Run-of-the-River Hydropower Project for Nuyakuk:

Development of an Economic Decision Support Tool to Support Planning Discussions

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Acknowledgements

Core Team

- Nushagak Electricity and Telephone Cooperative
  - Will Chaney
- McMillen Jacobs Associates
  - Cory Warnock
- RE Alaska
  - Rob Jordan
- National Renewable Energy Laboratory
  - Karin Wadsack

Subject Matter Experts

- Alaska Department of Fish & Game
  - Tim Sands
- Bristol Bay Regional Seafood Development Association
  - Andy Wink
- Bristol Bay Science and Research Institute
  - Bryan Nass
- Klein Schmidt Group
  - MaryLouise Keefe
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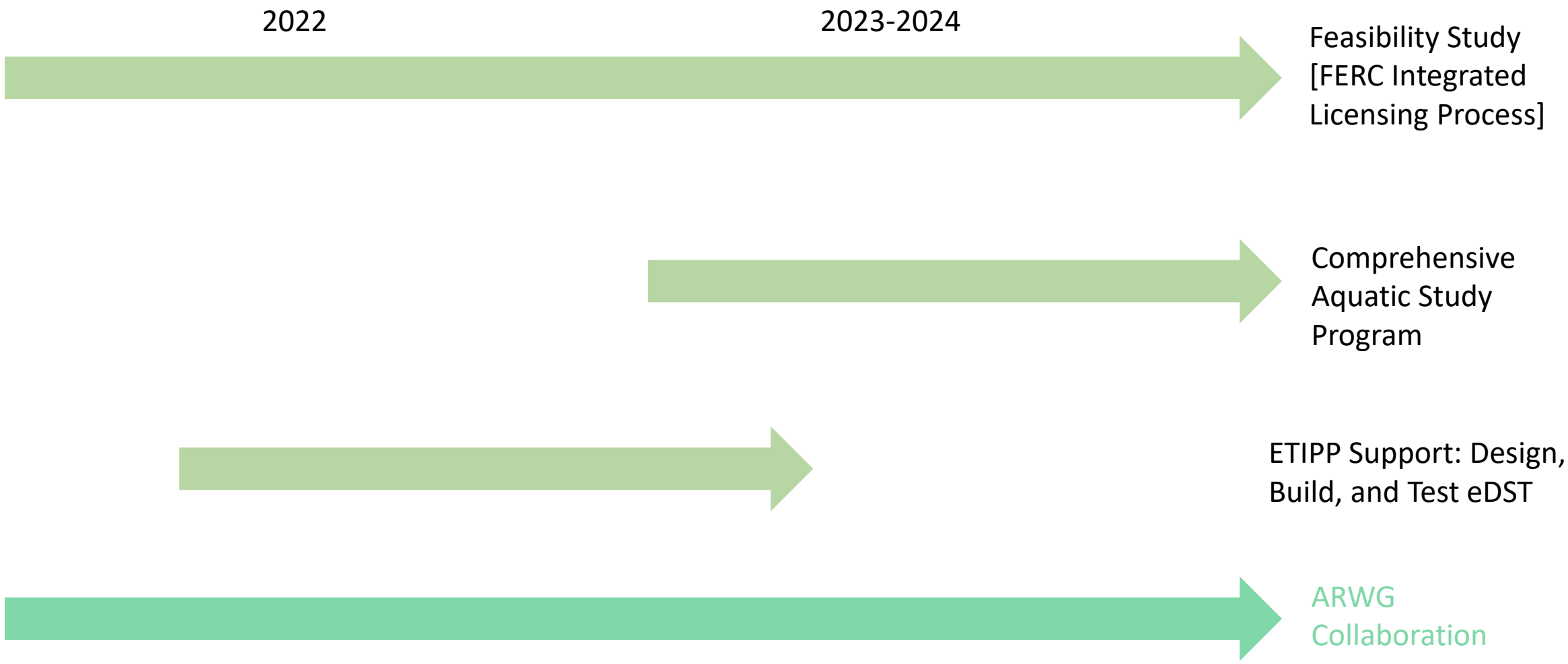
  - Noble Hendrix

Motivation

- Feasibility study currently in progress for siting a run-of the river hydropower project on the Nuyakuk River in Southwestern Alaska
- Working with Nushagak Electricity and Telephone Cooperative, Dillingham Alaska
- ETIPP supporting the planning and siting of this project

