

Chicago Underflow Plan (CUP)

McCook Reservoir

Construction of Distribution Tunnel
and
Pumps Installation



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Metropolitan Chicago's sewer system is comprised of combined sewers that collect both raw sewage and storm-water runoff. The combined sewers transport the mixed flow to water reclamation for treatment. When the capacity of the combine sewers is exceeded during storm events, the combine sewage is diverted to the Mainstream and Des Plaines deep tunnel system. There are also the Upper Des Plaines and Little Calumet Leg Tunnels. The Mainstream tunnel is measured 33 feet in diameter, bored 240 to 330 feet below ground, runs 40.5 miles and can hold more than one billion gallons of water. Currently, untreated Combine Sewage Overflow (CSO) is diverted to the waterway when the capacities of Stickney Water Reclamation Plant (WRP) and the Mainstream and Des Plaines tunnel system are exceeded during storm events.



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CUP-McCook Reservoir is to reduce flooding in the Chicago area by serving as a storage facility for excess runoff during storms. The reservoir will hold estimate 22,111 acre-feet (10.5 billion gallons) of combined sewage overflows (CSOs) until the Deep Tunnel System can convey the water to the Stickney Water Reclamation Plant (SWRP) prior to discharge to the Chicago Sanitary and Ship Canal.



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The major components of the project include tunnels, shafts and chambers, rock excavation, inlet structure, inflow/outflow structure, washdown system, aeration system, groundwater protection system, reservoir grading and overburden stabilization, pumps, gates and valves, and site development.

Construction of distribution tunnels and installation of two additional pumps is currently underway and are part of the overall project.



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McCook Reservoir includes electrical works for the installation of 2 pumps and its appurtenance equipment at the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) Main Stream Pump Station. The pumps are located at elevation -297' and the 15KV switchgears and control room at elevation +45 feet. Electrical equipment installed includes installation of two 15KV circuit breakers, protective relays, borehole cables, motor control switchboard, fiber optic cables, PLC/SCADA system and etc.



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The new large volute pumps are one low head with capacity of 330 CFS @ 150 feet head, 7,370 horsepower induction motor and high head with capacity of 330 CFS @ 330 feet, 17500 horsepower synchronous motor drive. These pumps are installed in existing underground pump houses together with other existing pumps. The low head pump is installed in the South Pump House and the high head pump in the North Pump House. Installation of pumps involved the survey of station intake and discharge connections, including structural work for pump casing and etc.

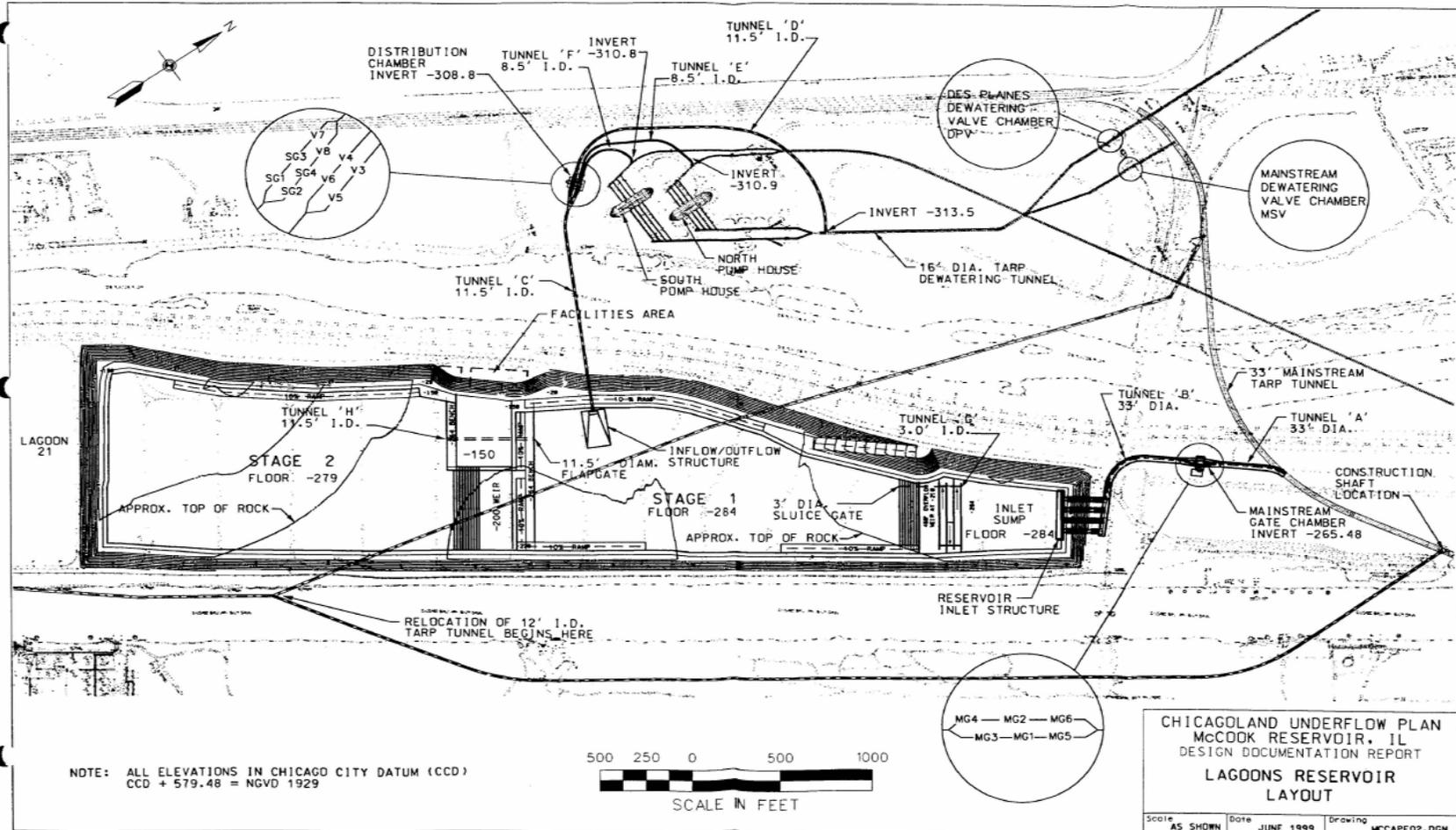


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Each motor is operating at 13.2 KV, 3 phases, 60 hertz. The switchgears are located in the switchgear room at +45 feet elevation and the pump motor at -297 feet elevation. Borehole type of power and control cables have to be rigidly supported at the top due to more than 300 feet drops.



