

Knepper Applicable PHMSA Training Completed			
	Online Computer Based Training	Status	Date
1	PHMSA-PL4LNG Fundamentals of Liquefied Natural Gas (LNG) WBT	Successful	6/15/2005
2	PHMSA-PL1HCA High Consequence Areas WBT	Successful	7/4/2005
3	PHMSA-PL1IPROC Integrity Management Processes WBT	Successful	7/6/2005
4	PHMSA-PL3OQ Operator Qualification WBT Course	Successful	1/31/2006
5	PHMSA-PL3SCCDA Stress Corrosion Cracking Direct Assessment WBT	Successful	8/23/2006
6	PHMSA-PL1PRESS Fundamentals of Gas Pressure Regulators WBT	Successful	2/26/2007
7	PHMSA-PL3PP Fundamentals of Plastic Pipe WBT	Successful	4/12/2007
8	PHMSA-PL3WELD Introduction to Pipeline Welding WBT	Successful	6/1/2007
9	PHMSA-PL3CP Fundamentals of Pipeline Corrosion and Cathodic Protection WBT	Successful	8/14/2007
10	PHMSA-PL3ELEC Fundamentals of Basic DC Electricity WBT	Successful	8/18/2007
11	PHMSA-PL3PIG Fundamentals of Launching and Receiving Maintenance Pigs WBT	Successful	6/8/2010
12	PHMSA-PL3SCADA Fundamentals of SCADA Systems WBT	Successful	3/14/2011
13	PHMSA-PL1ICDA Internal Corrosion Direct Assessment WBT	Successful	4/1/2011
14	PHMSA-PL3ECDA External Corrosion Direct Assessment WBT	Successful	4/1/2011
15	PHMSA-PL1ODOR Natural Gas Odorization WBT	Successful	4/4/2011
16	PHMSA-PL1DIMP Introduction of Distribution Integrity Management Program WBT	Successful	5/3/2011
17	PHMSA-PL1GLAW Introduction to Gas Laws WBT	Successful	8/11/2014
18	PHMSA-PL3REG Regulatory Overview WBT	Successful	4/8/2015
19	PHMSA-PL2P195 Introduction to Part 195 WBT	Successful	4/14/2015
20	PHMSA-PL2FLMEC - Fundamentals of Fluid Mechanics WBT	Successful	4/24/2015
21	PHMSA-PL1RA Introduction to Risk Assessment Methods WBT	Successful	4/25/2015
	COURSES	Status	Date
1	PHMSA-PL1297 Gas Integrity Management (IM) Protocol Course	Successful	5/5/2005
2	PHMSA-PL4253 Liquefied Natural Gas (LNG) Safety Technology and Inspection Course	Successful	7/29/2005
3	PHMSA-PL1250 Safety Evaluation of Gas Pipeline Systems Course	Successful	12/15/2005
4	PHMSA-PL2284 (HAZWOPER) Refresher for Pipeline Safety Representatives	Successful	1/9/2007
5	PHMSA-PL3322 Evaluation of Operator Qualification (OQ) Programs Course	Successful	1/11/2007
6	PHMSA-PL3256 Pipeline Failure Investigation Techniques Course	Successful	2/9/2007
7	PHMSA-PL1255 Gas Pressure Regulation and Overpressure Protection Course	Successful	4/12/2007
8	PHMSA-PL1310 Plastic and Composite Materials Course	Successful	6/15/2007
9	PHMSA-PL3242 Welding and Welding Inspection of Pipeline Materials Course	Successful	6/15/2007
10	PHMSA-PL3254 Joining of Pipeline Materials Course	Successful	6/15/2007
11	PHMSA-PL3257 Pipeline Safety Regulation Application and Compliance Procedures Course	Successful	8/17/2007
12	PHMSA-PL3600 Root Cause/Incident Investigation Course	Successful	8/21/2009
13	PHMSA-PL3292 Safety Evaluation of Inline Inspection (ILI)/Pigging Programs Course	Successful	6/11/2010
14	PHMSA-PL3293 Corrosion Control of Pipeline Systems Course	Successful	6/25/2010
15	PHMSA-PL3291 Fundamentals of (SCADA) System Technology and Operation Course	Successful	4/1/2011
16	PHMSA-PL3355 Safety Evaluation of Control Room Management Programs	Successful	8/29/2014
17	PHMSA-PL1245 Safety Evaluation of Distribution Integrity Management Programs (DIMP) Course	Successful	4/23/2015
18	PHMSA-PL2258 Safety Evaluation of Hazardous Liquid Pipeline Systems Course	Successful	5/15/2015
19	PHMSA-PL3267 Fundamentals of Integrity Management Course	Successful	7/31/2015
20	PHMSA-PL3306 External Corrosion Direct Assessment (EDCA) Field Course	Successful	8/14/2015
21	PHMSA-PL1297 Gas Integrity Management (IIM Protocol Course)	Successful	9/18/2015
22	PHMSA-PL3322 Evaluation of Operator Qualification (OQ) Programs Course	Successful	1/22/2016

(20) Cast Iron Bare Steel Replacement Program:

A cast iron/bare steel replacement program (“CIBS Program”) shall be implemented that will be based on a construction year(April through December). By no later than January 15 of each year, EnergyNorth shall provide a copy of its CIBS Plan, defined below, to Staff for review and comment. EnergyNorth shall meet with Staff in technical sessions to discuss the plan to be implemented for the subsequent construction year. After review by Staff, EnergyNorth will take all reasonable steps to carry out and implement the plan, taking into account Staff comments.

The CIBS plan, which will cover cast iron and bare steel pipe replacements, will describe each replacement project, itemizing the proposed projects by general category, along with the targeted amount of investment to be made during the following construction year, which budget shall not be less than the CIBS base amount for capital expenditures described in paragraph e below (“CIBS Plan”). The CIBS Plan will prioritize cast iron and bare steel pipe replacements based on factors including leakage, material condition, age and other components affecting pipe integrity. The CIBS Plan will not address replacement of cast iron and bare steel pipes required in public works projects and/or carried out pursuant to the Cast Iron Encroachment Policy referenced in Condition 12 above.

EnergyNorth agrees to engage in an annual evaluation and selection process to identify and target investments to be proposed in the CIBS Plan, as follows:

- a. It will undertake an annual review of the performance of its distribution system as it relates to the integrity of its cast iron and bare steel pipelines. This review will provide: (1) a detailed analysis of leak activity over the preceding ten years on the bare steel and cast iron gas mains, and (2) an evaluation of which main segments represent the highest priority segments for replacement. Consideration will be given to the age of the main, the date the leak(s) occurred, leak classification, type of leak, number of clamps used in leak repair, condition of main when repaired, specific leak location, building types in the area of the main segment and quantity of bare steel services attached to the potential segment to be replaced.
- b. Adjustments in the priority of main segment replacement could be made due to planned paving projects, public relations, or identification of new main segments by operating personnel in the field that were not captured through EnergyNorth’s data systems.
- c. Using the process identified in (a) and (b) above, EnergyNorth shall rank and prioritize those mains to be replaced in the associated construction year and provide its plans to the Commission.
- d. Categories of spending will include the following:

- 1.1 unprotected bare steel main replacement, as determined by the evaluation and selection process;
- 1.2. cast iron main replacement as determined by the evaluation and selection process;
- 1.3. cast iron or bare steel main replacement candidates requested by field operating personnel; and
- 1.4. bare steel services replaced as a result of a segment of bare steel main or cast iron main that is selected.

Categories of spending that are not included in the CIBS:

- 2.1. costs of moving inside meters to outside;
- 2.2. costs of reconnecting existing plastic services or existing coated steel services from cast iron mains or bare steel mains to the newly installed replacement main;
- 2.3. costs of any mains replaced made of polyethelene or steel that have a protective coating;
- 2.4. costs of any mains that are abandoned;
- 2.5. costs of coated steel mains that “act as bare steel mains” such as poorly coated steel mains or disbonded steel mains, unless approved by the Safety Division;
- 2.6. incremental costs of upsizing with the exception of (n) below; and
- 2.7. carryover costs in aggregate exceeding 5% of the approved estimated total expenditures under the CIBS program for the construction year, unless approved by the Safety Division. Such carryover costs include items such as restoration costs not incurred during the construction year.
- 2.8. Replacements made under the Cast Iron Encroachment Policy are not eligible for accelerated rate recovery in the Cast Iron/Bare Steel Program unless a special circumstance is approved by the Safety Division.

e) EnergyNorth shall bear the initial \$500,000 of capital expenditures under the CIBS program (“the CIBS Base Amount”) (in accordance with the Handy Whitman index). The CIBS Base Amount excludes replacement projects required by public works projects and/or carried out pursuant to the Cast Iron Encroachment Policy referenced in Condition 12. Provided that investments were made in accordance with the approved CIBS plan, EnergyNorth will be allowed a permanent increase in its base distribution delivery rates to recover the annual revenue requirement for those investments that are found to be reasonable and prudent made in the preceding construction year and in excess of the CIBS Base Amount. The permanent capital investment recovery allowance will not take effect until the actual costs of the

previous construction year are approved by the Commission. Petitions for cost recovery will be submitted annually thereafter not later than May 1, for an effective date of July 1.

f) After Staff completes the review of the CIBS Plan for a given construction year, EnergyNorth shall track all capital investments made in accordance with the approved CIBS Plan. EnergyNorth will reconcile actual capital expenditures with the CIBS Plan targets at the conclusion of the CIBS Plan period.

g) EnergyNorth agrees that it will file a report with the Commission on May 15 of each year detailing the actual amount of capital investments made in accordance with implementing the CIBS Plan during the prior construction year (“CIBS Report”). The report will include a calculation of the incremental revenue requirement associated with the capital investments in rate base that exceeds the CIBS Base Amount, using the Commission-approved imputed or actual capital structure and cost of capital determined using the Commission-approved return on equity and cost of debt. If the Commission has not made a final determination in the first rate case by the time the first adjustment is to be calculated, a reasonable proxy will be used for the rate calculation and an adjustment will be made to the revenue requirement to reconcile to the approved cost of capital rates when the rates from the first rate case go into effect.

h) EnergyNorth agrees to file its annual CIBS Report on the prior construction year’s activities at the time it makes its rate adjustment filing on May 15. The Settling Parties and Staff understand that, in implementing the CIBS Plan, the circumstances encountered during the year may require reasonable deviations from the original plan. In such cases, EnergyNorth shall include an explanation of any deviations in the report. For cost recovery purposes, EnergyNorth shall have the burden to show that any deviations were due to circumstances out of its reasonable control or, if within its control, were reasonable and prudent. The CIBS Report shall include a breakdown of footage replaced by municipal projects that involve Cast Iron /Bare Steel as well the footage replaced under the Cast Iron Encroachment Policy. Samples of reporting that Staff has reviewed previously are included in Attachment A.

i) The CIBS Program will remain in place through and beyond EnergyNorth’s future rate cases until terminated by the Commission or by mutual agreement at the end of a given construction year, with a final capital allowance pertaining to the final year.

j) EnergyNorth can elect to not finalize its CIBS Plan until after the winter frost patrol ends in early April. By May 1, EnergyNorth shall finalize actual projects and provide a copy of the final CIBS Plan to Staff. In addition, the priority rankings of main segments for replacement will be subject to change over the course of the year due to new information. In such case, if EnergyNorth believes it is prudent to change

the rankings from the approved CIBS Plan, it will notify Staff, stating the reasons for the change prior to construction. If Staff does not believe that particular components of the revised plans are reasonable and the matter is not resolved between EnergyNorth and Staff, Staff may object and the matter may be referred to the Commission for resolution.

k) EnergyNorth acknowledges that Staff review will not relieve EnergyNorth of its obligation to operate its business and maintain safe, reliable service through expenditures and other capital investments in the ordinary course of business that are not set forth in the CIBS Plan, nor will it bind Staff to a particular position regarding the adequacy and/or effectiveness of the plan.

l) However, EnergyNorth will be authorized to include in its CIBS Plan the replacement of cast iron and bare steel pipe located in the vicinity of public works projects, where replacement is not required as a part of the project, but permitted for convenience or other reasons, as determined by the Safety Division.

m) EnergyNorth shall provide GIS Mapping or other electronic means that shows the project scope with each submittal of the CIBS Plan.

n) No upsizing of pipe diameter shall be allowed for cost recovery within the CIBS Program on 60 psig systems. For low pressure systems (12 inches water column and below) no upsizing shall be allowed for cost recovery within the CIBS Program except for 3" nominal diameter low pressure pipe replaced with 4" nominal diameter pipe and other special circumstances as approved by the Safety Division.

o) EnergyNorth shall provide the Commission Staff with actual cutouts of the worst section within any bare steel main segment replaced prior to reconciling any cost adjustments for associated construction season. Cutouts shall be approximately 12 inches to 24 inches in length.

p) EnergyNorth shall provide a written report accompanying the actual cutouts in section 20(o) above that includes: photographs the replaced bare steel segment; a general description of the condition of the pipe; the street address from which it was taken; age of material; original wall thickness; measured depth of deepest pit of the cutout; operating pressure of replaced pipe; pH of soil condition of cutout surrounds; results of testing for microbiological acid producing bacteria (APB) and sulfate reducing bacteria (colonies per ML); and identification of the threshold of high bacteria counts.

Liberty Utilities Cast Iron Bare Steel Program								
	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
Address	Concord St	2-7 Cornell St	20-34 School St	18-56 Ash St	5-19 Lemon St	1-34 Dickerman St	Pennichuck St & Caron Ave	48 NEWBURY ST, NAS (ON UNDERHILL ST)
Town	Concord	Nashua	Hudson	Nashua	Nashua	Nashua	Nashua	Nashua
Pipe Size	2"	2"	2"	2"	2"	2"	2"	2"
Install Date	1953	1955	1947	1928	1902/1925	1902/1925	1956/1960	Unknown
Wall Thickness	0.166 in	Unknown	Unknown	Unknown	Unknown	0.154 in	0.143 in	0.188 in
Age	55	54	63	83	110	111	58	Unknown
Pressure	12 in water column	60 psig	12 in water column	12 in water column	12 in water column	12 in water column	12 in water column	12 in water column
Ground PH	7 to 8	7 to 8	7.5	6.5	6	7.5	6	6
Pipe Condition	Deep pitting/Significant wall loss	Good condition Coated steel	Deep Pitting/Fair to poor Condition	100% wall loss/Very poor Condition	100% wall loss/very poor condition	90% wall loss/poor condition	100% wall loss/very poor condition	100% wall loss/Very poor condition
Address	Woodman St	83 Pleasant St	2-18 Faxon St & 1-7 Faxon Ave	55-100 W North St	2-13 Grove St	1-44 Revere St & Fernwood St	90 Dodge St	49 Summer St (on Salem St)
Town	Concord	Concord	Nashua	Manchester	Nashua	Nashua	Nashua	Nashua
Pipe Size	1.5"	2"	2"	8"	2"	2"	2"	2"
Install Date	1929	1900	1912	1960	1910	1902/1925	1959	1924
Wall Thickness	0.130 in	Unknown	Unknown	Unknown	Unknown	0.188 in	0.160 in	0.218 in
Age	79	109	98	51	102	111	55	91
Pressure	12 in water column	12 in water column	12 in water column	12 in water column	12 in water column	12 in water column	12 in water column	12 in water column
Ground PH	7 to 8	6	7.5	6	7	6	6	6
Pipe Condition	Deep pitting/Significant wall loss	some areas of pitting and wall loss	Multiple large holes/very poor condition	Deep Pitting/Poor Condition	Deep pitting/poor condition	37% wall loss/moderate condition	100% wall loss/very poor condition	100% wall loss/very poor condition
Address	Connell St	25-28 Depot St	116-130 Bowers St			17-28 Sunset Dr	93 Walnut St	
Town	Hudson	Franklin	Nashua			Belmont	Nashua	
Pipe Size	2"	2"	2"			2"	2"	
Install Date	1928	1931	1913			Unknown	1913	
Wall Thickness	0.139 in	unknown	Unknown			0.188 in	0.160 in	
Age	80	78	97			Unknown	101	
Pressure	12 in water column	60 psig	12 in water column			60 psig	12 in water column	
Ground PH	6 to 7	6	7			6	6	
Pipe Condition	Deep pitting/Significant wall loss	Good condition Coated steel	Heavy wall loss/poor condition			100% wall loss/very poor condition	100% wall loss/very poor condition	
Address	Gloria Ave	80-113 Blossom St	1-19 Perkins St & 41-46 Bradley St			8-18 Maple St	57 Spaulding St	
Town	Hudson	Nashua	Concord			Nashua	Nashua	
Pipe Size	2"	2"	1.5"			2"	2"	
Install Date	1954	1908 & 1913	1955			1957	1956	
Wall Thickness	0.148 in	Unknown	Unknown			0.154 in	0.139 in	
Age	54	101	55			56	58	
Pressure	60 psig	12 in water column	12 in water column			12 in water column	12 in water column	
Ground PH	7 to 8	5	7			6.5	6	
Pipe Condition	Fair Condition	Extremely poor condition	Deep pitting/fair to poor condition			39% wall loss/moderate condition	100% wall loss/very poor condition	
Address	Library St	5-11 Bristol St	Chester St -59 Berkeley St			3-25 Pratt St & Zellwood St	95 Shaker Rd	
Town	Hudson	Nashua	Nashua			Nashua	Concord	
Pipe Size	4"	4"	2"			2"	1"	
Install Date	1908	1947, 1951, 1954, 1957	1947			1894/1914	Unknown	
Wall Thickness	0.234 in	Unknown	Unknown			0.188 in	0.133 in	
Age	100	62	63			119	Unknown	
Pressure	12 in water column	12 in water column	12 in water column			60 psig	60 psig	
Ground PH	6	7	7			7	6	
Pipe Condition	Fair Condition	Moderate uniform pitting/Fair Condition	Visible holes/Very poor condition			100% wall loss/very poor condition	27% wall loss/fair condition	
Address	Mulberry St	12-25 Buck St				5-21 Ridge St	249 Medford St	
Town	Nashua	Nashua				Nashua	Manchester	
Pipe Size	2"	2"				2"	2"	
Install Date	1912	1901, 1903 & 1911				Unknown	1956/1960	
Wall Thickness		Unknown				0.154 in	0.160 in	
Age	96	108				Unknown	58	
Pressure	12 in water column	12 in water column				12 in water column	60 psig	
Ground PH	7 to 8	6 to 7				6.5	6	
Pipe Condition	Concentrated deep pitting	Heavy Pitting/Poor Condition				39% wall loss/moderate condition	100% wall loss/very poor condition	
Address	Prescott St & Putnam St	2-4 Fourth St				1-6 Jewell Ln	348 Lincoln St	
Town	Nashua	Nashua				Nashua	Manchester	
Pipe Size	2"	2"				2"	3"	
Install Date	1924	1926				1947	1954	
Wall Thickness	Not Taken Due to Pipe Condition	Unknown				0.154 in	0.234 in	
Age	84	83				66	60	
Pressure	12 in water column	12 in water column				12 in water column	60 psig	
Ground PH	6 to 7	6				7	6	
Pipe Condition	Pipe breakage and pit holes	Significant deep pitting/Poor Condition				32% wall loss/moderate condition	12% wall loss/fair condition	
Address	Reed Court	31-39 Newbury St						
Town	Nashua	Nashua						
Pipe Size	2"	2"						
Install Date	1908	1898, 1910, 1928						
Wall Thickness	0.121 in	Unknown						
Age	100	111						
Pressure	12 in water column	12 in water column						
Ground PH	6	3 to 4						
Pipe Condition	Significan wall Loss	Significant wall loss/Poor condition						
Address		5-21 Winter St						
Town		Tilton						
Pipe Size		4"						
Install Date		1931						
Wall Thickness		Unknown						
Age		78						
Pressure		60 psig						
Ground PH		7						
Pipe Condition		Fair Condition						
42 Samples	8	9	5	2	2	7	7	2

LIBERTY UTILITIES BARE STEEL REPLACEMENT PROGRAM

2009-2016

2009 Bare Steel Replacement Reports



FY 2009

Address	Concord St
Town	Concord
Pipe Size	2"
Install Date	1953
Wall Thickness	0.166 in
Age	55
Pressure	12 in water column
Ground PH	7 to 8
Pipe Condition	Deep pitting/Significant wall loss



FY 2009

Address	2 Woodman St
Town	Concord
Pipe Size	1.5"
Install Date	1929
Wall Thickness	0.130 in
Age	79
Pressure	12 in water column
Ground PH	7 to 8
Pipe Condition	Deep pitting/Significant wall loss



FY 2009

Address	Connell St
Town	Hudson
Pipe Size	2"
Install Date	1928
Wall Thickness	0.139 in
Age	80
Pressure	12 in water column
Ground PH	6 to 7
Pipe Condition	Deep pitting/Significant wall loss



FY 2009

Address	Gloria Avenue
Town	Hudson
Pipe Size	2"
Install Date	1954
Wall Thickness	0.148 in
Age	54
Pressure	60 psig
Ground PH	7 to 8
Pipe Condition	Fair Condition



FY 2009

Address	Library St
Town	Hudson
Pipe Size	4"
Install Date	1908
Wall Thickness	0.234 in
Age	100
Pressure	12 in water column
Ground PH	6
Pipe Condition	Fair Condition



FY 2009

Address	Mulberry St
Town	Nashua
Pipe Size	2"
Install Date	1912
Wall Thickness	0.124 in
Age	96
Pressure	12 in water column
Ground PH	7 to 8
Pipe Condition	Concentrated Deep Pitting



FY 2009

Address	Prescott St & Putnam St
Town	Nashua
Pipe Size	2"
Install Date	1924
Wall Thickness	Not Taken Due to Poor Condition
Age	84
Pressure	12 in water column
Ground PH	6 to 7
Pipe Condition	Pipe Breakage and Pit Holes



FY 2009

Address	Reed Ct
Town	Nashua
Pipe Size	2"
Install Date	1908
Wall Thickness	0.121 in
Age	100
Pressure	12 in water column
Ground PH	6
Pipe Condition	Significant Wall Loss



2010 Bare Steel Replacement Reports



FY 2010

Address	2-7 Cornell St
Town	Concord
Pipe Size	2"
Install Date	1955
Wall Thickness	Unknown
Age	54
Pressure	60 psig
Ground PH	7 to 8
Pipe Condition	Good Condition
	Coated Steel



FY 2010

Address	83 Pleasant St
Town	Concord
Pipe Size	2"
Install Date	1900
Wall Thickness	Unknown
Age	109
Pressure	12 in water column
Ground PH	6
Pipe Condition	Some Areas of Pitting and Wall Loss



