

SECTION 02221

TRENCHING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.01 RELATED WORK

- A. Section 02485 - Seeding
- B. Section 02722 - Sanitary Sewers and Force Main
- C. Work under this section includes removal of surfacing and all materials encountered in the trench. All excavation is unclassified.

1.02 JOB CONDITIONS

- A. Provide for uninterrupted surface water flow during the work.
- B. All pipe shall be installed in a dry trench.
- C. Existing utilities, poles, service lines, fences, structures, signs, shrubs, or other improvements encountered during the construction, whether above or below ground, shall be protected by the Contractor. Any item damaged or removed by the Contractor shall be repaired or replaced at the Contractor's expense to at least its original condition and to the satisfaction of the Owner. It shall be the Contractor's responsibility to locate any existing utilities in the path of construction.
- D. Underpin or otherwise support adjacent structures which may be damaged
By excavation work.
- E. Protect excavations by shoring, bracing, sheet piling, underpinning or other methods required to prevent cave-ins or loose dirt from falling into excavation.
- F. Notify the Engineer of any unexpected subsurface conditions. Discontinue work in an area until the **HALLSDALE-POWELL UTILITY DISTRICT** provides notification to resume work.
- G. If conditions are such that blasting or any use of explosives is required, the Contractor, prior to blasting, shall submit to the Engineer's satisfaction evidence of blasting and explosive insurance in the amounts of bodily injury and property damage insurance

required in the Special Conditions and shall prove to the satisfaction of the Engineer the experience and capability of the Contractor's organization to safely handle and perform such operations.

- H. Handling and storing of blasting materials shall be performed only by qualified persons skilled in such work. Adequate precautions shall be taken to prevent accidents, injury to persons, or damage to property. Qualifications of blasting operations personnel and safety precautions shall be in full compliance with local codes governing such operations and shall be approved by the Engineer.
- I. All trenches shall be completely backfilled at the end of the work day. Temporary bridges and crossings shall be maintained by the Contractor until backfill adjacent to the bridge or crossing is complete and ready for traffic. Special care shall be taken when backfilling around existing utilities. Any damage caused to existing utilities during backfilling operations shall be promptly repaired at no cost to the Owner. All temporary protective and support systems installed on existing utilities shall remain in place until they can be supported and protected by the trench backfill. All workmen shall be out of the trench in the areas where backfill material is being placed in the trench by clamshell buckets or backhoe. Under no circumstances shall backfill materials be transported to the trench over workmen.
- J. Provide drainage and/or pumps to maintain a dry trench during the course of the work. The Contractor shall do all pumping necessary for de-watering trenches and to provide proper work conditions for installation of pipe and appurtenances.

1.03 PERMITS

- A. Obtain permits from authorities having jurisdiction before explosives are brought to the site.
- B. All work within State, County, & City rights-of-way shall be in accordance with the requirements of that respected department, including construction materials and methods, traffic control, maintenance of drainage facilities, clean up; repair/replacement of paved areas, road shoulders and drainage facilities; and any special provisions contained in the permit.

PART 2 - PRODUCTS

2.01 BEDDING MATERIAL

- A. Angular gravel, crushed gravel, or crushed limestone meeting the following gradation requirements:

SIEVE SIZE	PERCENT PASSING
1"	100
3/4"	90 - 100
3/8"	20 - 55
#4	0 - 10
#8	0 - 5

- B. Use for bedding, haunching, and initial backfill of sewer pipe, and for use for bedding of water pipe when rock or unstable subgrade is encountered at the bottom of the trench.
- C. Do not use frozen materials.

2.02 EARTH BACKFILL MATERIALS

- A. Material excavated from the trench, free from large stones, clods, debris, or frozen lumps.
- B. Use for final backfill of pipe in unpaved areas.

2.03 SELECTED BACKFILL MATERIAL

- A. Use for final backfill for all pipe under roads and paved or concrete drives.
- B. Material shall be approved by the **HALLSDALE-POWELL UTILITY DISTRICT** whether taken from trench excavation or from borrow area. Selected backfill material shall be capable of providing compaction to 95 per cent standard proctor.
- C. For sewer lines backfill material shall be crushed stone free from dust, clay, or trash. Granular fill shall be graded 1 1/2 inch to No. 4 as defined on ASTM C33.

