INFRAPIPES

Culvert Reline

Weholite®

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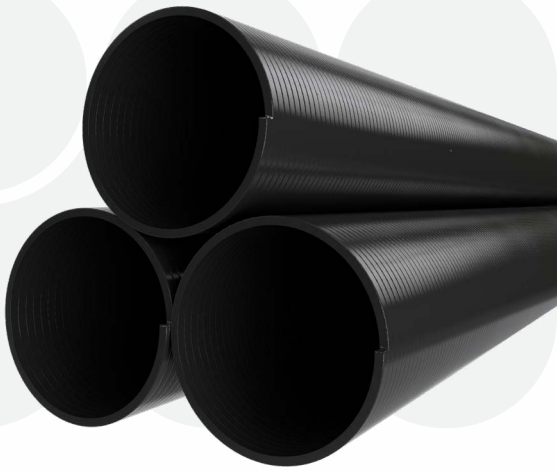
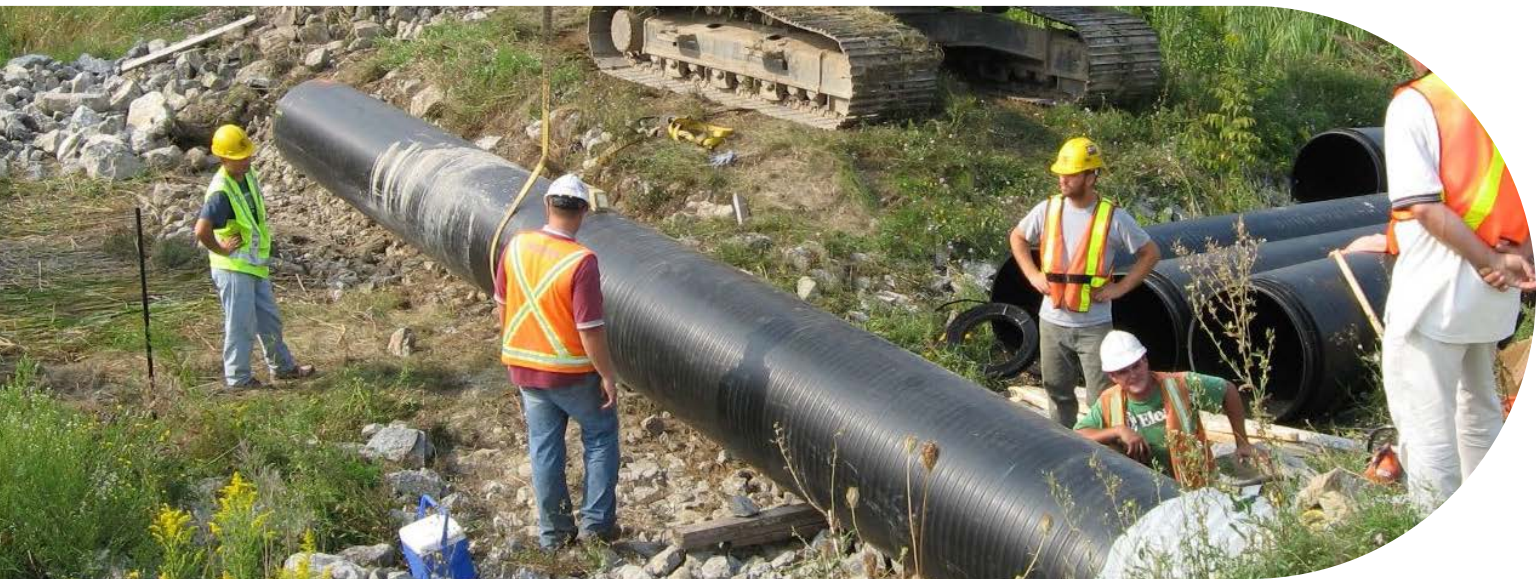


Across North America, many culvert pipe systems have reached the end of their expected lifespan and are deteriorating prematurely. Culvert failures can be catastrophic, often resulting in road collapses, injuries, or, in extreme circumstances, loss of life. The most common culvert failures are caused by corrosion and backfill loss due to leaking joints and perforations.

Infra Pipes is proud to offer culvert relining with Weholite®, our Large-Diameter Structural Profile Wall High-Density Polyethylene (HDPE) Pipe. Weholite's proven track record in North America with most provincial and state transportation authorities makes Weholite the ideal reline material for these culverts. Offered in sizes up to 132"/ ID, no host culvert is too big or too challenging.

Infra Pipes offers two options for culvert relining: Round pipe and Ovalized pipe.



