

69kV-138kV Cyclone Substation Design

SDMAY21-04

Team Members:
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Sponsor/Client:
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Advisor:
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Scope:

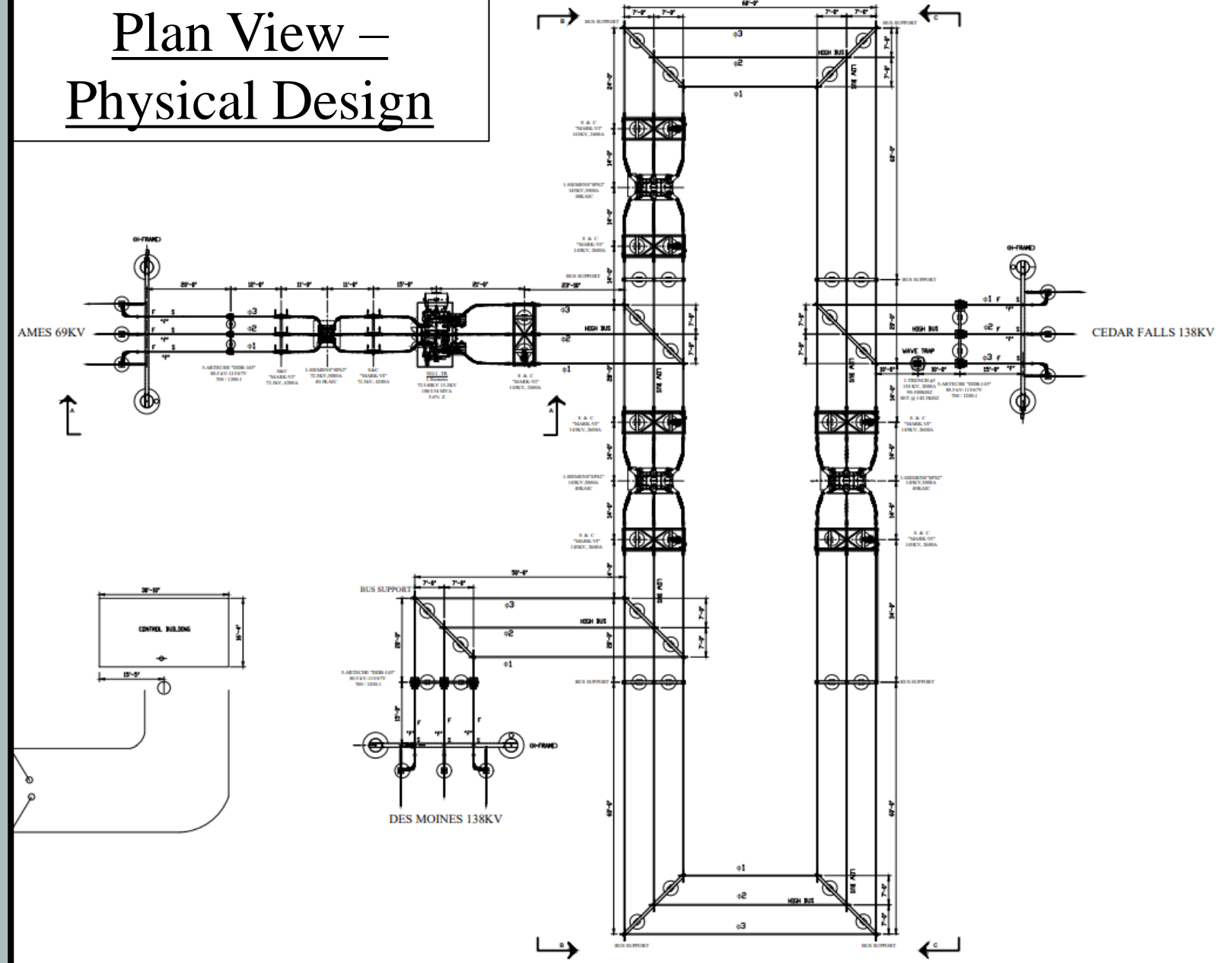
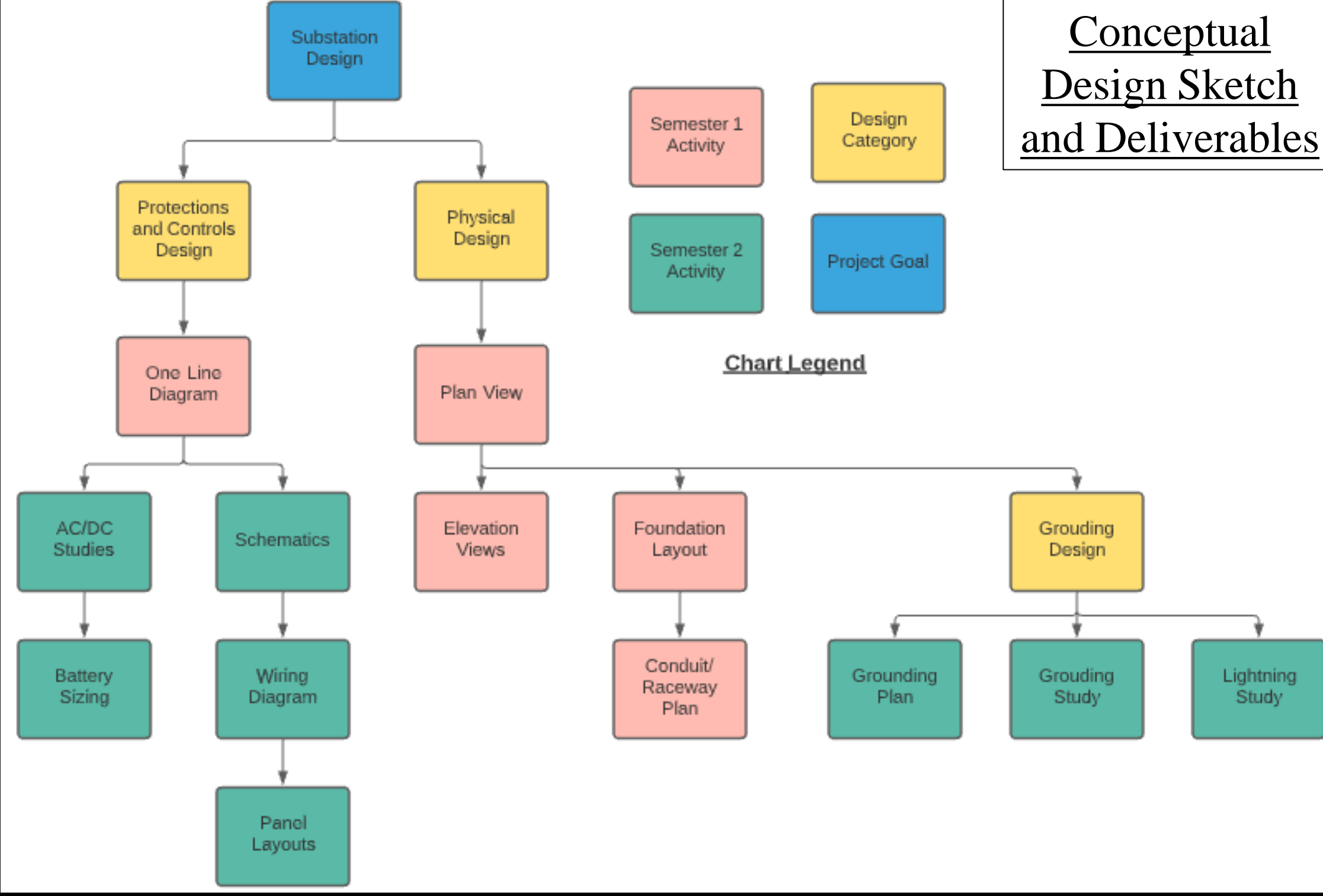
A substation needs to be designed to connect a 69 kV wind farm in Ames, IA to Cedar Falls, IA and Des Moines, IA via 138 kV transmission lines. The substation is needed to connect the generation resource with its customers. Residents and companies in Des Moines and Cedar Falls who utilize power from the electrical grid will benefit because the substation provides access to renewable energy.

