South Dakota Support for the Sanford Underground Research Facility

January 20, 2012

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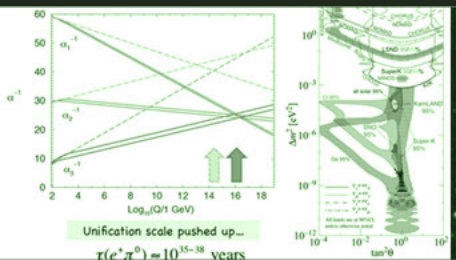
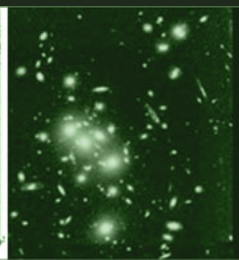
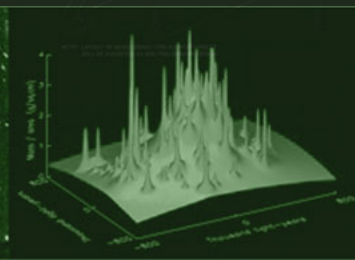
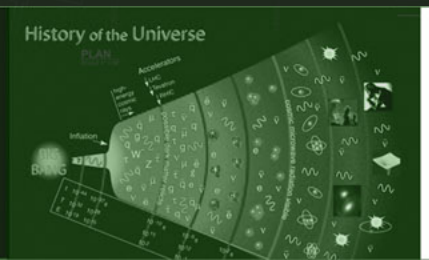
South Dakota Science and Technology Authority (SDSTA)







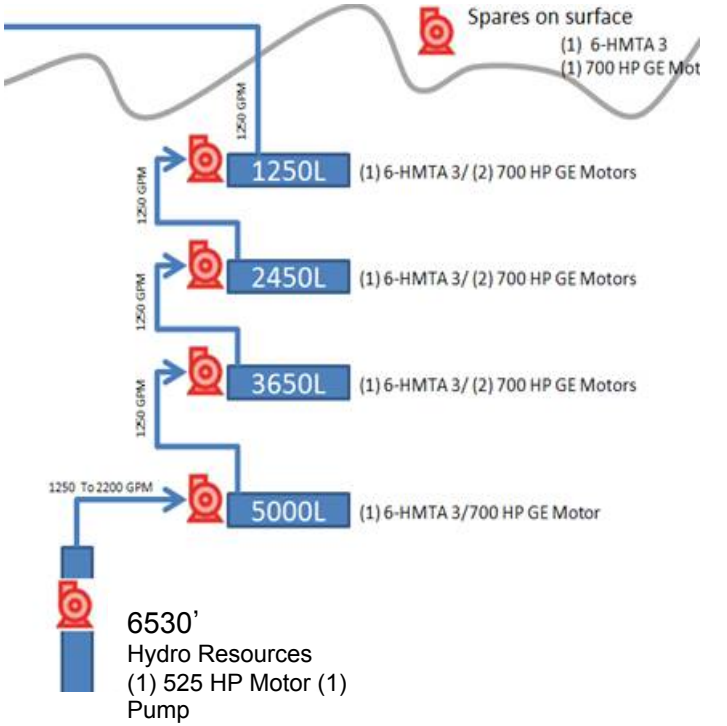


Sanford Underground Research Facility
SURF

Outline

- Sustaining operations, maintenance, future plans
  - Dewatering
  - Davis Campus Outfitting
  - Ross Shaft rehabilitation
  - Yates Shaft rehabilitation
- SDSTA commitment to SURF operations
- Additional SURF laboratory support