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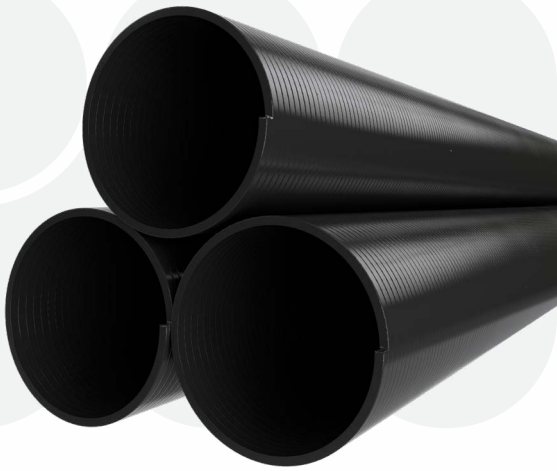

Benefits

Weholite®'s raw material properties have been combined with a patented structural design technology, resulting in a strong, robust, and lightweight pipe with superior performance and loading capacity.

Minimized Disruptions

Culvert relining with Weholite® requires minimal traffic control and eliminates the need for road and railway closures, reducing disruptions for daily commuters. The robust nature of Weholite® enables installations in heavy-traffic areas and is ideal for railway tracks prone to vibration.

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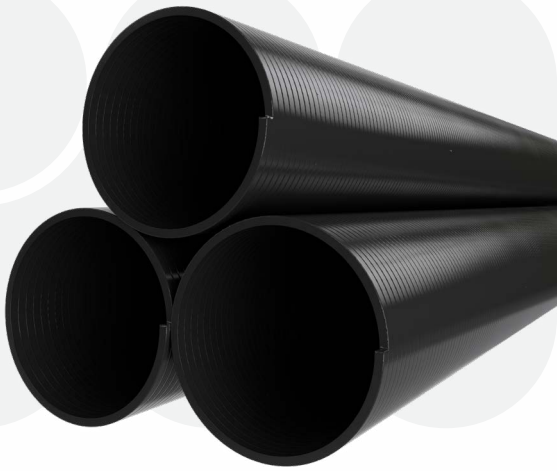


Cost-Effective

Relining with Weholite® is significantly more cost-effective than the traditional 'dig & replace' method. Weholite pipe is easy to handle and install, leading to cost savings in transportation, installation, and overall construction costs when compared to the 'dig & replace' method.

Corrosion Resistant

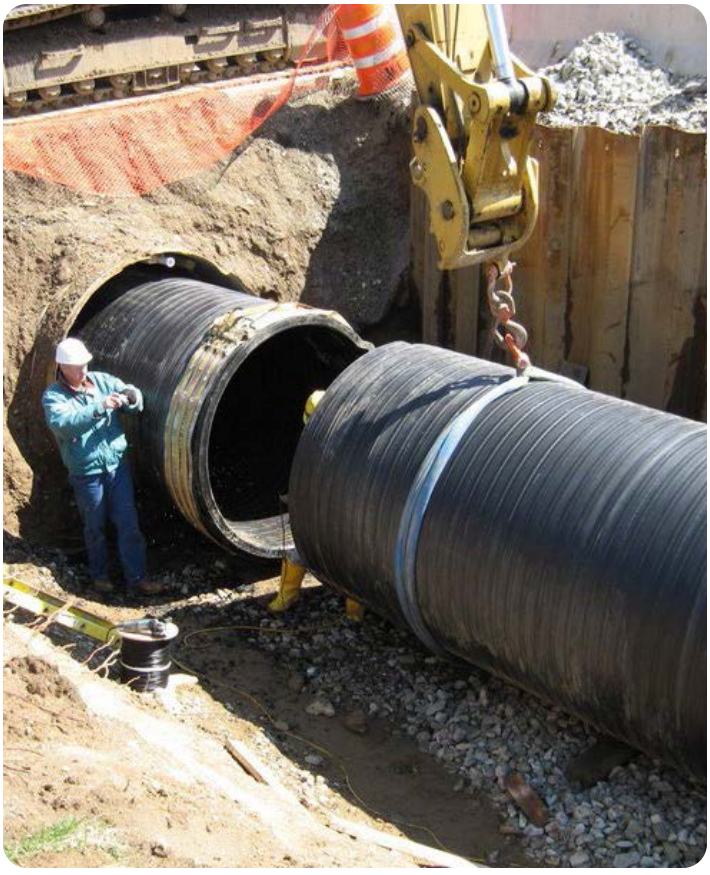
Weholite® will not corrode, rust, or tuberculate; is inert to most chemicals and saltwater; and is highly abrasion resistant. For environmentally sensitive areas Weholite can be fabricated with fish baffles, and/or flow attenuators. Road salts, de-icing fluids, and other chemicals will not cause corrosion or degradation of Weholite pipes.

Abrasion Resistance

Weholite's high abrasion resistance provides ideal protection for handling typical bedloads and flow conditions.

Superior Flow Characteristics

Weholite®'s smooth interior, 0.01 Manning's n surface enables a smaller-diameter Weholite to achieve the same or greater flow than the original host pipe.