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NOTE: ALL ELEVATIONS IN CHICAGO CITY DATUM (CCD)
 CCD + 579.48 = NGVD 1929



CHICAGOLAND UNDERFLOW PLAN
 MCCOOK RESERVOIR, IL
 DESIGN DOCUMENTATION REPORT
 LAGOONS RESERVOIR
 LAYOUT

| | | |
|----------|-----------|--------------|
| Scale | Date | Drawing |
| AS SHOWN | JUNE 1999 | MCCAPE02.DGN |

PLATE E-02

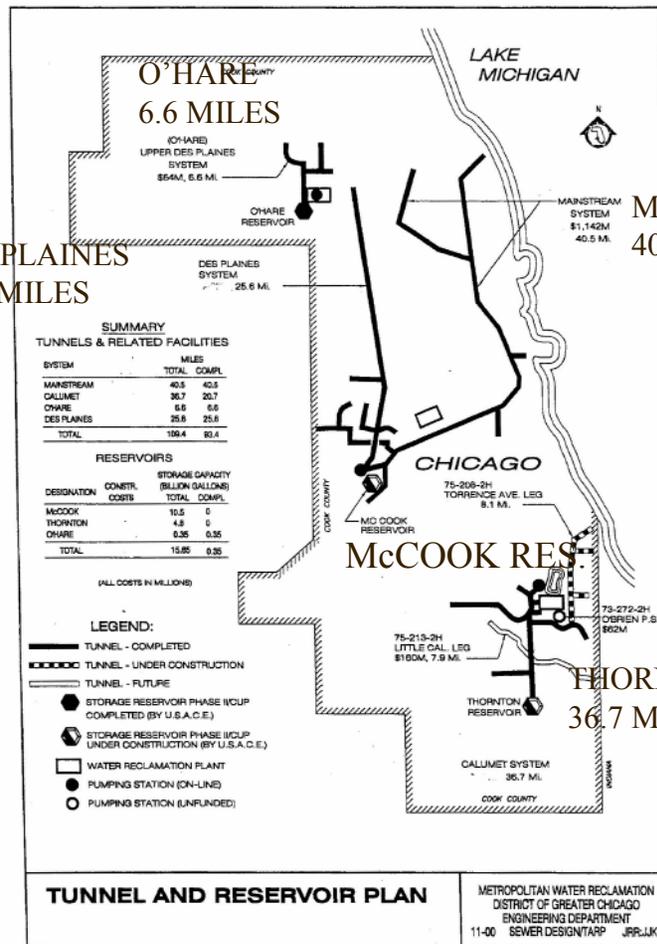


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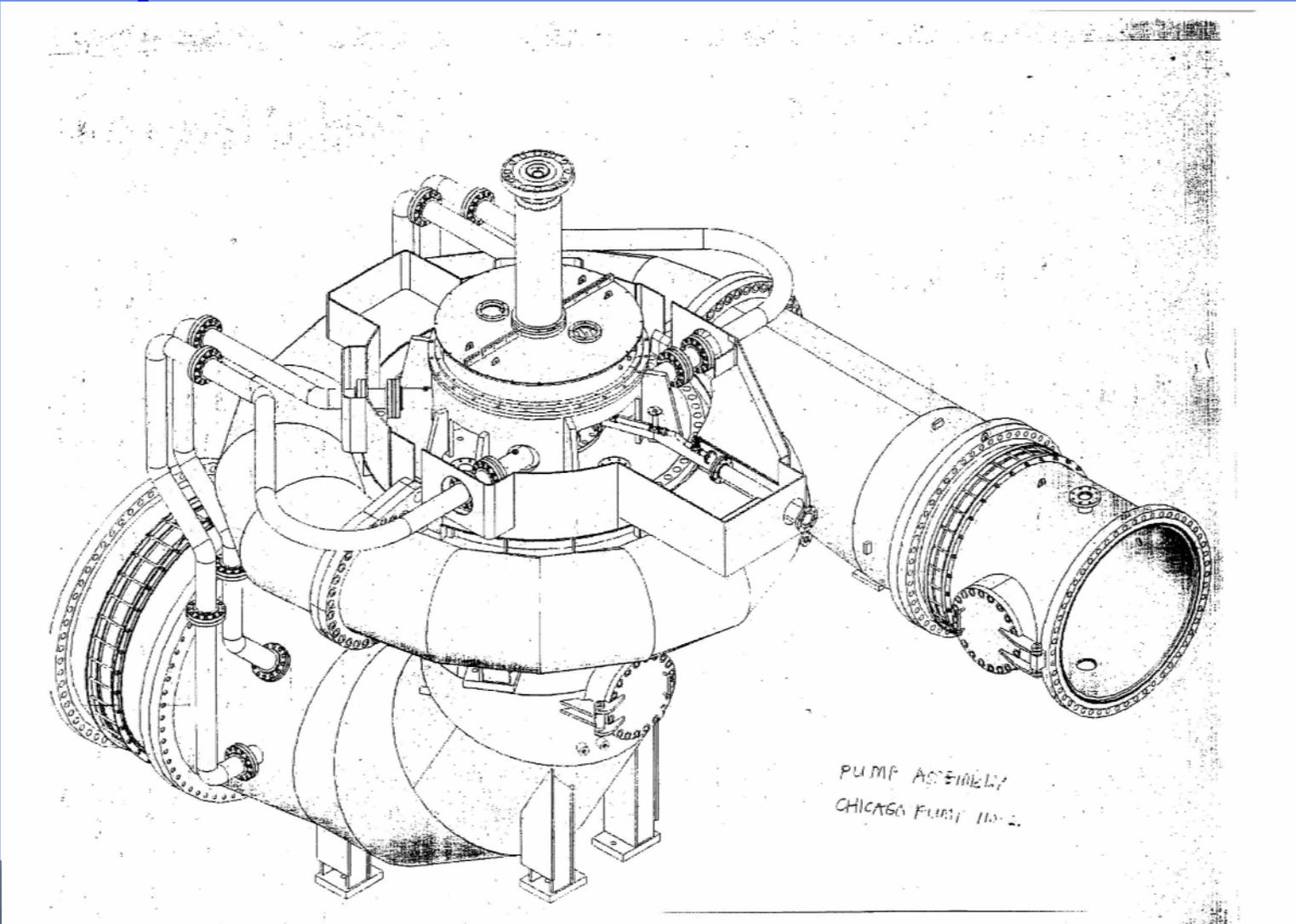
DES PLAINES
25.5 MILES