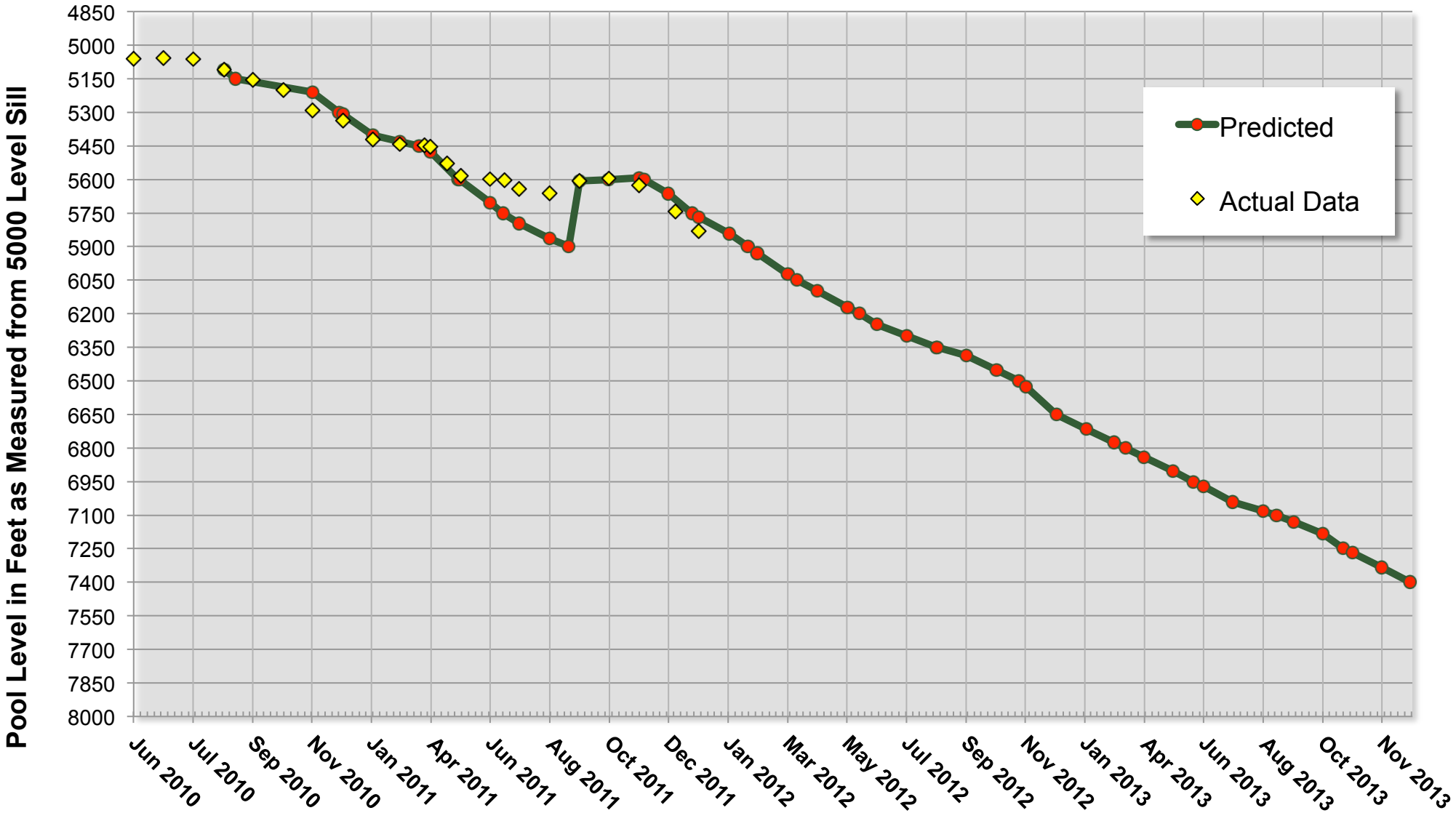
Dewatering Status



- Dewatering summary as of Dec 31, 2011 since start of operations in Jun 5, 2008
  - Total discharged - 3,819,294,206 gallons
  - Total from the pool - 2,250,116,943 gallons
  - Total tailings water - 1,670,297,837 gallons
- Water level on Jan 19 is at 5877.6'
  - Deep well pump off from Jul 23 to Oct 12 (80 days), lost 105.4' to a high of 5589.2'
  - Pumping rate from pool ~1200-1350 gpm
- Future Plans
  - Adding standby power for Yates Shaft pumps to protect the Davis Campus
  - Planning for staged replacement of older stationary pumps
  - Developing plans for longer term deep well pumping system and redundancy strategy

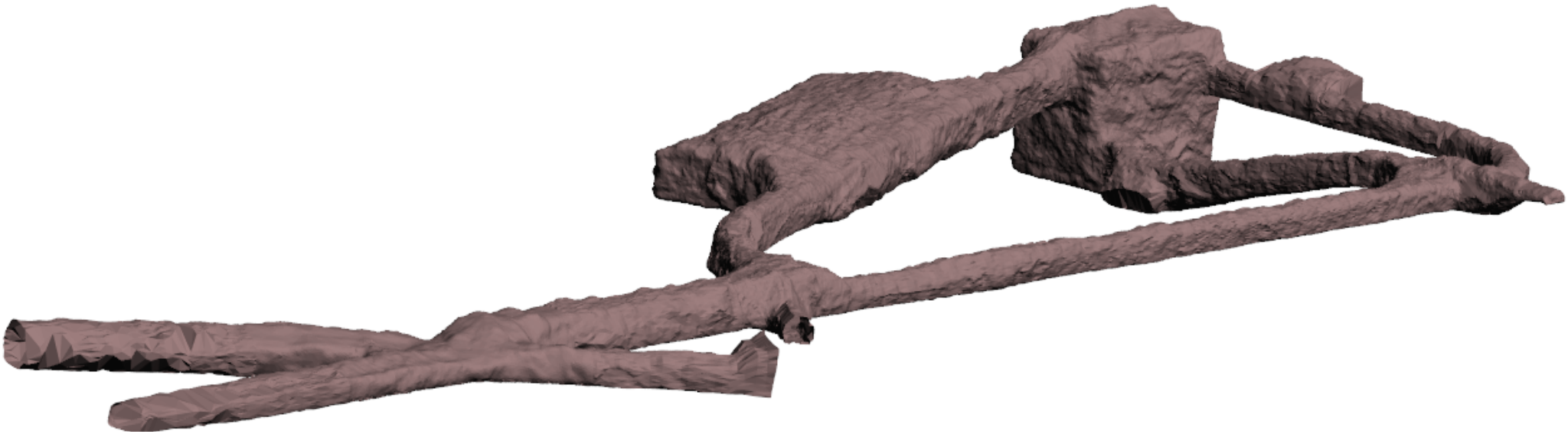
Dewatering Rate Projection

Current trend shows reaching 7400L in early 2014



Davis Campus Nearing Completion
Detailed Outfitting status covered by Jaret Heise

