PUBLIC INFORMATION

Dominion
Virginia Power

Transource Energy, LLC

# PROJECT PROPOSAL

## Axton to Clover 765 kV

***for:***

***2014 Long Term Window***

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# Axton to Clover 765 kV

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# A. Executive Summary

## A.1. Names and addresses of proposing entities

| Entity and address | Contact for Technical Inquiries |
|---|---|
| Dominion Virginia Power (Dominion)<br>701 East Cary Street<br>Richmond, Virginia 23139 | Ronnie Bailey<br>ronnie.bailey@dom.com<br>804-771-3155 |
| Transource Energy, LLC (Transource)<br>1 Riverside Plaza<br>Columbus, OH 43215-2372 | Joshua Burkholder<br>jburkholder@aep.com<br>614-716-2828 |

This proposal is a joint submittal by Dominion and Transource (together: the "Project Team") in response to the 2015 PJM RTEP Reliability Long Term Window. Transource and Dominion have agreed to jointly develop this project and will share in the investment, obligations, benefits and liabilities 50 percent each.

Transource was specifically formed as a joint venture between subsidiaries of American Electric Power Company (AEP) and Great Plains Energy Incorporated (GPE) to participate in competitive processes for transmission development. Transource can use any and all of the resources of AEP and GPE to develop and own transmission facilities. As such, the transmission experience and resources of AEP will be referenced throughout this proposal and are directly relevant to the success of the Project.

## A.2. General description of proposed project

The Project Team proposes to build the "Axton to Clover 765 kV project" (the "Project") in Virginia. The Project includes the following facilities:

- Approximately 60 miles of new single-circuit 765 kV alternating current overhead transmission line, rated at 5395 MVA summer normal and 6095 MVA summer emergency, between the existing Axton Substation owned by AEP and Clover Substation owned by Dominion.
- The Axton Substation will be expanded to accommodate the new 765 kV circuit with four new 765 kV breakers and one 150 MVAR reactor.
- The Clover Substation will be expanded to accommodate the new 765 kV circuit including one new 765 kV breaker, four new 500 kV breakers, and three new single-phase 750 MVA, 765/500 kV transformers.
- Dominion's Dooms Substation: Add a new 300 MVAR 230 kV Capacitor bank and associated switchgear.
- Dominion's Morrisville Substation: Add a new 300 MVAR 230 kV Capacitor bank and associated switchgear.
- Dominion's Shellhorn Substation: Add a new 300 MVAR 230 kV Capacitor bank and associated switchgear.
- Dominion's Liberty Substation: Add a new 150 MVAR 230 kV Capacitor bank and associated switchgear.
- Dominion's Cannon Branch Substation: Add a new 150 MVAR 230 kV Capacitor bank and associated switchgear.
- AEP's Jackson's Ferry Substation: Add a new 350 MVAR 765 kV capacitor bank and associated switchgear.
- AEP's Broadford Substation: Add a new 350 MVAR 765 kV capacitor bank and associated switchgear.

- Replace the relay at AEP's Cloverdale Station to improve the rating of the Cloverdale to Jackson's Ferry 765 kV line.
- Sag remediation of AEP's Fieldale-Thornton-Franklin 138 kV line involving relocation of distribution under-build structures.
- Replace terminal equipment at AEP's Danville and East Danville Substations to improve the rating of Danville to East Danville 138 kV line.
- Replace terminal equipment at Dominion's Carson and Rawlings substations to improve the rating of Carson to Rawlings 500 kV line.

The Project Team believes that the combination of shunt capacitors and new transmission line and station facilities included in the Project provides a robust, cost effective and feasible solution to address congestion under varying system conditions. In contrast, the Project Team evaluated various combinations of the shunt capacitor banks as standalone options (shunt-only options). Many shunt-only options do exceed the B/C threshold; however, the Project Team believes such upgrades would serve only as a short term fix to shift congestion to other areas rather than resolve the system issues. For example, a shunt-only option may reduce congestion across the AP South interface while increasing congestion across the AEP-Dom interface.

Furthermore, the Project Team believes the benefits of shunt-only options are mostly "on paper" (i.e. driven by the analysis approach) rather than benefits that will be delivered in real-time operations like those from a robust solution. To expand on this point, PJM's proxy methodology to simulate transfers across the interfaces by scaling the load up in the sink areas results in reactive deficiency which the shunt capacitors appear to stabilize. However, these analytical benefits are likely to be limited in a real-time simulation when opportunity transfers are taking place across the PJM system and sink areas are more expansive.

