US Army Corps of Engineers®
New York District

WESTCHESTER COUNTY STREAMS,

BYRAM RIVER BASIN

FLOOD RISK MANAGEMENT FEASIBILITY STUDY

FAIRFIELD COUNTY, CONNECTICUT AND WESTCHESTER COUNTY, NEW YORK

FINAL INTEGRATED FEASIBILITY REPORT & ENVIRONMENTAL IMPACT STATEMENT

APPENDIX C:
Cost Engineering

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1. INTRODUCTION

This Appendix presents the detailed cost estimates for Byram River (NED). The Byram River project involves removing the Route 1 bridges that straddle the Byram River in Port Chester, NY and replacing them at a higher elevation to allow more water to pass underneath. In the existing condition, the wide piers supporting the bridges and the low road profile constrict the flow of water; this causes water to build up behind the bridge, carry the local traffic of Route 1 as well as Interstate 95 traffic during emergencies, the bridges must be replaced after they are demolished. The Route 1 bridges would be replaced with two bridges in the same location that have roadway profiles about three feet higher than the existing profile and do not have center piers. The plan also includes minor channel improvements to remove accumulated sediment. The construction of the new bridges would be considered a relocation and a non-Federal sponsor responsibility. The Total First Cost is presented in Table 1 below.

Table 1 –First Cost

Feasibility Report Cost Estimate, October 2019 Price Level

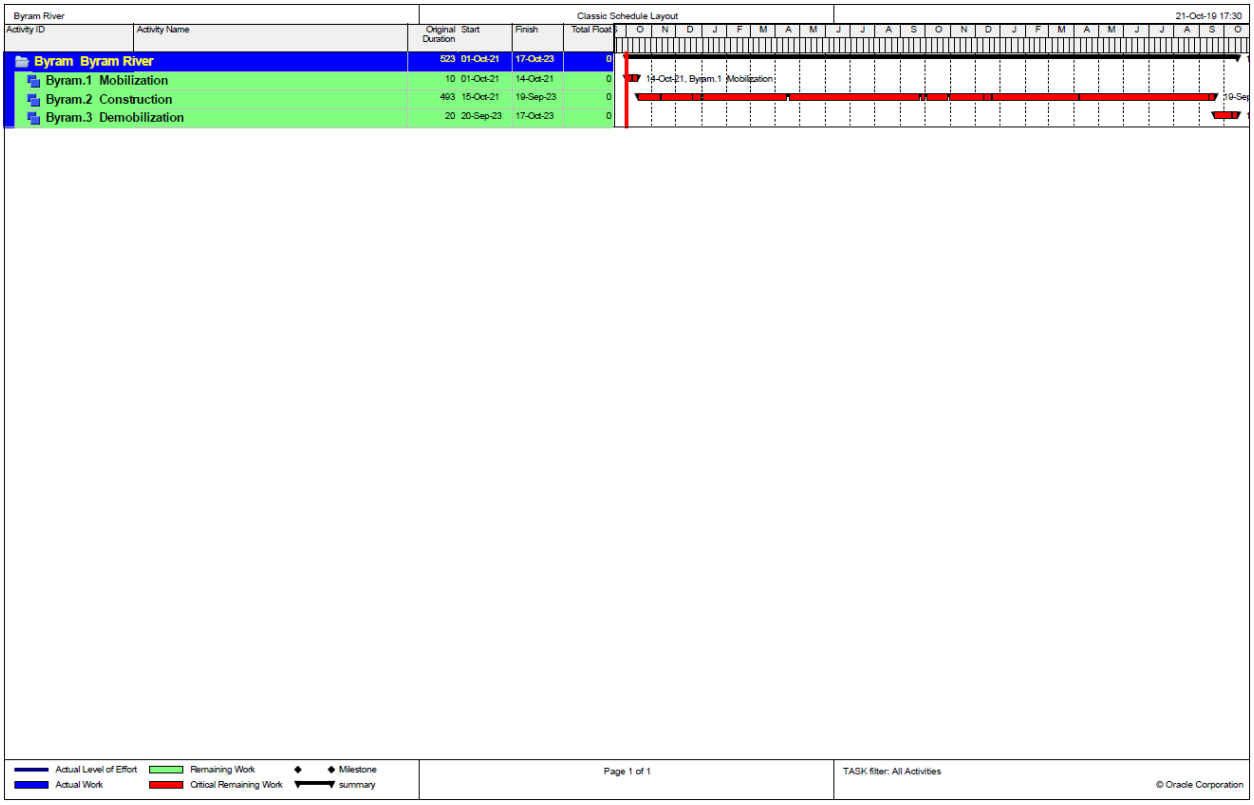
Description	Qty.	UoM	Subtotal	Cont. %	Cont $$	Total Cost
01- Lands and Damages	1	LS	$1,102,500	30%	$330,750	$1,433,250
02- Relocations	1	LS	$14,990,746	28%	$4,161,341	$19,152,088
06- Fish and Wildlife Facilities	1	LS	$34,000	13%	$4,580	$38,580
18- Cultural Resource Preservation	1	LS	$1,500,000	13%	$202,099	$1,702,099
30- Planning, Engineering,& Design	1	LS	$4,131,187	22%	$922,907	$5,054,094
31- Construction Management	1	LS	$1,735,098	17%	$290,108	$2,025,207
Total Byram River			**$23,493,531**		**$5,911,786**	**$29,405,317**

2. BASIS OF COST

The construction cost estimate was developed in MCACES, Second Generation (MII) using the appropriate Work Breakdown Structure (WBS) and based on current estimated quantities provided by CDM Smith Report. The cost estimate was developed from these quantities using cost resources such as RSMeans, historical data from similar construction features, and MII Cost Libraries. The contingencies were developed based on input to the Abbreviated Cost Schedule Risk Analysis (ARA) (template provided by the Cost Mandatory Center of Expertise, MCX, Walla Walla District). These contingencies were applied to the construction cost estimates to develop the Total Project First Cost. The construction duration for

Byram River was estimated at 25 months, as shown in Figure 1 on the following page. The construction schedule was developed based on the crew outputs referenced from RSMeans with the assumption that multiple crews would work simultaneously.

