

PART V

CONSTRUCTION SPECIFICATIONS & STANDARD DETAILS

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SECTION 01070

ABBREVIATIONS

PART 1 - GENERAL

1.1 Wherever used in these specifications the following abbreviations shall have the meanings indicated:

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturers Association
AASHTO	American Association of State Highway & Transportation Officials
AFBMA	Antifriction Bearing Manufacturers Association
AGMS	American Gear Manufacturers Association
AIA	American Institute of Architects
AIMA	Acoustical and Insulating Materials Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigeration & Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BUR	Built-up Roofing
CFM	Cubic feet per minute
CISPI	Cast Iron Soil Pipe Institute

CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standard
DWV	Drain, waste and vent
EI	Edison Electric Institute
EXH	Exhaust
FM	Factory Mutual System
FRP	Fiberglass reinforced plastic
FS	Federal Specifications
IBBM	Iron Body, Bronze Mounted
IEEE	Institute of Electrical and Electronics Engineers
IFI	Industrial Fasteners Institute
ISA	Institute Society of America
MCC	Motor Control Center
MCIP	Motor Control Instrument Panel
MIL	U.S. Military Specifications
MSL	Mean Sea Level
MSS	Manufacturer's Standardization Society of the Valves and Fittings
NAAMM	National Association of Architectural Metal Manufacturers
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NPT	National Pipe Thread
NRS	Non-Rising Stem
NWMA	National Woodwork Manufacturers Association
RIS	Redwood Inspection Services
RPM	Revolutions per minute

SDI	Steel Door Institute and Steel Deck Institute, as applicable
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SSPC	Steel Structures Painting Council
TCA	Tile Council of America
TFE	Teflon
UBC	Uniform Building Code
UL	Underwriters Laboratories
UPC	Uniform Plumbing Code
WCLIB	West Coast Lumber Inspection Bureau
WWPA	Western Wood Products Association

END OF SECTION

SECTION 01340

SHOP DRAWINGS, SAMPLES AND OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 General

- A. This section covers the submittal and review of Shop Drawings, Samples and Operation and Maintenance Manuals.
- B. Submittals may only be required when requesting a variance from the Town's criteria. Consult with the Town to determine what submittals will be necessary.

1.2 Submittal Requirements

- A. Submit Shop Drawings, Samples, Operation and Maintenance Manuals and other submittals as required by individual specification sections or when requested by the Town.
 - 1. The Town will not accept Shop Drawings or other submittals from anyone but the Contractor or the contractor's engineer.
- B. Do not submit operation and maintenance data with Shop Drawings unless so specified or required by the Town to determine if equipment will comply with the requirements of the Town.
- C. Identify in writing all deviations of submittal from the approved drawings.
- D. Unless otherwise specified, make all submittals in groups containing all associated items to insure that information is available for checking each item when it is reviewed. Partial submittals may be rejected as not complying with these specifications.
- E. Submit the information identified by the code symbol in the individual specification sections or if not so identified submit the appropriate information outlined below required to define each item proposed to be furnished. The information to be submitted for each code symbol is defined on the following page:

LEGEND

DATA REFERENCE SYMBOLS AND DESCRIPTIONS

SymbolDescription

A	Letters of Certification of Compliance on materials, equipment, etc.
B	Samples
C	Final Certified drawings showing outline dimensions, foundation layout or mounting information, and other pertinent dimensions.
D	Field erection instructions, assembly drawings and/or diagrams detail reference drawings lists, and lists of erection details.
E	Shop detail drawings showing individual subassemblies and fabricated pieces, with material specifications and other applicable data.
F	Installation instructions, operating and maintenance manuals and all other data pertinent to operating or servicing the complete apparatus. Preventive maintenance instructions and recommended frequency.
G	Schematic diagrams of power, control and piping system.
H	General bulletins and catalog cuts describing complete apparatus including operating principles and fundamentals.
I	Service data sheets showing design performance, utility requirements, etc., as applicable to the specific duty for which the equipment is furnished.
J	Head capacity curves for pumps. Impeller size furnished and maximum size available shall be noted on these data.
K	Curves and/or data for over-all range of operation from minimum to maximum capacity or load, showing capacity or load, utilities motive medium required, total or incremental differential head, and other pertinent information applicable to the equipment or its component assemblies.
L	Materials of construction of all components.
M	Renewal parts list with diagrammatic or cross-section drawings showing part identification. Material analysis or trades designation for each significant part is to be noted on parts lists or on a separate sheet.
N	Stuffing box sizes; packing sizes, specifications and arrangement; and mechanical seal details, specifications, etc., if furnished in equipment.

- O Bearing manufacturer's standard identification and/or interchangeable number for all antifriction bearings in the equipment proper and its accessory items.
 - P Material gradation, design mix, job mix formula and/or material analysis.
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F. Minimum Number Required:

1. Shop Drawings:
 - a. Number Contractor requires plus three (3) copies which will be retained by the Town, five (5) copies minimum.
 - b. Submit four (4) additional copies for inclusion in Operation and Maintenance manuals where Operation and Maintenance manuals are called for. Where field modifications are made after acceptance, indicate "as constructed" conditions, mark copies "AS CONSTRUCTED", and submit prior to Substantial Completion.
2. Samples: Two (2) unless required otherwise by individual specification sections.
3. Operation and Maintenance Manuals: The number required by Contractor plus four (4) copies to the Town.

1.3 Resubmittal Requirements

- A. Make corrections or changes required by the Town and re-submit as specified in paragraph 1.2 above until acceptable.
- B. Identify in writing, all revisions other than those called for by the Town on previous submissions.

1.4 Shop Drawings

- A. Include the following pertinent information for each submittal.
 1. Field dimensions, clearly identified as such.
 2. Applicable standards, such as ASTM or Federal Specification numbers.
 3. Motors: include horsepower, voltage, temperature rating, service factor, full load current, full load rotative speed, power factor at full load, efficiency at full load, code letter, and design letter.
 4. Color charts and similar items.
- B. Manufacturer's standard drawings, schematics and diagrams:
 1. Clearly mark each copy to identify pertinent products and models and to describe exactly which parts of the drawings apply to the equipment being furnished.
 2. Delete information not applicable to the Work.
- C. Reproductions or copies of portions of Contract Documents are not acceptable as complete fabrication or erection drawings. However, they may be used as a drawing upon which to indicate information on erection or to identify detail drawings.

D. Format:

1. Minimum sheet size: 8½ x 10"
2. Identify each submission with the following:
 - a. Date of submission.
 - b. Project title and number.
 - c. Names of Contractor, Supplier, and Manufacturer.
 - d. Specification section number, intended use of item in the work and equipment designation.
 - e. Identify details by reference to sheet, detail, schedule or room numbers shown in the specifications.
 - f. Deviations from specifications.
 - g. Revisions on resubmittals.
 - h. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the Town.
 - i. Provide a clear space approximately 3½" x 2½" for the Town's stamp.

1.5 Samples

- A. Samples shall be of sufficient size and quantity to clearly illustrate the functional characteristics of the product, with integrally related parts and attachment devices and the full range of color, texture, and pattern.

1.6 Operation and Maintenance Manuals

- A. Submit operation and maintenance manuals by the time the Work is 50% complete for all equipment so designated in the individual Specification Sections and for which the Shop Drawings have been reviewed and marked "No Exceptions Taken" or "Make Corrections Noted." In addition, submit instruction books and other pertinent information for equipment not so designated which requires special instruction or knowledge for proper operation and maintenance.
- B. Submit operation and maintenance manual for equipment by the time Work is 90% complete.
- C. Do not start or operate equipment until the respective operation and maintenance data has been reviewed, approved and copies made available at the site.
- D. The operation and maintenance manuals shall be in addition to instructions or parts lists packed with or attached to equipment when delivered.
- E. Include as a minimum the following information:
1. Equipment function, normal operating characteristics, and limiting conditions complete motor data, test data and performance curves where applicable.
 2. Operating instructions for start-up, routine and normal operations, regulations and control, shutdown, and emergency conditions.

3. Lubrication and routine maintenance instructions.
4. Guide to "troubleshooting."
5. Parts lists, predicted life of parts subject to wear and recommended list of spare parts to be on hand.
6. Outline, cross section, and assembly drawings; engineering data; and wiring diagrams.
7. Copy of accepted or as constructed Shop Drawings.
8. Temperature control diagrams.
9. System balancing report including a description of system operation as prepared by the balancing contractor which includes a schedule of inspection and maintenance.
10. System Schematic Flow Diagrams.

