit panelboard.

3.2 FIELD QUALITY CONTROL

A. Check for damage and torque electrical connections to factory specifications before energizing.

B. Measure primary and secondary voltages and make appropriate tap adjustments.

C. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding.

* * * END OF SECTION * * *

SECTION 16475

PACKAGE POWER SUPPLY

1. GENERAL

1.1 WORK INCLUDED

A. Package power supply units.

1.2 REFERENCES

A. ANSI/NEMA ST 20 - Dry Type Transformers for General Applications.

B. NEMA AB 1 - Molded Case Circuit Breakers.

1.3 SUBMITTALS

A. Submit shop drawings for equipment and component devices under provisions of Section 01340.

B. Include outline and support point dimensions, dimensions, unit weight, voltages, kVA, and circuit breaker arrangement and sizes.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store in a warm, dry location with uniform temperature.

B. Handle only using lifting eyes provided for that purpose.

2. PRODUCTS

2.1 PACKAGE POWER SUPPLY:

A. 480-volt primary, 120/240-volt secondary, 6-pole, 5-kVA, with two 5% full capacity taps. Square D Cat. No. MPZ554OF, or equal.

SECTION 16476

ENCLOSED CIRCUIT BREAKERS

1. GENERAL

1.1 SECTION INCLUDES

A. Enclosed Molded Case Circuit Breakers.

1.2 REFERENCES

A. NEMA AB 1 - Molded Case Circuit Breakers.

1.3 REGULATORY REQUIREMENT

A. Use circuit breakers listed by Underwriter's Laboratories, Inc., and suitable for specific application.

2. PRODUCTS

2.1 MANUFACTURERS

A. Square D

B. Westinghouse

C. General Electric

2.2 MOLDED CASE CIRCUIT BREAKER

A. Circuit Breaker: NEMA AB 1

2.3 CONFIGURATION

A. Configuration: Inverse time automatic tripping.

2.4 RATINGS

A. Ratings: NEMA AB 1; as scheduled.

2.5 TERMINAL LUGS

A. Size: NEMA AB 1.

2.6 ENCLOSURE

A. Enclosure: NEMA AB 1:

B. Fabricate enclosure from steel.

C. Finish using manufacturer's standard enamel finish, gray color.

3. EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify field measurements are as shown on Drawings.

C. Verify that required utilities are available, in proper location, and ready for use.

D. Beginning of installation means installer accepts conditions.

3.2 INSTALLATION

A. Install enclosed circuit breakers where shown on Drawings, in accordance with manufacturer's instructions.

3.3 FIELD QUALITY CONTROL

A. Inspect and test each circuit breaker to NEMA AB 1.

B. Inspect visually and perform several mechanical ON-OFF operations on each circuit breaker.

C. Verify circuit continuity on each pole in closed position.

D. Determine that circuit breaker will trip on overcurrent condition, with tripping time to NEMA AB 1 requirements.

* * * END OF SECTION * * *

SECTION 16480

MOTOR CONTROL

1. GENERAL

1.1 WORK INCLUDED

A. Magnetic motor starters.

B. Motor control centers.

C. Duplex motor controllers.

D. Float Switches

E. Intrinsically Safe Relays

1.2 RELATED WORK

A. Section 16190 - Supporting Devices: Housekeeping pads.

1.3 REFERENCES

A. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.

B. ANSI/IEEE 344 - Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations.

C. NEMA AB 1 - Molded Case Circuit Breakers.

D. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01340.

B. Indicate on shop drawings, front and side views of motor control center enclosures with overall dimensions. Include conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, and ground; electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time-current curves of all equipment and components.

C. Provide product data on motor starters and combination motor starters, relays, pilot devices, and switching and overcurrent protective devices.

D. Submit manufacturers' instructions under provisions of Section 01340.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 01700 or 01730.

B. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 01600.

B. Deliver in 60 inch maximum width shipping splits, individually wrapped for protection, and mounted on shipping skids.

C. Store and protect products under provisions of Section 01600.

D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

E. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to motor control center components, enclosure, and finish.

2. PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - MOTOR STARTERS

A. Square D.

B. General Electric.

C. Westinghouse.

D. Substitutions: Under provisions of Section 01600.

2.2 MAGNETIC MOTOR STARTERS

A. Magnetic Motor Starters: NEMA ICS 2; AC general-purpose Class A magnetic controller for induction motors rated in horsepower.

B. Full Voltage Starting: Non-reversing type.

C. Coil Operating Voltage: 120 volts, 60 Hertz.

D. Size: NEMA ICS 2; size as shown on Drawings.

E. Overload Relay: NEMA ICS 2; bimetal.

F. Enclosure: NEMA ICS 6; Type 1.

G. Combination Motor Starters: Combine motor starters with molded case circuit breaker disconnect in common enclosure. Combine motor starters with disconnecting means, type as scheduled.

