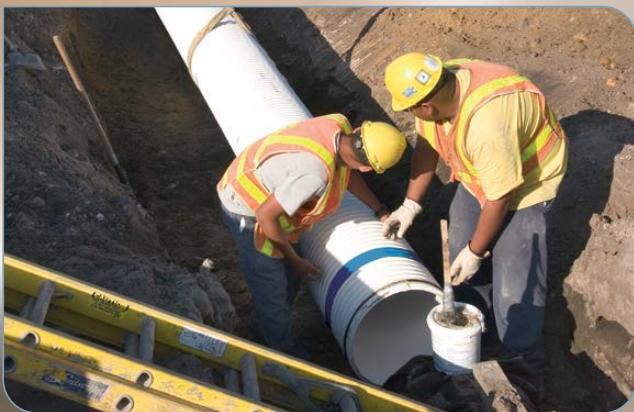




CONTECH
ENGINEERED SOLUTIONS
A QUIKRETE® COMPANY



A-2000™ PVC Pipe for Storm
Sewers and Drainage

CONTECH
PIPE SOLUTIONS

A-2000™ Drainage Pipe

Drainage systems are required to meet multiple criteria. The choice of a particular material depends upon a number of factors; however, the best choice is the one that yields the best performance over the project life cycle.

Thermoplastic Storm Sewer and Drainage Pipe

In recent years, the use of thermoplastic pipe for stormwater drainage systems has gained wide acceptance—based upon performance and economic advantages when contrasted with more conventional drainage pipe materials. **However, when it comes to performance, not all thermoplastic storm sewer pipes are equal.** There are distinct differences between A-2000 Polyvinyl Chloride (PVC) drainage pipe and other drainage pipes that can affect overall pipe system performance.

ConTech® A-2000 PVC Drainage Pipe: Available in Diameters 4"-36" and 14' or 22' lengths.

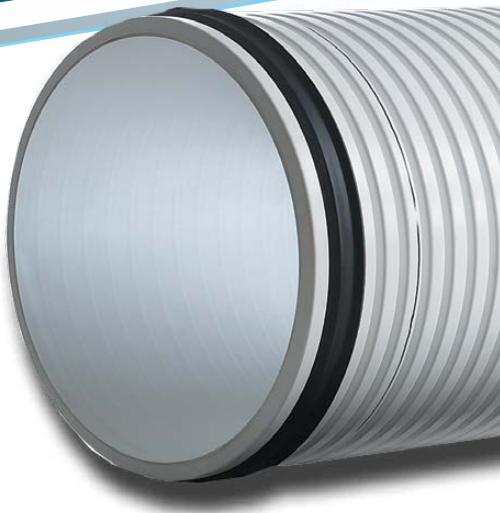
Originally developed in the early 1980's, A-2000 has built an outstanding performance history that's setting the standard for gravity flow, sanitary sewer applications. The material advantages offered by PVC—plus the innovative, double wall design with the unique, patented gasketed joint system—makes A-2000 the ideal choice for stormwater drainage systems. Now you can have all of the advantages without the limitations of HDPE or reinforced concrete pipe.



Compact A-2000 PVC profile is stable and not subject to local buckling like HDPE.

Strength

A-2000's PVC compound provides **6 times** greater long-term material stiffness as compared to HDPE drainage pipe materials. And A-2000 pipe, **UNLIKE** HDPE drainage pipe, has a minimum 46 pipe stiffness for **ALL** diameters.



Minimum Specified Pipe Stiffness (73°)*

Pipe Diameter	PVC ASTM F949	HDPE AASHTO M294
12	46	50
15	46	42
18	46	40
24	46	34
30	46	28
36	46	22

*Actual A-2000 pipe stiffness values are 50 psi

Better deflection control

When compared to other thermoplastic pipes on the market, A-2000 stands up to the test. In fact, it comes out on top.

When installed in accordance with ASTM D2321, A-2000 provides excellent shape control (performance).

The difference between effective pipe stiffness of A-2000 and HDPE drainage pipe during construction on a summer day can result in A-2000 being as much as **3 TIMES STIFFER**. This significant stiffness advantage, combined with PVC's lower strain sensitivity and temperature sensitivity, means A-2000 can be installed with conventional flexible pipe practice and not experience excessive shape distortions.



