

APPENDIX A: PUBLIC WORKS SPECIFICATIONS

SECTION 101: TITLE, PURPOSE AND APPLICABILITY

A. Title. This Chapter shall be entitled the "Public Works Minimum Specifications" of the Village of Essex Junction.

B. Purpose. The Village Trustees may adopt, and from time to time, amend, specifications for the design and construction of streets, water distribution facilities, sanitary sewer facilities, storm water facilities, and improvements and facilities appurtenant to any of these facilities. Such standards may apply to new construction and to reconstruction of existing facilities. Such standards may also apply to the construction or reconstruction of such facilities, whether publicly or privately owned, if such facilities connect to facilities, which are publicly owned. Prior to the adoption of any such standards, the Trustees shall consider such standards at a public meeting. Following such consideration, the Trustees shall act to adopt, not adopt, or adopt such standards with amendments by appropriate resolution of the Board.

C. Applicability. The provisions of this Chapter shall be applicable to any new construction as well as to reconstruction made necessary by obsolescence or deterioration. Variations from these specifications shall not be permitted without written approval by the Village Engineer. It shall be the policy that all engineering design be based on the latest methods and technologies when determining sizes, strengths and quantities.

For the purposes of this Chapter, Village Engineer shall mean the person or persons appointed by the Trustees in accord with the Village Charter to act in that capacity. The Village Engineer may authorize alteration in design or materials used when construction conditions justify such changes.

SECTION 102: STREET SPECIFICATIONS

A. Description. This item shall consist of a sub-base course of sand as approved by the Engineer and constructed on a prepared subgrade in accordance with the sections as shown on the accepted drawings.

B. Materials. Sand shall consist of material reasonably free from silt, loam, clay, or organic matter. It shall conform to the Vermont Standard Specification for sand borrow, No. 703.03A. It shall be obtained from approved sources and shall meet the requirements set forth in this table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieve
2"	100
1 ½ "	90-100
½ "	70-100
No. 4	60-100
No. 100	0-20

Sieve Designation	Percentage by Weight Passing Square Mesh Sieve
No. 200	0-8

C. Preparation of Subgrade. Objectionable and unsuitable materials shall be removed and replaced with approved material as directed by the Village Engineer. Subgrade shall meet the lines and grades shown on the drawings.

1. Sand shall be deposited and spread so as to distribute the material in uniform layers, compacted to a density of ninety five (95) percent of the maximum dry density using the Standard Proctor Test, according to ASTM D698.
2. Underdrains shall be installed where necessary to provide subgrade stabilization or to prevent the accumulation of water beneath the roadway in areas of highly frost reactive soils.
3. In areas where soil conditions are poor, the Village reserves the right to require that an inert filter fabric be installed beneath the roadbed.

SECTION 103: GRAVEL BASE - BOTTOM COURSE

A. Description. This item shall consist of a base course composed of dense graded crushed stone in accordance with VAOT specification 704.06A, as approved by the Engineer and constructed on a prepared subgrade in accordance with the sections as shown on the accepted drawings.

B. Materials. All materials shall be secured from approved sources. Such gravel shall consist of hard, durable stones, which show uniform resistance to abrasion and which are intermixed with sand or other approved binding material as directed by the Engineer. It shall meet the requirements of Vermont Standard Specification Item No. 704.06A, Dense Graded Crushed Stone for Sub-base. The gravel shall be uniformly graded from coarse to fine and shall meet the grading requirements set forth in this table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieve
3 ½ ”	100
3”	90-100
2”	75-100
1”	50-80
½ ”	30-60
No. 4	15-40
No. 200	0-6

All bottom course material shall be deposited and spread so as to distribute the material in uniform layers, compacted to a density of ninety five (95) percent of the maximum dry density using the Standard Proctor Test, according to ASTM D698.

C. Preparation of Subgrade. All boulders, organic material, soft clay, spongy material and any other objectionable and unsuitable material shall be removed and replaced with approved material as directed by the Village Engineer. The subgrade shall be complete with all underdrains, sand blanket, or filter fabric in place. Approval of the Village Engineer shall be necessary prior to placing of gravel bottom course.

SECTION 104: CRUSHER RUN - TOP COURSE

A. Description. This item shall consist of an upper course of crusher run gravel to be placed over the gravel base - bottom course, which will have been prepared in accordance with these specifications. This upper course shall conform to the following specifications and be placed in accordance with the lines, grades, and typical cross-sections as shown in the accepted drawings. Material shall meet Vermont Standard Specification Item No. 704.05A - Fine; crushed gravel for sub-base.

B. Materials. All materials shall be secured from approved sources. This gravel shall consist of angular and round fragments of hard durable rock of uniform quality throughout, reasonably free from thin, elongated pieces, soft or disintegrated stone, dirt or other objectionable matter. The grading requirements shall conform to the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieve
2"	100
1 ½ "	90-100
No. 4	30-60
No. 100	0-12
No. 200	0-6

This upper course of crusher run gravel shall be deposited and spread in a uniform layer, and compacted to a density of 95% of the maximum dry density using the Standard Proctor Test, according to ASTM D698.

SECTION 105: BITUMINOUS CONCRETE PAVEMENT

A. Description. This type of pavement shall be composed of mineral aggregate, mineral filler if required, and bituminous material, plant mixed and laid hot. This pavement shall be constructed in two (2) courses on the prepared or existing base in accordance with these specifications and in conformity with the lines, grades, thickness and typical cross-sections shown on the accepted drawings. No puddles will be allowed on streets or sidewalks.

B. Material:

1. The course aggregate shall consist of clean, hard crushed rock or screened crushed gravel free from dirt or foreign matter. It shall be reasonably free from soft and elongated pieces.
2. The fine mineral aggregate shall consist of sand or a mixture of sand and stone screenings of which at least fifty (50) percent by weight shall be sand. The sand shall consist of clean, hard, durable grains, free from dirt, unsuitable material, and pieces,

which are structurally weak.

3. The asphalt cement shall conform to all the requirements as set forth by the State of Vermont Standard Specifications for Highway Construction. (Section 702).

C. Construction Methods. Equipment for spreading and finishing the mixture shall be a mechanical spreading and finishing machine provided with an activated screed and heated if required. The machine shall be capable of spreading the mixture without segregation and shall be approved by the Village Engineer before being used.

Application of bituminous concrete pavement shall conform in all respects to Vermont Standard Specifications Section 406. These requirements shall include but not be limited to the following:

1. Weather Conditions, unless otherwise approved by the Village Engineer. The plant mixed material shall not be placed between November 1 and May 1. Bituminous wearing course shall not be applied prior to May 15 or after October 15. The material shall not be placed when the air temperature at the paving site in the shade and away from artificial heat, is forty (40) degrees Fahrenheit or lower. Placing shall not begin until the air temperature is over forty (40) degrees Fahrenheit and rising.
2. Spreading and Finishing. Immediately before placing the bituminous mixture, the existing surface shall be cleaned of all loose or unsuitable material. Contact surfaces of pavement, curbing, gutters and manholes shall be painted with a thin, uniform coat of Emulsified Asphalt Type RS-1 immediately prior to placement of the mixture against them.
3. Compaction. Immediately after the bituminous mixture has been spread, struck off and surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling. Along forms, curbs, headers, walls and other places not accessible to the rollers, the mixture shall be thoroughly compacted with hot or lightly oiled hand tampers, smoothing irons or with mechanical tampers. On depressed areas, a trench roller may be used or cleated compression strips may be used under the roller to transmit compression to the depressed area.
4. Surface Tolerance. The base course shall be finished to within a grade tolerance of one quarter ($\frac{1}{4}$) inch, provided that this deviation is not maintained for a distance longer than fifty (50) feet, and provided that the required crown or super-elevation is maintained. The surface course will be tested by the Engineer using a sixteen (16) foot straight edge at selected locations parallel with the centerline. Any variations exceeding one eighth ($\frac{1}{8}$) of an inch between any two contacts shall be satisfactorily eliminated. A ten (10) foot straight edge may be used on a vertical curve. The straight edges shall be provided by the contractor.
5. Bituminous concrete pavement and pathways shall be constructed using a mechanical spreading and finishing machine and shall be approved by the Village Engineer. After placement, the material shall be thoroughly compacted with rollers or other equipment approved by the Village Engineer.

