

2013 DAML Technical Specifications

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GENERAL PROVISIONS

1. SCOPE

This specification sets forth several items of work or conditions, which are required as integral parts of the successful completion of the Project. All items discussed herein are considered incidental to overall accomplishment of the Project and no separate payment shall be made therefore. **In these Technical Specifications each section defines scope of work and certain aspects of that work. Any work discussed in a Technical Specification not listed as a bid item shall be considered incidental to the Technical Specifications unless otherwise directed by the ENGINEER.**

When a Technical Specifications refer to a specification outside of these documents it shall refer to the current edition unless stated otherwise in the Contract Documents.

2. GENERAL DEFINITIONS

The following definitions clarify, supplement and/or amend those provided in APPENDIX C-“FINANCE and ADMINISTRATION CABINET GENERAL CONDITIONS.

- a). The term “Kentucky Division of Abandoned Mine Lands” may also be referred to in these Technical Specifications as “DAML” or “AML” and all refer to the same identity.
- b). The terms "Design Drawings", "Drawings", “Standard Details” and "Plans" are synonymous and all refer to the set of design drawings or standard details as published by AML.
- d). The term "ENGINEER" as used herein shall mean a Kentucky Division of Abandoned Mine Lands representative who is a licensed Professional Engineer in the Commonwealth of Kentucky and has administrative and engineering oversight authority for the project. This individual shall be identified at the Pre-Construction Conference.
- f). The term “Supervisor” as used herein shall mean the Kentucky Division of Abandoned Mine Lands representative who is the direct supervisor of the Resident Inspector.
- g). The term “Technician” as used herein shall mean the Kentucky Division of Abandoned Mine Lands representative who gives technical advice for the project to which they are assigned.
- h). The term “Resident Inspector” or “Inspector” as used herein shall mean the Kentucky Division of Abandoned Mine Lands or its representative who is assigned to monitor the daily construction activities for the project to which they are assigned.
- i). The term “CONTRACTOR” shall refer to the prime contractor who has obtained the contract and is responsible for the execution of the contract. It shall not refer to any of the CONTRACTOR’s sub-contractors.

- j). For the purposes of this Agreement, the "Contract Period" is defined as that time required for completion of this reclamation project in accordance with the existing Drawings and Specifications including any extensions approved by official change orders. This definition augments but does NOT amend Article 1.17 of the General Conditions.
- k) The term "BMP" shall refer to the Division of Abandoned Mine Lands Erosion and Sediment Control Best Management Practices (BMP) Plan.

3. **QUANTITY UNIT DEFINITIONS**

- a). **Lump Sum (LS)**: When this term is used as an item of payment, it shall be inferred that the complete structure, structural unit, or element of work is specified as the unit measurement. As such, it will be construed to include all necessary fittings and accessories, labor, equipment, and other incidentals required for installation. No final measurement will be made.
- b). **Each**: The definition for Lump Sum applies to the term "**Each**" except more than one may be included in the Project and the actual number installed will be the final measurement.
- c). **Plan (or Design) Quantity (PQ)**: When the "**Plan Quantity**" for a specific portion of the Project is designated as the method of payment in the Contract Documents, it shall be the final quantity for which payment will be made for such specified portion unless a significant computational error is encountered or the corresponding dimensions shown in the Drawings are revised by the ENGINEER.
- d). **Unit Price (UP)**: When "**Unit Price**" quantities for a specific portion of the Project are designated in the Contract Documents as the pay quantity, actual quantities for such specified portion will serve as the basis for payment. Actual quantities shall be determined by the differences in measurements taken before and after construction.
- e). **Actual Cost Units (ACU)**: When "**Actual Cost Units**" are designated as the method of payment, it shall be only for those documented costs directly associated with the completion of the specific work item that has been designated for this type of payment method. The CONTRACTOR shall supply the ENGINEER with all of the necessary documents supporting costs incurred by the CONTRACTOR to qualify for payment. Actual Cost will be paid for and measured in "**Actual Cost Units (ACU)**" and each unit shall equal the sum of \$1.00.

4. **MEASUREMENT DEFINITIONS**

All work completed under this Contract will be and/or has been measured by the ENGINEER according to United States standard measure. The following terms apply:

- a). **Linear Feet (LF)**: All items measured by the linear foot, such as pipe, guardrail, drains, etc., will be measured along or parallel to the baseline and/or centerline upon which such items are placed or constructed, unless specified otherwise on the Drawings or in subsequent sections of the Technical Specifications. No allowances will be made on installed items for fittings or laps at connections. (When used, the term "**station**" will be 100 linear feet measured horizontally.)
- b). **Areas and Volumes**: Areas and cross-sections determined in the field shall utilize standard surveying techniques. For the purpose of ascertaining quantities, it is agreed that the planimeter shall be considered an instrument of sufficient precision adapted to the measurement of areas **as well as computers**. In computing volumes of excavation and embankments, the average-end-area method will be used.
- c). **Surface Area**: Surface area, when used in these specifications, shall mean the actual area of expanded surface taking into account the configuration and slope of the item of work being measured, i.e., slope distances.
- d). **Horizontal Plane Area**: Horizontal plane area, when used in these specifications, shall mean the area of projection of the surface area on a horizontal plane. Unless otherwise noted, any reference to a unit of measurement for "area" shall be interpreted to mean horizontal plane area.
- e). **Weight**: When weight is used as the measurement standard, certified tickets, invoices, or tags for such items must be furnished to the ENGINEER. (When used, the term "ton" will mean 2,000 pounds avoirdupois.)

5. **CONTRACT DOCUMENTS ORDER OF PRIORITY**

In the event of conflicts between the various elements of these Contract Documents, the order of precedence shall be as follows:

1. Addendum
2. AML Contractual Obligations & Requirements (includes Bid Item Description)
3. AML Special Conditions/Notes
4. AML Design Drawings/Plans
5. AML Technical Specifications
6. AML Standard Details
7. Bid Schedule

6. **SUBCONTRACTING**

- a). The division of the Technical Specifications into sections and/or subsections is done for convenience of reference and is not intended to control the CONTRACTOR in dividing work among SUBCONTRACTORS or to limit the scope or type of work performed by any trade.

- b). If the CONTRACTOR intends to subcontract portions of the work, this intent shall be indicated and the areas identified in the space provided in the Form of Proposal.
- c). After the Award of Contract, the CONTRACTOR shall not modify and/or add additional subcontracting without prior written approval of the ENGINEER. No subcontracting of the work or assignment of the contract shall in any case release the CONTRACTOR of his liability under the contract and bond.
- d). The CONTRACTOR shall provide and maintain the proper plant facilities, clerical personnel and field superintendents for proper management and coordination of SUBCONTRACTORS and own forces as well as for providing and maintaining direct lines of communication between the PRIME CONTRACTOR and the ENGINEER. The ENGINEER shall not be required to deal directly with SUBCONTRACTORS of the CONTRACTOR. Failure of the CONTRACTOR to provide proper and qualified field management services will be cause for termination of the contract.

7. FUND AUTHORIZATION

Funds for this Project have been authorized by the U.S. Department for Interior, Office of Surface Mining, under the provisions of Title IV of Public Law 95-87. Funds are secured by a U.S. Treasury Letter of Credit. Federal funds will be released to the Kentucky State Treasurer to cover the CONTRACTOR'S periodic billings. On the basis of an approved invoice amount, the DAML will coordinate the release of federal funds and the payment to the CONTRACTOR by the COMMONWEALTH. All payments shall be by state checks issued by the Kentucky State Treasurer. This project is 100 percent federally funded unless otherwise stated.

8. SUBSURFACE INFORMATION

Site-specific geotechnical information is limited. Without regard to the materials encountered, all excavation shall be unclassified. It shall be distinctly understood that any reference to rock, soil, or any other material in the Drawings or in the Technical Specifications, whether in numbers, words, letters, or lines, is solely the COMMONWEALTH'S information and is not to be taken as an indication of classified excavation or the quantity of rock, soil, or any other material involved.

9. EXISTING CONDITIONS & REPAIR OF DAMAGE

The DAML will document pre-project conditions of items within the project area using video and photographic measures, however, the CONTRACTOR document any existing damage themselves. Any damage that is not documents prior to the work may be considered as caused by the CONTRACTOR and may require correction.

Any damage done to structures fills, roadways, or other areas not directed as part of the project or by the ENGINEER or caused by neglect on the CONTRACTOR'S part shall be repaired at the CONTRACTOR'S expense before final payment is made. In the event such damage occurs as a

result of instructions from the ENGINEER, payment will be made at the bid unit price for such item or in a lump sum as agreed to by both parties.

10. PROPERTY OWNER CONSIDERATION

Authority to enter and reclaim private property is obtained by written consent of the owner and is pursuant to Title IV of the Surface Mining Control Act of 1977, 30 U.S.C. 1231, and KRS 350.150. The COMMONWEALTH, in complying with these provisions, does not obtain title or rights to any property within the project area. All rights to property and existing materials within the project area will therefore remain the property of the owner.

Materials having a salvage value (coal, oil, gas, precious metals, timber, topsoil, etc.) shall remain the property of the owner. Salvageable material rejected by the owner shall become the responsibility of the CONTRACTOR to dispose of in a proper manner subject to the approval of the ENGINEER.

During the construction process it may happen that a property corner or property fence is disturbed as identified by the property owner(s). Every effort shall be made during the design phase to identify property corner or property fences. However, there are certain instances that they have not been identify either by DAML or the property owner. If the property corners or property fences have to be disturbed due to construction they will be surveyed and referenced to be returned to their original spot. It shall be noted that once property corners or property fences are reset the DAML does not certify those as actual property corners or property fences. To determine actual boundary lines an actual survey conducted by a licensed Land Surveyor in the Commonwealth of Kentucky will be required to establish property lines. The actual property owner(s) will be responsible for the establishment of said lines and not the COMMONWEALTH.

11. EQUIVALENT PRODUCTS/MATERIALS

The use of alternative/equivalent products and/or materials must be approved in writing by the ENGINEER prior to ordering or using the product/materials. The CONTRACTOR must submit to the ENGINEER all certifications, testing results, specifications, and any other information that may be helpful for the approval of the product/material. If the product/material is approved the CONTRACTOR and manufacture or supplier will be notified in writing of the determination and its use or limitations.

12. BLASTING RESTRICTIONS

It is the intent of the Project to accomplish the required work without the aid of blasting. Therefore, no blasting will be permitted, unless the CONTRACTOR has exhausted all appropriate alternatives to accomplish the required work. Once the CONTRACTOR has reached a decision to use blasting in the accomplishment of the work, he shall prepare written documentation outlining the blasting plan and requesting approval from the ENGINEER at least two (2) weeks in advance of such work. The ENGINEER (both the project engineer and the Division of Abandoned Mine Lands) will review the request and either approve or deny the

request in written form. If blasting is permitted, it shall comply with all applicable state (KRS Chapter 351, 805 KAR 4:010 through 4:150) and federal laws and the “Earthwork” section of these Technical Specifications.

13. COAL REMOVAL

No coal, refuse, or other mineral resources shall be removed neither from the project area nor from the construction areas in conjunction with this contract.

14. PRE-BID CONFERENCE

A Pre-Bid Conference will be held on site as determined by the bid documents. The Pre-Bid should be attended by representatives of the COMMONWEALTH (i.e. representatives of AML) and Contractors interested in bidding on the Project. There will be only one Pre-Bid Conference where questions can be asked at the site. No other conference will be held before the Bids are placed but the COMMONWEALTH will answer questions by the Contractor(s) through phone calls, e-mails, etc. **No individual site visits by the Contractor(s) or representatives of the COMMONWEALTH shall be held.**

15. METHOD OF BIDDING

The Bidder must use the Form of Proposal and Bid Schedule furnished by the COMMONWEALTH. All data and other information requested must be supplied. The bidder must submit unit price bids, extended and totaled, on all items contained on the Bid Schedule, regardless of whether the individual items of work are to be let by "Unit Price", "Lump Sum", "Actual Cost", or "Plan Quantities" as defined in Subsection 3.

The submission of a bid will be construed as evidence that a site visit and examination have been made, that the bidder is thoroughly familiar with, understands and agrees to all terms and intents of the Contract Documents, and that any conflicts within the documents or between the documents and other written instructions or verbal statements have been resolved to the satisfaction of the bidder. Claims for labor, equipment, materials, or other costs required due to difficulties which could have been foreseen had an adequate examination of the site been made, the Contract Documents read thoroughly and clarification sought will not be recognized.

16. AWARD OF CONTRACT

Award of Contract will be made to the qualified bidder submitting the low total bid amount as determined by the Finance and Administration Cabinet. The unit prices will control and extensions and totals will be checked. An obvious case of unbalanced bidding will be considered sufficient grounds for rejection of the entire bid. The COMMONWEALTH reserves the right to reject any and all bids if it is deemed to be in the best interest of the COMMONWEALTH.

17. PRE-CONSTRUCTION CONFERENCE

Following the signing of the Contract Documents and prior to the actual beginning of the construction, a pre-construction conference will be held. Representatives of the DAML, the CONTRACTOR, including any SUBCONTRACTORS, the Finance and Administration Cabinet, as well as other interested agencies and parties will be present to discuss the time and sequence for construction, methods and plans of operations, payment and other relevant questions. The time and locations of this meeting will be the responsibility of the DAML in consultation with the other parties.

18. WORKING HOURS & EXCUSED WORK DAYS

Critical working hours on this project shall be from 8:00 a.m. to 4:30 p.m., Monday through Friday, for the duration of the construction project. Critical work items, as determined in writing by the ENGINEER, will be scheduled for work during these times. The ENGINEER may approve Critical Work, at his sole discretion, at other times when the performance of such work is in the best interest of the COMMONWEALTH. If the CONTRACTOR performs Critical Work outside working hours or without prior approval of the ENGINEER, the ENGINEER is under no obligation to accept or pay for such work.

Emergency work, such as necessary pumping, fire quenching, smoke/fume control, or utility repair shall be completed as required, but the CONTRACTOR shall provide the ENGINEER as much notice as is practicable.

Non-critical work, as determined by the ENGINEER, that does not require the ENGINEER (or his representative) to be on site may be completed between the hours of 7:00 a.m. - 7:00 p.m., Monday through Saturday, if requested by the CONTRACTOR and approved by the ENGINEER.

The ENGINEER will provide a Resident Inspector during critical working hours. During these days, the Resident Inspector will keep a record of the weather and if conditions are suitable for working or not workings. These will be recorded as excused/non-excused work days. Holiday's recognized by the Commonwealth and weekends are not included in the excused/non-excused critical work day calculations. At the end of the project the net excused days will be calculated by subtracting the non-excused days from the excused days to determine the amount of weather related excused days that **may** be added to the contract by the ENGINEER. The ENGINEER is under no obligation to extend the contract due to weather related/excused days.

19. TEMPORARY SHUTDOWNS

The COMMONWEALTH desires to complete the project in the timeliest manner possible. However, in the event an extended construction "shutdown" is requested by the CONTRACTOR, due to circumstances beyond the CONTRACTOR'S control, the CONTRACTOR will be required to dress all disturbed areas to a reasonable smooth configuration, as approved by the ENGINEER, protect the areas in accordance with the provisions of "Revegetation" section of the Technical Specifications, and maintain sediment

control structures during this period. Such work shall include the applications of mulch, seed and/or netting, as directed by the ENGINEER. The COMMONWEALTH shall incur no additional costs for such work, or for the expense of demobilization or remobilization.

Areas that are not to final grade where construction has ceased for a period of 14 days or longer and soil stockpiles shall receive temporary mulch no later than 14 days from the last construction activity in that area.

All temporary shutdowns shall comply with the DAML's Erosion and Sediment Control BMP.

20. PROJECT INSPECTION/CONTROL OF WORK

Inspection of all construction features (i.e. quality control) shall be performed by;

**Division of Abandoned Mine Lands
2521 Lawrenceburg Road,
Frankfort, Kentucky 40601**

The ENGINEER and his representatives shall at all times have ready access to the project area. The control of work shall be as follows:

20.1. **Authority of the ENGINEER:** The ENGINEER will decide all questions regarding the quality and acceptability of materials furnished, work performed, and the rate of progress of the work; all interpretation of the Plans and Specifications; the acceptable fulfillment of the Contract and all changes to the documents including approval of all change orders in accordance with acceptable policies now in place. The ENGINEER will, in writing, suspend the work, wholly or in part when the CONTRACTOR fails to correct conditions unsafe for the workmen or the general public; for failure to carry out Contract provisions; for failure to carry out orders; for periods of unsuitable weather; for conditions unsuitable for the prosecution of the work; or for any other condition or reason determined to be in the public interest. To prevent misunderstanding, the ENGINEER, within a reasonable time, will decide any and all questions concerning the quality and acceptability of materials furnished, work performed, and as to the manner of performance and rate of progress of the work. The ENGINEER will decide all questions concerning the interpretation of the Contract relating to the work, and all questions concerning the acceptable fulfillment of the work performed by the CONTRACTOR. The ENGINEER will determine the quantity and quality of the several kinds of work performed and materials furnished that the COMMONWEALTH will pay for under the Contract, and such decision and estimate will be final and conclusive. In case any question arises, the Engineer's estimate will be a condition precedent to the right of the CONTRACTOR to receive any money due under the Contract. The ENGINEER will answer any questions as to the meaning of the Contract, or any obscurity as to the wording of the Contract and give all directions and explanations necessary to make definite any of the provisions of the Contract, or necessary to complete or give them due effect.

The CONTRACTOR may request and the ENGINEER will provide written instructions concerning any significant item.

20.2. **Authority of Supervisor:** Supervisor's shall make sure that the contract documents are being enforced. However, supervisors may not make any changes to the contract documents without written approval from the ENGINEER but can recommend changes to the ENGINEER. The supervisor will be responsible for the inspector's work and conduct. The supervisor shall check all work/documentation generated by the inspector and certify the work/documentation. Supervisors shall certify but not approve pay vouchers submitted by the CONTRACTOR.

20.3. **Authority of the Technicians:** The Technician is responsible to check jobs to insure contract documents are being enforced. However, Technicians cannot make changes to the contract documents without written approval of the ENGINEER, but can recommend changes to the ENGINEER. Technician's will not be responsible for the inspector's conduct but may notify the ENGINEER and Supervisor of any actions by the Resident Inspector that may not be in accordance with the contract, outside the scope of work, or detrimental to the COMMONWEALTH. The Technician will provide technical assistance to the inspector to clarify the contract documents when appropriate.

20.4. **Authority of Resident Inspectors:** Resident Inspectors employed by the COMMONWEALTH are authorized to inspect all work performed and materials furnished. Such inspection may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials furnished. The resident inspector shall advise the ENGINEER, Supervisor or Technician if any part of the work does not meet the contract documents and shall document any deficiencies. The resident inspector is not authorized to alter or waive provisions of the Contract. The resident inspector is not authorized to issue instructions contrary to the Contract, or to act as foreman for the CONTRACTOR. However, the resident inspector has the authority to reject work or materials until any questions are referred to and decided by the ENGINEER. Resident inspectors are required to document each day's work (inspection forms, pictures etc.) as approved by or directed by the ENGINEER to ensure the contract documents have been met. Resident inspectors shall certify but not approve pay vouchers submitted by the CONTRACTOR.

21. PROJECT EXTENT

The CONTRACTOR shall be responsible for satisfying himself as to the construction limits for the Project. The CONTRACTOR shall not establish work, storage, or staging areas outside the project limits, unless otherwise directed or approved by the ENGINEER

22. STAKING AND MARKING

22.1. **General:** Prior to the beginning of construction, the ENGINEER will stake the plan baselines and provide the CONTRACTOR with information regarding reference points for reestablishment of lines and bench marks as necessary; and will mark the construction limits. It is the CONTRACTOR'S responsibility to maintain all lines, points, and bench marks in an undisturbed state. The CONTRACTOR shall use the baseline and cross-sections shown on the plans for all volume estimates presented to the ENGINEER. No consideration will be given to

any quantities derived from other baselines or cross-section configuration. Truck counts shall not be used as a method to measure volumes but may be used for estimating purposes.

22.2. **Grade Staking**: Grade staking shall be the responsibility of the CONTRACTOR. Grade staking includes staking of all earthwork areas prior to and during performance of the required work. Staking is to be performed as necessary to assure the lines and grades specified on the Drawings are achieved. As a minimum, staking is to be updated monthly as the work progresses. The ENGINEER may direct more frequent updating as may be necessary to keep lines, grades, cut and fill designations current throughout construction. The CONTRACTOR shall be required to stake design grade lines a maximum of 100 feet apart.

Construction staking as specified is required to adequately delineate earthwork areas (both excavation and embankment); to provide horizontal and vertical control necessary to monitor the progress of the work, and to accurately define the alignment of appurtenances; to maintain plan baselines; to permit field adjustments where necessary; and to facilitate timely verification of progress estimates.

22.3. **Pre-Excavation and Backfilling Requirements**: Prior to any excavation or backfilling efforts, the CONTRACTOR shall be required to contact **Kentucky Underground Protection Inc. (KUP) (ph. 1-800-752-6007)** to obtain information concerning potential underground utilities within the project limit(s). All utilities that may be discovered by KUP shall be marked in the field AND disclosed to the ENGINEER. **No excavation or backfilling work of any type shall begin until the ENGINEER has given approval.**

22.4. **Cross-Sectioning**: The ENGINEER shall be responsible for cross-sectioning earthwork areas to determine "Actual Quantities", if required. Volumes shall be determined by before and after cross-sections conducted by DAML or its representative. Initial sections will be taken following site preparation and before earthwork is started.

23. PROTECTION AND SECURITY

The CONTRACTOR must exercise care in all phases of construction to prevent damage and/or injury to the life and property of others. In addition to other provisions of these Contract Documents, the CONTRACTOR shall be responsible for providing adequate security for his work areas, storage areas, office, equipment, and any other items or areas that he is using. Neither the COMMONWEALTH nor the property owners will be responsible for any damages attributable to insufficient site security, carelessness, or failure to comply with the provisions and intent of these Contract Documents.

The CONTRACTOR will ensure that site access is controlled through appropriate safety devices including plastic safety fences. Installation of temporary safety fences is required around any open trench or pit during construction and is incidental to the overall project work.

24. CONTRACTOR'S FACILITIES

The CONTRACTOR shall provide all temporary facilities for the proper completion of the work, as necessary and as specified.

24.1. **Sanitary Facilities**: The CONTRACTOR shall provide and maintain a portable toilet and all other necessary sanitary facilities at the site, in accordance with all applicable regulations, and shall properly remove same at completion of the Project.

24.2. **Utilities**: The obtaining of all utilities, which may be required for the construction, shall be the responsibility of the CONTRACTOR.

25. PROGRESS MEETINGS AND ESTIMATES

The ENGINEER the CONTRACTOR'S make available a representative who shall have authority to make binding decisions on behalf of the CONTRACTOR for progress meetings. These meetings may cover pay estimates for work performed, any construction problems which may have developed, review the scope of work proposed, and evaluate current progress versus the CONTRACTOR'S schedule of construction.

The CONTRACTOR shall be allowed to submit one (1) invoice for completed work every thirty (30) calendar days. The contractor must submit at least one (1) invoice every sixty (60) calendar days during the contract period for the work performed or completed since the previous invoice.

26. SCOPE OF PAYMENT

The contract prices - whether based on Each, Lump Sum, Plan (or Design) Quantity, Actual Cost, or Unit Price for the various bid items of the Contract Documents, shall be considered full compensation for all labor, material, equipment, and incidentals required for the complete incorporation of the item into the Project.

27. COMPENSATION FOR CHANGED QUANTITIES

The ENGINEER reserves the right to increase or decrease the actual quantities as site conditions warrant. When revised dimensions result in an increase or decrease in the quantities of such work, the final quantities for payment will be the amount represented by the authorized changes multiplied by the unit prices bid for such items **and covered by an approved change order.**

The quantities shown on the Bid Schedule and elsewhere in the Contract Documents represent the ENGINEER'S estimate of the amount required to accomplish the design intent. Reasonable care in computing and verifying such numbers has been used, particularly in the case of payment items for which Plan Quantities or Lump Sum is stated as the method of payment. In the event errors beyond those normally expected for the computational base are discovered, fair and reasonable adjustments may be made by the COMMONWEALTH based on the unit prices bid and the revised quantities. In such instances, tolerances provided in the Technical Specifications for particular work items may also require adjustment.

The use of Plan Quantities and Lump Sum methods of payment for selected work elements is intended to be in the best interest of the COMMONWEALTH, the ENGINEER, and the CONTRACTOR. The practice is not intended to be a mechanism by which risks associated with engineering computations is transferred to the CONTRACTOR.

28. EXTRA WORK

The CONTRACTOR shall perform extra work for which there is no quantity or price in the Bid Schedule only when directed to do so in writing by the COMMONWEALTH. Such work will be paid for at a lump sum price or at unit prices stipulated in a Change Order. No work shall commence until the CONTRACTOR is notified that the change order has been approved and is official.

29. INVOICING

The CONTRACTOR will call their assigned AML Field Office to notify the Administrative Specialist of their intention to invoice and to schedule an appointment. The AML Administrative Specialist will generate the electronic invoice for review by the residential inspector and supervisor before the contractor arrives.

During the appointment, the CONTRACTOR will be given a workstation to review the invoice. If any questions are raised about quantities or monies, then AML personnel will use the Resident Inspector's daily inspection reports and any other applicable AML reports and/or databases for verification of this information. If any information appears incorrect, the invoice will be reviewed again by the Resident Inspector and Supervisor.

Once the CONTRACTOR, Residential Inspector, and Supervisor are in complete agreement, then the CONTRACTOR will electronically sign the invoice and save the file. The Administrative Specialist will verify the saved file and make certain that it is signed and readable, then initiate the invoice through the approval process.

30. CLEAN UP

After all construction work is complete and prior to final inspection, all exposed areas shall be cleaned and left in a slightly condition. All unused materials, including but not limited to, channel lining larger than 6" and tree limbs and roots larger than 2" in diameter shall be removed and disposed of properly. Any disturbed areas shall be seeded in accordance with the applicable specification. The cleanup shall also include the removal of any trash and debris currently deposited within the project work limits or deposited during the contract period. The trash and debris shall be transported to an approved landfill in accordance with the Technical Specifications.

The Contractor shall also clean out behind all silt structures, i.e. silt checks, silt fence, silt basins, rock checks or any other place where sediment has been allowed to accumulate.

31. FINAL INSPECTION

Once the project is considered complete a Final Inspection will be held on site for all interested parties to review the Project and make sure that the intent of the Project has been met and that the Project has complied with the Contract Documents. Changes to the Contract shall be noted at this time. Also any deficiencies shall be noted at this time and a time table set to correct those deficiencies. Another site visit will not be required once the deficiencies are corrected but all interested parties will be notified that the deficiencies have been corrected and the Project deemed complete.

The Final Invoice for the project will not be processed until the Final Inspection is complete and all deficiencies are corrected.

32. ACTUAL DAMAGES

Actual Damages, not a penalty, shall be levied for each work day required to complete the project beyond the Contract Period. The damages shall be the exact administrative cost incurred by the DAML calculated using labor and travel expenses of the resident inspector, the project engineer, the field office supervisor and the environmental technologist for every day worked that exceeds the Contract Period.

33. GUARANTEE

The CONTRACTOR shall assume responsibility for all workmanship and materials for a period of one year from final payment. Any work found to be defective due to failure to comply with the provisions and intent of the Contract Documents shall be replaced at the CONTRACTOR'S expense.

34. PROOF OF COMPLIANCE

Whenever the Contract Documents require that a product be in accordance with Federal Specifications, ASTM designations, ANSI specifications, or other association standards, the CONTRACTOR shall present a certification from the manufacturer that the product complies therewith. When specified, the CONTRACTOR shall submit supporting test data to substantiate compliance.

All Certifications shall be maintained at the job site by the inspector and should be available upon request. Once the job is complete all certifications shall be place in the project file. Materials required to have proper certification(s) shall not be paid for until the proper certifications are produced.

35. TESTING

During the construction process there are certain sections of these Technical Specifications that require testing to insure that the Technical specifications are being adhered to. The Inspector, CONTRACTOR and ENGINEER shall be familiar with those tests as required and insure they

are done in accordance with these Technical Specifications. The Engineer at any time may require that additional tests be done to insure that the Technical Specifications are adhered to.

35.1. **Codes and Standards**: Testing, when required, will be in accordance with all pertinent codes and regulations and with selected standards of the American Society for Testing and Materials (ASTM) and the Kentucky Transportation Cabinet's Kentucky Methods. All testing shall be done by certified personnel.

35.2. **Payment for Testing Services**

35.2.1. **Initial Services**: The COMMONWEALTH will either pay or provide for all initial testing services which are required by the ENGINEER.

35.2.2. **Retesting Services**: When initial tests indicate non-compliance with the required specifications, all subsequent retesting made necessary by the non-compliance shall be paid by the CONTRACTOR.

35.2.3. **Contractor's Convenience Testing**: Inspection of testing performed exclusively for the CONTRACTOR'S convenience shall be the sole responsibility of the CONTRACTOR.

35.2.4. **Cooperation with the Testing Laboratory**: Representatives of the testing laboratory shall have ready access to the work at all times. The CONTRACTOR shall provide facilities for such access in order that the laboratory may properly perform its functions.

36. **ROADS**

36.1. **General**: The contractor will be responsible for keeping all roads clear of debris, mud, and loose gravel at all times during the project. For work within a public road right-of-way (Federal, State, and Municipal) all materials must be from approved sources on the KY Transportation Cabinet's Approved Materials list.

36.2. **State/Federally Maintained Roadways**: Damage to state and/or federally maintained roadways caused by accessing the job site shall be repaired by the CONTRACTOR unless work (i.e., culvert installation, roadway ditch, etc.) has been designated on the Drawings. The CONTRACTOR shall be responsible for adhering to all state and federal regulations that govern the roadway(s) he travels to access the job site.

36.3. **Public and/or Private Roadways**: Damage to public and/or private roadways caused by the CONTRACTOR during the contract period, and in order to mobilize equipment and supply materials to the site, shall be paid for under the Contract Documents. Use of a public and/or private route and/or roadway shall be submitted to the ENGINEER for approval.

36.4. **Haul Roads**: The CONTRACTOR, when required to use existing haul roads, shall upgrade the road to allow for proper surface drainage and a suitable roadway base as necessary to accommodate the required construction during all weather conditions. Upgrading of the haul

road shall be paid for under the Contract Documents. A plan to upgrade haul roads, unless already provided for in the plans, shall be submitted to the ENGINEER for approval.

36.5. **On-Site Construction Roads**: Roads constructed between work areas and/or waste areas for the convenience of the CONTRACTOR to accomplish the reclamation, as shown on the Drawings, shall be reclaimed following use to a stable, free draining configuration and vegetated in accordance with these Technical Specifications and appropriate barricades placed across said road to prevent ingress to the areas, at no expense to the COMMONWEALTH.

37. MAINTAINING STREAM FLOW

The CONTRACTOR shall obtain approval from the ENGINEER for temporarily blocking the flow of any stream within the project limits, if required. Consideration of downstream property owners must be made prior to blocking or releasing flow of the stream.

Should any existing culverts become inoperable or damaged because of work required under this Contract; the CONTRACTOR will immediately restore it to an operable condition. Existing culverts designated for cleaning shall be accomplished without any additional interference to flow at locations shown on the Drawings and with the approval of the ENGINEER.

Maintenance of stream flow shall be considered incidental to the overall accomplishment of the project.

38. DUST CONTROL

The CONTRACTOR shall be responsible for minimizing the generation of dust outside of the project limits. The CONTRACTOR shall be required to maintain all excavations, embankments, stockpiles, haul roads, permanent access roads, plant sites, waste areas, and all other work areas within or without the project boundaries free from dust, which would cause a hazard or nuisance to others. Approved temporary methods of stabilization consisting of sprinkling, chemical treatment, light bituminous treatment or similar methods will be permitted to control dust. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs.

39. SEDIMENT CONTROL

The CONTRACTOR will be responsible for control of siltation and erosion from the project within the construction limits of the project site. Control shall include all necessary measures to minimize the deposition of materials in downstream areas. The CONTRACTOR shall attempt to schedule construction activities so that the amount of exposed soil is minimized. This is to be accomplished by disturbing only those areas, which are to be worked immediately, and by vegetating each area as soon as practical. In addition, all silt control measures, as shown on the Drawings or as added by the ENGINEER, must be installed prior to construction activities in accordance with these Technical Specifications.

40. PERMITS

The CONTRACTOR shall obtain all applicable permits from state and federal agencies unless otherwise directed by the ENGINEER. **All permits or copies of permits obtained for the specified project shall be maintained at the site by both the Inspector and Contractor and be available upon request.**

41. CONTROL MEASURES

41.1 Solid Materials

No solid materials, including building materials, shall be discharged to waters of the U.S., except as authorized by a Section 404 permit and directed by the plans or Engineer. This includes rock and/or soil materials.

41.2 Waste Materials

All waste materials that may leach pollutants (paint and paint containers, caulk tubes, oil/grease containers, liquids of any kind, soluble materials, etc.) will be collected and stored in appropriate covered waste containers. Waste containers shall be removed from the project site on a sufficiently frequent basis as to not allow wastes to become a source of pollution. All personnel will be instructed regarding the correct procedure for waste disposal. Wastes will be disposed of in accordance with appropriate regulations. Notices stating these practices will be maintained on site by the contractor and the DAML onsite inspector.

41.3 Hazardous Waste

All hazardous waste materials will be managed and disposed of in the manner specified by local or state regulation. The contractor shall notify the DAML onsite inspector if there are any hazardous wastes being generated, and provide a plan for the management and disposal of such materials. Site personnel will be instructed with regard to proper storage and handling of hazardous wastes when required. These practices will be used to reduce the risks associated with all hazardous materials.

- a) Products will be kept in original containers unless they are not re-sealable.
- b) Original labels and material safety data sheets (MSDS) will be reviewed and retained.
- c) Contractor will follow procedures recommended by the manufacturer when handling hazardous materials.

41.4 Spill Prevention

Good housekeeping and material management practices will be used to reduce the risk of spills or other exposure of materials and substances to the weather and/or runoff.

Manufacturers' recommended methods for spill cleanup will be maintained on site and readily available upon request. All personnel will be made aware of procedures and the location of the information and cleanup supplies.

Materials and equipment necessary for spill cleanup will be kept in the material storage area. Equipment and materials will include as appropriate, brooms, dust pans, mops, rags, gloves, oil absorbents, sand, sawdust, and plastic and metal trash containers.

All spills will be cleaned up immediately after discovery.

The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with a hazardous substance.

Spills of toxic or hazardous material will be reported to the appropriate state/local agency as required by KRS 224 and applicable federal law.

The spill prevention plan will be adjusted, as needed, to prevent spills from reoccurring and improve spill response and cleanup.

Spills of products will be cleaned up promptly. Wastes from spill clean-up will be disposed of in accordance with appropriate regulations.

41.5 **Petroleum Products**

Vehicles and equipment that are fueled and maintained on site will be monitored for leaks, and receive regular preventative maintenance to reduce the chance of leakage. Petroleum products onsite will be stored in tightly sealed containers, which are clearly labeled and will be protected from exposure to weather. The Contractor shall not have a total of over 1,320 gallons of petroleum products on site at any given time. The total combined storage capacity of greater than or equal to 1,320 gallons of petroleum products requires an Oil Pollution Spill Prevention Control and Countermeasure plan per 40 CFR 112.

41.6 **Fertilizers**

Fertilizers will be applied at rates prescribed by the contract, standard specifications or as directed by the resident engineer. Once applied, fertilizer will be covered with mulch or blankets or worked into the soil to limit exposure to storm water. Storage will be in a covered shed. The contents of any partially used bags of fertilizer will be transferred to a sealable plastic bin to avoid spills.

41.7 **Concrete Truck Washout**

Concrete truck mixers and chutes will not be washed on pavement, near storm drain inlets, or within 75 feet of any ditch, stream, wetland, lake, or sinkhole. Where possible, excess concrete and wash water will be discharged to areas prepared for pouring new concrete, flat areas to be paved that are away from ditches or drainage system features, or other locations that will not

drain off site. Where this approach is not possible, a shallow earthen washbasin will be excavated away from ditches to receive the wash water.

ACCESS GATE

1. SCOPE

The work shall consist of furnishing all materials, equipment, and labor necessary to construct the access gate (or barriers) at the locations and in accordance with the details shown on the Drawings.

2. TYPES

2.1. **Farm Gates**: The gates and supports shall be made of either 1 3/4" diameter welded tubular steel (6 bars) or 5 5/8" wide galvanized panels (5 panels).

2.2. **Pipe Gates**: Pipe gates and there supports shall be made of a 2 1/2" diameter schedule 40 steel.

2.3. **Cable Gates**: Cable gates shall be made of 1" diameter steel cable with appropriate clamps.

3. MATERIALS

3.1. **Pipe**: The gate and supports shall be constructed of schedule 40 steel pipe -- 2 1/2" diameter, except the "swing sleeve" which shall be 3" diameter pipe.

3.2. **Plate Steel**: Top plates, stop plates, and lock plates shall be fabricated of 3/16" steel plate.

3.3. **Concrete**: Shall be Class A concrete conforming to the "Concrete" section of these Technical Specifications.

3.4. **Posts**: Posts shall be either 6" diameter pipe, 12" diameter treated post or 8" x 8" treated posts, each set in concrete with the appropriate hinges and lock plates.

3.5. **Hinges**: Hinges shall be appropriate to the type of gates and posts used to construct the barrier and as approved by the ENGINEER.

3.6. **Locks**: Locks shall consist of an appropriate commercial lock and either chain or lock plate(s). Locks shall have four keys (two to the property owner and two to the Commonwealth).

3.7. **Signs**: When required, signs attached to the gates shall be installed as shown on the Drawings or as directed by the ENGINEER.

3.8. **Grout**: Shall conform to the "Grout" section of these Technical Specifications.

3.9. **Fence:** The fence shall be woven wire, either aluminum coated steel No. 1047-6-9 or zinc coated steel No. 1047-6-9. All corner posts, intermediate posts, and accessories shall be fully galvanized coated. All fence fittings shall comply with ASTM F 626.

4. CONSTRUCTION

Upon completion of the access gate the ENGINEER shall determine the need and exact locations for the fencing. The fencing shall be erected and installed in accordance with the manufacturer's recommendations. The CONTRACTOR shall be responsible for placement of 2 cubic feet of grout at each post. The CONTRACTOR shall make sufficient provisions, which will allow the posts to be set at specified depths and alignment. The fence shall be erected after completion of all other work items in the vicinity.

5. FABRICATION

All elements of the gate/barrier shall be shop fabricated, except the top plate for the hinge (swing) post may be field welded. The welding material and procedures shall comply with the American Welding Society's Structural Welding Code D1.1, current edition, with modifications and/or additions as may be stated on the Drawings or as directed by the ENGINEER.

6. INSTALLATION

6.1. **General:** Installation shall be in accordance with the AML Standard Detail and/or as shown on the Drawings.

6.2. **Painting:** All steel materials shall be field cleaned and painted, unless otherwise directed by the ENGINEER.

BARRIER- BALE AND PLYWOOD

1. SCOPE

This work will consist of constructing a TEMPORARY wooden frame and stack of hay bales near the base of the slope as indicated on the Drawings or as directed by the ENGINEER. It also includes the complete removal of the wall when directed by the ENGINEER. This structure shall be installed prior to any surface disturbance on the slope or in the lower reaches of the drain channel.

2. MATERIALS

2.1. **Bales:** Either straw or hay bales may be used; typical of those described in the silt control section of these specifications under silt control. All bales are to be firmly bound by twine and securely fastened to the wood frame.

When protecting the bales with plastic it is recommended that black or white plastic be used instead of clear to prevent decay.

2.2. **Wooden Post:** All wooden post must consist of a single piece of treated wood and must be at least 4 inches by 4 inches square in cross section (nominal dimension) and 10 feet in height, available at most lumberyards.

2.3. **Plywood:** All sections of plywood used in construction must be solid wooden sections at least 4 feet in width by 8 feet in height and at least $\frac{3}{4}$ inch in width. **Plywood shall be marine plywood** and typical of plywood pieces which are available at most lumberyards. **Materials such as particleboard, chipboard etc. may not be substituted.**

3. INSTALLATION & REMOVAL

The exact location of the debris barrier wall is subject to adjustments based on site conditions. Installation shall be as depicted in the drawings and as directed by the ENGINEER. Some hand labor may be required to ensure adequate footing and strength of the wall. Once the wall is no longer needed in the opinion of the ENGINEER, it shall be completely dismantled and all wooden materials and fasteners removed from the job site and disposed of properly.

4. MAINTENANCE

During the course of the project the debris barrier wall(s) shall be maintained in sound condition. In the opinion of the ENGINEER, any feature (i.e. wood members, fasteners, haybales, etc.) of this item that found to be compromised shall receive maintenance work as soon as practical. **Accumulation of materials (i.e. soil, silt, rock, etc.) behind the wall greater than two (2) feet shall be removed** immediately. These materials shall be transported and placed within a designated waste area as directed by the ENGINEER.

BARRIER- RAIL / PIPE STEEL PANEL WALL

1. SCOPE

This work shall consist of furnishing all materials, equipment, and labor necessary for constructing the rail steel/steel panel retaining wall as shown on the Drawings or as directed by the ENGINEER. This effort includes drilling holes of required diameter, installation of rail steel piles, grouting piles in place, backfilling wall with aggregate and attaching steel panels.

2. MATERIALS

2.1. **Rail Steel**: Rail steel pile sections shall be 130 lbs/yd and in accordance with the standard size designation shown on the Drawings.

Rail steel shall be kept free from dirt, grease, and other foreign matter, and shall be protected from corrosion. Steel piles must be straight. Splicing of steel piles will not be permitted without permission of the ENGINEER. When authorized, all splicing shall be done in accordance with requirements specified in the AWS structural welding code and AWS D1.1 current edition with revisions.

2.2. **Grout**: Shall conform to the “Grout” section of these Technical Specifications. The materials shall have a minimum 28-day compressive strength of 3,000 psi.

2.3. **Steel Panels**: Shall conform to the “Steel” section of these Technical Specifications. The panels shall receive two coats of flat black rust preventative polymer paint.

2.4. **Pipe**: Shall be Schedule 80 pipe with a diameter of 6” and shall conform to the “Steel” section of these Technical Specifications. The steel pipe shall be kept free from dirt, grease, and other foreign matter and shall be protected from corrosion by coating the pipe with a rust preventive polymer paint prior to installation. The steel pipe must be straight.

2.5. **Backfill**: Shall conform to the “Crushed Aggregate and Channel Lining” section of these Technical Specifications

2.6. **Guardrail Lagging**: Shall conform to the “Guardrail” section of these technical specifications.

3. CONSTRUCTION METHODS

3.1. **Excavation**: Material excavated during site preparation, wall construction, and final grading shall be utilized in a manner as directed by the ENGINEER. Stockpiling of excavated material on the slope above the wall will not be permitted.

3.2. **Drill Holes**: A hole, of the minimum diameter shown on the Drawings, will be pre-drilled to the minimum depth shown on the Drawings prior to installation of the piles. Temporary casing of holes shall be used if needed to maintain an open, clean hole through the

soil overburden. The cost of any casing utilized shall be incidental to pile installation. If the test boring shows rock at a different depth than assumed in the Drawings, the design shall be adjusted in accordance with the rail guidance exhibits found in the drawings and these Technical Specifications.

3.3. **Rail Steel Piles:** The piles are to be grouted completely from the bottom of the hole to within two (2) feet of the existing ground line, or as directed by the ENGINEER. Holes shall be pumped free of water prior to injection of grout. The grout is to be pumped through a hollow pipe beginning at the bottom of the drilled hole. As grout is injected, the hollow pipe shall be raised with care to ensure that its tip remains approximately two (2) feet below the surface of the grout until the grout reaches a point three to five (3-5) feet below the surface.

The CONTRACTOR will be required to complete all grouting operations for holes drilled during the working day.

3.4. **Steel Panels:** **The steel panels shall be welded, bolted or strapped to the rail steel.** All welding shall be performed by a licensed welder or certified welder. The steel panels shall be welded at the top, middle, and bottom and shall be overlapped three (3) inches vertically and six (6) inches horizontally. The ENGINEER may change the overlaps if he deems necessary.

3.5. **Pipe:** A hole, of the elevation shown on the drawings shall be drilled and be kept open and clean. Before the pipe is placed in the hole, slots shall be cut in the portion of the pipe to be placed below grade as shown on the drawings or as directed by the ENGINEER for the grout to flow into the pipe center. Caps may be required to be placed on the top of the pipe if directed by the ENGINEER.

3.6. **Backfill:** Backfill behind the steel wall shall be as shown on the AML Standard Details, Drawings, or as directed by the ENGINEER.

3.7. **Tolerances:** Piles shall be located as shown on the Drawings or as directed by the ENGINEER. Pile centers shall be installed within ± 2 -inches of the plan locations. Should the elevation of the bottom of the pre-drilled hole vary from the plan elevation more than ± 1 -foot, the ENGINEER must approve the installation of the pile and injection of grout prior to placement. To verify acceptable alignment, the CONTRACTOR shall utilize a plumb bob, carpenter level, or other acceptable methods. The maximum permissible deviation for the exposed section of piles from vertical alignment shall be based on aesthetic and structural aspects.

Records shall be maintained by the CONTRACTOR, and provided to the ENGINEER, which show the depth to which each pile is placed, the deviation from vertical plumb, the amount of materials used, and any unusual conditions encountered during the installation.

BARRIER- CONCRETE

1. SCOPE

This work shall consist of furnishing all materials, equipment, and labor necessary for placing concrete barriers as shown on the Drawings or as directed by the ENGINEER.

2. MATERIALS

2.1. **Jersey Barriers**: Shall be made of Class A concrete and minimum 40 KSI reinforcing steel. The shape and size of the barriers shall be approximately as described in the AML Standard Details unless noted otherwise on the Drawings or Special Conditions. The CONTRACTOR must supply certification from the manufacturer certifying compliance.

2.2. **Curb Barriers**: Shall be made of Class A concrete and minimum 40 KSI reinforcing steel. The shape and size of the barriers shall be approximately as described in the AML Standard Details unless noted otherwise on the Drawings or Special Conditions. The CONTRACTOR must supply certification from the manufacturer certifying compliance.

BITUMINOUS REPAIR

1. SCOPE

The work shall consist of the resurfacing of paved, public roads disturbed or damaged as a direct consequence of achieving the requirements of these Contract Documents. This specification is generally intended to provide for the replacement of pavement disturbed as a part of the work, such as culvert installation **or the transporting of construction materials to the job site.**

At the ENGINEER'S discretion, the requirements of this specification may also apply to other damages to non-state-maintained roads, such as potholes and rutted areas, when in the opinion of the ENGINEER such damages are unavoidable in the prudent and practical accomplishment of the various items of work required to complete the Project. However, any damages to state-maintained roads and damages to non-state-maintained roads caused by negligence of the CONTRACTOR shall be the sole responsibility of the CONTRACTOR. Such damages shall be repaired to the satisfaction of the ENGINEER and the COMMONWEALTH shall incur no additional expense therefore.

Roads, bridges, and/or crossings on which the COMMONWEALTH will be reimbursing the CONTRACTOR for possible repairs and corrections associated therewith will be, insofar as possible, designated on the Design Drawings, and discussed at the "Pre-bid" showing of Project. Nonetheless, it shall be the CONTRACTOR'S responsibility to solicit clarifications and/or instructions from the ENGINEER on a site-specific basis prior to mobilizing to the individual sites.

2. GENERAL

Resurfacing and/or repair work shall be scheduled and conducted in such a manner to assure adequate flow of local traffic at all times.

2.1. **Resurfacing:** Resurfacing work shall consist of an asphalt overlay of bituminous concrete surface mix **compacted to a minimum thickness of one (1) inch** over the existing pavement surface. Increased thickness placement may be specified if one-inch minimum placement is not adequately repairing the surface "in kind" as determined by the ENGINEER—increased placement thickness shall be at the sole discretion of the ENGINEER. Leveling and tacking of the existing pavement shall be performed, as directed by the ENGINEER, to prepare the existing pavement or prepared surface for the resurfacing operation.

Segments of pavement slated for resurfacing which are severely rutted, broken, or otherwise damaged shall be repaired as directed by the ENGINEER, prior to resurfacing.

2.2. **Repair:** Roadway repair shall consist of the patching of potholes and rutted areas created by construction activity during the course of the Project. The ENGINEER shall determine the limits of pavement area to be repaired and the time period for repairs.

Repairs shall be made by excavating pavement areas to a minimum depth of 10 inches from the existing pavement surface elevation. The excavation shall be backfilled with a minimum 6-inch layer of dense graded aggregate compacted to no less than 8 percent of the solid volume throughout the layer. The dense graded aggregate shall be topped with a minimum of 4 inches of bituminous concrete surface mix placed and compacted in accordance with these Technical Specifications.

2.3. **Temporary Repairs**: Shall be used to repair holes in the road during construction to keep the roads in a suitable condition until the final repaving can take place. DGA shall also be used to level low spots before repaving and also to construct shoulders on roadways where the repaving operation leaves too much drop from the edge of the road to the original ground.

3. **MATERIALS**

3.1. **General**: All bituminous materials used in the resurfacing operation shall meet the requirements of the Kentucky Transportation Cabinet's "Standard Specifications for Road and Bridge Construction", current edition.

3.2. **Dense Graded Aggregate**: Shall conform to the "Crushed Aggregate and Channel Lining" section of these Technical Specifications.

3.3. **Leveling and Patching**: The bituminous mixture used for leveling and patching shall consist of the same bituminous concrete surface mix used in the resurfacing operation (**see subsection 3.5.**).

3.4. **Tack and Prime**: Any of the following emulsions are permitted for use as a tack material: SS-1, SS-1h, CSS-1, CSS-1h, AE-60, RS-1, or CRS-1. Primer-L shall be furnished as the bituminous material for prime. All tack and prime materials shall meet the applicable requirements of Section 806 of the Kentucky Transportation Cabinet's "Standard Specifications for Road and Bridge Construction", current edition. Cut back asphalts may be used only with the written permission of the ENGINEER, and shall be in conformance with all applicable laws and regulations concerning air pollution control.

The temperature limitations for applying prime and tack coats shall be that specified for the type of construction with which such work is included. Prime and tack coats shall not be applied to wet surfaces.

When RS-1 or CRS-1 is furnished for tack they shall be applied undiluted at the rate of 0.4 pound (0.05 gallon) per square yard, unless otherwise specified in the requirements for the bituminous mixture being placed. When SS-1, SS-1h, CSS-1, CSS-1h, or AE-60 is furnished for tack the material may be applied without dilution providing uniform and satisfactory coverage is achieved. Unless otherwise specified in the requirements for the bituminous mixture being placed, the application rate for undiluted SS-1, SS-1h, CSS-1, CSS-1h, or AE-60 shall be 0.4 pound (0.05 gallon) per square yard.

Prime coats shall be applied at the rate specified in the Plans, or as directed by the ENGINEER, when conditions justify variations in the rates of applications.

At the time of application, the temperature of prime and tack materials shall be within the ranges:

PRIME	
Primer L	60-120°F
TACK	
SS-1, SS-1h, CSS-1	
CSS-1h, AE-60	70-160°F
RS-1, CRS-1	70-140°F

On projects over which public traffic is being maintained, the tack coat shall be applied over one-half of the pavement width not to exceed one-half day's work in advance of the construction of the bituminous cover course; provided, that at no time shall the tack coat application end at a location hazardous to traffic. Tack coat application requiring an overnight lane closure will not be allowed. The work shall be arranged so that at the end of runs all tack shall be covered with the bituminous mat.

The CONTRACTOR shall provide necessary barricades, warning signs, and flagmen to ensure against traffic traveling over freshly applied prime or tack coat.

3.5. **Resurfacing Material:** Resurfacing material shall consist of Bituminous Concrete Surface, Class I, using coarse aggregate meeting the requirements of the Kentucky Transportation Cabinet's "Standard Specifications for Road and Bridge Construction", current edition. Natural conglomerate, crushed slag, crushed granite, crushed siliceous gravel, or crushed sandstone sand will be required in the proportions of no less than twenty (25) percent of the total combined fine and coarse aggregates in Bituminous Concrete Surface, Class I.

At least 10 days prior to the resurfacing operation, the CONTRACTOR shall supply the ENGINEER in writing with information concerning the composition of the surface mix intended for use as well as the source from which he intends to obtain the material.

4. PAVEMENT CONSTRUCTION

4.1. **General:** All equipment, pavement methods, and general procedures relative to the repair and resurfacing operations shall be in accordance with the Kentucky Transportation Cabinet's "Standard Specifications for Road and Bridge Construction", current edition.

4.2. **Spreading:** Bituminous concrete surface mix shall be maintained at a **temperature of 225° F** during placement and shall be spread with a paver meeting the requirements of the Kentucky Transportation Cabinet's "Standard Specifications for Road and Bridge Construction", current edition. The paver shall spread the mixture without tearing the surface and shall strike a finish true in density and texture and free of irregularities. The use of small hand tools shall be held to a minimum except where patching and leveling are necessary.

4.3. **Compaction:** Compacting shall be conducted in accordance with the appropriate section of the Kentucky Transportation Cabinet's "Standard Specifications for Road and Bridge Construction", current edition, using self-propelled rollers meeting the requirements of the appropriate section thereof. The surface mix shall be compacted to a minimum density of 95 percent of the optimum density as determined by the Marshall Method. The ENGINEER shall conduct Field density tests during the resurfacing operation to verify the proper density. Adjustments in the compactive effort shall be made based on these field density tests.

4.4. **Weather Limitations:** Bituminous concrete surface mix shall not be placed on any wet surface; when the ambient air temperature is below **40° F**; or when weather conditions otherwise prevent the proper handling or finishing of the bituminous mixture.

BURNING REFUSE

1. SCOPE

This work shall consist of furnishing all equipment and labor necessary to excavate and extinguish burning refuse in a safe manor by methods described herein. This shall include providing methane/carbon monoxide detectors and respirators as well as fire retardant clothing for workers on site.

2. MATERIALS

All materials extinguished shall be unclassified. It is anticipated that the majority of material in the refuse / burning refuse area will be burning. The burning material may be in large pocket masses and/or veins of burning refuse which may extend into otherwise non-burning areas. Also large unstable voids may exist within this area which may have low bearing capacity. During the extinguishing process, open flames and smoke/dust/gases should be expected to occur.

2.1. **Water**: The contractor shall have a minimum of 10,000 gallons of water available on site with a delivery system capable of an application pressure of 100 psi (pounds per square inch) minimum at the nozzle and a minimum flow rate of 250 gpm (gallons per minute). Water shall be on hand during all phases of the extinguishing process.

2.2. **Wetting Agent Concentrate**: Wetting agent concentrate shall be Cold Fire or an approved equivalent. The agent shall be provided onsite when directed and/or approved by the ENGINEER, with water to create a solution as described below.

The CONTRACTOR will create a 10% solution (10 parts water to 1 part wetting agent concentrate) and provide equipment and labor to maintain a minimum of 2,500 gallons of wetting agent solution and provide a delivery system capable of application pressure of 100 psi minimum and a minimum flow rate of 250 gpm. The solution shall be pre-mixed in tanks. Induction method will not be acceptable. Other solution percentages may be used as directed by the ENGINEER.

The ENGINEER must approve in advanced the utilization of wetting agent.

3. EXTINGUISHING METHODS

The primary extinguishing method shall consist of spreading the burning refuse material out and “mixing” with soil material (cover material) from the borrow areas. An alternate method using a wetting agent solution and/or water along with “mixing” shall be used if in the opinion of the ENGINEER “mixing” alone is not producing adequate results. If directed, the CONTRACTOR shall provide and maintain a minimum of 10,000 gallons of water and/or wetting agent solution on site until the burning refuse area is completely extinguished. Wetting agent solution shall consist of 10 parts water to 1 part wetting agent concentrate (Cold Fire or equivalent) when directed and/or approved by the ENGINEER (other solution percentages may be used as directed by the ENGINEER). The solution shall be pre-mixed in tank(s); induction

method of will not be acceptable. A delivery system capable of an application pressure of 100 pounds per square inch minimum (at nozzle) and a minimum flow rate of 250 gallons per minute shall be required to deliver water/wetting agent.