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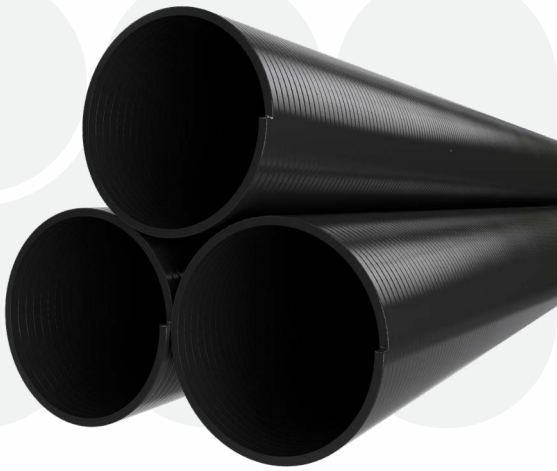
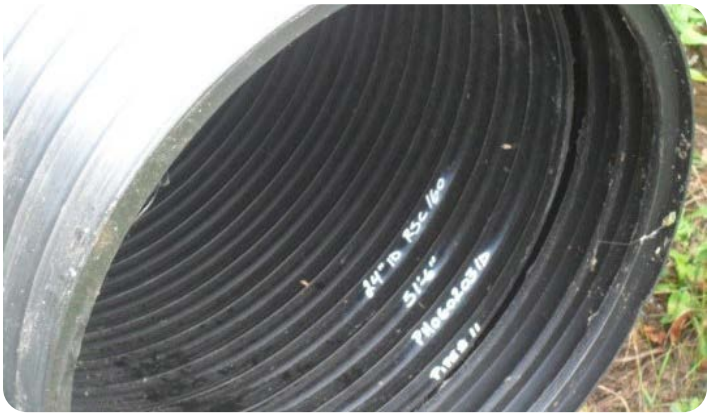


Weholite® Joining Methods

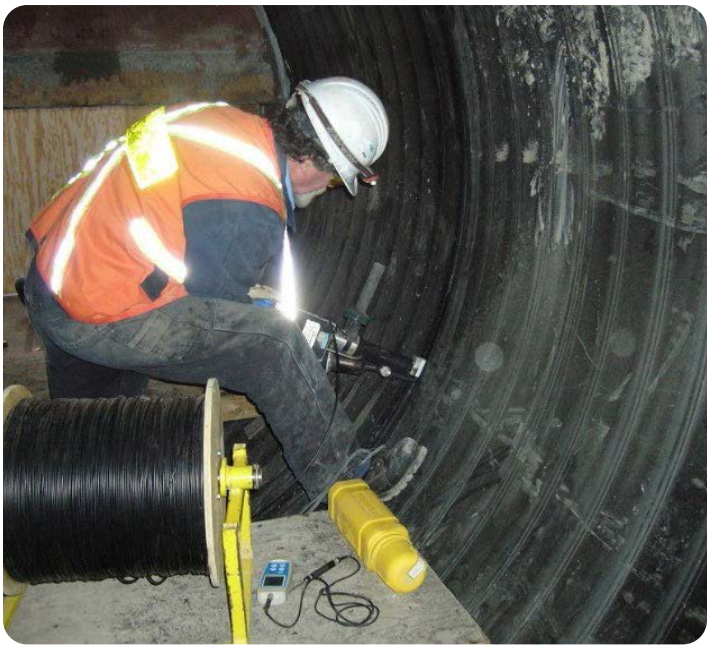
Threaded Joints

The unique threaded joint enables the installation of Weholite® without the need for special tools. This joining system provides sand- and silt-tight connections that can be made quickly in the field. Threaded joints will not separate, unlike other products that utilize stab-type joining systems. Threaded joints are fully restrained, allowing for the pipe to be pushed and/or pulled into place.



Extrusion Welding

Extrusion welding is specifically advantageous with larger diameters above 96"/2440mm and must be used to join Ovalized Weholite® pipe.



Internal Extrusion Welding

External Extrusion Welding

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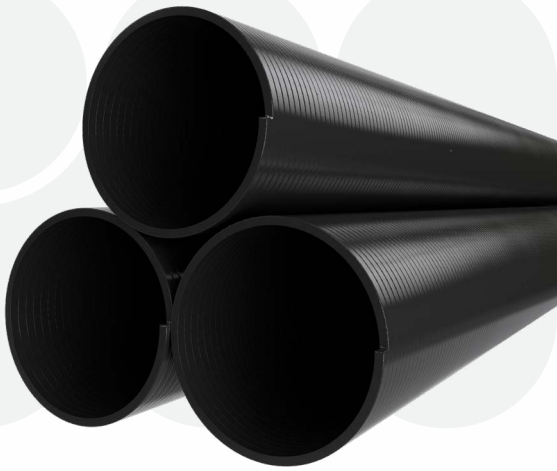

Steps to Culvert Rehabilitation

Inspection

- Clean and inspect the existing culvert, with particular attention to any deformation and obstacles that may obstruct the sliplining operation.

Pipe Selection

- After the correct host culvert diameter and length have been determined, an appropriately sized Weholite® pipe is selected.
- To determine the Ring Stiffness Constant (RSC), please refer to our Infra Pipes Online Calculator.

