



Improvise, Adapt and Overcome: Using Failure as an Asset

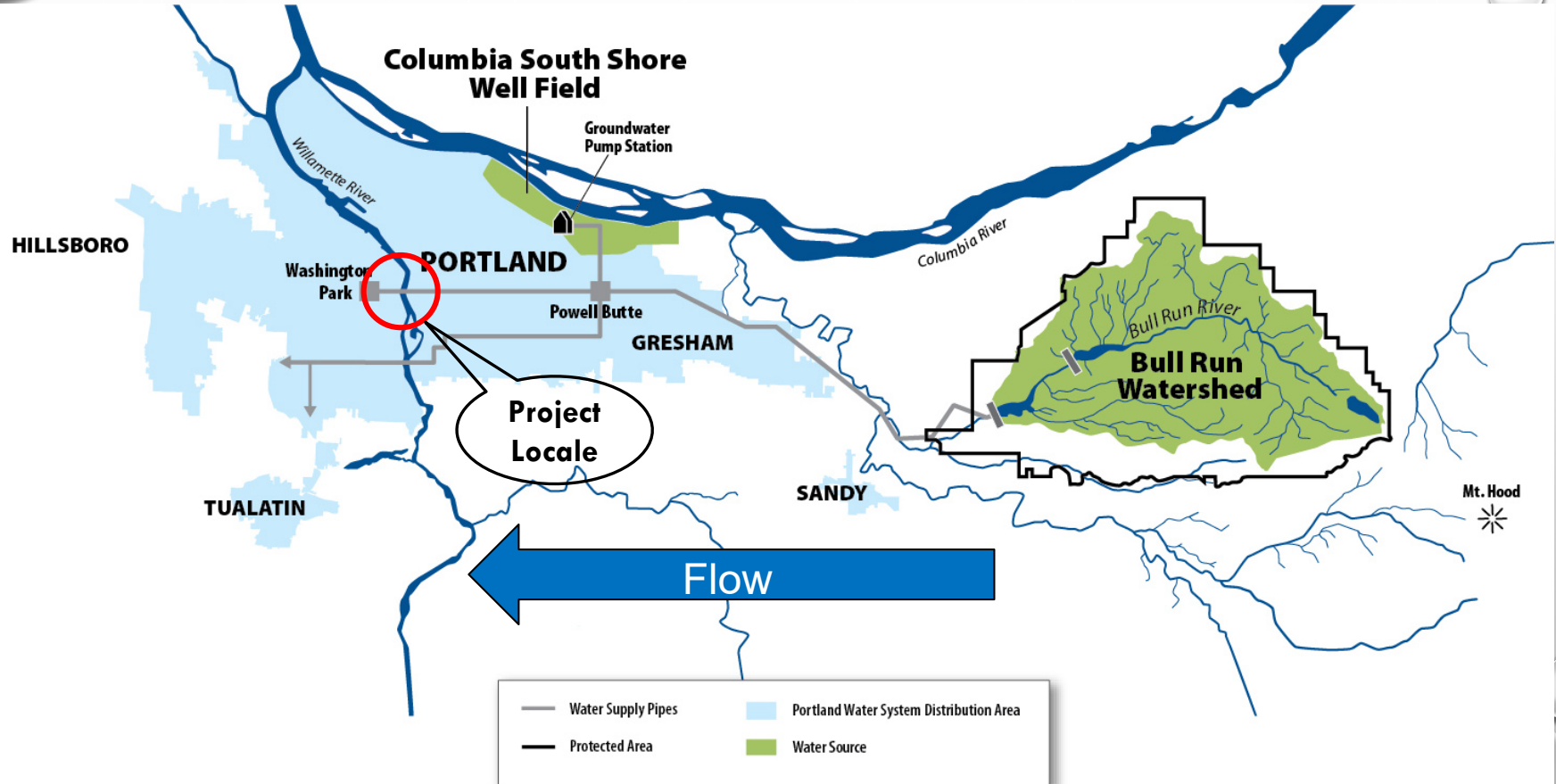
May 4, 2023

Tim Collins, P.E., G.E.
Portland Water Bureau
