

Dock Wall Assessment: Condition Survey and Depth of Embedment Determination in Winter

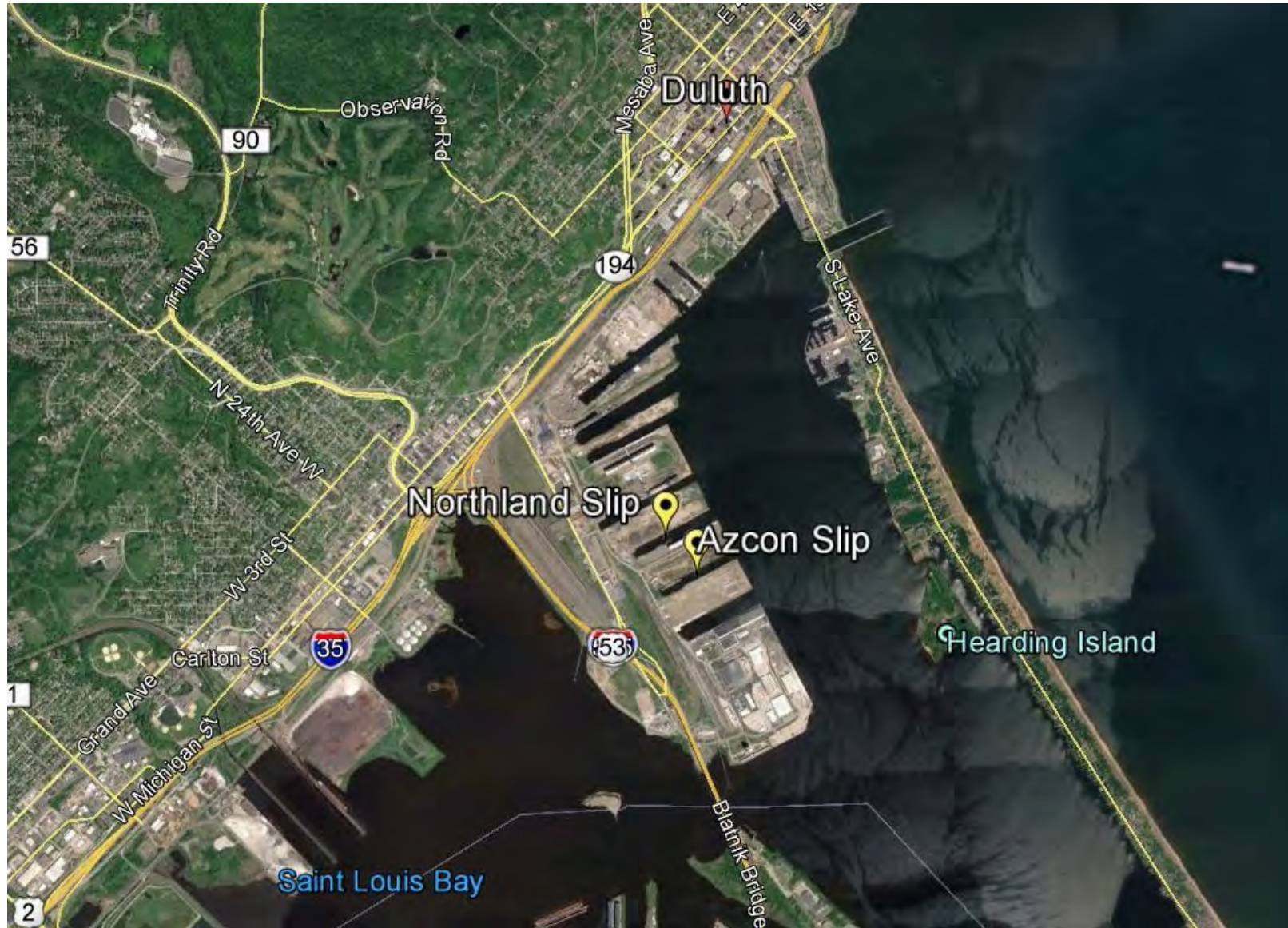
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Tetra Tech