SECTION 106: CEMENT CONCRETE CURB

A. Description. This item shall consist of a Portland Cement concrete curb constructed on a prepared subgrade in accordance with these specifications and the cross-section shown on the accepted drawings. In general, each property is allowed one curb cut. Additional curb cuts, and

curb cut locations, and layout shall be as specified in Section 705 of this code.

B. Materials. All concrete used in the construction of roadway curbs shall be Air Entrained five percent plus or minus one percent ($5.0\% \pm 1\%$) so determined by an air meter approved by the Village Engineer. This concrete shall have a twenty eight (28) day compressive strength of four thousand (4000) psi and meet State of Vermont Standard Specifications for Class A concrete, Section 541.

C. Construction Methods.

1. Preparation of subgrade - All boulders, organic material, soft clay, spongy material and any other objectionable material shall be removed and replaced with approved material. The concrete curbing shall be built to the required line and grade on a sub-base of gravel six (6) inches in depth, which shall be fully compacted.

2. Forms for concrete - The forms shall be of metal or of acceptable planed and matched lumber and of such construction that a smooth surface will be produced. All forms shall be oiled.

3. Placing and finishing concrete - Just prior to placing the concrete, the subgrade shall be moistened. The concrete mixed to the proper consistency shall be placed in the forms and thoroughly tamped in place so that all honeycombs will be eliminated and sufficient mortar will be brought to the surface. The use of vibrators or other compaction equipment to move the concrete within the forms is not approved. The curbing shall immediately upon removal of the forms, be rubbed down to a smooth and uniform finish, no plastering or patching will be allowed. After the forms have been removed, the trench shall be backfilled with approved gravel and fill as needed and thoroughly tamped, care being taken not to affect the alignment or grade of the curbing.

4. Expansion and contraction joints – One half-inch ($1/2''$) expansion joints shall be placed at intervals of twenty (20) feet for continuous pours. At intervals not greater than ten (10) feet nor less than five (5) feet, the concrete curbs shall be scored for a depth equal to one-third ($1/3$) the total depth of the concrete.

5. Curing the concrete - When completed, the concrete shall be kept moist for a period of not less than three (3) days and longer if the Engineer deems necessary and shall be protected from the elements in an approved manner. If the contractor elects, he may apply an approved curing compound according to directions of the manufacturer.

6. Seasonal Limits - No concrete shall be poured on a frost or thawing subgrade or during unseasonable weather conditions, or when the temperature is forty (40) degrees Fahrenheit or lower and falling.

7. Anti-Spalling Compound - Upon completion of the initial curing period (approximately twenty eight (28) days after placement), Anti-Spalling Compound is to be applied in two (2) coats. The first coat shall be applied at the rate of twenty-five thousandths (0.025) of a gallon per square yard and the second coat at a rate of fifteen thousandths (0.015) of a gallon per square yard. The air temperature during application shall not be lower than fifty (50) degrees Fahrenheit. All exposed surfaces shall be treated and shall be exceptionally clean prior to the time of application.

SECTION 107: GRANITE CURB

A. Description. This item shall consist of a granite curb constructed on a prepared subgrade

in accordance with these specifications and the cross-section shown on the accepted drawings.

B. Materials:

1. All curbs shall be obtained from approved sources and shall meet the requirements of Sections 707.01, Mortar, Type I and 729.01, Vertical Granite Curb of the Standard Specifications for Highway and Bridge Construction, Vermont Department of Highways.
2. Curb shall be cut from hard durable quarried granite, grey in color and free from seams, cracks or other structural defects. Curbstones shall be furnished in minimum lengths of six (6) feet and the top surface shall be sawed to true plane plus or minus one eighth ($\pm 1/8$) of an inch. The top front arias line shall be rounded to a two (2) inch radius and the front face shall be smooth quarry split. The top eight (8) inches of the front face shall have no projections greater than one (1) inch or depressions deeper than two (2) inches.
3. Curb Cuts - Same as for Cement Concrete Curb, as specified in section 705 of this Code.

C. Construction.

1. Excavation shall be made to the required depth and the base material shall be compacted to a firm true surface. A fine dirty stone such as "ShurPac" shall be used to level the bed for the curb.
2. Curb stones shall be set so that the front arias line conforms to the line and grade shown on the plan.
3. No joints larger than one (1) inch will be permitted between stones. All joints shall be completely filled with Type I Mortar and shall be neatly pointed on front and top.
4. Topsoil shall be filled against the back of curb and shall be blended to existing lawns. Fill slopes shall not exceed six to one (6:1) unless authorized by the Engineer.

SECTION 108: CEMENT CONCRETE SIDEWALK

A. Description. This item shall consist of sidewalk made of one course Portland Cement concrete not less than four (4) inches thick and with a width of not less than five (5) feet. Where physical constraints exist, and at the discretion of the Village, existing sidewalks less than five (5) feet may be reconstructed with a width less than five (5) feet. Where the sidewalk crosses a driveway the depth of concrete shall not be less than six (6) inches and, in some areas not less than eight (8) inches for the full width of the driveway. The sidewalk shall be constructed in accordance with these specifications and the cross-sections as shown on the accepted drawings.

B. Materials. Same as for Cement Concrete Curb.

C. Construction Methods:

1. Preparation of Subgrade - All boulders, organic material, soft clay, spongy material, and any other objectionable material shall be removed and replaced with approved material. The subgrade shall be properly shaped, rolled and uniformly compacted to conform with the accepted cross-sections and grades.
2. Base - Six (6) inches of compacted, approved gravel (704.05A-Fine) shall be constructed on the subgrade to accepted cross-sections and grades. Twelve (12) inches

base is required for drive aprons.

3. Forms for Concrete - The forms for the concrete shall be made of wood or metal, well oiled, straight, free from warps or kinks and of sufficient strength. They shall be staked securely enough to resist the pressure of the concrete to be deposited, they shall not vary from the approved line and grade and shall be kept so until the concrete has set.

4. Placing and Finishing Concrete - Just prior to placing the concrete, the sub-base shall be moistened. The concrete mixed to the proper consistency shall be placed in the forms and thoroughly tamped in place so that all honeycombs will be eliminated and sufficient mortar will be brought to the surface. Unless otherwise approved by the Village, sidewalk shall be cast in one hundred (100) foot sections with no expansion joints. Connection to existing sidewalk and between one hundred (100) foot sections shall be accomplished with steel dowels, spaced twelve (12) inches on center. Sidewalk adjacent to curb shall be separated with four (4) millimeter polyethylene. After this, the surface shall be brought to a smooth even finish by means of a wooden float. The surface shall be broom finished. All faces adjacent to the forms shall be spaded so that after the forms are stripped, the surface of the faces will be smooth, even and free of honeycombs. All edges shall be tool rounded with an edger having a quarter (0.25) inch radius.