Notwithstanding the method or methods utilized to extinguish the burning refuse, the material will be considered extinguished when it is reduced to a temperature of **100°F or less. Any material greater than 100°F is considered burning.** No material shall be placed in fill areas with a temperature higher than 100°F and until approval from the ENGINEER has been given. The ENGINEER will take temperature reading on a regular basis however it is the responsibility of the CONTRACTOR to ensure no burning material is being placed in fill areas. The ENGINEER reserves the right to spot check any composite material placed in the fill areas to ensure no re-ignition has taken place; this may include requiring the CONTRACTOR to excavate areas for examination and temperature readings. If re-ignition occurs, the CONTRACTOR shall be required extinguish it as soon as practical.

4. SAFETY

Due to the nature of refuse fires, safety is a primary concern and the CONTRACTOR is advised to use extreme caution when working in the burning refuse area. Gases such as methane, carbon monoxide, hydrogen sulfide and hydrogen may be emitted from the burning refuse and should be monitored as well as the possibility of explosions due to gas, steam and dust. The CONTRACTOR is also advised that voids may exist in the burning refuse area and should proceed with caution due to potentially low bearing capacity. Limiting the rate of extinguishing work and employing proper methods can minimize these risks. Proper safety equipment such as methane/carbon monoxide detectors as well as fire retardant clothing and respirators for workers shall be required. All OSHA regulations shall be followed.

At the end of the workday/workweek, the CONTRACTOR shall make every effort to minimize the risk of open flames and/or heavy smoke/dust/gases occurring during non-working hours. The CONTRACTOR shall be prepared to return to the site during non-working hours if such safety issues arise in the opinion of the ENGINEER. At no time shall the CONTRACTOR leave the work area with open flames and/or heavy smoke/dust/gases occurring.

CONCRETE

1. SCOPE

This work covers the furnishing of all materials and equipment, and performing all operations specified herein, including the manufacturing, transporting, placing, finishing, and curing of the reinforced concrete.

2. GENERAL

2.1. **Workmanship**: All concrete work which does not conform to the specified requirements, including strength tolerances and finishing, shall be corrected as directed by the ENGINEER at the CONTRACTOR'S expense and without extension of time therefore.

2.2. **Codes and Standards**: Comply with the provisions of the following codes, specifications and standards, latest editions, except as otherwise modified herein:

- (1) Kentucky Transportation Cabinet's "Standard Specifications for Road and Bridge Construction", current edition.
- (2) American Society for Testing and Materials, ASTM.
- (3) American Concrete Institute, ACI 311 "Recommended Practice for Concrete Inspection".
- (4) American Concrete Institute, ACI 347 "Recommended Practice for Concrete Formwork".
- (5) American Concrete Institute, ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures".
- (6) Concrete Reinforcing Steel Institute, "Manual of Standard Practice".
- (7) American Welding Society, AWS DR.1 "Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connectors in Reinforced Concrete Construction".

3. CLASSIFICATION

CLASSES OF CONCRETE							
Class of Concrete	Approximate % Fine to Total Aggregate		Maximum Free Water by W/C Ratio	28-day Compressive Strength	Slump	Minimum Cement Factor	Air Content
	Gravel	Stone	lb/lb	psi	inches	lb/cy	%
A	36	40	0.49	3,5000	2-4	564	6±2
AA	36	40	0.42	4,000	2-4	620	6±2
CLASSES & PRIMARY USES							
Class A. All headwalls, non-bearing structures & all structures where class is not specified.							
Class AA. All retaining walls and load bearing structures.							

4. MATERIALS

Concrete shall be Portland cement, water, fine aggregate, coarse aggregate, and when specified or approved in writing by the ENGINEER, admixtures for entraining air or retarding agents. The design of the concrete mixture shall be based on the water-cement ratio necessary to secure (a) a plastic workable mixture suitable for the specific conditions of placement, and (b) when properly cured, a product having durability, impermeability and strength in accordance with all the requirements of the structures covered by these specifications.

The consistency of any concrete shall be such that it can be worked readily into the corners and angles of the forms and around reinforcement with the method of placing employed, but without permitting the materials to segregate or excess free water to collect on the surface. The slump range shown in subsection 19.3 represents the extreme limits of allowable slump when tested, in accordance with ASTM Designation C-143.

Where vibrators are used, the ENGINEER may allow a slightly less slump than the specified minimum.

The quantity of mixing water shall not be changed without the consent of the ENGINEER.

4.1. Cement

4.1.1. Portland Cement: Portland cement shall meet the requirements of ASTM C-150 for Type I cement, unless otherwise directed by the ENGINEER.

4.1.2. Air-Entraining Portland Cement: Air entraining Portland cement shall meet the requirements of ASTM C-175 for the type of cement specified.

4.1.3. Sampling and Testing: Portland cement shall be subject to sampling and testing in accordance with ASTM C- 150.

4.2. **Aggregates**

4.2.1. **Fine Aggregate**: Fine aggregate shall be sand having clean, hard, durable, well graded particles and free from deleterious substances and shall conform to the provisions of ASTM C-33 and C-136.

4.2.2. **Coarse Aggregate**: Coarse aggregate shall be crushed limestone of hard, clean, durable particles free from deleterious substances and shall conform to the provisions of ASTM C-33 and C-136. Size No. 57 shall be used throughout.

4.3. **Water**

Water used in mixing concrete shall be fresh, clean and free from injurious amounts of sewage, oil, acid, alkali, salts, or organic matter, and its source shall be subject to the approval of the ENGINEER.

4.4. **Admixtures**

4.4.1. **Air-Entrainment**: The air-entraining admixtures shall fully meet the requirements of ASTM Designation C-260 and shall be subject to tests in accordance with ASTM C- 233.

4.4.2. **Retarding Agents**: Approved types of retarding agents shall be included in the concrete mix only when specified on the Drawings or authorized by the ENGINEER.

4.4.3. **Other Compounds**: The use of calcium chloride or other accelerators or anti-freeze compounds will not be allowed.

4.5. **Steel Reinforcement**

4.5.1. **Reinforcing Bars**: Shall conform to the “Steel” section of these technical specifications.

4.5.2. **Accessories**: All chairs and bolsters for use in exposed concrete shall have plastic covered tips or galvanized steel legs.

4.5.3. **Shop Fabrication**: Reinforcing steel shall be fabricated to shapes and dimensions indicated on the Drawings and in compliance with applicable provisions of ACI 315 and ACI 310. Bars shall be bent cold. Bars shall be prefabricated to detail and delivered to the job plainly tagged and ready to set.

4.6. **Fiber**: Fiber will be added at the rate of 3.0 pounds per cubic yard to all concrete unless otherwise specified the Drawing or Special Conditions. The fiber can be added at any time following the initial mixing of aggregate, cement and water. An extra 3-4 minutes shall be added to ensure that the fiber has been thoroughly distributed.

The fiber is not a substitute for steel reinforcement where structures are concerned.

5. AIR-ENTRAINED CONCRETE

5.1. **General:** Unless otherwise noted, all concrete shall be air-entrained. Air-entrainment shall be accomplished by using an air-entrained Portland cement or by using an air-entraining admixture with normal Portland cement. If the entrained air content falls below the specified limit when using air-entrained cement, an air-entraining admixture shall be used in sufficient quantity to bring the entrained air content within the specified limits. If the entrained air content is found to be greater than the maximum specified when using an air-entrained cement, the use of air-entraining cement shall be prohibited; and air-entrainment shall be accomplished by using an air-entraining admixture with normal Portland cement. Air-entraining admixtures shall be added in solutions to a portion of the mixing water by means of a mechanical batcher in a manner that will ensure uniform distribution of the agent throughout the batch. Air entraining agents shall comply with ASTM C-260.

The air content of freshly mixed air-entrained concrete shall not be less than 4 or more than 6 percent of the volume of the concrete when determined by the methods specified in ASTM C-138, C-173, or C-231. The air content shall be checked during the period of time that the required test cylinders are being cast.

5.2. **Adjustment of Mix Proportions:** When air-entrained concrete is specified, the amount of water and fine aggregate prescribed for normal concrete shall be reduced to compensate for the increased volume of air contained in the air-entrained concrete.

6. PROPORTIONING AND DESIGN OF MIXES

The CONTRACTOR shall be responsible for design mixes for each type of concrete shown and/or specified. He shall use an independent testing facility accepted by the ENGINEER for preparing and reporting proposed mix designs.

Design mixes shall be proportioned by weight for each class of concrete required, complying with ACI 613 "Recommended Practice for Selecting Proportions for Concrete" and the following data reported:

- (1) Complete identification of aggregate source of supply.
- (2) Tests of aggregates for compliance with specified requirements.
- (3) Scale weight of each aggregate.
- (4) Absorbed water in each aggregate.
- (5) Brand, type, and composition of cement.
- (6) Brand, type, and amount of each component.
- (7) Amounts of water used in trial mixes.

- (8) Proportions of each material per cubic yard.
- (9) Gross weight and yield per cubic yard of trial mixtures.
- (10) Measured slump.
- (11) Measured air content.
- (12) Compressive strength developed at 7 days and 28 days, from not less than 3 test cylinders cast for each 7-day and 28-day test, and for each design mix.

The CONTRACTOR shall submit written reports to the ENGINEER of each design mix for each type and class of concrete, at least 7 calendar days prior to the start of the specified work. Include in each report the project identification name and number, date of report, name of contractor, name of concrete testing service, concrete class, source of concrete aggregates, manufacturer and brand name of manufactured materials, the precise proportions of the concrete mix, the properties specified herein for the type and class of concrete, and the test results for each property specified for the design mix.

The concrete mixes shall be designed so that the compressive strength of laboratory-cured cylinders, for each required strength, will be at least 15 percent greater than the minimum specified compressive strength; and so that not more than one test, of any 10 consecutive tests for strength, will have a value less than 90 percent of the required strength.

The criteria specified herein are maximums or minimums, and shall not be construed to predetermine fixed quantities of materials in the mix design, or to preclude change of an accepted mix design at any time. Mix design adjustments may be requested by the CONTRACTOR when characteristics of materials, job conditions, weather, test results, or the circumstances warrant; at no additional cost to the COMMONWEALTH and as accepted by the ENGINEER. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by the ENGINEER before being used in the work.

7. CONCRETE SAMPLING AND TESTING

Standard tests of the materials and concrete may be made by the ENGINEER at any time he elects to do so. The testing service shall be selected by the COMMONWEALTH and paid by the COMMONWEALTH.

Materials and installed work may require testing and retesting as directed by the ENGINEER at any time during the progress of the work. The ENGINEER shall be allowed free access to material stockpiles and facilities at all times. Tests, not specifically indicated to be done at the COMMONWEALTH'S expense, including the retesting of rejected materials and installed work, shall be done at the CONTRACTOR'S expense.

Concrete shall be sampled and tested for quality control during the placement of concrete as follows:

- a) Sampling Fresh Concrete: ASTM C-172, except modified for slump to comply with ASTM C-94.
- b) Slump: ASTM C-143; one test for each set of compressive strength test specimens.
- c) Air Content: ASTM C-231, pressure method; one for each set of compressive strength test specimens.
- d) Compression Test Specimens: ASTM C-31; one set of four (4) standard cylinders for each compressive strength test.
- e) Concrete Temperature: Test hourly when air temperature is 40°F and below, or when 80°F and above; and each time a set of compression test specimens are made.
- f) Compressive Strength Tests: ASTM C-39; one set for each 50 cubic yards or fraction thereof, of each concrete class placed in any one day or in each separate feature of the project. One specimen will be tested at 7 days, one specimen will be tested at 28 days, and two specimens will be retained in reserve for later testing if required.

Test of a portion of a batch may be made on samples representative of that portion for any of the following purposes:

- a) Determining uniformity of the batch.
- b) Checking compliance with requirements for slump and air content when the batch is discharged over an extended period of time.
- c) Checking compliance of the concrete with the specifications when the whole amount is placed in a small structure, or a distinct portion of a large structure, is less than a full batch.

Test results shall be reported in writing to the COMMONWEALTH, ENGINEER, and CONTRACTOR on the same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of contractor, name of concrete supplier and truck number, name of concrete testing service, concrete type and class, location of concrete batch in the structure, design compressive strength at 28 days; compressive breaking strength for both 7-day tests and 28-day tests.

The testing service shall take core samples of in-place concrete when test results are such that there is reasonable doubt that the specified concrete strengths and other characteristics have not been attained in the structure. The testing service shall conduct tests to determine the strength and other characteristics of the in-place concrete by compression tests on cored cylinders complying with ASTM C-42, or by load as outlined in ACI 318, or by other methods as directed.

The CONTRACTOR shall provide stable, insulated storage boxes, equipped with thermostatically controlled heat or an approved alternate facility for the storage of compression test cylinders in the first 24 hours after molding.

8. FAILURE TO MEET STRENGTH REQUIREMENTS

Concrete should break at 75% of targeted strength at 7-days. If it does not, do not begin backfill operation until the 28-day test has been done. The 28-day test should be at or greater than the target strength.

In the event that concrete tested in accordance with the requirements of these Technical Specifications fails to meet the specified strength requirements, the CONTRACTOR may be required to remove such concrete from the structure and replace such sections in a manner satisfactory to the ENGINEER. The cost of the removal and replacing such sections of concrete shall be borne by the CONTRACTOR.

When it is determined that such concrete shall be removed and replaced, the CONTRACTOR shall be notified in writing, stating the extent of the replacement to be made. Neither additional compensation nor time extensions will be granted for such work.

9. BATCHING AND MIXING

9.1. **Equipment:** Ready-mix concrete may be used. Measurements of materials for ready-mixed concrete shall conform to ASTM C 94. The ENGINEER shall have free access to the mixing plant at all times. Truck mixers will be allowed provided the use of this method will cause no violation of any applicable provisions of specifications for concrete contained herein. Truck mixers, unless otherwise authorized by the ENGINEER, shall be of the revolving drum-type, watertight, and so constructed that the concrete can be mixed to ensure the uniform distribution of materials throughout the mass.

Each truck mixer shall be equipped with a tank of known capacity, which shall be equipped with an accurate device for measuring the amount of water added. Truck mixers and agitators shall be operated within the limits of capacity and speed of rotation designated by the manufacturer of the equipment.

9.2. **Mixing Time:** Neither the speed nor the volume capacity of the mixer shall exceed those recommended by the manufacturer. Excessive over mixing, requiring additions of water to preserve the required consistency will not be permitted. The mixing time for each batch, after all solid materials are in the mixer drum, provided that all the mixing water shall be introduced before one-fourth (1/4) of the mixing time has elapsed, shall be not less than 1-1/2 minutes for mixers having capacities up to two (2) cubic yards. For mixers of larger capacities, this minimum shall be increased fifteen (15) seconds for each cubic yard or fraction thereof of additional capacity. When a truck mixer is used, each batch of concrete shall be mixed not less than fifty (50) nor more than one hundred (100) revolutions, at a mixing speed of not less than four (4) rpm after all materials are in the mixer drum.

After adding all water, cement and aggregates to the mixer deliver and place concrete in its final position within the time limits of the following table. Do not use concrete that has developed initial set, that has become segregated or that has not been delivered within the time limits listed.

TIME OF DISCHARGE LIMITS (minutes)					
Normal Concrete			Retarded Concrete		
Agitated	Agitator	Non-Agitated	Agitated	Agitator	Non Agitated
60	45	30	90	60	30
1. All times begin when cement enters the mixer. 2. Normal concrete is concrete without additional water-reducing admixture. 3. Retarded Concrete is concrete to which an admixture has been added. 4. Agitated Concrete is concrete that has been continuously agitated until placed. 5. An Agitator is a truck with paddles.					

9.3. **Conveying:** Concrete shall be conveyed from mixer to forms as rapidly as practicable, by methods which will prevent segregation, loss of ingredients, or displacement of reinforcement. There shall be no vertical drop greater than five (5) feet, except where suitable equipment is provided, to prevent segregation and where specifically authorized by the ENGINEER.

The use of long chutes, troughs, belts, and pipes for conveying concrete from the mixing plant or point of delivery to the forms will be allowed only upon written permission. When such conveyors are allowed and the quality of concrete or methods of placing or working it therein are not satisfactory, the CONTRACTOR shall discontinue their use and re-equip his plant so that concrete will be placed in a satisfactory manner. Troughs, pipes, or chutes used as aids in placing concrete shall be arranged and used in such a manner that ingredients of the concrete are not separated. Where steep slopes are required, the chutes shall be equipped with baffle boards or be in short lengths that change the direction of movement. All chutes, troughs, and pipes shall be maintained clean and free from coating of hardened concrete by thoroughly flushing with water after each run or when out of operation for more than 30 minutes. Water used for flushing shall be discharged clear of concrete in place. The troughs, pipes, and chutes shall be either of metal or metal lined and shall extend as near as possible to the point of deposit. Aluminum or aluminum alloy troughs, pipes, or chutes will not be permitted.

Where wall forms exceed five (5) feet in height, suitable measures, such as the use of tremie tubes, where practicable, or portholes, shall be provided in the forms to limit the vertical drop of the concrete to a maximum of five (5) feet. Openings shall be spaced around the perimeter of the formed area so that lateral flow of fresh concrete will be limited to three (3) feet. Drop chutes, which may be provided to convey the concrete through wall ports, shall have an outside pocket under each form opening to stop the concrete and allow it to flow easily over into the form without separation.

No concrete shall be placed until the ENGINEER has given his approval of the subgrade, forms, and reinforcing steel in place. If the reinforcing steel is not placed in accordance with the

Drawings, the ENGINEER shall stop the CONTRACTOR from placing any concrete until the error is corrected. Under no circumstances shall an attempt be made to correct errors by inserting additional unscheduled bars. No concrete shall be placed except in the presence of the ENGINEER, and the CONTRACTOR shall give reasonable notice of his intention to place.

Before any concrete is placed, the forms and subgrade shall be free of chips, dirt, sawdust, or other extraneous materials.

10. PLACEMENT OF STEEL

10.1. **Storage:** Reinforcing steel delivered to the job, and not immediately placed in forms shall be protected from mud and excessive rust producing conditions.

10.2. **Placement:** Metal reinforcement shall be accurately placed in accordance with the plans and shall be adequately secured in position with not less than 16-gage annealed wire or suitable clips at intersections. Reinforcement shall be held securely the required distance from the forms by concrete or metal chairs and spacers, except that broken brick or tile may be used to support reinforcement in footings on ground. Nails shall not be driven into outside forms to support reinforcement.

Space metal chairs, spacers, and hangers shall be in accordance with ACI 315 and ACI 318.

Metal reinforcement, at the time concrete is placed, shall be free from rust scale or other coatings that will destroy or reduce bond. Bars with kinks or bends not shown on the plans shall not be used. A thin coating of firmly attached rust shall not be cause for rejection.

10.3. **Splicing:** Splicing of reinforcement not shown on Drawings will conform to the splicing table in the "Steel" section of these Technical Specifications. Splices shall not be made at point of maximum stress and shall provide sufficient lap to transfer stress by bond. **When splicing is approved by the ENGINEER the splicing shall be done with mechanical couplers or as approved by the ENGINEER.** Do not use mechanical couplers for splices at angles and corners. If the bars have to be overlapped to use a particular splicing method, the bars shall be overlapped

10.4. **Inspection:** The ENGINEER or his representative shall have 24 hour notice and the opportunity to inspect and pass upon the placement of reinforcing steel before concrete is placed, as follows:

- (1) For non-typical conditions. . Each condition
- (2) For typical conditions Each major placement

Such inspection shall be in the nature of assisting the CONTRACTOR to minimize errors, and in no case will they relieve the CONTRACTOR of his responsibility to provide the materials and workmanship required by the CONTRACT DOCUMENTS.

11. PLACEMENT OF CONCRETE

11.1. **General:** Concrete shall be placed in accordance with the “Times of Discharge” listed in these Technical Specifications. In hot weather or under conditions contributing to quick stiffening of the concrete, or where the temperature of the concrete is 85°F or above, the times shall be reduced to one-half the time as specified. The ENGINEER may allow a longer time, providing the setting time of the concrete is increased a corresponding amount by the addition of an approved set-retarding mixture. Concrete shall be deposited as closely as possible to its final position in the forms so that flow within the mass and consequent segregation is reduced to a minimum. Vibrators may be used to aid in the placement of the concrete provided they are used under experienced supervision, and the forms designed to withstand their action. The duration of vibration shall be limited to that necessary to produce satisfactory consolidation without causing objectionable segregation. Vibration shall not be applied directly to the reinforcement steel or the forms or to concrete which has hardened to the degree that it does not become plastic when vibrated.

When a vibrator is used, the CONTRACTOR shall also space the concrete along form surfaces a sufficient amount to prevent excessive size or numbers of air-void pockets in the concrete surface.

11.2. **Addition of Water at Jobsite:** When concrete arrives at the jobsite with a slump that is lower than allowed by design or specification and/or is of such consistency so as to adversely affect the placeability of the concrete, water can be added to the concrete to bring the slump up to acceptable or specified level. This can be done at the job site as long as the specified slump and/or water-cement ration is not exceeded. Addition of water in excess of the design mixing water will affect concrete properties, such as reducing strength and making it more susceptible to cracking.

Before any water is added to the mixture a slump test must be performed. If it is decided to add water with the approval of the Engineer, the amount of water must be measured and recorded. The water amount shall not be more than one (1) gallon of water at any one time. Once water is added the concrete shall be mixed by having the mixer drum do at least thirty (30) revolutions at mixing speed. Once water is added another slump test should be performed.

Water should not be added if the maximum water-cement ration is reached, the maximum slump is obtained or more than ¼ cubic yard of concrete has been discharged from the mixer.

11.3. **Lifts in Concrete:** The permissible depth of concrete placed in each lift shall be as shown on the Drawings or specified herein. All concrete shall be deposited in horizontal layers not exceeding twenty (20) inches in thickness, unless otherwise authorized or directed. The placement shall be carried on at such a rate that the formation of cold joints will be prevented. If a delay occurs in excess of a forty (40) minute interval between any two (2) consecutive batches or loads, or in case of any delay between placing batches that allows previously placed concrete to take initial set, the CONTRACTOR shall discontinue the placing of concrete and make, at his own expense, a construction joint satisfactory to the ENGINEER before proceeding with the placing operations. He shall remove any portion of the previously placed concrete that is

deemed necessary for the proper formation of the construction joint and no payment shall be made to the CONTRACTOR for the concrete removed.

The forty (40) minute limitation cited immediately above may be extended in those cases where an approved type retarder is added to the concrete mixture, to delay the set of the concrete. Use of a retarder in the mix shall be subject to approval of the ENGINEER. Hoppers, chutes, and pipes shall be used as necessary to prevent splashing of mortar on forms and reinforcing above the layer being placed.

11.4. **Placing Temperature:** Concrete shall be mixed and placed only when the atmospheric temperature is at least 40°F and rising, unless special permission to place is obtained from the ENGINEER.

When the atmospheric temperature may be expected to drop below 40°F at the time concrete is delivered to the work site, during placement or any time during the curing period, the following provisions shall apply:

- 1) The temperature of the concrete at the time of placing shall not be less than 50°F or more than 90°F. The temperature of neither aggregates nor mixing water shall be more than 100°F just prior to mixing with the cement. The ENGINEER shall approve all methods for heating the materials and protecting the concrete.
- 2) When the daily minimum temperature is less than 40°F, concrete structures shall be insulated or housed and heated after placement. The temperatures of the concrete and air adjacent to the concrete shall be maintained at not less than 50°F or more than 90°F for the duration of the curing period.
- 3) Methods of insulation, housing and heating the structure shall conform to "Recommended Practices for Cold Weather Concreting", ACI Standard 306.
- 4) When dry heat is used to protect concrete, means of maintaining an ambient humidity of at least forty (40) percent shall be provided unless the concrete has been coated with curing compound as specified in subsection 19.5.3 or is covered tightly with an approved impervious material.
- 5) Salt, chemicals, or other materials shall not be mixed with the concrete for the purpose of preventing freezing.
- 6) Before any concrete is placed, all ice, snow, and frost shall be completely removed and the temperature of all surfaces to be in contact with the new concrete shall be raised to as close as may be practical to the temperature of the new concrete that is to be placed thereon. No concrete shall be placed on a frozen sub grade or on one that contains frozen materials.

When climatic or other conditions are such that the temperature of the concrete may reasonably be expected to exceed 85°F at the time of delivery at the work site, during placement, or during the first 24 hours after placement, the following provisions shall apply:

- 1) The CONTRACTOR shall maintain the temperature of the concrete below 85°F during mixing, conveying, and placing. Methods used shall conform to "Recommended Practice for Hot Weather Concreting", ACI Standard 305.
- 2) The concrete shall be placed in the work immediately after mixing. Truck mixing shall be delayed until only time enough remains to accomplish it before the concrete is placed.
- 3) Exposed concrete surfaces which tend to dry or set too rapidly shall be continuously moistened by means of fog sprays or otherwise protected from drying during the time between placement and finishing, and after finishing.
- 4) Finishing of slabs and other exposed surfaces shall be started as soon as the condition of the concrete allows and shall be completed without delay.
- 5) Concrete surfaces exposed to the air shall be covered as soon as the concrete has hardened sufficiently and shall be kept continuously wet for at least the first 24 hours of the curing period, and for the entire curing period unless curing compound is applied as specified in accordance with these Technical Specifications.
- 6) Formed surfaces shall be kept completely and continuously wet for the duration of curing period (prior to, during, and after form removal) or until curing compound is applied as specified in accordance with these Technical specifications.
- 7) If moist curing is discontinued before the end of the curing period, white-pigmented curing compound shall be applied immediately.
- 8) Cover reinforcing steel with water soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
- 9) Wet forms thoroughly before placing concrete.

Concrete placement shall not be permitted when, in the opinion of the ENGINEER, the sun, heat, wind, or humidity prevents proper placement and consolidation.

11.5. **Concrete on Rock Foundations:** Rock surfaces upon which concrete is to be placed shall be clean, free from oil, standing or running water, mud, objectionable coatings, debris, loose, semidetached, or unsound fragments. Faults or seams shall be cleaned to a depth satisfactory to the ENGINEER, and to firm rock on the sides. Immediately before concrete is placed, all such rock surfaces shall be cleaned thoroughly by use of high velocity air-water jets, wet sandblasting, or other means satisfactory to the ENGINEER. All rock surfaces shall be kept continuously wet for forty-eight (48) hours and all approximately horizontal surfaces shall be

covered, immediately before the concrete is placed, with a layer of mortar of the same sand-cement ratio as used in the concrete; unless this criterion is waived by the ENGINEER.

11.6. **Concrete on Earth Foundations:** Unless otherwise authorized, all concrete shall be placed upon clean, damp surfaces free from frost, ice, or deleterious materials, and standing or running water. Concrete shall not be placed in mud, dried porous earth or upon fill that has not been subject to approved rolling or tamping until optimum compaction has been obtained. The CONTRACTOR shall take all measures to accomplish the results specified in this paragraph.

11.7. **Vertical Joint Spacing:** The layout of all monoliths shall be shown on the Drawings or as directed and approved by the ENGINEER before construction is started.

11.8. **Placing Concrete Through Reinforcement:** In dropping concrete through reinforcement, care shall be taken that no segregation of the coarse aggregate occurs.

11.9. **Concrete Pumps:** concrete pumps may be used, with the approval of the ENGINEER, provided the **designated strength** and **slump** are obtained. Before any concrete is ordered the proposed concrete mixture shall be submitted to the Project ENGINEER for review and approval.

11.10. **Placing Concrete Underwater:** Do not expose concrete to the action of water before setting, or deposit it in water, except upon the ENGINEER'S written permission. Mix all concrete deposited under water in proportions specified for Class A Modified. Place concrete deposited under water in its final position by means of a tremie or by other approved methods. Do not disturb it after depositing. Provide a sufficient number of tremies or other approved devices to ensure proper distribution of concrete to all portions of the seal. Maintain calm water at the point of deposit. Do not place any concrete in flowing water. Ensure that all form work, such as interlocking sheeting, designed to retain concrete under water is water-tight.

Regulate the consistency of the concrete to prevent segregation of materials. Maintain the surface of the concrete as nearly horizontal as practical at all times. To ensure thorough bonding, place each succeeding layer before the preceding layer has taken its initial set.

Close the discharge end at the start of work to prevent water from entering the tube. Induce the flow of concrete by slightly raising the tremie, but always keeping the discharge end in the deposited concrete. Stop the flow by lowering the tremie. Provide a continuous flow and, unless unavoidable, do not interrupt it until completing the work.

The Division will allow dewatering when the concrete is sufficiently strong to withstand hydrostatic pressure, but in no case in less than 3 calendar days after placing, or such additional length of time as the ENGINEER may direct. Remove all laitance or other unsatisfactory material from the exposed surfaces by scraping, chipping, or other means which will not injure the concrete surface, as the Engineer directs.

When it is necessary to use a concrete seal in construction of a foundation, construct it as hereinafter described. A concrete seal in a foundation is that volume of concrete placed under

water by means of a tremie or other approved means for sealing the entire bottom area of the excavated pit within the cofferdam against hydrostatic pressure, to dewater the excavation and construct the remainder of the foundation in dewatered forms. Use Class A Modified concrete for the seal, and in general make the thickness of the seal course 0.43 times the hydrostatic head exerting pressure on the bottom of the foundation, or of a thickness as specified in the Plans. Place the corners of the seal to an elevation lower than the remaining surface of the seal course for the purpose of dewatering. In such cases, do not exceed an elevation difference between the corners and the remaining surface of 6 inches.

12. JOINTS

12.1. **Construction Joints**: Construction joints shall be located as indicated on the Drawings, Special Conditions/Notes, AML Standard Details, or as approved by the ENGINEER. **Where no joint spacing is indicated, joints shall be placed at a minimum of 10' and a maximum of 20'**. The surfaces of construction joints shall be clean when covered with fresh concrete. Cleaning shall consist of the removal of all lattice, loose or defective concrete, and foreign material. Cleaning of the surface of construction joints shall be accomplished by the use of high velocity air-water jets, wet sandblasting, or other effective means satisfactory to the ENGINEER. Surfaces of construction joints that have been permitted to dry by reason of the succeeding lift or adjoining concrete not being placed within the specified post-curing period shall be moistened and kept continuously moist for at least forty-eight (48) hours immediately prior to the placing of the succeeding lift of adjoining concrete. All pools of water shall be removed from the surface of construction joints before the new concrete is placed.

12.2. **Expansion Joints**: Expansion joints shall be located as indicated on the Drawings, Special Conditions, AML Standard Details, as approved by the ENGINEER. Where no joint spacing is indicated joints shall be placed at 90'-100' centers. The joints will be sealed with an approved material as listed in the AML Standard Detail or detailed in the Drawings and/or Special Conditions and project notes.

13. PATCHING CONCRETE

Any concrete which is not formed as shown on the Drawings, or for any reason is out of alignment or level, or shows a defective surface, or shows defects which reduce the structural adequacy of a member or members, shall be considered as not conforming to the intent of these Technical Specifications and shall be removed from the job by the CONTRACTOR at his expense, unless the ENGINEER grants permission to patch the defective area. Permission to patch any such surface shall not be considered a waiver of the ENGINEER'S right to require complete removal of the defective work if the patching does not, in his opinion, satisfactorily restore the quality and appearance of the surface, or if patching does not restore the structural adequacy of the member or members. Repair work shall be performed only when the ENGINEER is present. Repair of formed surfaces shall be started within 24 hours after removal of the forms. All new concrete shall be secured with keys, dovetails, or anchors.

After removing forms, inspect all concrete surfaces. Patch any pour joints, voids, honeycomb, stone pockets, or other defective areas permitted by the ENGINEER to be patched, and all tie

holes (except where noted otherwise elsewhere). Where necessary, chop away defective areas to a depth of not less than one inch with the edges perpendicular to the surface.

Apply bonding agent to area to be patched with care to keep bonding agent off of areas to remain exposed. Apply bonding agent in accordance with manufacturer's printed instructions.

The patching mortar shall be made of the same material (and of approximately the same proportions) as used in the concrete for the same location except that the coarse aggregate shall be omitted for concealed locations. Patching mortar shall be of same composition as adjacent concrete in exposed-aggregate concrete. The mortar shall not be richer than one part cement and three parts sand. White Portland cement shall be substituted for a part of the gray Portland cement so as to match the color of the surrounding concrete. The proportion of white and gray cements shall be determined by making a trial patch. The amount of mixing water shall be as little as is consistent with the requirements of handling and placing. The mortar shall be retempered without the addition of water by allowing it to stand for a period of one hour, during which time it shall be mixed occasionally with a trowel to prevent setting.

Compact the mortar thoroughly into place, and screed off so as to leave the patch slightly higher than the surrounding surface. Leave patch undisturbed for a period of one to two hours to permit initial shrinkage before beginning final finishing. Finish patch in such a manner as to match the adjoining surface. All patches shall be finished and cured in accordance with requirements for the surface in which patch occurs. Keep patch moist for not less than three days after installation.

For unexposed concrete the following applies: Tie-holes left by withdrawal of rods, or the holes left by removal of ends of ties shall be filled solidly with mortar after first being wet thoroughly. For holes passing entirely through a wall, a plunger-type grout gun shall be used to force the mortar through the wall, starting at the back face. A piece of burlap or canvas shall be held over the hole on the outside; and when the hole is completely filled, the excess mortar shall be struck off with the cloth flush with the surface. Holes not passing entirely through the walls shall be filled with a small tool that will permit packing the hole solidly with mortar. Any excess mortar at the surface of the wall shall be struck off flush with a cloth.

14. FINISHING

14.1. **General:** In order that the rubbing required by these Technical Specifications shall be effective, non-supporting forms may be removed after 24 hours, provided the concrete is sufficiently strong not to be injured thereby. Initial rubbing required shall be completed within 48 hours after concrete placing. If possible, patching and rubbing shall be done at the same time. This requirement regarding form removal is secondary to heating requirements, and the specifications heretofore included regarding heating of concrete shall take precedence.

Joints and edges of unformed surfaces that will be exposed to view shall be chamfered or finished with molding tools. At tops of walls, strike-off smooth horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces and finish with a texture matching

adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise shown.

14.2. **Type I Finish**: Type I finish is a standard rough form finish for formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise shown or specified. This is the concrete surface having a texture imparted by the form facing material used, with defective areas repaired and patched as specified, and fins and other projections exceeding one-quarter inch (1/4") in height rubbed down with wood blocks. **Driveways shall have a Type I Finish.**

14.3. **Type II Finish**: Type II finish is a standard smooth finish for formed concrete surfaces exposed-to-view or that are to be covered with a coating of material applied directly to the concrete. This is the as-cast concrete surface as obtained with the form facing material, with defective areas repaired and patched as specified, and fins and other projections on the surface completely removed and smoothed. All surfaces that will show in the finished work shall be rubbed down with a coarse carborundum stone or covered with a masonry coating material approved by the ENGINEER. **Cast in place headwalls and drop boxes shall have a Type II Finish**

14.4. **Type III Finish**: Type III finish is a float finish to be used on all horizontal surfaces not subject to wear and those surfaces which do not receive Type II finish such as back walls and headwalls. The finish shall be accomplished by placing an excess of materials in the form and removing or striking of such excess with a wooden template, forcing coarse aggregate below the surface. After the concrete has been struck off as described, the surface shall be thoroughly worked and floated by hand with a wooden float leaving a fine grained, smooth-sanded surface. **Concrete retaining walls and concrete panels shall have a Type III Finish.**

15. CURING AND PROTECTION

15.1. **General**: Protect freshly placed concrete from premature drying and from excessive cold or hot temperatures, and maintain, without drying, at a relatively constant temperature for a period of time necessary for hydration of cement and proper hardening. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. If Weather permits, keep continuously moist for not less than seventy two (72) hours. Unhardened concrete shall be protected from heavy rains and flowing water. All concrete shall be adequately protected from damage.

Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least one-hundred sixty eight (168) cumulative hours (not necessarily consecutive) during which concrete has been exposed to air temperatures above 50°F. Avoid rapid drying at end of final curing period. All hot weather concreting shall conform to requirements set forth in ACI 305, "Recommended Practice for Hot Weather Concreting".

15.2. **Moist Curing**: Concrete shall be moist cured by maintaining all surfaces continuously (not periodically) wet for the duration of the entire curing period. Water for curing shall be clean

and free from any elements which will cause staining or discoloration of the concrete. Where wooden forms are used and left in place during curing, the wood shall be kept wet at all times.

15.3. **Membrane Curing**: At the option of the CONTRACTOR and when approved by the ENGINEER, the concrete may be cured with an approved curing compound of the surface membrane type in lieu of moist curing with water. The curing compound shall be applied to formed surfaces immediately after the forms have been removed and the surfaces cleaned of any loose sand, mortar, and debris. The surface to receive the compound shall be moistened thoroughly with water and the compound applied as soon as the moisture film has disappeared, but when the surface is still damp. On unformed surfaces the compound shall be applied immediately after the surface loses its free water and has a dull appearance.

The curing compound shall be applied in a two-coat continuous operation by approved spraying equipment and at coverage of not more than two hundred (200) square feet per gallon for both coats. The second coat shall be applied to overlap the first coat in a direction at approximately right angles to the direction of the first application. Concrete surfaces, which are subjected to heavy rainfall within three (3) hours after the curing compound has been applied, shall be re-sprayed by the method and at the rate of coverage specified herein. All concrete surfaces on which curing compound have been applied shall be adequately protected for the duration of the entire curing period from any damage that would disrupt the continuity of the curing membrane. The curing compound shall conform to Type 2 or Type 3 of ASTM Designation C 309. All curing compound shall be delivered to the site of the work in the original sealed container bearing the name of the manufacturer, the brand name and the manufacturer's batch number. The compound shall be approved prior to use. The compound shall be stored so as to prevent damage to the containers, and water-emulsion types shall be protected from freezing.

15.4. **Moisture Cover Curing**: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

15.5. **Curing Formed Surfaces**: Cure formed concrete surfaces and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by other applicable methods specified herein.

15.6. **Curing Unformed Surfaces**: Initially cure unformed surfaces, such as slabs and other flat surfaces, by moist curing; and final cure by applicable methods specified herein.

15.7. **Cold Weather**: The air and forms in contact with the concrete shall be maintained at temperatures above 40°F for at least five (5) days, and at a temperature above freezing for the remainder of the specified curing period. Concrete, permitted to be cured with curing compounds, shall be provided the same protection against freezing and low temperatures. No fire or excessive heat shall be permitted near or in direct contact with concrete at any time. All cold weather concreting shall conform to requirements set forth in ACI 306, "Recommended Practice for Cold Weather Concreting".

16. FORMWORK

16.1. **General:** Unless otherwise shown or specified, design, construct, erect, maintain and remove forms, and related structures for cast in place concrete work in compliance with the American Concrete Institute Standard ACI 347, "Recommended Practice for Concrete Formwork".

16.2. **Forms for Exposed Finish Concrete:** Unless otherwise shown or specified, construct all formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood-faced or other acceptable panel-type materials, to provide continuous, straight, smooth exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.

Use plywood complying with the U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood" Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible trademark of an approved inspection agency, unless otherwise acceptable to ENGINEER.

16.3. **Forms for Unexposed Finish Concrete:** Form concrete surfaces, which will be unexposed in finished structure with plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least two edges and one side for tight fit. Use 6-inch or 8-inch wide lumber, nominal 1-inch thickness, or as specified for exposed concrete, at CONTRACTOR'S option.

16.4. **Earth Forms for Trench Excavation:** Where trench excavation is used and walls of excavation are neatly cut in good soil, side forms may be omitted for footings and for some select retaining walls as permitted by the ENGINEER.

16.5. **Formwork Accessories:** Form ties where concrete is unexposed shall be standard crimped snapties. Form ties where concrete is exposed, as finish shall be a snap-in form tie with plastic cones. Form ties shall be manufactured by Meadow Steel Products Company, Dayton Sure-Grip and Shore Company, Universal Form Clamp Company, or equivalent.

Form releasing agent shall be non-staining "Form Oil" as manufactured by Texaco, Sinclair, Georgia Carolina Company, or equivalent.

16.6. **Form Construction:** Forms shall be constructed in accordance with ACI 347 and shall conform to shape, lines, and dimensions of members indicated, and shall be substantial and sufficiently tight to prevent leakage of mortar. They shall not deflect under dead load weight of concrete as a liquid or of construction load. Forms shall be braced or tied together so as to maintain position and shape. Construct forms so that they can be removed readily without hammering or prying against concrete. Forms for exposed concrete shall be carefully made and accurately placed to obtain correct shape and lines.

The CONTRACTOR shall be fully responsible for adequacy of formwork in its entirety. Forms shall support loads they will be required to sustain and shall maintain their dimensional and surface correctness to produce members required by the Drawing.

Trap door shall be built in the bottom of wall forms for access to interior of forms to permit inspection and cleaning.

The CONTRACTOR shall build bulkheads with keys in walls, footings, and slabs where it is necessary to stop placing of concrete.

16.7. **Reused Forms**: Forms which are reused shall be thoroughly cleaned of dirt, debris, concrete, and foreign matter. Forms shall not be reused if they have developed defects which would affect their tightness and strength.

Marred surfaces in contact with concrete shall be repaired before reuse.

16.8. **Plywood Forms**: Plywood forms shall be of material as specified in these Technical Specifications. Joints shall be butted tight on solid bearings. Arrangement of panels shall be orderly and symmetrical, and use of small pieces shall be avoided. Forms shall be chamfered for external corners of concrete, which will be exposed, in finished work.

16.9. **Removal of Forms**: Formwork not supporting weight of concrete, such as walls and similar parts of the work may be **removed 24 hours, but no sooner**, after placing concrete, provided concrete is sufficiently hard not to be damaged by form removal operations, and provided curing and protection operations are maintained. The CONTRACTOR shall assume full responsibility for removal of formwork and forms.

16.10. **Inspection and Approval of Formwork**: Forms, form joints, and reinforcing steel placement shall be checked by the ENGINEER before closing the forms. Concrete shall not be placed in any form until the placing of steel and erection of formwork have been completed and approved by the ENGINEER. Immediately after completion of pouring, tops of all forms shall be adjusted to line and approved by the ENGINEER as to conformity within the tolerances specified herein.

17. **EMBEDDED ITEMS**

17.1. **General**: Before placing concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the Drawings or required by the ENGINEER. All embedded items shall be thoroughly clean and free of oil and other foreign matter such as loose coatings of rust, paint, and scale. The embedding of wood or other perishable materials in concrete shall be prohibited unless specifically directed or authorized by the ENGINEER. Any air or water lines or the materials embedded in structures, as construction expedients authorized by the ENGINEER, shall conform to the above requirements and, upon completion of their use, shall be backfilled with concrete or grout as directed by the ENGINEER.

17.2. **Pipe Embedded in Concrete:** Where pipe is partially or wholly encased in concrete, care shall be taken that the pipe is firmly and securely held in place so that the alignment and grade of the pipe is not disturbed while the concrete is placed around the pipe. The trench excavated for the pipe shall be thoroughly cleaned and free from any foreign matter and completely filled with concrete to a depth one foot over the pipe.

18. PRECAST AND/OR PRESTRESSED CONCRETE STRUCTURES

All concrete structures (i.e. headwalls, culverts, lagging, etc.) that are precast and/or pre-stressed before being delivered shall meet the requirements of this Technical Specification as well as the Technical Specification covered in the Kentucky Transportation Cabinet's "Standard Specifications for Road and Bridge Construction", current edition. All structures shall carry a certification from the manufacturer that they will meet these specifications.

19. BACKFILL

Backfill consisting of either earthen material or rock shall not be placed until after the 7-day compressive strength test has been completed and reviewed by the ENGINEER. The ENGINEER shall approve when placement of the backfill can begin.

CONCRETE HEADWALLS

1. SCOPE

This work consists of construction of the concrete headwalls at the locations shown on the Drawings and furnishing the labor, materials, and equipment incidental thereto.

2. GENERAL

The headwalls, as shown on the Drawings shall be fabricated in accordance with the Standard Details or Drawings. Units may be cast in-place or pre-cast. Pre-cast units shall be accompanied by manufacturer's certification showing compliance with these requirements.

Regardless of placement method (cast in place, pre-cast) the units shall include all steel and concrete, grout and any other materials necessary to install each unit.

Multi-barrel headwalls should be cast in place unless authorized in writing by the ENGINEER.

3. MATERIALS

3.1. **Concrete**: Shall be have minimum 28-day strength of 3,500 psi and conform to the "Concrete" section of these Technical Specifications.

3.2. **Reinforcing Steel**: Shall be 60 KSI strength steel conforming to the "Steel" section of these Technical Specifications.

22.4. CONSTRUCTION

The headwall construction shall be accomplished in accordance with the details shown on the Drawings and at elevations and locations established by the ENGINEER.

CRUSHED AGGREGATE AND CHANNEL LINING

1. SCOPE

This work shall consist of furnishing and placing crushed aggregate in subsurface drains, rock core drains, as backfill, on roadway(s)/driveways; and, Class II/III aggregate in the appropriate items of work, as shown on the Drawings and/or as directed by the ENGINEER.

2. MATERIALS

2.1. **General:** Durable crushed limestone aggregate, which meets the criteria set forth herein, shall be used. Individual rock fragments shall be dense, sound and free from cracks, seams, and other defects conducive to accelerated weathering. Furthermore, the shape of rock fragments in the channel lining shall be angular to subrounded with a maximum 3:1 length to width ratio. Any limestone product used to add alkalinity to the water shall have a minimum 85% calcium carbonate content as reported by the KY Department of Agriculture or affidavit from the supplier.

Sandstone may be used in some applications as directed by the ENGINEER. Where Sandstone is to be used it shall be taken to a certified laboratory and a slate durability index (SDI) completed. The SDI shall not be less than 90. SDI test shall be in accordance with ASTM D 4644-04

2.2. Aggregates:

2.2.1. **Friable Particles:** Less than 0.25 percent by weight as determined by ASTM C 142.

2.2.2. **Finer than No. 200:** Less than 2.0 percent by weight as determined by ASTM C 117.

2.2.3. **Sulfate Soundness:** The weight loss after 5 cycles of magnesium sulfate soundness testing shall not exceed 16 percent as determined by ASTM C 88.

2.2.4. **Abrasion:** Abrasion loss shall not exceed 40 percent as determined by ASTM C 131.

2.2.5. **Coal and Lignite:** Less than 0.5 percent as determined by ASTM C 123.

2.3. Channel Lining:

2.3.1. **Specific Gravity:** The bulk specific gravity (saturated surface-dry) shall not be less than 2.5 as determined by ASTM C 127.

2.3.2. **Absorption:** Absorption shall not exceed 2 percent as determined by ASTM C 127.

2.3.3. **Sulfate Soundness:** The weight loss after 5 cycles of magnesium sulfate soundness testing shall not exceed 12 percent as determined by the provisions for ledge rock in AASHTO T 104.

2.3.4. Dense Graded Aggregate (DGA): DGA may be used, as shown on the Drawings and/or as directed by the ENGINEER, to augment or replace other aggregate.

3. GRADATION

3.1. Aggregate: Aggregate for drains, backfill, and roadways shall generally be size No. 57, No. 610, and No. 2 stone. All must meet the gradation requirements of "Sizes of Course Aggregates" table in this Technical Specification. Materials used for roadways must also meet Section 805.06 of the Kentucky Department of Highways "Standard Specifications for Road and Bridge Construction", current edition.

3.2. Limestone Sand: Limestone sand shall have a minimum 85% calcium carbonate (CaCO₃) content as reported by the KY Department of Agriculture with 100% less than 3/8" and at least 45% passing a No. 16 sieve.

3.3. Class II Channel Lining: Class II lining shall be produced by using a crusher, grizzly, or sieve with openings of 9-inches, and by such additional processing as may be necessary so that no more than 20 percent of the finished product will pass through a square opening of 5 inches by 5 inches.

3.4. Class III Channel Lining: Class III lining shall have no less than 80 percent of individual stones ranging in size from 7 to 18 inches. Stones of smaller sizes shall be permissible for use in filling voids in the upper surface and dressing to the proper slope. If stones of a larger size are used, it shall be the CONTRACTOR'S responsibility to oversize the excavated ditch to accommodate the larger stone, while achieving the configuration(s) shown on the Drawings.

3.5. Cyclopean Rip-Rap: Cyclopean rip-rap is a screened product of large rocks ranging in size from 1/2 to 1 1/2 cubic yard with rough, angular shapes.

3.6. Onsite Rock: Shall be rock recovered within the project limits. It shall meet the requirement of subsection 2.2 & 2.3 and be non-acidic durable material. Green sandstone shall be rejected.

4. SAMPLING

At least 15 days prior to delivery of material from sources other than approved Kentucky Department of Highways sources, the CONTRACTOR shall notify the ENGINEER in writing of the sources from which he intends to obtain the material. The CONTRACTOR shall provide the ENGINEER free access to the sources for the purpose of obtaining samples for testing.

5. PLACEMENT

5.1. **Subgrade Preparation**: The subgrade surfaces on which the stone is to be placed shall be graded to the lines and grades shown on the Drawings. Stone shall not be placed until the foundation has been inspected and approved by the ENGINEER.

5.2. **Placement of Channel Lining**: The appropriate sized channel lining as shown on the plan views or determined by the ENGINEER shall be used. Class II channel lining shall be used at designated locations and is not to be substituted for Class III channel lining unless directed in writing by the ENGINEER. The lining shall be placed by hand or by equipment on the surface and to the depths specified. The lining shall be constructed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying materials and/or damage to the underlying geotextile fabric. The rock shall be delivered and placed in a manner that will ensure that the lining in-place shall be reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rock and spalls filling the voids between the larger rocks.

5.3. **Placement of Aggregates**: The appropriate sized aggregate (e.g. DGA, No. 57 stone, No. 610, No. 2 stone) shall be placed in the designated areas by equipment and struck to the neat lines and grades shown on the Drawings or as directed by the ENGINEER. DGA used for roads, subgrade, or shoulders is to be compacted, as directed by the ENGINEER, to assure a suitable surface. **Roadway stone and DGA shall be placed only at locations approved in advance by the ENGINEER.** Typical applications shall consist of placement of roadway stone on residential driveways to repair “in kind” these features that have been disturbed due to normal construction activities. Also it is intended for some use, if needed, on designated access routes which lead to construction areas. HOWEVER, designated access routes shall ONLY receive roadway stone on impassable areas (i.e. soft, saturated, rutted, steep, etc.) to allow them to become “reasonably passable” and replacement “in kind” on these features that have been disturbed due to normal construction activities. Roadway stone is NOT intended as a mechanism for road improvement (i.e. improving a dirt road to gravel.)

SIZES OF COURSE AGGREGATES

Size	Sieve Max. Nominal Size	Amounts Finer Than Each Laboratory Sieve (Square Openings) Percentage by Weight															
		4"	3 1/2"	3"	2"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 100	No. 200
1	3 1/2"	100	90-100		25-60		0-15		0-5								
2	2 1/2"			10	90-100	35-70	0-15		0-5								
23	2 1/2"			10		40-90		0-15		0-5							
3	2"				100	90-100	35-70	0-15		0-5							
357	2"				100	95-100		35-70		10-30							
4	1 1/2"					100	90-100	20-55	0-15		0-5						
467	1 1/2"					100	95-100		35-70		10-30						
5	1"						100	90-100	20-55	0-10	0-5						
57	1"						100	95-100		25-60							
610	1"						100	85-100		40-75							
67	3/4"							100	90-100		20-55						
68	3/4"							100	90-100		30-65						
710	3/4"							100	80-100		30-75	0-30					
78	1/2"								100	90-100	40-75	5-25	0-10	0-5			
8	3/8"									100	85-100	10-30	0-10	0-5			
9-M	3/8"									100	75-100	0-25	0-5				
10	No. 4										100	85-100				10-30	
11	No. 4										100	40-90	10-40			0-5	
Dense Graded Aggregate	3/4"							100	70-100		50-80	30-65			5-20		0-8
Limestone Sand	3/8"										100	90-100		45-80		0-8	

DITCHES

1. SCOPE

This item consists of the construction of ditches (and channels) to the lines and grades depicted in the final cross-sections and Drawings. Lining materials shall meet the requirements of related sections of these Technical Specifications. Excavated rock ditches shall be constructed in accordance with details included in the plans.

2. MATERIALS

- 2.1. **Erosion Control Blanket**: Shall conform to the “Erosion Control Blanket” section of these Technical Specifications.
- 2.2. **Rock Aggregate**: Shall conform to the “Crushed Aggregate and Channel Lining” section of these Technical Specifications.
- 2.3. **Gabion**: Shall conform to the “Gabion” section of these Technical Specifications.
- 2.4. **Concrete**: Shall conform to the “Concrete” section of these Technical Specifications.
- 2.5. **Filter Fabric**: Shall conform to the “Filter Fabric” section of these Technical Specifications.
- 2.6. **Revegetation Materials**: Shall conform to the “Revegetation” section of these Technical Specifications.
- 2.7. **Bales**: Shall conform to the “Silt Control” section of these Technical Specifications.
- 2.8. **Silt Fence**: Shall conform to the “Silt Control” section of these Technical Specifications.

3. CONFIGURATIONS

The configurations of the ditches shall approximate the configurations in the Drawings so that the design water flow will safely pass through the ditches. The ENGINEER must approve any significant deviation from the design dimensions.

4. CONSTRUCTION

- 4.1. **Subgrade Preparation**: The subgrade surfaces on which filter fabric, and/or rock are to be placed shall be graded to the lines and grades shown on the Drawings and Standard Details. Filter fabric shall not be placed until the foundation and the subgrade surfaces have been prepared, inspected, and approved by the ENGINEER. Geo-grid may be used under ditches instead of filter fabric (see Standard Details and Drawings). Do not use geo-grid or filter fabric under ditches >10% slope.

4.2. **Rock Aggregate Placement:** Place and shape filter fabric or geo-grid under ditches less than 10% slope or as directed by the ENGINEER, AML Standard Details, and/or Drawings. The channel lining shall be carefully placed by hand or by equipment to the depths specified on the Drawings. The lining shall be constructed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying materials and damage to the underlying filter fabric. The rock shall be delivered and placed in a manner that will ensure that the lining, in-place, shall be reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another, and with the smaller rocks and spalls filling the voids between the larger rocks.

Where encountering solid rock, end the slope protection at the solid rock line as shown on the Drawings or as directed by the Engineer.

4.3. **Flexible Concrete Channel:** Prior to placing the flexible concrete channel lining prepare the sub grade as detailed in the plans. The area must be cleared of rocks and debris 3” or larger. Apply seed directly to the prepared soil prior to installation of the flexible channel lining. Use seed as per these technical specifications.

Install mats to the line and grade shown on the plans according to the manufactures installation guidelines. The manufacture shall provide technical assistance during the slope preparation and installation of the flexible channel lining.

4.4. **Gabion Lined Ditches:** Place and shape filter fabric or geo-grid under ditches less than 10% slope or as directed by the ENGINEER, AML Standard Details, and/or Drawings. Gabion ditches include gabion anchors and concrete cutoff end treatments.

4.5. **Unreinforced Concrete Fabric Ditches**

4.5.1. **Fabric Storage:** Upon delivery to the site the fabric shall be inspected and stored in a clean dry area where it will not be subject to mechanical damage or exposure to moisture or direct sunlight. Fabric allowed to become wet and then dried before installation, will be subject to shrinkage.

4.5.2. **Fabric Placement:** The surface to be protected shall be brought to the lines and grades as shown on the plans and be free of all obstructions and organic materials such as rocks and roots. Areas below grade shall be brought to grade using approved drainage stone. Anchoring of the fabric forms shall be accomplished through the use of anchor, terminal and toe trenches.