Heights of Cover

A-2000 PVC pipe can be used with 1 foot of cover under highway loading. Current AASHTO LRFD Design Methodology has required all thermoplastic pipes to have a minimum height of cover of 2 feet under pavement. This requirement was derived from a Minnesota DOT Research Report (2005) that studied HDPE pipe performance under highway loading. The report indicates significant thermal expansion of HDPE pipe under shallow fills. PVC pipe was not incorporated in this study, and it should be noted that HDPE experiences four times more thermal expansion than PVC.

When selecting a system based on pipe stiffness, material strength and structural capability, A-2000 PVC far exceeds the performance characteristics of HDPE drainage pipe.



A comparison of cover heights using AASHTO design methodology and H20 live loading for A-2000 and a major manufacturer's M294 HDPE pipe are summarized below.

A-2000 vs. M294 HDPE (AASHTO Heights of Cover)

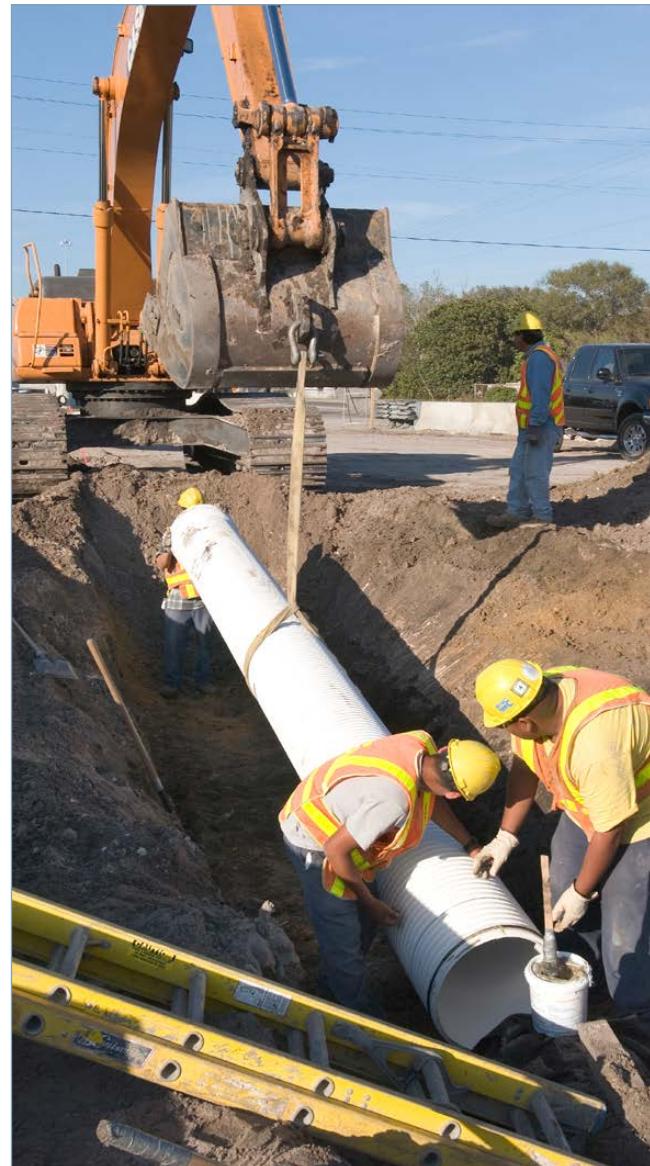
Pipe Type/Specification	Allowable Height of Cover	Allowable Structural Backfill	Min. Compaction	Min. Trench
PVC A-2000 - ASTM F949	2'-20'	A-1-a, A-1-b, A-3 A-2-4, A-2-5	90%	1.5 X O.D. +12"
	21'-35'	A-1-a, A-1-b, A-3	95%	1.5 X O.D. +12"
Corrugated HDPE - AASHTO M294	2'-10'	A1-a, A1-b, A-3	95%	O.D. + 36"
	11'-20'	A-1-a	95%	3.0 x O.D.
	21'-35'	Not Allowed		

Durability, Service Life

PVC materials used in the manufacture of gravity flow pipe offer excellent resistance to conventional corrosion and abrasion. In fact, profile wall PVC pipe has been shown to have better abrasion resistance than reinforced concrete pipe in side-by-side laboratory testing at California State University.