Engineering Supervisor

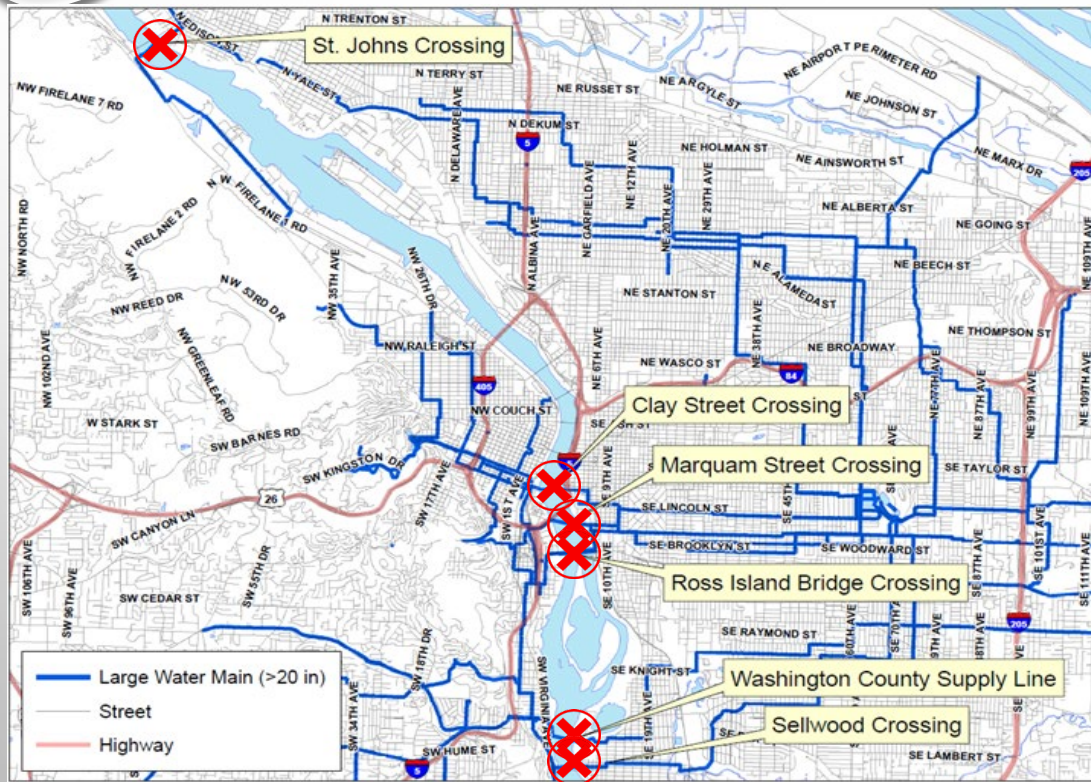
Dick Talley, P.E., PMP
Stantec Consulting Engineers, Inc.
Design Manager



