

ECONOMIC ANALYSIS

A. Introduction and Methodology

1. The economic analysis of the Djizzak Sewerage System Development Project has been prepared following ADB guidelines.¹ The project cost of \$96.56 million will be funded in part by an \$81 million loan from ADB, with the project implemented over a 5-year period (2016–2021). The project will involve rehabilitation and reconstruction of the existing sewerage collection network, installation of one new pump station and the rehabilitation of three pump stations, and construction of a new wastewater treatment plant (WWTP) with a capacity of 30,000 cubic meters (m³) per day, to provide increased sewerage coverage to the greater Djizzak city area and the adjacent district of Uch-Tepa.

2. Djizzak's current sewerage system has deteriorated to the extent that the frequent breakdowns, blockages, and spillages cause disruption to the public and constitute health hazards. Furthermore, the WWTP has not operated since 2002, resulting in discharge of raw sewage into the drainage system, with major negative environmental impacts. The present sewerage system was constructed in the 1980s and serves an estimated 38,000 people, representing 23% coverage of the Djizzak city core. The proposed project will expand coverage to serve 85,000 people by 2021, representing coverage of 46% of the city's core area.

B. Economic Rationale

3. Many health issues in Uzbekistan are associated with contaminated drinking water, and specifically inadequate sewerage collection and wastewater treatment. This is an acute problem in many second-tier cities such as Djizzak, where less than 25% of the population has indoor sanitary systems in which the household is connected to a functioning sewage system. Inadequate sanitation contributes to a greater incidence of public health issues, with a consequent impact on public health and productivity, and most importantly, infant mortality.

4. The WWTP in Djizzak city stopped functioning effectively in 2002 and ceased all operations in 2006, resulting in discharge of untreated sewage into the environment. The new WWTP and its associated facilities, pumping stations, and extended sewer connections are very urgently needed. Moreover, the recent promotion of Djizzak city as a special industrial zone (SIZ) has increased the need to have a functioning sewerage and wastewater collection and treatment system to attract investors to the site and facilitate the development of the planned industrial expansion and anticipated economic benefits. The proposed project is based on the city's general master plan up to the year 2030, which has the objective of providing sewerage service to at least 70% of the expanded city population in the long term. The project is fully in line with the country's water supply and sanitation sector roadmap, as described in the Program of Integrated Development and Modernization of Water Supply and Sewerage System of the Republic of Uzbekistan for the Years 2009-2020.

C. Wastewater Projections

5. The project feasibility study projected wastewater volumes produced by the population of Djizzak city within its extended boundaries and from the adjoining Uch-Tepa district for 2014–2035, based on anticipated population growth, and categorized as residential households,

¹ ADB. 1999. *Handbook for the Economic Analysis of Water Supply Projects*. Manila; ADB. 1997. *Guidelines for the Economic Analysis of Projects*. Manila.

budget organizations, commercial organizations, and the SIZ. Projections are based on the government's normative values for urban sewerage works, using 180 liters per capita per day of wastewater from the population within the area served by the existing sewerage network, and 25 liters per capita per day for the population living outside the service area that uses septic tanks and pit latrines. The projections show wastewater production from the expanded sewerage network will increase, from 10,590 m³/day in 2013 to 53,730 m³/day in 2035.

6. The project includes a WWTP capacity of 30,000 m³/day, which will meet the projected needs of 85,000 people. In 2021, the first year the WWTP will be fully operational, it is projected that 50% of the wastewater throughput will be generated by the residential population covered by the sewerage network, 15% by the population not covered by the system, 7% by nonrevenue-generating institutions, 5% by commercial customers, and 23% by the SIZ.

7. The economic analysis assumes the proposed new sewerage network and WWTP reach full capacity in 2020, when average daily wastewater production reaches the WWTP design capacity of 30,000 m³/day (providing coverage to and benefitting 85,000 people, or 46% of the people within Djizzak city and the adjacent Uch-Tepa district).

8. Non-residential connections—including nonrevenue-generating institutions (e.g., schools, hospitals, public institutions), commercial customers (including service providers, restaurants, hotels, and industrial enterprises), and new industrial enterprises in the SIZ—will also benefit directly from the improved services.

D. Least-Cost Analysis

9. A least-cost analysis was used to evaluate the wastewater and sanitation service options for Djizzak city. Two alternative wastewater sewerage treatment methodologies were considered: (i) a bio-ponds lagoon system, and (ii) a conventional sewerage treatment system. Three levels of service level were considered: (i) 24% of the core city area (equal to the status quo), and corresponding to 17% coverage of the greater city area; (ii) 41% of the core city, covering 33% of the greater city; and (iii) 100% of the core city area, covering 70% of the greater city. The possibility of expanding the use of septic tanks as an alternative was also considered. Following analysis and consultation with the government, the most suitable option—construction of a new modern wastewater treatment plant using conventional technology—was selected.² A phased approach to the development of sewerage services was chosen with the first phase supporting expansion of coverage to 46% of the core city area (33% of the greater city area). This is the most viable and appropriate option considering projected population growth and wastewater production in the medium term, and uncertainties concerning future growth, especially the rate of expansion of the SIZ and its consequent wastewater production.

