GEOCHEMICAL CHARACTERIZATION OF ACIDIC SAND USED AS URBAN CONSTRUCTION FILL MATERIAL

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INTRODUCTION

Sand from a Hampton Roads, VA, borrow pit was used to provide backfill for a street extension through a section of an old landfill.

Aluminum storm drain was then emplaced within the sand fill.

INTRODUCTION

Three months later there was significant pipe corrosion and in localized areas complete pipe faliure.

According to the pipe manufacturer the lifetime of this material should have been in excess of 15 years.

A detailed study was conducted to determine the cause of this corrosion.

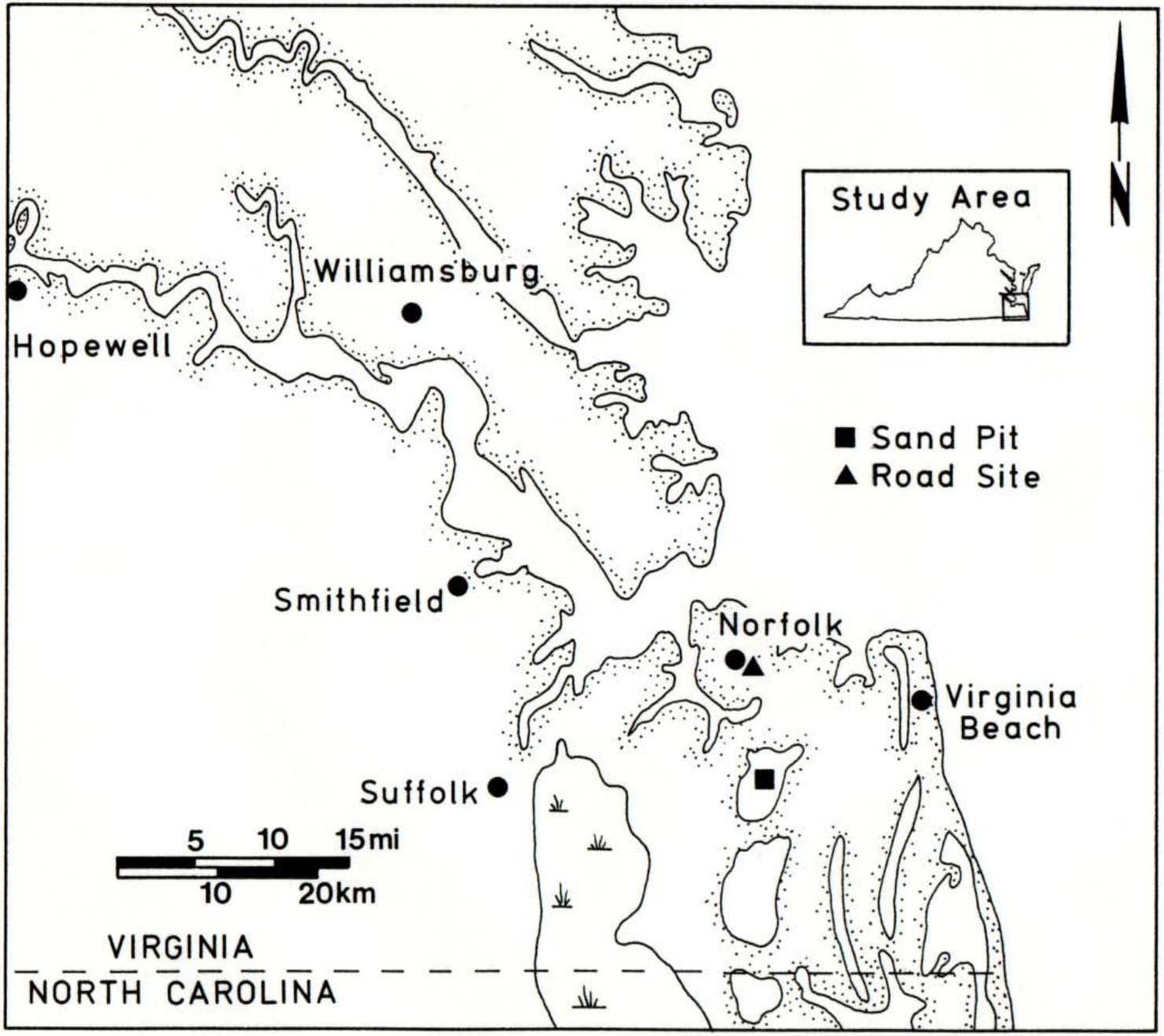


Figure 1. LOCATION MAP OF SOUTHEASTERN VIRGINIA

ROAD FILL SITE

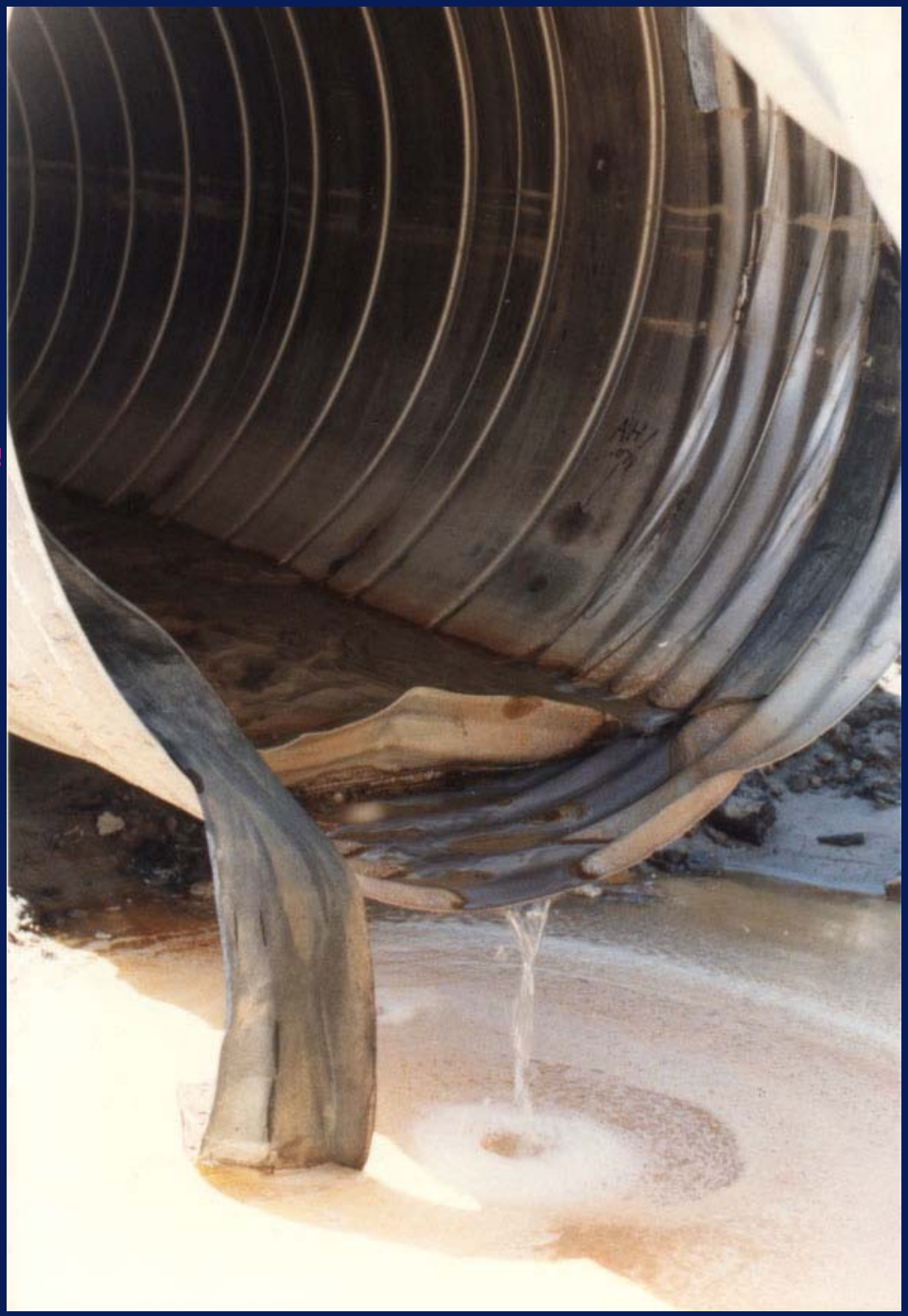
Road fill site with one section of damaged drain pipe removed

ROAD FILL SITE

Appearance of new drain pipe

DAMAGED DRAIN PIPE WITH MILD CORROSION

Groundwater/leachate discharge from storm drain. Note discoloration of pipe interior and of water.