F. Format:

1. Submit in a format suitable for binding in a three ring binder or a post binder.
2. Minimum sheet size: 8" x 10½"
3. Fold drawings larger than 11" x 17" and insert into individual pockets bound into the manuals.
4. Enclose sheets pages subject to frequent usage by operators in clear plastic.
5. Individually annotate standard drawings which are furnished, describe exactly which parts of the drawing apply to the equipment being furnished.
6. Identify each submission with the following:
 - a. Date of submission
 - b. Project title and number.
 - c. Names of Contractor, Supplier and Manufacturers, include telephone numbers and addresses.
 - d. Names of subcontractors with telephone numbers and addresses, contracted by Contractor for servicing and maintenance of portions of the project.
 - e. Specification section number, intended use of item in the Work, and equipment designation.
 - f. Identify details by reference to sheet detail, schedule or room numbers shown in the Contract Documents.

1.7 Review of Submittals

- A. A minimum of fourteen (14) days will be required for the Town to review each submittal or resubmittal following the receipt of all information required for review of the submittal. The Town will notify Contractor when the review time must be extended in order to correlate the submittal with other forthcoming submittals or for any other reason that prevents the Town's timely review.
- B. The Town will review submittals, affix a stamp, and initials or signature will indicate subsequent action to be taken and will return the submittals to Contractor for distribution. The review actions listed on the Town's stamp are defined on the following page:

1. No exception taken - Signifies material or equipment represented by the Submittal conforms to the design concept and complies with the information given in the Town's criteria. Contractor is to proceed with fabrication or procurement of the items and with related work.
2. Make corrections noted - Signifies material or equipment represented by the submittal conforms to the design concept, and complies with the requirements of the Town. Contractor may proceed with the work in accordance with the Town's notations.
3. Revise and resubmit - Signifies material or equipment represented by the submittal conforms with the basic design concept, however, it does not comply with the requirements of the Town. Contractor is to submit a revised submittal responsive to the notations marked on the returned submittal and to the requirements of the Town.
4. Rejected - Signifies material or equipment represented by the submittal does not conform to the design concept or comply with the requirements of the Town and is not acceptable. Contractor is to submit material or equipment responsive to the requirements of the Town.
5. Submit specified item - Signifies material or equipment represented by the submittal is not the item specified by the Town and is not to be incorporated into the work. Contractor is to submit only the material or equipment specified by the Town.

C. The Town will return the number of copies of submittals specified below depending on the action taken:

Action by the Town	No. Retained by the Town	No. Returned to Contractor	No. Required for Resubmittal
No Exception Taken	3	3	0
Make Corrections Noted	3	3	0
Revise and Submit*	1	5	6
Rejected*	1	5	6
Submit Specified Item*	1	5	6
* Only one copy of the submittals returned to the Contractor marked with these actions will be stamped annotated.			

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1 - GENERAL

1.1 Description

- A. The purpose of this section is to define the responsibilities for project staking and for performing the tests required by these specifications.

1.2 Construction Stake Out

A. General:

1. Construction stakes shall be provided by qualified, competent personnel for all construction.
2. Design Engineer shall establish all points of intersection for alignment and temporary bench marks for vertical control.
3. The grade and alignment shall be maintained by the use of suitable surveying instruments, or laser equipment operated continuously during construction.

B. Grade Stakes:

1. Sanitary sewer lines shall be staked as follows: The first hundred feet out of the manhole shall be stationed every 25'. From one hundred feet on, stationing will be every 100'. Cut sheets shall be provided indicating the percent and grade of the sewer line and cuts to the flow line of the sewer line. Sewer services shall be staked as required for each lot at a convenient offset for the Contractor, unless otherwise noted.
2. Water lines shall be staked on the center lines of the water lines, at all fittings and angle points, any other points necessary for establishing the line. Cuts will be established at all main fittings to insure proper depth of the line. Fire hydrants will be staked with 5' offset. Water services will be staked no closer than 10' on the uphill side of the sewer services in the lot, unless otherwise required by field location.

C. Survey Notes:

1. Enter all survey notes and construction stake out cut notes into bound, hard cover field books.
2. All survey data developed by the Contractor in performing the Work shall be available throughout the construction period.

1.3 Tests and Inspections

- A. The developer shall employ and the developer will pay for the services of a qualified independent testing laboratory to conduct the tests for:
 - 1. Soil compaction control as specified in Section 02221.
 - 2. Cast-in-place concrete as specified in Section 03300.
 - 3. Pavement repair and resurfacing as specified in Section 02575.
 - 4. Bacteriologic Tests as specified in Section 02710 (Appendix III).
 - 5. Bituminous concrete paving as specified in Section 02513 (Appendix II).

- B. The contractor shall conduct the following tests under the observation of and to the satisfaction of the Town:
 - 1. Pipe alignment tests.
 - 2. Sewer infiltration tests.
 - 3. Sewer exfiltration or air tests.
 - 4. Pipe deflection tests.
 - 5. Pressure and leakage tests.

1.4 Requirements for Independent Testing Laboratories

- A. Qualifications: Submit to the Town for prior approval:
 - 1. Name and address of proposed testing laboratory.
 - 2. Qualification of personnel.
 - 3. Description of facilities and equipment.
 - 3. Certificate of calibration of applicable testing equipment made by an accredited calibration agency within 12 months prior to the submittal date.

- B. Test Reports:
 - 1. Instruct the testing laboratory to submit, directly to the Town, two copies of all reports of tests or inspections made showing:
 - a. Project identification.
 - b. Date of test.
 - c. Location of test in the project.
 - d. Applicable specification section and standard for compliance.
 - e. Indication of compliance, irregularities or deficiencies.
 - f. Observations relating to compliance.
 - g. Name and signature of observer.

END OF SECTION

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 Temporary Utilities

- A. Temporary utilities for construction shall be the sole responsibility of the Contractor.

1.2 Temporary Controls

- A. Noise Control: Equip construction machinery and vehicles with practical sound and muffling devices and operate in a manner to minimize noise consistent with efficient performance of the work.
- B. Dust Control:
1. Take reasonable measures to prevent unnecessary dust.
 2. Moisten dirt roads used for transportation and haul with water or apply a chemical dust suppressant to control dust.
 3. Cover dusty material in transit when necessary to prevent blowing.
 4. Install silt fence or other barriers to prevent wind blown sediments from leaving the site.
- C. Pollution Control:
1. Prevent the pollution of drains and watercourses by sanitary wastes, sediment, debris and other substances resulting from construction activities.
 2. Retain all spent oils, hydraulic fluids and other petroleum fluids in containers for disposal off the site.
 3. Do not perform equipment maintenance or fueling within 50 feet of any water course.
- D. Erosion Control:
1. Take such measures as are necessary to prevent erosion of soil on the site and adjacent properties that might result from construction activities.
 2. Provide temporary materials such as hay bales, sand bags, plastic sheets, chain link fencing fabric, riprap or culverts to prevent the erosion of banks or excavation where runoff may be increased or concentrated due to construction activities.
 3. Adhere to all state and federal requirements regarding erosion and sediment control associated with stormwater runoff.

1.3 Traffic Regulation

- A. Keep traffic areas free of excavated material, construction equipment, pipe, and other materials and equipment unless otherwise stipulated and conduct operations in a manner to avoid unnecessary interference with public and roads.
- B. Furnish properly equipped flagmen where necessary to provide for public safety, or where required by jurisdictional authorities.
- C. Warning Signs and Lights:
 - 1. Provide barricades and warning signs for open excavations, parked equipment, and soil stockpiles.
 - 2. Illuminate by means of warning lights all barricades and obstructions from sunset to sunrise.
 - 3. Comply with "Manual on Uniform Traffic Control Devices", U.S. Dept. of Transportation, or applicable statutory requirements of State Highway Department.
- D. Provide suitable parking areas for the use of all construction workers and others performing work in furnishing services in connection with the Project so as to avoid interference with construction activities.

1.4 Project Identification And Signs

- A. Signs advertising the project, contractor, developer, etc. shall meet all pertinent local ordinances.

END OF SECTION

SECTION 02220

STRUCTURE EXCAVATION & BACKFILL

PART 1 - GENERAL

1.1 Description

- A. This section covers excavation, subgrade preparation, backfill for structures, and subgrade preparation and compaction for fills and embankments. It also includes disposition of excess materials, provision for imported materials, sheeting, shoring, pumping and initial site dewatering, and temporary drainage operations.
- B. Contents of this section may be modified to include more stringent requirements based on the soils report for the site.

1.2 Quality Assurance

- A. Soil Compaction Tests:
 - 1. ASTM D698 or AASHTO T99 - Standard Method of Test for Moisture Density Relations of Soils Using a 5.5 lb. Rammer and a 12 inch drop.
 - a. Use method A, B, C, Or D, as appropriate, based on soil condition and judgment of the testing laboratory.
 - b. Sample tests will be representative of materials to be placed.
 - c. Determine and provide optimum density curve for each type of material encountered or utilized.
 - d. Include Atterberg Limits, grain size determination and specific gravity.
 - 2. ASTM D2049 - Test for Relative Density of Cohesion less soils.
 - 3. Test results will be basis for Field Quality Control.