FY 2010

Address	25-28 Depot St
Town	Franklin
Pipe Size	2"
Install Date	1931
Wall Thickness	Unknown
Age	78
Pressure	60 psig
Ground PH	6
Pipe Condition	Good Condition
	Coated Steel



FY 2010

Address	80-113 Blossom St
Town	Nashua
Pipe Size	2"
Install Date	1908 & 1913
Wall Thickness	Unknown
Age	101
Pressure	12 in water column
Ground PH	5
Pipe Condition	Extremely Poor Condition



FY 2010

Address	5-11 Bristol St
Town	Nashua
Pipe Size	4"
Install Date	1947, 1951, 1954, 195?
Wall Thickness	Unknown
Age	62
Pressure	12 in water column
Ground PH	7
Pipe Condition	Moderate Uniform Pitting/ Fair Condition



FY 2010

Address	12-25 Buck St
Town	Nashua
Pipe Size	2"
Install Date	1901, 1903 & 1911
Wall Thickness	Unknown
Age	108
Pressure	12 in water column
Ground PH	6 to 7
Pipe Condition	Heavy Pitting/ Poor Condition



FY 2010

Address	2-4 Fourth St
Town	Nashua
Pipe Size	2"
Install Date	1926
Wall Thickness	Unknown
Age	83
Pressure	12 in water column
Ground PH	6
Pipe Condition	Significant Deep Pitting/ Poor Condition



FY 2010

Address	31-39 Newbury St
Town	Nashua
Pipe Size	2"
Install Date	1898, 1910, 1928
Wall Thickness	Unknown
Age	111
Pressure	12 in water column
Ground PH	3 to 4
Pipe Condition	Significant Wall Loss/ Poor Condition



FY 2010

Address	5-21 Winter St
Town	Tilton
Pipe Size	4"
Install Date	1931
Wall Thickness	Unknown
Age	78
Pressure	60 psig
Ground PH	7
Pipe Condition	Fair Condition



2011 Bare Steel Replacement Reports



FY 2011

Address	20-34 School St
Town	Hudson
Pipe Size	2"
Install Date	1947
Wall Thickness	Unknown
Age	63
Pressure	12 in water column
Ground PH	7.5
Pipe Condition	Deep Pitting/ Fair to Poor Condition



FY 2011

Address	2-18 Faxon St & 1-7 Faxon Ave
Town	Nashua
Pipe Size	2"
Install Date	1912
Wall Thickness	Unknown
Age	98
Pressure	12 in water column
Ground PH	7.5
Pipe Condition	Multiple Large Holes/ Very Poor Condition



FY 2011

Address	116-130 Bowers St
Town	Nashua
Pipe Size	2"
Install Date	1913
Wall Thickness	Unknown
Age	97
Pressure	12 in water column
Ground PH	7
Pipe Condition	Heavy Wall Loss/ Poor Condition



FY 2011

Address	1-19 Perkins St & 41-46 Bradley St
Town	Concord
Pipe Size	1.5"
Install Date	1955
Wall Thickness	Unknown
Age	55
Pressure	12 in water column
Ground PH	7
Pipe Condition	Deep Pitting/ Fair to Poor Condition



FY 2011

Address	Chester St-59 Berkeley St
Town	Nashua
Pipe Size	2"
Install Date	1947
Wall Thickness	Unknown
Age	63
Pressure	12 in water column
Ground PH	7
Pipe Condition	Visible Holes/ Very Poor Condition



2012 Bare Steel Replacement Reports



FY 2012

Address	18-56 Ash St
Town	Nashua
Pipe Size	2"
Install Date	1928
Wall Thickness	Unknown
Age	83
Pressure	12 in water column
Ground PH	6.5
Pipe Condition	100% Wall Loss/ Very Poor Condition



FY 2012

Address	55-100 W North St
Town	Manchester
Pipe Size	8"
Install Date	1960
Wall Thickness	Unknown
Age	51
Pressure	12 in water column
Ground PH	6
Pipe Condition	Deep Pitting/ Poor Condition



2013 Bare Steel Replacement Reports



FY 2013

Address	5-19 Lemon St
Town	Nashua
Pipe Size	2"
Install Date	1902/1925
Wall Thickness	Unknown
Age	110
Pressure	12 in water column
Ground PH	6
Pipe Condition	100% Wall Loss/ Very Poor Condition



FY 2013

Address	2-13 Grove St
Town	Nashua
Pipe Size	2"
Install Date	1910
Wall Thickness	Unknown
Age	102
Pressure	12 in water column
Ground PH	7
Pipe Condition	Deep Pitting/ Poor Condition



2014 Bare Steel Replacement Reports



FY 2014

Address	1-34 Dickerman St
Town	Nashua
Pipe Size	2"
Install Date	1902/1925
Wall Thickness	0.154 in
Age	111
Pressure	12 in water column
Ground PH	7.5
Pipe Condition	90% Wall Loss/ Poor Condition



FY 2014

Address	1-44 Revere St & Fernwood St
Town	Nashua
Pipe Size	2"
Install Date	1902/1925
Wall Thickness	0.188 in
Age	111
Pressure	12 in water column
Ground PH	7
Pipe Condition	37% Wall Loss/ Moderate Condition



FY 2014

Address	17-28 Sunset Dr
Town	Belmont
Pipe Size	2"
Install Date	Unknown
Wall Thickness	0.188 in
Age	Unknown
Pressure	60 psig
Ground PH	6
Pipe Condition	100% Wall Loss/Very Poor Condition



FY 2014

Address	8-18 Maple St
Town	Nashua
Pipe Size	2"
Install Date	1957
Wall Thickness	0.154 in
Age	56
Pressure	12 in water column
Ground PH	6.5
Pipe Condition	39% Wall Loss/Moderate Condition



FY 2014

Address	3-25 Pratt St & Zellwood St
Town	Nashua
Pipe Size	2"
Install Date	1894/1914
Wall Thickness	0.188 in
Age	119
Pressure	60 psig
Ground PH	7
Pipe Condition	100% Wall Loss/ Very Poor Condition



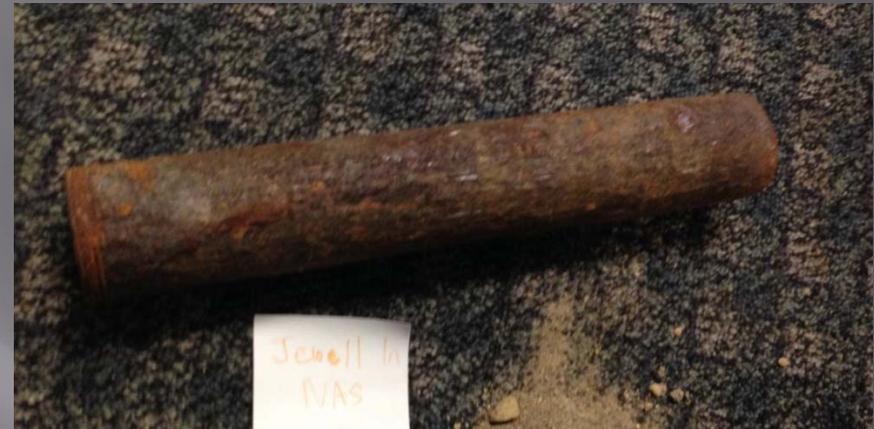
FY 2014

Address	5-21 Ridge St
Town	Nashua
Pipe Size	2"
Install Date	Unknown
Wall Thickness	0.154 in
Age	119
Pressure	12 in water column
Ground PH	6.5
Pipe Condition	39% Wall Loss/ Moderate Condition



FY 2014

Address	1-6 Jewell Lane
Town	Nashua
Pipe Size	2"
Install Date	1947
Wall Thickness	0.154 in
Age	66
Pressure	12 in water column
Ground PH	7
Pipe Condition	32% Wall Loss/ Moderate Condition

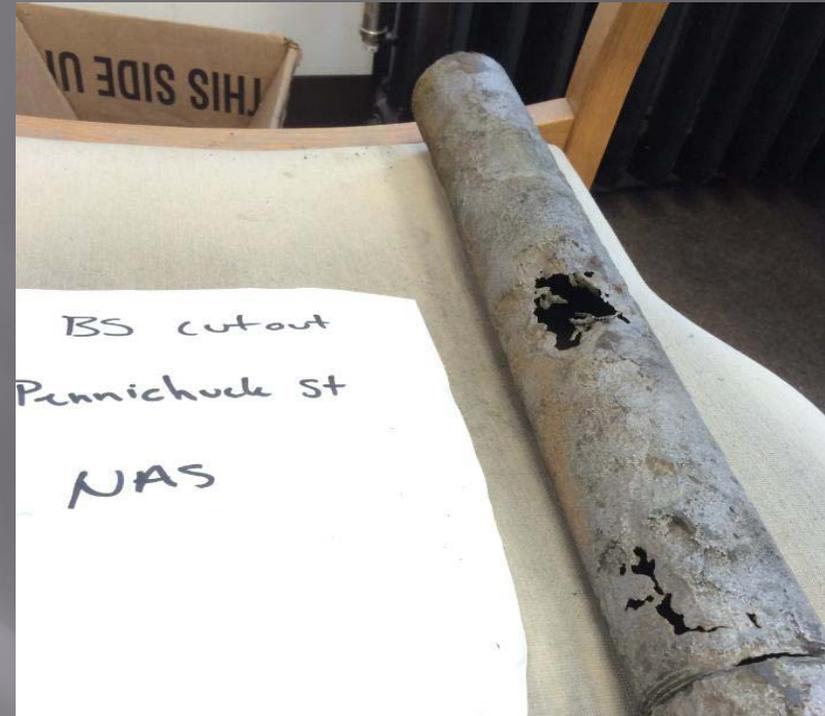


2015 Bare Steel Replacement Reports



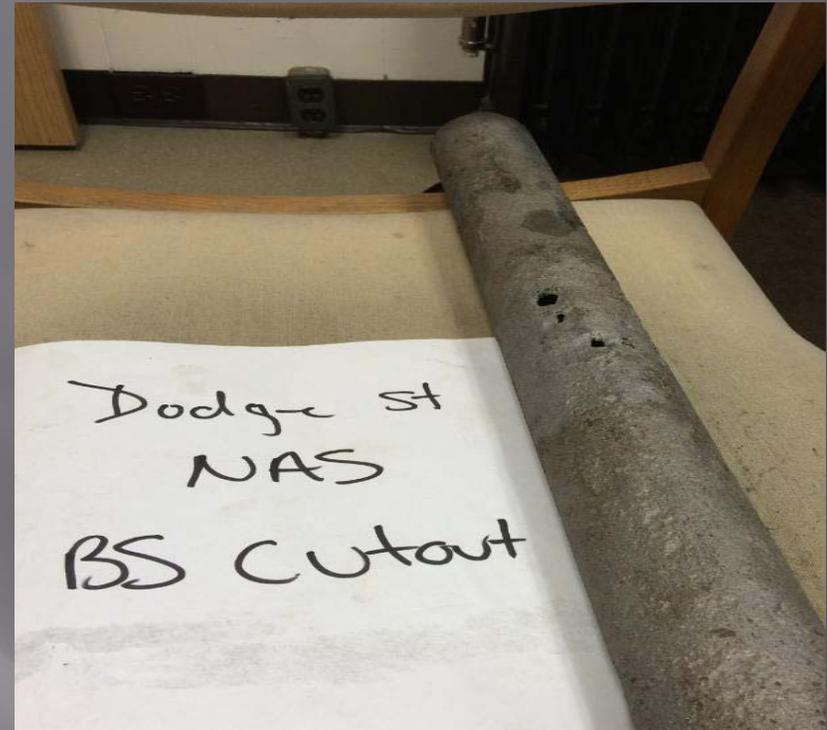
FY 2015

Address	Pennichuck St & Caron Ave
Town	Nashua
Pipe Size	2"
Install Date	1956/1960
Wall Thickness	0.143 in
Age	58
Pressure	12 in water column
Ground PH	6
Pipe Condition	100% Wall Loss/ Very Poor Condition



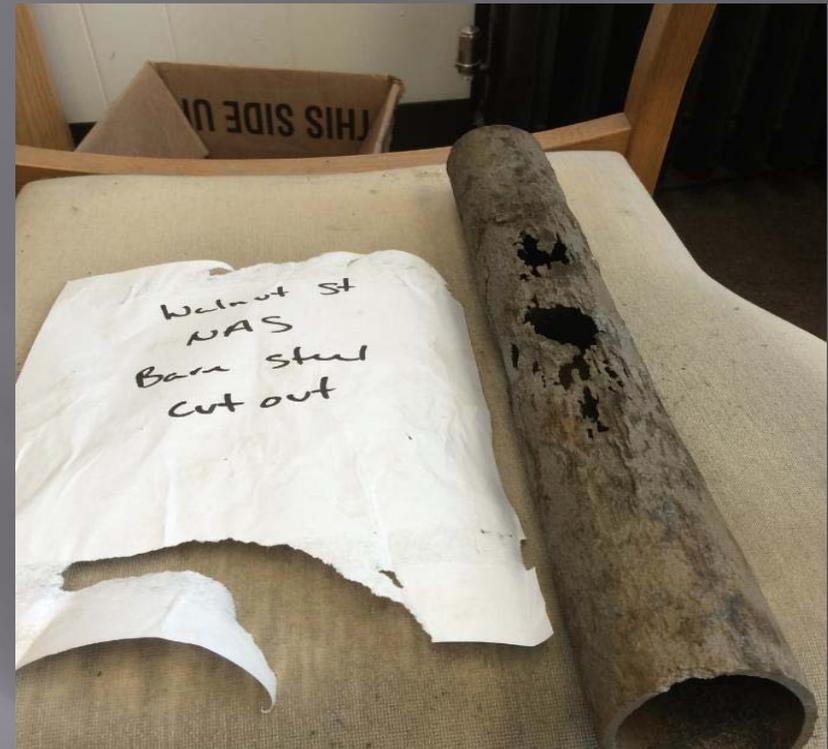
FY 2015

Address	90 Dodge St
Town	Nashua
Pipe Size	2"
Install Date	1959
Wall Thickness	0.160 in
Age	55
Pressure	12 in water column
Ground PH	6
Pipe Condition	100% Wall Loss/ Very Poor Condition



FY 2015

Address	93 Walnut St
Town	Nashua
Pipe Size	2"
Install Date	1913
Wall Thickness	0.160 in
Age	101
Pressure	12 in water column
Ground PH	6
Pipe Condition	100% Wall Loss/ Very Poor Condition



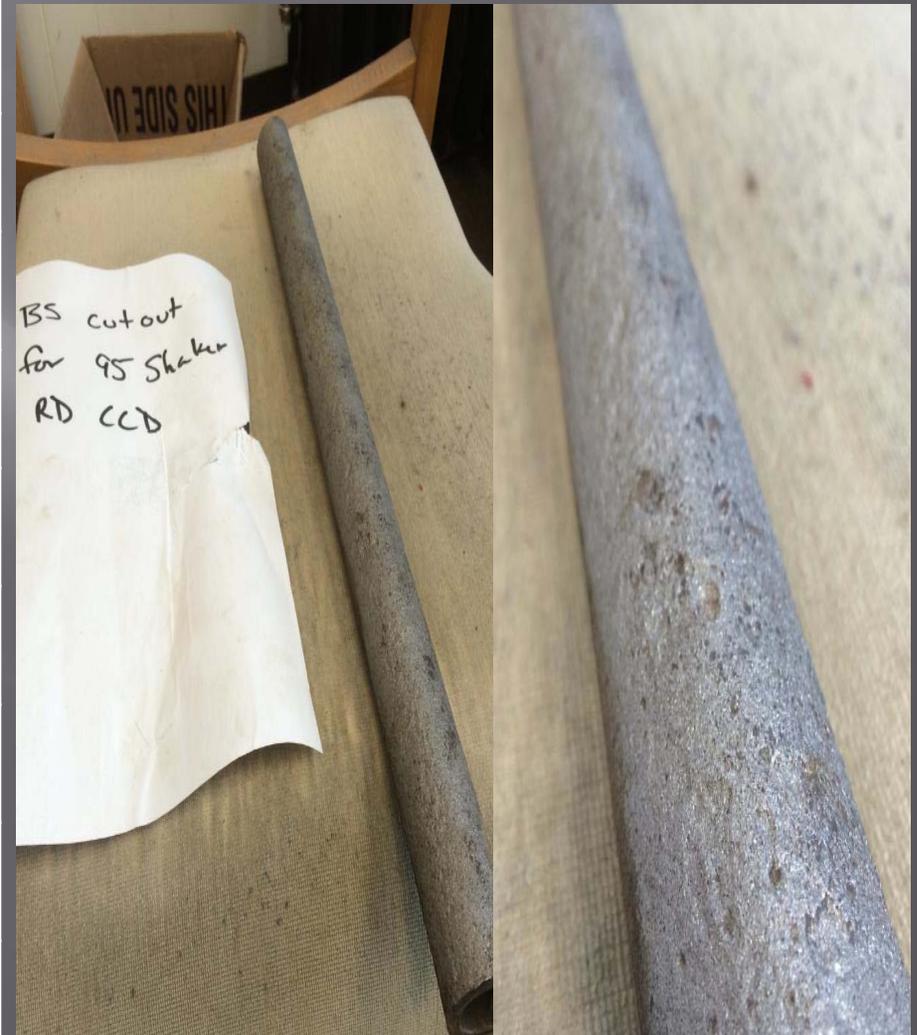
FY 2015

Address	57 Spaulding St
Town	Nashua
Pipe Size	2"
Install Date	1956
Wall Thickness	0.139 in
Age	58
Pressure	12 in water column
Ground PH	6
Pipe Condition	100% Wall Loss/ Very Poor Condition



FY 2015

Address	95 Shaker Road (Shaker Rd School)
Town	Concord
Pipe Size	1"
Install Date	Unknown
Wall Thickness	0.133 in
Age	Unknown
Pressure	60 psig
Ground PH	6
Pipe Condition	27% Wall Loss/ Fair Condition



FY 2015

Address	249 Medford St
Town	Manchester
Pipe Size	2"
Install Date	1956/1960
Wall Thickness	0.160 in
Age	58
Pressure	60 psig
Ground PH	6
Pipe Condition	100% Wall Loss/ Very Poor Condition



FY 2015

Address	348 Lincoln St
Town	Manchester
Pipe Size	3"
Install Date	1954
Wall Thickness	0.234 in
Age	60
Pressure	60 psig
Ground PH	6
Pipe Condition	12% Wall Loss/ Fair Condition



2016 Bare Steel Replacement Reports



FY 2016

Address	48 Newbury St NAS (On Underhill St)
Town	Nashua
Pipe Size	2"
Install Date	Unknown
Wall Thickness	0.188 in
Age	Unknown
Pressure	12 in water column
Ground PH	6
Pipe Condition	100% Wall Loss/ Very Poor Condition



FY 2016

Address	49 Summer St (On Salem St)
Town	Nashua
Pipe Size	2"
Install Date	1924
Wall Thickness	0.218 in
Age	91
Pressure	12 in water column
Ground PH	6
Pipe Condition	100% Wall Loss/ Very Poor Condition



Liberty Utilities (EnergyNorth Natural Gas) Corp. d/b/a Liberty Utilities

DG 16-449

2016 Cast Iron/Bare Steel Replacement Program Results

Staff Data Requests - Set 2

Date Request Received: 5/19/16
Request No. Staff 2-9

Date of Response: 5/25/16
Respondent: Richard MacDonald

REQUEST:

As discussed at the 5/18/16 tech session, please describe each of the issues, or factors, that are beyond the Company's control, resulting in CIBS projects not being completed during the construction year in which the jobs were initiated, shifting those carry over costs for restoration and paving work from one CIBS year to the next.

RESPONSE:

The Company determines its resource requirements for the calendar year by combining growth, CIBS, municipal construction and reinforcement projects to determine crew requirements for the calendar year. Resources are managed for all of the work processes mentioned above and for the priorities of the municipalities. There is competition for crews from a variety of sources, requiring careful planning of annual work plan requirements to ensure that crews are on the property for the full nine months of the construction season, thus enabling the Company to procure and retain the same skilled and qualified resources year after year. If more crews were hired in an effort to complete the work early, the Company would run the risk of losing the crews to other companies, since contractors seek a steady source of work year after year.

Due to the relatively short construction season all of the construction work continues through November and into December, weather permitting. CIBS projects are treated as the priority to assure all new lines have been installed and customers transferred over before the season ends. Typically, municipalities will not issue street opening permits until restoration paving for winter leaks has been completed. The Company manages the municipal requirements by replacing or relocating its facilities on municipal infrastructure projects usually during the 2nd and 3rd quarter of the construction season, allowing for some of the CIBS projects to start in the third quarter. The Company usually has the majority of the CIBS projects completed by the first or second week of November. As stated in the response to Staff 2-12, municipal requirements for the work that is completed in October and November requires a 10- to 30-day settlement period before the Company can permanently restore the trenches. The Company is not allowed to finish pave its excavations when the daily ambient temperature is 50 degrees or less, so it is difficult to finish pave for projects that are otherwise completed in October and November, causing the carryover of final restoration costs.

Liberty Utilities (EnergyNorth Natural Gas) Corp. d/b/a Liberty Utilities

DG 16-449

2016 Cast Iron/Bare Steel Replacement Program Results

Staff Data Requests - Set 2

Date Request Received: 5/19/16
Request No. Staff 2-10

Date of Response: 5/31/16
Respondent: Ian Crabtree

REQUEST:

As discussed at the 5/18/16 tech session, please create a table that shows for each year of the program, the CIBS final actual (loaded) cost for each project, including those actual costs that may have been carried over to the following year. In the same table, also show for each CIBS year, the estimated total (loaded) cost for each project completed in the forecasted construction year, and the projected (loaded) carry over costs for those projects started, but not completed until the following construction year. Include a column showing the annual percentage of estimated loaded project costs carried over from to the next year vs. the estimated total annual loaded costs associated with the completed projects during each construction year. Also, please produce line graphs plotting this data.