MAINSTREAM TUNNEL SYSTEM
40.5 MILES

THORNTON
36.7 MILES



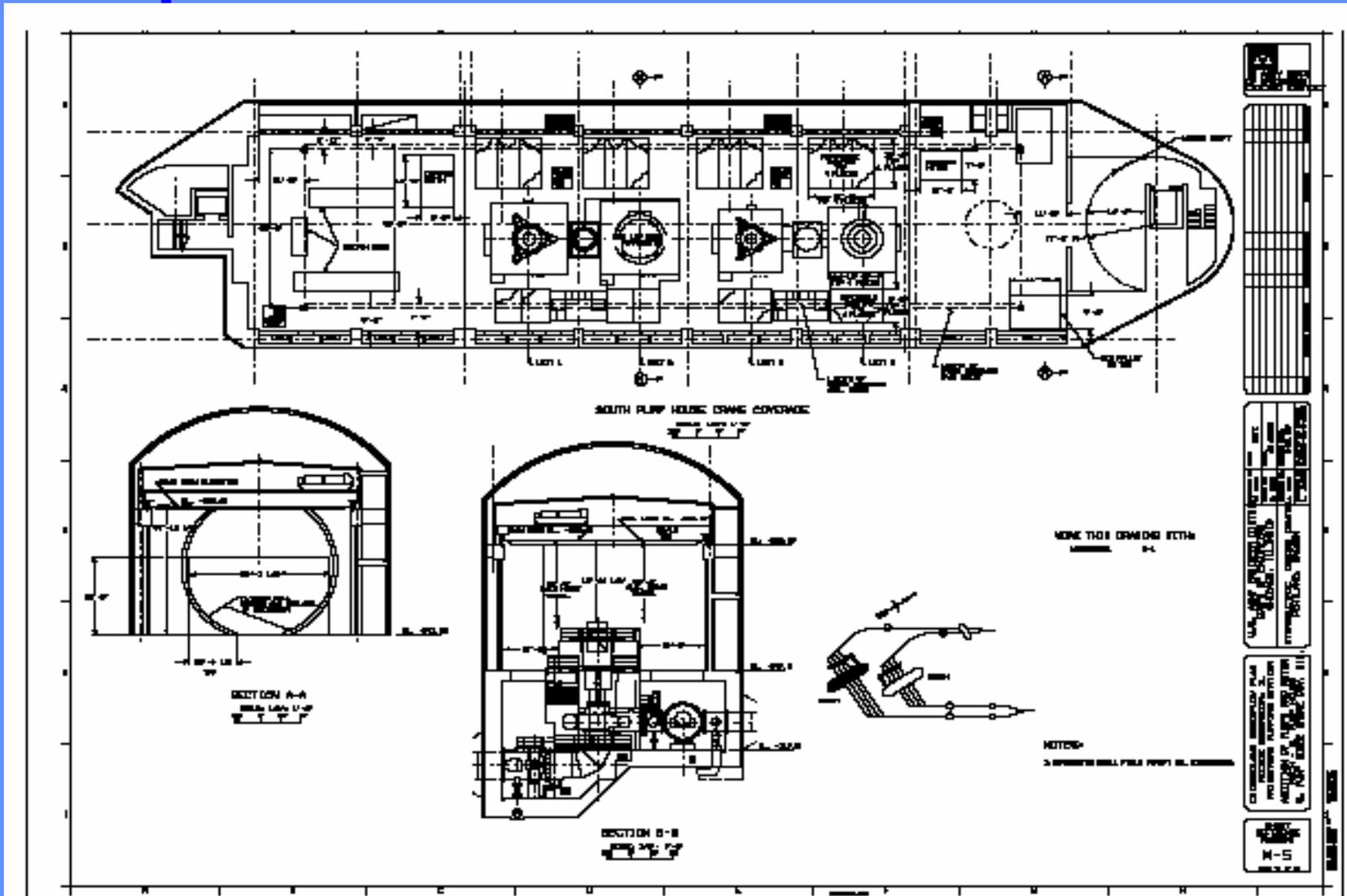
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PUMP ASSEMBLY