There are a number of violations in PJM's reliability analysis for the Gordansville, Pratts, and Remington areas of Dominion's system. These violations were part of the RTEP 2014 Window 2 for which PJM recommended a solution to resolve at the February 12, 2015 Transmission Expansion Advisory Committee meeting. This Project proposal assumes that PJM Board will approve that solution for implementation.

For the purpose of this proposal, the Project Team developed a Conceptual Route based on a desktop review of publicly available data. In addition, experienced line and station construction representatives from PAR Electric (PAR) conducted field visits to confirm the feasibility of the Conceptual Route. The Conceptual Route was used as the basis for the designs and estimates contained in this proposal. However, the Conceptual Route is not intended to represent a preferred, alternate or final route for purposes of the applicable siting, permitting and other regulatory approval processes.

The Project Study Corridor Map is provided below. Please note that this Proposal contains multiple graphics that are available in high-resolution format upon request.

[REDACTED]

**Figure 1. Project Study Corridor**

### A.3. Market efficiency flowgates addressed

The following flowgates interfaces are addressed by this solution. In addition, the Project addresses various other flowgates which are identified in section A8 below.

- AP SOUTH
- AEP-DOM

### A.4. Total proposed project cost

The estimated capital cost of the Project is approximately $317 million. This estimated cost includes all components of the Project, including components that PJM may consider as upgrades.

PJM can have confidence in the reasonableness of this cost estimate. Dominion and AEP, the two incumbent transmission owners in the immediate region of the Project, have extensive knowledge and experience developing, constructing, operating and maintaining similar facilities in Virginia.

Of particular relevance to the success of the Project, AEP is the nation's most experienced developer, owner and operator of 765 kV facilities and has a unique understanding of the cost of building such facilities. Dominion and AEP also have existing contractual relationships with multiple material vendors and service providers that further support the cost estimate presented above.

The work done by the Project Team was supplemented by analysis from Burns and McDonnell (BMcD) and PAR. BMcD provided supporting analysis and estimates for development (environmental/permitting/routing), engineering, and project management. PAR provided estimates for the construction of the line and substation components of the Project. Both BMcD and PAR are highly experienced in both the region of the Project and in building similar high-voltage transmission facilities.

### A.5. Overall schedule duration

The expected schedule duration is 58 months from the project award date. For purposes of this proposal, the Project Team has assumed a project award date of January 2016, resulting in an in-service date of October 2020.

### A.6. The value proposition

The Axton to Clover 765 kV Project will provide significant value to electric customers based on the following factors:

- **The Project delivers significant customer savings in excess of the cost.** The Project provides $693.1 million in net present value benefits, as calculated using PJM's methodology. This results in a projected benefit to cost ratio of 1.5.
- **The Project is a robust solution that greatly reduces congestion on the PJM system.** The 765 kV solution maximizes the power transfer capability over a wide geographic area. The Project increases the rating of AEP-DOM Contingency interface by 705 MW and significantly reduces loading on the AP SOUTH interface.
- **Land for the two required substation components are owned by the proponents.** AEP and Dominion own the land needed for the Axton and Clover substation expansions, respectively.
- **Extensive Virginia-specific siting and regulatory experience.** AEP and Dominion Power represent the two largest transmission owners in Virginia, providing unmatched experience navigating Virginia's unique siting and regulatory processes.
- **Unparalleled 765 kV and 500 kV experience.** AEP is the only U.S. utility that currently engineers and designs 765 kV transmission facilities bringing established standards, equipment specifications, vendor relationships, maintenance and testing practices that other utilities do not have. In addition, Dominion owns one of the largest 500 kV systems in PJM and brings deep expertise in all aspects of the Project.

- **Local knowledge and relationships in the immediate area of the Project.** Dominion and AEP's local presence and proven success mitigates many risks to the Project cost and schedule.
- **Experienced local operations and maintenance resources.** Dominion and AEP have resources in the immediate area of the Project that will provide timely operations and maintenance services that leverage existing work practices.
- **Elimination of a Special Protection System.** There is currently a Special Protection Scheme (SPS) at Clover to alleviate the transient stability risk for Clover generating units #1 and #2. This SPS is armed when the Clover to Rawlings 500 kV line is out of service. This Project will eliminate the need for the SPS thus improving the instability limitations for Clover units #1 and #2.