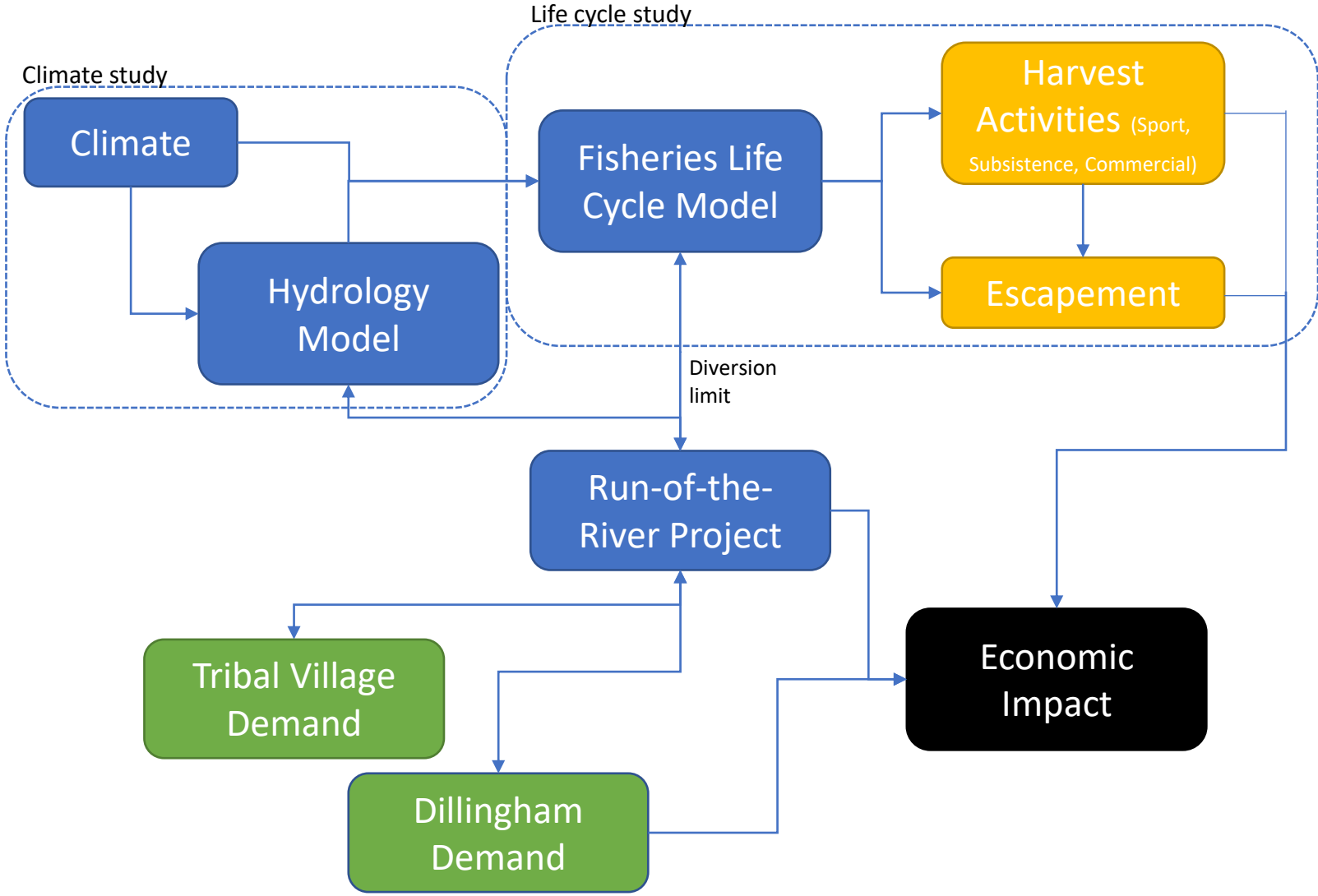
Source: https://www.nushtel.com/hydroelectric-project.htm