PART 3 - EXECUTION

3.01 PREPARATION AND LAYOUT

- A. Establish line and grade for trench. Designate and identify datum elevation.
- B. Perform clearing necessary to carry on construction in the proper manner. Material shall be removed only to the minimum and the necessary to allow proper construction.
- C. Maintain bench marks, monuments, and other reference points.
- D. Verify location of existing sewer laterals, manholes, and service connections.

3.02 UTILITIES

- A. Before starting excavation, establish the location and extent of underground utilities occurring in the work area.
- B. Notify and coordinate work activities with utility companies.
- C. Maintain, re-route, or extend as required, existing utility lines to remain which pass through the work area. Pay costs for this work, except those covered by the utility companies.
- D. Protect active utility services uncovered by excavation.
- E. Remove abandoned utility service lines from areas of excavation. Cap, plug, or seal such lines and identify at grade.
- F. Accurately locate and record abandoned and active utility lines re-routed or extended, on project drawings.

3.03 EXCAVATION

- A. Perform clearing, including removal of surfacing and pavement, necessary to carry on the construction in the proper manner. Material shall be removed only to the minimum width necessary to allow proper construction. Concrete and asphalt shall be saw cut.
- B. Trenches:

1. Keep pipe laying operation as close to the excavation operation as possible during the prosecution of the work. The HALLSDALE-POWELL UTILITY DISTRICT reserves the right to stop the excavation at any time when, in their opinion, the excavation is opened too far in advance of the pipe laying.
2. Pipe trenches shall be excavated as close to a depth that will insure a minimum of 30" of cover for all pipes not subject to traffic roads and 48" of cover under roads and drives for all types of pipe, except sewer service laterals. Trenches shall be only of sufficient width to provide a free working space on each side of the pipe. To prevent excess pressure on the pipe, the maximum width of trench at the top of the pipe and at the bottom of the trench shall not be greater than 2-foot or less than 18" more than the greatest exterior diameter of the pipe. If this maximum width is exceeded, it shall be the Contractor's responsibility to provide additional bedding or select backfill materials as the HALLSDALE-POWELL UTILITY DISTRICT may require. The excavation below the spring line shall be made to conform as near as possible to the shape of the lower third of the pipe. To protect the pipe lines from unusual stresses, all work shall be done in open trenches. Where grading is involved, do not cut trenches under roads, streets, or other areas until the final finish grading has been done, unless otherwise authorized.
3. Any trench exceeding a height of four feet shall be sloped, benched or sheeted (close sheeting or sheet piling) and shored to maintain the stability of the trench wall. No greater length of trench in any location shall be left open, in advance to the complete work, than shall be authorized by the Engineer. During excavation, materials suitable for backfill shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and prevent slides or cave-ins. If suitable bearing for the pipe or conduit is not encountered at the depth indicated for trench bottom due to wet or unstable material, such material shall be excavated to depth required and refilled and compacted to proper grade with coarse sand, fine gravel, or other suitable approved material.
4. Wherever necessary to prevent caving, excavating shall be adequately sheeted and braced, and the trench width shall be increased accordingly. Trench sheeting shall remain in place until the pipe has been tested and

backfilled to a depth of two feet over the top of the pipe. The Contractor shall leave sheeting and shoring in place where directed by the Engineer or the HALLSDALE-POWELL UTILITY DISTRICT.