1.3 Job Conditions

- A. Underground Obstructions:
 - 1. Underground obstructions known to Engineer are shown on Drawings. However, locations shown may prove inaccurate and other obstructions not known to Engineer may be encountered.
 - 2. Notify each utility owner and request utilities be field located by surface reference at least 48 hours prior to trenching or excavation.
 - 3. Expose and verify size, location and elevation of underground utilities and other obstructions where conflicts might exist sufficiently in advance to permit changes in the event of conflict.
 - a. Notify Engineer in case of conflict.
 - b. In case of conflict the proposed Work may be changed by Engineer.
 - 4. Maintain, protect and support by shoring, bracing or other means existing utilities and appurtenances.

5. If Contractor elects to remove underground obstructions, the following shall apply:
 - a. Replace all other underground obstructions with new materials.
 - b. Restore to original conditions or better.
 6. Clean drainage culverts so they are free to sediment after construction.
- B. No blasting will be allowed.
- C. Drainage and Groundwater:
1. Maintain excavations and trench free from water during construction.
 2. Remove and dispose of surface and ground water entering excavations, trenches or other parts of the Work.
 3. Conduct dewatering operations in addition to good, positive drainage and eliminate standing water. Dewater excavations for concrete structures or pipes extending below ground water level by lowering and maintaining the water level beneath such excavations 24 inches or more.
 4. Divert surface runoff and use sumps, gravel blankets, well points, drainage lines or other means necessary to accomplish the above.
 5. Keep excavations dry during subgrade preparation and continuously thereafter until the structure is built to the extent that no damage from hydrostatic pressure, floatation or other cause will result.
- D. Sheeting and Shoring:
1. Sheet, shore or brace banks and trenches not cut back to a stable slope as necessary to prevent sliding or caving to protect workmen and the Work.
 2. Design and build to withstand loads that might be caused by earth movement and pressure and to be rigid, maintaining its shape and position.
 3. Support sheeting in excavation in a manner so as not to concentrate loads or horizontal thrusts on piping.
 - a. Do not brace sheeting against the pipe.
 4. Sheeting Removal:
 - a. Do not remove prior to backfilling.
 - b. Use effective methods to protect construction, other structures, utilities and properties during sheeting removal.
 - c. Fill voids left by sheeting removal with dry sand.
- E. Weather:
1. Do not backfill or construct fills or embankments during freezing weather.
 2. Do not place backfill, fill or embankment on frozen surfaces.
 3. Do not place frozen materials, snow or ice in backfill, fill or embankment.
 4. Do not deposit, stamp, roll or otherwise mechanically compact backfill in water.

1.4 Product Delivery, Storage and Handling

- A. Select transportation schedule and truck routes with approval of Owner to keep impacts on public to a minimum.
- B. Do not stockpile excavated materials against existing structures or Work.

- C. If any material is stockpiled on the job site it shall be done in an orderly manner and kept a sufficient distance from banks, open trenches or excavations to avoid overloading and to prevent slides or cave-ins.

1.5 Correction Period

- A. Maintain and repair backfill, fill and embankment settlement and make necessary repairs to pavement, sidewalks or other structures which may be damaged as a result of settlement for a period of two (2) years after initial acceptance of the Work by the Town.
- B. Contractor may perform such maintenance and repairs by subcontract.

PART 2 - PRODUCTS

2.1 Fill, Embankment and Backfill Materials

- A. Crushed Gravel Base Course:
 - 1. Select base course meeting Colorado Department of Highways Specification, Class 6.
- B. Structure Backfill:
 - 1. Earth of non-expansive type, granular sand, gravel, small rocks and stone material.
 - 2. Free of organic material, trash, glass, broken concrete, or other deleterious material.
 - 3. Otherwise suitable backfill material containing rocks or stones larger than 6 inches in greatest dimension shall be screened so that backfill contains no stones or rocks of 6-inches or larger in size.
 - 4. Use suitable on-site excavated materials to the greatest extent possible.
 - 5. Import additional material, if required, using an approved pit-run sand and gravel.
- C. Fill and Embankment Materials:
 - 1. Fill and embankment shall be comprised of excavated on-site clay soils and sand & gravels to the greatest extent possible. Approved imported materials may be utilized as necessary.

PART 3 - EXECUTION

3.1 Preparation

- A. Clear and strip surface vegetation, sod and organic topsoil for subgrades for areas within site work boundaries as shown on Drawings. The stripped topsoil shall be stockpiled separately and stored for later use in the site Finish grading.

1. Remove topsoil to a depth of 4" or the depth of existing topsoil, whichever is greater.

3.2 Excavation

- A. Provide adequate space and clearances for the Work and for installation and removal of concrete forms.
- B. Do not undercut excavated faces for extended footings.

3.3 Subgrade

- A. Scarify to a depth of six (6) inches and compact.
- B. Do not work on subgrade while ground is frozen or muddy.
- C. Remove exposed cobbles, stones or boulders greater than six (6) inches in size that create an irregular surface at subgrade. Backfill resulting voids with crushed gravel base course compacted to specific density.
- D. Carefully compact near structures to avoid damage.
- E. Compact and consolidate subgrades for structures or trench bottoms such that they are free from mud and sufficiently stable to remain firm, dense and intact under the feet of workmen.
 1. Reinforce subgrades with stabilization material that are otherwise solid, but become muddy on top due to construction operations.
 2. Finish stabilized subgrade to elevations shown on the Drawings.
- F. Level and compact subgrade so that surface materials will bond well with the first layer of backfill, fill or embankment.

3.5 Backfill, Fill and Embankment

- A. Use material that meets the requirements for structure backfills, fill and embankment material:
 1. Do not place rocks or stones in upper 18 inches of fills, or embankments larger than 1½ inch in their greatest dimension.
 2. Use of rocks or stones within the allowable size limit in the remainder of fills or embankments is subject to their not interfering with proper compaction.
- B. Place on suitably prepared subgrades.
- C. Spread and compact materials in uniform lifts not exceeding 8 inches in incompact thickness:
 1. Spread and level material deposited in piles or windows prior to compaction.
 2. Distribute material so as to preclude the formation of lenses of material differing from the surrounding materials.

- D. Place and compact fill to an elevation at least one foot above top of proposed pipe where pipe will pass through backfill or fill prior to beginning trenching.
- E. Fill voids caused by demolition work or excavation or unsuitable material or over excavation with graded gravel in areas where structures, foundations or slabs will be constructed.
- F. Compaction Around Structures:
 - 1. Mechanically compact:
 - a. Use platform type tampers or similar equipment.
 - b. Rolling is permitted provided proper compaction is obtained and adequate measures are taken to prevent damage to structures.
 - 2. Do not compact by flooding or jetting.
 - 3. Do not backfill against new concrete walls less than 14 days after removal of forms:
 - a. Do not exceed ten (10) foot heights with backfill in less than 21 days after removal of forms.
- G. Compaction Equipment for Fills and Embankments:
 - 1. Use equipment suited to the soil being compacted.
 - 2. Sheepfoot Roller: If used provide with cleaner bars to attached as to prevent the accumulation of material between the tamper feet.
 - 3. Rollers: Use rollers so designed that the effective weight can be increased as required to obtain specified compaction.

3.6 Excess Material

- A. Excess excavated material and unsuitable excavated material shall be disposed of on Owner's property at his direction.

3.7 Finish Grading

- A. Grade all areas after structures, backfills and embankments have been completed to slopes, contours or elevations indicated on Drawings.
- B. Provide allowance for topsoil placement where required.
- C. Provide effective drainage with slopes of at least one (1) percent unless otherwise indicated.
- D. Replace topsoil to a minimum depth of 4 inches.

3.8 Field Quality Control

A. Field Compaction Control:

1. Field tests will be conducted to determine compliance of compaction methods with specified density in accordance with:
 - a. ASTM D2922 (AASHTO T238)) - Tests for Density of Soil and Soil - Aggregate In-Place by Nuclear Methods, or,
 - b. ASTM D1556 (AASHTO T191) - Tests for Density of soil In-Place by the Sand Cone Method.
 - c. ASTM D2167 (AASHTO T205) - Tests for Density of Soil In-Place by Rubber-Balloon Method.

B. Compaction shall be to the following minimum densities, reference ASTM D698 or AASHTO T99 unless otherwise indicated:

1. Subgrade:
 - a. Under footings or slabs on grade foundations: 98%.
 - b. All other locations: 95%.
2. Structure Backfill:
 - a. Under footings or foundations: 98%.
 - b. All other locations: 95%.
3. Fills and Embankments:
 - a. Under footings, foundations, roadways or parking areas: 98%.
 - b. Other locations: 95%.
 - c. Dry utility trenches shall be flow filled or backfilled at the Town's discretion.

C. Moisture Content

1. Compact soils within ± 2 percent of optimum moisture.
 - a. Add water, harrow, disc, blade or otherwise work material as required to insure uniform moisture content and adequate protection.