Linear Insertion

- Prepare the jobsite to receive Weholite® pipe and facilitate the insertion process.
- Install grout/vent tubes for the length of the host pipe or a standpipe at appropriate intervals of the existing culvert.
- Insert the first pipe length into the existing culvert by pushing and/or pulling until only the pipe end is exposed.
- If necessary, install blocking or use other suitable methods to prevent the Weholite® from floating during the grouting process.
- Place the next length and assemble. Repeat the process until the existing culvert has been lined.

Grouting

- Construct bulkheads at the culvert ends to contain grout within the annular void.
- Internal bracing can be used at the contractor's discretion to minimize ovalization during grouting.
- Grout annular void by pumping or by adopting the gravity method using cellular or cementitious grouts.
- Grout pressure must not exceed the maximum allowable grout pressure from the selected RSC.
- Large diameter Weholite® may have to be grouted in lifts to keep grout pressure within limits.

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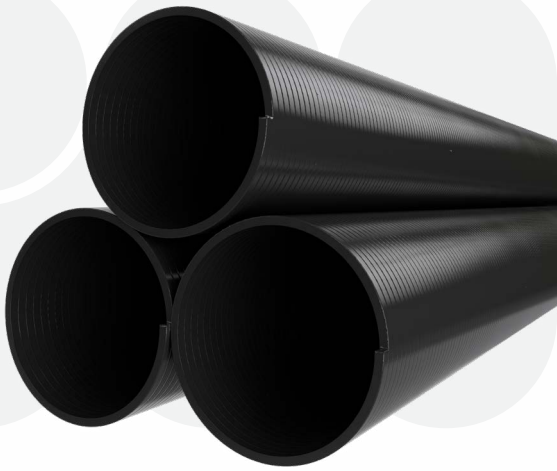


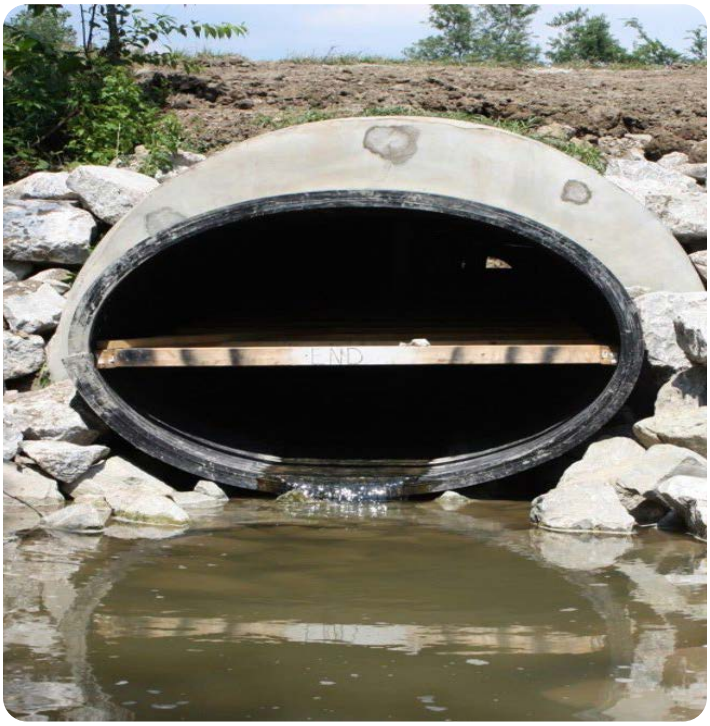
Ovalized Pipe

The challenge when relining a box, arched, or odd-shaped culvert is achieving acceptable flow rates, as any new liner inserted into the host pipe reduces the culvert's cross-sectional entrance area. Weholite® Ovalized culvert pipe solves this challenge in two ways. First, by offering shapes other than round, it maximizes the cross-sectional open area of the reline pipe. Second, by manufacturing pipes with a smooth internal surface, the hydraulic flow rates can quite often exceed those of the original culvert design.

Infra Pipes can provide Weholite® in Ovalized configurations, which fit irregular culverts, arches, and ovals.

Oval pipes range from 18" to 132" and are available with reduced rise and span dimensions up to 20 & Standard pipe lengths range from 20' to 25'.

Contact your local Infra Pipes rep, or our customer service at **customer.service@infrapipes.com** for the Ovalized dimensional chart.



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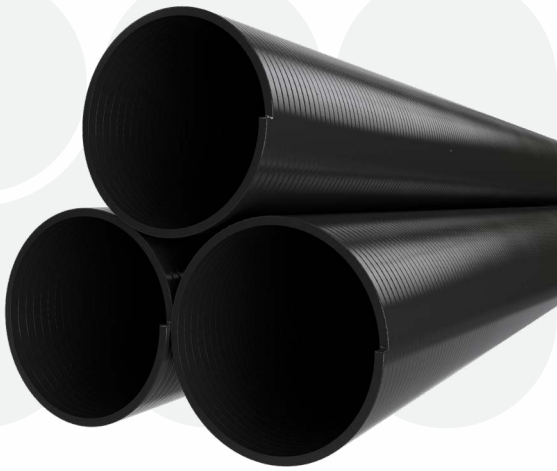