## A.7. Designated Entity

### A.7.a. Status/pre-qualification

Dominion has received Pre-Qualification status from PJM under ID 13-03a indicating satisfaction of the pre-qualification requirements for Designated Entity status as defined in the PJM Amended and Restated Operating Agreement ("PJM OA") in section 1.5.8(a). Consequently, Dominion is eligible as a Designated Entity to construct, own, and operate facilities within PJM's footprint. The information as posted on PJM's website reflects the Company's current qualifications.

Transource has received Pre-Qualification status from PJM under ID 13-05 indicating satisfaction of the pre-qualification requirements for Designated Entity status as defined in the PJM OA in section 1.5.8(a). Consequently, Transource is eligible as a Designated Entity to construct, own and operate facilities within PJM's footprint. The information as posted on PJM's website reflects the Company's current qualifications.

### A.7.b. Statement of intent

For this proposal, the Project Team seeks to be the designated entities to construct, own, operate, maintain and finance the Project, with the exception of any new facilities considered an upgrade by PJM.

## A.8. Discussion of analytical details and results

The Project Team has studied the calculations of AEP-DOM and AP South reactive interface limits and believes that these interfaces are interrelated. As such, any proposed project focused only on fixing the AP South interface will in turn increase congestion on AEP-DOM interface and vice versa. The Project Team has focused its efforts on proposals that not only meet or exceed the 1.25 Benefit / Cost (B/C) threshold, but also offer a considerable reduction in the projected congestion.

Determining the benefits offered by the Project requires a two-step process. The first step involves running a PV analysis to determine the increase or decrease in the ratings of AP South, AEP-DOM and other relevant reactive interfaces. The second step involves computing the regional or local benefits, based on the voltage of the proposal, using the change in ratings of the interface.

### A.8.a. Interface Ratings

The Project Team understands that the limit is computed using the latest RTEP peak model with Security Constrained Economic Dispatch (SCED). The incremental improvement in the AP South and AEP-DOM interface ratings should remain proportional as long as the source, sink, monitored elements and contingencies are consistent with PJM's document on "Determination of Real-Time Inter/Intra Regional Transfer Capability PJM EMS Transfer Limit Calculator".

For the AP South and AEP-DOM interfaces, the voltage deviation and the voltage magnitude limits are based on the TO's Planning Criteria. The Project Team has performed a generation to load transfer analysis, where generators in the source areas are scaled up and the load in the sink areas are scaled up. All Phase Angle Regulators (PAR) are locked, the source generators are scaled up to 110% of their limits, and sink loads are scaled up without limits. Capacitor banks and Load Tap Changers (LTCs) are allowed to adjust pre-contingency. Also, Capacitor banks are allowed to adjust post-contingency.

The rating improvements are listed below:

| **Interface** | **Rating Change (MW)** |
|---|---|
| AP South | 35 |
| AP South for loss of Black Oak – Bedington | 65 |
| AEP-DOM for loss of Black Oak – Bedington | 705 |
| Central | 40 |
| Western | 90 |
| 5004/5005 for loss of Kenny – Rocksprings | -5 |
| Black Oak – Bedington | 10 |
| Black Oak – Bedington for loss of T157 - Doubs | 15 |

**Table 1. Axton-Clover 765 kV Rating Improvements**

### A.8.b. Economic Benefits

The second step in the process involves computing the economic benefits of the Project. The Net Present Value (NPV) of the Project cost and benefits along with the calculated B/C are listed below. These values are based on the in-service date stated above.

| 15-Year Net Present Value of Aggregated Cost (in millions) | 15-Year Net Present Value of Benefits using the Regional Metric (in millions) | Benefit / Cost using the Regional Market Efficiency Metric |
|---|---|---|
| $461.2 | $693.1 | 1.5 |

