

TECHNICAL PROVISIONS, SPECIFICATIONS, DRAWINGS, AND MAPS
JORDANELLE - MIDWAY UNDERGROUND 138 kV LINE SECTION

UNDERGROUND TRANSMISSION PROJECT
FOR BIDDING

PacifiCorp
Issued for Proposal
Proposal Due: February 21, 2020

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TECHNICAL PROVISIONS, SPECIFICATIONS, DRAWINGS, AND MAPS FOR
JORDANELLE - MIDWAY 138 kV LINE
UNDERGROUND TRANSMISSION PROJECT

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JORDANELLE - MIDWAY 138 kV LINE
UNDERGROUND TRANSMISSION PROJECT

DIVISION 1 - GENERAL REQUIREMENTS
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I. INTRODUCTION

Midway City has requested that the joint 138kV transmission project for Heber Light & Power and Rocky Mountain Power be placed underground in the section through Midway City. The city has requested four different options with each option containing two sub-options. The first sub-option will be a design with an appropriately sized segmental 138kV underground conductor that is equivalent to 795 ACSR 26/7 “Drake” overhead conductor. The second sub-option will be a design with an appropriately sized GIL 138kV underground conductor that is equivalent to 795 ACSR 26/7 “Drake” overhead conductor. This sub-option will also need to have an environmental monitoring system for the SF₆ gas that is used in the GIL underground conductor.

Please note that this project is double circuit for two separate utilities. Each underground circuit shall be separate to allow access to each circuit while the other remains energized (each circuit within its own duct bank, separate vaults for each circuit, etc.). Duct banks must have a minimum of 4 feet between them from closest edge of each duct bank.

A map for each option is shown in the appendices.

Option 1:

Sub-Option A: Build a double circuit 138kV Underground transmission line that is approximately 6990 feet using an appropriately sized 138kV underground conductor. The project begins at Point A on the Option 1 map and ends at Point B.

This site is located entirely within Midway City limits. The elevation difference between the two sets of Termination poles is approximately 87 feet. Three phases and one spare cable will be installed per circuit, a total of eight cables.

Fiber will be installed by a separate contractor and is not included in this scope, however two 4” and one 3” additional conduits will be installed for communications. The two 4” conduits will terminate in one additional vault separate from the transmission line vault for Rocky Mountain Power. The 3” conduit will terminate in the transmission vault for Heber Light and Power. See appendix for conceptual vault locations and vault specifications. Contractor will propose final vault locations with bid.

This project should be bid as a Turnkey Project providing all required material, labor and testing. The material should include:

Cable, terminators, arrestors, ground cable, cable clamps, clamping brackets, splices, vaults, etc. (please see Summary of Work and pricing sheet for details). As the distance between the Termination structures exceeds the cable reel length, splices and vaults are

anticipated. Turnkey contractor shall determine the total number of vaults, the location of the vaults, complete the installation of the vaults and provide the brackets and clamps for the vaults and rack the cables.

This project will require the cable to be capable of providing 852 Amps continuous at 90 degree C during the summer and 1252 Amps continuous at 90 degree C during the winter. The bidder will provide Cymcap calculations (Continuous, 4hours and 30 minutes) using PacifiCorp standards for the duct bank, using soil thermal resistivity of 0.90 deg C-cm/W and duct bank concrete thermal resistivity of 0.65 deg C-cm/W. Also the bidder shall provide pulling calculations showing maximum anticipated tensions and sidewall pressures within the limits of the cable.

The termination poles will be designed by Rocky Mountain Power upon Turnkey contractor's determination of the 138kV Underground cable and are not included in this scope of work.

Sub-Option B: Build a double circuit 138kV Underground transmission line that is approximately 6990 feet using an appropriately sized GIL 138kV underground conductor. The project begins at Point A on the Option 1 map and ends at Point B.

This site is located entirely within Midway City limits. The elevation difference between the two sets of Termination poles is approximately 87 feet. Three phases and one spare cable will be installed per circuit, a total of eight cables.

Fiber will be installed by a separate contractor and is not included in this scope, however two 4" and one 3" additional conduits will be installed for communications. The two 4" conduits will terminate in one additional vault separate from the transmission line vault for Rocky Mountain Power. The 3" conduit will terminate in the transmission vault for Heber Light and Power. See appendix for conceptual vault locations and vault specifications. Contractor will propose final vault locations with bid.

This project should be bid as a Turnkey Project providing all required material, labor and testing. The material should include:

Cable, terminators, arrestors, ground cable, cable clamps, clamping brackets, splices, vaults, environmental monitoring system for the SF₆ gas, etc. (please see Summary of Work and pricing sheet for details). As the distance between the Termination structures exceeds the cable reel length, splices and vaults are anticipated. Turnkey contractor shall determine the total number of vaults, the location of the vaults, complete the installation of the vaults and provide and install brackets and clamps for the vaults and rack the cables.

This project will require the GIL cable to be capable of providing 852 Amps continuous at 90 degree C during the summer and 1252 Amps continuous at 90 degree C during the winter. The bidder will provide Cymcap calculations (Continuous, 4hours and 30 minutes) using PacifiCorp standards for the duct bank, using soil thermal resistivity of 0.90 deg C-cm/W and duct bank concrete thermal resistivity of 0.65 deg C-cm/W. Also the bidder shall

provide pulling calculations showing maximum anticipated tensions and sidewall pressures within the limits of the cable.

The termination poles will be designed by Rocky Mountain Power upon Turnkey contractor's determination of the 138kV Underground cable and are not included in this scope of work.

Option 2:

Sub-Option A: Build a double circuit 138kV Underground transmission line that is approximately 7400 feet using an appropriately sized 138kV underground conductor. The project begins at Point A on the Option 2 map and ends at Point B.

This site is located within Wasatch County and the entirety of Midway City. The elevation difference between the two sets of Termination poles is approximately 107 feet. Three phases and one spare cable will be installed per circuit, a total of eight cables.

Fiber will be installed by a separate contractor and is not included in this scope, however two 4" and one 3" additional conduits will be installed for communications. The two 4" conduits will terminate in one additional vault separate from the transmission line vault for Rocky Mountain Power. The 3" conduit will terminate in the transmission vault for Heber Light and Power. See appendix for conceptual vault locations and vault specifications. Contractor will propose final vault locations with bid.

This project should be bid as a Turnkey Project providing all required material, labor and testing. The material should include:

Cable, terminators, arrestors, ground cable, cable clamps, clamping brackets, splices, vaults, etc. (please see Summary of Work and pricing sheet for details). As the distance between the Termination structures exceeds the cable reel length, splices and vaults are anticipated. Turnkey contractor shall determine the total number of vaults, the location of the vaults, complete the installation of the vaults and provide the brackets and clamps for the vaults and rack the cables.

This project will require the cable to be capable of providing 852 Amps continuous at 90 degree C during the summer and 1252 Amps continuous at 90 degree C during the winter. The bidder will provide Cymcap calculations (Continuous, 4hours and 30 minutes) using PacifiCorp standards for the duct bank, using soil thermal resistivity of 0.90 deg C-cm/W and duct bank concrete thermal resistivity of 0.65 deg C-cm/W. Also the bidder shall provide pulling calculations showing maximum anticipated tensions and sidewall pressures within the limits of the cable.

The termination poles will be designed by Rocky Mountain Power upon Turnkey contractor's determination of the 138kV Underground cable and are not included in this scope of work.

Sub-Option B: Build a double circuit 138kV Underground transmission line that is approximately 7400 feet using an appropriately sized GIL 138kV underground conductor. The project begins at Point A on the Option 2 map and ends at Point B.

This site is located entirely within Wasatch County and the entirety of Midway City. The elevation difference between the two sets of Termination poles is approximately 107 feet. Three phases and one spare cable will be installed per circuit, a total of eight cables.

Fiber will be installed by a separate contractor and is not included in this scope, however two 4" and one 3" additional conduits will be installed for communications. The two 4" conduits will terminate in one additional vault separate from the transmission line vault for Rocky Mountain Power. The 3" conduit will terminate in the transmission vault for Heber Light and Power. See appendix for conceptual vault locations and vault specifications. Contractor will propose final vault locations with bid.

This project should be bid as a Turnkey Project providing all required material, labor and testing. The material should include:

Cable, terminators, arrestors, ground cable, cable clamps, clamping brackets, splices, vaults, environmental monitoring system for the SF₆ gas, etc. (please see Summary of Work and pricing sheet for details). As the distance between the Termination structures exceeds the cable reel length, splices and vaults are anticipated. Turnkey contractor shall determine the total number of vaults, the location of the vaults, complete the installation of the vaults and provide the brackets and clamps for the vaults and rack the cables.

This project will require the GIL cable to be capable of providing 852 Amps continuous at 90 degree C during the summer and 1252 Amps continuous at 90 degree C during the winter. The bidder will provide Cymcap calculations (Continuous, 4hours and 30 minutes) using PacifiCorp standards for the duct bank, using soil thermal resistivity of 0.90 deg C-cm/W and duct bank concrete thermal resistivity of 0.65 deg C-cm/W. Also the bidder shall provide pulling calculations showing maximum anticipated tensions and sidewall pressures within the limits of the cable.