5. Scoring Concrete - Sidewalk joints shall be saw cut at five (5) foot intervals to one third (1/3) the sidewalk depth. Struck transverse false joints shall not be utilized. Connections to existing concrete requires minimum one half (1/2) inch smooth steel dowels, spaced twelve (12) inches on center, and shall be installed by drilling.

6. Curing Concrete - All sidewalks shall be treated with Certi-Vex AC 1315, per the manufacturer's instructions.

7. Backfilling - Backfill shall be of suitable plant mixed gravel and shall be placed and tamped until firm and solid. Backfilling shall follow immediately after the concrete forms have been removed.

8. Seasonal Limits - Same as for Cement Concrete Curb.

9. Anti-Spalling Compound - Same as for Cement Concrete Curb.

D. Accessible Access. Sidewalk ramps shall be constructed as shown in these specifications and located in accordance with the approved plans at all intersections. Detectable surface shall be truncated domes constructed of cast iron. Saw cutting, exposed aggregate, or scoring sidewalk ramps is not acceptable.

SECTION 109: CEMENT CONCRETE DRIVEWAY APRONS (PRIVATE AND COMMERCIAL DRIVES)

A. Description. This item shall consist of a Portland Cement Concrete driveway apron not less than six (6) inches thick and in some areas not less than eight (8) inches thick at the discretion of the Village. The sub-base shall be constructed on the approved subgrade in accordance with these specifications and as shown on the accepted drawings.

B. Materials. Same as for Cement Concrete Curb.

C. Construction Methods.

1. Preparation of Subgrade - Same as for Cement Concrete Sidewalk.
2. Forms for Concrete - same as for Cement Concrete Curb.

3. Placing and Finishing Concrete - Same as for Cement Concrete Sidewalk.
4. Curb - Curbs shall be constructed so as to protrude one (1) inch above the roadway surface at the entrance to the driveway. This curb shall be constructed with a smooth and gradual depression transition.
5. Sidewalks - The section of sidewalk at the driveway shall be constructed to a thickness of not less than six (6) inches, but in some areas not less than eight (8) inches at the discretion of the Village Engineer.
6. Curing Concrete - Same as for Cement Concrete Curb.
7. Seasonal Limits - Same as for Cement Concrete Curb.
8. Anti-Spalling Compound - Same as for Cement Concrete Curb.

SECTION 110: BITUMINOUS CONCRETE DRIVEWAY APRONS (PRIVATE AND COMMERCIAL DRIVES)

- A. Description. Same as for Bituminous Concrete pavement.
- B. Materials Same as for Bituminous Concrete Pavement.
- C. Construction Methods
 1. Preparation of Subgrade - Same as for Cement Concrete Sidewalk. Minimum of twelve (12) inches compacted gravel (704.05A-Fine).
 2. Curb - Same as for Cement Concrete Driveway Aprons.
 3. Sidewalks - Same as for Cement Concrete Sidewalks.
 4. Method of Application - To be approved by the Engineer.

SECTION 111: RIGHT OF WAY MONUMENTS

- A. Description. This item shall consist of installing Right-of-way monuments below finish grade at all street corners and all points of curvature and/or tangency as shown on the accepted plans.
- B. Materials. Concrete - Concrete monuments shall be precast in one piece four (4) inches by four (4) inches by thirty-six (36) inches of Class B Concrete with four (4) reinforcing steel rods. Monuments shall meet the requirements of Title 26, Chapter 45, and Part 5 Minimum Standards for the Practice of Land Surveying.
- C. Construction Methods.
 1. The monuments shall be erected at locations indicated on the Plans, or as directed by the Village Engineer. They shall be set vertically and to a depth so that the top of the monument is at an established grade. The monuments are to be set in place after all other street development is completed.
 2. The location of monuments shall be established by a surveyor licensed to practice in the State of Vermont.

SECTION 112: WATER DISTRIBUTION SPECIFICATIONS

- A. Description. This item shall consist of the excavation and backfilling required for the

complete construction of the water mains, which shall include valves, tees, hydrants, elbows, reducers and all other appurtenances necessary for a complete water main system as indicated on the accepted drawings.

B. Materials.

1. Pipes - Water mains shall be double cement-lined Ductile Iron Pipe, A.W.W.A. thickness Class fifty two (52) of the size shown on the accepted plans: (Minimum diameter – eight (8) inches). PVC water mains are not acceptable.
2. Fittings - All fittings are to be mechanical joint cement lined Ductile Iron A.W.W.A., pressure rating three hundred and fifty (350) psi to twelve (12) inch diameter pipe, and to meet requirements of A.W.W.A. Standards C 110-77.
3. Other materials may be accepted on a case-by-case basis.

C. Gate Valves - Gate valves shall be A.W.W.A. C 500-80 Standard Gate Valves with mechanical joints of sizes as required on the plans. All valves shall be of cast or ductile iron body, parallel brass seats, non-rising stem, inside screw, resilient wedge construction with "O" Ring Stem Seals. All valves to be equipped with a valve box for a minimum of five (5) feet of cover material. The gate valves shall open left and be designed for a working pressure of two hundred (200) psi.

D. Construction Methods.

1. Installation - All water main installation and testing shall be made in accordance with A.W.W.A. Standard C.600. Depth of cover shall be no less than six (6) feet on all mains, valves, and fittings. In areas where deep fills occur, the fill shall be applied in six (6) inch layers and each layer shall be compacted to ninety five (95) percent Standard Proctor Density.
2. Excavation - The trench shall be excavated to the line and grade shown on the drawings. The trench should be as narrow as possible but ample to permit the pipe to be laid and joined properly.
3. Bell Holes - Holes for the bells shall be provided at each joint but shall be no larger than necessary for joint assembly and assurance that the pipe barrel will lie flat on the trench bottom. Push-on type joints require only minimum depressions for bell holes.
4. Rock Conditions - When excavation of rock is encountered, all rock shall be removed to provide a clearance of at least six (6) inches below and on each side of all pipe, valves, and fittings. When excavation is completed, a layer of appropriate backfill material shall be placed on the bottom of the trench to the previously mentioned depths, leveled, and tamped. All temporary supports need to be removed prior to burying the pipe.
Temporary support, adequate protection, and maintenance of all underground structures, drains, sewers, and other obstructions encountered in the progress of the work shall be furnished by the contractor.
5. Unsuitable Subgrade Material - When the subgrade is found to include ashes, cinders, refuse, organic material, or other unsuitable material, such material shall be removed to a minimum of at least six (6) inches and replaced with clean, stable backfill material. When such materials are encountered, polyethylene encasement should be used. The bedding shall be consolidated and leveled in order that the pipe may be installed properly.

