

**VILLAGE OF GRANVILLE, OHIO**

**CONSTRUCTION AND MATERIALS  
SPECIFICATIONS**

**ENGINEERING DESIGN GUIDELINES**

**STANDARD DRAWINGS**

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## GENERAL PROVISIONS

**ARTICLE 1. Definitions.** Whenever the words “Village,” “Village Manager,” “Engineer,” “Contractor,” or “Owner,” are used or implied in these specifications, they shall refer respectively to the Village of Granville; or to its authorized representatives; to the Engineer representing the Village of Granville; to the corporation or person undertaking an improvement under these specifications; and to the developer for private work and to the Village for public improvements.

Whenever the letters “CMS” are used in this document, it is referring to the City of Columbus Construction and Material Specification Document. Following are substitutions for words that are to be used in lieu of those indicated in the “CMS” document:

Director	-	Village Manager
City	-	Village of Granville
Franklin County	-	Licking County

**ARTICLE 2. Reference Specifications.** In these specifications direct reference will be made to the City of Columbus Construction and Materials Specifications, to the American Society for Testing Materials Specifications (ASTM), to the American Water Works Association Specifications (AWWA), and to other codes, rules and regulations, which, except as herein modified, are hereby made a part of these specifications by reference. Such reference shall refer, unless otherwise denoted, to the latest effective specifications or codes indicated.

It is the intent of the Village of Granville to be governed by the City of Columbus Construction and Material Specifications, latest edition. Also, the Standard Drawings will be City of Columbus Standards. Both may be supplemented by Village additions or substitutions. **In the event of a conflict between the City of Columbus Construction and Material Specifications and the Village of Granville requirements, the Village of Granville regulations shall govern.**

**ARTICLE 3. Intent of Construction Specifications.** The Granville Standard Construction and Material Specifications are intended to set forth minimum requirements only.

When conditions arise prior to plan approval by the Village which warrant construction specifications and materials that are not covered by these specifications, the appropriate specifications and details shall be clearly indicated on the construction plans, and the portion of the project to which they apply clearly indicated. When conditions are encountered in the field, which in the opinion of the Village are not adequately covered by these specifications, it shall be the duty of the Village to so inform the Contractor and the Developer. Such communication shall also state the engineering reasons for such exception. It shall then be the duty of the Developer, Contractor, and Village to coordinate efforts to arrive at a practical engineering solution to their mutual best interest.

The construction specifications shall apply to all development (both public and private) that connects to the Village of Granville’s system within or outside the corporation limits.

## SUPPLEMENTAL GENERAL PROVISIONS

**ARTICLE 4. Bidding Requirements and Conditions.** Bidding requirements will be as indicated in Item 102 of the “CMS” document. However, pre-qualification will not be required, but the Village Staff and Engineer have the discretion to determine the bidders qualifications.

**ARTICLE 5. Legal Relations and Responsibility to Public.** Contractors will adhere to all Items associated with Item 107 of the “CMS” document, except Contractor’s will not have to be licensed with the Village to install sewer and water lines.

Also disregard Item 107.14.

Use of explosives is not permitted without prior written approval from the Village Manager.

**ARTICLE 6. Prosecution and Progress of Work.** Contractors will adhere to all items associated in Item 108 of the “CMS” document. However, disregard Item 108.07 pertaining to liquidated damages.

**ARTICLE 7. Pavement Open Cut or Boring.** Open-cut of existing pavement will require prior approval (by the Village and Village Engineer) before construction commences. Borings shall conform to Federal, State, or Local Regulation and shall be approved as required.

**SUPPLEMENTAL DETAIL SPECIFICATIONS**

**ITEM 407-G**

**TACK COAT, TRACKLESS TACK, INTERMEDIATE AND SURFACE COURSE**

**General:** Meet all requirements of “CMS” Item 407 Tack Coat and include as noted below:

**Description:** This work consists of preparing and treating a paved surface with NTSS-1HM Trackless Tack produced by Blacklidge Emulsions, Inc.

**Material:** Conform to the following typical physical properties:

<b>Parameter</b>	<b>Test Method</b>	<b>MIN.</b>	<b>MAX.</b>
Saybolt Furol Viscosity, SFS @ 25°C	ASTM D88	15	100
Storage Stability, 24 hrs, %	ASTM D244	--	1
Storage Stability, 5 days, %	ASTM D244	--	5
Residue by Distillation, %	ASTM D244	50	--
Oil Distillate, %	ASTM D244	--	1
Sieve Test, %	ASTM D244	--	0.3
<b>Test on Residue:</b>			
Penetration, @ 25°C,	ASTM D5	--	20
Softening Point Range Deg C	ASTM D36	65	--
Solubility, %	ASTM D2042	97.5	--
Original Binder DSR@82°C			
G*/SIN δ, 10 rad/sec	AASHTO T111	1	--

Note: Product should not contain filler such as clay, etc  
Keep from freezing.

Supply certified test data to the Engineer showing the material supplied was tested for and meets the above properties.

**Equipment.** All requirements of 407.03 apply. See manufacturer’s representative for correct distributor settings. Thoroughly clean all equipment if cationic emulsion was previously used.

**Weather Limitations.** All requirements of 407.04 apply.

**Preparation of Surface.** All requirements of 407.05 apply.

**Application of Asphalt Material.** Uniformly apply the asphalt material with a distributor per the requirements of 407.06 except as noted.

If product is stored for an extended period of time, prior to application, agitate or gently circulate the material.

All nozzles and spray patters shall be identical to one another along the distributor spray bar. The angle of the nozzle should be at a 15 to 30 degree angle to the spray bar axis to maximize overlap or as recommended by the nozzle manufacturer. Contact the manufacturer's representative for required spray nozzle size, and distributor and nozzle settings.

Apply at a rate of 0.04 to 0.08 gallons per square yard. Recommended application temperature is 160°F to 180°F. Do not exceed 180°F.

Dilution is not allowed.

The Engineer and manufacturer's representative will approve rate of application, temperature, distributor settings, and areas to be treated before application of the tack coat. The Engineer will determine the actual application in gallons per square yard by a check on the project.

The application is considered satisfactory when the material is applied uniformly with no visible evidence of streaking or riding and the application rate is  $\pm 10\%$  of the specified rate.

**Method of Measurement.** All requirements of 407.07 apply.

**Basis of Payment.** All requirements of 407.08 apply.

**ITEM 801-G**  
**FURNISHING AND LAYING PIPE & FITTINGS**

**General:** Meet all requirements of “CMS” Item 801 Furnishing and Laying Pipe & Fittings and include as noted below:

**Description:** For all material types except HDPE pipe use compression fittings only. Flanged fittings are not allowed.

