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May 13, 2025

Tharon Wright
Public Utilities Regulatory Analyst III
California Public Utilities Commission
505 Van Ness Avenue
San Francisco, CA 94102
VIA EMAIL

RE: CPUC Data Request #6 for PG&E's Moraga to Oakland X 115 Kilovolt Rebuild Project (A.24-11-005) – Part B Response

Dear Ms. Wright,

This letter is in reply to your March 17, 2025, letter in which you request certain additional information regarding Pacific Gas and Electric Company's (PG&E's) application (A.24-11-005) for a Permit to Construct (PTC) and Proponent's Environmental Assessment (PEA) for the Moraga-Oakland X 115 kilovolt (kV) Rebuild Project (project). The original text for each data request item from the California Public Utilities Commission (CPUC) is included, followed by PG&E's response.

This letter provides the response to item ALT-1. Please refer to the Data Request #6 Part A response provided on April 21, 2025 for the other Data Request #6 items.

There is one attachment to this letter to support PG&E's response.

- Attachment 1 – ALT-1a Duct Bank Bend Radius Exhibit

PEA Chapter 4, Description of Alternatives

ALT-1 Some of the alternatives defined in PEA Chapter 4 would require that segments be installed underground in narrow and winding roadways, including some with "hairpin" turns. In addition, the feasibility of these 6 underground alternatives would depend on the presence and location of other buried utilities (water, sewer, distribution-level electricity, fiber, gas). The following additional information is required.

a. Please define the maximum bending angle for underground conduit or duct banks that could be constructed where all 4 circuits and are installed underground in one road, as well as for 2 circuits.

The maximum bending angle value of a duct bank can change depending on the radius of the bend in the road. Smaller bend radii would allow smaller bend angles and larger bend radii would allow larger bend angles. Therefore, the maximum bending angle is not a reliable value to consider when determining whether one or more duct banks can be installed in one road. Numerous engineering design criteria in addition to a single bend radius are required for a qualified, professional engineer to design an underground double-circuit duct bank. As such, the measurement unit of the bending radius – which is generally assumed to be approximately 40 feet for this project's cable type and double-circuit duct bank configuration (refer to Attachment 1, Duct Bank Bend Radius Exhibit) – is not useful on its own. Also, this bend radius of approximately 40 feet is reasonably feasible only when considered in the horizontal plane. Road geometry (including slope and grade) must be considered as well during design. Road geometry may not accommodate adequate lateral and longitudinal space for a double-circuit duct bank or its separation from an adjacent duct bank to maintain the required ampacity. The distance between the outside duct bank to the inside duct bank would need to maintain a minimum of 15 feet of separation.

Additionally, curvature in a duct bank is limited by cable installation criteria. Pulling tension in the cable increases exponentially through curves and sidewall pressure (a function of pulling tension) with inverse proportionality to curve radii. When a cable is pulled through a conduit, the cable brushes against the sidewall of the conduit as it is pulled into place. When the conduit is not straight, the cable will push against the sidewall as it moves around a bend. Tighter bends create more sidewall pressure. It becomes increasing difficult to pull the cable with the collective sidewall pressure resulting from the cumulative horizontal curvature (series of bends in the road).

The cumulative horizontal curvature between power line vaults determines the distance between adjacent vaults. Assuming the calculations allow, a cable might be able to be pulled through a single hairpin turn but the cable may not be able to be pulled through the next turn. The pulling calculations look at the entire run of the cable between vaults and not just individual turns. The more bends in the duct bank, the closer together the vaults need to be. Instead of the typical spacing of 1,000 to 1,200 feet, the vaults may need to be closer together to splice the line more frequently. However, lines with a greater number of splices, which would occur with more closely spaced vaults, often are less reliable during operation.

b. Please define the maximum bending angle for underground conduit or duct banks that could be constructed where only 2 circuits are installed underground in one road.

Refer to the response to ALT-1a and Attachment 1, Duct Bank Bend Radius Exhibit. The discussion on the maximum bending angle for underground conduit or duct banks that could be constructed where only 2 circuits (in a single double-circuit duct bank) are installed underground in one road does not differ from the maximum bending angle for two double-circuit duct banks installed in one road. However, in this scenario, road geometry only would need to accommodate adequate lateral and longitudinal space for one double-circuit duct bank instead of considering its separation from an adjacent duct bank to maintain the required ampacity.

c. Please define the minimum road width in which the 4 circuits could be installed underground. Would the minimum width be defined by the size and width of vaults, or by the space required for duct bank installation?