RESPONSE:

Please see Attachment Staff 2-10.xlsx

CONSTRUCTION STANDARDS AND DETAILS



CITY OF CONCORD
NEW HAMPSHIRE

2016

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References

All work performed in the City of Concord, New Hampshire shall, as a minimum, conform to the requirements of the latest edition of this manual and the following standards:

For addendums to the standards and other information, please visit the website at <http://www.concordnh.gov/engineering>

- A. Standard Specifications and drawings for Road and Bridge Construction of the New Hampshire Department of Transportation, current edition, as most recently adopted.
- B. Administrative Rules: Env-Wq 700 Standards of Design and Construction for Sewerage and Wastewater Treatment Facilities, as most recently adopted.
- C. Administrative Rules: Env-Wq 1500 Alteration of Terrain, as most recently adopted.
- D. Policy Relating to Driveways and Access to the State Highway System, NHDOT, Bureau of Highway Maintenance.
- E. Manual on Uniform Traffic Control Devices for Streets and Highways, published by the United States Department of Transportation, Federal Highway Administration; current edition.
- F. Requirements of the City of Concord's Driveway, Encumbrance, Monitoring Wells, Street Excavation, and Utility Connection Permits.
- G. Subdivision and Site Plan Regulations and the Municipal Code of Ordinances of the City of Concord, New Hampshire.
- H. City of Concord's Building and Plumbing Codes, and the International Plumbing Code, as currently adopted.
- I. Occupational and Safety Health Administration and The City of Concord Confined Space Entry Policy, current edition.
- J. A Policy on Geometric Design of Highways and Streets, AASHTO, current edition.
- K. Roadside Design Guide, AASHTO, current edition

Inspection Requirements

THE CONTRACTOR, DEVELOPER, OWNER SHALL BE RESPONSIBLE FOR ALL COSTS INCURRED DURING REQUIRED TESTING, AND WILL BE BILLED FOR ALL INSPECTIONS AND TESTING PERFORMED BY THE CITY.

Several City Divisions are involved in the inspection of a project once construction is underway. The following table outlines each division's inspection responsibilities. The Community Development Department is the lead agency concerning construction of public and private improvements. Therefore, an applicant or Contractor should first contact the Community Development Department if they have general questions regarding the construction inspection process. Specific questions should be addressed to the appropriate division listed in this section.

Construction Item	Division	Contact Person
Bridge information Driveway permits Sanitary sewer systems Storm drain systems Street encumbrances Street excavations Street construction Street records Traffic counting Water service systems	Engineering Services	City Engineer (603) 225-8520
Building construction inspection: electrical, mechanical, & plumbing Fire protection systems and life safety code Health & food service licenses Housing code Sign & yard sale permits Zoning Ordinance	Building and Code Services	Code Administrator (603) 225-8580
Landscaping Site compliance Subdivision regulation	Community Planning	City Planner (603) 225-8515
Municipal fire alarm cable Traffic signal systems	Fire Alarm/ Traffic Signals	Fire Alarm Superintendent (603) 225-8667

General Services Department		
Automated meter reading Backflow prevention Water metering Water and Sewer Investment Fees	Administration	Utility Billing (603) 225-8693
Sewer maintenance Water maintenance Roadway maintenance Storm drain maintenance	Highways and Utilities	Highway & Utility Superintendent (603) 228-2737

General Requirements

A. Site Conditions

The Contractor shall promptly notify the City Engineer or representative of any unusual conditions such as:

1. Subsurface or latent physical conditions at the site differing materially from those indicated on the approved plans;
2. Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent to work of the character provided for in the approved plans.
3. Encounters with a utility, whether damaged or simply unearthed, should that utility be mislocated or missing on the approved plans or should that utility be found in an unusual or deteriorated condition.

B. DIG SAFE

The Contractor shall be responsible for contacting Dig Safe (811) at least 72 hours prior to commencement of work. The City is a member of Dig-Safe, yet the Contractor shall coordinate their work with the following City Departments: Fire, Police, Community Development Department and the General Services Department. The location of all utility facilities shall be determined sufficiently ahead of excavation work to avoid damage and permit their relocation if necessary.

C. Control of the Work

Responsibility of Contractor:

The Contractor is responsible for the construction of all improvements as shown on the approved plans. The Contractor shall employ a competent construction supervisor or management team capable of establishing and maintaining all horizontal and vertical layout control, bench marks and structure locations to assure that all improvements will conform to the locations, lines, levels, and grades as indicated on the approved plans. Should site conditions warrant modifications to the approved plans, such changes shall be approved by the appropriate City Department prior to commencement of the work.

Permits:

A **Street Excavation Permit** and possibly an **Encumbrance Permit**, available from the Engineering Services Division will be required for all work within the City of Concord's Right-Of-Way. The permits are a formal agreement for which the Contractor assumes all responsibility and liability resulting from their activities within the public right-of-way. A DIG-SAFE Request Number is required to obtain a Street Excavation Permit.

Prior to the issuance of the Street Excavation Permit, the Contractor shall furnish an original copy of a \$1,000,000.00 Liability Insurance with the City of Concord named as additionally insured and a bond in the amount requested by the Engineering Services Division. The proof of insurance and bond amount must be submitted at the time of the permit request. It should be noted that, the bond amount will be held for a two (2) year period in case any workmanship deficiencies arise within the City of Concord's Right-of-Way.

The Contractor shall complete the work in a manner that will cause the least inconvenience to the general public. Contact the Engineering Services Division for the current fee schedule.

Compliance to Requirements:

The Contractor shall provide all City staff safe access to the work for the purpose of ascertaining that the work is in accordance with City requirements, even to the extent of uncovering or taking down portions of finished work.

Compliance with City Ordinances and Policies:

The Contractor shall abide by all city ordinances and policies, as most recently adopted, as they apply to construction.

11-3-1 - Fugitive Dust

(a) *The following is deemed and declared to be a public nuisance and is not allowed:*

(1) *Any airborne particulate matter generated from a construction site or by a construction activity that is visibly passing outside of the property lines where the source activity is occurring, or adversely affects any person, their property, or their reasonable enjoyment of their property. Any person responsible for any of the following activities shall take all reasonable actions to prevent particulate matter from becoming airborne:*

- a. Clearing of land;*
- b. Preparatory site work;*
- c. Earth materials removal;*
- d. Stockpiling of earth or construction materials;*
- e. Construction or demolition of buildings or structures;*
- f. Construction, grading, paving, and maintenance of, or within, roads, and streets.*

(2) *Depositing or dropping of particulate matter, dirt, or other material, that could become airborne, on any publicly owned street or right-of-way by vehicles leaving the source activity site.*

(b) *Appropriate materials including, but not limited to, water, City of Concord approved dust palliatives, asphalt, seed, or physical covers shall be used to prevent particulate matter from becoming airborne. Oil may not be used as a dust palliative.*

(c) *The requirements of this article do not apply to fugitive particulate matter emissions arising from the production of agricultural commodities in their unmanufactured state on the premises of the farm operation or emergency work as defined in Article 13-6-2*

(d) *An enforcement officer may order the immediate cessation of such operations or activities deemed and declared a public nuisance. If any person shall fail to immediately comply with the*

*order, the enforcing officer shall as soon as practicable file a complaint with a court of competent jurisdiction charging said person with violation of this ordinance.
(Ord. No. 2569, § I, 7-12-04)*

The control of fugitive dust (City Ordinance Article 11-3) , throughout the duration of the construction project, shall be performed in an approved manner, generally by use of water or calcium chloride application and shall be continued on a regular basis whenever necessary or as ordered by the City Engineer or representative. The Contractor shall be responsible for the control of dust during work suspension periods as well. Work suspension periods include, but are not limited to weekends, holidays, etc.

13-6-9 - Construction Noise

(a) Construction Noise. The generation of any noise from construction activity as defined in Section 13-6-2 or from a construction site that is clearly audible at a dwelling in any district is prohibited, except for noise generated:

- (1) Between 7:00 a.m. and 7:00 p.m. on weekdays; or*
- (2) Between 9:00 a.m. and 7:00 p.m. on Saturdays; or*
- (3) Between 9:00 a.m. and 7:00 p.m. on Sundays, and on the following holidays: January 1, Memorial Day or on a date to coincide with the federal observance if it is held on a different day, July 4, Labor Day, Thanksgiving Day, or Christmas Day from work done by a resident at the resident's dwelling; or*
- (4) Between 9:00 a.m. and 7:00 p.m. on a holiday as defined by RSA 288:1 as the third Monday in January, known as Martin Luther King Jr. Civil Rights' Day; the third Monday in February, known as Washington's Birthday; the second Monday in October, known as Columbus Day; the day on which the biennial election is held; and November 11, known as Veterans' Day.*

(b) Exceptions.

(1) Sections 13-6-8 and 13-6-9 shall not apply to routine or emergency City work including solid waste collection, street sweeping, street and sidewalk plowing, snow removal, and other periodic work necessary for the City to maintain its public streets and infrastructure.

(2) Emergency work as defined in Section 13-6-2 is exempt from hours of operations' restrictions. The Code Administrator may, in writing, grant exceptions to these provisions when the work, in the Code Administrator's sole discretion, is of an urgent or otherwise necessary for or in the interest of public or private safety and convenience.

(Ord. No. 2604, § V, 4-11-05)

Construction Vibration

The city has adopted the New Hampshire Department of Transportation specification regarding the maximum peak particle velocity (PPV) of ground vibration. This specification covers, but is not limited to blasting, pavement reclamation, driving and extracting sheeting, pile driving, trench and rock excavation, compaction associated with trench backfilling and paving operations.

In advance of construction, it is the Contractor's responsibility to review all properties, infrastructure, and underlying soil conditions in the project area and determine if vibration monitoring will be required. As a minimum, a sensitive structure will be defined as any building, wall or other vertical element susceptible to vibration impacts and may include older buildings, brick/masonry structures, buildings that are close to a significant construction operation, buildings that have plaster on wood lath construction and any other type of structure that may be subject to vibration damages. In areas where there are unusual concerns (i.e. historic structure, structure in disrepair, unusual masonry construction, and any other building elements susceptible to vibration damages) and even minimal vibrations could cause damages, the City Engineer or representative has the authority to reduce the PPV limits as needed to protect the area of concern. Furthermore,

where management of vibration causing activities produces complaints from abutters, the City Engineer or representative will modify and reduce vibration-causing activities and consider requiring vibration monitoring and/or preconstruction surveys to reduce abutting property impacts. Independent of the Contractor's evaluation, the City Engineer or representative may require vibration monitoring be performed at any time during the project. All monitoring shall be performed by a qualified testing firm.

Election Day Construction Policy

The public's ability to access the polls in our community is imperative. Although our staff does an outstanding job in managing the City's construction projects, it is extremely challenging to ensure that work in the public right-of-way will not result in restricted travel lanes, closed roads or impeded sidewalks that could discourage would-be voters on election days, all city contracts that entail any element of construction in the public right-of-way shall prohibit work during the hours in which Concord is holding a primary, general or special election as determined by the Concord City Clerk.

Should city staff serving as project managers believe the work that would otherwise be accomplished during voting hours is essential and can be carried out without any of the unacceptable conditions outlined below, they may seek a waiver from this policy.

Unacceptable Conditions

- *Road closures;*
- *Travel lane restrictions (including temporary lane reductions or one-lane usage);*
- *Detours;*
- *Sidewalk closures;*

Waiver requests shall be addressed to the City Manager and include the following:

- 1. Written explanation as to the critical nature of the work; and a*
- 2. Detailed written description of the construction indicating how unrestricted access will be maintained during the entirety of the work day.*

All requests for a waiver to this policy must be received by the City Manager's office, at least, 10 business days prior to the date for which relief is sought.

This policy does not preclude the City's leaf-collection efforts nor work in the public right-of-way to address unforeseen emergency situations that threaten public health or safety including, but not limited to, ruptured water/sewer lines, sink holes or downed trees.

D. Backfill and Compaction

All backfill material adjacent to pipes and structures shall be compacted in layers not exceeding 12-inches of compacted thickness, by pneumatic tampers, vibratory plate compactors or rolling compactors. Care shall be exercised to thoroughly compact the backfill under haunches of pipe and to assure that the backfill soil is in intimate contact around structures. Material in the trench backfill shall be compacted to not less than 95 percent of American Association of State Highway and Transportation Officials (AASHTO) T180, Modified Proctor. Nuclear density testing methods will be governed by ASTM D2922.

Backfill and fill material used in roads, travel ways and shoulders shall be natural material excavated from the trench during construction excluding: all debris, pieces of pavement, organic material, all wet or soft muck, peat or clay, all excavated ledge material, or rocks over 6 inches in largest dimension, or any material not approved by the City Engineer or representative. Materials shall be backfilled from the blanketing material over pipe to the base of the roadway structural

box and compacted in layers not to exceed 12 inches in compacted thickness by mechanical compaction means described above. Compaction testing shall be ordered at the expense of the Contractor if deemed necessary by the City Engineer or representative. Water jetting or ponding methods of compaction shall not be allowed.

Deep excavations or excavations through areas of unsuitable material: The Contractor may be required to perform extraordinary construction methods when encountering deep excavations or unsuitable materials. Alternate materials may be required to prevent long-term deflection in these areas; yet pipe materials shall remain continuous between structures. Compaction testing of the backfill material may be required at the discretion of the City Engineer or representative. This testing shall be performed at a minimum of 100-foot intervals unless otherwise directed by a City of Concord representative to assure proper compaction in roadway sections. Any required testing shall be performed at the expense of the Contractor unless other arrangements have been established with the Engineering Services Division.

E. Confined Space Entry

Definition:

Confined spaces normally include tanks, vessels of any type, underground pump stations, manholes and catch basins, vaults, meter pits, chemical storage areas, pipe chases, etc. Under certain conditions, such as the presence of soil contamination or organic deposits, open construction trenches may be determined confined spaces.

Policy Requirements:

Should any Contractor, Skilled Trade Worker, or Private Individual find it necessary to enter a confined space owned, maintained or operated by the City of Concord they must comply with the City of Concord's Confined Space Entry Policy.

Should a City employee be required on a private site; the Contractor shall comply with the Occupational Safety and Health Administration requirements and the City of Concord's Confined Space Entry Policy.

F. Maintenance of Traffic

This work shall consist of providing and maintaining safe and passable traffic accommodations for public travel, preventing dust nuisance, furnishing, erecting and maintaining construction signs, barricades, delineator lights, flashers and other warning devices as shown on the plans or as required by the City Engineer or representative. All traffic control devices used on street and highway construction, maintenance, utility or incident management operations shall conform to the Manual on Uniform Traffic Control Devices (MUTCD).

One Lane / Shoulder Closure:

The Contractor shall provide and maintain a sufficient surface for at least one lane of traffic, (minimum 12-foot width), controlled by the use of flaggers, 2-way radios or pilot vehicles. Construction materials or equipment shall not be left within the public right-of-way during work suspensions.

A Temporary Traffic Control Plan (TTCP) will be required for maintaining vehicle and pedestrian traffic for most sites. The traffic control plan must be designed, submitted and signed by a qualified traffic control engineer. The TTCP shall be submitted to the City Engineer or

representative for review at least two (2) weeks prior to the Mandatory Preconstruction Meeting. Under no circumstances will a “marked-up, hand copy” be deemed as a TTCP.

Road Closure:

Should a road closure be necessary, the Contractor is responsible for submitting a TTCP, in accordance the *Manual on Uniform Traffic Control Devices* (MUTCD) and a written request for the proposed closure at least two (2) weeks prior to the closure to the City Engineer or representative for review. The traffic control plan must be designed, submitted and signed by a qualified traffic control engineer. Under no circumstances will a “marked-up, hand copy” be deemed as a TTCP.

The City Engineer or representative will review and then provide his/her recommendation to the City Manager for the approval of the proposed road closure. Road closures in excess of 24 hours require approval from the City Manager or designee.

Sidewalk:

Sidewalks shall remain open to the public during construction. Should a sidewalk need to be closed for any duration, an alternate pedestrian route shall be provided. To the maximum extent feasible, the alternate circulation path shall be provided on the same side of the street as the disrupted route. Where it is not feasible to provide a same-side alternate circulation path and pedestrians will be detoured, the alternate path shall provide a similar level of accessibility to that of the existing disrupted route.

Where the alternate circulation path is exposed to adjacent construction, excavation drop-offs, traffic, or other hazards, it shall be protected with a pedestrian barricade or channelizing device. When it is necessary to block travel at the departure curb to close a crosswalk that is disrupted by excavation, construction, or construction activity, care must be taken to preserve curb ramp access to the perpendicular crosswalk. This may require additional pedestrian channelization if only a single diagonal curb ramp serves the corner. Pedestrian barricades and channelizing devices shall be continuous, stable, and non-flexible and shall consist of a wall, fence, or enclosures specified in section 6F-58, 6F-63, and 6F-66 of the MUTCD. A continuous bottom edge shall be provided 6” maximum above the ground or walkway surface. Devices shall provide a continuous surface or upper rail at 3’ minimum above the ground or walkway surface. Support members shall not protrude into the alternate circulation path.

Construction Signs:

All construction signs, barricades and warning devices shall be installed prior to the commencement of work activities and shall be free of chipping or damage that may render the device unsatisfactory or detract from reflectiveness.

All construction signs as shown on the plans or as ordered by the City Engineer or representative shall be erected on posts, barricades or easels so that all text is horizontal. At any time during the life of the project, at the discretion of the City Engineer or representative, any sign, barricade or warning device that is damaged, disfigured or found not to be in serviceable condition shall be required to be replaced at the cost of the Contractor.

Barricades:

Barricades and delineators shall be placed wherever necessary for the protection of public travel. Such hazards as pits and open trenches, drop offs, exceptionally rough stretches of roadway and all obstructions shall be barricaded in an acceptable manner. The Contractor shall make all necessary

arrangements for nighttime shutdown, to ensure that there are not any hazards to the traveling public or pedestrians.

Lighting:

Lighting devices shall be placed so they are clearly visible. Adequate artificial lighting shall be provided on construction projects to clearly reveal all hazards during night hours. Flagger stations and all hazards shall be lighted from sunset to sunrise should night work be approved.

G. Preparing Sites for Winter

This work shall consist of preparing the site for winter (November 1 to April 15) to prevent erosion and control sediment. Additional measures not specifically referenced and as noted in the Erosion Prevention and Sediment Control (EPSC) section of this document shall be used as necessary. Where differences between the Construction Standards and the project specific Stormwater Pollution Prevention Plan, the more stringent document shall govern.

General:

1. EPSC measures shall be checked, cleaned and reset as needed prior to November 1. EPSC measures may need to be replaced to ensure function throughout the period.
2. All proposed vegetated areas which are at final grade and which do not exhibit a minimum of 85% vegetative growth by November 1, shall be stabilized by seeding and installing erosion control blankets on slopes greater than 3:1, and seeding and placing 3 to 4 tons of mulch per acre, secured with anchored netting, elsewhere. The installation of erosion control blankets or mulch and netting shall not occur over accumulated snow or on frozen ground and shall be completed in advance of thaw or spring melt events.
3. All ditches or swales which do not exhibit a minimum of 85% vegetative growth by November 1, shall be stabilized temporarily with stone or erosion control blankets appropriate for the design flow conditions.

Off-site construction activities which occur after November 1 shall be stabilized as noted below:

1. All areas shall be stabilized.
2. All excavations within the roadway or sidewalk shall be brought to grade with subbase and surfaced with bituminous concrete pavement.
3. All slopes shall exhibit a minimum 85% vegetated growth, have a minimum of 3" of non-erosive material such stone or riprap installed, or have erosion control blankets installed per manufacturer's recommendation. The installation of erosion control blankets or mulch and netting shall not occur over snow greater than 1" in depth or on frozen ground.

On-site construction activities which occur after November 1 shall be stabilized as noted below:

1. All areas shall be stabilized
2. Base course gravels have been installed in areas to be paved and not open to the public.
3. All slopes shall exhibit a minimum 85% vegetated growth, have a minimum of 3" of non-erosive material such stone or riprap installed, or have erosion control blankets installed per manufacturer's recommendation. The installation of erosion control blankets or mulch and netting shall not occur over snow greater than 1" in depth or on frozen ground.

Streets/Sidewalks

A. Description

This work shall consist of furnishing and placing subgrade, base course, binder and wearing courses as shown on the plans or as ordered. These specifications include general requirements that are applicable to all types of roads and sidewalks within the City of Concord.

B. Materials

Certificates of Compliance shall be submitted by the Contractor for each material to the City Engineer or representative for review and approval.

The materials shall be subject to rejection at any time due to failure to meet any of the specification requirements.

Base Materials

Sand: Sand shall meet the following gradation requirements (NHDOT Item #304.1):

<u>Sieve Size</u>	<u>% Passing</u>
6 Inch	100
No. 4	70-100
No. 200*	0 - 12

*Fraction passing the #4 sieve

The maximum size of any stone or fragment shall not exceed three-fourths of the compacted depth of the layer being placed but in no case larger than 6 inches.

Gravel: Gravel shall meet the following gradation requirements (NHDOT Item #304.2):

<u>Sieve Size</u>	<u>% Passing</u>
6 Inch	100
No. 4	25 - 70
No. 200*	0 - 12

*Fraction passing the #4 sieve

The maximum stone size shall be 6-inches in any dimension for a 12-inch compacted lift. Large stones removed from the gravel box may be used for slope fill when properly placed.

Crushed Gravel: Crushed gravel shall meet the following gradation requirements (NHDOT Item #304.3):

<u>Sieve Size</u>	<u>% Passing</u>
3 Inch	100
2½ Inch	95 - 100
1 Inch	55 - 85
No. 4	27 - 52
No. 200*	0 - 12

*Fraction passing the #4 sieve

At least 50% of the material retained on the 1-inch sieve shall have a fractured face.

Crushed Stone (Fine Gradation): Crushed stone (fine gradation) shall meet the following gradation requirements (NHDOT Item #304.4):

<u>Sieve Size</u>	<u>% Passing</u>
2 Inch	100
1½ Inch	85 – 100
¾ Inch	45 – 75
No. 4	10 – 45
No. 200*	0 – 5

*in total sample

Crushed Stone (Coarse Gradation): Crushed Stone (coarse gradation) shall meet the following gradation requirements (NHDOT Item #304.5):

<u>Sieve Size</u>	<u>% Passing</u>
3½ Inch	100
3 Inch	85 – 100
1 ½ Inch	60-90
¾ Inch	40-70
No. 4	15-40
No. 200*	0 - 5

*in total sample

Pavements

1½” Bituminous Concrete Base Course: Base course materials shall conform to the specifications in Section 401 of the NHDOT Standard Specifications for 1½”inch aggregate pavement.

¾” Bituminous Concrete Base Course: Base course materials shall conform to the specifications in Section 401 of the NHDOT Standard Specifications for ¾ inch aggregate pavement.

Bituminous Concrete Wearing Course: Wearing course material shall conform to the specifications in Section 401 of the NHDOT Standard Specifications for ½ inch aggregate pavement.

