

# Aboveground Storage Tank Cathodic Protection Solutions

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# BASS

# AST Cathodic Protection Overview

## ***Cathodic Protection Solutions***

The approach to protect these assets is carefully decided based on each opportunity. A tank/facility solution is design specifically for each application.

### ***The first question we ask. Is this project ...***

New tank construction

Existing in-service tank

Existing out-of-service tank

Single bottom tank

Double bottom tank

# Design Considerations

## ***SP0193-2016-SG (formerly RP0193) External Cathodic Protection of Carbon Steel On-Grade Storage Tank Bottoms***

### ***Consider***

Bare steel tank bottom

Other pipe or below ground structures connected

- Should we attempt to isolate and/or decouple grounds
- Use zinc grounds so the tank bottom is not the anode

### ***Current requirement (5.4.2)***

Current density of 1 to 2 mA per square foot are generally sufficient.

Double bottom tanks, or tanks with non conductive (HDPE) liners may require less current (0.5 mA/sq-ft).

# Current Requirement

*Pie are square!*

Surface area:  $SA = \pi r^2$

Current requirement (Amps) = SA \* current density

Example 120' diameter tank:

$SA = \pi * 60^2 = 11,310 \text{ sq-ft}$

Current requirement =  $11,310 \text{ sq-ft} * 0.002 \text{ A/sq-ft} = 22.6 \text{ Amps}$



# New Tank Construction

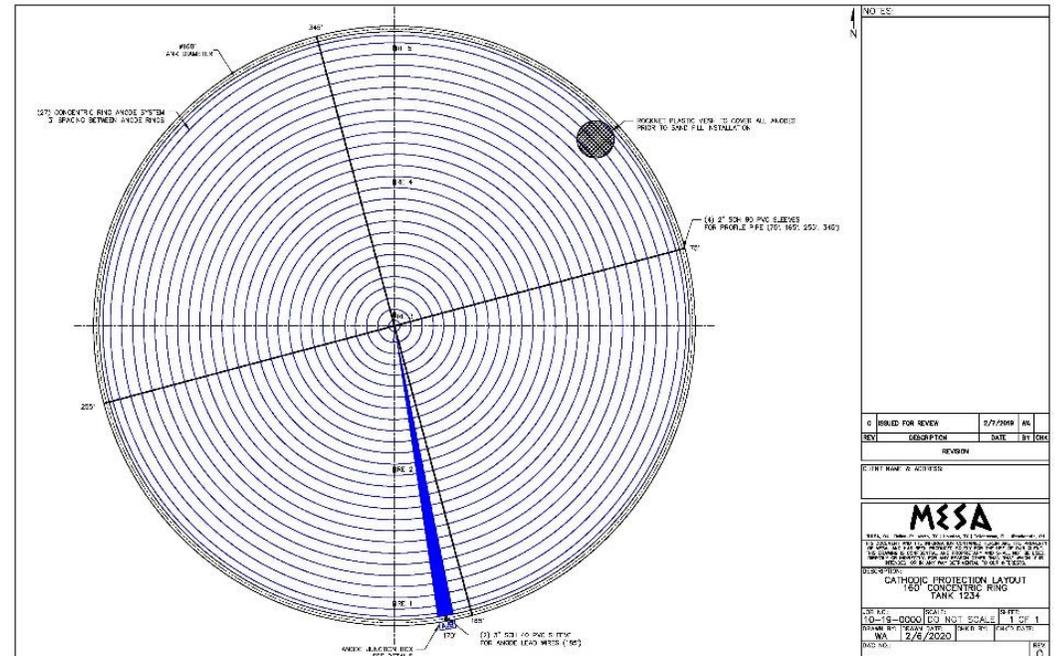
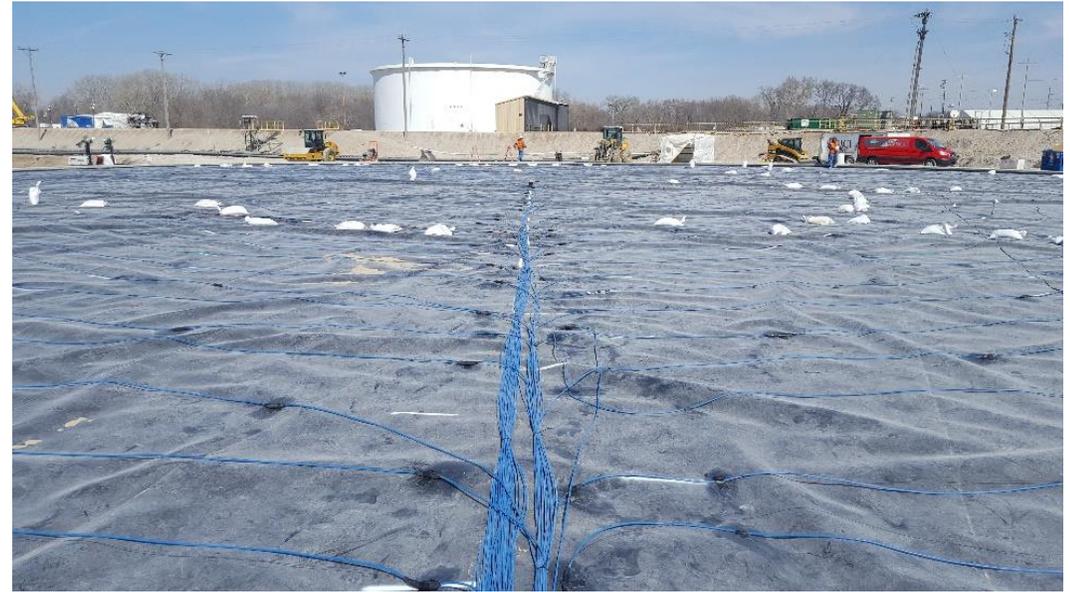
New tank construction opens the door to a variety of cathodic protection and monitoring solutions. Depending on the tank construction methods and the containment liner, the options may include the following.

