

# NJWEA Excavation, Safety & Proper Pipe Installation, Winter 2024

Comprehensive Review of Ductile Iron

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NJWEA 3/5/2024




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Sustainability & USA Content



- 85-95% ferrous scrap (75% post consumer, 25% pre-consumer)
- Also added to ferrous scrap: limestone, silica, coke
- DIPRA Sustainable Pipe Certification
- Recommended specification:  
 "The raw material for ductile iron shall have an average minimum content consisting of 90% recycled iron and steel. Ductile iron pipe shall be manufactured in the USA in accordance with ANSI/AWWA C151/A21.51"
- Buy America, BABA etc.

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Agenda

- Ductile Iron Pipe
  - How is it Made?
  - Pipe Joint and Applications
  - Horizontal Directional Drilling
  - Bridge Crossings
  - DDM

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WHAT IS DUCTILE IRON?

- GREY IRON TREATED WITH MAGNESIUM
- MAGNESIUM CAUSES GRAPHITE IN THE IRON TO FORM NODULES INSTEAD OF FLAKES




Gray Iron                      Ductile Iron

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Foundry Capabilities

Bessemer, AL  
12" – 64" TJ/HDSS/HP LOK

Mini Mill - Bessemer, AL  
4" – 12" TJ/HDSS (20')

Union City, CA  
3" – 24" TJ/HDSS/MJ/TR Xtreme(18')

Lynchburg, VA  
3" – 24" TJ/HDSS/MJ

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HOW IT IS MADE



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### Centrifugal Casting



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### Annealing



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### Bell Casting

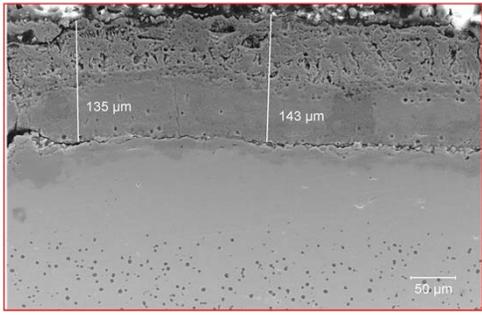


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### Annealing Oxide on O.D. of Pipe Wall Improves Corrosion Resistance



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### Mold Extraction



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### Annealing Oxide



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## Hydrostatic Testing



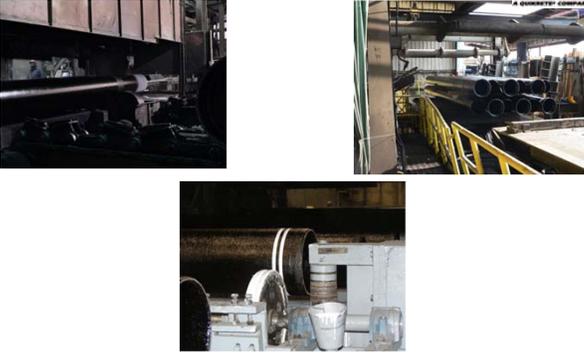
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## Finishing



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## Tuberculation



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## HOW IT IS MADE

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## Cement Mortar Lining



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## Pipe Joints & Applications



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## JOINT TYPES

- Push Joint
- Mechanical Joint
- Restrained Joint
- Flange Joint

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## Mechanical Joint Connections

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## Tyton Joint (Push-Joint)

3" – 64"

**TYTON JOINT® Pipe 3" – 24"**

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## Restrained joints (What & where?)

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## Mechanical Joint

3" – 24"

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## Thrust Restraint Calculator

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## Concrete Thrust Blocks



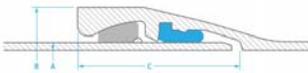
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## HDSS HIGH DEFLECTION HIGH PRESSURE



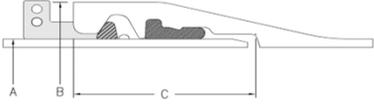
Available in sizes 4 thru 48"



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## HP LOK® 54" – 64"



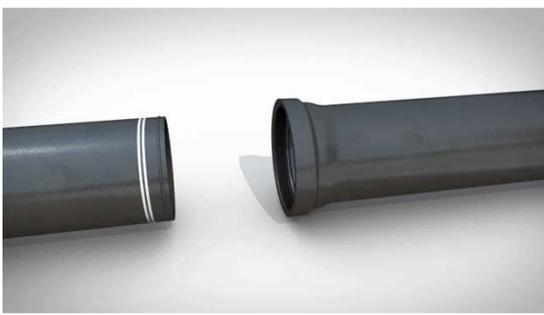
- Developed in 2003 for High Pressure demands
- Available in 54"-64"
- Uses Standard Tyton Joint Gasket
- Maximum working pressure of 350 PSI
- Maximum Deflection of .5 degrees