WEDA Midwest Chapter Meeting

March 8, 2019

Project Location – Duluth, MN



Scope of Work

- Perform above and below water Level I condition survey of
 - AZCON Slip
 - North dock wall between Station 0+00 and Station 12+00
 - South dock wall between Station 0+00 and Station 5+00
 - Northland/AGP Slip
 - South dock wall between Station 0+00 and Station 6+00
- Identify existing dock wall construction and materials and determine the dock wall vertical length and depth of embedment below the mud line.

Time Frame – be completed before April 2019 to facilitate remedial design for impacted sediment in each slip to be completed by USACE Detroit

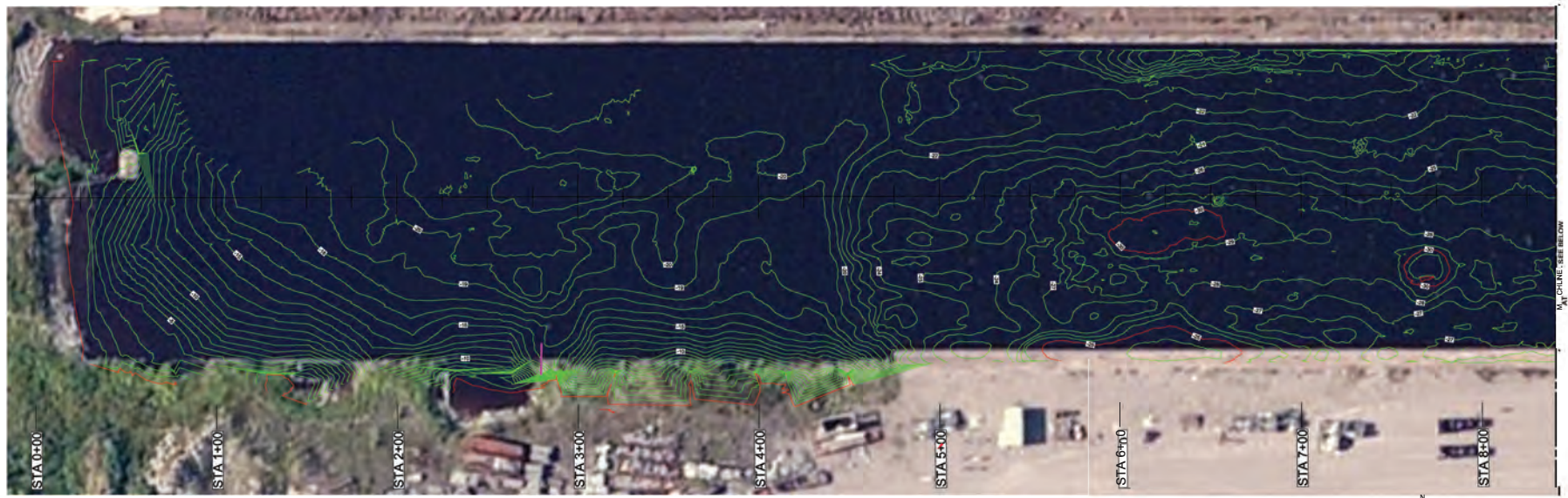
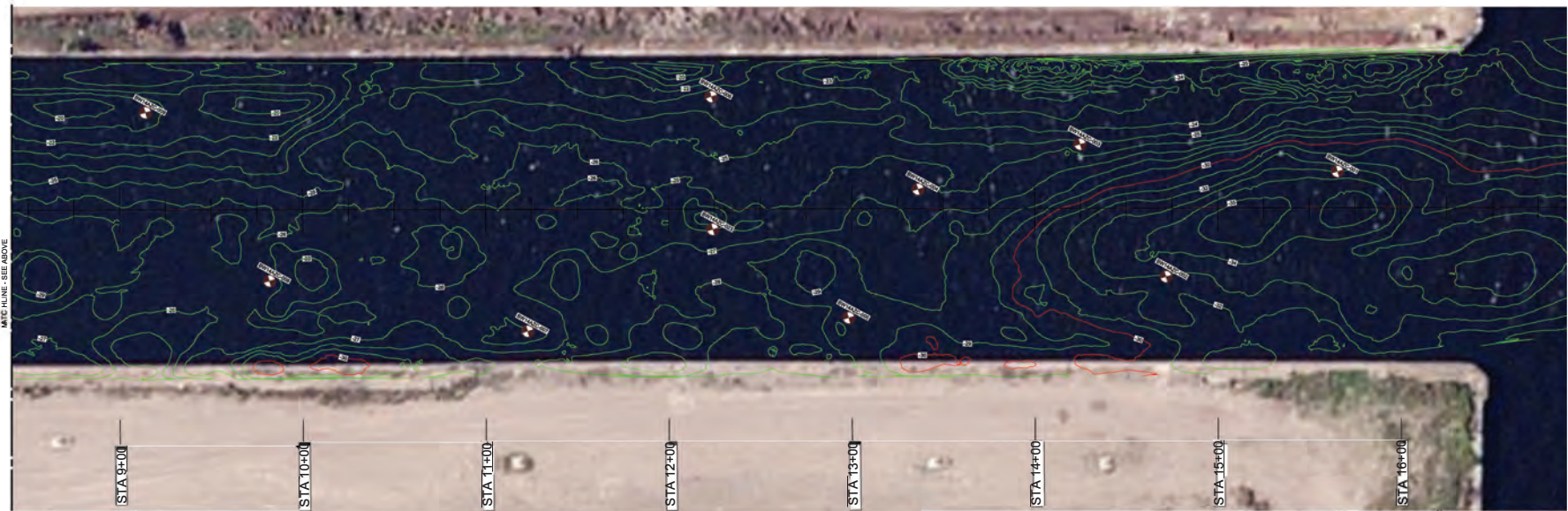