**Design Criteria:**

- A. Ductile Iron - AWWA C150, Manual M41
- B. Concrete - AWWA C301, Manual M9
- C. Steel - AWWA C200, C206 Manual M11
- D. PVC - AWWA C900, Manual M23
- E. HDPE - AWWA C906-07, Manual M55

**Ductile Iron Pipe:** All requirements of 801.03, .04 & .07 apply.

**Concrete Pipe:** All requirements of 801.05 & .08 apply.

**Steel Pipe:** All requirements of 801.06 & .08 apply.

**PVC Pipe:** This specification covers Polyvinyl Chloride (PVC) Pipe, 4”-12” with cast-iron pipe (CI) outside diameters.

Pipe shall be marked with size, plastic pipe material designation, standard thermoplastic pipe dimension ration, reference to applicable ASTM or Commercial Standard, pressure rating, AWWA approval, manufacturer’s identification and date of manufacture. Thickness of pipe shall be uniform throughout length, including bell.

The plain end of the pipe shall be marked in such a manner as to allow field checking of setting depth of the pipe in the bell or socket.

**Joints:** Pipe shall have integral wall bell and spigot push-on type joints using a rubber ring gasket placed in an annular recess in the pipe or fitting socket. Details of the joint design and assembly shall be in accordance with the manufacturer’s standard practice.

**Bedding Material** shall be gravel meeting Class 1-A ASTM D-2321 specification free from dirt and other deleterious materials.

**Materials:** Pipe shall be listed in latest “Seal of Approval Listing,” AWWA, and conform to the following:

- ASTM D-1784- rigid polyvinyl chloride compound
- ASTM D-1869- rubber rings

**Pipe and Fittings:** Clean, virgin pipe, AWWA C-900 CL-150 DR-18 or AWWA C-909 CL 150. Fitting shall meet AWWA C-153.

**Installation:** Earth excavation and backfilling shall be performed in accordance with “CMS” requirements and within measurement limits indicated on the Drawings.

Pipe and fittings shall be installed per ASTM designation D-2321 “Underground Installation of Flexible Thermoplastic Sewer Pipe.” Methods of cutting and joining the pipe shall follow the approved practice specified by the pipe manufacturer.

Pipe shall be installed with bedding as indicated on the Drawings, well tamped in 6 inch layers to 1.0 feet over the pipe. The pipe shall be uniformly supported through its length.

No pipe shall be laid within six inches of any rock, in water or on frozen trench bottom, or when in the opinion of the Resident Representative the trench conditions or the weather are unsuitable for such work.

Concrete thrust blocking shall be installed wherever the pipe line changes direction as at tees, bends and crosses, changes size at reducers, dead end stops and at valves.

**HDPE (High Density Polyethylene) Pipe and Fittings:** This specification covers high density polyethylene pipe (HDPE) and fittings for 4 inch and larger pipe.

**References:**

- A. To the extent referenced in this specification section, the standards and documents listed below are included, and made a part of this specification.
- B. In the event of a conflict, the requirements of this specification section prevail.
- C. Unless otherwise specified, references to documents shall mean the latest published edition of the referenced document in effect at the bid date of the project.

**ANSI/AWWA** [www.awwa.org](http://www.awwa.org)

- ANSI/AWWA C901-08 Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm) for Water Service
- ANSI/AWWA C906-07 Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission
- ANSI/AWWA C651 Standard for Disinfecting Water Mains
- AWWA M55 Manual of Water Supply Practices, PE Pipe-Design and Installation

**Plastics Pipe Institute, PPI** [www.plasticpipe.org](http://www.plasticpipe.org)

- PPI Handbook of Polyethylene Pipe – 2009 (2<sup>nd</sup> Edition)
- PPI TR-33 Generic Butt Fusion Joining Procedure for Polyethylene Gas Pipe
- PPI TR-34 Disinfection of Newly Constructed Polyethylene Water Mains
- PPI TR-41 Generic Saddle Fusion Joining Procedure for Polyethylene Gas Piping
- PPI TN-42 Recommended Minimum Training Guidelines for PE Pipe Butt Fusion Joining Operators for Municipal and Industrial Projects (2009)

**NSF** [www.nsf.org](http://www.nsf.org)

- NSF / ANSI 61 Drinking Water System Components-Health Effects

## ASTM [www.astm.org](http://www.astm.org)

- ASTM F 714 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
- ASTM F 905 Standard Practice for Qualification of Polyethylene Saddle-Fused Joints
- ASTM F 1055 Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing
- ASTM F 1290 Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings
- ASTM F 1412 Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems
- ASTM F 1417 Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air
- ASTM F 2164 Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure
- ASTM F 2206 Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock, or Block Stock
- ASTM D 2239 Standard Practice for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
- ASTM D 2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
- ASTM F 2620 Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings
- ASTM D 2683 Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
- ASTM D 2737 Standard Specification for Polyethylene (PE) Plastic Tubing
- ASTM D 2774 Standard Practice for Underground Installation of Thermoplastic Pressure Piping
- ASTM D 3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
- ASTM D 3350-08 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

## System Design Parameters

- A. The polyethylene system working pressure rating accommodates the normal operating pressure and the repetitive surges. The pressure rating applies at 80°F or less.
- B. Per AWWA 901 and C906, the repetitive surge pressure allowance is one half the pressure class of the pipe, and the occasional surge over pressure allowance is equal to the pressure class of the pipe. Allowable Total Pressure during Recurring Surge conditions equals 1.5 times the pipe's pressure class. Allowable Total Pressure during Occasional Surge conditions equals 2.0 times the pipe's pressure class.

Table 1 gives the Pressure Class per AWWA C901, Pressure Rating and Allowable Total Pressure During Recurring and Occasional Surge for PE4710 pipe at 80°F or less. For PE 3608, refer to Table 2.

Table 1. Pressure Class per AWWA C901 for **PE 4710** at 80°F or less

<b>Pipe Dimension Ratio (DR)</b>	<b>Pressure Class</b>	<b>Pressure Rating</b>	<b>Allowable Total Pressure During Recurring Surge</b>	<b>Allowable Total Pressure During Occasional Surge</b>
DR 9	250 psi	250 psi	375 psi	500 psi
DR 11	200 psi	200 psi	300 psi	400 psi
DR 14.3	150 psi	150 psi	225 psi	300 psi
DR 17	125 psi	125 psi	185 psi	250 psi
DR 21	100 psi	100 psi	150 psi	200 psi

Table 2 gives the Pressure Class per AWWA C901 and C906, Pressure Rating and Allowable Total Pressure During Recurring and Occasional Surge for **PE3608** pipe at 80°F or less.

