

# An Update on the LBNF/DUNE Project

Joshua Willhite

LBNF Far Site Conventional Facilities Project Manager

24 October 2017



# Who Am I?

- I'm responsible for construction of the “conventional facilities” for LBNF, which includes excavating the spaces underground, constructing a building on surface, providing a means to move rock, and getting utilities where needed.
  - Others are responsible for the more unique parts of the projects, such as cryogen handling and the detectors.
- I was born in Rapid City, and have spent most of my life in the area.
- For the past 7.5 years I have been associated with DUSEL, LBNE, and LBNF as an engineer and manager, approximately half of which was in this role.
- Prior experience includes 14 years as an engineer or manager for cement manufacturing facilities, most recently at GCC Dacotah in Rapid City for 7 years.
- Certified Project Management Professional (PMP)
- Registered Professional Engineer

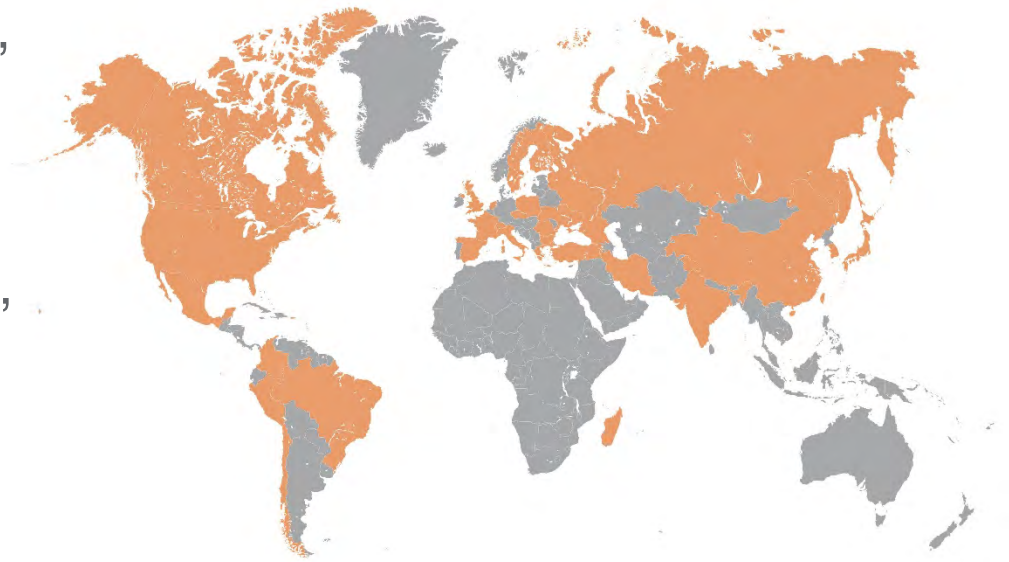
# The DUNE Collaboration

As of today:

>60 % non-US

**1032 collaborators from 176 institutions in 31 nations**

Armenia, Brazil, Bulgaria, Canada, CERN, Chile, China, Colombia, Czech Republic, Finland, France, Greece, India, Iran, Italy, Japan, Madagascar, Mexico, Netherlands, Peru, Poland, Romania, Russia, South Korea, Spain, Sweden, Switzerland, Turkey, **UK**, Ukraine, **USA**



**DUNE has crossed the 1,000 collaborator threshold!**

# UK Science and Technology Agreement

- First ever Science & Technology agreement between U.S. and U.K. signed on September 20<sup>th</sup> by Science Minister Jo Johnson
- Commits £65M (about \$88M) to DUNE, LBNF, and PIP-II
- First major commitment from a country!
- Working on more...





# Groundbreaking! (July 21)



- Strong support - Hosted by Governor Daugaard and SDSTA; participants included:
  - International agencies: CERN, INFN, and STFC
  - Congressional delegations
  - DOE
  - Executive Office of the President

## Strong support of project continues...

**Deputy Assistant to the President and Deputy U.S. Chief Technology Officer Michael Kratsios, Office of Science and Technology Policy:**

*“Today’s groundbreaking for the Long-Baseline Neutrino Facility... serves as a model for what the future of mega-science research looks like: an intensely collaborative effort between state, local and federal governments, international partners, and enterprising corporate and philanthropic pioneers whose combined efforts will significantly increase our understanding of the universe.”*

- FY 2019 Administration Research and Development Budget Priorities memorandum of 17 August 2017: “Innovative partnership models involving other agencies, state and local governments, the private sector, academia, and international partners can help maximize utilization of underused facilities and lead to sharing the costs of new R&D facilities.”



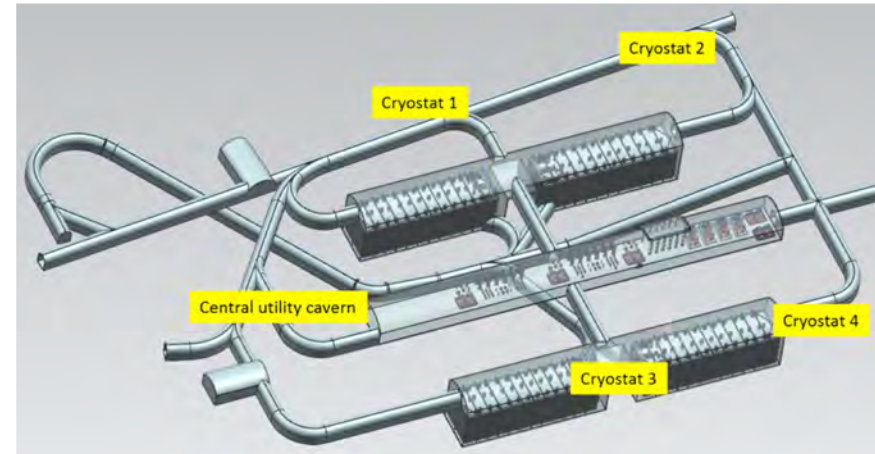
## And so we get to work



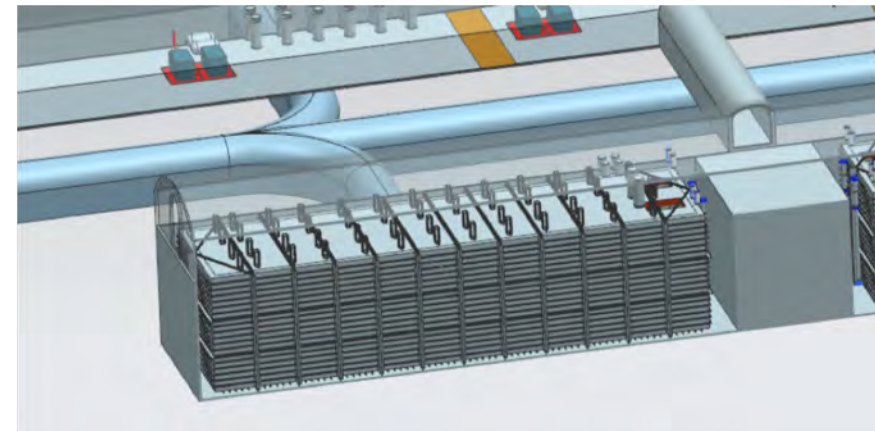
- Kiewit/Alberici Joint Venture (KAJV) and LBNF project team at 29/30 August kick-off meeting at Sanford Lab
- KAJV's initial scope is bidding pre-excavation work and supporting final design.

# Overview - “Far Site” - LBNF/DUNE at Sanford Lab, Lead, SD

- **Conventional Facilities:**
  - Surface and shaft Infrastructure including utilities
  - Drifts and two caverns for detectors
  - Central utility cavern for conventional and cryogenic equipment
- **Cryostats:**
  - Four membrane cryostats supported by external steel frames
- **Cryogenic Systems:**
  - LN2 refrigeration system for cooling and re-condensing gaseous Argon
  - Systems for purification and recirculation of LAr
- **Argon: 70kt LAr (~40kt “fiducial” mass)**
- **DUNE LAr-TPC Detectors**



4850L cavern and drift layout



Single cryostat



# Far Site Scope – Timeline

## 1. Sanford Lab Reliability Projects

*FY16 – 19*

- Ross shaft rehab
- Hoist motor rebuilds, more...