PVC and HDPE do **not** provide equal long-term durability performance. Under loading or localized tensile stress, some grades of HDPE are subject to environmental stress cracking—also known as slow crack growth. Exhibited as premature rupture, this phenomenon can occur when stressed HDPE plastics are attacked by a reagent (even storm runoff) that causes cracking or rupture at stress levels well below design performance expectations.

PVC pipe is not threatened by this type of cracking. When you consider durability and service life, A-2000 PVC far exceeds the performance characteristics of HDPE drainage pipe. (See the National Cooperative Highway Research Program study conducted by Drexel University, March, 1999: "HDPE Pipe: Recommended Material Specifications and Design Requirements".)



ConTech A-2000 PVC far exceeds the durability and service life of HDPE drainage pipe.

Hydraulic Efficiency

A-2000 vs. Concrete Pipe

Thermoplastic pipes, with smoother interiors and fewer joints, reduce resistance to flow and are hydraulically more efficient than conventional (i.e., RCP) storm drainage pipe materials.

Flow testing conducted in 2002 by the Utah Water Research Laboratory concluded

A-2000 PVC Pipe, with its inner wall formed over a polished mandrel, has the lowest wall friction factor (Manning's "n" = .009) of any thermoplastic pipe available and offers real advantages compared to RCP ($n = .012\text{-.013}$). This added efficiency means A-2000 can be designed as a smaller and less expensive pipe, with less excavation due to flatter pipe slopes and less manhole/junction box depth requirements.

A-2000 vs. HDPE Pipe

Hydraulic tests performed at a major United States Water Research Laboratory led researchers to conclude that HDPE drainage pipe's "n" factor varied "depending upon the smoothness of the liners" and "the bonding of the liner to the corrugations made the pipe interior somewhat wavy." Once installed, HDPE pipe walls are subject to local buckling (NCHRP Report 438) and the measured waviness increases with load. Using the method derived to estimate the effective Manning's "n" factor, Manning's "n" values of 0.017-0.022 provide a more accurate representation of HDPE's hydraulic efficiency when in-service and under load.

A-2000 PVC pipe, with its engineered, stable profile, is designed to **NOT** buckle.

When you're selecting a system based on hydraulic efficiency, A-2000 PVC pipe far exceeds the performance limitations of HDPE and RCP drainage pipe.



A-2000 PVC has a smooth, glossy interior for uninterrupted flow.



Best Pipe on the Planet

The Need for Tight Joints

Storm sewers have always presented special needs for tight jointing systems. Because of their function, they are subject to rapidly changing flow levels. The sudden rise and fall of flow levels leaves storm sewers susceptible to backfill migration into the sewer unless tight joints are used. This loss of backfill reduces the soil support of the pipe and causes settlement at the surface. Where storm sewers are below the existing water table, water tight joints are needed to prevent infiltration and maintain storm sewer capacity.

A-2000's long, 22-feet lengths and soil/water tight joints clearly make it the preferred choice with regard to system tightness. In comparison, RCP has many joints—increasing the opportunity for soil infiltration and settlement. And with A-2000 you don't have to specify special jointing requirements. Watertight gasketed joints are standard with A-2000.



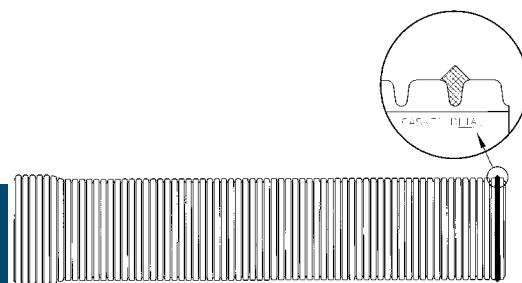
A-2000 is lightweight & easy to handle.

Handling and Installation

A-2000's easy handling weight and the availability of up to 22-feet lay lengths often result in reduced labor costs and more economical installation. Compared to heavy-weight and short-length RCP, A-2000 can be installed with greater ease and lower cost. And contrasted to HDPE, A-2000 has added beam strength—which means better line and grade control, increasing crew efficiency. Plus, A-2000 requires less trench width, lowering excavation costs and speeding installation.