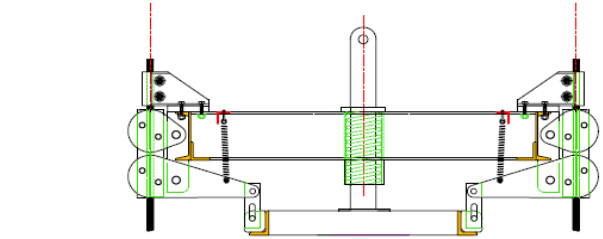
- $11.5M SD Commitment to Davis Campus Development for LUX and MAJORANA DEMONSTRATOR (MJD) experiments
  - $3.5M excavation and shotcrete; $8M outfitting contract
  - 16,632 tonnes excavated, $618.66/$m^3$ including ground support, shotcrete
  - 817m^2 floor area; 6000m^3 volume
  - Planning March 22, 2012 beneficial occupancy; early May completion
- Davis Lab Module suitable for G2 Dark Matter as follow-on



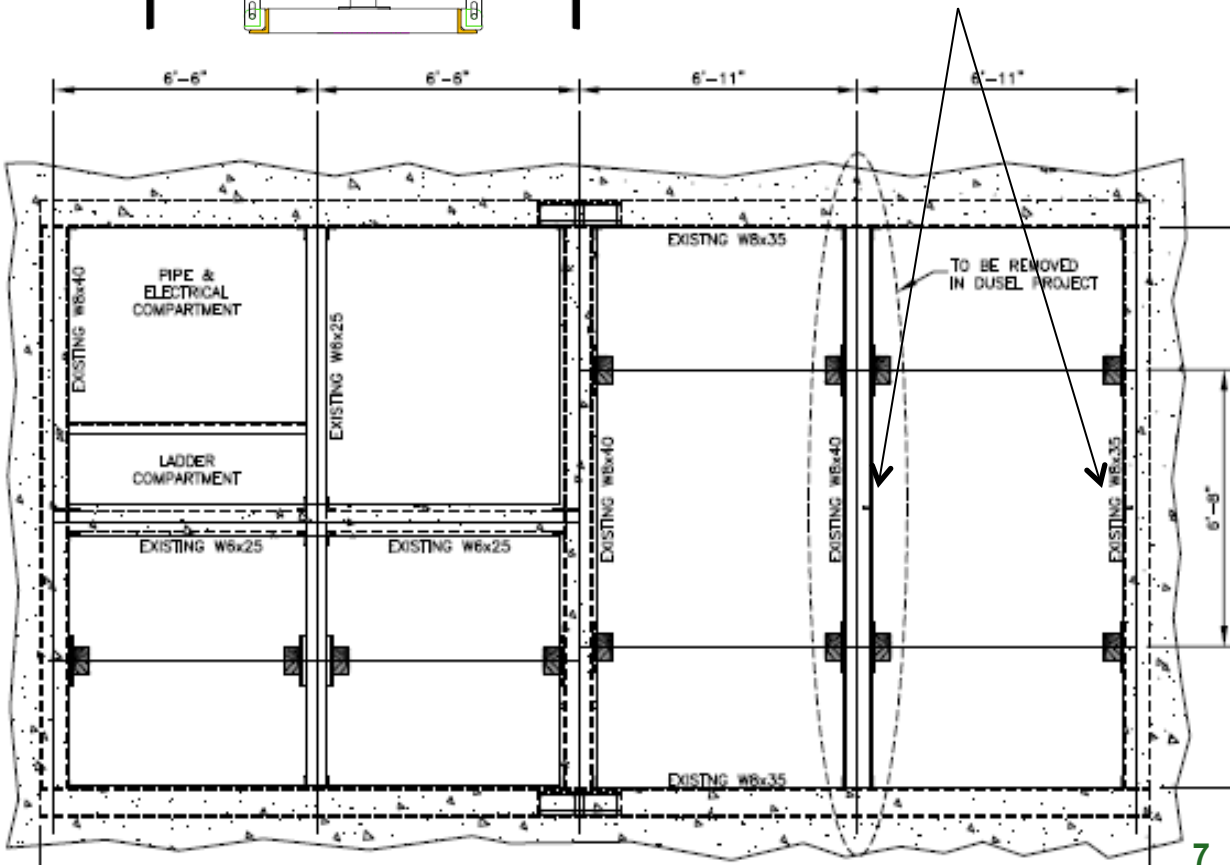
Davis Lab Module Construction Time Lapse