The minimum width is defined both by the size and width of vaults, the space required for duct bank installation and the minimum 15-foot separation between the closest circuit of each double-circuit duct bank. Refer to PEA at page 4-15 for the minimum road width definition of two double-circuit duct banks (4 circuits) not considering vaults or construction work areas and access:

> *Therefore, a minimum road width of at least 22 feet is needed to fit both double-circuit duct banks, not inclusive of other utility obstructions. However, utilities, including sewer and water, natural gas distribution, and telecommunication lines, are expected to be present in the roadways in unknown locations and may present additional constraints if they cannot be relocated to provide enough room for the duct banks.*

This minimum road width of at least 22 feet is required for the as-built completion and is applicable to straight sections of a road with no grade or slope. This minimum road width does not include design conditions resulting from connecting or adjacent infrastructure including connecting power line vaults, or geotechnical conditions of the road and the surrounding area. In the central portion of the project, other than the portion of Shepherd Canyon Road identified in PEA Alternative C, geotechnical conditions would likely preclude installation of two double-circuit duct banks in a single road. The risk of duct bank and road failure from a common landslide would be reduced if each double-circuit duct bank was placed in roads not within the same landslide potential. Refer to the response to Data Request #6 PD-10c, Construction in Park Boulevard Way, for additional discussion including the minimum work area width of 24 feet for installing a double-circuit duct bank between vaults.

Locations where vaults are required will necessitate more roadway width to accommodate two double-circuit duct banks (4 circuits). A minimum road width of 32 feet is needed for these locations when considering two double-circuit duct banks and the associated power line vaults, assuming that two vaults are not installed side by side and in a staggered position with a vault adjacent to a duct bank. This width is primarily defined by the size and width of the vaults as well as the required separation distance (15 feet) between cables in adjacent double-circuit duct banks. For the width of an installed power line vault connecting to a double-circuit duct bank, refer to PEA at page 3-16:

> *Vaults (approximately 22 feet by 12 feet and 10 feet tall) are located where sections of the underground cable line lengths are pulled through the duct banks and spliced together during construction. The 12-foot dimension is the vault width when installed which is less than the minimum road width of at least 22 feet is needed to fit both double-circuit duct banks.*

Construction work areas are expected to be wider than 22 feet for some construction equipment operation. From PEA page 4-16:

> *In addition, temporary construction areas wider than 22 feet would be needed for some construction activities. For example, a typical crane truck for installing precast power line vaults*

would require a work area of approximately 32 feet by 40 feet and additional space above that to rotate. Conservatively, a typical hydraulic excavator, while only approximately 16 feet wide, requires an approximately 53-foot-wide space to rotate.

d. Please define the process for determining the types, sizes, and locations of existing utilities buried in city or county roadways.

For utility surveying and locating, standard practice is to use the Utility Quality Levels based on American Society of Civil Engineers (ASCE) standard 33. The Quality Levels range from A to D. Quality Level A is the most accurate and complete and Quality Level D is a desktop study.

Quality Level D is based on documentation (historical records, utility construction and As-Built drawings, permits, locate markups, etc.).

Quality Level C builds on top of Quality Level D and requires the surveyor to go to the site and record accessible information. The surveyor will open covers and lids to utilities, mark the size of the enclosure as well as the size and direction of the utility.

Quality Level B further builds on Quality Level C by requiring the surveyor to perform a geophysical review of the site to look for all underground utilities. Data gathered during the geophysical study is added to the information recorded in the Quality Level C data.

Quality Level A is the most accurate level of utility locating by using the information from Quality Level B and visually inspecting the locations of the underground utilities. This includes going to the site and excavating each utility and providing data on the exact location of the utility and its depth.