The Performance Choice

With the increasing demands on our drainage and storm sewer systems, products designed and proven to provide the best performance over the project life cycle are needed. A-2000 PVC drainage pipe offers all of the initial cost advantages associated with thermoplastic pipe when compared with RCP but without the performance limitations of HDPE drainage pipe. There's no reason to compromise on performance—**Select A-2000 PVC: The Best Storm Sewer and Drainage Pipe on the Planet.**



A-2000™ Specifications

Constant Stiffness Thermoplastic Pipe

1.0 PIPE: Polyvinyl Chloride (PVC) storm sewer/drain pipe and fittings shall be manufactured and tested in accordance with ASTM F949.

2.0 MATERIAL AND DESIGN: The structural design of thermoplastic pipes shall be in accordance with AASHTO LRFD titled: "Buried Structures and Tunnel Liners." To ensure long-term design strength properties, PVC pipe shall be manufactured from 12454 cell class material per ASTM D1784. Pipe and fittings shall have a minimum pipe stiffness of 46 lbs./in./in., when tested in accordance with ASTM D2412.

3.0 JOINING SYSTEM: Joints shall be an integral bell-gasketed joint. When the joint is assembled, it shall prevent misalignment of adjacent pipes and form either a soil tight joint (2 psi hydrostatic test per AASHTO Standard Specification for Highway Bridges) or a watertight joint (10.8 psi test per ASTM D3212 titled: "Standard Specification for Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals") as required.

4.0 HYDRAULICS CAPACITY: The PVC Pipe covered in this section shall provide a Manning's "n" value of .009.

5.0 INSTALLATION: Thermoplastic pipe and fittings shall be installed in accordance with AASHTO Thermoplastic Specifications or ASTM D2321.

Additional Products & Applications

A-2000 for Roof Drainage Systems

Managing large volumes of stormwater runoff from roof areas of industrial, commercial and warehouse facilities is more demanding than for most gravity-fed sewer systems.

- High strength
- Tight Joints
- Unique gasket and bell design

A2™ Liner Pipe for Trenchless Rehabilitation

Utilize A2 Liner for your aging underground infrastructure—the proven, trenchless solution to sliplining existing sewers and culverts. Contech developed A2 Liner Pipe for sliplining deteriorating pipelines where open trenching is not practical or desirable.

- Diameter ranging from 12" - 36"
- Standard lengths ranging from 2.5' to 20'
- Light weight
- Installed cost savings

A-2000 Perforated Pipe for Subdrainage Systems

Contech A-2000 offers several critical features and benefits that make it the performance choice for subsurface drainage systems:

- 46 psi pipe stiffness for structural stability and improved deflection control.
- Glossy smooth interior for improved hydraulic capacity.
- PVC rigidity that provides essential beam strength for improved line and grade control during installation.
- Positive-gasketed jointing system.

Standard perforations for 4"-18" diameters are slots, while perforations for pipe sizes 21"-36" are circular $\frac{3}{8}$ " diameter (.375") holes. Fully perforated A-2000 is also available for even greater open area.



Perforation Dimensions

Pipe Size (in)	Slot Dimension/Hole Size (in) (min)	Centers (in)	Perforation Open Area (in ² /LF)
4	1.062L x 0.031W	0.42	1.90
6	1.375L x 0.031W	0.52	1.98
8	1.750L x 0.031W	0.69	1.90
10	2.187L x 0.031W	0.83	1.98
12	1.687L x 0.051W	1.03	2.00
15	1.250L x 0.051W	1.38	2.00
18	2.250L x 0.051W	1.38	2.00
21	0.375 Diameter	1.60	3.30
24	0.375 Diameter	1.90	2.70
30	0.375 Diameter	2.32	2.20
36	0.375 Diameter	2.61	2.00



MANUFACTURING AMERICA'S INFRASTRUCTURE™

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We work alongside owners, engineers, and customers to provide guidance, design support, and installation assistance, helping you build with confidence.

We look forward to working with you on your next project.



STORMWATER
SOLUTIONS



PIPE
SOLUTIONS



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