Design Consultant Cost Estimating Manual

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1.0 Purpose of this Manual

This purpose of this manual is to provide guidance on the rules and standards for the preparation of cost estimates in support of capital projects developed in accordance with JEA's Capital Project Delivery Process found in Attachment A.

The engineer's estimate is a critical part of JEA's project development process since it serves as a basis for probable construction cost, establishes the project budget, supports decision-making on project scope and serves as a guide to evaluate bidder's proposals. Accurate estimating is an important component of JEA's cost-management process, as well as an important decision-making tool for the design team in its selection of systems and materials.

Sound financial programming requires consistent and reasonable cost estimates. Accurate cost estimates allow project stakeholders to establish reliable funding plans for their projects and enables JEA to program sufficient funding to support those projects.

2.0 Application

This manual is required for use on all Water/Wastewater capital projects delivered in accordance with Attachment A. This typically includes all projects except for Development and Joint Agency projects or projects with design fees less than $35K. A Basis of Estimate Report will be developed and submitted, along with other required deliverables, at each of the design submittal milestones (e.g., 30%, 60%, etc.) in accordance with the JEA Capital Project Delivery Process. An updated estimate may be required for change orders that include revised or new design drawings and/or specifications.

Estimates must take into account the current climate of the construction industry and market conditions in and around Northeast Florida.

3.0 Detailed Procedures

3.1 General

The requirements detailed in this manual will help ensure the consistent development and updating of project cost estimates across all capital projects while allowing for reasonable estimate certainty and contingency determination. This manual is intended to improve understanding among all parties involved in preparing, evaluating and approving project cost estimates.

This manual provides requirements adapted from AACE Recommended Practices for applying the general principles of estimate classification to project cost estimates. The cost estimate classification system maps the stages of cost estimating together with project scope definition maturity and estimating methodology while establishing a guideline for estimate accuracy.

3.2 Estimate Submittals

Table 1 below shows the estimate class, level of project definition and expected accuracy ranges to be used when developing estimates in accordance with this manual. The information contained in Table 1 aligns with JEA's Capital Project Delivery Process found in Attachment A.

DESIGN SUBMITTAL	ESTIMATE CLASS	LEVEL OF PROJECT DEFINITION	EXPECTED ACCURACY
Project Definition	Class 5	3%-5%	-30% to +50%
10%	Class 4	10%	-30% to +30%
30%	Class 3	30%	-15% to +30%
60%	Class 2	60%	-15% to +20%
90%	Class 2	90%	-10% to +15%
100%	Class 1	100%	-5% to +10%

TABLE 1 – ESTIMATE SUBMITTALS

3.2.1 Project Definition Estimate

Description: Project Definition (PD) estimates correspond to projects in their initiation phase where the level of project definition is typically 3% to 5%. They are generally prepared based on limited information and subsequently have a wider range of potential outcomes and costs. Estimate basis assumptions at this stage should be documented in order to explain variances should future estimates be significantly higher or lower.

End Usage: PD estimates may be used for initial funding, forecasting future expenditures, initial project screening and preliminary project prioritization.

Accuracy Range: The PD estimate is equivalent to an AACE Class 5 estimate with an expected accuracy range of -30% to +50%.

3.2.2 10% Design Estimate

Description: 10% design estimates correspond to projects in the schematic design phase where the level of scope definition is approximately 10% and are prepared with more information than a PD Estimate but still with limited project details. Like PD estimates, 10% design estimates also have a fairly wide range of potential outcomes as the project scope still isn't well-defined. Typically, schematic design is comprised of, but not limited to, planned plant capacities, block schematics, route maps and/or site layouts.

End Usage: 10% design estimates may be used for initial project screening, determination of final scope, preliminary project prioritization, initial funding, forecasting future expenditures and reforecasting total project budget.

Accuracy Range: The 10% design estimate is equivalent to an AACE Class 4 estimate with an expected accuracy range of -30% to +30%.

3.2.3 30% Design Estimate

Description: This 30% design estimate is based upon documents prepared for the 30% design submittal and should include all major elements of the project. The Water/Sewer Milestone Deliverable Checklist found in Attachment B contains a detailed list of conceptual design deliverables that could influence the estimate prepared for 30% design. Project risks should be developed to support contingency levels contained in the 30% design estimate.