- C. If rock is encountered in the trench it shall be excavated in a manner approved by the owner and as specified below:
1. Trench excavation shall be considered unclassified.
 2. Where encountered in the trench bed, rock shall be excavated to a depth of 1/4 of the pipe diameter but in no case less than 8-inches below the bottom of the pipe. All undercut trench excavation shall be backfilled and tamped with materials as specified in the following paragraphs under Unstable Subgrade.
- D. Excavated material suitable for backfilling shall be stock-piled no closer than two feet from the edge of the trench and shall not obstruct crosswalks, sidewalks, or street intersections, and shall not interfere unreasonably with travel on the streets by occupants of adjacent property. Gutters and other drainage facilities shall not be obstructed. Free access shall also be maintained to fire hydrants, mailboxes, sewer and water manholes, gas meters, or other municipal facilities. Rock or other materials undesirable for backfill shall be spoiled outside the area in a neat manner.
- E. Unless otherwise shown on the drawings or required by the specifications or authorized by the HALLSDALE-POWELL UTILITY DISTRICT, all work shall be done in open, vertical trenches. Any sheeting driven below the level of the top of the pipe shall not be disturbed or removed.
- F. Excavation in Cultivated Fields and Farm Areas: In all cases where the pipeline passes through cultivated fields and/or farming areas, perform excavation in the following manner: Notify Owner of time and location of work. Schedule work so as not to interfere with farming operations. Remove the topsoil from the entire width of sewer trench to a minimum depth of 12 inches, stockpile topsoil in area so as not to interfere with farming operations, and protect stockpiled topsoil from erosion. After backfilling excavation to within 12 inches of the ground surface, replace topsoil uniformly over the entire excavation.
- G. Where blasting is required, conduct all blasting operations only with properly qualified personnel in accordance with all applicable ordinances and regulations. Cover all blasts with suitable blasting mats, and use all other safety precautions as required to prevent personal injury and property damage. Repair all damage caused by blasting operations, and settle in total cost all damage suits or claims which might arise from blasting operations.

3.04 GRAVITY FLOW SEWER PIPE BEDDING

A. General

1. Pipe bedding shall be 1/2" crushed stone (washed). Pipe bedding includes all materials placed below and on each side of the pipe and also INITIAL BACKFILL up to 12" above the pipe top. Remaining backfill from 12" above pipe top up to finished grade or paving subgrade (as applicable) shall be as specified hereinafter under BACKFILLING.
2. Do not install initial backfill until the pipework has been inspected and accepted by the Engineer.
3. Bedding shall be placed on trench subgrade to 12" above pipe top and shall be thoroughly hand tamped in 6" layers equally and uniformly into bell holes between pipework and trench walls, in each side and top of pipework, all to prevent pipe displacement and as approved by the Engineer, and as specified below.
4. Bedding shall be as indicated in the following table:

<u>BEDDING CLASS</u>	<u>APPLICATION</u>
A	Only where indicated on the drawings or authorized.
B	Unless otherwise specified or authorized, all gravity flow piping except PVC gravity flow sewers.
B modified	PVC gravity flow sewers, all piping under paved areas, and where indicated on the drawings.
C	Ductile Iron Pipe in general (non-rock) excavations.

B. Class A Bedding - This shall consist of: Concrete cradles, cast-in-place to full width of subgrade extending at least 8" or 1/4 pipe in diameter (whichever is greater) below pipe bottom, and extending up on sides of pipe to pipe horizontal centerline; and initial backfill from concrete up to 12" above pipe tops, hand placed and compacted before placing any remaining backfill.

C. Class B Bedding - This shall consist of: Granular bedding materials placed on subgrade

to full trench width, extending at least 8" or 1/8 pipe outside diameter (whichever is greater) below pipe bottom, and extending up on sides of pipe horizontal centerline; and initial backfill from pipe horizontal centerline up to at least 12" above pipe top, hand placed and compacted before placing any remaining backfill.

- D. Class B Modified Bedding - This shall consist of: Granular materials placed on subgrade to full trench width, extending 8" below bottom and extending up sides of pipe to 12" above pipe top, hand placed and compacted.
- E. Class C Bedding - This shall consist of: Pipe bedded on native material of subgrade (except in rock excavation); and initial backfill over and around pipe and in bell holes, up to 12" above pipe tops, hand placed and compacted before placing any remaining backfill.
- F. Initial Backfill Materials
 - 1. For Class A, B and C Pipe Bedding: Unless otherwise indicated, specified, or authorized this shall be finely divided earth, free of debris, organic material, stones or rock, and highly plastic clays.
 - 2. For Class B Modified Pipe Bedding and where otherwise indicated, specified, or authorized, this shall be granular materials.
- G. Granular Materials
 - 1. These shall conform to the requirements of Granular Pipe Bedding, specified hereinbefore.
- H. Compaction of Pipe Bedding (When required by the HPUD)
 - 1. Pipe bedding composed of selected earth specified above shall be compacted to 95% of the maximum density as determined by ASTM D698 (Standard Proctor).
 - 2. Pipe bedding composed of granular materials specified above shall be compacted to 100% of the maximum density as determined by ASTM D2049.