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## HDSS SEGMENT INSTALL



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## HP LOK®



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## HDSS Installation



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1030 PSI



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Bridge Crossing with Mech-Lok



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825 PSI



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Bridge Crossing with Mech-Lok

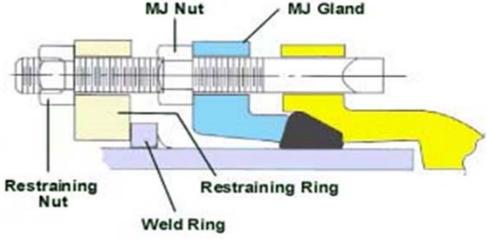


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MECH-LOK



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Mech Lck™ Restrained Joint  
Available in Sizes 4" – 24"

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Mech-Lok Pipe on Piers



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## BOLT-LOK

Bolt Lok™ Restrained Joint Pipe Available in Sizes 4" – 24"  
Spigots Available in 4" – 48"

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## Horizontal Directional Drilling (HDD)

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## FIELD-LOK 350®

Pressure Ratings  
4-24 inch-350 psi

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## Why HDD?

- Reduce the high cost of pavement removal, concrete roads and restoration
- Reduce the disruption to traffic, communities and businesses
- Reduce the environmental impacts
- Reduce the cost of damage and disruption to existing underground facilities
- Ability to install at depths not practical by other methods
- Not able to hang pipe on Bridges

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## Flanged Joint

3"-64"

**US PIPE**  
FABRICATION

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## STEP (1) PILOT HOLE DRILLED

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# NJWEA Excavation, Safety & Proper Pipe Installation, Winter 2024

**STEP (2) REAMING OUT THE HOLE**

1.5 TIMES THE LARGEST DIAMETER

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**Path Friction HDPE**

18/27/2004

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**STEP (3) THE PIPE PULLBACK**

TWO METHODS – CARTRIDGE OR STRINGING OUT

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**Path Friction PVC**

Per AWWA C900/905 – Pipe shall be free of significant scratches (10% or more of pipe wall).

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**Pipe Bore Path Friction**

Ductile-Iron Pipe

Ductile-Iron Pipe Bells only  
Contact the bore hole every 18-ft= lower pull forces

Light Weight Pipe Material

Constant contact w/ bore hole, higher buoyancy force= more Drag-Higher pull forces

DIP Has Lower Buoyancy Force

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Assemble & String Out or Cartridge

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Bridge Crossings

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Pulling Heads

Ductile Iron Pulling Heads 4-36"

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Bridge Crossings

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Why Go Ductile?

- Pressure Ratings up to 350 PSI
- High allowable pulling forces
  - Material and Joint strength
- Low Pullback Forces
- Generous allowable joint deflections
- Quick and easy joint assembly
- "Cartridge" installation method
- Easy pipeline location
- Material strength not affected by time or temperature
- No significant residual bending stresses
- Superior beam strength in trench loading conditions/bore holes
- Uses Standard, Stock Restrained Joint pipe

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## Correct Design







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## Likelihood Score Sheet

LIKELIHOOD FACTOR	POINTS	MAXIMUM POSSIBLE POINTS	
<b>DEPTHS</b>	+ 500' min. dia. 0 + 500' - 1000' min. dia. 25 + 1000' - 1500' min. dia. 50 + 1500' - 2000' min. dia. 75 + 2000' - 3000' min. dia. 100 + 3000' - 5000' min. dia. 125 + 5000' min. dia. 150	150	300
<b>EXPOSURE</b>	+ 500' min. - positive 5 50' - 100' span + 10 + 100' span - negative 10	5	5
<b>MOISTURE CONTENT</b>	+ 10% + 10' 5 8' - 10% + 10' 3 + 10% + 10' 1	5	5
<b>GROUND-WATER INFLUENCE</b>	Plus below the water table at any time 5	5	5
<b>pH</b>	pH < 4 4 pH > 4 < 8 4 pH < 4 < 8 with sulfates 4 pH < 4 < 8 with negative sulfates 4 pH > 8 0	4	4
<b>SULFIDE IONS</b>	any (1.0 ppm) 4 any (1.0 ppm) - 1 ppm 2 negative (1.0 ppm) 0	4	4
<b>REDUCED POTENTIAL</b>	+ negative 1 + negative @ 100 ms 1 + positive > 100 ms 0	2	2
<b>BI-MATERIALS CONSIDERATIONS</b>	Connected to other metals 2 No bi-materials 0 Connected to metals metals 2 No bi-materials 0	2	2
<b>TOTAL POSSIBLE POINTS</b>		60	
<b>Weighted Corrosion Environment</b>	Corros. Free (Water, Fluct. Soil, Environment)	25	