## **Cathodic Protection:**

- Surface anode bed
- Concentric ring system
- Grid system
- Linear CP systems (trenched)
- HDD CP System

## **Monitoring:**

- Profile monitoring tubes
- Stationary reference electrodes
- Electrical Resistance (ER) probes
- Ultrasonic Thickness (UT) probes
- Any combination of the above



# In-service Tank Questions

## ***Liner type***

Conductive – Claymax or Bentomat

Non-conductive – HDPE (will require anode be in the sand cushion below the floor plates)

## ***Access to containment area***

Concrete walls

Steep berms

## ***Working space around tank***

How much room do we have?

Is there above ground pipe or other structures we will need to work around?

## ***Other questions***

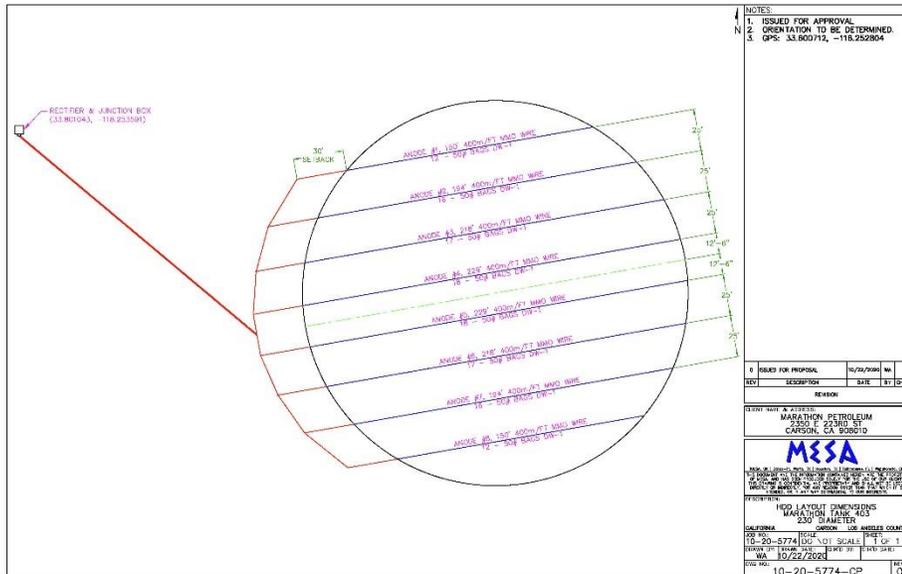
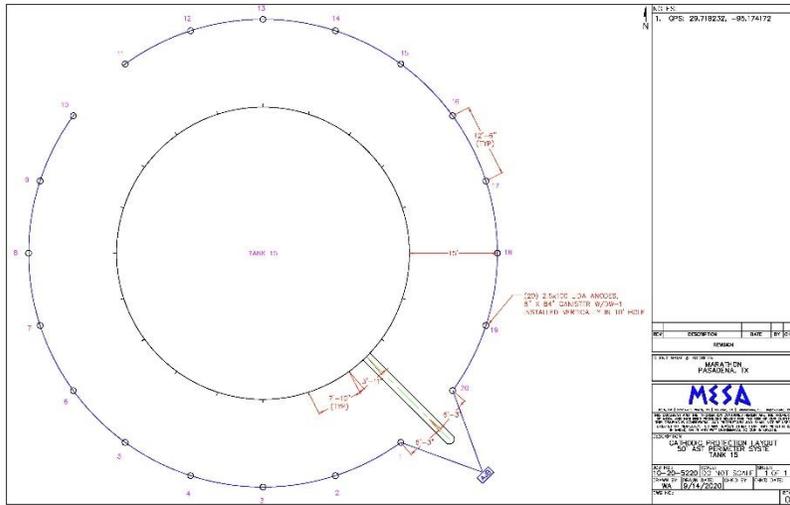
Soft digging requirements

