15. CONCLUSIONS AND RECOMMENDATIONS

This section provides a summary of the primary findings from the Feasibility Studies conducted by MWH during the period from 2011 through 2014, and offers a recommended path forward.

15.1. Conclusions

15.1.1. Technical Feasibility

The Project as configured is technically feasible, taking into account the following major considerations.

15.1.1.1. Need for Project

Alaska has a long, successful history of harnessing power safely from its abundant natural resources. Susitna-Watana Hydro is part of the state's long-term energy policy that calls for generating 50 percent of Alaska's power from renewable energy by 2025. In the Railbelt area where the Project is to be constructed, electrical loads are predicted to grow fairly slowly over the next 10 to 20 years. However, many factors can affect those future predictions, such as significant use of electric vehicles, or unexpected economic growth that introduces large, new loads on the system. Also, when the Project is constructed, utilities will then have the opportunity to retire older, less efficient "standby" thermal plant, thus improving the long-term reliability of the Railbelt system, while at the same time reducing overall system electricity costs over the 50-year economic life of the project (in fact, hydro is usually expected to perform for 100 years). These and other factors drive the need for this project.

15.1.1.2. Project and Unit Sizing

A "rated" turbine capacity of 459 megawatts (MW) at a reservoir El. 1950 ft. – equivalent to a generator output of 446 MW, was selected for the project based on reservoir operation and power generation modeling, including PROMOD runs, to determine how the project will best be integrated into the future Railbelt integrated electrical system. The Project would have a combined rated turbine output of 618 MW from the three 206 MW turbines operating at maximum head – equivalent to a generator outputs of 606 MW and 202 MW respectively. At lower pool levels, the plant output would be proportionately lower. At minimum operating level of El. 1850 ft. the total plant turbine output would be approximately 315 MW – equivalent to a generator output of 303 MW. The generating units will be comprised of Francis reaction type turbines coupled to synchronous generators, which will be capable of operating at high efficiencies over the broad range of expected power head and flow at the site.

It is suggested that the Project include provisions for the installation of a fourth generating unit, to allow future generations the flexibility to be able to use the resource in the most productive manner for the load at that time. The provisions for the installation of another unit will be a penetration through the dam and an empty unit bay. Under present regulations such an addition would require submissions to the Federal Energy Regulatory Commission (FERC) when and if an expansion decision is taken in the future.

15.1.1.3. Dam Type

Preliminary engineering studies were performed to compare three alternative types of dams that were deemed to be most suitable for the Susitna-Watana site: Earth Core Rockfill Dam, Concrete Faced Rockfill Dam, and Roller Compacted Concrete Dam. Lack of updated site investigation meant that these comparative studies had to be carried out using the geotechnical data available from the 1980s studies. Safe configurations based on all three types were drafted and construction costs estimated. In addition to cost factors, a Water Resources Assessment Methodology analysis was also performed to compare non-cost factors, and arrive at a recommended alternative. The comparison included judgments on ease of future raising; seismic resistance; risks of cost increase; visual intrusion; possibilities of development acceleration; cold weather construction; potential for design optimization; the accommodation of environmental mandates; and long-term cold weather performance. Taking all relevant factors into consideration, a configuration based on a RCC dam was selected as the preferred alternative. Final verification of the foundation characterization of the dam is vital to support the decision – which can be established by the completion of proposed site investigations (drilling in the valley and in the footprint of the dam; exploratory adits; structural geological mapping, etc.) prior to initiation of detailed design.

15.1.1.4. Reservoir / Storage Capacity

Elevation 2050 ft. was selected as the optimum normal maximum operating level – together with a minimum operating level of El. 1850 ft. – to provide maximum energy benefits to the Railbelt over time, using the 3.38 million acre-feet of active storage capacity created to store and release water to maximize project energy generation in the critical cold weather months from November through April. This storage capacity will also enable the Project to provide the required seasonal instream environmental and recreation flows in the Susitna River downstream of the dam, which are expected to be defined through the FERC licensing process over the next two years.

15.1.1.5. Powerhouse Type

The site is conducive to construction of a surface powerhouse, as opposed to the more costly subsurface powerhouse configuration envisioned in the 1980s studies. This is due to the fact that the RCC dam type (versus the previous embankment dam type) allows for a much more compact site development, allowing the powerhouse to be placed at the toe of the dam and thereby significantly shortening the power conduit length compared to earlier designs. The penstock can readily be constructed integral with the downstream face of the concrete dam and extended the short distance down to the surface powerhouse located at the toe of the dam. In addition, advances in technology since the 1980s have led to cost effective means of using temporary enclosures around (or even early prefabricated construction of the outside wall of) a surface powerhouses during construction to permit conventional concrete placement as needed without weather-related construction shutdowns as might have occurred in the past. The primary access to the powerhouse will be by a short tunnel, and emergency egress is possible at the opposite end of the powerhouse.