6. Pipe Plugs - At times when pipe laying is not in progress, the open ends of pipe shall be closed by a water-tight plug or other means approved by the Engineer. The plug shall remain in place until the trench is pumped completely dry. Care must be taken to prevent pipe flotation should the trench fill with water.
7. Joint Deflection - When it is necessary to deflect pipe from a straight line in either the horizontal or vertical plane, the amount of joint deflection shall not exceed five (5) degrees or eighteen (18) inches per eighteen (18) feet of pipe length.
8. Backfill Material - All backfill material shall be free from cinders, ashes, refuse, vegetable or organic material, boulders, rocks or stones, frozen soil, or other material that, in the opinion of the Engineer, is unsuitable.
 - (a) From one (1) foot above top of the pipe to the subgrade of the pavement, material containing stones up to eight (8) inches in their greatest dimension may be used, unless otherwise specified.
 - (b) When the type of backfill material is not indicated on the plans or is not specified, the excavated material may be used, provided that such material consists of loam, sand, gravel, clay, or other materials that, in the opinion of the Engineer, are suitable for backfilling.
 - (c) If excavated material is indicated on the drawings or specified for backfill, and there is a deficiency due to a rejection of part thereof, the required amount of sand, gravel or other approved material shall be provided.
9. Valve Location - Valves in water mains shall, where practical, be located within the street property lines unless shown otherwise on the plans, but not in the paved surface of the street or the sidewalks. Mains shall be drained through drainage branches or blow-offs. Drainage branches, blow-offs, air vents and appurtenances shall be provided with valves and shall be located and installed as shown on the plans. Drainage branches or blow-offs shall not be directly connected to any storm or sanitary sewer, submerged in any stream, or be installed in any other manner that will permit back-siphonage into the distribution system.
10. Valve Protection - A valve box or a vault shall be provided for every valve. All gate valve boxes, extensions and risers shall be cast iron.
11. Thrust Blocks - All plugs, caps, tees, hydrants, and bends deflecting twenty-two and a half (22 ½) degrees or more shall be provided with a thrust block bearing against undisturbed soil. At the approval of the Engineer, the contractor may, in proper soil conditions, install concrete blocks to provide thrust for water pipes.
12. Testing and Acceptance - The pipeline upon completion shall be tested for pressure and leakage by the contractor, in the presence of the Engineer, to a pressure of at least one and half (1.5) times the working pressure in the line at the lowest point or two hundred (200) psi, whichever is greater, for two (2) hours duration and shall not vary by more than plus or minus five (± 5) psi. Any defective work shown by this test will be replaced by the contractor at no extra cost to the owner. The contractor shall furnish all material, labor, and appliances for testing pipe sections as the work progresses. The contractor shall furnish all materials, labor and equipment to test for leakage in the system at one and a half (1.5) times working pressure by means of test meters or other means approved by the Engineers. The leakage shall not be greater than the determined by the following formula:

$$\frac{L}{\frac{S \times D \times (P^{0.5})}{148,000}}$$

in which L is the allowable leakage in gallons per hour; S equals length of pipeline tested in feet; D equals nominal pipe diameter in inches; and P equals average test pressure in psi. If leakage so measured exceeds the allowable amount the contractor shall at once locate the leaks and make the necessary repairs to bring the leakage within the acceptable limits at no extra cost to the owner. All visible leaks are to be repaired regardless of the amount of leakage.

13. Flushing - Prior to Chlorination, the contractor shall flush the mains to A.W.W.A. Standard C601 until a clear stream is obtained.

14. Chlorination - Chlorination of the water main shall be conducted only after the main has been satisfactorily pressure and leakage tested and flushed and a clean stream is obtained, as determined by the Engineer. The Contractor shall furnish all labor, equipment, materials, and tools necessary to disinfect the pipe and appurtenances in accordance with AWWA Standard for Disinfecting Water Main C651, latest revision. The continuous feed method shall be performed under the supervision of the Engineer. The Contractor shall thoroughly flush and dechlorinate while flushing the original chlorination of the main to completely remove all the chlorinated water. The Contractor shall coordinate with the Village of Essex Junction Wastewater Treatment Facility on the disposal of heavily chlorinated water flushed from the main. The disinfection process shall be deemed acceptable only after two samples of water from the flushed, disinfected main, collected twenty-four (24) hours apart, show no evidence of bacteriological contamination, as determined by the Health Department or other approved lab.

15. Protection of Water Supplies - Water mains shall be laid at least ten (10) feet horizontally from any existing or proposed sanitary sewer. This distance can be reduced to five (5) feet for storm sewers. The distance shall be measured edge of pipe to edge of pipe. Where impractical due to ledge, boulders, or other unusual conditions, to maintain ten (10) foot horizontal separation between water and sewer lines, the water line may be in a separate trench or on an undisturbed earth shelf in the sewer trench provided that the bottom of the water line is at least eighteen (18) inches above the top of the sewer. Wherever impossible or impractical to maintain eighteen (18) inches vertical separation, the sanitary sewer line shall be constructed to normal waterline standards and pressure tested to fifty (50) psi for fifteen (15) minutes prior to backfilling. No leakage shall be allowed for this test.

Sewer crossing water mains shall be laid beneath the water main with at least eighteen (18) inches vertical clearance between the top of the sewer and the bottom of the water main. When it is impossible to maintain the eighteen (18) inches vertical separation or where the sewer must be laid above the water main;

- (a) The crossing shall be arranged so that one full length of sewer is centered above or below the water line, with sewer joints as far as possible from water joints;
- (b) The sanitary sewer pipe must be constructed to water main standards for minimum distance of twenty (20) feet either side of the crossing or a total of three (3) pipe lengths, whichever is greater;
- (c) The section constructed to water main standards must be pressure tested to

maintain fifty (50) psi for fifteen (15) minutes without leakage prior to backfilling beyond one (1) foot above the pipe to assure water tightness; and

(d) Where water main crosses under a sewer, adequate structural support shall be provided for the sewer to prevent damage to the water main.

No water main shall pass through, or come into contact with, any part of a sanitary sewer manhole. There shall be no physical connection between the distribution system and any pipes, pumps, hydrants, or tanks, which are supplied or may be supplied with water that is, or may be, contaminated.

SECTION 113: HYDRANTS

A. All hydrants are to be three-way, five (5) inch minimum diameter and limited to the following makes:

1. Kennedy A.W.W.A K-81
2. Mueller A.W.W.A. Cat. No. A 243
3. Waterous A.W.W.A. Pacer

B. All threads shall be “double start” style and have:

1. Steamer connection: Five (5) inch STORZ Connector
2. Two and half (2½) inch spuds:
 - (a) Outside diameter of three and one eighth (3.125) inches plus zero (0) to two hundredths (0.02) inches;
 - (b) Inside diameter of two and a half (2½) inches six (6) threads per inch.
3. There shall be a minimum of twelve (12) inches between the ground and the bottom of the steamer cap.
4. Single family house subdivisions will require not more than three hundred and fifty (350) feet between hydrants, and a minimum water flow of not less than one thousand (1,000) gallons per minute from each hydrant. At least one hydrant shall be located at each intersection.
5. A ten (10) foot by ten (10) foot easement will be required around the hydrant if located on private property. Each hydrant must be a minimum of four (4) feet from the edge of the sidewalk (to the closest point of the hydrant). No structures or planting to be placed within this easement.
6. Color Code:

Gallons/minute	Color on cap of hydrant
more than 1000	green
500-1000	yellow
less than 500	red

The Village will test the hydrants and the contractor will paint the CAPS of the hydrant in accordance with the above color code chart. The base of the hydrant shall be painted red for all hydrants by the contractor.

7. Thrust Blocks: Thrust blocks must be installed in accordance with the specifications given in the water system section of these specifications.
8. No private hydrants will be approved.