Figure 1 - AZCON SLIP DOCK WALL INSPECTION - WESTERLY END



AZCON SLIP DOCK WALL INSPECTION - EASTERLY END



Figure 2 - AGP/NORTHLAND SLIP DOCK WALL INSPECTION - WESTERLY END



Reference Map



Legend

- Boring Location
- Dock Wall Condition Survey

Source: Bing Maps Hyndrid 2013

Northland & AZCON Slips
Duluth, St. Louis County, Minnesota

Figure 2 AZCON Slip



Prepared For: EPA

Prepared By: Tetra Tech Inc.



Reference Map



Legend

- Boring Location
- Dock Wall Condition Survey

Source: Bing Maps Hynrid 2013

Northland & AZCON Slips
Duluth, St. Louis County, Minnesota

Figure 1
Northland Slip



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Levels of Condition Survey

The three (3) levels of underwater inspections:

Level I - A simple visual or tactile (by feel) inspection, without the extensive use of tools or measuring devices. It is usually employed to gain an overview of the structure and will precede or verify the need for a more detailed Level II or Level III inspection.

Level II - A detailed inspection which involves physically cleaning or removing growth from portions of the structure. In this way, hidden damage may be detected and assessed for severity. This level is usually performed on at least a portion of a structure, supplementing a Level I.

Level III - A highly detailed inspection of a structure which is warranted if extensive repair or replacement is being considered. This level requires extensive cleaning, detailed measurements, and testing techniques that may be either destructive or non-destructive in nature.