The termination poles will be designed by Rocky Mountain Power upon Turnkey contractor's determination of the 138kV Underground cable and are not included in this scope of work.

Option 3:

Sub-Option A: Build a double circuit 138kV Underground transmission line that is approximately 8950 feet using an appropriately sized 138kV underground conductor. The project begins at Point A on the Option 3 map and ends at Point B.

This site is located within Wasatch County and the entirety of Midway City. The elevation

difference between the two sets of Termination poles is approximately 147 feet. Three phases and one spare cable will be installed per circuit, a total of eight cables.

Fiber will be installed by a separate contractor and is not included in this scope, however two 4" and one 3" additional conduits will be installed for communications. The two 4" conduits will terminate in one additional vault separate from the transmission line vault for Rocky Mountain Power. The 3" conduit will terminate in the transmission vault for Heber Light and Power. See appendix for conceptual vault locations and vault specifications. Contractor will propose final vault locations with bid.

This project should be bid as a Turnkey Project providing all required material, labor and testing. The material should include:

Cable, terminators, arrestors, ground cable, cable clamps, clamping brackets, splices, vaults, etc. (please see Summary of Work and pricing sheet for details). As the distance between the Termination structures exceeds the cable reel length, splices and vaults are anticipated. Turnkey contractor shall determine the total number of vaults, the location of the vaults, complete the installation of the vaults and provide the brackets and clamps for the vaults and rack the cables.

This project will require the cable to be capable of providing 852 Amps continuous at 90 degree C during the summer and 1252 Amps continuous at 90 degree C during the winter. The bidder will provide Cymcap calculations (Continuous, 4hours and 30 minutes) using PacifiCorp standards for the duct bank, using soil thermal resistivity of 0.90 deg C-cm/W and duct bank concrete thermal resistivity of 0.65 deg C-cm/W. Also the bidder shall provide pulling calculations showing maximum anticipated tensions and sidewall pressures within the limits of the cable.

The termination poles will be designed by Rocky Mountain Power upon Turnkey contractor's determination of the 138kV Underground cable and are not included in this scope of work.

Sub-Option B: Build a double circuit 138kV Underground transmission line that is approximately 8950 feet using an appropriately sized GIL 138kV underground conductor. The project begins at Point A on the Option 3 map and ends at Point B.

This site is located entirely within Wasatch County and the entirety of Midway City. The elevation difference between the two sets of Termination poles is approximately 147 feet. Three phases and one spare cable will be installed per circuit, a total of eight cables.

Fiber will be installed by a separate contractor and is not included in this scope, however two 4" and one 3" additional conduits will be installed for communications. The two 4" conduits will terminate in one additional vault separate from the transmission line vault for Rocky Mountain Power. The 3" conduit will terminate in the transmission vault for Heber Light and Power. See appendix for conceptual vault locations and vault specifications. Contractor will propose final vault locations with bid.

This project should be bid as a Turnkey Project providing all required material, labor and testing. The material should include:

Cable, terminators, arrestors, ground cable, cable clamps, clamping brackets, splices, vaults, environmental monitoring system for the SF₆ gas, etc. (please see Summary of Work and pricing sheet for details). As the distance between the Termination structures exceeds the cable reel length, splices and vaults are anticipated. Turnkey contractor shall determine the total number of vaults, the location of the vaults, complete the installation of the vaults and provide the brackets and clamps for the vaults and rack the cables.

This project will require the GIL cable to be capable of providing 852 Amps continuous at 90 degree C during the summer and 1252 Amps continuous at 90 degree C during the winter. The bidder will provide Cymcap calculations (Continuous, 4hours and 30 minutes) using PacifiCorp standards for the duct bank, using soil thermal resistivity of 0.90 deg C-cm/W and duct bank concrete thermal resistivity of 0.65 deg C-cm/W. Also the bidder shall provide pulling calculations showing maximum anticipated tensions and sidewall pressures within the limits of the cable.

The termination poles will be designed by Rocky Mountain Power upon Turnkey contractor's determination of the 138kV Underground cable and are not included in this scope of work.

Option 4:

Sub-Option A: Build Heber Light & Power's 138kV Underground transmission line that is approximately 9335 feet using an appropriately sized 138kV underground conductor. The project begins at Point A on the Option 4 map and ends at the Heber Light & Power substation deadend structure. Build Rocky Mountain Power's 138kV Underground transmission line that is approximately 9695 feet using an appropriately sized 138kV underground conductor. The project begins at Point A on the Option 4 map and ends at Rocky Mountain Powers substation deadend structure.

This site is located within Wasatch County and the entirety of Midway City. The elevation difference between the two sets of Termination poles is approximately 182 feet. Three phases and one spare cable will be installed per circuit, a total of eight cables.

Fiber will be installed by a separate contractor and is not included in this scope, however two 4" and one 3" additional conduits will be installed for communications. The two 4" conduits will terminate in one additional vault separate from the transmission line vault for Rocky Mountain Power. The 3" conduit will terminate in the transmission vault for Heber Light and Power. See appendix for conceptual vault locations and vault specifications. Contractor will propose final vault locations with bid.

This project should be bid as a Turnkey Project providing all required material, labor and testing. The material should include:

Cable, terminators, arrestors, ground cable, cable clamps, clamping brackets, splices, vaults, etc. (please see Summary of Work and pricing sheet for details). As the distance between the Termination structures exceeds the cable reel length, splices and vaults are anticipated. Turnkey contractor shall determine the total number of vaults, the location of the vaults, complete the installation of the vaults and provide the brackets and clamps for the vaults and rack the cables.

This project will require the cable to be capable of providing 852 Amps continuous at 90 degree C during the summer and 1252 Amps continuous at 90 degree C during the winter. The bidder will provide Cymcap calculations (Continuous, 4hours and 30 minutes) using PacifiCorp standards for the duct bank, using soil thermal resistivity of 0.90 deg C-cm/W and duct bank concrete thermal resistivity of 0.65 deg C-cm/W. Also the bidder shall provide pulling calculations showing maximum anticipated tensions and sidewall pressures within the limits of the cable.

The termination poles/substation deadend structures will be designed by Rocky Mountain Power upon Turnkey contractor's determination of the 138kV Underground cable and are not included in this scope of work.

Sub-Option B: Build Heber Light & Power's 138kV Underground transmission line that is approximately 9335 feet using an appropriately sized GIL 138kV underground conductor. The project begins at Point A on the Option 4 map and ends at Heber Light & Power's substation deadend structure. Build Rocky Mountain Power's 138kV Underground transmission line that is approximately 9695 feet using an appropriately sized GIL 138kV underground conductor. The project begins at Point A on the Option 4 map and ends at Rocky Mountain Powers substation deadend structure.

This site is located entirely within Wasatch County and the entirety of Midway City. The elevation difference between the two sets of Termination poles is approximately 182 feet. Three phases and one spare cable will be installed per circuit, a total of eight cables.

Fiber will be installed by a separate contractor and is not included in this scope, however two 4" and one 3" additional conduits will be installed for communications. The two 4" conduits will terminate in one additional vault separate from the transmission line vault for Rocky Mountain Power. The 3" conduit will terminate in the transmission vault for Heber Light and Power. See appendix for conceptual vault locations and vault specifications. Contractor will propose final vault locations with bid.

This project should be bid as a Turnkey Project providing all required material, labor and testing. The material should include:

Cable, terminators, arrestors, ground cable, cable clamps, clamping brackets, splices, vaults, environmental monitoring system for the SF₆ gas, etc. (please see Summary of

Work and pricing sheet for details). As the distance between the Termination structures exceeds the cable reel length, splices and vaults are anticipated. Turnkey contractor shall determine the total number of vaults, the location of the vaults, complete the installation of the vaults and provide the brackets and clamps for the vaults and rack the cables.

This project will require the GIL cable to be capable of providing 1114 Amps continuous at 90 degree C during the summer and 1649 Amps continuous at 90 degree C during the winter. The bidder will provide Cymcap calculations (Continuous, 4hours and 30 minutes) using PacifiCorp standards for the duct bank, using soil thermal resistivity of 0.90 deg C-cm/W and duct bank concrete thermal resistivity of 0.65 deg C-cm/W. Also the bidder shall provide pulling calculations showing maximum anticipated tensions and sidewall pressures within the limits of the cable.

The termination poles/substation deadend structures will be designed by Rocky Mountain Power upon Turnkey contractor's determination of the 138kV Underground cable and are not included in this scope of work.

This project is proposed for a beginning construction date of October 1, 2020. This is a fast track project; vendor should state if unable to meet the bid due date or construction start date. Bidders are encouraged to visit the work site to better understand the nature of work which will help to provide a competitive bid.

The bidder should note that the Turnkey contractor is required to acquire necessary construction permit.

Any questions regarding this project should be directed to Darin Myers, Project Manager: darin.myers@pacificorp.com – phone # 801-220-4042.

II. DEFINITION OF TERMS

The following terms have the following meanings when they appear in this document:

1. "Bidder" shall mean companies that submit proposals to supply and install the material required by the Specifications.
2. "Owner" shall be understood as referring to PacifiCorp.
3. "Contractor" shall mean the company that is awarded a contract to provide equipment and services to construct the 138 kV – Jordanelle - Midway underground double circuit transmission line.
4. "Project" shall mean supply and installation of all material for the 138kV transmission line.
5. "Engineer" shall be understood as referring to the Owner's designated

representative for the Project. The Owner's Engineer will act as the final authority on this project.