Pavement Overlay: The pavement overlay material shall conform to the specifications in Section 401 of the NHDOT Standard Specifications for ½ inch pavements.

Portland Cement Concrete: Concrete shall be NHDOT Class AA, 4000 psi, reinforced as shown in the City of Concord’s Construction Details.

Curb

Vertical Granite Curb: Shall be 5-inches wide and 16 to 18 inches deep. Granite shall be hard, durable, reasonably uniform in appearance and color and free from weakening seams.

Slope Granite Curb: Shall be 6 to 8-inches wide and 12-inches deep. Granite shall be hard, durable, reasonably uniform in appearance and color and free from weakening seams.

Cement: Cement shall be straight Portland Cement, Type I, II, or a Type I/II.

Mortar Sand: Mortar sand shall meet the following gradation requirements:

<u>Sieve Size</u>	<u>% Passing</u>
No. 8	100
No. 16	60-100
No. 50	15-35
No. 100	2-15
No. 200	0-5

Sidewalks

Bituminous Concrete: All bituminous sidewalks (base and wearing course) will be constructed with State of NH Sidewalk mix – Section 608, Table 1 – Composition of Mixtures.

Portland Cement Concrete: Portland cement reinforced concrete sidewalks shall be a minimum of 4-inch thickness (except at drives and curb ramps). Concrete shall be NHDOT Class A (3000 psi), with a maximum slump of 3-inches. Maximum aggregate size shall be 1-inch. Reinforcing shall be 6"x6" W2.9xW2.9 woven wire fabric.

Portland cement reinforced concrete sidewalks at drives and curb ramps shall be a minimum 6-inch thickness. Concrete shall be NHDOT Class AA (4000 psi), with a maximum slump of 3-inches. Maximum aggregate size shall be 1-inch. Reinforcing shall be 6"x6" W2.9xW2.9 woven wire fabric.

Detectable Warning Panels: Detectable Warning Panels shall be untreated cast iron. Dimensions and placement shall be as shown in the City of Concord's Construction Details.

Street Lights

Light poles shall be treated timber poles or tapered steel or aluminum. All poles shall demonstrate similar appearance and durability. All light poles, lights and their installation shall meet the requirements of **Unitil Energy Systems** located at #1 McGuire Street, Concord, NH.

Guardrail

Where guardrail is required or shown on the approved plans, the items shall conform to Section 606 of the NHDOT Standard Specifications for Steel Beam Guard Rail. Terminals shall comply with the City's Steel Beam Guardrail Terminal Unit details or Section 606 of the NHDOT Standard Specifications for Steel Beam Guard Rail as applicable. If the Owner/Developer/Contractor wishes to deviate from the requirement, a written request shall be sent to the City Engineer or representative for review and approval/disapproval.

Certificates of Compliance shall be submitted by the Contractor for each material to the City Engineer or representative for review and approval.

Posts shall be W6x8.5 shaped structural steel.

Signs

Street Signs: Street signs shall be fabricated in accordance with the Manual on Uniform Traffic Control Devices. Street sign letters will be 6-inches tall on a 9-inch aluminum backing

Pedestrian and School Crossing Signs: Pedestrian and school crossing signs shall have a florescent yellow-green background with black legend and border.

Sign Posts: Sign Posts shall be green enamel 2.5#/ft minimum flanged channel steel.

Right-of-Way Bounds

Right-of-way bounds shall be reinforced concrete or granite and measure 4"x4"x36" minimum.

C. Construction Requirements

The Community Development Department in conjunction with the General Services Department will oversee all work related to these utilities. Unauthorized use of hydrants is strictly prohibited. Should a Contractor desire to use City water for dust control, sewer testing and flushing operations, etc. the City will furnish a temporary meter. A deposit is required and the Contractor will be charged for the water used. **Only qualified City of Concord personnel are authorized to manipulate hydrants.** Unauthorized usage of City water is subject to a minimum \$1,000.00 fine.

Clearing and Grubbing

The entire width of disturbance between slope lines shall be cleared of all stumps, brush, roots, boulders, unstable material and trees not intended for preservation.

Blasting Operations

Slopes: When blasting is required, the required slopes or configuration shown on the plans shall be produced in a safe and stable condition.

Authority to prohibit blasting: The City Engineer or representative shall at all times have the authority to prohibit or halt the Contractor's blasting operations if it is apparent that: through the methods being employed the required slopes are not being attained; or the safety or convenience of the public is being jeopardized.

A pre-blast survey, subject to Engineering Services review, will be required for all buildings within a 500-foot radius of the blast site. No blasting is to take place without an approved pre-blast survey.

Seismic monitoring for frequency and acceleration will be required should adjacent structures be threatened.

The Contractor shall also comply with the NHDOT Standard Specifications for Road and Bridge Construction - Section #203 and #211.

Unsuitable Material

Removal of unsuitable material: Where excavation to the designed elevation results in a subgrade or slope of clay, peat, muck or other unstable material, the Contractor shall remove the unstable material to the depth necessary to attain a solid foundation.

Backfilling

Backfilling shall be done with approved materials and shall meet the requirements for: sand, gravel, broken rock or any combination thereof.

Rock fragments in fill shall be placed in layers not in excess of 2 feet. The lifts shall be placed in such a manner as to close all voids. Earth shall be placed in layers to the full width of the roadway, generally parallel to the finish grade. The layers shall not exceed 12-inches of loose depth. Each layer shall be spread to a uniform thickness and compacted to the required density. Continuous grading or shaping shall be carried out concurrently with the compactive effort to assure uniform density throughout each layer of material.

Subbase Application

Prior to the placement of any road base material, all underground utility crossings shall be accomplished, with trenches properly compacted. Gravel and crushed gravel shall not be placed until an independent testing laboratory has performed density testing on the underlying material and the material has met the density specification. Gravel and crushed gravel shall be placed in lifts not to exceed 12-inches in depth. "Drive through dumping" of material shall not be allowed. It shall be shaped true to the grade and cross-section as shown on the typical section.

Compaction: Compacting of subgrade, gravel and or crushed gravel shall be accomplished with an approved vibratory roller. The materials shall be compacted and rolled until the density requirements are met. When vibratory equipment is being operated, the amplitude of vibrations may be adjusted as necessary to avoid causing damage to adjacent buildings and property.

Bituminous Concrete Pavement Application

Placement of base course: Placement of the base course shall be in close conformity with the lines and grades, thickness and typical cross-sections as shown on the approved plans. Where curbing is to be installed, the base course of pavement may be paved a maximum of one foot (1') narrower on each side to allow for the installation of the curb.

Placement of the final wearing course: Placement of the wearing course shall be in close conformity with the lines and finish grades as shown on the approved plans. It shall be applied on a previous placed base course. All manhole covers, catch basin grates and curbing shall be in place and set to the proper grade before the wearing course is applied.

Environmental conditions: Mixtures shall be placed only when the underlying surface is dry, frost free, and the surface temperature is above 40 F for courses greater than or equal to 1-1/4" in compacted depth and above 50 F for courses less than 1-1/4" in compacted depth. The Engineer may permit, in case of sudden rain, the placing of mixture then in transit from the plant, if laid on a base free from pools of water, provided motorist visibility is not impaired and all other specifications are met. No load shall be sent out so late in the day that spreading and compaction cannot be completed during the daylight. If rapid surface cooling of the laid down mix is occurring due to wind, the Engineer may suspend operations for the day.

Waiver of environmental conditions: In special instances when the City Engineer or representative determines that it is in the best interest of the City of Concord, the above requirements may be waived for base course pavement only. Any material delivered to the spreader having a temperature lower than 250° Fahrenheit shall not be used.

Thickness of pavement: Unless otherwise noted, thickness of pavement as shown on the approved plans and/or the Typical Roadway Section, shall be the compacted thickness after rolling.

Removal of existing pavement: At the beginning and end of the project or project section, the existing pavement shall be removed to a sufficient depth to allow for the placing of the new pavement and construction of a transverse joint. The underlying course shall be clean and free of any foreign materials and loose bituminous patches and must present a dry and unyielding surface. Sawcutting or the use of a jackhammer is required before excavating pavement in the City right-of-way. The use of heavy equipment to "rip" pavement is not allowed.

Requirements for tack coat: A tack coat of emulsified asphalt shall be applied to all lifts of pavement immediately prior to placement unless waived by the City Engineer or representative.

The rate of application shall be between 0.02 and 0.05 gal/SY, as determined by the City Engineer or representative. Prior to the application of the tack coat, the asphalt binder surface shall be cleaned to the satisfaction of the City Engineer or representative. The use of a street sweeper may be required depending on the cleanliness of the surface.

Removal of unsatisfactory material: If any imperfect places are found in any course, the Contractor shall remove the unsatisfactory material and replace it after coating the exposed edges with a suitable bituminous emulsion.

Requirements for cold planing at bituminous joints: Surfaces that are to be overlaid with new bituminous pavement will require cold planing at the overlay joint. The existing bituminous surface shall be removed by a planing or milling machine capable of removing the bituminous pavement to the depth specified at the limits of the overlay, and to provide a smooth transition between the new and existing pavements.

Compaction: Compaction shall be completed in accordance with NHDOT specifications.

Bituminous Concrete Pavement Full Width Overlay

General Requirements: It shall be the responsibility of the Contractor to provide a full width permanent pavement overlay following extensive trench excavations within a public way. The Contractor shall furnish all labor and materials to install the bituminous pavement overlay over the full width of the roadway curb-to-curb or shoulder-to-shoulder throughout the entire project limits at the depth specified by the City Engineer or representative. A leveling or shim course of pavement may be required by the City Engineer or representative, to produce a uniform roadway section.

Placement of the pavement overlay: All existing pavement areas and base course trench patched areas are to be brought to a smooth level grade with a hot bituminous leveling shim course. All manhole covers, catch basin frames, water and utility valve boxes and curbing shall be reset to grade prior to overlay placement. The entire area shall be swept and cleaned of all debris.

Bituminous Concrete Pavement Repair

Bituminous Concrete Pavement shall be replaced in-kind. Repairs shall be performed as shown on the City of Concord's Construction Details. Depths of pavement, crushed gravel and gravel will match the existing depths unless otherwise determined by the City Engineer or representative.

Portland Cement Concrete Pavement Repair

Portland Cement Concrete Pavement shall be replaced in-kind. Repairs shall be performed as shown in the City of Concord's Construction Details. Traffic will not be allowed to travel on the repair for a minimum 28 days or until the concrete has reached 4000 psi compressive strength.

Vertical Granite Curb

Vertical granite curbing shall be set with a 7-inch reveal above finish pavement. Tip downs at driveway locations shall be at least 7 feet in length. "Curved Curb" shall be used at all curbed roundings when the radius of the rounding is 30-feet or less.

Placement: Vertical granite curb is to be placed after the asphalt base course of pavement has been applied. Installation of curbing shall be so that the front line conforms to the line and grade required. Joints shall be pointed with Portland Cement mortar and the exposed portions finished with a jointer.

Backfilling: Backfilling shall be done immediately after the curb is set and jointed. Backfill shall be crushed gravel placed and thoroughly compacted on both sides (12" street side, 24" back side minimum, as measured from face of curb) of the curbing until the density requirements are met with the use of a vibratory plate compactor or a "Jumping" jack compactor. **The use of hand compaction (i.e., tamping) is not permitted.**

Damaged or unsuitable curbing: Any curbing that is damaged or found unsuitable prior to finish pavement being applied shall be replaced with new curbing.

Slope Granite Curb

Slope granite curb shall be placed at locations as noted on the plans with a 5-inch reveal above the finish pavement, 6-inch reveal along splitter and refuge islands. A transition piece of granite curb, 6-feet in length, shall be used between the sloped granite curb and the vertical granite curb. Radial joints shall be used at all curbed roundings when the radius is less than 16'. Curved curb shall be used at all curbed roundings with the radius is 2- feet or less. Solid curved granite slope curb noses shall be used for all islands.

Placement: Slope granite curb is to be placed after the asphalt base course of pavement has been applied. Installation of curbing shall be so that the front line conforms to the line and grade required. Joints shall be pointed with Portland Cement mortar and the exposed portions finished with a jointer.

Backfilling: Backfilling shall be done immediately after the curb is set and jointed. Backfill shall be crushed gravel placed and thoroughly compacted on both sides (18" street side, 24" back side minimum, as measured from the face of curb) of the curbing until the density requirements are met with the use of a vibratory plate compactor or a "Jumping" jack compactor. **The use of hand compaction (i.e., tamping) is not permitted.**

Damaged or unsuitable curbing: Any curbing that is damaged or found unsuitable prior to finish pavement being applied shall be replaced with new curbing.

Mortar

Mortar shall consist of two parts mortar sand to one part Portland Cement. To obtain the proper ratio, one bag of Type I or Type II Portland Cement should be mixed with two-five gallon buckets of mortar sand. The mix shall be thoroughly blended only in such quantity as may be required for immediate use, and shall be used before the initial set has taken place. The mix shall be constantly worked over with hoe or shovel to keep it workable. Adding water after mixing to bring a hardened mix "back to life" will not be allowed.

Sidewalks

Sidewalk: Sidewalks shall comply in all respects to the most recently adopted State of New Hampshire Code for Barrier Free Design and the most recent guidance provided by the U.S. Access Board. Sidewalks shall be a minimum of 5-feet in width, exclusive of any curb, and shall have a transverse slope of 2%, sloping towards the street, driveway or parking area. All measurements shall be taken from the top of the granite curbing.

Curb Ramps: 6" reinforced concrete sidewalk with detectable warning panels shall be constructed at all intersections and at commercial driveways which (per the Revised Draft Guidelines for Accessible Public Right-of-Way, November 23, 2005, Advisory R221) are provided with traffic control devices or otherwise are permitted to operate like public streets.

Preparation of the base: Preparation of the base shall be accomplished by removing material to a depth of 7-inches below finish grade, except at drive locations where it shall be excavated 9-inches below finished grade. Any unsuitable material found will be removed and replaced with crushed gravel as directed.

Crushed Gravel: All sidewalks shall be founded on 6-inches (minimum) crushed gravel

Compaction: Prior to the placement of pavement or concrete, the crushed gravel subbase shall be thoroughly compacted with the use of a roller until the density requirements are met.

Bituminous Concrete Pavement Sidewalk

Placement: Pavement shall be a minimum 3" total thickness placed using a sidewalk or street paver in two lifts (1½" base course, 1½" wearing course).

Portland Cement Concrete Sidewalk

Placement: Before placing the concrete, all foreign materials shall be removed from the base. All forms shall be thoroughly cleaned, secured in position and coated with a form-release agent. Concrete shall be placed, struck off, consolidated, and finished to plan grade with a mechanical machine, vibrating screed or by hand finishing methods when approved.

Finishing: After concrete has been struck off and consolidated, a bull-float may be used to remove any high or low spots. The final finish shall be made with a clean fine bristled broom, lightly applied in an alternating grid pattern.

Curing: During curing, concrete shall be protected from loss of moisture, rapid temperature change and mechanical injury for a minimum of three days following the placement. Following the curing period, an approved concrete sealer shall be applied at the rate recommended by the manufacturer.

Joints: Joint pattern shall be detailed on the construction plans and shall not be altered without prior approval of the City Engineer or representative. Control or contraction joints shall be formed by sawing or by use of a pre-molded filler and shall be a minimum depth of one-fourth the slab thickness. Sawing shall begin when the concrete has hardened sufficiently to permit sawing without excessive raveling. Joints shall be continuous across the slab, be 5/16" inch to 1/4 inch in width and be completed before uncontrolled shrinkage cracks have occurred.

Guardrail

Placement: Guardrail shall be installed to a recommended height of 31" (27¾" minimum) to the top of rail. Steel posts shall be set plumb. All posts shall be retreated if damaged during installation.

Street Signs

For new streets the Contractor shall be required to provide City street name and traffic control signs. All street, warning, regulatory, etc. signs shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD).

Right-of-Way Bounds

Right-of-Way bounds shall be set 5/8" to 1" above the ground in residential areas, 4" to 6" above ground in wooded areas and slightly below grade when set in pavement. The bounds shall be set vertical. The surrounding soil shall be thoroughly compacted so that the bound will not move when struck.

D. Inspection Requirements

The Contractor, Developer, Owner shall be responsible for all costs incurred during required testing and will be billed for all inspections and testing performed by City forces.

E. Testing Requirements

The City Engineer or representative reserves the right to request testing of any material from an independent testing company at any time to ensure that the desired specifications have been met. All testing required by the City Engineer or representative shall be completed by a qualified testing agency at the Contractor's, Developer's, Owner's expense. Submittal of the testing agency's qualifications may be required.

Density testing

Testing Standards: Regardless of the application, the density of the subgrade material, gravel, and or crushed gravel shall be determined by AASHTO T191 (Sand Cone Method), or AASHTO T238 and T239 (Nuclear Methods). The density shall be not less than 95-percent (95%) of the minimum density determined in accordance with AASHTO T180 (Modified Proctor Density), and performed at a maximum of 100 feet between tests. Nuclear density methods will be governed by ASTM D2922.

Testing Frequency: **As a minimum, density testing shall be performed prior to placement of any pavement.** All test results shall be submitted to the City Engineer or representative AT LEAST 24-HOURS IN ADVANCE OF THE PAVING OPERATIONS.

Contaminated material

Previously tested and accepted materials contaminated by earthen, organic or other foreign material or degraded by hauling equipment to such an extent that the material ceases to meet the requirements, shall be removed and replaced.

Street Lights

All street lighting and traffic signal installations shall be in place and operational before final acceptance and reduction of financial guarantees.

Sanitary Sewer Systems

A. Description

This work shall consist of furnishing and installing, or removing and relaying, pipes, structures and appurtenances at the locations shown or ordered, including the necessary joints, fittings, and connections as required.

B. Materials

Certificates of Compliance shall be submitted by the Contractor for each material to the City Engineer or representative for review and approval.

The materials shall be subject to rejection at any time due to failure to meet any of the specification requirements. All fittings shall be of compatible construction materials and shall be used exclusively for the intended purpose of the manufacturer. All fittings used for repairs must first be approved by the Engineering Services Division prior to installation. Only new materials will be accepted for installation.

THE COMMUNITY DEVELOPMENT DEPARTMENT, ENGINEERING SERVICES DIVISION, RESERVES THE RIGHT TO REQUIRE A SAMPLE FOR EVALUATION OF ANY ITEM SUPPLIED. ALTERNATE ITEMS MUST RECEIVE PRIOR APPROVAL OF THE CITY ENGINEER.

Storage and Handling of Materials

Preventing damage: All materials shall be handled in a manner to prevent warping, twisting, bending, breaking, chipping, rusting or any damage whatsoever. Pipe and structures shall be lifted and moved with the appropriate apparatus without being pushed, pulled or rolled by equipment.

Storage of cement: Cement shall be stored under cover, off the ground, and shall be kept completely dry at all times.

Storage of reinforcing steel: All reinforcing steel shall be stored off the ground, or otherwise to prevent accumulations of dirt or grease, and in a position to prevent accumulations of standing water to minimize rusting.

Precast concrete handling: Precast concrete units shall be handled in a manner to prevent chipping or cracking.

Handling and storage of masonry products: Brick, block and similar masonry products shall be handled and stored in a manner to reduce breakage, chipping, cracking and spalling.

Damaged materials: All materials that have become so damaged as to be unfit for the intended use shall be promptly removed from the work site.

Sewer Mains

Polyvinyl Chloride (PVC) pipe:

Gravity pipe and fittings shall conform to ASTM D-3034 and shall be SDR 35. Pipe and pipe fittings between manholes are to be of the same manufacturer. Joint compression rings shall be of

an oil resistant rubber type or flexible elastomeric seals conforming to ASTM D-3212. Manufacturer's certificate of compliance shall be furnished to the City prior to installation. Pressure pipe and fittings shall conform to ASTM D2241 and shall be SDR 26 or approved equal.

Reinforced concrete pipe (RCP):

Pipe shall conform to the standard specifications for reinforced concrete sewer pipe, ASTM Designation C76; pipe shall be minimum Class III 2000D unless otherwise required due to shallow depth or loading.

The pipe interior shall comprise a continuous internal concrete skin and shall be smooth and even, free from roughness, projections, indentations, offsets, corrugations, exposed reinforcing or, other irregularities.

The pipe shall be clearly marked as required by ASTM C76, and shall not be shipped until 5 days after manufacture. Pipes that have been damaged during or after delivery will be rejected, and if such pipe has already been laid it shall be acceptably repaired (if permitted), or removed and replaced.

Ductile iron (DI) pipe:

Ductile iron pipe shall conform to ANSI/AWWA C150/A21.50 (pressure class pipe) with size as shown on the drawings (Class 51, 52, or 350). Pipe shall have either the rubber ring type, push on joint, or standard mechanical joint. Rubber gasket joints shall conform to ANSI A21.11 for mechanical and push on type joints. All pipe and fittings shall have a cement mortar lining and bituminous seal coat on the inside, and a coal tar enamel coat on the outside.

Should any pipe line be found unsatisfactory due to nonconformance to line or grade requirements or due to conflicts with other utilities and an adjustment in place will not correct the situation thus requiring the pipe to be physically removed; then the pipe may not be considered for reuse unless inspected and approved by the City Engineer or representative.

Sewer Service Laterals

Building service connections are to be SDR 35 or SDR 26 PVC pipe. Cast iron pipe and ductile iron pipe may be used should conditions warrant.

Repair Couplings

Rigid wrap-around stainless steel and PVC repair couplings or ductile iron couplings will be allowed on mainline repairs. The use of Fernco (or approved equal) couplings may be used when field conditions do not allow for other types of couplings. The use of Fernco (or approved equal) couplings must be approved by the City Engineer or representative.

Main and Service Lining

Lining materials shall meet the requirements as outlined in the current Cured-in-Place Pipe General Specifications as prepared by the National Association of Sewer Service Companies (nassco.org).

Poly Vinyl Chloride (PVC):

Poly Vinyl Chloride (PVC) as used for folded and formed methods. The PVC Alloy pipeliner will be manufactured from PVC Alloy compound, containing no fillers, and meet or exceed the following installation performance requirements: The pipeliner shall be capable of expanding without splitting or rupturing. After being expanded by Blow-Molding, the installed pipeliner will match the configuration of the host pipe.

Cured-in-Place (CIPP):

Cured in Place Pipe (CIPP) Resin impregnated felt, as used for cured in place methods. Tube Method - The sewn tube shall consist of one or more layers of absorbent non-woven felt fabric and meet requirements of ASTM F1216. The tube shall be constructed to withstand inversions pressures, have sufficient strength to bridge a missing pipe, stretch to fit irregular pipe sections, and shall invert smoothly around bends. The resin shall be a corrosion resistant polyester, vinyl ester, or epoxy and catalyst that when properly cured within the tube composite meets the requirements of ASTM F1216.

