HYDROELECTRIC FEASIBILITY STUDY
CORUNNA DAM

City of Corunna, Michigan

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CORUNNA HYDRO FEASIBILITY STUDY
STATEMENT OF FINDINGS

I. CONCLUSIONS AND RECOMMENDATIONS

Four design alternatives were considered for the proposed Corunna hydro project. The best alternative was installation of a single 70 kW Essex bulb turbine. The total cost of this option is $190,000, and an estimated $367,920 kWh of electricity would be produced annually. However, a cash flow analysis indicates that the Corunna hydro project is not economically feasible. Therefore, it is recommended that the Corunna Dam not be developed for hydropower production. It is further recommended that the dam be either repaired (at an estimated cost of $20,000) or removed.

II. BACKGROUND

The Corunna Dam is located on the Shiawassee River near the City of Corunna, Shiawassee County, Michigan. The dam was originally constructed in 1843 to provide mechanical power for a milling operation. The hydro plant was last operated in 1953, and the powerhouse superstructure and adjacent mills have since been demolished. The dam is presently owned by the City of Corunna.

III. DESCRIPTION AND PRESENT CONDITION OF THE FACILITY

The Corunna Dam consists of a 135-foot long gravity dam and an intake structure with two open flume bays. The dam is composed of earth and rockfill, and has a concrete cap to protect it against erosion and scour. Each bay of the intake structure measures 8 feet by 4 feet and contains a wooden lift gate. The powerhouse above the intake structure has been removed.

Because no prior dam inspection report was available, it was necessary to assess the structural integrity of the dam to determine the extent and nature of repairs necessary prior to installation of generating equipment. An above and below water inspection of the dam was conducted in March 1981. The full test of the report is included in Appendix A.

The following determinations were made during the course of this inspection:

- Although the concrete cap exhibits considerable cracking, the dam is stable and shows no evidence of movement or differential settling. Limited undermining and breaching has occurred but does not effect structural stability. The dam can be easily repaired.

- The main walls of the powerhouse appear sound and require only minor corrective action.

- The retaining walls and wing wall adjacent to the intake structure show signs of movement and settling. Cracks and joints have opened sufficiently to indicate repairs are necessary to stabilize the walls. The wing wall and adjacent powerhouse wall have been undermined, and if the foundation washes away, the powerhouse walls will settle. The west retaining wall has not been undermined, but seepage around and through the wall should be repaired.

- The gates, gate guides, and apron in the stoplog bays are in good conditions. Recommended repairs include control of seepage through the west retaining wall and control of the undermining of the wing wall and east powerhouse retaining wall. Control of seepage underneath the spillway is not necessary to insure structural stability, but may be accomplished at minimal additional expense when workers repair the walls. The estimated cost of these repairs is $20,000 excluding engineering and administrative costs.

IV. EXISTING ENVIRONMENTAL SETTING

The Corunna Dam is located in the outskirts of the City of Corunna. Several residences are located nearby. The Michigan Department of Natural Resources - District Fisheries Biologist has indicated that the Shiawassee River near Corunna supports rock bass, smallmouth bass, an assortment of course fish, and substantial populations of forage fish, (i.e. shiners and chubs). Provision of fish passage facilities does not appear to be an issue at this site. There is a possibility that a State-listed threatened mussel, Actinonaias ellipsiformis may be present in a shallow area in the vicinity of the dam.

The State Historic Preservation Officer has indicated the proposed development would have no effect on any archaeological site eligible for listing on the National Register of Historic Places. There are presently no known historic sites in the area. Copies of environmental correspondence may be found in Appendix B.

V. SITE HYDROLOGY

Stream flow data is available from a USGS gauging station 3 miles downstream of the dam. The average stream flow is 328 cfs. The Corunna impoundment is too small to provide storage capacity. Thus, the hydro facility would be operated in a run-of-the-river mode, resulting in no fluctuations in the impoundment level. A copy of the flow duration curve is included in Appendix B.

VI. THEORETICAL POWER POTENTIAL

Based on an average hydraulic head of 8 feet and an average stream flow of 328 cfs, the average available power potential is 182 kilowatts.

VII. EQUIPMENT SELECTION AND DESIGN ALTERNATIVES

Four design alternatives were considered for the Corunna hydro facility. These alternatives are summarized below:

1) Alternative No. 1 - Two, 70 kW Essex modular bulb turbine-generator units. Estimated annual production: 585,606 kWh.

2) Alternative No. 2 - One, 70 kW Essex modular bulb turbine-generator unit. Estimated annual production: 367,920 kWh.

3) Alternative No. 3 - Two, Allis-Chalmers tube turbines, (one, 50 kW unit; one, 150 kW unit). Estimated annual production: 622,585 kWh.