## 2. Pre-Excavation

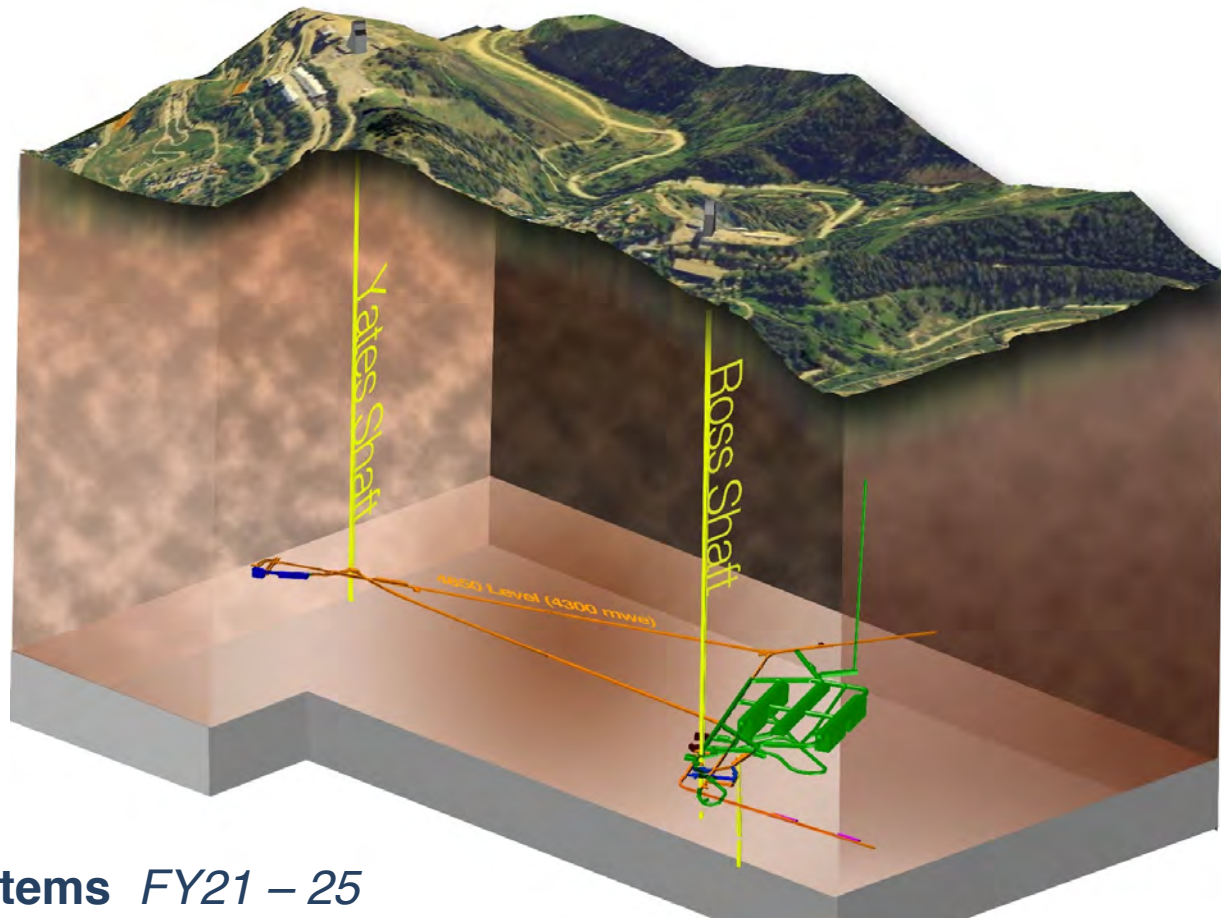
*FY17 - 19*

- Rock disposal systems
- Headframe Reinforcement
- Conveyor System

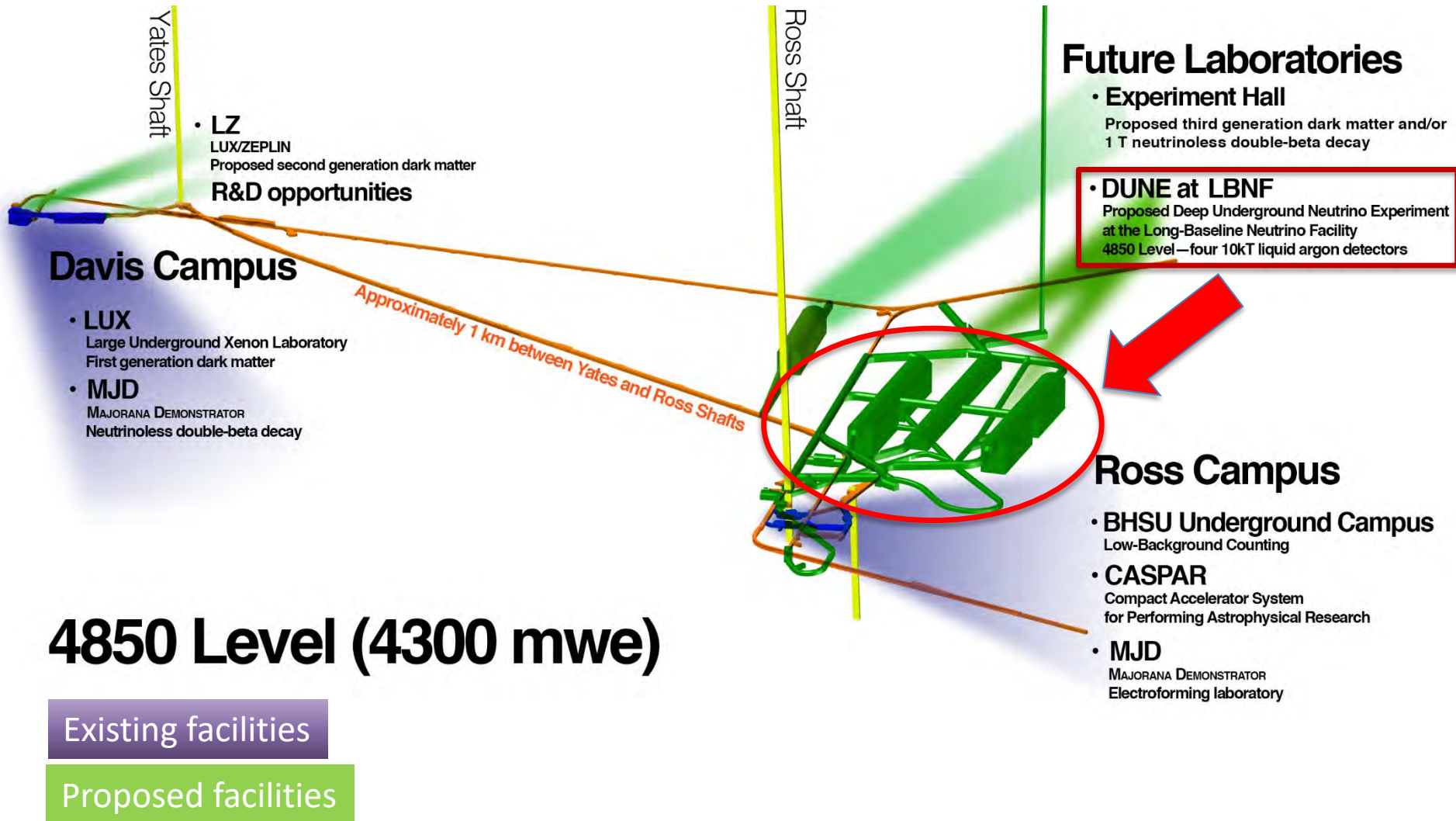
## 3. Excavation/Construction

*FY19 – 22*

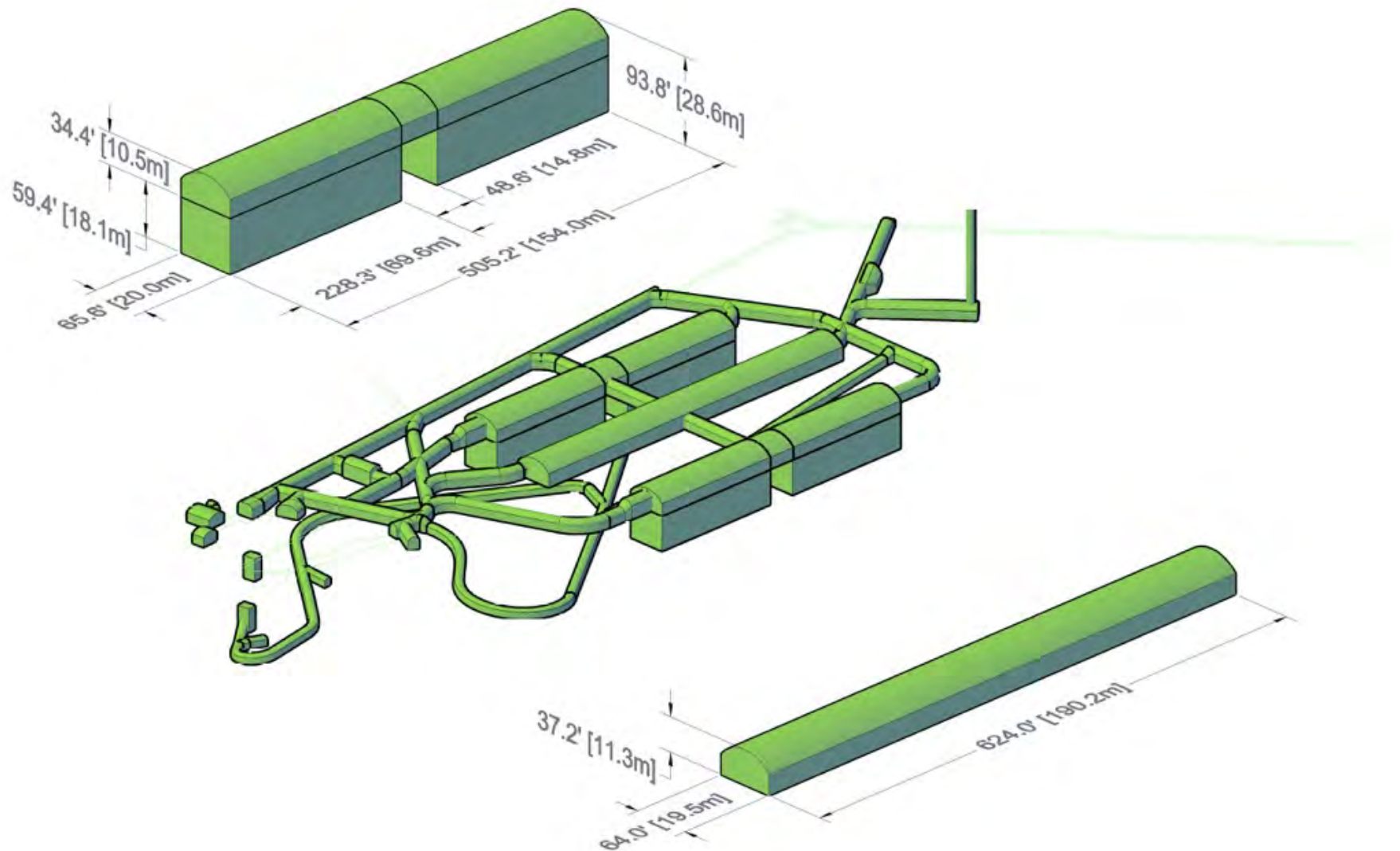
## 4. Cryostats/Cryogenic Systems *FY21 – 25*