End Usage: The 30% design estimate is required for the 30% design checkpoint to support project funding requests, forecasting future expenditures and reforecast total project budget.

Accuracy Range: The 30% Design estimate is equivalent to an AACE Class 3 estimate with an expected accuracy range of -15% to +30%.

3.2.4 60% Design Estimate

Description: This estimate is based upon documents prepared for the 60% design submittal and should include greater detail for the major project elements, as well as most minor elements. Many specific project risks should be understood at this time and should be used to support contingency levels contained in the estimate. The Water/Sewer Milestone Deliverable Checklist found in Attachment B contains a detailed list of final design deliverables that could influence the estimate prepared for 60% design.

End Usage: The 60% design estimate will be used to update the project budget and, if necessary, formally change it if there is a significant change (±10%) from the last trended estimate.

Accuracy Range: The 60% design estimate is equivalent to an AACE Class 2 estimate with an expected accuracy range of -15% to +20%.

3.2.5 90% Design Estimate

Description: The 90% design estimate is based upon documents prepared for the 90% design submittal. Engineering is in the final design phase and nearing completion. Most specific project risks should be understood at this time and should be used to support contingency levels contained in the estimate.

End Usage: The 90% design estimate will be used to update the project budget if there is a significant change (±10%) in the total project budget from the last trended estimate.

Accuracy Range: The 90% design estimate is equivalent to an AACE Class 2 estimate with an expected accuracy range of -10% to +15%.

3.2.6 100% Design Estimate

Description: The 100% design estimate is based upon documents prepared for the 100% design submittal. Engineering is complete and the estimate is based on the final design of the project, completed specifications and a detailed implementation schedule. The estimate should also consider any special terms or conditions in the contract. All of the project risks should be developed at this time in order to support the inclusion of a Supplemental Work Authorization in the estimate.

End Usage: The 100% design estimate is used to update the project budget and contributes to the final decision to bid the project for construction.

Accuracy Range: The 100% design estimate is equivalent to an AACE Class 1 estimate with an expected accuracy range of -5% to +10%.

3.3 General Estimate Requirements

Each estimate will indicate the phase of the project and the estimate classification. The estimate will include an assessment of the difficulties inherent in the construction work and will document the determination of productivity, production, and pricing for preparing the estimate. This includes such factors as labor conditions, construction equipment, construction supervision, material costs, and equipment installation costs. All reasonable costs a construction contractor can expect to incur must be included.

3.3.1 Characteristics of a Good Cost Estimate

In general, a cost estimate should answer a series of questions as shown below:

- Scope:
    - What is included?
    - What is excluded?
    - Does the scope of the estimate match the scope of the defining documents?
    - Any variations must be identified and the reason for the deviation explained.
- Quantities:
    - Are the quantities reasonable?
    - Is the method clear and easy to follow?
    - Has the math been checked?
    - Do the totals come forward to the summaries?
- Pricing:
    - Are the unit prices reasonable?
    - Are the explanations reasonable?
    - Does the pricing cover the type and quality of materials contemplated?
    - Are incidentals like sales tax and freight covered?
    - Have unusual working conditions been factored into the pricing?

- Support and other soft costs:
    - Did you consider work by others?
    - Are environmental studies considered?
    - Are preliminary engineering and final design included?
    - Are the construction staking and construction management covered?
- Presentation:
    - Is the estimate presentation clear?
    - Is it easy to follow?
    - Is the basis of the estimate documented in a concise fashion so that it will be readily understood by an unfamiliar party?

3.3.2 Estimate Accuracy

Estimates should be the best prediction of cost. They should take into account every reasonable cost but not be purposely high such that a more than ample budget is always set. Due to the expected accuracy ranges contained in Table 1, estimates already have a transparent bias towards a higher cost and, therefore, should not be artificially inflated. Figure 1 shows this bias graphically on a $1,000,000 estimate.

