THE CITY OF DAYTONA BEACH
OFFICE OF THE PURCHASING AGENT

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ADDENDUM NO. 1

DATE: **September 12, 2018**

PROJECT: **RFP 0118-2600**
2018 CURED IN PLACE PIPE (CIPP) REHABILITATION SERVICES TERM CONTRACT

OPENING DATE: ~~**September 17, 2018**~~ **October 2, 2018**

This addendum is hereby incorporated into the Bid/Proposal documents of the project referenced above. The following items are clarifications, corrections, additions, deletions and/or revisions to and shall take precedence over the original documents. Additions are indicated by underlining, deletions are indicated by ~~strikethrough.~~

1. The Bid Item Schedule is REVISED and ATTACHED. It is also available as a protected Excel spreadsheet. Proposers are encouraged to use this protected spreadsheet when preparing their Proposal. *Failure to use the revised Bid Item Schedule will render the Proposal non-responsive and ineligible for consideration of award.*

2. General Conditions, Section 18, Paragraph A is hereby REVISED to read as follows:

   "Ability of the Proposer and Performance of the Product:
   "Submit up to ~~5~~ **20** similar projects performed by the Proposer with at least 25% of those project performed in the State of Florida, completed within 5 years of the due date of this RFP, to verify the Proposer's performance on similar work in similar conditions as those found in the City of Daytona Beach. Provide references for each similar project submitted. Reference list shall include name and address of company/municipality, contact name; telephone number; email address, and date of installation completion. *Experience in coastal community systems is preferred.* ~~If the CONTRACTOR has installed the product for The City of Daytona Beach, the CONTRACTOR must include the CITY as a reference.~~

   "Provide a definitive statement from the manufacturer that the product meets the Minimum Qualifications in Special Instructions for the product as well as ASTM F1216-16 Standards.

   "Provide a letter from the Proposer's Surety confirming a minimum bonding capacity of $200,000 accompanied by a signed Power of Attorney.

“Weight = 25”

3. General Conditions, Section 18, Paragraph C is hereby REVISED to read as follows:

   “C. **Approach to the Scope of Work - CIPP**

   “Provide a narrative of the project approach to be used for the CIPP lining of sanitary sewer mains and stormwater mains in systems with similar site conditions as those found in the City of Daytona Beach. Discuss any product restraints or restrictions.

   “CONTRACTOR shall provide a complete list of all equipment/vehicles to be used on this contract (to include year, make and model numbers.) Provide definitive statement from the manufacturer that the ***equipment*** meets requirements for use and insertion of the resin impregnated line.

   “Weight = 10”

4. General Conditions, Section 18, Subsection E, first paragraph, is hereby REVISED to read as follows:

   “**Adequacy of the Proposer’s Safety Practice and History**

   “Provide documentation, OSHA logs and references to verify the safety practices and safety history of the Proposer and sub-contractors proposed to perform work in the City of Daytona Beach. Proposer and all sub-contractors related to the performance of this contract shall provide copies of their company’s safety logs submitted to the Occupational Health and Safety Administration (OSHA) including all OSHA cited violations for the ~~2013, 2014 and 2015~~ 2015, 2016, and 2017 calendar years with the Proposal. **Proposals lacking the OSHA logs will be rejected as non-responsive.** OSHA logs will not count towards the 100 page Proposal limit and should be included as an attachment to the Proposal.”

5. Scope of Work, Section II, 1st paragraph, 8th line, is hereby CHANGED to read, “…~~standard F1216-09~~ Designation F1216-16 and all applicable CITY, manufacturer…”

6. ASTM Designation F1216-16, referenced as Attachment A in Scope of Work, III, first paragraph, 2nd line is ATTACHED.

7. Scope of Work, Section III, ADD the following sentence the end of the 1st paragraph, “All thicknesses expressed on the Bid Item Schedule are the *finished thicknesses* of the liner after curing.”

8. Scope of Work, Section VII.K., add the following to the end of the last sentence, “…in accordance with ASTM Designation F2454-05, attached as Attachment B.”

9. Answers to Proposers’ written questions:

Question #1: Can the City please include specifications for Lateral CIPP Lining – Top Hat/Full Wrap – Up To 36” (Item Q)

Answer #1: All lateral lining contractors must meet ASTM Designation F1216-16.

Question #2:It appears line item Q-2 (Lateral Cutout) may be a duplicate of Ancillary General Services line item SS (Standard Services Reconnection). Can the City confirm both of these line items are valid? Or are they duplicates?
Answer #2: Item SS – Standard Services Reconnection does not include a liner for the lateral.

Question #3: It appears line item Q-3 (Lateral Grout) may be a duplicate of Ancillary General Services line item TT (Service Connection Pressure Grouting). Can the City confirm both of these line items are valid? Or are they duplicates?
Answer #3: Item WW Service Connection Pressure Grouting, has been deleted and the Bid Item Schedule *revised*.

Questions #4: Are line items R-1 (Interior Manhole Application – Precast) and R-2 (Interior Manhole Application – Brick) supposed to be measured in SF or VF?
Answer # 4: SF.

Question #5: Line item V-1 Manhole Cleaning is located under the sanitary portion of the bid tab. But line item AAA Manhole Cleaning is located under Ancillary General Services. Is V-1 a duplicate of AAA? Or should AAA be under the storm portion?
Answer #5: AAA Manhole Cleaning, has been moved under the stormwater items and the Bid Item Schedule *revised*.

Question #6: For Manhole/Lift Station Refurbishment Line Item (Section R) – there are no specifications informing the contract as to which application the City would prefer. (Ex: cementitious, epoxy, etc.) Can the City please specify which application to use?
Answer #6: Raven Type, Agru Retrofit, or approved equal

Question #7: For line item R-5 (Bench/Invert Repair) – more than likely, the City meant to have a quantity of around 100 for this line item rather than 2,000. Can the City please confirm the correct number of bench/invert repair quantities?
Answer #7: The quantity has been revised on the Bid Item Schedule to 200.

Question #8: For Line Reconstruction SDR 26 Less Than 10' Depth (Section T) and Line Reconstruction C900 Greater than 10' Depth (Section U): Is the intent of the sections meant for point repairs? If so, what is the limit? 10', 20'?
Answer #8: Intent is to replace pipe sections that are not able to be lined with SDR 26 or C-900. These items have been changed to a bid alternate.

Question #9: Are sections YY (Line Reconstruction Greater than 8' Depth) and ZZ (HDPE Line Reconstruction Less than 8') supposed to be under Ancillary General Services? Or are they supposed to be under the Stormwater section?
Answer #9: These items have been changed to a bid alternate.

Question #10: For line item DDD (Erosion and Sediment Control): What are the limitations on erosion control? What would be considered one unit of measure? Would the City consider this more of an allowance item than a bid item?
Answer #10: The City has revised the bid tabulations sheet to include unit pricing for gutter buddies, silt fence and floating turbidity barriers in lieu of a unit price for Erosion and Sediment Control.

Question #11 E. Adequacy of the Proposer's Safety Practice and History, page 8, states. "Proposer and all sub-contractors related to the performance of this contract shall provide copies of their company's safety logs submitted to OSHA including all OSHA cited violations for the 2013, 2014, and 2015 calendar years with the Proposal."
Can you confirm these are the years to be submitted?

Answer #11: Please refer to Item 4, above, that changes the dates of the OSHA logs to 2015-2017.

Question #12: Will the City consider extending the bid date for at least an additional week? The answers to many of these questions will play an extremely important of this bid's financials. Getting these answers in a timely manner then accounting for correct costs will take additional time.

Answer #12: The City will extend the bid closing date to Tuesday, October 2, 2018

Question 13: Please provide the Bid Tabulation from the last solicitation.

Answer 13: The Bid Tab from ITB 0113-1010 is ATTACHED.

10. Estimated annual budget for CIPP is $500,000.

11. All other terms and conditions remain the same.

The Proposer shall acknowledge receipt of this addendum in the transmittal letter covering their Proposal.

The City of Daytona Beach

Joanne Flick, CPPO, CPPB
Purchasing Agent

Remember to register with the City of Daytona Beach at www.vendorregistry.com to be notified of future bid opportunities with the City.

As of 9-30-18 we will no longer be using our current system.

REVISED BID ITEM SCHEDULE

	CIPP REHABILITATION - SANITARY SEWER MAINS				
ITEM	**DESCRIPTION**	**ESTIMATED QUANTITY**	**UNIT OF MEASURE**	**UNIT PRICE**	**EXTENDED PRICE**
A	**8" diameter**				
A-1	6.0 mm normal thickness (.236”)	10,000	LF	$	$
A-2	7.5 mm normal thickness (.295”)	10,000	LF	$	$
A-3	9.0 mm normal thickness (.354”)	5,000	LF	$	$
				TOTAL "A"	$
B	**10" diameter**				
B-1	6.0 mm normal thickness (.236”)	400	LF	$	$
B-2	7.5 mm normal thickness (.295”)	400	LF	$	$
B-3	9.0 mm normal thickness (.354”)	400	LF	$	$
				TOTAL "B"	$
C	**12" diameter**				
C-1	6.0 mm normal thickness (.236”)	400	LF	$	$
C-2	7.5 mm normal thickness (.295”)	400	LF	$	$
C-3	9.0 mm normal thickness (.354”)	600	LF	$	$
				TOTAL "C"	$
D	**15" diameter**				
D-1	6.0 mm normal thickness (.236”)	400	LF	$	$
D-2	7.5 mm normal thickness (.295”)	400	LF	$	$
D-3	9.0 mm normal thickness (.354”)	600	LF	$	$
				TOTAL "D"	$
E	**18" diameter**				
E-1	6.0 mm normal thickness (.236”)	300	LF	$	$
E-2	7.5 mm normal thickness (.0295”)	300	LF	$	$
E-3	9.0 mm normal thickness (.354”)	300	LF	$	$
E-4	10.5 mm normal thickness (.413”)	200	LF	$	$
				TOTAL "E"	$
F	**21" diameter**				
F-1	6.0 mm normal thickness (.236”)	300	LF	$	$
F-2	7.5 mm normal thickness (.295”)	300	LF	$	$
F-3	9.0 mm normal thickness (.354”)	300	LF	$	$
F-4	10.5 mm normal thickness (.413”)	300	LF	$	$
F-5	12.0 mm normal thickness (.472”)	200	LF	$	$
F-6	Charge for each 1.5 mm thickness increase per LF exceeding 12.0 mm	100	LF	$	$
				TOTAL "F"	$