Functional Design Requirements/ Constraints:

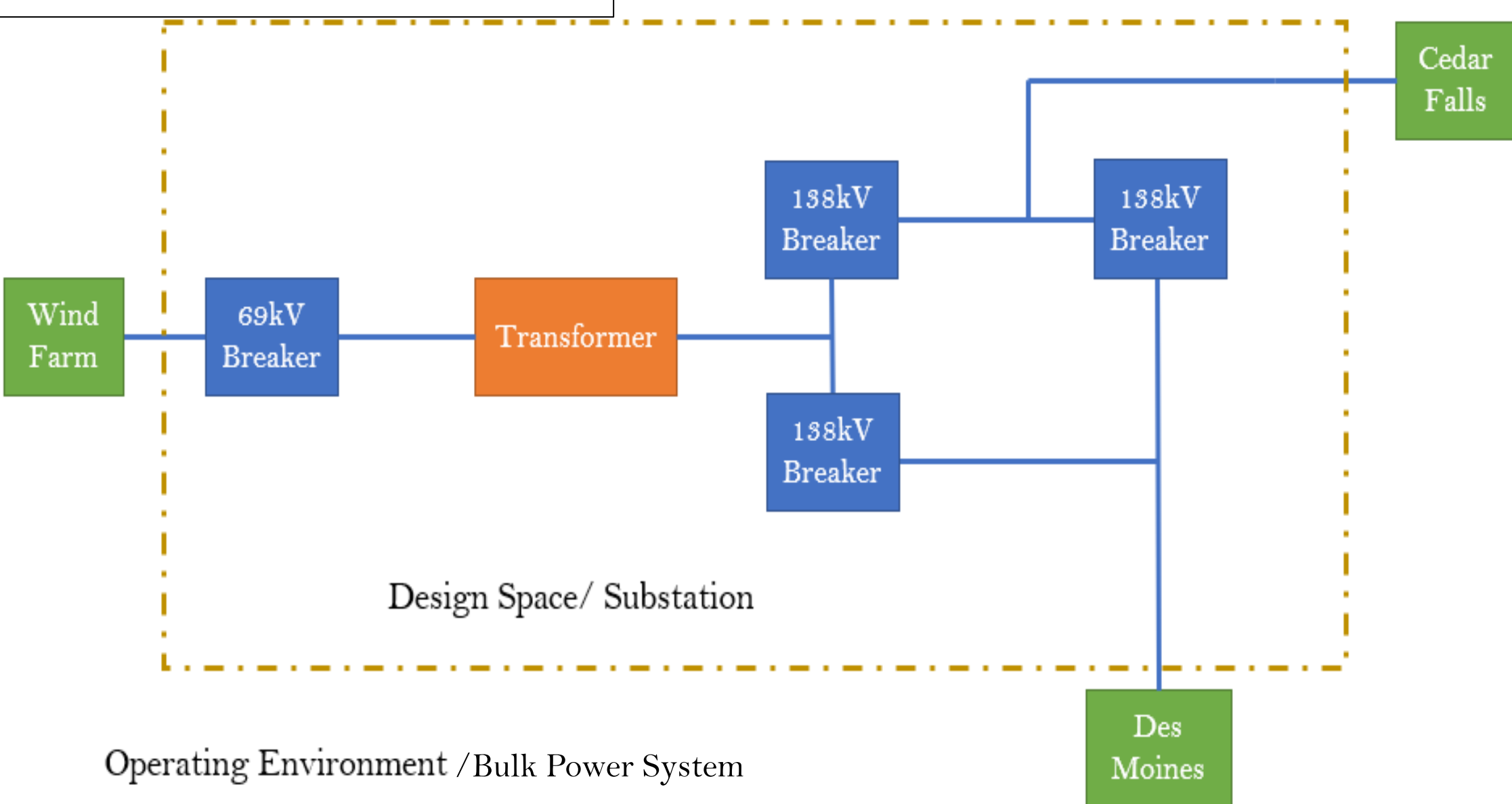
- Implement relaying per protection specification
- Plan for future expansion to serve an additional utility

Standards:

- IEEE 80 – For Substation Grounding
- IEEE 998 – For Lighting Protection
- IEEE 450, 484, 485, 1187, 1188 – For Battery Sizing



