APPENDIX B -- QPS Infrastructure

B.1. Location

The QPS device and infrastructure will be located in the 7600 Area of ORNL in a building that will have a dedicated facility enclosure. The new location, shown in Figure B.1, will recreate the existing infrastructure in Building 9201-2, which is the present home of the ORNL Fusion Energy Division (FED). Figures B.2 to B.5 show details of the proposed new FED building. Existing long-pulse plasma-heating systems, power supplies, de-mineralized water system, and control room are available for this experiment. Details of the infrastructure are given below.

Power Supplies. Some of the power supplies are shown in Figure B.6. Their specifications are listed below.

Modular Coil Power Supplies: The existing modular power supplies consist of four independent units capable of providing 1.3 kV, 120 kA for >5-s pulses and 40 MW (60 kA) in continuous operation.

VF, TF, Trim Power Supplies: There are three units of which two are capable of providing 625 V, 15 kV for 5-s pulses and 1.6 MW (2.6 kA) continuously, and one power supply capable of providing 625 V, 10 kA for 5-s pulses and 1.2 MW (1.9 kA) continuously.

ECH and ICRF Heating: Available power supplies will provide 80-kV, 100-A for 30-s pulses and 80-kV, 35-A continuously. The ECH group will provide 4 sockets with 28 GHz to 53.2 GHz capability. Additional space will be available if a fifth socket is required.