6. "Specifications" shall mean this document including all attachments.

Need to make sure drawings and appendices match up.

III. CONTRACT DRAWINGS

The drawings in Appendix 1 of this Specification are a part of the contract documents.

IV. PROJECT ALIGNMENT

The alignment for the Jordanelle - Midway 138kV underground double circuit transmission line is shown in the maps for each option in Appendix 1.

V. SUMMARY OF WORK

- A. The work covered by these specifications consists of the electrical design and installation of the cable system, furnishing all superintendence, labor and materials, and performing all work required for a complete and satisfactory installation of the underground transmission cables ready for operation. The work includes, but is not limited to, furnishing and installing the following:
 1. Appropriately sized cable per each option and their corresponding sub-options insulated and certified for 138kV nominal operation, installed in newly fabricated duct bank. Quantity listed in the introduction includes 100 extra feet per phase at each termination structure times four.
 2. Cable Pulling – 6990 centerline feet per circuit (1 circuit total=4 cables including spare cable) for Option 1, 7400 centerline feet per circuit for Option 2, 8950 centerline feet for Option 3, 9335 centerline feet for Heber Light & Power and 9695 centerline feet for Rocky Mountain Power for Option 4. Duct banks shall be proved out with a mandrel before pulling.
 3. Cable Lubricant – Turnkey contractor to determine required quantity. Use as needed for cable pulling.
 4. Cable Splicing – Cable splicing will be required for each option of this project. Turnkey contractor to determine the total number of required vaults and cable splices required to install the double circuit underground system.
 5. Concrete – The concrete needed to install the duct bank for each option is the responsibility of the Turnkey contractor. Turnkey contractor to determine the quantity of concrete required. Concrete encasing the 138kV cables shall be colored red and the concrete fill between and separating the two duct banks shall be a different color to be approved by project owners.

6. Concrete Vault – Turnkey contractor to determine the total number of vaults required for each option as listed in the introduction. Each vault shall be adequately grounded. Turnkey contractor is responsible for the installation of the vaults.
 7. Expanding Conduit Plugs - 8 per vault, insulated and certified for 138kV operation.
 8. Cable Terminations at each end of the underground cables (8 total per circuit). The cable terminations are to be rated and tested for the appropriately sized underground 138 kV insulated cables. These shall be pre-molded termination splices.
 9. Station Class metal oxide surge arresters – 8 total per circuit: 4 required at each the single pole termination structure. To be used in conjunction with the cable terminators. Please see electrical section for Arrestors details.
 10. Link Boxes, 4-phase – 1 required at each monopole termination structure. Grounding plan is required to show locations of SVL's.
 11. Cable Clamps – Turnkey contractor to determine the required quantity. These will be used to attach cables to guides in vaults and at the termination structure.
 12. Required length of new duct bank for each option and pulling tape with the total number of new vaults, as determined by the Turnkey contractor, constructed to meet PacifiCorp standards.
 13. Pavement cutting and paving– May be required along Wards Lane, Stringtown Road and across Highway 113 in Midway City, Utah.
 14. Pipe Bore – May be required to cross Highway 113 in Midway City, Utah.
 15. Trenching – Turnkey contractor to complete trenching for each option listed in the introduction.
 16. Counterpoise Wire – Ground wires to be installed in vaults and along the duct bank. 4/0 copper wire will be needed to connect link boxes at terminations throughout the length of the entire duct bank. Bare ground wire up to Linkbox and insulated above it or as specified by the cable manufacturer.
 17. Soak test and offline PD test will be performed by this contractor.
 18. All other required accessories—this includes, but is not limited to, sheath voltage limiters, grounding cables, ground rods, ground clamps, etc.
- B. Work covered by these specifications also includes of the following:
1. Mobilization and demobilization.
 2. Submittal and maintenance of schedules.
 3. Safety program.

4. Project control data.
5. Flagging - Required for installing the vault in the street, for pulling operations at each vault and termination, and for removing and replacing the steel casing under the railroad tracks.
6. Maintaining site cleanliness.
7. Furnishing, extending, maintaining, and removal of Contractor's temporary construction facilities (power, telephone, lighting, water, sanitary facilities, and field offices), including furnishing a lay down area for materials, and a local marshalling area.
8. Based on the present and planned future operating criteria, the existing route, and soils information (including thermal characteristics and resistivity) developed by Contractor, the Contractor shall perform calculations demonstrating that proposed cable will meet the following operating requirements during the summer:

Jordanelle - Midway 138 kV Minimum Line Ratings (Summer)

	Amperes per Conductor	Total MVA	Load Factor
Normal Loading (90°C) at 138 kV	852	204	0.75
4 Hour Contingency (100°C)	944	226	0.75
30 Min. Emergency (115°C)	1063	254	0.75

Jordanelle - Midway 138 kV Minimum Line Ratings (Winter)

	Amperes per Conductor	Total MVA	Load Factor
Normal Loading (90°C) at 138 kV	1252	299	0.75
4 Hour Contingency (100°C)	1307	312	0.75
30 Min. Emergency (115°C)	1383	331	0.75

- a. For proposal purposes an ambient Earth temperature of 25 °C shall be assumed. Earth thermal resistivity shall be assumed to be 90 °C - cm/watt.
 - b. A line to ground fault will produce a current level at 138-kV of 9527 amps. The longest expected fault clearing time is 30 cycles or 0.5 seconds.
9. Complete conductor testing at both the plant and in the field to ensure proper manufacture and installation of cable.
- C. Contractor shall be responsible for obtaining all construction permits.
- D. During periods of unfavorable weather, Contractor shall confine its operations such that work will not be adversely affected. No portion of work shall be constructed under conditions which would adversely affect the quality or efficiency thereof, unless special means or precautions are taken by Contractor to ensure work is performed in a proper and satisfactory manner.
- E. PacifiCorp has not conducted a Thermal resistivity test to input soil parameters into Cymcap to correctly calculate ampacity. This contractor will not need to perform geotechnical and geothermal analysis of the cable route to determine the proper cable rating and backfill requirements.
- F. All drawings prepared by Contractor for Company use shall be in AutoCAD 2016 or newer format.
- G. Work by Others:

The following items will be performed by PacifiCorp crews or negotiated in separate contracts.

- 1. Overhead to underground transition structure design and specification.
- 2. Termination structure foundation design, specification, and any activities and materials associated with constructing termination poles and termination support arms.
- 3. Furnishing termination structures, cable shroud and full length anchor bolt clusters.
- 4. Fiber optic communication cable, installed in a new conduit.
- 5. Removal of existing overhead line and replacing transmission structures where required.
- 6. Coordinating outages for the time required to install cables and terminations at the termination structures.
- 7. Final verification of Line Phasing prior to energizing.

VI. ALLOWABLE WORK WEEK

- A. The allowable workweek for Contractor shall be governed by the ordinances and permits obtained to perform the Work.
- B. Contractor's proposal shall be based on the Work being performed primarily during daytime hours and as governed by the ordinances and permits obtained to perform the Work
- C. Additional restrictions may require special work hours and/or permitting variances.

VII. SUBMITTALS

A. General:

All correspondence from the Contractor shall contain the following subject heading:

PacifiCorp
Jordanelle - Midway 138kV Line
Underground Transmission Project
Work Order No. 10070993

B. Technical Correspondence:

- 1. The original of all technical correspondence, drawings and data submittals shall be addressed to Owners Representative:

PacifiCorp
Attn: Darin Myers
1407 W North Temple Suite 220
Salt Lake City, UT 84116

- 2. Two copies of all technical correspondence, drawings and data submittals shall be addressed to Engineer:

PacifiCorp
Attn: Nicolle Kindall
1407 W North Temple, Suite 230
Salt Lake City, UT 84116

C. Commercial Correspondence:

The original and one copy of all commercial correspondence shall be addressed to:

Darin Myers

D. Drawings and Data:

- 1. Schedule of Contractor's Drawing Submittals: Within 4 weeks following receipt of

Tender of Contract, the Contractor shall furnish Owners Representative and Engineer a schedule for the submission of all drawings and data on materials and equipment for the line. Each drawing to be submitted for the work of the Contract shall be listed and properly identified on the schedule. The schedule will be reviewed by Owners Representative and Engineer, and Contractor shall correct any defects noted therein. The schedule shall at all times present a complete plan for the orderly submission of drawings and data and shall be revised as necessary to meet this requirement. Contractor shall promptly notify Owners Representative and Engineer of any event requiring a substantial revision of the schedule, giving a detailed explanation of the cause of the revision, and shall furnish a revised schedule within 1 weeks. Revised schedules will be reviewed and corrected in the same manner as the original schedule.

2. Submittal Procedure: Drawings and data shall be submitted as full-size drawings with numbered and dated transmittal letters. The preparation, submittal and intermediate handling of drawings shall be as follows:

- a. No design drawings or data will be considered for review which are not complete in all respects and which have not been thoroughly checked by Contractor. No design drawings or data will be considered for review, which cover features that are contingent upon review of other features for which Contractor has not submitted drawings for review.