 - 3. All trench compaction shall be subject to field density tests by the testing laboratory. Any trench compaction that is not compacted as specified above

shall be removed, replaced, recompact, and retested prior to its acceptance.

3.05 WATER AND FORCE MAIN PIPE BEDDING

A. General

1. Pipe bedding includes all materials placed below and on each side of pipe and also initial backfill up to 6" above pipe top. Remaining backfill from 6" above pipe top shall be specified under backfilling hereinafter.
2. Do not install initial backfill until the pipework has been inspected and approved.
3. Testing for leaks on the surface of the pipe prior to initial backfilling will not be required, but other test procedures, as specified in Testing and Sterilizing hereafter, shall be followed.

B. Bedding shall be placed on trench bottom to 6" above pipe top and shall be thoroughly hand tamped in 6" layers equally and uniformly into bell holes, between pipework and trench walls, on each side and top of pipework, all to prevent pipe displacement and as approved by the Engineer, and as specified below.

C. For general (non-rock) excavations: Pipe bedding for ductile iron and PVC pipe, unless otherwise indicated, specified or authorized shall consist of selected earth which is free of rocks, stone, bricks, broken concrete, rubbish, wood, vegetable matter, topsoil, and other unsuitable materials.

1. Where Type "III" Backfill (from 6" above pipe top to paving subgrade) is indicated or specified, pipe bedding shall consist of granular materials only from trench bottom to 6" above pipe top.
2. Where Type "I" and "II" Backfill (from 6" above pipe top to finished grade or paving subgrade) is indicated or specified hereinafter, pipe bedding shall consist of granular materials from trench bottom to approved limits only where authorized by the Engineer.

- D. For rock excavations, pipe bedding up to pipe bottom shall be as specified in Rock Excavation and Blasting hereinbefore. Remainder of pipe bedding shall be as specified in paragraph C above.
- E. Granular materials shall be one of the following:
 - 1. These shall conform to the requirements of Granular Pipe Bedding, specified hereinabove.
- F. Compaction of Pipe Bedding
 - 1. Pipe bedding composed of selected earth as described in paragraph C above shall be compacted to 95% of the maximum density as determined by ASTM D698 (Standard Proctor), unless otherwise specified.
 - 2. Pipe bedding composed of granular materials as described in paragraph E hereinabove shall be compacted to 100% of the maximum density as determined by ASTM D2049.
 - 3. All trench compaction shall be subject to field density tests by the testing laboratory. Any trench compaction that is not compacted as specified above shall be removed, replaced, recompact, and retested prior to its acceptance.

3.6 BACKFILLING - WATER AND FORCE MAIN PIPE

- A. General
 - 1. Backfilling specified as follows does not include Initial Backfill up to 6" above tops; Initial Backfill is specified hereinbefore under Pipe Bedding for the type pipe involved.
 - 2. After pipework and pipe bedding have been approved, backfill trenches with Type I, Type II, or Type III Backfill, as hereinafter specified, indicated, or as authorized.
 - 3. Pipes Crossing Streets, Roads, Gravel Driveways, and Dirt Driveways: Backfill the trenches and make the crossing usable by vehicular traffic immediately after laying pipe and obtaining approval thereof, and maintain these crossings usable by vehicular traffic until project acceptance. Do not under any circumstances leave street or road crossing or a private driveway unusable overnight.