Atmospheric monitoring

Rectifier location

Operating temperature

# In-service Tank – Conductive Liner



## *Perimeter CP systems may be an option*

Typically, only sufficient for smaller diameter tanks.

Due to geometry of the anode, there may be shielding by the ringwall.

## *Deep anode beds are an option*

May not supply adequate current distribution.

These installation primarily depend on a “remote” relationship.

## *Horizontal Directional Drilled (HDD)*

Can provide even current distribution directly to the tank bottom

Close-coupled system

Can install a profile monitoring tube

# Existing In-service Tank – HDD Systems

*Two option for installation; replaceable and non-replaceable*

## ***Replaceable systems***

- 3” Sch 40 Slotted PVC
- LIDA 400mA/ft 3.0mm copper core wire
- Loresco All-vent (3/4” or 1”)
- Loresco Coke Breeze (DW-1 or SC-3)
- HMWPE/Halar wire (#6 or #8)

## ***Non-replaceable systems***

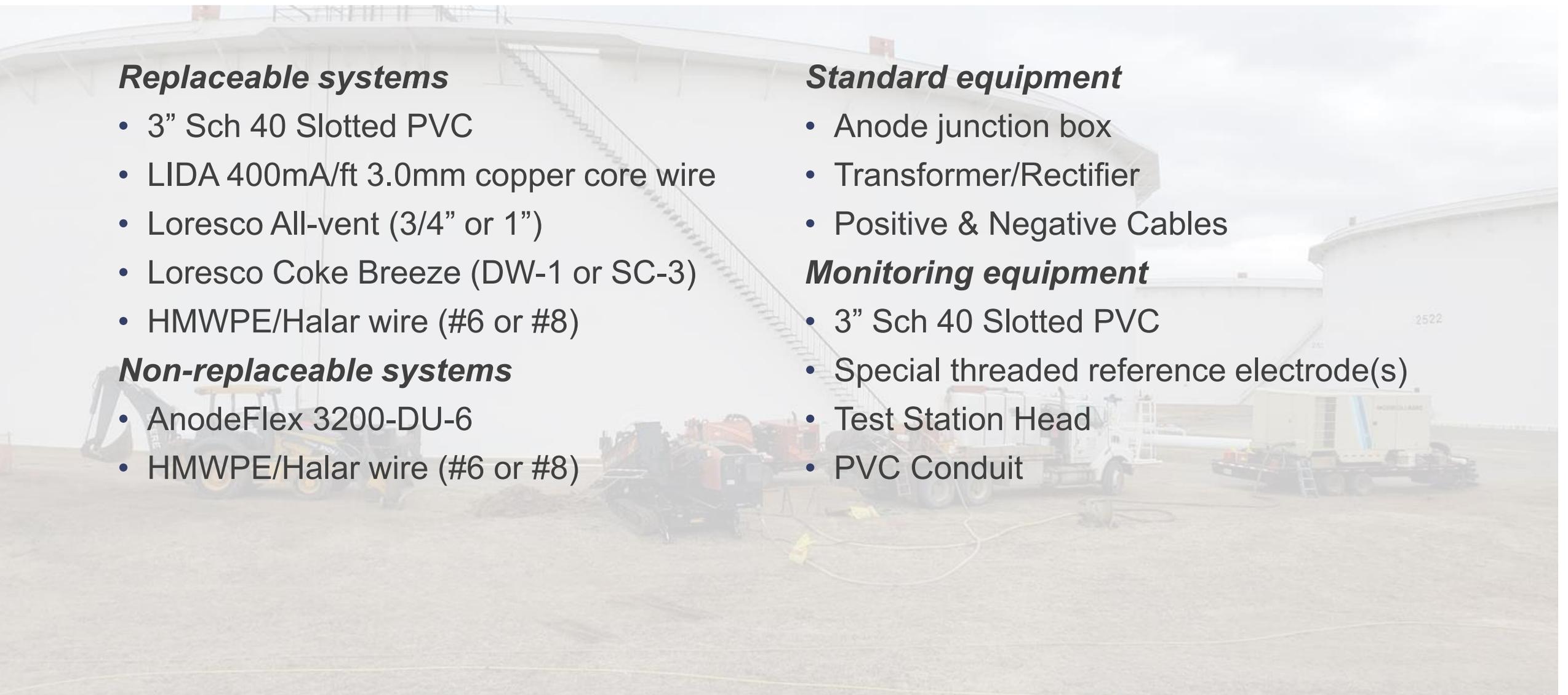
- AnodeFlex 3200-DU-6
- HMWPE/Halar wire (#6 or #8)