Figure 1 – Construction Schedule



2.1. CONTINGENCIES

As stated in ER 1110-2-1302, the goal in contingency development is to identify the uncertainty associated with an item of work or task to an acceptable degree of confidence. Consideration must be given to the detail available at each stage of planning, design, or construction for which a cost estimate is being prepared. Contingency may vary throughout the cost estimate and could constitute a significant portion of the overall costs when data or design details are unavailable. Final contingency development and assessment of the potential for cost growth is included in this cost estimate. To develop the Total Project First Cost, contingencies developed in the ARA were applied. The construction cost contingency developed per ARA for Byram River is shown in Table 2 on page 3.

Table 2 – Contingencies

Element	Contingency Factor
Relocations	27.76%
Fish & Wildlife Facilities	13.47%
Cultural Resource Preservation	13.47%
Total Construction Contingency	**26.43%**
Lands & Damages	30.00%
Planning, Engineering, and Design	22.34%
Construction Management	16.72%

2.2. LANDS AND DAMAGES

To construct the proposed plan, local stakeholders are required to provide certain lands and easements. Studies were conducted by the Real Estate Division to determine the estimated value of lands and easements needed for the channel improvement.

2.3. PLANNING, ENGINEERING AND DESIGN

The cost was developed for all activities associated with the planning, engineering and design effort. The cost for this account includes the preparation of Design Documentation Reports, plans, specifications, and engineering support during construction through project completion. It includes all the in-house labor based upon work-hour requirements, material and facility costs, travel, and overhead. The percentage breakdown in the Total Project Cost Summary (TPCS), as shown in Figure 2 on page 5, was developed based on input from respective offices in accordance with the CWBS.

2.4. CONSTRUCTION MANAGEMENT

The cost was developed for all construction management activities from pre-award requirements through final contract closeout. This cost includes the in-house labor based upon work-hour requirements, materials, facility costs, support contracts, travel and overhead. The cost was developed based on the input from the construction division in accordance with the Civil Works Breakdown Structure (CWBS) and includes, but is not limited to, anticipated items such as the salaries of the resident engineer and staff, surveyors, inspectors, drafters, clerical, and custodial personnel; operation, maintenance and fixed charges for transportation and for other field equipment; field supplies; construction management, general construction supervision; and project office administration, distributive cost of area office and general overhead charged to the project.

2.5. INTEREST DURING CONSTRUCTION

Interest during construction (IDC) is the amount of interest the construction cost would earn were it invested from the beginning of construction until the accumulation of benefits begins. IDC cost has been added to the project cost to determine investment cost. Average annual cost was determined based on investment cost, which includes IDC. The pre-base year costs were estimated using the Federal interest rate of 2.75 percent (FY20).

2.6. OPERATION AND MAINTENANCE

The Operation and Maintenance (O&M) cost was estimated to represent the anticipated annual costs necessary to maintain the project at full operating efficiency throughout the project life. Following completion of the project, operation and maintenance of project facilities would be the responsibility of the non-Federal sponsor in accordance with Federal regulations and operations manual.

3. ESTIMATED ANNUAL COST

Annual costs are based on an economic period of analysis of 50 years and an interest rate of 2.75%. The annual costs include the annualized investment cost along with annual operation and maintenance cost. A detailed breakdown of annual costs for Byram River is presented in Table 3 below.

Table 3 – Annualized Cost

Byram River Basin (NED)
Annualized Cost Summary

First Cost	$	29,405,317
Sunk Cost	$	-
Investment Cost		
Interest During Construction (a)	$	812,653
Total Investment Cost:	$	30,217,970
Annual Costs		
Annualized Investment Cost (b)	$	1,119,301
Annualized Operation & Maintenance Cost (c)	$	25,000
Total Annual Cost*	**$**	**1,144,301**

*October 2019 Price Level
(a) Based on 25 months of construction @ 2.75% (IDC, E&D, RE and Sunk costs calculated separately and
(b) Annualized investment cost only includes the remaining features. For annualized investment cost with the sunk cost, please see the economic appendix. I = 2.75% and n = 50 yrs
(c) From DOT letter dated 09JAN2017, annual O&M costs on current bridge are estimated $25,000.

4. COST SUMMARY

The Total Fully Funded Project cost is $31,922,000. The cost sharing partner for implementation is being coordinated and has not been identified as of the release of this Report.

Figure 2 – Total Project Cost Summary

**** TOTAL PROJECT COST SUMMARY ****

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PROJECT: Byram River (NED)
PROJECT NO: P2 145641
LOCATION: Greenwich, CT

DISTRICT: NAN - New York
POC: CHIEF, COST ENGINEERING, Mukesh Kumar

PREPARED: 10/21/2019

This Estimate reflects the scope and schedule in report; 0

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2020 Effective Price Level Date: 1 OCT 19									
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST ($K) C	CNTG ($K) D	CNTG (%) E	TOTAL ($K) F	ESC (%) G	COST ($K) H	CNTG ($K) I	TOTAL ($K) J	Spent Thru: 1-Oct-19 ($K)	TOTAL FIRST COST ($K) K	INFLATED (%) L	COST ($K) M	CNTG ($K) N	FULL ($K) O
02	RELOCATIONS	$14,990.746	$4,161.341	$0.278	$19,152.088	0.0%	$14,991	$4,161	$19,152	$0	$19,152	9.5%	$16,413	$4,556	$20,969
06	FISH & WILDLIFE FACILITIES	$34.000	$4.581	$0.135	$38.581	0.0%	$34	$5	$39	$0	$39	9.5%	$37	$5	$42
18	CULTURAL RESOURCE PRESERVATION	$1,500.000	$202.099	$0.135	$1,702.099	0.0%	$1,500	$202	$1,702	$0	$1,702	9.5%	$1,642	$221	$1,864
	CONSTRUCTION ESTIMATE TOTALS:	$16,524.746	$4,368.021		$20,892.767	0.0%	$16,525	$4,368	$20,893	$0	$20,893	9.5%	$18,093	$4,782	$22,875
01	LANDS AND DAMAGES	$1,102.500	$330.750	$0.300	$1,433.250	0.0%	$1,103	$331	$1,433	$0	$1,433	2.5%	$1,131	$339	$1,470
30	PLANNING, ENGINEERING & DESIGN	$4,131.187	$922.907	$0.223	$5,054.094	0.0%	$4,131	$923	$5,054	$0	$5,054	5.1%	$4,340	$970	$5,309
31	CONSTRUCTION MANAGEMENT	$1,735.098	$290.108	$0.167	$2,025.207	0.0%	$1,735	$290	$2,025	$0	$2,025	12.0%	$1,943	$325	$2,268
	PROJECT COST TOTALS:	$23,493.531	$5,911.786	$0.252	$29,405.317		$23,494	$5,912	$29,405	$0	$29,405	8.6%	$25,506	$6,416	$31,922

