

CRITICAL RISKS AND MITIGATION MEASURE
SARNEY DAM AND WATER SUPPLY SYSTEM PROJECT, IRAN

Risk Item	Risk Item Description	Severity	Possible Impact	Mitigation Measures
PROJECT RISKS				
A. DESIGN RISKS				
A.1.	<p>Geological and Seismic Risk: Iran sits on some of the world's most active seismic fault lines. Hormozgan Province is at the foot hill of Zargos mountain range and has active faults lines in this part of the range. Sarney Dam site is located in western side of Makran structural zone. Seism- tectonics studies show that the area around dam site, during and before 20th century, the seismic activities have been relatively high. Most of 20th century earthquakes are located in half northwest part of area around dam site (radius of 200 km). Most of historical earthquakes are located around Bandare-Abbas and Qeshm Island.</p> <p>Nearest earthquake to the site was on July 21, 1965 with magnitude of Ms5.1, at 13 km distance from the dam site. Recent field studies show the surface faulting process is not dominant in the dam site area. This is proved by continuation of outcrop key layers in Bed</p>	High	Dam failure leading to serious consequences in terms of property and human life loss.	<p>Seismic analysis was conducted by the consultant and adequate safety factors have been kept in designing the dam and allied structures. Thorough geological surveys and soil investigation have been carried out for the dam site and other structures to ensure the dam safety. A plan of dam safety instrumentation is a part of dam design. WRMO technical committee comprising six specialist from various institutes in Iran reviewed and approved the design.</p> <p>Moreover the supervision consultant will have the geotechnical and hydraulic specialists included in their team who will review the design during the construction for any unusual findings</p>

	River. The most important linear structures around the dam are two segments of Zendan fault at 2.5 and 3.75 km far from the site.			
A.2.	Hydrology risk: Dam location is in an arid to semi-arid region with an average annual rainfall of 247mm. There is a possibility of having dry seasons with no or low level of rain, consequently no or low water may be available for storage in dam lake.	Moderate /Low	The dam does not have enough water available for human consumption or aquifer recharging, consequently creating a drought situation and affecting quality and human life in the project area-failure to achieve the project objectives.	The simulations for the hydrology are based on the actual data for the past 35 years. Probable Maximum Flood (PMF) is used as the design basis and assumed to provide, in effect, a zero risk for the dam safety. The detailed analyses carried out by the consultant, Tamavan Consulting Engineers, who is well experienced in the design of hydraulic structures in the country. The analyses concludes that enough water will be available for the storage and human consumption over the life of project.
A.3.	Flood Damage to the Dam: Excessive flood may severely damage the dam structure.	Low	Dam failure leading to serious consequences in terms of property and human loss	The design of the dam complex/spillways is based on data extrapolation of 10,000 years flood peak flow rate and provision has been made for a safe operation of the dam by having adequate no. of sluice gates for releasing the flood water to downstream of the dam. Moreover a flood safety instrumentation plan is designed and is integral part of the dam design and construction that will give early warning for protective measure to be taken in case of excessive floods or any damage to the dam structure.
A.4.	Design Complexity: The dam is meant for water storage for human consumption and recharge of the	Moderate		The design of the dam and structure takes in to consideration the seismic and geological analyses carried out in detail