Yates Shaft – New Cage and Rope Dogs

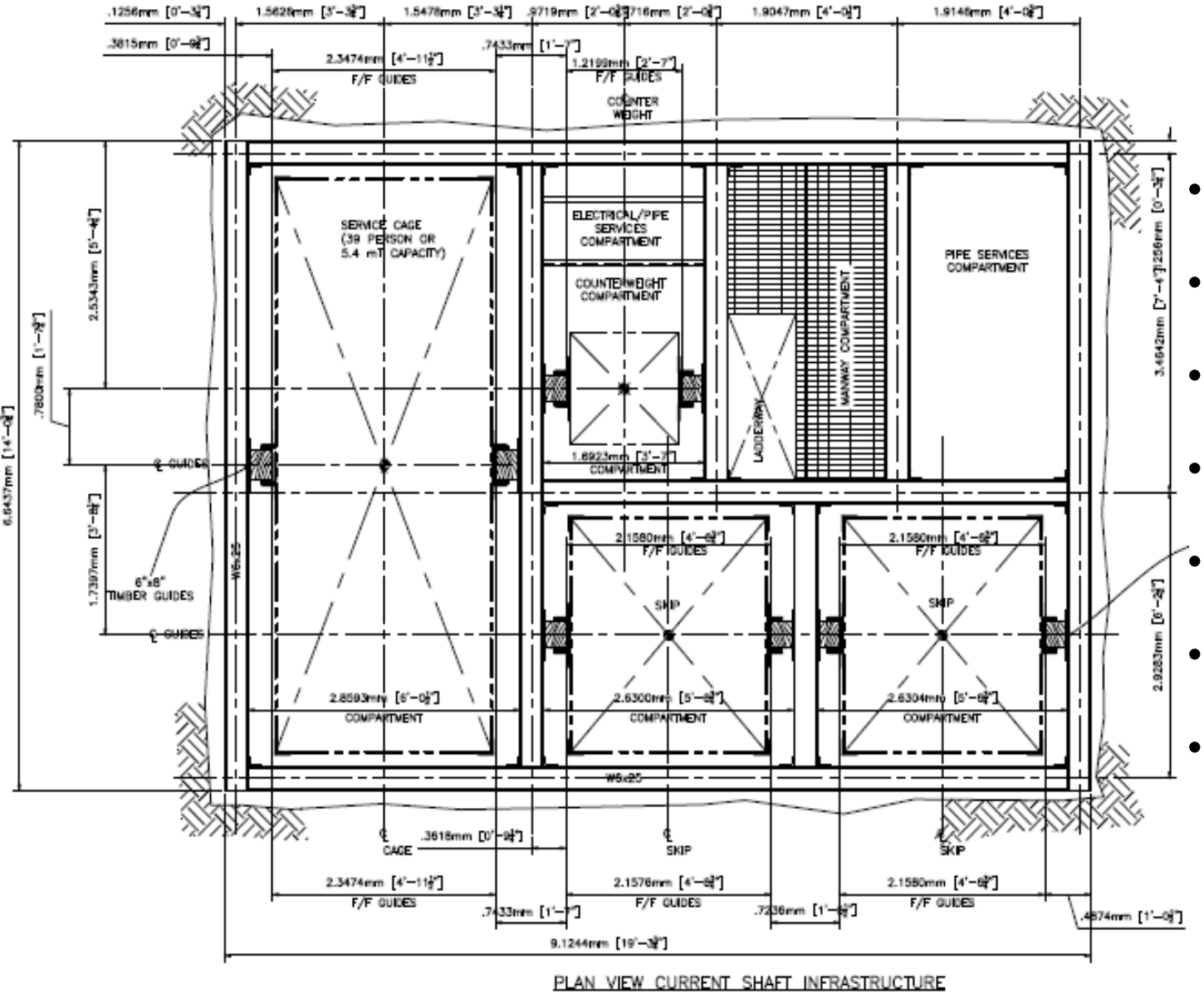
- Yates Shaft to serve as primary access during upcoming Ross Shaft refurbishment to support Davis Campus science (LUX and MJD) installation and site operations
- Rope dog support tower installation contract awarded; SDSTA will install ropes and integrate with cage; Completion planned for March 27
- Performance: 500fpm travel, 10,000lb load, Dimensions: 4’-7” W x 9’-0” H x 12’-6” L



Rope Guides



Ross Shaft Rehabilitation Project to Replace Shaft Steel, Install New Ground Support



PLAN VIEW CURRENT SHAFT INFRASTRUCTURE

Current Shaft Layout

- Shaft constructed in 1930s
- Steel set construction
- 6ft spacing between sets
- ‘H’ beam type construction
- All wood guides
- Bearing set spacing - 150’
- Currently operating at reduced speeds and loads due to steel condition; 500fpm down, 800fpm up