	CIPP REHABILITATION - SANITARY SEWER MAINS				
ITEM	**DESCRIPTION**	**ESTIMATED QUANTITY**	**UNIT OF MEASURE**	**UNIT PRICE**	**EXTENDED PRICE**
G	**24" diameter**				
G-1	9.0 mm normal thickness (.354”)	300	LF	$	$
G-2	10.5 mm normal thickness (.413”)	300	LF	$	$
G-3	12.0 mm normal thickness (.472”)	300	LF	$	$
G-4	13.5 mm normal thickness (.531”)	300	LF	$	$
G-5	15.0 mm normal thickness (.591”)	200	LF	$	$
G-6	Charge for each 1.5 mm thickness increase per LF exceeding 15.0 mm	100	LF	$	$
				TOTAL "G"	$
H	**27" diameter**				
H-1	9.0 mm normal thickness (.354”)	100	LF	$	$
H-2	10.5 mm normal thickness (.413”)	100	LF	$	$
H-3	12.0 mm normal thickness(.472”)	100	LF	$	$
H-4	13.5 mm normal thickness (.531”)	50	LF	$	$
H-5	15.0 mm normal thickness (.591”)	50	LF	$	$
H-6	Charge for each 1.5 mm thickness increase per LF exceeding 15.0 mm	100	LF	$	$
				TOTAL "H"	$
I	**30" diameter**				
I-1	9.0 mm normal thickness (.354”)	100	LF	$	$
I-2	10.5 mm normal thickness (.413”)	100	LF	$	$
I-3	12.0 mm normal thickness (.472”)	100	LF	$	$
I-4	13.5 mm normal thickness (.531”)	100	LF	$	$
I-5	15.0 mm normal thickness (.591”)	100	LF	$	$
I-6	Charge for each 1.5 mm thickness increase per LF exceeding 15.0 mm	100	LF	$	$
				TOTAL "I"	$
J	**36" diameter**				
J-1	10.5 mm normal thickness (.413”)	100	LF	$	$
J-2	12.0 mm normal thickness (.472”)	100	LF	$	$
J-3	13.5 mm normal thickness (.531”)	100	LF	$	$
J-4	15.0 mm normal thickness (.591”)	100	LF	$	$
J-5	16.5 mm normal thickness (.650”)	100	LF	$	$
J-6	18.0 mm normal thickness (.709”)	100	LF	$	$
J-7	Charge for each 1.5 mm thickness increase per LF exceeding 18.0 mm	100	LF	$	$
				TOTAL "J"	$

	CIPP REHABILITATION - SANITARY SEWER MAINS				
ITEM	**DESCRIPTION**	**ESTIMATED QUANTITY**	**UNIT OF MEASURE**	**UNIT PRICE**	**EXTENDED PRICE**
K	**42" diameter**				
K-1	10.5 mm normal thickness (.413”)	100	LF	$	$
K-2	12.0 mm normal thickness (.472”)	100	LF	$	$
K-3	13.5 mm normal thickness (.531”)	100	LF	$	$
K-4	15.0 mm normal thickness (.591”)	100	LF	$	$
K-5	16.5 mm normal thickness (.650”)	50	LF	$	$
K-6	18.0 mm normal thickness (.709”)	50	LF	$	$
K-7	Charge for each 1.5 mm thickness increase per LF exceeding 18.0 mm	100	LF	$	$
				TOTAL "K"	$
	TOTAL "A" THRU "K"				$
	CLEAN & INSPECTION - SANITARY SEWER MAINS				
L	**Light Cleaning and Inspection**				
L-1	8” – 12” diameter	6,000	LF	$	$
L-2	14” – 18” diameter	6,000	LF	$	$
L-3	20” – 24” diameter	6,000	LF	$	$
L-4	27” – 42” diameter	6,000	LF	$	$
L-5	48” – 72” diameter	6,000	LF	$	$
				TOTAL "L"	$
M	**Medium Cleaning**				
M-1	8” – 12” diameter	6,000	LF	$	$
M-2	14” – 18” diameter	6,000	LF	$	$
M-3	20” – 24” diameter	6,000	LF	$	$
M-4	27” – 42” diameter	6,000	LF	$	$
M-5	48” – 72” diameter	6,000	LF	$	$
				TOTAL "M"	$
N	**Heavy Cleaning**				
N-1	8” – 12” diameter	6,000	LF	$	$
N-2	14” – 18” diameter	6,000	LF	$	$
N-3	20” – 24” diameter	6,000	LF	$	$
N-4	27” – 42” diameter	6,000	LF	$	$
N-5	48” – 72” diameter	6,000	LF	$	$
		6,000	LF	$	$
				TOTAL "N"	$
O	**Root Removal**				
O-1	8” – 12” diameter	6,000	LF	$	$
O-2	14” – 18” diameter	6,000	LF	$	$
O-3	20” – 24” diameter	6,000	LF	$	$
O-4	27” – 42” diameter	6,000	LF	$	$
O-5	48” – 72” diameter	6,000	LF	$	$
				TOTAL "O"	$

	CLEAN & INSPECTION - SANITARY SEWER MAINS				
ITEM	**DESCRIPTION**	**ESTIMATED QUANTITY**	**UNIT OF MEASURE**	**UNIT PRICE**	**EXTENDED PRICE**
P	**Tuberculation Cleaning**				
P-1	8" – 12" diameter	6,000	LF	$	$
P-2	14" – 18" diameter	6,000	LF	$	$
P-3	20" – 24" diameter	6,000	LF	$	$
P-4	27" – 42" diameter	6,000	LF	$	$
P-5	48" – 72" diameter	6,000	LF	$	$
				TOTAL "P"	$
	TOTAL "L" THRU "P"				$
	SANITARY SEWER				
	LATERAL CIPP LINING-TOP HAT/FULL WRAP - UP TO 36"				
Q					
Q-1	Four (4) inch lateral connection per ASTM F1216-16	20	EA	$	$
Q-2	Six (6) inch lateral connection per ASTM F1216-16	20	EA	$	$
Q-3	Eight (8) inch lateral connection per ASTM F1216-16	20	EA	$	$
Q-4	Lateral lining 0 to 30' per ASTM F1216-16	100	LF	$	$
Q-5	Additional Lateral Lining > 30' per ASTM F1216-16	100	LF	$	$
Q-6	Lateral Cutout	20	EA	$	$
Q-4	Lateral Grout	20	EA	$	$
				TOTAL "Q"	$
	SANITARY SEWER				
	MANHOLE/LIFT STATION REFURBISHMENT				
R					
R-1	Interior Manhole Application (Precast)	2,000	SF	$	$
R-2	Interior Manhole Application (Brick)	2,000	SF	$	$
R-3	Interior Lift Station Application (Precast)	2,000	SF	$	$
R-4	Interior Lift Station Application (Brick)	2,000	SF	$	$
R-5	Bench/Invert Repair	200	EA	$	$
				TOTAL "R"	$
	SANITARY SEWER				
	CLEANOUT INSTALLATION				
ITEM	**DESCRIPTION**	**ESTIMATED QUANTITY**	**UNIT OF MEASURE**	**UNIT PRICE**	**EXTENDED PRICE**
S					
S-1	Four (4) inch cleanout	20	EA	$	$
S-2	Six (6) inch cleanout	20	EA	$	$
S-3	Eight (8) inch cleanout	20	EA	$	$
				TOTAL "S"	$

	MANHOLE CLEANING				
ITEM	**DESCRIPTION**	**ESTIMATED QUANTITY**	**UNIT OF MEASURE**	**UNIT PRICE**	**EXTENDED PRICE**
T	Manhole cleaning	2,000	SF	$	$
				TOTAL "T"	$
	TOTAL "Q" THRU "T"				$
	CIPP REHABILITATION - STORMWATER MAINS				
U	**8" diameter**				
U-1	6.0 mm normal thickness (.236")	500	LF	$	$
				TOTAL "U"	$
V	**10" diameter**				
V-1	6.0 mm normal thickness (.236")	400	LF	$	$
V-2	7.5 mm normal thickness (.295")	400	LF	$	$
				TOTAL "V"	$
W	**12" diameter**				
W-1	6.0 mm normal thickness (.236")	750	LF	$	$
W-2	7.5 mm normal thickness (.295")	750	LF	$	$
				TOTAL "W"	$
X	**15" diameter**				
X-1	6.0 mm normal thickness (.236")	1,000	LF	$	$
X-2	7.5 mm normal thickness (.295")	1,500	LF	$	$
X-3	9.0 mm normal thickness (.354")	1,000	LF	$	$
X-4	Charge for each 1.5 mm thickness increase per LF exceeding 9.0 mm	100	LF	$	$
				TOTAL "X"	$
Y	**18" diameter**				
Y-1	6.0 mm normal thickness (.236")	1,250	LF	$	$
Y-2	7.5 mm normal thickness (.295")	1,250	LF	$	$
Y-3	9.0 mm normal thickness (.354")	1,250	LF	$	$
Y-4	10.5 mm normal thickness (.413")	1,250	LF	$	$
Y-5	Charge for each 1.5 mm thickness increase per LF exceeding10.5 mm	100	LF	$	$
				TOTAL "Y"	$
Z	**21" diameter**				
Z-1	6.0 mm normal thickness (.236")	220	LF	$	$
Z-2	7.5 mm normal thickness (.295")	220	LF	$	$
Z-3	9.0 mm normal thickness (.354")	220	LF	$	$
Z-4	10.5 mm normal thickness (.413")	220	LF	$	$
Z-5	12.0 mm normal thickness (.472")	200	LF	$	$
Z-6	Charge for each 1.5 mm thickness increase per LF exceeding 12.0 mm	100	LF	$	$
				TOTAL "Z"	$

	CIPP REHABILITATION - STORMWATER MAINS				
ITEM	**DESCRIPTION**	**ESTIMATED QUANTITY**	**UNIT OF MEASURE**	**UNIT PRICE**	**EXTENDED PRICE**
AA	**24" diameter**				
AA-1	9.0 mm normal thickness (.354”)	700	LF	$	$
AA-2	10.5 mm normal thickness (.413”)	700	LF	$	$
AA-3	12.0 mm normal thickness (.472”)	700	LF	$	$
AA-4	13.5 mm normal thickness (.531”)	700	LF	$	$
AA-5	15.0 mm normal thickness (.591”)	700	LF	$	$
AA-6	Charge for each 1.5 mm thickness increase per LF exceeding 15.0 mm	100	LF	$	$
				TOTAL "AA"	$
BB	**27" diameter**				
BB-1	9.0 mm normal thickness (.354”)	220	LF	$	$
BB-2	10.5 mm normal thickness (.413”)	220	LF	$	$
BB-3	12.0 mm normal thickness (.472”)	220	LF	$	$
BB-4	13.5 mm normal thickness (.531”)	220	LF	$	$
BB-5	15.0 mm normal thickness (.591”)	220	LF	$	$
BB-6	Charge for each 1.5 mm thickness increase per LF exceeding 15.0 mm	100	LF	$	$
				TOTAL "BB"	$
CC	**30" diameter**				
CC-1	9.0 mm normal thickness (.354”)	600	LF	$	$
CC-2	10.5 mm normal thickness (.413”)	600	LF	$	$
CC-3	12.0 mm normal thickness (.472”)	600	LF	$	$
CC-4	13.5 mm normal thickness (.531”)	600	LF	$	$
CC-5	15.0 mm normal thickness (.591”)	600	LF	$	$
CC-6	Charge for each 1.5 mm thickness increase per LF exceeding 15.0 mm	100	LF	$	$
				TOTAL "CC"	$
DD	**36" diameter**				
DD-1	10.5 mm normal thickness (.413”)	500	LF	$	$
DD-2	12.0 mm normal thickness (.472”)	500	LF	$	$
DD-3	13.5 mm normal thickness (.531”)	500	LF	$	$
DD-4	15.0 mm normal thickness (.591”)	500	LF	$	$
DD-5	16.5 mm normal thickness (.650”)	250	LF	$	$
DD-6	18.0 mm normal thickness (.709”)	250	LF	$	$
DD-7	Charge for each 1.5 mm thickness increase per LF exceeding 18.0 mm	100	LF	$	$
				TOTAL "DD"	$