Estimate Submittal	PD	10%	30%	60%	90%	100%
Upper Accuracy Range %	50%	30%	30%	20%	15%	10%
Upper Estimate Value	$1,500,000	$1,300,000	$1,300,000	$1,200,000	$1,150,000	$1,100,000
Estimate Value	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
Lower Estimate Value	$ 700,000	$ 700,000	$ 850,000	$ 850,000	$ 900,000	$ 950,000
Lower Accuracy Range %	-30%	-30%	-15%	-15%	-10%	-5%

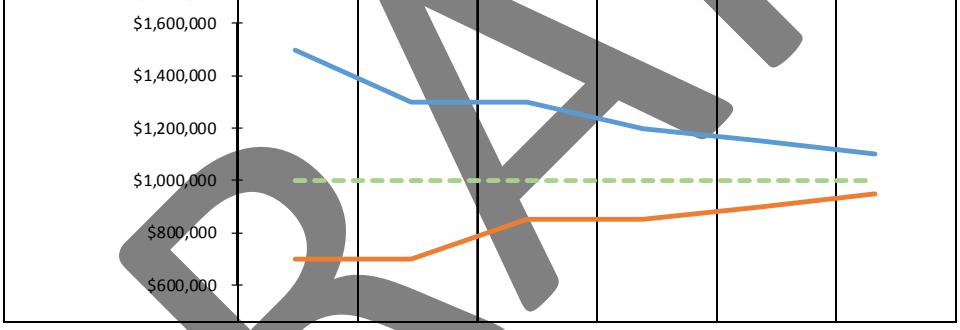

FIGURE 1 - ESTIMATE BIAS

3.4 Estimate Format

3.4.1 Basis of Estimate Report

All estimate documentation will be neatly bound in a report, or compiled in a single electronic file, called the Basis of Estimate (BOE) Report. AACE International Recommended Practice 34R-05 provides general guidance when creating the BOE.

A well prepared BOE will:

- Document the overall project scope.
- Communicate the estimator's knowledge of the project by demonstrating an understanding of scope and schedule as it relates to cost.
- Alert the project team of potential costs risks and opportunities.
- Provide a record of key communications made during estimate preparation.
- Provide a record of all documents used to prepare the estimate.
- Act as a source of support during dispute resolutions.
- Establish the initial baseline for scope, quantities and cost for use in cost trending throughout the project.

- Provide the historical relationships between estimates throughout the project lifecycle.
- Facilitate the review and validation of the cost estimate.
- Document the estimate in a logical, consistent and legible manner.

The following information is required in each BOE report:

- **Cover Page:** A cover page that clearly indicates the project, estimate classification, estimator and the date completed.
- **Purpose of Estimate:** A brief and concise description of why the estimate was performed (e.g., establishment of probable construction cost at the 30% level of design).
- **Scope Description:** A semi-detailed description of the scope of work for each major segment of the project. Identify any major pieces of process equipment or components.
- **Overall Cost:** A single line rollup of estimated construction cost including the high and low ranges based on estimate class. Clearly indicate the expected range of accuracy.
- **Estimate History:** A short description of the history of the estimate(s) generated to date for the project at a summary level.
- **Estimate Methodology:** A description of the primary estimating methodology used to prepare the cost estimate. This should include documentation of the use of cost resources, historical data and project benchmarking.
- **Source Documents:** A detailed list/description of the documents used to generate the estimate (e.g., drawings, specifications, etc.) including revision numbers and issue dates.
- **Markups:** Identification of markup percentages used (overhead and profit, builder's risk, and bonds) and how they were determined.
- **Escalation Rate:** A description of the escalation calculation including the assumed start, end and mid-point dates of construction, the annual escalation rate used and the resulting total escalation.
- **Cost Basis:** A description of the methods and resources used for determining all material, labor and subcontract pricing to include pricing sources for equipment, bulk material, labor hours, taxes, influence of local market conditions, etc.
- **Assumptions:** A detailed list of assumptions used to build the estimate.
- **Excluded Costs:** A list of costs not included in the estimate such as hazardous materials remediation, acquisition of land, financing, etc.
- **Allowances:** A list of allowances made for known requirements not yet specified in the source documents. Include the basis for calculating the cost (e.g. X percent of net total).
- **Contingency:** A detailed explanation of the contingency amount used in the estimate, what it's for and how it was derived.
- **Supplemental Work Authorization:** Justification, including calculations, for determining the Supplemental Work Authorization percentage at 100% design.
- **Exceptions:** A list of variances to this standard or significant deviations from the project and/or engineering deliverables normally required for the applicable class of estimate.
- **Appendices:**
    - Total Estimate Summary
    - Estimate Reconciliation
    - Detailed Construction Estimate
    - Reference Documents (e.g., vendor quotes, estimate calculation and takeoffs, assumptions, allowances and any other documentation gathered and/or utilized in the development of the estimate)

3.4.2 Basis of Estimate Report Appendices

3.4.2.1 Total Estimate Summary

The Total Estimate Summary is a one page summary that shows both direct and indirect project costs on a single page. The JEA Project Manager (PM) will provide the design consultant with the indirect costs in order to complete the estimate. Indirect costs generally include JEA Project Management labor, Engineering, Services During Construction, Project Support and Real Estate.