## Consequence Score Sheet

CONSEQUENCE FACTOR	POINTS	MAXIMUM POSSIBLE POINTS	
<b>PIPE SERVICE</b>	7" to 24" 0 30" to 36" 4 42" to 48" 8 54" to 60" 12	20	
<b>LOCATION</b>	Reserve Pipe for good access, minimal traffic/utility considerations 10 Reserve Pipe for good access, moderate traffic/utility considerations 5 Reserve Pipe for good access, heavy traffic/utility considerations 0	20	
<b>DEPTH OF COVER CONSIDERATIONS</b>	10' to 12' feet depth 10 5' to 10' feet depth 5 0' to 5' feet depth 0	15	
<b>WATER SUPPLY</b>	Water supply available - yes 10 Water supply available - no 0	10	
<b>TOTAL POSSIBLE POINTS</b>		50	

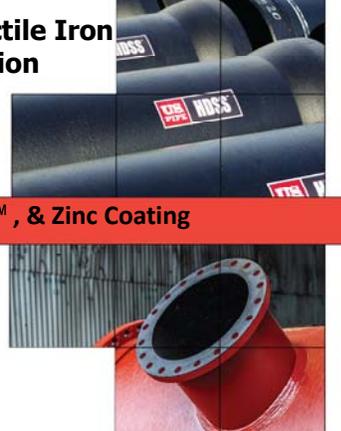
\* Both with correct Corrosion Environment will be assigned 25 points at the total of points for Likelihood Factors, whichever is greater.

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## Innovation in Ductile Iron Corrosion Protection

### DDM, V-BIO™, & Zinc Coating



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## Design Decision Model



### Recommendations

- 1 As manufactured with shop coat
- 2 V-Bio Enhanced Polyethylene Encasement
- 3 V-Bio Enhanced Polyethylene Encasement, or V-Bio Enhanced Polyethylene Encasement with Joint Bands
- 4 V-Bio Enhanced Polyethylene Encasement with Metallized Zinc Coating, or V-Bio Enhanced Polyethylene Encasement with LA Enhanced Cathodic Protection
- 5 V-Bio Enhanced Polyethylene Encasement with Metallized Zinc Coating, or V-Bio Enhanced Polyethylene Encasement with Cathodic Protection

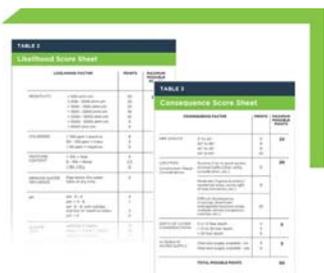
\*Recommendations in Items 4 and 5 require a potential difference between the anode and the cathode region. Distribution maps are generally made and used with the first application in a section to the opposite end. Corrosion protection should be considered when the potential is significant but in other cases, the protection could be not provided.

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## DDM POINTS

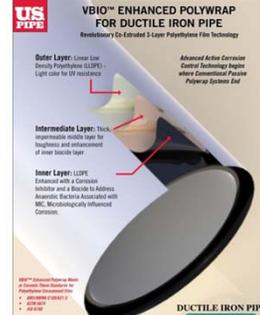
The Design Decision Model features point counts for various corrosion mitigation factors



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## V-BIO™



- Outer UV resistant layer
- Thick middle layer
- Advanced Inner layer:
  - Biocide to mitigate Microbiologically Influenced Corrosion (MIC)
  - Volatile Corrosion Inhibitor (VCI) to neutralize galvanic corrosion
- Meets all requirements for AWWA C105

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## V-BIO™ - Corrosion Inhibitor

- Corrosion inhibitor polar molecules infused within the polywrap are attracted to the pipe surface.
- These molecules create a barrier on the pipe surface that prevents oxidation

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## BURY – WAIT – EXCAVATE - EXAMINE

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## V-BIO™ Case Study

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## V-BIO™ – Case Study

6 years V-Bio Everglades

3 years No V-Bio Everglades

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## ARC SPRAY METALLIC ZINC

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**Zinc Self Healing**

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**Zinc Coating**

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