## ***Standard equipment***

- Anode junction box
- Transformer/Rectifier
- Positive & Negative Cables

## ***Monitoring equipment***

- 3” Sch 40 Slotted PVC
- Special threaded reference electrode(s)
- Test Station Head
- PVC Conduit



# Existing In-service Tank – HDD System

## ***Replaceable systems***

### Advantages:

- Longer (theoretical) life
- Can be flushed and replaced (larger diameter tanks may not be replaceable or cost effective)

### Disadvantages:

- Expensive material; PVC, Coke breeze, Vent Pipe
- Takes longer to install, which costs more in Labor & Equipment
- Freight costs for items over 20' in length

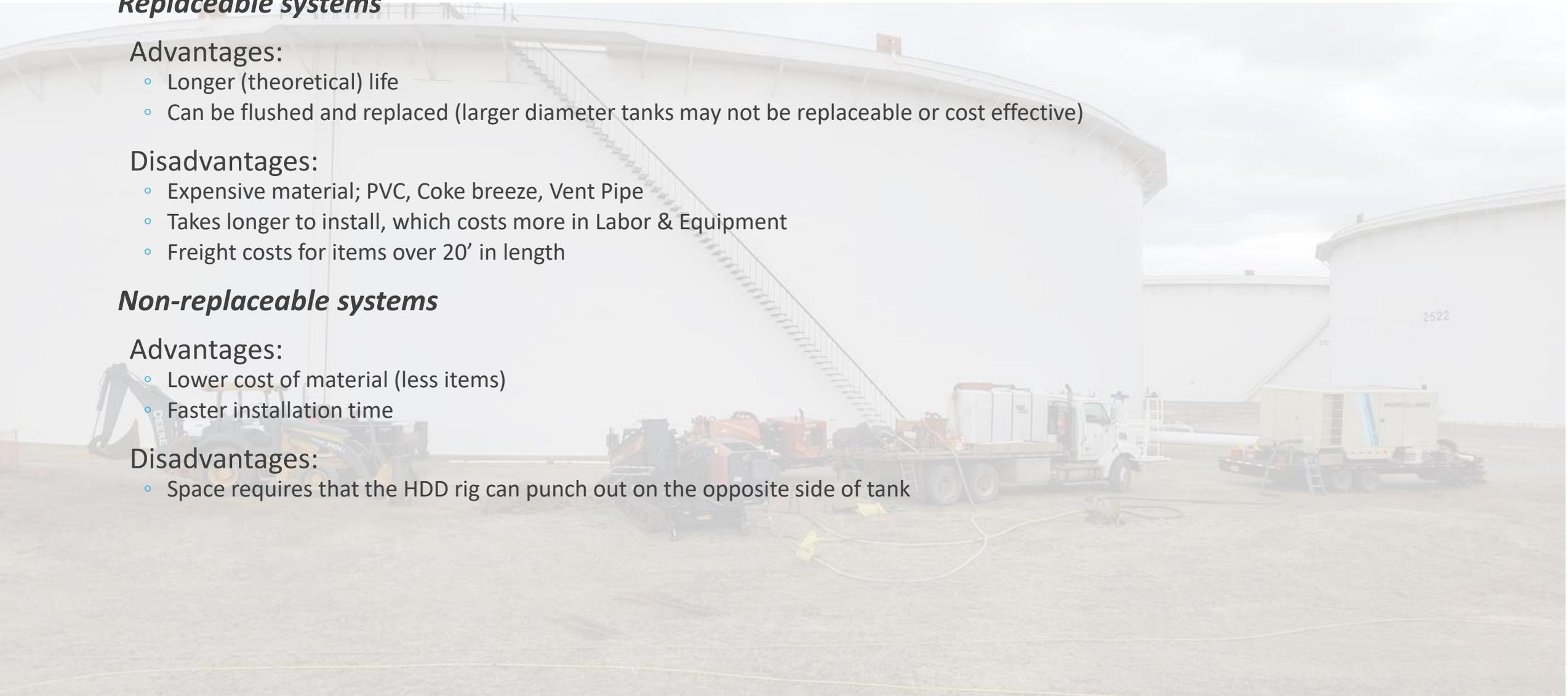
## ***Non-replaceable systems***

### Advantages:

- Lower cost of material (less items)
- Faster installation time

### Disadvantages:

- Space requires that the HDD rig can punch out on the opposite side of tank



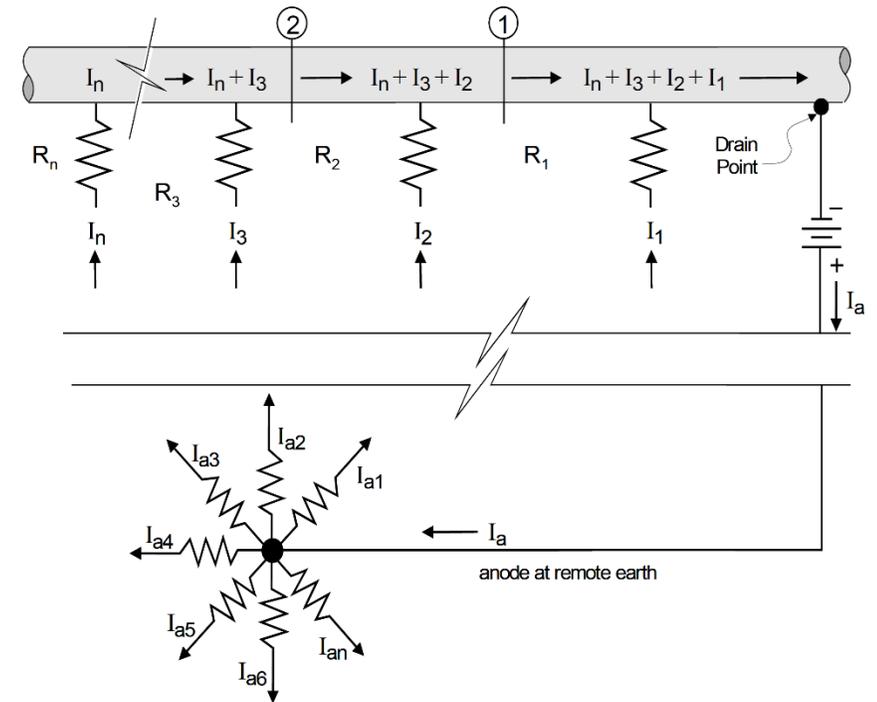
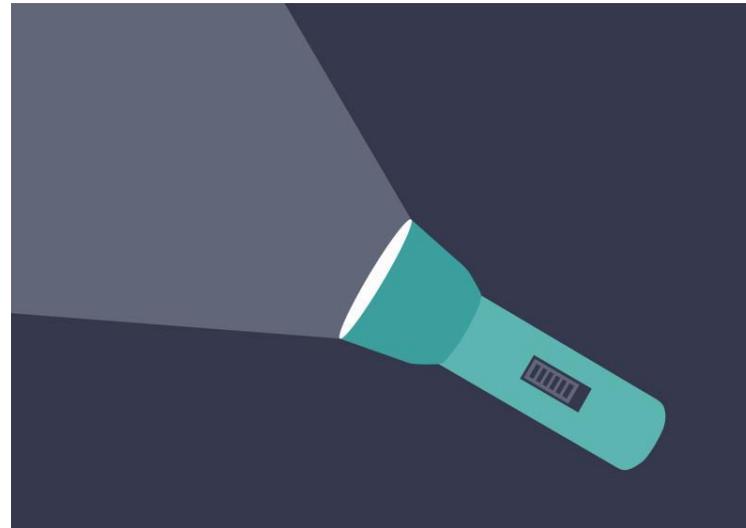
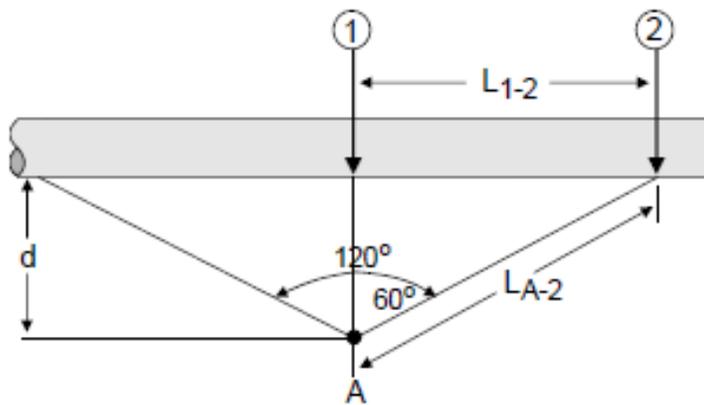
# Close-coupled Cathodic Protection Systems