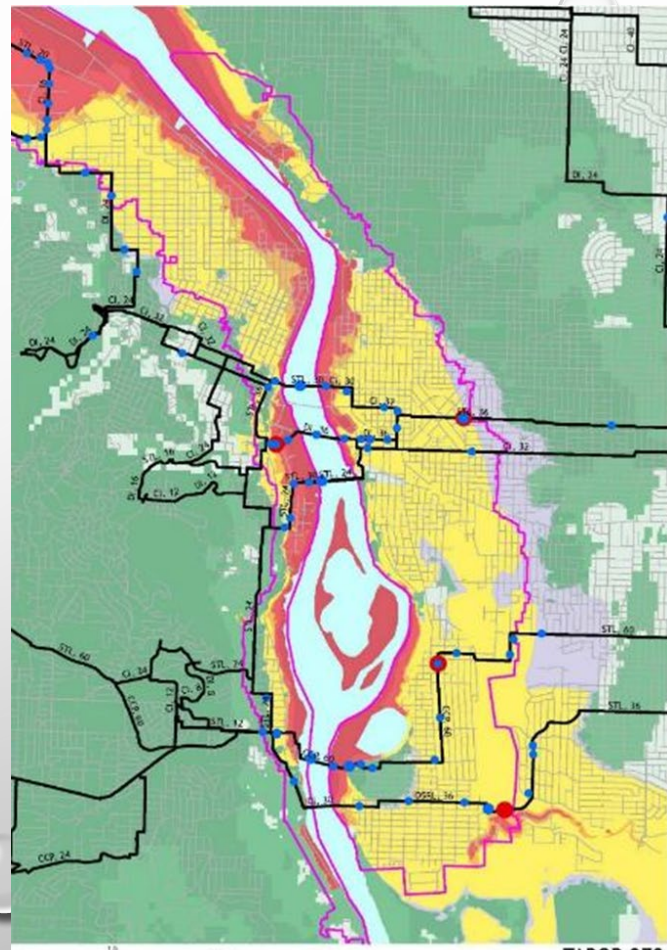
PORTLAND'S DRINKING WATER SYSTEM



No Seismically Hardened Crossings



All 6 crossings likely damaged during a Cascadia Subduction Zone (CSZ) Earthquake.





Project Objectives

- Seismically resilient crossing, trenchless technology
- Westside Average Daily Demand after earthquake
- Connection at westside and eastside header pipes
- Welded steel pipe with corrosion protection
- Minimize community impacts

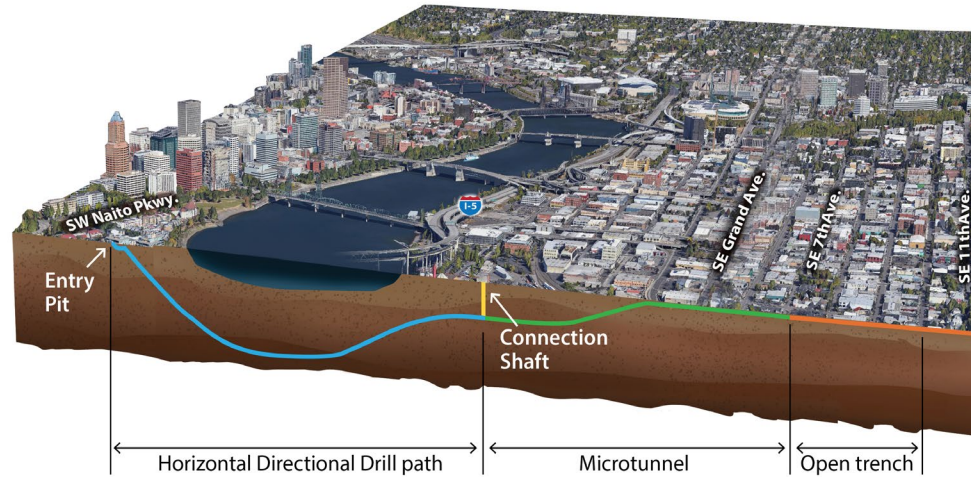
Project Parameters

Owners Rep: MJA (Delve Underground)

Design Builder: JW Fowler / Stantec

Fixed Fee Contract, Geoprobe exploration off ramp

\$90M total project costs



ESTABLISH THE TEAM

COMPLEX, EXPENSIVE, LONG-TERM PROJECTS REQUIRE:

- EXPERTISE
- DEPTH OF KNOWLEDGE
- APPROPRIATE NUMBER OF PEOPLE
- GROUND RULES
- ESTABLISHED LINES OF COMMUNICATION
- ADAPTABILITY/RESILIENCE

These are easier

This is one takes
more time

TEAM BUILDING

Know → Work → Trust



KNOW

- RECOGNIZE STAKEHOLDER BIASES
- RECOGNIZE YOUR OWN BIASES
 - ACKNOWLEDGE COMMUNICATION STYLES
 - ESTABLISH REALISTIC EXPECTATIONS
- CONSIDER MOTIVATIONS