Substation Block Diagram



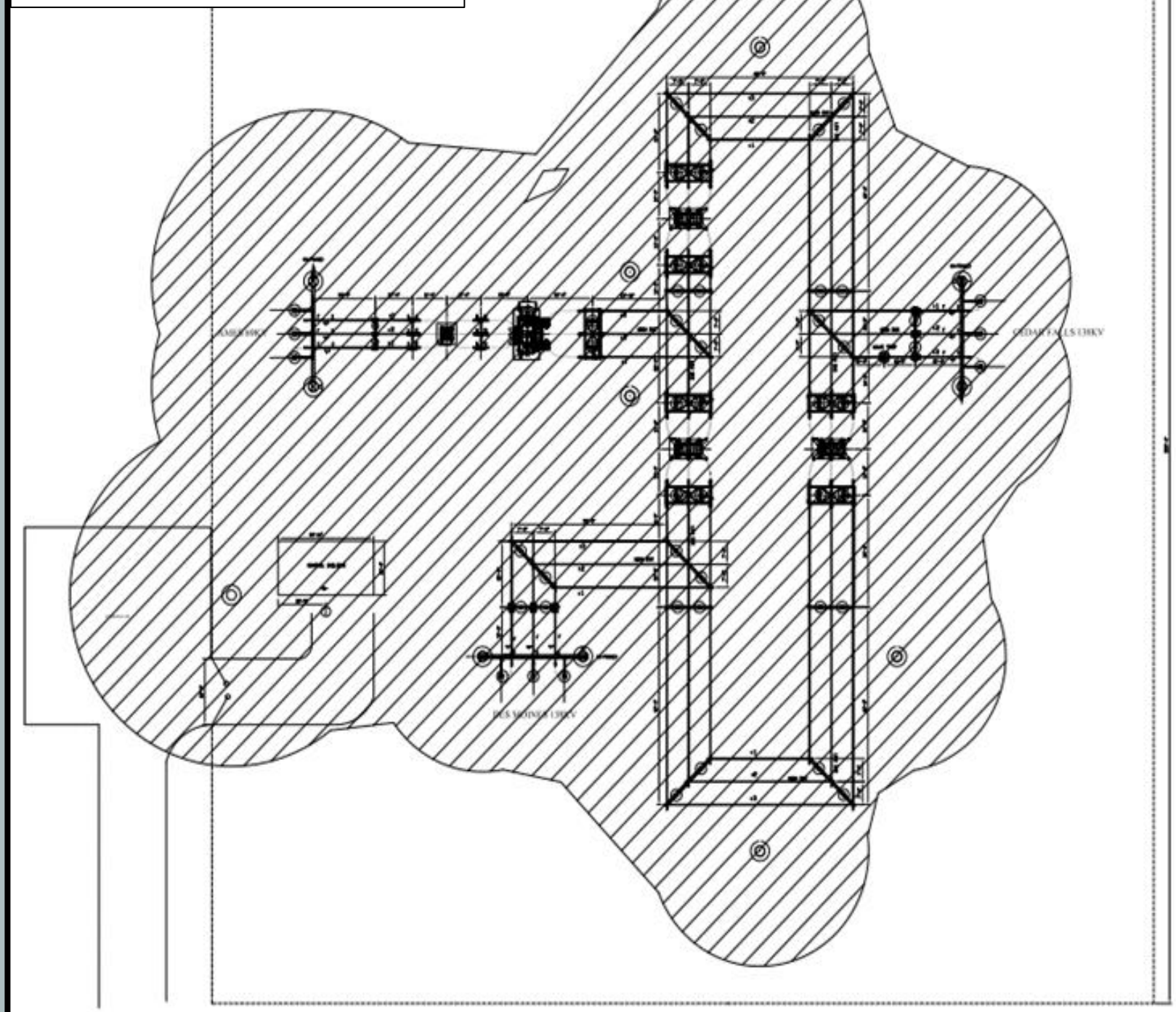
Testing Procedure:

1. Create design in sub-team
2. Verify design as sub-team against specifications and make changes (unit/ interface testing)
3. Verify design as whole-team against specifications and make changes (unit/ interface testing)
4. Send to client for review and make changes (acceptance testing)