Manholes and Appurtenances

Standard sanitary manholes: Manholes will be of precast concrete construction; precast concrete barrel sections and precast manhole bases shall conform to ASTM Designation C478. The wall thickness shall not be less than 5 inches for 48 inch inside diameter structures, or 6-inches for 60-inch and 7-inches for 72-inch inside diameter barrel sections. Lift holes are to be sealed with Portland cement mortar flush to the outside structure wall prior to backfilling.

Reinforcing steel shall conform to the requirements of NHDOT 544. Fibers shall only be used in structures with 4 feet or less inside diameter and shall be as shown on the NHDOT Qualified Products List.

Concentric or eccentric cone sections with 30-inch openings are required, except where the cover over the top of the pipe is less than 4-feet for 48-inch diameter manholes, or 7-feet for 60-inch and 72-inch diameter manholes, in which case, precast concrete top slabs designed for H-20 loading may be allowed.

The use of water plug is permitted for special applications where the City Engineer or representative deems appropriate.

Frames and Covers: North American and India castings are allowed, provided the India castings are from SIGMA Corporation or approved equal. All castings shall be designed for H-20 Loading. Covers shall have the word "SEWER" in 3 inch letters cast into the top surface.

Masonry Brick: Brick shall be solid, sound, hard, and have plain or smooth surfaces on both ends and on the face side, and be satisfactory to the City Engineer or representative. Brick shall comply with A.S.T.M. Standard Specifications for Sewer Brick, Designation C32, for Grade SS, Hard Red Brick. Brick samples will be required for approval prior to incorporation in the work.

Cement: Cement shall be straight Portland Cement, Type I, II, or a Type I/II. Lime mortar or Masonry cement is not to be used on structures.

Mortar Sand: Mortar sand shall meet the following gradation requirements:

<u>Sieve Size</u>	<u>% Passing</u>
No. 8	100
No. 16	60-100
No. 50	15-35
No. 100	2-15
No. 200	0-5

Sand Bedding / Blanket

Sand bedding and blanket material required for the installation of the sewer mains, services and appurtenances shall meet the following gradation requirements:

<u>Sieve Size</u>	<u>% Passing</u>
1/2 Inch	100
No. 200*	0-12

*Fraction passing the #4 sieve

Crushed Stone Bedding

Crushed stone shall be ¾ inch (ASTM #67) stone and meet the following gradation requirements:

<u>Sieve Size</u>	<u>% Passing</u>
1"	100
¾"	90-100
⅜"	20-55
#4	0-10
#8	0-5

C. Construction Requirements

The Community Development Department in conjunction with the General Services Department will oversee all work related to these utilities. Unauthorized use of hydrants is strictly prohibited. Should a Contractor desire to use City water for dust control, sewer testing and flushing operations, etc. the City will furnish a temporary meter. A deposit is required and the Contractor will be charged for the water used. **Only qualified City of Concord personnel are authorized to manipulate hydrants.** Unauthorized usage of City water is subject to a minimum \$1,000.00 fine.

Work under the control of the General Services Department

The Contractor may make the tap onto a sewer main and install service laterals to the property line, or request the General Services Department's utility forces to install services should they be available. In the former, the Contractor will be required to deposit the funds estimated to cover the cost of the City's Inspector assigned to the project. In the latter case, the applicant will be required to deposit separate funds estimated to cover the cost of the General Services Department's utility forces (not to be confused with the Engineering Services Division inspection fees).

Laying Sewer Pipe

1. In accordance with NHDES rules, mains are defined as any sewer pipe which connects two manholes. A gravity sewer may be smaller than 8 inches in nominal diameter only if the sewer:
 - a. is wholly contained within private property;
 - b. is constructed on a dead-end or cul-de-sac street;
 - c. serves, or is planned to serve, no more than 10 residences;
 - d. has a total estimated flow no greater than 2,000 gpd; and
 - e. has a nominal diameter of 6 inches and a minimum slope of 0.01 feet per foot.

2. State regulations require water mains to be separated from sanitary sewer mains by a minimum of 10-feet (horizontally)
3. In accordance with the 2009 IPC, water service pipe and the sewer service shall be separated by 5' of undisturbed or compacted earth, except as follows.
 - a. The required separation distance shall not apply where the bottom of the water service pipe within 5 feet of the sewer service is a minimum of 12 inches above the top of the highest point of the sewer pipe.
 - b. Water service pipe is permitted to be located in the same trench with the sewer service, provided the sewer is constructed of materials as noted elsewhere in the Standards.
 - c. The required separation distance shall not apply where a water service pipe crosses a sewer pipe, provided that water service pipe is sleeved to at least 5 feet horizontally from the sewer pipe centerline on both sides of such crossing.
4. Should construction operations reveal or expose a water main running under, approximately parallel to (less than 10-feet from a proposed sewer installation), and where it is not practical to relocate the sewer, the sewer shall be reconstructed of ductile iron pressure class pipe until the minimum 10-foot separation can be achieved.

Whenever sewers must cross over water mains, the sewer shall be constructed of ductile iron pressure class pipe for a minimum distance of 9 feet each side of the crossing. Joints shall be water pressure rated with zero leakage when tested at 25 pounds per square inch for gravity sewers and 1½ times working pressure for force mains, and joints shall not be located within 9 feet of the crossing point.

Should the vertical separation of the sewer and water main be less than 18", the water main or the sewer main must be relocated to achieve the required separation.

In conflicts requiring the relocation of utilities, preference shall be given:

- a. to utilities with grade restrictions.
- b. to existing utilities already in service.

5. Sewer service lateral sizing shall be as follows:
 - a. Single residential unit = 4-inch minimum.
 - b. Commercial, Industrial or multifamily = 6-inch minimum.
6. Sewer service laterals shall be constructed with the following minimum slopes, yet not to exceed a 10% slope:
 - a. 4 inch service = 1/4 inch per foot = 2%
 - b. 6 inch service = 1/8 inch per foot = 1%
7. All pipe utilizing Bell and Spigot joints shall be laid with the spigot end downstream. Bells will not be permitted in structures.
8. Green "sewer" warning tape shall be installed in the sewer trench twelve (12) inches above the utility.
9. Whenever feasible, all service connections shall be tied into a sanitary sewer manhole, if this is not possible then sanitary sewer service connections shall be accomplished by using an approved sanitary tee fitting.

10. Service laterals shall outlet into manholes at the top of the brick shelf. Where grades prohibit such a connection, service laterals shall connect to the manhole 2" above the inlet of the main where it enters the manhole. Refer to the City of Concord's Construction Details for additional information.
11. Should an existing sanitary sewer service lateral need to be replaced, it shall conform to the standards described here within.
12. An eccentric fitting shall be used when connecting dissimilar size services (small to large) to ensure that the flow line of the service is continuous and uninterrupted.
13. Service laterals greater than six (6) inches in diameter must terminate in a sanitary sewer manhole.
14. Ninety degree (90°) bends are not permitted for sanitary sewer service connections.
15. Where plumbing fixtures are installed on a floor with a finished floor elevation below the elevation of the street, such fixtures shall be protected by a backwater valve installed in the building drain, or horizontal branch serving such fixtures.
16. Sewer service laterals shall be designed for a minimum of four (4) feet of cover at the building foundation. Insulation will be required should the sanitary sewer lateral be less than the required four feet deep. Under no circumstances will the use of insulation be permitted without the authorization of the City Engineer or representative.
17. No trench shall be left open at the end of the workday. Contractor shall take all the necessary precautions to "button-up" the work zone for the general public during the night. Precautions include but not limited to, placing steel plates over the trench, barricades, lighting, signs, etc. Contractor shall contact the City Engineer or representative before leaving the site at the end of the day, to ensure that work zone has been adequately closed up for the safety of the public.
18. Prior to directional boring/drilling and or jacking, all utilities (communication, electric, gas, sewer, water, storm drain, etc.) in close proximity, shall be exposed to verify location. A fully detailed plan showing the proposed construction activity shall be submitted to the City Engineer or representative for review at least two (2) weeks prior to the commencement of the construction activity. The proposed sleeve shall consist of either steel or HDPE with a traceable wire placed over the utility.
19. Driveways should be avoided when determining the path of the service lateral.

Installing Sewer Manholes, Frames and Grates

1. Sewer manholes are required at every change in vertical grade, horizontal pipe alignment, and every 300'.
2. Sewer manholes shall be installed at the end of all dead end mains.
3. A 60-inch minimum inside diameter manhole will be required; if more than 4 service laterals are proposed for one manhole, or if a service lateral is greater than 6-inches in diameter.

4. Inside drop structures for mainline sewer construction require a minimum 60-inch inside diameter manhole. Inside drop service connection details must be submitted to the Engineering Services Division for approval prior to construction.
5. The use of sanitary sewer “doghouses” are not permitted unless approval has been granted by the City Engineer or representative.
6. All cast iron manhole frames and covers are to be set no less than 1/8-inch lower or no more than 1/4 inch lower than finish pavement. The concentric or eccentric cone should line up over the downstream invert or turned so as not to be in the vehicular wheel path, bicycle shoulder, or sidewalk.
7. All brickwork used to adjust manholes and catch basins to grade shall be laid in a header course pattern - (end showing) as opposed to a batter course – (edge showing).

Cleanouts

Cleanouts shall be constructed on 4 and 6 inch service laterals as directed by the City’s inspector and shall be located as follows:

1. Cleanouts shall be the same diameter as the carrying pipe.
2. A 6” cleanout shall be installed if and where a service transitions from 4” to 6”.
3. One cleanout shall be installed just upstream of any horizontal and/or vertical change in direction greater than 45°. Only one cleanout is necessary when two 45° bends are used to make up a 90° turn. A minimum of 2-feet of exposed pipe is required between bends. A cleanout is not required if the change in direction occurs within 25’ of the building if there is a cleanout inside the building.
4. If a service changes direction more than once, a cleanout will be required 5’ from the right-of-way for every two elbows regardless of the angle of change. (i.e. 1-22.5° & 1-45° requires one cleanout).
5. Cleanouts will be constructed using wyes (either 4x4x4 or 6x6x6 inch) and incorporating a 45° elbow to bring the stack vertical.
6. A cast iron cleanout box with cover marked “sewer” is required over 4” & 6” sewer service cleanouts.
7. Cleanouts will be required at or near the property line for testing purposes should the installation not be completed to a building or a manhole.
8. Each individual unit will have its own service connection and shall be accompanied by its own individual cleanout.
9. Cleanouts shall be located outside of the City of Concord’s right of way.
10. Cleanouts shall be located one per 100’ with no greater than 100-foot separation unless otherwise directed by the International Plumbing Code.

Excavation

Excavation shall be accomplished by methods that preserve the undisturbed state of the subgrade soils. A trench may be excavated by machinery to the designated subgrade, provided that the bottom of the trench remains in the undisturbed state and provides the proper foundation for the pipe bedding. Equipment may have to be modified by welding a blade to the bucket teeth to achieve the required shape to fit the lower 1/3 of the pipe exterior for pipe 36" in diameter and larger.

Crushed Stone Bedding

Contractor shall place ¾" crushed stone (ASTM #67): for bedding, to the haunch of the pipe and a minimum 6" beneath the pipe throughout the bottom of the excavated trench. PVC sanitary sewers and laterals shall be installed in accordance with ASTM D2321-89.

Mortar

Mortar shall consist of two parts mortar sand to one part Portland Cement. To obtain the proper ratio, one 94 pound bag of Type I or Type II Portland Cement should be mixed with two-five gallon buckets of mortar sand. The mix shall be thoroughly blended only in such quantity as may be required for immediate use, and shall be used before the initial set has taken place. The mix shall be constantly worked over with hoe or shovel to keep it workable. Adding water after mixing to bring a hardened mix "back to life" will not be allowed.

Brick Masonry

Brick masonry shall be protected from too rapid drying by approved means and shall be protected from weather and frost, as required. Bricks shall be laid in a full bed and joint of mortar without requiring subsequent grouting, flushing, or filling. Joints between bricks shall not exceed 3/8 inch and shall be tooled flush to the brick surface.

Brick masonry during winter conditions must be protected from freezing. A suitable heated shelter will be required to assure all materials remain above freezing for 3 days.

All brickwork used to adjust manhole and catch basin frames to grade shall be sealed on the outside of the structure with mortar.

Inverts: Manhole inverts shall be constructed to provide an uninterrupted flow channel and shall correspond in shape to the lower half of the pipe. Brick shall be laid on edge.

Mortar joints shall be tooled flush to the face of the brick to prevent minor depressions. Shelves shall be constructed to the midpoint of the pipe size ranging from 8-inches to 15-inches and to the highest pipe crown on larger pipe diameters. The brick shelf shall be pitched to drain toward the through channel with one inch of difference from the structure wall to the channel edge. Puddles or undue turbulence through the manhole trough will necessitate reconstruction.

The use of fiberglass inverts may be allowed per the authorization of the City Engineer or representative. The Contractor shall submit the manufacturer's shop drawings and other pertinent information as needed to the City Engineer or representative for review and approval.

Only solid masonry construction will be accepted under the brick shelf.

Adjusting Frames To Grade: Frames shall be centered over the manhole opening and are to be set no less than 1/8-inch lower or no more than 1/4 inch lower than finish pavement. A minimum of 2 courses of brick are required under the structure frame, yet the adjusting course shall not exceed

approximately one foot of brick - (normally 5 course maximum). The final course of brick may be laid on edge. Brick and mortar is the only masonry material to be used between the precast structure and the cast iron frame. The use of barrel blocks and concrete grade rings is not permitted.

Masonry Repairs: All work on existing facilities shall be performed by or under the direction of City forces. Only sound masonry materials shall be incorporated into the work, and any necessary repairs must first be approved by the City Engineer or representative, and observed prior to backfilling.

Discontinued Services: A Contractor installing a new or larger sewer service shall be responsible for properly discontinuing the abandoned service connections. The Contractor shall not disconnect any service connections without the proper authorization from Engineering Services.

Discontinued service connections shall be retired at the right-of-way and manhole, as applicable. The service shall be cut at the right-of-way and plugged with brick and mortar or a flexible cap secured with a stainless steel strap and hardware. If the service is connected to a manhole, the pipe shall be cut flush with the face of the manhole and plugged with brick and mortar, a flexible cap secured with a stainless steel strap and hardware, or a gripper/wing nut plug with stainless hardware

Main and Service Lining

Pre Video Camera Inspections: All pipelines shall be subject to the scrutiny of a video inspection, as outlined below, prior to rehabilitation and acceptance to assure flow characteristics. All pipelines shall be cleaned of all debris prior to the video camera inspection, the presence of debris will necessitate re-inspection following correction.

Piggyback Connections: Where possible, all piggyback connections should be eliminated. If it physically cannot be eliminated, it shall be the Contractor's responsibility to re-instate any piggyback connection located within the lined pipeline by using a remote controlled cutting device method or excavating at location to make a point repair to the piggyback connection.

Cleanout Connection: It shall be the Contractor's responsibility to maintain and reinstate all existing cleanout connections to service lines.

Limits of Service Lining: Services shall be lined full length from the building to the main at the Owner's expense.

D. Inspection Requirements

The Engineering Services Division's representative shall perform full time inspections to assure that all sanitary sewer work conforms to City standards. The Contractor, Developer, Owner shall be responsible for all costs incurred during the required testing and will be billed for all inspections and testing performed by the City.

Visual Inspections

Visual inspections are normally required to confirm the hydraulic integrity of sanitary sewer systems. Pipelines are required to be true to alignment and at a uniform slope between structures. "Ponding" or deviations in alignment will be cause for rejection. The Engineering Services Division shall determine if the ponding or deviations in alignment are cause for rejection.

Video Inspection

1. All pipelines will be subject to the scrutiny of a video inspection prior to acceptance to assure proper jointing and flow characteristics. The Engineering Services Division shall determine if the ponding or deviations in alignment are cause for rejection **All video inspections shall be performed by the City of Concord General Services Department, unless otherwise determined by the City Engineer or representative.**
2. Camera inspections will not be scheduled until construction of other utilities in the same area are completed and the pipeline under consideration has been backfilled and compacted to subgrade elevation for at least thirty days prior to the scheduled inspection. The Contractor shall contact General Services to schedule the inspection.
3. Cleaning of sewer mains and services, equipment, inspection and data reporting shall be done in accordance with the Pipeline Assessment and Certification Program (PACP).
4. All structures are to be accessible to the video inspection vehicle and all pipelines shall be cleaned of all debris prior to the inspection. The presence of debris or insufficient flushing water will necessitate re-inspection following correction. Any debris in the pipe shall be removed at the next structure and will not be allowed to continue downstream in the system.
5. Video camera inspections will be performed after flushing the sanitary sewer main or lateral with water containing a visible dye and allowed to drain. Excessive ponding or alignment deviation deemed by the City Engineer or representative is cause for rejection.
6. Only tractor-type units will be utilized for mainline inspections, push cameras will only be allowed for lateral inspections.
7. The camera shall have pan and tilt capabilities.
8. The camera shall be approved by the manufacturer for the pipe size being inspected (typical camera is rated for 8"-24", without additional accessories).
9. Optional: The camera should be equipped with an inclinometer (these only show the general trend of the pipe slope, not to be viewed alone as acceptance criteria).
10. The camera footage shall be shown on-screen.
11. The beginning of the inspection shall consist of a title screen that indicates the following information; date, time, location, company doing the inspection, contractor that laid the pipe, type of structure, pipe size and material, and if manhole numbers or line segments are not specifically labeled on the approved plans; than station numbers complete with right or left offsets shall be used to identify line segments.
12. When a lateral line is encountered during the inspection; the camera operator shall stop the camera unit and, using the pan and tilt function, inspect the lateral opening to the best of the camera's ability (dye should be introduced into the lateral, if feasible, to view flow characteristics).
13. When a questionable pipe joint is encountered during the inspection; the camera operator shall stop the camera unit and using the pan and tilt function, inspect the joint to the best of the

camera's ability. (Operator should also traverse the joint with the camera unit to observe the amount of drop/rise the camera experiences over questionable joints).

14. When a sag is encountered during the inspection; the camera operator shall record the beginning and end of said sag, if of questionable depth, then the operator shall drag a ½" tall non-buoyant object through the sag with the camera unit to observe and record actual depth.
15. All defects observed shall be logged into some sort of data management software (PACP compliant) and compiled into a video report to be submitted with the video inspection.
16. All video inspection submittals shall be in digital format on a flash drive or DVD. VHS will not be accepted.
17. Any submittal not meeting these requirements will be rejected.
18. **All costs associated with the video inspection shall be the responsibility of the Contractor, Developer, Owner unless otherwise determined by the City Engineer or representative. Contact the General Services Department for the current fee schedule.**

Video Inspection of Cured In-Place Pipe Liner

1. All pipelines shall be subject to the scrutiny of a video inspection prior to acceptance to assure flow characteristics. All pipelines shall be cleaned of all debris prior to the video camera inspection, the presence of debris will necessitate re-inspection following correction.
2. The lining of a service will require cleaning and video of the receiving main to ensure that the liner does not extend into the main.
3. The beginning of the inspection shall consist of a title screen that indicates the following information; date, time, location, company doing the inspection. The camera footage shall be shown on-screen, also the unit should be able to provide accurate footage, (1'±) and all measurements shall be taken from point of entry. All video inspection submittals shall be DVD format, no VHS will be accepted.
4. Inspection of pipelines shall be performed by a Contractor trained in locating breaks, and/or obstacles on pipelines by closed circuit television. The interior of the pipeline shall be carefully inspected to determine location of any conditions which may prevent proper installation of the liner into the pipelines, and it shall be noted so these conditions can be corrected.
5. Following installation of the CIPP, the Contractor shall conduct a post-rehabilitation video inspection of the completed work to verify that the liner installation is acceptable as defined in the technical specifications. The post-rehabilitation video inspection shall be performed at the point of entry of the liner and shall be such that the sewer lining can be clearly seen. The pipe shall be dry during all post-rehabilitation so that the bottom of the pipe can be seen. The Contractor shall submit a copy of the post-rehabilitation video inspection to the City of Concord Engineering Services Division after the liner is installed for review and approval.

E. Testing Requirements

Sewer Main Low Pressure Air Testing

Low pressure air testing has proven to be an efficient means of testing sewer lines for leaks. This test may be performed by an independent testing agency after notice to the City Engineer or representative. Should the Contractor conduct their own test, an Engineering Services inspector must be present to witness the results.

Test Requirements: The sanitary sewer main between structures, including laterals and all connections, regardless of length, must hold a positive pressure of 4 PSI over a period of 5 minutes with a maximum pressure loss of 1 psi.

Testing of minor sewer service repairs may be accomplished by visual inspection where "air" and "hydraulic" methods would be impractical.

Deflection Testing

Deflection tests are required for all flexible pipe (ductile iron and concrete pipe are not considered flexible). Deflection tests will be conducted a minimum of 30 days after installation of pipe and after the road has been constructed to subgrade and is ready for select materials. Deflection tests shall be performed on the entire length of the sewer main line on a manhole-to-manhole basis. The go, no-go mandrel test method shall be used and not performed before all utilities have been installed. Maximum deflection shall not exceed 5% of the pipe's internal diameter.

Sewer Force Main High Pressure Air Testing

All sanitary sewer force mains shall be tested for air and water tightness. As with low-pressure air testing, sanitary force main pressure testing may be performed by an independent testing agency. All test results shall be submitted by the independent testing agency to The City Engineer or representative for review.

Test requirements: The sanitary sewer main between structures, including laterals and all connections, regardless of length, must hold a positive pressure. Pressure for testing force mains should be a minimum of 100 PSI or higher as calculated according to the following formula: $HEAD \times 1.5$ (safety factor) / 2.31 ft/lb = pressure. The static pressure must hold for one hour to be acceptable.

Sewer Service Testing

Test requirements

The service lateral shall be tested at the point of connection with the public sewer to a point within the foundation as provided by the plumber. A water test under a head of 10 feet for 15 minutes or an air test of 4 psi for 5 minutes will be accepted.

Sewer Manhole Testing

Vacuum Test

The vacuum test method is the preferred method to insure manhole integrity; however, water exfiltration testing is an acceptable alternative.