# Underground Context

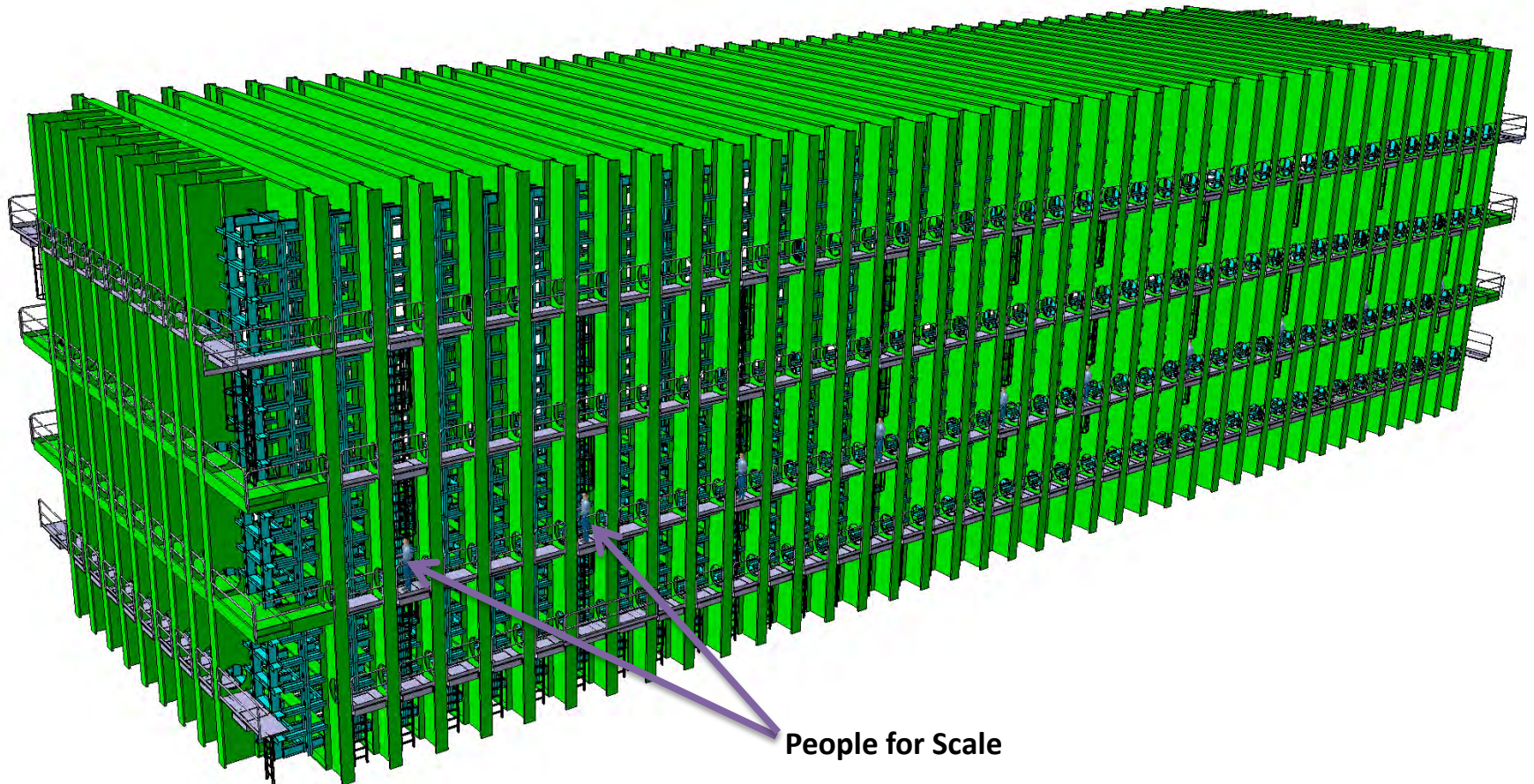


# Size of Excavations





# Steel Cryostat Design



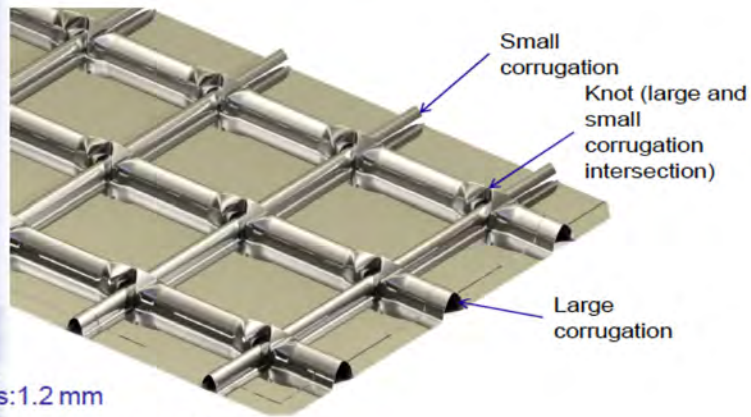
## External (Internal) Dimensions

19.1m (15.1m) W x 18.0m (14.0m) H x 66.0m (62.0m) L

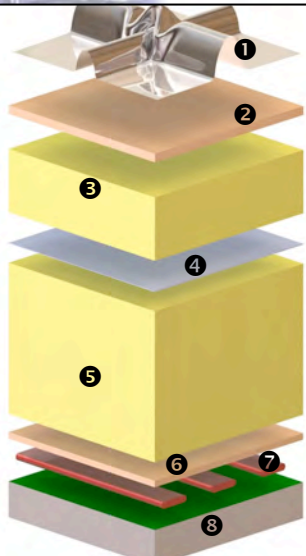
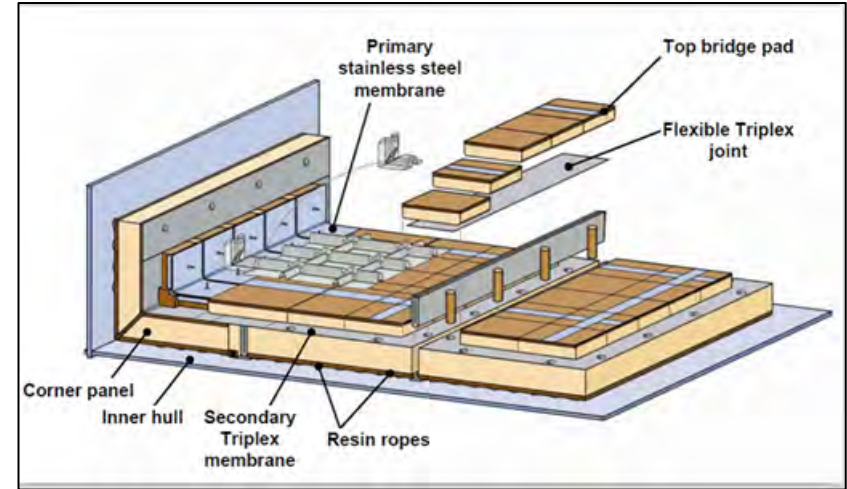
62.7' (49.5') W x 59' (45.9') H x 216.5' (203.4') L

# Membrane Cryostat Design

The corrugated stainless steel primary barrier:



- Thickness: 1.2 mm
- Material: Stainless steel 304L



- 1 Stainless steel primary membrane
- 2 Plywood board
- 3 Reinforced polyurethane foam
- 4 Secondary barrier
- 5 Reinforced polyurethane foam
- 6 Plywood board
- 7 Bearing mastic
- 8 Steel structure with moisture barrier





# ProtoDUNE progress at CERN... Single Phase Detectors







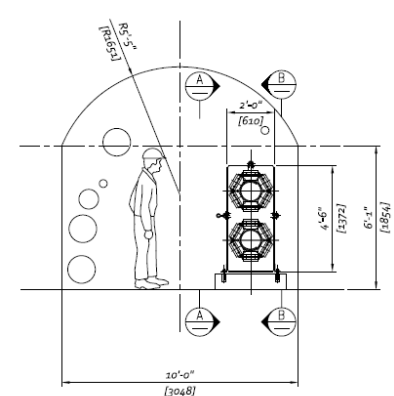