3. Contractor shall issue drawings for review to:

- a. The original of all technical correspondence, drawings and data submittals shall be addressed to Owners Representative:

PacifiCorp
Attn: Darin Myers
1407 W North Temple Suite 220
Salt Lake City, UT 84116

- b. Two copies of all technical correspondence, drawings and data submittals shall be addressed to Engineer:

PacifiCorp
Attn: Nicolle Kindall
1407 W North Temple Suite 220
Salt Lake City, UT 84116

4. Review Procedure: Engineer will review the drawings and data for compliance with Contract Specifications and will mark and stamp them to indicate whether changes or corrections are required. If changes or corrections are necessary, drawings and data, with such changes or corrections noted, will be returned to the Contractor in the form of full or half-size drawings. Contractor shall resubmit the corrected or changed drawings and data in the form of full or half-size drawings as specified in Division 1.VII.D.2. All changes and corrections shall be clearly indicated.

Engineer will review and mail drawings and data within 10 working days of the receipt of all related information necessary for such review. Upon receipt of comments, Contractor shall revise the original drawings and resubmit within 2 weeks. Contractor shall account for review periods in the preparation of the project schedule.

- a. The Contract Price shall cover a reasonable number of changes in drawings incident to rearrangement of equipment to meet the Engineer's requirements. Engineer shall be advised promptly if changes in equipment requested by the Company affect the Contract Price or delivery date.
- b. A letter of transmittal must accompany drawings or data and shall include all information listed under Division 1.VII.D.5.b.(1) through VII.D.5.b.(5). All transmittals received without a letter of transmittal containing such information will be returned to sender. In the letter, Contractor may include other pertinent data or information.
- c. Design information shall be included on the Certified Drawings. The fact that such design information may later be included in the instruction and/or operating manuals does not relieve Contractor from compliance with this requirement.
- d. Instruction and/or operating manuals shall be submitted in accordance with the requirements set forth in Subsection VII.E.
- e. All dimensions on Contractor's drawings shall be in inches or both inches and metric units. All notes and other data are to be in English.

5. Quality Requirements:

- a. General:
 - (1) Drawings and data submitted to Engineer shall be of such quality that when such drawings and data are reproduced, every line, character and letter shall be clearly legible and usable for further reproduction.
 - (2) Documents submitted to Engineer that do not conform to the requirements specified herein shall be subject to rejection by Engineer, and upon request, Contractor shall resubmit conforming documents. If conforming submittals cannot be obtained from the source documents, such source documents shall be retraced, redrawn or photographically restored as may be necessary to meet such requirements. Contractor's (or his subcontractor's) failure to initially satisfy the legibility quality requirements herein set forth, shall not relieve Contractor (or his subcontractors) from meeting the required schedule for submittal of drawings and data.
- b. Identifying information: All drawings submitted by Contractor shall include, as a minimum, the following identifying information:

(1) Company Name: PacifiCorp

(2) Project Name and Number:

Jordanelle – Midway 138kV Line
Underground Transmission Project
Work Order: 10070993

(3) Contractor's Name.

(4) Contractor's Order Number.

(5) Drawing Number. Each separate drawing submitted to Engineer shall have a discrete drawing number for proper identification.

- c. Contractor's individual drawings shall be made not to exceed the dimensions of 36 inches wide by 24 inches high, which include a one-half-inch border around the outside. Lettering in the body of the drawing shall be arranged to read from left (binding edge) to right or from the bottom to the top.
- 6. Specific Drawing Submittals: Contractor shall submit detailed, dimensioned drawings of the following (reviewed drawings shall be received from the Engineer before fabrication or construction begins):
 - a. Cable construction (outline and cross-section drawings and data).
 - b. Cable Terminator (bill of material, and electrical and mechanical assembly drawings).
- 7. Specific Data Submittals: Contractor shall submit the following data, which shall be reviewed by Engineer prior to fabrication or construction:
 - a. Cable ampacity and short circuit current capacity calculations.
 - b. Prior to cable pulling: A detailed description of the planned cable pulling procedure including loading information and equipment to be used.
 - c. After cable pulling: Detailed cable pulling log sheets showing pulling tensions and environmental conditions during each pull with data recorded every 100 feet.
 - d. One original and two copies of the certified test reports for all tests required by this Specification including detailed descriptions of the test procedures and test equipment.
 - e. The following electrical characteristics of the cable for the anticipated operating conditions:
 - (1) Effective (ac) resistance, inductive reactance, capacitive reactance, as

installed at 25°C, and at rated temperature per 1000 feet.

- (2) Dielectric loss per 1000 feet.
- (3) Guaranteed insulation power factor.
- (4) Zero sequence impedance per 1000 feet.

VIII. PROJECT CONTROL REQUIREMENTS

A. Services:

Contractor shall perform the services and support the Work including, but not limited to, the following:

- 1. Project Controls Requirements and Submittals as stated herein.
- 2. Planning and Scheduling.
- 3. Material and Equipment Control.
- 4. Document Control and Reproduction.

B. Key Personnel:

- 1. Company shall approve the assignment of all Contractor's supervisory personnel to the site.
- 2. Removal or reassignment of such personnel shall be subject to the prior written approval of Company.
- 3. Company may require Contractor to remove from the work employees whom Company deems incompetent, careless, insubordinate or otherwise objectionable (including refusal to follow safety practices), or whose continued employment on the work is deemed by Company to be contrary to the public interest, and such employee shall not again be employed by the Contractor in connection with the work of this Contract.

C. Safety and Accident Prevention:

- 1. Contractor shall at all times exercise reasonable precautions for the safety of persons engaged in the performance of the work and shall be responsible for the performance and maintenance of safety activities of its employees.
- 2. Contractor shall cooperate with Company's safety representatives and comply with any specific safety recommendations made by Company.
- 3. Contractor shall have an active safety program throughout the project and send updates to the engineer.

D. Asbestos, Use Thereof

Contractor shall use asbestos-free materials on all articles installed or used.

E. Work on Private Property

Contractor shall not enter upon nor allow any of its employees or employees of subcontractors to enter upon any private property without having received prior written authorization from Company and the property owner to do so. Contractor shall confine its operations and access to such operations within the land areas designated by Company.

F. As Built Drawings

Contractor shall maintain one complete set of drawings issued exclusively for record purposes. All changes, modifications and additions or deletions shall be noted on the drawings. These drawings shall include all final plan and elevations for the cable route. Company/Engineer will use the drawings for reference during construction and for "as built" records after completion. The "as built" record set must be maintained suitable to permit photocopy reproduction as required. Contractor shall designate a person to be responsible for modification of drawings. These "as built" drawings shall be updated as changes are made weekly as a minimum.

G. Schedule

Contractor shall perform the Work in accordance with the dates listed in Section I.

H. Coordination

Contractor shall coordinate its Work with the work of other contractors at the site if any. Contractor shall permit and make available areas for the performance of the construction activities of other contractors as required.

IX. PROJECT MEETINGS

A. Pre-proposal Meeting

There will be a video conference pre-proposal meeting, the contractor needing additional info on Specifications, the project scope, criteria, route and schedule should attend this meeting. The Project Manager will send notice on date and timing of this meeting. It shall be Contractor's responsibility to obtain any additional route information that may be necessary to submit a complete and comprehensive proposal for the specified work.

B. Pre-construction Meetings

1. Contractor's Site Manager shall schedule one or more meetings after Contract award, and prior to the beginning of construction.

2. The pre-construction meeting(s) shall be attended by representatives of Company, Contractor's Site Manager and Contractor's major subcontractors. Contractor's representatives must include a representative of management familiar with the Work.

C. Construction Meetings

1. Construction meetings shall be held periodically as required, however, County, Company, or Contractor's Site Manager may call a special meeting as required.
2. Normally, only County, Company, Contractor's Site Manager, and Contractor's major subcontractors shall attend; others may attend as necessary.

X. CONSTRUCTION SCHEDULE (CONTRACTOR'S)

- A. The Schedule of Work, herein specified, sets forth the commercial operating date, which Contractor is required to meet. Contractor shall be required to process the entire Work, from start to completion, in an orderly and continuous manner during the entire course of the Work.
- B. Contractor shall continuously show evidence of this orderly process, consistent with the Schedule of Work, by submitting schedules and progress reports.
- C. Contractor shall submit with proposal, a detailed bar chart type schedule showing all activities of Contractor, its Subcontractors and material suppliers. Contract scheduled start and completion dates and major restraints from or to other contractor's Work shall be listed. Within two (2) weeks following receipt of Notice of Tender of Contract, Contractor shall furnish Engineer a complete schedule showing all phases of the Project Work by line Segment. .
- D. It shall be the responsibility of Contractor to maintain the construction schedule, revising it as often as necessary to accurately indicate the planning and scheduling of remaining Work. Changes shall be submitted to Company and Engineer as soon as the necessity for revisions becomes apparent. Contractor's schedule must always indicate currently feasible logic and duration to maintain the specified completion dates.
- E. Contractor shall submit a bi-weekly forecast schedule covering work planned for the next week, as well as work completed in the previous week. These updated schedules shall be delivered to Engineer.

XI. TEMPORARY FACILITIES

- A. The contractor will be responsible for all cable reel unloading, storing and bringing to the jobsite.
- B. Temporary Electrical Service: Contractor shall provide temporary electric service during construction if needed.