Ross Shaft Rehab Plans

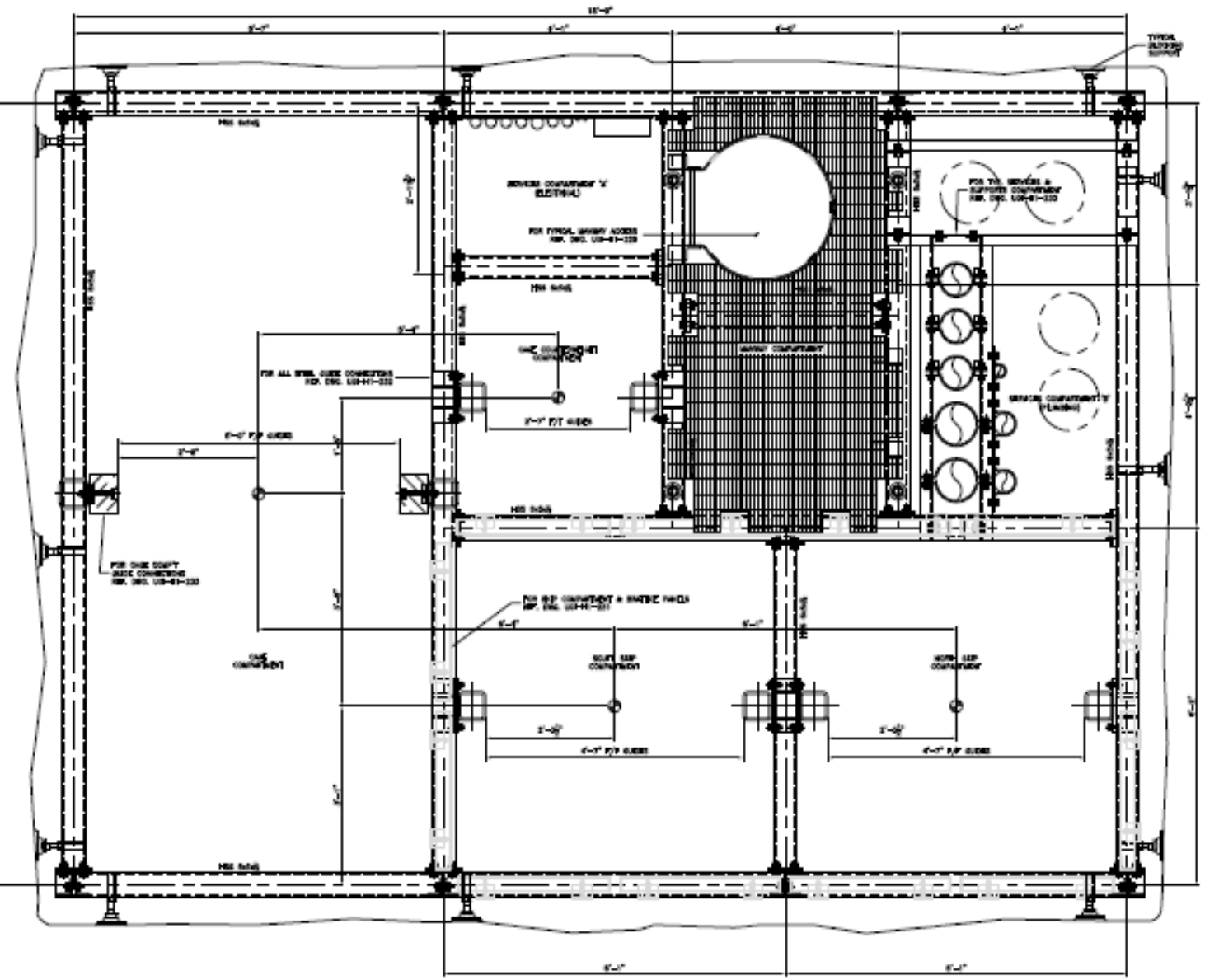
- Implementation performed by SDSTA in-house labor
- Ross planned to provide access for construction and ops
- Long term operation - 30+ years
- Single cage with 6 ton payload
- Waste rock removal at 3,000 ton per day; 2 - skips
  - Skips can be used for personnel emergency egress if needed
- Utilities located in services compartment
  - Normal and standby power
  - Industrial, fire, and discharge water – 4” to be installed
  - Communications
  - Compressed air – 4” to be installed

Ross Shaft Operating Parameters at Completion of Rehabilitation Project

Specifications		Ross Shaft	
		Service Hoist	Production Hoist
		Conical DD	Conical DD
Production required	tons/day	N/A	3,300
Payload	Mass (tons)	6	11
	Personnel	60	N/A
Rope mass	Mass (lbs)	21,785	31,415
Conveyance mass	Mass (lbs)	9,000	16,500
Number of ropes		1	1
Rope size	inch dia.	1.625	1.875
Rope strength	lbs	258,000	348,000
Rope FoS		6.0	4.98
Cage inside dimensions per deck	No. of Decks	2	N/A
	No. of Cages	1	N/A
	height (ft)	7'-0"	N/A
	width (ft)	4'-8"	N/A
	Length (ft)	12'-4½"	N/A
Slinging Dimensions Under Cage	height (ft)	7	N/A
	width (ft)	5	N/A
	Length (ft)	30	N/A
Guides		wood	wood
Shaft	Length (ft)	5,000	5,000
	From	surface	surface
	To	5000L	5000L
Set spacing (ft)		18	18
Hoisting speed	ft/min	2,200	2,800
Hoist Power Rated	HP	1,500	2,400
Motor Speed	rpm	340	375
Skip cycle time (one-way)	mins	N/A	3.60
Cage travel time (one-way)	mins	3.25	N/A
Cage load/unload time	mins	7.00	N/A
Cage total time (one-way)	mins	10.25	N/A
Cage total time (return)	mins	20.50	N/A
Availibility (after all planned maintenance)	hours/day	18	18
Production capacity	tons/day	N/A	3,000
Slinging capacity at 150fpm	tons	6.5	

