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INSTALLING INSITU REMEDIATION INFRASTRUCTURE UNDER BUILDINGS WITHOUT ENTERING THE BUILDING IN REMOTE AND DIFFICULT CONDITIONS

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ARCADIS Design & Consultancy for natural and built assets

What were the difficulties?

- The system field had to be installed under two hangars with minimal interruptions to the tenants. This precluded installation of trenching and extraction wells inside the hangars.
- The preferred installation time was December and January (typical temperatures range from -30 to -40^{o}C)
- There were numerous sensitive utilities ringing the hangars
- The soils are silty sands creating a small effective radius of influence for each well (only 2 to 4m).

Site History

The airport development started in the 1930's and was completed by 1942. During the Second World War, the airport was extensively used for Canadian and U.S. military operations.

The contamination was believed to be caused by Fuel transfer lines. These lines originated from a tank farm and transited through this area. In addition on site fuel tanks and refueling operations contributed to releases of fuel around and under the hangars.

Site Location

Whitehorse Airport AEC 8

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AEC 8 – Hangars D and E

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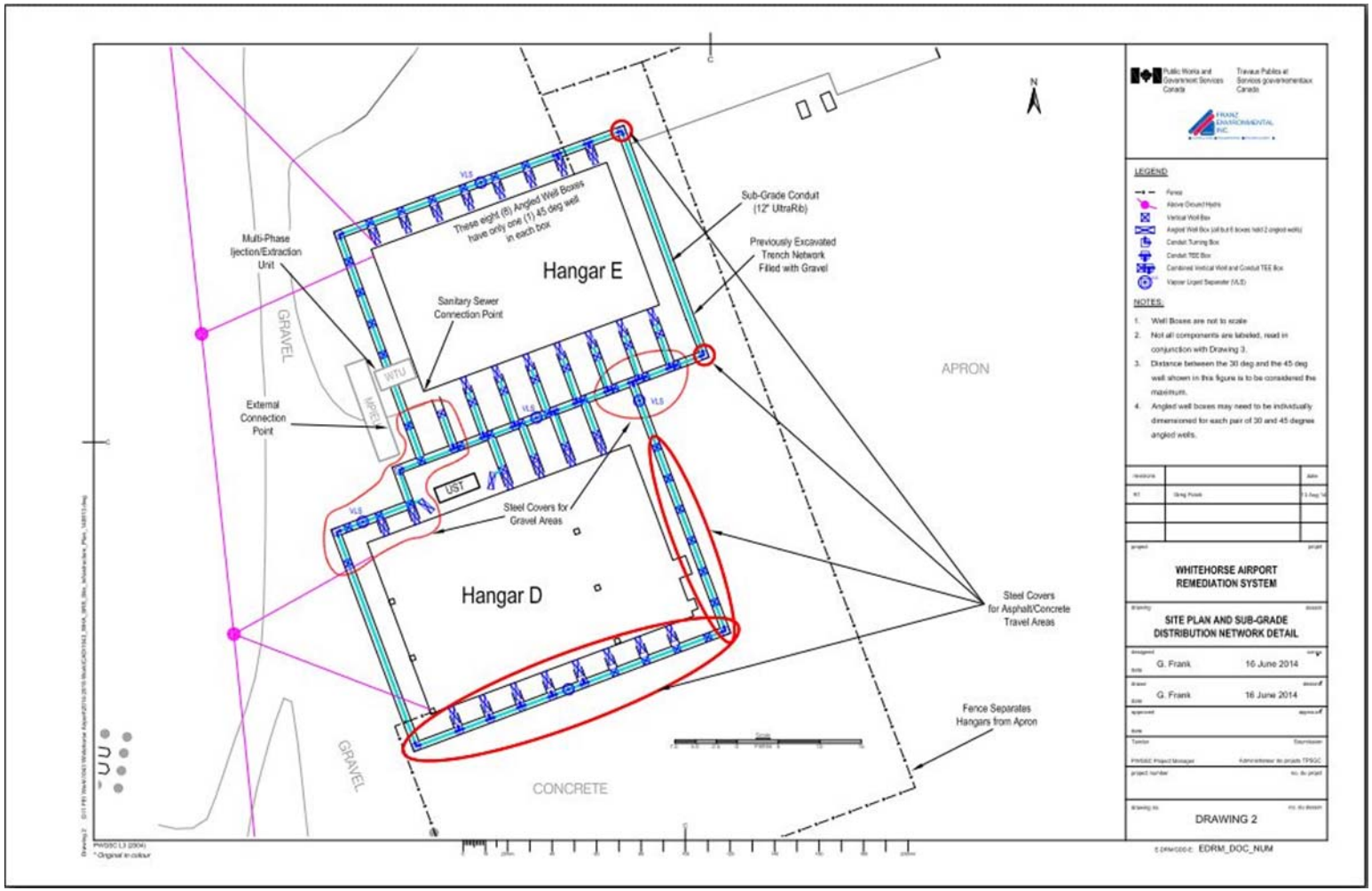
Remedial Plan – Insitu System