Tentative Timeline



Scope of ETIPP Effort

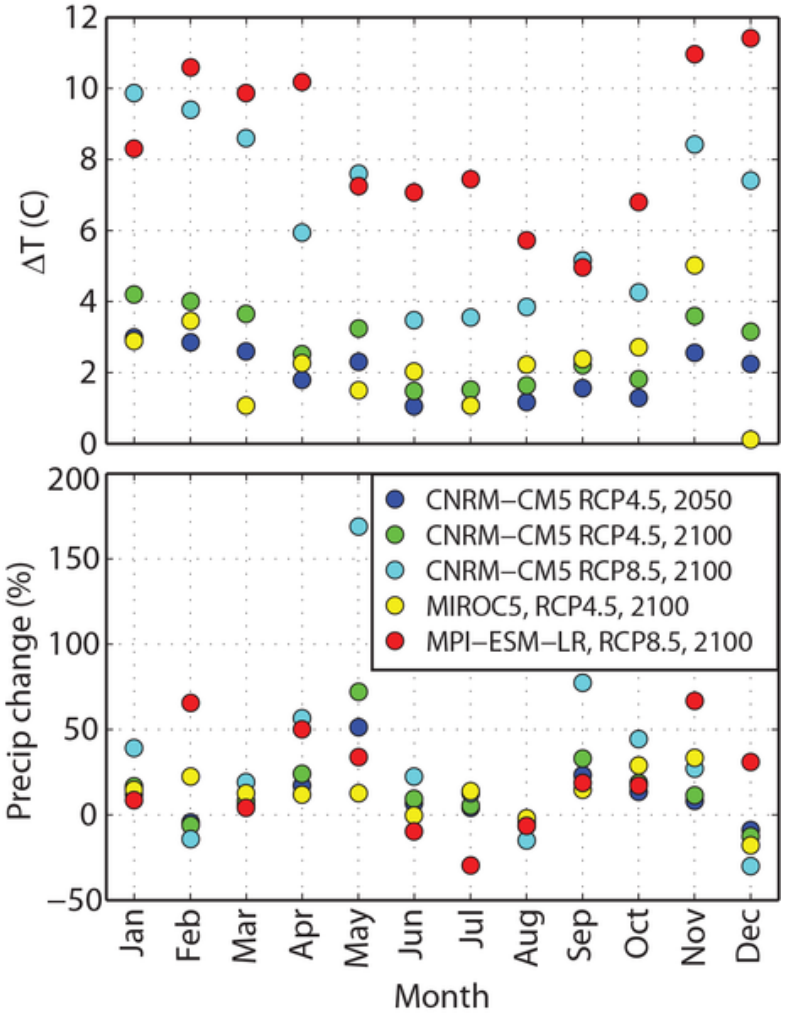
- Develop an economic decision support tool (eDST) that facilitates evaluation of different scenarios
- Our focus is on designing a model structure that enables changing of assumptions
  - Many of the planned studies will initiate in 2023
- Doing a series of meetings to improve our understanding of the dynamics and capturing our assumptions for initial construction of eDST



Hydrology Submodel

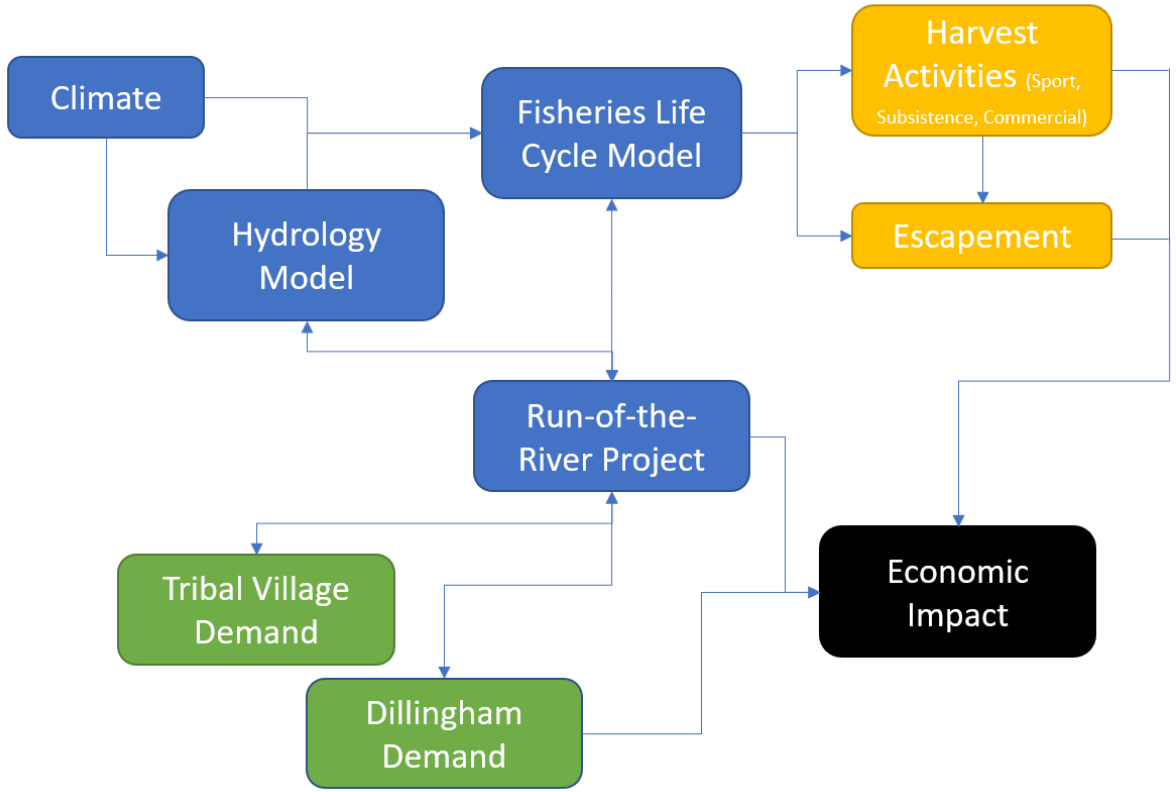
The eDST currently contains monthly values for river flow baselines as well as flow rate changes expected over time.