The fabric panels shall be placed over an approved geotextile filter fabric in accordance with these specifications. The factory assemble panels shall be joined in the field by means of zipper closures or US Federal Standard Type 101 stitches. All sewn seams shall be downward facing. Adjacent panels shall be joined top layer to top layer and bottom layer to bottom layer. The CONTRACTOR must make appropriate allowances for approximately 10% contraction of the fabric in each direction as a result of the grout injection. If joining of panels as described above is impractical, adjacent panels may be overlapped a minimum of 3 feet subject to the ENGINEER’S approval. In no caser shall butt joints be allowed.

4.5.3. **Fine Aggregate Concrete Injection:** Once fabric is properly placed the fine aggregate concrete (grout) shall be injected between the upper and lower layers of the fabric through small slits cut in the upper layer of fabric. The injection pipe shall be wrapped tightly at the point of injection with a strip of burlap during pumping. After pumping, the burlap shall be pushed into the slit as the injection pipe is withdrawn in order to minimize spillage of grout on the fabric surface. The burlap shall be removed prior to the final set of the grout and the injection area hand finished. The sequence of the grout injection shall be such to insure complete filling of the fabric to the desired thickness.

The grout shall be pumped in such a manner to prevent excessive pressure on the fabric forms and cold joints are avoided. A cold joint is defined as one in which the pumping of the grout into a given form is discontinued or interrupted for an interval of forty-five (45) minutes.

Foot traffic on the filled form shall be restricted to an absolute minimum for one hour after filling. After the grout has set and an appropriate curing time is allowed all anchors, terminal and toe trenches shall be backfilled and compacted as directed by the ENGINEER.

4.6. **Concrete Lined Ditches:** Place and shape filter fabric or geo-grid under ditches less than 10% slope or as directed by the ENGINEER, AML Standard Details, and/or Drawings.

4.7. **Excavated Rock Ditches:** Excavated Rock Ditches shall be constructed at locations shown on the plans or as directed by the ENGINEER. Excavated Rock Ditches shall be considered incidental to Earthwork if natural swales in “excavated to rock areas” exist and no additional work is required. If extremely hard rock is encountered, then a hoe ram shall be utilized to construct the ditches. The size of the hoe ram shall meet the requirements as specified in these Technical Specifications. The CONTRACTOR may utilize alternative equipment with the approval of the ENGINEER.

DROP BOX INLET/JUNCTION BOXES

1. SCOPE

This work consists of construction of drop-box inlets and/or junction boxes at locations shown on the Drawings and furnishing the labor, materials, and equipment incidental thereto.

2. GENERAL

The drop boxes and/or junction boxes shall be fabricated in accordance with the AML Standard Details and/or Drawings. Units may be cast in-place for pre-cast. Pre-cast units shall be accompanied by manufacturer's certification showing compliance with these requirements.

3. MATERIALS

3.1. **Concrete**: Shall be Class A concrete conforming to the "Concrete" section of these Technical Specifications.

3.2. **Reinforcing Steel**: Shall be 60 KSI steel conforming to the "Steel" section of these Technical Specifications.

3.3. **Backfill**: Shall conform to the "Crushed Aggregate and Channel Lining" section of these Technical Specifications.

4. CONSTRUCTION

Drop box inlet and/or junction box construction and placing the concrete for pavement restoration shall be accomplished in accordance with the details shown on the Drawings and at elevations and locations established by the ENGINEER, and in conformance with standard practices as presented in the AML Standard Details and/or Drawings.

EARTHWORK

1. SCOPE

The work shall consist of the required removal and proper utilization of all earthen materials and the shaping and finishing the area(s) to the required lines and grades as shown on the Drawings or as directed by the ENGINEER.

2. MATERIALS

2.1. **Excavated Materials**: All excavated materials shall be unclassified. It is anticipated that the majority of the material to be removed will consist of a mixture of loose, unconsolidated soil, vegetative debris and rock. It may also consist of residual soil and “mine spoil” produced from past mining operations. Also, large boulders may exist within the excavation areas.

2.2. **Refuse**: Shall be defined as coal, coal waste, rock and other debris that was produced and discarded by past mining practices. Some areas will have a higher content of coal than others depending on the mining method. Generally the material is sparsely vegetated and acidic. Some areas may be burning or have burned in the past.

2.3. **Rock**: Shall be defined as large consolidated fragments (boulders) or consolidated bedrock material that cannot be removed by normal excavation methods and must be removed by means such as blasting, ripping, hoe ram or other methods used in the construction industry that are generally accepted as methods to remove rock.

2.4. **Cover Material**: Acceptable cover materials should have a brown matrix color, soil water pH greater than 4.5, potential acidity of less than 2 tons calcium carbonate (CaCO₃) equivalent per thousand (1,000) tons of material, and less than 50% clay content.

2.5. **Agriculture Limestone**: Shall meet the requirements of the “Revegetation” section of these Technical Specifications.

3. GENERAL

3.1 **Material Removal**: Material removal shall include excavation to the designated depths, transportation of removed materials from points of removal to the points of final use and the shaping and finishing of all areas to the required lines and grades as shown on the Drawings or as directed by the ENGINEER. All boulders encountered during the construction, which are too large to be transportation to the waste area may be moved to the stable area within the project limits and buried on site with a minimum of two (2) feet cover or they may be reduced to a size that can be transported to the waste area or other areas designated on the Drawings or as directed by the ENGINEER. The boulders may be reduced by the use of hoe-ram as specified by these Technical Specifications or other methods approved by the ENGINEER.

3.2. **Waste Areas**: The materials to be placed in designated fill areas shall consist of those suitable materials, as determined by the ENGINEER, which are removed in the process of

achieving the templates shown on the Drawings and in accordance with this section of these Technical Specifications. Vegetative debris shall not be placed in the designated waste areas. It shall be the CONTRACTOR'S responsibility to dispose of unsuitable materials in accordance with the provisions of the Specification.

The ENGINEER shall inspect and approve the disposal sites before material is placed in a given area. Any boulders, which are transported to a waste area shall be buried a minimum of two feet under the final grade or reduced to a size that will not affect the fill operation. On all waste areas excavated topsoil and/or select material shall be uniformly distributed as a final cover material. The waste area(s) shall be revegetated in accordance with the "Revegetation" section of these Technical Specifications.

Old strip mine benches to be used as waste areas must be sampled every 50' feet to determine the presence of rock under the material that now exists. Once the rockline has been established and the edge of rock determined, the contractor upon approval from the Engineer shall begin placement of material on the bench. Material placed on the bench shall be at least 10' from the edge of the rockline determined by the field sampling and approved by the ENGINEER.

3.3. **Cover Material Harvesting Areas:** In the Cover Material Harvesting areas (borrow areas), all limits are to be approved by the ENGINEER prior to any work efforts (site prep, silt control, earthwork, etc.) commencing. Once excavation work is completed within a designated harvesting area, it shall be graded as directed by the ENGINEER. No areas shall have final slopes steeper than a 2.5: 1 nor shall trenches and/or pits be left as a final grade. All disturbed areas shall be revegetated as soon as practical in accordance with the revegetation specifications and Erosion and Sediment Control BMP. Diversions shall be set at least every 50' vertically and once across the top of the slope. The ENGINEER may require foundation benching prior to final grading as part of the cover material earthwork efforts. See the AML Standard Details for typical final slope configurations.

3.4. **Gradework Areas:** Grade areas to the lines and grades indicated on the Drawings or as directed by the ENGINEER to promote positive drainage.

3.5. **Subdrain:** Subdrain excavation for trenches exceeding depths of five (5) feet shall include the removal of rock and/or unclassified soils to facilitate construction.

4. CONSTRUCTION METHODS

4.1. **Conduct of Work:** The reclamation approach intent is to provide a lasting, stable configuration. The CONTRACTOR is required to exercise care to avoid intermediate site conditions which may result in unstable conditions during the construction process.

4.2. **Excavation:** The CONTRACTOR must utilize material removal techniques that are generally considered conducive to retaining stability. This includes, but is not limited to, working slopes from the top to the bottom to preclude undermining. Once disturbed, all earthwork areas shall be brought to the design template as soon as practicable and shall be

protected in accordance with the "Revegetation" section of these Technical Specifications as the work progresses.

The conditions set forth in this subsection shall firmly apply until the ENGINEER has accepted the area where material has been removed, as being satisfactorily complete. The ENGINEER will not accept any area as being satisfactorily complete if an adjacent work area remains in a condition, which may cause damage to the subject area. Once the ENGINEER has accepted an area, the COMMONWEALTH will then be responsible for interruptive slides, slippages, and/or erosion.

4.3. **Blasting**:

4.3.1. **General**: Blasting when permitted shall be done only to the depth, amount and extent, and in such locations, as approved by the ENGINEER. Blasting operations shall comply with all applicable State and Federal laws. Neither the COMMONWEALTH nor the ENGINEER shall assume any liability through approval of the CONTRACTOR'S blasting plan or methods of blasting. Such approval will not relieve the CONTRACTOR of his responsibility in the blasting operation, and no payment will be made for any necessary extra excavation below or outside of the limit lines designated by the ENGINEER, or modifications thereof, due solely to injury caused by over-shooting, improper blasting, or carelessness on the part of the CONTRACTOR.

A licensed blaster licensed in the Commonwealth shall be on site at all times dealing with all blasting activities such as pre-blast survey, pre-blast preparation, actual blasting and post-blast activities.

4.3.2. **Pre-Blast Survey**: A pre-blast survey shall be conducted on all dwellings or structures located within 1/2 mile radius of any proposed blasting activity. The survey shall be the responsibility of the CONTRACTOR and shall consist of an assessment of the conditions of each dwelling or structure and documentation of any pre-blasting damage and other physical factors that could reasonable be affected by the blasting. Assessments of structures such as pipes, cables, transmission lines, and other water systems shall be limited to surface condition and readily available data. Selected water wells shall be monitored for both quantity and quality during the initial survey and throughout the duration of blasting operations, at no additional cost to the COMMONWEALTH.

4.3.3. **Use of Explosives**: The transportation, handling, storage, and use of dynamite and/or other explosives shall be directed and supervised by a person of proven experience and ability in blasting operations. All blasting operations shall be in accordance with all applicable local, State, and Federal laws. Before any explosives are brought on the job, permission to do so shall be obtained from the ENGINEER.

4.4. **Sheeting and Bracing**: Sheeting and bracing as may be required to safely support the sides of excavations shall comply with the safety precautions as outlined in current and accepted safety manuals, such as "Associated General Contractors Manual of Accident Prevention in Construction". Where sheeting and bracing are necessary to prevent caving of the walls of excavation and to safeguard the workers, dig the excavations to such widths that proper

allowance is made for the space occupied by the sheeting and bracing. The CONTRACTOR shall perform the additional excavation required, furnish and place the necessary sheeting and bracing, and remove same as the excavation is filled at his own expense.

4.5. **Material Placement:** No material shall be placed in any area until the area has been stripped as specified and the ENGINEER has approved the foundation. Foundation benches shall be excavated in all waste areas where the original ground slope beneath the fill is 15 percent or greater. The CONTRACTOR shall keep the area free from water or unacceptable material after the placement operations have started. Where depicted or described in the Drawings, an average depth of eighteen inches (18") of topsoil shall be stripped from the area and stockpiled at locations designated by the ENGINEER; the excavated topsoil shall be uniformly redistributed once all backfilling efforts have been completed.

When soil material is placed against sloping sides of excavations, slopes of old embankment, or natural slopes, the old material shall be cut or broken by machine or hand methods approved by the ENGINEER, until it shows the characteristic color of moist material. The equipment shall then compact both materials, bonding them together.

An agricultural limestone barrier may be required by the Drawings or ENGINEER in conjunction cover material to support revegetation efforts. Earthen cover placed over acidic materials such as refuse and slurry fines shall be a minimum of two (2) feet depth.

Earthen material shall be spread as follows:

(1) The distribution throughout the area of fill shall be such that the fill will be free from voids, pockets, and bridging of material. The combined material removal and placement operations shall be such that the material, when compacted, will be blended sufficiently to ensure the best practicable degree of compaction and stability. Successive loads of materials shall be dumped to produce the best distribution.

(2) No material placed in the fill area by dumping in piles or windrows shall be incorporated in a layer in that position, but shall be moved and spread by blading or similar approved methods. The thickness of layers placed before compaction shall be as designated in Section 5.5.7.

(3) Material in the form of large soil lumps or soil masses shall be pulverized by disking, harrowing, or by the use of mechanical pulverizers prior to compacting.

The CONTRACTOR shall maintain and protect areas of fill in a satisfactory condition at all times until completion and acceptance of all work under the Contract. If, in the opinion of the ENGINEER, the hauling equipment causes horizontal shears of slicken sides, rutting, quaking, heaving, cracking, or excessive deformation of fills, the CONTRACTOR shall limit the type, load or travel speed of the hauling equipment on the areas of fill. During material placement, the CONTRACTOR shall remove from the areas of fill any material, which the ENGINEER considers objectionable, and shall also dispose of such material and refill the areas as directed, all at no additional cost to the COMMONWEALTH.

4.6. **Moisture Control**: During the compaction operation, the surface of the fill area and the materials being placed shall be maintained within the moisture content range required to permit proper compaction to the density specified herein. The moisture content shall be controlled in the following manner:

(1) When material deposited on the fill is too dry, the CONTRACTOR shall be required to sprinkle each layer and obtain uniform moisture distribution in the layer by disking, blading, or other approved methods. The amount of water applied shall be accurately controlled so that free water will not appear on the surface during or subsequent to compaction operations.

(2) Material deposited in fill areas that is too wet shall be removed or spread and permitted to dry, assisted by disking or blading if necessary, until the moisture content is reduced to the specified limits.

(3) When the top surface of a layer becomes too dry or too smooth to permit suitable bond with the subsequent layer, the CONTRACTOR shall loosen the material by scarifying, disking, or using other suitable equipment in an approved manner until the in-place material shows the characteristic color of moist material to a sufficient depth to provide a satisfactory bonding surface as determined by the ENGINEER. The ENGINEER may also require that the loosened material be moistened, to acceptable moisture content as generally determined by visual inspection, and the material reworked, prior to compacting the material to the specified density.

(4) Adjustments of moisture content shall be made based on determination of moisture by field tests as construction progresses.

4.7. **Special Handling**: Mixing, segregation, and/or other special handling of excavated materials may be required to avoid: concentrations of unsuitable materials in fill areas; development of lenses that may contribute to instability; and/or unacceptable voids, pockets, and bridging. Toward this objective, the CONTRACTOR may be required to excavate materials in a sequence which will, in the ENGINEER'S opinion, provide the best control for segregating extremely moist, weak, rocky, or other undesirable materials until same can be dried and/or otherwise properly incorporated into fill areas.

Materials consisting predominantly of non-friable rock, when placed in areas of fill shall not be dumped in final position, but shall be distributed in a manner that will ensure placement so that voids, pockets, bridging and settlement, or shifting are held to a minimum. Concentrations of predominantly rock materials, where the largest fragments do not exceed 1.5 cubic feet in size and the overall material sizes are generally in a well distributed range, may be placed in 2-foot (+) thick layers as approved by the ENGINEER. Larger rocks, particularly those approaching boulder proportions, are to be isolated in the fill and material compacted around them as otherwise required herein. Rocks of sizes and/or gradations outside or between the ranges described are to be handled as directed by the ENGINEER on a case-specific basis.

4.8. **Compaction:** Compaction requirements for all AML projects will fall into one of three categories, Maximum Compactive Effort, Moderate Compactive Effort, or Minimum Compactive Effort. **If the level of compactive effort is not designated elsewhere in the Specifications or on the Plans, then the fill area shall receive a Moderate Compactive Effort.**

(1) **Maximum Compactive Effort (Critical Use Areas):** Areas designated to receive maximum compactive effort shall have materials placed in 12 inch maximum horizontal lifts with an in-place moisture content within 3% of the optimum moisture content (ref. ASTM D-698). They shall be compacted with a minimum of 4 passes with a sheepsfoot roller with a foot contact area of 10 to 14 sq. ft. and foot contact pressure between 150 to 250 psi. Should this method not provide sufficient compaction to achieve 95% of the materials maximum dry density with an in-place moisture content within 3% of the optimum moisture content (ref. ASTM D-698), then additional compactive effort and/or shallower lifts shall be required. In-place density and moisture tests shall be performed, utilizing methods outlined in ASTM D-2922, for every lift of material placed. The number of tests per lift shall be as determined by the ENGINEER. The ENGINEER shall be responsible for taking compaction tests.

(2) **Moderate Compactive Effort (Non-Critical Use Areas):** Areas designated to receive moderate compactive effort shall have materials placed in 12-inch maximum horizontal lifts, spread, and compacted with successive passes of dozers or other tracked equipment. The satisfaction of the compaction/moisture control efforts shall be based on continuous assessments of the color, moistures, and overall suitability of materials slated for placement. The equipment to be used for spreading and compaction; as well as the reaction of the in-place materials to the applied loadings to ensure that pumping, weeping, heaving, and other conditions normally accompanying or indicating unacceptable compaction or moisture levels are not present. In the event of conflicts between the CONTRACTOR and ENGINEER, or persistence of placement/compaction problems, density and moisture testing will be initiated. Sufficient compaction shall be required to achieve 90% of the material's maximum dry density with in-place moisture content within 3% of the optimum moisture content and/or the ENGINEER may require a modification in the CONTRACTOR'S handling, placement, or compaction procedures.

(3) **Minimum Compactive Effort (Non-Critical Use Area):** Areas designated to receive minimum compactive effort shall have materials placed in 24 inch maximum horizontal lifts and spread and compacted with successive passes of dozers, track equipment, or rubber tired hauling equipment. Uniform compaction must be obtained throughout each lift. Moisture levels shall be monitored to ensure adequate compaction. If satisfactory compaction is not being achieved, then the ENGINEER may require to CONTRACTOR to meet compaction requirements established under moderate compactive effort.

Such testing, or the lack thereof, does not relieve the CONTRACTOR from ensuring that all lifts receive the appropriate amount of compactive effort. In-place material not meeting these specifications will be rejected and shall be removed and/or reworked until satisfactory results are obtained.

Unless specified otherwise on the Drawings or Bid Item Description, assume “Moderate Compactive Effort” is required for all earthwork efforts.

5. CONSTRUCTION TOLERANCES

Material removal shall include excavation to the designated depths, transportation of removed materials from points of removal to points of final use, and the shaping and finishing of all areas.

Material removal carried below the indicated depths, except when directed by the ENGINEER, shall be replaced with material satisfactory to the ENGINEER. Additional payment will not be made for unauthorized material removal or for any backfilling necessitated thereby. All areas shall be constructed to the lines, grades, and cross-sections indicated on the Drawings, unless otherwise directed by the ENGINEER.

The CONTRACTOR shall make every reasonable effort to construct the project uniformly. Tolerances, which will be allowed, before changes will be made in the quantities to be paid or before reworking of the constructed item is required, are as follows:

(1) The design intent is to stabilize the area(s) and to leave a free draining uniform surface suitable for revegetation. The nature of the Project does not lend itself very well to the establishment of numerical standards for permissible deviations from the templates and lines shown on the Drawings. A work area will generally be accepted when -- in the ENGINEER'S opinion the design intent has been achieved. However, in the event problems arise, the ENGINEER may require that the finished grades not deviate more than 1 foot (+) from the neat lines shown on the Drawings.

(2) No payment will be made for any earthwork performed outside the limits shown on the Drawings or those approved by the ENGINEER. No extra material shall be removed or placed outside of these limits without permission.

EQUIPMENT

1. SCOPE

This specification covers the supplying of the equipment, which is to be compensated for on an hourly basis, necessary to complete the project as it is described in these Technical Specifications and on the accompanying Drawings.

2. EQUIPMENT REQUIREMENTS

The following specifications will be applicable to any equipment required on this contract. The equipment will be operated at the capacity to produce the required horsepower and will be shifted at the resident inspector's request.

2.1. Crawler Tractors:

On any sites requiring more than 150 hours, the CONTRACTOR will be responsible for supplying two (2) tractors.

- A.
 - 1. Minimum Flywheel Horsepower: 500 h.p.
 - 2. Minimum Weight (including Blade): 140,000 lbs.
 - 3. Excellent working condition as certifiable by a Cabinet appointed mechanic.
 - 4. Equipped with Hydraulic Tilt Blade, Torque Convertor, Power Shift and Working Hourmeter
(Example Caterpillar D10)

- B.
 - 1. Minimum Flywheel Horsepower: 370 h.p.
 - 2. Minimum Weight (including Blade): 100,000 lbs.
 - 3. Excellent working condition as certifiable by a Cabinet appointed mechanic.
 - 4. Equipped with Hydraulic Tilt Blade, Torque Convertor, Power Shift and Working Hourmeter
(Example Caterpillar D9)

- C.
 - 1. Minimum Flywheel Horsepower: 270 h.p.
 - 2. Minimum Weight (including Blade): 80,000 lbs.
 - 3. Excellent working condition as certifiable by a Cabinet appointed mechanic.
 - 4. Equipped with Hydraulic Tilt Blade, Torque Convertor, Power Shift and Working Hourmeter
(Example Caterpillar D8)

- D.
 - 1. Minimum Flywheel Horsepower: 200 h.p.
 - 2. Minimum Weight (including Blade): 51,100 lbs.
 - 3. Excellent working condition as certifiable by a Cabinet appointed mechanic.
 - 4. Equipped with Hydraulic Tilt Blade, Torque Convertor, PowerShift and Working Hourmeter
(Example Caterpillar D7)

- E. 1. Minimum Flywheel Horsepower: 140 h.p.
 2. Minimum Weight (Including Blade): 30,600 lbs.
 3. Excellent working condition as certifiable by a Cabinet appointed mechanic.
 4. Equipped with Hydraulic Tilt Blade, Torque Convertor, Power Shift and Working Hourmeter
(Example Caterpillar D6)
- F. 1. Minimum Flywheel Horsepower: 120 h.p.
 2. Minimum Weight (Including Blade): 28,000 lbs.
 3. Excellent working condition as certifiable by a Cabinet appointed mechanic.
 4. Equipped with Hydraulic Tilt Blade, Torque Convertor, Power Shift and Working Hourmeter
(Example Caterpillar D6)
- G. 1. Minimum Flywheel Horsepower: 100 h.p.
 2. Minimum Weight (Including Blade): 15,000 lbs.
 3. Excellent working condition as certifiable by a Cabinet appointed mechanic.
 4. Equipped with Hydraulic Tilt Blade, Torque Convertor, Power Shift and Working Hourmeter
(Example Caterpillar D5)
- H. 1. Minimum Flywheel Horsepower: 50 h.p.
 2. Minimum Weight (Including Blade): 15,000 lbs.
 3. Excellent working condition as certifiable by a Cabinet appointed mechanic.
 4. Equipped with Hydraulic Tilt Blade, Torque Convertor, Power Shift and Working Hourmeter
(Example Caterpillar D4 & D3)

2.2. **Backhoe:**

Backhoe (Rubber Tired):

1. Minimum Bucket Capacity: 0.2 cu. yd. (heaped)
2. Minimum Digging Depth: 15 ft.
3. Minimum Reach: 17 ft.
4. Excellent working condition as certifiable by a Cabinet appointed mechanic.

Crawler Mounted Backhoe (Pull Shovel):

1. Minimum Horsepower: 130 h.p.
2. Minimum Bucket Capacity: 1.25 cu. yd. (heaped)
3. Minimum Digging Depth: 20 ft.
4. Minimum Reach: 30 ft.
5. Excellent working condition as certifiable by a Cabinet appointed mechanic.
6. Equipped with a Hydrostatic drive propel system and a working hourmeter.
7. Operating Weight: 38,000 lbs.

2.3. **Hoe Ram (Excavator Attachment):**

2.3.1 Excavator

1. Minimum Horsepower: 120 h.p.
2. Minimum Bucket Capacity: 1.5 cu. yd. (heaped)
3. Minimum Digging Depth: 20 ft.
4. Minimum Reach: 30 ft.
5. Operating Weight: 38,000 lbs.
6. Excellent working condition as certifiable by a Cabinet appointed mechanic.
7. Equipped with a Hydrostatic drive propel system and a working hourmeter.

2.3.2 Hoe Ram

1. Minimum Weight: 2000 lbs.
2. Minimum Delivery Rate: 300 rams per minute.

2.4. **Track Loader:** A crawler mounted loader which meets the following requirements will be required on the project.

- A.
1. Flywheel Horsepower 110
 2. Minimum Bucket Capacity: 2 cu. yds.
 3. Minimum Operating Weight: 30,000 lbs.
 4. Equipped with Torque Convertor, Power Shift and working hourmeter.

2.5. **Rock Trucks (Back dump):**

- A.
1. Two (2) Axles
 2. 35 Ton Minimum Capacity (hauling)
 3. Diesel Engine
 4. Rear Dump
- B.
1. One (1) Axle
 2. 8 Ton Minimum Capacity (hauling) Rear Dump

2.6. **Pump:**

2.6.1. **General:** The work will consist of utilizing a pump as set forth on the Bid Schedule.

2.6.2. **Equipment:** A pump with an intake as set forth on the Bid Schedule.

2.7. **Crimper:** See the “Revegetation” section of these Technical Specifications.

3. EQUIPMENT CERTIFICATION

All equipment specified and furnished by the CONTRACTOR on this project must be certified as being in excellent working condition by the CONTRACTOR and approved by the Division of Abandoned Lands, Environmental and Public Protection Cabinet. Upon the recommendation of the Resident Inspector, the Division of Abandoned Lands reserves the right to engage the services of a certified mechanic to inspect any equipment on site. Any equipment found not to be in compliance with these specifications will be repaired or replaced within a reasonable period of time. Inspection costs for any equipment determined to be substandard will be paid by the CONTRACTOR.

All equipment must meet the minimum requirement specified. The ENGINEER will not accept any substitutions for the equipment requirements as outlined in this specification. At the ENGINEER'S request, the CONTRACTOR may be required to supply the following:

- a. A factory certification of flywheel horsepower.
- b. A certified weight ticket of the tractor's weight, including blade. A representative of the Division of Abandoned Lands will be present when the tractor is weighed.

4. EQUIPMENT FAILURE AND REPLACEMENT

In the event of equipment failure or breakdown, the CONTRACTOR will repair or provide replacement equipment within ten (10) days of the initial breakdown or failure. Replacement equipment furnished after the breakdown must meet the same specifications as listed in this specification and be approved by the Division of Abandoned Lands.

Failure to repair and/or replace broken down equipment within ten (10) days by the CONTRACTOR will be considered by the Division of Abandoned Lands and the Finance and Administration Cabinet as failure to perform. This declaration of failure to perform will result in an unsatisfactory Performance Evaluation and Receiving Report, Form B111-43. An unsatisfactory rating could have a bearing on future bidding privileges and/or approval of future bids.

5. OPERATOR QUALIFICATIONS

All equipment operators shall be competent and experienced with the type of equipment for which they are assigned.

Failure of any operator to display productivity commensurate to this requirement shall be grounds for the ENGINEER to require a replacement in that specific operating position.

6. SAFETY STANDARDS

All equipment used on this project must meet all of the appropriate Federal and state (OSHA) safety requirements.

EROSION CONTROL BLANKET

1. SCOPE

The work shall consist of placing erosion control blankets in ditches and on slopes as indicated on the Drawings or as directed by the ENGINEER.

2. MATERIALS

The erosion control blankets shall consist of a machine-produced blanket of natural organic fibers with a mesh opening of approximately 3/4-inch x 3/4-inch. The blanket will be comprised of UV-stable polypropylene top and bottom nets with approximate weight of 3 lbs/1,000 ft² with biodegradable stitching thread.

The top net should be heavy weight polypropylene (3.0 lbs/1,000ft²) and the bottom net should be a light weight polypropylene material (1.5 lbs/1,000 ft²). The mat should be comprised of 70% straw at a minimum 0.3 lbs/yd² and 30% coconut at 0.1 lbs/yd². **Products used in ditches must be rated for a maximum flow velocity of 8.0 ft/s.**

3. CONSTRUCTION METHODS

After subgrade preparation, the area shall be seeded in accordance with the "Revegetation" section of the Technical Specifications before placement of the blanket.

The blankets shall be unrolled in the direction of water flow. When using two blankets side by side, the seams shall not be placed in the center of the ditch, but shall be offset by one (1) foot. Blankets shall be stapled in place by the use of "U" shaped staples of the size and at the prescribed intervals and arrangement specified by the manufacturers. When blankets are laid side by side, they shall be stapled to anchor the edge of each roll. Overlap of blankets shall be in accordance with the manufacturer's recommendations.

FENCE

1. SCOPE

This work shall consist of furnishing and constructing fence(s) of the height, type, and at the location specified in the Drawings or as directed by the ENGINEER. Where fences exist they shall be replaced in kind and at actual cost. New fences shall be subject to a regular bid item.

2. GENERAL

Fence shall involve the construction of fences as either safety fence, property fence or replacement fence. In all cases fences shall be as required by the Drawings or as directed by the Engineer. If an existing fence is encountered during construction that has not been identified on the drawings then it should be determined what type of fence it is, and then proceed as directed by the ENGINEER. In most all cases we will attempt to match the existing fence.

2.1. **Temporary Safety Fences:** Temporary safety fences are plastic orange barriers used to mark active construction boundaries, limit access, and restrict entry around open trenches, pits, holes, ect. These are incidental to the overall construction efforts. They are only used as long as an open void is present and construction is not actively occurring.

2.2. **Permanent Safety Fences:** Standard Safety Fences (**chain link or woven wire**) are the ones to be used to prevent injury to the general public. In general safety fences will be placed along the top/front of retaining walls, highwalls, and other various places that may cause a potential hazard to the public.

2.3. **Property Fences:** Property Fences (**chain link or barb-wire**) are the fences that will be disturbed in the process of doing the work required by the Drawings or as directed by the ENGINEER. Where a fence exists between two or more property owners the fence shall be treated as a property line and surveyed and referenced before construction begins. Once construction is complete the fence line shall be resurveyed and a new in kind fence placed at the exact location of the previous fence. Also where property point(s) are existing in the field they shall be surveyed and referenced so that they may be reestablished following construction. **However the Division of Abandoned Mine Lands does not state nor infer reestablishment of said features to be the true property boundary corners and/or lines establishment of property boundary corners and lines are beyond the scope of this effort. See “Structure Removal / Replacement” section of these Technical Specifications for further information regarding property fences.**

2.4. **Replacement Fences:** Replacement fences are those fences (e.g. farm fence) located in the field that are clearly not property fences or safety fences but are those fences that will be disturbed in the process of doing the construction called for in the drawings. These fences shall be replaced in kind. **See “Structure Removal / Replacement” section of these Technical Specifications for further information regarding replacement fences.**

3. MATERIALS

- 3.1. **Plastic Fence**: Use standard plastic/nylon construction orange fencing.
- 3.2. **Chain-Link Fabric**: Use 0.148-inch nominal diameter wire woven in 2-inch mesh. Coat Type I fabric to conform to Class D. Furnish fabric for fences 5 feet high that has the top selvages knuckled and bottom selvage knuckled or twisted and barbed. Furnish fabric for fences 8 feet high or higher with both top and bottom selvages twisted and barbed.
- 3.3. **Chain-Link Post Caps and Socket Type Brace Connections**: Post, Rails, Gate Frames, and Expansion Sleeves. With zinc-coated steel fabric or with aluminum-coated steel fabric, use either zinc-coated steel or zinc-acrylic coated steel. With aluminum alloy fabric, use aluminum alloy. Furnish steel posts that comply with Subsection 816.07.01.
- 3.4. **Fabric Ties**: Use either a minimum 0.148-inch nominal diameter aluminum alloy or 0.120-inch nominal diameter galvanized steel.
- 3.5. **Hog Rings and Tension Wire**: With zinc-coated steel fabric or with aluminum-coated steel fabric use zinc-coated steel wire or aluminum-coated steel wire. Ensure that steel ties and wire conform to ASTM F 626, except that the minimum weight of coating is 0.6 ounces per square foot. With aluminum alloy fabric, use aluminum alloy wire.
- 3.6. **Miscellaneous Fittings and Hardware**: With zinc coated steel fabric or with aluminum-coated steel fabric use zinc-coated steel. With aluminum alloy fabric, use aluminum alloy.
- 3.7. **Woven Wire Fabric**: Use either zinc-coated steel or aluminum-coated steel. Provide the type and size and style specified in the Contract. Zinc-coated fabric shall conform to ASTM A 116 and aluminum-coated fabric to ASTM A 584. If barbed wire is used it shall be either zinc-coated steel, aluminum coated steel or aluminum alloy in accordance with KYTC Standard Specifications for Road and Bridge Construction. Use barbs of 4-point pattern spaced at intervals of 5 inches.
- 3.8. **Posts and Braces**: Posts and braces shall be either steel posts/braces conforming to ASTM F 1043 and ASTM F 1083 or treated wood posts/braces conforming to either AWPA C 5 or AWPA C 2.
- 3.9. **Brace Wire**: Shall conform to ASTM A 777-91 except provide a minimum weight coating of 0.6 ounce per square foot. Use size 0.148-inch nominal diameter or larger.
- 3.10. **Woven-Wire Fabric Ties**: Use either a minimum 0.109 nominal diameter galvanized steel conforming to ASTM F 626 except ensure that the minimum weight of coating is 0.6 ounce per square foot or 0.148-inch nominal diameter aluminum alloy.
- 3.11. **Concrete**: Shall be Class A concrete conforming to the “Concrete” section of these Technical Specifications.

4. CONSTRUCTION

Before starting fencing operations, remove all brush, stumps, logs, and debris that will interfere with the proper construction of the fence. Remove or trim sound standing trees in the fence line as directed. Construct fence with new materials according to the Standard Drawings and as specified in this section. Install fence as one of the first construction operations. Where it is impractical to install fence initially in its final form or location, construct a suitable temporary fence or to delay fence erection until the permanent fence may be erected. Where tying fence to a new structure, erect a temporary fence until the structure is complete and the permanent fence can be anchored to the structure in the manner specified in the Plans. Install fence at locations specifically indicated on the Plans or as instructed by the ENGINEER. Install fence facing the property owner except on horizontal curves. On horizontal curves, install the fence to pull against all posts. Apply sufficient tension between pull posts to make the fence stock tight. Install pull posts at all breaks in horizontal alignment of the fence, and at sharp breaks in vertical alignment. For tangents and curves up to one degree, space pull posts a maximum of 500 feet on centers; ensure that curves over one degree to 4 degrees have pull posts spaced a maximum of 250 feet on centers; and curves over 4 degrees have pull posts installed each time the angle of deflection increases 5 degrees.

4.1. **Setting Posts:** Set all posts at the required depths and intervals designated in the Drawings or Standard Drawings. Set posts plumb and in true alignment on the side where the wire is attached. Dig holes for posts to full depth and with sufficient diameter to allow placement of concrete. When encountering solid rock at grade or below, drill a hole one foot deep and slightly larger than the outside dimensions of the post or brace in the rock, and concrete in the post. At line posts where top of rock is 8 inches or less below grade, remove the anchor plate. Field cut posts and braces to fit maximum depth whenever encountering solid rock. Set all end, gate, corner, and pull posts, and anchor them in concrete placed to the top of the ground, finished smooth, and sloped to drain. Brace all end, gate, and corner posts. Brace pull posts in two directions. Brace corner posts in the direction of each line of the fence. Anchor the metal braces from the metal posts in concrete that is crowned at the top to shed water. Brace concrete posts with a pole or bar of the same type of material as the post. Loop galvanized smooth wire having a minimum diameter of 0.148 inch around the braced post near the ground, and then loop it around the line post at 12 inches below its top continuing between the posts until four strands of wire are in place and the ends of the wire are securely fastened together. Then twist the strands of wire together until the brace pole is in compression. Do not allow the compression to be great enough to cause lateral springing in the brace pole. Allow concrete anchors to cure for at least 5 days before erecting the fence.

Where safety fences are called for on concrete walls the posts shall be bolted to the front of the wall. Posts shall not be set on the top of the concrete walls.

4.2. **Fencing:** Tie any intersecting fence to an independent pull post. Stretch fence fabric taut and securely fasten it to each post. Accomplish stretching with a stretcher that will produce equal tension in each line wire. Stretch fabric until the tension is just below the point of producing displacement in the tension crimps. At each end, corner, or gate post, cut and turn each strand of line wire around the post and tie it back to itself with no less than 3 turns. When it

is necessary to splice 2 sections of fence, make the splice by placing together the end stay wires of each section, and twist the end of each line wire around the stay wires and back onto itself with no less than 3 turns; or splice the fence by using ENGINEER approved splicing sleeves designed for that purpose. Attach the fence to each wood post with a staple for each line wire and as many additional staples as necessary to firmly secure the wire. Use tension wires and rails in erection of fences to stretch the fabric. When shown on the Standard Drawings, place, stretch taut, and secure at ends the top or bottom tension wires to all posts in a manner before placing fabric. When a top rail is required, secure the bar at each end before stretching and tying the fabric. Secure ends of the fabric with stretcher bars threaded through the loops of the fabric and secured to the posts by means of clamps with bolts and nuts. Use the number of clamps as indicated. Place the fabric by securing one end and applying sufficient tension to remove all slack before making attachments elsewhere. Fasten the fabric to the line posts and to the top tension wire or to the top rail, with tie wires or bands. Determine the number of tension bands required per post of fence by taking the height of the fence in feet and subtracting one. Space tie wires for attaching fence to the top tension wire or top rail on 24-inch centers. Space tie wires for attaching fence to intermediate or line posts on 14-inch centers. Space tie wires on chain link gates on 24-inch centers (when applicable). Install the chain link fence around utility installations facing the highway with the barbed wire arms at a 45-degree angle extending toward the highway. Design and install post caps for all tubular posts to exclude moisture from inside the posts, and install socket type brace end connections to exclude moisture from inside the rails.

4.3. **Gates:** Erect gates at locations specified in the Plans or as the Engineer directs. Erect the gate plumb with its hinges firmly attached to the post and to the gate. Allow the gate to swing freely when opened. Install the latch so it works easily and secures the gate when closed.

4.4. **Finishing:** Ensure that the tops of all posts are at a uniform height above the ground or at a uniform distance above the top of the chain-link fabric. Ensure that the finished fence is true to line, taut, and solid at all points. Dispose of all surplus excavated material and other debris resulting from construction and leave the fence line with a neat and orderly appearance.

FILTER FABRIC

1. SCOPE

This work will consist of furnishing and placing filter fabric beneath ditches, around subsurface drains, and/or other applications as shown on the Drawings or as directed by the ENGINEER.

2. MATERIALS

2.1. Woven Fabrics:

WOVEN FABRIC		
PROPERTY	MINIMUM VALUE	TEST METHOD
Tensile or Grab Strength	200 lbs	ASTM-D-4632
Elongation	15%	ASTM-D-4632
Sewn Seam Strength	180 lbs	ASTM-D-4632
Puncture Strength	80 lbs	ASTM-D-4833
Trapezoidal Tear	50 lbs	ASTM-D-4533
Apparent Opening Size	U.S. Sieve # 40	ASTM-D-4751
Permeability	0.004 cm/s	ASTM-D-4491
Ultraviolet Degradation @ 500 hrs	70 % strength	ASTM-D-4353
Flow Rate	20 gal/min/sf	ASTM-D-4491

These materials are generally used for surface applications including under ditches and behind walls and road stabilization.

2.2. Non-Woven Fabrics:

LIGHT WEIGHT NON-WOVEN FABRIC (3-4.5 oz/sy)		
PROPERTY	MINIMUM VALUE	TEST METHOD
Tensile or Grab Strength	80 lbs	ASTM-D-4632
Elongation	50%	ASTM-D-4632
Puncture Strength	40 lbs	ASTM-D-4833
Trapezoidal Tear	30 lbs	ASTM-D-4533
Apparent Opening Size	U.S. Sieve # 50	ASTM-D-4751
Permeability	2.2 cm/sec	ASTM-D-4491
Ultraviolet Degradation @ 150 hrs	70% strength	ASTM-D-4355
Flow Rate	150 gal/min/sf	ASTM-D-4491

MEDIUM WEIGHT NON-WOVEN FABRIC (6-8 oz/sy)		
PROPERTY	MINIMUM VALUE	TEST METHOD
Tensile or Grab Strength	160 lbs	ASTM-D-4632
Elongation (%)	50%	ASTM-D-4632
Puncture Strength	90 lbs	ASTM-D-4833
Trapezoidal Tear	60 lbs	ASTM-D-4533
Apparent Opening Size	U.S. Sieve # 70	ASTM-D-4751
Permeability	1.5 cm/sec	ASTM-D-4491
Ultraviolet Degradation @ 150 hrs	70% strength	ASTM-D-4355
Flow Rate	110 gal/min/sf	ASTM-D-4491

HEAVY WEIGHT NON-WOVEN FABRIC (10-16 oz/sy)		
PROPERTY	MINIMUM VALUE	TEST METHOD
Tensile or Grab Strength	250 lbs	ASTM-D-4632
Elongation (%)	50%	ASTM-D-4632
Puncture Strength	155 lbs	ASTM-D-4833
Trapezoidal Tear	100 lbs	ASTM-D-4533
Apparent Opening Size	U.S. Sieve # 100	ASTM-D-4751
Permeability	1.2 cm/sec	ASTM-D-4491
Ultraviolet Degradation @ 150 hrs	70% strength	ASTM-D-4355
Flow Rate	80 gal/min/sf	ASTM-D-4491

Generally the non-woven fabric is used for drainage purposes.

2.3. **Other:** All fabrics shall be formed in widths of at least 6 feet. Sheets of fabric may be sewn together to form fabric widths as required. The sheets of fabric shall be sewn together at the point of manufacture or other approved locations. During all periods of shipment and storage, the fabric shall be wrapped in a heavy-duty protective covering to protect the fabric from direct sunlight, ultraviolet rays, temperatures greater than 140°F, mud, dirt, dust, and debris.

All fabric shall be approved before use. The CONTRACTOR shall furnish a Certificate of Compliance from the manufacturer with each shipment of fabric. The certificate, signed by an authorized official having legal authority to bind the company, shall attest that the fabric meets the specified chemical, physical, and manufacturing requirements. The certificate also shall include actual test results for each physical requirement of this specification. A sample of five (5) square yards shall be furnished with each shipment for verification testing.

3. INSTALLATION

The surface to receive filter fabric and aggregate shall be prepared to a relatively smooth condition free of obstructions, debris, or sharp objects that may puncture the fabric. The fabric shall be placed with the long dimension parallel to the flow line and shall be laid smooth and free of tension, stress, folds, wrinkles, or creases.

The filter fabric shall not be exposed to sunlight for a period of greater than two weeks. If the fabric is damaged during construction, placing a piece of fabric that is large enough to cover the damaged area and meet the overlap requirement shall repair the torn or punctured section.

3.1. **Laps:** When more than one strip is necessary, the strips shall overlap (longitudinally) a minimum of 24 inches. Transverse overlaps shall be a minimum of 18 inches and shall be placed so the upstream strip laps over the downstream strip. Install fastener pins through both strips of overlapped fabric at no less than 5-foot intervals along a line through the midpoint of the overlap, and at any other locations as necessary to prevent slippage of the fabric.

3.2. **Channel Lining:** Protect the fabric from damage due to the placement of the channel lining by limiting the height of drop of the material to no greater than 3 feet, or by placing a cushioning layer of sand on top of the fabric before dumping the material, at the CONTRACTOR'S option. Fabric shall not be placed until it can be covered with stone promptly to avoid damage from water, wind, and deterioration from undue exposure. The CONTRACTOR shall demonstrate that the placement technique will not damage the fabric.

3.2. **Subsurface Drains:** Place and shape the fabric to the sides and bottom of the trench without stretching the fabric. Protect the fabric from damage due to the placement of the crushed aggregate by limiting the height of drop of the material to no greater than 3 feet, or by placing a cushioning layer of sand on top of the fabric before dumping the material, at the CONTRACTOR'S option. Fabric shall not be placed until it can be covered with stone promptly to avoid damage from water, wind, and deterioration from undue exposure. The CONTRACTOR shall demonstrate that the placement technique will not damage the fabric. Fold the fabric over the backfilled trench and secure it with steel pins at intervals of 5 feet to produce a double thickness of fabric over the top of the trench, unless the fill aggregate is to be brought to the surface and left exposed.

FLEXIBLE CONCRETE CHANNEL LINING

1. SCOPE

The work shall consist of furnishing and installing flexible concrete channel lining where shown on the Drawings or as otherwise directed by the ENGINEER.

2. GENERAL

The flexible concrete channel lining shall be Flex-a-Mat as manufactured by Motz Enterprises, or equivalent.

3. MATERIALS

3.1 **Concrete:** The unit weight of the concrete used shall not be less than 125 lbs. per cubic foot on an oven dried basis. Pre-cast concrete and machine made blocks shall have a compressive strength of 4,000 psi minimum, 5% air entrained, and 5" slump during manufacturing. Use 2" long fibers weighing one-pound per cubic yard of concrete. The fibers are a micro-reinforced fiber for concrete. Machine made concrete blocks strength shall be determined by testing random cubes, cut from the body of the block. The cementitious materials shall conform to **ASTM C-33**.

The flexible liner shall be a tied concrete block mat delivered in rolls. The individual blocks must be pyramid rectangular shape 2" thick at center and 7" x 7" with 1.5" spacing between the blocks. The blocks shall be cast around and held together with high strength polypropylene geogrid.

2.3. **Equivalency:** Equivalent products, from companies are acceptable and shall be provided with certification from the manufacturer that the product will perform satisfactorily for maximum flow volumes and velocities as reported in manufacturer's literature for Flex-A-Mat product. Any materials that are suspect will be tested to determine compliance.

4. PROPERTIES

<u>INDEX PROPERTY/TEST</u>	<u>VALUES</u>	<u>UNITS</u>
Block Size	6.5" x 5.5"	(length x width)
Block Weigh	3.0	Pounds
Block Ground Cover	75%	%
Reinforcing Grid	Fornit 30/30	style
Underlayment	Fortrac 3D-30	style
Straw Coverage Rate	12 oz/sy	oz/sy

FLUME

1. SCOPE

The work covered by this specification shall include all labor, equipment, materials, and performing all operations necessary to provide and install a cutthroat flume in accordance with these technical specification and as indicated on the Drawings.

2. MATERIALS

2.1. **Cutthroat flume**: Flumes should be as manufactured by TRACOM, Inc.; 6575-A Industrial Way, Alpharetta, Georgia 30004, (877) 435-8637, www.tracomfrp.com or approved equivalent. The flume shall have a permanently attached high visibility staff gauge graduated in tenths and hundredths of a foot. Most applications will use 36”L x 8”W sized for 39 - 2,712 GPM discharge rate.

2.2. **Timber**: Use 6” x 6” and 4” x 4” pressure treated lumber in the flume approach and outlet sections.

2.3. **Spikes**: Spikes shall be 5/16 inch diameter galvanized steel nails.

2.4. **Reinforcement Bars**: Shall be 60 KSI, #5 rebar conforming to the “Steel” section of these Technical Specifications.

2.5. **Concrete**: Shall be Class A concrete conforming to the “Concrete” section of these Technical Specifications.

3. PROCEDURE

After the embankment in the area of the flume construction is compacted and accepted by the Engineer, the CONTRACTOR shall construct the flume approach and outlet structure with timbers, spikes, and rebar as shown on the Drawings, outlined in the manufacture’s installation instructions, or as approved by the ENGINEER.

Ensure that the flume is plumb and the bottom is level. Embed the flume in concrete or grout, or attach appropriate installation material to the anchor clips as recommended by the manufacturer or as directed by the ENGINEER.

Hand compaction of the embankment material near the approach and outlet structure and the flume may be required as directed by the ENGINEER.

GABIONS

1. SCOPE

The work shall consist of furnishing and installing rock filled, wire mesh gabions where shown on the Drawings or as otherwise directed by the ENGINEER.

2. MATERIALS

2.1. **Wire:** The wire incorporated in the lid and body of gabion units shall be constructed of galvanized steel. The mesh shall be constructed by double twisting the adjoining wire, i.e., both wires must be twisted in an interlocking, non-raveling fashion. All wire for corners, edges, selvages, and binding shall be heavily galvanized with a minimum zinc coating of 0.80 ounces per square foot of uncoated wire surface, as determined by tests conducted in accordance with ASTM A90. The tensile strength of the wire shall be at least 60,000 pounds per square inch, and the mesh must have sufficient elasticity to permit 10 percent elongation diameter of the individual wires. The following minimum wire diameters are required for **non-PVC coated** units only.

Type / Use of Wire	--Minimum Diameter--
	Gabion
Mesh wire	0.118
Selvage/corner wire	0.150
Lacing/connecting wire	0.0866

2.2. **Course Aggregate:** The baskets shall be filled with clean, hard durable limestone from a source approved by the ENGINEER. The stone shall be well graded, with sizes ranging from a minimum of 5 inches to a maximum of 8 inches as measured in the greatest dimension; and shall otherwise conform to the “Crushed Aggregate and Channel Lining” section.

2.3. **Anchors:** Steel anchors shall be standard deformed type bars conforming to ASTM A-615. The bars shall be manufactured from new billet steel of American manufacture, and shall have minimum yield strength of 60,000 psi (Grade 60).

2.4. **Filter Fabric:** Conform to the “Filter Fabric” section of these Technical Specifications.

3. FABRICATION

3.1. **General:** The gabion units shall be fabricated in such a manner that the base, sides, ends, and lids can be assembled at the construction site into a rectangular unit of the specified sizes. The body of the units shall be of single unit construction; the base, ends, sides, and lids formed of a single woven mesh unit. All perimeter edges of the mesh forming the unit shall be securely selvaged so that the joints formed by tying the selvages have at least the same strength as the body of the mesh. Lacing wire shall be supplied in sufficient quantity to permit all sides, ends,

and diaphragms of the body to be securely fastened, as well as to fasten the top to all sides, ends, and diaphragms of the body.

Tolerance limits for height, length, and width are ± 3 percent of the manufacturer's stated sizes.

Gabions shall be made in 3' cells (3' H, 3' W, and 3' L) unless otherwise approved by the ENGINEER.

3.2. **Gabions**: The gabions shall be constructed with a hexagonal weave having an opening of approximately 3 1/4 inches by 4 1/2 inches. When the gabion length exceeds its width, it shall be supplied with diaphragms to form individual cells of equal length and width. The gabion unit shall be furnished with the necessary diaphragms secured in position on the base so that no additional tying will be necessary. The diaphragms shall be of the same material composition as the gabion.

3.3. **Certification**: Each shipment of gabions to a job site shall be accompanied by a certification from the manufacturer, which states that the material conforms to the requirements of this Specification. The certification shall be on the manufacturer's letterhead and shall be signed by an officer of that company. Any gabions that are suspect will be tested to determine if they meet these technical specifications

4. INSTALLATION

The foundation shall be prepared to accept the gabions as indicated on the Drawings. The foundation shall be inspected and approved by the ENGINEER. Filter fabric shall be installed and accepted, when applicable, prior to placement of the units.

Empty units shall be assembled individually on a hard, flat surface. Care must be exercised to assure that each basket is stretched or manipulated as necessary to achieve the proper rectangular shape. Sides, ends, and diaphragms must be erected and laced to ensure the correct orientation of all seams and creases. Once assembled, empty units shall be set to the lines and grades shown on the Drawings, or as directed by the ENGINEER.

All units shall be connected to the adjoining units, while empty, by lacing wire along the perimeters of their contact surfaces. Securing diaphragms, ends and sides, closure of units, and connecting adjoining units shall be accomplished by continuous stitching with alternating single and double loops at 4-inch intervals. All ends of lacing wire are to be securely fastened and not protruding.

Empty units are to be stretched, after being properly laced and connected to the adjoining unit(s), to obtain uniform alignment and to remove kinks. A standard fence stretcher, "come-along", or other means of tensioning the unit may be used. **Adjacent rows of gabion units are to be placed such that the seams are offset.**

The units shall be carefully filled with stone by hand and/or machine to maintain alignment; to avoid bulges, damage to coating, and/or separation of units; and to minimize voids. The

maximum height from which stone may be dropped into gabion units shall not exceed 36 inches. In gabions over 2-foot high, the stone is to be placed in 12-inch lifts; adjusted by hand, if necessary, to form a reasonable smooth surface, and cross-ties (or bracing wires) installed. Cross-ties are to be looped through the mesh on opposing sides of the basket, and the wire tightened by twisting.

The ENGINEER may require the CONTRACTOR to use hand labor to selectively place the layers of stone along exposed surfaces (i.e., top, front, and ends) to provide a uniform surface and an overall appearance suitable to the site-specific situation at each installation. After each unit has been filled, the lid shall be leveled as necessary and secured to the sides, ends, and diaphragms using the previously described lacing (or stitching) technique.

5. ALTERNATIVE GABION SYSTEMS

5.1. **Gabion Soil Reinforced Walls:** Shall be the Terramesh System by Maccaferri Inc., or an approved equivalent. Installation will follow the manufacturer recommendations.

5.2. **Reinforced Soil Walls:** These are the Green Terramesh product manufactured by Maccaferri, or an approved equivalent. Installation will follow the manufacturer recommendations.

5.3. **Welded Wire Mesh:** The CONTRACTOR with the approval of the ENGINEER may elect to use gabion baskets manufactured from a welded wire mesh. Such baskets shall demonstrate similar or greater strengths and durability as the baskets specified by this specification. Welded wire fabric shall be composed of a series of longitudinal and transverse steel wires arranged substantially at right angles to each other, and welded together at the points of intersection by electrical resistance welding to form fabricated sheets. Gabions shall have a mesh opening of 3-inches by 3-inches with a tolerance of $\pm 1/8$ inch. Wire shall meet minimum requirements of ASTM 641, ASTM A854, ASTM 856, or ASTM 809. The minimum wire diameter shall be 0.120-inch. Spiral binders shall have a minimum wire diameter of 0.120-inch. Lacing wire shall have a minimum wire diameter of 0.087-inch. The baskets, lacing system, and entire gabion system shall be in accordance with manufacturer's recommendation.

5.4. **Gabion Unit Fasteners:** As an alternate to lacing wire, the Engineer may allow gabion unit fasteners that conform to gabion unit manufacture's recommended assembly and connection instructions.

Alternate's to the lacing wire may be used in gabion lined ditches, on all gabions to secure the shape of the gabion before placing and on horizontal surfaces where attached to each row of gabion. **All vertical surfaces in retaining walls must be secured with the standard lacing wire and secured in accordance with these Technical Specifications.**

GATE VALVES

1. SCOPE

This work shall consist of furnishing all labor, equipment and materials, and performing all operations involved with the installation of the gate valves and valve enclosures in accordance with the Drawings and these technical specifications.

2. MATERIALS

2.1. **Gate Valve:** The valves shall be six (6) inch and ten (10) inch “non-rising stem” Polyvinyl Chloride (PVC) gate valves with two (2) inch square operating nuts. The valves shall be as manufactured by Asahi/America, Inc., or an approved equivalent.

2.2. **Mechanical Joint Restraints (Flange Connection):** All connections between pipe and flanges on gate valves shall be according to the manufacturer’s recommendation and approved by the Engineer.

2.3. **Valve Stem Extension:** The valve operating nuts shall be connected to valve stem extensions that will allow valve operation from the surface. The Contractor shall provide the Division with two (2) tools for operating the valve from outside the enclosure. The tools must be at least 1” diameter painted tubes.

2.4. **Valve Enclosure and Lid:** The valve enclosure shall be cylindrical in shape with a minimum inside diameter necessary to accommodate the valve body, and installed to the depth and dimensions shown on the Drawings, or as directed by the Engineer. The valve enclosure may be commercial valve/meter box or a high density or corrugated polyethylene pipe. Valve enclosures shall have a removable locking lid as approved by the ENGINEER.

3. PROCEDURE

The gate valve and enclosure shall be installed at the locations and to the elevations shown on the Drawings or as directed by the ENGINEER. Gate valves shall be installed plumb, and according to the manufacturer’s recommendations.