	<p>aquifer downstream of the dam. The dam height is 52 m with an overall length of 460 m. The dam is classified “under 60m height” with a total reservoir capacity of 61 MCM, thus classified as not complex design in relative terms.</p> <p>Also, the water treatment plant at Minab will be conventional type with traditional tested and tried technologies.</p>			<p>by the consultant The water conveyance pipe line is gravity, one meter diameter with a length of 36 km and is made out of corrosion resistant material (GRP) for longer life. No pumping or complex networking is involved. The treatment plant conceptual design has been prepared and detailed design will be prepared by the selected contractor. The design will be reviewed by the project consultant for its soundness and efficiency and approved by the EA.</p>
B. IMPLEMENTATION AND PROJECT COMPLETION RISKS				
B.1.	<p>Land Acquisition: Land for dam, dam lake, access road, water conveyance pipeline and treatment plant is to be acquired for project implementation. The land is owned by the villagers who own the land for generations. The land owner may not be willing to sell the land to GOI.</p>	Moderate /High	<p>Delay or failure to acquire land for project may delay or stop the project implementation. This would result in failure to achieve the project objectives and increase peoples’ sufferings.</p>	<p>EA has already started the land acquisition process. Dam Site and Lake: The total area of land for dam and lake at peak flood level is estimated to be 436 ha. The agreements with land owners have been signed and transaction for 142 ha been completed. The balance land acquisition is expected to be completed in one year time. The EA and the Ministry of Energy gave their firm commitment to complete the process in the stipulated time.</p> <p>Water conveyance Pipeline and Access Road: The bas foundation of the access road has already been completed pending asphaltting. The land is fully owned by the EA/GOI. The pipeline from the dam to the Water Treatment Plant will be laid</p>

				<p>within the right of way of the road.</p> <p>Water Treatment Plant: The treatment plant will be constructed within the premises of the existing Minab Water Treatment Plant. The land of the treatment plant is fully owned by the Bandar Abbas Water and Wastewater Company.</p>
B.2	<p>Delay in project implementation by the contractors: The contractors may not be able to complete the project on time because of its capacity, technical abilities, man power non-availability or issues, contractual disputes, financial difficulties, construction material availability etc..</p> <p>The lessons learned from post evaluated projects shows that all of these projects had completion delays from 7 months to six years.</p>	Moderate / High	The project may not be able achieve its outputs on time and delay the realization of the project outputs, outcomes and impact, thus	<p>Contractors' Pre-qualification: The contractors will be pre-qualified for their experience in similar projects, technical capabilities of their personnel, construction equipment, financial capabilities etc. to make sure the good quality of the contractors are selected for the project.</p> <p>Contract conditions: The contractual conditions, performance bond, warranty period and retention money etc. are some measures in the contract to assure contractors performance and on time completion.</p> <p>Mode of procurement: Qualified contractors will be selected through ICB/MC giving a wider range of choice and participation from member countries to ensure the selection of the technically capable and financially sound contractors for project implementation.</p> <p>Project implementation schedule: Overall project implementation schedule takes in to account the pessimistic and</p>

				<p>maximum time for the critical activities to derive the optimistic schedule with the help of Microsoft Project software by experienced personnel incorporating the experience and lesson learnt from similar projects. The contracts will incorporate adequate penalties for the implementation delays while a PMC will be responsible for the effective implementation of the project under the direct supervision of the EA and Ministry of Energy.</p> <p>IDB supervision: IDB plans to launch regular supervision mission during the project implementation period.</p> <p>Contract packaging: The project is divided in to several contracts to avoid the dependency risk on a single contractor. The contracts components under GOI financing are already being implemented.</p> <p>Standard Bid Documents and RFP IDB standard bid documents and RFP will be used for the procurement of civil works and consultancy services.</p>
B.4	<p>Mode of Financing: Traditional commercial financing/ lending has limited involvement of institutions during the project implementation phase as the interest of institution is to make profit on their lending.</p>	Moderate/low	<p>Improper lending instrument may affect implementation schedule and delay completion consequently delaying the project impact and objectives.</p>	<p>Istisnaa' mode of financing is selected for the proposed project. This ensures against such risk as IDB will be the owner of the assets till their completion and handing over to the EA. This will ensure IDB involvement and its interest in implementation support /supervision for timely completion and delivery of</p>