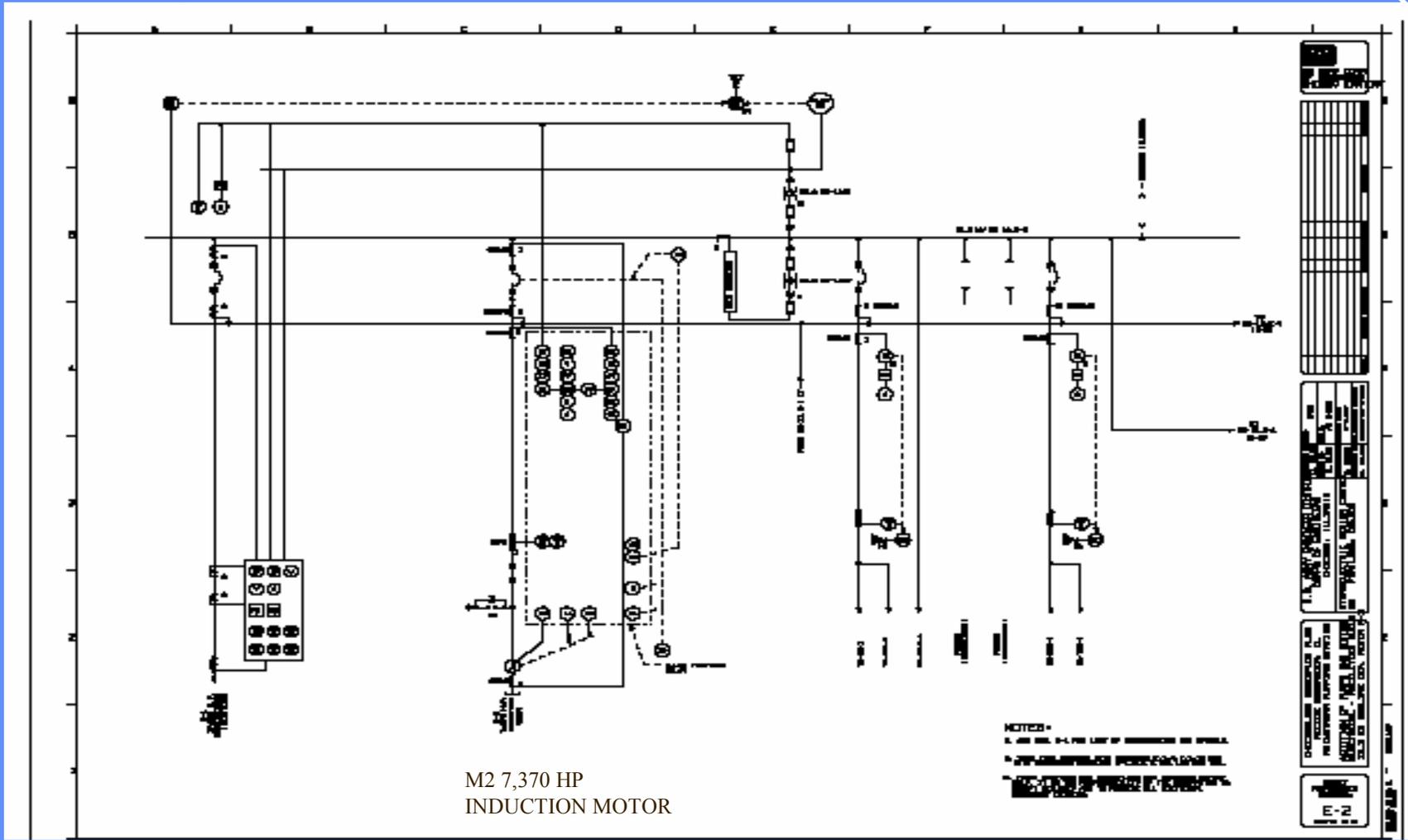
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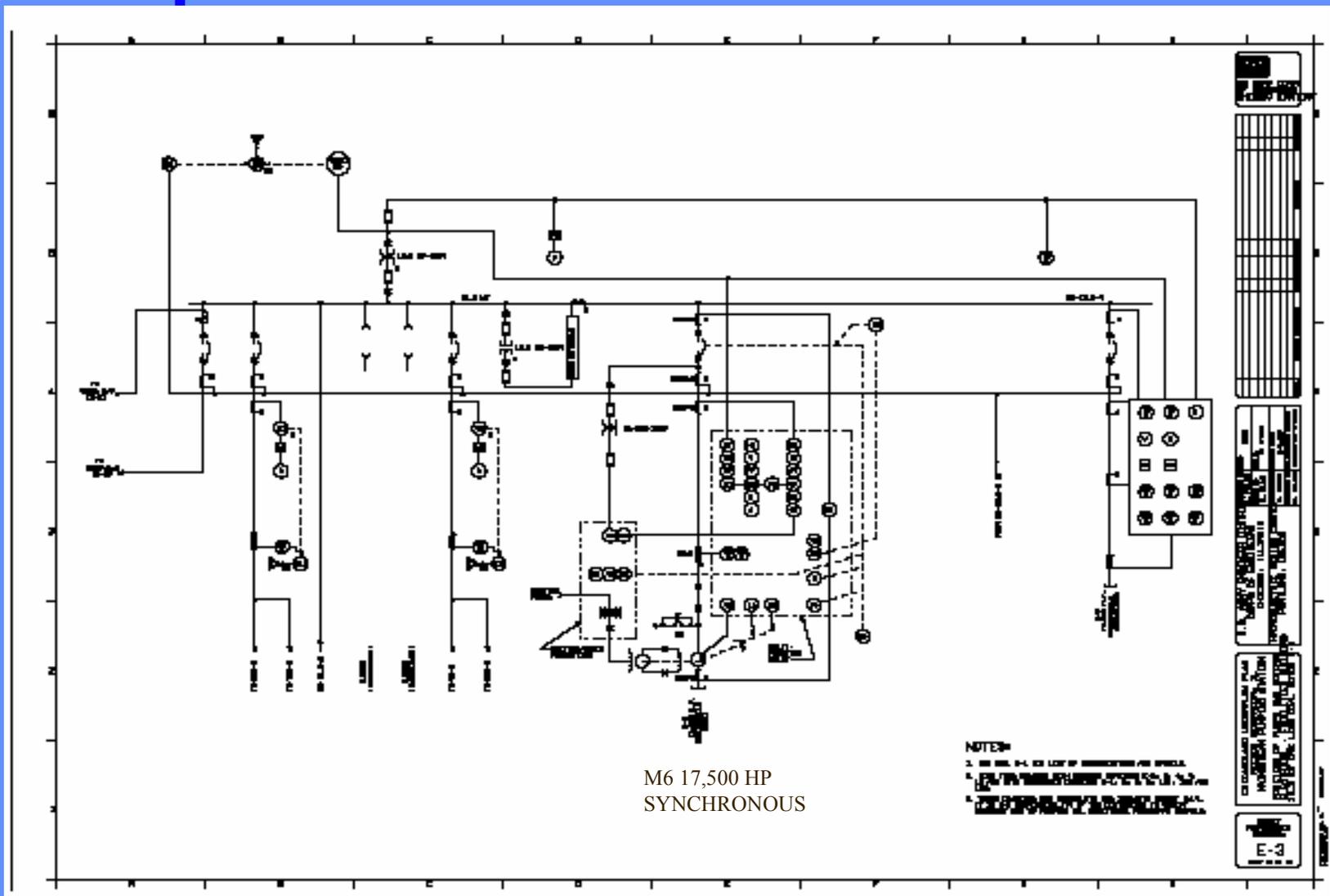
SOUTH PUMP HOUSE CRANE COVERAGE



