"HDPE sewer pipe systems: a panacea or a problem"

Peter Klouda

Overview

"Is a polyethylene sewer system which combines welded pipe and fabricated fittings, an improvement on existing PVC rubber ring jointed systems?".

Topics

- Why change from PVC to PE
- What are the actual issues
- History
- Design – Size / Flow/ Stiffness
- Installation costs
- Repair Methods
- Site Issues
- Conclusion

Why The Change?

One of the primary reasons cited by Brisbane was the requirement for a fully sealed system to overcome

- Infiltration
- Exfiltration
- Root intrusion

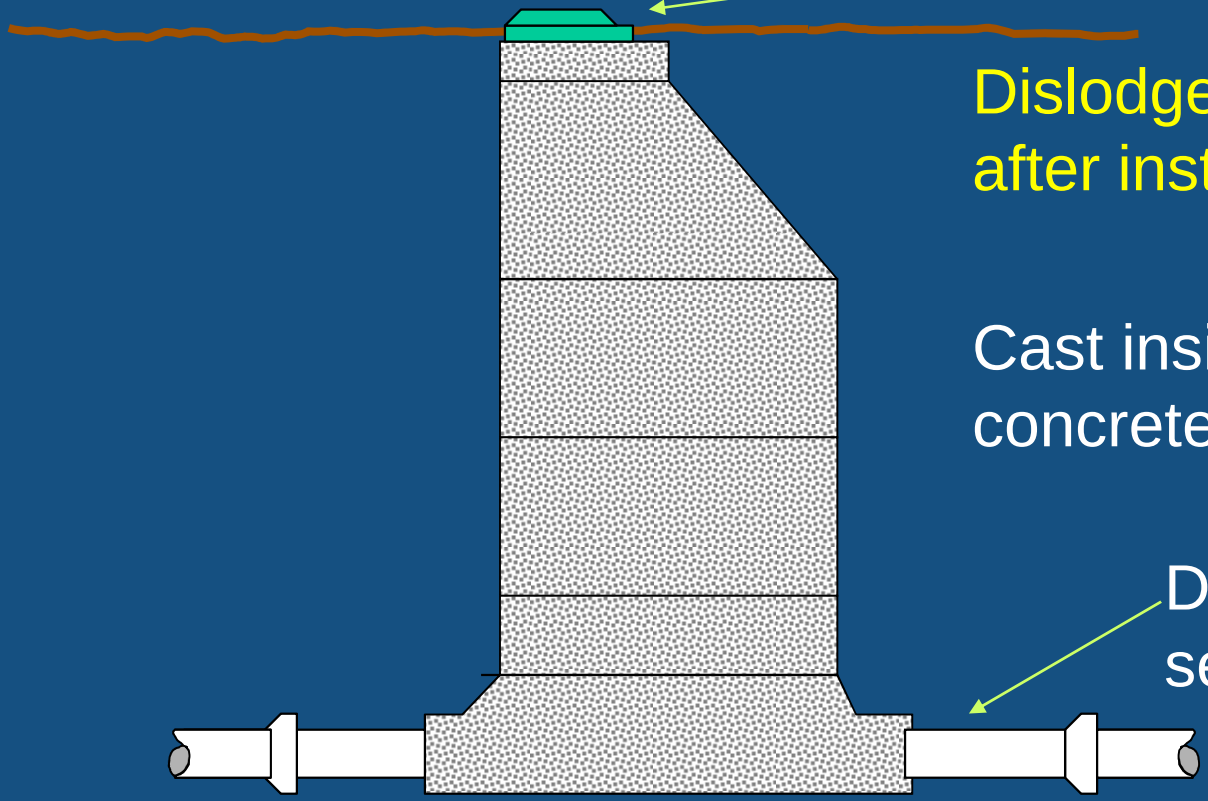
ORG (Overflow Relief Gullies)

- Illegal connection of storm water
- Drainage of landscape to sewers
- Non compliance

Yarra Valley Water
40% Infiltration is through the ORG
20% Illegal Connections
Confirmed by ALLCONNEX