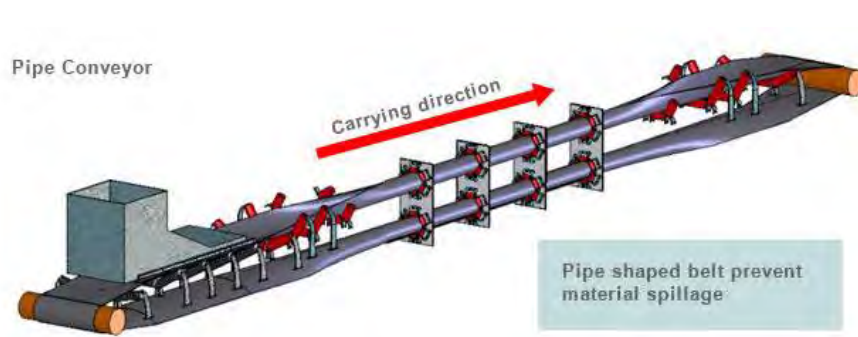
## Focus on South Dakota

The balance of the presentation will focus on what's happening here in South Dakota in the next ~year.

# Rock Handling

This most significant near term work is to establish a system for handling excavated rock. For this we're planning a pipe conveying system.

- As a reminder, a pipe conveyor is a form of belt conveyor that folds over itself to create a “pipe” shape. This allows the conveyor to turn tighter corners than traditional belt conveyors, and also keeps the material completely enclosed for most of the conveyor length.
- Homestake had the world’s longest pipe conveyor (at the time) in the same area.

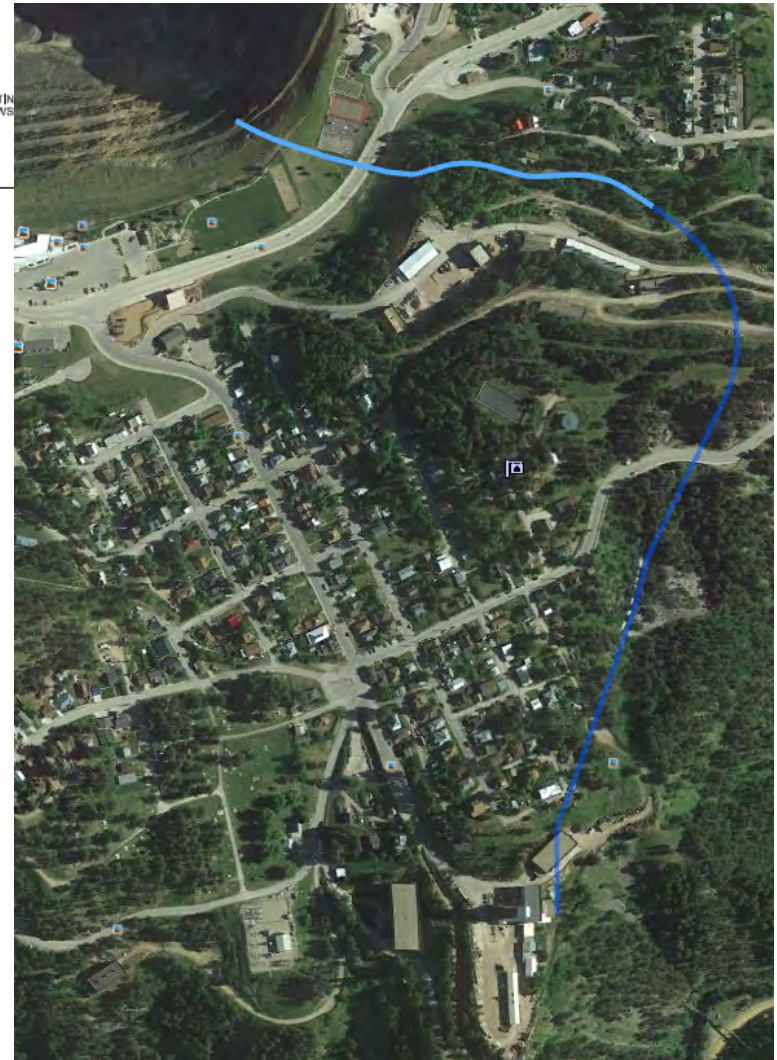
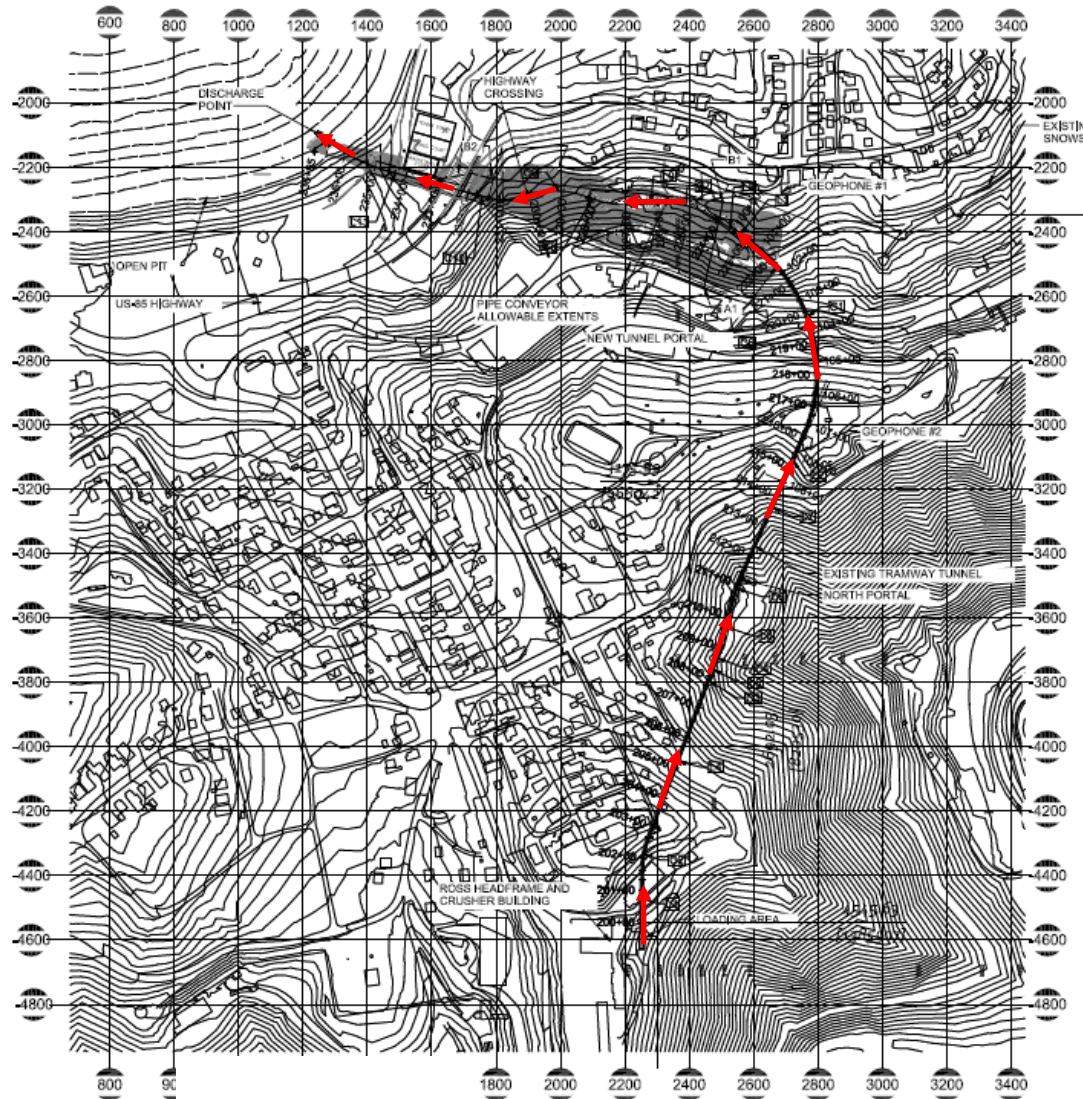