All sanitary sewer manholes will be vacuum tested prior to backfilling around the structure. If the structure is struck by equipment during backfilling operations, the Contractor shall be responsible for re-testing of the manhole. The initial test pressure is to be negative 10-inches of mercury. Maximum allowable test time for a 1-inch loss in pressure from negative 10-inches of mercury to

negative 9-inches of mercury is 120 seconds for a structure up to ten (10) feet deep (as measured from the floor of the structure to the top of the precast unit). For structures measuring over 10 feet and up to 15 feet deep 150 seconds are allowed. Structures over 15 feet and up to 20 feet deep require up to 180 seconds for acceptance. Structures over 20 feet and up to 25 feet deep require 210 seconds without a 1-inch total loss of vacuum.

Water Exfiltration Test

Water exfiltration test procedures for 4'-0" or 5'-0" diameter manholes are as follows:

The manhole pipelines shall be plugged and the structure filled with water to the top of the cone section. If the excavation has not been backfilled and observation indicates no visible leakage on the outside of the structure, the manhole shall be considered satisfactorily watertight. If the test as described above is unsatisfactory, as determined by the City Engineer or representative, or if the manhole has been backfilled, the test shall continue.

A period of time shall be required for absorption. After absorption, the manhole shall be refilled to the top of the cone section and a measuring time of 8 hours begun. At the end of the test time, the manhole shall be refilled to the top of the cone section, being careful to measure the volume of water added. This amount shall be converted to the 24 hour rate per vertical foot of depth.

The rate is not to exceed 1 gallon per vertical foot for a 24 hour period. If the test fails this requirement, repairs by approved methods or total reconstruction of the manhole may be ordered by the inspector to bring the leakage within the allowable limits.

8-hour exfiltration test for 4'-0" diameter or 5'-0" diameter manholes

STRUCTURE HEIGHT	GALLONS ALLOWABLE LEAKAGE	MAXIMUM WATER DROP ALLOWED IN 30 INCH OPENING	
		FEET	INCHES
4'	1.3	0.0354	3/8
5'	1.7	0.0463	1/2
6'	2.0	0.0545	5/8
7'	2.3	0.0626	3/4
8'	2.7	0.0735	7/8
9'	3.0	0.0817	1
10'	3.3	0.0899	1-1/8
11'	3.7	0.1008	1-1/4
12'	4.0	0.1089	1-3/8
13'	4.3	0.1171	1-1/2
14'	4.7	0.1280	1-5/8
15'	5.0	0.1362	1-3/4
16'	5.3	0.1444	1-3/4
17'	5.7	0.1553	1-7/8
18'	6.0	0.1634	2
19'	6.3	0.1716	2-1/8
20'	6.7	0.1825	2-1/4

Water Systems

A. Description

This work shall consist of furnishing and installing, or removing and relaying, pipes, and appurtenances at the locations shown or ordered, including the necessary joints, fittings, and connections as required.

B. Materials

Certificates of Compliance shall be submitted by the Contractor for each material to the City Engineer or representative for review and approval.

The materials shall be subject to rejection at any time due to failure to meet any of the specification requirements. All fittings shall be of compatible construction materials and shall be used exclusively for the intended purpose of the manufacturer. All fittings used for repairs must first be approved by the Engineering Services Division prior to installation. Only new materials will be accepted for installation.

THE COMMUNITY DEVELOPMENT DEPARTMENT, ENGINEERING SERVICES DIVISION, RESERVES THE RIGHT TO REQUIRE A SAMPLE FOR EVALUATION OF ANY ITEM SUPPLIED. ALTERNATE ITEMS MUST RECEIVE PRIOR APPROVAL OF THE CITY ENGINEER.

Storage and Handling of Materials

1. All materials shall be handled in a manner to prevent warping, twisting, bending, breaking, chipping, rusting or any damage whatsoever. Pipe and structures shall be lifted and moved with the appropriate apparatus without being pushed, pulled or rolled by equipment.
2. All materials that have become so damaged as to be unfit for the intended use shall be promptly removed from the work site.
3. Prior to the storing of water pipe on the job site, the City Engineer or representative **shall be notified at least 24 hours in advance** as to when pipe and fittings will arrive. Upon arrival, Engineering Services will visually inspect the pipe for class rating and evidence of mishandling.
4. After approval of the pipe and fittings, the Contractor shall be required to provide a watertight seal at both ends of the pipe, with a minimum of 1.5 mil polyethylene plastic wrap. This shall be accomplished using sheet plastic or bags secured with duct tape.
5. All pipes shall be stacked on 4" x 4" timbers in tiers with chocks nailed at each end to prevent movement of the pipe. A maximum allowance for stacking height is included in the detail section according to pipe size
6. Loader forks are allowed for the unloading and stacking of pipe provided it is done with care. If pipe hooks are used in the ends of pipe for unloading purposes, they should be of special shape and padded so as to fit either the plain or bell end without damaging the pipe lining. Lifting chains will not be allowed in place of pipe hooks due to safety precautions.

7. Moving the pipe from the stacked pile to the trench by loader using forks or approved hooks is acceptable provided it is done with care. The pipe may not be strung along the ditch line until Engineering Services has reviewed and approved the locations.
8. Fittings, valves and fire hydrants must be stored off the ground so they will not collect moisture or be damaged.

Connection Hardware

All connection hardware, including fasteners, shall be a minimum 304 stainless steel. Clamps and retaining rings shall be ductile iron.

Water Mains

All materials coming in physical contact with drinking water must be certified to meet the ANSI/NSF Standard 61 by either the Underwriters Labs (UL) or the National Sanitation Foundation (NSF).

Ductile Iron Pipe:

1. Ductile Iron Pipe 4" to 8" diameter may be Pressure Class 350. Diameters greater than 8" shall be Thickness Class 52. Pipe shall meet, or exceed, current AWWA C151 specifications for ductile iron water pipe.
2. Maximum length is twenty and a half feet (20.5'). Double cement lining, seal coating inside and bituminous outside coating shall meet, or exceed, AWWA C104.
3. Push-on joints shall conform to current AWWA 111.
4. Pipe to be furnished complete with gaskets and lubricant.

Gate Valves:

1. All valves to be **mechanical joint**.
2. For sizes 4-inch through 12-inch, gate valves shall be required. Gate valves will be resilient seat with non-rising stem and conform to, or exceed, current **AWWA** specification C509 or C515. Valves are to be supplied with all accessories.
3. Direction to open – **RIGHT (coded red)**
4. Acceptable makes and models:
 - a. Clow - (F series)
 - b. Kennedy - (Ken-Seal)
 - c. Mueller G.V. (A-2360)
 - d. M & H (style 4067)
 - e. AFC-2500
5. Post indicator gate valves will be resilient seat and shall open to the **LEFT (coded black)**.

Large Valves:

1. For valves larger than 12-inch, horizontal operating resilient wedge valves are required and must conform to or exceed current AWWA C504 unless otherwise approved by the City of Concord Representative. Valves are to be supplied with all accessories.
2. Direction to open – **RIGHT (coded red)**

3. Acceptable makes and models:
 - a. Clow 4500
 - b. Henry Pratt Co. "Groundhog"
 - c. M & H 4500
 - d. Mueller Linesal III
 - e. AFC-2500 series (horizontal operating)

Fittings:

1. Fittings shall be gray cast iron or ductile iron with mechanical joints. Fittings and accessories shall conform to or exceed current AWWA C153. Compact ductile iron fittings meeting AWWA C153 are acceptable. Fittings to be new, unused, free from rust, coated, and cement lined.
2. Mechanical joints and accessories shall meet AWWA C111.
3. Double cement lining, inside seal coating and bituminous outside coating shall meet AWWA C104 for all fittings.
4. Restrained joints shall use Romac "Grip Ring" / "Meg-A-Lug" or approved equal.

Valve Boxes:

1. Base: 36-inch or longer to suit grade. No stacking of base sections is permitted.
2. Top: 5 1/4" x 24" or 26" with top flange - (Screw type is not acceptable).
3. Cover: marked "Water" supplied.
4. Two piece boxes are required.
5. Only North American Made valve boxes are acceptable.

Water Services

Backflow Prevention Devices:

All domestic backflows installed after January 4, 2014 must be lead free compliant with the EPA Reduction of Lead in Drinking Water Act. An approved list of backflow prevention devices can be found in Appendix A.

Curb Boxes:

1. 5'-6" curb box (complete) with cover, stainless 36" rod (single piece) and stainless steel or brass connecting pin.
2. Perma Rod Box with arch pattern base. Number 3 cover with pentagon brass plug and quick-release thread.
3. Opens **LEFT** – 1/4 turn.

Copper Tubing:

1. Tubing shall conform to or exceed current ASTM specification B-88.
2. Sizes 3/4" and 1" American made type "K" soft in 60 or 100 foot coils. 1" recommended to minimize potential lack of service pressure.
3. 1 1/2" & 2" - American made type "K" soft in straight lengths or coils.
4. **No 1 1/4" services.**
5. 3" Cement Lined Ductile Iron may be substituted for 2" copper tubing.

Brass Fittings - (For Underground Use):

1. Only NSF-61 which is lead free brass, is acceptable.
2. Acceptable makes of fittings: ball valve, curb stops and plug type or ball valve type corporation stops with conductive compression connections:
 - a. Ford
 - b. Mueller
 - c. McDonald
 - d. Hays
3. **"Stop and Waste valves" are not allowed.**

Meter Settings:

1. 5/8" x 3/4" meter horn with backflow prevention device.
2. 1" meter horn with backflow prevention device.
3. Meter horns shall be isolated with full open valves per the City of Concord's Building and Plumbing Code Regulations and the International Plumbing Code, 2003 Edition.
4. Backflow prevention device (#7 Watts or acceptable dual-check) shall be installed on the downstream side of the meter horn.
5. Laying length of meters: Refer to Construction Detail W-9.

Hydrants

Acceptable makes and models: Darling B62B preferred but Clow Eddy F2641 is acceptable.

Features:

1. Direction to open – **LEFT**
2. Breakable flange (Traffic model).
3. Valve opening 5-1/4".
4. Two 2½" NST hose nozzles.
5. One 5¼" NST pumper nozzle.
6. Operating nut and nozzle caps - NS pentagon 1½" flat to point.
7. Depth of trench - 6 foot.
8. Six inch mechanical joint connection with accessories for 7.10" O.D. ductile iron pipe.
9. Drain hole shall be plugged.
10. Marker flag with retro-reflective marker plate.
11. All hydrants shall be bagged until placed in service.

Sand Bedding / Blanket

Sand bedding and blanket material required for the installation of the water mains, services and appurtenances shall meet the following gradation requirements:

<u>Sieve Size</u>	<u>% Passing</u>
1/2 Inch	100
No. 200*	0-12

*Fraction passing the #4 sieve

C. Construction Requirements

The Community Development Department in conjunction with the General Services Department will oversee all work related to these utilities. Unauthorized use of hydrants is strictly prohibited. Should a Contractor desire to use City water for dust control, sewer testing and flushing operations, etc. the City will furnish a temporary meter. A deposit is required and the Contractor will be charged for the water used. **Only qualified City of Concord personnel are authorized**

to manipulate hydrants. Unauthorized usage of City water is subject to a minimum \$1,000.00 fine.

Water Mains

1. Water mains and services must be bedded on a 6-inch sand cushion and covered with a minimum 12-inch layer of compacted sand – no stones. Where unsuitable/unstable material is encountered below pipe grade it will be removed and replaced with crushed stone or suitable gravel fill below the sand bedding as directed.
2. Laying depth must be 5 feet 6 inches (5.5-feet) compacted from the top of the pipe to the finished grade of the proposed roadway. Where extra depth may be required at utility crossings the pipe must return to the specified laying depth by the use of fittings as directed by the Engineering Services Division. In no case will the pipe depth be allowed in excess of 6-feet at water main valves.
3. The use of insulation installed over the top of the pipe when the required depth cannot be achieved, will not be permitted without the approval of the City Engineer or representative.
4. Joint deflection of ductile iron pipe is not acceptable unless approved by the City Engineer or representative. Should the use of deflection be allowed, the Contractor shall provide manufacturer literature specifying the allowable deflection
5. Water mains must be separated from storm drain systems for frost protection. Should the separation be less than 3 feet from a storm drain manhole, catch basin, or pipeline; 2" rigid polystyrene thermal insulation with a minimum "R" value of 10 will be required two-feet each side of the utility and a distance to be specified by the City Engineer or representative, (a minimum of 8' is required). The City Engineer or representative shall be contacted prior to the installation of the insulation.
6. Should the vertical separation of the sewer and water main be less than 18", the water main or the sewer main must be relocated to achieve the required separation.
7. State regulations require water mains to be separated from sanitary sewer mains by a minimum of 10-feet (horizontally). This applies for new construction and renovations to existing structures.
8. Should construction operations reveal or expose a water main running under, approximately parallel to (less than 10-feet from a proposed sewer installation), and where it is not practical to relocate the sewer, the sewer shall be reconstructed of ductile iron pressure class pipe until the minimum 10-foot separation can be achieved.
9. Whenever sewers must cross over water mains, the sewer shall be constructed with (replaced with) ductile iron pressure class pipe for a minimum distance of 9 feet each side of the crossing. Joints shall be water pressure rated with zero leakage when tested at 25 pounds per square inch for gravity sewers and 1½ times working pressure for force mains, and joints shall not be located within 9 feet of the crossing point.
10. When utilities cross under a **cast iron** water main and the vertical distance between the bottom of water main and the top of the other utility is four feet or greater; the water main shall be cut out and replaced with ductile iron pipe. The new ductile iron pipe section shall

span the excavation back into original ground. This procedure will require approval and inspection by the City Engineer or representative.

11. In conflicts requiring the relocation of utilities, preference shall be given:
 - a. to utilities with grade restrictions.
 - b. to existing utilities already in service.
12. No trench shall be left open at the end of the workday. Contractor shall take all the necessary precautions to "button-up" the work zone for the general public during the night. Precautions include but not limited to, placing steel plates over the trench, barricades, lighting, signs, etc. Contractor shall contact the City Engineer or representative before leaving the site at the end of the day, to ensure that work zone has been adequately closed up for the safety of the public.
13. A **"watertight plug"** must be inserted as each length or fitting is installed. This "end plug" will be left in place at the end of the workday.
14. Blue "water" warning tape shall be installed twelve (12) inches above the utility
15. Prior to directional boring/drilling and or jacking, all utilities (communication, electric, gas, sewer, water, storm drain, etc) in close proximity, shall be exposed to verify location. A fully detailed plan showing the proposed construction activity shall be submitted to the City Engineer or representative for review at least two (2) weeks prior to the commencement of the construction activity. The proposed sleeve shall consist of either steel or HDPE with a traceable wire placed over the utility.
16. A hydrant shall be installed at the end of all dead end mains.

Mechanical Fittings and Accessories

1. Retaining glands, tie rods or a combination of poured concrete (2000 psi minimum) thrust blocks and retainers must be used on all mechanical fittings. A durable flat surfaced rock may be substituted should it possess adequate bearing area against undisturbed earth. If tie rods are used, they shall be coated with an approved rust proofing agent.
2. A torque wrench must be used on all fittings to insure manufacture's recommended torque.

Generally Accepted Torques:

- 70 lbs.** on set screws
- 75-90 lbs.** on glands with 3/4" - (19)mm bolts
- 60 lbs.** on glands with 5/8" - (16)mm bolts

3. Assembly Instructions For Ductile Iron Pipe:

Clean bell and spigot end and lubricate gasket with approved pipe lubricant. Set gasket into position to assure even seating in the bell. When gland is in position, insert bolts and tighten with fingers. Tighten bolts to the normal range of bolt torque while maintaining approximately the same distance between the gland and the face of the socket. A proper joint is accomplished by: 1) partially tightening the bottom bolt, 2) the top bolt; 3) the bolts at both sides; and 4) the remaining bolts. Repeat this process until all bolts are within the appropriate torque range.
4. All main line valves at pipe intersections (including hydrant valves) are to be placed within 2-feet of the tees.

5. Large valves (10-inches or greater) must be supported with blocking to prevent the pipe from supporting the valve's weight during installation.
6. Install valve boxes with a cushion of sand between the valve and the valve box. A Gate Box Aligner shall be required under the operating nut. In wet areas, washed stone is to be placed around the valve box with a layer of hay or a geotextile fabric to prevent fine soil from mixing with stone during initial backfill.
7. Exercise each valve in the presence of the inspector. The number of turns must be recorded before the valve is installed.
8. Stainless steel tapping sleeves are acceptable up to $\frac{1}{2}$ the diameter of the existing pipe size. Full body cast iron tapping sleeves will be used for sizes greater than $\frac{1}{2}$ the diameter of the existing pipe.
9. No Contractor will operate City valves or curb stops without the explicit permission of the City.

Hydrants

1. Hydrants are to be installed at the proper depth and a concrete slab or large flat rock is to be used to support the hydrant's weight. Use of a level to assure proper alignment is required. Hydrant extension kits will be required for height adjustments to assure the proper break point, visibility, and accessibility of the hydrant.
2. The Contractor shall be responsible for hydrant painting. Requirements for hydrant painting are included in the City of Concord Construction Details.
3. Hydrants located further than 20-feet from the water main will require an 8-inch feed.
4. Contractor is responsible for the installation of the "marker flag" as show on the hydrant detail.
5. All hydrants shall be bagged until the hydrants are operational and then removed by City of Concord personnel.

Water Services

1. Corporations will be installed at either the two o'clock or the ten o'clock position on the pipe circumference.
2. An (S) loop must be provided in the tubing nearest the corporation, and set no higher than the water main.
3. Any service longer than sixty feet from the main to the curb stop must be a minimum of one-inch diameter to provide for adequate flow.
4. Stainless steel (304 minimum) saddles are required for service taps over $\frac{3}{4}$ " on 6" diameter mains and smaller; and double strapped saddles with a AWWA taper thread (CC Thread) is required for service taps over 1" on mains larger than 6" diameter.

5. Curb valves will be set on the right-of-way of City Streets. If curb box extensions are needed, no more than one - 12" galvanized or black iron nipple with coupling will be allowed. The maximum depth for curb valves is 6 feet while the minimum depth is 5 feet-6 inches.
6. Curb boxes shall not be set in driveways or walkways unless field conditions do not permit the installation. The City Engineer or representative shall be contacted if the requirement cannot be met prior to the installation.
7. In accordance with the 2009 IPC, water service pipe and the sewer service shall be separated by 5' of undisturbed or compacted earth, except as follows.
 - a. The required separation distance shall not apply where the bottom of the water service pipe within 5 feet of the sewer service is a minimum of 12 inches above the top of the highest point of the sewer pipe.
 - b. Water service pipe is permitted to be located in the same trench with the sewer service, provided the sewer is constructed of materials as noted elsewhere in the Standards.
 - c. The required separation distance shall not apply where a water service pipe crosses a sewer pipe, provided that water service pipe is sleeved to at least 5 feet horizontally from the sewer pipe centerline on both sides of such crossing.
8. Adjacent curb boxes must be set at least 4-feet apart.
9. Minimum distances for service lines:
 - a. From an underground utility shall be: 5-feet
 - b. From a septic tank shall be: 10-feet
 - c. From a leach bed or dry well shall be: 25-feet
10. The minimum depth of the water service shall be 5½-feet. Should the water service line be less than 5½-feet deep, 2" rigid polystyrene thermal insulation with a minimum "R" value of 10 will be required two-feet each side of the utility and a distance to be specified by the City Engineer or representative, (a minimum of 8' is required). The City Engineer or representative shall be contacted prior to the installation of the insulation.
11. Blue "water" warning tape shall be installed twelve (12) inches above the utility.
12. A Contractor installing a new or larger water service shall be responsible for properly discontinuing the abandoned service connection(s). The Contractor shall not discontinue any service connections without the proper authorization from Engineering Services.

Discontinued service connections are normally retired at the water main. A copper service can be cut and capped at the property line should circumstances exist where access to the water main is impracticable. Discontinued service connections of lead or iron piping shall be abandoned at the water main.

Fire Suppression Lines:

Should the fire suppression and domestic service originate from a single tap off of the main, fire suppression lines shall remain exclusive for that purpose after the fire/domestic split.

Irrigation Lines:

Irrigation lines shall be split from the domestic service after the shut-off for the domestic water service.

Back-Flow Prevention Devices:

1. For cases of single family and attached townhouse residential units, dual-check devices or setters with dual-checks are required.
2. Non-residential or lawn irrigation system installations shall require either a testable **double-check (DCVA)** or a **reduced pressure principle (RP)** device. The Contractor is to contact General Services Department, Utility Billing, to arrange for a sanitary survey and/or site analysis for confirmation.
3. All water piping and fittings to the backflow device are to be copper, brass, or cement lined ductile iron pipe.
4. Per Env-Dw 505 Backflow-Prevention Devices shall not be installed in a location where it will:
 - a. Be subject to corrosive fumes, grit, or sticky or abrasive liquids;
 - b. Be subject to flooding or mechanical abuse;
 - c. Not be easily accessible for testing and repair
 - d. Be in a pit or built into or close to walls or other obstructions; or
 - e. Be in a vertical position unless the backflow prevention device was certified for that orientation.

Metering

1. Temporary meters shall be required for City water use during construction. The Contractor must agree to adhere to City operational procedures. Seasonal requirements may apply such as a hydrant being pumped after each use in winter conditions. The Contractor can be fined a minimum of \$1,000.00 without the proper authorization from the City of Concord.
2. It is the responsibility of the Owner/Developer/Contractor to install meter setter horns or flanges in which the City will place the permanent meter. The meter is supplied and owned by the General Services Department.
3. The General Services Department's policy concerning the number of City meters at any building is as follows:
 - a. Single units (residential or otherwise), and each unit within multiple attached units (such as townhouses or duplexes) that have their own cellar or first floor space shall have its own individual water service and City water meter.
 - b. For apartment or condominium type units within shared buildings, (which are either new or conversions), and when there is no common first floor space: the Owner can choose to: 1) service each unit on an individual water line, or 2) service multiple units from one water line. In the former a City meter will be set for each unit, and an account will be established for those meters. In the latter one or more City meters can be set according to the Owner's wishes. If one City meter is desired then one account will be established for that complex.
 - c. The Owner is not precluded from installing their own private meters downstream (after the City meter), for the purpose of splitting the usage to tenants; but the City of Concord, General Services Department will not provide individual billing.
 - d. Multiple billing accounts can be established for each unit. A monthly fee will be levied on each additional account after the first City meter.