## What do we need to consider?

(Most) Current does not go to “remote earth” before traveling to the tank

Current flows directly from the anode to the tank through the soil between the anode and tank bottom.

Why is this different than a typical anode bed for a pipeline?



# Installation of HDD CP Systems

## Planning

Coordination with facility operations

Tank info: foundation depth, sump construction, piping

OneCall

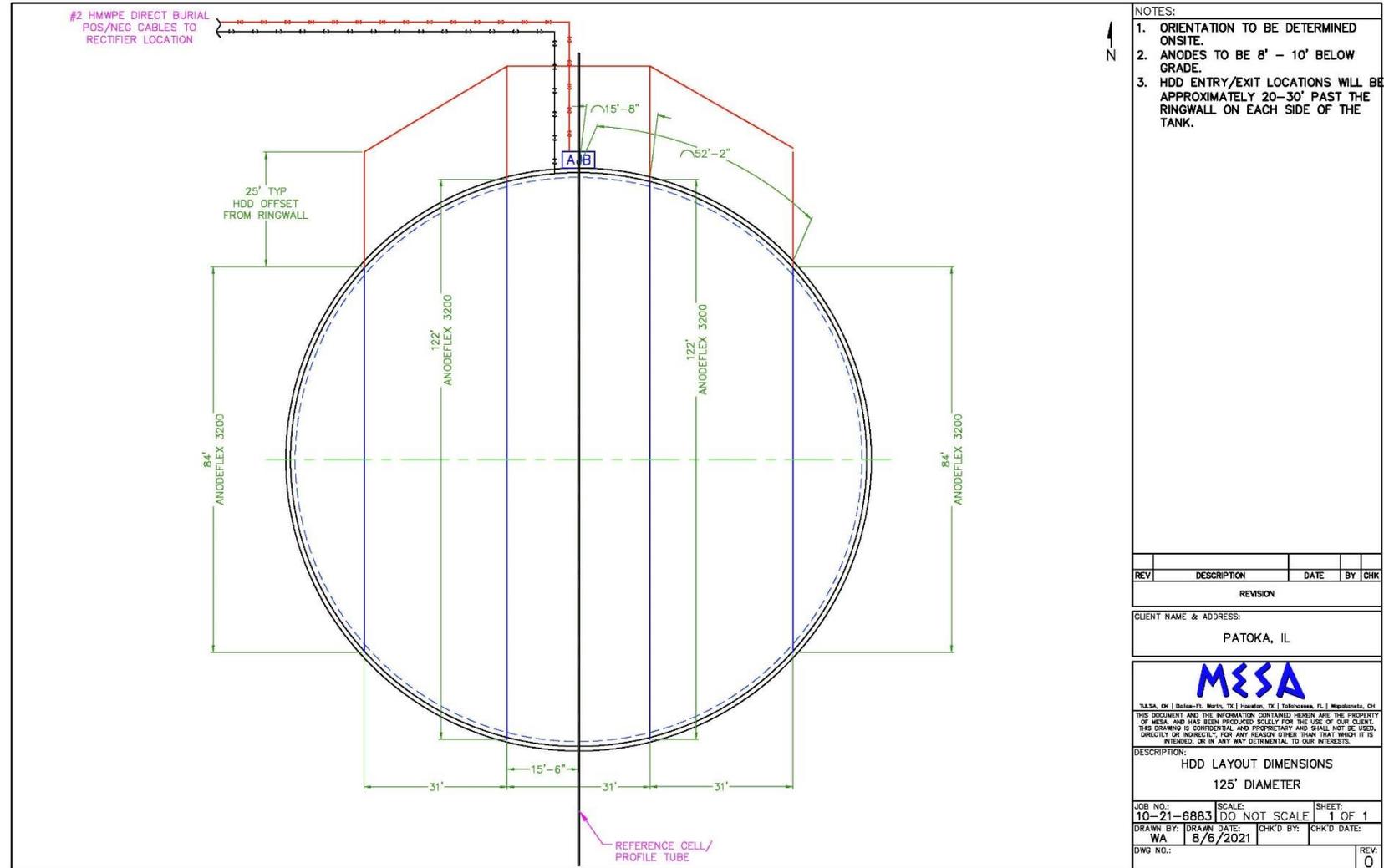
Facility permits (safe work, excavation, hot work)