ROAD FILL SITE

Road fill (partially excavated) beside landfill (LF). Note iron stain from acid sand reactions in water.

ROAD FILL SITE

Closer view of groundwater with mixture of leachate acid reaction products and. Note LF debris and stain on pipe.

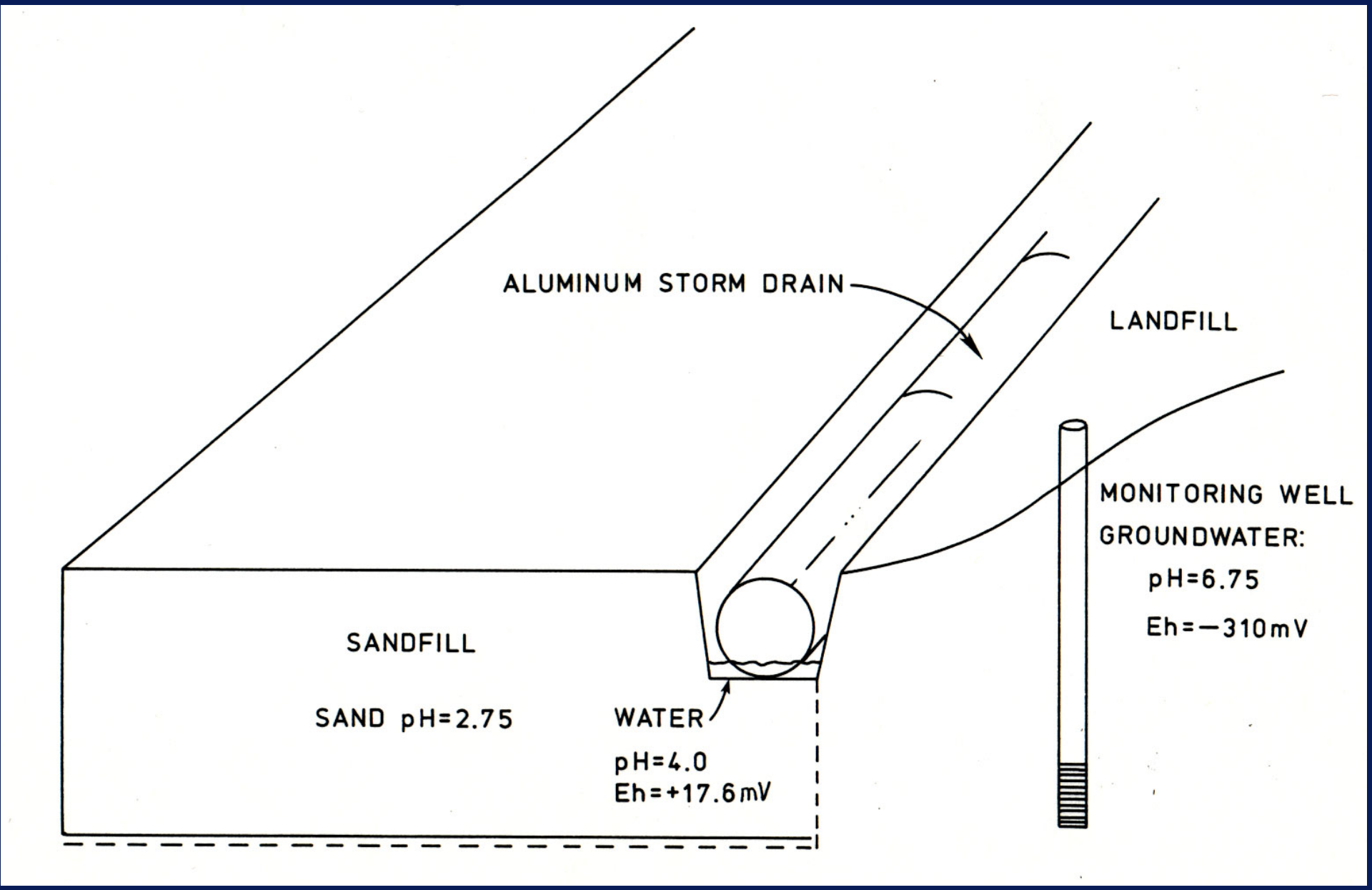