Please refer to PEA Section 3.5.4.2 Utilities for the timing of utility surveys and the activities that will follow a utility survey:

> *Prior to any excavation, PG&E will notify utility companies (via the Underground Service Alert [USA]) to locate and mark existing underground structures along the power line rebuild locations and any other area of ground disturbance. Additionally, PG&E will conduct exploratory excavations (potholing) to prove the locations for proposed facilities as needed. A final determination on the need to relocate utilities will be made during final engineering. Localized underground utilities will be identified during final design and will be either avoided or relocated in coordination with the facility owner. If buried utilities are identified during construction and it is not reasonably feasible to avoid the line, PG&E will coordinate with the utility owner to relocate the facility. Construction methods will be adjusted as necessary to assure that the integrity of existing utility lines is not compromised. If any utility requires relocation, PG&E will provide adequate operational and safety buffering.*

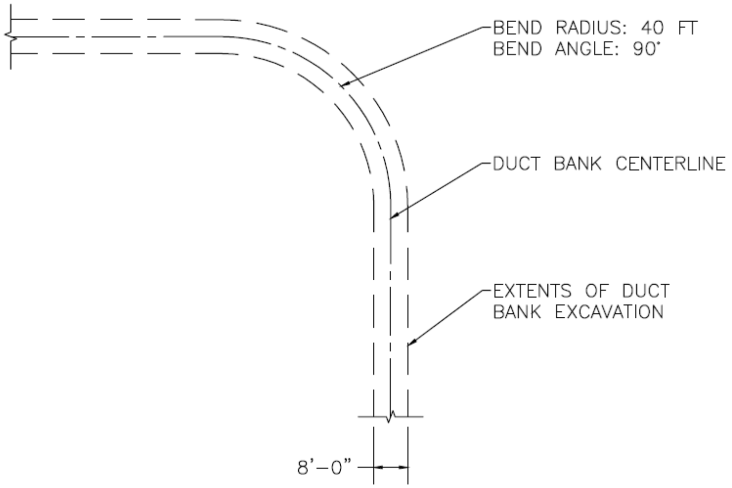
We trust the information provided herein is fully responsive to your requests. However, should you have any further requests, please contact me at **415-990-6001** or **BXLG@pge.com**.

Sincerely,

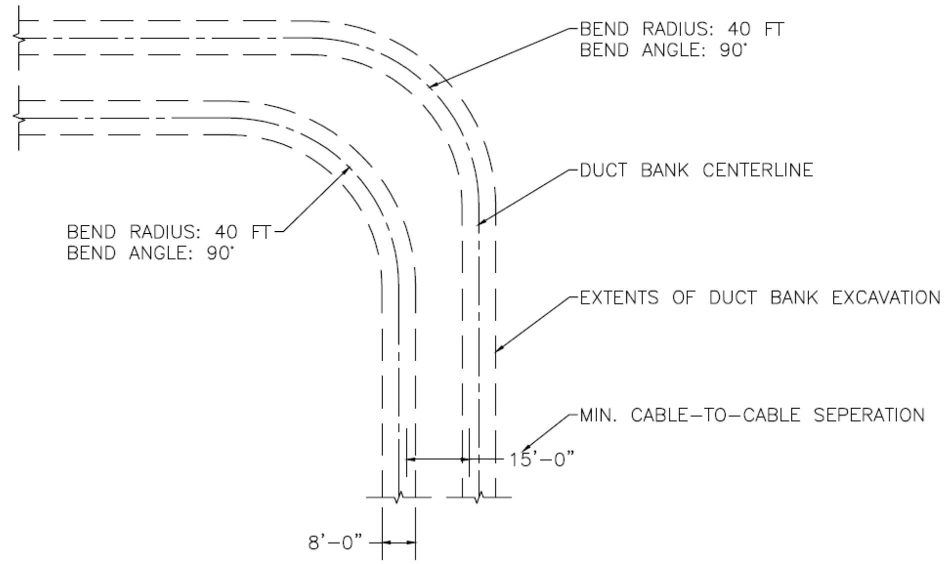
Brandon Liddell
Principal Land Planner

Attachment:
Attachment 1 – ALT-1a Duct Bank Bend Radius Exhibit

cc:
Michelle Wilson, CPUC CEQA Unit
Erica Schlemer, PG&E Law Department
Colleen Taylor, Jacobs
Hedy Koczwara, Aspen Environmental Group



PLAN VIEW
ONE (1) DOUBLE CIRCUIT DUCT BANK
BEND RADIUS EXAMPLE



PLAN VIEW
TWO (2) DOUBLE CIRCUIT DUCT BANK
BEND RADIUS EXAMPLE

CPUC Energy Division Data Request 6 Item ALT-1a
Duct Bank Bend Radius Exhibit
Moraga-Oakland X 115 kV Rebuild Project
Pacific Gas and Electric Company

Exact duct bank type, configuration, and dimensions will be determined by CPUC requirements, final engineering, and other factors and are subject to change.

Preliminary and Subject to Change Based on CPUC Requirements, Final Engineering, and Other Factors

Jacobs