WORK

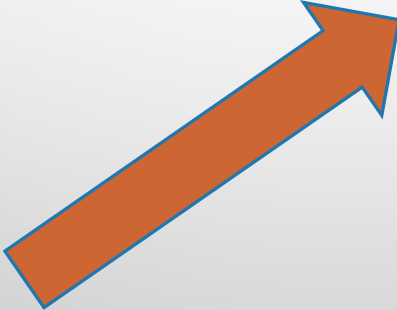
- LISTEN
- QUESTION
- CONSIDER
- DECIDE
- FOLLOW THROUGH

TRUST

- TAKES TIME TO GAIN
 - EASY TO LOSE
- MAINTAINED BY CONSISTENT PERFORMANCE
- WORTH THE EFFORT

WHY ????

TEAM WILL BE MORE:

- CAPABLE
 - ADAPTABLE
 - RESILIENT
 - REWARDED
- 
- DESIRED PROJECT OUTCOMES
 - SUCCESS IS REALIZED

EXECUTION

Risk Mitigation

- Geotechnical Exploration
- Pilot Bore

Technology/Alignment


- Constraints
- Right of Way

Failure

- When the worst happens

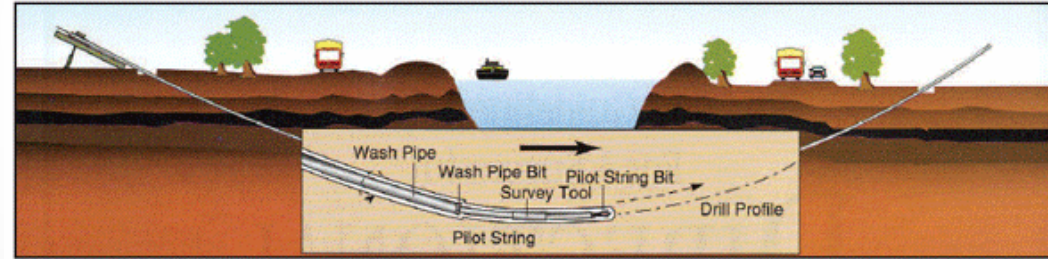


PLAN FOR THE WORST, WORK TOWARDS THE BEST

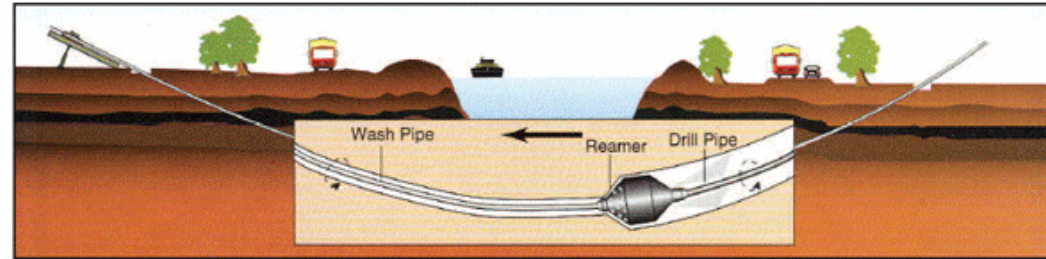
- TRENCHLESS WORK IS INHERENTLY RISKY AND UNCERTAIN
 - GEOTECH EXPLORATION ONLY PROVIDES A SMALL SAMPLING OF THE GEOLOGY
 - DEVELOP STRATEGIES THAT PROVIDE TIMELY ASSESSMENT OF RISKS
- 