**Table 2. Axton-Clover 765 kV Economic Benefits**

The table below shows sizeable reduction in congestion on various interfaces and facilities identified by PJM

| Flowgate | Congestion Reduction in 2022 (in millions) | Congestion Reduction in 2025 (in millions) |
|---|---|---|
| AP South FLO Black Oak – Bedington 500 kV | $26 | $46 |
| AEP-DOM FLO Black Oak – Bedington 500 kV | $10 | $19 |
| Fieldale – Thornton 138 kV FLO Cloverdale – Jackson's Ferry 765 kV | $9 | $14 |
| Danville – East Danville 138 kV FLO of Jackson's Ferry – Antioch 500 kV | $3 | $8 |

**Table 3. Axton-Clover 765 kV Congestion Reduction**

## B. Company Evaluation Information

Note: Dominion and Transource will execute the Axton to Clover 765 kV Project using Dominion and AEP's proven resources and standardized practices to develop, own, operate and maintain transmission assets. Dominion and AEP have successfully executed similar projects within their territories, including those within Virginia.

### B.1. Technical and engineering qualifications

#### B.1.a. Dominion

Dominion is one of the nation's largest producers and transporters of energy, with a portfolio of approximately 24,600 megawatts of generation, 10,900 miles of natural gas transmission, gathering, and storage pipeline and 6,455 miles of electric transmission lines. Dominion operates one of the nation's largest natural gas storage systems with 949 billion cubic feet of storage capacity and serves utility and retail energy customers in 11 states.

Dominion's existing electric transmission facilities are all within the PJM footprint. Dominion has an Electric Transmission staff of over 800 engineers, technicians, operators, and other construction and support personnel dedicated to develop, construct, maintain, and operate these facilities. Dominion has over 80 years' experience in developing, constructing, maintaining and operating transmission facilities, including the most recent nine years as a PJM member.

Dominion has a fully-staffed Substation Engineering team inclusive of Physical Design, System Protection Design, Communications support, Site Plan Development; and Transmission Line Engineering inclusive of overhead and underground design, Civil Engineering support and Geotechnical support. Dominion is fully-staffed for engineering support activities inclusive of siting/routing transmission lines, site development for substations as well as all real estate-related activities.

#### B.1.b. Transource / American Electric Power Company & Great Plains Energy

AEP is one of the largest electric utility holding companies in the United States. AEP is headquartered in Columbus, Ohio. AEP delivers electricity to more than five million customers in 11 states. AEP operating utilities provide service to retail and wholesale customers in Arkansas, Indiana, Kentucky, Louisiana, Michigan, Ohio, Oklahoma, Tennessee, Texas, Virginia and West Virginia. AEP directly or indirectly serves about 10 percent of the electricity demand in the Eastern Interconnection and approximately 11 percent of the electricity demand in the Electric Reliability Council of Texas region.

AEP owns, operates and maintains the largest transmission system in the United States, across the widest spectrum of voltage classes, with $8.6 billion in transmission assets in 2012. This is forecasted to grow to more than $11 billion by 2015. This 39,000-mile network includes 2,022 miles of 765 kV Extra-High Voltage (EHV) transmission lines, which is more than all other U.S. transmission systems combined.

The entire AEP transmission system is planned and operated on an integrated basis through the coordinated efforts of the AEP Transmission Department (AEP Transmission), a business unit of American Electric Power Service Corporation. AEP Transmission employs over 2,000 professionals with the capability to develop, engineer, design, construct, operate and maintain transmission assets at any voltage. AEP Transmission coordinates all development and operational aspects, including engineering, project management, design, development, rights-of-way acquisition, construction, operation and maintenance, of AEP's transmission business on behalf of its utility operating companies and transmission companies.

AEP Transmission employs nearly 450 professionals in line, station, and protection and control engineering functions. In-house engineering expertise allows AEP to consistently

deliver high-quality results and advanced technical innovations that both improve the transmission system and add value for customers. These skills have been developed over a 100+ year history of siting, designing, constructing and operating over 39,000 miles of transmission lines and over 4,000 substations.

GPE is the holding company of Kansas City Power & Light and Greater Missouri Operations, two of the leading regulated providers of electricity in the Midwest serving more than 823,000 customers in Kansas and Missouri. GPE is headquartered in Kansas City, Missouri. GPE has a strong history for enhancing and investing in its core business and new strategic growth opportunities in order to provide customers with reliable and effective electric service. Through these investments and strategic initiatives, GPE has doubled its rate base investments over the last several years. GPE is a significant transmission owning company and one of the largest transmission owning members of the Southwest Power Pool; GPE operating companies own over 2,600 miles of transmission lines operating at voltages up to and including 345 kV.