- All assumptions for values can be changed as aquatic study insights are generated
- For now, leveraging insights from the historical record as well as projections in the literature regarding possible hydrologic changes



Wobus C et al. 2015

Submodels are in active development

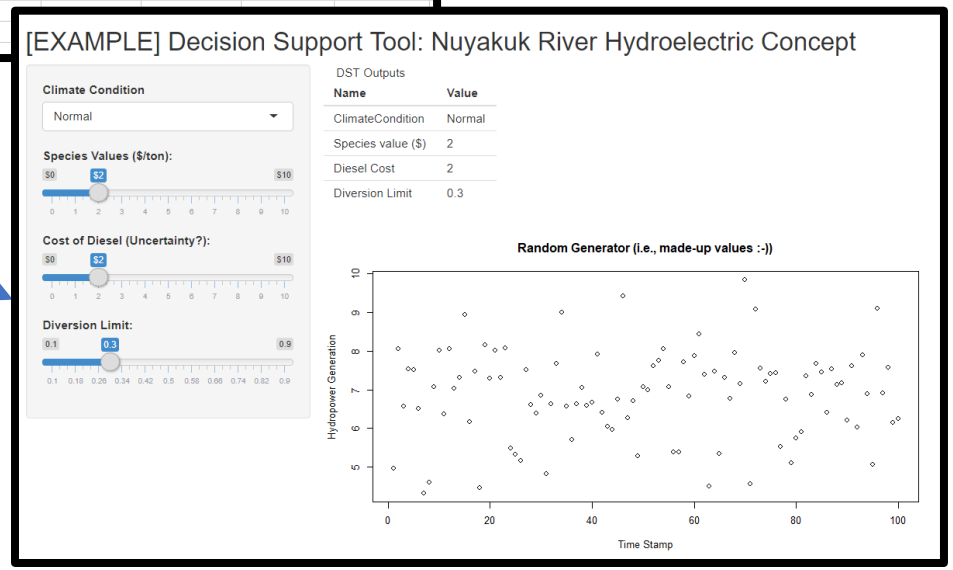


- Economic model buildouts
  - River flow output
  - Impact of building the hydropower plant
- Validation of the diesel baseline and hydropower models to reach the appropriate base electricity rate
- Capturing fish dynamics across river flow, power production, and economic impacts

(Vision) Final Output

	Estimated Costs for Hydro Generation		Units	Pre-Constructio	Construction Spend		
	Construction			Year -4	Year -3	Year -2	Year -1
	Reservoirs and dams	-	($)				
x	Pre-construction costs	10,000,000		10,000,000			
x	Powerhouse structure civil works	18,900,000	($)			9,450,000	9,450,000
x	Water conveyence systems	19,700,000	($)			9,850,000	9,850,000
x	Electro-mechanical equipment	11,500,000	($)			5,750,000	5,750,000
x	Transmission and interconnection	31,000,000	($)				31,000,000
x	Lands and site preparation	27,574,000	($)		27,574,000		
x	Licensing and permitting	8,110,000	($)		8,110,000		
x	Project management	12,165,000	($)		4,055,000	4,055,000	4,055,000
x	Taxes and insurance	1,622,000	($)		499,862	366,101	756,038
x	Contingencies	20%			80,478	58,942	121,722
	Total Project Cost			10,000,000	40,319,339	29,530,043	60,982,760
	Plant Size	10	MW				
	Construction Period	3	Years				
	Construction Interest Rate	2.00%					
	Debt/Equity Ratio	70%					
	Operational Period Costs						

eDST Engine
(Workhorse)



eDST Interface
(Scenario Outputs)

- Economic decision support tool (with a front end interface)
  - eDST Engine (documents various assumptions and has coded interactions between variables)
  - eDST Interface (simpler visualization of primary inputs for scenarios as well as outputs of results)
- Slide Deck summarizing model design, build, and test activities