D. Soils Engineer:

1. A soils engineer will inspect the natural soil at the bottom of excavations for structures. Provide the Town with 72 hours notice (exclusive of weekends and holidays) when the areas are expected to be ready for such inspections.
2. Do not prepare subgrade or place concrete or asphalt until such inspection has taken place (or waived by the Town) and resulting recommendations of the Town has been carried out.

3.9 Flowable Backfill

A. Scope:

1. This section specifies requirements for design, materials, production, and placement of low strength, flowable concrete backfill. Flowable backfill is an alternative to conventional, compacted earth backfill. The primary application for this type of backfill is in utility trenches.

B. Mix Design:

1. A mix design shall be prepared in a testing laboratory by a Colorado Registered Professional Engineer competent in the field of materials engineering. In lieu of a mix design, documentation of field test data may be submitted. Samples of the mix, with its formula, shall be made available to the Town for testing prior to construction. Town reviewed mixes may be considered pre-qualified for subsequent usage. Flowability and strength requirements shall be as follows:
 - a. Slump: 10" minimum
 - b. 28-day strength: 30-90 psi
 - c. 90-day strength: 35-95 psi

C. Materials and Production:

1. Flowable backfill shall be produced from a job mix formula as specified above.

D. Placement:

1. Before depositing flowable backfill, debris shall be removed from the space to be occupied by the flowable backfill. Flowable backfill shall be held low enough from the pavement surface to allow adequate trench patching depth per the Street Cut Utility Trench Detail shown in Part II Street Design, Construction Standards and Details. Vibratory or other compaction equipment shall be used only when necessary to fill inaccessible voids.

E. Excess Excavation:

1. All excess excavation material shall be removed from the job site at the Contractor's expense and shall become the property of the Contractor.

F. Structure Backfill (Flow-Fill) Requirements for Bridge Abutments and Pipes:

<u>Ingredients</u>	<u>lbs./c.y.</u>	<u>kg/m³</u>
Cement	50	30
Coarse Aggregate (AASHTO No. 57 or 67)	1700	1009
Fine Aggregate (AASHTO M 6)	1845	1095
Water (39 gallons) (147 L)	325(or as needed)	193(or as needed)

- G. The amount of water shall be such that the structure backfill (flow-fill) flows into place properly without excessive segregation. Approximately 39 gallons of water per cubic yard (193 L/m³) of structure backfill (flow-fill) is normally needed.

- H. The Contractor may use aggregate which does not meet the above specifications of the cement is increased to 100 pounds per cubic yard (lbs/c.y.) (60 kg/m³) and the aggregate conforms to the following gradation:

<u>Sieve Size</u>	<u>%Passing</u>
1 inch (25.0mm)	100
No. 200	0-10

The Contractor may substitute 30 lbs./c.y. (15 kg/m³) of cement and 30 lbs./c.y. (18 kg/m³) of fly ash for 50 lbs/c.y. (30 kg/m³) of cement or may substitute 60 lbs/c.y. (36 kg/m³) of cement and 60 lbs./c.y. (35 kg/m³) of fly ash for 100 lbs/c.y. (60 kg.m³) of cement.

- I. Recycled Broken Glass (Glass Outlet)
1. Aggregate including glass must conform to the required gradations.
 2. All containers used to produce the outlet shall be amply prior to processing. Chemical, pharmaceutical, insecticide, pesticide or other glass containers containing or having contained toxic or hazardous substances shall not be allowed and shall be grounds for rejecting the glass outlet.
 3. The maximum debris level in the outlet shall be 10%. Debris is defined as any deleterious material, which impact the performance of the flowfill including all non-glass confluents.
- J. The maximum layer thickness for structure backfill (flow-fill) shall be three feet (1 m). Additional layers shall not be placed until the structure backfill (flow-fill) has lost sufficient moisture to be walked on without indenting more than two inches (50mm). Any damage resulting from placing structure backfill (flow-fill) in layers that are too thick from not allowing sufficient time between placements of layers shall be repaired at the Contractors expense.

END OF SECTION

SECTION 02221

TRENCHING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.1 Description

- A. This section covers excavation and trenching, including drainage, preparation of subgrades, pipe bedding, backfilling, compacting, and finish grading for underground pipelines, conduits, cables and appurtenances.
- B. Contents of this section may be modified to include more stringent requirements based on the soils report for the site.

1.2 Job Conditions

- A. Right-of-Way: Haul and stockpile excess material or erect suitable bulkheads to prevent deposition of excavated material where permanent right-of-way or temporary construction easement is not adequate to stockpile all excavated material without depositing it on private property.
- B. Blasting: No blasting or other use of explosives will be permitted.
- C. Drainage and Groundwater:
 - 1. Maintain excavations and trench free from water during construction.
 - 2. Remove water encountered in the trench to the extent necessary to provide a firm subgrade, to permit joints to be made in the dry, and to prevent the entrance of water into the pipeline.
 - 3. Divert surface runoff and use pumps, gravel blankets, well points, drain lines or other means necessary to accomplish the above.
 - 4. Maintain the excavation or trench free from water until the structure, or pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, floatation, or other cause will result.
 - 5. Obtain approval of individual owners and ditch companies for discharge to their property or facilities.
 - 6. Prevent puddling or continuous running water around trees or cultured plants.
- D. Sheet piling and Shoring: Use sheet piling and shoring where banks are not cut back on a stable slope and as necessary to prevent caving or sliding and to protect workmen, the Work and adjacent structures and facilities.
- E. Sequence of Operation:
 - 1. Install the pipeline within a minimum of 100 linear feet of trench excavation in developed areas and 300 feet in all other locations.

2. Backfill the trench within a minimum of 150 linear feet of the pipe installation in developed areas and 200 feet in all other locations.
3. Clean up the right-of-way within a minimum of 500 linear feet of trench excavation in developed areas and 1000 feet in all other locations.

F. **Underground Obstructions:**

1. Underground obstructions known to Engineer are shown on Drawings. However, locations shown may prove inaccurate and other obstructions not known to Engineer may be encountered. Contractor shall field locate and verify all obstructions whether or not shown on the Drawings.
2. Notify each utility owner and request utilities are field located by surface reference at least 48 hours prior to trenching or excavation.
3. Expose and verify size, location and elevation of underground utilities and other obstruction where conflicts might exist sufficiently in advance to permit changes in the event of conflict.
 - a. Notify Engineer in case of conflict.
 - b. In case of conflict the proposed Work may be changed by Engineer.
4. Maintain, protect and support by shoring, bracing or other means existing utilities and appurtenances.
5. Take such protective measures as the utility may direct where alterations or moving of utilities is required.
6. If Contractor elects to remove underground obstructions, such as sprinklers, drainage culverts, catch basins or other structures, the following shall apply:
 - a. Drainage culverts may be salvaged, stored and reused if not damaged unless otherwise noted on the Drawings.
 - b. Replace all other underground obstructions with new materials.
7. Maintain the flow in field drains at the quantity, quality, and velocity present prior to the temporary removal of the drainpipe, unless otherwise noted on the Drawings.

1.3 Product Delivery, Storage and Handling

- A. Select transportation schedule and truck routes with approval of Owner to minimize impacts to the public.
- B. Do not mix stabilization material or bedding material with topsoil or job-excavated material.

1.4 Maintenance and Correction

- A. Maintain and correct all trench settlement and make necessary repairs to pavement, sidewalks or other structures which may be damaged as a result of backfill or settlement for a period of one (1) year after conditional acceptance by the Town.
- B. Contractor may perform such maintenance and correction by subcontract. If subcontracted submit a copy of any subcontract or authorization as evidence of Contractor's faithful intention to perform necessary corrections during the one-year correction period.

PART 2 - PRODUCTS

2.1 Stabilization Material

- A. Top 6 Inches of Pipe Subgrade: Granular bedding material as specified below.
- B. Subgrade Below Top 6 Inches:
 - 1. Pit-run gravel or crusher-run rock meeting ASTM D448 gradation No. 357 (2" to No. 4 sieve) or
 - 2. Same as top 6 inches except that broken concrete and rock may be included in size permitting compaction specified without discernible voids.

2.2 Bedding Materials

- A. Concrete: Meet requirements of Section 03300 with a minimum 28-day compressive strength of 4000 psi.
- B. Granular Material: Crushed rock or gravel with 100% passing a 1" sieve, 95% passing a ¾" sieve and not more than 5% passing No. 4 sieve or well graded crushed, stone or gravel meeting requirements of ASTM D448, gradation 67.
- C. Select Soil: Material free from rocks, clods and stones greater than 1½ inch in any dimension and meeting other requirements of trench backfill material OR granular material.
- D. Barrier Material: Finely divided job excavated material free from stones organic matter and debris meeting a soil classification of GC, SC, CL, or ML-CL.