_____ CHIEF, COST ENGINEERING, Mukesh Kumar

_____ PROJECT MANAGER, Rifat Salim

_____ CHIEF, REAL ESTATE,

ESTIMATED TOTAL PROJECT COST: $31,922
Federal Cost Share: TBD
Non-Federal Cost Share: TBD

**** TOTAL PROJECT COST SUMMARY ****

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**** CONTRACT COST SUMMARY ****

PROJECT: Byram River (NED)
LOCATION: Greenwich, CT
This Estimate reflects the scope and schedule in report; 0

DISTRICT: NAN - New York
POC: CHIEF, COST ENGINEERING, Mukesh Kumar
PREPARED: 10/21/2019

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 21-Oct-19 Effective Price Level: 1-Oct-19				Program Year (Budget EC): 2020 Effective Price Level Date: 1 OCT 19								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	RISK BASED CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	PHASE 1 or CONTRACT 1													
02	RELOCATIONS	$14,991	$4,161	27.8%	$19,152	0.0%	$14,991	$4,161	$19,152	2023Q1	9.5%	$16,413	$4,556	$20,969
06	FISH & WILDLIFE FACILITIES	$34	$5	13.5%	$39	0.0%	$34	$5	$39	2023Q1	9.5%	$37	$5	$42
18	CULTURAL RESOURCE PRESERVATION	$1,500	$202	13.5%	$1,702	0.0%	$1,500	$202	$1,702	2023Q1	9.5%	$1,642	$221	$1,864
	CONSTRUCTION ESTIMATE TOTALS:	$16,525	$4,368	26.4%	**$20,893**		$16,525	$4,368	$20,893			$18,093	$4,782	$22,875
01	LANDS AND DAMAGES	$1,103	$331	30.0%	$1,433	0.0%	$1,103	$331	$1,433	2020Q4	2.5%	$1,131	$339	$1,470
30	PLANNING, ENGINEERING & DESIGN													
1.5%	Project Management	$248	$55	22.3%	$303	0.0%	$248	$55	$303	2020Q4	2.9%	$255	$57	$312
3.0%	Planning & Environmental Compliance	$496	$111	22.3%	$606	0.0%	$496	$111	$606	2020Q4	2.9%	$510	$114	$624
12.0%	Engineering & Design	$1,983	$443	22.3%	$2,426	0.0%	$1,983	$443	$2,426	2020Q4	2.9%	$2,040	$456	$2,495
1.0%	Reviews, ATRs, IEPRs, VE	$165	$37	22.3%	$202	0.0%	$165	$37	$202	2020Q4	2.9%	$170	$38	$208
0.5%	Life Cycle Updates (cost, schedule, risks)	$83	$18	22.3%	$101	0.0%	$83	$18	$101	2020Q4	2.9%	$85	$19	$104
1.0%	Contracting & Reprographics	$165	$37	22.3%	$202	0.0%	$165	$37	$202	2020Q4	2.9%	$170	$38	$208
3.0%	Engineering During Construction	$496	$111	22.3%	$606	0.0%	$496	$111	$606	2023Q1	12.0%	$555	$124	$679
3.0%	Planning During Construction	$496	$111	22.3%	$606	0.0%	$496	$111	$606	2023Q1	12.0%	$555	$124	$679
0.0%	Adaptive Management & Monitoring	$0	$0	22.3%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Project Operations	$0	$0	22.3%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
9.0%	Construction Management	$1,487	$249	16.7%	$1,736	0.0%	$1,487	$249	$1,736	2023Q1	12.0%	$1,665	$278	$1,944
0.0%	Project Operation:	$0	$0	16.7%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
1.5%	Project Management	$248	$41	16.7%	$289	0.0%	$248	$41	$289	2023Q1	12.0%	$278	$46	$324
	CONTRACT COST TOTALS:	$23,494	$5,912		$29,405		$23,494	$5,912	**$29,405**			$25,506	$6,416	**$31,922**

MII Reports

Print Date Thu 31 October 2019
Eff. Date 10/1/2019

U.S. Army Corps of Engineers
Project : Byram River
-Detailed Report-

Time 10:00:48
Project Cost Summary Report Page 1

Description	Quantity	UOM	ProjectCost
Project Cost Summary Report			**16,524,746**
02 Relocations	**1.00**	**LS**	**14,990,746**
06 Fish and Wildlife Facilities	**1.00**	**LS**	**34,000**
18 Cultural Resource Preservation	**1.00**	**LS**	**1,500,000**

Labor ID: NY180017 EQ ID: EP16R01 Currency in US dollars TRACES MII Version 4.4

Abbreviated Risk Analysis
(ARA)

Abbreviated Risk Analysis

Project (less than $40M): Byram River — Alternative: Alt 5A (NED)
Project Development Stage/Alternative: Feasibility (Recommended Plan)
Risk Category: Moderate Risk: Typical Project Construction Type — Meeting Date: 3/6/2017

Total Estimated Construction Contract Cost = $ 16,524,746

	CWWBS	Feature of Work	Contract Cost		% Contingency	$ Contingency	Total
	01 LANDS AND DAMAGES	Real Estate	$1,102,500		30.00%	$ 330,750	$ 1,433,250
1	02 RELOCATIONS	Relocations	$ 14,990,746		27.76%	$ 4,161,341	$ 19,152,088
1	06 FISH AND WILDLIFE FACILITIES	Fish and Wildlife	$ 34,000		13.47%	$ 4,581	$ 38,581
2	18 CULTURAL RESOURCE PRESERVATION	Cultural Resource	$ 1,500,000		13.47%	$ 202,099	$ 1,702,099
3			$ -		0.00%	$ -	$ -
5			$ -		0.00%	$ -	$ -
6			$ -		0.00%	$ -	$ -
7			$ -		0.00%	$ -	$ -
8			$ -		0.00%	$ -	$ -
9			$ -		0.00%	$ -	$ -
10			$ -		0.00%	$ -	$ -
11			$ -		0.00%	$ -	$ -
12	All Other	Remaining Construction Items	$ -	0.0%	0.00%	$ -	$ -
13	30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	$ 4,131,187		22.34%	$ 923,003	$ 5,054,189
14	31 CONSTRUCTION MANAGEMENT	Construction Management	$ 1,735,098		16.72%	$ 290,084	$ 2,025,182
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)					$ -	