## Pipe Conveyor Supplier Info

- LBNF is working with a pipe conveyor design and manufacturing team to finalize the design of the pipe conveyor and begin construction. The team includes the following players:
  - NAFCO is based out of Northern Alabama and is the manufacturing company that will build the conveyor
  - Wolf Point is NAFCO's design division based out of Chicago doing all design not specific to the conveyor itself
  - CKIT is a design firm subcontracted to NAFCO, based in South Africa and specializing in pipe conveyor design
- NAFCO has committed to providing all US-sourced materials.
- KAJV is responsible for installation of everything NAFCO supplies.

# Pipe Conveyor Route





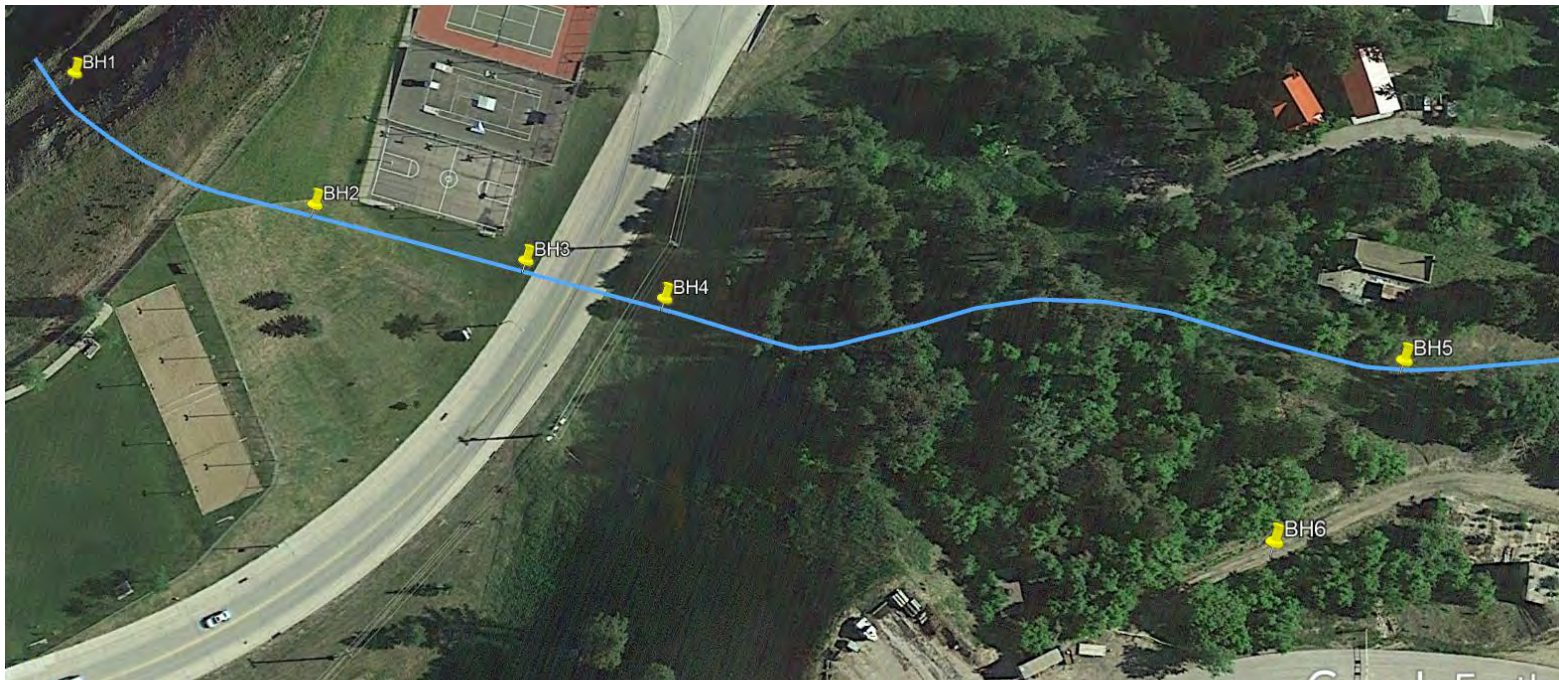
# Surface Component of Route





# Geotechnical Analysis

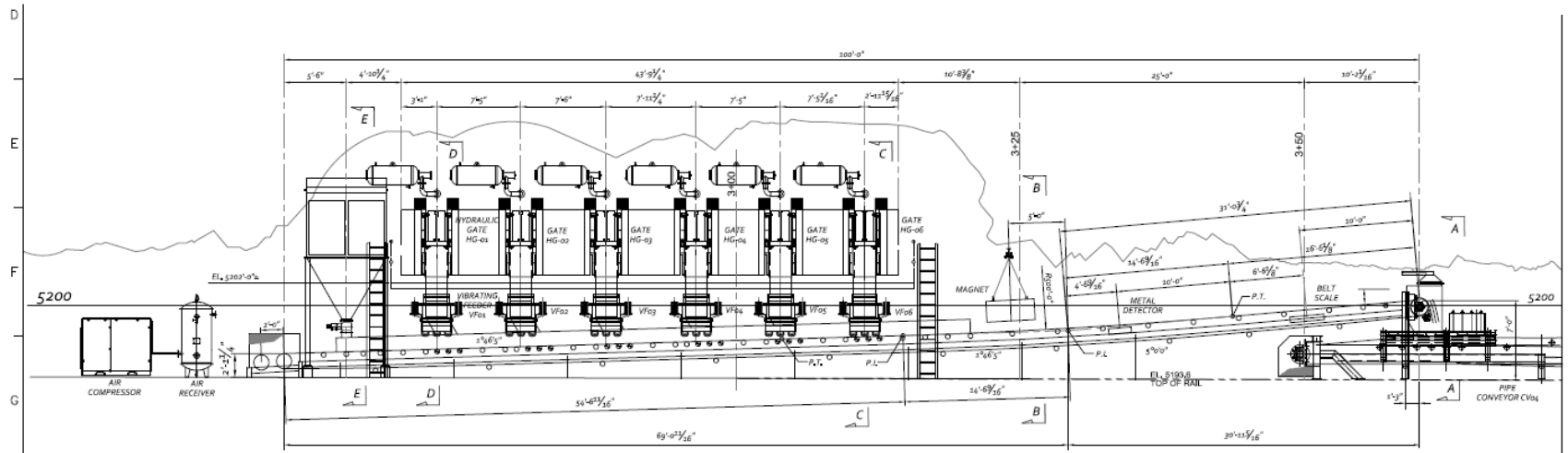