Problem – Extraction Well Installation

Since the Hangars could not be removed, remediation wells would need to be installed to intercept the contamination under the hangars.

Constraints on Well Installation

- Both hangars are occupied
  - Hangar D is currently the home of Yukon Wildlands Fire Management

Constraints on Well Installation

– Hangar E is Currently used for Storage and Training

Constraints on Well Installation

- Utilities cross under the hangars
- Precise locations are not known
- Sewer lines are too deep to accurately locate
- Pilot testing indicated that wells could not be placed more that 4 m apart

Possible Well Installation Solutions

- Vertical well field inside and outside of the hangars
  - Not possible to drill wells and install infrastructure inside of the hangars
- Horizontal wells under the building
  - Insufficient space for horizontal drilling
  - Risk of damaging sewer and water lines too great
- Combination of Angled and Vertical Wells
  - Very shallow wells would be required
  - Placement of sand pack and seal would be difficult

Could the field be installed in the Winter

- After a careful evaluation it was determined that while it was possible to install the wells in the winter it was NOT possible to excavate the trenching in winter conditions.
- Therefore we had to cheat a little bit….
- We also learned that even though the wells could be drilled in the winter, completion of the shallow (30 degree) wells was problematic.

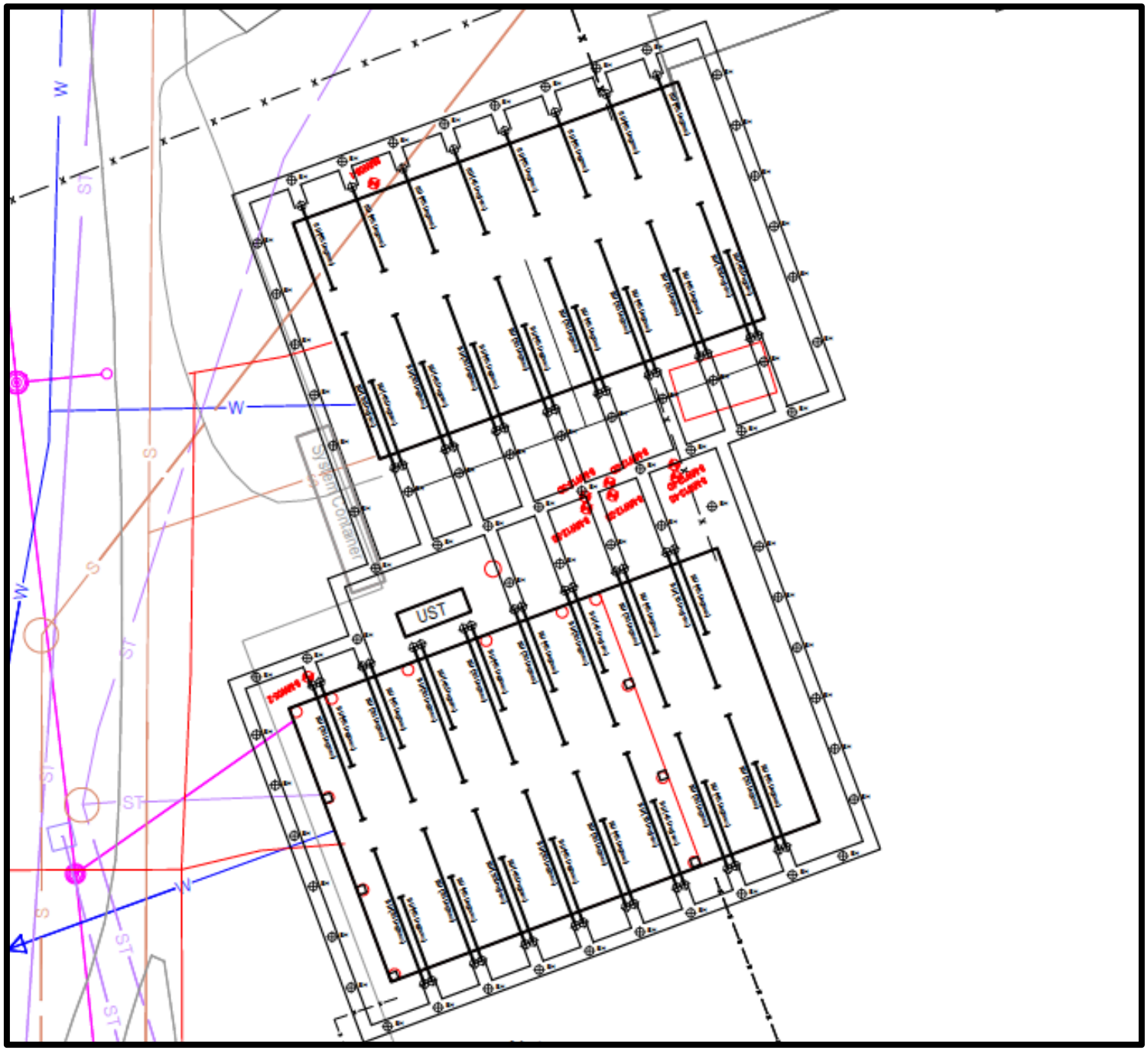
Preparing the Ground

- The solution was to excavate trenches and approaches to the building during the warmer fall weather. We then filled these trenches with a material that would not freeze (clean crushed gravel).
- The drain rock would allow unimpeded access around the hangar and yet allow for easy removal in the winter to allow for installation of the angle wells and interconnecting piping

Preparing the Ground - Trenches

Very Shallow Well Drilling at -30C

- Three sets of wells would be installed:
  - Vertical
  - 45 degrees from vertical
  - 60 degrees from vertical (30 degrees from horizontal)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Very Shallow Well Drilling at -30C

- The selected drill rig with the proven ability to complete the shallow wells was the FRASTE MITO Drill

FRASTE MITO DRILL

- Has the required low profile
- Articulating head can drill at any angle
- Track mounted can move into tight locations
- Can drill horizontal wells when benched into the ground
- Effective at very cold temperatures