- C. Laydown Area: Contractor shall be solely responsible for obtaining, and shall pay all costs in connection with any Work area, storage sites, access to the site, temporary fencing, or temporary right-of-way which may be required for proper completion of the work.
- D. Temporary Water Service: Contractor shall provide potable water source. Contractor shall provide ice and containers required for dispensing drinking water.
- E. Contractor shall furnish and maintain a dumpster for disposal of Contractor's and subcontractor's rubbish, etc.
- F. Contractor shall furnish and maintain necessary construction toilets for the use of Contractor's or subcontractor's personnel.
- G. Contractor shall furnish any temporary telephone service that may be required.

XII. PROTECTION OF PROPERTY AND PUBLIC LIABILITY

- A. Contractor shall notify the property owner before disturbing any private property, including the cutting of pavement. Contractor shall remove and replace the disturbed property (such as driveways, sidewalks, lawns, trees and shrubs) to the original condition, as nearly as possible.
- B. If trenching or excavation becomes necessary, Contractor shall protect, shore, brace, support, and maintain all underground pipes, conduits, drains, and other underground construction uncovered or otherwise affected by the construction work performed by Contractor. All pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, fences, and other surface structures affected by construction operations, together with all sod and shrubs in yards and parks, shall be restored to their original condition, whether within or outside the easement. All replacements shall be made with new materials. Contractor shall notify each owner two (2) weeks prior to commencing construction work on driveways and driveway ramps and should be approved by PacifiCorp.
- C. Prior to any trenching or digging of any kind, Contractor shall contact Blue Stake at 801-532-5000 to have known underground utilities staked.

XIII. ENVIRONMENTAL CONTROL PRACTICES

Responsibility: Contractor shall conduct all operations and work in compliance with the environmental Codes and Ordinances of the United States Environmental Protection Agency (USEPA), the State of Utah, and Wasatch County.

XIV. NOISE CONTROL

To minimize noise on and adjacent to the work area, the following measures shall be taken:

- A. Trucks and other motorized equipment shall be equipped with noise control devices and

shall be maintained to meet the applicable noise emission standards set forth by EPA (40 CFR Parts 204 and 206).

- B. If signals are used for start and finish of work each day and for lunch time, the signal period shall not be more than five (5) seconds long.

XV. DUST CONTROL

- A. Contractor shall continually take steps necessary to minimize dust created by all equipment, vehicles or work activities in its work and storage areas. These steps shall include watering roads and work areas as necessary.
- B. Contractor shall not deposit mud or debris on public streets or adjacent property. If any material is deposited on public streets or adjacent property, Contractor shall remove it immediately.

XVI. AIR POLLUTION CONTROL

- A. Open burning IS NOT PERMITTED.
- B. Trucks and other vehicles shall be maintained such that exhaust emissions from Contractor's vehicles meet EPA emission limitations applicable to motor vehicles and motor vehicles' engines (40 CFR Parts 204 and 206).

XVII. TOXIC SUBSTANCE CONTROL

- A. Toxic or deleterious wastes, including insulating fluids resulting from Contractor's activities, require special attention to prevent their introduction into natural situations, which could result in harm to people, wildlife or the natural growth of the area. Contractor shall take precautions relative to the conditions herein specified.
- B. Toxic liquids, chemicals, fuels, lubricants, insulating fluids, and bitumens shall be deposited or discharged into containers for salvage or subsequent removal by a Licensed Disposal Contractor. Care shall be taken to avoid the storage or handling of toxic liquids adjacent to, or draining into, drainage facilities.
- C. Supplies of absorbent materials or compounds shall be kept corresponding to the extent of possible spills.
- D. Solid wastes shall be disposed of in compliance with governing regulations of the State of Utah.
- E. Sewage resulting from Contractor's portable chemical toilets shall be disposed of legally.

XVIII. INSPECTION, TESTING, AND QUALIFICATION

- A. Contractor shall provide inspection, testing, and qualification in accordance with the Specification, Drawings and applicable codes. Copies of all required test and inspection

reports shall be submitted to Engineer and dates of any such inspection should be notified to the engineer beforehand. Testing and inspection includes, but is not limited to, the following:

1. The parts and components produced and the services provided in fulfilling the requirements of the Specification shall be performed in accordance with the requirements of Contractor's Quality Program. Contractor's Quality Program shall be documented in sufficient detail to assure that the Specification requirements are met during the design, procurement, assembly and test of the materials and components. Contractor's Quality Program, as a minimum, shall provide the implementing details to address the following requirements:
 - a. Organization: Personnel vested with the responsibility for the inspection and acceptance of the material, parts and components shall be remote from the responsibility for the fabrication or assembly.
 - b. Design and Document Control: The program shall provide assurance that the Specification requirements are correctly translated into and included in the design documents and drawings. The program shall further assure that the approved design documents (including changes) are available to and used by the required manufacturing, inspection and test personnel.
 - c. Procurement Control: The procurement process shall assure that purchased items, whether purchased directly or through the manufacturer's sub-suppliers/contractors, comply with the requirements of the Specification. This assurance shall be provided by the inclusion of the quality requirements into the procurement documents and adequate inspection of the material at its source or upon receipt.
 - d. Material Control: The program shall provide assurance that procured and subsequently processed material meets the Specification requirements. Material identification shall be provided and maintained throughout the manufacturing cycle. Controls shall be provided for the documentation and disposition of nonconforming material, parts or components, and their subsequent rework/repair and re-inspection. The program shall also provide for the prior notification of Company of proposed rework/repair of non-conformances, for its evaluation and approval.
 - e. Special Processes: Contractor shall assure that special processes such as welding, soldering, brazing, heat treatment, cleaning, nondestructive examination, etc., are performed in accordance with documented process procedures. The procedures shall describe the process sequence and methods, process prerequisites, equipment, qualification of personnel and equipment, and acceptance criteria. The procedures shall also describe the preparation and retention of documents used to record the results of special processes.
 - f. Inspection: The Quality Program shall provide for the in-process and final

inspection of items and activities to assure compliance with the requirements of the Specification.

- g. Calibration: Procedures shall be established to assure that test and measuring devices used to test, inspect, or accept material or components are calibrated at specified intervals to maintain the proper accuracy. Devices used shall be of the proper range, type and sensitivity to reliably measure the parameters being evaluated. The calibration of such devices shall be documented and shall be performed using certified measurement standards.
- h. Company reserves the right for its representative to inspect the Contractor's manufacturing facilities during manufacturing of the cable to be shipped for this Project.
- i. Test Control: The test program shall be suitably documented to assure that the required component or sub-component testing is properly performed. The test program shall address pertinent test prerequisites, test instrumentation selection and calibration, acceptance criteria, documentation of test results and evaluation of test results by qualified personnel.

2. Welding:

- a. All welders for structural steel welds shall be qualified in accordance with AWS D1.1.
- b. Any inspectors for Contractor or subcontractors shall be certified for whatever inspections they perform.

3. Cable Tests:

- a. Qualification Tests: Samples of cable which were manufactured using the same manufacturing facilities and which used the same polymer compounds as will be used to manufacture the cable to be supplied shall have passed the Qualification Tests specified in the most recent version of AEIC CS7.
- b. Production Sampling Tests:
 - (1) Routine Production Sampling Tests: The power cable shall be subjected to the Production Sampling Test requirements of the most recent version of AEIC CS7.
 - (2) Longitudinal Water Blocking Tests:
 - (a) In addition to the Production Sampling Tests specified in AEIC CS7, a ten-foot long sample of the cable from the structural stability tests shall be tested as follows to demonstrate the effectiveness of the longitudinal water blocking of the cable core.

(b) The test shall be performed with the cable at ambient temperature (25°C, $\pm 5^\circ\text{C}$). A ring of the cable jacket shall be removed at the center of the cable and the exposed cable core shall be subjected to water at a pressure of three (3) psig for a period of one (1) hour. The cable sample shall show no evidence of water at the ends of the cable sample after a period of one (1) hour.

c. Tests on Completed Cable:

- (1) The power cable shall be subjected to the tests on completed cable required by AEIC CS7. Contractor shall notify Company at least two (2) weeks in advance of the schedule for tests to be performed on the reels of cable to be shipped to permit Company or its representative the opportunity to witness all or part of these tests.
- (2) Contractor shall obtain approval from Company to perform any ac high-voltage tests (except for an in-process test not exceeding five (5) seconds) on the power cable less than 20 days after the cable is manufactured.
- (3) Contractor shall notify Company of any cable breakdowns that occur during ac high-voltage with stand testing of the cable that is manufactured for Company. Company shall also be notified if any reels of cable must be re-terminated in order to pass the partial discharge test requirements.
- (4) Contractor shall perform a jacket integrity test on each section of cable between manholes to demonstrate that the cable jacket has not been damaged during shipping or installation. The cable jacket shall withstand a dc voltage of 10 kV for one (1) minute.
- (5) Contractor's proposal shall include recommendations for final high-voltage acceptance testing of the completed cable system. As a minimum, the cable system shall be energized and operate without problem for a period of 48 hours.

XIX. DRAWINGS AND STANDARDS

The following drawings and standards are being supplied in Appendix A for Contractor reference only. Contractor is responsible for gathering all other information that may affect the cable size and installation.