2.3 Trench Backfill Material

- A. Dry utility trenches shall be flow filled or backfilled at the Town's sole discretion.
- B. Trench backfill may be job-excavated material or select material as specified below.
- C. Job Excavated Material shall be free of frozen material, stumps, roots, brush, other organic matter, cinders or other corrosive material, debris, and rocks or stones greater than the following dimensions:
 - 1. 3 inches in any dimension for material placed within one foot of pavement subgrade or finished surface in unpaved areas.
 - 2. 6 inches in any dimension for the remainder of the trench provided they are distributed in the finer material.

C. Imported Backfill Material: Pit-run gravel or crusher-run rock with the following gradation:

Sieve Size	% Passing
2 inch	100
No. 10	80
No. 200	0 - 15

1. Material passing a No. 40 sieve shall have a liquid limit less than 35 and a plastic index less than 6 when tested in accordance with AASHTO T-89 and T-91, respectively.

D. Highway Right-of-Way: Obtain approval by the agency having jurisdiction over highway maintenance for material placed within the limits of paved surfacing, gravel shoulders, or shoulder slopes.

PART 3 - EXECUTION

3.1 Preparation

A. Clearing:

1. Remove and disposing of trees, shrubs, bushes, downed trees, upturned stumps, weeds and other vegetation within the limits of clearing.
2. Limit clearing to as narrow a width as practical within the right-of-way or permanent easements.
3. Remove only non-cultured shrubs, bushes and other vegetation within the limits of the temporary easements.
4. Trim trees in lieu of removal when practicable.
5. Apply wound paint to cuts or scarred surfaces of trees or shrubs.
6. Protect root zones of trees and cultivated plants not removed.

B. Topsoiling:

1. Remove topsoil from all areas to be disturbed by construction.
2. Minimum depth of removal: Equal to depth of existing topsoil or 4 inches whichever is greater.
3. Stockpile topsoil and keep segregated from granular materials and inorganic trench materials and debris.

C. Sod Removal:

1. In lawn areas, cut and roll back sod before trenching.
2. If sod is to be reused store and protect sod from damage and drying.
3. Do no reuse when stored for more than 48 hours.

D. Pavement Removal:

1. Remove pavement, drives, curbs, and sidewalks to clean straight lines. Saw cutting is required if a clean straight line cannot be obtained by other methods.
2. On concrete surfacing, if saw cut would fall within 3 feet of a construction joint, cold joint or edge, remove concrete to that location.

3.2 Trenching

A. Excavate trenches by open cut methods, except where boring or tunneling is indicated in the Contract Documents, required by jurisdictional agencies or desired by Contractor to avoid removal of obstruction.

B. Do not use mechanical equipment in locations where its operation would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground. In all such locations, hand-excavating methods shall be used.

C. Use mechanical equipment so designed and operated that the rough trench excavation bottom elevation can be controlled with uniform trench widths and vertical sidewalls from an elevation one foot above the top of the installed pipe to the bottom of the trench, and trench alignment sufficiently accurate to permit pipe to be aligned properly with adequate clearance between the pipe and sidewalls of the trench. Do not undercut the trench sidewall to obtain clearance.

D. Excavation in Rock:

1. Over excavate a minimum of six inches below the bottom of the pipe for pipe 24 inches in diameter or less and nine inches for pipe larger than 24 inches, wherever the trench bottom is rock, shale, or other hard or semi-hard material.
2. Backfill over depth with Granular Material.

E. Preparation of Trench Bottom:

1. Grade trench bottoms uniformly to provide clearance for each section of pipe.
2. Remove loose materials, water and foreign objects.
3. Provide firm subgrade suitable for application of bedding material.
4. Wherever unstable material that in the opinion of the Owner's Representative is incapable of supporting the pipe is encountered in the bottom of the trench, over-excavate such material to a depth suitable for construction of a stable subgrade. Backfill over-depth with Stabilization Material and compact.

F. Stockpiling Excavated Materials:

1. Pile suitable material for backfilling in an orderly manner a sufficient distance from banks of the trench to avoid overloading and to prevent slides or cave-ins.
2. Remove and dispose of excess excavated materials not suitable or not required for backfilling.
3. Do not stockpile excavated material against existing structures, or appurtenances, trees or cultivated shrubs.

G. Limiting Trench Widths:

1. Excavate trenches to provide adequate working space and pipe clearances for proper pipe installation, jointing and embedment. Provide a minimum clearance of 6 inches on each side of the pipe for pipe 12 inches in diameter or less, 8 inches for pipe between 14 inches and 30 inches in diameter, and 12 inches for pipe larger than 30 inches in diameter.
2. If PVC pipe is used and maximum cover over the pipe exceeds 17 feet, use granular material compacted to 95% of maximum density to an elevation 1 foot above the top of the pipe.

H. Over-depth Excavation:

1. Restore over-excavated subgrades to proper elevation with Stabilization Material.

3.3 Pipe Bedding

A. Bedding Classes: Place pipe bedding in accordance with the details shown in this Appendix. Bedding shall be Class B or better except where other Classes are specifically required. Provide higher-class bedding where maximum trench width is exceeded and the higher class is required to avoid overloading the strength of pipe being placed as determined by ENGINEER.

B. Placement and Compaction:

1. Distribute and grade bedding material to provide uniform and continuous support beneath the pipe at all points between bell holes or pipe joints.
2. Deposit bedding material and compact uniformly and simultaneously on each side of the pipe to prevent lateral displacement.
3. Compact carefully compacted bedding material to 95% of maximum density.

C. Ground Water Barriers:

1. To impede passages of water through bedding material, construct a ground water barrier the full trench width, approximately 4 feet long, and from the bottom of all Granular Material to 1 foot above top of pipe.
2. Location:
 - a) Sanitary Sewers: Approximately 10 feet downstream from each manhole.
 - b) All other pipelines: Approximately 500 feet apart.

3.4 Backfilling and Compaction

A. Sheeting Removal:

1. Do not remove sheeting prior to backfilling.
2. Use effective methods to protect the construction, other structures, utilities and properties during sheeting removal.
3. Fill voids left by sheeting removal with dry sand.

- B. Deposit backfill material in uniform layers not exceeding eight inches in incompact thickness. Increased layer thickness may be acceptable provided it is demonstrated that the specified compacted density will be obtained.
- C. Use methods and equipment appropriate for the backfill material. Do not use equipment or methods that will transmit damaging shocks to the pipe.
 - 1. Do not perform compaction by jetting.
- D. Import material for trench backfill if compaction cannot be obtained with job excavated material.
- E. Backfill in Fields:
 - 1. Do not mechanically compact the top 2 feet of backfill in fields.
 - 2. Estimate the amount of material required to backfill the trench and form sufficient mound so that after normal settlement has occurred, the finished surface will match the existing grade.
- F. Topsoiling: Replace topsoil to the depth of stripping over all areas disturbed by construction operations and which will not receive other surface treatment.
- G. Obtain a site for and dispose of excess excavated materials and material not suitable for backfilling.

3.5 Field Quality Control

- A. Moisture Density Tests: The following tests shall be conducted on representative samples of each type of material encountered or utilized and will be used as a basis for compaction control.
 - 1. ASTM D698 or AASHTO T99 - Standard Method of Test for Moisture Density Relations of Soils Using a 5.5 lb Rammer and a 12-inch drop.
 - a. Use method A, B, C or D as appropriate, based on soil condition and judgment of the testing laboratory.
 - b. Determine and provide optimum density curve for each type of material encountered or utilized.
 - c. Include Atterberg Limits, grain size determination and specific gravity.
 - 2. ASTM D2049 - Test for Relative Density of Cohesionless Soils.
- B. Compaction Control:
 - 1. Field tests will be conducted to determine compliance of compaction methods with specified density in accordance with one of the following methods:
 - a. ASTM D2922 - Tests for Density of Soil and Soil - Aggregate In Place by Nuclear Methods.
 - b. ASTM D1556 - Tests for Density of Soil In-Place by the Sand Cone Method.
 - c. ASTM D2167 - Tests for Density of Soil In-Place by Rubber-Balloon Method.

2. Conduct a minimum of 3 tests for every 1000 linear feet of trench at locations and depths designated by ENGINEER. Excavate to designated depths and backfill tests holes in accordance with the backfilling and compacting specifications.
- C. Compaction shall be to the following minimum densities:
1. Subgrade:
 - a. Under footings or foundations: 100%
 - b. All other locations: 95%.
 2. Barrier material: 95%
 3. Pipe bedding:
 - a. Carefully compacted select soil: 90%.
 - b. Lightly compacted select soil: 80%.
 - c. Compacted granular material: 80% (ASTM D2049).
 - d. Barrier material: 95%.
 4. Trench backfill:
 - a. State highways
 - 1) 100% for paved areas and shoulder slopes.
 - 2) 95% for all other areas.
 - b. Paved roadways, sidewalks and other areas to receive pavements
 - 1) Top 4 feet: 95%.
 - 2) Remainder of trench: 90%.
 - c. Gravel roadways: 90%.
 - d. Sodded or lawn areas: 90% (top two feet only).
 - e. Fields and all other areas: 90% or equal to the density of undisturbed adjacent material, whichever is greater unless otherwise indicated.
 - f. Under footings, foundations or structures: 100%.
 - g. All other locations: 95%.
 5. Where granular materials are used in lieu of cohesive soils, reduce the above percentages specified in paragraphs 1. and 4. above by 15% to arrive at the relative density and ASTM D2049 shall apply.
- D. Moisture Content: Compact soils within (\pm)2% of optimum moisture. Add water, harrow, disc, and blade or otherwise work material as required.