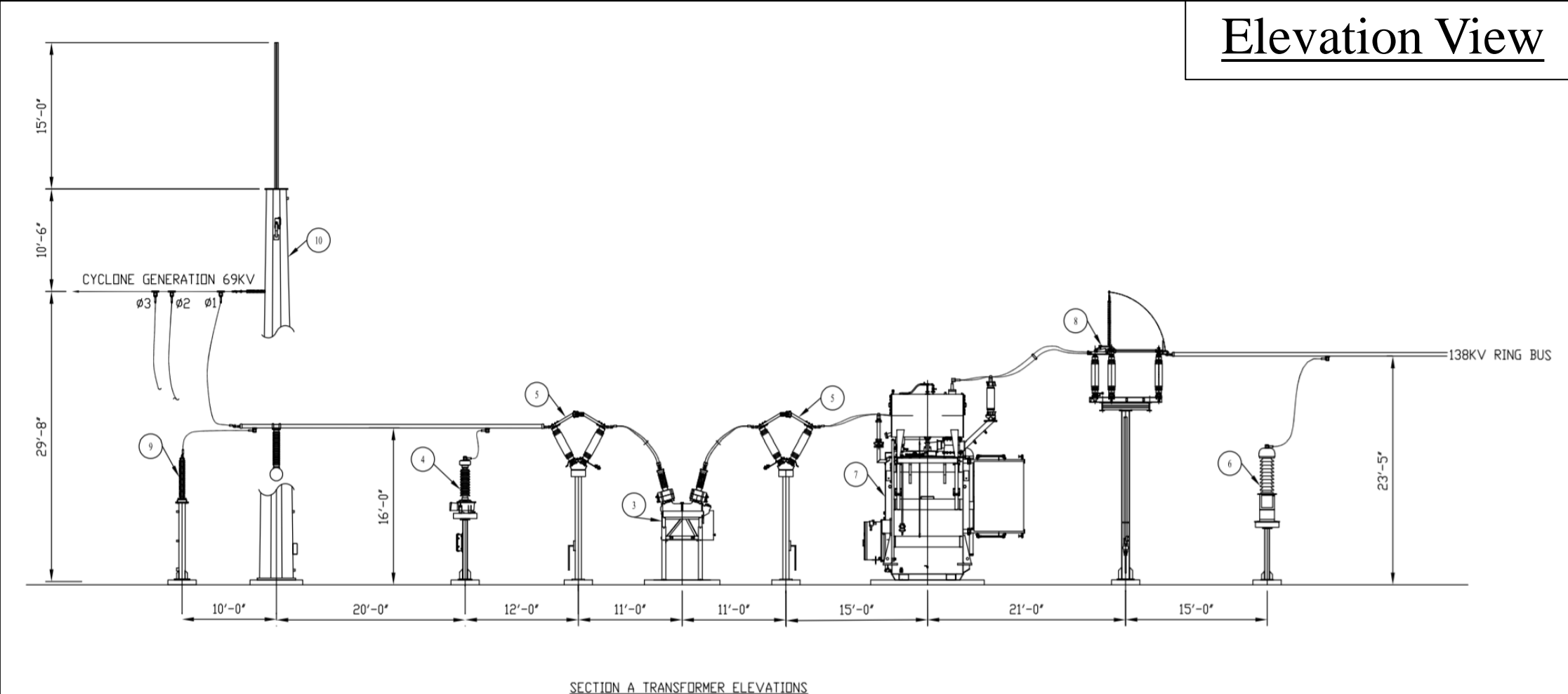
Testing Results:

- Identification of components in the design that do not follow client/industry standards or specifications

Lightning Study Protection Results



Elevation View



Non-Functional Reqs.:

- Ring bus configuration with plan for future expansion
 - (3) 138 kV Circuit Breakers
- (1) 72kV – 142kV Transformer
- (1) 69kV Circuit Breaker

Users:

- Local utility companies
- Construction crews

Safety/Security Features:

- Relay control and monitoring
- Grounding grid
- Fence
- Back up batteries

Relevant Courses:

- EE 303, EE 456

Project Resources:

- AutoCAD

Substation One-Line