- Cage dimensions unchanged from current configuration
  - 4'-8" W x 7'-0" H x 12'-4.5" L
- Travel performance returned to similar level during mining operations ~3 min from Surface to 4850L

Ross Shaft – Refurbishment Set Design



Design Highlights

- 18’ set spacing
- Tubular steel sets
- Steel guides for skipping and counterweight
- 180’ bearing set spacing

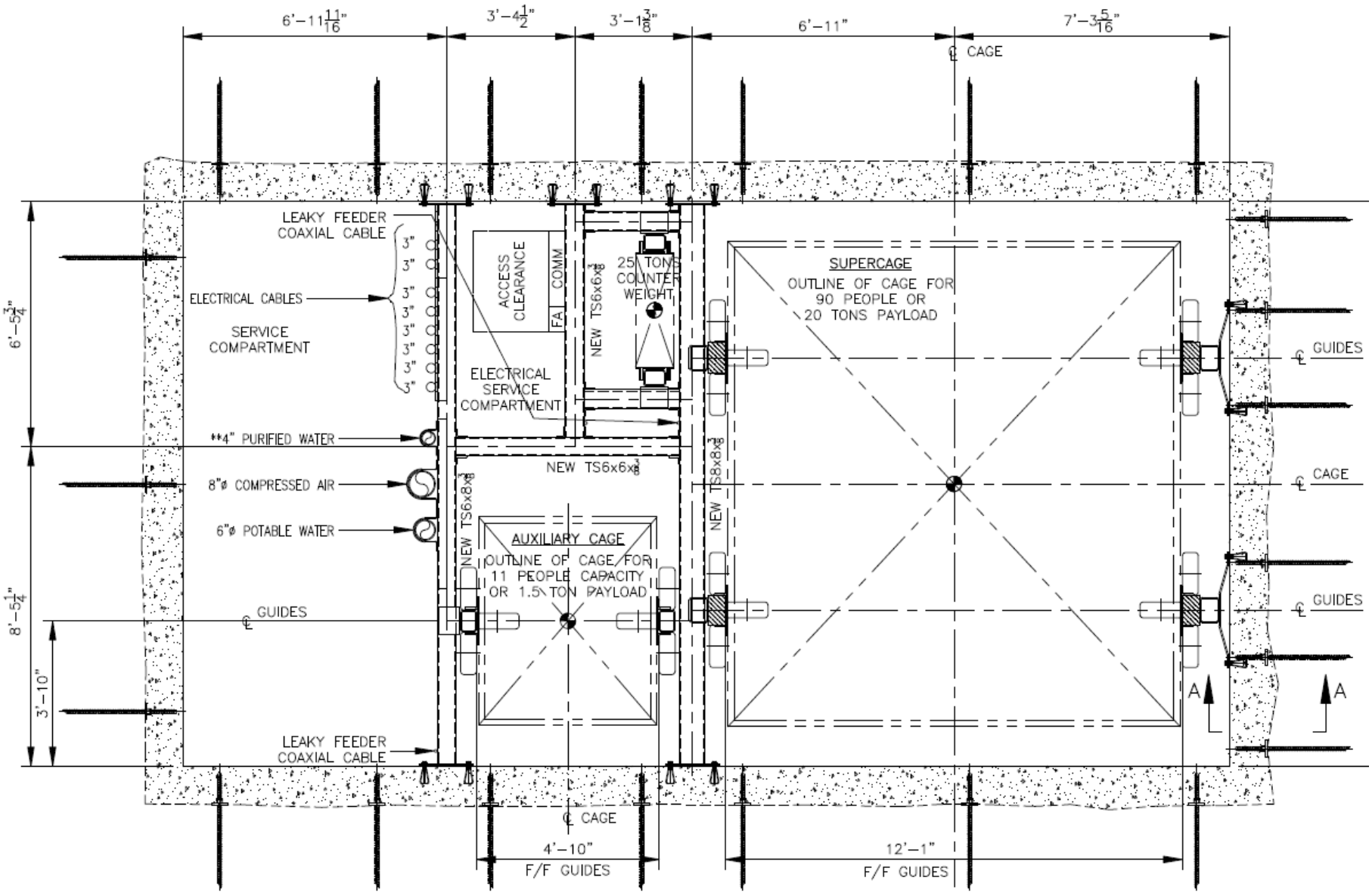
Ross Shaft Refurbishment Schedule

Milestone	Due Date	Status
Shaft Construction Specialist started	11/7/11	Completed
Develop Shaft Survey Plan	11/12/11	Completed
75% design documents due	11/15/11	Completed
Work deck concept design complete	11/21/11	Completed
Construction plan updated	11/21/11	Completed
Steel RFP released (Round 2 with 100% designs)	1/30/12	100% designs on track
First delivery of steel received	4/01/12	
Work Decks delivered to site	4/20/12	Design RFP released
Install work decks and start steel replacement	4/27/12	
Completion of refurbishment	12/2014	

