ECONOMIC ANALYSIS

A. Introduction

1. Economic analysis of the project was conducted in accordance with the Asian Development Bank’s (ADB) Guidelines for the Economic Analysis of Projects. The objective of the economic analysis is to demonstrate the economic rationale and viability of the project. Demand analysis was conducted based on a sector review in line with the urban development plans of the project cities. The least-cost alternatives that were previously considered in the project feasibility study report were analyzed and reconfirmed. The assessment of the project benefits and costs was conducted with a calculation of the economic internal rate of return (EIRR). The project risks were assessed through a sensitivity analysis against various risk scenarios.

B. Project Rationale

2. The Government of the People’s Republic of China (PRC) initiated the “Western Development Program” in the year 2000 to stimulate regional economic development, improve living standards, speed up infrastructure construction, promote industrial development, enhance environmental protection, and improve environmental conditions in the western PRC. The program aims to reduce the gap in economic development between the western and coastal regions of the country. The program covers a total of 12 provinces and autonomous regions in the western part of the PRC, including Gansu Province. Development of Zhangye and Dingxi cities are important components of the program, because these cities are of critical economic and social importance for the province’s overall development.

3. The 12th Five-Year Plan (2011–2015) includes an initiative to achieve sustainable urbanization of the PRC’s secondary and tertiary cities. The plan projects that urbanization in the PRC will reach 75% by the year 2050 as a result of rural—urban migration. To facilitate the immigration process and accommodate these inhabitants, cities will need to expand and improve their urban infrastructure. In addition to the socioeconomic growth resulting from urbanization, the large number of urban inhabitants will provide an abundant work force to fuel the growth of industries and other economic activities.

4. ADB has been helping the PRC government to develop the western regions of the PRC, including Gansu province, by providing financial and technical support for government initiatives and efforts to stimulate sustainable economic growth and urban development of the project cities. The project will help the municipal governments develop and improve urban infrastructure and municipal services and stimulate social and environmental development that will promote economic growth and development in the two project cities.

C. Demand Analysis

5. The level and quality of the municipal water supply and wastewater treatment in Dingxi and Zhangye are inadequate, and many communities and industries still use alternative sources of water or are self-supplied. The water quality does not meet national safe water standards or sanitary requirements. There are households and industrial companies without full wastewater coverage in both cities, and wastewater in these areas is discharged directly into the streets and nearby creeks, or used for agriculture irrigation. In addition to the inadequate living conditions, the discharged wastewater serves as a breeding ground for insects and increases the risk of disease in urban communities.

6. Installation of underground pipelines will connect the new district to a new water supply and the existing wastewater treatment plants, provide proper access to clean water,
and facilitate discharge of domestic and industrial wastewater. It will also help the city close illegal and improper self-supplied water wells. It is estimated that water demand in Zhangye will reach 79,700 m³/day by 2020. Details of the water demand estimation are in the tables for economic analysis¹, Table 1.

7. A city’s economic growth depends on its socioeconomic structure and environment, and usually involves technological development, and the availability of abundant resources and associated services to fuel growth; the latter include various aspects of economic production, distribution, circulation, and consumption. The city's infrastructure needs to be developed in order to enable further economic development, and the benefits will be felt in various socioeconomic sectors, across the entire city.

8. Socioeconomic development encourages further infrastructure development as a society seeks to maintain positive growth. Economic development enables funding of new and maintenance of existing infrastructure improvements, but a balance between infrastructure and the natural environment must be established if socioeconomic development is to be sustainable.

9. Wetlands are diverse habitats that support tourism and research activities, serve as natural defenses to and provide treatment for pollution, provide a source of agriculture and aquaculture products, and serve as water reserves in times of drought. The presence of a wetland within the city boundary will attract both people and investment to support creation of communities around the wetland.

D. Economic Least-Cost Analysis

10. Economic analysis of the project is based on the least-cost analysis to achieve the project development objectives and meet the forecasted demand. Least-cost analysis compares the economic costs of technically viable project options and selects the option with the lowest (present value) economic costs. Given the same final outcome, the costs related to each option and alternative can be easily contrasted. Least-cost analysis was conducted to ensure that the selected investment options are the most economical interventions.

E. Economic Evaluation

11. Economic costs. The economic costs include (i) capital costs such as civil works, equipment, capacity strengthening, land acquisition and resettlement, project preparation, and implementation costs; (ii) physical contingencies; and (iii) operation and maintenance costs.

12. The updated financial costs were converted to economic costs and items such as transfer payments, price contingencies, and depreciation are excluded in the computation of the economic costs. The analysis (i) excluded taxes, duties, and interest during construction; (ii) used domestic price numeraire, with tradable items multiplied by the shadow exchange rate factor of 1.12; and (iii) applied a conversion factor of 0.8 to unskilled labor, because of the considerable surplus supply; no conversion factor was applied to skilled labor. The economic costs are phased over the planning period of 25 years.