	CIPP REHABILITATION - STORMWATER MAINS				
ITEM	**DESCRIPTION**	**ESTIMATED QUANTITY**	**UNIT OF MEASURE**	**UNIT PRICE**	**EXTENDED PRICE**
EE	**42" diameter**				
EE-1	10.5 mm normal thickness (.413")	250	LF	$	$
EE-2	12.0 mm normal thickness (.472")	250	LF	$	$
EE-3	13.5 mm normal thickness (.531")	250	LF	$	$
EE-4	15.0 mm normal thickness (.591")	250	LF	$	$
EE-5	16.5 mm normal thickness (.650")	250	LF	$	$
EE-6	18.0 mm normal thickness (.709")	250	LF	$	$
EE-7	Charge for each 1.5 mm thickness increase per LF exceeding 18.0 mm	100	LF	$	$
				TOTAL "EE"	$
FF	**48" diameter**				
FF-1	12.0 mm normal thickness (.472")	200	LF	$	$
FF-2	13.5 mm normal thickness (.531")	200	LF	$	$
FF-3	15.0 mm normal thickness (.591")	200	LF	$	$
FF-4	16.5 mm normal thickness (.650")	200	LF	$	$
FF-5	18.0 mm normal thickness (.709")	200	LF	$	$
FF-6	19.5 mm normal thickness (.768")	100	LF	$	$
FF-7	21.0 mm normal thickness (.827")	100	LF	$	$
FF-8	Charge for each 1.5 mm thickness increase per LF exceeding 21.0 mm	100	LF	$	$
				TOTAL "FF"	$
GG	**52" diameter**				
GG-1	10.5 mm normal thickness (.413")	25	LF	$	$
GG-2	12.0 mm normal thickness (.472")	25	LF	$	$
GG-3	13.5 mm normal thickness (.531")	25	LF	$	$
GG-4	15.0 mm normal thickness (.591")	25	LF	$	$
GG-5	16.5 mm normal thickness (.650")	25	LF	$	$
GG-6	18.0 mm normal thickness (.709")	25	LF	$	$
GG-7	19.5 mm normal thickness (.768")	25	LF	$	$
GG-8	21.0 mm normal thickness (.827")	25	LF	$	$
GG-9	22.5 mm normal thickness (.886")	100	LF	$	$
GG-10	Charge for each 1.5 mm thickness increase per LF exceeding 22.5 mm	100	LF	$	$
				TOTAL "GG"	$

	CIPP REHABILITATION - STORMWATER MAINS				
ITEM	**DESCRIPTION**	**ESTIMATED QUANTITY**	**UNIT OF MEASURE**	**UNIT PRICE**	**EXTENDED PRICE**
HH	**54" diameter**				
HH-1	10.5 mm normal thickness (.413”)	25	LF	$	$
HH-2	12.0 mm normal thickness (.472”)	25	LF	$	$
HH-3	13.5 mm normal thickness (.531”)	25	LF	$	$
HH-4	15.0 mm normal thickness (.591”)	25	LF	$	$
HH-5	16.5 mm normal thickness (.650”)	25	LF	$	$
HH-6	18.0 mm normal thickness (.709”)	25	LF	$	$
HH-7	19.5 mm normal thickness (.768”)	25	LF	$	$
HH-8	21.0 mm normal thickness (.827”)	25	LF	$	$
HH-9	22.5 mm normal thickness (.886”)	100	LF	$	$
HH-10	Charge for each 1.5 mm thickness increase per LF exceeding 22.5 mm	100	LF	$	$
				TOTAL "HH"	$
II	**60" diameter**				
II-1	10.5 mm normal thickness (.413”)	25	LF	$	$
II-2	12.0 mm normal thickness (.472”)	25	LF	$	$
II-3	13.5 mm normal thickness (.531”)	25	LF	$	$
II-4	15.0 mm normal thickness (.591”)	25	LF	$	$
II-5	16.5 mm normal thickness (.650”)	25	LF	$	$
II-6	18.0 mm normal thickness (.709”)	25	LF	$	$
II-7	19.5 mm normal thickness (.768”)	25	LF	$	$
II-8	21.0 mm normal thickness (.827”)	25	LF	$	$
II-9	22.5 mm normal thickness (.886”)	100	LF	$	$
II-10	Charge for each 1.5 mm thickness increase per LF exceeding 22.5 mm	100	LF	$	$
				TOTAL "II"	$
JJ	**72" diameter**				
JJ-1	10.5 mm normal thickness (.413”)	25	LF	$	$
JJ-2	12.0 mm normal thickness (.472”)	25	LF	$	$
JJ-3	13.5 mm normal thickness (.531”)	25	LF	$	$
JJ-4	15.0 mm normal thickness (.591”)	25	LF	$	$
JJ-5	16.5 mm normal thickness (.650”)	25	LF	$	$
JJ-6	18.0 mm normal thickness (.709”)	25	LF	$	$
JJ-7	19.5 mm normal thickness (.768”)	25	LF	$	$
JJ-8	21.0 mm normal thickness (.827”)	25	LF	$	$
JJ-9	22.5 mm normal thickness (.886”)	100	LF	$	$
JJ-10	Charge for each 1.5 mm thickness increase per LF exceeding 22.5 mm	100	LF	$	$
				TOTAL "JJ"	$
	Total CIPP Rehabilitiation - Stormwater Mains ("U" THRU "JJ")				$

	CLEAN & INSPECTION - STORMWATER MAINS				
ITEM	**DESCRIPTION**	**ESTIMATED QUANTITY**	**UNIT OF MEASURE**	**UNIT PRICE**	**EXTENDED PRICE**
KK	**Light Cleaning and inspection**				
KK-1	8"- 12" diameter	6,000	LF	$	$
KK-2	14" - 18" diameter	6,000	LF	$	$
KK-3	20" - 24" diameter	6,000	LF	$	$
KK-4	27" - 42" diameter	6,000	LF	$	$
KK-5	48" - 72" diameter	6,000	LF	$	$
				TOTAL "KK"	$
LL	**Medium Cleaning**				
LL-1	8" - 12" diameter	6,000	LF	$	$
LL-2	14"- 18" diameter	6,000	LF	$	$
LL-3	20" - 24" diameter	6,000	LF	$	$
LL-4	27" - 42" diameter	6,000	LF	$	$
LL-5	48"- 72" diameter	6,000	LF	$	$
				TOTAL "LL"	$
MM	**Heavy Cleaning**				
MM-1	8" - 12" diameter	6,000	LF	$	$
MM-2	14" - 18" diameter	6,000	LF	$	$
MM-3	20" - 24" diameter	6,000	LF	$	$
MM-4	27"- 42" diameter	6,000	LF	$	$
MM-5	48"- 72" diameter	6,000	LF	$	$
				TOTAL "MM"	$
NN	**Root Removal**				
NN-1	8" - 12" diameter	6,000	LF	$	$
NN-2	14" - 18" diameter	6,000	LF	$	$
NN-3	20" - 24" diameter	6,000	LF	$	$
NN-4	27" - 42" diameter	6,000	LF	$	$
NN-5	48"- 72" diameter	6,000	LF	$	$
				TOTAL "NN"	$
OO	**Tuberculation Cleaning**				
OO-1	8" - 12" diameter	6,000	LF	$	$
OO-2	14" - 18" diameter	6,000	LF	$	$
OO-3	20" - 24" diameter	6,000	LF	$	$
OO-4	27"- 42" diameter	6,000	LF	$	$
OO-5	8" - 72" diameter	6,000	LF	$	$
				TOTAL "OO"	$
PP	**Stormwater Manhole Cleaining**	2,800	SF	$	$
				TOTAL "PP"	$
	TOTAL "KK" THRU "PP"				$

	ANCILLARY GENERAL SERVICES				
ITEM	**DESCRIPTION**	**ESTIMATED QUANTITY**	**UNIT OF MEASURE**	**UNIT PRICE**	**EXTENDED PRICE**
QQ	**By-Pass Pumping**				
QQ-1	8" diameter	5	LS	$	$
QQ-2	10" diameter	5	LS	$	$
QQ-3	12" diameter	5	LS	$	$
QQ-4	15" diameter	5	LS	$	$
QQ-5	18" diameter	5	LS	$	$
QQ-6	21" diameter	5	LS	$	$
QQ-7	24" diameter	5	LS	$	$
QQ-8	27" diameter	5	LS	$	$
QQ-9	30" diameter	5	LS	$	$
QQ-10	36" diameter	5	LS	$	$
				TOTAL "QQ"	$
RR	**Standard Service Reconnection**	**25**	Each		
				TOTAL "RR"	
SS	**Traffic Control - FDOT Right of Way**				
SS-1	Flagman	10	Setup	$	$
SS-2	Arrow Board	10	Setup	$	$
SS-3	Barricades	10	Setup	$	$
SS-4	Lane Dividers	10	Setup	$	$
				TOTAL "SS"	$
TT	**Traffic Control - City Right of Way**				
TT-1	Flagman	10	Setup	$	$
TT-2	Arrow Board	10	Setup	$	$
TT-3	Barricades	10	Setup	$	$
TT-4	Lane Dividers	10	Setup	$	$
				TOTAL "TT"	$
UU	**Traffic Control - County Right of Way**				
UU-1	Flagman	10	Setup	$	$
UU-2	Arrow Board	10	Setup	$	$
UU-3	Barricades	10	Setup	$	$
UU-4	Lane Dividers	10	Setup	$	$
				TOTAL "UU"	$

	ANCILLARY GENERAL SERVICES				
ITEM	**DESCRIPTION**	**ESTIMATED QUANTITY**	**UNIT OF MEASURE**	**UNIT PRICE**	**EXTENDED PRICE**
VV	**Easement Access**				
VV-1	6" to 12" diameter	100	LF	$	$
VV-2	14" to 18" diameter	100	LF	$	$
VV-3	20" to 24" diameter	100	LF	$	$
VV-4	27" to 30" diameter	100	LF	$	$
VV-5	36” to 42” diameter	100	LF	$	$
VV-6	48” to 54” diameter	100	LF	$	$
				TOTAL "VV"	$
WW	**Grout fill abandoned pipe**	1,000	CY	$	$
				TOTAL "WW"	$
XX	**Chemical and physical product testing**	10	EA	$	$
				TOTAL "XX"	$
YY	**Erosion and sediment control**				
YY-1	Silt Fencing	200	LF	$	$
YY-2	Floating Turbidity Barrier	200	LF	$	$
YY-3	Gutter Buddy	100	EA	$	$
				TOTAL "YY"	$
ZZ	**Mobilization**	20	Setup	$	$
				TOTAL "ZZ"	$
AAA	**Bonds**	100,000	Percentage	%	$
				TOTAL "AAA"	$
	TOTAL "QQ" THRU "AAA"				$
	TOTAL ESTIMATED BID AMOUNT			$	

	ADDITIVE ALTERNATE No. 1				
	SANITARY SEWER				
	LINE RECONSTRUCTION SDR 26 LESS THAN 10' DEPTH				
ITEM	**DESCRIPTION**	**ESTIMATED QUANTITY**	**UNIT OF MEASURE**	**UNIT PRICE**	**EXTENDED PRICE**
BBB					
BBB-1	15"	100	LF	$	$
BBB-2	18"	100	LF	$	$
BBB-3	24"	100	LF	$	$
BBB-4	30"	100	LF	$	$
BBB-5	36"	100	LF	$	$
BBB-6	42"	100	LF	$	$
BBB-7	48"	100	LF	$	$
BBB-8	54"	100	LF	$	$
BBB-9	60"	100	LF	$	$
BBB-10	66"	50	LF	$	$
BBB-11	72"	50	LF	$	$
				TOTAL "BBB"	$
	SANITARY SEWER				
	LINE RECONSTRUCTION C900 GREATER THAN 10' DEPTH				
CCC					
CCC-1	15"	100	LF	$	
CCC-2	18"	100	LF	$	$
CCC-3	24"	100	LF	$	$
CCC-4	30"	100	LF	$	$
CCC-5	36"	100	LF	$	$
CCC-6	42"	100	LF	$	$
CCC-7	48"	100	LF	$	$
CCC-8	54"	100	LF	$	$
CCC-9	60"	100	LF	$	$
CCC-10	66"	50	LF	$	$
CCC-11	72"	50	LF	$	$
				TOTAL CCC"	$