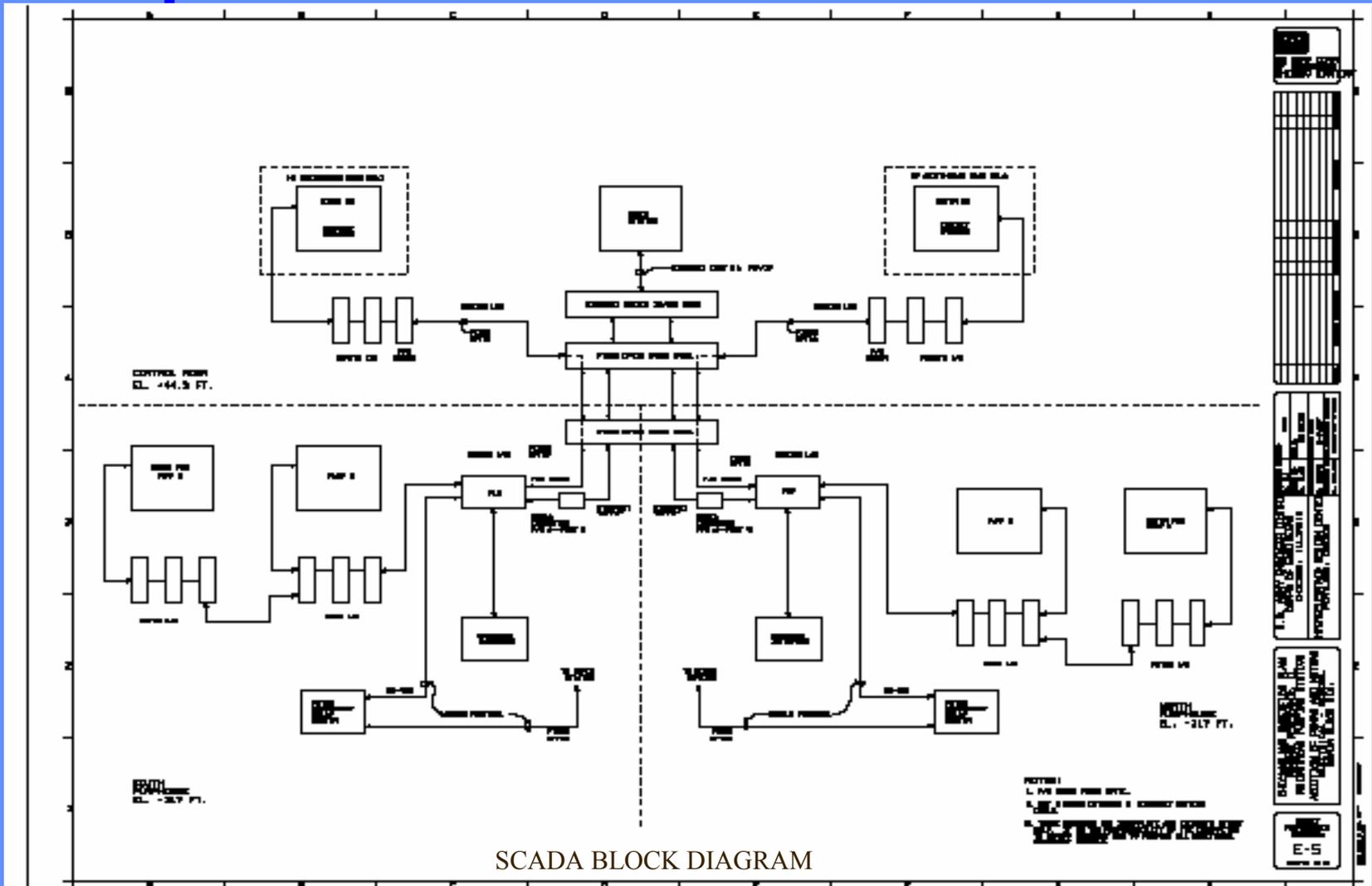
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SCADA BLOCK DIAGRAM



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Start Permissive:

The new pumps 2 and 6 motor circuit breaker shall be interlocked with all of the following conditions exist:

- . The pump discharge valve in closed position.
- . The pump discharge valve ready.
- . The pump suction valve in open position.
- . The pump guard valve in open position.
- . The discharge tunnel valve in open position.
- . Pump suction pressure is above preset value.
- . Differential pressure for pump shaft seal water flow is above/below preset value.
- . Quantity of bearing cooling water flow is above/below preset value.
- . Ventilation running.

0. Motor oil pressure is above preset value and motor oil pressure not low.

PERMISSIVE



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Trips

Motor circuit breaker will be tripped when ever any of the following condition exist.:

1. The head-cover vibration remains very high for a period of time.
2. The pump guide bearing vibration remains very high for a period of time.
3. The pump guide bearing oil temperature is very high.
4. The pump casing temperature is very high.
5. The pump guide bearing metal temperature is very high.
6. Pump suction pressure is below preset value.
7. The ventilation system tripped.
8. The motor thrust bearing metal shoe temperature is very high.
9. The motor upper guide bearing temperature is very high.
10. The motor lower guide bearing temperature is very high.
11. The motor speed remained below 5% for a period of time during start.
12. The motor speed remained below 50% for a period of time when the motor is starting.
13. The motor speed remained below 98% for a period of time when the motor is running.
14. The motor stator winding temperature is very high.
15. The exciter field over current.
16. The exciter loss of field.
17. The exciter loss of control circuit output voltage.
18. The pump discharge valve trouble.