- A. Map for Options 1-4. These maps detail beginning and ending points and the proposed line alignment.
- B. Underground Cable Standards TU 085 – TU 420

XX. WARRANTIES

Contractor shall warrant that the cable and all other material furnished under these

specifications are of first class material and workmanship throughout, that they have been tested in accordance with these specifications, and that the results of the tests comply with the requirement of these specifications for a period of at least three years from the time that the acceptance test are completed. If a warranty covered cable failure should occur, Contractor shall be required to pay all costs associated with putting the line back in service and restoring the cable to its original specifications. Contractor's proposal shall state the incremental cost of extending the warranty period to five (5) years and in 5 year increments thereafter, if available.

DIVISION 2 - SITE WORK

XXI. TRAFFIC CONTROL

A. General:

1. Contractor shall, during the progress of the Work, use proper precautions and methods of procedure and construction for the protection and control of pedestrians and vehicular traffic per City, County, or State requirements.
2. Contractor shall conduct the Work to provide the least possible obstruction and inconvenience to the public and shall have under construction no greater length or amount of work than can be prosecuted properly with regard to the safety of the public.
3. Contractor shall provide, install and maintain all necessary signs, lights, flares, barricades, markers, cones and other protective facilities and shall take all necessary precautions for the protection and for the convenience and safety of public traffic. All such protective facilities and precautions to be taken shall conform with the current applicable traffic codes and the current U.S. Federal Highway Administration's "Manual on Uniform Traffic Control Devices for Streets and Highways, Part VI - Traffic Controls for Street and Highway Construction and Maintenance Operations."
4. All required permits shall be obtained by Contractor before work on any portion of a public street or highway may begin. Copies of any required permits shall be provided to Engineer.
5. If Contractor fails to promptly provide adequate warning signs, lights, walkways and detours, Company may, at its option, so provide them at Contractor's expense. Contractor shall pay the cost of such work to Company, or Company may deduct the cost from any moneys due Contractor from the Company. The performance of such work by Company shall in no way to release Contractor from his liability for the safety of the public or the Work.

B. Access:

1. During the progress of the Work, Contractor shall provide free access to water meters, water valves and abutting public and private property. No material or obstruction of any sort shall be placed within 25 feet of any fire hydrant. Fire hydrants must be readily accessible to the Fire Department at all times.
2. Contractor shall provide proper traffic bridges where necessary so that all streets, roads, lanes, alleys, driveways and garages will be accessible to traffic at all times. These bridges shall be constructed so that their decks are flush with the pavement, and maintained free from projecting nails, splinters, or rough edges. In lieu of the traffic bridges, Contractor may use suitable steel plates. The bridges and steel plates

shall be able to support all legal highway loads permitted by law and shall have a non-skid surface.

3. Special attention is called to private and public rights-of-way. Driveways shall be kept open unless the owners of the property using these rights-of-way are otherwise provided for satisfactorily. During construction of driveways and driveway ramps, satisfactory accesses shall be provided by Contractor.
4. When material excavated for substructure construction is placed adjacent to the trench or excavation, it shall be placed in such a manner as to economize space and minimize interference with traffic. If necessary, such material shall be confined by suitable bulkheads or other devices. If the street is not of sufficient width to hold excavated material without using part of an adjacent walkway, a passageway at least one-half the width of such walkway, but not less than three feet wide, shall be open at all times.
5. When excavations cross street intersections, safe crossings for vehicles and pedestrians shall be provided and maintained. Pedestrian crossings shall be of a safe non-slip material, be separate from vehicle crossings, and be provided with handrails.
6. Contractor shall cooperate with Engineer, City, County, or State personnel and other authorized persons in locating all warning signs, lights, walkways and detours required under this section.

C. Restrictions:

1. General:

- a. A minimum of one lane in each direction of travel shall be open for vehicular traffic during working hours and non-work periods.
- b. During non-working hours, Contractor shall cover all trenches on public streets.
- c. Contractor shall provide and maintain paved detours as necessary.
- d. A roadway may be closed only with the permission of the applicable city or county authorities.
- e. Contractor shall not disturb existing traffic control signs, pavement markers, striping and markings that are to remain. All such controls disturbed by the construction activities shall be restored by the Contractor at no cost to Company.
- f. Contractor shall notify the applicable Police Department and Fire Department of the construction work in progress and the blocking of any streets during construction.

2. Construction on City and County Streets: Contractor shall apply for necessary permits at the applicable City or County, prior to commencing its operations.

XXII. FINAL CLEANUP, GRADING AND SEEDING

It is the intent of this Specification that, at the end of the Work, all holes, ruts, settlements, and depressions resulting from the Work shall be filled and graded to match elevations of adjacent surfaces, and all areas disturbed by construction shall be restored to their original condition to the extent practicable and as acceptable to the Company, City, County or State permitting authorities.

DIVISION 3- ELECTRICAL

I. GENERAL

Contractor shall supply and install all material to provide a 138 kV underground transmission cable system in existing and fabricated vaults and duct banks. The required underground transmission system will be composed of two separate circuits as described in Division 1. Material will include, but not be limited to insulated cables, neutral conductors, cable terminators, cable splices, cable support hardware, sheath voltage limiters, link boxes, surge arresters, overhead conductor dead-ending hardware and insulators, duct bank, concrete, trenching, vaults.

Rocky Mountain Power shall provide termination structures at the locations described in the introduction and as shown on the maps for each option.

On this project a total of 8 cables, 4 cables per circuit, will be installed and terminated.

II. DESIGN CALCULATIONS TO BE PERFORMED BY CONTRACTOR

Contractor shall complete the following design calculations for each cable to be provided and submit them to Company for approval prior to the start of cable manufacturing:

- A. Cable Ampacity Calculations: Ampacity calculations shall be performed with soil resistivity and ambient soil temperature data obtained from field measurements along the cable route. These calculations shall demonstrate that the cable system to be supplied to Company will meet the ampacity requirements of this Specification for the depths required. Soil thermal resistivity has been performed by PacifiCorp. Please use 0.9 deg C-cm/w for soil and 0.65 deg C-cm/w for duct bank concrete. Contractor should comply with PacifiCorp standard TU220 and TU018
- B. Cable Short Circuit Calculations: Calculations shall be submitted to demonstrate that the cable metallic sheath is capable of conducting the specified fault current without damage to any of the transmission cable components. The calculations shall show the assumed initial cable temperature and maximum allowable cable component short circuit temperatures.
- C. Cable Induced Sheath Voltages: Calculations shall be completed to demonstrate that induced sheath voltages do not exceed commonly accepted limits as discussed in IEEE Std. 575.
- D. Cable Pulling Tension: Calculations shall be completed to demonstrate that the cable pulling tension and side wall bearing pressure do not exceed the values recommended by the cable manufacturer and that they are in accordance with the recommended limits in AEIC G5.

- E. Cable Impedances: Calculations shall be completed to qualify the following electrical parameters:
1. Positive and Zero sequence series impedances.
 2. Shunt capacitive reactance.
 3. Shunt MVAR charging requirements.
- F. Insulation Coordination: Calculations shall be performed to determine the appropriate arrester rating to be used to adequately protect the cable high-voltage insulation from electrical transient over-voltages.

III. CABLES

- A. Contractor shall furnish and install all cable required to construct the line segment.
1. System Voltage: The nominal system voltage will be 138 kV phase to phase. The supplied cable shall be rated for 138 kV operation with a minimum of BIL 650 kV and impulse withstand voltage of 815 kV.
 2. Operating Frequency: The nominal system frequency will be 60 hertz.
 3. Cable Lengths:
 - a. The underground transmission cable system shall consist of three phases + one spare of 138 kV cable for each circuit and shall be the length listed in the introduction for each option. The length is the length from termination structure to termination structure and additional cable as required for riser poles and termination.
 - b. Contractor shall determine specific cutting lengths and final cable lengths for cable manufacture and installation.
 - c. Contractor shall calculate cable-pulling tensions.
 4. Company or its agent may be present for all factory testing of the cable.
- B. Cable Construction: The cable shall be suitable for installation in a concrete encased duct bank system, or direct buried, in wet or dry conditions. The components of the proposed cable shall meet the following requirements:
1. Cable Conductor: The cable conductor shall be as specified in the introduction for each of the four options and their corresponding sub-options. The manufacturer should verify that it meets the ampacity requirements specified in Division 1.V.B.8.
 2. Conductor Shield: The conductor shield shall consist of a layer of semi-conducting

extruded thermosetting polymer compound that is firmly bonded to the overlying insulation with minimum dimensions and tolerances specified in the most recent edition of AEIC CS7-93. A semi-conducting tape may be included in the cable construction between the conductor and the extruded conductor shield. The maximum protrusions of the semi-conducting conductor shield and the volume resistivity of the material shall comply with the requirements of the most recent edition of AEIC CS7.

3.High-Voltage Insulation: Cross-linked Polyethylene insulated cables shall be unfilled cross-linked polyethylene suitable for a maximum conductor temperature of 90°C under normal operation conditions. Contractor's proposed cable construction shall have a minimum average insulation thickness of 650 mils for 138 kV cables.

4.Emergency Temperature: The emergency operating temperature of the high-voltage insulation and conductor shield shall not exceed 105°C. The Contractor shall state the emergency operating temperature that is recommended for the proposed cable construction.