Table 2. Pressure Class per AWWA C901 and C906 for **PE 3608** at 80°F or less

<b>Pipe Dimension Ratio (DR)</b>	<b>Pressure Class</b>	<b>Pressure Rating</b>	<b>Allowable Total Pressure During Recurring Surge</b>	<b>Allowable Total Pressure During Occasional Surge</b>
DR 9	200 psi	200 psi	300 psi	400 psi
DR 11	160 psi	160 psi	240 psi	320 psi
DR 14.3	120 psi	120 psi	180 psi	240 psi
DR 17	100 psi	100 psi	150 psi	200 psi
DR 21	80 psi	80 psi	120 psi	160 psi

### Submittals

#### A. Quality Assurance / Control Submittals

1. Affirmation that product shipped meets or exceeds the standards set forth in this specification. This shall be in the form of a written document from the manufacturer attesting to the manufacturing process meeting the standards. [The specifier can also ask for various test results to be supplied that are done according to the standards]
2. Manufacturers recommended fusion procedures for the products.

### Delivery – Storage – Handling

- A. Handle the pipe in accordance with the PPI Handbook of Polyethylene Pipe (2<sup>nd</sup> Edition), Chapter 2 using approved strapping and equipment rated for the loads encountered. Do not use chains, wire rope, forklifts or other methods or equipment that may gouge or damage the pipe or endanger persons or property. Field storage is to be in compliance with AWWA Manual of Practice M55 Chapter 7.
- B. If any gouges, scrapes, or other damage to the pipe results in loss of 10% of the pipe wall thickness, cut out that section or do not use.

## Pipe

- A. Polyethylene pipe shall be made from HDPE material having a material designation code of PE3608 or higher. The material shall meet the requirements of ASTM D 3350 and shall have a minimum cell classification of PE345464C. In addition, the material shall be listed as meeting NSF-61.
- B. The Pipe and fittings shall meet the requirements of AWWA C906.
- C. HDPE pipe shall be rated for use at a pressure class of DR11 psi. The outside diameter of the pipe shall be based upon the IPS or DIPS sizing system.

## Fittings

- A. Butt Fusion Fittings – Fittings shall be made of HDPE material with a minimum material designation code of PE3608 and with a minimum Cell Classification as noted in 2B.01A. Butt Fusion Fittings shall meet the requirements of ASTM D3261. Molded and fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All fittings shall meet the requirements of AWWA C906.

Markings for molded fittings shall comply with the requirements of ASTM D 3261. Fabricated fittings shall be marked in accordance with ASTM F 2206. Socket fittings shall meet ASTM D 2683.

- B. Electrofusion Fittings – Fittings shall be made of HDPE material with a minimum material designation code of PE 3608 and with a minimum Cell Classification as noted in 2B.01A. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All electrofusion fittings shall be suitable for use as pressure conduits, and have nominal burst values of four times the Working Pressure Rating (WPR) of the fitting. Markings shall be according to ASTM F 1055.
- C. Flanges and Mechanical Joint Adapters (MJ Adapters) – Flanges and Mechanical Joint Adapters shall have a material designation code of PE3608 or higher and a minimum Cell Classification as noted in 2B.01A. Flanged and Mechanical Joint Adapters can be made to ASTM D 3261 or if machined, must meet the requirements of ASTM F 2206. Flanges and MJ Adapters shall have a pressure rating equal to the pipe unless otherwise specified on the plans. Markings for molded or machined flange adapters or MJ Adapters shall be per ASTM D 3261. Fabricated (including machined) flange adapters shall be per ASTM F 2206.

Van-Stone style, metallic (including stainless steel), convoluted or flat-plate, back-up rings and bolt materials shall follow the guidelines of Plastic Pipe Institute Technical Note # 38, and shall have the bolt-holes and bolt-circles conforming to one of these standards: ASME B-16.5 Class 150, ASME B-16.47 Series A Class 150, ASME B-16.1 Class 125, or AWWA C207 Class 150 Series B, D, or E. The back-up ring shall provide a long-term pressure rating equal to or greater than the pressure-class of the pipe with which the flange adapter assembly will be used, and such pressure rating shall be marked on the back-up ring. The back-up ring, bolts, and nuts shall be protected from corrosion by a system such as paint, coal-tar epoxy, galvanization, polyether or polyester fusion

bonded epoxy coatings, anodes, or cathodic protection, as specified by the project engineer.

- D. Service connections shall be electrofusion saddles with a brass or stainless steel threaded outlet, electrofusion saddles, sidewall fusion branch saddles, tapping tees, or mechanical saddles.

For electrofusion saddles with threaded outlet the size of the outlet shall be one inch IPS unless a larger size is shown on the plans. Electrofusion saddles shall be made from materials required in part B. Electrofusion Fittings.

For sidewall fusion saddles the size of the saddle shall be as indicated on the plans. The saddle can be made in accordance to ASTM D 3261 or ASTM F 2206. After installation, approximately ¼” of the PE pipe shall be visible beyond the saddle to confirm that proper surface preparation occurred. Saddle faces that do not provide ¼ inch of area beyond the saddle are not acceptable.

Tapping tees shall be made to ASTM D3261 or D2683.

Mechanical strap-on saddles can only be used where their use on PE pipe is approved by the mechanical saddle manufacturer. The body of the saddle shall be stainless steel, epoxy coated cast iron or brass. The gasket material and design must be acceptable for PE pipe. The outlet shall be threaded for one inch IPS unless a larger size is shown on the plans. Mechanical strap-on saddles will be installed per the manufacturer’s instructions.

### **Pipe and Fitting Identification**

- A. The pipe shall be marked in accordance with the standards to which it is manufactured.
- B. Color identification by the use of stripes on pipe to identify pipe service shall be optional. If used, stripes or colored exterior pipe product shall be blue for potable water, or green for wastewater/sewage, or purple (lavender) for reclaimed water.
- C. Tracing wire shall be placed parallel and above, but separate from the pipe and shall be 10 AWG or engineer approved equal.
- D. Marking tape shall be approved by the engineer and placed between 6 and 12 inches above the crown of pipe.