Alarm Indications:

1. Pump guide bearing oil temperature indication and high temperature alarm.
2. Pump shaft seal housing temperature indication and high temperature alarm.
3. The pump seal and guide bearing cooling water low flow alarm.
4. The head-cover high vibration 1 alarm.
5. The head-cover high vibration 2 alarm.
6. The pump guide bearing high vibration 1 alarm.
7. The pump guide bearing high vibration 2 alarm.
8. Pump guide bearing metal 2 temperature indication.
9. Pump guide bearing oil temperature high alarm.
10. Pump guide bearing oil temperature leakage alarm.
11. Pump casing temperature high alarm.
12. Pump casing temperature leakage alarm.
13. Pump guide bearing metal temperature high alarm.
14. Pump guide bearing metal temperature leakage alarm.
15. Thrust bearing shoe 3 temperature indication.
16. Thrust bearing shoe 7 temperature indication.
17. Thrust bearing oil reservoir 2 temperature indication.
18. Upper guide bearing 2 temperature indication.
19. Lower guide bearing 2 temperature indication.
20. Lower guide bearing oil reservoir 2 temperature indication.





CONSTRUCTION OF DISTRIBUTION TUNNEL 300' BELOW



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Distribution Tunnel Weld



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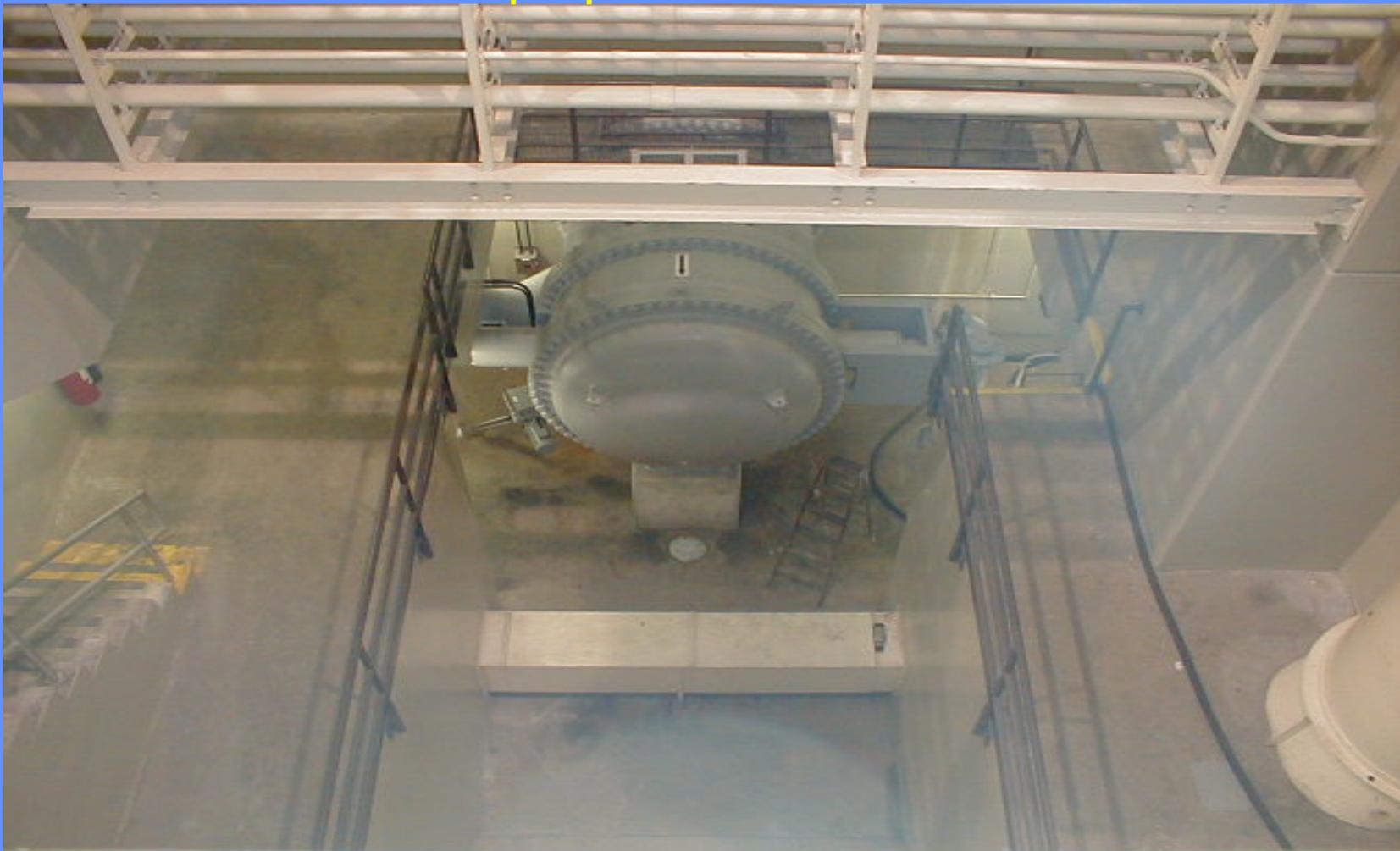


Transporting the Pump



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Before pump installation at -317' elevation



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No. 6 CASING → No. 6 SUCTION TUBE LINER