Totals					
Real Estate	$ 1,102,500	30.00%	$ 330,750	$ 1,433,250	
Total Construction Estimate	$ 16,524,746	26.43%	$ 4,368,021	$ 20,892,767	
Total Planning, Engineering & Design	$ 4,131,187	22.34%	$ 923,003	$ 5,054,189	
Total Construction Management	$ 1,735,098	16.72%	$ 290,084	$ 2,025,182	
Total Excluding Real Estate	**$ 22,391,031**	**25%**	**$ 5,581,107**	**$ 27,972,138**	
		Base	**50%**	**80%**	
Confidence Level Range Estimate ($000's)		$22,391k	$25,740k	$27,972k	

* 50% based on base is at 5% CL

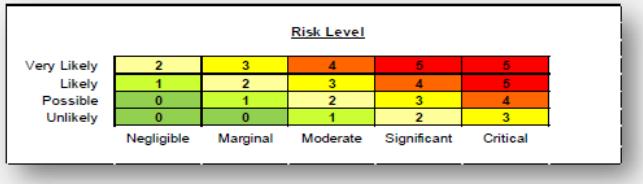
Fixed Dollar Risk Add: (Allows for additional risk to be added to the risk analsyis. Must include justification. Does not allocate to Real Estate.	64.75

Byram River Alt 5A (NED)

Feasibility (Recommended Plan)

Abbreviated Risk Analysis

Meeting Date: 6-Mar-17



Risk Register

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Impact	Likelihood	Risk Level
Project Management & Scope Growth				Maximum Project Growth		75%
PS-1	Relocations	Investigations sufficient to support design assumptions?	Although there has been decent amount of researches done on the bridges, there is still a possibility of unknown field condition that can cause design update. However the impact would be marginal.	Marginal	Possible	1
PS-2	Fish and Wildlife	Investigations sufficient to support design assumptions? Project accomplish intent?	There are no endanger and or threaten species, critical habitat within the project area. Any requirements can be accomplished through restricted construction windows.	Marginal	Possible	1
PS-3	Cultural Resource	Potential for scope growth. Bridges are eligible for the national register of historic places	Bridge design must be sympathetic to the surrounding neighborhood.	Marginal	Possible	1
PS-4	0			Negligible	Unlikely	0
PS-5	0			Negligible	Unlikely	0
PS-6	0			Negligible	Unlikely	0
PS-7	0			Negligible	Unlikely	0
PS-8	0			Negligible	Unlikely	0
PS-9	0			Negligible	Unlikely	0
PS-10	0			Negligible	Unlikely	0
PS-11	0			Negligible	Unlikely	0
PS-12	Remaining Construction Items			Negligible	Unlikely	0
PS-13	Planning, Engineering, & Design	Potential for scope growth, added features and quantities. Design confidence. Investigations sufficient to support design assumptions.	Change in regulation requiring positive BCR for each structure rather than entire project is likely and can cause a marginal impact	Marginal	Likely	2
PS-14	Construction Management	N/A	N/A	Negligible	Unlikely	0

Acquisition Strategy				Maximum Project Growth		30%
AS-1	Relocations	Limited bid competition anticipated? Contracting plan firmly established?	There are significant amount of contractors who can do this work. There is a possibility of this project going out as multiple contracts which would require additional mob/demob and staging area. Additional mob/demob and staging area would translate into a marginal impact.	Marginal	Possible	1
AS-2	Fish and Wildlife	Contracting plan firmly established? Limited bid competition anticipated?	There are significant amount of contractors who can do this work. There is a possibility of this project going out as multiple contracts however the impact should be negligible for the Fish and Wildlife account.	Negligible	Possible	0
AS-3	Cultural Resource	Contracting plan firmly established. Limited bid competition anticipated.	There are significant amount of contractors who can do this work. There is a possibility of this project going out as multiple contracts however the impact should be negligible for the Cultural Resource.	Negligible	Possible	0
AS-4	0			Negligible	Unlikely	0
AS-5	0			Negligible	Unlikely	0
AS-6	0			Negligible	Unlikely	0
AS-7	0			Negligible	Unlikely	0
AS-8	0			Negligible	Unlikely	0
AS-9	0			Negligible	Unlikely	0
AS-10	0			Negligible	Unlikely	0
AS-11	0			Negligible	Unlikely	0
AS-12	Remaining Construction Items			Negligible	Unlikely	0
AS-13	Planning, Engineering, & Design	Limited bid competition anticipated	The possibility of this project going out as multiple contracts would require additional planning, engineering and design effort. However impact should be marginal.	Marginal	Possible	1
AS-14	Construction Management	Limited bid competition anticipated	The possibility of this project going out as multiple contracts would require additional staffing. However impact should be marginal.	Marginal	Possible	1

Construction Elements				Maximum Project Growth		25%
CE-1	Relocations	High risk or complex construction elements, site access, in-water? Water care and diversion plan? Potential for construction modification and claims?	Limitation in site access for staging area due to surrounding properties and neighborhood, along with the construction modification and claims are possible. However they shouldn't cause a significant impact since the water care diversion plan are more stringent in 1977, which would mitigate the impact to moderate.	Moderate	Possible	2
CE-2	Fish and Wildlife	Potential for construction modification and claims?	Potential for construction modification and claims is always a possibilty in a construction project however a negligible impact for Fish and Wildlife.	Negligible	Possible	0
CE-3	Cultural Resource	Potential for construction modification and claims?	Potential for construction modification and claims is always a possibilty in a construction project however a negligible impact for Cultural Resource.	Negligible	Possible	0
CE-4	0			Negligible	Unlikely	0
CE-5	0			Negligible	Unlikely	0
CE-6	0			Negligible	Unlikely	0
CE-7	0			Negligible	Unlikely	0
CE-8	0			Negligible	Unlikely	0
CE-9	0			Negligible	Unlikely	0
CE-10	0			Negligible	Unlikely	0
CE-11	0			Negligible	Unlikely	0
CE-12	Remaining Construction Items			Negligible	Unlikely	0
CE-13	Planning, Engineering, & Design	Potential for construction modification and claims	Potential for construction modification and claims can most likely cause unexpected home conditions. However this would be a marginal impact in relation to the overall project scale.	Marginal	Likely	2
CE-14	Construction Management	Potential for construction modification and claims	Potential for construction modification and claims can most likely cause unexpected site conditions. However this would be a marginal impact in relation to the overall project scale.	Marginal	Likely	2