## B.2. Experience

### B.2.a. Types of facilities proposed

The facilities being proposed for this joint proposal are within both AEP and Dominion's existing transmission zones in PJM. The types of facilities in this proposal are those both companies have extensive experience developing, operating and maintaining on a daily basis.

***AEP's Unique Experience with 765 kV Facilities***

Of particular relevance to the Axton to Clover 765 kV Project, AEP is the only utility in the United States that currently owns, operates, engineers, and constructs 765 kV facilities. AEP currently owns and operates 2,022 line miles and 39 substations at 765 kV. AEP's established design criteria, standards and specifications, created through over 40 years of AEP's research, development and operational experience, are not available to other utilities and are a decided advantage when designing a project in an efficient and cost effective manner. AEP's rigorously proven standards, practices and procedures will be used on this Project.

With 765 kV facilities as the primary backbone of its transmission network, AEP has standards, equipment specifications, vendor relationships, maintenance, and testing practices that other utilities would not. Material and equipment for 765kV line voltage are not standard catalog items and cannot be developed by extrapolating lower-voltage designs; AEP has experience and capability at this voltage.

The 765 kV facilities also present unique challenges for safe and reliable operations and maintenance. AEP East Transmission crews have been performing maintenance on the 765 kV system since its inception in the 1960s. Safety is paramount, and AEP has developed the knowledge, skills, and equipment to perform maintenance safely and cost-effectively. In addition to performing the work with its own staff, AEP has the capabilities to effectively oversee the work being done by third-party providers. Maintenance completed that is indicative of these skills includes:

- Bucket trucks with insulation levels required for 765 kV maintenance.
- Insulator string and spacer replacements.
- Conductor bundle repair and replacement.
- Tower maintenance and replacement of fallen structures.

- AEP also pioneered helicopter live line maintenance for 765 kV to perform many maintenance tasks without requiring outages.

### B.2.b. Standardized construction, maintenance, and operating practices

Both AEP and Dominion also have fully developed standardized construction, maintenance, and operating practices. All work and design meets and adheres to the *PJM Transmission and Substation Design Technical Requirements* and *PJM Manual 7 - PJM Protection Standards*.

As mentioned above, the Project is completely within the existing transmission footprint of AEP and Dominion and exclusively interconnects to existing facilities owned by Dominion and AEP. As such, construction, maintenance and operations of the Project will seamlessly integrate into the successful ongoing practices of both owners. These new facilities will use the same standard construction, maintenance, and operating practices for their respective utilities.

It is important to point out again that AEP is the only utility in the United States with established standardized construction, maintenance and operating practices for 765 kV facilities. No other transmission developer can rely on its own experience and resources for safe and cost effective construction, maintenance and operations of new 765 kV facilities.

For more information on either Company, please refer to the pre-qualification documents posted on PJM's website.

### B.2.c. Working and acquiring rights-of-way in the geographical region

The Project is within the geographical region of both AEP and Dominion's existing transmission system. For Transource, this will become part of the PJM Western region; for Dominion, the facilities will be part of the PJM Southern. All new facilities will be operated and maintained by existing resources of both companies.

As one of the largest transmission owners in Virginia, both AEP and Dominion have extensive experience in working in southern Virginia, including right-of-way acquisition. As mentioned above, AEP owns over 2,700 miles of transmission line in various parts of the state. Dominion has over 6,400 miles of transmission of which the majority is in the state of Virginia.

AEP has successfully sought and obtained certificates of public convenience and necessity from the Virginia State Corporation Commission authorizing the construction of over 15 recent transmission projects with voltages of 138 kV, 230 kV, 345 kV, 500 kV and 765 kV, including a 90 mile interstate 765 kV transmission line, about 60 miles of which is located in Virginia.

Dominion has successfully sought and obtained certificates of public convenience and necessity from the Virginia State Corporation Commission authorizing the construction of over 20 recent transmission projects with voltages of 230 kV, and 500 kV, including a 65-mile 500 kV Meadowbrook to Loudoun transmission line, a 61-mile 500 kV Carson to Suffolk transmission line, and a 96-mile 500 kV Mount Storm to Doubs transmission line.