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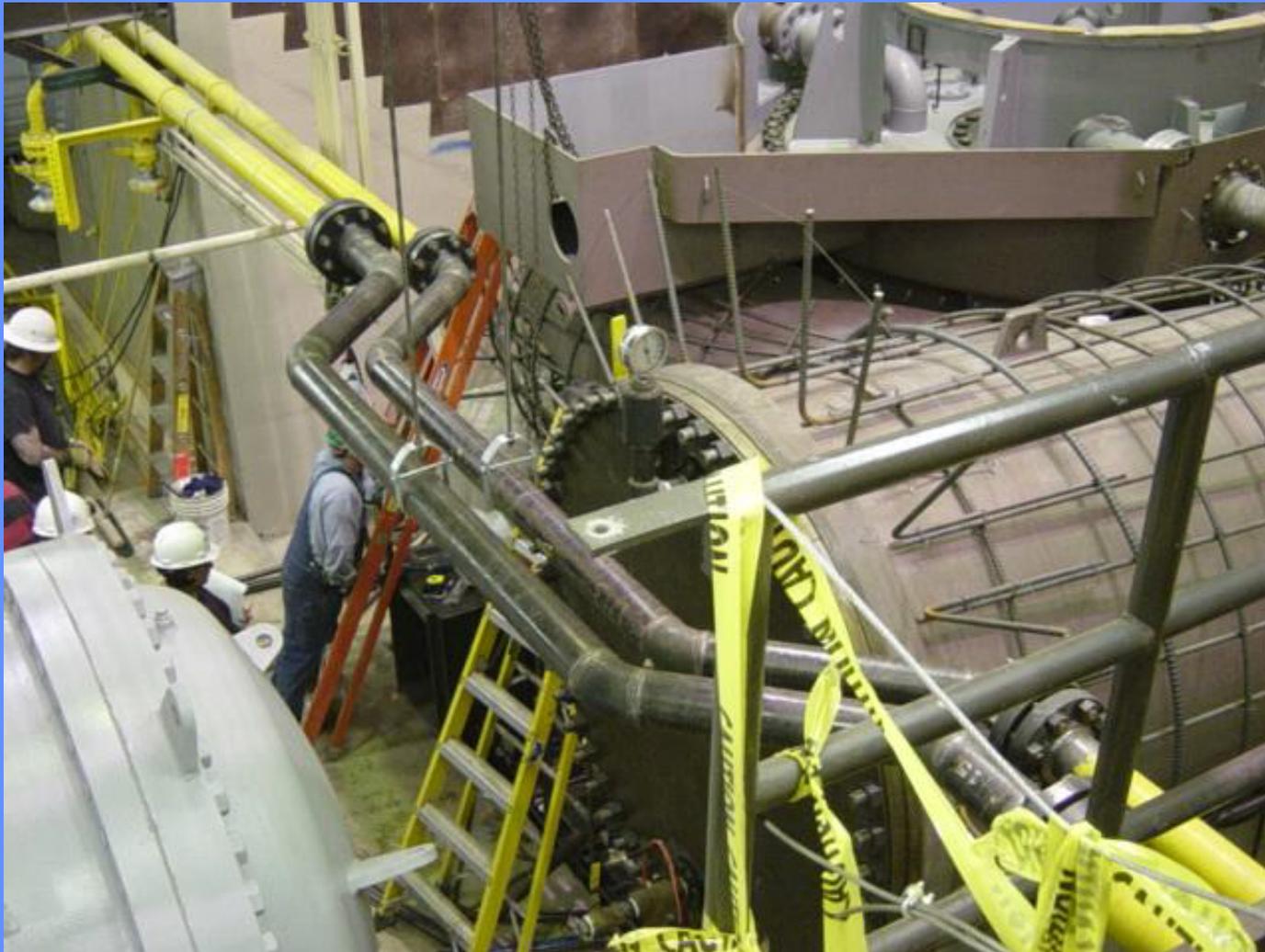
**Pump Propeller
is ready to be
dropped from
+45' to the
pumphouse at
-297' below.**