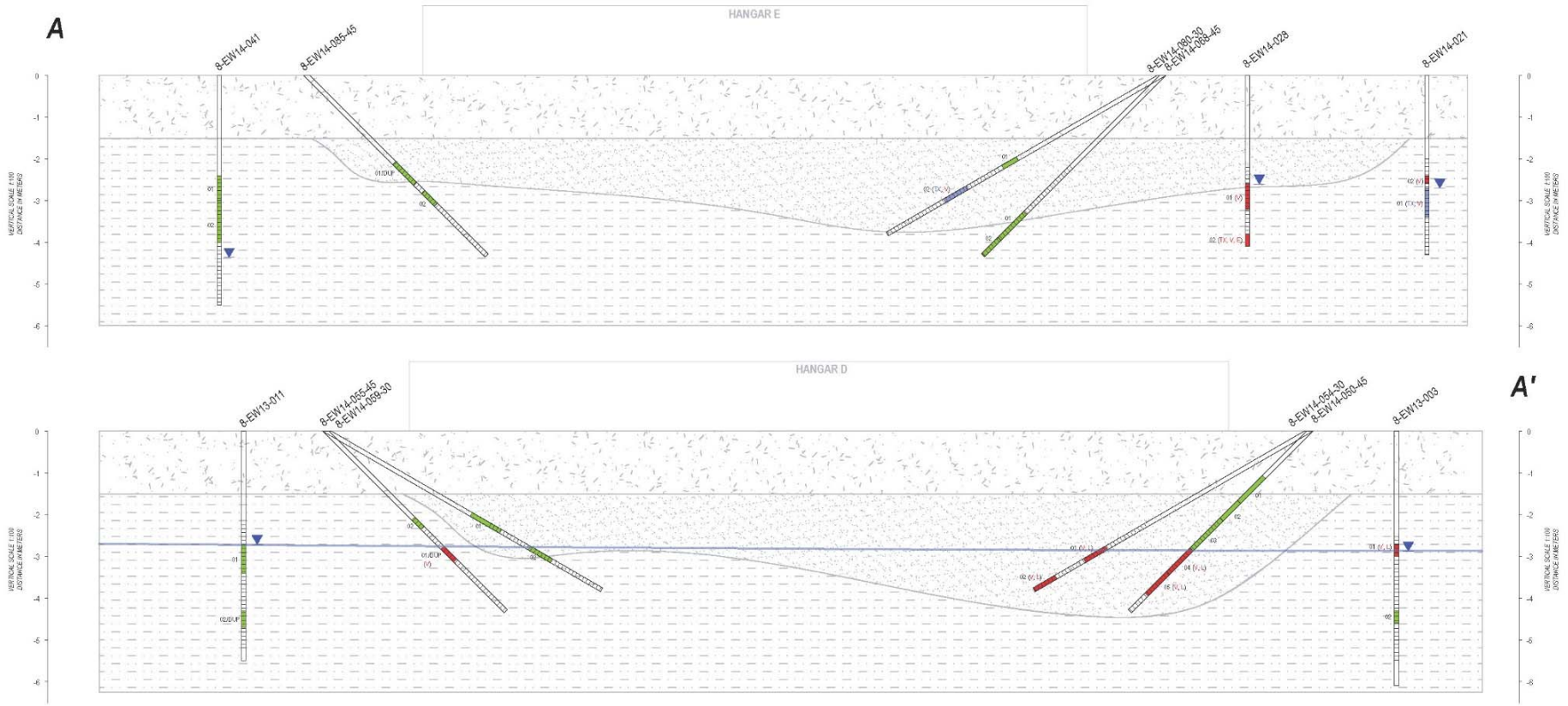
Well Completions – Shallow Angle @ -30 °C