SECTION 114: SERVICE CONNECTIONS

- A. Description. This item shall consist of the installation of individual services from the water main to the meter with the necessary corporations, curb stops, curb boxes, stop and drains, meter spacers with stubs and pipe as indicated on the accepted drawings.
- B. Materials:
1. Pipe - Service pipes shall be three quarter (3/4) inch Type "K" Copper Tubing manufactured according to ASTM Specifications B.88-62, or approved equal.
 2. Corporation Stops - All corporation stops shall be constructed of brass according to A.W.W.A. Standard C 800 and be three quarter (3/4) inch thread compression corporation stops Mueller Cat. No. H-15000 or equal.
 3. Curb Stops - All curb stops shall be constructed of brass according to A.W.W.A. Standard C 800 and be three quarter (3/4) inch inverted key curb stop, Mueller Cat. No. 15200 or equal with compression fittings.
 4. Curb Boxes - All curb boxes shall be Extension Type with stationary rod and arch pattern base, Mueller Cat. No. H-10334 or equal with a five (5) foot bury. Curb box couplings and extensions will be the same material as the curb box.
 5. Ball Valves - Ball Valves shall be three quarter (3/4) inch.
- C. Construction Methods
1. Services – One (1) curb stop and one (1) water meter shall be installed for each individual dwelling unit, condominium unit, apartment unit, commercial, or office occupancy. Exceptions will be permitted in cases where a condominium association signs a binding agreement to be responsible for all collections of water bills. In cases where condominiums are converted into separate apartments, separate curb stops and water meters shall be installed for each unit. All water meters shall be purchased through the Village Water Department and shall be installed by Village employees. The contractor shall make all necessary taps into the water main and for each lot, install an approved brass corporation stop, connect the three quarter (3/4) inch type "K" copper service pipe to the compression which pipe shall be connected to the three quarter (3/4) inch type Brass Curb Stop with inlet and outlet for three quarter (3/4) inch type "K" copper service pipe. Such curb stop shall be installed within the strip of Right-of-way between the sidewalk and property line. Curb stops must be located within the public Right-of-way or within a Right-of-way granted to the Village of Essex Junction for access. The corporation stop shall be left open and the curb stop closed. Such curb stop shall be located not less than five (5) feet below the ground surface and shall be accessible from the surface through an approved valve box.
 2. Service Connections - The service connections shall be made by installing three quarter (3/4) inch type "K" copper pipe, or approved equal, on the end of the approved brass curb stop and proceeding through the cellar wall to an approved three quarter (3/4) inch ball valve on each side of the meter. Meter space shall be provided between the ball valve. All service connections must be installed to the curb stop for all lots in a subdivision before the streets are paved.

SECTION 115: SANITARY SEWER SPECIFICATIONS. Sewer Mains Polyvinyl Chloride (PVC)

A. Description. This item shall consist of the excavation and backfilling required for the complete construction of gravity sewers which shall include manholes, service connections and all other appurtenances necessary for a complete Sanitary Sewer System as indicated on the accepted drawings.

B. Installation. All pipe fittings shall be installed in accordance with Specifications herein, the Contract Drawings and the manufacturer's recommendations. Both ends of all new sewer lines must be closed (capped) during construction to prevent the entry of earth into the sewer system.

C. Materials:

1. Pipes - For gravity sewers a minimum pipe diameter of eight (8) inches shall be used. Polyvinyl Chloride (PVC) shall meet ASTM Specification D 3034-SDR 35. The nominal laying length of the pipe shall be twenty (20) feet or twelve and a half (12.5) feet.

2. Joints - The pipes and fittings shall be joined with flexible elastomeric seals meeting the requirements of ASTM D-3212.

3. Manholes - Pre-cast Reinforced Concrete manholes shall be furnished with reinforced copolymer polypropylene ladder rungs, with a five (5) inch wall thickness, and minimum inside diameter of four (4) feet of all barrel sections, and with a wall thickness varying from five (5) inches at the bottom to eight (8) inches at the top of all cone sections.

4. Bedding Material - All sewer pipe shall be laid on a six (6) inch layer of three quarter ($\frac{3}{4}$) inch crushed stone so that one hundred (100) percent will pass a three quarter ($\frac{3}{4}$) inch square opening sieve and eighty (80) to one hundred (100) percent will be retained in a No. 4 sieve.

5. Manhole Frame and Cover - Manhole frames and covers shall be of the form and dimensions shown on the accepted drawings and shall be machined to provide a good tight non-rocking fit and have a minimum weight of four hundred (400) pounds. The cover pattern shall be a diamond pattern with lift holes around the perimeter. These frames and covers shall be the same as those manufactured by C.E. Maguire by LeBaron Foundry - Catalog LC266, Wt. 400#, LC268-1 Self Sealing Frame and Cover, or an approved equal.

D. Construction Methods

1. Excavations - Excavations shall be made to a point at least six (6) inches below the pipe invert to accommodate the bedding material. All excavations are to be kept dry while pipe is being laid and until each joint and pipe has been inspected by the Engineer and approval given to commence backfilling operations.

2. Laying Sewer Pipe - The bell end of the pipe shall face upgrade at all times, and be placed in such a position as to make the invert even when the next pipe section is inserted. Where required by adverse grading conditions, the contractor shall fill any gully to make a suitable bedding for the sewer pipe. The fill shall be compacted to a ninety five (95) percent Standard proctor density upon which the six (6) inches of bedding material shall be placed. Any pipe which is not laid to grade and alignment shall be re-laid to the

satisfaction of the engineer. The bedding material shall be placed and compacted on each side of the pipe to a height six (6) inches above the pipe and for the full width of the excavated trench or as shown on the accepted plans.

3. Backfill - Backfill shall consist of approved material placed in six (6) inch layers with each layer being thoroughly compacted to a density of 95% of the maximum dry density using the Standard Proctor Test, according to ASTM D698. Debris, frozen material, large clods or stones, organic matter, or other unstable materials shall not be used for backfill. No stones in excess of one and one half (1.5) inch diameter shall be placed within two (2) feet of the outside of the pipe. Particular precautions shall be taken in placement and compaction of the backfill material in order not to damage and/or break the pipe. The backfill shall be brought up evenly on both sides of the pipe for its full length. Walking or working on the completed pipeline except as may be necessary in tamping or backfilling, shall not be permitted until the trench has been backfilled to a height of at least two (2) feet over the top of the pipe. During construction all openings to the pipe lines shall be protected from contamination by earth or other materials.

4. Manholes - Manholes shall be installed at the end of each line, at all changes in grade, size or alignment of pipe, at all pipe intersections, and at distances not greater than three hundred (300) feet. Pre-cast Reinforced Concrete Manholes shall have the top section set at a grade that will place the riser a minimum of three (3) inches and a maximum of twelve (12) inches from the top of the pre-cast manhole cone. Adjustments shall be made using pre-cast concrete riser rings, expanded polypropylene riser rings, or cast-in-place concrete. Bricks shall not be used. All joints shall be grooved type and shall be fully bedded with mastic seal when setting sections. Lifting holes in all manhole sections shall be filled solid with mortar. No cracked, damaged or defective sections will be allowed in the work. Inlet and outlet pipes shall be joined to the manhole with a rubber-gasketed flexible watertight connection that allows differential settlement of the pipe and manhole wall to take place. If the elevation difference of pipe inverts is twenty four (24) inches or more, a drop manhole shall be provided. Drop manholes shall have an external drop encased in concrete or an internal drop using a drop bowl. If an internal drop is used, the manhole inside diameter shall be increased to a minimum of five (5) feet.

5. Inverts - Inverts may be constructed of red hard burned brick set on edge, or pre-cast concrete.

6. Leakage and Testing - If inspection of the completed sewer or any part thereof shows any pipe, manhole, or joint which allows infiltration of water, the defective work, or material, shall be replaced or repaired as directed by the Engineer. After the sewer has been completed, the contractor shall furnish all labor and materials necessary, and in general, assist the Engineer to conduct such leakage tests at such times and at such locations as the Engineer deems necessary.

(a) Air Testing Procedures:

(i) Plug all openings in the test section.

(ii) Add air until the internal pressure of the line is raised to approximately four (4.0) pounds/square inch (psi) greater than the average pressure of any ground water. After this pressure is reached, allow the pressure to stabilize. The pressure will normally drop as the air temperature stabilizes. This usually takes two (2) to five (5) minutes depending on the pipe size. The pressure may be reduced to three and one

half (3.5) psi before starting the test.