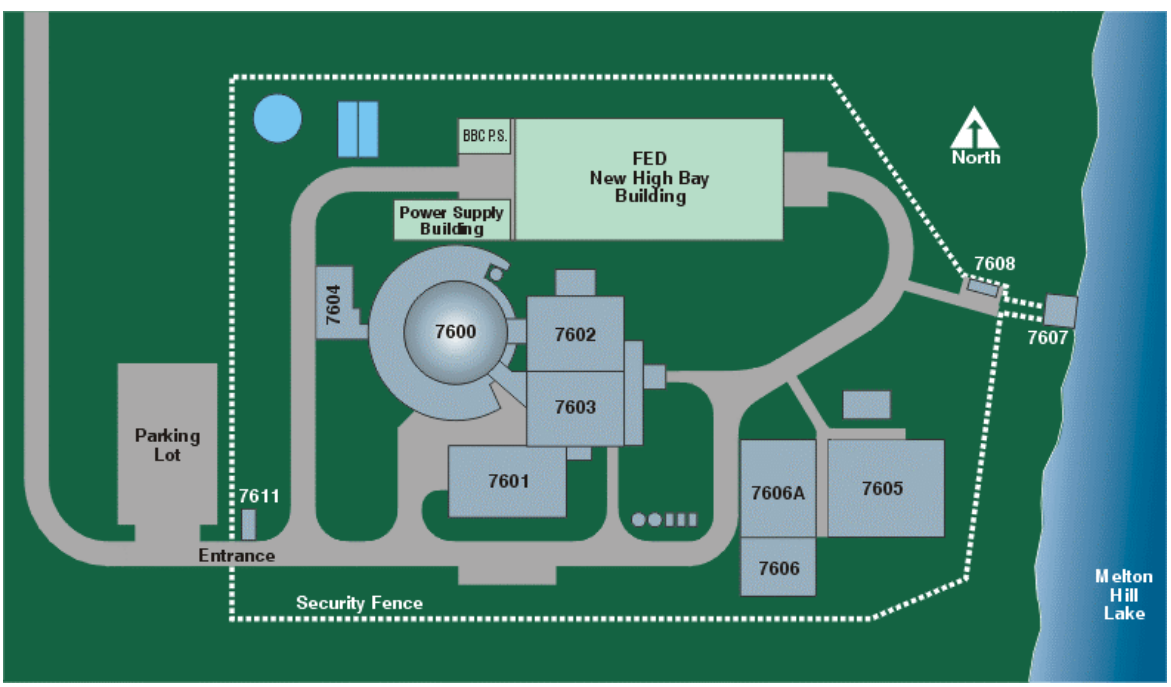

Figure B.1. Site Plan for proposed FED High Bay Building & power supplies

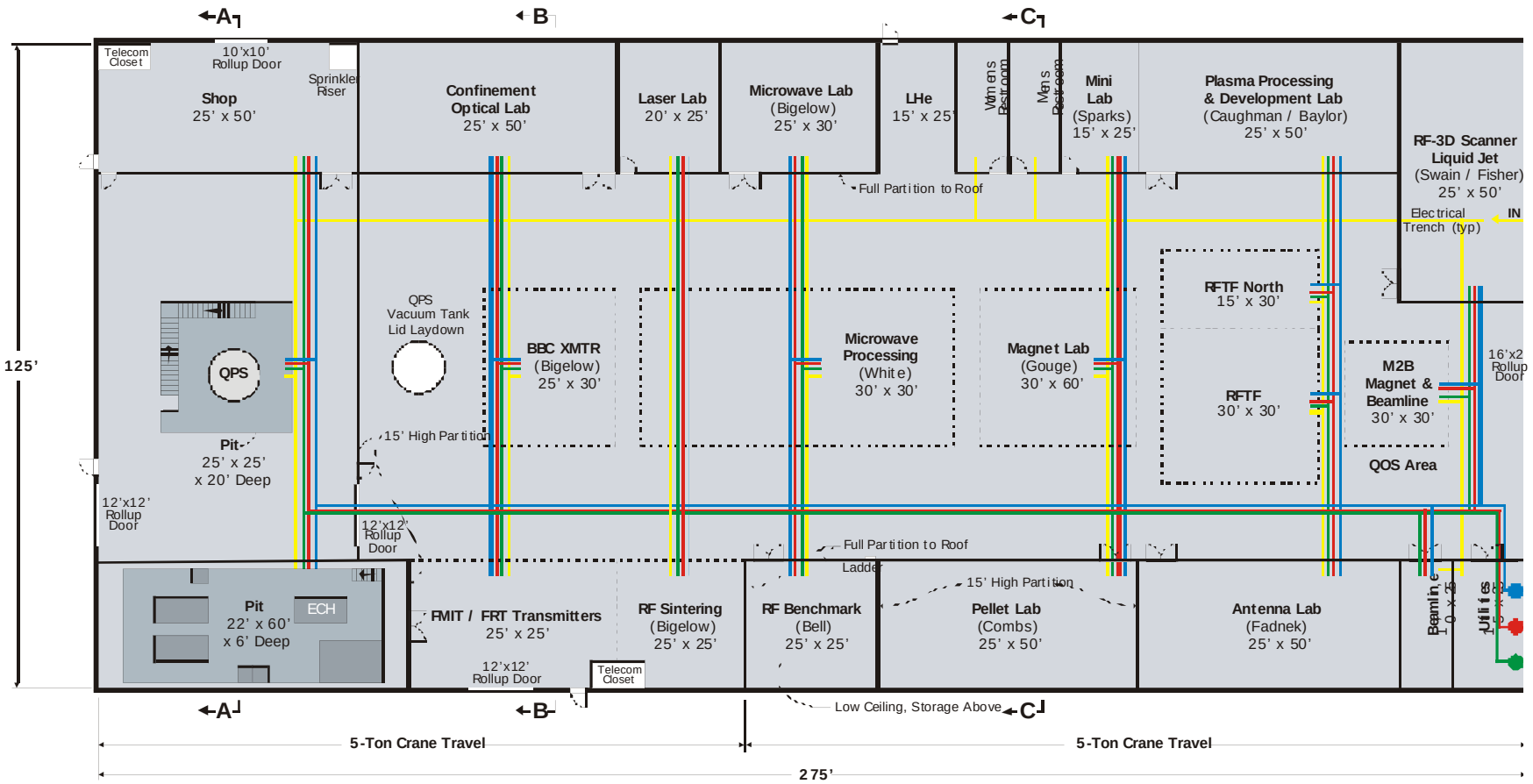

Figure B.2. First Floor Plan for proposed FED High Bay Building

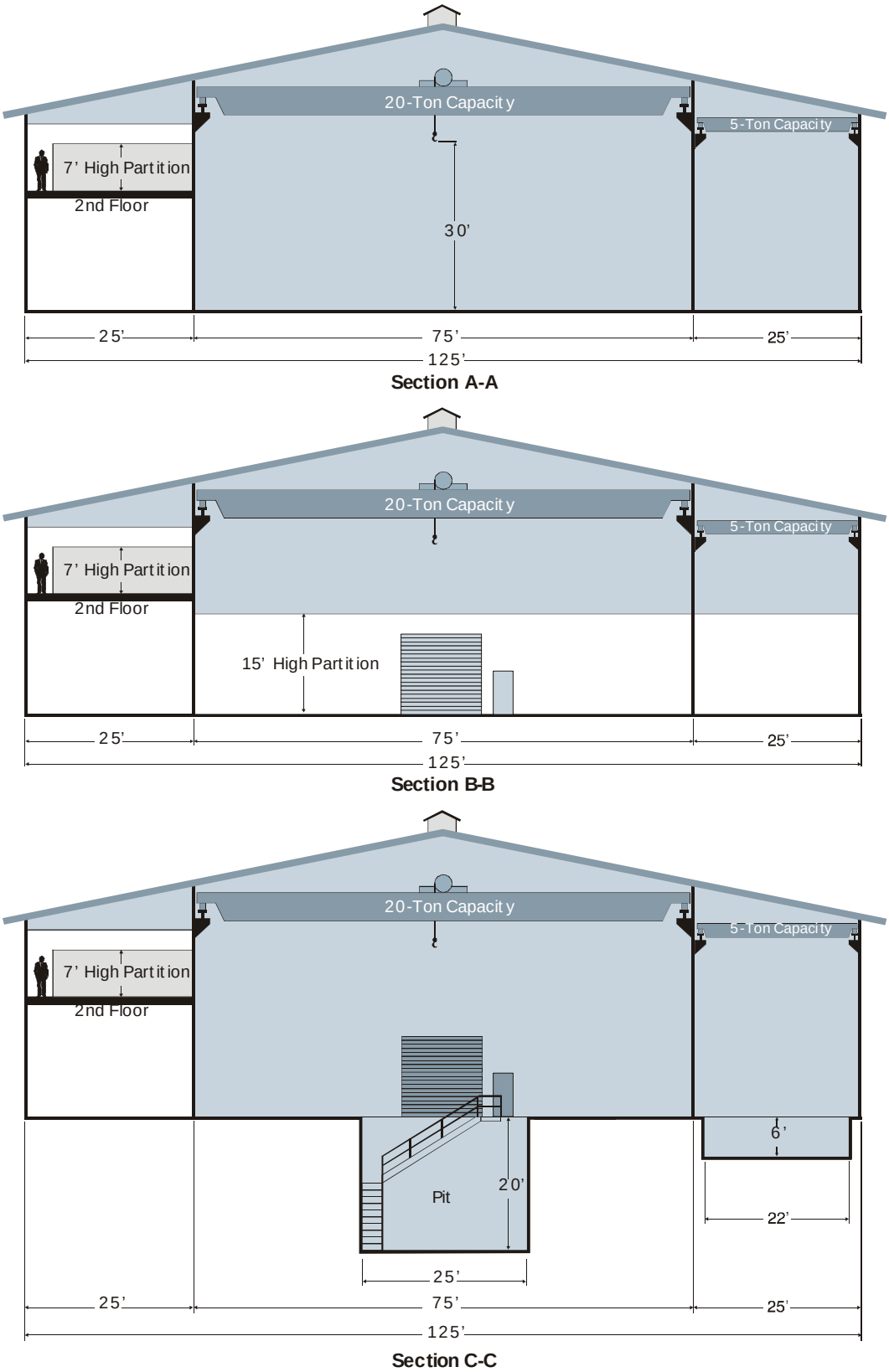

Figure B.3. High Bay Building elevation sections

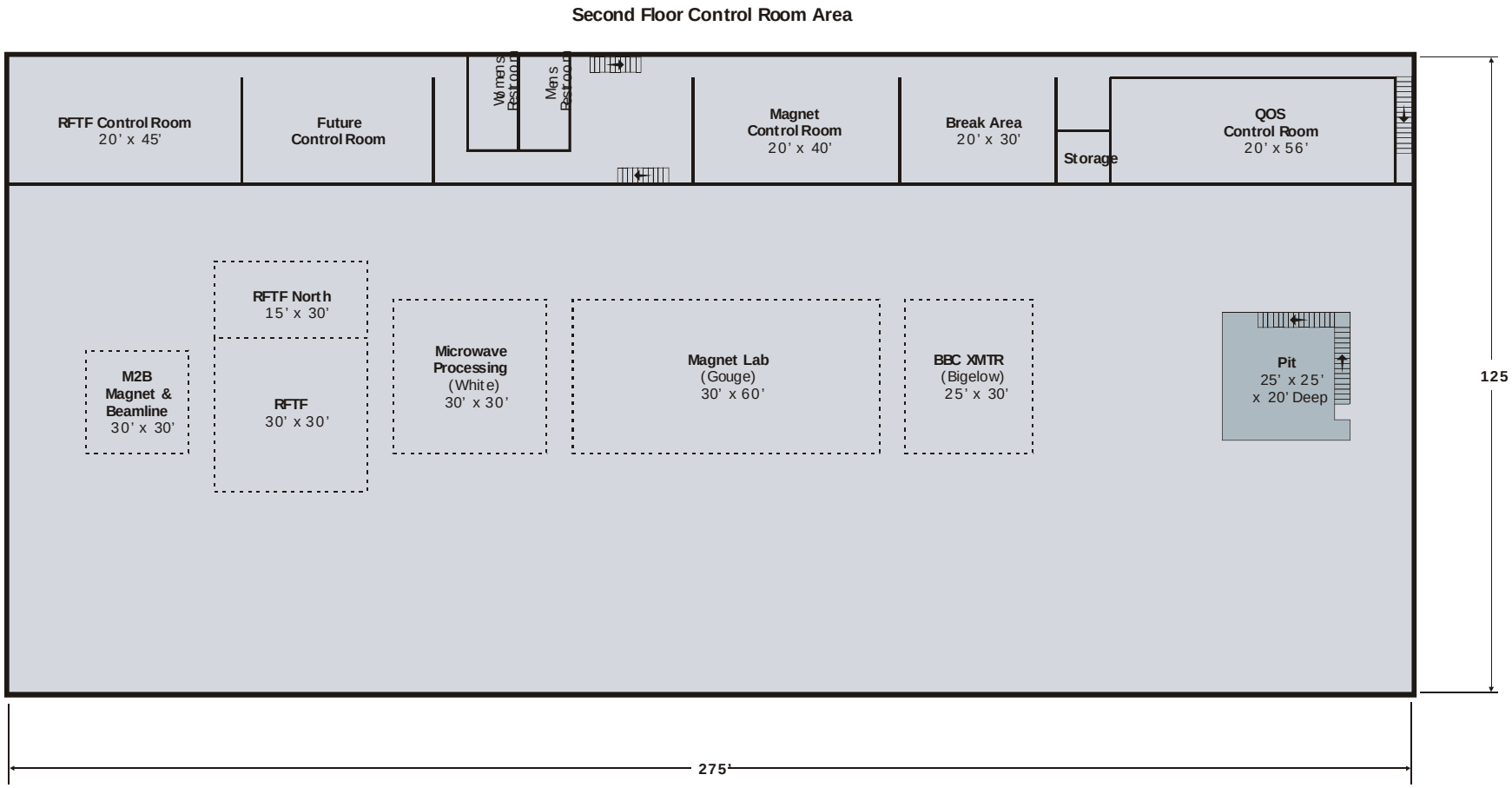

Figure B.4. FED High Bay Building, second floor control rooms

Figure B.5. FED High Bay Building exterior end view

Bus Work: Bus work will be available in the facility to the point of tie-in from the device to the power source.

Cooling Water: The facility will be capable of providing cooling water for ancillary equipment required for the QPS device. The cooling water piping will be available for tie-in from the device to the source. The facility has two Baltimore Aircoil Cooling Towers, Model 2420, each capable of delivering approx. 750 gal/min, at 60 psi and provide 2.1 MW of average cooling.