The valves, enclosures, and lids shall be installed according to the manufacturer’s recommendations. Stem extensions shall be braced or laterally supported and connected to the valve operating nuts according to the manufacturer’s recommendation. Stem extensions shall extend to the finished grade surface and shall accommodate hand tool T-bars necessary for operations from the surface.

The Contractor shall exercise extreme care during backfill and compaction operations, to prevent any damage or undue stress to the valves, flanges, or enclosures. Any compaction of earth backfill within three (3) feet of the gate valves shall be accomplished by hand tamping, or small-scale manually driven equipment. The Contractor shall, at his own expense, repair or replace any damaged valves, flanges, or enclosures, as directed by the ENGINEER.

GEOGRID

1. SCOPE

The work shall consist of furnishing and installing a geogrid system and its components as indicated on the Drawings or as otherwise directed by the ENGINEER.

2. GENERAL

Uniaxial geogrids are to reinforce soil and backfill masses in retaining wall structures.

Biaxial and Triaxial geogrids are for base reinforcement for access roads and retaining walls.

Flexible geogrid mesh (Biaxial Geogrid and Uniaxial Geogrid) shall be fabricated of polypropylene or polyester yarn encapsulated with protective coating and shall feature aperture configurations and sufficient cross sections at junctions and ribs to permit significant interlock with soil materials. The geogrid shall have high tensile modulus relative to the soil, high flexural rigidity, and high continuity of tensile strength through all junctions and ribs. The geogrid shall retain its reinforcement characteristics under repeated dynamic loads in service. The geogrid shall be resistant to ultra-violet radiation, chemical degradation and damage from normal construction practices.

3. MATERIALS

3.1. **Uniaxial Geogrid**: Shall be a UX 1400 HS product for approved equivalent. The material must have minimum strength characteristics as defined by ASTM-D-4759:

Dynamic Load Capacity True Tensile Strength	
2% Strain (lbs/ft)	1,000
5% Strain (lbs/ft)	1,165

3.2. **Biaxial Geogrid**: Shall be a BX 1200 product for approved equivalent. The material must have minimum strength characteristics as defined by ASTM-D-4759:

Dynamic Load Capacity True Tensile Strength		
	Machine Direction (MD)	Cross Direction (XD)
2% Strain (lbs/ft)	410	600
5% Strain (lbs/ft)	810	1340

3.3. **Triaxial Geogrid:** Shall have the following minimum strength characteristics as defined by ASTM-D-4759:

Manufacture's Product	Aperture Stability kg-cm/deg @ 5.0 kg-cm	Radial Stiffness @ low strain lb/ft @ 0.5% strain
TX130 or Comparable	3.0	15,075
TX160 or Comparable	3.6	20,580

3.5. **Certification:** Each shipment of geogrid materials to the job site shall be accompanied by a certification from the manufacturer, which states that this material conforms to the requirements of this specification. The certification shall be provided on the manufacturer's letterhead and shall be signed by an officer of that company.

4. STORAGE AND HANDLING

Geogrids shall be stored at temperatures greater than 20°F and be shaded from periods of prolonged exposure to sunlight. CONTRACTOR shall ensure that the geogrid mesh remains free of accumulations of mud, cement, debris, grease, and other contaminants.

5. INSTALLATION

5.1. **Site Preparation:** Excavation and backfill zones shall be free of trees, stumps, water concentrations, debris, boulders and other impediments which could adversely affect the installation of the geogrid. The surface should be graded as uniformly as practicable prior to deployment of the geogrid.

5.2. Alignment and Orientation:

5.2.1. **General:** Geogrid re-enforcement shall be installed at the elevations, locations, and orientation as shown on the construction Drawings and as directed by the ENGINEER.

Manufactures guidelines shall be followed except as directed in writing by the ENGINEER.

5.2.2. **Biaxial and Triaxial Geogrid:** Each strip should be aligned parallel with the long axis of the main force. If joints are determined to be necessary the geogrids shall be overlapped a minimum of two (2) feet.

5.2.3. **Uniaxial Geogrid:** The embedment length shall be ten feet and oriented the long axis perpendicular to the face of the wall. Joints will not require overlap of fabric. Each strip of uniaxial geogrid shall be continuous (without slice or overlaps).

5.3. **Anchoring:** Geogrid shall be secured in place during construction using staples, pins, sand bags, or backfill as dictated by field conditions or as directed by the ENGINEER. It shall be secured as uniformly parallel to the prevailing in-place slope as practicable and shall be deployed fully, without kinks or wrinkles.

5.4. **Backfill**: Backfill material shall be placed in lifts and compacted so as to minimize displacing, wrinkling, or tearing the geogrid. The geogrid shall be covered in 18" lifts. Tracked equipment shall not operate directly on the geogrid with less than 6" of fill material and shall not be turned with less than 12" of fill material on the geogrid. Rubber-tired equipment may be operated on the geogrid at speeds less than 10 mph. Sudden braking and sharp turning shall be avoided.

GROUT PRODUCTS

1. SCOPE

This work shall consist of furnishing all materials, equipment, and labor necessary for placing grout as shown on the drawings and as directed by the ENGINEER.

2. MATERIALS

2.1. **Grout**: Grout shall consist of a mixture of Portland cement, fine aggregate, and water. Portland cement shall be Type II conforming to ASTM C 150. Fine aggregate shall consist of inert natural sand conforming to ASTM C 33 or C 404. Water shall be clear, fresh, and free from injurious amounts of oil, acid, organic matter, or other deleterious substances. The materials shall be proportioned to provide a minimum 28-day compressive strength of 4,500 psi ASTM C 109. Water Cement Ratio shall not exceed 0.44.

2.2. **Flowable Fill**: Flowable fill shall consist of controlled, low-strength, cement mixed to achieve a twenty-eight (28) day compressive strength between 1,000 and 1,200 psi. The following mixture portions shall be utilized with variations allowed by the ENGINEER depending on availability of materials locally:

Cement	Fly Ash Type F	Sand (S.S.D.)	Water
(lb/cyd)	(lb/cyd)	(lb/cyd)	(lb/cyd)
200-250	300	3,000	400-450

2.3. **Shotcrete**: Shotcrete shall be composed of Portland cement, fine and coarse aggregate, and water. Either wet-mix or dry-mix shotcrete may be used. The mixture shall have minimum 28-day strength of 2,500 psi.

GUARDRAILS

1. SCOPE

This work shall consist of furnishing all materials, equipment, and labor necessary for placing guardrails as shown on the drawings and as directed by the ENGINEER.

2. MATERIALS

2.1. **Guardrails**: Shall be steel “W” beam material meeting the requirements of AASHTO M180 “Standard Specifications for Corrugated Sheet Steel Beam for Highway Guardrail, Type 2 Class A” and the KY Transportation Cabinet’s “Standard Specifications for Road and Bridge Construction”, current edition.

2.2. **Guardrail End Treatment**: Shall be steel “W” beam material meeting the requirements of AASHTO M180 “Standard Specifications for Corrugated Sheet Steel Beam for Highway Guardrail, Type 2 Class A” and the KY Transportation Cabinet’s “Standard Specifications for Road and Bridge Construction”, current edition.

2.3. **Wooden Post**: Shall KY Transportation Cabinet’s “Standard Specifications for Road and Bridge Construction”, current edition.

2.4. **Steel Post**: Shall the KY Transportation Cabinet’s “Standard Specifications for Road and Bridge Construction”, current edition.

HAZARDOUS MATERIAL

1. SCOPE

The work shall consist of the proper disposal and documentation of all hazardous material remains located within the construction limits.

2. MATERIALS

Disposal of hazardous materials includes oil, fuel, batteries, lubricants, and chemical treatment (previously used for water treatment) located within the construction limits.

3. GENERAL

Generally the work shall consist of the disposal of all hazardous material from the project area and its transportation to, and appropriate placement, in a permitted disposal facility. All hazardous materials located within the construction limits shall be marked or flagged by the ENGINEER. It is recommended that the contractor walk the sites and determine the risk. Those materials, which have a salvage value, may be disposed of in a manner as approved by the ENGINEER. The remains shall be transported in a safe manner, being covered or otherwise secured as necessary to prevent loss in transit.

It is the CONTRACTOR'S responsibility to determine the amount of effort required to complete this bid item. This includes any permits and safety measures that are necessary during all phases of this work.

HIGHWALL- SLOPE ROCKFALL BARRIER FENCE

1. SCOPE

The work shall consist of providing safeguards and protection to the residents, private property, and public infrastructure from rocks, boulders, mud, debris, trees or other materials that are excavated or dislodged during the construction project.

2. GENERAL

The rock fall barrier shall be an AXI-050 barrier manufactured by Geobrugg North America, LLC or an approved equivalent.

The rockfall barrier system shall be manufactured and assembled in accordance with the contract documents and plans, and the manufacturer's standards and requirements as follows:

Provide a rockfall control fence system with a minimum height of at least fourteen 14.70 feet and of sufficient structural capacity to absorb impact design loads of 184 foot-tons (500 kJ) of kinetic energy without the passage of particles larger than 30 inches (76 mm) in diameter through the barrier and with little or no maintenance required after multiple rock impacts. No tie-back (retaining) ropes for the posts will be allowed in the design.

Supply at the time of proposal submission a certification that the barrier to be supplied has received a Swiss Federal Research Institute (WSL) or European ETAG 27 Category A test report and certificate (or equal) for that specific system design being provided on the contract demonstrating the barrier equals or exceeds the stated performance in a vertical drop test. A proposal received without the system's certified test report and ETA certification will be rejected.

Select a manufacturer engaged in designing and manufacturing rockfall protection systems, having a minimum of five (5) years of documented experience manufacturing of such systems used in a similar application and capacity. Supply written evidence from manufacturer demonstrating certification of a quality assurance program, as well as proof and validity of seller's liability insurance.

3. MATERIALS

3.1. **Ring Nets:** The nets shall be made from interlocking steel rings, each ring with a maximum nominal diameter of 300 mm (11.81 inches). Rings shall be composed of steel wire coiled into a loop with 7 loops per ring. Three steel clips shall be fastened around each ring to hold the ring together. Each ring shall connect to the four adjoining rings by passing through them.

The wire shall be high tensile strength carbon steel wire with a nominal 3 millimeter (0.118 inches) diameter and the minimum breaking strength of the wire shall be 1,770 Newtons/square millimeter (256,0000 pounds/square inch).

The wire shall be coated with super coating and the minimum weight of the coating shall be 125 grams/square meter (0.41 ounces/square foot).

3.2. **Wire Mesh:** Nets shall be covered with chain link mesh, which shall be attached to the wire rope netting and fastened with galvanized hog rings and/or galvanized tie wire on 2-foot centers horizontally and vertically. Chain link material shall be 2 inch; 9-gauge minimum and shall conform to AASHTO M181-90, shall be zinc coated in accordance with A392-84, Class 1 Standards, and may be PVC coated for color.

3.3 **Net Support Posts:** Posts shall be fabricated from HEB-180 / W8x35 wide flange structural members for the 3.0 meter high system. The posts shall meet the requirements for ASTM A36 for preformed steel shapes.

Posts shall be fabricated with a ground plate designed for rock or loose soil/concrete foundation depending on site conditions. The posts shall attach to the ground plates with breakaway pins that protect the ground plates.

Post and base plates shall be hot dipped galvanized for corrosion protection.

3.4. **Net Support Ropes:** The system shall have double top and double bottom support ropes and shall be manufactured from 19 millimeter (3/4-inch) diameter, galvanized, 6x19 construction or equivalent, IWRC wire rope.

A brake rope sling shall be installed at the end of each support rope run using GS-8001 brake rings.

3.5. **Lateral Anchor Ropes:** Lateral anchor ropes shall incorporate a factory swedged eye on one end and shall be manufactured from 19-millimeter (3/4-inch) diameter, galvanized, 6x19 construction or equivalent, IWRC wire rope.

3.6. **Lateral Anchors:** The anchors shall be wire rope anchors made from 19 millimeter (3/4-inch) diameter, galvanized, 6x19 construction or equivalent, IWRC wire rope and shall incorporate a factory swedged eye on one end.

The anchor pullout strength shall be 260 kilonewtons (58,540 pounds) and must be verified by the contractor in the field. The testing shall consist of a pullout test incorporating 20% of the total number of anchors. If more than 25% of the tested anchors fail, all anchors shall be tested. Failed anchors shall be replaced by the contractor at no additional cost to the owner. Testing shall be performed using a temporary yoke or load frame. No part of the yoke or load frame shall bear within 3 feet of the anchor.

3.7. **Vertical End Ropes:** The ropes shall be made from 19 millimeter (3/4-inch) diameter, galvanized, 6x19 construction or equivalent, IWRC wire rope and shall incorporate a factory swedged eye on each end.

3.8. **Shackles**: Shackles shall be used to fasten the ring nets to each other and to the support ropes. Along the top and bottom of each net, 1/2-inch shackles shall be used. Along the sides of each net, 7/16-inch shackles shall be used.

3.9. **Miscellaneous Materials**: All miscellaneous hardware such as wire rope clips, thimbles, bolts, etc. shall be supplied by the manufacturer with the system.

3.10. **Wire Rope Specifications**: All wire rope for the support ropes, lateral anchor ropes, vertical end ropes, run top ropes and wire rope anchors shall meet the Federal Specification RR-W-410D or ASTM A1023/1023M or equivalent.

3.11. **Corrosion Protection**: The ropes for the support ropes, lateral anchor ropes, vertical end ropes, run top ropes and wire rope anchors shall meet Federal Specification RR-W-410D or ASTM A1023/A1023M for galvanizing. Hog rings or tie wire shall be supplied with zinc coating meeting the requirements of ASTM A641-92.

4. CONSTRUCTION

4.1. **Excavation and Foundations**: The excavation work by the contractor shall be in accordance with the design drawings. The contractor shall place excess excavated material at the designated waste area.

The foundation work for the columns and rock and soil anchors shall be performed in accordance with the typical cross sections shown on the design drawings. The distance from centerline to centerline of the columns must be kept as close as possible to that shown on the design drawings. The spacing cannot exceed plus or minus 3 inches of the distance as indicated on the design drawings.

Prior to placing of concrete, the contractor shall moisten the earth subgrade to a minimum depth of 2 inches from the soil and concrete surfaces. All loose soil or rocks shall be removed from the holes. The minimum concrete strength is to be 4,000 psi. The contractor shall determine the consistency in the field by a slump test, ASTM C143-78.

After the concrete placement in the forms, the contractor shall maintain the concrete at a minimum temperature of 50 degrees F for a period of 72 hours.

4.2. **Rockfall System Installation**: The rockfall system shall be installed in accordance with the AXI-050 Product Manual.

4.3. **Field installation Supervision**: The manufacturer shall include one day at 8 hours per day installation supervision by a qualified Field Engineer in order to ensure the system is properly installed. Travel and living expenses shall be borne by the manufacturer. The cost for the installation supervision shall be included in the cost for the system.

4.4. **Shipping and Labeling of Materials**: All material shall be properly labeled by the manufacturer in order for the contractor to identify the system components easily with the manufacturer's design drawings to minimize installation time.

All materials shall be shipped by the manufacturer to the job site via common carrier. The cost for shipping shall be included in the cost for the system.

4.5. **Design Drawings**: The manufacturer shall submit copies of the generic layout and design drawings to the contractor at time of quotation submittal for comments and/or approval.

Fabrication of the system shall commence only after the manufacturer has received drawing approval from the customer.

The cost for the manufacturer's assistance and drawings shall be incidental.

5. ROCK FALL PAD

The rock fall pad will be a temporary energy absorption system to prevent falling rocks from damaging the rock fall barrier and public property. The pad shall be constructed to conform to the dimensions of the plans and details. It can be constructed from shale talus or soil excavated within the project limits or from sand or gravel imported from a quarry. There will be no additional payment for materials used, neither imported nor excavated. The rock fall pad can be built in segments in the precise area of excavation or it can be built in its entirety. The Contractor shall devise a system and staging that is compatible with his construction technique.

HIGHWALL- SLOPE ROCKFALL NETTING LIGHT DUTY

1. SCOPE

This shall include all highwall preparation efforts and securely installing rockfall netting on all designated areas as depicted in the drawings and as directed by the ENGINEER. In addition, it shall include installing anchor bars with grout to fasten the rockfall netting to highwall as directed by the ENGINEER. It shall be flexible zinc coated rockfall netting of the type and sizes specified below. It is made of wire mesh of the type and size and selvages as specified in the following paragraphs.

2. MATERIAL

2.1. **Wire**: All wire used in the fabrication of the rockfall netting and in the wiring operations during construction for the Zinc Coating and Tensile Strength shall be in accordance with the requirements of ASTM A- 641-92, Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire, for galvanized wire, class 3, and soft temper, as measured before fabrication of the netting. The nominal diameter of the wire used in the fabrication of the netting shall be 0.120 inches mesh, 0.85 oz/sq. ft. Standard Zinc-Coated rockfall netting shall have a nominal length of 150 feet and nominal width of 12 feet. Other dimensions may be used as approved by the ENGINEER.

2.2. **Zinc**: All wire used in the fabrication of the rockfall netting and in the wiring operations during construction shall be coated to ASTM A-641-92 for zinc coated (galvanized) carbon steel wire. The minimum weight of the zinc coating shall be according to the figures shown in the table below when tested in accordance with ASTM A- 90-93.

The adhesion of the zinc coating to the wire should be such that, when wrapped around a mandrel in accordance with ASTM A-641-92, the zinc coating will not crack or flake to such an extent that any zinc can be removed by rubbing with the bare fingers.

2.3. **Lacing Wire**: Sufficient lacing and connecting wire shall be supplied with the rockfall netting for all wiring operations carried out in the construction of the meshwork. The lacing wire procedure consists of cutting a length of lacing wire approximately 1-1/2 times the distance to be laced (not to exceed 5 feet). Securing one of the wire at the corner by looping and twisting, alternately lacing with single and double loops every other mesh opening at intervals of not more than six (6) inches (150 mm) and securing the other end of the wire to selvages by looping and twisting. The **nominal** diameter of lacing wire shall be 0.0866 inches, 0.70 oz/sq. ft.

2.4. **Fasteners**: Rings can be used in lieu of lacing wire for assembly and installation operations of the mesh. Rings shall be supplied with the same zinc coating as the mesh and the wire diameter of the rings conforming to the “Gabion” section of these technical specifications. Spacing of the fasteners must not exceed six (6) inches.

2.5. **Selvages**: All edges of the standard rockfall netting including end-panels and the diaphragms, if any, shall be mechanically selvaged in such a way as to prevent unraveling of

the mesh and to develop the full strength of the mesh. The wire used for the selvedge shall have a diameter greater than that of the wire used to form the mesh, namely:

For the 8 x 10 type mesh made of wire having a **nominal** diameter of 0.120 inches the selvedge shall be of wire having a **nominal** diameter of 0.1535 inches or greater, 0.90 oz. /sq. ft. coating weight.

2.6. **Anchor bars**: Unless shown otherwise on the plans, anchor bars shall consist of No. 5 reinforcement bar bent into an L-shape. The short leg of the L-shaped bar shall be approximately 6 inches long and the long leg 2 feet long.

2.7. **Shotcrete**: Shall conform to the “Grout” and “Shotcrete” sections of these Technical Specifications.

3. **FABRICATION**

The mesh shall be hexagonal woven mesh with the joints formed by twisting each pair of wires through three half turns. Because of their appearance, the joints are often termed triple twisted. The size of the mesh conforms to the specifications issued by the plant and shall be of 8 x 10 type mesh. Nominal mesh size is 3-1/4 x 4-1/2 inches.

According to engineering requirements the rockfall netting incorporate diaphragms to form cells having a length not greater than one and half the width of the mesh.

4. **INSTALLATION**

4.1. **Highwall Preparation**: The highwall shall be thoroughly cleaned and secured to remove all loose rock, soil and debris prior to the installation of rockfall netting. This shall be achieved by pressure washing or other methods approved by the ENGINEER. A hoe ram shall be utilized as well to remove the existing overhang and other protruding/large unstable rock as directed by the ENGINEER. The hoe ram shall have a minimum weight of 2,000 lbs. and a minimum delivery capability of 300 rams per minute.

The CONTRACTOR shall exercise extreme caution with working around highwall area as loose rock and debris exists within this area. The CONTRACTOR shall prevent workers from entering areas where potentially loose rock and other debris may fall thereby eliminating potential hazards to workers. The CONTRACTOR shall take measures to protect the existing structure during this and all phases of work.

4.2. **Rockfall Netting Installation**: Once highwall has thoroughly cleaned and secured, anchor bars (#5 Rebar) shall be set into predrilled holes 24” (depth min.) within the highwall and grouted in place. The rockfall netting shall be secured to the anchor bars using lacing wire or other techniques approved by the ENGINEER. The ENGINEER reserves the right to request the CONTRACTOR to place the anchor bars more frequently than depicted in the drawings if in the opinion of the ENGINEER it is warranted for long term structural integrity. Rockfall netting shall be shape to contour the highwall (2-inch max. off highwall face) with weep holes installed

(8" PVC Pipe) sloped to drain outward. No shotcrete shall be applied to the rockfall netting until approval is given from the ENGINEER.

4.3. **Anchor bars:** Unless otherwise shown on the plans, anchor bars shall be placed at approximately 8-foot (3.1 meters) centers maximum with the beginning row near the top of highwall, both horizontal and vertical, in 1 ¼-inch (31.8mm) holes drilled into the rock/soil face 24 inches deep. The drilled hole shall be blown clear prior to installation of the anchor bar. The drilled hole shall be completely filled with neat cement grout using a grout tube extending to the bottom of the hole. The anchor bar shall be pushed into the grout-filled hole and centered such that the short leg of the L-shaped bar points upward and is located about 1½ inches (38mm) from the rock/soil surface. Other locations and more frequent spacing may be required when the opinion of the ENGINEER, significant attachment is being achieved.

5. **TOLERANCES**

Tolerances on the diameter of all wire in the above clauses shall be permitted in accordance with ASTM A-641-92 Table 3. Tolerances of (+/-) 5% on the width, and length of the rockfall netting shall be permitted.

All dimensions are subject to confirmation as manufacturing requirements may dictate that the nominal sizes shall be varied from those given herein and tolerance shall apply to these adjusted dimensions.

Test shall be made on the wire before fabrication of the rockfall netting on a sample twelve inches long. Elongation shall not be less than 12%, in accordance with the requirements of ASTM A-370-92, Standard Test Methods and Definitions for Mechanical Testing of Steel Products.

HIGHWALL-SLOPE ROCKFALL NETTING HEAVY DUTY

1. SCOPE

This work shall consist of the careful preparation and installation of the rockfall system in accordance with these specifications and the manufacturer's instructions and guidelines. The intent is to stabilize a large section of exposed rock slope of an almost vertical highwall created by pre-law mining practices.

2. GENERAL

The work consists of furnishing, transporting and constructing a slope protection system in accordance with the contract documents and plans. The system is to be installed at the location shown on the final plans as approved by The ENGINEER.

The system shall be designed to withstand static and dynamic forces generated from rocks sliding under the permanently installed system. The system design shall have been previously used and shall have a demonstrated satisfactory performance in similar applications and capacities. The CONTRACTOR shall submit references for previous installations.

The system shall be constructed of relatively lightweight components and shall be compact in order to minimize transportation costs and installation time onsite.

The manufacturer shall be regularly engaged in the manufacturing of rockfall protection systems, having documented experience with manufacturing of rockfall protection systems used in a similar application and capacity. The manufacturer shall supply written evidence demonstrating certification of a quality assurance program, as well as proof and validity of seller's liability insurance. The manufacturer shall also include one (1) day at 8 hours per day installation supervision by a qualified Field Engineer in order to ensure the system is properly installed. Travel and living expenses shall be borne by the manufacturer. The cost for the installation supervision shall be included in the cost for the system.

All materials shall be shipped by the manufacturer to the job site via common carrier. The cost for shipping shall be included in the cost for the system. All material shall be properly labeled by the manufacturer in order for the Contractor to identify the system components easily with the manufacturer's design drawings to minimize installation time.

3. MATERIALS

3.1. **Netting**: The rockfall netting shall be S4 SPIDER® Slope Drape manufactured by GEOBRUGG® or an approved equivalent. The netting shall be woven construction and shall be diamond shaped with an inner-circle opening of 9.1 inches. The netting shall be made with 4-millimeter diameter wire in a 1x3 strand construction with the ends of each wire formed into a loop and twisted. The loops of the wire netting shall be fastened together to prevent unraveling of the net. The wire shall be alloyed high strength carbon steel wire with a minimum tensile

strength of 1,770 N/mm² or 256 KSI. The mesh shall have a minimal load capacity tensile strength of 220 kN/m or 15.1 kips/ft.

The wire shall be galvanized with a zinc/aluminum coating with a minimum weight of 150 g/m² or 0.0256 lb/ft². The coating shall be 95% zinc and 5% aluminum.

The size of the net opening shall be 11.5 inches by 19.7 inches ($\pm 2\%$) and the twisted strand diameter will be 8.6 mm or 0.339 inches. The net shall have 1.04 meshes per foot going across the net and 0.61 meshes per foot going down the net.

Rolls shall measure 11.5 feet wide by 65.5 feet in length (753 sq. ft.).

3.2. **No.9 Gauge Wire Fencing Mesh and Hog Rings:** The No.9-Gauge, 2-inch by 2-inch, galvanized chain link wire mesh fencing placed underneath the SPIDER® Mesh or an approved equivalent shall be attached by means of 9-gauge galvanized hog rings on two-foot centers. 9-gauge wire fencing mesh shall conform to AASHTO M181-90, shall be zinc coated in accordance with A392-84, Class 1 Standards, and may be PVC coated for color.

3.3. **Net Support Ropes ¾-inch:** Support ropes shall have a diameter of ¾-inch and shall be of 6x19 construction (or equivalent), IWRC with a minimum breaking strength of 52,920 lbs.

3.4. **Rock and Soil Anchors:** Wire rope anchors shall be constructed from ¾-inch wire rope of 6x19 (or equivalent) construction, IWRC with a minimum breaking strength of 52,920 lbs and be 10 feet long. Each anchor shall have minimum pullout strength of 6 tons and must be verified by the Contractor in the field. The testing shall consist of a pullout test incorporating 20% of the total number of anchors. If more than 25% of the tested anchors fail, all anchors shall be tested. Failed anchors shall be replaced by the Contractor at no additional cost to the owner. Testing shall be performed against a temporary yoke or load frame. No part of the yoke or load frame shall bear within 3 feet of the anchor.

Anchors shall consist of 132 lb/yd steel rail measuring 8 feet in length. All rail used for anchors shall be in good condition and free of defects, and shall be painted with two coats of rust protection paint

It is anticipated that the anchors will be 8 feet in length with 6 feet in rock, and spaced to allow a 20-foot spacing of the anchor cables on the support cable. Two additional anchors shall be set beyond the supporting anchors, with the anchors cables attached to the ends of the support cable to prevent sagging of the support cable. It is the responsibility of the CONTRACTOR to determine the proper spacing/layout of the anchors to achieve the appropriate anchor cable spacing, and the CONTRACTOR shall submit an anchoring layout plan to the ENGINEER for approval prior to installation. The anchor cables will be attached to the anchors and will run down to the support cable located immediately above the highwall. The anchor cables will be attached to the support cable on a 20-foot spacing in such a manner as to prevent slippage (see sheet 4). The support cable will be located approximately 5 feet above the top of the highwall. The wire mesh sheets will then be draped over the supporting cable and secured. Each wire mesh panel will overlap the next by at least 2-feet. See the plan details for the anticipated general layout of anchors and cables.

3.5. **Miscellaneous Materials:** All miscellaneous hardware such as ¾-inch wire rope clips and ¾-inch thimbles shall be galvanized.

3.6. **Shackles:** Three-eighth (3/8) inch galv. SPA shackles are used to fasten the net panels to each other. Three-fourth (¾) inch shackles are used to fasten the support rope to the netting.

3.7. **Wire Rope Specifications:** All wire rope for the support ropes, seam ropes, and wire rope anchors shall meet the Federal Specifications RR-W-410D or equivalent.

3.8. **Corrosion Protection:** All wire ropes shall meet Federal Specification RR-W-410D for wire rope. All miscellaneous material associated with the rockfall system such as wire rope clips, bolts, nuts, and thimbles shall be hot dipped galvanized

4. **INSTALLATION**

4.1. **Highwall Preparation:** The highwall shall be thoroughly cleaned and secured to remove all loose rock, soil and debris prior to the installation of rockfall netting. This shall be achieved by pressure washing or other methods approved by the ENGINEER. A hoe ram shall be utilized as well to remove the existing overhang and other protruding/large unstable rock as directed by the ENGINEER. The hoe ram shall have a minimum weight of 2000 lbs. and a minimum delivery capability of 300 rams per minute.

The CONTRACTOR shall exercise extreme caution with working around highwall area as loose rock and debris exists within this area. The CONTRACTOR shall prevent workers from entering areas where potentially loose rock and other debris may fall thereby eliminating potential hazards to workers. The CONTRACTOR shall take measures to protect the existing structure during this and all phases of work.

4.2. **Rockfall Netting:** Panels of the S4 SPIDER® Mesh or equivalent will be secured together with 3/8-inch shackles to form one large drape mesh. Nine-gauge, 2-inch by 2-inch, galvanized chain link will be secured to the SPIDER® Mesh or equivalent using 9-gauge galvanized hog rings to prevent smaller rock from passing through the larger mesh. A length of ¾-inch wire rope will be woven into the mesh's upper length to serve as a top support rope.

Wire rope anchors (¾"), 10 feet in length will be secured equidistant in a line approximately 40 feet above the position where the drape's top support rope is desired to be located. Wire rope anchors will be secured to highwall by drilling 2 ½ inch diameter hole drilled minimum 4 foot into rock and grouted into place. Sets of ¾-inch offset ropes with thimbles and wire rope clips on each end will then connect the mesh's top support rope with the wire rope anchors via ¾-inch shackles.

IMPERVIOUS LINING (LLDPE OR PVC)

1. SCOPE

This work shall consist of furnishing all labor, equipment, and materials, and performing all operations necessary for the placement of sand and LLDPE liner and geotextile fabric to the elevations, lines, and grades indicated on the Drawings, or as directed by the ENGINEER, in accordance with these technical specifications.

2. MATERIALS

2.1. **Liner Low Density Polyethylene (LLDPE) Liner:** The LLDPE liner shall have a nominal thickness of forty (40) mils and shall conform to the following physical properties:

The liner shall be furnished in the width shown on the Drawings and fabricated in the shop to the maximum practical length. Where a seam is required for a continuous seal, it will be joined in the field with an adhesive recommended or supplied by the manufacturer to ensure compatibility with the liner.

The liner shall be as manufactured by Agru America, 500 Garrison Road, Georgetown, South Carolina 29440, telephone 1-800-321-1379 or 1-843-546-0600, or an approved equivalent.

2.2. **Polyvinyl Chloride (PVC) Liner:** The PVC liner shall have a nominal thickness of thirty (30) mils and shall conform to the following physical properties:

PROPERTY	MINIMUM VALUES	TEST METHOD
Gauge (nominal)	30	
Specific Gravity (min)	1.2	ASTM D-792
Tensile Properties (min)		ASTM D-882
Break Strength, lbs/in width	73	Method A (MD & TD)
Elongation at Break, %	350	
Modulus at 100%, lbs/in width	34	
Tear Resistance, lbs (min)	8.5	ASTM D-1004, Die C
Low Temperature, pass °C	-29	ASTM D-1790
Dimensional Stability, % (max)	3	ASTM D-1204 (MD & TD)
Water Extraction, % loss (max)	0.15	ASTM D-3083
Volatile Loss, % loss (max)	0.7	ASTM D-1203 (A)
Resistance to Soil Burial, % change (max)		ASTM D-3083
Break Factor	±5%	
Elongation at Break	±20%	
Modulus at 100%, lbs/sq. in (min)	±20%	
Hydrostatic Resistance, lbs/sq. in (min)	100	ASTM D-751 (A)

2.3. **Sand:** Sand for LLDPE linings shall be obtained from a source approved by the Engineer. The approval of a source shall not be construed as constituting the approval of all materials taken from that source. Sand shall consist of hard, tough, durable uncoated particles and shall meet the physical requirements of the appropriate sections of the Kentucky Transportation Cabinet Specifications, current edition.

2.4. **Geotextile Fabric:** Shall conform to the “Filter Fabric” section of these Technical Specifications for a medium weight (8 oz.) non-woven fabric

3. **PROCEDURE:**

3.1. **Foundation Preparation:** Areas on which impervious lining is to be used shall be graded and dressed in accordance with the Drawings. Surfaces to be lined, shall be free of all rock, sharp stones, sticks, roots, sharp objects, or debris of any kind. The surface should provide a firm unyielding foundation for the liner with no sudden, sharp, or abrupt changes or breaks in grade. If unsuitable foundation material is encountered, the Contractor shall excavate to a greater depth, as directed by the Engineer, and backfill with suitable material. The liner material shall not be placed on frozen ground. No liner installation shall begin until approval is granted by the ENGINEER.

3.2. **Placement:** The CONTRACTOR shall provide a field panel layout plan to the ENGINEER. This plan shall show and identify all individual field panels that will be installed and seamed in the field. The field panel layout plan must be approved by the ENGINEER prior to installation.

After the area to be lined with the LLDPE or PVC liner has been prepared, and approved by the Engineer, a two (2) inch thick bed of sand shall be placed on the area. The LLDPE or PVC liner shall be placed on this bed and unrolled without stretching. LLDPE or PVC liner shall be spread evenly and smoothly and be in contact with the sand bed at all points, in accordance with the Drawings.

In lieu of the bed of sand, and upon approval by the ENGINEER, the CONTRACTOR may choose to install a medium weight non-woven geotextile fabric per the “Filter Fabric” section of these Technical Specifications. Whenever more than one section of fabric is required, the fabric must be overlapped approximately one (1) foot to assure continuity. The fabric shall be anchored in a satisfactory manner to prevent displacement. If the fabric is damaged prior to or during the placement of the LLDPE or PVC liner, the liner shall be removed from the damaged area. A fabric patch large enough to cover the damaged section, including a one (1) foot overlap, shall be placed over the damaged section.

The CONTRACTOR shall install a geotextile fabric directly on top of the LLDPE or PVC liner and sand base (or geotextile fabric). Whenever more than one section of fabric is required, the fabric must be overlapped a minimum of one (1) foot, to assure continuity. The fabric shall be anchored in a satisfactory manner to prevent displacement. If the fabric is damaged prior to or during the placement of aggregates or rock, the geotextile fabric and/or liner shall be removed

from the damaged area and a patch of fabric large enough to cover the damaged section, including one (1) foot overlap, shall be placed on top of the damaged section.

Geotextile fabric and LLDPE or PVC liner shall be wrapped into a berm anchor trench and backfilled with clean material unless materials are folded to encapsulate fill material.

3.3. **Field Joints**: Lap joints shall be used to seal factory fabricated field panels of LLDPE or PVC together in the field. Lap joints shall be formed by lapping the edge of the panels a minimum of six (6) inches. The contact surfaces of the pieces shall be wiped clean to remove all dirt, dust, moisture, or other foreign materials. Sufficient cold applied vinyl-to-vinyl bonding solvent shall be applied to both contact surfaces in the joint area and the two (2) surfaces pressed together immediately. Any wrinkles shall be smoothed out.

3.4. **Pipe Boots**: In areas of the treatment ponds where pipes penetrate the liner. Pipe boots shall be provided by the liner manufacturer, or as approved by the ENGINEER, and have a minimum of six (6) inch radial overlap with adjoining liner. Pipe boots shall be sealed to the liner and pipe with an adhesive recommended by the manufacturer to ensure compatibility of materials.

INDUSTRIAL MINING DEBRIS REMOVAL

1. SCOPE

The work shall consist of the demolition, removal, and proper disposal of all mining equipment, abandoned utilities, foundations, structural materials and domestic debris remains located within all construction limits.

2. MATERIALS

Industrial mining debris consists of any heavy equipment (bulldozers, trucks), pipes, steel beams, large cables, tanks, trusses, metal roofing, and other items commonly associated with industrialize mining operations. This definition also includes abandoned utility poles, exposed concrete foundations and passenger vehicles located within all construction limits.

All rights to property and existing materials within the project area will remain the property of the owner. Salvageable material rejected by the owner shall become the responsibility of the CONTRACTOR to dispose of in a proper manner subject to the approval of the ENGINEER.

All non-salvageable or rejected structural elements, abandoned equipment and debris are to be transported to nearby project areas already requiring earthwork and buried as directed by the ENGINEER. Disturbances associated with demolition activities are to be graded and otherwise cleaned-up to the satisfaction of the ENGINEER, and then revegetated in accordance with the "Revegetation" section of these Technical Specifications.

3. GENERAL

Generally the work shall consist of the demolition and removal of all mining equipment, abandoned utilities, foundations, metal roofs and domestic debris from the project area and its transportation to, and appropriate placement, in a permitted landfill. The CONTRACTOR shall advise the ENGINEER of the landfill to be used or salvage intent and shall obtain the ENGINEER'S approval prior to the hauling of all remains. The remains shall be transported in a safe manner, being covered or otherwise secured as necessary to prevent loss in transit.

The CONTRACTOR shall provide for safe conduct of the work, removal and disposition of materials, and protection of property, which is to remain undisturbed. The CONTRACTOR shall construct and maintain shoring, bracing, and supports as required. The CONTRACTOR shall insure that structural elements are not overloaded, and shall be responsible for increasing structural supports by adding new supports as may be required as a result of any cutting or removal of other elements. The CONTRACTOR shall take all necessary precautions to insure against damage to adjoining structure(s), which are to remain in place.

Foundations of demolished structure(s) shall be removed to a minimum of two (2) feet below the finished ground lines.

INTERLOCKING CELLULAR BLOCKS

1. SCOPE

The work shall consist of furnishing and installing interlocking cellular concrete blocks where shown on the Drawings or as otherwise directed by the ENGINEER.

2. MATERIALS

2.1. **Concrete**: Shall be Class A concrete conforming to the “Concrete” section of these Technical Specifications.

2.2. **Cellular Concrete Blocks**: The cellular concrete blocks shall be interlocking components dimensioned within a 16” module. Each component shall lock into the minimum of three adjacent components in a manner which inhibits horizontal movement. The blocks shall have a thickness of either 4” or 6” and shall be specified on the drawings.

The unit weight of the concrete used shall not be less than 125 lbs. per cubic foot on an oven dried basis. Pre-cast concrete and machine made blocks shall have a compressive strength of 4,000 psi minimum. Machine made concrete blocks strength shall be determined by testing random cubes, cut from the body of the block. The cementitious materials shall conform to **ASTM C-33**.

The assembled cellular block system shall have voids at the ground/block interface of a minimum 16% and shall provide, when required, adequate channels between cells below the top level of the blocks for the migration of vegetation from cell to cell if called for in the drawings. The voids may also be filled with stone as specified or as directed by the ENGINEER.

The assembled cellular concrete block system shall flex to a minimum of 3 feet radius in any two directions a minimum of 60 degrees apart without separation of the blocks at the base. The interlock must remain securely fastened at this radius.

2.3. **Aggregate**: Shall conform to the “Crushed Aggregate and Channel Lining” section of these Technical Specifications.

3. INSTALLATION

The slope must be stable independent of the erosion system and filled slope shall be compacted to minimum 90% proctor. Before placing the cellular concrete block system on the underlying geotextile as specified in the drawings, the slope shall be inspected to insure that it is free from obstructions, such as tree roots, projecting stones or foreign matter, voids or soft areas should be filled with the suitable material and well compacted. Although some variation in contour will be permitted, no sudden changes in level can be accepted. The maximum difference in level between any cuts shall be 1.5”.

A concrete header will be poured with the top edge flush with the top surface of the concrete blocks. The bottom shall extend below the concrete blocks as noted on the AML Standard Detail. After the subgrade is prepared construct a compacted base using dense grade aggregate compacted to minimum 90% proctor.

The entire perimeter of the cellular block system shall be turned and buried beneath the adjacent ground level to a depth of not less than three (3) feet or as shown on the drawings. Any junction with other structures shall be made as noted on the drawings, but shall always provide a permanent soil tight joint to prevent the migration of soil between structures. Grout if necessary

MOBILIZATION/DEMOBILIZATION

1. SCOPE

This element of work shall consist of the mobilization of the CONTRACTOR'S forces and equipment necessary for performing the work required under the contract documents.

It shall include the purchase of contract bonds; transportation of personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary facilities at the site; and other preparatory work at the site. This specification covers mobilization for work required by the contract at the time of the award.

The work shall also include final cleanup of the work area and the demobilization of the CONTRACTOR'S forces and equipment.

2. MOBILIZATION

2.1. **General:** Mobilization shall be paid as a lump sum as shown on the Bid Schedule depending on ENGINEER'S ESTIMATE and shall reflect the CONTRACTOR'S cost for final demobilization in addition to his initial mobilization.

2.2. **Payment:** Reimbursement for "Mobilization" shall be divided into two (2) incremental payments per project / site-- approximately equal to seventy-five percent (75%) and twenty-five percent (25%), respectively of the **approximate percentage value of work to be done at each project or site based on the Summary of Quantities breakdown.**

The **first payment** (per project or site) shall be made only after sufficient personnel, materials, equipment, and facilities have been mobilized to each particular project/site to demonstrate the CONTRACTOR'S intent to undertake the bulk of the work. And not until the field office (if required), related facilities and utilities are in place as may be required by the ENGINEER.

The **second payment** (per project or site), i.e., the remaining twenty-five percent (25%), shall be made after the CONTRACTOR has completed an amount of work equal to ten percent (10%) of the total for remaining bid items as based on percentage value for each project/site, and only after an acceptable schedule, as required under Article C of the Contractual Obligations & Requirements, has been received for each site.

Payment will not be made under this item for the purchase costs of materials having a residual value, the purchase costs of materials to be incorporated in the project, or the purchase costs of operating supplies.

Payment of the total lump sum price for "Mobilization" as entered on the bid schedule shall constitute full compensation for all labor, materials, equipment, and all other items necessary for and incidental to completion of this element of work. Moreover, this payment amount shall be considered total payment for all mobilization (and demobilization) efforts for all projects, which

include all designated projects / sites and shall never exceed under any circumstance, the stated amount entered on bid schedule(s).

2.3. **Adjustments**: This specification covers mobilization for work required by the contract at the time of award. If additional mobilization costs are incurred during performance of the Contract as a result of changed or added items of work for which the CONTRACTOR is entitled to an adjustment in contract price, compensation for such costs shall be included in the price adjustment for the items of work changed or added.

3. **DEMOBILIZATION**

3.1. **General**: The Contractor shall perform all work and operations necessary to accomplish Final Clean Up as specified in the Technical Specifications, also to move personnel, equipment, supplies, and incidentals from the project site; to remove all offices, buildings, and other facilities that were necessary for performing the work; and to accomplish all other work that must be performed, including costs that must be incurred, after acceptable completion of construction operations on the project.

3.2. **Final Cleanup**: The COMMONWEALTH will not consider the work complete and **will not make final payment** until the Contractor cleans up all areas the Contractor occupies in connection with the reclamation work. This includes but not limited to all rubbish, equipment, excess materials, temporary structures, weeds and all other items deemed unacceptable by the ENGINEER. All rubbish and waste materials shall be removed from the construction area and disposed in a manner consistent with all applicable state and federal laws. All property, both public and private, that was damaged in the prosecution of the work shall be restored in an acceptable manner, restore positive drainage where practical, and leave all space under structures unobstructed and in such condition that drift will not collect and induce scouring or clogging.

3.3. **Payment**: Demobilization shall be paid as a lump sum as shown on the Bid Schedule depending on ENGINEER'S ESTIMATE and shall be withheld from the final invoice until the final cleanup and demobilization are completed to the satisfaction of the ENGINEER.

Demobilization will not be paid to Contractors who fail to complete the project within the allowed contract period.

MSC NON-REINFORCED CONCRETE BLOCK WALLS

1. SCOPE

Work includes furnishing and installing concrete retaining wall units to the lines and grades designated on the construction drawings and as specified herein.

2. MATERIALS

2.1. **Type I Wall Units**: Shall be a Keystone material, or an approved equivalent. All walls must conform to the requirements of ASTM C1372 - Standard Specifications for Segmental Retaining Wall Units and the following specification.

Structural, Geometric, Construction Requirements	
Compressive Strength	3,500+ psi
Unit Size	8" H x 18" W x 18" D ± 1/8" minimum
Unit Weight	100 lbs/unit min.

The walls shall have a vertical setback: 1/8" (3 mm) ± per course (near vertical) or 1" (25 mm) + per course per the design. The alignment and grid positioning mechanism is with fiberglass pins set at a minimum of two per unit minimum. The maximum horizontal gap between erected units shall be ≤ 1/2 inch.

2.2. **Type I Wall Shear Connectors**: Shear connectors shall be 1/2-inch (12 mm) diameter thermoset isophthalic polyester resin-pultruded fiberglass reinforcement rods or equivalent to provide connection between vertically and horizontally adjacent units. Strength of shear connectors between vertical adjacent units shall be applicable over a design temperature of 10°F to 100°F. Shear connectors shall be capable of holding the geogrid in the proper design position during grid pre-tensioning and backfilling.

2.3. **Type II Wall Units**: Shall be as manufactured by Redi-Rock or an approved equivalent. The type of wall units used shall be approved by the ENGINEER before construction is allowed to begin.

2.3.1. **Concrete**: Shall have minimum 28 -day compressive strength of 4,000 PSI

2.3.2. **Sheer Knobs**: Shall have a height of 4" (min.) and diameter of 8" (min.) and be set approximately 1/2 the length of the block and at least 6" from the edges.

2.3.3. **Sizes**: Full block sizes are 18" tall X 46" wide X 28", 41", or 60" deep.

2.4. **Aggregate Backfill**: Shall conform to the "Crushed Aggregate and Channel Lining" section of these Technical Specifications

- 2.5. **Pipes**: Shall conform to the “Drainage Pipe” section of these Technical Specifications.
- 2.6. **Concrete**: Shall be Class A concrete conforming to the “Concrete” section of these Technical Specifications.
- 2.7. **Steel Reinforcement**: Shall be 60 KSI steel conforming to the “Steel” section of these Technical Specifications.
- 2.8. **Geo-grid**: Shall conform to the “Geo-grid” section of these Technical Specifications.

3. DELIVERY, STORAGE, AND HANDLING

The CONTRACTOR shall check the materials upon delivery to assure proper material has been received AND shall protect the materials from damage. Damaged material shall not be incorporated in the project. The CONTRACTOR shall prevent excessive mud, wet cement and like materials from coming in contact with the SRW units.

4. CONSTRUCTION WALL SYSTEM

4.1. **Excavation**: Contractor shall excavate to the lines and grades shown on the construction drawings.

4.2. **Foundation Soil Preparation**: Native foundation soil shall be compacted to 95% of standard proctor or 90% of modified proctor prior to placement of the leveling pad material.

In-situ foundation soil shall be examined by the ENGINEER to ensure that the actual foundation soil strength meets or exceeds assumed design strength. Soil not meeting the required strength shall be removed and replaced with acceptable, compacted material.

4.3. **Leveling Pad Placement**: The leveling pad can be crushed stone or reinforced concrete. The final plan details will dictate as to what type of leveling pad will be used. All leveling pads shall be placed on undisturbed native soils or suitable replacements fill materials.

The crushed stone leveling pad shall have a 6 inch minimum depth for walls under 8 feet in height and a 12 inch minimum for walls over 8 feet in height. The crushed stone leveling dimensions shall extend beyond the blocks in all directions to a distance at least equal to the depth of the pad or as shown on the design plan details.

The concrete leveling pad shall be placed as shown on the construction drawings.

If the design leveling pad is a concrete footing, the footing will be 24 inches minimum in thickness. Pad dimensions shall extend beyond the blocks in all directions to a distance at least equal to the depth of the pad or as designed by Engineer. For the width of the footing and for minimum steel reinforcement, see plan details. For the purpose of placing the blocks on the concrete footing shall be allowed to cure a minimum of three (3) days before placing block on the footer.

For steps and pavers, a minimum of 1" - 1 ½" of free draining sand shall be screeded smooth to act as a placement bed for the steps or pavers.

4.4 Type I Unit Installation

4.4.1. Blocks: First course of units shall be placed on the leveling pad at the appropriate line and grade. Alignment and level shall be checked in all directions and insure that all units are in full contact with the base and properly seated. Place the front of units side-by-side. Do not leave gaps between adjacent units. Layout of corners and curves shall be in accordance with manufacturer's recommendations. Install shear/connecting devices per manufacturer's recommendations. Place and compact drainage fill within and behind wall units. Place and compact backfill soil behind drainage fill. Follow wall erection and drainage fill closely with structure backfill. Maximum stacked vertical height of wall units, prior to unit drainage fill and backfill placement and compaction, shall not exceed two courses.

4.4.2. Structural Geogrid Installation: Geogrid shall be oriented with the highest strength axis perpendicular to the wall alignment. Geogrid reinforcement shall be placed at the strengths, lengths, and elevations shown on the construction design drawings or as directed by the Engineer. The geogrid shall be laid horizontally on compacted backfill and attached to the modular wall units. Place the next course of modular concrete units over the geogrid. The geogrid shall be pulled taut, and anchored prior to backfill placement on the geogrid. Geogrid reinforcements shall be continuous throughout their embedment lengths and placed side-by-side to provide 100% coverage at each level. Spliced connections between shorter pieces of geogrid or gaps between adjacent pieces of geogrid are not permitted.

4.4.3. Reinforced Backfill Placement: Reinforced backfill shall be placed, spread, and compacted in such a manner that minimizes the development of slack in the geogrid and installation damage. Reinforced backfill shall be placed and compacted in lifts not to exceed 6 inches (150 mm) where hand compaction is used, or 8 - 10 inches (200 to 250 mm) where heavy compaction equipment is used. Lift thickness shall be decreased to achieve the required density as required. Reinforced backfill shall be compacted to 95% of the maximum density as determined by ASTM D698. The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer and shall be dry of optimum, + 0%, - 3%. Only lightweight hand-operated equipment shall be allowed within 3 feet (1m) from the tail of the modular concrete unit. Tracked construction equipment shall not be operated directly upon the geogrid reinforcement. A minimum fill thickness of 6 inches (150 mm) is required prior to operation of tracked vehicles over the geogrid. Tracked vehicle turning should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid. Rubber tired equipment may pass over geogrid reinforcement at slow speeds, less than 10 MPH (15 KPH). Sudden braking and sharp turning shall be avoided. At the end of each day's operation, the Contractor shall slope the last lift of reinforced backfill away from the wall units to direct runoff away from wall face. The Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

4.4. Cap Installation: Cap units shall be glued to underlying units with an all-weather

adhesive recommended by the manufacturer.

4.5. **Type II Unit Installation**

4.5.1. **Blocks**: The first course of wall units shall be placed on the prepared leveling pad with the aesthetic surface facing out and the front edges tight together. All units shall be checked for level and alignment as they are placed.

Ensure that units are in full contact with leveling pad. Proper care shall be taken to develop straight lines and smooth curves on base course as per wall layout.

The backfill in front and back of entire base row shall be placed and compacted to firmly lock them in place. Check all units again for level and alignment. All excess material shall be swept from top of units.

Install next course of wall units on top of base row. Position blocks to be offset from seams of blocks below. Blocks shall be placed fully forward so knob and groove are engaged. Check each block for proper alignment and level. Backfill to 12 inch width behind block with free draining Backfill. Spread backfill in uniform lifts not exceeding 9 inches. Employ methods using lightweight compaction equipment that will not disrupt the stability or batter of the wall. Hand-operated plate compaction equipment shall be used around the block and within 3 feet of the wall to achieve consolidation. Compact backfill to 95% of standard proctor (ASTM D-698, AASHTO T-99) density within 2% of its optimum moisture content.

Install each subsequent course in like manner. Repeat procedure to the extent of wall height. Allowable construction tolerance at the wall face is 2 degrees vertically and 1 inch in 10 feet horizontally. All walls shall be installed in accordance with local building codes and manufacture requirements.

4.5.2. **GEOGRID INSTALLATION FOR REINFORCED TYPE II WALLS**: For any 21” block wall with heights greater than 15 feet or any 21” block wall regardless of wall height that will have constant additional surcharge loadings applied behind it, the contractor will be required to install geogrid and make proper connection to the retaining wall blocks for reinforced soil walls. For 41” or 60” block walls, geogrid may not be needed. Always check final plan design for these types of walls to see if geogrid will be used.

The geogrid shall be composed of polypropylene or high density polyethylene resins. The geogrid shall be laid at the proper elevation and alignment as shown on the construction drawings. The geogrid shall be installed in accordance with the installation guidelines provided by the manufacturer or as directed by the ENGINEER.

The geogrid may be temporarily secured in place with ties, staples, pins, sand bags or backfill as required by fill properties, fill placement procedures or weather conditions or as directed by the ENGINEER. Geogrid reinforced soil walls shall be constructed per the detailed design prepared by a Professional Engineer.

Use specified geogrid (per detailed design) with the strong direction (i.e. roll direction) PERPENDICULAR to the wall face. Length of geogrid is measured from the face of the wall to the back of geogrid. Geogrid must be pulled tight and pinned down prior to placing and compacting additional backfill.

Place lifts of backfill from wall face back, to ensure further geogrid tensioning. Perform compaction from face of wall to rear excavation.

Geogrid placement on corners shall follow the procedures outlined in the Design Manual for Segmental Retaining Walls, Second Edition, Copyright 1997, National Concrete Masonry Association, Herndon, VA. See the following details or convex and concave curve corners.

Grind smooth any rough edges on the back of the concrete blocks prior to placement to avoid damage to the geogrid under tension.

Drainage features shall be installed per the AML Standard Details or Drawings. The site should include drainage swales or other methods to direct water away from the wall.

5. AGGREGATE BACKFILL PLACEMENT

Granular fill material shall be placed in lifts and compacted. Clean granular fill is preferred for all types of geogrids. Type I & II geogrids require fill with a maximum particle size of 1.5 inches. Type III geogrid require fill with a maximum particle size of 2.5 inches. Granular fill material shall be placed, spread, and compacted in such a manner that minimizes the development of wrinkles in the geogrid and/or movement of the geogrid.

A minimum loose fill thickness of 6 inches is required prior to operation of tracked vehicles over the geogrid. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid. Rubber-tired equipment may pass over the geogrid reinforcement at slow speeds (less than 10 mph) when integrally-formed geogrids are used. When woven, multi-layer or welded-strip geogrids are used, rubber-tired equipment shall not be allowed to pass directly on the geogrid. Sudden braking and sharp turning movements shall be avoided.

Any roll of geogrid damaged before, during and after installation shall be replaced by the Contractor at no additional cost to the Owner. Proper replacement shall consist of replacing the affected area adding 3ft (1m) of geogrid to either side of the affected area.

6. GEOGRID CONNECTION

Fiberglass rod used in the Type 1 geo-grid connection shall be 7/16" diameter. Only fiberglass rod obtained from an authorized supplier shall be used. Geogrid connections shall be made using one of the following types of connections:

6.1. **Type 1 Connection**

The Type 1 connection is made with one 7/16" diameter solid fiberglass rod available from an authorized supplier. Install a complete row of retaining wall blocks. Sweep the top of the blocks clean. Lay the geogrid across the top of the block and let it hang down to the bottom of the front face. Place one 40" fiberglass rod over the geogrid into the geo-connector slot. Pull the geogrid back over the rod and extend the tail beyond the back of the block to provide a minimum of 3' embedment. If applicable, a steel angle can be used to hold the rod and geogrid in position as shown. Install the next course of retaining wall blocks to lock the geogrid connection in place. Pull the geogrid flat and tight. Secure it in place with pins or staples as recommended by the manufacturer. Place 2 to 3 inches of drain stone between the anchored tail and the primary geogrid layer. Backfill and compact as specified.