Transource will secure federal and state regulatory approvals to finance, construct, own, operate and maintain the new transmission facilities as a transmission-only entity in Virginia. Transource will draw on AEP's extensive experience and successful track record of securing federal and state regulatory approvals for transmission-only entities in states both within and outside of its traditional utility footprint. AEP has received approvals for new transmission-only utility companies in ten states within the last several years. PJM can also be confident in the ability of Transource to secure these approvals because Transource has demonstrated success to date with its utility subsidiary in Missouri.

### B.3. Financing plan

Dominion Virginia Power is a subsidiary of Dominion Resources, a leading Fortune 200 energy company with a market capitalization of $43 billion. Dominion Resources has a long and consistent track record for large annual capital investments. Dominion Resources will acquire and invest over $19 billion over the next 6 years. Dominion Virginia Power will invest approximately $4.4 billion of that amount over the same period in electric transmission assets. Dominion Resources, Inc. will provide all appropriate financial and credit support to Dominion Virginia Power.

Transource and its subsidiaries are backed by the significant financial strength and experience of its investment-grade owners, AEP and GPE, which have combined assets totaling approximately $66 billion and well-established relationships with more than 40 banks specializing in the financing needs of the energy generation and delivery industry. In particular, AEP has been highly active in the capital markets, successfully raising approximately $8.2 billion in debt since the start of 2011. Specifically, Transource successfully established a $350 million construction financing in the fall of 2013 for its two projects under construction in Missouri.

Refer to the filed pre-qualification documents of Transource and Dominion posted on PJM's website for more information regarding the financing strength of both companies.

### B.4. Cost containment and adherence to construction schedules

AEP and Dominion, combined, employ more than 250 professionals in the Transmission Project and Construction Management functions. AEP and Dominion annually manage large projects with a combined value of over $2 billion. AEP and Dominion's substation and line project managers are capable of executing projects of varying complexity from small projects, such as the addition of circuit breakers, to large projects, including the construction of 765 kV line in mountainous terrain.

A few examples of AEP and Dominion's recent projects delivered on-schedule and within budget include:

- As part of a PJM approved project, Dominion constructed the Carson to Suffolk 500 kV line project. This projected consisted of 60 miles of 500 kV line on new or paralleled ROW and a new 21.5 mile 230 kV circuit on existing ROW. The total estimated project cost as provided to the VA SCC for the CPCN filing was $224 million of which the line portion was estimated at $200.3 million. The final installed cost of the total project came in at $205 million with an actual line construction cost of $179.2 million. The CPCN filing for this project is publically available from the VA SCC.
- Dominion constructed the 65 mile line #580 to Loudoun 500 kV line (Part of 502 Junction-Loudoun) – Obtained right-of-way (ROW) and Certificate of Public Convenience and Necessity (CPCN) approval in Virginia and constructed line by the PJM target date of 6/01/2011 within the approved budget.
- Dominion rebuilt 96 miles of the Mt Storm to Doubs 500 kV rebuild project – Obtained CPCN in Virginia. Project was completed one year in advance of the PJM required target date of 6/01/2015 and within the approved budget.
- AEP managed the construction of approximately 465 miles of double-circuit 345 kV lines and 16 substations and the acquisition of ROWs across 578 tracts of land, coordinating efforts between multiple ROW agencies, construction companies and suppliers for the Competitive Renewable Energy Zone (CREZ) projects in Texas. AEP simultaneously constructed the line in sections while managing it as one project to ensure completion of this exceptional project within the project schedule. AEP Transmission's $1.5 billion investment in the CREZ program makes it the largest transmission project in AEP history.
- AEP worked with engineers, government entities, ROW agents, construction contractors, city, state, and local authorities to oversee the reconductoring of approximately 216 energized miles of 345 kV transmission lines in south Texas.

- AEP managed the construction of a new transmission substation near Sunbury, Ohio. The 765/345/138 kV Vassell Station is a major transmission reinforcement effort to help AEP maintain transmission reliability in central Ohio.

### B.5. Commitments

The Project Team commits to not seek any return on equity risk adders for any portion of the Project designated jointly to the Project Team.

### B.6. Assumptions in developing proposal

Key assumptions are noted within the applicable sections of this proposal document.

## C. Proposed Constructability Information

[REDACTED]

## Appendix A – Project Component Diagrams

[REDACTED]