Specialty Construction or Fabrication				Maximum Project Growth		65%
SC-1	Relocations	N/A	N/A	Negligible	Unlikely	0
SC-2	Fish and Wildlife	N/A	N/A	Negligible	Unlikely	0
SC-3	Cultural Resource	N/A	N/A	Negligible	Unlikely	0
SC-4	0			Negligible	Unlikely	0
SC-5	0			Negligible	Unlikely	0
SC-6	0			Negligible	Unlikely	0
SC-7	0			Negligible	Unlikely	0
SC-8	0			Negligible	Unlikely	0
SC-9	0			Negligible	Unlikely	0
SC-10	0			Negligible	Unlikely	0
SC-11	0			Negligible	Unlikely	0
SC-12	Remaining Construction Items			Negligible	Unlikely	0
SC-13	Planning, Engineering, & Design	N/A	N/A	Negligible	Unlikely	0
SC-14	Construction Management	N/A	N/A	Negligible	Unlikely	0

Technical Design & Quantities				Maximum Project Growth		30%
T-1	Relocations	Level of confidence based on design and assumptions? Sufficient investigations to develop quantities?	New bridge design has been created per change in regulation. Historical requirement might impact final design. However impact to quantities would be minor if any.	Marginal	Possible	1
T-2	Fish and Wildlife	Level of confidence based on design and assumptions? Sufficient investigations to develop quantities? Possibility for increased quantities due to loss, waste, or subsidence?	Possible increase in quantities pending mitigation requirements when permit is obtained but changes are estimated to be minor if any.	Marginal	Possible	1
T-3	Cultural Resource	Level of confidence based on design and assumptions. Sufficient investigations to develop quantities. Possibility for increased quantities due to loss, waste or subsidence	Potential increase in quantities pending execution of memorandum agreement but changes are estimated to be minor if any.	Marginal	Possible	1
T-4	0			Negligible	Unlikely	0
T-5	0			Negligible	Unlikely	0
T-6	0			Negligible	Unlikely	0
T-7	0			Negligible	Unlikely	0
T-8	0			Negligible	Unlikely	0
T-9	0			Negligible	Unlikely	0
T-10	0			Negligible	Unlikely	0
T-11	0			Negligible	Unlikely	0
T-12	Remaining Construction Items			Negligible	Unlikely	0
T-13	Planning, Engineering, & Design	Potential for construction modification and claims	Changes to design assumptions might lead to additional planning, engineering and design effort however impact would be marginal in relation to the overall project scale.	Marginal	Possible	1
T-14	Construction Management	Potential for construction modification and claims	Changes to design assumptions might lead to additional construction management effort however impact would be marginal in relation to the overall project scale.	Marginal	Possible	1

Cost Estimate Assumptions				Maximum Project Growth		35%
EST-1	Relocations	Overuse of Cost Book, lump sum, allowance. Assumptions related to prime and subcontractor markups/assignments.	Cost for MPT might increase overall along with increase in policy involvement. Heavily use of cost book however productivity adjustment is considered due to site condition. Material cost are at both national average and current price level. Changes to labor, material and equipment could be significant.	Significant	Possible	3
EST-2	Fish and Wildlife	Lack of confidence on critical cost items	Cost of mitigation is also dependent on permit requirements. Therefore it is estimated that any possible changes would cause a marginal impact.	Marginal	Possible	1
EST-3	Cultural Resource	Lack of confidence on critical cost items	Cost of mitigation is also dependent on memorandum agreement requirements. Therefore it is estimated that any possible changes would cause a marginal impact.	Marginal	Possible	1
EST-4	0			Negligible	Unlikely	0
EST-5	0			Negligible	Unlikely	0
EST-6	0			Negligible	Unlikely	0
EST-7	0			Negligible	Unlikely	0
EST-8	0			Negligible	Unlikely	0
EST-9	0			Negligible	Unlikely	0
EST-10	0			Negligible	Unlikely	0
EST-11	0			Negligible	Unlikely	0
EST-12	Remaining Construction Items			Negligible	Unlikely	0
EST-13	Planning, Engineering, & Design	Lack of confidence on critical cost items, assumptions regarding crew, productivity, overtime. Assumptions related to prime and subcontractor markups/assignments.	Minor premium due to "Greenwich". Labor rates are higher because the county had set higher rate. Some properties in Port Chester, NY are to be acquired. Consultant office location can impact productivity and accessibility moderately.	Moderate	Possible	2
EST-14	Construction Management	Lack of confidence on critical cost items, assumptions regarding crew, productivity, overtime. Assumptions related to prime and subcontractor markups/assignments.	Minor premium due to "Greenwich". Labor rates are higher because the county had set higher rate. Some properties in Port Chester, NY are to be acquired. Consultant office location can impact productivity and accessibility moderately.	Moderate	Possible	2

External Project Risks				Maximum Project Growth		40%
EX-1	Relocations	Political influences, lack of support, obstacles? Unanticipated inflations in fuel, key materials? Potential risk of weather?	Lack of public support is possible which can substantially impact traffic and the cost for MPT might increase overall, along with increase in police involvement. Multiple jurisdictions may cause possible delays and implementations. Also this project is located within the flood zone and there is always a possibility of unforeseen weather condition that can postpone the project. However the impact would be marginal compared to the overall scale of the project.	Marginal	Likely	2
EX-2	Fish and Wildlife	Political influences, lack of support, obstacles?	There could be a possibility of identifying new endanger threaten species or changes in existing compliance could be more restrictive. Species being evaluated or known to be protected are to use urban area is possible. Current data suggest the area is not utilized.	Marginal	Possible	1
EX-3	Cultural Resource	Political influences, lack of support, obstacles.	There could be a possibility of additional requirements beyond what is assumed for the memorandum agreement requirement.	Marginal	Possible	1
EX-4	0			Negligible	Unlikely	0
EX-5	0			Negligible	Unlikely	0
EX-6	0			Negligible	Unlikely	0
EX-7	0			Negligible	Unlikely	0
EX-8	0			Negligible	Unlikely	0
EX-9	0			Negligible	Unlikely	0
EX-10	0			Negligible	Unlikely	0
EX-11	0			Negligible	Unlikely	0
EX-12	Remaining Construction Items			Negligible	Unlikely	0
EX-13	Planning, Engineering, & Design	Political influences, lack of support, obstacles?	The possibilty of putting the project on hold due to lack of public support is equivalent putting Planning, Engineering and Design efforts on hold. The effort will be picked up when the project is back in the table. This would not affect the funding needed for the effort and therefore a negligible impact to the overall project cost.	Negligible	Possible	0
EX-14	Construction Management	Political influences, lack of support, obstacles?	The possibilty of putting the project on hold due to lack of public support typically occur pre-construction and therefore it would translate to a negligible impact on construction management effort.	Negligible	Possible	0