END OF SECTION

SECTION 02486

SEEDING

PART 1 - GENERAL

1.1 Description

- A. This section covers soil preparation, seeding, fertilizing, mulching, watering and initial care.

1.2 Quality Assurance

- A. Furnish in bags or containers clearly labeled to show the name and address of the supplier, the seed name, the lot number, net weight, the percent of weed seed content and the guaranteed percentage of purity and germination.
1. All seed furnished shall be free from noxious seeds such as Russian or Canadian thistle, European bindweed, Johnson grass and leafy spurge.
 2. If seed available on the market does not meet the minimum purity and germination percentages specified, compensate for a lesser percentage of purity or germination by furnishing sufficient additional seed to equal the specified product. Product comparison shall be made on the basis of pure live seed in pounds.
 3. Normally, seeding should be accomplished in one or another of two planting seasons within a specified time. Planting seasons are between September 1st and November 1st or April 15 and June 15.
- B. Double amount of seed per acre if seeding is done at times other than the above stated planting seasons.
1. Need not be quadruple if seed and mulch are supplied in single application.

PART 2 - PRODUCTS

2.1 Fertilizer

- A. Commercial Product:
1. Native areas:
 2. Available nutrients by weight:
 - a. Nitrogen (N) is 15 lbs/acre.
 - b. Phosphorous (P_{205}) at 10 lbs/acre.

2.2 Lawn Areas

- A. Available Nutrients by Weight:
1. Nitrogen (N) at 28 lbs/acre.
 2. Phosphorous (P_{205}) at 20 lbs/acre.

- B. Uniform in Composition, Dry and Free Flowing.
- C. Deliver in Original, Unopened Containers.

2.3 Seed

- A. Native Seed: combination of at least two of the following:

	<u>SPECIES</u>	<u>PLS/ACRE</u>
(1)	Crested wheatgrass	11.5
(2)	Indian grass	2.5
(3)	Hard Fescue	1.0
(4)	Alkali sacaton	0.15
(5)	Sainfoin	5.25
(6)	Western wheatgrass	19.8
(7)	Blue gramma	3.0
(8)	Switch grass	5.6

- B. Alternative seed types may be used by Approval only.
- C. All seeding rates are for drilled seeding and must be doubled if broadcast.
- D. Do not use seed that has become wet, moldy, or otherwise damaged in transit or in storage.

2.4 Mulch

- A. Clean Hay or Straw.
- B. Wood Cellulose Fiber.
- C. Soil Retention Blanket:

1. Jute
2. Loosely twisted construction of heavy mesh with a uniform open plain weave of unbleached single jute yarn.
3. Average twist of not less than 1.6 turns per inch.
4. Thickness shall not vary more than one-half its normal diameter.
5. Furnish in approximately 90 pound rolled strips.
 - a. Length: Approximately 75 yards.
 - b. Width: 48 inches, plus or minus one inch.
 - c. 78 warp ends per width of cloth.
 - d. 41 weft ends per yard.
 - e. Weight: Average of 1.22 pounds per linear yard, plus or minus 5 percent.
 - f. Staples: 0.091 inch diameter minimum, "U"-shaped with a 1 inch crown and legs 6 inches in length or "T" shaped, 8 inch minimum length after bending with bar at least 4 inches long having a single wire end bent downward approximately 3/4 inch.

- D. Erosion Control Fabric:
1. Knitted construction of yarn with uniform openings interwoven with strips of biodegradable paper, furnished in rolls with suitable protection for outdoor storage at a construction site.
 - a. Width: 10 feet minimum.
 - b. Length: 360 feet average.
 - c. Approximate weight: 0.2 pounds per square yard.
 - d. Packaging: 4 - 6 ml opaque polyethylene bag.
 - e. Staples: 1 gage wire, "U" shaped with a 1-inch crown and legs 6 inches in length.

PART 3 - EXECUTION

3.1 Preparation

- A. Till, fertilize, and harrow areas to be seeded:
1. Thoroughly till the soil in areas that previously supported vehicle traffic.
 2. Till soil to a depth of 12 inches after areas have been cleared and brought to grade.
- B. Work the soil only when moisture conditions are suitable.
- C. Remove rocks and other objects 2 inches and greater in any dimension.
- D. Smooth, firm and mix fertilizer into top 2 inches of soil by use of a weights harrow prior to seeding.
- E. Correct irregularities in the ground surface resulting from soil preparation operations and slope to drain.

3.2 Seeding

- A. Apply seeding by means of approved mechanical power-drawn drills followed by packer wheels, broadcast-type seeders, or hydraulic type seeders.
- B. Do not drill or sow during windy weather or when ground is frozen or untillable.
- C. Apply water when necessary.
- D. Seeding by mechanical power-drawn drills:
1. Set depth bands to maintain a planting depth of at least $\frac{1}{4}$ inch.
 2. Set to space rows not more than 7 inches apart.
 3. Sow seeds of different sizes from the mixtures from at least two separate hoppers adjusted to provide the proper coverage.

- E. Seeding by broadcast type seeders:
1. "Rake in" or otherwise cover seed with soil to a depth of at least ¼ inch.
 2. Roll to obtain a firm seed bed.
 3. Do not use hand method of broadcasting seed except on small areas not accessible to machine method.
- F. Hydraulic seeding:
1. Equipment shall include a pump capable of being operated at 100 gallons per minute at 100 psi.
 2. Equipment shall have an acceptable gage and a nozzle adaptable to hydraulic seeding requirements.
 3. Storage tanks shall have a means of agitation and a means of estimation of the volume used, or remaining in the tank.

3.3 Mulching

- A. Apply mulch or Soil Retention Blanket on all seeded areas:
1. On slopes flatter than 4:1, mulch may be hay, straw or wood cellulose fiber.
 - a. Spread hay or straw mulch uniformly at rate of 2 tons per acre.
 - b. Immediately following the spreading of hay or straw mulch, anchor the material into the soil a minimum of 3 inches by means of a mulch anchoring machine equipped with large goulter-type discs spaced at approximately 8 inch centers.
 - c. Apply wood cellulose fiber in the manner and at the rate recommended by the manufacturer for the specific fiber used.
- B. Apply Soil Retention Blanket on 4:1 slopes and steeper:
1. Drape blanket loosely over ground surface, smooth but not taut.
 2. Fabric shall have close ground contact.
 3. Prepare, fertilize and seed prior to installation of Soil Retention Blanket.
 4. If the slope is greater than 3:1, fabric shall be applied vertically with paper strips oriented parallel to the slope.
 5. Dig a 6 inch deep check slot 1 foot back from the top of slope and at toe of the slope.
 - a. Fold and place fabric in slot, and drive staple in fabric every 9 inches.
 - b. Fill slot with soil and compact.
 6. Dig a 4 inch deep check slot perpendicular to the direction of water flow at 50 foot intervals on slopes and ditches more than 100 feet long.
 - a. Drape fabric down into check slot.
 - b. Fill slot with soil and compact.
 7. Overlap 4 inches (minimum) when 2 or more lengths of fabric are required to be installed side-by-side to cover an area.
 - a. Secure each length of fabric with staples driven in 3 rows, at each edge and the center with staples placed on 3-foot centers (maximum).

8. Overlap 12 inches (minimum) with the upgrade section on top of the lower grade section when fabric lengths are installed end-to-end.
 - a. Secure overlapped ends with staples driven in 3 rows, at each edge and the center with staples placed on 9-inch centers (maximum) across the fabric overlap.
9. Overlap 12 inches (minimum) where one roll ends and a second roll starts with the upslope piece brought over the buried end of the second roll to form a junction slot.
10. Staple:
 - a. 2 foot interval on outside edges and centers of rolls.
 - b. 6-inch interval on check slots and junction slots.
 - c. Use sharp pointed hardened steel 3-inch fence type staples on soil that is extra hard.

3.4 Hydraulic Seeding and Mulching

- A. As an option, CONTRACTOR may accomplish seeding, fertilizing and mulching by hydraulic spray application at the direction of the Town. Seed and fertilizer in the amounts per acre designated, and wood cellulose fiber mulch at the rate recommended by the manufacturer for the specific fiber mulch used. Combine with water to provide a slurry. Perform hydraulic application in such a manner that the liquid carrier will uniformly distribute the material over the entire area to be seeded at rates not less than indicated herein. Do not compact. Double the amount of seed per acre if seed and mulch are applied in a single application. Hydro seeding will only be allowed in irrigated areas.