## **EXECUTION**

### **Joining Methods**

- A. Butt Fusion: The pipe shall be joined by the butt fusion procedure outlined in ASTM F 2620 or PPI TR-33. All fusion joints shall be made in compliance with the pipe or fitting manufacturer’s recommendations. Fusion joints shall be made by qualified fusion technicians per PPI TN-42.

- B. Saddle Fusion: Saddle fusion shall be done in accordance with ASTM F 2620 or TR-41 or the fitting manufacturer's recommendations and PPI TR-41. Saddle fusion joints shall be made by qualified fusion technicians. Qualification of the fusion technician shall be demonstrated by evidence of fusion training within the past year on the equipment to be utilized on this project. [Saddle fusion is used to fuse branch saddles, tapping tees, and other HDPE constructs onto the wall of the main pipe] (ASTM F905).
- C. Socket Fusion: Molded socket fusion fittings are only to be used for joining of HDPE pipe from 1/2 inch to 2" in size. Socket fusion shall be done in accordance with ASTM F 2620 or the fitting manufacturer's recommendations. Socket fusion is the process of fusing pipe to pipe, or pipe to fitting by the use of a male and female end that are heated simultaneously, and pressed together so the outside wall of the male end is fused to the inside wall of the female end. Qualification of the fusion technician shall be demonstrated by evidence of socket fusion training within the past year on the equipment to be utilized on this project. [Socket fusion is not widely used, and the specifier may decide to prohibit its use.]
- D. Electrofusion: Electrofusion joining shall be done in accordance with the manufacturers recommended procedure. Other sources of electrofusion joining information are ASTM F 1290 and PPI TN 34. The process of electrofusion requires an electric source, a transformer, commonly called an electrofusion box that has wire leads, a method to read electronically (by laser) or otherwise input the barcode of the fitting, and a fitting that is compatible with the type of electrofusion box used. The electrofusion box must be capable of reading and storing the input parameters and the fusion results for later download to a record file. Qualification of the fusion technician shall be demonstrated by evidence of electrofusion training within the past year on the equipment to be utilized for this project.
- E. Mechanical:
1. Mechanical connection of HDPE to auxiliary equipment such as valves, pumps, and fittings shall use mechanical joint adapters and other devices in conformance with the PPI Handbook of Polyethylene Pipe, Chapter 9 and AWWA Manual of Practice M55, Chapter 6.
  2. Mechanical connections on small pipe under 3" are available to connect HDPE pipe to other HDPE pipe, or a fittings, or to a transition to another material. The use of stab-fit style couplings is allowed, along with the use of metallic couplings of brass and other materials. All mechanical and compression fittings shall be recommended by the manufacturer for potable water use. When a compression type or mechanical type of coupling is used, the use of a rigid tubular insert stiffener inside the end of the pipe is recommended.
  3. Mechanical couplings that wrap around the pipe and act as saddles are made by several manufacturers specifically for HDPE pipe. All such saddles, tapping saddles, couplings, clamps etc. shall be recommended by the manufacturer as being designed for use with HDPE pipe at the pressure class listed in this section.
  4. Unless specified by the fitting manufacturer, a restraint harness or concrete anchor is recommended with mechanical couplings to prevent pullout.
  5. Mechanical coupling shall be made by qualified technicians. Qualification of the field technician shall be demonstrated by evidence of mechanical coupling training

within the past year. This training shall be on the equipment and pipe components to be utilized for this project.

- F. Joint Recording – The critical parameters of each fusion joint, as required by the manufacturer and these specifications, shall be recorded either manually or by an electronic data logging device. All fusion joint data shall be included in the Fusion Technician’s joint report.

**Installation**

- A. Primary installation would be by directional boring.
- B. Buried HDPE pipe and fittings shall be installed in accordance with ASTM D2321 or ASTM D2774 for pressure systems and AWWA Manual of Practice M55 Chapter 7.
- C. Pipe embedment – Embedment material should be Class I, Class II, or Class III, materials as defined by ASTM D-2321 Section 6. The use of Class IV and Class V materials is not recommended, however it may be used only with the approval of the engineer and appropriate compaction.
- D. Bedding: Pipe bedding shall be in conformance with ASTM D2321 Section 8. Compaction rates should be as specified in ASTM D2321. Deviations shall be approved by the engineer.
- E. Haunching and backfill shall be as specified in ASTM D 2321 Section 9 with Class I, II, or III materials. Compaction shall be in excess of 85% Proctor [Specifier to put in the percent compaction and other site specific information as needed]

**Watermain Cleaning and Flushing:** All requirements of 801.13 apply.

**Hydrostatic Test:** All requirements of 801.14 apply.

**Chlorination of Completed Pipe Line:** All requirements of 801.15 apply.

**Main Shuts:** All requirements of 801.16 apply.

**Certification:** All requirements of 801.17 apply.

**Measurement/Payment:** The lengths of the various sizes of pipe to be paid for in this Item shall be the lengths actually furnished and placed in accordance with these Specifications, measured along the axis after the pipe, fittings, and valves have been connected in place.

Payment for the tees bends, crosses and reducers (fittings) is included with the main line pipe.

**ITEM 805-G**  
**WATER SERVICE TAPS**

**General:** Meet all requirements of “CMS” Item 805 Water Service Taps except as noted below:

**Pipe and Fitting:** Include the following for 3 inch and smaller HDPE pipe per AWWA C901 (For reference see Item 801-G).

**Pipe**

- A. Polyethylene pipe shall be made from a HDPE material having a minimum material designation code of PE 4710 or PE 3608. The material shall meet the requirements of ASTM D 3350 and shall have a minimum cell classification of PE445474C for PE 4710 and PE345464C for PE 3608. In addition, the pipe shall be listed as meeting NSF-61.
- B. The pipe shall meet the requirements of AWWA C901.
- C. HDPE pipe shall be rated for use at a pressure class of DR11 psi. The outside diameter of the pipe shall be based upon the IPS, CTS, or SIDR sizing system.

**Fittings**

- A. Butt Fusion Fittings – Fittings shall be made of either PE4710 or PE 3608, with a minimum Cell Classification as noted in 2A.01A. Butt Fusion Fittings shall meet the requirements of ASTM D3261. Molded and fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans.

Markings for molded fittings shall comply with the requirements of ASTM D 3261. Fabricated fittings shall be marked in accordance with ASTM F 2206. Socket fittings shall meet ASTM D 2683.