4. For each section of pipe laid, allow only a minimum length of trench to remain without backfill at the end of the day on which the section of pipe was laid. All unbackfilled trenches shall be provided with barricades, warning lights and other safety devices or measures when the work is not in progress.
 5. All compaction of backfill shall be subject to field density tests by the testing laboratory.
 6. At Contractor's expense, remove, replace, and recompact all backfill which fails to comply with compaction density requirements hereinafter specified.
 7. Unsatisfactory Backfilling Conditions: For just cause, the Owner may stop pipe laying at any time and require the Contractor to properly backfill and/or clean up previously laid sections of pipe.
- B. Type I Backfill, for pipe under non-paved areas, except areas within 10 feet horizontal distance from edge of pavement, and for pipe where indicated or authorized:
1. Unless otherwise indicated, specified, or authorized, place all Type I backfill from 6" above pipe tops up to finished grade by approved methods. Windrow excess excavated materials over the trenches, and after sufficient settlement satisfactory to Engineer and Owner has occurred, complete the surface dressing, surplus material removal, and surface cleanup and restoration.
 2. Type I backfill materials from top of pipe bedding up to finished grade shall be any materials removed from the excavation and suitable for backfill, except do not use as backfill material any pieces of the following materials which are larger than 6" in their greatest dimension for up to 3 feet above top of pipe and 12" in their greatest dimension thereafter up to finished grade: rock, stone, concrete, asphalt paving, or masonry.
- C. Type II Backfill, for pipe which parallels paved surfaces and which is installed within 10 feet horizontal distance from edge of pavement and for pipe where indicated or authorized:
1. Unless otherwise indicated, specified or authorized, place all Type II Backfill from top of pipe bedding to finished grade or paving subgrade in 6" maximum thickness loose layers, and compact each layer with mechanical tampers to obtain 95% of the maximum density as determined by ASTM D698 (Standard Proctor).

2. Backfill materials from top of pipe bedding up to finished grade or paving subgrade shall be any materials removed from the excavation and suitable for backfill, except do not use as backfill materials any pieces of the following materials which are larger than 6" in the greatest dimension for up to 3 feet above top of pipe and 12" in their greatest dimension thereafter up to finished grade: rock, stone, concrete, asphalt paving, or masonry.
- D. Type III Backfill, or pipe under paved areas, for areas proposed to be paved, and for pipe where indicated or authorized:
1. Where Type III backfill is indicated, specified, or authorized, backfill trenches from top of pipe bedding to paving subgrade with granular materials compacted to 100% of the maximum density as determined by ASTM D2049.
- E. Dispose of all excavated materials which are not replaced as backfill in a manner and location approved by the Owner and Engineer.
- F. Final Requirements
1. Throughout construction of the project until the time of final acceptance, and also during the duration of the guarantee period, maintain the backfilled and repaved trenches.
 2. At the Contractor's expenses:
 - a. Refill, recompact, and smooth off as required all backfill which settles, so that all backfill finally conforms to the original grade of paving subgrade, as applicable.
 - b. All pavement which may be damaged by settlement of backfill shall be removed and replaced after backfill has been repaired as specified above.

3.07 TRENCH FOUNDATION AND BACKFILLING - GRAVITY SEWER

- A. In order to secure proper bearing for the pipe, the Contractor shall always provide granular bedding material for the pipe. Material shall be properly compacted and shaped as specified. Minimum thickness below the barrel shall be 8".
- B. In the event that rock or unsuitable material is encountered, the HALLSDALE-POWELL UTILITY DISTRICT shall be notified.

- C. If excavation is carried below the required depth or wider than allowed, granular or other material satisfactory to the HALLSDALE-POWELL UTILITY DISTRICT shall be placed by the Contractor to secure a firm foundation for the lower 1/3 of the pipe.
- D. Bell holes shall be dug to a sufficient depth that the bell will not come in contact with the bottom of the hole. After the joint is made the bell hole shall be carefully filled with granular material.
- E. Backfill up to the centerline of the pipe shall be made with crushed stone materials. The material shall be evenly and carefully placed under the haunches of the pipe and hand tamped.
- F. Backfill from the centerline of the pipe up to a point one foot above the top of the pipe shall be made with granular (crushed stone)excavation material.
- G. The remainder of the backfill from one foot above the pipe shall be made by any acceptable method which will not dislodge or damage the pipe or cause bridging action in the trench. However, no stone, rock or boulder larger than 6" in its greatest dimension shall be used in the backfilling.
- H. Excess excavated material shall be disposed of by the Contractor, in a manner approved by the HALLSDALE-POWELL UTILITY DISTRICT.