(iii) When the pressure has stabilized and is at or above the starting test pressure of three and one half (3.5) psi above maximum groundwater pressure, start the test. If the pressure drops more than one (1.0) psi during the test time, the line is presumed to have failed the test. If a one (1.0) psi drop does not occur within the test time, the line has passed the test.

(b) Test Time:

(i) The following table shows the required test time, T, in minutes per one hundred (100) feet of pipe for each nominal pipe size. Test times are for a one (1.0) psi pressure drop from three and one half (3.5) to two and one half (2.5) psi.

(ii) If the section of line to be tested includes more than one pipe size, calculate the test time for each size and add the test times to arrive at the total test time for the section.

(iii) It is not necessary to hold the test for the whole period when it is clearly evident that the rate of air loss is less than the allowable.

MINIMUM TEST TIME FOR VARIOUS PIPE SIZES

Nominal Pipe Size (Inches)	T (time) min/100 feet
3	0.2
4	0.3
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4

Nominal Pipe Size (Inches)	T (time) min/100ft
21	3.0
24	3.6
27	4.2
30	4.8
33	5.4
36	6.0
39	6.6
42	7.3

(c) Manholes - All manholes shall be tested for leakage. Manholes shall be tested for leakage in accordance with one of the following:

(i) Water Test - After the manhole has been assembled in place, all lifting holes and exterior joints shall be filled and pointed with an approved non-shrinking mortar. All pipes and other openings into the manhole shall be suitably plugged and the plugs placed to prevent blowout.

(ii) Each manhole shall be checked for exfiltration by filling with water to the top of the cone section. A stabilization period of one (1) hour shall be provided to allow for absorption. At the end of this period, the manhole shall be refilled to the top of the cone, if necessary, and the measuring time

of at least six (6) hours begun. At the end of the test period, the manhole shall be refilled to the top of the cone measuring the volume of water added. This amount shall be converted to a twenty-four (24) hour rate and the leakage determined on the basis of depth. The leakage for each manhole shall not exceed one (1) gallon per vertical foot for a twenty-four (24) hour period for exfiltration and there shall be no visible infiltration.

(d) Vacuum Test - Vacuum testing of manholes shall also be considered acceptable using the following guidelines: The test shall be done after assembly of the manhole. The manhole to pipe connection shall be flexible. A sixty (60) inch/lb. Torque wrench shall be used to tighten the external clamps. All lift holes shall be plugged with a non-shrink mortar, as approved by the Engineer. The seal between manhole sections shall be approved, preformed flexible mastic per ASTM C923. The completed manhole shall not be backfilled prior to testing. Manholes which have been backfilled shall be excavated to expose the entire exterior prior to vacuum testing or the manhole shall be tested for leakage by means of a hydrostatic test. Interior piping and plugs shall be adequately braced to prevent movement. A vacuum of ten (10) inches of Hg shall be drawn within the manhole. The manhole shall pass the test if the vacuum remains between ten (10) inches Hg and nine (9) inches Hg for at least two (2) minutes.

7. Deflection Testing – Deflection tests shall be performed on all flexible pipe after the final backfill has been in place for at least thirty (30) days. The deflection test shall be run using a rigid ball or mandrel having a diameter equal to ninety-five (95) percent of the inside diameter of the pipe. No mechanical pulling devices shall be used during the deflection tests. All pipe not meeting the deflection test shall be re-excavated and replaced at the Contractor's expense.

SECTION 116: SERVICE CONNECTIONS

A. Description. This item shall consist of the installation of individual services from the sewer main to the property line as shown on the accepted drawings. There shall be Sanitary Sewer Service installed for each lot as shown on the Plan. All sewer services must be installed beyond the R.O.W. for all lots in a subdivision before the streets are paved, and before the leakage test on the sewer main is performed.

B. Materials:

1. Pipes - Sanitary sewer services shall have a minimum pipe diameter of four (4) inches and made of the same material as the main sanitary sewer system. All pipe and joints shall meet the specifications set forth for the sewer mains.
2. Bedding Material - All sewer services shall be laid on a six (6) inch layer of three quarter ($\frac{3}{4}$) inch crushed stone.
3. Any tap into existing sewer main shall utilize a new "wye" fitting connected to the existing main with rigid, gasketed couplings. Saddle type connectors shall not be used.

C. Construction Methods

1. Excavation - Same as for sewer main.
2. Laying Sewer Pipe - Same as for sewer main.
3. Backfill - Same as for sewer main.

4. Markers - The end of the service shall be plugged, as recommended by the pipe manufacturer, and marked with a two (2) inch PVC Pipe with both ends capped, which shall extend above the surface of the ground. The bottom of the two (2) inch pipe shall be left at the elevation of the service invert.
5. Leakage and Testing - In conjunction with sewer mains.
6. Seasonal Limits - Same as for sewer mains.

SECTION 117: STORM SEWER SPECIFICATIONS - STORM DRAINS

A. Description. This item shall consist of catch basins, manholes and pipe meeting the specifications for the diameter of pipe required, and installed as indicated on the accepted drawings.

B. Materials:

1. Pipe Specifications:

(a) Polyvinyl chloride pipe:

PVC pipe shall conform in all respects to the latest revision of ASTM specification D3034 or F679 or F794, Type PSM, HDPE ADS N-12 (or equivalent) or PS Polyvinyl Chloride (PVC) Sewer Pipe and Fittings, SDR 35 or Perma-Loc Series 46. Wall thickness of all PVC pipe shall meet ASTM Specifications for SDR 35 or Perma-Loc Series 46 pipe. All pipe and fittings shall be clearly marked as follows:

Manufacturer's Name and Trademark

Nominal pipe size

Material Designation 12454C PVC

Legend "Type PSM SDR 35 PVC Sewer Pipe" or "PS 46 PVC Sewer Pipe"

Designation ASTM D3034, F794 or F679

Joints shall be push-on type using elastic gaskets, and shall conform to ASTM D3212. The gaskets shall be factory installed. The pipe shall be furnished in nominal thirteen (13) foot lengths. Sufficient numbers of short lengths and fully machined fittings shall be provided for use at manholes, chimneys, and connections. All connections will require the use of manufactured fittings. Field fabricated saddle type connections will not be considered acceptable.

Any pipe or fitting having a crack, or other defect, or which has received a severe blow shall be marked rejected and removed at once from the work site.

All field cuts are to be made with saw, at ninety (90) degrees to the pipe centerline. The cut end is to be beveled to the same angle as the factory bevel and all interior burrs are to be removed. A homing mark will be placed on all pipes prior to assembly.

The pipe installed under this specification shall be installed so that the deflection shall be less than five (5) percent as measured a minimum of thirty (30) days after installation.

The Contractor will submit certification that the materials of construction have been sampled, tested, inspected and meet all the requirements including wall thickness in accordance with ASTM D3034 for all pipe and fittings to be included in the project work.

PVC pipe shall not be installed when the temperature drops below thirty-two (32) degrees Fahrenheit or goes above one hundred (100) degrees Fahrenheit.

During cold weather, the flexibility and impact resistance of PVC pipe is reduced. Extra care is required when handling PVC pipe during cold weather.

(b) Smooth Interior and Annular Exterior Corrugated High Density Polyethylene (HDPE) Pipe:

This specification describes four (4) to sixty (60) inch (one hundred (100) to one thousand five hundred (1500) millimeters) Smooth Interior and Annular Exterior Corrugated High Density Polyethylene (HDPE) Pipe with a Silt Tight and Leak Resistant Joint for use in nonpressure gravity flow drainage applications.