- B. Electrofusion Fittings – Fittings shall be PE4710 or PE 3608, with a minimum Cell Classification as noted in 2A.01A. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans.
- C. Flanges and Mechanical Joint Adapters (MJ Adapters) - Flanges and Mechanical Joint Adapters shall be PE4710 or PE 3608, with a minimum Cell Classification as noted in 2A.01A. Flanged and Mechanical Joint Adapters can be made to ASTM D 3261 or if machined, must meet the requirements of ASTM F 2206. Flanges and MJ Adapters shall have a pressure rating equal to the pipe unless otherwise specified on the plans. Markings for molded or machined flange adapters or MJ Adapters shall be per ASTM D 3261. Fabricated (including machined) flange adapters shall be per ASTM F 2206.

Van-Stone style, metallic (including stainless steel), convoluted or flat-plate, back-up rings and bolt materials shall follow the guidelines of Plastic Pipe Institute Technical Note # 38, and shall have the bolt-holes and bolt-circles conforming to one of these standards: ASME B-16.5 Class 150, ASME B-16.47 Series A Class 150, ASME B-16.1

Class 125, or AWWA C207 Class 150 Series B, D, or E. The back-up ring shall provide a long-term pressure rating equal to or greater than the pressure-class of the pipe with which the flange adapter assembly will be used, and such pressure rating shall be marked on the back-up ring. The back-up ring, bolts, and nuts shall be protected from corrosion by a system such as paint, coal-tar epoxy, galvanization, polyether or polyester fusion bonded epoxy coatings, anodes, or cathodic protection, as specified by the project engineer.

- D. Service connections shall be electrofusion saddles with a brass or stainless steel threaded outlet, electrofusion saddles, sidewall fusion branch saddles, tapping tees, or mechanical saddles.

For electrofusion saddles with threaded outlet the size of the outlet shall be one inch IPS unless a larger size is shown on the plans. Electrofusion saddles shall be made from materials required in part 2A.02 B. Electrofusion Fittings.

For sidewall fusion saddles, the size of the saddle shall be as indicated on the plans. The saddle can be made in accordance to ASTM D 3261 or ASTM F 2206. After installation, approximately ¼” of the PE pipe shall be visible beyond the saddle to confirm that proper surface preparation occurred. Saddle faces that do not provide ¼” inch of area beyond the saddle are not acceptable.

Tapping tees shall be made to ASTM D3261 or D2683.

Mechanical strap-on saddles can only be used where their use on PE pipe is approved by the mechanical saddle manufacturer. The body of the saddle shall be stainless steel, epoxy coated cast iron or brass. The gasket material and design must be acceptable for PE pipe. The outlet shall be threaded for one inch IPS unless a larger size is shown on the plans. Mechanical strap-on saddles will be installed per the manufacturer’s instructions.

### **Pipe and Fitting Identification**

- A. The pipe shall be marked in accordance with the standards to which it is manufactured.
- B. Color identification by the use of stripes on pipe to identify pipe service shall be optional. If used, stripes or colored exterior pipe product shall be blue for potable water.
- C. Tracing wire shall be placed parallel and above, but separate from the pipe and shall be 10 AWG or engineer approved equal.
- D. Marking tape shall be approved by the engineer and placed between 6 and 12 inches above the crown of pipe.

### **Installation**

- A. Primary installation would be by directional boring.
- B. Buried HDPE pipe and fittings shall be installed in accordance with ASTM D2321 or ASTM D2774 for pressure systems and AWWA Manual of Practice M55 Chapter 7.

- C. Pipe embedment – Embedment material should be Class I, Class II, or Class III, materials as defined by ASTM D-2321 Section 6. The use of Class IV and Class V materials is not recommended, however it may be used only with the approval of the engineer and appropriate compaction.
- D. Bedding: Pipe bedding shall be in conformance with ASTM D2321 Section 8. Compaction rates should be as specified in ASTM D2321. Deviations shall be approved by the engineer.
- E. Haunching and backfill shall be as specified in ASTM D 2321 Section 9 with Class I, II, or III materials. Compaction shall be in excess of 85% Proctor [Specifier to put in the percent compaction and other site specific information as needed]

**Control Valve and Boxes:** Include the following:

**Description:** The Contractor is to provide all labor, material and equipment to install The Vadle Curb Box Lock at the locations shown on the plans.

**Installation:** For 1” and ¾” curb stops and curb boxes installation, simply place The Vadle on a properly prepared sub base under the curb stop. If the anti-twist ring fits over the key of the curb stop then push the ring onto The Vadle until it locks into place (with the ¾ Mueller Mark II Oriseal make sure the tab on the side of the key is on the side of the centering ring with the cut-out in it and press down until the ring is resting on the curb stop. The ring will lock onto the curb stop). If the curb stops has a cone shape design, place the larger end of the valve body in the larger side of The Vadle. Then place the curb box over The Vadle. Finally backfilling according to the construction specifications for installation of curb stops and curb boxes.

Curb box installation where The Vadle is going to be placed upside down. The 1” Ford inverted key or a 1” McDonald inverted plug curb stop, simply turn The Vadle upside down and push into the ground securely under the curb stop. Then set the valve on The Vadle and put the curb box over the valve. These two curb stops fit securely in the curb box. The Vadle serves as a stable base and foundation in this application. Finally backfilling according to the construction specifications for installation of curb stops and curb boxes.

When installing The Vadle on soft or unstable ground The Vadle can be secured to a larger base such as a block or stepping stone. Simply screw The Vadle down onto a larger base with any form of anchoring screws to create a solid secure foundation. Next place the curb stop into The Vadle. Then place the curb box over The Vadle. Finally backfilling according to the construction specifications for installation of curb stops and curb boxes.

**Basis of Payment:** Payment shall be at the unit price shown in the proposal and shall be complete compensation for providing all work necessary to furnish and install The Vadle Curb Box Lock as covered in these specifications.

Payment will be made at the contract price for:

<u>Item</u>	<u>Unit</u>	<u>Description</u>
805-G	Each	The Vadle Curb Box Lock

**ITEM 809-G**  
**FIRE HYDRANTS**

**General:** Meet all requirements of “CMS” Item 809 Fire Hydrants except as noted below:

**Scope of Work:** All requirements of 809.01.

**Description of Fire Hydrant:** Fire hydrants furnished shall be first line hydrants and shall conform to the requirements of Item 809.02 of the “CMS”, **except that the only fire hydrant approved for use in the Village of Granville is the Mueller “Centurion” or Mueller “Super Centurion”.** Hydrant shall come primed and painted from Mueller using Granville’s standard paint scheme for hydrants, blue barrel with white cap and bonnet.