Concrete Chambers

Points for infiltration



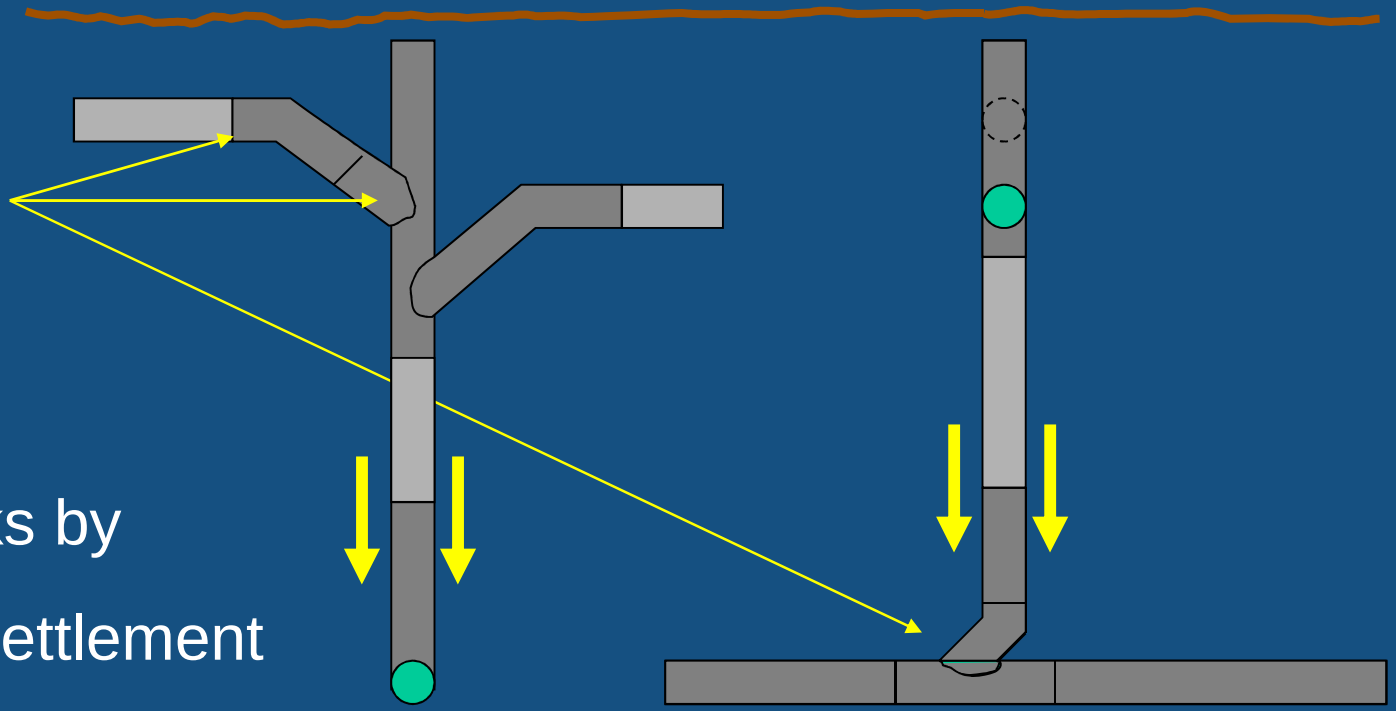
Cover and Frame

Dislodged during and after installation

Cast insitu – poorly placed concrete

Differential settlement

House Connections



Cause of leaks by

- Differential Settlement
- Damaged caused by plumbers making new connections + insufficient bedding and backfill

History

Australia – Diameters DN150 to DN375

Material	**PVC**	**PE**
Australia	1974 37 Years	Yes 5 Years
Global	Yes 50 years	No Germany but allow RRJ

N.B. PE used in high rise buildings but not gravity sewer lines

Dimension/Flows

	PVC	PE
Nominal Diameter	150	160
Class	SN 8	*SN 10*
Internal Diameter	149.6 mm	144.60 mm
Weight	3.7 kg / m	3.7 kg/m
Flow	16.50 l/s	14.70 l/s

12% loss in flow with PE pipe.