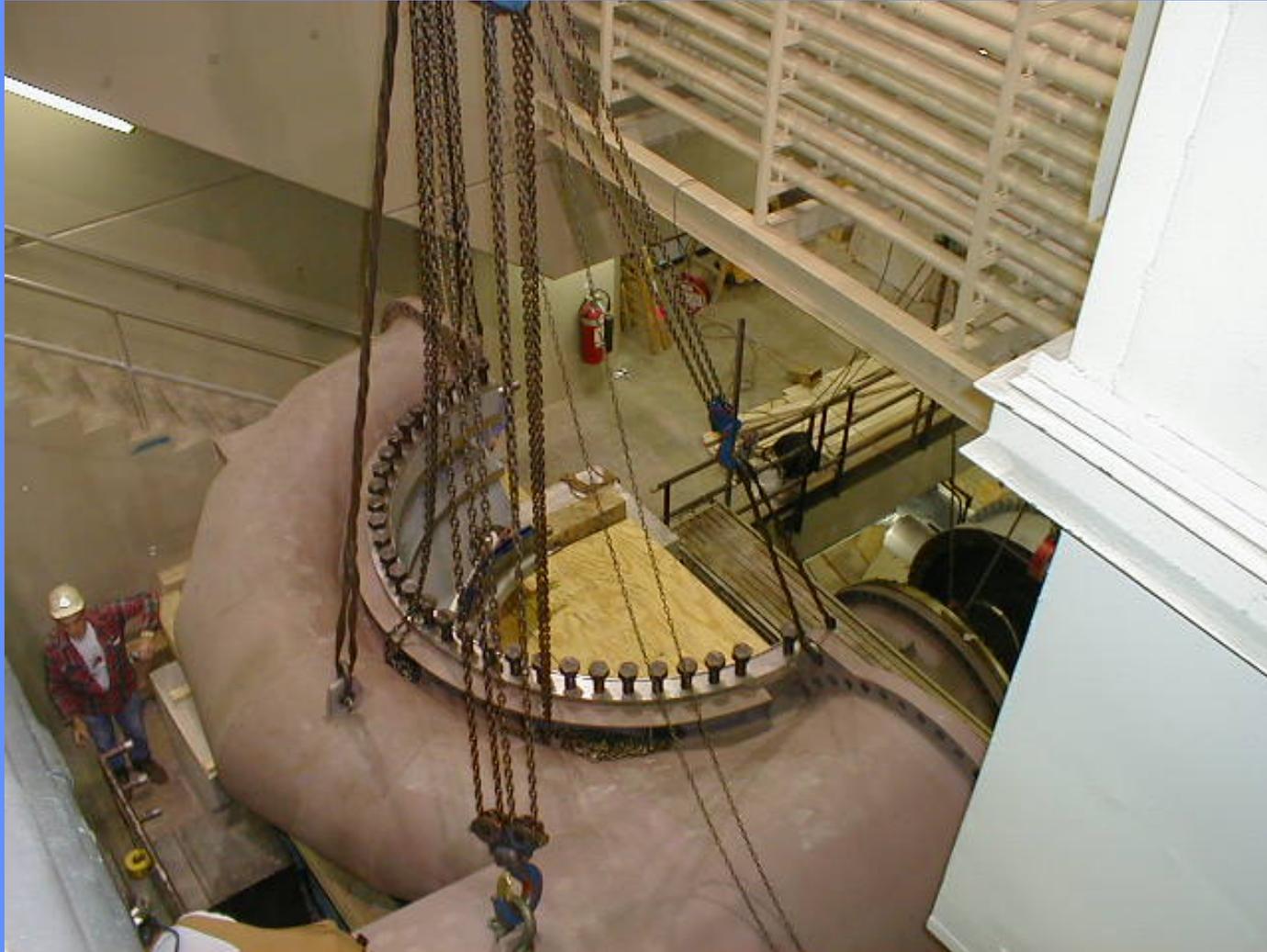
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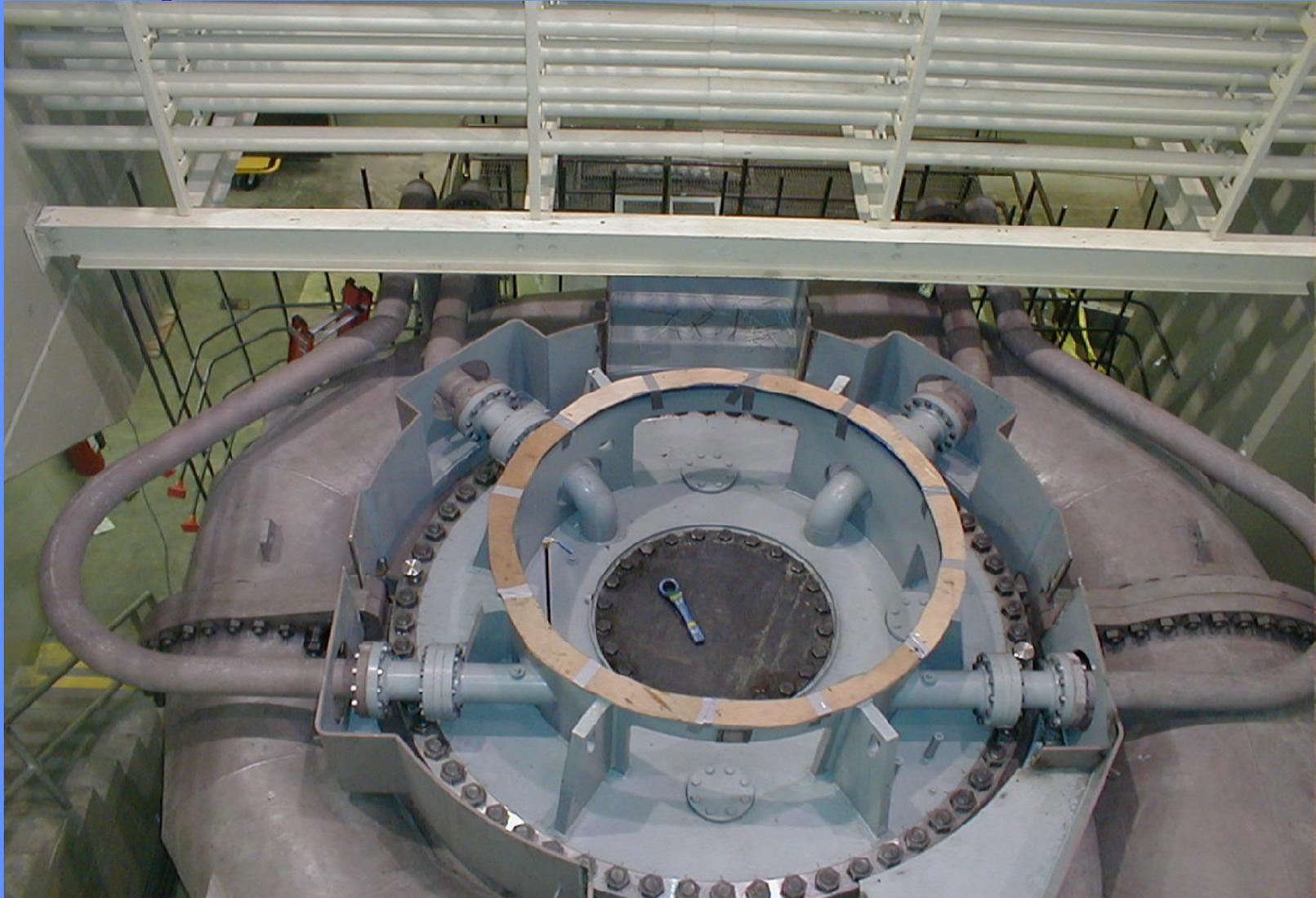
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PUMP CASING AND PIT LINER INSTALLED



Installation of Stator



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Installation of Pump Shaft



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Lifting of rotor



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Dropping of Rotor



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Motor Control Cabinet (CCM)



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CCM Cabinet Interior



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HV Cable Termination



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Vibration Instruments



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Wiring



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Alarm Panel In Pit Area



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Switchboard



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Pumps Installation

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Henry Stewart, ME, PE, CELRC

Bharat Shah, ME, CELRC

**Larry Green, PG; Rich Hurt; Nick Karnezis, PE –CELRC-CO
USAED – USACE, Japan**

Construction of Distribution Tunnel

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