RISK MITIGATION STRATEGY

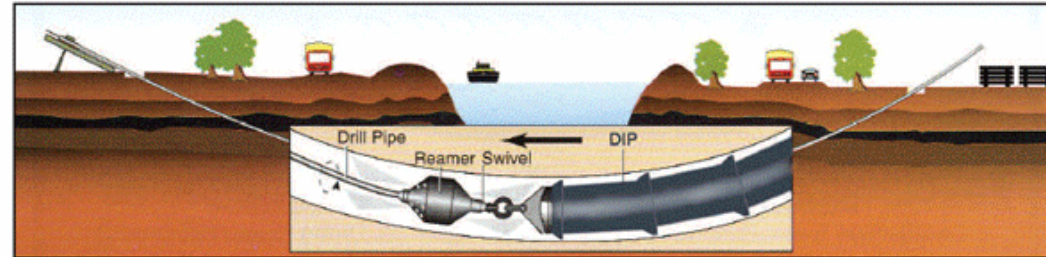
- CONTRACT OFF RAMP CLAUSE
- HIRE CONTRACTOR TO ASSESS DATA AND DETERMINE ALIGNMENT
- GEOPROBE ALONG THE ACTUAL ALIGNMENT DRILLED BY DB SUBCONTRACTOR



PILOT HOLE



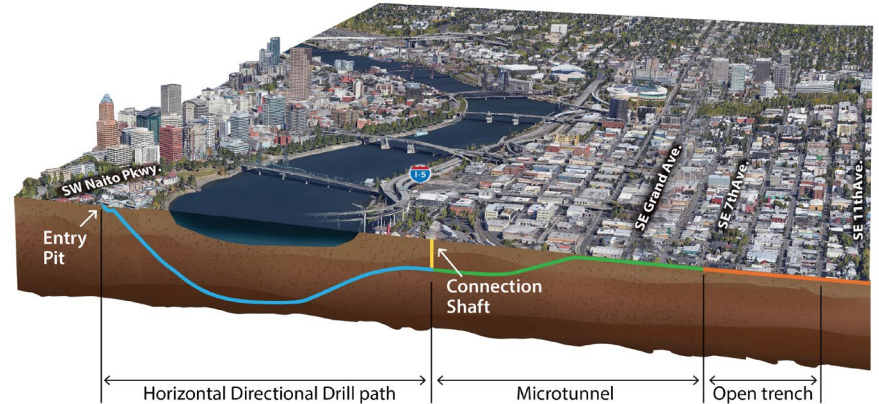
PRE-REAMING



PULL-BACK

ORIGINAL CONCEPT

- Horizontal Directional Drill (HDD) technology to insert a 36-inch pipe
- HDD (2,750 feet) to connection shaft with MicroTunnel casing
- MicroTunnel casing for storage and pull back of pipe



Original plan
(2018)

COMPLEXITIES AND RISK IDENTIFICATION

- TWO COMPOUND CURVES (VERTICAL AND HORIZONTAL)
- INITIATED IN ACCESS PIT ON THE WEST SIDE (25 FEET BGS) CROSSING MULTIPLE UTILITIES, A MAJOR ROADWAY, AND BENEATH A PILE SUPPORT PARKING GARAGE BEFORE CROSSING THE RIVER.
- COMPLEX GEOLOGICAL PROFILE AGGRESSIVE TO HDD TECHNOLOGY

RISK MITIGATION MEASURES

- EXTENSIVE FIELD EXPLORATION AND SAMPLING WHERE ACCESS WAS POSSIBLE
- UTILITIES AND GARAGE SUPPORT PILES WERE LOCATED BOTH HORIZONTALLY AND TIP ELEVATIONS
- 3D PIPELINE MODEL TO “VISUALIZE” ALIGNMENT, GEOTECHNICAL CONTACTS, UTILITIES AND OBSTRUCTIONS.
- CONDUCT A PILOT PROBE. THE PRIMARY PURPOSE OF THE PILOT PROBE WAS TO EVALUATE RISKS TO HDD.

“NOT FEASIBLE”!