Weholite Diameters and Weights

	NPS		OV Avg		OD Max		Shipping Weight	
	(in)	(mm)	(in)	(mm)	(in)	(mm)	(lbs/ft)	(kg/m)
RSC160	18	460	20.3	516	22.3	566	18	27
	19.5	495	22.0	559	23.9	607	20	30
	21	530	23.6	599	27.1	688	21	31
	24	610	26.9	683	30.4	772	24	36
	27	690	30.2	767	33.8	859	27	40
	30	760	33.5	851	37.0	940	30	45
	33	840	36.7	932	40.2	1021	38	57
	36	910	40.5	1029	41.0	1041	42	62
	40	1020	44.5	1130	45.1	1146	46	28
	42	1070	46.5	1181	47.1	1196	52	77
	48	1220	52.8	1341	53.5	1359	60	89
	54	1370	59.4	1509	60.2	1529	70	104
	60	1520	65.4	1661	66.2	1681	90	134
	66	1680	71.9	1826	72.8	1849	100	149
	72	1830	78.3	1989	79.3	2014	120	179
	78	1980	84.7	2151	85.8	2179	150	223
	84	2130	91.1	2314	92.3	2344	160	238
	90	2290	97.5	2477	98.8	2510	170	253
	96	2440	103.5	2629	104.8	2662	190	283
	102	2590	110.0	2794	111.3	2827	215	320
	108	2740	116.3	2954	117.8	2992	240	357
	120	3050	129.1	3279	130.7	3320	280	417
	132	3355	141.5	3594	143.2	3637	330	491
RSC250	33	840	37.5	953	38.0	965	47	70
	36	910	40.8	1036	41.4	1052	51	76
	40	1020	44.8	1138	45.4	1153	60	89
	42	1070	46.9	1191	47.6	1209	70	104
	48	1220	53.4	1356	54.1	1374	80	119
	54	1370	59.9	1521	60.7	1542	90	134
	60	1520	66.3	1684	67.2	1707	100	149
	66	1680	72.7	1847	73.7	1872	120	179
	72	1830	79.1	2009	80.2	2037	150	223
	78	1980	85.5	2172	86.6	2200	160	238
	84	2130	92.0	2337	93.1	2365	190	283
	90	2290	98.3	2497	99.6	2530	200	298
	96	2440	104.7	2659	106.1	2695	230	342
	102	2590	111.1	2822	112.5	2858	250	372
	108	2740	117.5	2985	119.0	3023	270	402
	120	3050	130.2	3307	131.9	3350	330	491
	132	3355	142.6	3622	144.4	3668	370	551

*RSC400 is available if required.

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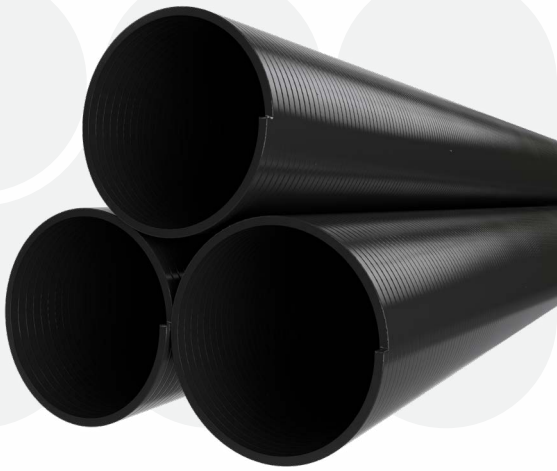

Weholite Grouting Pressures

	NPS		Unconstrained Pipe Wall Buckling (Grouting pressure)[1]		Cellular Grout 40 pcf / 640 kg/m³			Cement Grout 125 pcf / 2000kg/m³		
					Lift Height		Number of Lifts[2]	Lift Height		Number of Lifts[2]
	(in)	(mm)	kPa	psi	(ft)	(m)		(ft)	(m)	
RSC160	18	460	72	10.5	37.1	11.3	1	12.1	3.7	1
	19.5	495	67	9.7	34.1	10.4	1	11.1	3.4	1
	21	530	62	9.0	31.9	9.7	1	10.4	3.2	1
	24	610	55	7.9	28	8.5	1	9.1	2.8	1
	27	690	49	7.1	25.1	7.6	1	8.1	2.5	1
	30	760	43	6.2	21.8	6.6	1	7.1	2.2	1
	33	840	38	5.6	19.7	6	1	6.4	1.9	1
	36	910	46	6.7	23.7	7.2	1	7.7	2.3	1
	40	1020	34	5	17.6	5.4	1	5.7	1.7	1
	42	1070	30	4.3	15.3	4.7	1	5	1.5	1
	48	1220	24	3.5	12.6	3.8	1	4.1	1.2	1
	54	1370	25	3.6	12.8	3.9	1	4.1	1.3	2
	60	1520	18	2.7	9.4	2.9	1	3.1	0.9	2
	66	1680	18	2.6	9.1	2.8	1	2.9	0.9	2
	72	1830	17	2.5	8.7	2.7	1	2.8	0.9	3
	78	1980	16	2.3	8.3	2.5	1	2.7	0.8	3
	84	2130	16	2.3	8	2.4	1	2.6	0.8	3
	90	2290	15	2.2	7.6	2.3	1	2.5	0.8	4
	96	2440	12	1.8	6.3	1.9	2	2.1	0.6	4
	102	2590	12	1.7	6.2	1.9	2	2	0.6	5
	108	2740	12	1.6	6.1	1.9	2	2	0.6	5
	120	3050	11	1.5	5.8	1.9	2	1.9	0.6	6
	132	3355	10	1.4	4.9	1.8	3	1.6	0.5	7