Safety First

- Airline icing.
- Rapid ascent to surface, dry-suit blowup.
- Hypercapnia, and CO excess.
- Delta P- Differential Pressures
- Decompression sickness.
- Diver entrapment.
- Umbilical fouling or entanglement.
- Hyperthermia (hot-water suit), hypothermia (environmental conditions, dry-suit).
- Hypoxia
- Overhead hazards, construction equipment falling from overhead surfaces.
- Sinus squeeze, barotrauma, suit squeeze (dry-suit).
- Diver strangulation (dive helmet).





Inspection was conducted using surface-supplied air equipment including a Kirby Morgan dive helmet with full diver-to-surface communications



Routine Underwater Condition Assessment Rating Descriptions

Good: No visible or only minor damage was noted. Structural elements may show very minor deterioration but no oversteering was observed. No repairs are required.

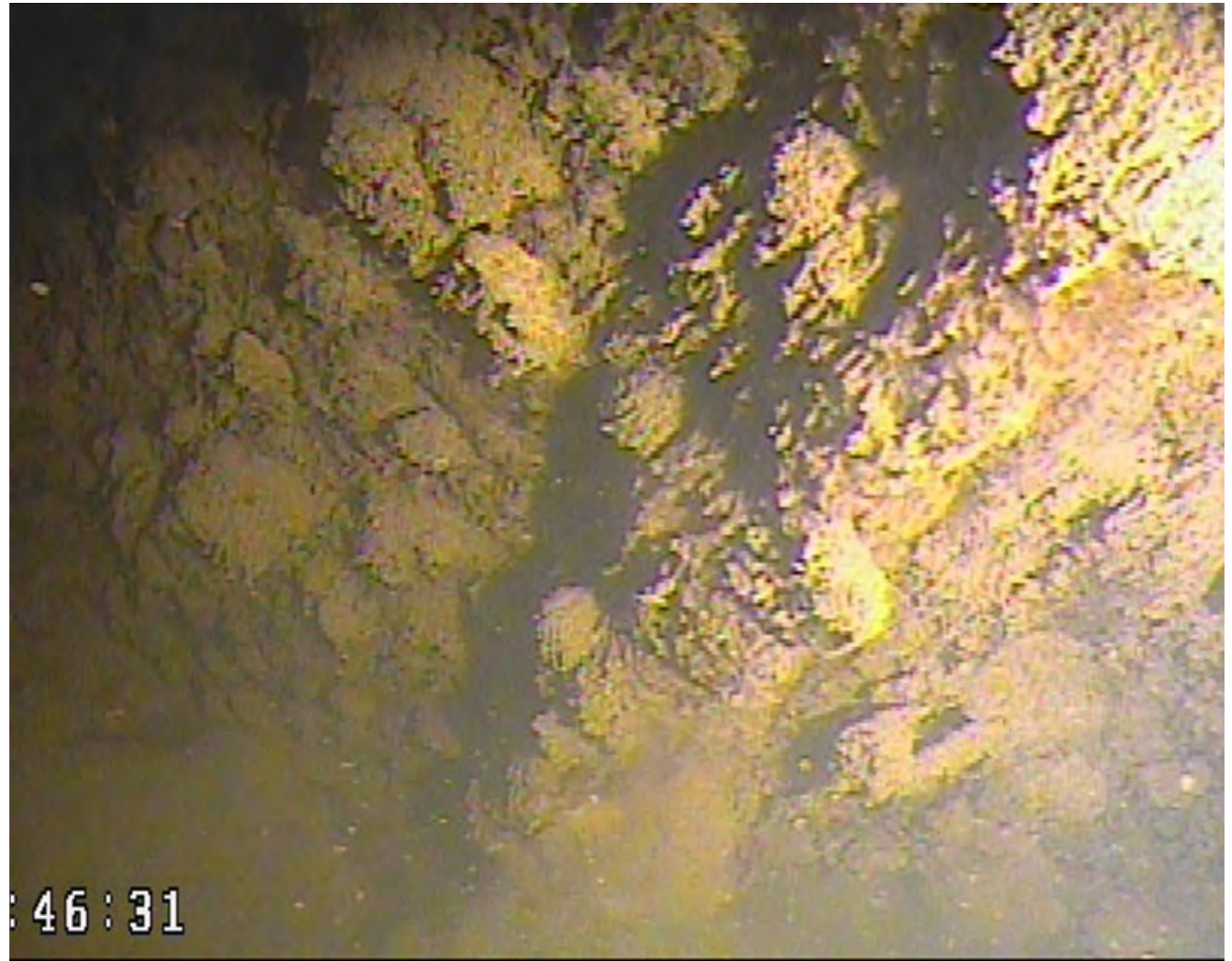
Satisfactory: Limited minor to moderate defects or deterioration are observed, but no oversteering was observed. No repairs are required.