3.08 DITCH OR CREEK CROSSINGS

- A. Utilize construction methods that will minimize siltation and erosion.
- B. All backfill shall be granular material as specified for embedment material or crusher run stone.
- C. Clean up, grading, seeding and other restoration work shall begin immediately and exposed areas shall not remain unprotected for more than 7 days.
- D. Check dams shall be installed in the bedding and backfill of all new or replaced sewer lines to limit the drainage area subject to the french drain effect of gravel bedding. Major rehabilitation projects should also include check dams in the design. Dams shall consist of compacted clay bedding and backfill at least three (3) feet thick to the top of the trench and cut into the walls of the trench two (2) feet. Alternatively, concrete may be used, keyed into the trench walls. Dams shall be placed no more than 500 feet apart. The preferred location is upstream of each manhole. All stream crossings will include check dams on both sides of the crossing.

3.09 UNSTABLE SUBGRADE

- A. In the event that unsuitable material is encountered at or below the excavation depth specified or shown on the drawings, the HALLSDALE-POWELL UTILITY DISTRICT shall be notified. Such material shall be removed and replaced with suitable material. Methods and materials used for replacement shall be one of the following as directed by the HALLSDALE-POWELL UTILITY DISTRICT in writing.
 - 1. Suitable earth or sand, compacted in the trench.
 - 2. Gravel or crushed limerock, compacted in the trench.
 - 3. Existing materials, stabilized after removal and then replaced and compacted in the trench.
- B. The HALLSDALE-POWELL UTILITY DISTRICT shall determine the methods and materials to be used, based upon the condition of the excavation, the pipe structure to be supported, and the availability and character of stabilizing materials.

3.10 RESTORATION OF SURFACE IMPROVEMENTS

- A. Roadways, including shoulders, alleys and driveways of shell, limerock, stabilized soil or gravel, grass plots, sod, shrubbery, ornamental trees, signs, fences, or other surface improvements on public or private property which have been damaged or removed in excavating, shall be restored to conditions equal to or better than conditions existing prior to beginning work. Restoration of shoulders shall consist of seeding and mulching or stabilizing with limerock as selected by the HALLSDALE-POWELL UTILITY DISTRICT.
- B. Materials for roadways, road shoulders, alleys, or driveways, shall be compacted to a minimum of 95% of the maximum density as determined by AASHTO, Method T-180.

3.11 PAVEMENT REPLACEMENT

- A. Do not cut streets, roads, sidewalks, and other paved surfaces except where boring and jacking cannot be accomplished. At Contractor's expense, repair all damage outside of the specified limits. Maintain all crossings until project completion.
 - 1. Paved surfaces shall be lined and neatly sawed parallel to trenches and around

work items prior to excavation.

- B. Asphalt pavement shall be removed by saw cutting on a straight line with edges as vertical as possible. Concrete pavement or asphalt surfaced concrete shall be removed by cutting with a concrete saw in as straight a line and vertically as possible. Materials to replace State Highway paving shall conform to the specifications required by the Tennessee Department of Transportation. Other asphalt pavement replacement shall conform to the requirements of the applicable State, City or Knox County Transportation Specifications for asphaltic concrete surface and binder course.
- C. Prior to replacing concrete or asphalt pavement replacement, a mineral aggregate base shall be laid. The base for concrete pavement and for asphalt pavement shall be 6-inches (minimum) of compacted thickness. The base course for each shall be compacted to a minimum of 98% of the maximum density as determined by AASHTO, Method T-180. The Contractor will have tests made by an independent testing laboratory to verify compaction results. One test will be made for each block of continuous trench cut.
- D. Non-asphalt pavement replacement shall be replaced of like material and thickness. Asphalt or built-up asphalt pavement replacement shall be replaced with like material of concrete as directed by the HALLSDALE-POWELL UTILITY DISTRICT. Where concrete pavement is required, the concrete shall have a minimum of 6-inches in thickness and be reinforced with 6 by 6 No. 6 gage welded wire fabric. Concrete for paving shall be 3,000 psi design strength. Where the pavement replacement is of like material, it shall be replaced in thickness equal to or better than that existing at the time of removal.
- E. Unless the base is sealed or other temporary paving applied over areas to be paved, pavement shall be replaced not later than 3-weeks after completion of backfill.
- F. Restore to at least the conditions which existed before excavation, all surfaces which have been disturbed by the pipeline installation, as specified below. As each surface is being cut, the Engineer will examine the existing surface in the Contractor's presence, and the type of surface to be replaced in each case shall be determined by the Engineer.
- G. The maximum width of all pavement and all other surface repairs allowable for payment by the Owner shall be the maximum trench width at the tops of the pipes (as specified hereinbefore) plus 12 inches, or six inches beyond each side of the specified maximum trench width at the tops of the pipes. For special instances where Open Cut Highway Crossing is permitted, the maximum width of pavement repair allowable for payment by the Owner shall be three inches beyond each side of the concrete cap or bituminous binder courses. At Contractor's expense, make all repairs outside of this limit. If the