[1]Factor of Safety used in calculations of unconstrained pipe wall buckling is 1.5. Pipe ovality is assumed not to exceed 2%. Possion's ratio of 0.35 and 10hr / 100° F material modulus of elasticity value of 46,900 psi has been used. Use PPI's Engineering Handbook, Chapter 6, to determine grouting pressure (unconstrained pipe wall buckling) characteristics at temperatures and load durations different from those indicated above.

[2]For convenience, the number of grout lifts has been shown based on the case of the culvert pipe being essentially on a flat grade. Where there is a significant grade, the recommended grout lift height may increase the number of recommended grout lifts.

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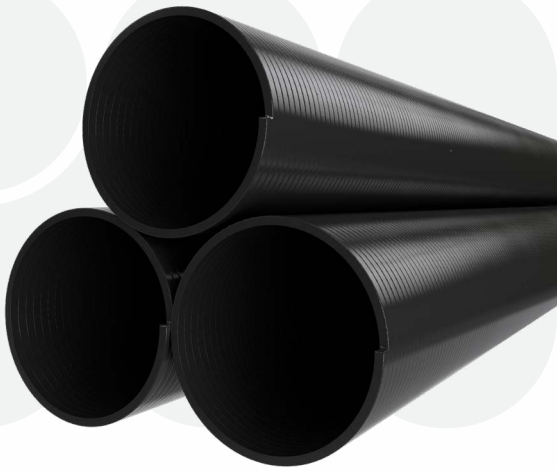

Weholite Grouting Pressures (Continued)

	NPS		Unconstrained Pipe Wall Buckling (Grouting pressure)[1]		Cellular Grout 40 pcf / 640 kg/m³			Cement Grout 125 pcf / 2000kg/m³		
					Lift Height		Number of Lifts[2]	Lift Height		Number of Lifts[2]
	(in)	(mm)	kPa	psi	(ft)	(m)		(ft)	(m)	
RSC250	33	840	89	8.6	30.3	9.2	1	9.8	3	1
	36	910	55	8	28.3	8.6	1	9.2	2.8	1
	40	1020	42	6	21.3	6.5	1	6.9	2.1	1
	42	1070	40	5.8	20.3	6.2	1	6.6	2	1
	48	1220	35	5	17.9	5.5	1	5.8	1.8	1
	54	1370	31	4.6	16.1	4.9	1	5.2	1.6	1
	60	1520	29	4.2	14.7	4.5	1	4.8	1.5	2
	66	1680	26	3.8	13.4	4.1	1	4.4	1.3	2
	72	1830	24	3.5	12.4	3.8	1	4	1.2	2
	78	1980	22	3.3	11.5	3.5	1	3.7	1.1	2
	84	2130	21	3.1	10.9	3.3	1	3.5	1.1	2
	90	2290	20	2.9	10.3	3.1	1	3.3	1	3
	96	2440	19	2.7	9.7	2.9	1	3.1	1	3
	102	2590	18	2.6	9.2	2.8	1	3	0.9	3
	108	2740	17	2.5	8.8	2.7	2	2.8	0.9	4
	120	3050	16	2.3	8.1	2.5	2	2.6	0.8	4
	132	3355	15	2.1	7.5	2.3	2	2.4	0.7	5

[1] Factor of Safety used in calculations of unconstrained pipe wall buckling is 1.5. Pipe ovality is assumed not to exceed 2%. Possion's ratio of 0.35 and 10hr / 100° F material modulus of elasticity value of 46,900 psi has been used. Use PPI's Engineering Handbook, Chapter 6, to determine grouting pressure (unconstrained pipe wall buckling) characteristics at temperatures and load durations different from those indicated above.