Fair: All primary structural elements are sound, but minor to moderate defects or deterioration was observed. Localized areas of moderate to advanced deterioration may be present but do not significantly reduce the load-bearing capacity of the structure. Repairs recommended, but the priority of the recommended repairs was low.

Poor: Advanced deterioration or oversteering was observed on the widespread portions of the structure but does not significantly reduce the load-bearing capacity of the structure. Repairs may need to be carried out with moderate urgency.

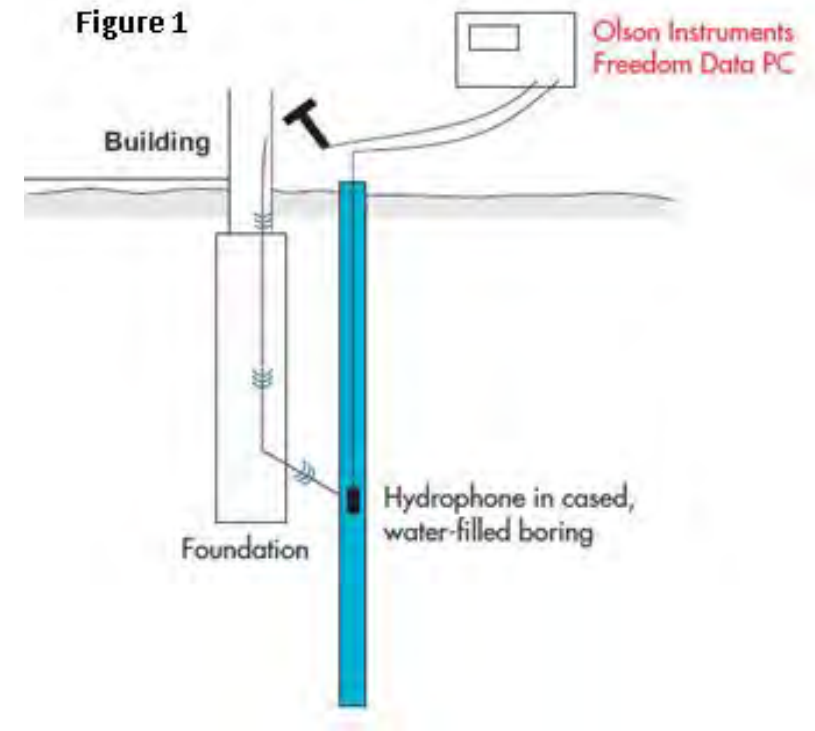
Serious: Advanced deterioration oversteering, or breakage may have significantly affected the load-bearing capacity of primary structural components. Local failures are possible and loading restriction may be necessary. Repairs may be carried out on a high-priority basis with urgency.

Critical: Very advanced deterioration, oversteering or breakage has resulted in localized failure(s) of primary structure components. More widespread failures are possible or likely to occur, and load restriction should be implemented as necessary. Repairs may need to be carried out on a very high priority basis with strong urgency.