repairs do not reach this limit, the Owner will pay only for the actual extent of the repairs. Replace with new surfaces all existing surfaces which are cut, removed, or otherwise damaged by the work under this Contract, as specified hereinafter. All new surfaces shall conform accurately to the elevations and contours of the existing adjacent undisturbed surfaces.

1. Existing gravel surfaces: replace these with a six inch thick compacted layer of new road gravel of the same type gradation as the existing.
 2. Existing asphalt ("black top") surfaces: replace these with a six inch (minimum) thick compacted base course of new road gravel, and a 3" binder, 2" surface course minimum thickness of hot-lay plant-mix type asphaltic concrete conforming to the applicable road or street paving specifications of the area in which the work is located. Before laying asphaltic concrete surface course, apply a prime coat to the underlying base course as specified hereinafter.
 3. Existing double bituminous surface treatment surfaces: replace these with a six inch thick compacted base course of new road gravel, and a double bituminous surface treatment course to match the existing surface course and conforming with the applicable road or street paving specifications of the area in which the work is located. Before laying double bituminous surface treatment course, apply a prime coat to the underlying base course as specified hereinafter.
 4. Prime coat: this shall be one of the following types of liquid asphalt as authorized for the conditions involved: RC-70, RC-250, MC-70, MC-250. Heat the priming material and apply it with a suitable asphalt distributor at a uniform rate of 0.25 to 0.50 gallons per square yard of base, as approved.
- H. Where pipe is installed on the shoulders parallel to asphalt, double bituminous surface treatment, concrete, or other surfaces, maintain ditches until they are firm and present no traffic hazard. Where authorized, place six inch thick compacted layers of new road gravel on the shoulders.
- I. Road Gravel Material: Road gravel shall be of the same type and gradation as that used for street and road work by the local street or County Road Department in the area in which the sewer system is located.
- J. Unless otherwise authorized, all trenches subject to paving shall be backfilled with granular material and compacted and pavement repairs completed immediately. Failure by the Contractor to satisfy this requirement shall result in rejection of periodic estimates

for payment until surface repairs are completed. Not having sufficient area to warrant moving equipment or subcontractor to work areas shall not be an acceptable reason for delaying surface repairs.

K. State, City and County Approvals: All entries into State, City and County roads shall be subject to the approval of each entity involved. Final Payment will not be made until the Contractor has obtained all necessary road department approvals and submitted acceptable written evidence thereof.

L. Repair of Existing Concrete Surfaces including Sidewalks, Curbs, and Gutters

1. General: Remove existing sidewalks and curbs and gutters only as required for new pipe line installation, and replace removed sidewalks and curbs and gutters with new sidewalks and curbs and gutters, which shall match existing undisturbed corresponding items in dimensions, finishes, grades, and arrangements.
2. New concrete shall be 4,000 psi with an air entrainment value of six percent (1± percent). The water cement ratio shall be not greater than 0.50 by weight. Concrete slump shall be one to three inches.
3. Expansion Joints: Provide expansion joints on 20 foot maximum centers in curbs and gutters and on 35 foot maximum centers in sidewalks, full depth of concrete cross section, and formed with ASTM D1751 1/2" thick expansion joint filler.

3.12 TESTS (If Required by HPUD)

- A. The Contractor shall furnish facilities for making all density tests and make such restorations as may be necessary due to tests operations. All density tests on backfill or base replacement will be made by a commercial testing laboratory employed by the Contractor and at such locations as may be recommended by the HALLSDALE-POWELL UTILITY DISTRICT. If the densities as determined by the specified tests fall below the required minimums, the Contractor shall pay for all retests.

END OF SECTION