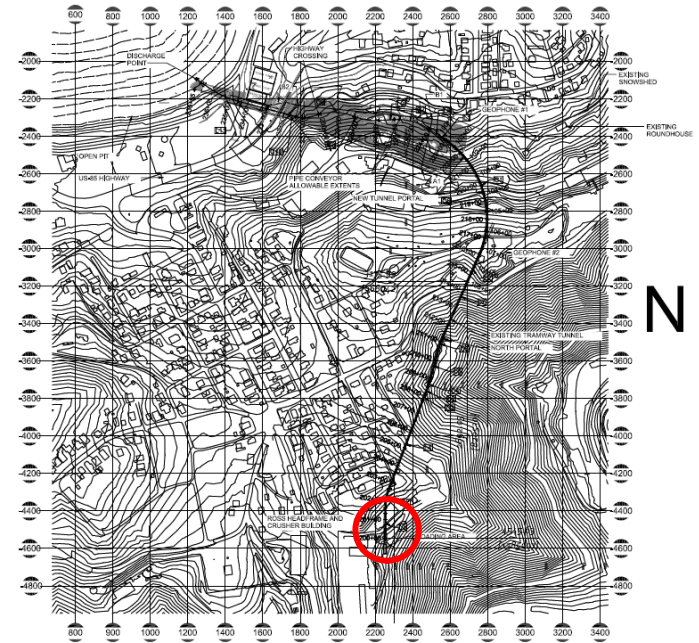
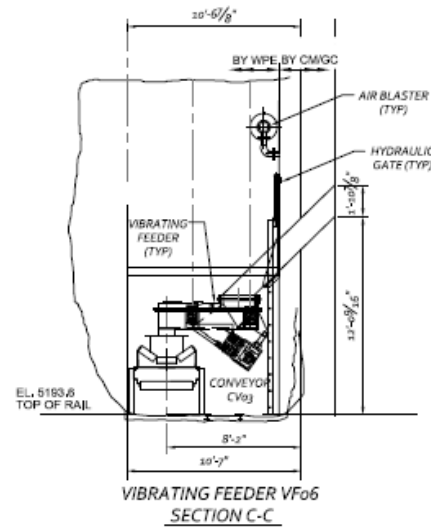
- LBNF and the NAFCO team are moving forward with a geotechnical plan to better understand and design the foundations for the pipe conveyor.
- NAFCO is working with local contractors to clear access (McDirt) for geotechnical analysis (NTI) at six locations along the pipe conveyor route.
- In the coming weeks you will see some of this work at the open cut, by the basketball courts, and on the other side of the highway. To reduce any noise disturbances this work is limited to 7am-5pm during the week.



## Design Updates

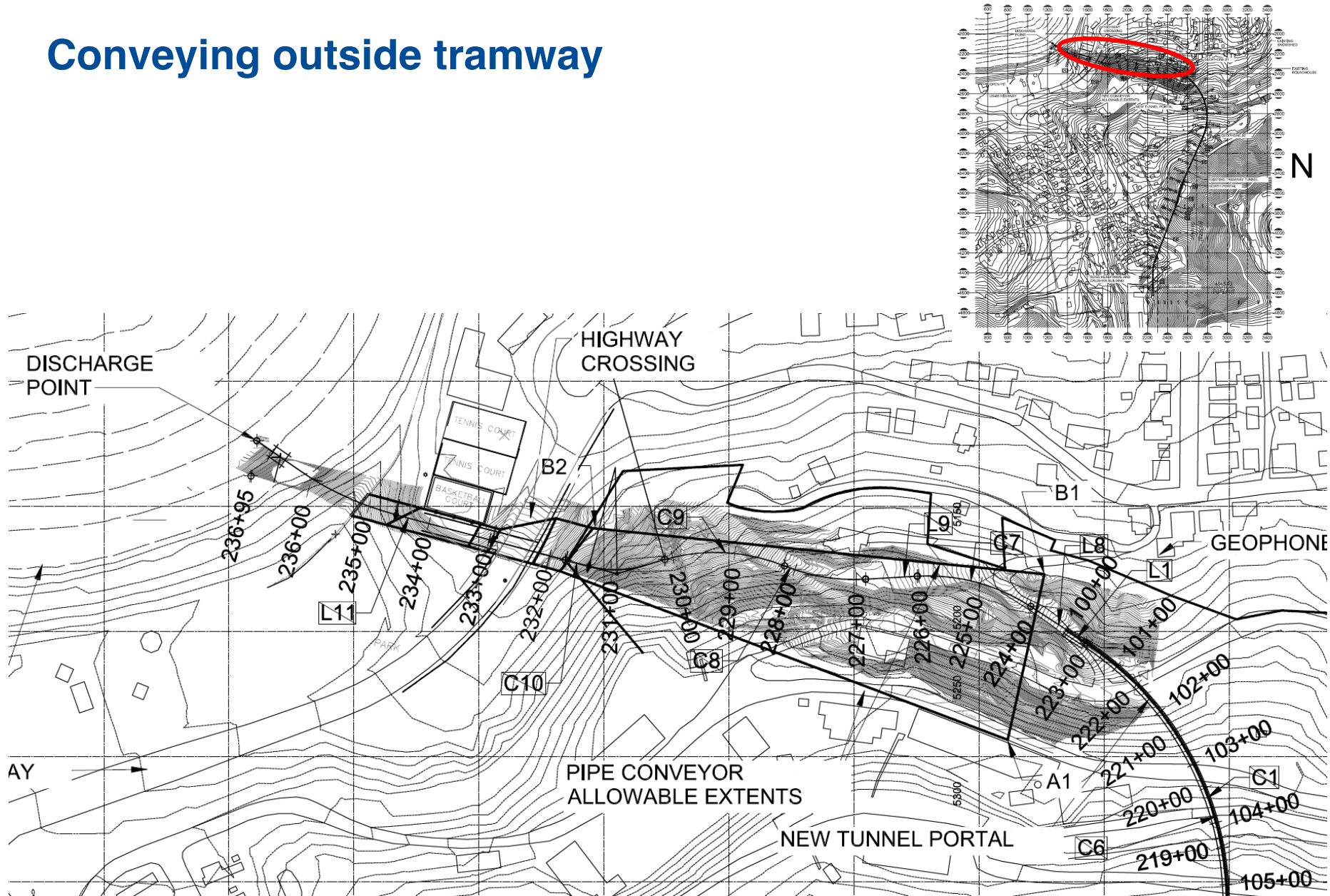
We recently received a 50% complete design from NAFCO. The following slides are advancements of what was shared in March.

