

### Nuyakuk Project Cost Estimate for 2019 and 2020 Studies

Aquatics/Fisheries Resources						
Number	Study/Assessment	Timing	Description	Approximate Cost Estimate		
				2019	2020	Totals
1	Bathymetric Modeling of the Falls	Spring or Fall 2019	To the extent possible given the natural constraints, aerial surveys utilizing a drone will be utilized to define habitat conditions, bathymetry, substrate, etc. in the bypass reach. Primary intent of the study is to confirm suitable passage corridors will be maintained/improved for upstream migrating fish as a result of Project operations. Modeling of these data results and incorporation of data from other studies will be a key component of the overall effort (see #6 task below)	\$100,000	\$125,000	\$225,000
2	Fish Species Distribution, Migration and Abundance	2019-2020	Primary focus will be placed on "forebay" area and two miles upstream. Surveys during anadromous and resident spawning and associated with juvenile outmigration periods would take place. Potential exists for visual surveys, snorkeling, juvenile trapping and/or radio tagging of "priority species" and subsequent tracking. The goal would be to document species presence, use and distribution near the Project area. Staff will need to be on site for long periods of time to document seasonal migration timing.	\$400,000	\$400,000	\$800,000
3	Fish Passage Assessment	2019	Focus would be on the falls itself. A comprehensive amount of surveying and flow measurements at various seasonal river conditions would occur to determine what level of bypass flow would be needed to pass migratory fish upstream. Effort would also be placed on documenting run timing and areas of priority utilization prior to passage and during the ascent of the falls. Portions of this effort would be done in concert with and/or utilize data from #1 above. Results from this work would assist with the Aquatic Modeling effort (#6) described below.	\$125,000	\$100,000	\$225,000
4	Geomorphology/Chanel Maintenance/Sediment Transport	2019-2020	Intent would be to document existing channel maintenance processes and determine the impact of the forebay on continued sediment transport and deposition downstream of the project. Various sampling techniques including cross-sections, sediment traps, pebble counts, etc. may be utilized. Sediment routing may be incorporated into the Aquatic Modeling task (#6).	\$125,000	\$125,000	\$250,000
5	Icing Studies	2019-2021	Overall scope of this effort is still a bit ambiguous. The icing assessment may be primarily associated with the temporal aspects and involve a set of remote cameras documenting icing conditions with specific focus placed on areas near the intake and tailrace outflow	\$50,000	\$50,000	\$100,000
6	Aquatic Modeling	2019-2020	Data collected from the various aquatic studies would be incorporated into a holistic model that documents existing conditions and describes natural modifications to the channel, fish behavior, upstream and downstream migration corridors, etc. with different operational scenarios. From an analytical perspective, this will be the culmination of all aquatic data collected in that it will define the impacts to the aquatic environment (positive and negative) associated with Project development and operations.	\$50,000	\$300,000	\$350,000
Water Resources						
7	Water Quality Evaluation	2019-2020	Intent would be to define existing baseline conditions in appropriate locations near the Project to document any impacts related to project implementation. Field efforts would include long-term deployment of monitoring equipment (hydroloabs, temperature loggers, DO monitors, etc.). Data analysis component of this effort would potentially include DO and temperature modeling.	\$175,000	\$175,000	\$350,000