6.2. **Type 2 Connection**

The Type 2 Connection is made with a patent pending fiberglass rod and wedge available from an authorized supplier. Install a complete row of retaining wall blocks. Sweep the top of the blocks clean. Lay the geogrid to the centerline of the knobs. Insert the geogrid into the vertical groove. Place the fiberglass rod in the groove. Pull the geogrid back over the rod and extend to the back of the block to provide a minimum of 4" overlap. Place the fiberglass wedge over the geogrid and rod. Install the next course of retaining wall blocks to lock the geogrid and connection in place. Pull the geogrid flat and tight. Secure it in place with pins or staples as recommended by the manufacturer. Backfill and compact as specified.

6.3. **Type 3 Connection**

The Type 3 Connection is made with a fiberglass bar available from authorized suppliers. The Type 3 Connection relies on a mandatory anchored tail (3' long minimum) to generate connection strength. It is typically used in extreme loading conditions. Install a complete row of retaining wall blocks. Sweep the top of the blocks clean. Lay the geogrid over the top and down the face of the Rock block. Insert the geogrid into the vertical groove. Place the fiberglass bar in the groove. Pull the geogrid back over the bar and extend behind the back of the block to provide a 3' minimum "anchored tail". Place soil to provide 3 inches of separation between the main geogrid reinforcement and the anchored tail. Install the next course of retaining wall blocks to lock the geogrid and connection in place. Pull the geogrid flat and tight. Secure it in place with pins or staples as recommended by the manufacturer. Backfill and compact as specified.

PILE AND LAGGING RETAINING WALL

1. SCOPE

This work shall consist of furnishing all materials, equipment, and labor necessary for installing Pile and Lagging Retaining Wall as shown on the Drawings or as directed by the ENGINEER. Efforts include drilling, installation of steel piles, and placement of concrete lagging, filter fabric, subdrain, and stone backfill.

2. MATERIALS

2.1. **Steel Piles**: Shall conform to the “Steel Piles and Reinforcement” section of these Technical Specifications.

2.2. **Steel Reinforcement**: Shall conform to the “Steel” section of these Technical Specifications.

2.2. **Concrete**: Shall be Class AA concrete conforming to the “Concrete” section of these Technical Specifications.

2.3. **Pre-cast Concrete Lagging**: Precast concrete lagging shall be Class AA concrete conform to requirement of the “Concrete” section of these Technical Specifications.

2.4. **Filter Fabric**: Shall conform to the “Filter Fabric” section of these Technical Specifications.

2.5. **Drain Pipe**: Shall conform to the “Drainage Pipe” section of these Technical Specifications

2.6. **Aggregate Backfill**: Shall conform to the “Crushed Aggregate and Channel Lining” section of these Technical Specifications.

3. CONSTRUCTION

3.1. **Excavation**: Material excavated during site preparation, wall construction, and final grading shall be utilized in a manner in accordance with the “Earthwork” section of these Technical Specifications or as directed by the ENGINEER. Stockpiling of excavated material on the slope above the wall will not be permitted.

3.2. **Piles**: A hole, of the minimum diameter shown on the Drawings, will be pre-drilled to the minimum depth shown on the Drawings prior to installation of the piles. The piles are to be concreted completely from the bottom of the hole to within two (2) feet of the existing ground line, or as directed by the ENGINEER. Holes shall be pumped free of water prior to injection of grout. The concrete is to be pumped through a hollow pipe beginning at the bottom of the drilled hole. Concrete shall be placed in such a manner that it does not strike any obstruction such as the reinforcing steel or sides of the drill hole to avoid segregation of concrete. As concrete is

injected, the hollow pipe shall be raised with care to ensure that its tip remains approximately two (2) feet below the surface of the concrete until the concrete reaches a point three to five (3-5) feet below the surface.

The CONTRACTOR will be required to complete all concrete placement operations for holes drilled during the working day.

3.3. **Casing:** Permanent or temporary casing of holes shall be used as required by the Engineer to maintain an open clean hole through the soil overburden **and to prevent holes with unstable sides from squeezing**. The diameter shall be as depicted and/or described in the drawings. Temporary casing or non-cased holes may be allowed provided an open clean hole of a required diameter through the soil overburden can be maintained.

3.4. **Tolerances:** Piles shall be located as shown on the Drawings or as directed by the ENGINEER. Pile centers shall be installed within ± 2 -inches of the plan locations. Should the elevation of the bottom of the pre-drilled hole vary from the plan elevation more than ± 1 -foot, the ENGINEER must approve the installation of the pile and injection of grout prior to placement. To verify acceptable alignment, the CONTRACTOR shall utilize a plumb bob, carpenter level, or other acceptable methods. The maximum permissible deviation for the exposed section of piles from vertical alignment shall be based on aesthetical and structural aspects.

Records shall be maintained by the CONTRACTOR, and provided to the ENGINEER, which show the depth to which each pile is placed, the deviation from vertical plumb, the amount of materials used, and any unusual conditions encountered during the installation.

3.5. **Lagging:** Lagging shall be installed between adjacent piles such that each lagging member extends to within one inch of the pile web. Final grading at the front of the wall shall not proceed until lagging placement is complete.

3.6. **Filter Fabric:** The filter fabric shall be placed as shown on the Drawings.

3.7. **Subdrain:** Retaining wall subdrain shall be installed as shown on the Drawings.

3.8. **Backfill:** Aggregate backfill shall be placed behind the wall to the lines and grades shown on the Drawings. If filter fabric is used, the CONTRACTOR will be required to limit the drop of rock backfill to no more than 3 feet. Backfill operations shall not commence until all lagging and filter fabric have been placed, and not until a test cylinder of the concrete has been successfully broken at 4,000 psi.

3.9. **Final Grading:** The rock backfill when indicated on the Drawings shall be covered with filter fabric and a layer of soil shall be placed over the exposed surface behind the wall if required by the Drawings. In all cases at least a 5' strip of rock must be left exposed behind the wall. Areas adjacent to the wall shall be shaped and finished to blend with the surroundings as directed by the ENGINEER.

PIPE

1. SCOPE

This work shall consist of furnishing and installing **drainage pipe at the locations shown on the drawings or as directed by the Engineer**, including all necessary fittings and backfilling with appropriate materials **in accordance with these technical Specifications**

2. MATERIALS

2.1. **Corrugated Metal Pipe (CMP)**: All corrugated metal pipe shall conform to the requirements of AASHTO M 36. Pipe shall have welded seams with helical corrugations having a pitch of 2-2/3 inches and a depth of 1/2 inch. The minimum metal thickness of the pipes shall be 14 gage for 24-inch diameter or less and 12 gage for 36-inch and greater diameter, **unless fill heights dictate a different gage according to the AML Standard Details pipe fill charts.**

2.2. **CMP Connections**: The connections between sections of pipe and end treatments shall be made with coupling bands or other mechanisms of durability equal to or greater than the pipe. Coupling bands shall meet the requirements of AASHTO M-36.

2.3. **CMP Coatings**: Any damage to the coating shall be repaired by thoroughly wire brushing the damaged area, removing all loose and cracked coating, removing all dirt and greasy material with solvent, and painting with two coats of material. If the coating is damaged in any individual area larger than 12 square inches, or if more than 0.2 percent of the total surface area of a length of pipe is damaged, the length will be rejected.

2.3.1. **Zinc Coating**: The repair coating shall be a zinc dust-zinc oxide primer or equivalent as specified by the manufacturer.

2.3.2. **Bituminous Coatings**: All BCCMP pipe shall be fully bituminous coated in accordance with AASHTO M-190. Breaks and scuffs in bituminous coatings that are less than 36 square inches in area shall be repaired by the application of two (2) coats of hot asphaltic paint or a coating of cold applied bituminous mastic. The repair coating shall be at least 0.05 inches thick after hardening and bonded securely and permanently to the pipe. Whenever individual breaks exceed 36 square inches of area or when the total area of breaks exceed 0.5 percent of the total surface area of the pipe, whichever is less, the pipe will be rejected.

2.4. **Reinforced Concrete Pipe (RCP)**: The drainage pipe shall be Class III RCP **unless fill heights dictate a different class according to the AML Standard Details pipe fill charts.** The pipe can be circular or non-circular and the length as indicated on the Drawings or as directed by the Engineer. **RCP WILL BE USED UNDER ALL PAVED ROADS WITH FLOWABLE FILL.**

2.5. **High Density Polyethylene Pipe (HDPE)**: The drainage pipe shall be made of virgin high density polyethylene compounds which conform to the requirements of Type III, Category 4, 5, Grade P30 or P34 Class C per ASTM D-128. HDPE and pipe shapes shall meet the

requirements of ASTM F405, ASTM F667 AASHTO M-294-851; ASTM D-2122 with minimum 20-foot lengths.

2.5.1. **HDPE Connections:** Corrugated Fittings may be either molded or fabricated by the manufacture. The use of fittings supplied by the manufactures other than the supplier of the pipe shall not be permitted without the approval of the ENGINEER.

Couplings shall be corrugated to match the pipe corrugations and the width shall not be less than half the nominal diameter of the pipe, split couplings shall be manufactured to engage an equal number of corrugations on each side of the pipe joint. Where required by Engineer, a mastic type gasket or other gasket acceptable to the ENGINEER may be used.

2.6. **Polyvinyl Chloride (PVC) Pipe:** PVC pipe and fittings shall be Schedule 40 meeting the requirements of ASTM D-1785.

The PVC pipe shall be delivered to the job site and handled by means, which provide adequate support to the pipe and do not subject it to undue stresses or damage. When handling and placing the PVC pipe, care shall be taken to prevent impact blows, abrasion damage, and gouging or cutting (by metal surfaces or rocks). All special handling requirements of the manufacturer shall be strictly observed. Special care shall be taken to avoid impact when the pipe must be handled at temperatures of forty degrees (40°F) or less.

The PVC pipe shall be stored on a relatively flat surface so that the barrels are evenly supported. Unless the pipe is specially manufactured to withstand exposure to ultraviolet radiation, it shall be covered with an opaque material when stored outdoors for a period of fifteen days or longer.

All fittings and appurtenances for the PVC pipe shall be manufactured and furnished by the pipe supplier and have bell and spigot configurations compatible with that of the pipe. All solvent cement joints for PVC pipe and fittings shall be made in accordance with ASTM D-2855 for PVC pipe and fittings.

All connections between the pipe and flanges on valves shall be according to the manufacturer's recommendations and approved by the ENGINEER.

2.7. **Aggregate Backfill:** Shall consist of No. 57 crushed stone in accordance with the "Crushed Aggregate and Channel Lining" section of these Technical Specifications.

2.8. **Flowable Fill Backfill:** Shall conform to the "Grout" section of these Technical Specifications.

3. CONSTRUCTION

In all operations, such as placing the pipe, jointing, bedding and backfilling, care shall be exercised. It shall be the CONTRACTOR'S responsibility to see that pipes are not damaged during unloading or placement, during compaction of the backfill by movement of excessively heavy equipment over the backfill, or by any other forces that may cause damage.

Trenches for pipes shall be excavated to the lines and grades shown on the Drawings. The trench shall be dry and unfrozen at the time the pipe is installed. Soft and/or hard spots shall be made as uniform as practical with sand, gravel, crushed stone, or other suitable material to ensure even settlement of the pipe. Backfill shall be placed in layers not exceeding 6 inches loose thickness for hand operated machine compactors and 8 inches loose thickness for other compaction methods, unless otherwise specified. Fill material shall be free from organic material, stumps, large rocks, hard lumps, or clods larger than 3 inches in diameter. Sod, cinders, and frozen fill will not be allowed. The pipe shall be laid so outside laps of circumferential joints point upstream, with no longitudinal joints in the lower quadrant. Bedding shall be of the type and thickness shown on the Drawings. Maximum stone size shall not exceed the maximum size recommended by the pipe manufacturer, whichever is smaller. Hand tampers for compacting horizontal layers should weigh not less than 20 pounds and have a maximum face of 6 inches x 6 inches. Sheepsfoot and rubber-tired tamping rollers can be used to compact backfill around the pipe **provided they will not cause damage to the pipe. Power tampers and rollers must not contact the pipe. Fill adjacent to the pipe must be hand or mechanically tamped.** The backfill shall be brought up evenly on both sides of pipe for the full length of the pipe. The remainder of the trench, except for special materials for roadways, shall be backfilled with satisfactory material. Special materials for roadways shall be used as designated on the Drawings or provided in writing by the ENGINEER. Pipe that is not in true alignment, or which shows abnormal settlement after placement, shall be removed and relain.

Where flowable fill is used the CONTRACTOR shall take extra care to anchor the pipe, especially HDPE pipe, in accordance with these Technical Specifications. Failure to properly anchor pipes where they are in not proper alignment or grade in accordance with the Drawings shall result in the CONTRACTOR removing the pipe and relaying the pipe to the proper alignment and grade.

All pipe placed without the use of a headwall or any type of anchor shall be flush with the slope, where the water flowing out of the pipe will not create a condition that will cause the pipe to be undercut.

Installation of the pipe (including excavation, backfill, and temporary traffic base) shall be completed in one day; and coordinated beforehand with local residents. All necessary arrangements are the responsibility of the CONTRACTOR, subject to the ENGINEER'S approval. **The Drawings may specify that the construction not interrupt the flow of traffic. In that case the Contractor must submit a plan to keep traffic flowing while constructing the pipe crossing and will be subject to the approval of the ENGINEER.**

PNEUMATIC BACKSTOWING

1. SCOPE

The work shall consist of filling openings and voids with select graded aggregates utilizing a **pneumatic** backstowing process only.

2. MATERIALS

2.1. **Granular Fill**: Granular fill shall be size No. 57 or No. 8 coarse aggregate and conform to the “Crushed Aggregate and Channel Lining” section of these Technical Specifications.

3. CONSTRUCTION

Work shall consist of granular fill pneumatically stowed in the designated features such as, but not limited to, portal closures and mountain breaks. Debris, rubble, and other loose material shall be removed from these areas prior to backfilling efforts. All material except soil and rock (e.g. domestic debris) shall be disposed of in a suitable manner as approved by the ENGINEER.

POLYURETHANE FOAM

1. SCOPE

This work shall consist of furnishing and installing all materials necessary to place polyurethane foam in areas or for certain applications as depicted in the Drawings and as directed by the ENGINEER.

2. MATERIALS

2.1. Polyurethane Foam (PUF): Shall meet the follow criteria:

PUF CHARACTERISTICS	STANDARD	TESTING METHOD
Density (PCF)	2.00 or greater	ASTMD-1622
Closed Cell Content (%)	80 or greater	ASTMD-2856
Parallel Compressive Strength (PSI)	22 or greater	ASTMD-1621
Perpendicular Compressive Strength (PSI)	10 or greater	ASTMD-1621
Shear Strength (PSI)	28 or greater	ASTMC-273
Water Absorption (PSF)	0.01 or greater	ASTMD-2842-69
Immersion	Coast Guard Tests	ASTM
Tensile Adhesion (PSI)	20 or greater	ASTMD-1623
K-Factor (BTU in hr. ft. 2°F)	0.140 or greater	ASTMD-518
Buoyancy Losses	.3 or greater	ASTMD-2842-69
Percent Volume Change (% humidity)		
Humid Days (95%)	-2.0 or greater	
Dry Days	+1.0 or greater	

These products roughly exhibit the following characteristics when mixed between 30° and 90° Fahrenheit:

Initiation of Rise (Sec)	20 - 30
Gel Time (Sec.)	130 - 160
Tack Free Time (Sec.)	190 - 240
Core Density (PCF)	2.3 - 2.6

3. CONSTRUCTION METHODS

3.1. **General:** Foam applications shall be constructed in accordance with manufacturer's recommendations regarding the use of the foam materials. Construction of bulkheads and protective covers shall be conducted in accordance with commonly accepted construction practices. Reasonable alternatives to the guidelines provided on the drawings shall be allowed if approved by the ENGINEER.

The CONTRACTOR may be required to reinforce the foam construction with pieces of steel rebar, wire mesh, or broken concrete embedded within the foam. Native stone, earth, concrete, grout, and aggregates may be required for forming efforts as needed. Bulkheads shall be constructed from similar materials and common construction materials such as wood, plastic, sheet metal, tin and fibrous materials. Any flammable materials used in the outer bulkheads shall be removed after the foam hardens and before required cover material placement.

Foam must be applied in layers allowing each successive layer to expand, cool, and harden before the next layer can be applied. PUF shall not be applied to foam that is currently expanding. PUF shall be applied in such a manner as to fill the voids in the portal and not create pockets inside the foam plug and shall form a solid wall around pipes at the outer barrier.

The entire surface of the foam plug shall be backfilled with two (2) feet (min.) of earth materials/aggregate or one (1) foot (min.) of concrete grout combined with cobbles or boulders. Backfill shall form a fire resistant ultra-violet proof cover for the foam plug.

3.2. **Safety:** Workers shall be required to wear organic respirator masks, safety glasses or goggles, body covering such as coveralls, and gloves while working with foam materials.

PORTAL CLOSURE

1. SCOPE

This work shall consist of furnishing and installing all materials, equipment, incidentals, and labor necessary to properly seal mine portals as shown in the Drawings. The ENGINEER may revise the type of closure used depending on conditions encountered at the time of construction.

2. GENERAL

The intent of the portal closures, whichever type is to be used, is to prevent human access.

Where it is determined that the particular mine portal is considered habitat for bats or that bats are present the opening shall be closed using at least a 36" pipe or bat gates as shown in the AML Standard Details. The minimum opening for the bat access using grates/bars shall be twenty four (24") inches horizontal and six (6") inches vertical.

3. CLOSURE TYPES

3.1. **Concrete Block:** This closure shall consist of solid concrete block 8"x 8" x 16" with the exception of the vent holes as shown in the Standard details. A drain pipe shall be placed as directed to allow drainage as shown in the AML Standard Details.

The openings at the top and sides shall be filled with mortar and the blocks set on a concrete footer as shown in the Standard Details.

3.2. **Concrete Block with Human Access:** This closure is for mine entries where the owner is obtaining water from the portal and shall be the same as the concrete block closure with the exception that an access door is built into the opening and the drainage pipe at the bottom of the opening is deleted as shown in the AML Standard Details.

3.3. **Earth Closure:** The earth closures shall be as shown in the AML Standard Details.

3.4. **Rock Closures:** Rock closures shall consist of pneumatically backstowed pea gravel or Class II channel lining and a drainage pipe placed in the opening as shown in the AML Standard Details. Sufficient rock material shall be placed against the opening and highwall to allow proper closure of the mine workings and allowing for shrinkage or slumping of the material.

3.5. **Polyurethane Foam Closures (PUF):** These closures shall consist of the materials in accordance with the AML Standard Details.

3.6. **Wildlife Closures:** Wildlife Closures shall be used at locations specified on the Drawings or as directed by the ENGINEER and shall consist of two types of closures

3.6.1. **Wildlife Closure with Pipe:** Wildlife access closures with pipe shall consist of a HDPE culvert (minimum of 36" for Bat Closures) with a 1/2" reinforcing bars grate recessed (Wildlife Gate) as shown in the AML Standard Details

3.6.2. **Wildlife Closure with Grate/Bars:** Wildlife Closures using grates or bars shall be constructed at locations shown on the Drawings or as directed by the ENGINEER and as shown in the AML Standard Details

4. MATERIALS

4.1. **Concrete:** shall be Class B concrete, with a 28-day compressive strength of 2,500 psi, and otherwise conform to the "Concrete" section of these Technical Specifications.

4.2. **Concrete Block:** shall conform to ASTM C-129.

4.3. **Mortar:** strength shall meet AASHTO T-71.

4.4. **Pipe:** shall be high density polyethylene pipe conforming to the "HDPE Pipe" section of these Technical Specifications, PVC or equivalent and conform to ASTM D-2729, except wall thickness shall conform to ASTM D-2665 unless otherwise directed by the ENGINEER. Size and spacing of perforation in perforated pipe shall conform to AASHTO M-189.

4.5. **Rock:** shall be Class II channel lining and size No. 57 stone size 8 or 9 crushed aggregate and shall conform to the "Crushed Aggregate and Channel Lining" section of these Technical Specifications.

4.6. **Doors:** shall be 1/4 inch steel plate or equivalent equipped with suitable hinges, hasp, and padlock. The door shall be securely anchored to the concrete block and secured by a lock.

4.7. **Filter Fabric:** shall conform to the "Filter Fabric" section of these Technical Specifications.

4.8. **Steel Bars:** shall be 1/2 inch steel bars welded together and shall conform to the Kentucky Transportation Cabinet's "Standard Specifications for Road and Bridge Construction", current edition.

The steel reinforcing bars shall be placed to allow for a minimum opening as shown in the Standard Details and welded to a steel band or alternatively secured as shown on the Drawings, to allow the openings as shown in the Standard Details.

4.9. **Polyurethane Foam:** shall conform to the "Polyurethane Foam" section of these Technical Specifications.

4.10. **Pneumatic Backstow:** shall conform to the "Pneumatic Backstow" section of these Technical specifications.

5. CONSTRUCTION METHODS

5.1. **General:** All debris, rubble, and other loose material shall be excavated from the mine openings in a prudent fashion prior to beginning construction of the closure, unless a dangerous safety hazard exist. Excavation efforts shall begin at the top most of each designated portal closure and proceed incrementally downward until all of the material has been removed down to grade.

As excavation work proceeds, the CONTRACTOR shall be watchful for the presence of mine water. Any mine water detected, shall be immediately reported to the ENGINEER and excavation work halted until the ENGINEER has granted approval to proceed further. The mine water shall be tested and shall meet the requirements of these technical specifications for “Water Treatment and Disposal”. If the ENGINEER approves work to continue, the CONTRACTOR will be required as directed to control the flow rate of all mine water effluent, to have proper drainage controls (i.e. surface ditches and pipes) in place to safely move the water throughout the project area, and take any other efforts that may needed as not to harm any receiving streams.

All material except soil and rock shall be disposed of in a suitable manner beyond the limits of the project. Soil and rock may be placed in the mine openings provided they do not interfere with drainage or the construction specified in the Drawings.

Following construction of the mine closure, each site is to be cleaned-up, including smoothing earth disturbance, and revegetated in accordance with the “Revegetation” section of these Technical Specifications, and shall be considered incidental to the completion of each mine closure.

5.2. **Rock, Block, and Earth Closure:** The drainage pipe shall be placed in the mine opening. The pipe shall be protected by rock (No. 57 stone), then wrapped in filter fabric unless otherwise shown on the Drawings or directed by the ENGINEER. The portion of the pipe from the inside face of the wall to the outlet shall be non-perforated as shown on the Drawings. The outlet end of the pipe shall be protected with a rodent guard as shown on the Drawings. More than one pipe may be required in some openings as directed by the ENGINEER.

5.3. **Wildlife Closures:** Pea gravel shall be pneumatically backstowed or other means to fill in the area around the wildlife gates as shown on the drawings or as directed by the ENGINEER to secure the pipe and or wildlife gate, close the entry, and support any overhangs.

On openings where there is a dangerous overhang and a wildlife gate is to be used the wildlife gate shall be placed far enough from the opening where workers will not be directly under the overhang. The wildlife gate shall be constructed so that the opening is covered on all sides. Some of the openings with the approval of the ENGINEER may have to be covered by bending the reinforcing bars where they touch the dangerous areas, thus preventing access.

All mine portals that are currently open shall be closed as wildlife access closures unless otherwise directed by the ENGINEER.

REINFORCED CONCRETE PILINGS AND CAP

1. SCOPE

This work shall consist of furnishing and installing all materials, equipment, incidentals, and labor necessary to construct reinforced concrete pilings and caps as shown in the Drawings.

2. MATERIALS

2.1. **Concrete**: Shall be Class AA concrete conforming to the “Concrete” section of these Technical Specifications.

2.2. **Steel Reinforcement**: Shall conform to the “Steel” section of these Technical Specifications.

2.3. **Casings**: Shall provide sufficient sidewall strength to allow insertion of reinforcing steel and concrete.

3. CONSTRUCTION

The CONTRACTOR shall drill the holes of the diameter and depths stated on the Drawings and as directed by the ENGINEER. The CONTRACTOR will ensure that each hole will remain open. This may require the use of casing materials. Water shall be pumped from the holes prior to placement of concrete. Concrete shall be placed in a manner that will ensure the concrete does not fall an unacceptable distance as stated in the “Concrete” section.

REVEGETATION

1. SCOPE

The work will consist of furnishing all labor, equipment, and materials for preparing the seedbed; soil amendments and seed, and their application; spreading mulch, and installing netting. All disturbed areas are to be revegetated in accordance with this specification unless another surface treatment is specified for the area on the Drawings or elsewhere in these Technical Specifications.

2. GENERAL

Seed mixtures are listed in APPENDIX A. The mixture to use at each site shall be listed on the appropriate Plans/Drawings.

All seeding operations shall conform to the Erosion and Sediment Control BMP. Areas brought to final grade shall be revegetated within five (5) days. Areas that are not to final grade and where construction has ceased for fourteen (14) days or longer and soil stock piles shall receive temporary mulch no later than fourteen (14) days from the last construction activity.

2. MATERIALS

2.1. **Lime**: Agricultural ground limestone (ag-lime) or its equivalent shall be used. The ground limestone must have minimum 85% calcium carbonate (CaCO_3) equivalent, and must be fine enough so that not less than 90 percent shall pass through a U.S. Standard No. 10 sieve; and not less than 35 percent shall pass through a U.S. Standard No. 50 sieve. Agricultural ground limestone shall be purchased from quarries tested by the Kentucky Department of Agriculture. Ag-lime that fails to meet the minimum requirements may be used, but additional ag-lime must be added at no extra cost to the COMMONWEALTH to make up the deficiency. On excavated to bedrock areas ag-lime or rock dust shall be used that meets the above standards and 100 percent shall pass through a U.S. Standard No. 50 sieve.

Because some of the lime may be applied to steep slopes, the CONTRACTOR shall be required to provide a blower or side casting type piece of equipment to apply some of this material.

All lime must be delivered to the job site only when the resident inspector is present on the site to visually inspect the delivery and receive the lime weigh tickets.

2.2. **Fertilizer**: The fertilizer shall be a commercial fertilizer containing the plant nutrients of nitrogen (N), available phosphoric acid (P_2O_5), and soluble potash (K_2O) at the rates specified in this specification. Bagged fertilizer shall display the following information on the bag or on a sticker or tag attached to the bag: net weight, brand and grade, guaranteed analysis, and name and address of manufacturer. Bulk fertilizer (dry or liquid) shall be accompanied by a statement from the manufacturer, which contains the same information required for the bagged fertilizer. Either bagged or bulk (dry or liquid) fertilizer must be manufactured and sold under the

jurisdiction of the Division of Regulatory Services of the University of Kentucky Agricultural Experiment Station.

2.3. **Seed:** Seed will be paid as “PURE LIVE SEED”. Seed shall be applied to all disturbed areas in accordance with the seed mixture tables in APPENDIX A herein with no alterations except with the written consent of the ENGINEER. See APPENDIX A for the formula to calculate pure live seed.

The seed mixture shall be totally free of any quack grass, dodder, Johnson grass, Canada thistle seed, and contain less than 2 percent weed seed. The number of noxious weeds per pound shall not exceed a combined total of 30 seed per pound. The seed shall also comply with all Kentucky seed laws and regulations (KRS 205.020 to 250.170).

Seed shall be furnished fully tagged and labeled in accordance with the State laws and the U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act in effect on the date of invitations for bids. All seed must be from the latest crop available. No seed will be accepted with a date of test of more than nine (9) months prior to the date of delivery to the site. Any seed, which has become wet, moldy, or otherwise, damaged in transit or storage will not be accepted.

All seed shall be delivered in separate bags or packages according to species. The ENGINEER at the site shall remove the tags from each seed bag. These tags will be required for final payment. **Pre-mixed seed will not be accepted.**

All legume seed shall be treated with inoculants prior to seeding in accordance with this section of these Technical Specifications. All legume seeds shall be applied separate from all other grass seed, unless a hydraulic seeder is used.

Any and all seeding of lespedeza species (i.e., Kobe, Korean, and Sericea) will require unhulled seeding during the period of July 1 to December 31. Hulled and scarified seed will be required during the period of January 1 to June 30.

The percent of hard seed shall be considered as part of the germination rate.

See SEEDING RATE TABLE (**APPENDIX A**) for the specified seed mix and how to calculate pure live seed.

2.4. **Mulch:** Mulch shall consist of hay or straw. The mulch material shall be air dry, reasonably light in color, low in weed content, and shall not be musty, caked, or otherwise of low quality. The use of mulch that contains thistles, Johnson grass, or wild onion shall not be permitted. On excavated to bedrock areas hydro-mulch shall be cellulose fiber or processed straw.

The mulch shall be delivered only when the resident inspector is on the job site.

2.5. **Hardwood Bark Mulch:** This material is a composted hardwood bark mulch product free of noxious weeds or debris produced from trees. The product should be composted and have a moisture content not >50%. The pieces should be less than 3" long x 1" wide.

2.6. **Netting:** Plastic netting manufactured from extruded rectangular mesh plastic, a minimum of 45" wide with approximately 3/4" x 1" mesh openings; weighing not less than 2.6 lbs. per 1000 sq. ft. shall be used. Other netting may be used if approved by the ENGINEER. Staples will be U-shaped and made from steel wire of No. W1-W1.5 or W2 as recommended by manufacturer for installation conditions. The staples shall have a minimum length of 6 inches. Staples shall be driven flush with soil surface.

2.7. **Tack:** Tack shall be an organic tackifier. Tack shall be applied at the manufactures recommended rate.

2.8. **Inoculants:** The inoculants for treating legume seeds shall be a pure culture of nitrogen-fixing bacteria prepared specifically for the species and shall not be used later than the date indicated on the container or otherwise specified. The amount of the inoculants recommended by the manufacturer shall be used; except, when seed is applied by use of a hydraulic seeder, four times the amount of inoculants recommended by the manufacturer shall be used. Seed shall be sown within 24 hours of treatment and shall not remain in a hydraulic seeder longer than four (4) hours.

2.9. **Cover Crop:** Whenever the project is to be shut down for any length of time a cover crop (i.e. winter shutdown or other reasons), usually 10 bushel per acre of winter wheat for fall/winter seeding or German foxtail millet for spring/summer seeding shall be applied to the disturbed areas as directed by the ENGINEER.

2.10. **Disk:** The disk shall be either a tandem or offset disk meeting the following specifications:

- 1) Disk size: 22 inches minimum.
- 2) Disk spacing: 13 inches maximum.
- 3) Weight: 400 lbs. per foot of cut minimum.
- 4) Equipped with a drag of sufficient weight to remove any furrows left by the disk.

3. **SEEDBED PREPARATION**

Immediately following final grading, the areas to be seeded shall be dressed to a reasonably smooth, firm surface as determined by the ENGINEER. Lime and fertilizer shall be applied uniformly at the rates noted in the Project Description, Bid Item Description, Drawings, or Erosion and Sediment Control BMP.

The surface shall be tilled to a minimum depth of 6 inches with either a tandem or offset disk.

Seedbed preparation shall be suspended when soil conditions are not suitable for the preparation of a satisfactory seedbed. The ENGINEER shall make this determination.

On slopes too steep to disk, the CONTRACTOR shall be required to provide a dozer or equivalent to "walk-in" or break up the surface of the soil prior to seeding. This work shall be classified as seedbed preparation.

4. SEEDING

The specified mixtures of pure live seed (PLS) will be used on all disturbed areas within the project limits designated on the Drawings using the seasonal variations shown.

All areas shall be seeded immediately following seedbed preparation. In the event the date does not concur with the seeding schedules specified, seeding shall be accomplished using any one of the specified rates or an equivalent rate designed to fit the site and weather conditions, as directed by the ENGINEER.

All seed shall be broadcast evenly over the area, immediately following tilling, using a cyclone seeder, hydroseeder, or equivalent (incidental). Hydroseeder slurry water pH must remain above a pH of 5.0 and the CONTRACTOR shall provide an accurate pH meter to monitor the slurry at all times.

5. MULCHING

The mulch shall be applied uniformly over all seeded areas to obtain at least 90% cover. Mulch application must immediately follow seeding unless otherwise noted. Clumps of mulch must be spread. As a rule of thumb 2 tons of dry straw or 3 tons of dry hay should (before crimping) should achieve the desired coverage, however, more per acre may be required if the material is subpar. Hardwood bark mulch may be prescribed on the Drawings for acidic soils with low organic matter. The Drawings for project documents will specify the application rate.

6. CRIMPER

Crimping can be performed immediately following mulching. On all designated areas that require crimping, a crimper meeting the following specifications shall be used:

- | | |
|-------------------------------|---------------|
| 1. Minimum disk size: | 20 inches |
| 2. Minimum depth spacing: | 8 inches |
| 3. Minimum depth of crimping: | 3 inches |
| 4. Minimum weight: | 1,300 pounds* |

*This weight can be increased at the discretion of the ENGINEER if soil conditions warrant such an increase.

7. NETTING

Netting shall be installed on all slopes exceeding 30 percent. The netting shall be installed with a minimum of 6" overlap with previous row. Staples shall be installed at 4' maximum spacing on

all edges and laps. Interior rows of staples shall be at 4' maximum spacing with staples spaced in the row at 8' maximum spacing. Staples in an interior row shall alternate in spacing with staples on an adjacent interior row. All staples shall be driven flush with the soil surface.

The ENGINEER may approve the use of netting on areas which are flatter than 30 percent if the CONTRACTOR requests.

8. HYDROMULCH & HYDROSEEDING

The COMMONWEALTH will only pay for the use of a hydroseeder when used to apply hydromulch on project areas specified in the Drawings, Special Conditions, and on all areas where soil material has been removed to bedrock. No seedbed preparation or netting is required on these areas. Hydro-mulch, either cellulose fiber or processed straw, shall be used and applied at a rate of 1,500 pounds per acre. The seed mixture stated in the Drawings and/or Special Conditions will be used at the standard project rate and fertilizer at the standard project rate. Tack shall be used on all stripped to rock areas. **The hydromulch/hydroseeder, seed, fertilizer, and tack are all incidental to the bid item.** Ag-lime or rock dust meeting the requirements of this section and 100 percent shall pass through a U.S. Standard # 50 sieve shall be applied at a rate of 1 ton per acre and is not incidental.

9. RESIDENTIAL SEEDING

In areas around houses, lime, fertilizer, and seeding rates will vary and additional seedbed preparation work will be required for revegetation of residential areas. Hydrated lime (90 percent CaCO₃ equivalent content and 85 percent passing a #200 sieve) shall be applied at a rate of 20 pounds per 1,000 square feet. Fertilizer will be applied at a rate of 15 pounds per 1,000 square feet using a "10-10-10" fertilizer. Seed shall consist of a 3:1 mixture of turf type fescue (NOT KY31) and Perennial Ryegrass applied at a combined rate of 4 pounds (PLS) per 1,000 square feet. Additional seedbed preparation shall be required to remove all rock and debris larger than 2" (two inches) and to rake the area to a completely smooth surface. Do not seed on hard ground. Hand raking and tilling will be required. Mulch shall be applied at rates indicated in these Technical Specifications following all other operations. **Residential Seeding includes seedbed preparation, lime, seed, fertilizer, mulch and any other material or items necessary to complete the required work.**

10. LANDSCAPE ALLOWANCE

This shall consist of replacement "in kind" of any landscape in and around residential areas as part of normal construction techniques to facilitate the completion of other construction bid items. When approved, landscape to be replaced shall be of same species. To qualify for reimbursement, advanced approval from the ENGINEER must be given for removal and subsequent replacement. All removal and replacement shall be documented by the inspector. Any landscape damaged due to CONTRACTOR carelessness shall be replaced "in kind" at the CONTRACTOR'S expense.

SHEET DRAINS

1. SCOPE

This work shall consist of installing geotextile material sheet drains at locations shown on the Drawings, AML Standard Details, and/ as directed by the engineer.

2. MATERIALS

2.1. **General:** The sheet drains shall be a heavy-duty, high density polyethylene geonet core with ridges heat fused to a non-woven geotextile.

2.2. **Equivalency:** The drains must be equivalent to the Nilex NuDrain™ DN50-1 product produced by Nilex Civil Engineering Group. The CONTRACTOR must provide the ENGINEER with documentation from other companies certifying that the product meets these specific criteria and is equivalent to Nilex NuDrain™ DN50-1 product.

Property	Test		Unit
Compressive Strength	ASTM D-1621	40,000	psf
Thickness	ASTM D-1777	0.22	inches
In-Plane Flow	ASTM D-4716	8.5	gpm/ft
Flow	ASTM D-4491	135	gpm/ft
Puncture	ASTM D-4833	65	lbs
Apparent Opening Size		70	US Sieve
Grab Tensile Strength	ASTM D-4632	120	lbs

SHOTCRETE

1 SCOPE

This work shall consist of constructing a pneumatically applied shotcrete blanket onto rock/soil surfaces at locations shown on the plans or as directed by the engineer. These specifications refer to premixed cement and aggregate pneumatically applied by suitable equipment and competent operators.

2. CONTRACTOR QUALIFICATIONS

At least 30 days prior to beginning shotcrete work, the contractor shall provide written evidence that the supervisor, nozzle operator, and delivery equipment operator have performed satisfactory work in similar capacities elsewhere for a sufficient length of time to be fully qualified to perform their duties.

The supervisor shall not have less than 2 years' experience as a shotcrete nozzle operator. The nozzle operator and delivery equipment operator shall have served at least 1 year of apprenticeship on similar applications with the same type of equipment. Prior to the start of shotcreting for this job, nozzle operators shall, in the presence of the engineer, demonstrate their ability to apply shotcrete of the required quality on a test panel. One satisfactory test panel shot in a vertical position for each mix design used during the course of the work shall be the minimum qualification test for nozzle operators before they will be permitted to place shotcrete.

3. MATERIALS

3.1. **Shotcrete**: Shall conform to the "Grout" section of these Technical Specifications. Either wet-mix or dry-mix shotcrete may be used. The shotcrete shall be reinforced with either welded wire fabric or steel fibers.

The shotcrete shall be applied according to these specifications and applicable sections of the American Concrete Institute's Guide to Shotcrete (ACI 506R-85).

The contractor shall be responsible for the design of shotcrete mixes and for the quality of shotcrete placed.

3.2. **Pre-packed**: Premixed and prepackaged concrete product, with or without steel fibers, specifically manufactured as a shotcrete product may be provided for on-site mixed shotcrete, if approved by the engineer. The packages shall contain cement, aggregate and if appropriate, steel fibers conforming to the materials portion of this specification.

3.3. **Admixtures**: Admixtures shall not be used without permission of the engineer. If admixtures are used to entrain air, reduce water-cement ration, retard or accelerate setting time, or accelerate the development of strength, they shall be used at the rate specified by the manufacturer and must be compatible with the cement used. Use of calcium chloride

accelerating agent will not be permitted. When used, admixtures shall be dissolved in water before introduction into the mixture. Any color additive shall be approved by the engineer before use. Final acceptance will be made following a test section that has been allowed to cure for at least four (4) days.

3.4. **Water:** In addition to the requirements set forth in the Standard Specifications, the water used in the shotcrete mix shall also be free of elements which would cause staining.

3.5. **Aggregates:** The combined gradation of fine and coarse aggregate used in the shotcrete shall meet the following grading requirements:

SIEVE SIZE	PERCENT PASSING BY WEIGHT
½" (12.7 mm)	100
3/8" (9.7mm)	90 to 100
No. 4	70 to 85
No. 8	50 to 70
No. 16	35 to 50
No. 30	20 to 35
No. 50	8 to 20
No. 100	2 to 10

3.6. **Steel Fiber Reinforcement:** When the plans or specifications require the use of steel fiber reinforced shotcrete, the steel fiber reinforcement shall meet the following requirements. Steel fibers shall have a length between 1 and 1 3/8 inches (35.1mm), have blunt or hooked ends, have a length to diameter ratio of less than 80, and shall be cold drawn carbon steel with a minimum tensile strength of 160,000 psi. Only steel fibers manufactured specifically for use in shotcrete applications will be allowed. The steel fiber content shall not be less than one hundred (100) pounds for each cubic yard of shotcrete. The steel fibers must be premixed with the cement.

4. Acceptance Sampling and Testing

4.1. **General:** Shotcrete test panels shall be prepared by the contractor on vertically supported molds. Test panels shall be approximately 24 inches by 24 inches (610mm x 610mm) by a minimum of 3 inches (76.2mm) deep. The material used to form the back and sides of the molds shall be rigid, nonabsorbent and be non-reactive with cement. The shotcrete placement in vertical molds shall be accomplished utilizing the same shotcrete mix, air and water pressure, and nozzle tip as used for the actual placement of shotcrete on production surfaces. The panels shall be left undisturbed and protected at the point of placement for at least 24 hours or until the final set has taken place. The shotcrete shall be applied to a thickness of 3 to 3.25 inches (76.2mm to 89mm), with no sagging.

4.2. **Preproduction Testing:** The contractor shall prepare at least two test panels for each mix design for testing. The test panels shall be cured using the approved curing compound in a

manner similar to the anticipated field conditions. The engineer shall receive a copy of the mix design and the compressive test results at least 5 days prior to starting any production work. Production shotcrete work shall not begin until satisfactory test results are obtained.

4.3. **Shotcrete Compressive Strength**: The shotcrete shall be capable of attaining 2,500 psi compressive strength at 7 days (1,800 psi at 3 days) and 4,000 psi at 28 days as determined by AASHTO T 22 (ASTM C39-84) testing of compression test cylinders.

NOTE: Higher strength may be required and specified in the Drawings, Special Conditions, Project Description, or as directed by ENGINEER.

4.4. **Failure of Shotcrete**: Should any shotcrete section be deficient in any of the specified criteria, that section shall be remedied to the engineer's satisfaction at the contractor's expense. Such remedies may include, but not be limited to, removal and replacement of the substandard section.

5. **EQUIPMENT**

5.1. **Pump System**: The pump system used to convey premixed shotcrete ingredients shall deliver a uniform and uninterrupted flow of material without segregation or loss of the ingredients. The mixing equipment shall be capable of thoroughly mixing the specified materials in sufficient quantity to maintain continuous placing.

5.2. **Air Compressor**: The air compressor shall be capable of maintaining a supply of clean air adequate for maintaining sufficient nozzle velocity for all parts of the work and for the simultaneous operation of a blow pipe for clearing away rebound. The compressor shall be capable of providing a minimum of 250 cfm per operating nozzle.

5.3. **Dry-Mix Process**

5.3.1. **Batching and Mixing Equipment**: The mixing equipment shall be capable of thoroughly mixing the materials in sufficient quantity to maintain continuous application.

5.3.2. **Delivery Equipment**: The equipment shall be capable of discharging the aggregate-cement mixture into the delivery hose and delivering a continuous stream of uniformly mixed material to the discharge nozzle. The discharge nozzle shall be equipped with a manually operated water injection system (water ring) to direct an even distribution of water through the aggregate-cement mixture. The water valve shall be capable of ready adjustment to vary the quantity of water and shall be convenient to the nozzleman. The water pressure at the discharge nozzle shall be sufficiently greater than the operating air pressure to assure that the water is thoroughly mixed with the other material. The water pressure shall be steady (non-pulsating). Equipment parts, especially the nozzle liner and water ring, shall be regularly inspected and replaced as required.

5.4. **Wet-Mix Process**

5.4.1. **Batching and mixing equipment:** The mixing equipment shall be capable of thoroughly mixing the specified materials in sufficient quantity to maintain continuous application.

5.4.2. **Delivery equipment:** The equipment shall be capable of discharging the premixed materials into the delivery hose and delivering a continuous stream of uniformly mixed material to the discharge nozzle. Recommendations of the equipment manufacturer shall be followed for the type and size of nozzle to be used and for cleaning, inspection, and maintenance of the equipment.

6. **CONSTRUCTION REQUIREMENTS**

6.1. **Surface Preparation:** Immediately prior to shotcrete /rock fall netting application, rock surfaces of the areas to be shotcreted shall be scaled of all contaminating and loose material and be thoroughly cleaned by use of air or water jets, or other means approved by the ENGINEER, in order to provide a suitable bonding surface (see “Highwall-Slope Rockfall Netting Light Duty” section of these Technical Specifications). Soil surfaces shall be cleaned of loose material by an air jet.

Shotcrete shall not be placed on any surface that is frozen, spongy, or where there is free water. The surface shall be dampened before applying shotcrete.

6.2. **Shotcrete Blanket Thickness Control:** The thickness of the shotcrete blanket shall be controlled by installing noncorrosive pins, nails, or other gauging devices normal to the face, such that they protrude the required shotcrete thickness outside the face. These pins shall be placed on a maximum 8-foot (2.4 meters)-square pattern. When rockfall netting reinforcement is used, a minimum 1-inch (25.4mm) cover of shotcrete shall be placed over the welded wire fabric.

The lower 2 feet (.61 meters) of the rock slope shall not be shotcreted to allow drainage.

6.3. **Weep Holes:** Unless otherwise shown on the plans, weep holes shall be provided throughout the shotcrete mat at 10-foot (31 meters) centers maximum, horizontal and vertical. The weep holes shall be in contact with open points in the natural rock. Prior to shotcreting, survey stakes shall be driven into open joints. Shotcrete shall be applied around the stakes. After the shotcrete has reached the initial set, the stakes shall be removed to leave the drain hole open.

7. **Batching and Mixing Shotcrete**

7.1. **Dry-mix Process:** The cement and aggregate shall be batched by weight. Pre-dampening shall be carried out prior to flow into the main hopper and immediately after flow out of the packing in order to ensure that the premix will flow at a uniform rate (without slugs) through the main hopper, delivery hose and nozzle to form uniform shotcrete, free of dry

pockets. No pre-dampened cement/aggregate mix shall be used if allowed to stand for more than 90 minutes.

7.2. **Wet-Mix Process:** Batching and mixing shall be done according to the applicable provisions of ASTM C 94.

7.3. **Batching and Mixing Steel Fibers:** Steel fibers shall be premixed with the cement prior to batching shotcrete.

7.4. **Shotcrete Application:** Unless shown on other plans, the minimum thickness of shotcrete shall be 2 inches (50.8mm) and the maximum thickness shall be 3 inches (76.2mm) for steel fiber reinforced shotcrete. Where rockfall netting is used, the mesh shall be covered with a minimum of 1 inch (25.4mm) of shotcrete (3" total thickness approx.).

The shotcrete shall be applied from the lower portion of the area upward so that rebound does not accumulate on the portion of the surface that still has to be covered. Rebound material shall not be worked into the finished product. Rebound is defined as the shotcrete constituents that fail to adhere to the surface to which shotcrete is being applied. It shall not be salvaged and included in later batches. Shotcrete shall emerge from the nozzle in a steady uninterrupted flow. When, for any reason, the flow becomes intermittent, the nozzle shall be diverted from the work until steady flow resumes. A nozzleman's helper, equipped with an air blowout jet, shall attend the nozzleman at all times during the placement of shotcrete to keep the working area free from rebound.

Shooting shall be suspended if:

- a) High winds prevent the nozzleman from proper application of the material.
- b) The temperature is below 40°F (5°C).
- c) External factors, such as rain or seepage, wash cement out of the freshly placed material or cause sloughs in the work.
- d) Construction joints shall be tapered over a minimum distance of 12 inches (305mm) to a thin edge and the surface of such joints shall be thoroughly wetted before any adjacent section of mortar is placed. Square construction joints shall not be permitted.
- e) The surface shall be sounded with a hammer for unsound areas resulting from rebound pockets or lack of bond. Areas, sags, or other defects shall be carefully cut out and replaced with a succeeding layer at the contractor's expense. When fabric reinforcement is used and is damaged or destroyed by such repairs, the damaged area shall be replaced by properly lapped and tied additional wire fabric.
- f) Where a layer of shotcrete is to be covered by a succeeding layer, it shall first be allowed to take its initial set. The initial layer shall be cleaned of all loose material prior to placing succeeding layers.

7.5. **Finishing**: The shotcrete surface shall be left in the natural gun finish.

7.6. **Curing**: Placed shotcrete shall be cured by applying a white pigmented, liquid membrane-forming curing compound, as specified in the Standard Specifications. The curing compound shall be applied immediately after gunning. The air in contact with shotcrete surfaces shall be maintained at temperatures above freezing for a minimum of seven days. Curing compounds shall not be used on any surfaces against which additional shotcrete or other cementitious finishing materials are to be bonded unless positive measures, such as sandblasting, are taken to completely remove curing compounds prior to the application of such additional materials.

SILT CONTROL

1. SCOPE

This work shall consist of furnishing all materials, equipment, labor, and incidentals necessary for the installation of silt control facilities depicted in the Drawings and as directed by the ENGINEER.

All efforts to control sediment shall comply with the Division of Abandoned Mine Lands Erosion and Sediment Control Best Management Practices (BMP) Plan.

2. GENERAL

The ENGINEER shall direct the exact locations, configuration, and dimensions of the various types of silt control at the time of construction. These structures shall be installed prior to any surface disturbance for which they are necessary to control silt. As erodible areas are exposed, construct temporary drainageways where needed to divert runoff from erosive soils areas to the silt traps.

The CONTRACTOR shall schedule construction activities so that the amount of exposed soil is minimized. This is to be accomplished by disturbing only those areas, which are to be worked immediately, and by vegetating each area as soon as practical.

Silt Structures shall remain in place until the area has a substantial stand of grass to prevent erosion or as directed by the ENGINEER.

3. MATERIALS

3.1. **Silt Barrier- Bales:** Either straw or hay bales, firmly bound by twine, and installed using wooden stakes as shown in the Drawings

3.2. **Silt Barrier- Fence:** Shall conform to AASHTO M-288 for temporary silt fence. Provide fabric with a minimum height of 3 feet. If biodegradable silt fence is used it shall be Koir Fence 1250 or equivalent.

3.3. **Silt Barrier- Waddles:** Waddles shall be either straw or koir and be either 6" or 9".

3.4. **Silt Check- Geotextile Bags:** Silt Bags shall be made of a non-woven Type II geotextile fabric double stitched with polyester thread and filled with either No. 57 stone or sand and shall be between 50-60 pounds full.

3.5. **Wooden Stakes:** Shall be made of hardwood, greater than 4 feet long, minimum of 1 ½" by 1 ½" with cross sections straight enough to provide a fence without noticeable misalignment.

3.6. **Fasteners:** Use No. 9, one-inch long, wire staples, and/or fabric ties.

3.7. **Stone:** Stone silt checks shall meet the requirements of the “Crushed Aggregate Section and Channel Lining” section of these Technical Specifications.

3.8. **Gabions:** Gabion silt structures shall meet the requirements as set forth in the “Gabion” Section of these Technical Specifications.

3.9. **Geotextile Dewatering Tubes/Bags:** Geotextile Dewatering Tubes/Bags shall meet the following minimum requirements:

<u>PROPERTY</u>	<u>TEST METHOD</u>	<u>ENGLISH UNITS</u>
Puncture Strength	ASTM D-4833	130 lbs.
Burst Strength	ASTM D-3786	400 psi
Apparent Opening Size	ASTM D-4751	50 US Sieve
Water Flow Rate	ASTM D-4491	24 g/m/sf
Trapezoidal Tear	ASTM D-4533	85 lbs.
Seam Strength	ASTM D-4884	400 psi

3.10. **Concrete:** Shall conform to the “Concrete” section of these Technical Specifications.

4. INSTALLATION

4.1. **Silt Barrier- Bales:** Place bales with **1/2 foot** overlap and two stakes per bale.

4.2. **Silt Barrier- Silt Fence:** Construct continuous and traverse to the flow. Silt fence shall be installed per manufacturer’s instructions or as shown on the Drawings. Limit the equivalent runoff area to 1,000 square feet per 10 feet of temporary silt fence. **The fence must be trenched in place.**

4.3. **Silt Barrier- Wattles:** Install per manufacturer’s instructions or as shown on the Drawings.

4.4. **Silt Check- Geotextile Bags:** Silt Bags shall be placed at the inlet end of all structures as shown in the Drawings and Standard Details.

4.5. **Silt Check- Rock:** Stone silt structures shall be installed at the locations shown on the Drawings or as directed by the ENGINEER and in accordance with the Standard Details current edition.

4.6. **Silt Trap– Type A:** Construct excavated pits from 2-4 feet in depth, 20-30 feet in length, and 5-10 feet in width. Transport excavated materials to waste area or area designated by ENGINEER. The ENGINEER may elect to convert this item into a permanent trap using the appropriate AML Standard Detail as a template.

4.7. **Silt Trap- Type B:** Construct excavated pits from 2-4 feet in depth, 20-30 feet in length, and 5-10 feet in width and line the outside with Class II/III to contain all flow with a low spot in

middle of dike to control the flow of water from the area. Transport excavated materials to waste area or area designated by the ENGINEER. The ENGINEER may elect to convert this item into a permanent trap using the appropriate AML Standard Detail as a template.

4.8. **Silt Check- Gabion**: All gabion silt structures shall be installed at locations shown on the Drawings or as directed by the ENGINEER. Gabions shall be installed in accordance with the Gabion Section of these Technical Specifications.

4.9. **Concrete Weirs**: Construct and install concrete weirs into original ground as noted on the Standard Detail. They may be formed and poured in place or pre-cast. Pre-cast units may require additional concrete to extend the edges into original ground.

4.10. **Silt Check- Tubes/Bags**: Geotextile Dewatering Tubes/Bags shall be installed at the locations shown on the plans or as directed by the ENGINEER. Water flowing from these tubes/tubes shall be tested to determine if treatment is needed. If water shows treatment is needed then the water shall be treated in accordance with the “Water Treatment and Disposal” section of these Technical Specifications.

Once the tubes/bags are full they shall be given sufficient time to dry and the contents disposed of in an area where the silt will not return to the stream during a rainfall event. Once disposed of the material shall be revegetated in accordance with the “Revegetation” section of these Technical Specifications.

5. **MAINTENANCE**

Inspect all erosion control devices weekly and after each 0.1-inch rainfall event. Remove all accumulated silt when the devices are 50 percent full and place in approved waste area or as directed by ENGINEER.

Upon completion of the project, the ENGINEER may direct the CONTRACTOR to remove, clean, or replace silt control structures and revegetate such disturbances in accordance with the “Revegetation” Section of these Technical Specifications. **Silt control fence (geofabrics) shall be removed and disposed of properly at the end of construction activities.**

The Erosion and Sediment Control BMP plan shall include a clear description of the maintenance procedures necessary to keep the control measures in good and effective operating condition. **Any problems will be noted within 1 business day and will be corrected by the contractor within 5 days.** Critical failures will be addressed immediately unless site conditions are too dangerous. All deficiencies and corrections will be recorded in the onsite inspector’s daily report.

Following final project acceptance by the ENGINEER, DAML will be responsible for identification and correction of deficiencies regarding ground cover and other storm water BMP’s not created because of the CONTRACTOR’S workmanship and/or materials or landowner disturbances

SITE PREPARATION

1. SCOPE

The work shall consist of the clearing, grubbing, and/or stripping of all construction areas as shown on the Drawings, and removing and disposing of any trash and debris within the project limits. In addition, pipe removal and disposal shall be considered part of Site Preparation.

2. CLEARING AND GRUBBING

All trees, snags, logs, stumps, shrubs, rubbish, and garbage shall be removed from the cut and fill areas shown on the Drawings or as directed by the ENGINEER.

Unless otherwise specified or directed, all stumps, roots, and root clusters having a diameter of 1 inch or larger shall be grubbed out to a depth of at least 1-foot below ground surface in all designated areas.

3. STRIPPING

Areas on which excavation or fill operations are to be performed shall be stripped of all vegetation, topsoil, and other organic material as directed by the ENGINEER.

Stripped soil material shall be utilized or disposed of in a manner directed by the ENGINEER. Stockpiling of topsoil-type material will be required.

4. DISPOSAL

All trees cleared from the construction areas, including the waste areas, are properties of the surface owners. The CONTRACTOR shall be responsible for transporting to and storing trees on individual surface owner's property at locations designated by each owner.