	STORMWATER MAINS				
ITEM	**DESCRIPTION**	**ESTIMATED QUANTITY**	**UNIT OF MEASURE**	**UNIT PRICE**	**EXTENDED PRICE**
DDD	**Line Reconstruction (concrete collars are incidental) greater than 8' depth and under roadways**				
DDD-1	15" RCP	250	LF	$	$
DDD-2	18" RCP	250	LF	$	$
DDD-3	24" RCP	250	LF	$	$
DDD-4	30" RCP	250	LF	$	$
DDD-5	36 'RCP	250	LF	$	$
DDD-6	48" RCP	250	LF	$	$
DDD-7	54" RCP	250	LF	$	$
DDD-8	60" RCP	250	LF	$	$
DDD-9	72" RCP	500	LF	$	$
				TOTAL "DDD"	$
EEE	**HDPE Line Reconstruction less than 8'**				
EEE-1	15" HDPE	250	LF	$	$
EEE-2	18" HDPE	250	LF	$	$
EEE-3	24" HDPE	250	LF	$	$
EEE-4	30" HDPE	250	LF	$	$
EEE-5	36" HDPE	250	LF	$	$
EEE-6	42" HDPE	250	LF	$	$
EEE-7	48" HDPE	250	LF	$	$
EEE-8	54" HDPE	250	LF	$	$
EEE-9	60" HDPE	250	LF	$	$
EEE-10	70" HDPE	500	LF	$	$
				TOTAL "EEE"	$
	TOTAL "BBB" THRU "EEE"				$

Designation: F1216 – 16

Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube[1,2]

This standard is issued under the fixed designation F1216; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This practice describes the procedures for the reconstruction of pipelines and conduits (2 to 108-in. diameter) by the installation of a resin-impregnated, flexible tube which is inverted into the existing conduit by use of a hydrostatic head or air pressure. The resin is cured by circulating hot water or introducing controlled steam within the tube. When cured, the finished pipe will be continuous and tight-fitting. This reconstruction process can be used in a variety of gravity and pressure applications such as sanitary sewers, storm sewers, process piping, electrical conduits, and ventilation systems.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific precautionary statements, see 7.4.2.

2. Referenced Documents

2.1 *ASTM Standards:*[3]

D543 Practices for Evaluating the Resistance of Plastics to Chemical Reagents

D638 Test Method for Tensile Properties of Plastics

D790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

D903 Test Method for Peel or Stripping Strength of Adhesive Bonds

D1600 Terminology for Abbreviated Terms Relating to Plastics

D3567 Practice for Determining Dimensions of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fittings

D3839 Guide for Underground Installation of "Fiberglass" (Glass-Fiber Reinforced Thermosetting-Resin) Pipe

D5813 Specification for Cured-In-Place Thermosetting Resin Sewer Piping Systems

E797/E797M Practice for Measuring Thickness by Manual Ultrasonic Pulse-Echo Contact Method

F412 Terminology Relating to Plastic Piping Systems

2.2 *AWWA Standard:*

Manual on Cleaning and Lining Water Mains, M 28[4]

2.3 *NASSCO Standard:*

Recommended Specifications for Sewer Collection System Rehabilitation[5]

3. Terminology

3.1 Definitions are in accordance with Terminology F412 and abbreviations are in accordance with Terminology D1600, unless otherwise specified.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *cured-in-place pipe (CIPP)*—a hollow cylinder containing a nonwoven or a woven material, or a combination of nonwoven and woven material surrounded by a cured thermosetting resin. Plastic coatings may be included. This pipe is formed within an existing pipe. Therefore, it takes the shape of and fits tightly to the existing pipe.

3.2.2 *inversion*—the process of turning the resin-impregnated tube inside out by the use of water pressure or air pressure.

[1] This practice is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.67 on Trenchless Plastic Pipeline Technology.

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[2] The following report has been published on one of the processes: Driver, F. T., and Olson, M. R., "*Demonstration of Sewer Relining by the Insituform Process, Northbrook, Illinois*," EPA-600/2-83-064, Environmental Protection Agency, 1983. Interested parties can obtain copies from the Environmental Protection Agency or from a local technical library.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[4] Available from American Water Works Association (AWWA), 6666 W. Quincy Ave., Denver, CO 80235, http://www.awwa.org.

[5] Available from the National Association of Sewer Service Companies, 2470 Longstone Lane, Suite M Marriottsville, MD 21104. http://www.nassco.org/

***A Summary of Changes section appears at the end of this standard**

3.2.3 *lift*—a portion of the CIPP that has cured in a position such that it has pulled away from the existing pipe wall.

4. Significance and Use

4.1 This practice is for use by designers and specifiers, regulatory agencies, owners, and inspection organizations who are involved in the rehabilitation of conduits through the use of a resin-impregnated tube inverted through the existing conduit. As for any practice, modifications may be required for specific job conditions.

5. Materials

5.1 *Tube*—The tube should consist of one or more layers of flexible needled felt or an equivalent nonwoven or woven material, or a combination of nonwoven and woven materials, capable of carrying resin, withstanding installation pressures and curing temperatures. The tube should be compatible with the resin system used. The material should be able to stretch to fit irregular pipe sections and negotiate bends. The outside layer of the tube should be plastic coated with a material that is compatible with the resin system used. The tube should be fabricated to a size that, when installed, will tightly fit the internal circumference and the length of the original conduit. Allowance should be made for circumferential stretching during inversion.

5.2 *Resin*—A general purpose, unsaturated, styrene-based, thermoset resin and catalyst system or an epoxy resin and hardener that is compatible with the inversion process should be used. The resin must be able to cure in the presence of water and the initiation temperature for cure should be less than 180°F (82.2°C). The CIPP system can be expected to have as a minimum the initial structural properties given in Table 1. These physical strength properties should be determined in accordance with Section 8.

6. Design Considerations

6.1 *General Guidelines*—The design thickness of the CIPP is largely a function of the condition of the existing pipe. Design equations and details are given in Appendix X1.

7. Installation

7.1 *Cleaning and Inspection:*

7.1.1 Prior to entering access areas such as manholes, and performing inspection or cleaning operations, an evaluation of the atmosphere to determine the presence of toxic or flammable vapors or lack of oxygen must be undertaken in accordance with local, state, or federal safety regulations.

TABLE 1 CIPP Initial Structural Properties[A]

Property	Test Method	Minimum Value psi	Minimum Value (MPa)
Flexural strength	D790	4 500	(31)
Flexural modulus	D790	250 000	(1 724)
Tensile strength (for pressure pipes only)	D638	3 000	(21)

[A]The values in Table 1 are for field inspection. The purchaser should consult the manufacturer for the long-term structural properties.

7.1.2 *Cleaning of Pipeline*—All internal debris should be removed from the original pipeline. Gravity pipes should be cleaned with hydraulically powered equipment, high-velocity jet cleaners, or mechanically powered equipment (see NASSCO Recommended Specifications for Sewer Collection System Rehabilitation). Pressure pipelines should be cleaned with cable-attached devices or fluid-propelled devices as shown in AWWA Manual on Cleaning and Lining Water Mains, M 28.

7.1.3 *Inspection of Pipelines*—Inspection of pipelines should be performed by experienced personnel trained in locating breaks, obstacles, and service connections by closed-circuit television or man entry. The interior of the pipeline should be carefully inspected to determine the location of any conditions that may prevent proper installation of the impregnated tube, such as protruding service taps, collapsed or crushed pipe, and reductions in the cross-sectional area of more than 40 %. These conditions should be noted so that they can be corrected.

7.1.4 *Line Obstructions*—The original pipeline should be clear of obstructions such as solids, dropped joints, protruding service connections, crushed or collapsed pipe, and reductions in the cross-sectional area of more than 40 % that will prevent the insertion of the resin-impregnated tube. If inspection reveals an obstruction that cannot be removed by conventional sewer cleaning equipment, then a point repair excavation should be made to uncover and remove or repair the obstruction.

7.2 *Resin Impregnation*—The tube should be vacuum-impregnated with resin (wet-out) under controlled conditions. The volume of resin used should be sufficient to fill all voids in the tube material at nominal thickness and diameter. The volume should be adjusted by adding 5 to 10 % excess resin for the change in resin volume due to polymerization and to allow for any migration of resin into the cracks and joints in the original pipe.

7.3 *Bypassing*—If bypassing of the flow is required around the sections of pipe designated for reconstruction, the bypass should be made by plugging the line at a point upstream of the pipe to be reconstructed and pumping the flow to a downstream point or adjacent system. The pump and bypass lines should be of adequate capacity and size to handle the flow. Services within this reach will be temporarily out of service.

7.3.1 Public advisory services will be required to notify all parties whose service laterals will be out of commission and to advise against water usage until the mainline is back in service.

7.4 *Inversion:*

7.4.1 *Using Hydrostatic Head*—The wet-out tube should be inserted through an existing manhole or other approved access by means of an inversion process and the application of a hydrostatic head sufficient to fully extend it to the next designated manhole or termination point. The tube should be inserted into the vertical inversion standpipe with the impermeable plastic membrane side out. At the lower end of the inversion standpipe, the tube should be turned inside out and attached to the standpipe so that a leakproof seal is created. The inversion head should be adjusted to be of sufficient height to cause the impregnated tube to invert from point of inversion to point of termination and hold the tube tight to the pipe wall, producing dimples at side connections. Care should be taken during the inversion so as not to over-stress the felt fiber.

7.4.1.1 An alternative method of installation is a top inversion. In this case, the tube is attached to a top ring and is inverted to form a standpipe from the tube itself or another method accepted by the engineer.

NOTE 1—The tube manufacturer should provide information on the maximum allowable tensile stress for the tube.

7.4.2 *Using Air Pressure*—The wet-out tube should be inserted through an existing manhole or other approved access by means of an inversion process and the application of air pressure sufficient to fully extend it to the next designated manhole or termination point. The tube should be connected by an attachment at the upper end of the guide chute so that a leakproof seal is created and with the impermeable plastic membranes side out. As the tube enters the guide chute, the tube should be turned inside out. The inversion air pressure should be adjusted to be of sufficient pressure to cause the impregnated tube to invert from point of inversion to point of termination and hold the tube tight to the pipe wall, producing dimples at side connections. Care should be taken during the inversion so as not to overstress the woven and nonwoven materials. **Warning—**Suitable precautions should be taken to eliminate hazards to personnel in the proximity of the construction when pressurized air is being use.

7.4.3 *Required Pressures*—Before the inversion begins, the tube manufacturer shall provide the minimum pressure required to hold the tube tight against the existing conduit, and the maximum allowable pressure so as not to damage the tube. Once the inversion has started, the pressure shall be maintained between the minimum and maximum pressures until the inversion has been completed.

7.5 *Lubricant*—The use of a lubricant during inversion is recommended to reduce friction during inversion. This lubricant should be poured into the inversion water in the downtube or applied directly to the tube. The lubricant used should be a nontoxic, oil-based product that has no detrimental effects on the tube or boiler and pump system, will not support the growth of bacteria, and will not adversely affect the fluid to be transported.