DQC Comments

District Quality Control (DQC)

05 April 2018

OBSERVATION: Alternative 5 cost estimate submitted at FY18 PL with a first cost of $23,437,690 and fully funded cost of $24,454,000. Costs have been updated.

CONSTRUCTION SCHEDULE: According to the project schedule, it appears that the ADM is scheduled on 1/31/19. However according the construction schedule provided on the cost appendix, it appears the mobilization starts on 10/1/18. Recommend coordinating with PPMD for a more appropriate Notice to Proceed date. Also recommend updating the construction schedule in 3 sections: (1) Mobilization (consisting of noticed to proceed, coordination meeting and mobilization), (2) Roads, Railroads & Bridges (consisting of the construction work to the Route 1 bridge) and (3) Demobilization (consisting of punchlist, demobilization and project closeout). Note that with updated noticed to proceed date, it would affect our midpoint of construction date and thus our fully funded cost. Adjustments made.

TPCS: According to the project schedule, the chief report is currently scheduled on 1/30/2020. Recommend updating the first cost for the chief report from FY 19 PL to FY 20 PL. Updated.

COST APPENDIX: Recommend adding "Attachment C2 – Abbreviated Risk Analysis (ARA)" under the table of content between MII report attachment and the DQC attachment. Also recommend incorporating the input tab and the risk register tab of the ARA file for alternative 5 in the cost appendix as one of the attachments. Attachments have been included.

IDC: Recommend changing the project and location name under the Byram IDC in the excel file provided for alternative 5 to project specific name and location. Fixed.

COST TABLES: It appears the excel file provided includes the Byram River TPCS, First Cost table, IDC and Annualized Cost, however it does not include the CWCCIS tab to verify if the Date of Index Factors are up to date for the fully funded cost and the first cost for the chief's report. Recommend incorporating CWCCIS onto the excel file provided. Updated with newest approved TPCS template.

ANNUALIZED COST: It appears the excel file provided shows #REF for both the Annualized Investment Cost and the Total Annualized Cost. Please revisit and revise as appropriate. Fixed reference.

Agency Technical Review (ATR) Comments

Appendix C - Cost: The reported cost contingency of 17 percent in Table C1 used for the construction replacement of Route 1 Bridges seems low considering the current undefined features and design requirements of new Route 1 Bridge foundations. Appendix B4 Structural Engineering, section 3.7 Scour Analysis page B4-12, recommends bridge abutment foundations to be founded on competent rock. Geotechnical test borings drilled in the vicinity of the Route 1 Bridges, DH-6 and DH-7, did not encounter competent rock at depths of 20 and 24 foot below the ground surface. The Geotechnical Appendix also does not provide preliminary Route 1 Bridge foundation recommendations and anticipated depths to competent rock or competent soil bearing layers that are below anticipated scour depths of the proposed Route 1 Bridges. In my opinion the cost risk being applied to the construction, specially construction or fabrication, technical design and quantities, and cost estimate assumptions for the Route 1 Bridges need to be reevaluated to more accurately represent the current understanding of the Bridge foundation requirements.	ARA has been adjusted, and additional contingency added. MII estimate has been looked at and additional cost has been added.
OBSERVATION: Documents received included MCACES MII file (file titled "Byram River Bridge Replacement ALT 5 bridge only FY18 mIIv4.4 REV2.mlp"), Abbreviated Risk Assessment ("Byram River ARA - Alt 5 REV4 2018-05-24.xlsx"), project schedule ("Byram River Bridges Construction Schedule REV2.mpp"), and two TPCS files ("BRYAM ALT 5 TPCS, IDC - REV2.xlsx" and "BRYAM ALT 5 TPCS, IDC - REV2 7% interest.xlsx"). Other documents include Route 1 Bridges – Bridge Alternative Impacts by CDM Smith (file titled "ATTPOAPP.PDF"), Plans, quantities, and cost estimates by CDM Smith ("Appendix B4 - Attachments.pdf"), and the Real Estate appendix ("Appendix E_Real Estate 4-18-18.pdf"). The main report ("Main Report- Byram River Draft Integrated Feasibility Report and EIS.pdf") and Cost Engineering appendix ("Appendix C-Cost.pdf) was downloaded from the Byram River Basin Flood Risk Management Feasibility Study website (http://www.nan.usace.army.mil/Byram/).	Noted.
OBSERVATION: This Cost Engineering ATR is based upon submitted and downloaded documents. The review comments are primarily based upon the following Corps regulations and guidance that must be adhered to: ER 1110-2-1150, Engineering and Design for Civil Works Projects ER 1110-2-1302, Civil Works Cost Engineering ETL 1110-2-573, Construction Cost Estimating Guide for Civil Works	Noted.
OBSERVATION: The breakdown of items in the Relocations and Roads, Railroads, and Bridges folders are a step above feasibility level. Well done.	Noted.