**Installation:** All requirements of 809.03.

**Backfilling:** All requirements of 809.04.

**Hydrant Delivered:** All requirements of 809.05.

**Hydrant Relocation:** All requirements of 809.06.

**Hydrant Abandoned:** All requirements of 809.07.

**Basis of Payment:** All requirements of 809.08.

**ITEM 1000-G**  
**STREET LIGHTING**

**General:** Meet all requirements of “CMS” Item 1000 street lighting and include as noted below:

**Poles:** Specifications for poles shall be those as manufactured by:

- A. Unique Solutions (Newark, Ohio), Hamilton or Mount Vernon.
- B. Heritage Casting and Ironworks (Ontario, Canada) Pole Series P416-4P.
- C. LSI Industries Inc. (Cincinnati, Ohio) Abolite Nostalgic Poles.
- D. Or approved equal.

**Luminaire:** Specifications for luminaires shall be those as manufactured by:

- A. Unique Solutions (Newark, Ohio) Granville Series, west liberty style decorative arm fitted, and esplanade.
- B. Heritage Solutions (Ontario, Canada) F12 Series.
- C. Or approved equal.

**Lamp:** Specifications for lamps shall be manufactured by:

- A. Ledtronics Inc. (Torrance, CA)

Part No. LED30MH-600-TPW-002 (100-277VAC, True White, E26 Edison 7R) or Part No. LED30MH-600-TPW-002-BU (100-277VAC, True White, E26 Edison, BU 7R), LED Emitting Color True White.

- B. Or approved equal.

**ITEM SPECIAL**  
**BACKFLOW PREVENTER**

**General:**

(A) An approved backflow prevention device shall be installed on each service line to a consumer's water system serving premises, where in the judgment of the supplier of water or the Village Manager, a pollutional, system, health or severe health hazard to the public water system exists.

(B) An approved backflow prevention device shall be installed on each service line to a consumer's water system serving premises where any of the following conditions exist:

1. Premises having an auxiliary water system on the premises, unless such auxiliary system is accepted as an additional source by the supplier of water and the source is approved by the director;
2. Premises on which any substance is handled in such a fashion as to create an actual or potential hazard to a public water system. This shall include premises having sources or systems containing process fluids;
3. Premises having internal cross-connections that, in the judgment of the supplier of water, are not correctable, or intricate plumbing arrangements which make it impracticable to determine whether or not cross-connections exist;
4. Premises where, because of security requirements or other prohibitions or restrictions, it is impossible or impractical to make a complete cross-connection survey;
5. Premises having a repeated history of cross-connections being established or re-established; or
6. Others specified by the director;

(C) The following requirements apply to premises that have an auxiliary water system on the real property that is owned or under control of the consumer and adjacent to the premises.

1. A physical separation shall be maintained between the public water system or a consumer's water system and the auxiliary water system as required by paragraph (B) of rule 3745-95-02 of the Administrative Code; and
2. An approved backflow prevention device shall be installed on each service connection serving the consumer's water system, unless the supplier of water does all of the following:
  - (a) Determines, on a case-by-case basis, that the installation of an approved backflow prevention device on a service connection is not required in consideration of factors including, but not limited to, the past history of cross connections being established or re-established on the premises, the ease or difficulty of connecting

the auxiliary water system with the public water system on the premises, the presence or absence of contaminants on the property or other risk factors;

- (b) Requires the consumer to sign an agreement which specifies the penalties, including those set forth in rule 3745-95-08 of the Administrative Code, for creating a connection between the public water system and the auxiliary water system;
- (c) Conducts or causes to be conducted an inspection at least every twelve months to certify that no connection or means of connection has been created between the public water system and the auxiliary water system;
- (d) Maintains an inventory of each consumer's premises where an auxiliary water system is on or available to the premises, or on the real property adjacent to the premises; and
- (e) Develops and implements an education program to inform all consumers served by the public water system about the dangers of cross-connections and how to eliminate cross-connections.

(D) An approved backflow prevention device shall be installed on each service line to a consumer's water system serving, but not necessarily limited to, the following types of facilities unless the director determines that no severe health, system or pollutional hazard to the public water system exists:

1. Hospitals, mortuaries, clinics, nursing homes;
2. Laboratories;
3. Piers, docks, waterfront facilities;
4. Sewage treatment plants, sewage pumping stations, or storm water pumping stations;
5. Food or beverage processing plants;
6. Chemical plants;
7. Metal plating industries;
8. Petroleum processing or storage plants;
9. Radioactive material processing plants or nuclear reactors;
10. Car washes; and
11. Others specified by the Village Manager.

(E) An approved backflow prevention device shall be installed at any point of connection that is approved in accordance with paragraph (B) of rule 3745-95-02 of the Administrative Code between a public water system or a consumer's water system and an auxiliary water system, unless such auxiliary system is accepted as an additional source by the supplier of water and the source is approved by the Village Manager.

(F) The type of protection required under paragraphs (A), (B), (C) and (D) of rule 3745-95-04 of the Administrative Code shall depend on the degree of hazard which exists as follows:

1. An approved air gap separation shall be installed where a public water system may be contaminated with substances that could cause a severe health hazard;
2. An approved air gap separation, an approved reduced pressure principle backflow prevention assembly or an approved reduced pressure detector check assembly shall be installed where a public water system may be contaminated with any substance that could cause a system or health hazard;
3. An approved air gap separation, an approved reduced pressure principle backflow prevention assembly, an approved reduced pressure principle-detector check assembly, an approved double check valve assembly or an approved double check-detector check valve assembly shall be installed where a public water system may be contaminated with any substance that could cause a pollutional hazard.

(G) The type of protection required under paragraph (E) of rule 3745-95-04 of the Administrative Code shall be an approved air gap separation or an approved interchangeable connection.

(H) Where an auxiliary water system is used as a secondary source of water for a fire protection system, the provisions of paragraph (G) of this rule for an approved air gap separation or an approved interchangeable connection may be waived by the director, provided:

1. At premises where the auxiliary water system may be contaminated with substances that could cause a system, health or severe health hazard, a public water system or a consumer's water system shall be protected against backflow by installation of an approved reduced pressure principle backflow prevention assembly or an approved reduced pressure principle-detector check assembly;
2. At all other premises, a public water system or a consumer's water system shall be protected against backflow by installation of an approved reduced pressure principle backflow prevention assembly, an approved reduced pressure principle-detector check assembly, an approved double check valve assembly or an approved double check-detector check valve assembly;
3. A public water system or a consumer's water system shall be the primary source of water for the fire protection system;
4. The fire protection system shall be normally filled with water from a public water system or a consumer's water system; and
5. The water in the fire protection system shall be used for fire protection only, with no other use of water from the fire protection system downstream from the approved backflow prevention device.