All remaining cleared and grubbed material shall be disposed of in a manner acceptable to the ENGINEER and in a manner not detrimental to the project or the inhabitants of the area. The CONTRACTOR will be responsible for determining and complying with local ordinances, regarding disposal, and/or burning of such materials.

4.1. **Chipping**: The CONTRACTOR may be required to chip trees up to 20" diameter as use as onsite mulch product or for erosion control. The chips may be no larger than 3" long and 1" wide.

4.2. **Windrolling**: This method requires the creation of wind rolled piles generally not exceeding 10' tall and with breaks of >20' for every 30' of windrolled material. These materials should not be left in a manner that will create erosion problems or an aesthetically unpleasing feature.

4.3. **Burning**: Open burning of any shall be accomplished in strict accordance with current Kentucky Division of Forestry rules and precautions and then only with the approval and under the direction of the ENGINEER. The ENGINEER'S permission to burn and/or his presence at the site shall not be construed as relieving the CONTRACTOR of any responsibility in the event damage occurs or a citizen's complaint arises. The COMMONWEALTH accepts no responsibility for damage or costs associated with burning operations.

4.3.1. **The "6:00 Burning Law"**: KRS 149.400 established February 15 through April 30 and October 1 through December 15 as the FIRE HAZARD SEASON. During these fire seasons, everyone is prohibited from burning anything capable of spreading fire within one-hundred-and-fifty (150) feet of any woodland or brush land, except between the hours of 6:00 p.m. and 6:00 a.m., prevailing local time, or when the ground is covered with snow.

4.3.2. **Additional Forest Protection Laws**: The provisions of KRS 149.370 are of particular importance on abandoned mine land reclamation sites. Briefly, chief provisions require:

- a) that the consent of the owner of the land on which burning is to be performed be obtained beforehand;
- b) that adjacent landowners be notified beforehand;
- c) that "reasonable precautions" be taken to prevent the escape of fire to adjoining lands.

4.3.3. **Precautions**: The Kentucky Division of Forestry has provided the following list of precautions to help reduce the potential of forest fires:

- b) If burning must be performed, WAIT UNTIL AFTER 6:00 P.M. - or even later if the weather has been dry and/or windy.
- c) Burn only WHEN THE WINDS ARE CALM and there is no chance of gusts.
- d) Burn ONLY ON LEVEL GROUND. On slopes and in gullies, a fire can escape more easily and make a fast run uphill.
- e) When burning trash, use a barrel or deep pit with a screen over top.
- f) CLEAR THE AREA ten feet around where the fire will be. This creates a fire break. If possible, also plow around the area where the fire will be.
- g) Make sure THE AREA OVERHEAD IS CLEAR of material that could burn.
- h) HAVE TOOLS HANDY: a water hose, buckets of water, rakes, hoes, shovels, wet sacks, etc. These can be used to keep the flames inside the cleared area, subdue the flames if the wind picks up or the fire grows too big, smother the fire, or put a control line around it if it is getting out of hand. (More sophisticated equipment may be required by the ENGINEER.)

- i) Have more than one person to watch the fire. Be sure THE FIRE IS ATTENDED at all times by responsible people.
- j) Watch for SPOT FIRES. Cinders and sparks can carry through the air and start a "spot" of fire off in the distance.
- k) FEED THE FIRE SLOWLY. Do not burn everything all at once. This will control the level of burning and intensity of the fire.
- l) Stay with the fire UNTIL THE LAST SPARK IS DEAD OUT. Carefully inspect the burned area the next morning.
- m) If your fire escapes out of control, IMMEDIATELY REPORT IT to the Kentucky Division of Forestry's local guard or ranger. The local fire department, county dispatcher, or state police may also help if you want to report a forest fire.

4.3.4. Contractor's Responsibilities:

- a) Assure that all persons in his employ, including SUBCONTRACTORS and their employees, are knowledgeable of all provisions of KRS 149;
- b) Provide the ENGINEER with all particulars regarding proposed burning generally one full workday in advance;
- c) Comply fully with the letter and intent of the precautions established, and all other reasonable precautions, as if the term "the CONTRACTOR must" is implied;
- d) Accept responsibility for the actions of his personnel;
- e) Comply with all instructions of the ENGINEER regarding safe and legal burning techniques.

4.3.5. Disposal: The CONTRACTOR shall dispose of ash, and unburned or partially burned debris in a neat and safe fashion, as approved by the ENGINEER.

4.3.6. Restrictions: No burning will be permitted in or adjacent to areas where coarse or fine coal refuse materials are encountered.

5. MISCELLANEOUS SITE PREPARATION WORK

5.1. Debris Removal and Disposal: The work shall consist of the removal of domestic household trash & mining debris from the project area (i.e. construction limits, project limits, work limits, etc.) and its transportation to, and appropriate placement, in a permitted landfill. The CONTRACTOR shall advise the ENGINEER of the landfill to be used and shall obtain the ENGINEER'S approval prior to the hauling of trash and mining debris. All debris shall be

transported in a safe manner, being covered or otherwise secured as necessary to prevent loss in transit.

5.2. **Pipe Removal and Disposal**: The work shall consist of the removal of pipes and culverts (if instructed on Drawings or by the ENGINEER) from the project area and its transportation to, and appropriate placement, in a permitted landfill. The CONTRACTOR shall advise the ENGINEER of the landfill to be used and shall obtain the ENGINEER'S approval prior to the hauling of trash and mining debris. All debris shall be transported in a safe manner, being covered or otherwise secured as necessary to prevent loss in transit

STEEL

1. SCOPE

This section describes the types of steel piles used during construction. The actual size and placement of the products are noted on the Drawings and/or as directed by the ENGINEER.

2. MATERIALS

Steel shall be kept free from dirt, grease and other foreign matter, and shall be protected from corrosion.

2.1. **Steel Piles:** Shall be “W” and/or “HP” beams in accordance with the type and size designation shown on the Drawings. Steel piles shall conform to ASTM A-36. Steel piles must be straight. Splicing of the steel piles to accommodate actual field conditions is permissible provided the splice is covered by concrete. The location of all splices must be pre-approved by the ENGINEER. All splicing shall be done in accordance with requirements specified in the AWS structural welding code and AWS D1.1, current edition with revisions. Any splicing performed shall be considered incidental to the cost of the pile. **Portions of the piles remaining above ground shall be painted with an epoxy rust resistance paint to prevent corrosion of the beams.**

2.2. **Steel Reinforcement:**

2.2.1. **Strength:** Steel reinforcement shall be deformed type bars conforming to ASTM A-615. Reinforcement shall be manufactured from new billet steel of American manufacturer, and shall conform to Grade 60, yield strength 60,000 psi minimum.

ASTM STANDARD REINFORCING BARS				
Bar Size	Nominal Mass	Nominal Dimension-Round Sections		
English	pounds per foot	Diameter inches	Cross Section Area, sq., inches	Perimeter inches
#3	0.376	0.3750	0.11	1.178
#4	0.668	0.5000	0.20	1.571
#5	1.043	0.6250	0.31	1.963
#6	1.502	0.7500	0.44	2.356
#7	2.044	0.8750	0.60	2.749
#8	2.670	1.0000	0.79	3.142
#9	3.400	1.1280	1.00	3.544
#10	4.303	1.2700	1.27	3.990
#11	5.313	1.4100	1.56	4.430
#14	7.650	1.6930	2.25	5.320
#18	13.600	2.2570	4.00	7.090

2.2.3. **Shop Fabrication:** Reinforcing steel shall be fabricated to shapes and dimensions indicated on the Drawings and in compliance with applicable provisions of ACI 315 and ACI 310. Bars shall be bent cold. Bars shall be prefabricated to detail and delivered to the job plainly tagged and ready to set.

2.2.4. **Field Fabrication:** Any field fabrication of reinforcing steel shall comply with requirements of shop fabrication specified in these Technical Specifications.

2.2.5. **Mill Tests:** Mill tests of reinforcement shall be submitted prior to use for each 15 tons, or less, shipped to the job site. Tests shall be conducted in conformance with ASTM A-615.

2.2.6. **Testing:** Shall meet the requirements ASTM A-615 or KYTC Kentucky Method 64-101-06.

2.2.7. **Embedment & Splice Lengths:** Splices and embedment shall conform to the following:

Bar Size	Embedment	Splice
#3	1'-0"	1'-9"
#4	1'-0"	1'-9"
#5	1'-3"	2'-2"
#6	1'-6"	2'-7"
#7	1'-11"	3'-3"
#8	2'-6"	4'-3"
#9	3'-2"	5'-5"
#10	4'-0"	6'-10"
#11	5'-0"	8'-5"

2.3. **Steel Panels:** The steel panels shall be eleven (11) gauge corrugated galvanized steel panels with approximately 1 inch corrugations. All panels shall be newly manufactured. Panels shall be free from dirt, grease, and other foreign matter.

2.4. **Pipe:** shall be of the diameter specified on the AML Standard Details, Drawings, Special Conditions, or as directed by the ENGINEER. All pipe shall be free from dirt, grease, and other foreign matter.

STREAM CHANNEL PROTECTION & RESTORATION

1. SCOPE

This item consists of structures to protect streams during work along or within the channel and constructing and/or reconstructing channels at designated locations. Work shall include construction of temporary diversion, riffle structures, pools, bank stabilization utilizing boulders and cobbles excavated from the slide/borrow areas. Work also includes planting trees and shoots at designated locations.

Note: These items require the ability to identify bankfull stage and Rosgen stream classification. Many of the structure have references to angles that are critical to the overall stability of the structure and stream channel. **The placement of all structures must be designed.**

2. MATERIALS

2.1. **Filter Fabric**: Shall conform to the “Filter Fabric” section of these Technical Specifications.

2.2. **Anchor Pins**: Shall have a minimum length of 18 inches (0.45 meters), and accompanying washers should have a minimum diameter of 1 inch (2.5 centimeters).

2.3. **Geotextile Bags**: Shall be sand or stone filled bags conforming to the “Silt Control” section of these Technical Specifications.

2.4. **Impervious Sheeting**: Shall consist of polyethylene or other material which is impervious and resistant to puncture and tearing.

2.5: **Logs**: Shall be single logs at least 8 to 10 inches (20 to 25 centimeters) in diameter. Smaller logs may be acceptable provided they are bolted securely together (unless noted otherwise in the AML Standard Detail or Drawings).

2.6. **Rip-Rap**: Shall conform to the “Crushed Aggregate and Channel Lining” section of these Technical Specifications. Size of aggregate is listed on the Drawings, Special Conditions, and AML Standard Details.

2.7. **Large Rocks**: Shall conform to the “Crushed Aggregate and Channel Lining” section of these Technical Specifications. Size of aggregate is listed on the Drawings, Special Conditions, and AML Standard Details.

2.8. **Vortex Rocks**: Shall conform to the “Crushed Aggregate and Channel Lining” section of these Technical Specifications. Size of aggregate is listed on the Drawings, Special Conditions, and AML Standard Details. These rocks will be large enough to achieve the desired height when partially buried in the stream bed and should be sized to resist movement from shear stresses expected for the design flow.

2.8. **Footer Rocks:** Shall conform to the “Crushed Aggregate and Channel Lining” section of these Technical Specifications. Size of aggregate is listed on the Drawings, Special Conditions, and AML Standard Details. These rocks will be long and flat.

3. **PIPE DIVERSION**

3.1. **Description:** The work should consist of installing flow diversion pipes in combination with sandbag or stone diversions when construction activities occur within the stream channel.

3.2. **Effective Uses & Limitations:** Diversion pipes with an insufficient flow capacity can cause the channel diversion to fail thereby resulting in severe erosion of the disturbed channel section under construction. Therefore, in-channel construction activities should occur only during periods of low flow.

3.3. **Construction:**

- a. Sandbag/stone barriers should be sized and installed. The materials should be sized to withstand base flow velocities.
- b. All excavated material should be deposited and stabilized in an approved area outside the 100-year floodplain unless otherwise instructed in the Drawings, Special Conditions, or by the ENGINEER.
- c. The diversion pipe should have a minimum capacity sufficient to convey the 2-year flow for projects with a duration of two weeks or greater. For projects of shorter duration, the capacity of the pipe can be reduced accordingly. Sediment control devices are to remain in place until all disturbed areas are stabilized and the inspecting authority approves their removal.

4. **SANDBAG/STONE CHANNEL DIVERSION**

4.1. **Description:** The work should consist of installing sandbag or stone flow diversions for the purpose of erosion control when construction activities occur within the stream channel.

4.2. **Effective Uses & Limitations:** Diversions are used to isolate work areas from flow during the construction of in-stream projects. Diversions which have an insufficient flow capacity can fail and severely erode the disturbed channel section under construction. Therefore, in-channel construction activities should occur only during periods of low rainfall. This temporary measure may not be practical in large channels.

4.3. **Construction:**

- a. The diversion structure should be installed from upstream to downstream.
- b. The height of the sandbag/stone diversion should be a function of the duration of the project in the stream reach.

- c. For projects with duration less than 2 weeks, the height of the diversion should be one half the stream bank height, measured from the channel bed, plus 1 foot (0.3 meters) or bankfull height, whichever is greater. For projects of longer duration, the top of the sandbag or stone diversion should correspond to bankfull height. For diversion structures utilizing sandbags, the stream bed should be hand prepared prior to placement of the base layer of sandbags in order to ensure a water tight fit. Additionally, it may be necessary to prepare the bank in a similar fashion.
- d. All excavated material should be deposited and stabilized in an approved area outside the 100-year floodplain unless otherwise instructed in the Drawings, Special Conditions, or by the ENGINEER.
- e. Sheeting on the diversion should be positioned such that the upstream portion covers the downstream portion with at least an 18-inch overlap.
- f. Sandbag or stone diversions should not obstruct more than 45% of the stream width. Additionally, bank stabilization measures should be placed in the constricted section if accelerated erosion and bank scour are observed during the construction time or if project time is expected to last more than 2 weeks.
- g. Prior to removal of these temporary structures, any accumulated sediment should be removed, deposited and stabilized in an approved area outside the 100-year floodplain unless otherwise instructed in the Drawings, Special Conditions, or by the ENGINEER..
- h. Sediment control devices are to remain in place until all disturbed areas are stabilized in accordance with “Silt Control” and “Revegetation” section of these Technical Specifications and the ENGINEER approves their removal.

5. FABRIC-BASED CHANNEL DIVERSION

5.1. **Description:** The work should consist of installing fabric-based diversion channels for the purpose of erosion control when construction activities occur within the stream channel.

5.2. **Effective Uses & Limitations:** Diversions are used to divert flow during construction of in-stream projects. Diversions which have an insufficient flow capacity can fail and severely erode the disturbed channel section under construction. Therefore, in-channel construction activities should occur only during periods of low rainfall.

5.3. **Construction:** All erosion and sediment control devices, including mandatory dewatering basins, should be installed as the first order of business. Installation should proceed from upstream to downstream during periods of low flow. Construction of fabric-based channel diversions involves channel excavation, placement of geotextile fabric, and installation of flow diverters for both the main channel and all tributaries contributing flow to the work area.

5.3.1. Channel Excavation:

- a. All disturbances resulting from construction of the channel should be contained by appropriate sediment control measures.
- b. Excavation of the channel should begin at the downstream end and proceed upstream. The channel should have a minimum capacity sufficient to convey the stream's base flow for projects with duration of 2 weeks or less. For projects of longer duration, channels should have a capacity sufficient to convey bankfull flow. All excavated materials should be stockpiled outside of the 100 year flood plain and temporarily stabilized to prevent re-entry into the stream channel.
- c. The process of excavation and stabilization with fabric should be a continuous and uninterrupted operation. All materials should be on-site prior to channel construction.
- d. The downstream and upstream connection to the natural channel should be constructed under dry conditions. The stream should be contained by sandbags along the opposing bank during the process of cutting the diversion channel into the natural stream channel. Excavation and stabilization should be a continuous and uninterrupted operation.
- e. All debris such as rocks, sticks, etc. should be removed and the channel surfaces made smooth so that the fabric will rest flush with the channel at all sides and bottom.

5.3.2. Stabilization with Geotextile Fabric:

- a. The fabric should have a minimum width such that it is keyed in and anchored at the top of stream bank.
- b. Fabric should be placed so that it rests flush with the channel at all points of contact.
- c. Fabric should be placed such that one piece will line the entire channel. If this is not possible, fabric should be placed so that transverse overlapping occurs in accordance with the detail. Longitudinal overlaps should not be allowed. Upstream sections should overlap downstream sections. Overlap width should equal 2 feet (0.6 meters) minimum.
- d. The fabric should be keyed into 2 by 2-foot (0.6 by 0.6-meter) trenches located at the upstream edge and at 50-foot (15.25-meter) intervals with the overlap placed nearest to each 50 feet increment. The key-in should be from top of channel to top of channel. Class II riprap mixed with No. 2 stone should be carefully placed into the trench with zero drop height.
- e. The fabric sections should be secured with hold down pins and washers. Overlaps should be pinned along transverse and longitudinal axes with spacing equal to 3 feet (0.9 meters) maximum.

5.3.3. Alternate Methods of Placing the Fabric:

- a. The above design may be modified to allow sewing of the geotextile fabric. Sewing of the geotextile fabric, rather than overlapping, should eliminate the requirement for transverse placement of the fabric. Either transverse or longitudinal placement should work equally well.
- b. The spacing of the pins could be either larger or smaller depending on the anticipated velocities and thickness and type of geotextile fabric.
- c. The entire bottom of the channel could be riprapped if high velocities are anticipated. When the area is riprapped, it is not required that the geotextile fabric underneath the riprap be pinned.

5.3.4. Removal of Diversion:

- a. Water should not be allowed through the natural stream until all construction is completed.
- b. After redirecting the flow through the natural channel, all fabric should be removed from the temporary diversion. The diversion should then be backfilled and stabilized. Points of tie-in to the natural channel should be protected with riprap according to the riprap guidelines.

6. **BRUSH MATTRESS**

6.1. **Description:** Brush mattresses are formed from live branches which are wired together to create an erosion resistant mat. This mat is then secured to the bank by live and/or dead stakes and partially covered with fill soil to initiate growth of the cuttings.

6.2. **Effective Uses & Limitations:** Brush mattresses provide bank protection soon after establishment. They are generally resistant to wave and current action and function to:

- capture sediment and rebuild stream banks;
- facilitate the colonization of native riparian vegetation; and
- provide long-term durability and erosion control, especially when used on Rosgen stream types B3, B4, B5, B6, C1, C2, C3, C4, C5, C6, DA, E3, E4, E5, and E6.

Brush mattresses should be limited to use on:

- sites having only low to moderate water level fluctuations and slope gradients not exceeding 2H:1V, C streams with low to moderate suspended sediment loads since high loads may precipitate the burial of these bioengineering systems and complicate future planting efforts at the site, and
- native fill soils which contain enough fine material to allow the live branches to root and grow readily; key trenches backfilled with topsoil may be required on rocky slopes. Additionally, this measure should be initiated in conjunction with a revegetation strategy since brush mattresses make it more difficult to propagate vegetative plantings once the mats become established.

6.3. **Construction:** Brush mattresses should be installed as follows:

- a. Live branches should be oriented in crisscross layers perpendicularly to the flow of water in slight manmade depressions along the embankment. The butt ends should alternate to provide a uniform mat thickness of at least 12 inches and a minimum percentage of air voids.
 - Approximately 20 to 50 branches should be used per running meter provided their lengths are the same as the slope length.
 - If the branches are not long enough to cover the entire slope from the toe to the top of slope, multiple layers should be utilized with the branches in the lower layers overlapping those in the upper layers by at least 1 foot.
- b. Once in position, the mattresses should be bound with wire and secured with 3-foot wooden stakes spaced at 2 to 3-foot intervals. The wire should be tied to notches in the stakes before they are driven into the ground; this allows for tension to develop in the wire when the stakes are driven, thereby pulling the mattress firmly to ground.
- c. Upon being bound and secured to the embankment, the mattresses should be covered with alternating layers of soil and water until only a portion of the top layer of branches is exposed, but all butt ends must be covered. The use of alternating applications of soil and water helps to insure a proper soil-branch interface to initiate growth.
- d. Finally, the toe of the embankment should be reinforced against undercutting with a rock toe and vegetative measure such as a live fascine.

7. **LIVE STAKES**

7.1. **Description:** The work should consist of inserting live, woody, rootable plant cuttings into streambanks and encouraging their growth. When properly utilized, the binding root mass of the mature shrubs and/or trees will ultimately stabilize and reinforce the soil.

7.2. **Effectiveness Uses & Limitations:** Live staking is an economical method when local supplies of woody cuttings are readily available since the implementation of this measure requires minimal labor. When utilized effectively, live stakes can:

- act to trap soil particles in sediment laden water resulting from the erosion of adjacent land;
- slow water velocities, trap sediment, and control erosion when organized in clustered arrays along the sides of gullies;
- repair small earth slips and slumps which are frequently wet;
- help control shallow mass movement when placed in rows across slopes; and
- promote bank stabilization, especially when used in conjunction with one of the following Rosgen stream types: B3, B4, B5, B6, C1, C2, C3, C4, C5, C6, DA, E3, E4, E5, and E6.

Live staking is a *preventative* measure and should be employed before severe erosion problems occur. Additionally, in order to be effective, live stakes should be:

- planted only on streams with low to moderate flow fluctuations,
- established in the original bank soil on moderate slopes of 4:1(H:V) or less,
- planted where appropriate lighting exists, and
- used jointly with other restoration techniques especially on slopes with high erosion rates and incidents of mass wasting

7.3. **Construction:**

- a. Live stake rooting areas should be soaked in barrels of water for 24 to 48 hours just prior to installation.
- b. While keeping the bark of the live stakes intact, the side branches should be cleanly removed, the basal ends angled for easy insertion, and the tops cut square.
- c. The cuttings should be implanted with the angled basal end down and buds oriented up at a minimum angle of 10 degrees to the horizontal so that rooting will not be restricted. All stakes should be positioned above the normal baseflow level. Project planners may need to study an aptly chosen vegetated reference reach for further guidance when installing live stakes.
 - In soft soils, the stakes can be inserted perpendicularly into the slope using a dead blow hammer; in hard soils, however, a steel rod should be employed to create a pilot hole before the stakes are planted.
 - Twenty percent of the live stake, and a minimum of two lateral buds, should be exposed above the slope so that green, leafy shoots will readily grow.
 - Split or otherwise damaged stakes should be discarded.
- d. After the stakes have been inserted into the ground, soil should be tamped firmly around their bases to encourage root growth.
- e. Successive stakes should be arranged in a triangular configuration and spaced a distance of 2 to 3 feet apart, allowing for a typical density of 2 to 4 cuttings per square yard. Willow posts require additional room for growth and propagation and should be planted at 3 to 5-foot intervals. When inserted in arrays, the stakes should be spaced 12 to 18 inches apart to form chevron-like rows that point downstream.
- f. Unstable slope toes should be reinforced against scouring and undercutting using live fascines or rock fill to give the live stakes the best opportunity to root and grow.

8. **STEP POOLS**

8.1. **Description:** The work should consist of constructing step-pool sequences in steep headwater stream channels for grade control and the creation of aquatic habitat through flow diversification. Step-pool channels are characterized by a succession of channel-spanning steps formed by large grouped boulders called clasts that separate pools containing finer bed sediments. As supercritical flow tumbles over the step, energy is dissipated in roller eddies and becomes subcritical in the associated downstream plunge pool.

8.2. **Effective Uses & Limitations:** Step-pool morphologies are typically associated with well confined, high-gradient channels with slopes greater than 3%, having small width-depth ratios and bed material dominated by cobbles and boulders. Step pools generally function as grade control structures and aquatic habitat features by reducing channel gradients and promoting flow diversity. At slopes greater than roughly 6.5%, similar morphologic units termed cascades spanning only a portion of the channel width are formed in these channel conditions. Step pools and cascades are generally found in the following Rosgen stream types: A1-A3 and B1-B3.

8.3. **Construction:**

- a. The stream should be redirected by an approved temporary stream diversion. The construction area should be dewatered, and any disturbed banks should be stabilized.
- b. Step-pool units should be designed and constructed to have a characteristic step height, H, and step length, L, as shown in the AML Standard Details, and all steps should be firmly anchored into the stream bank.
- c. Step rocks shall be placed on footer rocks so that they rest on two halves of each footer rock below, and so that the step rock is offset in the upstream direction. Footer rocks should extend below the scour pool elevation.
- d. As a general guideline, the ratio of the mean steepness, defined as the averaged value of step height over step length, to the channel slope, S, should lie in the range of 1 to 2 (1 to $\{(Height / Length)_{Average} / Slope\}$ to 2). Typical spacing for step pools and cascades are provided in the AML Standard Detail relating to alluvial channel morphologies.
- e. Whenever practical, a reference reach with similar flow rates, bed and bank material characteristics, type and density of riparian vegetation, and channel gradient should be surveyed at low flows to determine appropriate values of H and L. At high discharges, step-pool characteristics may be obscured.
- f. Once construction is completed, the diversion should be removed from upstream to downstream. Sediment control devices, including perimeter erosion controls, are to remain in place until all disturbed areas are stabilized in accordance with an approved sediment and erosion control plan and the inspection authority approves their removal.

9. **LOG VANES**

9.1. **Description:** The work should consist of installing log vanes to direct normal flows away from unstable stream banks and to improve/create aquatic habitat by enhancing flow diversity through the formation of scour pools.

9.2. **Effective Uses & Limitations:** Log vanes are single-arm structures which are partially embedded in the streambed such that they are submerged even during low flows. When properly positioned, log vanes induce secondary circulation of the flow thereby promoting the

development of scour pools. Log vanes can also be paired and positioned in a channel reach to initiate meander development or migration. Additionally, the following limitations apply to log vanes:

- Vanes should be used carefully in vertically unstable streams unless measures have been taken to promote stream stability so that it may retain a constant planform and dimension without signs of migration or incision
- Vanes are ineffective in bedrock channels since minimal bed scouring occurs. Conversely, log vanes should be used carefully in streams with fine sand, silt, or otherwise unstable substrate since significant undercutting can destroy these measures.
- Vanes should not be used in stream reaches which exceed a 3% gradient.
- Vanes should not be used in streams with large sediment or debris loads.
- Vanes are best suited to Rosgen types B2-B5 and C2-C4.
- Banks opposite these structures should be monitored for excessive erosion.

9.3. **Construction:**

- a. The stream should be diverted according to an approved practice, and the construction area should be dewatered.
- b. Combinations of log vanes should be installed according to the Drawings, Special Conditions, and as directed by the ENGINEER. When placed to initiate meander development, vanes should be spaced 5 to 7 stream bankfull widths apart and arranged on alternating banks. Vanes used for habitat creation should be spaced 1 or more channel widths apart depending upon the pattern of scour pools in natural reference reaches. Additionally, the following primary design criteria need to be satisfied: shape and orientation, height, and length.
 - Shape and orientation. Vanes should be angled 20 to 30 degrees from the upstream bank.
 - Height. The bank-end of the vane should be at the bankfull elevation and the tip of the vane should be partially embedded in the streambed such that it is submerged even during low flows. The vane should be placed at a vertical angle of 3% to 7%.
 - Length. Vanes should span a maximum of 1/3 of the channel width, depending on the channel size. Channels less than 20 feet may require a vane to extend 1/2 of the channel width. The larger the channel, the shorter the vane should be relative to the channel width.
- c. When installing vanes, the bank end of the structure should be firmly anchored a minimum of 5 to 6 feet into the slope. When two or more smaller logs are used in place of one larger log, they should be anchored to each other with 3-foot rods of 1/2 to 5/8-inch diameters. The rods should be driven in until 4-inch tail remains, which should be bent in a downstream direction. When necessary, the logs may also be secured with cables. Log structures should be anchored to the stream bed with support pilings with lengths exceeding probable scour depths.
- d. Large rocks can be positioned on the downstream face of the vanes to provide further stability.

- e. All disturbed areas should be permanently stabilized in accordance with an approved sediment and erosion control plan.

10. **ROCK VANES**

10.1. **Description:** The work should consist of installing rock vanes to direct normal flows away from unstable stream banks and to improve/create aquatic habitat by enhancing flow diversity through the formation of scour pools.

10.2. **Effective Uses & Limitations:** Rock vanes are single-arm structures which are partially embedded in the streambed such that they are submerged even during low flows. When properly positioned, rock vanes induce secondary circulation of the flow thereby promoting the development of scour pools. Rock vanes can also be paired and positioned in a channel reach to initiate meander development or migration.

Additionally, the following limitations apply to rock vanes:

- Vanes should not be used in unstable streams unless measures have been taken to promote stream stability so that it may retain a constant planform and dimension without signs of migration or incision
- Vanes are ineffective in bedrock channels since minimal bed scouring occurs. Conversely, streams with fine sand, silt, or otherwise unstable substrate should be avoided since significant undercutting can destroy these measures. In these streams, log vanes may be considered.
- Vanes should not be used in stream reaches which exceed a 3% gradient.
- Vanes should not be used in streams with large sediment or debris loads.
- Vanes are best suited to Rosgen types B2-B5 and C2-C4.
- Banks opposite these structures should be monitored for excessive erosion.

10.3. **Construction:**

- a. The stream should be diverted according to an approved practice, and the construction area should be dewatered.
- b. Combinations of rock vanes should be installed according to Drawings, Special Conditions, and as directed by ENGINEER. When placed to initiate meander development, vanes should be spaced 5 to 7 stream bankfull widths apart and arranged on alternating banks. Vanes used for habitat creation should be spaced 1 or more channel widths apart depending upon the pattern of scour pools in natural reference reaches. Additionally, the following primary design criteria need to be satisfied: shape and orientation, height, and length.

Shape and orientation. Vanes should be angled 20 to 30 degrees from the upstream bank.

Height. The bank-end of the vane should be at the bankfull elevation and the tip of vane should be partially embedded in the streambed such that it is submerged even during low flows. The vane arm should be placed at a vertical angle of 3% to 7%.

Length. Vanes should span a maximum of 1/3 of the channel width, depending on the channel size. The larger the channel, the shorter the vane should be relative to the channel width.

- c. When installing vanes, the bank end of the structure should be firmly anchored a minimum of 2-3 rocks into the bank.
- d. All rocks should touch adjacent rocks to form a tight fit. Vane rocks shall be placed on top of footer rocks so that each vane rock rests upon two halves of each footer rock below, and so that the vane rock is offset in the upstream direction. Vane rocks shall be shingled upstream.
- e. All disturbed areas should be permanently stabilized in accordance with an approved sediment and erosion control plan.

11. J-HOOK VANES

11.1. **Description:** The work should consist of installing rock vanes to direct normal flows away from unstable stream banks and to improve/create aquatic habitat by enhancing flow diversity through the formation of scour pools.

11.2. **Effective Uses & Limitations:** J-hook vanes are single-arm structures whose tip is placed in a “J” configuration and partially embedded in the streambed such that they are submerged even during low flows. When properly positioned, J-hook vanes induce secondary circulation of the flow thereby promoting the development of scour pools. J-hook vanes can also be paired and positioned in a channel reach to initiate meander development or migration.

Additionally, the following limitations apply to J-hook vanes:

- J-hook vanes should not be used in unstable streams unless measures have been taken to promote stream stability so that it may retain a constant planform and dimension without signs of migration or incision.
- J-hook vanes are ineffective in bedrock channels since minimal bed scouring occurs. Conversely, streams with fine sand, silt, or otherwise unstable substrate should be avoided since significant undercutting can destroy these measures.
- J-hook vanes should not be used in stream reaches which exceed a 3% gradient.
- J-hook vanes should not be used in streams with large sediment or debris loads.
- J-hook vanes are best suited to Rosgen types B2-B5 and C2-C4.
- Banks opposite these structures should be monitored for excessive erosion.

11.3. **Construction:**

- a. The stream should be diverted according to an approved practice, and the construction area should be dewatered.
- b. Combinations of J-hook vanes should be installed according to the Drawings, Special Conditions, and the ENGINEER. When placed to initiate meander development, vanes should be spaced 5 to 7 bankfull widths apart and arranged on alternating banks. Vanes used for habitat creation should be spaced 1 or more channel widths apart depending upon the pattern of scour pools in natural reference reaches. Additionally, the following primary design criteria need to be satisfied: shape and orientation, height, and length.

Shape and orientation. Vanes should be angled 20 to 30 degrees from the upstream bank.

Height. The bank-end of the vane should be at the bankfull elevation and the tip of vane should be partially embedded in the streambed such that it is submerged even during low flows. This tip should be placed to form a semi-circular structure at the streambed. The vane arm should be placed at a vertical angle of 3% to 7%.

Length. Vanes should span a maximum of 1/3 of the channel width, depending on the channel size. J-hooks may span up to 60% of the channel width. The larger the channel, the shorter the vane should be relative to the channel width.

- c. When installing vanes, the bank end of the structure should be firmly anchored a minimum of 1-2 rocks into the bank.
- d. Vane rocks should be placed on top of footer rocks such that each vane rock touches adjacent rocks and rests upon two halves of each footer rock below it, and so that the vane rock is offset in the upstream direction. Vane rocks shall be shingled upstream.
- e. All disturbed areas should be permanently stabilized in accordance with an approved sediment and erosion control plan.

12. **STREAM DEFLECTORS**

12.1. **Description:** The work should consist of installing stream deflectors to provide flow diversity for aquatic habitat.

12.2. **Effective Uses & Limitations:** Structures which limit channel width thereby accelerating normal flows through the constricted section are referred to as stream deflectors. Single-wing and triangular deflectors are the two most commonly used types of this measure. Single-wing deflectors consist of a main log or placed rock angled downstream as shown in Detail 3.5. Log wing deflectors consist of a triangular log frame filled with tightly packed rock. When properly constructed either singly or in series in low gradient meandering streams, deflectors divert base flows towards the center of the channel and, under certain conditions, increase the depth and velocity of flow thereby creating scour pools and enhancing fish habitat.

Channel constrictors, or paired deflectors on opposite banks, are well suited to shallow stream reaches where the flow needs to be contracted significantly to produce the required velocities to scour the channel bottom. Backwater effects caused by channel constrictors facilitate gravel deposition upstream thereby improving spawning habitat for fish. Stream deflectors should be constructed in the lower half of long riffles to prevent undesired backwater effects from reaching upstream. Additionally, the following limitations apply to stream deflectors:

- Deflectors should not be used in unstable streams which do not retain a constant planform or are actively incising at a moderate to high rate.
- Deflectors are ineffective in bedrock channels since minimal bed scouring occurs. Conversely, streams with fine sand, silt, or otherwise unstable substrate should be avoided since significant undercutting can destroy these measures.
- Deflectors should not be used in stream reaches which exceed a 3% gradient.
- Deflectors should not be used in streams with large sediment or debris loads.
- Single-wing deflectors are best suited to Rosgen types B2-B5 and C2-C4.
- Banks opposite these structures should be monitored for excessive erosion.

12.3. **Construction:**

- a. The stream should be diverted according to an approved practice, and the construction area should be dewatered.
- b. Combinations of log and/or stone deflectors should be installed according to a Drawings, Special Conditions, or as directed by the ENGINEER. When deflectors are used in series for bank protection, they should be spaced one or more stream widths apart (as measured along the bank). When placed to initiate meander development, deflectors should be spaced 5 to 7 stream widths apart and arranged on alternating banks. Additionally, the following primary design criteria need to be satisfied: shape and orientation, height, and length.

Shape and orientation. Deflectors should be positioned to conform to the natural meander of the stream and should not exceed a downstream angle of 30 to 40 degrees with the stream bank. The greater the flow velocity, the smaller the angle of deflection should be in the specified range. Angles greater than 40 degrees may result in erosion of the opposite bank and expose the structure to more direct forces. In faster flowing streams and rivers, a separation zone can form downstream of the deflector thereby accelerating bank erosion. To avoid this problem with triangular deflectors, the angle of the trailing edge of the deflector can be reduced to allow for the gradual expansion of the flow.

Height. No more than 6 inches (15 cm) of the deflector should be above the normal flow level.

Length. The distance from the stream bank to the tip of the deflector should be no more than 1/2 of the channel width, depending on the channel size. The larger the channel, the shorter the deflector should be relative to the channel width. Additionally, straight or angled deflectors may extend a maximum of 3/4 of the channel in grossly over-widened and ponded reaches.

- c. When installing single-wing deflectors, all logs should be firmly anchored into the stream bank a minimum of 5 to 6 feet. Additionally, when two or more smaller logs are used in place of one larger log, they should be anchored to each other with 3-foot rods of 1/2 to 5/8-inch diameters. The rods should be driven in until a 4-inch tail remains, which should be bent in a downstream direction. When necessary, the logs may also be secured with cables. The log structures should be anchored to the stream bed with support pilings with lengths exceeding probable scour depths.
- d. The first step in constructing a log wing deflector is to trench the main (upstream) log into the bank at a suitable angle in the specified range. The log should be anchored a minimum of 5 to 6 feet into the bank and secured to the stream bottom using 3 to 5-foot rebar pins spaced at five-foot intervals. Next, the brace, or downstream, log should be trenched into the bank so that it joins the main log at a 90 degree angle, positioned on top of the main log, cut to an exact fit, and pinned with 2-foot rebar pins. The main deflector log can overhang the brace log by a few feet to provide extra scouring effect if warranted. The brace log should also be secured to the stream bottom with rebar pins or some other measure. Once the frame is completed, stone should be tightly packed into the frame, and the connection between the logs and stream bank should be reinforced with larger stones for added stability and erosion control. If more than one layer of logs is used, heavy lumber should be sandwiched between the upper and lower main logs to provide a tighter, more secure fit. If a wing deflector is to be constructed entirely from stone, rocks sized for bankfull flow according to the Drawings, Special Conditions, and when directed by the ENGINEER. Riprap should be employed to form the upstream and downstream edges. Keying these rocks into the bank and channel bed helps to stabilize the structure. Once the upstream and downstream edges are in position, dense, angular rock from 4 to 30 inches in diameter should be shingled against the frame to form the fill.
- e. Channel constrictors, made from two deflectors, are designed to reduce the stream width from 25 to 80 percent depending on specific site conditions such as relative bank stability, substrate size, and design flow with associated hydraulic characteristics. At the midpoint of the structure, the constrictor should be roughly the height of the expected high stream flow. To allow for the expansion of flows passing through the constrictor, banks downstream should be reinforced against scour and erosion. If the constrictors are placed in series in straight reaches, they should be spaced according to step-pool configurations as noted in the appropriate subsection of this Technical Specification and the AML Standard Details.
- f. If necessary, the bank opposite the deflector should be reinforced against scouring effects with cover logs, riprap, or other measures. Additionally, large stones should be hand-placed on the downstream side of the deflectors to protect against scouring from flood flows since high flows which overtop the deflectors are directed into the bank.
- g. All disturbed areas should be permanently stabilized in accordance with an approved sediment and erosion control plan.

13. CROSS VANES

13.1. **Description:** Low profile in-stream structures such as cross vanes are primarily used to create aquatic habitat in the form of scour pools and for grade control on incising streams and rivers. Additionally, they are well-suited for channeling flow away from unstable banks.

13.2. **Effective uses & Limitations:** Cross vanes are typically suited for use in moderate to high gradient streams. Cross vanes are best suited to Rosgen stream types A3-A4, B3-B4, C3-C4, F3-F4, and G3-G4. When constructed and spaced properly, cross vanes can simulate the natural pattern of pools and riffles occurring in undisturbed streams while forming gravel deposits which fish use as spawning grounds. Cross vanes can also be used to stabilize banks when designed properly. Cross vanes should be avoided in channels with bedrock beds or unstable bed substrates, and streams with naturally well-developed pool-riffle sequences.

13.3. Construction:

- a. The stream should be diverted according to a recommended measure, and the construction area should be dewatered.
- b. Cross vanes are typically designed with a “U” shape such that the apex of the structure points upstream. The angle the arms make with the upstream bank should be approximately 20 to 30 degrees so that flows are directed away from the banks and deeper pool areas are created directly downstream of the vane or weir. All rocks should touch adjacent rocks to form a tight fit. Vane rocks shall be placed on top of footer rocks so that each vane rock rests upon two halves of each footer rock below, and so that the vane rock is offset in the upstream direction. Vane rocks shall be shingled upstream. On unstable bed substrates, two tiers of footer rocks may be required to prevent the downstream face of the vortex weir or cross vane from being undermined. The top elevation of the center rock(s), at the apex of the weir or vane, should be at or near bed level to permit fish passage at low flows, and the end rocks on either bank should be at bankfull level. Once the excavated portion of the bank has been backfilled, it should be armored with appropriately sized riprap, sod mats, or willow transplants.
- c. Adjacent cross vanes should be spaced sufficiently far apart to allow for proper riffle or pool development according to step-pool and pool-riffle configurations stated in the appropriate subsection of these Technical Specifications and the AML Standard Details. Additionally, it has been recommended that the overall maximum drop controlled by a set of weirs should be less than 2 feet (0.6 meters) for stability reasons.
- d. All disturbed sections of the channel, including the banks and streambed, should be stabilized with approved methods.
- e. All cross vanes should be monitored to determine if:
 - their orientation and geometry (e.g., the height of the drop) hinder fish migration,
 - their performance is adversely affected by deposited sediment, and

- their placement causes bank instabilities and undesirable lateral stream movement especially in the vicinity of the plunge pools.

14. **WEIRS**

14.1. **Description**: Low profile in-stream structures such as vortex rock weirs and w-weirs are primarily used to create aquatic habitat in the form of scour pools and for grade control on incising streams and rivers. Additionally, they are well-suited for channeling flow away from unstable banks.

14.2. **Effective Uses & Limitations**: Weirs are typically suited for use in moderate to high gradient streams. Vortex weirs are best suited to Rosgen stream types A3-A4, B3-B4, C3-C4, F3-F4, and G3-G4. W-weirs are best suited for types B3-B4, C3-C4, and F3- F4. Additionally, w-weirs are best used in rivers with bankfull widths greater than 40 feet (12 meters). When constructed and spaced properly, weirs can simulate the natural pattern of pools and riffles occurring in undisturbed streams while forming gravel deposits which fish use as spawning grounds. W-weirs can also be used to stabilize banks when designed properly. Weirs should be avoided in channels with bedrock beds or unstable bed substrates, and streams with naturally well-developed pool-riffle sequences.

14.3. **Construction**:

- a. The stream should be diverted and the construction area should be dewatered in according to the appropriate subsection of this Technical Specification, Drawings, Special Conditions, recommended measures.
- b. *Vortex Rock Weir Installation*. Vortex weirs are typically modified horseshoe shapes such that the apex of the structure points upstream. The angle the arms make with the upstream bank should be approximately 20 to 30 degrees so that flows are directed away from the banks and deeper pool areas are created directly downstream of the vane or weir. The top layer of vortex rocks should rest upon at least one tier of footer rocks and so that they are offset in the upstream direction. Vortex rocks should be partially buried in the streambed a minimum of 6 inches (15 centimeters). Vane rocks should be shingled upstream. On unstable bed substrates, two tiers of footer rocks may be required to prevent the downstream face of the vortex weir from being undermined. The top elevation of the center vortex rock(s) at the apex of the weir should be at or near bed level to permit fish passage at low flows, and the end rocks on either bank should be at bankfull level. The vortex rocks of vortex weirs should be spaced 1/3 to 1/2 a rock diameter apart with the exception of the end rocks. The end vortex rocks should be partially buried in the streambank and should touch the adjoining vortex rocks. Once the excavated portion of the bank has been backfilled, it should be armored with appropriately sized riprap, sod mats, or willow transplants as necessary.
- c. *W-Weir Installation*. W-weir installation should proceed similarly to vortex weir construction and should account for the more complicated geometry of the structure.

- d. Adjacent weirs should be spaced sufficiently far apart to allow for proper riffle or pool development according to step-pool and pool-riffle configurations as provided in *Step Pools* AML Standard Drawings and the appropriate subsection of these Technical Specifications. Additionally, it has been recommended that the overall drop controlled by a set of weirs should be less than 2 feet for stability reasons.
- e. All weirs should be monitored to determine if:
- their orientation and geometry (e.g., the height of the drop) hinder fish migration,
 - their performance is adversely affected by deposited sediment, and
 - their placement causes bank instabilities and undesirable lateral stream movement especially in the vicinity of the plunge pools.

STRUCTURE REMOVAL/REPLACEMENT

1. SCOPE

The work shall consist of the required removal and “in – kind” replacement of existing structural features to facilitate normal construction activities as determined by the ENGINEER. Work primarily includes removal and replacement of wooden decks, carports, sheds, dog pens, property fences and replacement fences as depicted / described on the drawings or as directed by the ENGINEER.

2. CONSTRUCTION METHODS

Prior to work concerning any designated structure, the CONTRACTOR and ENGINEER shall document the size, layout, and condition of all structural features subject for temporary removal. **Property fences that are approved for removal / replacement efforts shall be surveyed, and then resurveyed so that the replacement fence can be constructed in the exact location as was located prior to initial construction activities. See “Fence” section of these Technical Specifications for further information regarding property fences.** During removal efforts, the CONTRACTOR shall make a reasonable effort to preserve reusable material(s) for subsequent replacement work. Replacement work shall be completed using original or like materials and reconstructing as existing prior to removal (size, shape, and design); HOWEVER, the ENGINEER reserves the right to make modifications from the original condition to ensure long term structural integrity of any replacement feature. All such removal and replacement activities are to be performed with the prior approval of the ENGINEER.

3. NON-QUALIFYING FEATURES

Structural features such as stick built homes, garages (on foundations), mobile homes, trailers, and other residential type structures shall NOT be considered for temporary relocation under any circumstance. Other structural features, which may otherwise qualify for removal/replacement, will not be subject under this specification IF in the opinion of the ENGINEER movement of item(s) is merely for convenience. No structural elements outside of the designated construction limits shall be subject for removal and replacement. No replacement efforts, in part or in whole, shall be performed on any structural element damaged due to CONTRACTOR carelessness.

4. HOME RELOCATION

The moving of homes shall comply with the “Uniform Relocation Assistance and Real Property Acquisition Final Rule” as published in Part IV, Federal Register Volume 51, Number 39, February 26, 1986, and otherwise subject to the approval of the ENGINEER. All electrical and plumbing work shall be performed by appropriately licensed electricians and plumbers and shall comply with all pertinent codes.

5. UTILITIES

Utility items including electric, plumbing, water, wastewater, septic are in accordance with the “Utility Relocation” section of these Technical Specifications.

SUBSIDENCE CLOSURE

1. SCOPE

This work shall consist of furnishing and installing all materials, equipment, incidentals, and labor necessary to properly seal subsidence features, mountain breaks, and shafts as shown in the Drawings. The ENGINEER may revise the type of closure used depending on conditions encountered at the time of construction.

2. MATERIALS

2.1. **Rock**: Shall be Class II channel lining and size No. 57 stone size 8 or 9 crushed aggregate and shall conform to the “Crushed Aggregate and Channel Lining” section of these Technical Specifications.

2.2. **Polyurethane Foam**: Shall conform to the “Polyurethane Foam” section of these Technical Specifications.

2.3. **Pneumatic Backstow**: Shall conform to the “Pneumatic Backstow” section of these Technical specifications.

2.4. **Shaft Monument**: Shall conform to the Standard Drawing.

2.5. **Filter Fabric**: Shall conform to the “Filter Fabric” section of these Technical Specifications.

2.6. **Concrete**: Shall be Class A concrete conforming to the “Concrete” section of these Technical Specifications.

2.7. **Grout**: Shall conform to the “Grout” section of these Technical Specifications.

2.8. **Pipe**: Shall be high density polyethylene pipe or PVC as shown on the Drawings or AML Standard Details, and conform to the “Drainage Pipe” section of these Technical Specifications.

13. CONSTRUCTION METHODS

3.1. **General**: All debris, rubble, and other loose material shall be excavated from the openings in a prudent fashion prior to beginning construction of the closure, unless a dangerous safety hazard exist. Excavation efforts shall begin at the top most of each designated portal closure and proceed incrementally downward until all of the material has been removed down to grade.

All material except soil and rock shall be disposed of in a suitable manner beyond the limits of the project. Soil and rock may be placed in the mine openings provided they do not interfere with drainage or the construction specified in the Drawings.

Following construction of the mine closure, each site is to be cleaned-up, including smoothing earth disturbance, and vegetated in accordance with the “Revegetation” section of these Technical Specifications, and shall be considered incidental to the completion of each mine closure.

3.2. **Grout Injection**: Follow the Project Specific directions include on the Drawings, Project Notes, Project Description, Special Conditions, and as directed by the ENGINEER.

SUBSURFACE DRAINS

1. SCOPE

The work shall consist of furnishing all labor, materials (including rock backfill, sand, filter fabric, and pipe), equipment, and incidentals for the construction of the subsurface drains shown on the Drawings or other areas designated by the ENGINEER.

2. MATERIALS

2.1. **Pipe**: The tubing shall be 8" diameter, dual wall, smooth interior HDPE tubing. All caps, bands, and other fittings shall be made of the same material as the tubing. All pipe-to-pipe connections shall be snap-in-place bands or a split band taped in place with polyethylene tape to the satisfaction of the ENGINEER. Remote ends shall be capped with a snap-in-place cap.

When pipe is to be placed deeper than 5 feet it may be specified as a different type pipe. Subdrains deeper than 5 feet shall conform to details on the Drawings or as approved by the Engineer.

2.2. **Filter Fabric**: The filter fabric shall conform to the requirements of the "Filter Fabric" section of these Technical Specifications. Monofilament fabric shall be used where acid mine drainage is present or at the direction of the ENGINEER.

2.3. **Course Aggregate**: The drain fill shall be a No. 2 and 57 aggregate and conform to the requirements of the "Crushed Aggregate and Channel Lining" section of these Technical Specifications.

2.4. **Subdrain Collars**: These shall be Class A concrete conforming to the "Concrete" section of these Technical Specifications.

2.5. **Coupling Bands**: Provide coupling bands recommended by the manufacturer.

3. SUBDRAIN CONSTRUCTION

Excavate the trench to a depth below the outside bottom of the plan subsurface drain elevation to allow for the placement of sufficient bedding eliminating any irregularities in the trench bottom, and to a width of at least one foot wider than the external diameter of the pipe. Place perforated pipe with the perforations in the invert. Subsurface drains shall have a **minimum slope of 1 percent UNLESS** specified otherwise. Close the upgrade ends of all subsurface drain pipe with plugs to prevent entry of debris. Equip the outlet end of subsurface drain pipe with a screen. Join perforated sections with coupling fittings or bands. Place and compact granular backfill of Size No. 2 or 57 aggregate and natural sand around the pipe ensuring that the pipe is true to line and grade and the haunches are fully supported. The remaining backfill shall be accomplished using the on-site materials, which were removed during excavation

Subdrains that are less than 5 feet in depth may be wrapped in filter fabric or may use “sock-pipe” as approved by the Engineer. When drains are greater than five feet in depth they shall use “sock-pipe” as the only option. All subdrains shall be constructed in accordance with the Drawings or as directed by the Engineer.

In areas where the subdrains are not designed to pick up ground water but are designed to transfer the water to a defined channel the pipe in that portion of subdrain shall be solid pipe and non-perforated. Set a subdrain collar at the junction of the perforated and non-perforated pipe.

Sheeting and bracing, or other structural and/or special construction techniques, must be utilized, if necessary, for safety reasons.

4. ROCK CORE DRAIN CONSTRUCTION

The Drawings will specify if native stone may be used in the central drain. If not stated then assume that limestone must be used in the drain as shown on the AML Standard Details. Filter fabric, rock, and soil backfill are all incidental to the bid item.

5. ROCK TOE BUTTRESS CONSTRUCTION

The Drawings will specify if native stone may be used in the central drain. If not stated then assume that limestone must be used in the drain as shown on the AML Standard Details. Filter fabric, rock, and soil backfill are all incidental to the bid item.

TEMPORARY LOW WATER CROSSING

1. SCOPE

This work shall consist of constructing a temporary low water crossing at locations depicted on the drawings for the safe passage equipment and materials. Included is all maintenance and complete removal of item at the completion of work.

2. MATERIALS

2.1. **Course Aggregate:** Shall consists of durable crushed limestone aggregate, which meets the criteria set forth in the “Crushed Aggregate and Channel Lining” specification of these Technical Specifications for various gradations needed as approved by the ENGINEER.

2.2. **Pipe:** Shall consist of an inside diameter of 24” minimum and 36” maximum and be of significant strength to withstand all anticipated loads throughout the duration of the project. The ENGINEER reserves the right to reject any pipe(s) not meeting any criteria set forth herein.

2.3. **Concrete:** Shall conform to the “Concrete” specification of these Technical Specifications. The concrete mix shall be designed so that the compressive strength test will yield a 28-day minimum compressive strength of 3,500 psi.

3. CONSTRUCTION REQUIREMENTS

The low water crossing(s) shall be constructed as depicted/described in the Drawings and in accordance with Kentucky Division of Water Guidelines Floodplain Management Branch. The crossing shall be maintained throughout the construction period as directed by the ENGINEER. All gradework leading to and from the crossing shall be considered incidental to this item. All pipes shall be regularly inspected and cleaned as needed to ensure maximum hydraulic capacity during the project duration. Any failing pipes shall be removed and replaced as directed by the ENGINEER. The CONTRACTOR is advised that the channel bottom dimension and number of pipes shown on the low water crossing detail drawing is approximate; the CONTRACTOR shall satisfy himself as to the amount of resources and materials needed to complete the work within the guidelines set forth. At the completion of the project, the crossing (concrete, aggregate, and pipes) shall be completely removed as directed by the ENGINEER with all disturbed areas return to preexisting conditions (i.e. existing topography configuration of area in and around the low water crossing area) and vegetated.

4. KY DIVISION OF WATER GUIDELINES

There shall be a maximum fill height of four and one-half (4 ½) feet measured from the channel bottom to the top of the proposed crossing.

- a) The pipes used for the proposed **crossing shall not be less** than 24” in diameter or more than 36” in diameter.

- b) There shall not be more than one (1) foot spacing between the pipes measured between the outside edges of the pipes.
- c) As many pipe as possible shall be placed within the stream banks.
- d) Fill material used to cover the pipes shall be composed entirely of clean rock or concrete. No soil shall be allowed in the fill.
- e) All pipes shall be laid flush with the bottom of the stream channel.
- f) The maximum cover over the top of the pipe shall not be greater than eighteen (18) inches.

TRAFFIC CONTROL

1. SCOPE

This item consists of providing traffic control on all public adjacent to the project areas, including the placement of two flag persons, signs, markers, and barricades as may be required. The CONTRACTOR shall develop a traffic control plan for the review and approval of the ENGINEER.

2. CODES AND STANDARDS

Traffic shall be maintained in accordance with the standards set forth in the Federal Highway Administration's "Manual on Uniform Traffic Control Devices", current edition; and the Kentucky Transportation Cabinet's "Standard Specifications for Road and Bridge Construction", current edition; and Standard Drawing No. TSC-202, current edition.

3. TRAFFIC CONTROL DEVICES

All traffic control devices shall meet the above requirements. Such devices shall be placed starting and proceeding in the direction of the flow of traffic and removed starting and proceeding in the direction opposite to the flow of traffic. The ENGINEER and the CONTRACTOR, or their authorized representatives shall review the signing before any lane closures are constructed. Warning signs for construction shall be diamond shaped (square with one diagonal vertical), having a black symbol or message on an orange background. A minimum size of **36 inches by 36 inches** may be used for construction approach warning signs, provided that a minimum **letter size of 5 inches** can be accommodated on this size. All other traffic control signs, symbols, dimensions, and markings shall conform to the size and shapes as shown in the "**Manual on Uniform Traffic Control Devices**". The ENGINEER shall approve all signing on a case-by-case basis before such work can begin.

4. MISCELLANEOUS REQUIREMENTS

The CONTRACTOR shall cover any signs, either existing or temporary, which do not properly apply to the current traffic phasing; and shall maintain such coverings until the signs are applicable or are to be removed.

The CONTRACTOR'S vehicles shall always move with and not against the flow of traffic on all public roads. Vehicles shall enter and leave affected areas of pavement in a manner which will not be hazardous to nor unduly interfere with normal traffic flow. Construction vehicles shall not park or stop along the roadway, except within areas designated by the ENGINEER.