(i) AASHTO M252: Standard Specification for Corrugated Polyethylene Pipe, four (4) inches to ten (10) inches (one hundred (100) to two hundred and fifty (250) millimeters), Type S.

(ii) AASHTO M294: Standard Specification for Corrugated Polyethylene Pipe, twelve (12) inches to forty-eight (48) inches (three hundred (300) to one thousand two hundred (1200) millimeters), Type S.

(iii) AASHTO MP7-97: Standard Specification for Corrugated Polyethylene Pipe, fifty-four (54) inches to sixty (60) inches (one thousand three hundred and fifty (1350) to one thousand five hundred (1500) millimeters), Type S.

(iv) ASTM D2321: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

(v) ASTM D3350: Standard Specification for Polyethylene Plastic Pipe and Fittings Materials.

(vi) ASTM F477: Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

(vii) Pipe and fitting material shall be high-density polyethylene meeting ASTM D3350 minimum cell classification 324420C for four (4) through ten (10) inch diameters or 335420C for twelve (12) through sixty (60) inch diameters.

(viii) Pipe manufactured for this specification shall comply with the requirements for test methods, dimensions, and markings found in AASHTO M252, AASHTO M294 and/or AASHTO MP7-97. The prescribed sizes of pipe are nominal inside diameters. Pipe sizes shall be no less than ninety-nine (99) percent of nominal inside diameter and have a minimum of twenty (20.0) feet laying length.

- (ix) For four (4) to ten (10) inch (one hundred (100) to two hundred and fifty (250) millimeter) diameters, the pipe supplied shall be smooth Interior and Annular Exterior Corrugated High Density Polyethylene (HDPE) Pipe meeting the requirements of AASHTO M252, Type S.
 - (x) For twelve (12) to forty-eight (48) inch (three hundred (300) to one thousand two hundred (1200) millimeter) diameters, the pipe supplied shall be smooth Interior and Annular Exterior Corrugated High Density Polyethylene (HDPE) Pipe meeting the requirements of AASHTO M294, Type S.
 - (xi) For fifty-four (54) to sixty (60) inch (one thousand three hundred and fifty (1350) to one thousand five hundred (1500) millimeter) diameters, the pipe supplied shall be smooth Interior and Annular Exterior Corrugated High Density Polyethylene (HDPE) Pipe meeting the requirements of AASHTO MP7-97, Type S.
 - (xii) Manning's "n" value for use in design shall not be less than one hundredth (0.010).
 - (xiii) Fittings shall conform to AASHTO M252, M294 or MP7-97. Fabricated fittings shall be welded on the interior and exterior at all junctions.
 - (xiv) Pipe shall be joined with bell-and-spigot joints meeting AASHTO M252, M294 or MP7-97. Joints shall provide silt tight and leak resistant joint.
 - (xv) Pipe joints shall incorporate a gasket meeting the requirements of ASTM F477 to form silt tight and leak resistant connection. Joints shall exceed the soil tight joint performance criteria of AASHTO Standard Specifications for Highway Bridges, Division II, Section 26.
 - (xvi) Gaskets shall be installed by the pipe manufacturer and covered with a removable wrap to ensure the gasket is free from debris.
 - (xvii) A joint lubricant supplied by the manufacturer shall be used on the gasket and bell during assembly.
 - (xviii) Smooth Interior and Annular Exterior Corrugated HDPE Pipe shall be Sure-Lok F477 as manufactured by Hancor, Inc. or a pre-approved equal. All alternate products must be submitted to the Village Engineer two weeks before bid date for approval.
 - (xix) Minimum depth of burial shall be as per manufacturing recommendation for the diameter specified.
2. Catch Basins or Manholes: A pre-cast (or cast in place) concrete catch basin or manhole shall be installed at the end of each line, at all changes in grade, size or alignment of pipe, at all pipe intersections, and at distances not greater than three hundred (300) feet.
- (a) Catch Basins - The catch basins shall conform to requirements for precast risers and base sections found in ASTM C913, latest edition. The cast iron frame and grate shall be Type D LeBaron #LF 248-2, or equal with a minimum weight of four hundred and eighty (480) pounds. For steep grades, a Type E LeBaron #LK 120A, or equal may be supplemented with a minimum weight of four hundred and thirty (430) pounds. There shall be either a manhole or a catch basin every three hundred (300) feet on normal slopes to allow for proper cleaning of

the lines.

(b) Manholes - The manholes and manhole frames and covers shall conform to the specifications as set forth under Sanitary Sewer Specifications.

(c) Booted connections shall be used for thirty-six (36) inch pipe and smaller.

C. Construction Methods

1. Pipeline Trenches - The trenches and other excavations shall be of sufficient width and depth at all points to allow all pipes to be laid, joints to be formed and structures and appurtenant construction to be built in the most thorough and workmanlike manner and to allow for sheeting and shoring, pumping and draining and for removing and replacing unsuitable material. Trenches and excavations shall be at least twelve inches wider than the outside dimensions of the structure they are to contain; trenches must not be unnecessarily wide so as to materially increase load on the pipe resulting from backfill. Bottoms of trenches and other excavations shall be carried to lines and shapes satisfactory to the Engineer. Bottoms of trenches for pipe shall be carried to a depth six inches greater than grade of pipeline, refilled to grade and bedded in the specified bedding method as detailed on the Detail Plans.

Wherever boulders or ledge rock are encountered in excavations for pipelines or structures, such boulders or ledge rock shall be removed to a depth of six inches below grade and space occupied by them shall be refilled to grade with the specified bedding material. Trenches shall be opened at such times and to such extent only as may be permitted by the Engineer. All driveways, crosswalks, sod, shrubs, trees and any other surface material affected by the work shall be carefully taken up and kept separate from the other excavated material. If suitable, excavated material shall be used for embankments, backfill and fill. Side slopes of excavations shall be less than the angle of repose of material excavated and shall be flat enough to prevent slides or cave-ins. Any excavation required as a result of slides or cave-ins shall be done by the Contractor at his own expense.

Placement of bedding material shall not be done until the ground has been thoroughly dewatered and the Contractor is ready to install pipe or to construct foundations of various structures.

The total running length of trench allowed to be open shall be kept as short as is practical. Only that length of trench which can be protected by means of barricades, fences, and the like shall be allowed to remain open overnight. All trench excavations shall be backfilled prior to work shut-down for each weekend.

2. Pipe Laying - Storm drains and culverts shall be constructed on a trench bottom prepared and bedded as shown on the Detail Plans. Each pipe shall be checked just prior to laying to ensure that it is clear of all dirt and debris and shall be laid true to line and grade. All joints shall be tight and inverts shall be continuous. When pipe is to be laid within the State Highway Right-of-way it shall also be installed in accordance with requirements of Section 601 of the Vermont Highway Department Specifications. Metal pipe shall be firmly joined with coupling bands, concrete and PVC and HDPE pipe joints shall be rubber gasket type. PVC and HDPE pipe shall be bedded from the trench bottom, six (6) inches below the invert of the pipe, to six (6) inches above the crown of the pipe with approved granular pipe bedding.

3. Backfilling Trenches - Frozen material shall not be placed in backfills and backfills shall not be placed on frozen material. No stones in excess of three (3) inches

diameter shall be placed within two (2) feet of the pipe. Larger stones may be used in the backfill provided care is taken that stones do not become nested and that all voids between stones are completely filled with fine materials. The size and quantities of stone used in backfill will be subject to approval by the Engineer. No backfill shall be dropped from a height of more than three (3) feet from the top of the pipe.