7.6 *Curing:*

7.6.1 *Using Circulating Heated Water*—After inversion is completed, a suitable heat source and water recirculation equipment are required to circulate heated water throughout the pipe. The equipment should be capable of delivering hot water throughout the section to uniformly raise the water temperature above the temperature required to effect a cure of the resin. Water temperature in the line during the cure period should be as recommended by the resin manufacturer.

7.6.1.1 The heat source should be fitted with suitable monitors to gage the temperature of the incoming and outgoing water supply. Another such gage should be placed between the impregnated tube and the pipe invert at the termination to determine the temperatures during cure.

7.6.1.2 Initial cure will occur during temperature heat-up and is completed when exposed portions of the new pipe appear to be hard and sound and the remote temperature sensor indicates that the temperature is of a magnitude to realize an exotherm or cure in the resin. After initial cure is reached, the temperature should be raised to the post-cure temperature recommended by the resin manufacturer. The post-cure temperature should be held for a period as recommended by the resin manufacturer, during which time the recirculation of the water and cycling of the boiler to maintain the temperature continues. The curing of the CIPP must take into account the existing pipe material, the resin system, and ground conditions (temperature, moisture level, and thermal conductivity of soil).

7.6.2 *Using Steam*—After inversion is completed, suitable steam-generating equipment is required to distribute steam throughout the pipe. The equipment should be capable of delivering steam throughout the section to uniformly raise the temperature within the pipe above the temperature required to effect a cure of the resin. The temperature in the line during the cure period should be as recommended by the resin manufacturer.

7.6.2.1 The steam-generating equipment should be fitted with a suitable monitor to gage the temperature of the outgoing steam. The temperature of the resin being cured should be monitored by placing gages between the impregnated tube and the existing pipe at both ends to determine the temperature during cure.

7.6.2.2 Initial cure will occur during temperature heat-up and is completed when exposed portions of the new pipe appear to be hard and sound and the remote temperature sensor indicates that the temperature is of a magnitude to realize an exotherm or cure in the resin. After initial cure is reached, the temperature should be raised to post-cure temperatures recommended by the resin manufacturer. The post-cure temperature should be held for a period as recommended by the resin manufacturer, during which time the distribution and control of steam to maintain the temperature continues. The curing of the CIPP must take into account the existing pipe material, the resin system, and ground conditions (temperature, moisture level, and thermal conductivity of soil).

7.6.3 *Required Pressures*—As required by the purchase agreement, the estimated maximum and minimum pressure required to hold the flexible tube tight against the existing conduit during the curing process should be provided by the seller and shall be increased to include consideration of the external ground water, if present. Once the cure has started and dimpling for laterals is completed, the required pressures should be maintained until the cure has been completed. For water or steam, the pressure should be maintained within the estimated maximum and minimum pressure during the curing process. If the steam pressure or hydrostatic head drops below the recommended minimum during the cure, the CIPP should be inspected for lifts or delaminations and evaluated for its ability to fully meet the applicable requirements of 7.8 and Section 8.

7.7 *Cool-Down:*

7.7.1 *Using Cool Water After Heated Water Cure*—The new pipe should be cooled to a temperature below 100°F (38°C) before relieving the static head in the inversion standpipe. Cool-down may be accomplished by the introduction of cool water into the inversion standpipe to replace water being drained from a small hole made in the downstream end. Care should be taken in the release of the static head so that a vacuum will not be developed that could damage the newly installed pipe.

7.7.2 *Using Cool Water After Steam Cure*—The new pipe should be cooled to a temperature below 113°F (45°C) before relieving the internal pressure within the section. Cool-down may be accomplished by the introduction of cool water into the section to replace the mixture of air and steam being drained from a small hole made in the downstream end. Care should be taken in the release of the air pressure so that a vacuum will not be developed that could damage the newly installed pipe.

7.8 *Workmanship*—The finished pipe should be continuous over the entire length of an inversion run and be free of dry spots, lifts, and delaminations. If these conditions are present, remove and replace the CIPP in these areas.

7.8.1 If the CIPP does not fit tightly against the original pipe at its termination point(s), the space between the pipes should be sealed by filling with a resin mixture compatible with the CIPP.

7.9 *Service Connections*—After the new pipe has been cured in place, the existing active service connections should be reconnected. This should generally be done without excavation, and in the case of non-man entry pipes, from the interior of the pipeline by means of a television camera and a remote-control cutting device.

8. Inspection Practices

8.1 For each inversion length designated by the owner in the Contract documents or purchase order, the preparation of a CIPP sample is required, using one of the following two methods, depending on the size of the host pipe.

8.1.1 For pipe sizes of 18 in. or less, the sample should be cut from a section of cured CIPP at an intermediate manhole or at the termination point that has been inverted through a like diameter pipe which has been held in place by a suitable heat sink, such as sandbags.

8.1.2 In medium and large-diameter applications and areas with limited access, the sample should be fabricated from material taken from the tube and the resin/catalyst system used and cured in a clamped mold placed in the downtube when circulating heated water is used and in the silencer when steam is used. This method can also be used for sizes 18 in. or less, in situations where preparing samples in accordance with 8.1.1 can not be obtained due to physical constrains, if approved by the owner.

8.1.3 The samples for each of these cases should be large enough to provide a minimum of three specimens and a recommended five specimens for flexural testing and also for tensile testing, if applicable. The following test procedures should be followed after the sample is cured and removed.

8.1.3.1 *Short-Term Flexural (Bending) Properties*—The initial tangent flexural modulus of elasticity and flexural stress should be measured for gravity and pressure pipe applications in accordance with Test Methods D790 and should meet the requirements of Table 1.

8.1.3.2 *Tensile Properties*—The tensile strength should be measured for pressure pipe applications in accordance with Test Method D638 and must meet the requirements of Table 1.

8.2 *Gravity Pipe Leakage Testing*—If required by the owner in the contract documents or purchase order, gravity pipes should be tested using an exfiltration test method where the CIPP is plugged at both ends and filled with water. This test should take place after the CIPP has cooled down to ambient temperature. This test is limited to pipe lengths with no service laterals and diameters of 36 in. or less. The allowable water exfiltration for any length of pipe between termination points should not exceed 50 U.S. gallons per inch of internal pipe diameter per mile per day, providing that all air has been bled from the line. During exfiltration testing, the maximum internal pipe pressure at the lowest end should not exceed 10 ft (3.0 m) of water or 4.3 psi (29.7 kPA) and the water level inside of the inversion standpipe should be 2 ft (0.6 m) higher than the top of the pipe or 2 ft higher than the groundwater level, whichever is greater. The leakage quantity should be gaged by the water level in a temporary standpipe placed in the upstream plug. The test should be conducted for a minimum of one hour.

NOTE 2—It is impractical to test pipes above 36-in. diameter for leakage due to the technology available in the pipe rehabilitation industry. Post inspection of larger pipes will detect major leaks or blockages.

8.3 *Pressure Pipe Testing*—If required by the owner in the contract documents or purchase order, pressure pipes should be subjected to a hydrostatic pressure test. A recommended pressure and leakage test would be at twice the known working pressure or at the working pressure plus 50 psi, whichever is less. Hold this pressure for a period of two to three hours to allow for stabilization of the CIPP. After this period, the pressure test will begin for a minimum of one hour. The allowable leakage during the pressure test should be 20 U.S. gallons per inch of internal pipe diameter per mile per day, providing that all air has been evacuated from the line prior to testing and the CIPP has cooled down to ambient temperature.

NOTE 3—The allowable leakage for gravity and pressure pipe testing is a function of water loss at the end seals and trapped air in the pipe.

8.4 *Delamination Test*—If required by the owner in the contract documents or purchase order, a delamination test should be performed on each inversion length specified. The CIPP samples should be prepared in accordance with 8.1.2, except that a portion of the tube material in the sample should be dry and isolated from the resin in order to separate tube layers for testing. (Consult the tube manufacturer for further information.) Delamination testing shall be in accordance with Test Method D903, with the following exceptions:

8.4.1 The rate of travel of the power-actuated grip shall be 1 in. (25 mm)/min.

8.4.2 Five test specimens shall be tested for each inversion specified.

8.4.3 The thickness of the test specimen shall be minimized, but should be sufficient to adequately test delamination of nonhomogeneous CIPP layers.

8.5 The peel or stripping strength between any nonhomogeneous layers of the CIPP laminate should be a minimum of 10 lb/in. (178.60 g/mm) of width for typical CIPP applications.

NOTE 4—The purchaser may designate the dissimilar layers between which the delamination test will be conducted.

NOTE 5—For additional details on conducting the delamination test, contact the CIPP contractor.

8.6 *CIPP Wall Thickness*—The method of obtaining CIPP wall thickness measurements should be determined in a manner consistent with 8.1.2 of Specification D5813. Thickness measurements should be made in accordance with Practice D3567 for samples prepared in accordance with 8.1. Make a minimum of eight measurements at evenly spaced intervals around the circumference of the pipe to ensure that minimum and maximum thicknesses have been determined. Deduct from the measured values the thickness of any plastic coatings or CIPP layers not included in the structural design of the CIPP. The average thickness should be calculated using all measured values and shall meet or exceed minimum design thickness as agreed upon between purchaser and seller. The minimum wall thickness at any point shall not be less than 87.5% of the specified design thickness as agreed upon between purchase and seller.

8.6.1 *Ultrasonic Testing of Wall Thickness*—An alternative method to 8.6 for measuring the wall thickness may be performed within the installed CIPP at either end of the pipe by the ultrasonic pulse echo method as described in Practice E797/E797M. A minimum of eight (8) evenly spaced measurements should be made around the internal circumference of the installed CIPP within the host pipe at a distance of 12 to 18 in. from the end of the pipe. For pipe diameters of fifteen (15) in. or greater, a minimum of sixteen (16) evenly spaced measurements shall be recorded. The ultrasonic method to be used is the flaw detector with A-scan display and direct thickness readout as defined in 6.1.2 of E797/E797M. A calibration block shall be manufactured from the identical materials used in the installed CIPP to calibrate sound velocity through the liner. Calibration of the transducer shall be performed daily in accordance with the equipment manufacturer's recommendations. The average thickness should be calculated using all measured values and shall meet or exceed minimum design thickness as agreed upon between purchaser and seller. The minimum wall thickness at any point shall not be less than 87.5 % of the specified design thickness as agreed upon between purchaser and seller.

8.7 *Inspection and Acceptance*—The installation may be inspected visually if appropriate, or by closed-circuit television if visual inspection cannot be accomplished. Variations from true line and grade may be inherent because of the conditions of the original piping. No infiltration of groundwater should be observed. All service entrances should be accounted for and be unobstructed.

APPENDIXES

(Nonmandatory Information)

X1. DESIGN CONSIDERATIONS

X1.1 *Terminology*:

X1.1.1 *partially deteriorated pipe*—the original pipe can support the soil and surcharge loads throughout the design life of the rehabilitated pipe. The soil adjacent to the existing pipe must provide adequate side support. The pipe may have longitudinal cracks and up to 10.0% distortion of the diameter. If the distortion of the diameter is greater than 10.0%, alternative design methods are required (see Note 1).

X1.1.2 *fully deteriorated pipe*—the original pipe is not structurally sound and cannot support soil and live loads or is expected to reach this condition over the design life of the rehabilitated pipe. This condition is evident when sections of the original pipe are missing, the pipe has lost its original shape, or the pipe has corroded due to the effects of the fluid, atmosphere, soil, or applied loads.