Included in Traffic Control is the requirement by the CONTRACTOR to keep the roadways clean from mud and any other debris considered to be and impediment to the flow of traffic. Construction may be suspended if the CONTRACTOR fails to keep the roadways clean after previous instructions by the ENGINEER to do so.

5. TRAFFIC COORDINATOR

The CONTRACTOR shall designate an employee to be traffic coordinator, if such is required, or if the need for such individual designation as becomes apparent as determined by the ENGINEER. The traffic coordinator shall be responsible for supervising the traffic control operations, policing the traffic control area, and reporting all related incidents to the ENGINEER. The CONTRACTOR shall furnish the name and telephone number where the traffic coordinator can be contacted at all times.

UNREINFORCED CONCRETE FABRIC LINING

1. SCOPE

This work shall consist of installing an unreinforced concrete fabric lining by positioning specially woven, double-layer synthetic forms on the surface to be protected and filling them with a pumpable, fine aggregate concrete (structural grout) in such a way as to form a stable lining of required thickness, weight and configuration at locations shown on the plans or as directed by the ENGINEER.

The CONTRACTOR shall furnish all labor, materials, equipment and incidentals required to perform all operations in connection with the installation of the proposed unreinforced concrete lining in accordance with the lines, grades, design and dimensions as shown on the plans or as directed by the ENGINEER.

2. MATERIALS

2.1. **Fine Aggregate Concrete:** Fine aggregate concrete shall consist of Portland cement, fine aggregate (sand) and water. The consistency of the fine aggregate concrete delivered to the concrete pump shall be proportioned and mixed to have an efflux time 9-12 seconds when passed through the 0.75 inch (19 mm) orifice of the standard flow cone that is described in ASTM C-939. Pozzolan, fluidifier or pumping aid conforming to this specification may be used at the option of the CONTRACTOR or as approved by the ENGINEER. The mix shall exhibit a compressive strength of 2,500 lb\sq. in (13MPa) at 28 days, when made and tested in accordance with ASTM C-31 and C-39.

MATERIAL	TEST METHOD	COMMENT
Portland Cement	ASTM C-150	Type I or Type II
Fine Aggregate Concrete	ASTM C-33	
Pozzolan	ASTM C-618	Optional
Plasticizing & Air Entraining Admixtures	ASTM C-618	Class C, R, or N
Water for mixing shall be clean and free from injurious amounts of oil, acid, salt alkali, organic matter or other deleterious substances.		

2.2. **Fabric Forms:** The Fabric Forms shall be composed of nylon and/or polyester. Forms shall be woven with a minimum of 50% textured yarns (by weight) to improve adhesion to fine aggregate concrete and to improve filtration. Type and thickness of fabric forms shall be specified by the ENGINEER.

Fabric forms shall consist of double-layer woven fabric joined together by spaced, interwoven filter points to form a concrete lining with a finished thickness, a nominal mass per unit area and a deeply cobbled surface appearance.

MINIMUM PROPERTY REQUIREMENTS			
PROPERTY	TEST METHOD	VALUE	UNIT
PHYSICAL			
Composition		Nylon or Polyester	
Mass Per Unit Area	ASTM D-5261	12	oz/sy
Thickness	ASTM D-5199	25	mils
Mil Width		76	in
MECHANICAL			
Tensile Strength	ASTM D-4595	9.2	psi
Elongation @ Break	ASTM D-4595	30	%
Trapezoidal Tear Strength	ASTM D-4533	8.3	psi
MECHANICAL			
Apparent Opening Size (AOS)	ASTM D-4751	40	US Std. Sieve
Flow Rate	ASTM D-4491	90	gal/min/sf

Fabric porosity testing may be required at the start of the project as directed by the ENGINEER. The suitability of the material shall be demonstrated by injecting grout into 5½ inch (140mm) sleeves. The sleeves shall be constructed of a basic layer of the same basic fabric material. Test cylinders shall be cut from each specimen and tested in accordance with ASTM C-39. The test will be run once at the start of the project unless otherwise directed by the ENGINEER.

The fabric can be factory sewn into predetermined custom sized panels. The fabric rolls are first cut into the specified lengths. These fabric pieces are then joined, top layer to top layer and bottom layer to bottom layer. This will allow for the finished revetment to have the full mat thickness between the top and bottom seam. A single seam in which all four layers of fabric are joined at one point will not be permitted. All factory seams shall face downwards and shall be made using a double-needled machine utilizing the Standard Type 401 stitch. If required bulkheads (grout stops) may be installed parallel to and in between individual mil widths at the predetermined intervals to regulate the flow of the fine aggregate concrete. Grout stops shall be designed as to produce full mat thickness along the full length of the grout stop. The proper spacing shall be maintained throughout the panel.

UTILITY RELOCATION

1. SCOPE

The work shall consist of the required relocation/replacement of existing utilities in order to facilitate construction. Work may possibly include relocation of utility poles and lines, water lines, gas lines, sewer lines, or septic systems as shown on the Drawings, or encountered during approved construction activities.

2. GENERAL

All work shall be completed by the appropriate utilities or under their supervision and in accordance with their guidelines and regulations. The CONTRACTOR shall be responsible for making appropriate arrangements regarding utility relocations and shall coordinate such activities to ensure timely completion of the individual components of the entire project. All such activities are to be performed under the direction and with the approval of the ENGINEER. A genuine effort must be made to prevent any disturbance of service; in the event such disruption occurs, the CONTRACTOR must immediately correct same.

3. UTILITY POLES AND LINES

The utility poles shall be relocated if in the opinion of the ENGINEER excavation has progressed such that the pole is limiting construction or if the stability of the pole has been jeopardized due to the excavation. Guy wires and anchors may be relocated in the event that they are disturbed during the excavation process while leaving the pole undisturbed.

4. ELECTRIC, WATER, GAS, WASTEWATER AND SEWER

If water lines, gas lines, or sewer lines must be relocated to facilitate construction then relocation shall be made in accordance with the appropriate utility company regulations.

Connections to houses (home relocation) shall be performed by a licensed professional in accordance with pertinent codes.

5. SEPTIC SYSTEMS

The CONTRACTOR shall be responsible for physically locating and determining the operating condition of all existing septic systems (i.e. tanks, leach beds, and inflow lines) within the project limits. Every reasonable effort shall be taken not to disturb septic systems, which are located within defined construction limits or along access routes. In situations where this is not feasible, the CONTRACTOR shall receive approval from the ENGINEER prior to working on or through any existing system. If construction activities cannot be completed without disturbance to a septic system, then the CONTRACTOR shall repair or replace the septic system with one, which meets the approval of the ENGINEER as well as all local & state governing authorities. In designated waste areas, no septic systems shall be disturbed in any fashion without the express prior approval of the ENGINEER. This includes filling on or traversing across with equipment.

WATER TREATMENT AND DISPOSAL

1. SCOPE

This work shall consist of furnishing all equipment, labor, materials and incidentals that may be necessary to treat and discharge all water from the project area in accordance with the following specification.

2. EFFLUENT LIMITATIONS

2.1. **Sampling and Testing**: Any impounded mine water encountered, either surface water or underground water, during the performance of the project shall be sampled and analyzed by AML personnel with the appropriate equipment and experience before its release. In the event that the receiving stream has limiting effluent parameters that cannot be tested in the field, AML will collect a sample and submit it for analysis to a laboratory with an existing contract with the Commonwealth. Calibrated meters, field kits, litmus paper are approved field testing methods for pH, total iron, acidity, alkalinity, and sulfates.

If the impounded water is determined to contain pollutants in excess of the concentrations specified, then water treatment will be necessary before release into a receiving stream. Periodic sampling and testing will be performed by the ENGINEER throughout the treatment and discharge process.

2.2. **Effluent Limitations**: The minimum effluent limitations shall be a total iron content of 25 mg/L and pH between six (6) & nine (9). If the KY Division of Water has established a Total Maximum Daily Load (TMDL) for the receiving stream the stricter limitations will apply. This applies to surface impoundments and deep mine sources where the construction efforts will increase the discharge from the source, such as draining a mine.

2.3. **Maximum Concentration**: In the event that the maximum pollutant concentrations specified are exceeded by any sample, the method of water treatment shall be immediately adjusted or changed to achieve compliance.

The discharge shall be resampled and reanalyzed as soon as possible to evaluate the new treatment level or procedure. If the pollutant concentrations prove to be within the specified limits, then further adjustments will not be needed. If the pollutant concentrations continue to exceed the specified limits, the ENGINEER may require that some or all other activities at the project site cease until the pollutant concentrations are within the specified limits.

2.4. **Noncompliance**: Failure to meet the effluent limitations specified herein shall constitute a violation of the Federal Water Pollution Control Act and may be subject to such penalties as are provided in KRS 224.994 and 224.995. The CONTRACTOR shall bear the responsibility for all violations.

3. WATER TREATMENT

3.1. **General:** The CONTRACTOR shall accomplish water treatment through mixing of the untreated water and the treatment agent to assure maximum contact. Aeration should be provided whenever possible to maximize the treatment effect. At a minimum surface ditches should be very rough to create aeration. Mechanical aeration must be used for surface impoundments greater than three feet (3') deep unless exempted by the ENGINEER in writing.

3.2. **Primary Treatment Agent and Method:** Water treatment shall be accomplished by the application of hydrated lime that meets ASTM Specification C-207 for type N hydrated lime. The rate shall be determined and shall be adjusted to the appropriate level by field trial.

Water from the impoundments will be pumped into an agitating tank. Hydrated lime will be added to the water and the mixture will be thoroughly mixed. Once the first batch of reagent is mixed, this process will be continuous with the mixed reagent being discharged into the suction hose of the circulating pump. The circulating pump will be situated in a manner that will cause the most even blending of treated water with untreated water. **The water must be aerated during the treatment process, and any stratification of the pooled area must be eliminated.** Treatment will continue until the entire pooled area has a pH between six (6) and nine (9).

The treated water will be allowed to settle out for twenty-four hours and then tested. If water is not within quality standard, additional treatment will be applied with the same process of treatment and testing. When the water quality is acceptable for release, it will be pumped or drained from the pooled area through a silt control structure.

3.3. **Alternative Treatment Agents or Methods:** The CONTRACTOR may use a treatment method or agent other than that specified, subject to the approval of the ENGINEER. The CONTRACTOR shall request in writing permission to use the alternate method or agent and shall provide any information necessary to evaluate the request.

Alternate treatment methods may include limestone sand, caustic soda drips, and sodium briquettes.

3.4. **Limestone Sand Treatment:** The Engineer may require the placement of limestone sand within ditches, waterways, and streams for additional water treatment. Temporary silt collection berms and basins should be placed downstream of the application when possible. The limestone sand should be a minimum of 85% calcium carbonate with 100% passing a 3/8 inch sieve.

4. OTHER POLLUTANTS

If it is determined during the course of the project that pollutants in the impounded water other than those noted in this specification occur in such concentrations as to prove deleterious to the receiving stream, the ENGINEER may require that the water treatment method or agent be adjusted or changed to provide for the treatment of the unspecified pollutant. The effluent limitations that shall pertain to any pollutants not specified herein shall be as promulgated by the U.S. EPA in 40 CFR 434 or a current KY DOW standard for the receiving stream.

5. DISCHARGE OF WATER

Once water has been properly treated it shall be ready for discharge from the source. In the case of impounded water, cuts to release water shall not exceed six (6") inches and the cuts shall be in original or stable ground as approved by the ENGINEER. The discharge of water may be halted if it causes either a hazard or potential hazard, or the water suddenly falls below the acceptable standard.

The dewatering operation shall be performed at a controlled rate, which will prevent:

- (1) downstream flooding;
- (2) erosion of the existing stream channels;
- (3) transportation of sediment outside the project area;
- (4) damage to the aquatic life and its habitat.

WATER WHEEL POWERED DOSER

1. SCOPE

This work shall consist of furnishing all materials, equipment, labor, and incidentals necessary for the installation of a water wheel powered doser as depicted in the Drawings and directed by the ENGINEER.

2. MATERIALS

2.1. **Dosing Unit**: The dosing unit shall an Aqua-Fix unit produced by Aqua-Fix Water Treatment Systems of Kingwood, WV or an approved equivalent.

The unit shall be constructed of metal with a powder coating paint finish. The preferred paint color is dark green. The unit should be roughly 4' x 7' and capable of being transported with in a standard size truck. The unit must have a feeding hopper capable of holding 1 ton of reagent with an water wheel powered auger feed system.

2.2. **Alkaline reagent**: The main alkaline reagent will be pelletized quick lime (calcium oxide).

2.3. **Intake Line**: The intake line must be at least 2" diameter and sufficient long to extend upstream to a point at least 5' vertically above the intake elevation on the doser unit.

WELDED WIRE REINFORCED SOIL WALL

1. SCOPE

This work shall consist of furnishing all materials, equipment, labor, and incidentals necessary for the construct a welded wire reinforced soil wall as depicted in the Drawings and directed by the ENGINEER.

2. MATERIALS

2.1. **Welded Wire Forms**: Welded wire form facing units shall be pre-fabricated from #4 black wires (WWF 4" X 4").

Adjacent forms shall be overlapped 2" and secured with #4 black wire or comparable strength metal fasteners. Support struts shall be fabricated from #4 black wire at lengths specified by manufacturers' shop drawings, suitable for the wire forms. Struts shall be spaced at not less than 2' spacing.

2.2. **Geo-grid**: Shall conform to the "Geo-grid" section of these Technical Specifications.

2.3. **Turf Reinforced Mat**: Shall be C350 Permanent Turf Reinforcement Mat as produced by North American Green or an approved equivalent.

2.4. **Subdrain**: Shall conform to the "Subsurface Drains" section of these Technical Specifications.

2.5. **Aggregate Backfill**: Shall conform to the "Crushed Aggregate and Channel Lining" section of these Technical Specifications.

3. CONSTRUCTION

Excavate the slide and stockpile the soils onsite. Keep the soil dry by separating the materials and covering the stockpile with plastic. Excavate and compact a level foundation for the wall. Install the subdrain pipe and backfill. Install the welded wire forms and set the support struts. Supports struts should be placed at a maximum of 40" centers. Cover the forms with geo-grid extending to the subdrain. Cover the form and geo-grid face with the turf reinforcement mat. Backfill the form with stockpiled soils and **compact in 9" lifts to 95% standard proctor**. Set the next unit 6" back and continue to build the units to the design height. Vegetate the exposed soil faces and top. Erosion control blanket may be required over the top surface of the wall.

Key or turn the sides of the wall into the existing slope. Transition all sides into the natural ground as directed by the ENGINEER.

APPENDIX

A

SEED MIXES

PURE LIVE SEED

Pure Live Seed (PLS) is determined by multiplying the percent germination of the seed times the percent purity. Then dividing this product into the specified rate yields the application.

$$\text{Seed Required} = \text{Application Rate} / \text{Germination Rate} / \text{Purity}$$

Example: Germination Rate- 70%
 Purity Rate- 90%
 Application Rate- 50 lbs PLS/acre

$$\text{Seed Required} = 50 \text{ lbs. PLS} / (0.90) / (0.70) = 79 \text{ lbs} / \text{acre}$$

Seed mix for Acidic Conditions

Spring Seed Mix (March 1 TO June 15TH)	
	Lbs/acre PLS
KY 31 Tall Fescue	20
Switchgrass	10
Redtop	5
Deer Tounge	10
Unhulled Bermudagrass	5
Birdsfoot Trefoil	5
Korean Lespedeza (Hulled)	10
Flat pea	10
Alsike Clover	5
	80 LBS.

No Seeding Between June 16TH TO August 14TH

Fall Seed Mix (August 16th to April 30th)	
	Lbs/acre PLS
KY 31 Tall Fescue	20
Switchgrass	10
Orchardgrass	10
Timothy	5
Redtop	5
Alsike Clover	5
Flat Pea	10
Yellow Sweet Clover	10
Korean Lespedeza	5
	80 LBS.

Seed mix for General Reclamation

On slide areas replace Yellow sweet Clover with Crown Vetch

Spring Seed Mix (March 1 TO June 15TH)	
	Lbs/acre PLS
KY 31 Tall Fescue	20
Switchgrass	10
Redtop	5
Orchardgrass	10
Birdsfoot Trefoil	10
Korean Lespedeza (Hulled)	10
Yellow Sweet Clover	5
Ladino Clover	5
Alsike Clover	5
	80 LBS.

No Seeding Between June 16TH TO August 14TH

Fall Seed Mix (August 16th to April 30th)	
	Lbs/acre PLS
KY 31 Tall Fescue	20
Switchgrass	10
Orchardgrass	15
Timothy	10
Redtop	5
Ladino Clover	5
Medium Red Clover	5
Yellow Sweet Clover	5
Korean Lespedeza	5
	80 LBS.

Seed mix for Hayland

Spring Seed Mix (March 1 TO June 15TH)	
	Lbs/acre PLS
Tall Fescue	30
Orchardgrass	20
Timothy	5
Ladino Clover	5
Medium Red Clover	10
Birdsfoot Trefoil	10
	80 LBS.

No Seeding Between June 16TH TO August 14TH

Fall Seed Mix (August 16th to April 30th)	
	Lbs/acre PLS
Tall Fescue	25
Perennial Ryegrass	10
Orchardgrass	15
Redtop	5
Ladino Clover	5
Birdsfoot Trefoil	10
Medium Red Clover	10
	80 LBS.

Seed mix for Pasture

Spring Seed Mix (March 1 TO June 15TH)	
	Lbs/acre PLS
Kentucky Bluegrass	30
Orchardgrass	20
Redtop	5
Ladino Clover	5
Medium Red Clover	10
Alfa- Graze alfalfa	10
	80 LBS.

No Seeding Between June 16TH TO August 14TH

Fall Seed Mix (August 16th to April 30th)	
	Lbs/acre PLS
Kentucky Bluegrass	25
Perennial Ryegrass	10
Orchardgrass	15
Redtop	5
Ladino Clover	5
Birdsfoot Trefoil	10
Medium Red Clover	10
	80 LBS.

Seed mix for Wildlife

Spring Seed Mix (March 1 TO June 15TH)	
	Lbs/acre PLS
Switchgrass	15
Sideoats Gramma	15
Orchardgrass	20
Timothy	5
Ladino Clover	5
Medium Red Clover	10
Korean lespedeza	10
	80 LBS.

No Seeding Between June 16TH TO August 14TH

Fall Seed Mix (August 16th to April 30th)	
	Lbs/acre PLS
Switchgrass	10
Perennial Ryegrass	10
Orchardgrass	20
Timothy	10
Redtop	5
Alfalfa	10
Ladino Clover	5
Medium Red Clover	5
Korean lespedeza	5
	80 LBS.

APPENDIX B



Erosion and Sediment Control Best Management Practices (BMP) Plan

March 2010

OVERVIEW

This Best Management Practices (BMP) plan is intended as a guide for Kentucky Division of Abandoned Mine Lands (DAML) projects. It contains information regarding preventing, reducing and controlling erosion, sediment, and pollutant runoff from Abandoned Mine Land (AML) Reclamation and Acid Mine Drainage (AMD) Abatement project construction sites. The information in this BMP will aid DAML staff and contractors in selecting, installing and maintaining erosion prevention and sediment control measures during the different stages of construction. This BMP plan, in accordance with DAML Technical Specifications and Standard Drawings, is intended to protect Kentucky's streams from potential water quality impacts as a result of DAML projects.

This general BMP document is meant to outline the various pollution prevention measures that may be used on AML Reclamation or AMD Abatement Projects. The primary sources of pollutants are solids that are mobilized during storm events and precipitants from mineralized mine drainage. Other sources of pollutants include oil/fuel/grease from servicing and operating construction equipment, concrete washout water, sanitary wastes and trash/debris.

EROSION PREVENTION AND SEDIMENT CONTROL MEASURES

Plans for Reclamation and AMD abatement construction projects will include erosion control measures on the planview sheets when possible, and will depict Disturbed Drainage Areas (DDAs) and related information. Other control measures may be described in construction notes and the project description. The Contractor and Engineer may select an additional BMP for the project as the project changes and construction progresses. Projects that do not have DDAs annotated in the plans will employ the same concepts selecting and implementing this general BMP plan.

Disturbed areas or sources of sediments will be addressed by the most effective means that can be established in the specific work area. All non-storm water discharges will be directed to sediment basins/traps or to a filter fence enclosure in a flat vegetated infiltration area or filtered via another approved commercial product. All deep mine and surface impoundment water will be tested and treated, when as necessary, to meet the DAML Water-Treatment and Disposal Technical Specification unless stricter limitations are listed in the contract documents.

A) Pre-Bid Field Review Walk-Thru:

Prior to the Bid Opening, an on-site pre-bid field review will be conducted by the Project Engineer, Construction Branch Personnel, Project Design Technician, and Field Office Staff, to review the construction plans and identify any changes needed. The locations and types of site specific BMP and any other erosion prevention and sediment control measures will be evaluated and chosen for incorporation into the final design plans.

B) Pre-Bid Conference

DAML will present the project specific BMP and permit requirements/conditions to the potential contractors during the pre-bid conference meeting.

C) Pre-Construction Conference

Prior to the actual beginning of the project, a pre-construction conference will be held between representatives of the DAML, the Contractor, including any Subcontractors, as well as other interested agencies and parties. Items discussed will include the time and sequence for construction, methods and plans of operation, payment, and other relevant questions. Any permit requirements and the erosion and sediment control BMP will also be discussed at the meeting. The contractor and DAML personnel will develop a work plan timeline for the project.

D) Construction Access

This is the first land-disturbing activity. Construction entrances shall be a minimum of 20' wide by 50' long, measured from the shoulder of the public road, and consist of No. 2 aggregate over a filter fabric base. As soon as construction begins, bare areas will be stabilized with gravel and temporary mulch and/or vegetation.

E) Clearing and Grubbing

The following techniques will be used for clearing and grubbing activities:

- 1) Leave areas undisturbed when possible
- 2) Construct silt basins to provide silt volume for large areas
- 3) Construct silt Traps Type A (20'L x 5'W x 2'D min dugout) for small areas
- 4) Install rock checks in front of existing drop inlets which are to be saved
- 5) Construct diversion ditches to catch sheet runoff and carry it to basins or traps or to divert it around areas to be disturbed
- 6) Maintain brush and/or other barriers to slow and/or divert runoff
- 7) Construct silt fences/hay bales to catch sheet runoff on short slopes For longer slopes, multiple rows of silt fence/hay bales may be considered
- 8) Temporarily mulch areas which are not feasible for the aforementioned types of protections
- 9) Employ non-standard or innovative methods

F) Stream Crossings / Work Along Streams

- 1) Temporary low-water stream crossings will follow the guidelines included in the DAML Technical Specifications and those established by the KY Division of Water Floodplain Management Section. Removal of a temporary crossing may be required in some cases to accommodate large storm events.

- 2) The Engineer must approve all temporary stream flow blockages and restrictions that occur within the project construction limits. The Contractor will make every effort to avoid causing flooding of all properties both upstream and downstream of the project.
- 3) The Contractor will make every effort to minimize equipment contact time with the stream water including diverting water around equipment when work is performed in or along streams. Diversions must be maintained within the existing stream channel except as authorized by a Section 404 permit.

G) Deep Mine and Surface Water Impoundments

Mine water from deep mines and surface impoundments on the project area will be tested to determine the pH and total iron content. The water will be treated until it meets the DAML Water-Treatment and Disposal Technical Specification or an existing TMDL, whichever is stricter, before release through a silt control structure(s). Types of structures/facilities include:

- 1) Silt Traps Type A (20'L x 5'W x 2'D min dugout)
- 2) Silt Traps Type B (20'L x 5'W x 2'D min dugout with rock berm)
- 3) Silt Check - Rock checks installed in channels and in front of pipes
- 4) Channel lining
- 5) Erosion control blanket
- 6) Sediment collection bags
- 7) Temporary silt control fence with Class II filter berm

H) Cut and Fill and Placement of Drainage Structures

Types of structures/facilities include:

- 1) Silt Traps Type B (20'L x 5'W x 2'D min dugout with rock berm)
- 2) Silt Checks - Bags in front of pipes after they are placed
- 3) Channel lining
- 4) Erosion control blanket
- 5) Temporary mulch and/or seeding for areas where construction activities will be ceased for 14 days or more
- 6) Non-standard or innovative methods

I) Temporary Shutdown

Items to be completed prior to shutdown include:

- 1) Clean out behind, repair or replace silt fence and/or hay bales
- 2) Clean out all silt traps
- 3) Temporary mulch tracked into the soil
- 4) Sow cover crop (weather permitting)

J) Finish Work

Items to be completed prior to demobilization include:

- 1) Removal of Silt Check - Rock checks from ditches and drainways if they are protected with other BMPs sufficient to control erosion and vegetation has been established.
- 2) Maintain all silt traps and basins
- 3) Permanent seeding and protection
- 4) Planting trees and/or shrubs where they are included in the project.

K) Demobilization

- 1) Clean out behind, repair or replace silt fence and/or hay bales
- 2) Clean out all permanent silt traps and basins

L) Post-Construction

The Contractor shall assume responsibility for all workmanship and materials for a period of one year from the date of final payment, as directed by the Contract Documents. Any work found to be defective due to failure to comply with the provisions and intent of the Contract Documents shall be corrected at the Contractor's expense. Problems determined not to be created by the landowner or due to the Contractor will be addressed by the DAML for a period of up to five years, pending available funding.

OTHER CONTROL MEASURES

A) Solid Materials

No solid materials, including building materials, shall be discharged into waters of the U.S., except as authorized by a Section 404 permit and directed by the plans or Engineer.

B) Waste Materials

All waste materials that may leach pollutants (paint and paint containers, caulk tubes, oil/grease containers, liquids of any kind, soluble materials, etc.) will be collected and stored in appropriate covered waste containers. Waste containers shall be removed from the project site frequently as to not allow wastes to become a source of pollution. All personnel will be instructed regarding the correct procedure for waste disposal. Wastes will be disposed of in accordance with appropriate regulations. The Contractor will notify the DAML onsite inspector of the waste disposal methods.

C) Hazardous Waste

- 1) All hazardous waste materials will be managed and disposed of in the manner specified by local or state regulation. The contractor shall notify the DAML onsite inspector if there are any hazardous wastes being generated, and provide a plan for the management and disposal of such materials. Site personnel will be instructed with regard to proper

storage and handling of hazardous wastes when required. These practices will be used to reduce the risks associated with all hazardous materials.

- 2) Products will be kept in original containers unless they are not re-sealable.
- 3) Original labels and material safety data sheets (MSDS) will be reviewed and retained.
- 4) Contractor will follow procedures recommended by the manufacturer when handling hazardous materials.

D) Spill Prevention

- 1) Good housekeeping and material management practices will be used to reduce the risk of spills or other exposure of materials and substances to the weather and/or runoff.
- 2) Manufacturers' recommended methods for spill cleanup will be maintained on site and readily available upon request. All personnel will be made aware of procedures and the location of the information and cleanup supplies.
- 3) Materials and equipment necessary for spill cleanup will be kept in the material storage area. Equipment and materials will include brooms, dust pans, mops, rags, gloves, oil absorbents, sand, sawdust, plastic and metal trash containers, as appropriate.
- 4) All spills will be cleaned up immediately after discovery.
- 5) The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with a hazardous substance.
- 6) Spills of toxic or hazardous material will be reported to the appropriate state/local agency as required by KRS 224 and applicable federal law.
- 7) The spill prevention plan will be updated, as needed, to prevent spills from reoccurring and improve spill response and cleanup.
- 8) Spills of products will be cleaned up promptly. Wastes from spill clean up will be disposed of in accordance with appropriate regulations.

E) Petroleum Products

Vehicles and equipment that are fueled and maintained on site will be monitored for leaks, and receive regular preventative maintenance to reduce the possibility of leakage. Petroleum products onsite will be stored in tightly sealed containers, which are clearly labeled and will be protected from exposure to weather. The Contractor shall not have a total of over 1,320 gallons of petroleum products on site at any given time. The total combined storage capacity of greater than or equal to 1,320 gallons of petroleum products requires an Oil Pollution Spill Prevention Control and Countermeasure plan per 40 CFR 112.

F) Fertilizers

Fertilizers will be applied at rates prescribed by the contract, standard specifications or as directed by the Engineer. Once applied, fertilizer will be covered with mulch, erosion control blankets or worked into the soil to limit exposure to storm water. Storage will be in a covered shed. The contents of any partially used bags of fertilizer will be transferred to a sealable plastic bin to avoid spills.

G) Concrete Truck Washout

Concrete truck mixers and chutes will not be washed on pavement, near storm drain inlets, or within 75 feet of any ditch, stream, wetland, lake, or sinkhole. Where possible, excess concrete and wash water will be discharged to areas prepared for pouring new concrete, flat areas to be paved that are away from ditches or drainage system features, or other locations that will not drain off site. Where this approach is not possible, a shallow earthen washbasin will be excavated away from ditches to receive the wash water.

INSPECTIONS

Inspection and maintenance practices that will be used to maintain erosion and sediment controls:

- 1) All erosion prevention and sediment control measures will be inspected by the Contractor and DAML onsite inspector at least once each week and following any rain of 0.1 inch or more.
- 2) Silt control inspections will be recorded by the DAML onsite inspector in their daily report.
- 3) Areas at final grade will be seeded and mulched within 5 days.
- 4) Soil stock piles and areas that are not at final grade but where construction has ceased for a period of 14 days or longer, shall receive temporary mulch no later than 14 days from the last construction activity in that area.
- 5) All measures will be maintained in good working order; corrective actions will be initiated within 24 hours of being reported and completed within 5 days.
- 6) Built-up sediment will be removed from behind the silt fence/hay bales before it has reached halfway up the height of the fence.
- 7) Silt fences/hay bales will be inspected for bypassing, overtopping, undercutting, depth of sediment, tears, and to ensure attachment to secure posts.
- 8) Silt traps and basins will be inspected for depth of sediment, and built-up sediment will be removed when it reaches 50 percent of the design capacity and at the end of the job.
- 9) Diversion dikes and berms will be inspected and any breaches promptly repaired. Areas that are eroding or scouring will be repaired and re-seeded / mulched as needed.
- 10) Temporary and permanent seeding and mulching will be inspected for bare spots, washouts, and healthy growth. Bare or eroded areas will be repaired as needed.
- 11) All material storage and equipment servicing areas that involve the management of bulk liquids, fuels, and bulk solids will be inspected weekly for conditions that represent a release or possible release of pollutants to the environment.

MAINTENANCE

The maintenance procedures necessary to keep the control measures in good and effective operating condition, will be discussed at the Pre-construction conference. Any problems will be noted within one (1) business day and will be corrected by the contractor within five (5) days. Critical failures will be addressed immediately unless site conditions are too dangerous. All deficiencies and corrections will be recorded in the onsite inspector's daily report.

Following final project acceptance by the Engineer, DAML will be responsible for identification and correction of deficiencies regarding ground cover and other storm water BMP not created because of the Contractor's workmanship and/or materials or landowner actions.

ENFORCEMENT

At all times, representatives from DAML and enforcement agencies will have access to the project site. The DAML Engineer reserves right to stop work until erosion prevention and sediment control problems are addressed to his/her satisfaction. The Engineer reserves the right to withhold payment for erosion prevention and sediment control work that is not satisfactory.

APPENDIX C

**PART III
ENERGY AND ENVIRONMENT CABINET
DEPARTMENT FOR NATURAL RESOURCES
DIVISION OF ABANDONED MINE LANDS**

GENERAL CONDITIONS

These General Conditions apply to each section of the specifications and are binding upon the Contractor and all Subcontractors as each are subject to the provisions contained herein:

These General Conditions are intended to define and establish certain rules and provisions of the Contract governing the operation so that the Work may be continued and be completed in an orderly, expeditious and workmanlike manner.

These General Conditions, together with the specifications and Contract Documents, shall further establish the standards of material and workmanship for the Work.

1. Definitions of Terms Wherever used in these General Conditions or in other Contract Documents, the following terms have the meaning indicated which are applicable to both the singular and plural thereof:

1.1 Agency is the state government entity which utilizes the Work being contracted.

1.2 Architect is the person or entity, either architect, engineer, or consultant, who is identified as such in the Contract Documents and on the drawings or any replacement architect, engineer, or consultant identified by the Owner.

1.3 Certification of Payment is the Owners Progress Payment Forms, DOA-24 and DOA-25.

1.4 Change Order means a written order to the Contractor executed by the Owner and the Architect after execution of the Contract, directing a change in the Work and may include a change in the Contract Price or the Contract Completion Time, or any combination thereof.

1.5 Contract is the legal relationship, duties and obligations between the Owner and Contractor as evidenced by the Contract Documents for the Project.

1.6 Contract Completion Time is the number of calendar days between the Date of Commencement and the dates set for Substantial Completion and Final Completion of the Work, including any adjustments thereto, all as established in the Contract between Owner and Contractor.

1.7 Contract Documents include the Invitation for Bids, the Instructions to Bidders, the Payment and Performance Bonds, the General Conditions, the Special or Supplemental Conditions, the drawings, specifications, solicitation addenda, the contractors response to the solicitation, any written clarification of the response, the award document containing the Agreement between Owner and Contractor, and modifications issued after execution of the Contract. Modifications include (1) Change Orders issued as provided in Article 14, and (2) Field Orders for minor changes in the work issued by the Architect as provided in Article 14. Documents not included or expressly contemplated in this Paragraph, 1.7, do not, and shall not, form any part of the Contract between the Owner and the Contractor.

1.8 Contract Sum means the sum stated in the Contract including any authorized adjustments thereto and is the total amount payable by the Owner to the Contractor for the performance of the Work under the Contract Documents.

1.9 Contractor means the person or entity with whom the Owner has executed the Contract for construction.

1.10 Date of Commencement is the date specified in the Contract as the date upon which the Contractor is

authorized to begin work.

‘1.11 Direct Expenses is defined as “All items of expenses directly incurred by or attributable to a specific project, assignment or task” and “Direct costs consist of direct materials, direct labor, subcontract costs, and other miscellaneous direct costs such as bonding and equipment rentals, that are directly related to and can be specifically attributed to an individual contract.”

‘1.12 Drawings are the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

‘1.13 Extra Work as used in Article 14 is defined as Work not part of the existing Contract Documents which is being added to the Contract by Change Order.

‘1.14 A Field Order is a written order issued by the Architect which clarifies or interprets the Contract Documents, or orders minor changes in the Work which does not require a change under Article 14.

‘1.15 Final Completion is defined as the Work being acceptable under the Contract Documents and the Contract fully performed in accordance with the terms and conditions of the Contract Documents and the entire payment balance due the Contractor is due and payable.

‘1.16 Final Completion Date shall have the meaning as described to it in Paragraph 19.3.

‘1.17 Notice of Intent to Award is a written letter issued to the apparent successful contractor after acceptance of bid price, unit prices, subcontractors and equipment and materials to inform them of such acceptance and request the required additional documentation to initiate the Contract. **This is NOT an authorization to proceed.**

‘1.18 Owner means the Commonwealth of Kentucky, acting through the Finance and Administration Cabinet and its Administrative Agent, the Department for Facilities Management.

‘1.19 The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner or by separate Contractors.

‘1.20 Resident Observer means an individual who has a direct contract with the Owner to observe and report on activities at the work site. A Resident Observer employed by the Owner is not authorized to serve as the Owners Representative, unless so designated by the Owner in writing.

1.21 Retainage means money earned by a contractor for work accepted by the Owner, but withheld to ensure proper performance by the contractor.

‘1.22 Shop Drawings means drawings, completion diagrams, schedules, and other data specially prepared for the Work by the Contractor or any Subcontractor, lower tier subcontractors, manufacturer, supplier, or distributor to illustrate some portion of the Work.

‘1.23 Subcontractor means the person or entity having a direct contract with the Contractor for the performance of a part of the Work.

‘1.24 Substantial Completion is the point at which, as certified in writing by the Architect, the Project is at a level of completion in strict compliance with the Contract, and necessary approval by public authorities has been given, such that the Owner or the Agency can enjoy beneficial use or occupancy and can use, operate and maintain (the Owner has received all required warranties and documentation) it in all respects, for its intended purpose. Partial use or occupancy of the Project shall not result in the Project being deemed substantially complete and such partial use or

occupancy shall not be evidence of Substantial Completion.

‘1.25 Substantial Completion Date shall have the meaning as described to it in Paragraph 19.2.

‘1.26 The Work includes the construction and services required by the Contract Documents, whether completed or partially completed, and includes all labor, supervision, materials, equipment, services, and things provided or to be provided by the Contractor to fulfill the Contractor’s obligations.

‘2. Intent and Interpretation

‘2.1 Anything that may be required, implied or inferred by the documents which make up the Contract, or any one or more of them, shall be provided by the Contractor for the Contract Sum;

‘2.2 Nothing contained in the Contract Documents shall create, nor be interpreted to create, privet or any other relationship whatsoever between the Owner and any person except the Contractor;

‘2.3 When a word, term, or phrase is used in the Contract Documents, it shall be interpreted or construed first, as defined herein; second, if not defined, according to its generally accepted meaning in the construction industry; and third, if there is no generally accepted meaning in the construction industry, according to its common and customary usage;

‘2.4 The words “include”, “includes”, or “including”, shall be deemed to be followed by the phrase, “without limitation”.

‘2.5 The specification herein of any act, failure, refusal, omission, event, occurrence or condition as constituting a material breach of the resulting Contract shall not imply that any other, non-specified act, failure, refusal, omission, event, occurrence or condition shall be deemed not to constitute a material breach of the resulting Contract;

‘2.6 In the event of any conflict, discrepancy, or inconsistency, the following shall control:

‘2.6.1 As between figures given on plans and scaled measurements, the figures shall govern;

‘2.6.2 As between large scale plans and small scale plans, the large scale plans shall govern;

‘2.6.3 As between plans and specifications, the requirements of the specifications shall govern;

‘2.7 Meaning of Execution. Execution of the Contract Documents by the Contractor is a representation that the Contractor has thoroughly examined the site of the Work, become familiar with the local conditions under which the Work is to be performed, and correlated personal observations with the requirements of the Contract Documents. Execution of the Contract Documents is a further representation that Contractor has received, reviewed and carefully examined all of the Contract Documents, and has found them in all respects to be complete, accurate, adequate, consistent, coordinated and sufficient for construction, the Contractor is fully qualified to act as the contractor for the Project and has, and shall maintain, any and all licenses, permits or other authorizations necessary to act as the contractor for, and to construct the Project.

‘2.8 Prior Agreements. The Contract Documents supersede any and all prior discussions, communications, representations, understandings, negotiations or agreements between the Owner and the Contractor and the Agency and the Contractor.

‘2.9 Contractor’s Performance. The Contractor shall perform all of the Work required, implied or reasonably inferable from the Contract including, but not limited to, the following:

‘2.9.1 Construction of the Project;

‘2.9.2 The furnishing of any required surety bonds and insurance;

‘2.9.3 The provision or furnishing, and prompt payment therefore, of labor, supervision, services, materials, supplies, equipment, fixtures, appliances, facilities, tools, transportation, storage, power, fuel, heat, light, cooling, or other utilities, required for construction and all necessary building permits and other permits required for the construction of the Project;

‘2.9.4 The creation and submission to the Owner of detailed and comprehensive as-built drawings, depicting all as-built construction. Said as-built drawings shall be submitted to the Owner upon final completion of the Project and receipt of same by the Owner shall be a condition precedent to final payment to the Contractor.

‘2.10 **Time.** All limitations of time set forth in the Contract Documents are material and are of the essence of the Contract.

‘2.11 **Intent of Contract Documents.** The intent of the Contract Documents is to include all items necessary for the proper completion of the Work by the Contractor. Labor or materials which are evidently necessary to produce the desired results, even though not specifically mentioned in the Contract Documents, shall be included in the Work.

‘2.12 **Contract Documents Complementary, etc.** The Contract Documents are complementary, and what is required by one shall be as binding as if required by all. In case of conflicts between the various Contract Documents, the order of precedence shall be as follows: (1) Addenda, (2) Division 1 - General Requirements of the Specifications; (3) Special Conditions, (4) General Conditions, (5) Technical provisions of the Specifications; (6) Drawings.

‘2.13 **Questions to Architect.** In the event a question arises regarding the meaning or intent of the drawings and specifications, the Contractor shall report it at once to the Architect. The Architect shall furnish, with reasonable promptness, additional instructions, by means of drawings or otherwise, necessary for the proper execution of the work, consistent with the requirements of Article 3.

‘2.14 Paragraph, titles or headings are for convenience only and form no operative part of the Contract.

‘3. **The Architect** Unless otherwise directed by the Owner in writing, the Architect shall perform those duties and discharge those responsibilities allocated to the Architect in the Contract Documents. The duties, obligations and responsibilities of the Architect shall include, but are not limited to, the following:

‘3.1 **Owner’s Representative.** The Architect will be the Owner’s Agent during construction and until final payment has been made. The Architect will advise and consult with the Owner. In the event the Owner should find it necessary or convenient to replace the Architect, the Owner shall retain a replacement architect and the role of the replacement architect shall be the same as the role of the Architect.

‘3.2 **Communication Through Architect.** Except as otherwise provided in the Contract Documents, the Owner’s instructions to the Contractor shall be forwarded through the Architect, and the Contractor’s communications with the Owner shall be through the Architect.

‘3.3 **Review of Work.** The Architect shall approve, or respond otherwise as necessary concerning shop drawings or other submittals received from the Contractor. The Architect shall be authorized to refuse to accept work which is defective or otherwise fails to comply with the requirements of the Contract. If the Architect deems it appropriate, the Architect shall be authorized to call for extra inspection or testing of the work for compliance with requirements of the Contract. The Architect shall review the Contractor’s Payment Requests and shall approve in writing those amounts which, in the opinion of the Architect, are properly owing to the Contractor as provided in the Contract. The Architect shall perform those inspections required by the Owner.

‘3.4 **Interpretation of Contract Documents.** The Architect shall be the interpreter of the requirements of the Contract Documents and the judge of the performance there under by the Contractor, subject to the provisions of Article 26. Claims, disputes, and other matters in question that arise relating to the execution or progress of the Work shall be referred initially to the Architect for decision, which he will render in writing within a reasonable time. Either party may appeal the Architect’s decision to the Secretary of the Finance and Administration Cabinet in accordance with the provision of Article 26.

The Architect shall have authority to reject Work which does not conform to the Contract Documents. In the event of rejection, the Architect may recommend withholding payment to the Contractor for the rejected Work, and such recommendation shall give the Owner the authority to withhold payment for such Work.

‘3.5 Review of Shop Drawings, etc. The Architect shall review and approve, or take other appropriate action upon Contractor’s submittals (such as Shop Drawings, product data, and samples) for conformance with the design concept and the information given in the Contract Documents. Such action shall be taken with reasonable promptness so as to cause no delay. The Architect’s approval of a specific item shall not indicate approval of an assembly of which the item is a component. The Architect’s approval of Shop Drawings or samples shall not relieve the Contractor from his responsibility for any deviations from the requirements of the Contract Documents unless the Contractor has in writing called the Architect’s attention to such deviation at the time of submission and the Architect has given written approval to the specific deviation, nor shall any approval by the Architect relieve the Contractor from responsibility for errors or omissions in the Shop Drawings.

‘3.6 Preparation of Change Orders. The Architect, in consultation with the Owner, shall prepare Change Orders. The Architect shall also have authority to order minor changes in the Work as provided in Article 14.2.

‘3.7 Final Inspections, Certification. The Architect shall conduct inspections to determine the dates of Substantial Completion and Final Completion. The Architect shall also receive and forward to the Owner, for the Owner’s review, written warranties and related documents required by the Contract and assembled by the Contractor.

‘3.8 Payment Requests. The Architect shall review the Contractor’s Payment Requests and shall approve in writing those amounts which, in the opinion, of the Architect, are properly owing to the Contractor as provided in the Contract. The Architect’s approval of payment requests shall not relieve the Contractor from his responsibility for any deviations from the requirements of the Contract Documents

‘3.9 The Architect shall be authorized to require the Contractor to make changes which do not involve a change in the Contract Sum or in the Contract Completion Time for the Contractor’s performance consistent with the intent of the Contract.

‘3.10 The duties, obligations and responsibilities of the Contractor under the Contract shall in no manner whatsoever be changed, altered, discharged, released, or satisfied by any duty, obligation or responsibility of the Architect. The Contractor is not a third-party beneficiary of any Contract by and between the Owner and the Architect. It is expressly acknowledged and agreed that the duties of Contractor to the Owner are independent of, and are not diminished by, any duties of the Architect to the Owner.

‘3.11 The duties, obligations and responsibilities of both the Architect and the Contractor, under their respective Contracts, shall in no manner whatsoever be changed, altered, discharged, released, or satisfied by any duty, obligation or responsibility of the Resident Observer. It is expressly acknowledged and agreed that the duties of Contractor and/or Architect to the Owner are independent of, and are not diminished by, any duties of the Resident Observer to the Owner. A copy of the Resident Observers Duties, Responsibilities and Limitations are attached hereto and made a part thereof.

‘4. Construction Schedule The Contractor, within fifteen (15) days of the Date of Commencement shall prepare and submit for the Owner and Architect’s approval a construction schedule for completing the Work. The schedule shall indicate the starting and completion dates of the various stages of the Work, shall not exceed time limits established by the Contract Documents for the various stages of Work, shall be updated monthly and furnished to the Owner and Architect, shall be related to the Work of any other contractors on the

Project to the extent required by the circumstances, and shall provide for expeditious and practicable execution of the Work. The original schedule shall be accompanied by a proposed schedule of values as described in Article 18.1. The Contractor shall promptly notify the Architect and Owner if the Contractor is materially ahead of, or behind the updated construction schedule. Failure to so notify the Architect and Owner shall relieve the Owner from liability for damages caused by delay or impact. Strict compliance with the requirements of this paragraph shall be a condition precedent to payment to the Contractor, and failure by the Contractor to strictly comply with said requirements shall constitute a material breach of the Contract.

For projects with a contract amount of \$1,000,000 or greater the schedule shall be in critical path format. The schedules shall include all activities necessary for performance of the work showing logic (sequences, dependencies, etc.) duration of each activity with the critical path highlighted. The schedules shall include, but not be limited to, submittal processing, fabrication and delivery of materials, construction, testing clean-up, work and/or materials to be provided by the Owner, dates and durations for major utility outages requiring coordination with the Owner and the Owner's operations, and significant milestones related to the completion of the Project.

5. Shop Drawings; Submittals

5.1 Schedule for Submittals. Prior to submission of the first application for payment and in sufficient time to allow the Architect reasonable time for review, the Contractor shall submit to the Architect a schedule of submittals which shall be coordinated with the construction schedule. The Contractor shall keep the schedule of submittals current.

5.2 Submittals of Shop Drawings, Samples, etc. The Contractor shall review, approve, and submit Shop Drawings, samples, and product data in accordance with the approved schedule as herein detailed. The Contractor's stamp of approval on any Shop Drawing or sample shall constitute a representation to Owner and Architect that the Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, or he assumes full responsibility for doing so, and that he has reviewed or coordinated each Shop Drawing or sample with the requirements of the Work and the Contract Documents. The Architect shall review and approve, with reasonable promptness, the Shop Drawings, or return for corrections as required. The review and approval shall be for conformance with the design concept of the Project and for compliance with the information given in the Contract Documents. The approval of a separate item will not indicate approval of the assembly in which the item functions.

The Contractor shall make any corrections required by the Architect for compliance to the Contract and shall return the required number of corrected copies of Shop Drawings and resubmit new samples until approved. The Contractor shall direct specific attention, in writing, or on resubmitted Shop Drawings, to revisions other than the corrections called for by the Architect on previous submissions.

Where a Shop Drawing or sample submission is required by the specifications, no related work shall be commenced until the submission has been approved by the Architect. A copy of each approved Shop Drawing and each approved sample shall be kept in good order by the Contractor at the site and shall be available to the Architect.

The Architect's approval of Shop Drawings or samples shall not relieve the Contractor from his responsibility for any deviations from the requirements of the Contract Documents unless the Contractor has in writing called the Architect's attention to such deviation at the time of submission and the Architect has given written approval to the specific deviation, nor shall any approval by the Architect relieve the Contractor from responsibility for errors or omissions in the Shop Drawings.

The Contractor shall maintain a submittal log which shall include, at a minimum, the date of each submittal, the date of any resubmittal, the date of any approval or rejection, and the reason for any approval or rejection.

6. Documents and Samples at the Site Unless otherwise provided in the Contract Documents, the Contractor shall be furnished, free of charge, sufficient copies of the drawings and specifications as are reasonably necessary for the execution of the Work. However, the number of free copies shall not exceed twenty (20) unless otherwise determined by the Department Project Architect/Engineer and Purchasing Officer. If the number of copies required exceed twenty (20) or the number established by the Department Project Architect/Engineer, they shall be purchased by the Contractor at production cost. The Contractor shall maintain at the site one record copy of the drawings, specifications, addenda, Change Orders and other modifications, in good order and marked currently to record changes and selections made during construction. Unless otherwise directed, the Contractor shall also keep approved Shop Drawings, product data, samples and similar required submittals on hand. These shall be available to the Architect and Owner as requested. Upon completion of the Work, the record documents described above shall be delivered to the Architect for submittal to the Owner along with the as-built drawings.

7. Contract Documents Property of Owner The Contract Documents, and each of them, as well as any other documents furnished by the Owner, shall remain the property of the Owner. The Contractor shall have the right to keep one (1) copy of the Contract Documents upon completion of the Project; provided, however, that in no event shall the Contractor use, or permit to be used, any portion or all of such Contract Documents on other projects without the Owner's prior written authorization.

8. Supervision and Construction Procedures

8.1 Supervision of the Work. The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention so as to ensure expeditious, workmanlike performance in accordance with the requirements of the Contract Documents. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures. He shall be responsible for the acts and omissions of persons directly employed by him, as he is for Subcontractors and others under Article 17. He shall be responsible for coordinating all portions of the Work under the Contract unless the Contract Documents give other specific instructions concerning these matters.

8.2 Obligation to Follow Contract Requirements. The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents by the activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor.

8.3 The Contractor shall not perform Work without adequate plans and specifications, or, as appropriate, approved Shop Drawings, or other submittals. If the Contractor performs Work knowing or believing it involves an error, inconsistency or omission without first providing written notice to the Architect and Owner, the Contractor shall be responsible for such Work and pay the cost of correcting same.

8.4 All Work shall strictly conform to the requirements of the Contract Documents.

8.5 The Work shall be strictly supervised, the Contractor bearing full responsibility for any and all acts or omissions of those engaged in the Work on behalf of the Contractor.

8.6 The Contractor shall at all times enforce strict discipline and good order among his employees and Subcontractors and shall not employ on the Work any person not skilled in the Work assigned to him.

8.7 The Contractor shall employ and maintain at the Project site only competent supervisory personnel.

8.8 The Contractor shall have a continuing duty to read, examine, review, compare and contrast each of the Contract Documents, Shop Drawings, and other submittals and shall give written notice to the Owner and the Architect of any potential conflict, ambiguity, error or omission which the

Contractor may find with respect to these documents and their adequacy and sufficiency for construction as required by the Contract before proceeding with the affected Work. The express or implied approval by the Owner or the Architect of any Shop Drawings or other submittals shall not relieve the Contractor of the continuing duties imposed hereby, nor shall any such approval be evidence of the Contractor's compliance with the resulting Contract. The Owner has relied upon the Architect to prepare documents for the Project, including the plans and specifications for the Project, which are accurate, adequate, consistent, coordinated and sufficient for construction, and in issuing the Contract to the Contractor, the Owner's established legal duties to the Contractor notwithstanding, the Owner has relied upon the Architect's professional expertise in fulfilling its legal duty to the Owner in addition to the Contractor's full and good faith compliance with its duties set forth above.

'8.9 Superintendent. The Contractor shall employ a qualified, competent superintendent and any necessary assistants who shall be in attendance at the Project site during performance of the Work. The Department reserves the right to approve the Superintendent selected by the Contractor. The superintendent shall have full authority to act in behalf of the Contractor and all instructions given to the superintendent shall be considered as given to the Contractor. It shall be the responsibility of the Contractor's superintendent to coordinate the work of all the Subcontractors.

The superintendent shall not be changed except under the following circumstances:

- '8.9.1 where the superintendent proves to be unsatisfactory to the Contractor or ceases to be in his employ, in which case the Contractor shall give timely prior written notice to the Owner of the impending change in superintendent and a reasonable explanation for the change; or
- '8.9.2 where the Owner has reasonable grounds for dissatisfaction with the performance of the superintendent and gives written notice to the Contractor of these grounds. The Contractor, upon receiving such written notice, shall replace the existing superintendent with a successor, to whom the Owner has no objection.

'9. Labor, Material

'9.1 Contractor Provisions. Unless otherwise stipulated, the Contractor shall provide and pay for all materials, supervision, labor, water, tools, equipment, light, power, temporary heat, hoist, supplies, appliances, transportation, and other facilities and things necessary for the execution and completion of the Work. In the event the Owner elects to make available the electric power, at no cost, to the Contractor for construction purposes, it shall not be utilized as a means for temporary heat.

'9.2 Contractor Warranty. The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work will strictly conform with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

'9.3 Substitution - Materials and Equipment. Substitution of previously approved equipment and materials shall be considered only for the following reasons:

- '9.3.1 unavailability of the material or equipment due to conditions beyond the control of the Contractor
- '9.3.2 inability of the supplier to meet Contract schedule; or
- '9.3.3 technical and immaterial noncompliance to specifications.

Inclusion of a certain, make or type of materials or equipment by the Contractor shall not obligate the Owner to accept such material or equipment if it does not meet the requirements of the plans and specifications. Substitutions not properly approved and authorized may be considered defective work. The Contractor shall, if required, furnish satisfactory evidence as to the kind and quality of materials and equipment.

'9.4 Recycled Content

KRS 45A.520 mandates that every state agency require a minimum recycled content for those materials it purchases. In accordance with 200 KAR 5:330, all listed are to be offered by the awarded contractor ONLY as a recycled product. Except as provided in KRS 45A.510, construction related materials requiring a minimum recycled content include Building Insulation, Aluminum products, concrete, cement and steel products. For a complete listing of those items requiring minimum recycled content please refer to 200 KAR 5:330
<http://www.lrc.state.ky.us/kar/200/005/330.htm>

'10. Surveys, Permits, Fees, Notices, and Tests

'10.1 Owner-Furnished Surveys. The Owner shall furnish whatever surveys are specifically required by the Contract Documents. Approvals, assessments, easements for permanent structures or permanent changes in existing facilities, and utility tap-on fees shall be secured and paid for by the Owner, unless otherwise provided in the Contract Documents.

'10.2 Permits. Building, sewer, and water permits and similar kinds of permits required by local ordinances shall be obtained by the General Contractor, but no fee shall be charged to or paid by the Contractor as the Commonwealth is exempt from such charges. The Contractor shall procure and pay for any necessary licenses to do business in the locale of the Work.

'10.3 Notices. The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and lawful orders of public authorities bearing on the performance of the Work.

'10.4 Required Regulatory Tests and Inspections. Regulatory agencies of the government having jurisdiction may require any Work to be inspected, tested or approved. The Contractor shall assume full responsibility therefore, including related costs, unless otherwise noted, and shall furnish the Architect the required certifications of inspection, testing or approval.

'10.5 Any delays by governmental agencies in obtaining Permits, Notices, Required Regulatory Tests and Inspections (10.2, 10.3, 10.4) and not the fault of one of the parties shall be shared by the Contractor and Owner with appropriate time extensions only. Liquidated damages and Contractor compensation for such delays or impact are not applicable and shall not be payable.

'10.6 Payment for Tests. Tests of materials, products and equipment in place, required by the Architect or the Owner, to prove quality standards shall be paid by the Contractor. Should results of testing indicate that construction is not in compliance with Contract Documents, the Contractor shall bear the cost of any additional tests of the materials, products or equipment. The Contractor shall give the Architect timely notice of readiness of the Work for all inspections, tests or approvals.