# Conveying underground

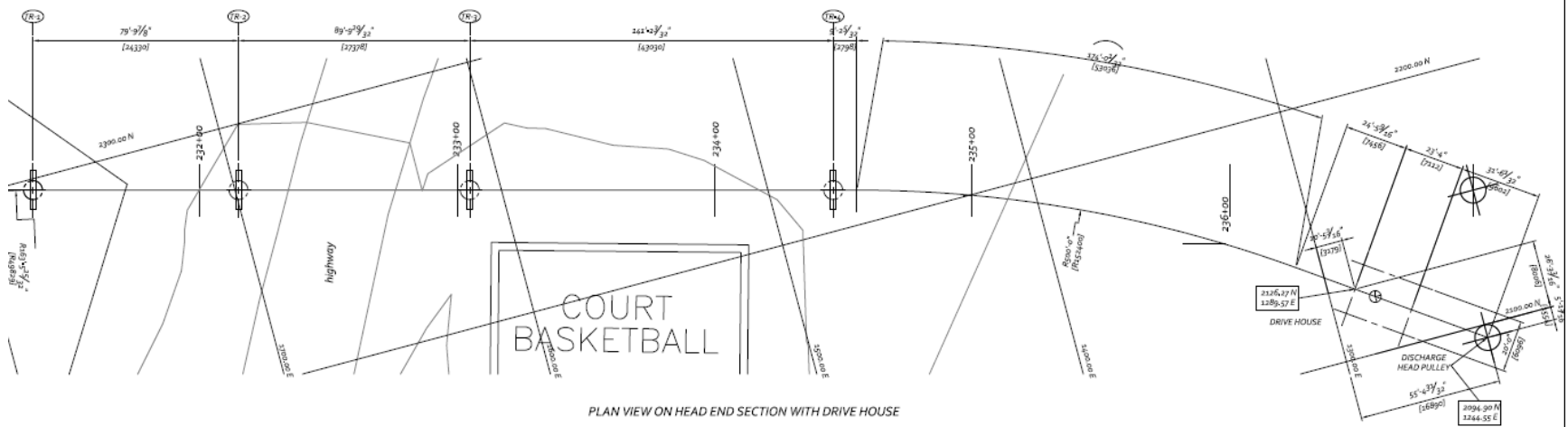
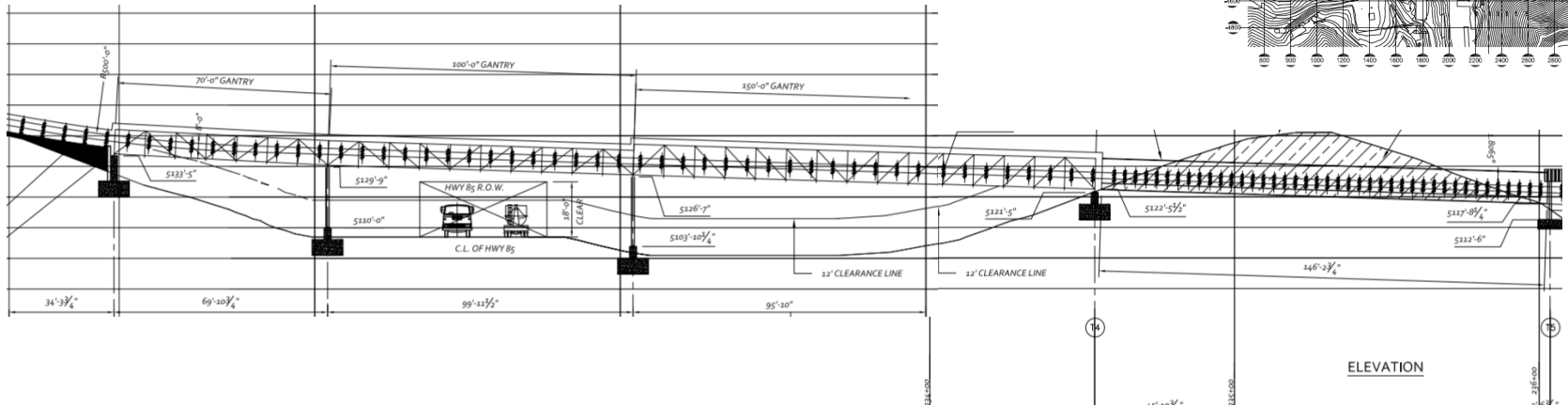
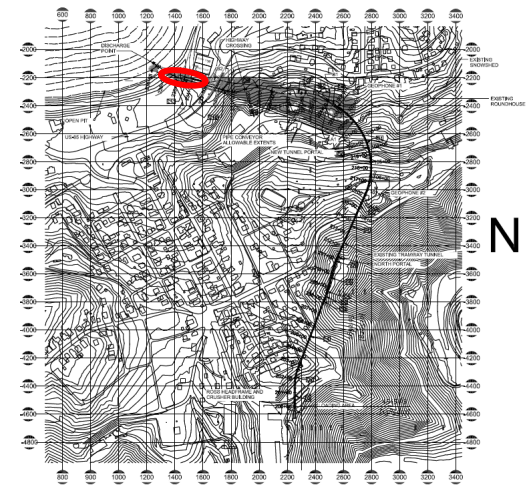




# Conveying outside tramway

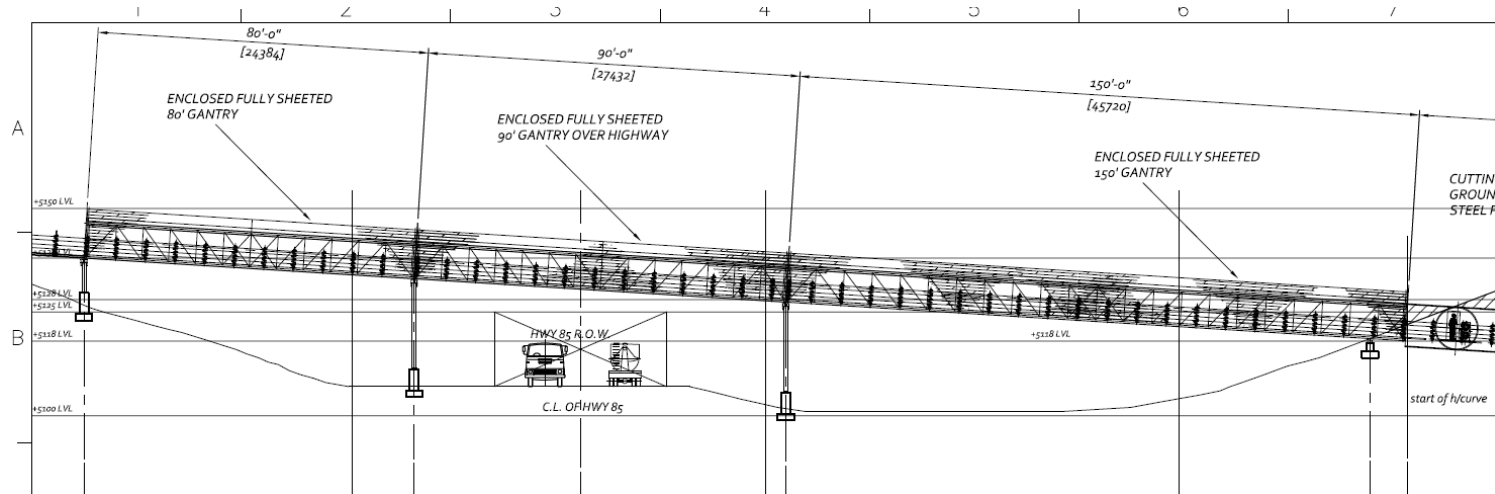


# Conveyor Road and Park Crossing



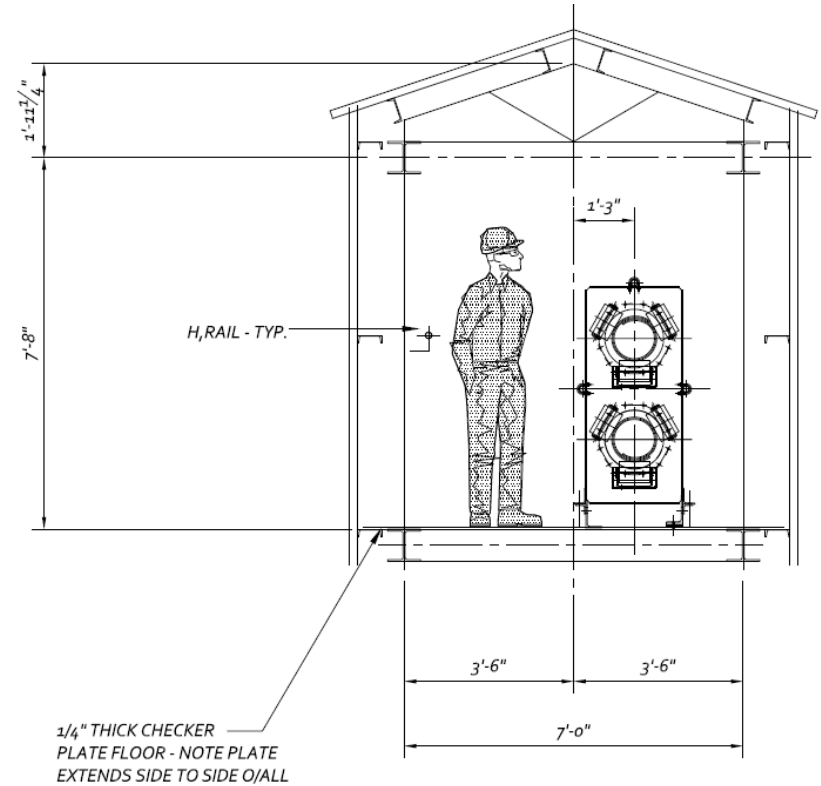
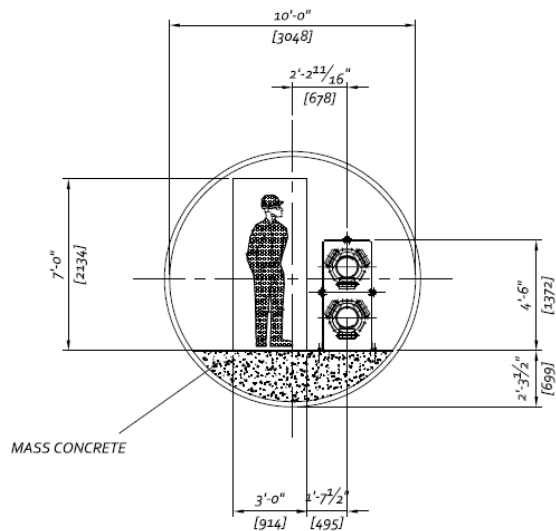
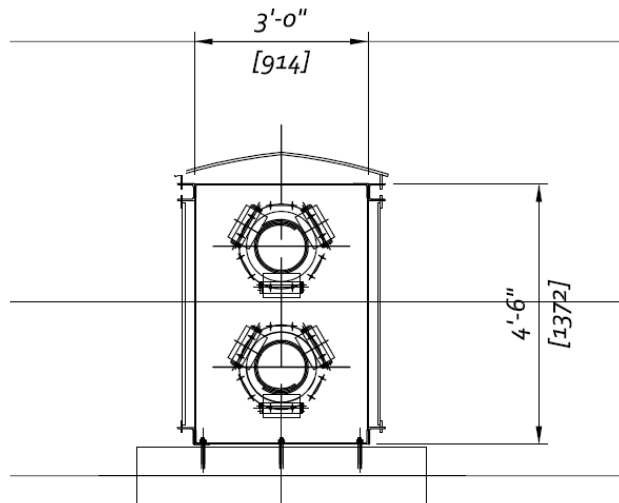