- Pre Packed Well Screens
- Adding sand
- Well seal
- Hydrating the well seal

Sand Pack and Seal Placement

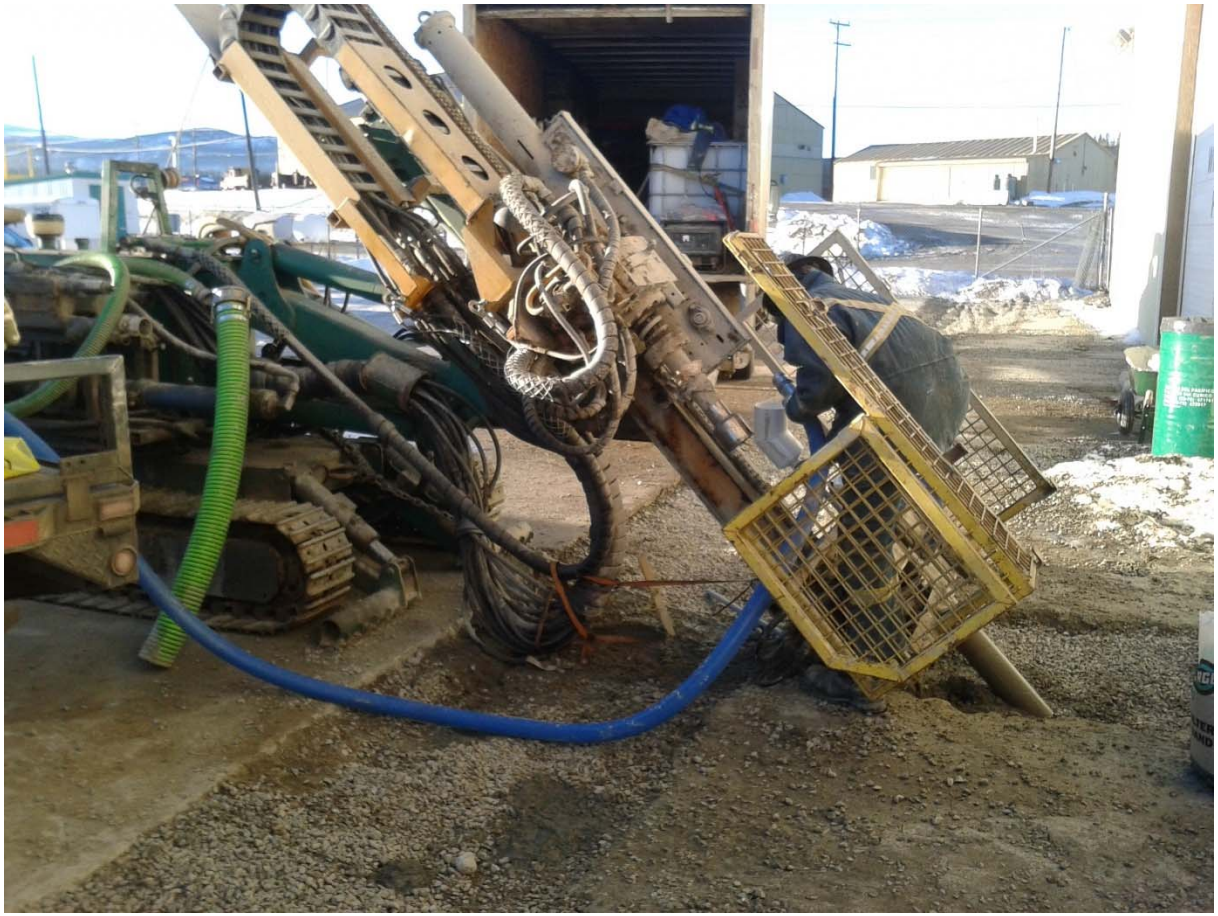
- When Planning the work we forgot that Sand does not flow into the well easily at a 30 degree angle
- This problem was resolved by utilizing water to “wash” the sand and bentonite into the hole.
- We knew this would create a second problem of freezing water but we also forgot just how quickly water freezes at -40^{o}C
- As a rapid field fix we addressed the freezing water issue by purchasing piping and plastic at the nearby hardware store to construct a light weight heated temporary enclosure

Wells in Cross Section



Please note the 5X exaggerated vertical scale

Water Injection to Wash Sand and Bentonite down the Borehole



Drill with hoarding removed for photo

Hoarding Framework

Drill Clearance required to work near the building

- To simplify connections we designed the tops of the vertical well, the 45 degree well and the 30 degree well to meet at the surface.
- This created one last issue. There were no off the shelf flush mount covers for the angle wells, so a custom made box or cover had to be constructed to protect these wells.

Custom Boxes to Enclose all Three Extraction Wells

Questions

Questions and Comments