3.5 Watering

- A. After seeding and mulching, wet down seeded area and keep moist during germination.
- B. Avoid allowing standing water, surface wash, or scour.

3.6 Reseeding and Repair

- A. Reseed and mulch areas where there is not a satisfactory stand of grass at the end of 5 weeks after seeding.

3.7 Fertilizing

- A. Broadcast fertilizer over the seeded area after the germination of seed:
 1. Apply at a rate of 5 lbs. per 1000 sq. ft.
- B. Do not apply fertilizer until at least 6 weeks after seeding operations are complete if seeding is done during the germination season.

3.8 Establishment

- A. Water and care for seeding planted until Final Acceptance.
- B. Field seed shall be established at least 30 days prior to Final Acceptance.

SECTION 02575

PAVING REPAIR AND RESURFACING

PART 1 - GENERAL

1.1 Description

- A. This section covers surface obstructions which CONTRACTOR removes and replaces such as pavement, drives, curbs, gutters, sidewalks, and similar surfaces as required to perform the Work.
1. CONTRACTOR has the option of protecting instead of removing and replacing obstructions that interfere with the Work.

1.2 Quality Assurance

- A. The words "Standard Specifications" as used herein refer to the State Department of Highways, Division of Highways, State of Colorado, "Standard Specifications for Road and Bridge Construction," adopted 1976.
1. Measurement and payment sections of "Standard Specifications" are not applicable to the Work.

PART 2 - PRODUCTS

2.1 Materials

- A. Soil Sterilizing Agent: Reference "Standard Specifications," Section 217.02.
- B. Aggregates for Base Course and Gravel Surface: Reference "Standard Specifications," Section 703.04, Grading "E."
- C. Aggregates for Pavement: Reference "Standard Specifications," Section 703.04, Grading, Class 6.
- D. Filler Material: Reference "Standard Specifications," Section 703.06 and AASHTO M17.
- E. Hydrated Lime: Reference "Standard Specifications," Section 712.03.
- F. Bituminous Materials: Reference "Standard Specifications," Section 702.
1. Asphalt Cement Penetration Grade of AC-10, AASHTO M226, 6.0% by weight of mix.
 2. Prime Coat Liquid Asphalt, MC -70, AASHTO M82.
 3. Tack Coat Emulsified Asphalt, CSS01, AASHTO M140.

- G. Concrete: Reference Section 03300, "Cast-In-Place Concrete."
- H. Premolded Expansion Joint Fillers: Reference AASHTO M213 (ASTM D1751), ½" thickness.

PART 3 - EXECUTION

3.1 Asphalt Concrete Including Base and Gravel Surfacing

- A. Remove, dispose of and restore to original or better condition asphalt concrete pavement, curbs, drives, sidewalks and gravel surfacing.
 - 1. Remove pavement, drive or sidewalk to clean straight lines.
 - a. Saw cutting is required if a clean straight line cannot be obtained by other methods.
 - 2. Subgrade compaction - Reference Section 0221, "Trenching, Backfilling and Compaction."
 - 3. Soil Sterilization - Sterilize subgrade prior to construction of base course.
 - 4. Base Course - Construct in accordance with Section 02513 of Part II.
 - a. **Existing asphalt shall be milled 18' back from the vertical edge before patching operation commences to form a weather tight seal.**
 - b. Pavement and driveway base course - Restore to same thickness as existing, but in no case less than 6 inches.
 - c. Sidewalk base course - Restore to same thickness as existing, but in no case less than 4 inches.
 - 5. Primer Coat - Tack Coat - Apply prior to placement of asphalt concrete in accordance with Section 02513 of Appendix II.
 - 6. Asphalt concrete pavement, drives and sidewalks - restore to existing alignment, dimensions and grade.
 - a. Pavement and driveway - Restore to same thickness as existing, but in no case less than 2 inches.
 - b. Sidewalk - Restore to same thickness as existing but in no case less than 4 inches.
 - 7. Gravel Surfacing - Restore to existing alignment and grade.
 - a. Restore to same thickness as existing, but in no case less than 4 inches.
 - b. Perform grading necessary to provide a smooth roadway.

3.2 Concrete Surfacing

- A. Remove, dispose of and restore to original or better condition concrete drives, curbs, gutters, sidewalk and similar structures.
 - 1. Remove concrete to neatly sawed edges or to existing smooth joint lines.
 - a. Saw concrete to a minimum depth of 2 inches.
 - b. If saw cut would fall within 3 feet of construction joint, cold joint, expansion joint, or edge, remove concrete to the joint.
 - 2. Subgrade compaction - Reference Section 02221, "Trenching, Backfilling, and Compaction."

- B. Restore to existing alignment, dimensions and grade.
- C. Provide for a diameter lap if existing concrete that is removed contains reinforcing steel. New steel shall be of same diameter and of equal or better quality.
- D. Match existing expansion joints and contraction joints.
- E. Restore all surface improvements to the same thickness as existing, but in no case less than the following:
 - 1. Driveway and slab - 6 inches.
 - 2. Patio - 4 inches.
 - 3. Gutter - 6 inches measured at flowline.
 - 4. Concrete base for bricks - 6 inches.
 - 5. Sidewalk - 4 inches.
- F. Tool outside edges of sections and joints with a ¼" radius edging tool.
 - 1. Replace W/S curb face marking as necessary.
- G. Curing:
 - 1. Cure faces exposed by form removal immediately after forms are removed.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 Description

- A. This Section covers all cast-in-place concrete, including forms, reinforcing steel, finishing, curing and other appurtenant work for use with small projects such as vaults, headwalls, and utility encasements.

1.2 Quality Assurance

- A. Reference Standards:

1. Except as modified or supplemented in these Specifications, all structural concrete shall meet the requirements of the following standards. Refer to the standards for detailed requirements.
 - a. ACI 301 Specification for Structural Concrete for Buildings.
 - b. ACI 347 Recommended Practice for Concrete Formwork (Chapters 1 through 5).

- B. Mix Design:

1. Compressive Strength: 4000 psi at 28 days:
 - a. Minimum number of cylinders passing above requirement shall be 90%.
 - b. Minimum strength of cylinder acceptable, 2800 psi.
2. Cement Content: 6 bags per cubic yard, minimum.
3. Maximum permissible Water - cement ratio:
 - a. For 3500-psi strength, non air-entrained, absolute ratio by weight 0.58.
 - b. For 3500-psi strength, air-entrained, absolute ratio by weight 0.46.
4. Slump: 4 inch maximum.
5. Air Content: 5% ± 8% for concrete with exposed surfaces or subject to freezing and thawing; not required for other concrete. Low air content may be field adjusted at the Town's discretion.

1.3 Product Delivery, Storage and Handling

- A. Cement: Store in weather-tight enclosures and protect against dampness, contamination and warehouse set. Do not use cement that has become caked or lumpy.

- B. Aggregates:

1. Stock pile to prevent excessive segregation or contamination with other materials or other sizes of aggregates.
2. Use only one supply source for each aggregate stockpile.
3. Do not use the bottom 6 inches of aggregate piles in contact with the ground.

C. Admixtures:

1. Store to prevent contamination, evaporation, or damage.
2. Protect liquid admixtures from freezing or harmful temperature ranges.
3. Agitate emulsions prior to use.

D. Mixing and Transporting Ready-Mixed Concrete:

1. The maximum elapsed time from the time water is added to the mix until the concrete is in place shall not exceed 1½ hours when concrete is transported in revolving-drum truck bodies. This includes the time in which air packs are added.

E. Reinforcing Steel:

1. Deliver to site in bundles marked with metal tags indicating bar size and length.
2. Carefully handle and store on supports, which will keep the steel from coming in contact with the ground.
3. Remove all mud, oil, loose rust or mill scale and other foreign materials prior to placing concrete.
4. Rust or mill scale which is "tight" will be permissible without cleaning or brushing, provided weights, dimensions, cross sectional area, and tensile properties meet the requirements of ASTM A615.

1.4 Job Conditions

A. Environmental Requirements:

1. Do not place concrete during rain, sleet or snow unless adequate protection is provided.
2. Do not allow rainwater to increase the mixing water or damage the surface finish.

B. Cold Weather Concreting:

1. Conformance: ACI 306, "Recommended Practice for Cold Weather Concreting."
2. Temperature of concrete when placed shall not be less than the following:

Minimum Concrete Temp. °F Air Temp. Sections with Least Dimension		
°F	Under 12"	12" and Over
30 to 45	60	50
0 to 30	65	55
Below 0	70	60

3. When placed, heated concrete shall not be warmer than 80°F.
4. Prior to placing concrete, all ice, snow, surface and subsurface frost shall be removed, and the temperature of the surfaces to be in contact with the new concrete shall be raised above 35° F.
5. Protect concrete during specified curing period.
6. Heated enclosures shall be strong and windproof to insure adequate protection of corners, edges and thin sections.
7. Do not permit heating units to locally heat or dry the concrete.
8. Do not use combustion heaters during the first 24 hours unless the concrete is protected from exposure to exhaust gases, which contain carbon dioxide.

