Statement on the Adoption of Hydrological Data for Preliminary Design Report of Xiaogushan Hydropower Plant

Gansu Province Water Conservancy & Hydraulic Power Survey Design Institute was established in 1958. This institute is the only Class A comprehensive survey and design unit in Water Conservancy industry in Gansu Province. It is qualified for surveying, planning, designing, scientific study, consulting, and engineering supervision for all styles of hydropower plants and it is well experienced in implantation of above mentioned aspects. There are 613 professional staffs including senior engineers, engineers and other kinds of technical staffs in the institute.

Gansu Province Water Conservancy & Hydraulic Power Survey Design Institute possess 9 Class A national certificates and 3 Class B national certificates in the aspects of engineering survey, engineering supervision, engineering consultancy, engineering mapping, soil and water conservation, and Environmental Assessment of Engineering construction projects. Since 1978, more than 90 outcomes of engineering design and scientific achievements of our institute was awarded National and provincial Prizes for advanced technology and superb designs, which witnessed our position as the first class hydraulic and hydropower survey and design institute in China.

The Feasibility Study Report, the Preliminary Design Report as well as the Engineering design for Xiaogushan Hydropower Plant, were accomplished and designed by Gansu Province Water Conservancy & Hydraulic Power Survey Design Institute.

For the designing of hydropower plant, the accurate and reliable hydrologic data of the Heihe River is the most important data for calculating the capacity and the average annual power generation. The catchment area at the sluice gate site of Xiaogushan Hydropower Plant is F=9427.8km^2, which locates 29.6km upstream to Yingluo Gorge Hydrological Observation Station. Since Yingluo Gorge Hydrological Observation Station was founded in 1944, up to now, the catchment area of Yingluo Gorge Hydrological Observation Station is F=10009 km^2. This hydrologic station covers complete observation items with long time observation data series (n=57 years), good control on selection of sections and high testing accuracy, so this hydrologic station is the main referential station for Xiaogushan hydropower station design.

The runoff of Heihe River is mainly recharged from the precipitation water and melting snow in Qilian Mountain area. Its annual distribution is not even, which is corresponding to feature of annual precipitation distribution characteristics. The most runoff appears in the flood season (from June to September). The variation of annual water condition is as following: from April to May, with the rising of temperature, snow in mountain area upstream melt and recharged into the river. The flow is increasing, the amount of which accounts for 11.7% of annual flow. Flood period lasts from June to September. The flow accounts for 68.2% of annual flow also the historical flood

generally would occur during this period. The precipitation is reduced from October to November, which is the recession period, and its flow accounts for 10.5% of annual flow. The dry season lasts from December to March (next year) and the runoff is mainly recharged from underground water. Due to the influence of frozen river, some precipitation is frozen in the flow channel; it will be melt into runoff until the next spring. During this period, its amount accounts for 9.6% of annual flow.

According to the analysis of the annual runoff series data from Yingluo Gorge Hydrological Observation Station, it shows that there is no obvious periodic variation as wet season or dry season. Above-30 years' observation data series, the parameters fluctuate steadily, especially, above- 40years' observation data series, the statistical parameters fluctuate very little. In terms of the average annual runoff, data can keep in the range from 50.2 m^3/s to 50.8m^3/s and the value Cv keeps in the range from 0.139 to 0.152; so it concludes that Yingluo Gorge Hydrological Observation Station has 57-year annual runoff series from 1944 to 2000 as excellent representatives. It can be used for engineering design.

According to hydrological features of hydropower plant and river, the selected typical years are based on the evidence that the annual water flow and water flow in the flood season (June ~September) are both close to design frequency. The detailed information as follows: flood year (P=15%, 1959); normal year (P=50%, 1965); dry year (P=85%, 1992). Total installed capacity and annual average power production are calculated based on putting the water flow data of typical years into the formula. With reference to industrial common practice, hydro energy computation for hydropower plant is strictly based on relevant regulations of *Specification for Hydropower and Hydro Energy Design (SL76-94) and The Normal of Hydraulic design of Hydropower Plant*. The selected hydraulic data from year 1944 to year 2000 (57 years) is monitored and provided by Yingluo Gorge Hydrological Observation Station, which belongs to Hydrological and Water Resources Exploration Bureau of Zhangye City and the data is accurate and reliable. In order to utmost utilize water head, when our institute designed Xiaogushan hydropower plant, designers from our institute calculated total installed capacity and annual average power production of the plant objectively based on relevant regulations. According to the existing hydrological data, the core data is calculated, which is the best and most accurate data obtained with various factors taken into account. The design of the hydropower plant is based solely on reliable data without human factors such as deliberately reduce annual operation hours or annual power production.