The backfill shall consist of two separate zones:

(a) The first zone shall extend from the top of the bedding material to a height of twenty-four (24) inches above the crown of the pipe. Select excavated material with stones no larger than three (3) inch diameter shall be placed in six (6) inch lifts and compacted to a density of ninety five (95) percent of the maximum dry density using the Standard Proctor Test, according to ASTM D698 or AASHTO T99 (latest version). The materials shall be placed carefully so as not to disturb the pipe or cause it to break or misalign.

(b) The second zone shall extend from the top of the first zone to within four (4) inches of finished grade or to road subgrade. Material in this zone shall be select excavated material, placed in six (6) inch lifts and compacted to a density of ninety five (95) percent of maximum dry density using the Standard Proctor Test, according to ASTM D698 or AASHTO T99 (latest version). Suitable cohesive soil can be backfilled in this zone and compacted using impact type equipment, pneumatic tampers, engine or self-propelled, sheepsfoot rollers on wide trenches or other suitable equipment, providing the ninety five (95) percent compaction requirement is met. In cohesionless soils, vibratory plates in confined areas and vibratory rollers in unconfined areas can be utilized, providing the specified degree of compaction is met. Granular cohesionless material may, in some cases and upon approval of the Engineer, be compacted using water jetting or immersion type vibrators with flooding and pooling.

4. Installing Catch Basins and Manholes - All construction of sewer manholes must be carried out to ensure watertight work. Any leaks in manholes shall be completely repaired to the satisfaction of the Village Engineer or the entire structure shall be removed and rebuilt. All manhole lift holes shall be grouted inside and out with expandable grout. The pipe opening in the precast manhole riser shall have a cast-in-place flexible gasket or an equivalent system for pipe installation, as approved by the Village Engineer. Joints between manhole risers shall be soft butyl joint sealer (rope form). Joints between pipes and catch basin base sections shall be sealed with boots for pipes thirty-six (36) inch diameter or smaller and with cement mortar for pipes larger than thirty-six (36) inch diameter, smoothed on the inside and built up with a heavy bed of excess mortar on the outside. Frames shall be brought to grade with precast concrete riser rings, expanded polypropylene riser rings, or cast-in-place concrete, and shall be set in a full bed of mortar. In roadways, the frames shall be set to final grade only after the base course paving has been completed.

SECTION 118: RESTRICTIONS AND CONDITIONS OF RIGHT-OF-WAY

All work relating to the Village of Essex Junction Rights-of-way shall be approved by authorized official before any construction commences.

A. Laying of Pipes, Conduits:

1. After any pipes, conduits, drains or other underground structures are laid, or any excavation is made in the roadway, the trenches or openings shall be properly backfilled with suitable material; the backfill shall be thoroughly tamped, and the surface of the road over said structures shall be left even with the adjoining ground. If the work is done in cold weather, no frozen material shall be used for backfilling.
 2. Whenever the hardened surface of the roadway, gutters or any part of the surface of the highway is disturbed it shall be replaced in as good condition as before it was disturbed, and if new materials are required they shall correspond with those already in place on the road.
 3. Where service pipes are to cross the highway the connections shall be made without disturbing the hardened surface of the roadway, fabric or underdrain, by driving the pipes under the roadway, or the service pipes shall be carried under and across the road in a large pipe, unless otherwise ordered by the Engineer.
 4. All repairs to Village facilities within the Right-of-way will be provided with a one (1) year warranty.
- B. Poles, Wires, Overhead Structures, and Cutting and Trimming of Trees:
1. No trees, fences, phone booths, or other structures shall be erected in the Right-of-way unless authorized by the Village. All mail boxes, telephone, and electric utility boxes shall be located at least three (3) feet outside the edge of the sidewalk. All above ground utility boxes shall be landscaped with evergreen shrubs that will not exceed the height of the utility box by more than one (1) foot when mature.
 2. No structure except for the street lights shall be erected in the Right-of-way within fifty (50) feet of an intersection. This includes above ground utility boxes.
- C. General Conditions:
1. During the progress of the work all structures underground and above ground shall be properly protected from damage or injury; such barrier shall be erected and maintained as may be necessary for the protection of the traveling public; the same shall be properly lighted at night; and the party or parties shall be responsible for all damages to persons or property due to or resulting from any work done.
 2. All utilities in new subdivisions shall be underground, including electric, cable TV, telephone, and other wires. All utilities, including gas and electric, shall be installed in the Right-of-way prior to the installation of underdrain, fabric, sub-base or paving of the street.
- D. Street Lights. Street lights shall be located as specified in Section 704 of this Code.

SECTION 119: INSPECTION

These inspections shall be required of the Developer and work shall not proceed until each check has been made with work reviewed by the Village Engineer. The developer pays for the cost of all of these inspections.

- A. Streets, Curbs and Sidewalks:
1. Stake out

2. Completion of subgrade
 3. Completion of base courses
 4. Completion of Surface
- B. Storm Drainage Systems:
1. Stake out
 2. Pipe laid - prior to any backfilling
 3. Connections to structures
 4. Completion of backfill to within two (2) feet of subgrade
 5. Completion of backfilling
- C. Sewer System:
1. Stake out
 2. Pipe laid - prior to any backfill
 3. Connections to structure or piping
 4. Completion of backfill to with two (2) feet of subgrade
 5. Completion of backfilling
 6. Lamping of pipe runs
 7. Testing
 8. Mandrel testing
 9. Initial operation
 10. Completion of appurtenances
- D. Water Mains
1. Stake out
 2. Connection to existing mains
 3. Pipe laid and thrust blocks cast - prior to any backfill
 4. Completion of backfill to within two (2) feet of subgrade
 5. Completion of backfilling
 6. Pressure and leakage tests
 7. Disinfection
 8. Initial operation
 9. Completion of appurtenances

SECTION 120: FINAL INSPECTION CHECK LIST

- A. Streets, Curbs, and Sidewalks:
1. Settlement, depression or imperfections in finish surface
 2. All required monuments and front boundary line markers installed.
 3. Seeding and erosion control on cut and fill slopes
 4. Surface drainage (during rainstorm)
 5. General appearance
 6. Material testing results, lab reports and record drawings complete and on file
- B. Storm Drainage Systems:
1. Catch basins, manholes and pipe lines clean
 2. Ditches and outlets clean

3. Erosion control measures completed
 4. General appearance
 5. Material testing results, lab reports, manufacturer's certificates, and record drawings complete and on file
- C. Sewer System:
1. Manholes, pipe lines and appurtenances clean
 2. Inverts and shelves completed to plans with smooth transitions
 3. Manhole frames and covers set at proper elevation
 4. General appearance
 5. Material testing results, lab reports, manufacturer's certificate, leakage test results for pipe and manholes, and mandrel deflection tests complete and on file
- D. Water System:
1. Valves, hydrants and curb stops operating properly
 2. Valve box covers and curb boxes set at proper elevations
 3. General appearance
 4. Tie information and record drawing complete
 5. Material testing results, lab reports, manufacturer's certificates, pressures and leakage test results and disinfection test results are complete and on file
- E. As Built Plans:
1. One set of mylars and two paper copies of plans showing all as built utilities, and water and sewer house connections must be submitted to the Village Engineer by the developer in accordance with Chapter 9. In addition, the developer shall provide to the Village the record drawings in an AutoCAD™ compatible electronic format; as well as a complete set of the record drawings in PDF format.

SECTION 121: VARIATIONS AND WAIVERS

Requests for waivers of any provisions of this Chapter, or for approval of variations to those provisions, shall be submitted to the Village Engineer in writing, along with technical information supporting the request. The Village Engineer must approve, modify, or deny such requests, and all decisions by the Village Engineer shall be in writing.