A sample Total Estimate Summary is included as Attachment A. The values used in the sample are for example use only.

3.4.2.2 Estimate Reconciliation

The purpose of the Estimate Reconciliation is to show the evolution of the project estimate over time, identification of significant variances and explanations of the same. The Estimate Reconciliation should summarize the estimate at Level 2 as defined in 3.5 below.

Each Level 2 asset line will include the compounded markup percentages for Overhead & Profit, Builders Risk, Bonds and Escalation. Note that JEA SWA is only used on the 100% design estimate in the place of contingency. The SWA percentage must be calculated using section 3.8 below.

A sample Estimate Reconciliation is included as Attachment C. The values used in the sample are for example use only.

3.4.2.3 Detailed Construction Estimate

The detailed construction estimate contains the quantity, unit and hours information used to develop the total construction cost. The detailed construction estimate should break down detailed asset construction costs to Level 3 (i.e., individual assets) depending on the scope of the project and requirements of the Property Retirement Unit Catalog (PRUC) as discussed in section 3.5 below.

Each individual row of the detailed cost estimate should contain the following:

- Line #
- WBS
- Asset/Item Description
- Quantity
- Units
- Labor Man-Hours
- Labor Rate
- Labor Total Cost
- Material Unit Cost
- Material Total Cost
- Equipment Unit Cost
- Equipment Total Cost
- Unit Cost
- Total Cost

It's understood that consultants may utilize software to perform estimates and that different software packages have differing capabilities. Because of that, the detailed cost estimate data listed above is flexible but should be adhered to as much as possible. The consultant should notify the JEA PM at the design kick off meeting if they are unable to provide the information listed above to ensure the detailed estimate meets JEA's asset cost accounting requirements.

3.4.2.4 Reference Documents

Any reference documents (excluding drawings) supporting the development of the construction estimate should be included in this section of the BOE report.

3.5 Work Breakdown Structure

The Work Breakdown Structure (WBS) provides a mechanism to organize the project into a hierarchical framework for the purposes of planning, estimating, and monitoring. The construction scope of the project is to be broken down into unique and manageable parts that correspond to property units (Level 2) and assets (Level 3 and 4) as defined by the JEA Property

Retirement Unit Catalog (PRUC). Once the WBS is developed, costs are estimated at Level 3 (or below) for the detailed construction estimate and rolled up to Level 2 for the Estimate Reconciliation. The design consultant is not required to develop the indirect cost portion of the WBS.

In general terms, the construction estimates are to be organized as follows:

3.5.1 Plant Projects

- Level 1: Project
    - Level 2: JEA Property Unit (Per JEA PRUC)
        - Level 3: JEA Asset (Per JEA PRUC)

Example:

- *Northwest Regional WTP*
    - *Building*
        - *Building*
        - *Bridge Crane and Motor*
    - *Pumps*
        - *High Speed Pump – Pump ≥ 15 hp*
        - *High Speed Pump – Motor*
    - *Supply Main*
        - Supply Mains – Steel
        - Valves

3.5.2 Grid Projects

- Level 1: Project
    - Level 2: JEA Property Unit (Per JEA PRUC)
        - Level 3: JEA Asset (Per JEA PRUC)

Example:

- *William Burgess Rd – SR200 to Harts Rd – Trans – New – FM*
    - *Force Main – Sewer*
        - *16" PVC*
            - *16" Tee*
            - *16" ARV*
    - *Valves*
        - *16" Gate Valve*

Consultants are responsible to provide adequate definition of the project and its major components so that the WBS can be developed with the JEA project team. The JEA PM may provide the consultant additional breakdown criteria to meet capital fixed asset cost accounting requirements.

3.6 Projects with Multiple Utility Types

Though infrequent, some capital projects may include both water and sewer utility assets. This is more likely to occur on grid than plant projects. In instances where multiple utility types are involved, JEA capital cost accounting practices mandate that separate estimates be performed for each utility type.