Gradient : 1 in 200

Colebrook white roughness k mm= 0.01

Kinematic Viscosity (sq.m/s)= 10.01×10^{-6}

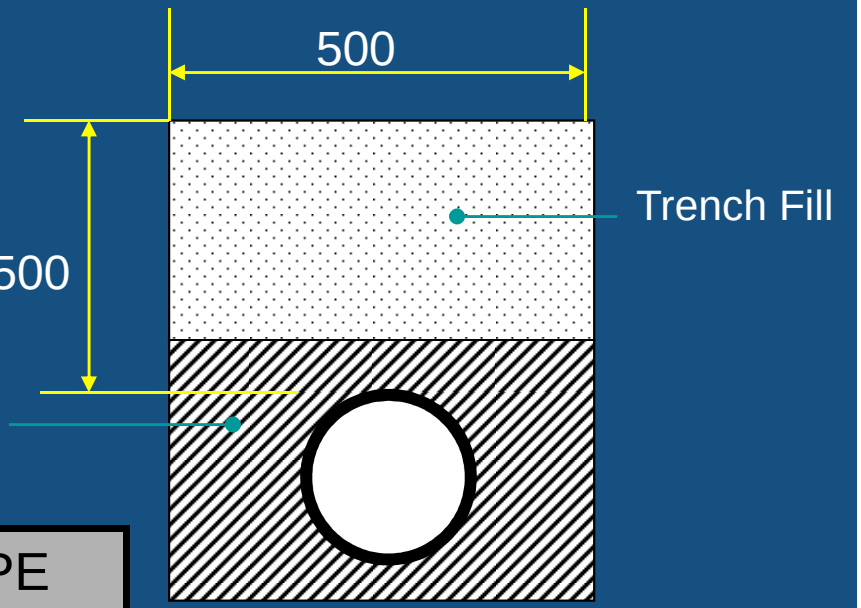
Design

Depth to cover 4.5m

Water Table to surface

Native Soil Clay

No Traffic Loading



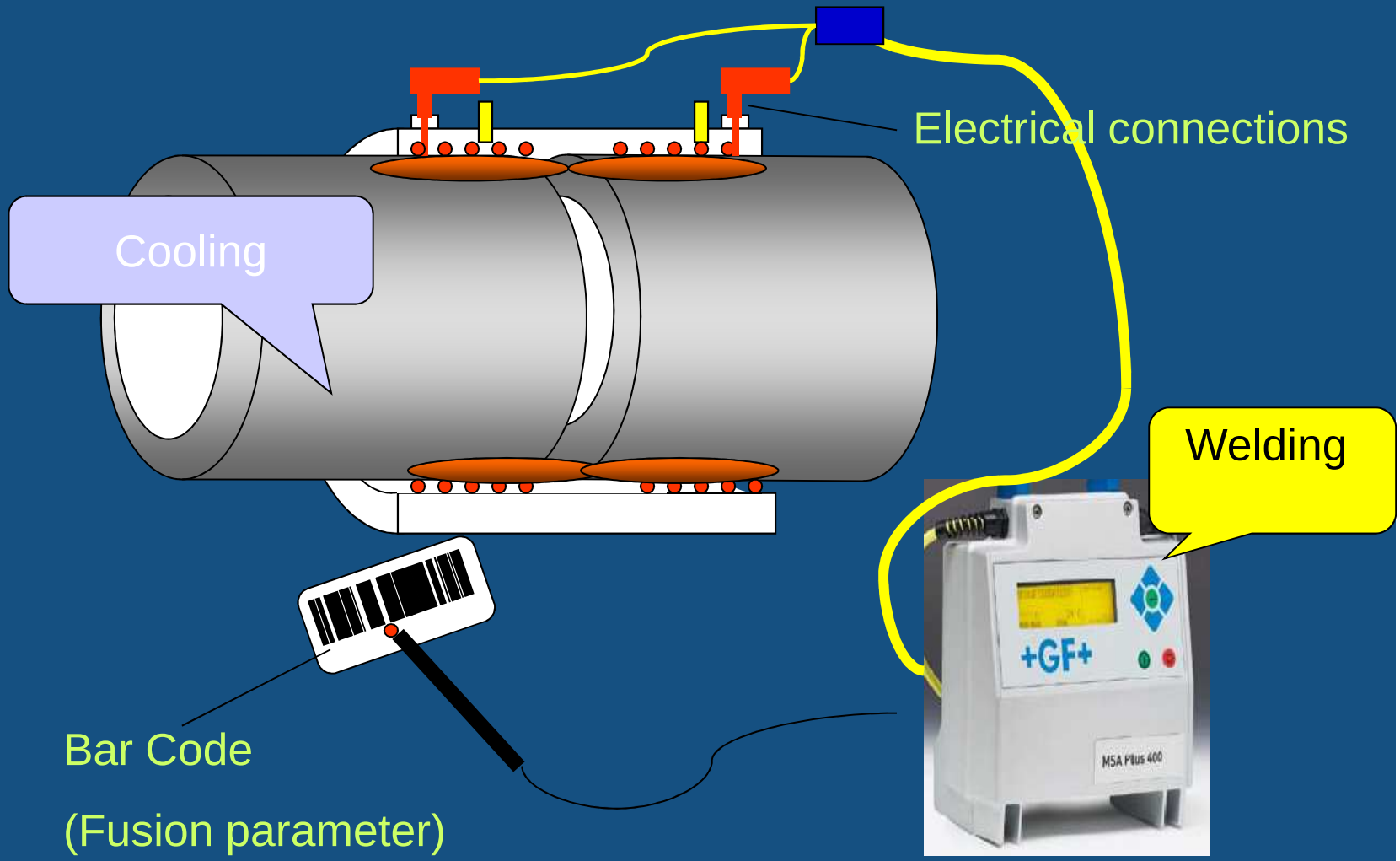
In accordance with AS/NZS2566	PVC DN150	PE DN160
Stiffness SN (N/m.m)	**8,000**	**10,000**
Vertical deflection %	**2.7**	**2.7**
F of S (buckling) Required 2.5	**4.47**	**4.38**
Modulus of Elasticity (MPa)	**2750**	**260**