				assets.
B.5.	<p>Environment Risk: Dams invariably impact the natural and socio-economic environment. The Sarney Dam is therefore, expected to have both adverse and positive effects on surface and groundwater resources, air quality, sound levels, and biological, socio-economic and health conditions of the project area and its surroundings.</p>	<p>Moderate /low</p>	<p>- Construction sites are the origin of water pollution that affects water quality downstream of rivers. -Soil resources will be affected with borrow material movement. -Air Quality & Sound Levels: Excessive dust and noise will result during construction. -The biological and aquatic environment has the most potential to be affected during dam -adverse effect on river hydrology is expected which will affect agriculture downstream of the dam. -Adverse Effects on the Socio-Economic and Health Conditions are expected. During the impounding of Sarney Dam at normal level, 2.03 hectares of irrigation lands, 4.56 hectares of rain-fed lands, 38.41 hectares of orchards and 0.011 hectares of residential lands will be submerged.</p>	<p>The project consultant performed a comprehensive Environment Management Plan (EMP), which covers the pre-construction, construction and operational activities of the Sarney Dam and Water Supply Project. A major part of the EMP is on mitigation measures during construction therefore, it has been made a part of all project construction contracts. EMP details the environmental obligations of the Construction Contractors and their Sub-Contractors during construction, to safeguard the environment. The EMP is aligned and in compliance with the GOI Environmental Policy, Iranian Environmental Laws and Standards.</p>
B.6	<p>Funds Availability: The funds availability is key to the success of achieving the project outputs. Funds availability can be delayed by GOI or IDB for project execution because of various reasons including difficulties posed by the political environment, transactional difficulties or bureaucratic procedures.</p>	<p>Moderate /low</p>	<p>Delay in funds availability will hamper the implementation period and delay the project completion and its impact.</p>	<p>80% of the project will be financed by IDB. The remaining 20% will be covered under GOI financing. High level commitments for on time funds availability have been ensured by the Ministry of Finance, Governor of Hormozgan Province and the Ministry of Energy. Meanwhile the GOI has already started working on the implementation of</p>

				their part of the components. The construction of access road is estimated to have 70% completed and the work on the Diversion Tunnel is in progress.
B.7.	<p>Social Safeguard: The impact on the people living in the dam lake area will be affected as they will lose their sources of livelihood and living place.</p>	Moderate / low	Moving people from their original habitats would make them socially and economically insecure and increase their sufferings. They may not agree abandon and create legal issues in the project implementation	. There will be a total of 44 families that will be affected out of which 35 have agreed to take cash compensation whereas the remaining 9 have opted for alternate land. In addition to compensation for the lost land and houses the government will provide educational and health facilities and involve the locals in the new constructions in order to ensure socio-economic development of the region. The successful implementation of such activities could be facilitated by on-time compensation of damages and training of rural youths as the main work force for the dam construction
B.8.	Riparian Rights:	Nil		The Sarney River flows through Iran territory.
B.9.	<p>Cost Overrun: All the post evaluated projects in Iran has cost over-run in the range of 2-200%. This is attributed to inflation, currency fluctuations, modifications, import restrictions or delayed implementation.</p>	Moderate / High	Delayed project implementation as well as non-availability of additional funds would result. The project objectives may not be achieved as envisaged or planned.	The cost estimates have been calculated keeping in account the expected inflation during the construction period, i.e., in the coming 5 years. Moreover, the contracts for the diversion tunnel (Euro 5.18 m) and a access road (Euro 3.06 m) have already been awarded and their execution started. The foreign cost element is about 25% of the total project cost and unforeseen fluctuation in the foreign cost elements expected to impact the project