Yates Shaft Plans
Rehab planned as follow-on to Ross Shaft project

- Yates planned to provide access for science installation and ops
- DUSEL Preliminary Design and LBNE conceptual designs included complete strip / re-equip over 2 year period; 20T “super cage”
- Shaft is currently timber framed; Constructed in 1930s/40s; Requires replacement with steel for long term operations
- Likely parameters
  - Long term operation - 30+ years
  - 18’ set spacing - tubular steel construction
  - Different compartment layout – DUSEL / LBNE design and “hybrid” under consideration
  - Super Cage – Upgrade path that would likely require hoisting upgrade
  - Auxiliary conveyance(s) located in skipping compartment
- Utilities located in services compartment
  - Normal power and communications
  - Domestic and fire water

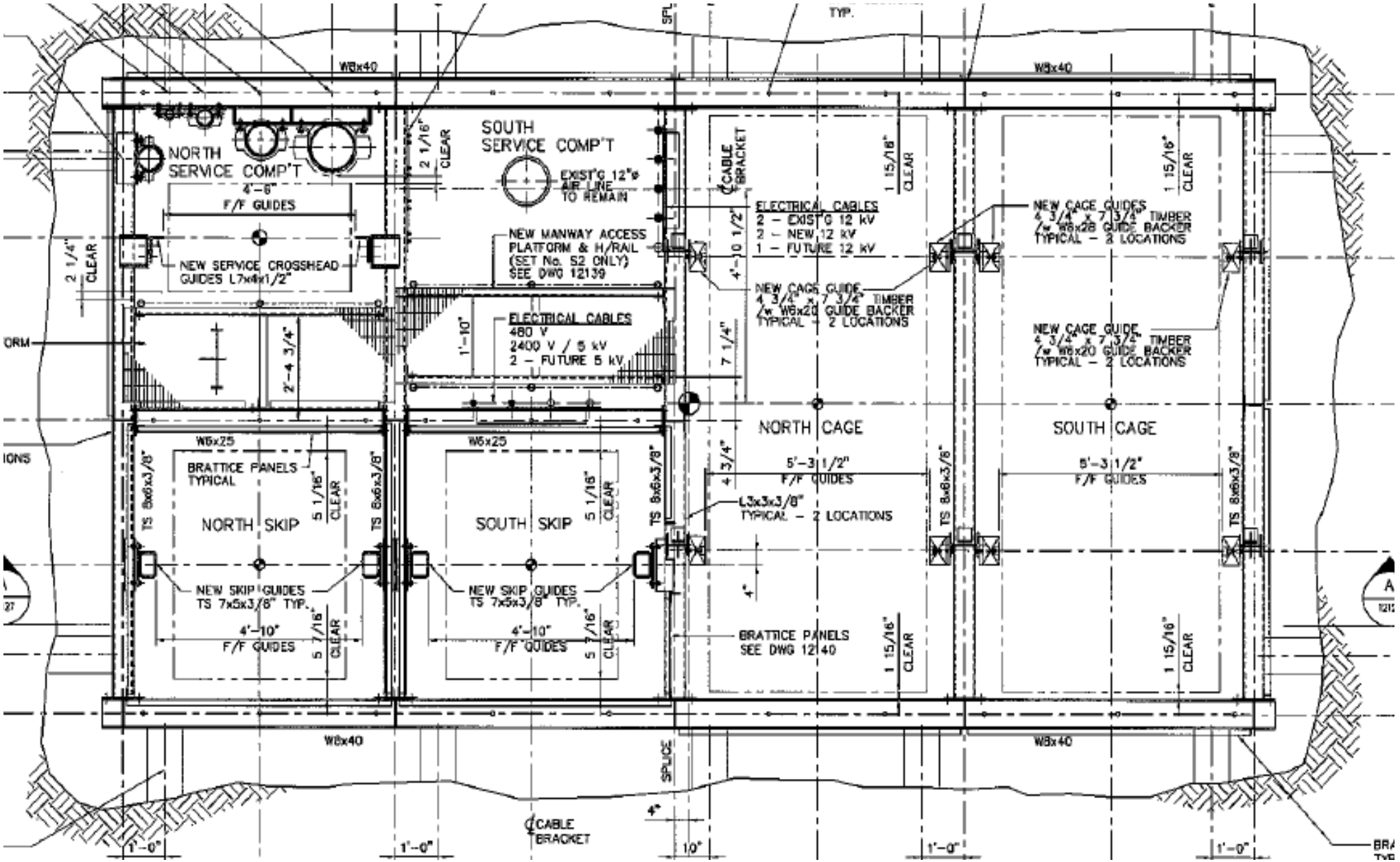
Yates Shaft – Strip and Re-Equip Design



Supercage dimensions: 11’-6” W x 11’-4” H x 12’ L

Yates Shaft – Hybrid Design

Cage Dimensions similar to current



SDSTA Commitment to SURF Operations

- Since site selection, SDSTA performed reentry, ops, and facility rehab
  - Appropriated funds from state of South Dakota for operations activities - $50M+
  - Private, donated funding from Mr. T. Denny Sanford for site rehabilitation - $70M
  - HUD grant for initial re-entry - $10M
- Remaining Sanford funds sponsoring $8M Davis Campus outfitting, $6.5M for Ross Shaft materials, and other capital improvements
- If federal project proceeds, $20M in Sanford private funding will remain for Sanford Center for Science Education (SCSE)
- SDSTA is funding a portion of early science activities at SURF
  - State of South Dakota's FY2012-2014 (July 1, 2011 to June 30, 2014 - three years total)
  - $300K (direct) - Funds 4 early science liaison staff and supplies such as liquid nitrogen
  - SDSTA funding its Executive Director, administrative staff member, communications staff

FY12/13 South Dakota Funded Capital Projects

SDSTA Project #	Project Description	Budget
CAP2012-01	Rope Rescue Safety Equipment	$ 10,000
CAP2012-02	Davis Campus Electrical Substation	$ 123,000
CAP2012-03	Yates Power Cable Replacement (4100L to 4850L)	$ 75,000
CAP2012-04	4850L Yates Station Track Repairs	$ 2,300
CAP2012-05	Davis Campus Outfitting - 3rd Party Engineering Support	$ 42,626
CAP2012-06	Davis Campus - Water Purification Plant	$ 125,000
CAP2012-07	Davis Campus Outfitting	$ 7,553,063
CAP2012-08	Science Support Tools - Davis Campus	$ 56,917
CAP2012-09	Ross Shaft Rehab - Equipment/Tools	$ 492,500
CAP2012-10	Ross Shaft Rehab - Materials/Consumables	$ 162,000
CAP2012-11	Ross Shaft Rehab - Shaft Steel	$ 466,516