5.Cable Extrusion: High-voltage XLPE insulation shall be extruded onto the cable using a dry cure process. Cable extrusion lines that expose the high-voltage cable to steam during the cross-linking process are not acceptable. The cable shall be manufactured on a cable extrusion line that applies the high-voltage insulation, conductor shield, and insulation shield in the same pass through the cable extrusion line and that are cured simultaneously.

6.Insulation Shield: The semi-conducting insulation shield shall consist of an extruded layer of semi-conducting thermoset material that is firmly bonded to the cable insulation. The thickness requirements are to be those specified in the most recent version of AEIC CS7.

7.Longitudinal Moisture Barrier: A layer or layers of semi-conducting, water swellable tape shall be provided to limit the longitudinal migration of water between the cable sheath and the cable core. The water swellable tape shall be selected to accommodate expansion and contraction of the cable core for conductor temperatures in the range of 0°C to 105°C.

8.Metallic Sheath / Metallic Shield: All cable shall be manufactured with a moisture impervious aluminum or copper sheath. Both a longitudinally corrugated aluminum sheath and a solid smooth aluminum sheath will be considered. The average thickness and manufacturing tolerances for the metallic sheath shall be in accordance with ICEA S-66-525 and ICEA P-45-482.

9.The cable system shall be designed to minimize induced sheath current bases and to maintain induced sheath voltages in accordance with the recommendations of IEEE Std. 575. Cable sheaths shall be cross-linked at each vault and termination to meet these requirements.

10. Polyethylene Jacket: The cable shall be manufactured with a black, abrasion-resistant, extruded polyethylene jacket in accordance with ICEA S-66-524 with a minimum average thickness of 110 mils.

11. Jacket Coating: The cable shall be shipped with an electrically conducting coating on the outside of the polyethylene jacket that is suitable for jacket integrity tests and that will be electrically continuous after the cable is installed. This coating shall be a graphite varnish coating or a semi-conducting extruded layer.

12. Marking: The cable jacket shall be durably marked at intervals not exceeding three (3) feet with the following information:

- a. Manufacturer's name.
- b. Type of insulation.
- c. Conductor size.
- d. Conductor material.
- e. Rated voltage.
- f. Year of manufacturer.
- g. Insulation thickness.
- h. Country of manufacturer.

C. Cable Handling and Storage:

1. Contractor shall inspect each reel of cable to verify that no damage occurred during shipment. If any damage of the cable is noted, repair procedures and Company or its Engineer shall approve repairs.
2. The cable ends shall be sealed with heat shrinkable caps. The cap shall contain an adhesive that will ensure a moisture impervious seal from the time that the cable is shipped until it is installed.
3. Cable reels shall be lagged with wood to provide physical protection for the cable during shipment, storage, and handling prior to installation. A trailing rope shall be provided on each reel to secure the tail end of the cable to the reel.
4. Any spare cable shall be shipped on steel reels.
5. All cable reels shall be provided with a permanent identification tag. The tag shall be made of metal which will not corrode as a result of long-term exposure to moisture and heat. The identification tag shall have the following information:
 - a. Company's name.

- b. Company's project name and number.
 - c. Specification number.
 - d. Cable voltage rating.
 - e. Cable conductor size and metal.
 - f. Length of cable contained on the reel.
 - g. Reel number, which identifies the reel of cable to the Contractor.
 - h. Gross and net weight.
 - i. Delivery date.
6. Contractor shall paint an identification mark on both sides of each cable reel in addition to the permanent identification tag. The identification, which shall be at least two (2) inches high, shall indicate the conductor size in kcmil, the reel number which identifies the cable to Contractor, and the total number of reels shipped to Company.

D. Cable Installation:

- 1. Only experienced, skilled, competent personnel shall be used in the installation, splicing, and termination of cables. The cable system shall provide adequate support for the cable in all vertical and horizontal runs.
- 2. Contractor shall perform all work in a manner that protects the cable system from moisture and contamination.
- 3. Contractor shall perform all cable pulling operations in strict accordance with the installation procedures prescribed by the cable manufacturer.
- 4. During cable pulling, Contractor shall ensure the cable does not encounter a radius less than 79 inches, which will cause damage to the cable insulation.
- 5. A direct reading dynamometer shall be used for continuous recording of the pulling tensions.
- 6. A footage-measuring device shall be provided to show the amount of cable that has been pulled and an instrument shall be provided to show the pulling speed at any time.
- 7. The protective covering shall not be removed from the reel until it is certain that installation will proceed.
- 8. During cable pulling operations, the cable shall not be permitted to slide along the ground.

9. Reliable communication shall be provided between the winch operator and the person in charge at the reel-end of the cable pulling operation.
10. The speed of pulling shall be kept to a rate that will permit a thorough visual inspection of the cable jacket for flaws, breaks, or abrasion. The speed shall be low enough to give proper control of the pull and to allow stopping the pull to evaluate the cable if necessary.

IV. SURGE ARRESTERS

- A. Surge arresters of appropriate voltage rating shall be supplied for installation with each cable termination pothead (one (1) per conductor termination) to protect the cable system from transient over voltages. Contractor should comply with PacifiCorp standard TU275
- B. Ohio Brass PVN 314084-3001 (84MCOV) or equivalent should be used
- C. The surge arresters shall be of the metal-oxide varistor type and shall comply with the latest version of ANSI/IEEE C82.11.

V. CABLE TERMINATIONS (POTHEADS)

Cable termination potheads shall be provided by the Contractor, shall be the open-air type, and shall meet the following requirements:

Operating Voltage	138 kV
Cable Size	By Contractor
Minimum Leakage Distance	130"
Maximum Steady-State Voltage	145 kV
Impulse Withstand	815 kV
Cable Connection	NEMA 4-hole pad

- A. The Owner prefers cable terminations with non-ceramic (composite) shells and weather sheds. Contractor should comply with PacifiCorp standard TU 274
- B. The manufacturer of the potheads shall state in writing that the potheads to be supplied have passed the complete series of electrical and mechanical tests specified in IEEE Standard 48, "Standard Test Procedures and Requirements for High-Voltage Alternating - Current Cable Terminations." The potheads shall comply with all applicable sections of IEEE Standard 48.
- C. The cable manufacturer shall approve supplied potheads.
- D. Cable terminators shall be supplied complete with hardware for mounting onto the Owner furnished cable termination structures and mounting plates.
- E. Cable terminators shall be supplied with isolation insulators compatible with the cable system grounding configuration and that will allow for cable jacket testing.

- F. The terminators shall be supplied with lead wiping sleeves to maintain the hermetic sealing of the cable system where the metallic sheath is connected to the termination.

VI. OPEN-AIR TERMINATION STRUCTURES

- A. Company will design, furnish, and install open-air overhead to underground transition structures and foundations, including mounting plates. These structures will support the cable, termination pothead assemblies, and surge arresters. The existing riser structures are located at east and west side of the Golf Course, where the overhead terminates and underground begins.
- B. Contractor shall provide design information with required cable clamping arrangements, terminator pothead, and arrester mounting requirements to the Engineer for design of the Company's structures and foundations. The design information shall include weights and dimensions of hardware to be supported by the structures and any special clearance requirements.
- C. Contractor shall provide cable clamps to firmly support the power cable and attach it to the support structures.
- D. Company will design and provide a cable shroud for installation on the tubular steel termination structure. Company will coordinate delivery of the shroud to the project site. The company crew will install this shroud.

VII. LINK BOXES AND SHEATH VOLTAGE LIMITERS

- A. Contractor shall supply hermetically sealed sheath voltage limiters to ensure that the cable sheath interrupts and cable jacket are not damaged during transient over-voltage conditions and fault conditions. Contractor shall indicate the exact number of sheath voltage limiters to be supplied and the basis determining this number of sheath voltage limiters.
- B. Link boxes, shall be supplied which will make it possible to test the integrity of the cable jacket by removing bolted links.

VIII. GROUNDING

- A. The following articles cover the installation of grounding materials complete as indicated on the drawings and specified herein.
 - 1. All grounding materials required shall be furnished new and undamaged in accordance with the following requirements.
 - a. Molds, cartridges, materials, and accessories as recommended by the manufacturer of the molds for the items to be welded, any connections to the ground grid should be exothermic welds. Cadweld heavy-duty or acceptable equal. Molds and powder shall be furnished by the same manufacturer.

- b. All clamps, connectors, bolts, washers, nuts, and other hardware used with the grounding system shall be of copper.
2. Grounding system materials shall be installed according to the drawings and the requirements, which follow.
- a. Exposed conductors shall be installed inconspicuously in vertical or horizontal positions on supporting structures. When located on irregular supporting surfaces or equipment, the conductors shall run parallel to or normal to dominant surfaces.
 - (1) Conductors routed over concrete, steel, or equipment surfaces shall be kept in close contact with those surfaces by using fasteners located at intervals not to exceed 3 feet.
 - (2) Damaged ground system conductors shall be repaired or replaced by Contractor as directed by Company.
 - b. All connections shall be made by the exothermal welding process except where otherwise indicated on the drawings or in these specifications. The manufacturer's instructions on the use of exothermal welding materials shall be followed in all details. All surfaces to be joined by the welds shall be thoroughly cleaned. Paint, scale, and other deleterious substances shall be removed from surfaces of un-galvanized structural steel members by grinding. Galvanized steel surfaces shall be cleaned with emery paper. Powder and molds shall be kept dry and warm until used. Worn or damaged molds shall not be used.
 - (1) All exothermally welded connections shall successfully resist moderate hammer blows. Any connection which fails such test or which, upon inspection, indicates a porous or deformed weld shall be remade.
 - (2) All exothermal welds shall encompass 100 percent of the ends of the materials being welded. Welds which do not meet this requirement shall be remade.
 - (3) Worn, damaged, incorrectly sized, or improperly shaped molds which, in the opinion of Company, do not make satisfactory welds shall be removed from the jobsite.
 - (4) All bolted and screwed connections shall be securely tightened.