**Installation:**

Backflow prevention assemblies shall be installed so that the inlet shut-off valve of the backflow preventer is the next piped fitting (including piping) after the water meter, except where a meter bypass, limited area fire system or strainer is needed.

Where the meter is located in the pit and the backflow preventer has been approved to be installed in the building, the backflow assembly inlet valve shall be twelve (12) inches from the wall or immediately after the ninety degree bend where the supply enters from the floor.

All assemblies are to be installed in a horizontal orientation.

Minimum and maximum ground clearance is measured from the floor to the lowest part of the assembly.

Each installation shall include properly located test cocks and manufacturer approved tightly closing shutoff valves.

No Backflow Prevention Assembly shall be subject to excessive heat or freezing.

It is recommended that a floor drain be installed as close as possible to the Assembly.

Reduced Pressure Principal Backflow Assemblies shall not be installed in a pit, vault or any area subject to flooding and shall always have an approved Air Gap Assembly.

Pressure Vacuum Breakers shall never be subject to back pressure and must be installed a minimum of 12” above the highest downstream discharge.

Lawn Irrigation Systems shall not have any outside exposed tees, drains or hose bibbs.

Backflow Prevention Assemblies shall prevent the release of on-site pressure to the public distribution water system. Therefore, internal compensation in accordance with the Ohio Plumbing Code shall be considered and made when needed to relieve any excessive increase in on-site pressure due to hot water heating systems or other heat sources.

No Backflow Prevention Assembly shall be bypassed unless the bypass line contains equal backflow protection and the approval of the Village.

**Basis of Payment:**

The Village will make payment at the contract price for;

<u>Item</u>	<u>Unit</u>	<u>Description</u>
Special	Each	Backflow Preventer Assembly Complete

## ENGINEERING DESIGN GUIDELINES

**SECTION 1. General.** This section is intended to provide basic engineering design guidelines to be used in conjunction with the Village of Granville Subdivision Regulation for the preparation of engineering plans for the Village of Granville. The use of the minimum standards provided in these guidelines is not a guarantee of adequate design. The Engineer preparing the plans is responsible for determining if the minimum standards are sufficient for the specific site. These guidelines are not intended to be detailed specifications. Upon review of the engineering plans, the Village Engineer may require additional or stricter standards for the site design.

**SECTION 2. Street.** The design of streets shall conform with the Village of Granville design standards Chapter 1117.02. The minimum street rights-of-way and pavement widths are listed in the following table:

	R/W	P/W
Arterial	70'	36'
Collector	60'	28'
Local	60'	26'
Cul-de-Sac	60'	26'
Service	50'	26'

All streets shall have curb unless the requirement is waived by the Planning Commission.

All pavement width for streets with curb shall be dimensioned face of curb to face of curb.

Any street that is not curbed shall have ditches on each side of the street.

All concrete base streets shall have pavement relief joints. All concrete streets shall have transverse contraction and longitudinal joints.

Stationing for streets shall be from west to east and from south to north.

Vertical curves are required if the algebraic difference in the street grades is 2 or greater. The minimum vertical curve length shall be 20 times the algebraic difference of the street grades.

The minimum street grade is 0.50%.

The minimum curb return radius is 20 feet.

All streets shall have sidewalks on both sides of the street unless the requirement is waived by the Planning Commission.

All streets shall have underdrains.

All guardrails shall conform to City of Columbus standards.

Maximum length of cul-de-sac shall not exceed one thousand five hundred (1,500') feet and where a turn-around with a right-of-way radius of fifty (50') feet is provided.

Dead-end streets shall be prohibited except as stubs to permit further street extensions into adjoining undeveloped tracts or when designed as cul-de-sacs.

All sidewalks shall conform to handicap standards.

Profile grade is defined as the grade at the top of curb.

**SECTION 3. Sanitary Sewers.** The maximum spacing between sanitary manholes is 300 ft.

Numbering for sanitary manholes shall begin with 1 at the furthest manhole downstream.

All sanitary sewers and laterals shall have 3 feet minimum cover.

All sanitary laterals shall have a minimum slope of 2.08%. Minimum lateral size is 6 inches. A minimum of one lateral is required for every building.

All sanitary manholes below the 100 yr. flood level of a ditch or stream shall have water tight lids.

Any sanitary sewer which has a 15% grade or more shall have concrete anchors with a 100 foot maximum spacing.

Any manhole with a 2 foot or greater difference between the inlet pipe and the outlet pipe shall be provided with a drop. Outside drops shall be used for new manholes and inside drops shall be used for existing manholes.

There shall be a 10 foot horizontal clearance between any sanitary sewer and storm sewer or waterline that parallels it.

Manholes are required at all pipe grade changes and directional changes in the sewer. Manholes are also required at sewer junctions.

Roof drains, foundation drains and other clean water connections to the sanitary sewer system are prohibited.

Sanitary sewer stationing shall begin with 0+00 at the downstream end of each sanitary run.

The minimum size of a sanitary sewer is 8 inches.

A sampling manhole is required on the sanitary service for any pretreatment program designated user. The manhole shall be located on the site and not within the public right-of-way.

When a sanitary sewer is provided for a subdivision, the service shall be stubbed to the right-of-way or past any utility or walk, whichever is further.

The minimum easement width for sanitary sewer is 20 feet. All sanitary sewers not in the right-of-way shall be located in an easement.

There shall be a minimum of one foot of vertical clearance between a sanitary sewer and a storm sewer.

Where a waterline does not maintain 18 inches vertical separation above or below a sanitary sewer, the sanitary sewer shall be encased in water main type materials which will withstand a 50 psi pressure test for a distance of 10 feet on both sides of the waterline.

Sanitary sewers shall be designed with a minimum full pipe flow velocity of 2 feet per second.

The design capacity for a sanitary sewer shall be per the following table:

<u>Pipe Size</u>	<u>Design Capacity</u>
8" to 15"	50% Full
18" to 42"	75% Full
over 42"	92% Full

All sanitary sewers within the right-of-way and under pavement shall have compacted granular backfill to three feet beyond the edge of pavement or back of curb.