Parallel Seismic Survey

- Parallel Seismic (PS) Survey is a non-destructive testing method to determine the depth of long, slender pile structures
- PS pile testing, one relies on identifying direct arrival times of compressional and shear waves at the receiver locations, as well as the wave amplitudes.
- Some portion of the structure that is connected to the foundation must be exposed for the hammer impacts
- Borehole required that extends 10-15 feet below bottom of structure.



Borehole Construction

- 1 75-foot boring installed at each dock wall.
- Boring located within 5 feet of Northland and AZCON North. Between 5-10 at AZCON south
- 2-inch diameter PVC casing with an end cap was lowered down the borehole through the drill casing



The PVC casing was filled with water during installation. Cement grout was used to fill the annular space around the PVC



Parallel Seismic Survey

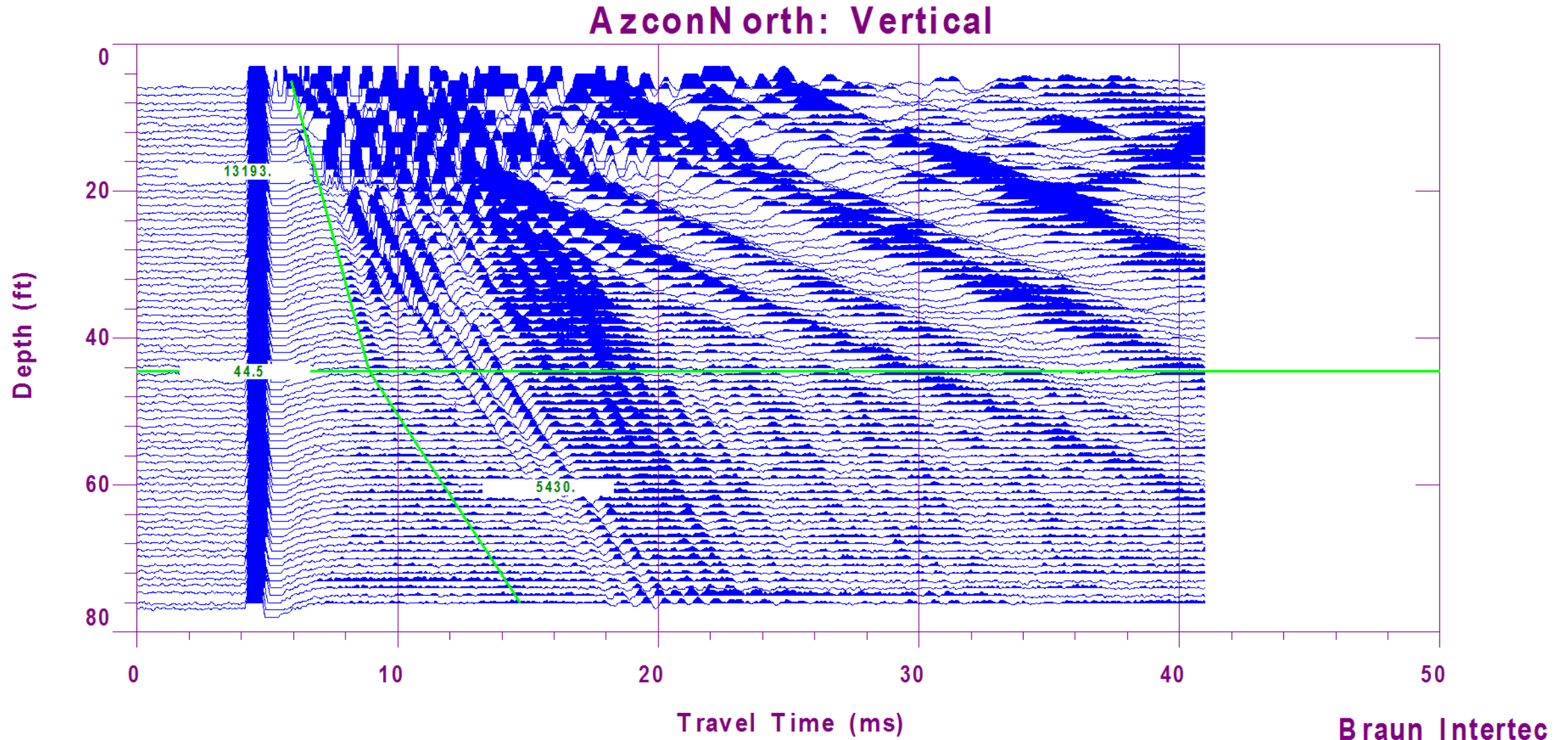
- Waveform from each depth interval was first analyzed individually to determine the time of first arrival.
- After analysis of each individual wave, the entire data set is plotted together to analyze the combined arrival times and wave speeds
- When plotted together, analysis is performed by observing the changes in the slope of the lines, suggesting a change in wave speed (and material) of the corresponding impact wave
- Data for this project was processed using the programs WinGEO-T and IXFoundation, developed by Olson Instruments