- e. Secondary City meters used to determine the usage for a specific purpose such as irrigation or other non-sewered consumption shall only be allowed for "closed" systems that do not have threaded fittings for hose connections. Secondary meters shall be installed in parallel, and will be charged an additional monthly fee.
4. Meters shall be placed where they will be easily accessible for reading and maintenance The General Services Department will install and seal the meter.
 5. Prior to having the meter installed the following must occur:
 - a. Application for service made at the General Services Department Utility Billing Office - 311 North State Street.
 - b. All fees and charges including Special Investment Fees if applicable are paid.
 - i. Water Investment Fee (WIF)
 - ii. Sewer Investment Fee (SIF)
 - c. Final Inspection of the project by the Engineering Services Division. No water meter will be installed until all outstanding project related issues, if any, are addressed.

ENGINEERING SERVICES WILL NOT "SIGN-OFF" FOR A CERTIFICATE OF OCCUPANCY PERMIT UNTIL THE WATER METER IS INSTALLED AND ALL OUTSTANDING PROJECT RELATED (ONSITE AND OFFSITE) ISSUES ARE ADDRESSED.

D. Inspection Requirements

The Engineering Services Division's representative shall perform full time inspections to assure that all water work conforms to City standards. The Contractor, Developer, Owner shall be responsible for all costs incurred during the required testing and will be billed for all inspections and testing performed by the City.

Visual Inspections: Visual inspections of water main installation will be performed to assure compliance with construction standards. Pipelines are to be true to grade and alignment. Pipe must be sound and flawless. Cracked, chipped or deformed pipe, fittings or accessories must be replaced.

E. Testing Requirements

Flow Test

Projects which require a flow test shall follow the following procedure.

1. The contractor should call General Services at 228-2737 to schedule a flow test and ask for the Water Systems Supervisor or Water Distribution Supervisor.
2. The City conducts flow tests early in the morning, due to the disturbance of the water mains, because allowing the water to flow at a heavy rate can stir up the water and create dirty water calls. The City will not conduct flow-tests during the winter months because of the freezing temperatures and the icing that it would cause on the roads.
3. The contractor supplies their own gauges and a witness for the test. The City will turn the hydrants on and off.
4. The City will fax the results to the contractor.
5. Contact the General Services Department for the current fee schedule.

Water Line Testing

6. Testing shall be scheduled with and performed in the presence of a City of Concord Representative.
7. The Contractor shall provide all materials necessary for water line testing including; corporations, ball valves, blow-offs, etc. for main line testing.
8. Fire hydrants shall be used as “blow-off valves”, venting, etc. When field conditions do not allow the use of a fire hydrant, use of a blow-off valve (type and location) shall be determined by the City of Concord Representative; the Contractor shall not install a blow-off valve without the proper authorization.

Pressure Testing

All water mains and services shall be pressure tested. A pressure test is required before any water supply main will be accepted. Water mains will not be tested during disinfection.

1. Services and mains 2-inches in diameter or greater must be pressure tested as follows. Pressurize the water line to 150 psi (min) or 1.5 times the static pressure in excess of 100 psi - **not to exceed 200 psi**. The static pressure must hold for one hour to be acceptable.
2. Services less than 2” shall be tested by one of two methods.
 - a. Pressurize the water line from the meter horn back to a closed valve to a pressure of 100 psi. The pressure must hold for 15 minutes to be acceptable.
 - b. Static test using the pressure from the adjacent water main. With, 1) the valve open, 2) the service bled and shut off inside the building or crimped at the building, and 3) the trench open and accessible to the inspector with appropriate safety measures available (trench box, etc.), the service shall not show any signs of leaking for a minimum of 15 minutes.
3. Tests will be performed by the Contractor or a reputable testing firm. A City of Concord Representative shall be present to witness the test. The test results shall be forwarded to Engineering Services or their consultant for review and acceptance.

Bacterial Testing / Disinfection

All water lines greater than two inches in diameter must be disinfected. Disinfection shall be in accordance with the American Water Works Association (AWWA) standard **C651-86** (Disinfecting Water Mains). The Contractor will use a liquid disinfectant to clean the pipeline. Engineering Services recommends a chlorine concentration of 100 ppm. An Engineering Services Inspector must be present to witness the disinfection and operate all City valves. The Contractor will take water samples for bacterial analysis to a State certified testing laboratory. The reports shall be directed to the Community Development Department – Engineering Services Division.

Storm Drainage Systems

A. Description

This work shall consist of furnishing, constructing and/or reconstructing catch basins, manholes; with frames, grates, or manhole covers; as shown on the plans. This work shall also consist of furnishing and installing, or removing and relaying, pipes, pipe end sections, and pipe sleeves at the locations shown or ordered, including the necessary joints, fittings and connections as required.

B. Materials

Certificates of Compliance shall be submitted by the Contractor, for each material or structure, to the City Engineer or representative for review and approval.

Storage and Handling of Materials

Preventing damage: All materials shall be handled in a manner to prevent warping, twisting, bending, breaking, chipping, rusting or any damage whatsoever. Pipe and structures shall be lifted and moved with the appropriate apparatus without being pushed, pulled or rolled by equipment.

Storage of cement: Cement shall be stored under cover, off the ground, and shall be kept completely dry at all times.

Storage of reinforcing steel: All reinforcing steel shall be stored off the ground, or otherwise to prevent accumulations of dirt or grease, and in a position to prevent accumulations of standing water to minimize rusting.

Precast concrete handling: Precast concrete units shall be handled in a manner to prevent chipping or cracking.

Handling and storage of masonry products: Brick, block and similar masonry products shall be handled and stored in a manner to reduce breakage, chipping, cracking and spalling.

Damaged materials: All materials that have become so damaged as to be unfit for the intended use shall be promptly removed from the work site.

Pipe

Reinforced Concrete Pipe (RCP):

1. **Conformance to standard specifications:** Pipe shall conform to the standard specifications for reinforced concrete culvert and storm drain. Pipe shall be minimum Class III 2000D typically unless otherwise required due to shallow depth or loading.
2. **Gasketed pipe joints:** Gasketed pipe joints are required for all City installations and shall conform to ASTM C443 Standard Specifications for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
3. **Fittings and accessories:** Fittings and accessories must be approved by the Engineering Services Division prior to installation.

Polyvinyl Chloride (PVC) Pipe:

1. **Conformance to standard specifications:** Pipe and fittings shall conform to ASTM D-3034 and shall be SDR-35 or SDR-26.
2. **Gasketed pipe joints:** Joint compression rings shall be of an oil resistant rubber type, elastomeric seals conforming to ASTM D-3212, or flexible elastomeric seals conforming to ASTM 3212.

Polypropylene (PP) Pipe

1. Use of PP: PP shall only be used on private sites and must meet all the City's current concrete pipe standards for water tightness and sanitary sewer standards for roundness. Where a private drain line may cross the City of Concord's Right-of-Way, there shall not be a combination of two different products such as the use of concrete and PP. The entire drain line shall be constructed of either RCP or PVC.
2. **Conformance to standard specifications:** Pipe and fittings shall meet ASTM F2736, F2881. Connections shall meet ASTM D3212, ASTM F477

High Density Polyethylene Pipe (HDPE)

1. **Use of HDPE:** HDPE pipe shall only be used on private sites and must meet all the City's current concrete pipe standards for water tightness and sanitary sewer standards for roundness. Where a private drain line may cross the City of Concord's Right-of-Way, there shall not be a combination of two different products such as the use of concrete and HDPE. The entire drain line shall be constructed of either RCP or PVC.
2. **Conformance to standard specifications:** This product must be designed for the intended application and should it be proposed for traffic load conditions it must meet H-20 live load requirements. The manufacturer must recommend the product for closed mainline storm drain systems.
3. For use in culvert installations concrete headwalls are required.
4. **Gasketed pipe joints:** A watertight joint must meet or exceed concrete pipe standards ASTM C924, C969, and C1103. The pipe system must utilize a bell and spigot type joint design or a solid collar system to eliminate displacement and deformation at the joint. Joint integrity must meet ASTM D-3212.
5. **Compatibility:** Concentric corrugations or a smooth exterior is necessary to mate the pipe to concrete structures utilizing neoprene boot systems that maintain a watertight seal.
6. **Fittings:** Manufacturers fittings for lateral services must meet the City's current water tightness standards.

Ductile iron (DI) pipe:

1. **Conformance to standard specifications:** Ductile iron pipe shall conform to ANSI/AWWA C150/A21.50 (pressure class pipe) with size as shown on the drawings.
2. **Gasketed pipe joints:** Pipe shall have either the rubber ring type, push on joint, or standard mechanical joint. Rubber gasket joints shall conform to ANSI A21.11 for mechanical and push on type joints. All pipe and fittings shall have a cement mortar lining and bituminous seal coat on the inside, and a coal tar enamel coat on the outside.

Catch Basins

Eight inch (8-inch) walled, reinforced concrete structures are recommended when tying into existing structures and five inch (5-inch) minimum wall reinforced concrete structures are required for new construction. The structures shall be designed to handle H2O Loading.

Reinforcing shall be steel, or structural fibers. Steel shall conform to the requirements of NHDOT 544. Fibers shall only be used in structures with 4 feet or less inside diameter and shall be as shown on the NHDOT Qualified Products List.

For five-inch thick, reinforced structures, a neoprene boot to securely seal the pipe stub in the opening is preferred. If booting cannot be done due to trench constraints, a **sand stub** may be utilized to provide a secure seal.

Eccentric or Concentric conical top sections are allowed as illustrated on the standard details. Slab top sections shall be used only when the distance from top of grate to top of pipe is less than 48-inches.

Every catch basin is required to have a 3-foot sump as measured from the outlet pipe invert to the floor of the structure. The sump shall be a solid precast unit. Should a center hole be cast in the base, it must be plugged with mortar.

Catch basins with an oil/debris trap (Snout/Eliminator for example) shall be a minimum 5' diameter and maintain a minimum 42" clear space inside the basin for maintenance. The basin shall be positioned such that the grate/cover is not directly over the trap.

THE USE OF BARREL BLOCKS OR CONCRETE GRADE RINGS IS NOT PERMITTED FOR NEW CONSTRUCTION.

Catch basins shall be accurately located one (1) foot off the curb line for 4-foot I.D. structures to ensure that the frame will be flush to the curb and centered over the structure. In no case should the frame and grate not be flush against the face of the curb. Shall the frame and grate not be flush against the face of curb; the Contractor/Developer will be responsible for re-setting the frame/grate and or the entire structure to achieve the proper placement.

Although catch basins may not be required to be tested for water tightness, infiltration is not acceptable.

Should site conditions require modifications to structure openings, only methods approved in advance by the Engineering Services Division such as core drilling or sawing will be accepted.

All PVC pipe connections to structures (such as under-drain and footing drains) must be cored and booted to assure a secure seal.

Drain Manholes

Drain manholes shall be of similar construction to catch basins with the exceptions that a 30-inch opening for a top section is required and the 3' sump is replaced with a brick invert as noted in the Construction Requirements.

Frames, Grates and Covers

8" cast iron catch basin frames and grates shall be NHDOT Type B grate for roadway slopes less than 3%, as shown on the detail of the New Hampshire Standard Plans for Road and Bridge

Construction, Standard DR-1, Plate 2. Where roadway slopes are equal to or greater than 3%, NHDOT Type-F, "Bicycle Safe" frames and grates shall be installed as shown on the detail of the New Hampshire Standard Plans for Road and Bridge Construction, Standard DR-2, Plate 1. Where existing catch basins are located within a crosswalk or pedestrian route, a grate which meets current ADA guidelines shall be used (Neeah R-3210-Q or approved equal). North American and India castings are allowed, provided the India castings are from SIGMA Corporation or approved equal. All castings shall be designed for H-20 Loading.

6" manhole frames and covers shall be NHDOT Standard Manhole cover and frame as shown in the New Hampshire Standard Plans for Road and Bridge Construction, Standard DR-2, Plate 2. All castings shall be designed to handle H20 Loading

Underdrain

Underdrain shall be a minimum 6" diameter PVC pipe meeting SDR-35 requirements or other straight pipe designated for roadway. Coiled slotted house foundation underdrain or corrugated metal underdrain is not permitted for roadway construction.

Perimeter Drain Laterals

Perimeter drain laterals within the right-of-way shall be a minimum 6" diameter PVC pipe meeting SDR-35 requirements or other straight pipe designated for roadway. Coiled slotted house foundation underdrain or corrugated metal underdrain is not permitted within the right-of-way.

Stone Fill

Where indicated or required to stabilize a particular slope or water course, stone fill shall consist of: approved quarry stone, or broken rock of a hard, sound, and durable quality, reasonably free of thin or elongated pieces.

Masonry

Brick: Brick shall be solid, sound, hard, and have plain or smooth surfaces on both ends and on the face side, and be satisfactory to the City Engineer or representative. Brick shall comply with A.S.T.M. Standard Specifications for Sewer Brick, Designation C32, for Grade SS, Hard Red Brick. Brick samples will be required for approval prior to incorporation in the work.

Cement: Cement shall be straight Portland Cement, Type I, II, or a Type I/II. Lime mortar or Masonry cement is not to be used on structures.

Mortar Sand: Mortar sand shall meet the following gradation requirements:

<u>Sieve Size</u>	<u>% Passing</u>
No. 8	100
No. 16	60-100
No. 50	15-35
No. 100	2-15
No. 200	0-5

Crushed Stone Bedding

Crushed stone shall be ¾ inch (ASTM #67) stone and meet the following gradation requirements:

<u>Sieve Size</u>	<u>% Passing</u>
1"	100
¾"	90-100
⅜"	20-55
#4	0-10
#8	0-5

C. Construction Requirements

The Community Development Department in conjunction with the General Services Department will oversee all work related to these utilities. Unauthorized use of hydrants is strictly prohibited. Should a Contractor desire to use City water for dust control, sewer testing and flushing operations, etc. the City will furnish a temporary meter. A deposit is required and the Contractor will be charged for the water used. **Only qualified City of Concord personnel are authorized to manipulate hydrants.** Unauthorized usage of City water is subject to a minimum \$1,000.00 fine.

Excavation

Excavation shall be accomplished by methods that preserve the undisturbed state of the subgrade soils. A trench may be excavated by machinery to the designated subgrade, provided that the bottom of the trench remains in the undisturbed state and provides the proper foundation for the pipe bedding. Equipment may have to be modified by welding a blade to the bucket teeth to achieve the required shape to fit the lower 1/3 of the pipe exterior for pipe 36" in diameter and larger.

Crushed Stone Bedding

Contractor shall place ¾" crushed stone (ASTM #67): for bedding, to the haunch of the pipe and a minimum 6" beneath the pipe throughout the bottom of the excavated trench. After placing the pipe, ¾" crushed stone shall be placed to ½ the outside diameter for pipe less than 24" inside diameter. ¾" crushed stone shall be placed to the top of pipe for diameters greater than or equal to 24".

Mortar

Mortar shall consist of two parts mortar sand to one part Portland Cement. To obtain the proper ratio, one bag of Type I or Type II Portland Cement should be mixed with two-five gallon buckets of mortar sand. The mix shall be thoroughly blended only in such quantity as may be required for immediate use, and shall be used before the initial set has taken place. The mix shall be constantly worked over with hoe or shovel to keep it workable. Adding water after mixing to bring a hardened mix "back to life" will not be allowed.

Brick Masonry

Brick masonry shall be protected from too rapid drying by approved means and shall be protected from weather and frost, as required. Bricks shall be laid in a full bed and joint of mortar without requiring subsequent grouting, flushing, or filling. Joints between bricks shall not exceed ⅜ inch and shall be tooled flush to the brick surface.

Brick masonry during winter conditions must be protected from freezing. A suitable heated shelter will be required to assure all materials remain above freezing for 3 days.

All brickwork used to adjust manhole and catch basin frames to grade shall be sealed on the outside of the structure with mortar.

Inverts: Manhole inverts shall be constructed to provide an uninterrupted flow channel and shall correspond in shape to the lower half of the pipe. Brick shall be laid on edge. Only solid masonry construction will be accepted under the brick shelf.

Mortar joints shall be tooled flush to the face of the brick to prevent minor depressions. Shelves shall be constructed to the crown of the pipe for diameters greater than 15 inches. The brick shelf shall be pitched to drain toward the through channel with one inch of difference from the structure wall to the channel edge. Puddles or undue turbulence through the manhole trough will necessitate reconstruction.

Adjusting Frames To Grade: Frames shall be centered over the catch basin / manhole opening. Manhole frames shall be set no less than 1/8-inch lower than the finish pavement or no more than 1/4 inch lower than finish pavement. Catch basin frames shall be set no less than 1/8" lower than the finish pavement or no more than 1/2 inch lower than finish pavement. A minimum of 2 courses of brick are required under the structure frame, yet the adjusting course shall not exceed approximately one foot of brick - (normally 5 course maximum). One course of brick may be laid on edge. Brick and mortar is the only masonry material to be used between the precast structure and the cast iron frame. The use of barrel blocks and concrete grade rings is not permitted.

Masonry Repairs: All work on existing facilities shall be performed by or under the direction of City forces. Only sound masonry materials shall be incorporated into the work, and any necessary repairs must first be approved by the City Engineer or representative, and observed prior to backfilling.

Storm Drain Systems

1. The minimum pipe inside diameter for cross culverts and closed storm drain systems accepting roadway runoff shall be 15-inches. The minimum pipe inside diameter for driveway culverts shall be 12 inches. The use of pipe smaller in diameter than 12-inches is not permitted.
2. A minimum 4' of cover shall be provided over all storm drains. Should conditions result in storm drains with less than 36-inches of cover; 2" rigid polystyrene thermal insulation with a minimum "R" value of 10 will be required two-feet each side of the utility and a distance to be specified by the City Engineer or representative, (a minimum of 8' is required). The City Engineer or representative shall be contacted prior to the installation of the insulation.
3. Proper catch basin location is essential to assure compatibility with finished roadway curb and structure installations.
4. A minimum 6" of ¾" crushed stone bedding is required under the load bearing section of all storm drain pipe from the undisturbed stable soil to the mid-diameter of the pipe.
5. A minimum 8" of ¾" crushed stone bedding is required under all catch basins and manholes.
6. Granular fill over the pipe may be required should the excavated material contain >50% cobbles and threaten to injure the pipe.
7. Should unsuitable soils be encountered in the excavated trench all material will be removed and replaced with granular fill to the limits as directed by the City Engineer or representative.

8. Manholes or catch basins shall be required at every change in vertical grade or horizontal pipe alignment.
9. Manholes shall be installed at the end of all dead end pipes that are placed with the expectation of future connection. Capping/plugging and burying the pipes will not be allowed.
10. Should storm drain pipelines or structures approach water lines or appurtenances with less than 36-inches of separation; 2" rigid polystyrene thermal insulation with a minimum "R" value of 10 will be required two-feet each side of the utility and a distance to be specified by the City Engineer or representative, (a minimum of 8' is required). The City Engineer or representative shall be contacted prior to the installation of the insulation.
11. Headwalls shall be placed outside of the "clear zone" as defined in the Roadside Design Guide.
12. Prior to directional boring/drilling and or jacking, all utilities (communication, electric, gas, sewer, water, storm drain, etc) in close proximity, shall be exposed to verify location. A fully detailed plan showing the proposed construction activity shall be submitted to the City Engineer or representative for review at least two (2) weeks prior to the commencement of the construction activity. The proposed sleeve shall consist of either steel or SDR 11 with a traceable wire shall be placed over the utility.
13. High density polyethylene and PVC pipe used in conjunction with concrete structures may require special treatment to assure a watertight seal. Manufacturer's recommendations must be followed to assure long-term performance.

Underdrain

Underdrain, if not detailed on the approved plans, may be required should site conditions warrant. Seasonal high water table must be kept to a minimum of 2-feet below subgrade across the roadway section. Should the water table be encountered during subgrade preparation, an appropriate engineering solution must be submitted for approval to correct the situation.

Underdrain shall be bedded in crushed stone wrapped in the appropriate geotextile fabric. Storm drain warning tape shall be placed twelve (12) inches above the utility. All daylighted underdrain shall have either a pre-cast concrete headwall or a masonry headwall along with a rodent proof end grate installed at the outlet.

Drain Laterals

1. Storm drain service taps will be accomplished using a sanitary tee connection at the main in accordance with the International Plumbing Code, as adopted.
2. Perimeter drain laterals shall be bedded in ¾-inch crushed stone from the top of the pipe to 6-inches below the invert.
3. Drain cleanouts for house service connections shall be installed at the building foundation or as directed by the City Engineer or representative.
4. Building foundation drains that discharge to daylight shall have a rodent proof end grate installed at the out-flow end of the pipe along with a pre-cast concrete headwall or a masonry headwall.

5. Should a building foundation perimeter drain discharge near a pond, stream bed, or an area subject to flooding then a check valve shall be installed before the outlet.
6. Shallow drains (less than 4-feet of cover) may require frost protection should they cross under paved areas. In no case, shall insulation be placed without the permission of the City Engineer or representative.
7. For sump pump installations: 1-1/2-inches or 2-inches - polyethylene pressure pipe can be used to carry ground water from the foundation drain.
8. A cast iron cleanout box with a cover marked "drain" is required over all cleanouts.

Slope Stabilization

Maximum slopes for earthen structures intended for vegetation shall be 3:1. The use of slope stabilization products for slopes equal to or greater than 3:1 such as Geotextile fabrics or other approved alternatives are strongly encouraged in lieu of stone fill where conditions permit.

Should the Contractor request the use of stabilization products in lieu of stone fill as shown on the approved design plans, the Contractor shall obtain a written description of the proposed geotextiles and the stability of the slope using the proposed product from the design engineer and submit same to the City Engineer or representative for review.

Stone Fill Requirements

Where indicated or required to stabilize a particular slope or water course, stone fill shall be graded as shown on the approved design plans.

If the approved design plans do not indicate the type of stone, the size, etc. for the slope or pipe outfall to be stabilized, the Contractor shall contact the design engineer to determine the proper material and size to be used. The information shall be supported by type of design storm, design method, piping system, etc. All information shall be submitted to the City Engineer or representative for review prior to the placement of the material.

<u>Stone Fill</u>	<u>Minimum Depth</u>
Class A	24"
Class B	18"
Class C	12"

Safety Barriers

Should perimeter fencing be required as shown on the approved design plans where hazardous conditions are identified, a 6-foot minimum height fence with a 14-foot access gate shall be constructed, using standard chain link fabric.

D. Inspection Requirements

Visual Inspections

Visual inspections of drain pipe will be performed to assure compliance with Construction Standards. Visual inspections are normally required to confirm the hydraulic integrity of Storm drains. Pipe must be sound and flawless. Cracked, chipped or deformed pipe must be replaced. Pipelines are required to be true to alignment and at a uniform slope between structures. "Ponding" or deviations in alignment will be cause for rejection. The Engineering Services Division shall determine if the ponding or deviations in alignment are cause for rejection during the review of the Storm drain video prepared by the Contractor.