X1.2 *Gravity Pipe*:

X1.2.1 *Partially Deteriorated Gravity Pipe Condition*—The CIPP is designed to support the hydraulic loads due to groundwater, since the soil and surcharge loads can be supported by the original pipe. The groundwater level should be determined by the purchaser and the thickness of the CIPP should be sufficient to withstand this hydrostatic pressure without collapsing. The following equation may be used to determine the thickness required:

$$P = \frac{2KE_L}{(1 - \nu^2)} \cdot \frac{1}{(DR - 1)^3} \cdot \frac{C}{N} \qquad (X1.1)$$

where:

P = groundwater load, psi (MPa), measured from the invert of the pipe

K = enhancement factor of the soil and existing pipe adjacent to the new pipe (a minimum value of 7.0 is recommended where there is full support of the existing pipe),

E_L = long-term (time corrected) modulus of elasticity for CIPP, psi (MPa) (see Note X1.1),

ν = Poisson's ratio (0.3 average),

DR = dimension ratio of CIPP,

C = ovality reduction factor =

$$\left(\left[1 - \frac{\Delta}{100}\right] / \left[1 + \frac{\Delta}{100}\right]^2\right)^3$$

Δ = percentage ovality of original pipe equals

$$100 \times \frac{(Mean\ Inside\ Diameter - Minimum\ Inside\ Diameter)}{Mean\ Inside\ Diameter}$$

or

$$100 \times \frac{(Maximum\ Inside\ Diameter - Mean\ Inside\ Diameter)}{Mean\ Inside\ Diameter}$$

and

N = factor of safety.

NOTE X1.1—The choice of value (from manufacturer's literature) of E_L will depend on the estimated duration of the application of the load, P, in relation to the design life of the structure. For example, if the total duration of the load, P, is estimated to be 50 years, either continuously applied, or the sum of intermittent periods of loading, the appropriately conservative choice of value for E_L will be that given for 50 years of continuous loading at the maximum ground or fluid temperature expected to be reached over the life of the structure.

NOTE X1.2—If there is no groundwater above the pipe invert, the CIPP should typically have a maximum *SDR* of 100, dependent upon design conditions.

X1.2.1.1 If the original pipe is oval, the CIPP design from Eq X1.1 shall have a minimum thickness as calculated by the following formula:

$$1.5\frac{\Delta}{100}\left(1+\frac{\Delta}{100}\right)DR^{2}-0.5\left(1+\frac{\Delta}{100}\right)DR=\frac{\sigma_L}{PN} \quad (X1.2)$$

where:

σ_L = long-term (time corrected) flexural strength for CIPP, psi (MPa) (see Note X1.5).

X1.2.1.2 See Table X1.1 for typical design calculations.

X1.2.2 *Fully Deteriorated Gravity Pipe Condition*—The CIPP is designed to support hydraulic, soil, and live loads. The groundwater level, soil type and depth, and live load should be determined by the purchaser, and the following equation should be used to calculate the CIPP thickness required to withstand these loads without collapsing:

$$q_t=\frac{1}{N}\left[32\,R_w\,B'\;E'_s\cdot C\left(E_L I/D^3\right)\right]^{1/2} \quad (X1.3)$$

TABLE X1.1 Maximum Groundwater Loads for Partially Deteriorated Gravity Pipe Condition

Diameter, in. (Inside Diameter of Original Pipe)	Nominal CIPP Thickness, mm	CIPP Thickness, *t*, in.	Maximum Allowable Groundwater Load[A] (above invert)	
			ft	m
8	6	0.236	40.0	12.2
10	6	0.236	20.1	6.1
12	6	0.236	11.5	3.5
15	9	0.354	20.1	6.1
18	9	0.354	11.5	3.5
18	12	0.472	27.8	8.5
24	12	0.472	11.5	3.5
24	15	0.591	22.8	6.9
30	15	0.591	11.5	3.5
30	18	0.709	20.1	6.1

[A]Assumes K = 7.0, E = 125 000 psi (862 MPa) (50-year strength), ν = 0.30, C = 0.64 (5 % ovality), and N = 2.0

where:

q_t = total external pressure on pipe, psi (MPa),
= $0.433H_w + wHR_w/144 + W_s$, (English Units),
$0.00981H_w + wHR_w/1000 + W_s$, (Metric Units)
R_w = water buoyancy factor (0.67 min) = $1 - 0.33\,(H_w/H)$,
w = soil density, lb.ft^3 (KN/m^3),
W_s = live load, psi (Mpa),
H_w = height of water above top of pipe, ft (m)
H = height of soil above top of pipe, ft (m),
B' = coefficient of elastic support = $1/(1 + 4e^{-0.065H})$ inch-pound units, $(1/(1 + 4e^{-0.213H})$ SI units
I = moment of inertia of CIPP, in.^{4}/in. (mm^4/mm) = $t^3/12$,
t = thickness of CIPP, in. (mm),
C = ovality reduction factor (see X1.2.1),
N = factor of safety,
E'_s = modulus of soil reaction, psi (MPa) (see Note X1.4),
E_L = long-term modulus of elasticity for CIPP, psi (MPa), and
D = mean inside diameter of original pipe, in. (mm)

X1.2.2.1 The CIPP design from Eq X1.3 should have a minimum thickness as calculated by the following formula:

$$\frac{EI}{D^3}=\frac{E}{12(DR)^3}\geq 0.093\,(inch-pound\ units), \quad (X1.4)$$

or

$$\frac{E}{12(DR)^3}\geq 0.00064\,(SI\ units)$$

where:

E = initial modulus of elasticity, psi (MPa)

NOTE X1.3—For pipelines at depth not subject to construction disturbance, or if the pipeline was originally installed using tunneling method, the soil load may be calculated using a tunnel load analysis. Finite element analysis is an alternative design method for noncircular pipes.

NOTE X1.4—For definition of modulus of soil reaction, see Practice D3839.

X1.2.2.2 The minimum CIPP design thickness for a fully deteriorated condition should also meet the requirements of Eq X1.1 and X1.2.

X1.3 *Pressure Pipe*:

X1.3.1 *Partially Deteriorated Pressure Condition*—A CIPP installed in an existing underground pipe is designed to support external hydrostatic loads due to groundwater as well as withstand the internal pressure in spanning across any holes in the original pipe wall. The results of Eq X1.1 are compared to those from Eq X1.6 or Eq X1.7, as directed by Eq X1.5, and the largest of the thicknesses is selected. In an above-ground design condition, the CIPP is designed to withstand the internal pressure only by using Eq X1.5-X1.7 as applicable.

X1.3.1.1 If the ratio of the hole in the original pipe wall to the pipe diameter does not exceed the quantity shown in Eq X1.5, then the CIPP is assumed to be a circular flat plate fixed at the edge and subjected to transverse pressure only. In this case, Eq X1.6 is used for design. For holes larger than the d/D value in Eq X1.5, the liner cannot be considered in flat plate loading, but rather in ring tension or hoop stress, and Eq X1.7 is used.

$$\frac{d}{D} \leq 1.83 \left(\frac{t}{D}\right)^{1/2} \tag{X1.5}$$

where:

d = diameter of hole or opening in original pipe wall, in. (mm),
D = mean inside diameter of original pipe, in. (mm), and
t = thickness of CIPP, in. (mm).

$$P = \frac{5.33}{(DR-1)^2}\left(\frac{D}{d}\right)^2 \frac{\sigma_L}{N} \tag{X1.6}$$

where:

DR = dimension ratio of CIPP,
D = mean inside diameter of original pipe, in. (mm),
d = diameter of hole or opening in original pipe wall, in. (mm),
σ_L = long-term (time corrected) flexural strength for CIPP, psi (MPa) (see Note X1.5), and
N = factor of safety.

NOTE X1.5—The choice of value (from manufacturer's literature) of σ_L will depend on the estimated duration of the application of the load, *P*, in relation to the design life of the structure. For example, if the total duration of the load, *P*, is estimated to be 50 years, either continuously applied, or the sum of intermittent periods of loading, the appropriately conservative choice of value of σ_L will be that given for 50 years of continuous loading at the maximum ground or fluid temperature expected to be reached over the life of the structure.

X1.3.2 *Fully Deteriorated Pressure Pipe Condition*—A CIPP to be installed in an underground condition is designed to withstand all external loads and the full internal pressure. The design thicknesses are calculated from Eq X1.1, Eq X1.3, Eq X1.4, and Eq X1.7, and the largest thickness is selected. If the pipe is above ground, the CIPP is designed to withstand internal pressure only by using Eq X1.7.

$$P = \frac{2\sigma_{TL}}{(DR-2)\,N} \tag{X1.7}$$

where:

P = internal pressure, psi (MPa),
σ_{TL} = long-term (time corrected) tensile strength for CIPP, psi (MPa) (see Note 12),
DR = dimension ratio of CIPP, and
N = factor of safety.

NOTE X1.6—The choice of value (from manufacturer's literature) of σ_{TL} will depend on the estimated duration of the application of the load, *P*, in relation to the design life of the structure. For example, if the total duration of the load, *P*, is estimated to be 50 years, either continuously applied, or the sum of intermittent periods of loading, the appropriately conservative choice of value of σ_{TL} will be that given for 50 years of continuous loading at the maximum ground or fluid temperature expected to be reached over the life of the structure.

X1.4 *Negative Pressure*—Where the pipe is subject to a vacuum, the CIPP should be designed as a gravity pipe with the external hydrostatic pressure increased by an amount equal to the negative pressure.

NOTE X1.7—Table X1.1 presents maximum groundwater loads for partially deteriorated pipes for selected typical nominal pipe sizes. CIPP is custom made to fit the original pipe and can be fabricated to a variety of sizes from 2 to 108-in. diameter which would be impractical to list here.

X2. CHEMICAL-RESISTANCE TESTS

X2.1 *Scope*:

X2.1.1 This appendix covers the test procedures for chemical-resistance properties of CIPP. Minimum standards are presented for standard domestic sewer applications.

X2.2 *Procedure for Chemical-Resistance Testing*:

X2.2.1 Chemical resistance tests should be completed in accordance with Practices D543. Exposure should be for a minimum of one month at 73.4°F (23°C). During this period, the CIPP test specimens should lose no more than 20 % of their initial flexural strength and flexural modulus when tested in accordance with Section 8 of this practice.

X2.2.2 Table X2.1 presents a list of chemical solutions that serve as a recommended minimum requirement for the chemical-resistant properties of CIPP in standard domestic sanitary sewer applications.

X2.2.3 For applications other than standard domestic sewage, it is recommended that chemical-resistance tests be conducted with actual samples of the fluid flowing in the pipe. These tests can also be accomplished by depositing CIPP test specimens in the active pipe.

TABLE X2.1 Minimum Chemical Resistance Requirements for Domestic Sanitary Sewer Applications

Chemical Solution	Concentration, %
Tap water (pH 6–9)	100
Nitric acid	5
Phosphoric acid	10
Sulfuric acid	10
Gasoline	100
Vegetable oil	100
Detergent	0.1
Soap	0.1

SUMMARY OF CHANGES

Committee F17 has identified the location of selected changes to this standard since the last issue (F1217–09) that may impact the use of this standard.

(1) Revised 1.1 and Note X1.7 to include pipe diameter sizes 2-in. to 108-in.

Designation: F2454 – 05 (Reapproved 2016)$^{\varepsilon 1}$

Standard Practice for Sealing Lateral Connections and lines from the mainline Sewer Systems by the Lateral Packer Method, Using Chemical Grouting[1]

This standard is issued under the fixed designation F2454; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

ε^1 NOTE—Editorial changes were made throughout in May 2016.

INTRODUCTION

The infiltration of water in sanitary sewer systems through the lateral service connection and the first few joints of the lateral below the groundwater table is a major problem for collection system owners. The combined length of the lateral services often exceeds the length of the mainline sewers. Often, the lateral services have been built with little or no supervision and little or no above-ground access for monitoring and inspection.