- Drilled for 45 days
- 3 different alignments
- Didn't get any farther than 800'
- Troutdale Formation less cemented and more abrasive than anticipated.
- Drill shoe completely destroyed



Bullet Bits

End View of the Cutting Shoe on the 13-5/8-inch Steel Wash-Over Casing



Cutting Shoe after 120 feet of Advance in the

The slide features a light gray background with several realistic water droplets of varying sizes. Some droplets are at the top, some are along the right edge, and others are at the bottom. The main title is centered at the top in a bold, brown, sans-serif font.

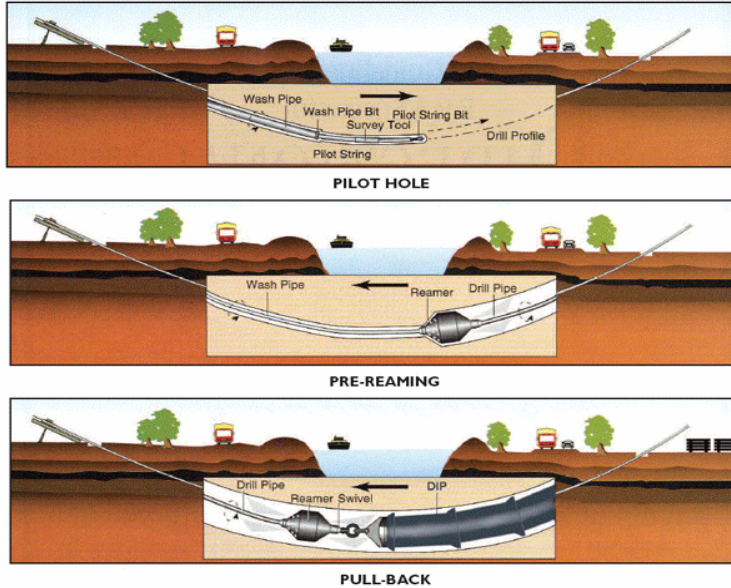
WHEN THE WORST HAPPENS

- GIVE TEAM TIME TO RECOUP AND MOURN
- TAKE STOCK
- GATHER TEAM AND STAKEHOLDERS FOR BRAINSTORMING
- DEVELOP TRANSITION PLAN
- REINFORCE TEAM CONNECTIONS

REVISED ALIGNMENT

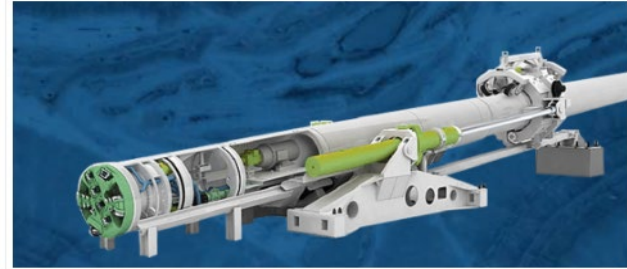


Horizontal Direction Drill vs Direct Pipe

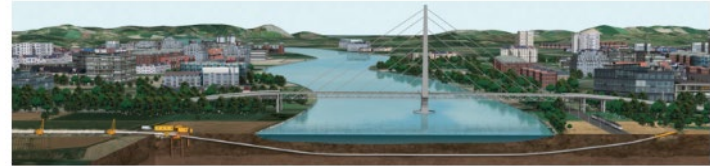


Horizontal Directional Drill (HDD)

Unsupported boring
Multiple passes
More community impacts
\$\$\$



The following figure depicts a direct pipe installation passing beneath a river.