C. Hot Weather Concreting:

1. Conformance: ACI 305 "Recommended Practice for Hot Weather Concreting."
2. Take precautions when the ambient air temperature is 90°F or above.
3. Temperature of concrete when placed shall not exceed 85°F.
4. Cool forms and reinforcing to a maximum of 90°F by spraying with water prior to placing concrete.
5. Do not use cement that has reached a temperature of 170°F or more.
6. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.
7. Do not place concrete when the evaporation rate (actual or anticipated) equals or exceeds 0.20 pounds per square foot per hour, as determined by Figure 2.1.4 of ACI 305.
8. Approved set retarding and water reducing admixtures may be used when ambient air temperature is 90°F or above to offset the accelerating effects of high temperature.

PART 2 - PRODUCTS

2.1 Concrete Materials

- A. Cement: ASTM C150, Type I.
- B. Aggregates:
1. Fine aggregate - ASTM C33.
 2. Coarse aggregate - ASTM C33 except air-cooled blast furnace slag is acceptable.
 - a. Nominal maximum size - as permitted by ACI 318.
- C. Water: Clean and fresh.
- D. Air-Entraining Agent: ASTM C260.
- E. Ready-Mixed Concrete: Mixed and delivered, ASTM C94.
- F. Batching and Mixing Equipment: ACI 304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete."

2.2 Form Materials

A. Forms:

1. Plywood - PSI, waterproof, resin-bonded, exterior type, Douglas fir.
2. Lumber - straight, uniform width and thickness, free from knots, offsets, holes, dents and other surface defects.
3. Designed to produce hardened concrete having the shape, lines and dimensions shown on the Drawings.

B. Form Oil:

1. Light colored paraffin oil, or other non-staining material. For exposed surfaces not in contact with earth backfill, acceptable chemical release agents are Protex Industries, "Pro-Cote," Symons Corp., "Magic Kote," L & M, "Debond," or equal.

C. Form Ties:

1. Commercially manufactured permanently embedded type with removable ends for all exposed surfaces.
2. Permanently embedded portion shall terminate not less than one inch from the face of the concrete.

2.3 Reinforcing Materials

A. Bars: ASTM A615, Grade 60 unless specified otherwise.

B. Welded Wire Fabric: ASTM A185 or A497.

C. Fabrication ACI 315 and 318 unless shown otherwise on Drawings.

2.4 Non-Shrink Grout

A. Ferrolith G.D.S. grout by Sonneborn Building Products, Inc., Embeco Grout by Master Builders Co., Vibrofoil by W.R. Grace Co., Construction Materials Division, or equal.

2.5 Curing and Sealing Compounds

A. ASTM C309, Type 1, Class B.

B. Use Protec "Triple Seal," Symons Corp., "Cure and Seal," or equal.

PART 3 - EXECUTION

3.1 Erection of Forms

A. Brace or tie to maintain desired position, shape and alignment before, during and after concrete placement.

- B. Construct forms for beams and slabs supported by concrete columns so the column forms can be removed without disturbing the beam or slab supports.
- C. Provide temporary openings at the bottom of columns and wall forms and at other locations where necessary to facilitate cleaning and inspection.
- D. Where concrete is placed against rock, remove loose pieces of rock and clean the exposed surface with a high-pressure air hose.
- E. Place Chamfer strips in forms to bevel salient edges and concrete corners of exposed surfaces except the top edges of walls and slabs that are to be tooled. Unless otherwise noted on the Drawings, bevels shall be $\frac{3}{4}$ inch wide.
- F. Remove mortar or grout from previous concrete and other foreign material from the surfaces. Coat form surfaces with approved coating material before either the reinforcing steel or concrete is placed.
- G. Do not allow form coating to:
 - 1. Stand in puddles in the forms.
 - 2. Come in contact with the reinforcing steel.
 - 3. Come in contact with hardened concrete against which fresh concrete is placed.

3.2 Removal of Forms

- A. Do not remove or disturb forms until the concrete has attained sufficient strength to safely support all dead and live loads.
- B. Remove forms with care to avoid surface gouging, corner or edge breakage, and other damage to the concrete.

3.3 Reinforcing

- A. Installation:
 - 1. Accurately place reinforcing bars and maintain in proper position while concrete is being placed and compacted. Reinforcing bars that are rusty, dirty or oily shall not be used.
- B. Bar Supports:
 - 1. Provide minimum number of supports as required by ACI 315.
 - 2. Do not use pebbles, pieces of broken stone, common or face brick, metal pipe or wood blocks to support reinforcement.
 - 3. On ground, where necessary, supporting solid concrete bricks may be used. Use one-half concrete bricks whenever possible.
 - 4. Use metal, plastic or approved bar chairs, bolsters and spacers over form surface.
 - 5. Where the concrete surface will be exposed to the weather in the finished structure the portions of all accessories within $\frac{1}{2}$ inch of the concrete surface shall be non-corrosive or protected against corrosion.

3.4 Concrete Placement

A. Conveying:

1. Convey to the point of final deposit by methods that will prevent the separation or loss of ingredients.
2. During and immediately after placement, concrete shall be thoroughly compacted, worked around reinforcements and embedments, and worked into all corners of the forms.

3.5 Expansion and Contraction Joints

A. Installation:

1. Formed where shown on the Drawings. (See storm detail).
2. Install expansion joints, fillers and waterstops as detailed on the Drawings or in accordance with manufacturer's instructions, in no case less than 400' and at all PCR's.
3. Do not extend reinforcement through expansion joints, except where specifically noted or detailed on the Drawings.

3.6 Construction Joints

A. Location:

1. Formed where shown on the Drawings.
2. Construct in one continuous concrete placing operation all concrete included between construction joints.
3. Obtain Engineer's approval for location of additional construction joints desired.

3.7 Finishing Formed Surfaces

A. Rough Form Finish:

1. Rough form finish is unacceptable for surfaces. A smooth finish is required on all cast-in-place or pre-cast, whether it is exposed or not.
2. Patch tie holes with mortar.
3. Repair defects.
4. Smooth form finish is acceptable alternative.

B. Smooth Form Finish:

1. Provide smooth form finish for surfaces not specified to have grout cleaned finish.
2. Use form facing to produce a smooth, hard, uniform surface.
3. Keep number of seams to a minimum.
4. Patch all tie holes with mortar.
5. Remove all fins.
6. Repair all defects.

C. Grout Cleaned finish:

1. Provide grout cleaned finish for surfaces so designated on the Drawings and the following surfaces:
2. Complete operations for smooth form finish.
3. Wet surface and apply grout mix of 1 part Portland Cement and 1½ parts of fine sand.
4. Substitute white Portland Cement for gray as required to match surrounding concrete.
5. Rub surface with cork float or stone to fill air bubbles and holes.
6. Remove excess grout by rubbing with a rubber float, sack or other means.
7. Do not begin cleaning until all contiguous surfaces are completed and accessible.

3.8 Finishing Unformed Surfaces

A. Slabs, Pavements, Sidewalks, Driveways, Curb and Gutters and Similar Structures:

1. Screen and give an initial float finish as soon as concrete has stiffened sufficiently for proper working.
2. Remove coarse aggregates disturbed by the initial floating or which cause a surface irregularity and replace with mortar.
3. Initial floating shall produce a surface of uniform texture and appearance.
4. Follow with a second floating at the time of initial set. This floating shall produce a finish of uniform texture and color.
5. In areas where concrete is to remain exposed, follow the second floating with a broomed treatment to the surface to provide a uniform abrasive texture of constant color, except where steel trowel surface is indicated.

3.9 Defective Concrete

- A. Repair in accordance with ACE 301, Chapter 9.

3.10 Curing

A. Keep concrete continuously moist for at least 7 days after placement by use of:

1. Ponding or continuous sprinkling.
2. Wet burlap, wet absorptive mats, or wet sand.
3. Waterproof sheets.
4. Polyethylene film.
5. Membrane curing compound.
 - a. Do not use membrane-curing compounds when the surface is to be painted or other material is to be bonded to the surface.

- B. Maintain concrete within 50° to 70° F range during curing.

- C. Apply curing and sealing compounds in accordance with manufacturer's instructions.

3.11 Field Quality Control

A. Test Cylinders:

1. Make a set of test cylinders (four 4"x8" or four 6"x12") for each 100 cubic yards placed or portion thereof. More frequent testing may be required where more than one class of concrete is being used.
2. Deliver test cylinders to testing laboratory.
3. Comply with ASTM C912.

END OF SECTION