ROAD FILL SITE

Corrosion of pipe is evident

ROAD FILL SITE

Close-up view of severe pipe corrosion

SCHEMATIC OF ROAD FILL SITE

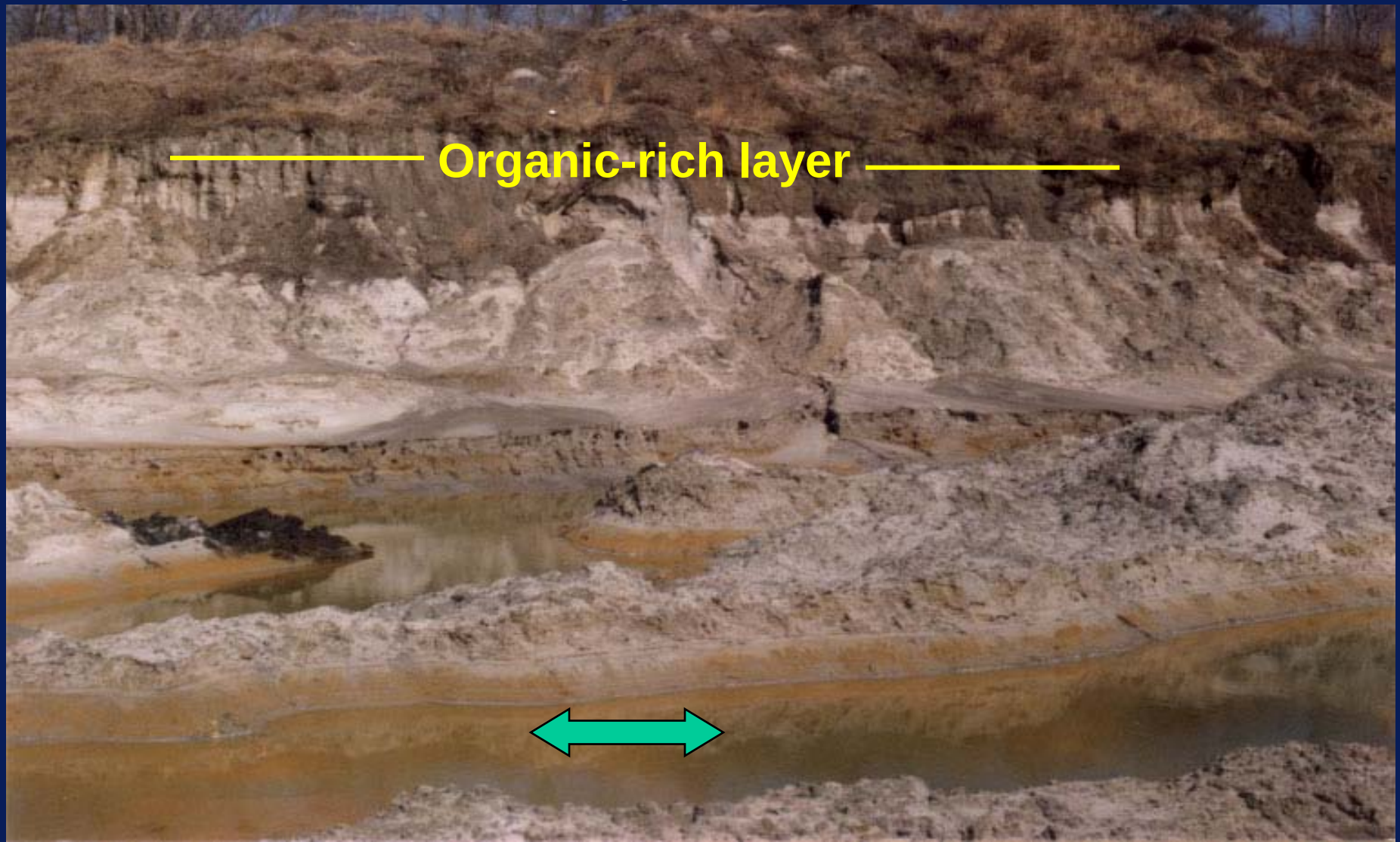


SAND PIT

Note dark colored layer at surface in the background, Fe-stains at the base and white-colored crust on the sand pile.