8	Installation and Monitoring of Stream Gauge/Hydrologic Assessment*	2019-2020	Intent would be to document existing hydrologic conditions and assist with operations development. Gauge would be installed in early 2019 (Spring) and regular calibrations and discharge measurements would accompany its data collection. This is an essential piece of the entire study program and will likely need to be monitored for the duration of the license. Data from the licensing period would be incorporated into the overall aquatics modeling effort (see "Modeling" task).	\$100,000	\$75,000	\$175,000
<b>Terrestrial Resources</b>						
9	Wildlife Surveys of Project Area	2019-2020	Intent would be to define the wildlife habitat and presence of species potentially located in the project area. Mammals, shorebirds, waterbirds, raptors all included in this assessment. Seasonal surveys needed to assess both migratory and resident species. Area outside of the defined project area needs to be studied (regional level) to fully assess existing condition and define potential impacts of the project. Emphasis would be placed on the transmission line corridor. Extensive study area. Both on the ground and aerial surveys would be likely.	\$200,000	\$200,000	\$400,000
10	Botanical Surveys	2019-2020	Intent would be to define the habitat availability and "priority species potentially present in the project area. Native, and invasive species would be included in this comprehensive assessment. Seasonal surveys may be needed. Area outside of the defined project area needs to be studied (region level) to fully assess existing condition and define potential impacts of the project. Emphasis would be placed on the transmission line corridor. Extensive study area.	\$125,000	\$125,000	\$250,000
11	Wetland Assessment	2019 - 2020	Intent would be to quantify and classify the extent and type of wetlands present in the project area and subsequently define the potential impact of project development and operations. Focus would be on the transmission line corridor. Extensive on-site wetland/GIS mapping, soil core sampling, etc. Large area to survey.	\$175,000	\$125,000	\$300,000
12	Rare, Threatened and Endangered Species Assessment	2018 or 2019	Intent would be to identify habitat and species presence for any wildlife and/or botanical RTE species present in the project area and outline the associated project impact associated with project development and operations.	\$75,000	\$100,000	\$175,000
<b>Cultural</b>						
13	Cultural Resources Study	Likely start in 2019 and extend into 2020	Per the Section 106 process, the intent would be to define the Area of Impact associated with project development and subsequently conduct desktop and field studies to identify document and classify all historical properties in the project area. Significant levels of on-foot and aerial surveys of the Project area, including the transmission line corridor would take place. Extensive collaboration with the State Historical Preservation Office required and ultimate product will be a Historical Properties Management Plan.	\$175,000	\$125,000	\$300,000
<b>Recreation and Aesthetics</b>						
14	Recreation Surveys	Likely start in 2019 and extend into 2020	Intent would be to define the extent of the recreational activities that occur in the project area and define all impacts associated with project development and operations. Seasonal studies needed to comprehensively define activities. Entirety of the Project area would be surveyed. A combination of on-foot, boat and aerial surveys along with surveys at strategic locations would likely be utilized.	\$100,000	\$100,000	\$200,000
15	Visual and Aesthetic Analysis	2019 or 2020	Intent would be to define the extent of the potential visual impacts associated with project development and operations. A combination of on-foot and aerial surveys would likely be conducted. Simulated renderings would likely be the ultimate product.	\$75,000	\$50,000	\$125,000
<b>Other</b>						
16	Geology and Soils	2019	Intent would be to supplement any historical data that exists in the area related to long-term geology and soil condition in the project area. A combination of on-foot and aerial surveys of the Project area would be utilized to characterize the existing geology.	\$65,000	\$15,000	\$80,000

17	Socioeconomics	2019	Likely a desktop exercise that utilizes existing data along with phone interviews and in-person meetings to fully described primary economic conditions in the project area and assesses the impacts associated with project development and operations.	\$35,000	\$10,000	\$45,000	
18	Land Use	2019	Likely a desktop exercise that utilizes GIS to document existing land ownership/use and documents necessary permits, easements, etc. that would be necessary to construct and operate the Project.	\$35,000	\$10,000	\$45,000	
19	Climate Change	2019-2020	The extent to which this assessment will be needed is still unclear. At a minimum, some assessment of climate change and its impact on the ability of the project to operate long-term at the defined parameters and its potential impact on the current natural environment will likely be needed. A review of existing historical hydrology and associated weather conditions would be utilized along with a trend analysis to model potential future snowpack and precipitation conditions.	\$75,000	\$10,000	\$85,000	
<b>Engineering</b>							
20	Geotech Drilling Program	2019	This would involve the assessment of material conditions both in-water and out of water associated with the layout of the Project. Confirmation of appropriate rock composition for infrastructure would be acquired via hard rock drilling techniques. A majority of the focus would be placed on the main infrastructural components (intake, tunnel, penstock, powerhouse, etc.). The transmission line corridor would be assessed as well. Large equipment will be required to conduct this assessment. Mobilization of this equipment is a key consideration.	\$800,000	\$150,000	\$950,000	
<b>Regulatory</b>							
21	Regulatory/Licensing Process and Overall Project Management	2019-2020	This task would involve all aspects of coordinating with FERC and all stakeholders, meeting facilitation, attendance and minutes, document development (study plans and reports, FERC filings, etc.), internal and external strategic planning, GIS and overall natural resource study program management. It is notable that all fundamental licensing documents (DLA, FLA, etc.) and associated drawings would come in 2021 and later.	\$300,000	\$300,000	\$600,000	
					<b>Cost Estimate Total</b>		<b>\$6,030,000</b>
					<b>Highlights</b>		<b>\$525,000</b>