Visual check and inductive sweep

Determine rectifier location and positive/negative cable route

Layout anode location plan

Bore hole planning



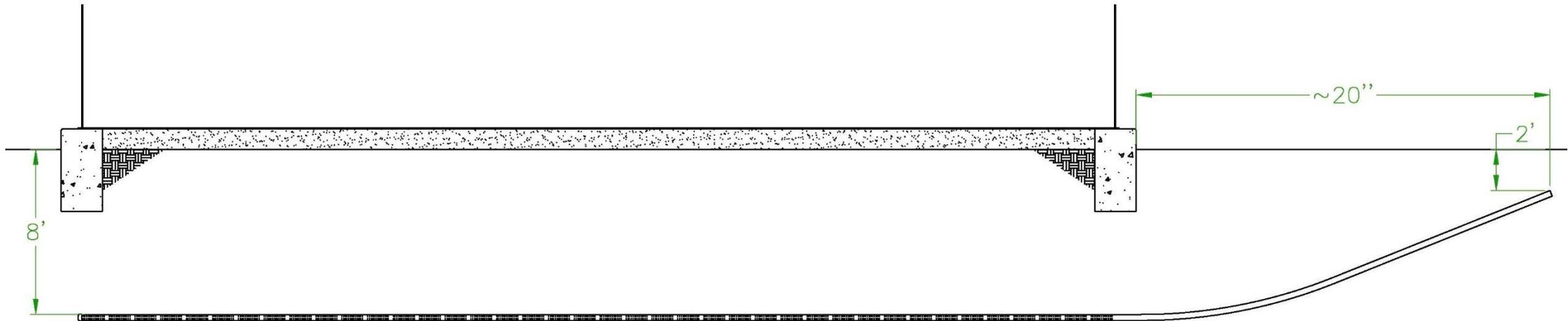
# Installation of HDD CP Systems

## *Bore Profile*

Target depth of 8-10' below tank chime.

Set back approximately 20' from edge of tank.

Plan for flat profile.



# HDD Installation Procedure

## *HDD Locating System*

### DigiTrack Falcon F1

- Allows scanning for active interference
- Select best frequency for locating
- Use 19" rebar sonde

Direct measurement of depth prior to entering under tank.

Monitor pitch and roll after entering under tank.

Calculate depth based on pitch.

Document on Bore Log

Successfully drilled across 300' diameter tanks without signal issues.











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## Questions / Comments

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