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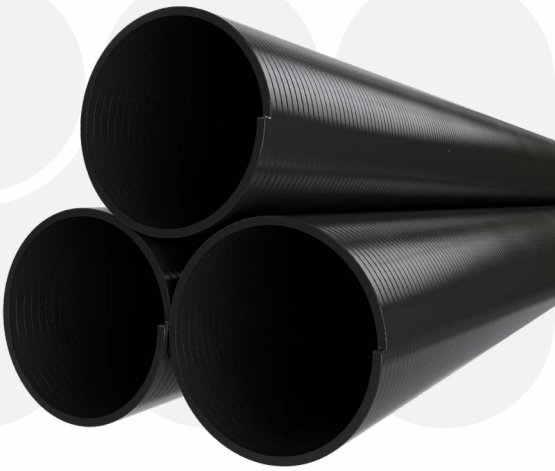
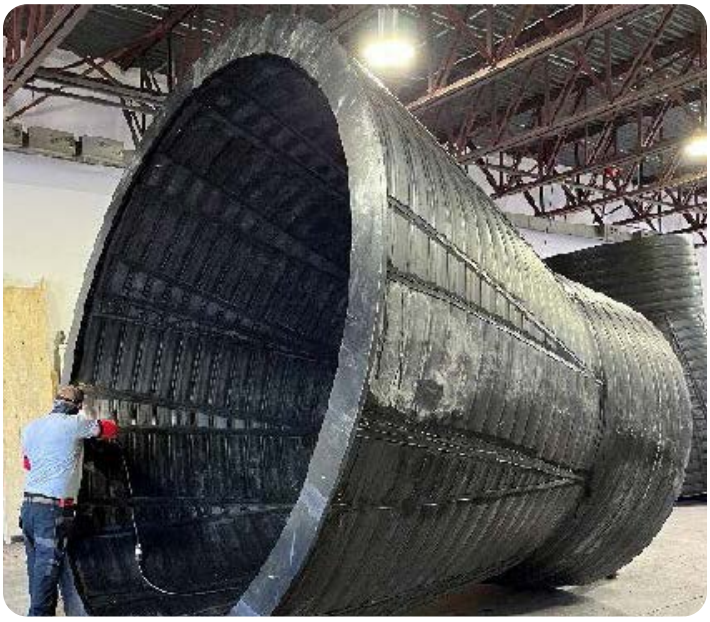
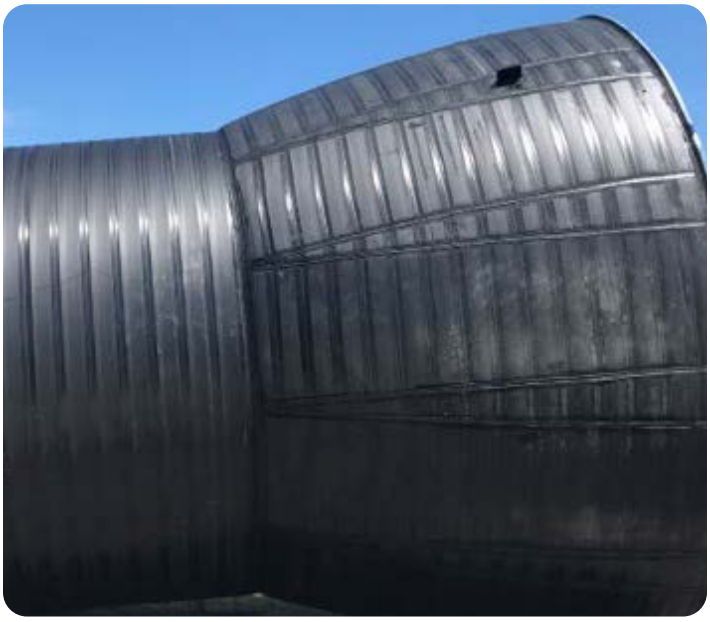
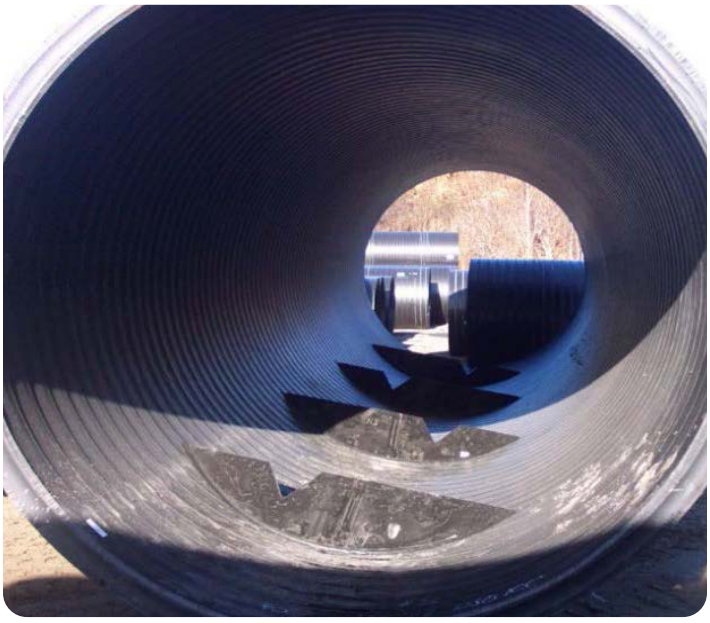
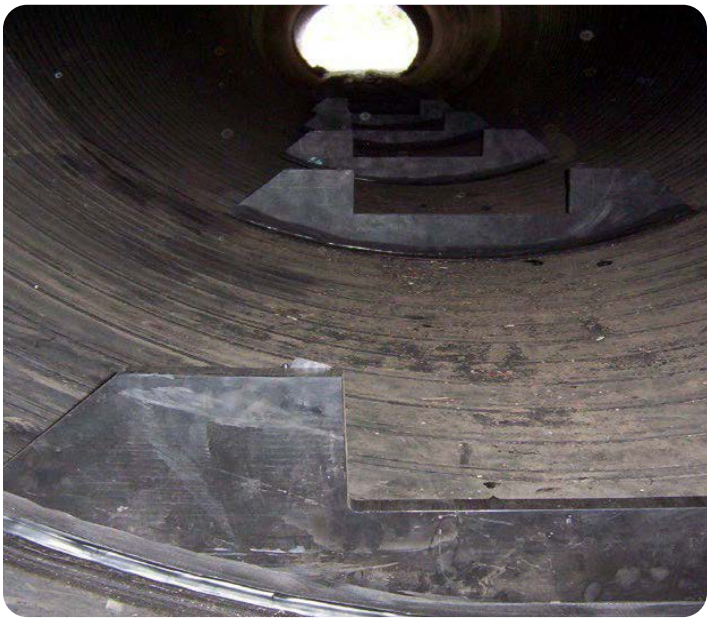