Infiltration:

Storm drain systems are inspected for infiltration visually and by video camera. Should infiltration be observed, other than minor signs of moisture, repair or replacement will be required.

Observation for Uniformity of Flow:

Water used to flush lines will be observed for uniformity of flow through each pipeline from structure to structure.

Video Inspection

1. All pipelines will be subject to the scrutiny of a video inspection prior to acceptance to assure proper jointing and flow characteristics. The Engineering Services Division shall determine if the ponding or deviations in alignment are cause for rejection **All video inspections shall be performed by the City of Concord General Services Department, unless otherwise determined by the City Engineer or representative.**
2. Camera inspections will not be scheduled until construction of other utilities in the same area are completed and the pipeline under consideration has been backfilled and compacted to subgrade elevation for at least thirty days prior to the scheduled inspection. The Contractor shall contact General Services to schedule the inspection.
3. Cleaning of the system, equipment, inspections and data reporting shall be done in accordance with the Pipeline Assessment and Certification Program (PACP).
4. All structures are to be accessible to the video inspection vehicle and all pipelines shall be cleaned of all debris prior to the inspection. The presence of debris or insufficient flushing water will necessitate re-inspection following correction. Any debris in the pipe shall be removed at the next structure and will not be allowed to continue downstream in the system.
5. Video camera inspections will be performed after flushing the storm drain system with water containing a visible dye and allowed to drain. Excessive ponding or alignment deviation deemed by the City Engineer or representative is cause for rejection.
6. Only tractor-type units will be utilized for mainline inspections, push cameras will only be allowed for lateral inspections.
7. The camera shall have pan and tilt capabilities.
8. The camera shall be approved by the manufacturer for the pipe size being inspected (typical camera is rated for 8"-24", without additional accessories).
9. Optional: The camera should be equipped with an inclinometer (these only show the general trend of the pipe slope, not to be viewed alone as acceptance criteria).
10. The camera footage shall be shown on-screen.
11. The beginning of the inspection shall consist of a title screen that indicates the following information; date, time, location, company doing the inspection, Contractor that laid the pipe, type of structure, pipe size and material, and if structure numbers or line segments are not specifically labeled on the approved plans; than station numbers complete with right or left offsets shall be used to identify line segments.

12. When a lateral line is encountered during the inspection; the camera operator shall stop the camera unit and, using the pan and tilt function, inspect the lateral opening to the best of the camera's ability (dye should be introduced into the lateral, if feasible, to view flow characteristics).
13. When a questionable pipe joint is encountered during the inspection; the camera operator shall stop the camera unit and using the pan and tilt function, inspect the joint to the best of the camera's ability. (Operator should also traverse the joint with the camera unit to observe the amount of drop/rise the camera experiences over questionable joints).
14. When a sag is encountered during the inspection; the camera operator shall record the beginning and end of said sag, if of questionable depth, then the operator shall drag a ½" tall non-buoyant object through the sag with the camera unit to observe and record actual depth.
15. All defects observed shall be logged into some sort of data management software (PACP compliant) and compiled into a video report to be submitted with the video inspection.
16. All video inspection submittals shall be in digital format on a flash drive or DVD. VHS will not be accepted.
17. Any submittal not meeting these requirements will be rejected.
18. **All costs associated with the video inspection shall be the responsibility of the Contractor, Developer, Owner unless otherwise determined by the City Engineer or representative. Contact the General Services Department for the current fee schedule.**

E. Testing Requirements

Deflection Test

Deflection test will be required on all flexible pipes. Concrete and Ductile Iron are considered to be rigid pipe.

HDPE Testing

Deformation testing will be required and must not exceed five per cent (5%) of the inside pipe diameter in any axis.

Landscaping

A. Description

This work shall consist of preparing the soil and furnishing and applying seed of the type or types specified, fertilizer, limestone, and mulch if required, on all areas designated for turf establishment as shown on the plans or ordered.

This work also includes furnishing and installing landscaping materials, including all layout, fertilizing, soil conditioning, staking, guying, watering, excavating, weeding, herbicides, fungicides, pesticides, refertilizing as necessary, replanting as needed, and stake and guy removal after the establishment period, as shown on the plans or as ordered.

The installer shall be a firm having at least five years of successful experience planting trees of similar scope to each particular project. This would include handling and planting large specimen trees in urban areas.

B. Materials

Loam, Seed, & Slope Stabilization

1. **Loam / Screened Loam:** Loam shall meet the requirements of the NHDOT Standard Specifications, Section 641. In addition, loam shall be fertile, natural soil, typical of the locality, free from large stones, roots, sticks, clay, peat, weeds, and sod, and obtained from a naturally well drained area. It shall not be excessively acid or alkaline nor contain toxic material harmful to plant growth. The loam shall contain no particles over two (2) inches in diameter. When possible, topsoil from the proposed development shall be redistributed so as to provide the required cover. Screened loam to be used in lawn areas shall meet the above specification and shall contain no particles over three eighths (3/8) inch in diameter.
2. **Seed:** Seed shall meet the requirements of the NHDOT Standard Specifications, Section 644. Generally, Park Seed Type 15 shall be used on lawn areas and Slope Seed Type 44 shall be used for all slope work.
3. **Slope Stabilization Products:** Maximum slopes for intended for vegetation shall be 3:1. The use of slope stabilization products for slopes equal to or greater than 3:1 such as Geotextile fabrics or other approved alternatives are strongly encouraged in lieu of stone fill where conditions permit.

Should the Contractor request the use of stabilization products in lieu of stone fill as shown on the approved design plans, the Contractor shall contact the design engineer for the project and a written letter describing the proposed geotextiles and the stability of the slope using the proposed product shall be submitted to the City Engineer or representative for review and approval.

Recommended Street Trees

Street tree species should be native or non-invasive species appropriate for an urban environment, soil conditions, and climate. Proposed trees species should be selected to encourage biological diversity and high wildlife habitat value.

If a tree is not chosen from this list it has to be approved by the City Representative before installation.

Ornamental Trees (suitable for under utility wires)

Amur Maple (*Acer ginnala*), "Flame" or "Ruby Slipper", single stem
Paperbark Maple (*Acer griseum*)
*Serviceberry (*Amelanchier sp.*)
Eastern Redbud (*Cercis canadensis*)
Amur maackia (*Maackia amurensis*)
Crab apple (*Malus sp.*), fruitless varieties
Sourwood (*Oxydendrum arboretum*)
Sargent Cherry (*Prunus sargentii*), "Columnaris" or "Pink Flair"
Canada Red Cherry (*Prunus virginiana*) "Schubert"
Kwanzan Flowering Cherry (*Prunus serrulata*)
Japanese Lilac (*Syringa reticulata*)

Shade Trees

Armstrong Maple (*Acer x freemanii* 'Armstrong')
*Red Maple varieties (*Acer rubrum*)
*Sugar Maple (*Acer saccharum*)
Horsechestnut (*Aesculus carnea*), "Fort McNair"
*American Hornbeam (*Carpinus caroliniana*)
Katsuratree (*Cercidiphyllum japonicum*)
Yellowwood (*Cladrastis kentukea*)
*American Beech (*Fagus grandifolia*)
Thornless Honey Locust (*Gleditsia triacanthos inermis*) "Shademaster", "Skyline," or "Halka" - avoid "Sunburst" variety
Kentucky Coffeetree (*Gymnocladus dioica*) "Espresso" or other seedless varieties only
Sweetgum (*Liquidambar styraciflua*)
Tulip Tree (*Liriodendron tulipifera*)
Dawn redwood (*Metasequoia glyptostobodies*)
*Tupelo (*Nyssa sylvatica*)
*Sycamore (*Platanus occidentalis*) "Liberty" or "Bloodgood"
*Northern Red Oak (*Quercus rubra*)
*White Oak (*Quercus alba*)
Pin Oak (*Quercus palustris*)
*American Linden (*Tilia americana*)
*American Elm (*Ulmus americana*) "Valley Forge", "Princeton" or other DED resistant varieties only

*Native to the Northeast

C. Construction Requirements

Loam, Seeding and Slope Stabilization

1. **Loam:** All disturbed land shall be covered with loam with a rolled minimum compacted depth of at least six (6) inches. When possible, topsoil from the proposed development shall be redistributed so as to provide the required cover.
2. **Seeding and initial fertilizing:** Seeding and initial fertilizing shall be done between April 1 and June 1, or between August 15 and October 15.
3. **Windy weather or frozen ground requirements:** Seeding shall not be done during windy weather or when the ground is frozen, excessively wet or otherwise untillable.
4. **Preparation for seeding:** All areas to be seeded shall be prepared to provide a reasonably firm but friable seed bed. All areas shall meet the specified grades and shall be free from weed growth and debris. **Protection and care:** The Contractor shall be responsible for protecting and caring for the seeded area until final acceptance of the work.
5. **Watering:** The seeded areas shall be carefully and suitably watered as necessary to produce a satisfactory growth.
6. **Re-seeding requirements:** Any part of the seeded areas that fail to show a uniform stand shall be re-seeded until all areas are covered with grass.

Street Trees

1. Trees benefit the City as a whole both functionally and aesthetically and shall be preserved in the development of building sites.
2. All trees and plants including the root ball dimensions or trunk size caliper ratio shall conform to ANSI Z60.1 "American Standard for Nursery Stock" latest edition.
3. Trees shall have a caliper no less than two and one-half (2 ½) to three (3) inches at the time of planting. The caliper of a tree is the diameter of the tree measured at six (6) inches from the ground for trees four (4) inches and under in caliper and measured at twelve (12) inches from the ground for trees measuring over four (4) inches in caliper
4. The Contractor shall provide healthy stock, grown in a nursery and reasonably free of die-back, disease, insects, eggs, bores and larvae. At the time of planting all plants shall have a root system, stem and branch form that will not restrict normal growth, stability and health for the expected life of the plant. Refer to all Landscaping Details for acceptable crown observations for high and low branched trees as well as acceptable root observations.
5. Tree planting shall be performed during those periods when weather and soil conditions are suitable for planting, typically May through October.
6. No trees are to be planted within 30-feet of an intersection.
7. Plantings shall not be placed in locations that inhibit sight distance per AASHTO Policy, Geometric Design of Highways and Streets.

8. Only City approved trees will be planted under aerial utilities.
9. Trees planted with City funds must be planted within 10-feet of the right-of-way so as to benefit the public.
10. Trees to be located to avoid conflicts with underground utility services.
11. All wire and burlap material shall be removed from the root ball before planting.
12. The Contractor agrees to replace defective work and defective trees for two years after the date they were planted. If a tree has to be replaced the contractor agrees to warranty this replacement tree for two years.
13. The Contractor agrees to remove all tree wrap, ties and guying unless agreed to by the City's representative to remain in place at the end of the two year warranty period.

D. Inspection Requirements

Visual Inspections

The City's representative shall visually inspect all landscaping items prior to placement for any new subdivisions or city projects.

Erosion Prevention and Sediment Control

A. Description

Permanent control:

This work shall consist of furnishing and placing hay mulch, bark mulch, wood, straw or coconut fiber mat, synthetic mat, paper mat, jute mesh or other material as a soil stabilization product for erosion prevention and sediment control on slopes or ditches for protection to hold the ground and/or cover material (loam, sod, seed, etc.) in place, at locations shown on the plans or where ordered.

Temporary control:

This work shall consist of furnishing, stockpiling, placing, installing, sowing, maintaining, and removing temporary erosion prevention and sediment control devices at locations shown on the plans, or where ordered. Erosion prevention and sediment control device examples include: temporary seeding, silt fence, temporary mulch, stone check dams, and erosion stone.

B. Materials

Mulch

Hay mulch shall consist of cured hay, free from noxious weeds and rough or woody materials.

Bark mulch shall be bark chippings graded to approximately 3/8" to 2" width. The chippings shall not have been stored so long and under such conditions that the material has decomposed sufficiently so that it has lost its fibrous texture. Bark mulch must be approved as to grading and condition prior to its use.

Temporary mulches may be hay, straw, fiber mats, netting, wood cellulose, bark, chips or other acceptable material and shall be reasonably clean and free of noxious and materials toxic to plant growth.

Soil Stabilization

The soil stabilization materials furnished shall be of sufficient construction and strength to hold the processed ground and/or cover material (loam, sod, seed, etc.) in place until an acceptable growth of natural or planted material is established.

Grass Seed for erosion control shall be one of the following:

1. Seed for temporary control shall be a quick growing species suitable to the area, such as annual or perennial ryegrass, providing a temporary cover which will not compete with the grasses subsequently sown for permanent cover.
2. Seed for a more permanent control shall be of the type specified in the plans or as set forth in NHDOT 644.

Geotextile filter fabric for silt fence shall be made from polypropylene, polyester, or other approved polymeric chemically stable material and be resistant to ultra violet radiation degradation for at least 12 months. Silt retention capacity shall be no less than 75 percent of silt and suspended solids.

Posts for silt fence shall be either wood or steel. Wood posts shall be sound quality hardwood with a minimum cross sectional area of 1.6 square inches. Steel posts shall be stand T or U section

weighing not less than 1 pound per linear ft with projections for fastening wire to the fence. Maximum post spacing shall be 10 ft.

Staples for soil stabilization material matting shall be those specified by the manufacturer.

C. Construction Requirements

Permanent and Temporary erosion prevention and sediment control measure shall be incorporated into the project at the earliest practicable time, as specified on the plans. Temporary measures shall be installed prior to the start of construction, maintained during construction, and removed after final site stabilization has been obtained. An area shall be considered “stabilized” when it is in a condition in which the soils on the site will not erode under the conditions of a 10-year storm. Temporary measures shall also be used to correct conditions that develop during construction to temporarily control erosion not associated with permanent control features.

All areas of disturbance must have temporary or permanent stabilization within 21 days of initial disturbance. After this time, any disturbance in the area must be stabilized at the end of each work day. The following exceptions apply:

1. Stabilization is not required if earthwork is to continue in the area within the next 24 hours and there is no precipitation forecast for the next 24 hours.
2. Stabilization is not required if the work is occurring in a self-contained excavation (i.e. no outlet) with a depth of 2 feet or greater (e.g. house foundation excavation, utility trenches).

All areas of disturbance must have permanent stabilization within 48 hours of reaching final grade.

D. Inspection Requirements

Personnel shall visually inspect all erosion control measures and cleared and graded areas of the construction site at least once every 7 calendar days and within 24 hours of the end of a storm event of 0.5 inches or greater, during the construction season.

The inspection will verify that any erosion control measures are in good condition. Discharge locations will be inspected to verify that pollutants are not entering the stormwater conveyance systems. Vehicle access points will be inspected for evidence of off-site sediment tracking. Any off-site accumulations of sediment will be immediately removed, and the area will be restored to pre-construction conditions.

Site Work

Driveways

1. **Drive entries:** All drive entries shall be located as shown on the approved plans or as directed by the City Engineer or representative.
2. **Locating driveways not shown on the approved plans:** In those areas where the driveways are not located on the approved plans or the proposed driveway location is in question, the Developer/Owner/Contractor shall contact their design engineer and a written letter verifying the sight distance and a plan sheet showing the proposed location of the driveway shall be submitted to the City Engineer or representative for review. **No Driveway Permits will be authorized when the driveway is not shown or is in question. The City of Concord is not responsible for the layout of any commercial or residential driveway.**
3. **Physical dimensions:** Drives shall be located at a minimum of 5-feet from property lines. Placement of the drive is dependent upon the location (Urban or Rural) within the City of Concord.
4. **Drive aprons:** In subdivisions where sidewalks are required the drive aprons shall be paved to the back of sidewalk. In those areas where there is no sidewalk, the drive aprons shall be paved for a minimum of 10-feet from the gutter.
5. **Drive openings:** Drive openings on residential streets shall be a maximum of 28-feet wide at the right-of-way. Should the driveway lie within a vertical curbed section, the curbs on each side of the drive opening shall be tipped down with curb at least 7-feet long.
6. **Construction requirements:** Minimum construction requirements for driveways shall be as follows:
 - 6-inches crushed gravel
 - 3-inches hot bituminous pavement (1½" of ¾" aggregate base course and 1 ½" of ½" aggregate wearing course)
7. **Grades:** Driveway grades shall adhere to the City of Concord's Construction Details.

Dumpster Pads

Dumpster pads and associated screening shall be placed where the refuse bins can be accessed with a single turning movement with a 35' front loading truck. The width of the gate should be taken into account when reviewing turning movements. Dumpster pads shall be located a minimum 25-feet from any drainage structure, inlet, or stormwater facility. See the City of Concord's Construction Details for additional information.

Monitoring Wells

1. No less than 12" of horizontal separation shall be maintained between the monitoring well and any existing underground utility.
2. The well box shall be structurally sound and strong enough to support vehicular traffic. It shall be traffic rated as tested by an official testing laboratory to meet AASHTO standard for "H-20" truck loadings.
3. The top of the well shall be permanently marked with large letters "monitoring well"
4. The well cover shall be bolted down, or equivalent, to provide protection against unauthorized access.
5. The well cover shall be water-tight to protect against entry of surface water.
6. The top of the well shall be set 1.0" to 1.5" above surrounding grade to provide for drainage away from the cover, except for wells installed in sidewalk or paved areas where top of the concrete pad shall be installed flush and match existing conditions.

7. A concrete pad with a minimum thickness of 6" shall be constructed around the well box. The pad shall extend laterally a minimum of 12" from outside of the well box. The pad shall be constructed to be free of cracks or other defects likely to affect water tightness.
8. A locking watertight well cap shall be installed at the top of the well casing so that surface water that may enter the vault will not enter the well.

Retaining Walls

Any retaining wall proposed on any site (private or public) having a minimum height 4-feet or greater, **must be approved by the Engineering Services Division.** Detailed shop drawings, stamped and signed by a licensed structural engineer registered in the State of New Hampshire, shall be submitted to Engineering Services at least **3 weeks** prior to the construction of the proposed wall. Shop drawings submittals not bearing the stamp and signature of the structural design engineer shall be rejected.

Retaining walls constructed without an approved set of plans by a registered structural engineer and the City Engineer or representative are subject to removal and the wall will be reconstructed.

The Engineering Services Division has the right to refuse to sign-off on a Certificate of Occupancy Permit if a retaining wall located on any site has not been approved by a registered structural engineer and the City Engineer or representative, and the workmanship is in question.

Private Utilities

All underground utilities are to be placed immediately after preparation of the roadway to subgrade, yet prior to placement of select roadway materials in streets under construction. **ALL underground utilities shall have warning** tape installed in the trench twelve (12) inches above the utility. Tracer wires shall be placed, as a minimum, along all non-traceable **utilities within the right-of-way.**

When underground utilities are encountered, the Contractor shall notify the appropriate agency to assure proper construction procedure in that area. Any damage to a utility is to be reported to and repaired by that utility prior to backfilling.

Any poles, structures, conduits, cables or wires, the location of which **have already been approved** by the local land use board as part of a subdivision, site plan, or other development approval, shall, if such location becomes a public highway, be deemed legally permitted or licensed without further proceedings under RSA 231:160-a provided, that copies of the appropriate utilities' easements, work plans, or other data showing locations of such structures, are submitted to the municipality for recording purposes.

Any poles, structures, conduits, cables or wires, the location of which **have not been approved** pursuant to RSA 231:160-a, shall, pursuant to Concord Code of Ordinance Article 5-4 be subject to the approval of the City's Poles and Wires Committee through the Engineering Services Division.

Abandoned or unused utilities that are required to be discontinued, sealed, or removed within the scope of a project shall be completed prior to placement of selects or finished materials such as gravel, pavement, and landscaping.

Electric

The Engineering Services Division requires all underground electric conductors to be contained within rigid conduits at all road crossings. Crossings shall be perpendicular to the roadway whenever possible.

Conduit Required: These requirements apply to all primary and secondary electric service installations within the paved area of the street and extending to a point at least 3-feet, measured perpendicular to the traveled way, beyond the edge of pavement.

1. 5-inch (min) diameter Schedule 80 PVC or 5-inch (min) diameter rigid steel conduit (Contractor's option).
2. Encasement with low strength concrete (Flowable Fill, NHDOT Class F, Item 520.421) may be allowed for thin walled communication conduit installations.
3. Electrical Site Work must be performed by Licensed Electrical Contractors only - **not General Contractors.**

Municipal Cables

Municipal fire alarm cable and traffic signal installations are under the jurisdiction of the Fire Department's Alarm / Traffic Division – (225-8667). This division is to be notified prior to any street alterations especially at signal controlled intersections.

Gas, Telephone, and Cable TV

These underground utility service installations shall cross streets perpendicular to the traveled way in a straight trench, and at a uniform depth at least 12 inches below subgrade. These utilities will be protected under paved areas in conduit and in the manner prescribed by that utility.

Fiber Optic Cable

Fiber optic cables shall be installed according to the approved design plans. Where the utility crosses City streets, steel, PVC or HDPE casing pipes shall be used. Tracer wires shall be placed above the conduit in the trench for all fiber optic cable installations. Additional conduit for expansion, replacement, or use by other utilities should be included in the installation.

Utility Conflicts

Utility service lines (municipal and private) are to be laid out and installed to avoid crossings whenever possible. Overhead utilities and landscaping should be considered obstructions when proposing a new service location.

Appendices

A. Backflow Prevention Devices

B. Traffic Signal Systems

*Replacement pg 161
FOR exhibit # 2
Tab 6 of original
Filing*

Liberty Utilities (EnergyNorth Natural Gas) Corp. d/b/a Liberty Utilities

DG 16-449

2016 Cast Iron/Bare Steel Replacement Program Results

Staff Data Requests - Set 2

Date Request Received: 5/19/16
Request No. Staff 2-1

Date of Response: 5/25/16
Respondent: David Simek

REQUEST:

Ref. Attachment GMC-ITC-1, Bates p. 27, Table 1. Please calculate the revenue requirement without the FY 2015 remaining carry-over costs of \$514,440 and provide revised Exhibits DBS-1 through DBS in both hard copy and Excel.

RESPONSE:

Exhibits DBS-1 and DBS-2 are the only two exhibits that change when we remove the FY 2015 remaining carry-over costs of \$514,440. Attachment Staff 2-1.1.xlsx is the Microsoft Excel version of Revised Exhibit DBS-1 and Attachment Staff 2-1.2.xlsx is the Microsoft Excel version of Revised Exhibit DBS-2. A hard copy of both Revised Exhibits is provided as Attachment Staff 2-1.3.