SAND PIT

Note organic-rich layer at top of the sequence in the background and iron-stained sand in foreground.



SAND PIT

Acid water with Fe-oxide precipitates; Note acid-tolerant algae in the foreground and well-leached sand in the background.

SAND PIT

Acidic water with
Fe-oxide precipitation

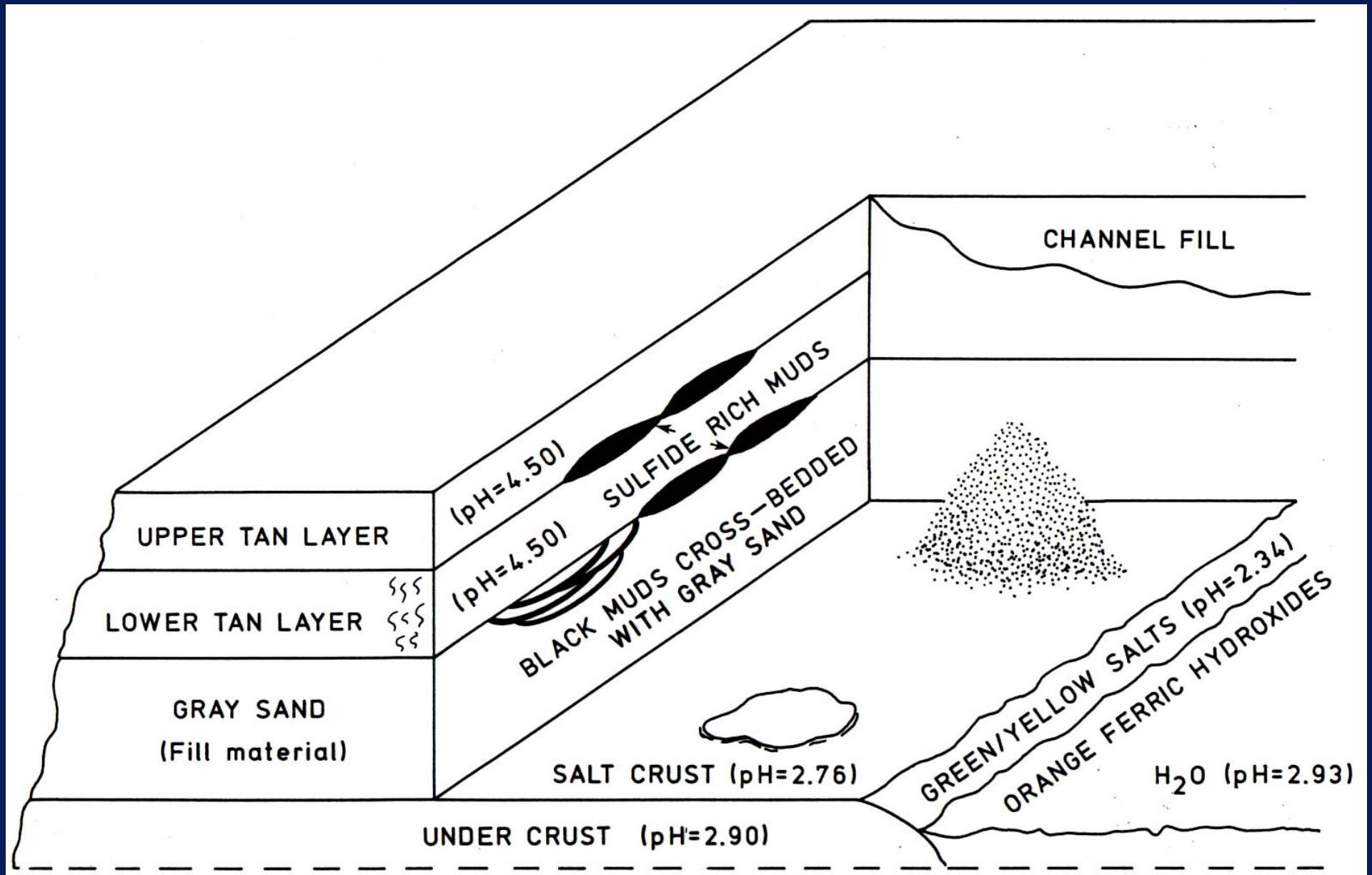
SAND PIT

Sands layered with organic-rich reduced muds.