4) Alternative No. 4 - Two Leroy-Somer hydroelectric turbines, (one, 34 kW unit; one, 23 kW unit). Estimated annual production: 320,265 kWh.

Further information of these alternatives may be found in Appendix C.

VIII. PROJECT COSTS

Project costs reflect criteria established by the U.S. Department of Energy, current information from manufacturers, and engineer's estimates of the cost of labor and materials. Engineering experience on projects of a similar nature and size was also taken into account. Project costs include capital costs and interest during construction. Project costs are detailed in Appendix C and summarized below.

Alternative No.	Project Costs
1	$ 326,000
2	$ 190,000
3	$ 465,000
4	$ 274,000

IX. POTENTIAL ELECTRIC MARKETS

No sizable City-owned loads or private consumers were identified near the Corunna Dam. Thus, the potential power markets include bulk sale to Consumers Power Company or bulk sale to a remote interconnected utility. Under the Public Utilities Regulatory Policy Act, Consumers Power Company must purchase power from the dam at a rate based on the company's avoided cost of alternate sources of power. This rate is currently 2.8¢/kWh and can be considered an assured selling price. However, it may be possible to negotiate a long term power purchase contract at a higher selling price with Consumers or a remote interconnected utility.

X. ECONOMIC AND FINANCIAL EVALUATION

The four design alternatives were compared in terms of first-year cost per kWh of production. First-year costs include operation, maintenance, and administrative costs as well as debt amortization costs. Debt amortization costs are based on 10.5% interest rate and a 24-year bond life, representative of current municipal (general obligation)

bond terms. Operation, maintenance and administrative costs were calculated as 2% of equipment costs plus $\frac{1}{4}$ man year of labor at $20,000/year. Costs are summarized below.

Alternative No.	First Year Cost	Annual Production	First Year Cost/kWh
1	$ 46,653	$ 585,606 kWh	8.0¢/kWh
2	$ 28,945	$ 367,920 kWh	7.9¢/kWh
3	$ 63,707	$ 622,485 kWh	10.2¢/kWh
4	$ 35,682	$ 320,265 kWh	11.1¢/kWh

Based on this comparison, Alternative No. 2, a single 70 kW Essex bulb turbine, was selected as the best alternative and subjected to a more detailed cash flow analysis. The full test of this analysis is indicated in Appendix D.

An initial cash flow analysis was performed assuming a selling price of 2.8¢/kWh, escalating at 8% per year, and a 6% annual escalation in operation and maintenance costs. The project shows 19 years of negative cash flow, with a net loss of $194,597 at the end of the 24-year bond life.

A second cash flow analysis was based on a long term fixed power purchase price of 12¢/kWh for 30 years. A longer bond term (30 years at 11%) was also assumed. The 30 year net cash flow is $115.601 surplus. However, the last 8 years of operation show negative cash flow, and it is unlikely a power purchase agreement like this could be negotiated. The selling price is so high the purchaser would not break even for 20 years.

XI. RECOMMENDED DEVELOPMENT OPTION

The proposed Corunna Dam hydroproject is not judged to be economically or financially feasible.

XII. ENVIRONMENTAL IMPACT ASSESSMENT

Impacts during construction of the best available hydro development alternative would

be of overall insignificance if it can be ensured that A. ellipsiformis is not located in the area or is protected from water level fluctuations. Fish passage facilities would not be required. Impacts during operation and maintenance of the facility would be minimized because the facility would be operated in a run-of-the-river mode, eliminating stress on the aquatic biota.

Under a no action alternative, the dam would continue to deteriorate and settle, and would eventually fail. Structural failture would result in increased downstream discharges and the release of silt which has accumulated behind the dam. In addition, upstream (impoundment) water levels would drop several feet. It is difficult to measure the magnitude of associated damages, but the City of Corunna is located just downstream of the dam. The City of Corunna will have to decide whether to repair or remove the dam. Deterioration is not likely to be an acceptable alternative.

XIII. PROJECT IMPLEMENTATION

It appears that the project would be eligible for all permits and licenses required for construction and operational maintenance of the facility. These requirements are summarized in Appendix E.

XIV. PROJECT FINANCING

Alternative sources for financing were reviewed to determine the possibility for improving the cash flow position of the project. Potential grant and loan sources are organized into those that could be used to repair the Corunna Dam's structural problems and those that could be used to complete the hydroelectric installation. A detailed discussion of these grant sources is found in Appendix F.

As a result of the cash flow analysis conducted for the Corunna hydro project, it is clear that a substantial level of outside funding would be needed to make the project economically feasible. Given the current level of appropriations for most assistance programs, it would be necessary to secure a number of grants before sufficient funds would be available to alter the project's economic feasibility. Current reorganization of the federal budget makes this level of grant support extremely unlikely, and it is therefore concluded that the project is not economically feasible.