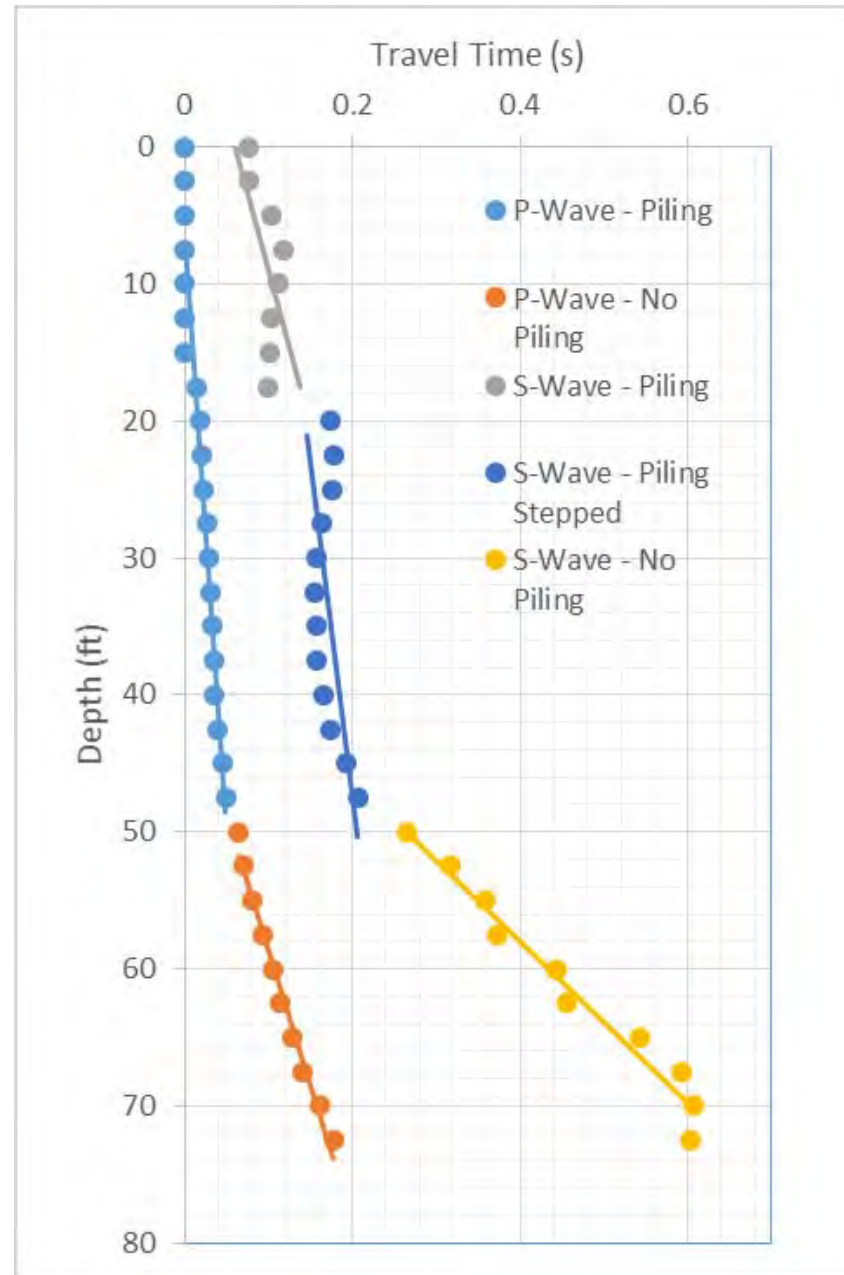




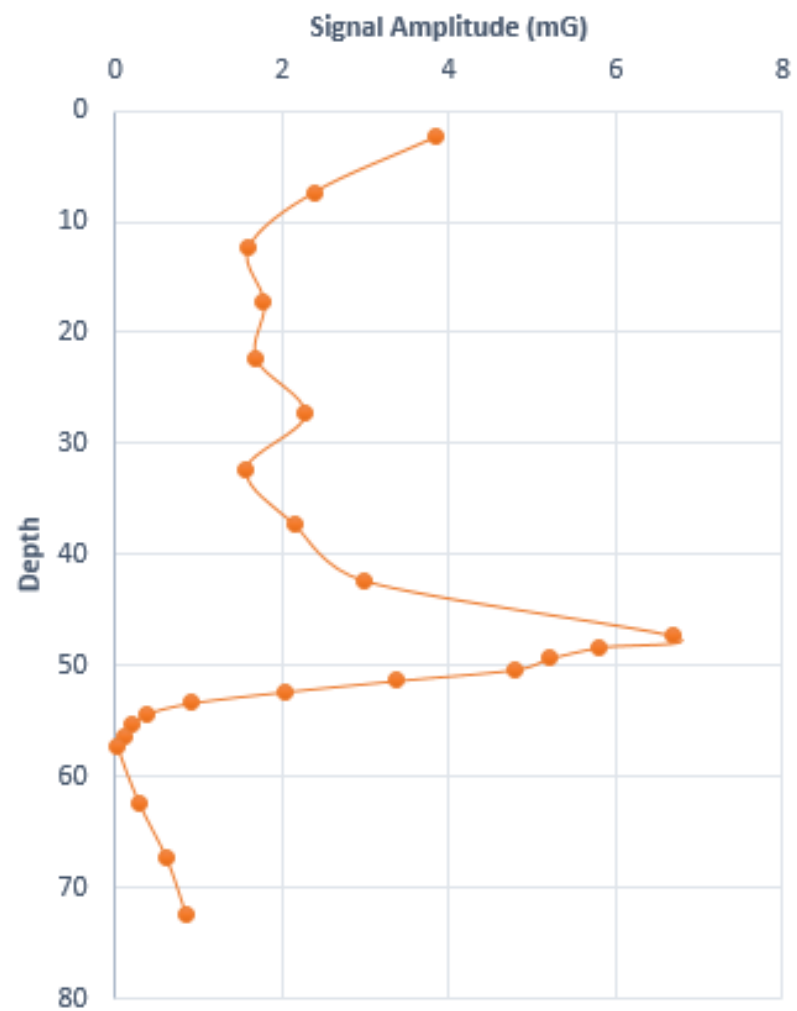


Parallel Seismic Raw Data





Magnetometer Readings Northland Slip



Summary

- Dock wall inspection in winter conditions feasible, not desirable
- Parallel Seismic and Magnetometer useful NDT methods for embedment depth
- Site Specific
 - AZCON North Wood-Fair Condition about 40 ft to embedment
 - AZCON South Wood-Serious Condition depth not determined
 - Northland Steel-Satisfactory Condition about 50 ft to embedment

Questions?