Cost Book. COMMENT: The MII estimate is utilizing the 2015 Rev A cost book. SIGNIFICANCE: High. RESOLUTION: Reprice the estimate with the 2016 cost book.	The MII estimate has been updated using the 2016 Cost Book.
Fuel Prices. COMMENT: The Equipment tab of the project properties indicates fuel prices were updated as of 9/18/17 but should be further updated to today's fuel price as they have increased. SIGNIFICANCE: Medium. RESOLUTION: Update fuel prices.	Fuel prices updated to 8/13/2018 prices New England(PADD1A) from eia.gov
Labor rates. COMMENT: Labor rates have been updated using a recent wage determination (from 3/9/2018), however it appears several of the labor classes were not updated (see Pile Drivers, Plumbers and Electricians). A more recent wage determination is available (7/27/2018) and should be utilized for all labor classes. SIGNIFICANCE: Medium. RESOLUTION: Reprice all labor classifications with most current wage determination.	Labor rates have been updated using FY18 wage determination dated 08/10/2018 from www.wdol.gov
Notes. COMMENT: There is an author note in the Note tab of the Project Properties which include many outdated references. SIGNIFICANCE: Low. RESOLUTION: Revise project notes to include current information only.	Updated notes in the notes tab, under project properties.
Equipment Escalation. COMMENT: The estimate includes a 4.72% escalation on equipment but there is no explanation as to how this escalation was calculated (index used, start date, end date). CWCCIS is the index that should have been used but there is no mention of it. SIGNIFICANCE: Low. RESOLUTION: Provide information on how this escalation was calculated.	Added notes and updated the Equipment Escalation. Also included materials to this escalation. Starting date 1st Quarter 2016, ending date 1st Quarter 2018.
Material Escalation. COMMENT: An escalation has been applied to the equipment but not the materials in the estimate. A majority of material costs in the estimate have not been revised with quotes and, therefore, should be escalated to bring the material costs to current price levels. SIGNIFICANCE: High. RESOLUTION: Include escalation for materials from assumed quarter of 2016 cost book (NAE SOP is to use Q1FY16 as the start date for cost book escalation). Again, CWCCIS should be used to generate the material escalation rate.	Added notes and updated the Equipment Escalation. Also included materials to this escalation. Starting date 1st Quarter 2016, ending date 1st Quarter 2018.
Sales Tax. COMMENT: The estimate is using CT sales tax percentage, however the estimate is also assuming NY prevailing wages. Reviewer would assume some consistency in wages/sales tax. SIGNIFICANCE: Low. RESOLUTION: Utilize Westchester County tax rate (I believe it's currently 7.375%).	Updated sales tax rate used to Westchester County, NY sales tax rate. Current rate for Westchester Co. is 7.375%.
Painted Pavement Markings. COMMENT: The crew output of the painted pavement markings (Source Tag 321723130710) has been altered with a note stating "decreased output to even 12 hours", however the duration of this item is only 1.2 hours. The ManHours state 6 hours, however that is 5 laborers x 1.2 hours each. In order for the duration of the job to be 6 hours (6 hours split between NY and CT), the crew output needs to be revised to 333.3333 (from 1666.6667). SIGNIFICANCE: Low. RESOLUTION: Revise crew output.	Decreased crew outputs to 333.3333 to make an even 12 hours for the painted pavement markings (Source Tag 321723130710) task.

Subsurface prep for Abutments/Footings. COMMENT: The estimate appears to be missing subsurface prep for the abutments and footings. Reviewer would expect some additional excavation, compaction, gravel, etc. to prepare for installation of the new abutments and footings. SIGNIFICANCE: High. RESOLUTION: These items should be added to the estimate.	Included 50 CY gravel and compaction into the folders North and South Bridge Abutment and Footing.
Mob/Demob. COMMENT: Mob/Demob is calculated using a percent of total direct cost, however the estimate is detailed enough that an itemized mob/demob can be included. SIGNIFICANCE: Medium. RESOLUTION: Provide itemized mob/demob.	Itemized mob/demob was built and given 10 hours in the estimate to match the 10 hours combined on the construction schedule.
Sidewalk and Barrier. COMMENT: The estimate is missing formwork for the barriers. The other items in these folders indicate the barrier will be cast in place and will require formwork and finishing to provide the stone pattern called for on the drawings by CDM Smith. SIGNIFICANCE: Medium. RESOLUTION: Include formwork and finishing for the barriers on both the north and south bridges.	Formwork has been added to the retaining walls.
Concrete Finishing. COMMENT: The estimate is missing finishing for the sidewalk and deck slab. SIGNIFICANCE: Medium. RESOLUTION: Include finishing for the sidewalk and deck slab on both the north and south bridges.	Flatwork finishing RSM 033513300100 has been added to sidewalks and roadway.
Cofferdams. COMMENT: The estimate includes shore driven temporary sheeting for the demolition of the existing abutments but it is unclear if either cofferdam is being extended to demo the existing pier at each bridge location. It is also assumed that these cofferdams will remain in-place for the installation for the new abutments. SIGNIFICANCE: High. RESOLUTION: Confirm assumed construction methodology for removal of the pier at each bridge. Confirm assumption regarding cofferdam remaining in-place for demo of existing abutment and installation of new abutment.	It is assumed the bridges will be demolished during the low to no flow season, cofferdams will not be required during this portion of work. The cofferdams will be in-place for installation of new abutments, assuming a total height of 45 feet for each cofferdam (15 feet + 30 feet into river bed).
Dewatering. COMMENT: The estimate appears to be missing dewatering of the cofferdam. Dewatering should be included for whatever duration the cofferdam(s) are assumed to be in place. SIGNIFICANCE: High. RESOLUTION: Include dewatering for the necessary duration at each bridge cofferdam.	Dewatering items added for each cofferdam (2 per bridge) for 75 days each.
Cofferdam Removal. COMMENT: The estimate appears to be missing removal of the temporary cofferdams. SIGNIFICANCE: Medium. RESOLUTION: Include removal of the temporary cofferdam. This can be done using the same Cofferdams, shore driven, temporary sheeting line item but removing the material cost.	Added cofferdam removal by using the same line item, and using 0 for material cost.
Prime Contractor HOOH. COMMENT: The estimate states the prime contractor is assumed to be capable of performing little of the work itself and will subcontract a majority of the project. The HOOH rate used is more indicative of a larger self-performing GC	Changed Prime HOOH to 8%.