15.1.1.6. Site Access and Infrastructure

The site is remote, and requires the construction of a new road for access and operation. Three routes were proposed after lengthy studies by Alaska Department of Transportation and Public Facilities (ADOT&PF) for Alaska Energy Authority (AEA); including two southern routes which are not connected to the public road system (i.e. no public road access is possible). This study does not favor a particular route, but has utilized the southern (Gold Creek) route solely for the purposes of estimating the project construction cost.

Most personnel, fresh food, and emergency spares would be transported to the construction site by air, but most bulk materials (e.g., cement, fuel, reinforcing steel) and manufactured items (e.g., transformers, power parts) for dam construction would be transported to the site by the road access from a railhead.

In addition to the road and the associated railhead facilities and bridges, the Project will require substantial site infrastructure such as temporary and permanent housing for a construction workforce that peaks at approximately 1,200 personnel, water and wastewater infrastructure and an airstrip. Preliminary designs for these various facilities and infrastructure have been completed to a level of detail sufficient for feasibility-level cost estimating.

15.1.1.7. Transmission and Interconnection

The Project will provide power to the Fairbanks area to the north and to the Anchorage/Mat-Su/Kenai areas south of the project site. Extensive planning and Railbelt system modeling studies, including economic comparisons, were undertaken to determine the proposed transmission line and interconnection configuration for the Project. The transmission alignment studies were performed in parallel with site access road studies to minimize construction cost and keep the corridor as small as possible to minimize environmental impacts. Although the transmission will include three new 230 kilovolt lines interconnecting with the existing Alaska Intertie, no final transmission corridor selection has been made as yet. The estimate of construction costs is based on the transmission of Susitna-Watana power through two circuits running east to Gold Creek, and one circuit running north to Cantwell.

15.1.1.8. Estimated Project Cost

Detailed construction planning has been executed for the key project tasks such as road construction; bridge construction; river diversion; quarry development; dam foundation excavation; RCC placement; transmission construction. Although AEA has not yet published any procurement strategy, for the Opinion of Probable Construction Cost (OPCC) it was assumed that there would be 12 separate supply, service and construction contracts – each initially executed with AEA. For proper management it is envisaged that some service and supply contracts would be assigned from AEA to the main contractor. It was assumed that all contracts would be engineered, then bid and constructed using the traditional Design-Bid-Build approach.

In addition, non-construction costs have been estimated based on significant input from AEA. The total project cost is estimated to be US$ 5.655 billion, in Q2 2014 dollars. No allowance has been made in the estimate for escalation, interest during construction etc. The estimated costs have been subject to probability analysis to account for estimating variations.

15.1.1.9. Design and Construction Schedule

A comprehensive engineering and construction schedule has been prepared based on the feasibility design work completed to date, and using the contract packages noted above. The current schedule shows that the first generating unit can be placed into service 10-years and four months after a notice to proceed is given for the site investigation and assuming no lag between phases. The schedule assumes that Licensing tasks, submission of license application and issuance of a FERC license will not be delayed, and that the construction contracts can be awarded immediately following the license issuance (together with the subsequent permitting, etc.).

The construction of the road is vital to enable any work to begin on site, but the road construction cannot begin until the license is issued. The overall schedule for construction is aggressive including a high assumed rate for placement of RCC in the dam. Nevertheless, the schedule is considered to be achievable by a first rate, experienced contractor.

15.1.1.10. Power Production

Operation simulation modeling indicates that the average annual energy generation capability of the Project is approximately 2,800 gigawatt-hours (rounded up). This assumes that all of the potential power and energy can be utilized to meet future integrated Railbelt system electrical loads. The amount of load following assumed at Susitna-Watana will not materially affect annual energy generation. However, the current generation estimate does reflect the inclusion of forecasting of basin runoff from snowmelt, enabling shaping of monthly generation to best match monthly load shapes and minimizing spill that would reduce energy generation.

15.1.1.11. Operating Plans

AEA has not yet developed a detailed organization plan for the operating phase of the Project. As such, only a general description of the likely operation and maintenance program requirements has been provided for this Report based on experience gained by AEA and the Railbelt Utilities at Bradley Lake, and from experience of other large utilities at other large, remote hydro projects in North America. An estimated annual operation and maintenance (O&M) budget for the project was derived through parametric means, using data on other similar projects to make a provisional estimate for economic and financial modeling being performed by AEA. An operating organization plan will need to be developed for inclusion in the FERC License Application.