Enhanced Weholite® Culvert Improvements





Fish Baffles and Flow Attenuators

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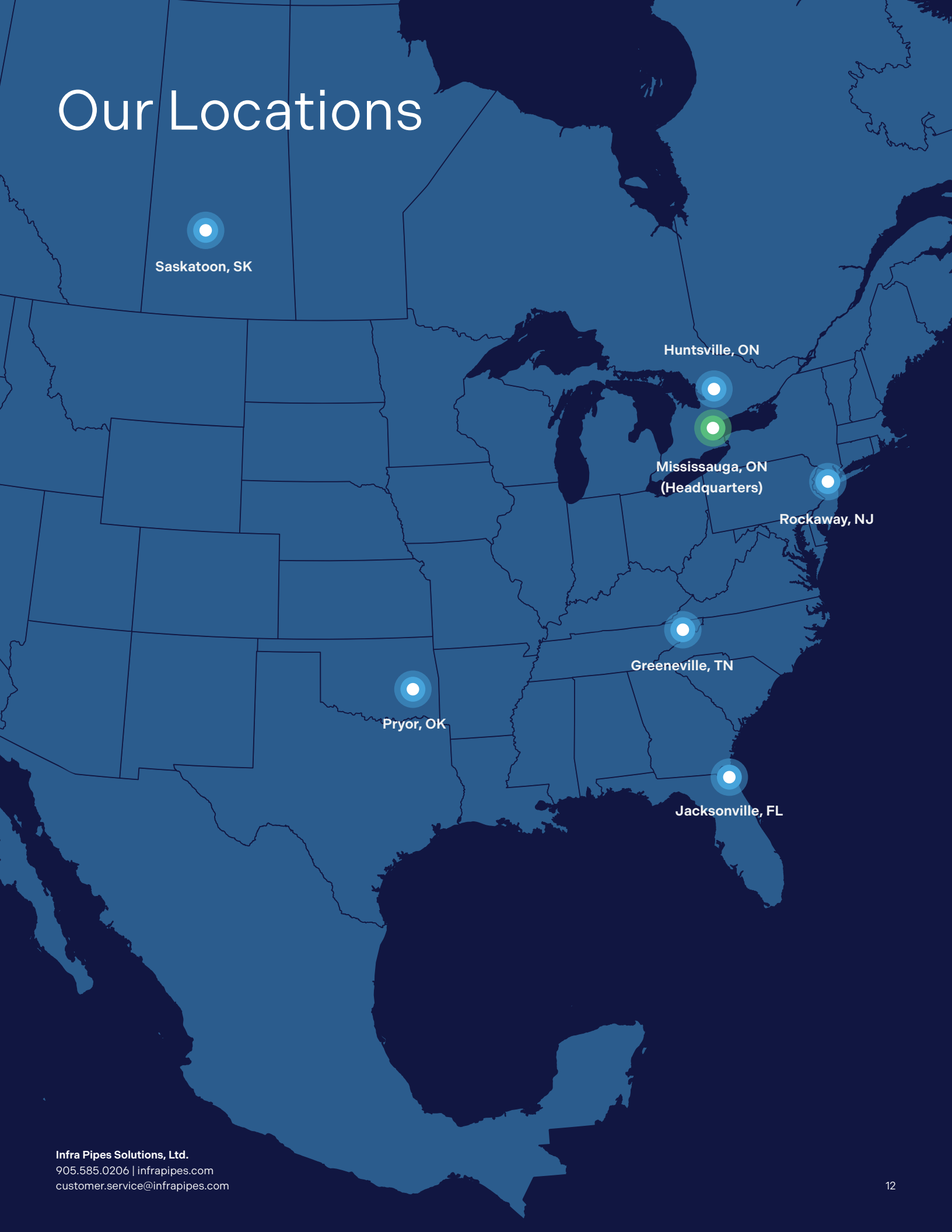
Our Locations



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