'11. Protection of Work, Property, Employees and Public

'11.1 Safety Precautions and Programs. The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Project.

'11.2 Safety of Persons and Property. The Contractor shall continuously maintain adequate protection of all Work from damage and shall protect the Owner's property from injury or loss arising in connection with this Contract. He shall make good any such damage, injury, or loss, except such as may be directly due to errors in the Contract Documents or caused by agents or employees of the Owner. He shall adequately protect adjacent property as provided by law and the Contract Documents.

The Contractor shall take all necessary precautions for the safety of employees on the Work site, and shall comply with all applicable provisions of federal, state, and municipal safety laws and building codes to prevent accidents or injury to persons on, about, or adjacent to the premises where the Work is being performed.

The Contractor shall designate a responsible member of his organization on the Work site as safety officer whose duty shall be to enforce safety regulations. The name and position of the person so designated shall be reported to the Architect by the Contractor.

In an emergency affecting the safety of life, or of the Work, or of adjoining property, the Contractor, without special instruction or authorization from the Architect or Owner, shall act at his discretion to prevent such threatened loss or injury.

'11.3 Hazardous Materials. In the event the Contractor unexpectedly encounters on the site material reasonably believed to be asbestos, polychlorinated biphenyl (PCB) or other classified hazardous substances/materials which have not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner and Architect in writing. The Work in the affected area shall not thereafter be resumed except by written agreement of the Owner and Contractor if in fact the material is asbestos, polychlorinated biphenyl (PCB), or other classified hazardous substances/materials which have not been rendered harmless. The Work in the affected area shall be resumed in the absence of any classified hazardous substances/materials or when it is determined that they have been rendered harmless.

'12. Inspection of Work/Discovering and Correcting Defective or Incomplete Work The Owner, the Architect, and their representatives shall at all times have access to the Work whenever it is in preparation or progress and the Contractor shall provide proper facilities for such access and for inspection. The Contractor shall be given timely notification in order to arrange for proper inspection of any Work performed outside of the normal working day or week.

If the specifications, the Architect's instructions, laws, ordinances, or any public authority require any Work to be specially tested or approved, the Contractor shall give the Architect timely notice of its readiness for inspection. Inspections by the Architect shall be made promptly.

In the event that the Contractor covers, conceals or obscures its Work in violation of the Contract or in violation of a directive from the Owner or the Architect, such Work shall be uncovered and displayed for the Owner's or Architect's inspection upon request, and shall be reworked at no cost in time or money to the Owner.

If any of the Work is covered, concealed or obscured in a manner not covered by the above paragraph, it shall, if directed by the Owner or the Architect be uncovered and displayed for the Owner's or Architect's inspection. If the uncovered Work conforms strictly with the Contract, the costs incurred by the Contractor to uncover and subsequently, replace such Work shall be borne by the Owner. Otherwise, such costs shall be borne by the Contractor.

The Contractor shall, at no cost in time or money to the Owner, correct Work rejected by the Owner or by the Architect as defective or failing to conform to the Contract. Additionally, the Contractor shall reimburse the Owner for all testing, inspections and other expenses incurred as a result thereof.

The Owner may, but shall in no event be required to, choose to accept defective or nonconforming Work. In such event, the Contract Price shall be reduced by the greater of (1) the reasonable costs of removing and correcting the defective or nonconforming Work, and (2) the difference between the fair market value of the Project as constructed and the fair market value of the Project had it not been constructed in such a manner as to include defective or nonconforming Work. If the remaining portion of the unpaid Contract Sum, if any, is insufficient to compensate the Owner for the acceptance of defective or nonconforming Work, the Contractor shall, upon written demand from the Owner, pay the Owner such remaining compensation for accepting defective or nonconforming Work.

'13. Royalties and Patents The Contractor shall pay all royalties and license fees and shall defend all suits or claims for infringement of any patent rights and shall save the Owner harmless from loss on account thereof.

'14. Changes in the Work/Change Orders

'14.1 Change Orders. One or more changes to the Work within the general scope of the Contract may be ordered by Change Order. The Contractor shall proceed with any such changes, (including additions, reductions, deletions, other revisions), and same shall be accomplished in strict accordance with the following:

Change Order means a written order to the Contractor executed by the Owner and the Architect

after execution of the Contract, directing a change in the Work and may include a change in the Contract Price, or the Contract Completion Time, or any combination thereof. Any change in the Contract Sum resulting from a Change Order shall be determined by one of the following methods:

- (1) by mutual agreement of a lump sum amount between the Owner and the Contractor as evidenced by (a) the Change in the Contract Sum being set forth in the Change Order, (b) such change in the Contract Sum, together with any conditions or requirements relating thereto, being initialed by both parties and (c) the Contractor's execution of the Change Order;
- (2) by unit prices stated in the Contract Documents or subsequently agreed upon; or
- (3) If no mutual agreement occurs between the Owner and the Contractor, the Change in the Contract Sum, if any, shall be derived by determining the reasonable actual costs or savings achieved resulting from revisions in the Work.

Items (1) and (3) above shall include a component for all overhead, profit, indirect costs or other items not to exceed fifteen percent (15%). Any such costs or savings shall be documented in the format, and with such content and detail as the Owner or the Architect requires. The Contractor shall only receive one fifteen percent (15%) for the "jobsite overhead and profit" component whether such work be done by the Contractor or by his Subcontractor.

For all charges relating to any Change Order, whether determined under subparagraph 1, 2 or 3 above, the following provisions shall apply:

- (1) The Contractor shall keep and present in such form as the Architect may direct, a correct account of all items in such form comprising the net cost of such Work, together with vouchers. The determination of the Architect shall be final upon all questions of the amount and cost of Changes in the Work, and it shall include in such cost, the cost to the Contractor of all materials used, of all labor, common and skilled, or foremen, trucks and teams, and the fair rental of all machinery used and for the period of such use. If said Work requires the use of machinery not already upon the work or to be otherwise used upon the Work, then the cost of transportation of such machinery to and from the Work shall be added to the fair rental, but said transportation shall not cover a distance exceeding one hundred (100) miles.
- (2) The Architect shall not include in the net cost of Work any cost or rental or small tools, or any portion of time of the Contractor or his Superintendent, or any allowance for the use of capital, or any additional bond premium, insurance cost applicable to the Work or any actual or anticipated profit, or any job or office overhead not previously mentioned, these items being considered as being covered by the added fifteen (15%) percent for the jobsite overhead and profit component.
- (3) In all cases where Changes in the Work are covered by unit prices set forth in the Contract, the value of such Work shall be determined only upon the basis of such unit prices.
- (4) Pending final determination of value, payments on Changes in Work shall be made only upon the estimate of the Architect.

If the Contractor claims that any instructions by the Architect involve additional cost and/or time extension, he shall give the Architect written notice thereof **within a reasonable time after the receipt of such instructions and before proceeding to execute the change in Work.**

On all Change Orders that exceed \$25,000 the Contractor shall submit the following certification: "I (the Contractor) certify to the best of my knowledge and belief, the cost or pricing data submitted is accurate, complete and current as of the date of the proposed change."

If the Owner and Contractor cannot agree on the effect of an ordered change on the adjustment to the Contract Sum or Contract Completion Time, this matter may also be referred to the Architect for determination.

If the Owner and/or Contractor do not agree with the Architect's determination regarding the valuation of a change, the related adjustment to the Contract Sum or to the Contract Completion Time, the matter shall be subject to the disputes procedure set out in Article 26.

The execution of a Change Order by the Contractor shall constitute conclusive evidence of the Contractor's agreement to the ordered changes in the Work, the resulting Contract as thus amended, the Contract Sum and the time for performance by the Contractor. The Contractor, by executing the Change Order, waives and forever releases any claim against the Owner for additional time or compensation for matters relating to or arising out of or resulting from the Work included within or affected by the executed Change Order.

The Contractor shall notify and obtain the consent and approval of the Contractor's Payment and Performance Bond sureties with reference to all Change Orders if such notice, consent or approval are required by the Owner, the Architect, the Contractor's sureties or by law. The Contractor's execution of the Change Order shall constitute the Contractor's warranty to the Owner that the sureties have been notified of, and consent to, such Change Order and the sureties shall be conclusively deemed to have been notified of such Change Order and to have expressly consented thereto.

'14.2 Minor Changes. The Architect may authorize minor changes in the Work which do not involve additional cost or extension of the Contract Completion Time, and which are not inconsistent with the intent of the Contract Documents. Such changes shall be effected by a Field Order issued by the Architect, which shall be binding on the Owner and Contractor. The Contractor shall carry out such orders promptly. However, if the Contractor claims that a Field Order involves additional cost or a delay to completion of the Work, he shall give the Architect written notice thereof within a reasonable time after receipt of the Field Order. Otherwise, he shall be deemed to have waived any right to claim an adjustment to the Contract Sum or to the Contract Completion Time.

'15 Project Records All documents relating in any manner whatsoever to the Project, or any designated portion thereof, which are in the possession of the Contractor, or any Subcontractor of the Contractor, shall be made available to the Owner or the Architect for inspection and copying upon written request by the Owner. Furthermore, said documents shall be made available, upon request by the Owner, to any state, federal or other regulatory authority and any such authority may review, inspect and copy such records. Said records include, but are not limited to all drawings, plans, specifications, submittals, correspondence, minutes, memoranda, tape recordings, videos, or other writings or things which document the Project, its design, and its construction. Said records expressly include those documents reflecting the cost of construction to the Contractor. The Contractor shall maintain and protect these documents for no less than ten (10) years after final completion of the Project, or for any longer period of time as may be required by law or good construction practice.

'16. Delays and Extensions of Time It is agreed that time is of the essence for each and every portion of the resulting Contract and where under the Contract an additional time is allowed for the completion of any Work, the new time limit fixed by such extension shall be of the essence of the Contract. Provided, that the Contractor shall not be charged with liquidated damages or any excess cost when the delay in completion of the Work is due to:

- (1) any preference, priority, or allocation order duly issued by the government;
- (2) unforeseeable cause beyond the control and without the fault or negligence of the Contractor, including,

but not restricted to, acts of God, or of the public enemy, acts of the Owner, acts of another contractor in the performance of a contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes and unusually severe weather; or

- (3) any delays of Subcontractors or suppliers occasioned by any of the causes specified in subsections (1) and (2) of this Article:

The Contractor shall, within fifteen (15) calendar days of the occurrence of the event, notify the Architect in writing. The Architect shall ascertain the facts and extent of the delay and notify the Contractor within a reasonable time of its decision in the matter. Any change in the Contract Completion Time resulting from any such claim shall be incorporated in a Change Order. An extension of time shall not be construed as cause for extra compensation under the Contract. Extensions of time relating to concealed conditions as defined in Article 26 shall be governed by the provisions of that Article.

'17 Subcontractors

'17.1 Contractor Fully Responsible for Subcontractors. The Contractor is fully responsible to the Owner for the acts and omissions of his Subcontractors and of persons and entities either directly or indirectly employed by them. Nothing contained in the Contract Documents shall create any contractual relationship between the Owner and a Subcontractor.

'17.2 Flow-down Requirement. By contract, the Contractor shall require each Subcontractor:

- (1) to be bound to the Contractor by the terms of the Contract Documents insofar as they apply to the Work to be performed by the Subcontractor; and
- (2) to assume toward the Contractor all the obligations which the Contractor, by the Contract Documents, assumes toward the Owner.

'17.3 Contracts with Subcontractors. The Contractor shall contract with those Subcontractors listed in the Contractors Bid Response and deemed acceptable by the Owner in accordance with the procedure outlined in the Instruction to Bidders. All subcontracts shall afford the Contractor rights against the Subcontractor which correspond to those rights afforded to the Owner against the Contractor herein, including those rights of Contract termination as set forth herein.

'17.4 Substitution of Subcontractors. The Contractor shall not contract with any substitute Subcontractor or change a Subcontractor without providing timely written notice of the proposed substitution to the Architect, Project Engineer and Purchasing Officer. The substitution shall not be made if the Owner, Architect, Project Engineer, or Purchasing Officer object in writing to such change.

'18. Payment The Owner shall make payments, less ten percent (10%) retainage, to the Contractor on the amount of the Work performed or materials furnished for the Work in accordance with the following procedures:

'18.1 Schedule of Values. At the same time it submits a construction schedule, within fifteen (15) days of the Date of Commencement, as provided in Article 4, the Contractor shall submit a Schedule of Values apportioning the Contract Sum among the different elements of the Project for purposes of periodic and final payment, prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. The Contractor shall not imbalance its Schedule of Values, nor artificially inflate any element thereof. The violation of this provision by the Contractor shall constitute a material breach of the Contract. Upon written approval by the Architect and the Owner, the Schedule of Values and construction schedule shall become the basis for the Contractor's Payment Requests during construction.

'18.2 Application for Progress Payment. Not more often than once a month, the Contractor shall submit to the Architect a signed application for payment (sometimes referred to as Payment Request), for the Work completed as of the date of the application and accompanied by such data and schedules as the Architect may reasonably require. Therein, the Contractor may request payment for ninety percent (90%) of that part of the Contract Sum allocable to Contract requirements properly

provided, labor, materials and equipment properly incorporated in the Project. If payment is requested on the basis of materials and equipment not incorporated in the Project, but delivered and suitably stored at the Project site or at another location agreed to in writing by the Owner, the application for payments shall also be accompanied by such data, satisfactory to Owner, as will establish the Owner's title to the material and equipment and protect his interest therein, including written documentation of full insurance against loss or damage and the bonding of the storage sites. Storage sites must be bonded. Each subsequent application for payment shall include an affidavit of the Contractor stating that all previous progress payments received on account of the Work have been applied to discharge in full all of the Contractor's obligations reflected in prior applications for payment. Each Payment Request shall be signed by the Contractor and shall constitute the Contractor's representation that the quantity of Work has reach the level for which payment is requested, that the Work has been properly installed or performed in strict compliance with this Contract, and that the Contractor knows of no reason why payment should not be made as requested.

'18.3 Approval of Payments. The Architect shall review the application for payment and shall review the work at the Project site or elsewhere to determine whether the quantity and quality of the Work is as represented in the application for payment and is as required by this Contract. The Architect shall, within ten (10) business days after receipt of each application for payment, approve in writing the amount which, in the opinion of the Architect, is properly owing to the Contractor. The Owner shall make payment to the Contractor within twenty (20) business days following the Architect's written approval of each application for payment. A reasonable delay on the part of the Owner in making payment to the Contractor for any given payment shall not be a breach of contract. The amount of each such payment shall be the amount approved for payment by the Architect less such amounts, if any, otherwise owing by the Contractor to the Owner or which the Owner shall have the right to withhold as authorized by this Contract. The Architect's approval of the Contractor's application for payment shall not preclude the Owner from the exercise of any of its rights as set forth herein. The Contractor warrants and represents that, upon payment of the application for payment, title to all Work included in such payment shall be vested in the Owner.

'18.4 Contractor's Warranty of Title. The Contractor warrants and guarantees that title to all Work, materials and equipment covered by any application for payment, whether incorporated in the project or not, will pass to Owner at the time of payment free and clear of all encumbrance.

'18.5 Retainage Reduction. Until fifty percent (50%) of the construction work has been completed in accordance with the contract, the Owner may withhold no more than ten percent (10%) retainage from the amount of any undisputed payment due, and retainage held after fifty-one percent (51%) of the construction project has been completed shall not be more than five percent (5%) of the total contract amount.

'18.6 Completion, Acceptance and Final Payment. Upon certification by the Architect of Substantial Completion of the Work, the Contractor shall continue to make normal pay requests as defined within this document. Within thirty (30) days after substantial completion, the Owner shall release the retainage less an amount equal to two hundred percent (200%) of the Owner's reasonably estimated cost of the balance of any contractor's contractually obligated, yet uncompleted, work remaining.

Final payment, shall be made by the Owner to the Contractor when the Contract has been fully performed by the Contractor in accordance with the Contract Documents and a final Certificate of Payment is issued by the Architect. Such final payment shall be made by the Owner not more than 30 business days after the issuance of the final Certificate of Payment. The Contractor shall submit with the application for final payment an affidavit that all payrolls, bills for materials, supplies and equipment, and other indebtedness connected with the Work have been paid or otherwise satisfied, along with such supporting evidence of payment as the Architect requires. Final payment is conditioned on satisfactory compliance with this requirement.

'18.7 Waiver of Claims. The making of final payment shall constitute a waiver of all claims by the Owner except those arising from:

'18.7.1 unsettled liens;

'18.7.2 faulty or defective Work appearing after Substantial Completion;

'18.7.3 failure of the Work to comply with the requirements of the Contract Documents; or

'18.7.4 terms of any special warranties required by the Contract Documents.

The acceptance of final payment by the Contractor shall constitute a waiver of all claims except those previously made in writing and identified by the Contractor as unsettled at the time of the final application for payment.

'18.8 Contractor's Payment to Subcontractors. When payment is received from the Owner, the Contractor shall immediately pay all Subcontractors, material men, laborers and suppliers the amounts they are due for the Work covered by such payment. In the event the Owner becomes informed that the Contractor has not paid a Subcontractor, material man, laborer, or supplier as provided herein, the Owner shall have the right, but not the duty, to issue future checks and payment to the Contractor of amounts otherwise due hereunder naming the Contractor and any such Subcontractor, material man, laborer, or supplier as joint payees. Such joint check procedure, if employed by the Owner, shall create no rights in favor of any person or entity beyond the right of the named payees to payment of the check and shall not be deemed to commit the Owner to repeat the procedure in the future. The Contractor shall, by an appropriate agreement with each Subcontractor, require each Subcontractor to make payment to his subcontractors in similar manner.

The Architect may, on request, furnish to any Subcontractor information regarding the percentage of completion of the amounts applied for by the Contractor and the action thereon by the Architect.

Neither the Owner nor the Architect shall have any obligation to make payment to any Subcontractor except as may otherwise be required by law.

'18.9 Owner's Rights Relating to Payments. Neither payment to the Contractor, utilization of the project for any purpose by the Owner, nor any act or omission by the Owner shall be interpreted or construed as an acceptance of any Work of the Contractor not strictly in compliance with this Contract.

The Owner shall have the right to refuse to make payment and, if necessary, may demand the return of a portion or all of the amount previously paid to the Contractor due to:

'18.9.1 The quality of a portion, or all, of the Contractor's Work not being in accordance with the requirements of this Contract;

'18.9.2 The quantity of the Contractor's Work not being as represented in the Contractor's Payment Request, or otherwise; **'18.9.3** The Contractor's rate of progress being such that, in the Owner's opinion, substantial or final completion, or both, may be inexcusably delayed;

'18.9.4 Claims made, or likely to be made, against the Owner;

'18.9.5 Loss caused by the Contractor;

'18.9.6 The Contractor's failure or refusal to perform any of its obligations to the Owner.

In the event that the Owner makes written demand upon the Contractor for amounts previously paid by the Owner as contemplated in this Paragraph, the Contractor must promptly comply with such demand.

'19. Completion

'19.1 Commencement and Completion of Work. The Contractor shall begin the Work on the Date of Commencement as specified in the Contract issued by the Owner. He shall diligently and expeditiously continue the performance of the Contract to and until Substantial Completion and Final Completion of the Project. The Contractor shall accomplish the Work in accordance with the construction schedule so as to achieve Substantial Completion and Final Completion dates as

defined in the Contract Documents. All time limits stated in the Contract Documents are the essence of the Contract.

'19.2 Substantial Completion of the Work. The Substantial Completion Date shall be that date certified by the Architect in accordance with the following procedures.

'19.2.1 When the Contractor determines that Substantial Completion has been achieved, the Contractor shall notify the Owner and the Architect in writing. The notification shall be accompanied by a Contractor prepared list of those items of Work still to be completed or corrected. The failure of the Contractor to include any item or items on such list not completed or needing correction shall not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

'19.2.2 The Architect shall, within a reasonable time after receipt of notification from the Contractor of Substantial Completion, make such inspection to confirm that the Work has achieved Substantial Completion.

'19.2.3 Upon its confirmation that the Contractor's work is substantially complete, the Architect shall prepare a Certificate of Substantial Completion which shall establish the Substantial Completion Date and the responsibilities between the Owner and Contractor for security, maintenance, heat, utilities and insurance, if not otherwise provided for in the Contract Documents, and a tentative list of items to be completed or corrected, within thirty (30) calendar days from the Substantial Completion Date. The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of the responsibilities assigned to them in the certificate.

'19.2.4 If, after making the inspection, the Architect fails to find that the Contractor's Work has achieved Substantial Completion, he will notify the Contractor in writing, giving the reasons therefore.

'19.2.5 If the Architect through its inspection fails to find that the Contractor's Work has achieved Substantial Completion and is required to repeat all, or any portion, of its, the Contractor shall bear the cost of such repeat inspections which cost may be deducted by the Owner from any payment then or thereafter due the Contractor.

'19.3 Final Completion of the Work. The Architect, upon receipt of written notice from the Contractor that the Work is finally complete and is ready for final inspection and acceptance, will promptly make such inspection and when he finds the Work completed and acceptable under the Contract Documents and the Contract fully performed, he will so notify the Contractor in writing and promptly issue a final Certificate of Payment to the Owner. If the Architect is unable to issue its final Certificate of Payment and is required to repeat its final inspection of the Project, the Contractor shall bear the cost of such repeat inspection(s), which costs may be deducted by the Owner from the Contractor's final payment; When the Owner accepts and occupies a building, all operations, maintenance, utilities and insurance become the responsibility of the Owner.

'19.4 Use of Substantially Complete Portions. The Owner may use or occupy a specified portion of the Work at any stage, provided that:

'19.4.1 such use or occupancy is consented to by insurers and

'19.4.2 it is authorized by public regulatory bodies having jurisdiction over the Work; and

'19.4.3 prior to such use or occupation, the affected portion of the Work is jointly inspected by the Owner, Contractor and Architect to determine the precise stage of completion.

Such possession and use shall not be deemed an acceptance of any Work not completed in accordance with the Contract Documents.

'19.5 Liquidated Damages

'19.5.1 The Contractor shall pay the Owner an amount identified in the Contract Documents for each and every calendar day of unexcused delay in achieving Substantial Completion and Final Completion beyond the date set for each.

Any sums due and payable hereunder by the Contractor shall be payable, not as a penalty,

but as liquidated damages representing delay damages sustained by the Owner, estimated at the time of executing this Contract.

'19.5.2 When the Owner reasonably believes that Substantial Completion will be inexcusably delayed, the Owner shall be entitled, but not required, to withhold from any amounts otherwise due the Contractor an amount then believed by the Owner to be adequate to recover liquidated damages applicable to such delays. If and when the Contractor overcomes the delay in achieving Substantial Completion, or any part thereof, for which the Owner has withheld payment, the Owner shall promptly release to the Contractor those funds withheld, but no longer applicable, as liquidated damages.

'20. Correction of Work

'20.1 ***Correction of Work Prior to Final Payment.*** The Contractor shall promptly correct Work which is rejected by the Architect as failing to conform to the requirements of the Contract Documents. Such correction shall be required regardless of whether or not the nonconformities are observed before or after Substantial Completion, or whether or not the work has been fully fabricated, installed or completed.

'20.2 ***Correction of Work After Final Payment.*** Neither the Final Certificate of payment nor any provisions in the Contract Documents shall relieve the Contractor of responsibility for failure to conform to the requirements of the Contract Documents. If within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct is promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. This period of one year shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of the Work. This obligation under this paragraph shall survive acceptance of the Work under the Contract and termination of the Contract. The Owner shall give such notice promptly after discovery of the conditions.

'20.3 ***Responsibility for Related Costs.*** In addition to being responsible for correcting the Work and removing any nonconforming Work or materials which are not corrected from the jobsite, the Contractor shall bear all other costs of bringing the affected Work into compliance with the Contract Documents. These include costs of any required additional testing and inspection services, Architect's services, and any resulting damages to property or to construction Work of other contractors or of the Owner.

'20.4 ***Correction by Owner.*** If the Contractor fails to correct nonconforming Work within a reasonable time, the Owner may take steps to correct the Work itself. If, within a ten (10) day period after receipt of written notice to correct the nonconformity, the Contractor has not made serious efforts to correct the nonconformity, the Owner may without prejudice to any other remedies it may have, proceed to correct the non-conforming Work. In such cases a Change Order shall be issued by the Owner with the approval of the Architect reflecting an equitable deduction from the Contract Sum to cover the cost of correcting the Work, including compensation for the Architect's additional services and other related expenses and damages. The amount of the Change Order shall be deducted from payments then or thereafter due the Contractor. If final payment has already been made, the Contractor shall pay the difference.

'20.5 ***Ongoing Liability of Contractor for Defective Work.*** The foregoing provisions establishing the specific obligation of the Contractor to perform corrective Work do not establish a period of limitations on other obligations of the Contractor under the Contract Documents. Even after the Contractor is no longer specifically obligated to perform corrective Work itself, it shall still be held liable for nonconforming Work and for other breaches of its obligations under the Contract Documents.

'20.6 Deduction for Uncorrected Work. If the Owner deems it not expedient to correct Work which is not in accordance with the requirements of the Contract Documents, an appropriate Change Order shall be issued by the Owner with the approval of the Architect reflecting an equitable deduction from the Contract Sum on account of the uncorrected Work. The amount of the Change Order shall be deducted from payments then or thereafter due the Contractor. If final payment has already been made, the Contractor shall be responsible for paying the difference to the Owner.

'21. Suspension of Work

'21.1 Suspension by the Owner. The Owner shall have the right at any time to direct the contractor to suspend its performance, or any portion thereof for a period of not more than thirty (30) calendar days. The notice of suspension shall be in writing and shall set forth the reason for the suspension. The written notice shall fix the approximate date on which Work is contemplated to be resumed. The Owner shall pay the Contractor as full compensation for such suspension the Contractor's Direct Job Expenses.

'21.2 Other Suspension. In the event the Owner should be prevented or enjoined by court order from proceeding with the Work or from authorizing its prosecution, either before or after the award, for a period up to ninety (90) days, the delay shall not constitute cause for termination by the Contractor and the Contractor shall not be entitled to make or assert claim for damage by reason of said delay, but time for completion of Work shall be extended to such reasonable time as the Owner may determine will compensate for time lost by such delay. Such determination shall be set forth in a Change Order shall be final and binding upon both parties, and shall not require the signature of the Contractor to be in effect.

The Owner shall pay the Contractor as full compensation for such suspension the Contractor's reasonable costs actually incurred and paid as follows:

'21.2.1 demobilization and remobilization, including such costs paid to subcontractors;

'21.2.2 preserving and protecting work in place;

'21.2.3 storage of materials or equipment purchased for the Project, including insurance thereon;

'21.2.4 performing in a later, or during a longer, time frame than contemplated by this Contract.

'21.3 Suspension by the Contractor. If, through no act or fault of the Contractor, the Work is suspended for a period of more than thirty (30) days by the Owner, or more than ninety (90) days under an Order of the Court or other public authority, then the Contractor may, after ten (10) days from delivery of a written notice to the Owner and the Architect, terminate the Contract and recover from the Owner payment for all Work executed and reasonable expenses sustained. If the Architect has failed to act on a request for payment, within thirty (30) working days of submission, or if the Owner has failed to make any payment, within forty-five (45) working days of receipt of an approval application for payment, the Contractor may, upon ten (10) days written notice to the Owner and the Architect stop the Work until he has been paid all amounts then due, in which event and upon resumption of the Work, a Change Order shall be issued adjusting the Contract Price or extending the Contract Completion Time, or both, to compensate for the costs and delays attributable to the stoppage of the work, any such compensation being subject to the provisions, conditions and limitations contained in Article 26.

'22. Termination

'22.1 Termination of Contract for Convenience of Owner. The Owner, for any reason whatsoever, may terminate the Contract for its own convenience when it determines that such termination will be in the best interest of the Commonwealth of Kentucky. The Owner shall give written notice of such termination to the Contractor specifying when termination becomes effective. The Contractor shall incur no further obligations in connection with the Work and the Contractor shall stop Work when such termination becomes effective. The Contractor shall also terminate outstanding orders and subcontracts. The Contractor shall settle the liabilities and claims arising out of the termination of Subcontracts and orders. The Owner may direct the Contractor to assign the Contractor's right, title and interest under termination orders or subcontracts to the Owner or its designee. The Contractor shall transfer title and deliver to the Owner such completed or partially completed

Work and materials, equipment, parts, fixtures, information and Contract rights as the Contractor has. The Commonwealth shall negotiate a fair and just settlement with the Contractor in accordance with 200 KAR 5:312 Section 2. In such event, the following procedure shall be required:

- '22.1.1 The Contractor shall submit a termination claim to the Owner and the Architect specifying the amounts due because of the termination for convenience together with costs, pricing or other data required by the Owner or the Architect. If the Contractor fails to file a termination claim within one (1) year from the effective date of termination, the Owner shall pay the Contractor, an amount derived in accordance with paragraph (3) below;
- '22.1.2 The Owner and the Contractor may agree to the compensation, if any, due to the Contractor hereunder pursuant to 200 KAR 5:312 Section 2;
- '22.1.3 Absent agreement to the amount due to the Contractor, the Owner shall pay the Contractor the following amounts:
 - '22.1.3.1 Contract prices for labor, materials, equipment and other services accepted under this Contract;
 - '22.1.3.2 Reasonable costs incurred in preparing to perform and in performing the terminated portion of the Work and in terminating the Contractor's performance, plus a fair and reasonable allowance for direct jobsite overhead and profit thereon (such profit shall not include anticipated profit or consequential damages); provided however, that if it appears that the Contractor would have not profited or would have sustained a loss if the entire Contract would have been completed, no profit shall be allowed or included and the amount of compensation shall be reduced to reflect the anticipated rate of loss, if any;
 - '22.1.3.3 Reasonable costs of settling and paying claims arising out of the termination of subcontracts or orders pursuant to the initial Paragraph of 22.1. These costs shall not include amounts paid in accordance with other provisions hereof.

The total sum to be paid the Contractor under 22.1 shall not exceed the total Contract Sum, as properly adjusted, reduced by the amount of payments otherwise made, and shall in no event include duplication of payment.

'22.2 **Termination of Contract for Cause.** If the Contractor should be adjudged as bankrupt, or if he should make a general assignment for the benefit of his creditors, or if a receiver should be appointed on account of his insolvency or, if the Contractor does not perform the Work, or any part thereof, in a timely manner, supply adequate labor, supervisory personnel or proper equipment or materials, or if it fails to timely discharge its obligations for labor, equipment and materials, or proceeds to disobey applicable law, or otherwise commits a violation of a material provision of the resulting Contract, then the Owner, in addition to any other rights it may have against the Contractor or others, may terminate the performance of the Contractor upon ten (10) days written notice by registered mail of declaration of default and assume possession of the Project site and of all materials and equipment at the site and may complete the Work. In such case, the Contractor shall not be paid further until the Work is complete. After final completion has been achieved, if any portion of the Contract Sum, as it may be modified hereunder, remains after the cost to the Owner of completing the Work, including all costs and expenses of every nature incurred, has been deducted by the Owner, such remainder shall belong to the Contractor. Otherwise, the Contractor shall pay and make whole the Owner for such cost. This obligation for payment shall survive the termination of the Contract. In the event the employment of the Contractor is terminated by the Owner for cause pursuant to this Paragraph 22.2 and it is subsequently determined by a Court of competent jurisdiction that such termination was without cause, such termination shall thereupon be deemed a Termination for Convenience under Paragraph 22.1 and the provisions of Paragraph 22.1 shall apply.

'23. **Indemnification** The Contractor shall indemnify and hold the Owner harmless from any and all claims, liability, damage, loss, cost and expense of every type whatsoever, regardless of whether such liability, claim, damage, loss, cost or expense is caused in part by the Owner, including, without limitation, attorneys' fees and expenses, in connection with the Contractor's performance of this Contract, provided that such claims, liability, damage, loss, cost or

expense is due to sickness, personal injury, disease or death, or to loss or destruction of tangible property (other than the Work itself), including loss of use resulting therefrom, to the extent caused by the Contractor, or anyone for whose acts the Contractor may be liable.

24. Insurance

24.1 The Contractor shall furnish the Owner with certificates evidencing the required insurance coverage prior to commencing work. Contractor shall keep up-to-date copies of such certificates on file with Owner until work is completed. Owner may require Contractor to submit policy endorsements or complete policy copies of the required insurance.

24.2 Contractor shall procure and maintain for the duration of the contract insurance against claims for injuries to persons or damages to property which may arise from or in connection with the performance of the work hereunder by Contractor, its agents, representatives, employees or subcontractors.

24.3 Minimum Scope of Insurance

Coverage shall be at least as broad as:

24.3.1 Insurance Services Office commercial general liability coverage (“occurrence” Form CG 0001, Ed. 10/93).

24.3.2 Insurance Services Office Form CA 0001 (Ed. 12/93) covering automobile liability, Code 1 “any auto.”

24.3.3 Workers’ compensation insurance as required by the Workers’ Compensation Act (as contained in KRS Chapter 342) and employers liability insurance.

24.4 Minimum Limits of Insurance

Contractor shall maintain limits no less than:

24.4.1 Commercial General Liability:

\$1,000,000 combined single limit per occurrence for bodily injury, personal injury and property damage with a \$3,000,000 annual aggregate. The deductible or Self-Insured Retention per occurrence shall not be more than \$10,000.

24.4.2 Automobile Liability: \$500,000 combined single limit per accident for bodily injury and property damage.

24.4.3 Workers’ Compensation and Employers Liability: Workers’ compensation with statutory benefits without limit, as required by the Kentucky Workers Compensation Act, and employers liability limits of \$1,000,000 per accident.

24.5 Other Insurance Provisions

The policies are to contain, or be endorsed to contain, the following provisions:

24.5.1 Commercial General Liability and Automobile Liability Coverage

24.5.1.1 Owner, its officers and employees are to be covered as insured as respects: liability arising out of activities performed by or on behalf of the Contractor; general supervision of the work by Owner; products and completed operations of the Contractor; premises owned, occupied or used by the Contractor, or automobiles owned, leased, hired or borrowed by the Contractor. The coverage shall contain no special limitations on the scope of protection afforded to Owner, its officers or employees.

24.5.1.2 The Contractor’s insurance coverage shall be primary insurance as respects Owner, its officers and employees. Any insurance of self-insurance maintained by Owner shall be excess of the Contractor’s insurance and shall not contribute to it.

24.5.1.3 Any failure to comply with reporting provisions of the policies shall not affect coverage provided to Owner, its officers or employees.

24.5.1.4 The Contractor’s insurance shall apply separately to each insured against whom claim is made or suit is brought except with respect to the limits of the insurer’s liability.

24.5.2 All Coverages. Each insurance policy required by this clause shall be endorsed to state

that coverage shall not be suspended, voided, canceled by either party, reduced in coverage or in limits except after thirty (30) days' prior written notice by certified mail, return receipt requested, has been given to Owner.

'24.6 Acceptability of Insurers

Insurance is to be placed with insurers with an A.M. Best's rating of no less than A VII, authorized to write insurance in the Commonwealth of Kentucky.

'24.7 Verification of Coverage

The Contractor shall furnish the Owner with certificates evidencing the required insurance coverage prior to commencing work. Contractor shall keep up-to-date copies of such certificates on file with Owner until work is completed. Owner may require Contractor to submit policy endorsements or complete policy copies of the required insurance.

'24.8 Subcontractors

Contractor shall include all subcontractors as insureds under its policies or shall furnish separate certificates and endorsements for each subcontractor. All coverage's for subcontractors shall be subject to all of the requirements stated herein.

'24.9 The Contractor shall provide all Risks Insurance in an amount of not less than one hundred percent (100%) of the insurable value of all the work. The coverage, is to be written on CP 00 20 06 95 or equivalent acceptable to the Commonwealth. All coinsurance clauses in the Risks Insurance policy will be waived. All rights of subrogation against the Owner (i.e. the Commonwealth) will be waived by the insurer. Such insurance shall be for the benefit of the Contractor, Owner and any Subcontractor engaged on this project, as the Owner shall find their respective interest may appear. The Risks Insurance must be dated and in force on the date indicated in the Contract to begin work.

'24.10 The insurance coverage required by the contract documents shall be in compliance with the laws of the Commonwealth of Kentucky and shall be placed with a licensed resident or non-resident agent who represents insurance companies authorized to do business in Kentucky.

'24.11 The Certificate of Insurance or Certificates of Insurance will have the following endorsements as an attachment to the Certificate or Certificate's.

'24.11.2 The Commonwealth of Kentucky, Division of Engineering and Contract Administration will be named as an additional insured.

'24.11.3 The policy is primary coverage and any insurance or self-insurance maintained by the Commonwealth of Kentucky shall be excess.

'24.11.4 Any failure of the named insured to comply with the reporting provisions of the policy shall not affect coverage provided to the Commonwealth of Kentucky, it's officers or employees.

'24.11.5 All Coverages. Each insurance policy required by this clause shall be endorsed to state that coverage shall not be suspended, voided, cancelled by either party, reduced in coverage or in limits except after thirty (30) days' prior written notice by certified mail, return receipt requested, has been given to Owner.

'25. Performance and Payment Bonds The Contractor shall furnish separate performance and payment bonds to the Owner. The Contractor shall furnish a performance bond satisfactory to the Owner in an amount equal to one hundred percent (100%) of the Contract Sum as security for the faithful performance of the Contract. The Contractor shall also furnish a payment bond satisfactory to the Owner in an amount equal to one hundred percent (100%) of the Contract Sum for the protection of all persons performing labor or furnishing materials, equipment or supplies for the Contractor or his Subcontractor for the performance of the Work provided for in the Contract, including security for payment of all unemployment contributions which become due and payable under Kentucky Unemployment Insurance Law. Each bond furnished by the Contractor shall incorporate by reference the terms of the Contract as fully as though they were set forth verbatim in such bonds. In the event the Contract Sum is adjusted by Change

Order executed by the Contractor, the penal sum of both the performance bond and the payment bond shall be deemed increased by like amount.

The performance and payment bonds shall be executed by a surety company authorized to do business in this Commonwealth, and the contract instrument of bonds must be countersigned by a duly appointed and licensed resident agent.

Unless the Project is exempt from the prevailing wage requirements of KRS 337.505-337.550, the Contractor's bond(s) shall include a provision as will guarantee the faithful performance and payment of the prevailing hourly wage as set forth in the schedule incorporated in the Contract.

'26. Claims by the Contractor/Concealed Conditions/Disputes

'26.1 Claims by the Contractor against the Owner are subject to the following:

'26.1.1 All Contractor claims against the Owner shall be initiated by a written claim submitted to the Owner and the Architect. Such claim shall be filed with the Owner and the Architect no later than seven (7) calendar days after the event, or the first appearance of the circumstances, causing the claim, and same shall set forth in detail all known facts and circumstances supporting the claim;

'26.1.2 The Contractor and the Owner shall continue their performance regardless of the existence of any claims submitted by the Contractor.

'26.1.3 In the event the Contractor discovers previously concealed and unknown site conditions which differ materially from those indicated in the Contract Documents, or unknown site conditions which are materially at variance from those typically and ordinarily encountered in the general geographical location of the Project, the Contract Sum shall be modified, either upward or downward, upon the written claim made by either party within seven (7) calendar days after the first appearance to such party of the circumstances. As a condition precedent to the Owner having any liability to the Contractor due to concealed and unknown conditions, the Contractor must give the Owner and the Architect written notice of, and an opportunity to observe, such condition prior to disturbing it. The failure by the Contractor to give the written notice and make the claim as provided by this paragraph shall constitute a waiver by the Contractor of any rights arising out of or relating to such concealed and unknown condition;

'26.1.4 In the event the Contractor seeks to make a claim for an increase in the Contract Sum, as a condition precedent to any liability of the Owner therefore, the Contractor shall strictly comply with the requirements of the first paragraph of this Article and such claim shall be made by the Contractor before proceeding to execute any additional or changed Work. Failure of the condition precedent to occur shall constitute a waiver by the Contractor of any claim for additional compensation;

'26.1.5 In connection with any claim by the Contractor against the Owner for compensation in excess of the Contract Sum, any liability of the Owner for the Contractor's cost shall be strictly limited to direct cost incurred by the Contractor and shall in no event include indirect cost or consequential damages of the Contractor.

'26.1.6 The Owner shall not be liable to the Contractor for claims of third-parties including subcontractors, unless and until liability of the Contractor has been established therefore in a court of competent jurisdiction;

'26.2 In the event the Contractor should be delayed in performing any task which at the time of the delay is then critical, or which during the delay becomes critical, as the sole result of any act or omission by the Owner or someone acting in the Owner's behalf, or by Owner-authorized Change Orders, unusually bad weather not reasonably anticipatable, fire or other Acts of God, the date for achieving Substantial Completion, or, as applicable, final completion, shall be appropriately adjusted by the Owner upon the written claim of the Contractor to the Owner and the Architect. An extension of time shall not mean that the Contractor is entitled to additional compensation. A task is critical within the meaning of this paragraph if, and only if, said task is on the critical path of the Project schedule so that a delay in performing such task will delay the ultimate completion of the Project. Any claim for an extension of time by the Contractor shall strictly comply with the

requirements of the first paragraph of this Article above. If the Contractor fails to make such claim as required in this paragraph, any claim for an extension of time shall be waived.

'26.3 All claims under this Contract shall be made in accordance with KRS 45A.225 to 45A.290. The provisions of these statutes do not toll the running of the Statute of Limitations set forth in KRS 45A.260. Any suit pursuant to KRS 45A.245 shall be commenced within one (1) year of the Substantial Completion Date specified in the Contract. If the Contractor does not commence suit within one (1) year of the date specified in the Contract, the Contractor shall be foreclosed from proceeding in court pursuant to KRS 45A.245.

The Owner and Contractor agree that any suit, action or proceeding with respect to this Contract may only be brought in or entered by the courts of the Commonwealth of Kentucky situated in Frankfort, Franklin County, Kentucky, or the United States District Court for the Eastern District of Kentucky, Frankfort Division, and the parties hereby submit to the non-exclusive jurisdiction of such courts for the purpose of any such suit, action, proceeding or judgment and waive any other preferential jurisdiction by reason of domicile or location. The parties hereby agree that any such legal action shall be tried by the court sitting without a jury. The parties hereby irrevocably waive any objection that they may now or hereafter have to the laying of venue of any suit, action or proceeding arising out of or related to this Contract brought in the courts of the Commonwealth of Kentucky situated in Frankfort, Franklin County, Kentucky, or the United States District Court for the Eastern District of Kentucky, Frankfort Division, and also hereby irrevocably waive any claim that any such suit, action or proceeding brought in any one of the above-described courts has been brought in an inconvenient forum.

'27 Liens The filing and perfection of liens for labor, materials, supplies and rental equipment supplied on the work are governed by KRS 376.195 to 376.260. The lien shall attach only to any unpaid balance or retainage due the Contractor for the improvement from the time a copy of statement of lien, attested by the County Clerk, is delivered to the Owner, pursuant to the provisions of KRS 376.240 Statements of lien shall be filed with the Franklin County Clerk and action to enforce the same must be instituted in the Franklin Circuit Court, Frankfort, Kentucky, pursuant to KRS 376.250(2).

'28 Assignments Neither party to the Contract shall assign the Contract, or any portion thereof without the written consent of the other, nor shall the Contractor assign any monies due or to become due to him hereunder without notification to the Owner. Notification of Assignments, shall be given on State forms and in accordance with the procedures and regulations of the Finance and Administration Cabinet.

'29 Separate Contracts

'29.1 *Owner's Right to Perform Construction and to Award Separate Contracts.* The Owner reserves the right to let other contracts in connection with the Project or to perform Work with its own forces. The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their Work and shall properly connect and coordinate his Work with theirs. If any part of the Contractor's Work depends for proper execution or results upon the Work of any other contractor, the Contractor shall promptly report to the Architect any observed defects in such Work that render it unsuitable for proper execution or connection. His failure to inspect and report shall constitute an acceptance of the other contractor's Work as fit and proper for the reception of his Work, except as to defects which may develop in the other contractor's Work after the execution of his Work.

Whenever Work being done by the Owner's forces or by other contractors is contiguous to Work covered by this Contract, the respective rights of the various interests involved shall be established by the Architect to secure the completion of the various portions of the Work in general harmony.

'29.2 *Mutual Responsibility of Contractors.* Should the Contractor cause damage to any separate contractor on the Work, the Contractor agrees, upon due notice, to settle with such contractor if he

will so settle. If such separate contractor sues the Owner on account of any damage alleged to have been so sustained, the Owner shall notify the Contractor who shall defend such proceedings at the Contractor's expense and if any judgment against the Owner arises therefrom, the Contractor shall pay or satisfy it and pay all costs incurred by the Owner.

'30 **Cash Allowances** The Contractor shall have included in the Contract Sum all allowances stated in the Contract Documents and shall cause the Work so designated to be done as the Owner may direct. If the actual price for purchasing the "allowed material" is more or less than the "cash allowance," the Contract Sum shall be adjusted accordingly. The adjustment in Contract Sum shall be made on the basis of the purchase price without additional charges for overhead, profit, insurance or any other incidental expenses. The cost of installation of the "allowed materials" shall be included in the applicable sections of the Contract specifications covering this Work.

'31. **Miscellaneous Provisions Regarding Contractor's Work**

'31.1 ***Project Site Limits.*** The Contractor shall confine his apparatus, the storage of materials, and the operations of his workmen to Project site limits indicated by the Contract Documents.

'31.2 ***Points of Reference.*** The Contractor shall carefully preserve bench marks, reference points and stakes, and in case of willful or careless destruction, he shall be charged with the resulting expense of replacement and shall be responsible for any mistake that may be caused by their unnecessary loss or disturbance.

'31.3 ***Cutting and Patching.*** The Contractor shall be responsible for cutting, fitting or patching required to complete the Project or make its parts fit together in a proper manner. The Contractor shall not endanger other parts of the Project, including work by the Owner or other contractors as provided in Article 29, by cutting, patching, or excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a separate contractor without written consent of the Owner or such separate contractor. Such consent shall not be unreasonably withheld.

'31.4 ***Cleanup.*** The Contractor shall at all times keep the Project premises and surrounding area free from the accumulation of waste materials or rubbish caused by his operations in connection with the Project. Upon completion of the Work, and prior to final inspection and acceptance, the Contractor shall remove all remaining waste materials, rubbish, Contractor's construction equipment, tools, machinery, and surplus materials and leave the Project (including but not limited to glass, hardware, fixtures, masonry, tile and marble) in a clean and usable condition satisfactory to the Architect. Floors shall be cleaned and waxed in accordance with the requirements of the Contract specifications. If the Contractor fails to clean up as provided in the Contract Documents, the Owner may perform the cleaning tasks and charge the cost to the Contractor.

'31.5 ***Guarantees, Warranties and "As-Built" Drawings.*** Prior to final payment for the Work, the Contractor shall assemble and present to the Architect all guarantees and warranties required by the Contract Documents. Additionally the Contractor shall provide "Record" Drawings prior to final payment.

'32 **Other Miscellaneous Provisions**

'32.1 ***Governing Law.*** The Contract shall be governed by the laws of the Commonwealth of Kentucky.

'32.2 ***Statutory Limitation Periods.*** Statutes of Limitations are governed by KRS 45A.260(2).

'32.3 ***Written Notice.*** Written notice shall be deemed to have been given if delivered in person to the individual or to a member of the organization or entity or to an officer of the corporation for which it was intended, or if delivered at or sent by registered or certified mail to the last known business address known to the notifying party.

'33 Prevailing Wage Law Requirements

Compliance Required on Covered Projects. In performing the Work, the Contractor and Subcontractors are required to comply with all provisions of the "Act Relating to Contracts for Public Work," KRS 337.505-337.550, except where the Contract meets the exemption requirements for certain public works construction projects as set forth under KRS 337.010 and detailed at the following site:

'33.1 Prevailing Wage The term "prevailing wage" for each classification of laborers, workmen, and mechanics engaged in the construction of public works within the Commonwealth of Kentucky, means the sum of:

- (1) Base rate The basic hourly rate paid or being paid subsequent to the labor commissioner's most recent wage determination to the majority of laborers, workmen, and mechanics employed in each classification of construction upon reasonably comparable construction in the locality where the work is to be performed.
- (2) Fringe rate An additional amount per hour equal to the hourly rate of contribution **irrevocably made or to be made by an employer on behalf of employees within each classification of construction to a trustee or to a third person** pursuant to an enforceable commitment to carry out a financially responsible plan or program, which was communicated in writing to the employees affected, for the following fringe benefits.
 - (a) medical or hospital care
 - (b) pensions on retirement
 - (c) death compensation for injuries or illness resulting from occupational activity
 - (d) life insurance
 - (e) defraying costs of apprenticeship or other similar programs
 - (f) cash; the employer may pay an additional amount per hour to the employee in cash or partly in cash and partly by contributions.

Fringe does not include costs associated with programs or taxes required by federal state or local law such as workers' compensation or unemployment insurance tax. Accidental, disability or sickness insurance may be considered a fringe if paid under the conditions as stated in bold letters above. Fringe does not include costs associated with vacation and holiday unless paid as stipulated above in bold lettering or if paid in the form of cash as indicated in stated in (f).

'33.2 Requirement To Pay Prevailing Wages 1. Where a prevailing rate of wages has been determined and prescribed, the contract executed between a public authority and the successful bidder or contractor shall contain a provision requiring the successful bidder and all of his subcontractors to pay not less than the rate of wages so established. The successful bidder or contractor and all subcontractors shall strictly comply with these provisions of the contract. 2. All contractors and subcontractors required by KRS 337.505 to 337.550 and by contracts with any public authority to pay not less than the prevailing rate of wages, shall pay such wages in legal tender without any deductions.

'33.3 Overtime Any laborer, workman, or mechanic worked in excess of eight (8) hours per day or forty (40) hours per week, except in cases of emergency shall be paid not less than one and one-half (1-1/2) times the basic hourly rate of pay as defined and fixed under this chapter for all overtime worked. This shall not prohibit any laborer, workman, or mechanic from working more than eight (8) hours in one (1) calendar day, but not more than ten (10) hours in one (1) calendar day where the employee and employer enter into an agreement in writing prior to the working of any one (1) day in excess of eight (8) hours, or where provided for in a collective bargaining agreement.

'33.4 Payroll Records All contractors and subcontractors affected by the terms of KRS 337.505 to 337.550 shall keep full and accurate payroll records covering all disbursements of wages to their employees to whom they are required to pay not less than the prevailing rate of wages. The recordkeeping requirement is: 1. Hours worked each day by each employee 2. Hours worked in each classification of work by each employee 3. Amount paid each employee for his work in each classification. They shall be open to the inspection and transcript of the commissioner or his authorized representative at any reasonable time, and shall be in compliance with all regulations issued by the commissioner. These payroll records shall not be destroyed or removed from this state for one (1) year following the completion of the improvement in connection with which they

are made. This recordkeeping requirement is in addition to the requirement as provided by KRS 337.320 and 803 KAR 1:066.

'**33.5 Posting Of Rates** Each contractor and subcontractor subject to the provisions of KRS 337.505 to 337.550 shall post and keep posted in a conspicuous place at the site of the construction work, a copy of the applicable prevailing wage rates for each and every classification involved in the construction of the public works.

'**33.6 Inspections** Every employer shall permit the commissioner or his authorized agents to question any of his employees at the site of the public work and during work hours in respect to the wages paid, hours worked and duties of such employee or other employees.

'**34. Apprentices** Apprentices (for all classifications of work) shall be permitted to work only under an apprenticeship agreement approved by the Kentucky Supervisor of Apprenticeship and by the Kentucky Apprenticeship Council which is recognized by the Bureau of Apprenticeship and Training, U. S. Department of Labor.

'**35. Nondiscrimination in Employment**

During the performance of the Contract, the Contractor agrees as follows:

'**35.1** The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, age, national origin, or disability in employment.

'**35.2** The Contractor will take affirmative action in regard to employment, upgrading, demotion, transfer, recruitment, recruitment advertising, layoff, termination, rates of pay or other forms of compensation, and selection for training, so as to ensure that applicants are employed and that employees during employment are treated without regard to their race, color, religion, sex, age, or national origin; however, when layoffs occur, employees shall be laid off according to seniority with the youngest employees being laid off first. When employees are recalled, this shall be done in the reverse way the employees were laid off;

'**35.3** The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, age, or national origin;

'**35.4** The Contractor will post notices in conspicuous places, available to employees and applicants for employment, setting forth the provisions of the nondiscrimination clauses required by this section;

'**35.4** The Contractor shall send to each labor union or representatives of workers with which he has a collective bargaining agreement or other contract or understanding, a notice advising the labor union or workers' representatives of the Contractor's commitments under this section. Failure to comply with the above nondiscrimination clause constitutes material breach of Contract.

'**36 Affirmative Action; Reporting Requirements**

'**36.1** The Contractor and Subcontractors are exempt from any affirmative action or reporting requirements, under the Kentucky Equal Employment Act of 1978, KRS 45.560 to 45.640 hereinafter referred to as The Act, if any of the following conditions are applicable:

- (1) the Contract or subcontract awarded is in the amount of five hundred thousand dollars (\$500,000) or less, and the amount of the contract is not a subterfuge to avoid compliance with the provisions of The Act; or
- (2) the Contractor or Subcontractor utilizes the services of fewer than eight (8) employees during the course of the Contract ; or
- (3) the Contractor or subcontractor employs only family members or relatives; or
- (4) the Contractor or Subcontractor employs only persons having a direct Ownership interest in the business and such interest in not a subterfuge to avoid compliance with the provisions of

The Act.

'36.2 The Contractor or Subcontractor not otherwise exempted shall for the duration of the Contract, hire minorities from within the drawing area to satisfy the agreed upon goals and timetables set out in addenda to the Contract. Should the union with which the Contractor has collective bargaining agreements be unwilling to provide sufficient minorities to satisfy the goals and timetables, the Contractor shall hire minorities from other sources within the drawing area to satisfy the goals and timetables in the addenda to the Contract.

'36.3 The equal employment provisions of The Act may be met in part by the Contractor subcontracting to a minority contractor or subcontractor. A minority contractor or subcontractor shall be defined by the addenda to this Contract, or if none, by the Act.

'36.4 Each Contractor shall, for the length of the Contract, furnish such information as required by The Act and by such rules, regulations and orders issued pursuant thereto and will permit access to all books and records pertaining to his employment practices and work sites by the contracting agency and the department for purposes of investigation to ascertain compliance with The Act and such rules, regulations and orders issued pursuant thereto.

'36.5 If the Contractor is found to have committed an unlawful practice against a provision of The Act during the course of performing under this Contract, (if covered by The Act), the Owner may cancel or terminate the Contract, conditioned upon a program for future compliance approved by the Owner. The Owner may also declare such Contractor ineligible to bid on further contracts until such time as the Contractor complies in full with the requirements of The Act.

'36.6 The Contractor shall not be required to terminate an existing employee, upon proof that employee was employed prior to the date of the Contract nor hire anyone who fails to demonstrate the minimum skills required to perform a particular job.

'37 Access to Records The contractor, as defined in KRS 45A.030(7), agrees that the contracting agency, the Finance and Administration Cabinet, the Auditor of Public Accounts, and the Legislative Research Commission, or their duly authorized representatives, shall have access to any books, documents, papers, records, or other evidence, which are directly pertinent to this contract for the purpose of financial audit or program review. Furthermore, any books, documents, papers, records, or other evidence provided to the contracting agency, the Finance and Administration Cabinet, the Auditor of Public Accounts, or the Legislative Research Commission which are directly pertinent to the contract shall be subject to public disclosure regardless of the proprietary nature of the information, unless specific information is identified and exempted and agreed to by the Secretary of the Finance and Administration Cabinet as meeting the provisions of KRS 61.878(1)(c) prior to the execution of the contract. The Secretary of the Finance and Administration Cabinet shall not restrict the public release of any information which would otherwise be subject to public release if a state government agency was providing the service. (22 Ky.R. 1510; eff. 5-16-96.)