1. Scope

1.1 This practice covers the procedures for testing and sealing sewer lateral connections and lateral lines from the mainline sewer with appropriate chemical grouts using the lateral packer method. Chemical grouting is used to stop infiltration of ground water and exfiltration of sewage in gravity flow sewer systems that are structurally sound.

1.2 This practice applies to mainline sewer diameters of 6 to 24 in. with 4, 5, or 6 in. diameter laterals. Larger diameter pipes with lateral connections and lines can be grouted with special packers or man-entry methods. The mainline and lateral pipes must be structurally adequate to create an effective seal.

1.3 Worker safety training should include reviewing the biohazards and gases from sewage, confined spaces, pumping equipment, and related apparatus. Additional safety considerations including proper handling, mixing, and transporting of chemical grouts should be provided by the chemical grout manufacturer or supplier, or both. Their safe operating practices and procedures should describe in detail appropriate personal protective equipment (PPE) for the various grouting operations. Operations covered should include the proper storage, transportation, mixing, and disposal of chemical grouts, additives, and their associated containers.

1.4 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F2304 Practice for Sealing of Sewers Using Chemical Grouting

2.2 *NASSCO Standard:*[3]

NASSCO Specification Guidelines Wastewater Collection System Maintenance and Rehabilitation, 2003

3. Significance and Use

3.1 The inspection, testing, and repair of lateral connections for sanitary sewers are regular practice necessary for the maintenance and optimal performance of the system. It is important to identify methods that use the most current compounds and technology to ensure the reduction of infiltration and exfiltration. It is important to minimize disruption to

[1] This practice is under the jurisdiction of ASTM Committee F36 on Technology and Underground Utilities and is the direct responsibility of Subcommittee F36.20 on Inspection and Renewal of Water and Wastewater Infrastructure.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from National Association of Sewer Service Companies (NASSCO), Inc., 2470 Longstone Lane, Suite M, Marriottsville, MD 21104, http://www.nassco.org.

traffic and lessen the environmental impacts for both the municipal and private owners.

3.2 This practice serves as a means to inspect, test, and seal sewer lateral connections and a predetermined portion of the lateral lines from the mainline sewer, having selected the appropriate chemical grouts using the lateral packer method. Television (or optical) inspection and sewer lateral connection testing are used to assess the condition and document any repairs.

3.3 This practice should not be used where mainline and lateral connections are found with longitudinally cracked pipe, structurally unsound pipe, or flattened or out of round pipe.

4. Contract Responsibilities

4.1 The lateral connection sealing contracts should define or affix responsibility for, or make provisions for, the following items:

4.1.1 *Notice of Client/Owner Requirements,* which are relevant to, and within the scope of, work to be performed under the contract.

4.1.2 *Municipal and Other Licenses and Permits,* (see Practice F2304) and assistance in obtaining approvals or consent from utilities or carriers or other persons or organizations upon whose property or authority might be impinged by the performance of work under the contract; or a written release from responsibility for the performance of work under the contract if and to the extent that such work is precluded by the inability to obtain approvals or consent. If working on private property permission from the owner's representative, the sewer line owner and the building department.

4.1.3 *Access to Site of Work,* to be provided to the extent that the owner is legally able to do so, if unable to, a written release from responsibility for the performance of work at sites where access cannot be made available.

4.1.4 *Clearances of Blockages or Obstructions,* in the sewer system, if any, if such clearance is required for performance of work under the contract and if such clearance is not otherwise provided for within the contract.

4.1.5 *Location and Exposure of All Manholes,* unless otherwise provided for in the technical specifications of the contract.

4.1.6 *A Manhole Numbering System,* for all areas of the project, and accurate manhole invert elevations when required for performance of the work.

4.1.7 *The Shutdown or Manual Operation of Certain Pump Stations,* if such becomes necessary for performance of the work.

4.1.8 *Water,* necessary for performance of work under the contract, with permission to use water from fire hydrants at the site of work, or other suitable designated sources within a reasonable distance from work areas.

4.1.9 *Disposal Area,* for all materials removed from the sewers during the performance of the work and the unencumbered right of the contractor to transport and expeditiously dispose of such materials at a location designated by the owner.

4.1.10 *A Secure Storage Area,* of a size adequate to accommodate the required vehicles, equipment, and materials for the period of the contract.

4.1.11 *Notice to Third Parties,* (such as utilities) of the contractor's intent to perform work in an area where such parties may have rights to underground property or facilities. Request for maps or other descriptive information as to the nature and location of such underground facilities or property and assurance of the contractor's ability to enter any public or private lands to which access is required for performance of the work under the contract.

4.1.12 *Information Pertinent to the Site,* including reports prepared under previously accomplished studies or surveys and other data relative to the project, such as, maps, drawings, construction specifications sewer system records, and so forth.

4.1.13 *Authorization,* to perform work that must be performed during nighttime hours, on weekends, or on holidays.

4.1.14 *Traffic Control,* by uniformed officers when the safety of workers or the public requires such protection, or as may be specified.

4.1.15 The contractor shall certify that backup equipment is available and can be delivered to the site within 48 hours.

4.1.16 Submit equipment utilization schedule to the owner's representative for review and approval prior to commencement of the project.

4.1.17 Submit equipment operating procedures and systems to the owner's representative for review and approval prior to commencement of the project.

5. Chemical Grouts (Chemical Sealing Materials)

5.1 *Intent*—The intent of this section is to define the properties that a chemical sealing material must have to perform effectively in the intended application and under expected field conditions. The intended application is remotely sealing sewer lateral connections and a predetermined portion of the lateral from the connection to the mainline sewer with a lateral packer as specified in Section 12.

5.1.1 Generic chemical sealing materials currently in use are listed in 5.3 with the basic properties, performance standards, and mix ratios, which are known to give acceptable performance.

5.1.2 It is recognized that new and improved chemical sealing materials will become available from time to time. Sources, manufacturers, and product names of chemical sealing materials will thus change, and therefore; specific sources, manufacturers, and product names are not given.

5.1.3 In every case, mixing and handling of chemical sealing materials shall be in accordance with the manufacturer's or supplier's, or both, recommendations.

5.2 *General*—All chemical-sealing materials used in the performance of the work specified must have the following characteristics:

5.2.1 While being injected, the chemical sealant must be able to react/perform in the presence of water (groundwater).

5.2.2 The cured material must withstand submergence in water without degradation.

5.2.3 The resultant chemical grout formation must prevent the passage of groundwater (infiltration) through the surrounding soil ring, the sewer lateral connection, and the joints within the predetermined portion of the lateral from the lateral connection to the mainline sewer.

TABLE 1 Maximum Depth of Flow-Television (or Optical) Inspection

6- to 10-in. pipe	20 % of pipe diameter
12- to 24-in. pipe	25 % of pipe diameter

TABLE 2 Maximum Depth of Flow-Joint Testing/Sealing

6- to 10-in. pipe	25 % of pipe diameter
12- to 24-in. pipe	30 % of pipe diameter

5.2.4 The sealant material, after curing, must be flexible as opposed to brittle.

5.2.5 The cured sealant must not be biodegradable.

5.2.6 The cured sealant should be chemically stable and resistant to the mild concentrations of acids, alkalis, and organics found in normal sewage.

5.2.7 Packaging of component materials must be compatible with field storage and handling requirements. Packaging must provide for worker safety and proper clean up procedures should spillage occur.

5.2.8 Measurement of the component materials being mixed must be compatible with field operations not requiring precise measurements of the ingredients by field personnel.

5.2.9 Cleanup must be done without inordinate use of flammable or hazardous chemicals.

5.2.10 Residual sealing materials must be easily removable from the sewer line to correct conditions that affect the sewage flow.

5.3 *Chemical Sealing Materials*—The following is a generic listing of chemical sealing materials currently in use and the basic requirements, properties, and characteristics of each:

5.3.1 *Acrylamide Base Gel:*

5.3.1.1 A minimum of 10 % acrylamide base material by weight in total sealant mix. A higher concentration of acrylamide base material may be used to increase strength or offset dilution during injection.

5.3.1.2 The ability to tolerate some dilution and react in moving water during injection.

5.3.1.3 A viscosity of approximately 2 centipoise, which can be increased with additives.

5.3.1.4 Maintains a constant viscosity during the reaction period.

5.3.1.5 A controllable reaction time from 10 s to 1 h.

5.3.1.6 A reaction (curing), which produces a homogeneous, chemically stable, non-biodegradable, firm, flexible gel.

5.3.1.7 The ability to increase mix viscosity, density, and gel strength by the use of additives.

5.3.2 *Acrylic Base Gel:*

5.3.2.1 A minimum of 10 % acrylic base material by weight in the total sealant mix. A higher concentration of acrylic base material may be used to increase strength or offset dilution during injection.

5.3.2.2 The ability to tolerate some dilution and react in moving water during injection.

5.3.2.3 A viscosity of approximately 2 centipoise, which can be increased with additives.

5.3.2.4 A constant viscosity during the reaction period.

5.3.2.5 A controllable reaction time from 10 s to 1 h.

5.3.2.6 A reaction (curing), which produces a homogenous, chemically stable, non-biodegradable, flexible gel.

5.3.2.7 The ability to increase mix viscosity, density and gel strength by the use of additives.

5.3.3 *Urethane Base Gel:*

5.3.3.1 One part urethane prepolymer thoroughly mixed with between 5 and 10 parts of water weight. The recommended mix ratio is 1 part urethane prepolymer to 8 parts of water (11 % prepolymer). When high flow rates from leaks are encountered, the ratio of water being pumped may be lowered.

5.3.3.2 A liquid prepolymer having a solids content of 75 to 95 %, and a specific gravity of greater than 1.00.

5.3.3.3 A liquid prepolymer having a viscosity of between 100 and 1500 centipoise at 70°F that can be pumped through 500 ft of ½-in. hose with a 1000-psi head at a flow rate of 1 oz/s.

5.3.3.4 The water used to react the prepolymer should have a pH of 5 to 9.

5.3.3.5 A cure time appropriate for the conditions encountered.

5.3.3.6 A relatively rapid viscosity increase of theprepolymer/water mix. Viscosity should increase rapidly in the first minute for 1 to 8 prepolymer/water ratio at 50°F.

5.3.3.7 A reaction (curing) that produces a chemically stable and non-biodegradable, tough, flexible gel.

5.3.3.8 The ability to increase mix viscosity, density, gel strength, and resistance and shrinkage by the use of additives.

6. Optional Additives

6.1 Additives enhance the performance of the chemical sealing materials and can be used for specific applications. Owner's Representative should consult with grout manufacturers to determine appropriate additives.

7. Sewer Line Cleaning Procedures

7.1 The intent of sewer line cleaning is to remove foreign materials from the lines to obtain proper seating of the packer. Refer to NASSCO Specification Guidelines.

8. Sewer Flow Control

8.1 When sewer line depth of flow at the upstream manhole of the section being worked on is above the maximum allowable for televisioinspection, joint testing or sealing, or combination thereof, the flow shall be reduced to the level shown below by operation of pump stations, plugging, or blocking of the flow, or by pumping and bypassing of the flow as specified in Table 1.

8.2 Depth of flow shall not exceed that shown in Table 2 for the respective pipe sizes as measured in the manhole when performing television inspection, joint testing, or sealing, or combination thereof.