H. Auxiliary Contacts: NEMA ICS 2: 4 field convertible contacts in addition to seal-in contact.

I. Pushbuttons: NEMA ICS 2; START/STOP in front cover.

J. Indicating Lights: NEMA ICS 2; RUN: green in front cover.

K. Selector Switches: NEMA ICS 2; HAND/OFF/AUTO in front cover.

L. Relays: NEMA ICS 2.

M. Transient Suppression Module: NEMA ICS 2, Square D Class 9999, Type ST, or equal.

2.3 CONTROLLER OVERCURRENT PROTECTION AND DISCONNECTING MEANS

A. Molded Case Protector: NEMA AB 1; circuit breakers with integral instantaneous magnetic trip in each pole.

2.4 ACCEPTABLE MANUFACTURERS - MOTOR CONTROL CENTER

A. Square D.

B. General Electric.

C. Westinghouse.

D. Substitutions: Under provisions of Section 01600.

2.5 MOTOR CONTROL CENTER

A. Motor Control Centers: NEMA ICS 2; Class I, Type A.

B. Motor Starters: As scheduled.

C. Feeder Tap Units: Molded case thermal-magnetic circuit breakers.

D. Voltage Rating: 480 volts, three phase, three wire, 60 Hertz.

E. Horizontal Bussing: Copper, with a continuous current rating of 600 amperes. Include copper ground bus entire length of control center.

F. Vertical Bussing: NEMA ICS 2; copper.

G. Integrated Equipment Short Circuit Rating: 10,000 amperes rms symmetrical at 480 volts.

H. Configuration: Units front mounting only, accessible from the front only.

I. Enclosure: ANSI/NEMA ICS 6; Type 1.

J. Finish: Manufacturer's standard gray enamel.

K. Provide phase loss protection relay with contacts to de-energize each motor starter in control center.

L. Seismic Requirements: ANSI/IEEE 344; Class I.

2.6 DUPLEX MOTOR CONTROLLER

A. Manufacturer: Square D Class 8941, or equal

B. Electrical Characteristics: 480 volts, 3-phase, 60 hertz.

C. Enclosure: NEMA 4 at outdoor locations and NEMA 12 at indoor locations.

D. Furnish with thermal overload relays and circuit breakers for each motor.

E. Furnish with operating handles to indicate on and off positions. Handles to be capable of being locked in the off position.

2.7 FLOAT SWITCH ASSEMBLIES

A. Float switch assemblies shall be 316 stainless steel stems with 316 stainless steel floats and ABS plastic junction box. Transamerica Delaval Gems LS-800 series, or equal.

B. Instrically safe relays shall be Transamerica Delaval Gems Cat. No. 22445, or equal.

3. EXECUTION

3.1 INSTALLATION

A. Install motor control equipment in accordance with manufacturer's instructions.

B. Select and install heater elements in motor starters to match installed motor characteristics.

C. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

D. Install float switch assemblies plumb and as specified by the manufacturer.

E. Adjust float switches to operate at the liquid levels specified by the Engineer.

* * * END OF SECTION * * *

SECTION 16510
LIGHTING FIXTURES

1. GENERAL

1.1 WORK INCLUDED

A. Interior luminaires and accessories.

B. Exterior luminaires and accessories.

C. Lamps.

D. Ballasts.

E. Photocell Relays.

1.2 REFERENCES

A. ANSI C82.1 - Specification for Fluorescent Lamp Ballasts.

B. ANSI C82.4 - Specifications for High-Intensity-Discharge Lamp Ballasts (Multiple Supply Type.)

C. FS W-F-414 - Fixture, Lighting (Fluorescent, Alternating-Current, Pendant Mounting.)

D. NEMA LE 2 - H-I-D Lighting System Noise Criterion (LS-NC) Ratings.

1.3 SUBMITTALS

A. Submit product data under provisions of Section 01340.

B. Include outline drawings, lamp and ballast data, support points, weights, and accessory information for each luminaire type.

C. Submit manufacturer's installation instructions under provisions of Section 01340.

2. PRODUCTS

2.1 EXTERIOR LUMINAIRES AND ACCESSORIES

A. Enclosures: Complete with gaskets to form weatherproof assembly.

B. Provide low temperature ballasts, with reliable starting to 0 degrees F.

2.2 LAMPS

A. Fluorescent Lamps: Cool white; all by same manufacturer. See Lighting Fixture Schedule on Drawings for Type 'A' lamp.

B. Incandescent lamps: clear, rough service type. See Lighting Fixture Schedule on Drawings for Type 'B' lamp.

2.3 HID BALLASTS

A. HID Ballast: ANSI C82.4; selected by luminaire manufacturer.

B. LS-NC Rating: NEMA LE 2; equal to or less than ratings listed in Table C-1.

2.4 PHOTOCELL RELAY

A. Photocell relay shall be Hubble Cat. No. PTL-1, or equal.

3. EXECUTION

3.1 INSTALLATION

A. Install lamps in luminaires and lampholders.

B. Support surface-mounted luminaires directly from building structure.

3.2 RELAMPING

A. Relamp luminaires which have failed lamps at completion of Work.

3.3 ADJUSTING AND CLEANING

A. Align luminaires and clean lenses and diffusers at completion of Work. Clean paint splatters, dirt, and debris from installed luminaires.

B. Touch up luminaire finish at completion of work.

* * * END OF SECTION * * *