on a very large project. SIGNIFICANCE: High. RESOLUTION: HOOH should be revised to 8% at a minimum.	
Debris disposal. COMMENT: The estimate includes an accounting of disposal fees for the roadways, sidewalks, driveways and grading (8300 cy) and includes an accounting for the hauling of this material as well as hauling of the actual bridge demo material but does not include a disposal fee for the actual bridge demo material. SIGNIFICANCE: Medium. RESOLUTION: Provide assumption as to what will happen with bridge demo material and, if appropriate, include disposal fees in the estimate.	The estimate includes over $1.5 million. The estimator believes this is adequate to cover disposal of the bridge. Quantities were provided by CDM Smith.
Productivity Adjustment. COMMENT: A majority of items in the estimate are using the default crew output. Considering the project location (congested area, around water, etc.) productivity will likely not reach 100%, especially for items related to the abutment construction. SIGNIFICANCE: Medium. RESOLUTION: A productivity reduction should be applied to account for working both sides of the bridge, working around water, in a congested area, etc. This reduction should, at a minimum, be applied to the abutments/footings folders. Suggest productivity factor of 87.5% (assuming loss of 1 hour every 8 hour shift).	Productivity adjustment of 87.5% has been added to the MII estimate.
Accumulated Sediment. COMMENT: The description of the TSP in the project properties notes mentions removal of accumulated sediment, however no accounting for this activity appears to be included in the estimate. SIGNIFICANCE: High. RESOLUTION: Estimator should verify this activity is necessary and include items in the estimate to account for it (to include access to the sediment, excavation, hauling, disposal/tipping fee, etc.).	There is excavation and disposal of 8300 CY included in the MII estimate. If CDM Smith did not include a quantity, or state sediment disposal is required, then it is not included in the MII estimate.

Construction Schedule. COMMENT: Construction schedule shows continuous work through two winters, to include abutments and footings installation in Jan-Apr (North Bridge) and Dec-Apr (South Bridge). SIGNIFICANCE: High. RESOLUTION: Confirm schedule is correct with assumption of winter concrete placement. Additional concrete pouring/finishing costs will be required to be added to the cost estimate to account cold weather placement.	Schedule is provided to show durations of each feature of work, and is not necessarily the exact days work will be performed. Majority of work should be able to be completed in Spring-Fall for the first bridge, and same the following year for the second bridge.
Project Schedule. COMMENT: Schedule submitted includes only construction activities. Provide project schedule to show approval of Chief's Report, executing the PPA(s), design activities, real estate, cultural resource preservation activities, fish and wildlife activities, and acquisition into the assumed NTP of the construction schedule. SIGNIFICANCE: High. RESOLUTION: Provide project schedule to provide a basis for midpoint dates in the TPCS.	Project Schedule will be provided by the PM. Construction schedule is included in the Cost appendix. Regardless, the mid-point of construction is determined from the construction start date and the cost is escalated from current PL to mid-point of construction.
Acquisition Strategy. COMMENT: The impact, especially to the Relocations and Bridges risk elements, are too low. There is no mention in the concern or discussion about acquisition strategy which can affect your construction items (IFB may allow for an inexperienced contractor who performs the work inefficiently and at a higher cost). There is mention about the number of contracts going out being unknown which translates to competition. Lack of available competition can certainly affect cost of those items. SIGNIFICANCE: Medium. RESOLUTION: Revise IMPACT to at least Relocations and Bridges (if not to Fish and Wildlife and Cultural Resources depending on what, exactly, is assumed to be captured in those items) to at least Marginal to better account for these risks.	The impact for relocations and bridges will be adjusted to marginal for Acquisition Strategy
Construction Elements. COMMENT: There is discussion in the Fish and Wildlife and Cultural Resource risk elements discussing construction modifications and claims. This same discussion very much applies to the Relocations and Bridges risk elements. The risk of mods, in addition to the discussion in these risk elements regarding water diversion, should drive the impact to something higher than marginal. SIGNIFICANCE: Medium. RESOLUTION: Revise IMPACT to at least Relocations and Bridges (if not to Fish and Wildlife and Cultural Resources depending on what, exactly, is assumed to be captured in those items) to at least Moderate to better account for these risks.	The impact for relocations and bridges will be adjusted to moderate for Construction Element to account for construction modifications and claims

Cost Estimate Assumptions. COMMENT: There are two items in the MII that account for nearly 30% of the project cost; the two "Fabricated highway bridges, concrete in place, no reinforcing, beams, includes shoring" items. Reviewer is concerned material cost and level of effort for installation for this item is not representative of the prestressed concrete box beam unit that is called for in the design. Further, as the ARA states, there is a heavy use of the cost book with no revisions to productivity to account for site conditions specific to this project and no quotes obtained for major cost drivers (concrete, pavement, fill, etc.). SIGNIFICANCE: Medium. RESOLUTION: Revise IMPACT to Relocations to Significant and Bridges to Moderate to better account for these risks.	The impact for relocations and bridges will be adjusted to significant and moderate respectively under Cost Estimate Assumptions.
External Project Risks. COMMENT: There should be some accounting for potential risk of weather. The project is located in an area at risk for flooding and with a construction period of two solid years all construction activities are likely to be impacted by weather at some point. SIGNIFICANCE: Medium. RESOLUTION: Revise LIKELIHOOD of Relocations and Bridges to Likely to better account for these risks.	The likelihood of Relocations and Bridges to account for potential risk of weather under external project risks will be revised to likely in the following submission.
PDT Discussions and Conclusions (all items). COMMENT: There is very little detail in the PDT discussions & conclusions which discuss why/how the Impact and Likelihood was selected for each risk element. SIGNIFICANCE: Low. RESOLUTION: Additional detail and explanation should be included to provide context as to how selections were made.	Additional texts will be incorporated under PDT discussions & conclusions to discuss why/how the impact and likelihood was selected for each risk element.
OBSERVATION: The TPCS is complete and matches the provided MII estimate and ARA results. A project schedule will corroborate the time periods selected for midpoint of design, lands and damages, and construction.	Noted.

IEPR Comments

1. Document assumptions and identify risks, including potential foundation and cofferdam issues that must be resolved and investigations that must be performed during the next phase of design in order to move the design forward and improve the accuracy of the cost estimate. 2. Evaluate the potential for flooding impacts resulting from installing cofferdams at both abutments simultaneously to determine whether schedule and costs may be underestimated. 3. Update the cost estimate for the TSP using estimated quantities and realistic allowances	1. Adopt. The cost appendix will be updated to include a statement about why the construction contingency is 17.18%. 2. Not Adopt. This request is beyond the scope of the feasibility phase. Schedule and cost impacts of risks are included as contingency and will be documented in the Risk and Uncertainty Analysis section of the main report. 3. Not Adopt. The team accepts the risk of not using site-specific information and quantities. The risk of the implementation cost being higher than estimated, and the schedule being longer, has been communicated to the vertical team and included in the risk register. The

where appropriate for the various elements of construction, based on rational assumptions for the work required at the project site.	risk register is the team's primary risk management tool and allows the team to consider study and implementation risks in one location.