ICRF Transmitters: The FMIT Transmitter is capable of delivering 1.5 MW of 30-s pulsed power and 0.5 MW of continuous power. The 13.8-kVA transformer is included with the transmitter. The BBC Transmitters will be on site and can provide 2 MW of 30-s power or 1 MW of continuous power.

Operations.

Device Enclosure: Safely operating the QPS device is of extreme importance to the program. As such, an enclosure with the appropriate safety interlocks and Kirk keys will be available within the building. The QPS enclosure and pit is indicated in Figures B.2 to B.4.

Control Room: A control room will be available for operation of QPS. Tie-ins from the major equipment and diagnostics to the control room will be required, as indicated in Figure B.2.

Staffing: The Fusion Energy Division has the existing core staffing required to operate a successful compact stellarator experimental program over the time period anticipated for QPS. The staff has expertise in the areas of program management, compact stellarator theory, diagnostics, RF theory and technology, fueling and pumping technology, engineering, and stellarator and tokamak operations. Some staff presently on assignment to other Divisions and working part-time on plasma programs will also be available. In addition, there is a large group of technical experts available within ORNL that can be called upon for help in specific areas. Although ORNL will be primarily responsible for operating QPS, ~1/2 of the physics program staff will be made up of collaborators from other institutions, thesis students, and post-docs.

Figure B.6. Some of the power supplies that will be used for QPS.