**SECTION 4. Storm Water,** The maximum spacing between storm structures is 300 ft.

The maximum depth of a Standard Catch Basin is 5 feet. The maximum depth of a Curb Inlet Type "B" is 6 feet.

All structures in pavement areas shall have heavy ditch grates & frames.

The maximum spacing between curb inlets for a dedicated street is 350 ft. for mountable curb & gutter and 500 ft. for standard curb and gutter. The maximum drainage area per storm inlet is 1.5 acres.

Numbering for storm structures shall begin with 1 at the furthest structure downstream.

Storm sewer stationing shall begin with 0+00 at the downstream end of each storm sewer run.

There shall be a minimum of 1 foot vertical clearance between all storm sewer and sanitary sewers or waterlines.

The minimum pipe size for a subdivision is 12 inches with a minimum velocity of 3 fps. The minimum pipe size for private development is 8 inches. Orifice plates shall be used to restrict the outflow for detention.

The minimum storm sewer easement width shall be 20 feet.

The Engineer shall provide sufficient layout dimensions to ensure that detention or retention basins can be constructed to its design capacity.

Any detention basin with a bottom slope of less than 1 percent shall have a paved gutter.

The maximum ponding depth in a parking lot is 1 foot.

All storm sewers within the right-of-way and under pavement shall have compacted granular backfill to three feet beyond the edge of pavement or back of curb.

All storm sewers with less than 3.5 feet of cover under a public street shall be concrete encased.

All storm pipes that discharge into a detention or retention basin, stream or ditch shall have been provided with a headwall or endwall and rock channel protection. Rock channel protection shall be designed using City of Columbus design standards.

Headwalls shall be provided where any ditch stream or detention or retention basin discharges into a storm sewer. Driveway pipes 15" in diameter or less are not required to have headwall or endwalls.

The minimum ditch grade shall be 0.50%.

Where a sanitary sewer, storm sewer or waterline crosses a stream or significant ditch, water course erosion protection shall be provided at the crossing. The minimum requirements are Type "C" Rock Channel Protection, 2.5 feet deep, and extending across the width of the channel.

Alteration of the amount of tributary area for a drainage basin is prohibited.

All development must conform to the flood plain regulations of the Village of Granville.

Storm structures are required at all pipe grade or directional changes and at all sewer junctions.

Pipe shall be of the same material from structure to structure and shall not change materials except at structures.

The hydraulic head must be taken into account when sizing the outlet from a detention basin, retention basin, or ponding area.

A storm sewer shall not decrease in capacity from upstream to downstream unless it is necessary for detention purposes.

Storm sewers shall be sized using Manning's Equation.

The minimum design capacity for storm sewers discharging into a detention or retention basin shall be the 2 year storm with the post developed runoff rate. The hydraulic gradeline shall be checked to ensure it does not exceed the top of casting or window elevation of a storm structure.

The minimum time of concentration shall be 10 minutes.

The minimum design capacity for a roadway culvert is the 10 year storm except arterial streets which shall be the 25 year storm.

The minimum design capacity for a bridge is the 100 year storm.

The minimum design capacity for a ditch is the 10 year storm flowing full.

A flood routing path shall be provided for the 100 year storm.

**SECTION 5. Waterlines.** All water mains and services shall have a minimum of 4 feet of cover.

The maximum spacing between fire hydrants is 300 feet for dedicated streets. One fire hydrant shall be provided within 150 feet of terminus of a dead end street or cul-de-sac.

There shall not be more than 7 feet of cover of the fire lead at the fire hydrant location.

All fire hydrant leads shall be 6" diameter pipe.

If the distance between the fire hydrant and the water main exceeds 25 feet, a second valve will be required on the fire hydrant lead.

Fire hydrants shall be set 2 feet behind the back of curb or 8 feet behind the edge of pavement.

All valves located in pavement shall have heavy duty valve boxes.

Stationing for waterlines shall be from west to east and from south to north.

No public waterline shall be within 20 feet of a building foundation or overhang.

For private development, a minimum of one fire hydrant shall be within 300 feet of every building or part thereof, and a minimum of one additional fire hydrant within 500 feet of every building or part thereof.

Wye connections are not permitted to waterlines.

The minimum public waterline size is 6 inches.

A valve is required whenever one waterline is connected to another waterline. The preferred location of the valve is at the right-of-way.

A thrust block is required for all deadend waterlines. A valve is required 10 feet from the thrust block of any waterline that may be extended.

The minimum easement width for a waterline is 20 feet.

All service boxes shall be located one foot inside the right-of-way or easement.

A minimum of one water service is required per building. One water service may be required per unit of a multi-unit building.

**SECTION 6. Grading.** The minimum recommended grade for parking lots and private drives is one percent. The maximum is five percent.

The minimum grade for a swale shall be 0.50 percent.

The grade between the curb and the right-of-way shall be 3/8 in/ft.

The maximum slope for mounds shall be 3:1. Mounds shall be located outside the right-of-way and shall not interfere and shall be checked for sight distance.

The slope for the first 8 feet from a house or other residential unit shall be 1/4 in/ft.

The minimum slope for sheet flow over a grass lot shall be one percent. Two percent is recommended.

The maximum driveway grade from R/W to the building shall be 12 percent.

**SECTION 7. Stormwater Management and Erosion/Sediment Control.** Soil erosion control measures shall be practiced at all sites. Any site over one acre requires the preparation of a Soil Erosion Control Plan.

Design criteria for stormwater management shall be in accordance with Village of Granville Codified Ordinances Chapter 1197 (or latest revision) pertaining to comprehensive stormwater management including any supplements thereto.

Design criteria for erosion/sediment control shall be in accordance with Village of Granville Codified Ordinances Chapter 1199 (or latest revision) pertaining to erosion/sediment control including any supplements thereto.

Inlet protection is required at all storm inlets.

A stabilized construction entrance is required for all sites.

Sediment fences are required to prevent soil from washing off the site due to sheet flow. Sediment fences shall be placed at the construction limits.

Straw bales shall be placed in swales and ditches. Maximum spacing is 250 feet.

Temporary stream crossings shall be provided whenever it is necessary to cross a stream or significant ditch for construction purposes prior to construction of the permanent roadway.

Temporary sediment basins shall be constructed to provide sediment settling facilities for concentrated stormwater runoff during construction. The capacity of the basin shall be 67 cubic yard per acre of drainage area.

Sediment basin, detention basin, and retention pond outlets shall be provided with sediment filters.