In an effort to ease the burden on the design consultant, only one BOE report will be required that covers both utility types. However, the design consultant will be required to submit a set of appendices for each utility type (i.e., two total estimate summaries, two estimate reconciliations and two detailed construction estimates).

The JEA PM will provide the indirect cost estimates for each utility type.

3.7 Contingency

Contingencies are used to cover unknowns and unanticipated conditions that are not possible to adequately evaluate from the data at the time a cost estimate is prepared, but must be represented by a sufficient cost to cover identified risks. A construction contingency is assigned to cover changing market conditions, design incompleteness, detail changes, alternative design changes, and associated costing inaccuracies during the construction cost estimating portion of the design phase of the project. Contingency specifically excludes major scope changes such as changes in end product specification, capacities, building sizes, and location of the project; extraordinary events such as major strikes and natural disasters. As detailed design progresses and design information becomes known, the construction contingency is reduced until it's replaced with a Supplemental Work Authorization at the 100% design.

Table 2 below provides a recommended range of contingencies based on design submittals but the design consultant is expected to recommend a contingency based on the actual completeness of the project documents. The design consultant will justify any contingency amount in the contingency section of the BOE report as required in paragraph 3.4.1. Contingency recommendations greater than the ranges identified below should be accompanied by a detailed risk analysis.

DESIGN SUBMITTAL	ESTIMATE CLASS	LEVEL OF PROJECT DEFINITION	CONTINGENCY RANGE	SWA RANGE
Project Definition	5	3% to 5%	20% to 30%	0%
10%	4	10%	20% to 30%	0%
30%	3	30%	15% to 25%	0%
60%	2	60%	10% to 20%	0%
90%	2	90%	0% to 10%	0%
100%	1	100%	0%	0% to 10%

TABLE 1 – RANGES FOR CONTINGENCY AND SUPPLEMENTAL WORK AUTHORIZATION

Contingency cannot be abstract and must represent something unknown that is adequately described in the BOE report. Estimates received that have contingency but no backup documentation will be rejected for resubmittal. At no time will an estimate contain both contingency and SWA.

3.8 Supplemental Work Authorization (SWA)

JEA uses SWA allowances in its construction contracts to provide an efficient mechanism to manage unforeseen or discoverable work (not for adding scope) identified after a construction contract is executed. SWA expedites project management processes and reduces administrative costs by providing an allowance for unforeseen work during construction. In these instances, SWA is added as an allowance on the bid form and is included in the construction contract. Typically, the SWA percentage should be between 0% and 5% but could be as high as 10% in special circumstances. Proposed SWA percentages greater than 5% must be accompanied by a detailed risk analysis.

After the construction contract is issued, the use of the SWA allowance is solely at the discretion of JEA. The contractor is not guaranteed that any SWAs will be issued during construction.

Estimating of the SWA allowance to include in the construction bid shall be done through a risk identification and analysis process in coordination with the JEA PM as part of the 100% design estimate. Table 3 below contains an SWA Risk Matrix that's to be used to determine SWA, as a percentage of total direct cost, for each identified risk based on probability of occurrence and severity. The final SWA percentage is an average of all risk SWA percentages. The SWA percentage is then multiplied against the total direct cost value and rounded up to the nearest $1,000 increment.

Severity	High	4%	8%	10%
	Med	3%	5%	8%
	Low	2%	3%	4%
		Low	Med	High
		Probability		

TABLE 2 – SUPPLEMENTAL WORK AUTHORIZATION RISK MATRIX

3.8.1 Identification of Project Risks

No two projects are the same and many different variables will determine risk severity and the probability of those risk occurrences. The design consultant should identify the project risks that could impact the project, assess the severity and probability and recommend a SWA percentage/allowance.