CAP2012-12	4850L - Drift Rehab - Secondary Egress	$ 200,000
CAP2012-13	Underground Water Inflow Controls	$ 359,000
CAP2012-14	Ross Hoist Room Roof Replacement	$ 13,735
CAP2012-15	New Yates Conveyance	$ 50,000
CAP2012-16	Warehouse Inventory Materials	$ 50,000
CAP2012-19	Refuge Units for Underground Pump Rooms	$ 150,000
CAP2012-22	Ross and Yates Hoist Room Buildings Structural Repairs	$ 200,000
CAP2012-23	Yates Dry and Warehouse Roof Replacement	$ 105,000
CAP2012-24	Yates Dry Tunnel Repair	$ 50,000
CAP2012-25	Ross Hoist - Generator Rewinding	$ 205,000
CAP2012-26	Ground Support Installation Equipment	$ 57,000
CAP2012-27	Ross Shaft Rehab - Shaft Steel (related to 2012-11)	$ 4,878,984
CAP2012-28	Ross Shaft Rehab - Work Deck Design and Fabrication	$ 500,000
CAP2012-29	Oro Hondo Fan Bearing and Pedistal Replacement	$ 25,000
CAP2012-30	Underground Locomotive Battery Charger	$ 5,000
CAP2012-31	Yates Sump - Pumping Backup Generator	$ 100,000
	Total	$ 16,057,641

Additional SURF Laboratory Support

- SURF engineering team playing major role for LBNE Far Site designs
  - SDSTA will hold future far site design / construction contracts related to LBNE
  - Contracts will be structured to ensure integration with facility designs for other experiments
- SURF EH&S continues to mature; Advancing a safety culture
  - SURF contractor TRC rate dropped to zero in October 2011
  - Operations taking lead role in work planning with focus on safety with SOPs/JHAs
  - Categorical Exclusion received for LUX and MJD activities on 4850L and operations
  - SDSTA established agreement with state of South Dakota Office of Risk management for oversight of Health and Safety issues; EHS Oversight Committee still operating as well
- Project Controls, Business Services, Finance / HR Departments from SDSTA and DUSEL consolidated and integrated for SURF
  - Established User Support Office for interaction with science collaborations at SURF
  - Intense effort placed on project-wide scheduling and interfaces with LUX and MJD for Davis Campus outfitting and science installation, coordination with Shaft rehab plans

Conclusions

- SURF team organized for sustaining ops, early science, facility development
- Dewatering progressing well and preserving future options
- Davis Campus on target for a March 2012 Beneficial Occupancy
- Shaft rehabilitation plans moving forward with cost effective approach to provide long-term support for SURF construction and science
- SDSTA / Sanford commitment to Homestake is advancing facility's readiness for early science and future generations of experiments
- SURF team playing major role in LBNE; Advancing on many fronts overall