15.1.2. Economic Feasibility

A final determination on economic feasibility of the Project has not been established, however, extensive production cost modeling has been undertaken as part of the current feasibility studies, with the following general conclusions made possible at this time.

15.1.2.1. PROMOD Results

Results of the most recent PROMOD (production modeling) simulations both with – and without – the Project, show that the inclusion of the Project in the integrated Railbelt system will result in a significant reduction in the use of gas and oil by the utilities, and a large decline in the use of what is now (thermal) peaking plant over time. Because it has the lowest operating cost and the highest reliability among the generation sources, the addition of substantial hydro capacity at the Susitna-Watana Project will inevitably reduce the need for oil and gas fired generation, even from combined cycle units in future years.

The most significant production savings for the whole Railbelt system will be realized if and when the system is operated with centralized dispatch. Discussions with the Railbelt utilities will be required to arrive at the optimum contractual and organizational arrangements for regional power dispatch.

Total annual net savings to the system will depend on the ultimate cost to develop the Project, financing terms, dispatch efficiency, and most importantly, the future price of natural gas.

The addition of a 459 MW (turbine rating) Susitna-Watana Hydro resource intended to serve the total Railbelt system, together with sufficient transmission to incorporate it into that system will almost certainly result in a re-evaluation of commitment and dispatch practices, which will further enhance the long-term value of the Project.

15.1.2.2. Future Economic / Financial Studies by AEA

Ongoing economic and financial studies being conducted by AEA and other consultants will determine the ultimate economic viability and optimal timing of the Project, as well as establish the Plan of Finance. Such evaluations are being made outside the context of this report.

15.1.3. Environmental Considerations

The Susitna-Watana Project will be located in a remote region of Alaska with abundant natural resources. As such, it can be expected that it will have some impacts (both beneficial and potentially adverse) on these resources both during its construction and over the long-term operation. AEA is pursuing a license under FERC's Integrated Licensing Process regulations. A Pre-Application Document that identified existing information regarding the existing environmental conditions and potential impacts of the Project was filed with FERC in December 2011.

AEA is currently performing 58 individual studies (of which three are engineering studies) as a result of an extensive collaborative study plan preparation process agreed with interested stakeholders in 2012.

Implementation of the studies is well underway with one full year of study complete. The initial results from the first year of study efforts were documented in the Initial Study Report filed with FERC on June 3, 2014. Calendar year 2015 is projected to be the second and final year of these studies with a final report due to FERC in 2016.

AEA is taking a collaborative approach to performing the environmental studies. AEA is working closely with licensing participants in the execution of studies that will support their License Application, inform protection, mitigation and enhancement measures, serve as a foundation to environmental review under the National Environmental Policy Act, and support all needed state and federal permits including FERC's licensing determination under the Federal Power Act.

15.2. Recommendations

The following recommendations are offered regarding the path forward for the Project.

15.2.1. Funding

Funding should be secured in sufficient amount to enable completion of the geotechnical site investigation and remaining environmental studies needed to support the FERC License Application as soon as practical.

15.2.2. Geotechnical

Further geotechnical investigation before commencing design – including exploratory adit(s) in the dam site abutment foundation rock – are vital for the verification of assumptions made so far in the studies. The investigations should be completed in sufficient detail to support initiation of detailed design work as scheduled, without a delay caused by the need to adjust the feasibility design and/or first collect additional site geotechnical data.

15.2.3. Engineering

Pre-design engineering work should be completed to enable AEA to initiate detailed design as early as possible, to ensure the targeted project on-line date is met.

15.2.4. Procurement Plan

Additional work on developing a procurement plan should progress to firm up AEA's plans for contracting for project design and construction, to maintain the current project development schedule.

15.2.5. Integrated System Studies

Should the utilities negotiate the rules and agreements associated with centralized dispatch – and as stakeholder agreements are reached with respect to releases etc. – additional system production modeling studies should be undertaken. These proposed studies should analyze the response of the integrated Railbelt system units, such as Bradley Lake Hydro, to the proposed Susitna-Watana Project, in addition to determining the response and benefits of the project in the interconnected system.

15.2.6. Centralized Dispatch Planning

Studies to date have shown that the maximum benefits from the Project would be realized through a centralized commitment and dispatch process. Plans should progress for establishing a centralized dispatch organization so that maximum long-term economic impacts can accrue to the Railbelt and the State.