By analyzing on and comparing to the hydrological data from year 1944 to year 2000 (57 years), it is concluded that the Heihe River has been in the wet period for the last six years. The increased water flow of Heihe River is the main reason of the increase in power production. It is unpredictable and uncontrollable.

Hereby the statement.

December 9th, 2011

Gansu Province Water Conservancy & Hydraulic Power Survey Design Institute

甘肃省水利水电勘测设计研究院

关于小孤山水电站初设报告设计采用水文数据的说明

甘肃省水利水电勘测设计研究院(水利部兰州勘测设计研究院)始建于 1958 年，是甘肃省水利行业唯一的甲级综合勘察设计单位，具有承担大中小型水利水电工程勘察、规划、设计、科研、咨询、工程监理及工程总承包的能力和丰富的实践经验。全院现有高级工程师、工程师等各类专业技术人员 613 人。甘肃省水利水电勘测设计研究院现具有国家颁发的工程勘察、工程设计、工程监理、工程咨询、工程测绘、水土保持 9 个甲级资格证书以及工程建设项目环境评价等 3 个乙级资格证书。1978 年以来，我院共有 90 多项工程设计和科研成果荣获国家、省（部）颁发的科技进步奖和优秀设计奖。是中国一流的水电设计研究院。

小孤山水电站可行性研究报告、设计报告的编制和工程设计是由甘肃省水利水电勘测设计研究院负责进行。

对于水电站来讲，有所在河流翔实准确可靠的水文资料是精确计算电站装机容量和多年平均发电量的重要数据。小孤山水电

站闸址集水面积 F=9427.8km^2，位于莺落峡水文站上游 29.6km。莺落峡水文站 1944 年设站至今，集水面积 F=10009 km^2，观测项目较齐，资料系列长（n=57 年），断面控制良好，测验精度也较高，是小孤山水电站设计的主要参证站。

黑河径流主要由祁连山区降水和融冰化雪补给，径流在年内分配很不均匀，与降水的年内分配特性相应，绝大部分径流集中在汛期 6～9 月。一年内的水情变化大致如下：4～5 月气温升高，上游山区冰雪融化补给河流，河流径流量逐渐上涨，其量占年水量的 11.7%；6～9 月为河流汛期，其量占年水量的 68.2%，历年最大洪水皆发生于此期间；10～11 月降水减少，为河流的退水期，其水量占年水量的 10.5%；12 月～次年 3 月为冬季枯水期，径流主要由地下水补给，由于河流结冰的影响，这一时期的水量有一部分在河槽内结为冰块储存起来，到第二年春天才化为径流，这一时期的水量占年水量的 9.6%。

对黑河莺落峡站历年平均流量进行了分析，年平均流量无明显的丰、枯周期性变化，资料系列超过 30 年以后，统计参数趋于稳定，特别是资料系列超过 40 年以后，统计参数变化甚小，平均流量 50.2～50.8m^3/s 之间，Cv（流通能力）值在 0.139～0.152 之间，由此分析可知莺落峡站 1944～2000 年（n=57 年）径流系列有良好的代表性，可供工程设计使用。

根据电站与河流的水文特性，选择典型年时考虑年水量与汛期（6～9 月）水量都较接近设计频率的年份为典型，具体选择如

下：丰水年（P=15%）1959 年典型；平水年（P=50%）1965 年典型；枯水年（P=85%）1992 年典型。通过对典型年径流数据带入公式的计算，便可得出小孤山电站总装机容量和多年平均发电量。

小孤山电站水能计算严格按照《水电水能设计规程（SL76—94）》和《水力发电站水文计算规范（SL77—94）》的有关规定计算，并参照行业普遍做法，所采用的黑河 1944 年至 2000 年（57 年）的水文数据是由甘肃省张掖市水文水资源勘测局下属的莺落峡水文站实测的资料，数据准确可靠。我院在对小孤山水电站设计时，为最大限度地利用好电站所在河段水头，我院设计人员依据相关规程规范，客观精确地计算出电站总装机容量和多年平均发电量，电站的这些核心数据是我院依据当时已有的水文数据计算所得，是综合充分考虑了各种因素得出的最佳最准确的数据。水电站的设计一切以所掌握的可靠的数据为依托，不存在人为故意降低年利用小时数或年发电量的情况。

对照 1944 年至 2000 年(57 年)的水文资料可以发现，从 2005 年至 2010 年，黑河连续 6 年处于丰水状态。黑河水量的增加是不可预见的，不受人为因素所控制，也是导致电量增加超出预期设计值的主要原因。

特此说明。

二〇一一年十二月九日