# Conveyor General Appearance



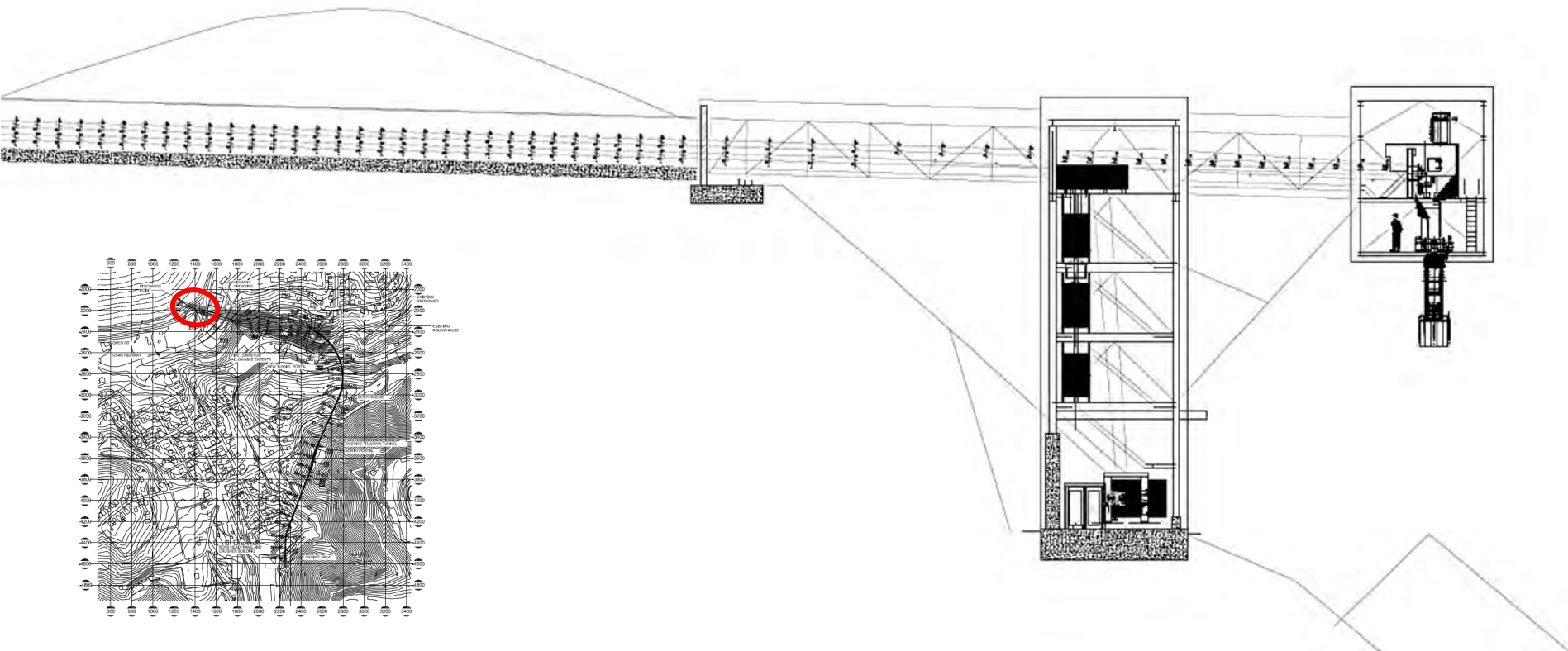


# Conveyor Enclosures



# Pipe Conveyor Discharge

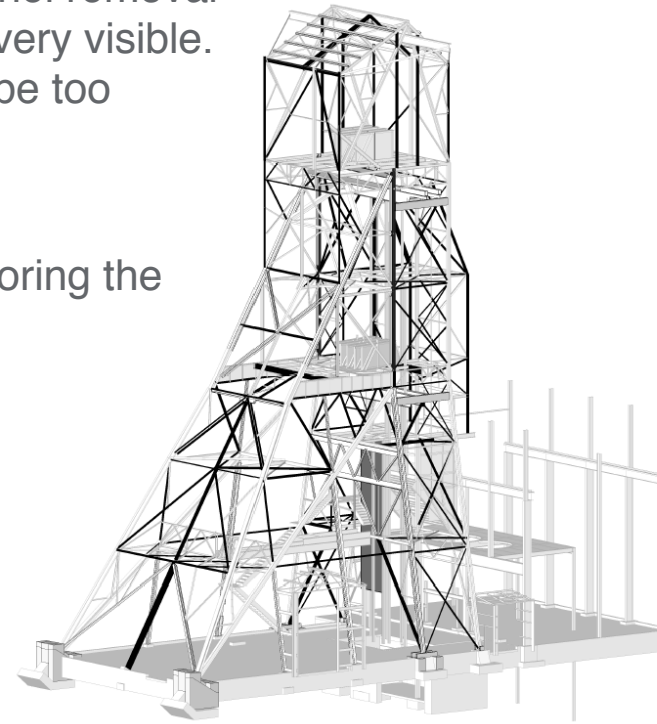
The drive tower will use a telescopic chute to allow for the entire volume of excavated rock to free flow down the high wall without any “working” of the pile.  
A key element of this is to provide a combination of chute, dust collection, and dust suppression to control dust generation.





## Other upcoming work by KAJV

- KAJV is developing their schedule now, with plans to mobilize next spring. In addition to the pipe conveyor, some potential work they'll start with includes:
  - Ross Headframe reinforcement – may include some panel removal for access, but this is primarily internal work and won't be very visible. It's lots of relatively small steel pieces, so deliveries won't be too frequent.
  - Ross crusher restoration – all indoor work
  - Underground work including installing shaft cables, restoring the skip loading system, establishing ventilation controls, etc.
  - Mobilization activities, such as establishing offices



## Other near term (next couple of years) projects not in KAJV scope

- Additional office space is being planned for the LBNF team in the Ross Dry
- Rebuilding the centrifugal fan at the Oro Hondo shaft in Kirk Canyon
  - Proposals were just received by SDSTA for the first part of this – the variable speed drive and motor rebuild. Plan for installation in late spring next year.
  - A mechanical rebuild will be planned next year also.
  - This means running the vane-axial fan during the rebuilds
- Rebuilding the Ross shaft hoists (motors, clutches, brakes) and installing modern drive systems
- New cage and skips for the Ross shaft

## Other updates

- Staffing
  - Recently hired a logistics manager to develop plans to get all the parts and pieces not managed by KAJV to Lead
  - Currently seeking a Construction Coordinator and Procurement Administrator to be based in Lead. Two additional Construction Coordinators are planned in the future.
  - The DOE is seeking a representative to spend ~50% of their time in Lead (but based in Chicago)
  - KAJV will have a subcontractor outreach workshop locally on 11/16.
- Funding
  - The President's Budget Request included a line item for \$55M for LBNF, \$5M more than FY17
  - Both the House and Senate markups add substantially to that number
  - Either way, the work in Lead is a priority and isn't likely to be affected
  - The continuing resolution we're under now is not slowing progress



# Questions?