8.3 *Plugging and Blocking*—When authorized by sewer owner/operator, a sewer line plug shall be inserted into the line upstream of the section being serviced. The plugging system shall be so designed that any or all portions of the sewage can be released. During television (or optical) inspection, testing, and sealing operations, flow shall be reduced to within the limits specified above. After the work has been completed, flow shall be restored to normal.

8.4 *Pumping and Bypassing*—When pumping and bypassing is required, the contractor shall supply the pumps, conduits, and other equipment to divert the flow of sewage from an upstream manhole to a downstream manhole, isolating the pipe run in which work is to be performed. The bypass system shall be of sufficient capacity to handle existing flow plus additional flow that may occur during a rainstorm. The contractor will be responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing system. All engines shall be equipped to operate within environmental quality regulations in a manner to keep noise to a minimum.

8.5 *Flow Control Precautions*—When flow in a sewer line is plugged, blocked, or bypassed, sufficient precautions must be taken to protect the sewer lines from damage that might result from sewer surcharging. Further, precautions must be taken to insure that sewer flow control operations do not cause flooding or damage to public or private property being served by the sewers involved.

9. Television (or Optical) Inspection, Main Sewers

9.1 After cleaning, the mainline sewer sections shall be remotely inspected by means of color closed-circuit television "pan & tilt" or "pan & rotate" cameras or optical scans. The inspection will be done one manhole section at a time and the flow in the section being inspected will be suitably controlled as specified. The camera must be stopped and rotated at each lateral connection. The original recording of this inspection must be delivered to the sewer owner/operator. The recording must capture the date and time of the recording and use the agreed upon system to identify the pipe location being viewed.

9.2 Cleaning of the mainline sewer shall be performed by the contractor and is to be adequate for seating a lateral packer in the mainline and inserting and seating an inflatable sealing bladder in the lateral. The lateral shall be cleaned, if provided for in the contract, of obstructions and roots (that prevent the complete inversion of the lateral bladder or proper seating of the lateral bladder) over the predetermined portion to be sealed from the mainline sewer connection plus a distance of 1 ft (0.3 m).

9.2.1 Recorded (closed-circuit television) inspections shall be done in the mainline from manhole to manhole and in each lateral on the length to be sealed plus 1 ft (0.3 m). A pan and tilt camera, from the mainline, will normally be acceptable for inspecting the predetermined portion of the lateral from the mainline connection of up to 4 ft (1.2 m). For longer sealing portions of the lateral from the mainline connection or when the pan and tilt camera does not provide an acceptable view, a camera positioned from the mainline or positioned from an above ground access through the lateral shall be used if provided for in the contract. The recording must capture the date and time and use the agreed upon system to identify the lateral location being viewed. The original recording of this inspection must be delivered to the sewer owner/operator. A Lateral Connection Data Report shall be originated at the time of the inspection. A separate Lateral Connection Data Report form shall be filled out for each lateral with all the required information and submitted to the owner's representative.

9.2.2 Service laterals protruding more than ⅝ in. (1.6 cm) into the mainline shall be cut back or otherwise removed to avoid interference with the testing and sealing equipment, if provided for in the contract.

10. Lateral Sealing Packers

10.1 Lateral sealing packers are operated from the mainline sewer. The design accommodates the various sealing bladders for 4, 5, or 6-in. (10, 13, or 15-cm) diameter laterals and the different sealing lengths (up to 20 ft (6 m)). The lateral sealing bladder shall have an expandable end bulb. The void area or grout chamber of the packer shall be minimal to limit the amount of residual grout. A sensing device located within the void area shall accurately transmit the void pressure readouts to the control panel at the grouting truck or to a pressure gauge on the packer read and recorded by the closed-circuit television camera. The packer must have one connection for the test medium and two connections for the two-component grout. Each connection shall have its own port in the grouting chamber and be closed or opened by adjustable non-dripping check valves.

11. Testing of the Laterals

11.1 *Scope*—Lateral connection testing identifies those lateral sewer connections and the predetermined portion of the laterals that are defective (allowing groundwater to enter into the sewer system and sewage to exfiltrate from the sewer system) and that can be successfully sealed by the internal lateral connection sealing process. Testing will be performed on all lateral connections and predetermined portion of the laterals from the mainline connection in a section, unless visibly leaking, as this is a positive leak indicator. Testing each non-visibly leaking connection and predetermined portion of the lateral from the mainline connection, ensures that this portion of the lateral is watertight even if the groundwater table is below the invert of the pipe.

11.2 *Significance and Use*—Lateral connection testing is used to test the integrity of the individual lateral connections and predetermined portion of the lateral from the mainline connection. Testing will not be performed and will not be required on cracked or broken pipe.

11.3 *Apparatus*—The basic equipment used shall consist of a pan & tilt television (or optical) camera, a lateral connection testing device (known as a lateral test & seal packer) with inflatable mainline end elements and lateral bladder, and test monitoring equipment. The equipment shall be constructed in such a way as to provide a means for introducing a controlled test medium, under pressure, into the void area created by the expanded mainline elements and expanded lateral bladder. The equipment will also provide a means for continuously measuring the static pressure of the test medium and chemical grout within the void area created by the inflation of the lateral packer. All pressure measurements shall be made within the void area.

11.3.1 Void pressure data shall be transmitted from the void to the monitoring equipment or recorded video picture of a pressure gage mounted on the packer and connected to the void area. All test monitoring equipment shall be above-ground and in a location to allow for simultaneous and continuous observation of the television monitor and test monitoring equipment by the owner's representative.

11.3.2 *Procedure:*

11.3.3 Initial Testing—Before starting the lateral connection testing phase of the work, a control test shall be performed as follows.

11.3.4 To insure the accuracy of the testing equipment, a demonstration test may be performed in an above-ground lateral and pipe connection setup (8-in. (200-mm) mainline and 6-in. (150-mm) lateral assembly). The setup shall have two taps with a valve and a gage at each end of the lateral to simulate leaks. The contractor uses this setup to prove the validity of the air testing and the reliability of the test equipment.

11.3.5 If this controlled test cannot be performed successfully, the contractor shall be instructed to repair or otherwise modify the equipment until the results are satisfactory to the owner's representative.

11.3.6 Test Pressure—Joint test pressure shall be 3 psi (20 kPa) higher than the groundwater pressure, if any, outside the pipe, up to a maximum of 6 psi (41 kPa).

11.3.7 Current and reasonable groundwater pressure may be determined by the installation of groundwater depth gages inside a manhole that would indicate the level of groundwater above the invert of the sewer. In the absence of groundwater pressure data, the test pressure shall be equal to 0.5 psi per vertical foot of pipe depth or 6 psi maximum, whichever is greater.

11.4 *Test Procedure*—The testing device shall be positioned within the line section as to first straddle the most downstream lateral connection within this pipe section. The testing device shall be rotated (remotely) to align the lateral bladder with the lateral connection. Air pressure is used to invert/inflate the lateral bladder from the mainline assembly into the lateral pipe. The mainline elements are then inflated to isolate the lateral connection and predetermined portion of the lateral to be tested. Inflation pressures of the testing device shall be in accordance with the manufacturer's recommendations.

11.4.1 Air Test—Air is then introduced into the void area until a pressure equal to or 10 % greater than the required test pressure is observed with the void pressure monitoring equipment. After the void pressure is observed to be equal to but not greater than 10 % of the required test pressure, the airflow shall be stopped and the air test line vented. The operator will observe this void pressure for a period of 15 s. If the pressure is maintained, with a pressure drop of less than 2 psi, then the lateral connection and that portion of the lateral pipe will be considered has having passed the test. If the pressure shows any additional decay within the 15-s time period, it will be considered as having failed the test and shall be sealed as described in Section 12. Upon completion of the sealing, the lateral will be retested at the established test criteria (post test).

12. Grouting of Laterals

12.1 Laterals that do not pass the air test or show visible signs of leakage shall be grouted. The lateral packer remains in position, maintaining the isolated void. A two-component chemical grout sealant is pressure injected through the lateral packer into the isolated void. The grout material is then forced into the soil through leaking joints and pipe defects. The pumping rate and reaction or gel time must be chosen to ensure that enough grout will be placed outside the pipe to provide an effective seal. Typically a gel time of 25 s is acceptable when using a low void packer and grouting 4 ft of the lateral from the mainline/lateral connection.

12.2 The pump capacity must be sufficient to fill the isolated void initially before the gelling of the two-component grout. After filling the isolated void, the pumping rate should be adjusted to bring up and maintain a back pressure of 8 psi (55 kPa) into the isolated void at the mainline level. When the time for a drop of pressure from 8 to 6 psi (55 to 41 kPa) exceeds 20 s after cessation of pumping, the sealing is considered successful. However, when the effective quantity of grout pumped exceeds 1 gal/ft (12 L/m) of sealing distance plus 3 gal (11 L), it will be suspected that there are significant voids on the outside of the pipe. Grout staging can be attempted if agreed upon between the contractor and the owner's representative. A grout dam may be constructed by repeatedly pumping and curing the grout until the area is dammed off and the refusal pressure of 8 psi (55 kPa) is obtained (to avoid plugging the crevices from the inside, time interval between grout pumping, shall be shorter than the gel time). The owner's representative may determine that the grout consumption is too high and stop subsequent attempts to seal a lateral. The effective volume of grout pumped is recorded on the lateral data sheet.

12.2.1 The amount of chemical per pump stroke shall be measured periodically, and then the number of pump strokes could be used to determine the amount of chemical delivered to each lateral.

12.2.2 *Lateral Connection Sealing Verification*—Upon achieving a seal at the connection and the predetermined portion of the lateral from the mainline/lateral connection, the packer and lateral bladder remain in position and the post air pressure test procedure is performed (see Section 11). This sequence of testing and sealing is done until a seal is obtained or it is decided by the owner's representative that this lateral connection and portion of this lateral cannot be sealed.

13. Lateral Flow Verification

13.1 It is the responsibility of the Contractor to verify that the sealing of the laterals did not obstruct the lateral flow and remove any grout that would significantly restrain the flow. Lateral flow shall be verified after the sealing of each lateral. With the lateral connection being viewed with the pan and tilt camera, an attempt is made to obtain a water flush by the occupant. If the flow seems abnormal, it is assumed that the lateral sewer is blocked with grout and must be cleared. If a water flush cannot be obtained and if no other foolproof verification technique could be used, the contractor shall inspect the lateral 3 ft (0.9 m) further than the sealing distance from the mainline/lateral connection, if provided for in the contract. The contractor remains responsible for checking and cleaning the lateral even if his verification is accepted by the owner's representative.

13.2 *(Optional)* The contractor shall attach to the door of each home or building for which laterals have been grouted a notification to the occupant stating that the lateral servicing this listed address was grouted on this particular date and if any blockage of sanitary flow occurs, the occupant should call the contractor. The contractor shall supply these notification forms.

14. Work Exempt from Grouting

It is intended that no rehabilitation by chemical grouting shall be performed on any sanitary sewer line that has been scheduled for point repair, replacement or other work involving excavation or new connections until the scheduled work has been completed or as otherwise authorized by the Owner's Representative.

15. Keywords

15.1 chemical grouting; infiltration; laterals; sealing; sewers

THE CITY OF DAYTONA BEACH **BID TABULATION** CIPP Pipe Rehab Ann'l Contract **BID DATE AND TIME**	
April 15, 2013	
Page 1 of 1	
Proposals Received From:	**Miller Pipeline, Indianapolis IN**
	Lanzo Trenchless Technologies South, S Daytona FL
	Inland Waters Pollution Control, Stone Mountain, Ga
	Layne Inliner LLC, Orleans, IN
	Insituform Techologies, Jacksonville, FL