Direct Pipe

Supported boring
Single pass
Less community impacts
\$\$\$\$

LESSONS LEARNED

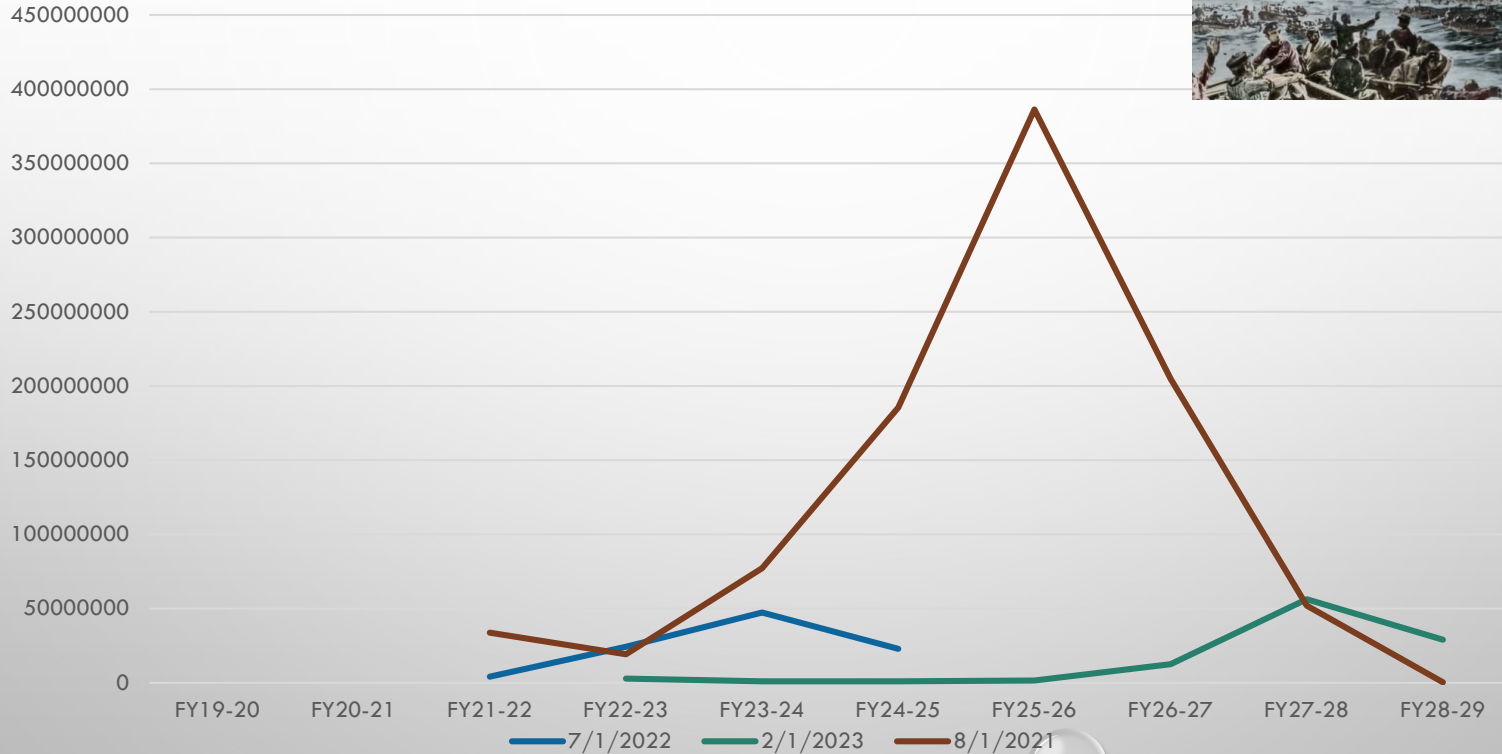
- BE FAMILIAR WITH THE LANGUAGE OF RISK
- TRENCHLESS WORK REQUIRES A CREATIVE AND PROGRESSIVE APPROACH
- BUILDING A RESILIENT TEAM IS IMMEDIATE AND ONGOING
- ALTERNATIVE PROCUREMENT DOESN'T SAVE MONEY OR TIME, BUT INCREASES THE LIKELIHOOD OF SUCCESS

SOMETIMES IT IS BETTER JUST TO RUN



COLLISION!

WRX vs Filtration Spending Estimates



Peak spending overlapping

NEXT STEPS

- PAUSE FOR 2-3 YEARS
- CLOSE OUT EXISTING CONTRACTS
- KEEP CURRENT ALIGNMENT
- START CONSTRUCTION IN 4 YEARS





Questions?