				cost will be well within the cost estimates. For any unexpected circumstances, a contingency of 20% is kept in the total project cost estimate to avoid any cost over-run.
C. DELIVERY QUALITY RISK				
C.1.	<p>Operations Sustainability: The operation and maintenance of the dam and water conveyance pipeline will be the responsibility of the new Hormozgan Regional Water Authority. The post evaluated projects in Iran were generally found in satisfactory condition during operations, however the budget allocations by EAs (GOI) for O&M activities were not adequate to operate the facilities efficiently.</p>	Moderate / High	The long term sustainability and utilization efficiency of assets will be affected adversely resulting in short life span of the investments, lower IRR and project objectives may not be achieved to full extent.	<p>Company experience and staff: HRWA is responsible for the operations & maintenance of various facilities including the existing 4 Dams in the province, offshore water supply lines to islands, water wells system, irrigation water networks etc. and have well experienced staff and established procedures. HRWA will operate and maintain the dam and water conveyance pipeline. The company has regular training programs for their staff within and outside the country to keep up the capacity building of their staff.</p> <p>Revenue assurance: The company has a water sales agreement with the local Water and Wastewater Company that is renewed every year to establish the sales price for the new year. This sales price is transferred in accounting books of the company by the GOI. Any losses are compensated by GOI through subsidies.</p> <p>Removal of subsidies: Like in energy sector, GOI has the plan to remove subsidies in future and privatize the operations. The cost will be transferred to</p>

				<p>the end-users with the removal of subsidies. Removal of subsidies will ensure financial sustainable operations.</p> <p>Treatment Plant Operations: The treatment plant will be operating under the responsibility of the Bandar Abbas Water and Wastewater Company who is responsible for the water treatment and distribution throughout the region. The company is well experienced in the operations and have trained staff. The revenues are collected periodically with over 90% recovery. The revenues do not cover all the cost of operation and maintenance and are dependent upon the subsidies provided by the GOI.</p>
C.2.	<p>Reservoir siltation: Siltation/ Sedimentation is an unavoidable phenomenon in dam reservoirs. It is estimated that about 500 tons/ km² of silt will be deposited in the dam reservoir per year. Like Minab dam reservoir that has lost over 30% of its storage capacity since its operations from 1984, Sarney dam reservoir may also lose its potential storage capacity.</p>	Moderate	<p>Loss of storage capacity will lead to reduced water supply to Bandar Abbas and neighbouring villages affecting the quality of life in these areas. Thus it would result in affecting level of project outcomes and impact.</p>	<p>Operation Management: Siltation is controlled through proper operations management of the dam during the flood times i.e., by controlling discharge, flushing operations, operations at peak water levels.</p>
C.3.	<p>Dry seasons: Sarney River is located in an arid to semi-arid region with an average rainfall of 247mm per annum. Dry seasons with low or no rain can result in low levels of water storage available for human consumption in Bandar</p>	Moderate	<p>Lower reservoir levels will result in reduced water supply for human consumption in the project areas. The project objectives and impacts will not be fully realized.</p>	<p>In case of a dry season the dam reservoir, with its 61 MCM capacity, will still have the two-three year water supply ensuring the continuity and sustainability of the project.</p>

	Abbas and neighbouring villages.			
C.4.	<p>Increased Water Losses through city network: The UfW (unaccounted for water) in the city of Bandar Abbas is at 27% level presently which is close to the national average. The old pipe network in the city and transmission line from Minab to Bandar Abbas may have increasing losses because of aging and corrosion. The water theft may also increase in case of subsidy removal by the government.</p>	Moderate	<p>The increase in water losses will increase the per capita water consumption and reduce the project impact; consequently increase peoples' sufferings. Also, the revenue collection will suffer affecting the project sustainability in longer run. The cost of water per unit will also increase affecting peoples' affordability and would impede the economic activity in the project region.</p>	<p>Company experience: The city network is being maintained by HWWC who has been able to bring the UfW from 31% to the present level of 27% in the last few years. The HWWC is further taking the following measures to reduce water losses in the network by rehabilitating and maintaining the existing network. Mitigation measures:</p> <ol style="list-style-type: none"> 1. Purchase and installation of counters (water meters) at water production sources for accurate measurement-completed in all cities; 2. Installation of metering stations at the entry of water to city networks. 3. Installation of metering station at branches to the green areas under municipalities. 4. Installation of barometer in all cities network for regulating, monitoring, maintaining and quick adjustment/response to water demand by analysing problem areas in the network pressure. 5. Water balancing network problems identification and remedial measures. 6. Renovation and rehabilitation of pipe networks. 7. To standardize branches and networks.