13. Economic benefits. The economic benefits for the two urban infrastructure components were calculated in terms of savings resulting from the improved roads and traffic conditions under the with-and without-project scenarios. The economic benefits include (i) travel time savings, (ii) lower vehicle maintenance costs, (iii) reduced traffic jams, and (iv) reduced traffic accidents. The improved infrastructure will also attract more people to

¹ Tables for Economic Analysis (accessible from the list of linked documents in Appendix 2).
settle in the new district and bring in new business opportunities in areas that were previously not easily accessible.

14. **Traffic estimation.** The traffic composition for both Dingxi and Zhangye are relatively similar and are described in the tables for economic analysis (footnote 1), Table 2. The traffic projection is estimated until year 2035 and is detailed in SLD 17, Tables 3 and 4.

15. **Accident cost saving.** The road conditions will be improved as a result of the infrastructure component, thereby reducing the risk of accidents. This cost saving is calculated by multiplying the estimated number of vehicles accessing the road to the total road length. The cost estimations, based on the project design institute study under without-project scenarios for the project cities, are in the tables for economic analysis (footnote 1), Tables 5, 6 and 7. Over 25 years, the total projected accident savings are CNY57.8 million for Dingxi and CNY293.2 million for Zhangye. Given the PRC’s rapid economic growth and the government’s efforts to boost economic and social development of the country’s western region, this figure is expected to be potentially higher.

16. **Value of time.** The time value benefit is calculated based on the time value of passengers being transported in a given vehicle. The values for Dingxi and Zhangye are CNY1.27/car and CNY12.36/bus, based on multiples of the time value for passengers, passengers per vehicle, and time opportunity indicated in the tables for economic analysis (footnote 1), Table 8 and 9.

17. **Vehicle efficiency saving.** Vehicle efficiency savings incorporate savings in vehicle maintenance and operating costs. Improved road conditions will reduce the frequency of maintenance and gasoline usage. The project design institute’s study estimate for Dingxi is an average of CNY16.00 without the project, and CNY10.40 with the project from 2013 to 2018. The total savings for the 25-year project are calculated to be CNY1.166 billion (SLD 17, Table 10). In Zhangye, the costs average CNY6.00 without the project, and CNY3.90 with the project, with total savings for the 25-year project of CNY2.24 billion (SLD 17, Table 11).

18. The overall project economic benefits are summarized in the tables for economic analysis (footnote 1), Tables 12 and 13.

19. **Water supply benefits.** The newly constructed water supply plant will provide 80,000 cubic meters of drinking water per day to Dingxi’s Binhe New Area, enabling 200,000 residents to receive safe drinking water, with an estimated consumption of 89–156 liters per person per day (based on 8,000–14,000 liters per month per household, and an average of 3 persons per household).

20. The economic evaluation was undertaken using the domestic price level and numeraire and constant 2012 prices. Financial costs are converted to economic costs. Tradable items were multiplied by the shadow exchange rate factor of 1.12. A conversion factor of 0.8 was applied to unskilled labor because there is considerable surplus labor. No conversion factor was applied to skilled labor. The total projected benefit for the water supply plant will be CNY18.8 million, with an EIRR of 16.3%. There are significant economic benefits that were not valued, and the calculated EIRR is therefore a conservative estimate of the true EIRR. Non-quantitative benefits of the new water supply plant subcomponent include (i) disease incidence reduction due to safer water, (ii) improved water use efficiency and tariff collection rate, (iii) reduction of nonrevenue water for the city, and (iv) growth of the local economy and are indicated the tables for economic analysis (footnote 1), Table 14.

21. **Wetland protection.** The economic benefits for the Zhangye Wetland Protection component consist of (i) the wetland’s economic output, and (ii) the wetland’s economic...
function. In its feasibility study report, the project design institute estimated the annual output of the wetland under the project is CNY177 million annually. Using an exponential decay estimate of the time it will take for the wetland to disappear (referenced with past data), it was approximated that half of the wetland will disappear by about 2047. It is projected that with project implementation, the annual economic benefit is CNY1.8 million. Similarly, the total economic function of the wetland is estimated at CNY224.41 million; using the same half-life model, estimated first-year savings are CNY2.2 million in economic function.

22. Economic internal rate of return calculation. The EIRR was calculated for the (i) Dingxi urban infrastructure component (15.5%); (ii) the Zhangye urban infrastructure component (15.7%); the Zhangye water supply component (16.3%); and (iv) the Zhangye wetland protection component (15.8%). The overall project EIRR is 15.7%. The EIRR calculation, which is detailed in the tables for economic analysis (footnote 1), Table 15, indicates that the project is economically viable.

F. Sensitivity Analysis

23. Sensitivity analysis was undertaken to test the impact of unfavorable changes on the calculated economic net present value and EIRR of both the project components and the overall project (the tables for economic analysis (footnote 1), Table 16). Sensitivity analysis confirms that the project will remain economically viable even if some relatively significant unfavorable changes occur (e.g., a 10%–20% increase in costs, 10%–20% decrease in benefits, and 10% increase in cost with a 10% decrease in benefits).