Project risks that could warrant mitigation through SWA could include:

- Brownfield versus Greenfield project
- Age of facility or infrastructure
- Availability or condition of as-built drawings
- Limited advance surveying or investigation
- Inaccessibility of internal plant equipment
- Safety or health stand-offs
- Lack of access to closed systems
- Expected conflict structures or where underground conditions are not fully known
- Design inaccuracies

3.8.2 SWA Calculation Example

A new 12" water main is being installed along a tight corridor containing multiple conflicts. There are indications of a possible force main in one area of the planned route that hasn't been located despite multiple attempts. As built drawings show the force main but it isn't shown in GIS. Reports from O&M indicate the force main may have been placed out of service. Identified risks and SWA percentages include:

- Risk #1: SSO due to hitting an un-located active force main
  - Impact: Cost and Schedule
  - Severity: Medium
  - Probability: Low
  - SWA: 3%
  - Action: Mitigate by ensuring the contractor is fully aware of the un-located force main at the pre-construction meeting and that precautions are taken while working in the area.
- Risk #2: Increased unit quantities due to utility conflicts
  - Impact: Cost
  - Severity: Low
  - Probability: Low
  - SWA: 2%
  - Action: Accept
- Calculation:
  - Calculate the average of both risks
    - SWA=3%+2%=5%/2=2.5%
  - For a total direct cost of $2,500,000, the SWA allowance is calculated as:

- $2,500,000(2.5%)=$62,500=$63,000 (after rounding up)

3.9 Project Labor Rates

The labor rates used in the detail cost estimate will include the base rate (paid wages plus fringe benefits) plus burden (employer taxes: social security, Medicare/Medicaid, workers compensation and unemployment insurance). The labor rates are to exclude field or office overhead and profit which instead are to be added as a markup to the net total cost.

4.0 Estimate Key Performance Indicators

It's imperative that estimates are accurate as possible to ensure the project's scope, and identified risks, are accurately represented and so that the proper amount of budget is allocated for each capital project. Two estimate Key Performance Indicators (KPI) will be used to evaluate the design consultant's estimating process and will be used by the PM when completing vendor performance evaluations after construction bids are opened and after project completion. The closer to zero (0) the two KPIs are the closer the estimate was to the bid amount or final project cost. A KPI result of zero (0) would be ideal but very unlikely. Design consultants should strive for KPI results that are within the accuracy of the 100% estimate (+10%/-5%).

4.1 Award Growth Percentage

The Award Growth Percentage (AGP) KPI measures the accuracy of the engineer's 100% estimate when compared to the winning construction bid. The formula for calculating the AGP is:

$$AGP = 100\left(\frac{Bid\ Amount - Engineer's\ 100\%\ Estimate}{Engineer's\ 100\%\ Estimate}\right)$$

Example:

$$AGP = 100\left(\frac{\$1{,}200{,}000 - \$1{,}500{,}000}{\$1{,}500{,}000}\right) = 100\left(\frac{-\$300{,}000}{\$1{,}500{,}000}\right) = -20\%$$

4.2 Estimate Growth Percentage

The Estimate Growth Percentage (EGP) KPI measures the accuracy of the engineer's 100% estimate when compared to what was paid to the contractor after project completion including change orders. The formula for calculating the EGP is:

$$EGP = 100\left(\frac{Paid\ to\ Contractor - Engineer's\ 100\%\ Estimate}{Engineer's\ 100\%\ Estimate}\right)$$

Example:

$$EGP = 100\left(\frac{\$2{,}000{,}000 - \$1{,}900{,}000}{\$1{,}900{,}000}\right) = 100\left(\frac{\$200{,}000}{\$1{,}900{,}000}\right) = 5.26\%$$

5.0 References

- *Recommended Practice 31R-03, Reviewing, Validating and Documenting the Estimate.* AACE International. TCM Framework 7.3. Morgantown, WV, 2009.
- *Recommended Practice 18R-97, Cost Estimate Classification System - as Applied In Engineering, Procurement, and Construction for the Process Industries.* AACE International. TCM Framework 7.3. Morgantown, WV, 2011.
- *Recommended Practice 34R-05, Basis of Estimate.* AACE International. TCM Framework 7.3. Morgantown, WV, 2014.

- *Recommended Practice 40R-08, Contingency Estimating - General Principles.* AACE International. TCM Framework 7.6. Morgantown, WV, 2008.
- *Recommended Practice 36R-08, Development of Cost Estimating Plans - As Applied In Engineering, Procurement, and Construction for the Process Industries.* AACE International. TCM Framework 7.3. Morgantown, WV, 2015.

Appendix A – Capital Project Delivery Process

Appendix B – Water/Sewer Milestone Deliverable Checklist

Appendix C – Total Estimate Summary

Appendix D – Estimate Reconciliation