SAND PIT

Reduced layer containing well-preserved organic matter.

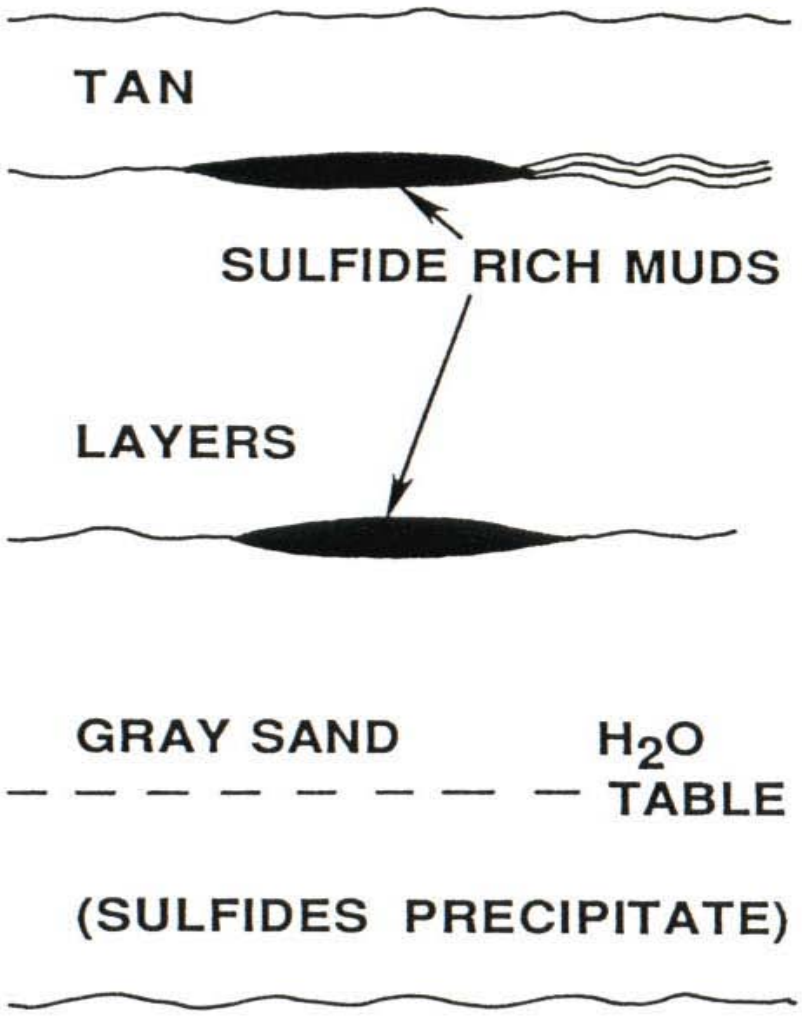
SCHEMATIC OF SAND PIT



MECHANISM OF SULFIDE ACCUMULATION

SUPERGENE ENRICHMENT:

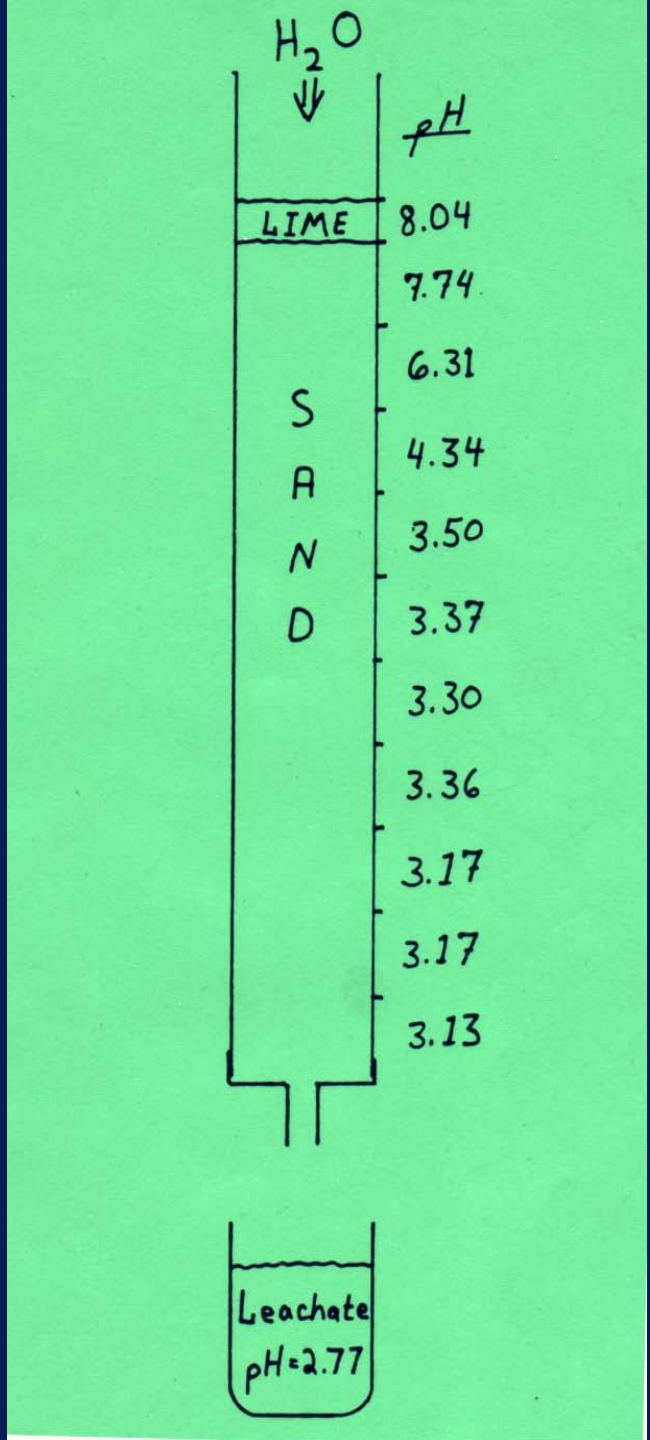
1. SULFIDES OXIDIZED TO SULFATES
2. SULFATES LEACH TO BELOW WATER TABLE
3. SULFATES REDUCED TO SULFIDES AND ACCUMULATE OVER TIME



DETERMINATION OF LIME REQUIREMENT

Leaching column for determination for lime requirement of acid sand in Lowery Road. Data are for the first few column volumes of water leached through the column.

Migration of lime downward was much too slow for surface application of lime to be an acceptable remedial action.



SEDIMENT (SAND) pH and Eh

Sample	pH	Eh (mv)
Lowery Road 1	2.8	+376
Lowery Road 2	2.7	+406
Sand Pit 1	2.5	+386
Sand Pit 2	2.5	+386

WATER SAMPLE pH AND Eh AT THE LOWERY ROAD SITE

Sample	pH	Eh (mv)
Land Fill 1	6.8	-309
Land Fill 2	6.8	-314
Land Fill 3	6.8	-309
Land Fill 4	6.8	-314
Lowery Rd Drain	4.0	+176

CORROSION TEST RESULTS

- Corrosion tests of the Al storm drain material predicted a corrosion rate of 0.98 mm in three months.
- In some cases corrosion of 1.5 mm of material occurred in the fill site.
- Corrosion tests predicted that severe pipe failure would occur within one year.
- All Al storm drain was removed and replaced within one year of the study.

SUMMARY & CONCLUSIONS

- Sand from the borrow pit caused pipe deterioration.
- Groundwater from the adjacent landfill was a source of neutralization of the acidity from the sand fill, but had no overall impact on corrosion rates.
- The source of the acidity was organic-rich muds from an overlying Pleistocene swamp deposit.

SUMMARY & CONCLUSIONS

- Sulfide reserves in this type of sand are sufficient to generate acid production over a several month period.
- Fill sands from these types of depositional environments should be tested prior to emplacement.
- Corrosion rates of reactive material can be successfully predicted from laboratory test results.