DIVISION 4- PROPOSAL REQUIREMENTS

Prior to completion of this proposal, Contractor shall be required to visit the site of proposed Work to determine any conditions that may affect the overall design. In addition, Bidders shall submit the following information with their proposals:

- A. Calculations to demonstrate that the proposed cable and conductor sized will meet the ampacity requirements stated in Division 1.V.B.8 of this document.
- B. A guaranteed completion date, including delivery date, for the transmission cable and accessories and any other milestones upon which this completion date is based.
- C. A proposed schedule for project completion.
- D. A list of exceptions to the requirements of this document and Bidder's reasons for the exceptions. If none, then so state.
- E. A list of key personnel that will be assigned to the Project..
- F. The completed documents included in Appendices B-F.
- G. Documentation to show that the cable to be supplied complies with AEIC CS7-93 including successful completion of CS7-93 Qualification tests for XLPE transmission cables.
- H. Information that describes previous experience in supplying 138kV extruded dielectric cable systems with the accessories that are proposed for the Owner's underground transmission line.
- I. A cable cross section drawing showing the components, materials, and nominal dimensions of the proposed cable. Insulation and shield compounds shall be identified.
- J. Recommended spacing between clamps on the termination support structures to support the 138kV transmission cables.
- K. Recommended minimum horizontal spacing between the surge arrestors and the cable terminations.
- L. A description of support services that are available from Bidder for emergency repairs to the underground transmission line.
- M. List of subcontractors along with their qualifications that will be used by the Bidder.

APPENDIX A – CONTRACT DRAWINGS

This appendix is to contain the following drawings:

- A. Maps for each of the four different options. Each map shows the proposed line alignment. Please remember that two separate 138kV underground systems are required for each option and that option's corresponding sub-options.
- B. Riser Pole Drawing
- C. PacifiCorp Underground Standards TU085 – TU420
- D. Heber Light and Power fiber cable/transmission trench specifications
- E. Conceptual Vault Locations
- F. PacifiCorp fiber optic trench detail

APPENDIX B – JACKET INTEGRITY TEST REPORTING.

Contractor shall record the results of all transmission cable jacket integrity tests using the following form:

CABLE JACKET INTEGRITY TEST RECORD

CONTRACTOR: _____ DATE: _____

PROJECT: _____

CIRCUIT: _____

SECTION: FROM: _____ TO: _____ LENGTH: _____

JACKET TYPE: _____ THICKNESS: _____

CABLE REEL NUMBER: _____ ☐ ON REEL ☐ TALLED

CABLE INSTALLED IN: _____

DESCRIPTION OF TEST EQUIPMENT: TYPE _____ RATING _____

LOCATION OF TEST EQUIPMENT: _____

CABLE PHASE	TEST VOLTAGE	TIME (Min.)	CURRENT (uA)	REMARKS

TESTED BY: _____ DATE: _____

WITNESSED BY: _____ DATE: _____

APPENDIX C – CONDUIT MANDREL TEST REPORT

Contractor shall record the results of all conduit mandrel tests using the following form:

DUCT SWABBING AND MANDREL TEST RECORD

CONTRACTOR: _____ DATE: _____

PROJECT: _____

CIRCUIT: _____

SECTION: FROM: _____ TO: _____ LENGTH: _____

MANDREL: LENGTH: _____ DIAMETER: _____ MATERIAL: _____

WINCH LOCATION: _____

CONDITION OF MANDREL: _____

NUMBER OF SWABS: _____

CONDITION OF SWABS: _____

REMARKS: _____

TESTED BY: _____ DATE: _____

WITNESSED BY: _____ DATE: _____

APPENDIX D – CABLE PULLING TENSION TEST REPORT

Contractor shall record the results of all transmission pulling tensions using the following form:

CABLE PULLING TENSION RECORD

CONTRACTOR: _____ DATE: _____

PROJECT: _____

CIRCUIT: _____ CABLE: _____

SECTION: FROM: _____ TO: _____ LENGTH: _____

PULLING LUBRICANT USED: _____ METHOD OF APPLICATION: _____

PULLING ROPE TYPE: _____

WINCH TYPE/LOCATION: _____

DYNOMETER USED: _____ CALIBRATION DATE: _____

MAXIMUM SUSTAINED PULLING TENSION: _____

MAXIMUM PULLING TENSION: _____

SURGING ENCOUNTERED: ☐ YES ☐ NO

REMARKS: _____

TESTED BY: _____ DATE: _____

WITNESSED BY: _____ DATE: _____

APPENDIX E – PROPOSAL INFORMATION FORM

The information required on the following pages is required by the Owner to evaluate the proposal information from a technical standpoint.

138 kV EXTRUDED DIELECTRIC CABLE AND ACCESSORIES

138Kv Cable Construction

Voltage rating nominal kV _____

Voltage rating maximum kV _____

BIL rating kV _____

Sheath short circuit 30 kA for 30 cycles _____

Minimum Sheath Thickness _____

Sheath Material _____

Short circuit conductor
Temperature, °C _____

Conductor material _____

Conductor size3, kcmil _____

Conductor construction _____

Type Stranding _____

Conductor diameter, inches _____

Conductor shield, type _____

Minimum thickness, mils _____

Insulation, type _____

Average thickness, mils _____

Maximum deviation from the
Average insulation thickness
± mils _____

Insulation overall diameter, mils
Min. _____

Max. _____

Insulation shield, type _____

Thickness, mils _____

Insulation shield overall diameter, mils

Min. _____

Max. _____

Bedding tape, type _____

Minimum thickness, mils _____

Sheath, type _____

Nominal thickness, mils _____

Jacket, (medium density) type _____

Nominal thickness, mils _____

Overall diameter, inches _____

Weight, pounds per foot _____

Maximum DC conductor
resistance at 25°C, ohms
per 1000 feet _____

Maximum allowable sidewall
pressure for cable pulling
pounds per radial foot _____

Minimum bending radius of
the cable, installation (inches) _____

Minimum bending radius of
the cable, permanent (inches) _____

Maximum allowable pulling
tension, pounds _____

Recommended minimum installation
temperature, °C _____

Recommended maximum operation
temperature, °C _____

Normal _____

Emergency _____

Recommended emergency temperature
maximum duration, hours _____

Ampacity for installation
criteria indicated in Section 9, amperes:

Normal, 90°C _____

Emergency, 105° (or 130°C) _____

Manufacturer's recommended emergency
ampacity (if operating temperature is
greater than 105°C) _____

Amperes _____

Cable Dielectric loss (W/ft at 90 °C): _____

Cable Dielectric loss (W/ft at Emergency Temp.): _____

Impedance, for single conductor,
ohms per 1000 feet:

Positive sequence impedance
Z, (typically R+jX) _____

Zero sequence impedance
Z, (typically R+jX) _____

Positive sequence capacitance, microfarads
per 1000 feet _____

Zero sequence capacitance microfarads
per 1000 feet _____

Charging current, amperes
per 1000 circuit feet _____

Design average voltage stress,
volts per mil _____

Design maximum voltage stress,
volts per mil _____

Reel material _____

Reel size, inches

flange _____

drum _____

traverse _____

Reel weight, pounds

with cable _____

without cable _____

CABLE MANUFACTURING

Location of Plant (Country, City,
And Address) _____

ISO registration and latest date of certification _____

Type of extrusion process used _____

Method of insulation curing _____

Degassing time before applying
jacket (De-gassing period), days _____

Method of applying sheath (if applicable) _____

Sheath type _____

Source and type of semi-conducting
material _____

Source of polyethylene compound _____

Designation _____

138kV TERMINATIONS

Locations of Plant (Country, City,
And Address) _____

Point of Shipment _____

Manufacturer _____

Model-catalog number _____

Continuous current rating,
amperes _____

Insulator material _____

Color _____

BIL rating, kV _____

Nominal creepage path, inches _____

Able lubricant manufacturer, type _____

Mechanical load:

Tension, pounds _____

Compression, pounds _____

Torsion, pound-feet _____

Chemical composition of stress
relief device _____

Chemical composition of insulating
material/assembly grease _____

Range of cable OD which stress
relief device fits, inches _____

SHEATH LINK BOX (S)

Type: _____

Dimensions: _____

Enclosure Material: _____

CABLE CLAMPS

Manufacturer _____

Model/catalog number _____

Mounting Requirements _____

Maximum Load _____

Vertical _____

Horizontal _____

GROUNDING

Method of attaching to cable shield/sheath _____