Pipe Cost

	PVC	PE
Pipe	$9.40/m	$12.35 /m
Joint	Included	$26.00 each
Pipe including joint	$9.40/m	$16.68/m

PE 78% dearer than PVC

Electrofusion welding process



Instillation Cost

	PVC	PE
Pipe including joint	$9.40/m	$16.68/m
Excavate, bed + backfill	Same	Same
Join time	30 Seconds	210 Seconds
Length of line 120m	$1,128.00	$2,001.60
Cost to install joint	$20.0	$70.0
Total (Pipe + Join t+ labour)	$9.60/m	$17.30

PE 80% dearer to install

Add on House connections this can go to 120% plus

No house connections. Straight section between chambers

PE utilises 2 x welding machines (reduce welding joint time)

Assumed 1 Forman and 1 labourer

Repairs

PE

- Electrofusion and or
- Butt Welding
- Mechanical Couplings

Repair in dry weather or Initial repair with MC then install EF

Require Steel insert with mechanical couplings

PVC

- Slip Couplings
- Mechanical Couplings

Can be repaired in inclement weather

Site Issues With PE

Contamination

- Sweat / Water
- Dirt
- Sun Screen
- Wrong wipes

- Peeling

Site Issues With PE

Fabricated Fittings
Hand welded
50% strength of parent material

Incorrect Insertion

Site Issues With PVC

- Inadequate insertion spigot/socket
- Rolled / pinched rubber rings
- No rubber rings
- Ovality

Whole Life Coast Analysis

It is critical when choosing the right product that the overall cost are determined which include

•Pipe	• PE > PVC
•Installation	• PE > PVC
•Life	• Same 100 years
•Maintenance / Repair	• PE > PVC
•Depreciation	• PE > PVC
•Total asset	• PE? – PVC Known

Presently there are no public records available on PE lines (History/ Surveys)

PVC Conclusion

In use for over 30 years #

- Known history / cost / repair
- Can be used in brown field sites
- Minor changes required to gravity sewers to make them seal proof system

Reference WSA 02-2002 with regards to exhumed pipes Sydney / Ipswich

Improvement To Existing System

RIGS - Reduce Inflow Gravity Sewers Gold Coast Water Innovation

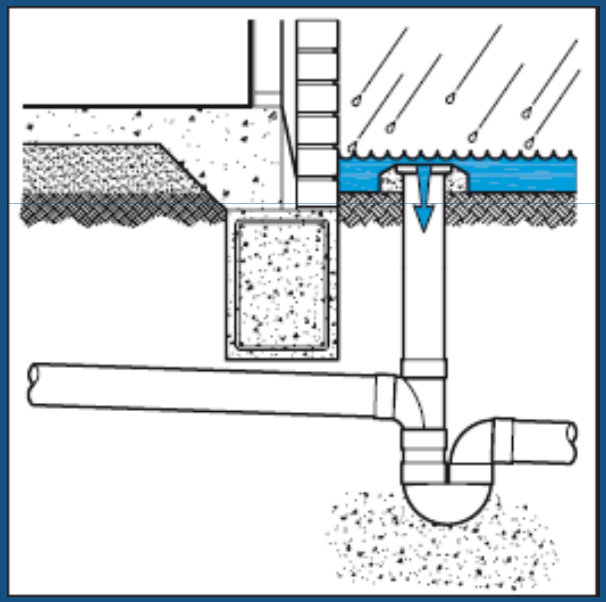
Introduced

- Reinforced fittings (deep/ house connections)

- Maintenance shafts
  - fewer concrete chambers

- Precast Inspection chambers

Change ORG to ORC



PE Conclusion

- Dearer system to purchase and install.
- Issues in wet weather
  - Can use mechanical couplings but this is defeating the issue of no rubber joints.
- Specialised pipe required in brown field sites.

  Not available in Australia
- Track record unknown at this time.

General Conclusion

Yarra Valley Water re Infiltration:-

40% ORG

40% Concrete chambers, damaged pipes

20% Illegal connection

60% to 80% of infiltration has nothing to do with the pipe system.

Going to a smaller diameter in PE will not work unless the above issues are resolved.

More Importantly

There are no studies on existing PE systems

So why change to PE?

Special Thanks to
Bruce Douglas Allconnex (Gold Coast City Council)