E. Project Description

10. DSSDP will have two major components:

- (i) **Sewerage system reconstruction and development.** This component comprises wastewater rehabilitation and expansion of the existing sewerage system of Djizzak city and Uch-Tepa district center, consisting of: (a) rehabilitation of 16.75 kilometers (km) of the existing sewer network and

² A conventional sewerage treatment system was considered to be the most appropriate, as the alternative bio-ponds sewerage treatment technology has not been proven to be effective and reliable in situations similar to Djizzak, with its annual temperature extremes.

construction of 45.8 km of new sewer networks, (b) construction of one new and full rehabilitation of three existing sewerage pump stations, and (c) construction of a new WWTP with a capacity of 30,000 m³/day. The sewer network construction is targeted for completion in 2019, and the wastewater treatment facility in 2020. Therefore, the related economic benefits start in 2020 and 2021, respectively.

- (ii) **Project management, capacity development and transitional support.** This component includes support for project implementation and management through (a) a project management unit and project implementation unit, (b) operational and management support for the initial operation of the WWTP, and (c) implementation of a transitional program to help the government establish a new provincial organization and restructure the operation and management of all water supply and sewerage services in Djizzak Province to improve water supply and sanitation sector efficiency.

F. Economic Costs

11. The analysis uses constant 2014 prices over the 30-year project lifespan. The total project cost of \$96.56 million in financial terms, excluding taxes, duties and price contingencies but including physical contingency, was converted to economic values using a world price numeraire. A standard conversion factor of 0.9 has been applied to all domestic costs and non-tradable items and a shadow wage rate factor of 0.80 has been applied to unskilled labor costs in recognition of the level of unemployment and underemployment in Uzbekistan. The land acquisition cost takes into account the opportunity cost of forgoing the use of the land for agriculture. The resulting economic cost is estimated to be \$66.67 million.

G. Economic Benefits

12. Currently around 94% of the city's population is served with water, and an estimated 86% of apartments and multilevel housing are connected to the sewerage network, although they suffer from frequent disruptions, and some buildings no longer have a functioning sewerage system, requiring the residents to install unplanned pit latrines and soak-away pits. The use of these rudimentary wastewater disposal facilities and shared toilet facilities is inconvenient and unhygienic. Moreover, 99% of single-level private houses are not connected to the network, and use outside facilities.

13. The primary project beneficiaries are: (i) an estimated 38,000 people residing in the city's core (about 23% of the core population of 162,000) whose existing sewerage service (characterized by interrupted and unreliable services) will be improved; and (ii) an additional 47,000 people (currently not connected and reliant on other sanitation facilities), who will be served by the expanded network. In total, 85,000 people are projected to benefit directly from the sewerage services, thereby increasing the overall coverage to 46% of the city's core population (equal to 33% of the greater city's population). In addition, non-residential connections—including nonrevenue-generating institutions, commercial services and manufacturing operations, and new industrial enterprises in the Djizzak SIZ—will also benefit directly from the improved services. The rest of the greater Djizzak city population will benefit from the improved services to some extent—e.g., through better sanitation facilities within educational and health facilities, better workplace environments, reduced pollution from spilled sewerage, and improved road surfaces.

14. The project's economic viability is assessed from a national perspective, based on the benefits of rehabilitating and improving the sewerage system for Djizzak city. The main quantified economic benefits are (i) incremental benefits, including (a) health benefits from improved sanitation, particularly for the population not currently served by the sewerage network; (b) time and resource savings from not having to use alternative and inadequate sanitation facilities; and (c) net savings in operation and maintenance costs of the current inefficient network and alternative facilities (septic tanks and latrines); and (ii) non-incremental benefits accruing to residential, commercial, and industrial users of the sewerage system and wastewater treatment. Public health impacts derive from a reduction in infectious disease caused by poor sanitation (hepatitis, dysentery, and diarrhea), resulting in reduced infant mortality, and savings on medical expenses and productive time lost through sickness, as indicated by available data and the socioeconomic survey.³ Time savings result from replacement of inadequate outside sanitation facilities (mostly pit latrines) with in-house toilets and wastewater disposal facilities. Savings in the cost of operating and maintaining the existing dilapidated sewerage system and maintaining pit latrines and septic tanks were assessed based on information gained from the socioeconomic and poverty social survey conducted on a representative sample of households in Djizzak. Incremental access to sewerage facilities and the WWTP by the new beneficiaries has been valued based on their stated willingness-to-pay in the socioeconomic survey.⁴ In addition, there are social development and environmental benefits; however, these are difficult to quantify and have not been included in the calculation.

H. Economic Analysis Results

15. The economic analysis demonstrates the project is economically viable, with an economic internal rate of return of 14.12%. The summary cost-benefit analysis (Table 1) is considered conservative for two reasons. First, the service population of 85,000 people is probably understated, as it is (i) based on norms that likely overestimate anticipated per capita wastewater generation, and (ii) proposed tariff increases and improved metering and billing are likely to result in use of water and production of wastewater. In addition to the target residential population, the project also serves non-residential connections, including nonrevenue-generating institutions, commercial service and manufacturing operations, and new industrial enterprises in the proposed SIZ. Second, the estimation of benefits is conservative, and did not include, for example: (i) long-term risks to human health from exposure to untreated sewerage, which can only be quantified through a complex health-risk assessment; and (ii) the economic opportunity loss if industries fail to establish and operate in Djizzak because of the lack of an adequate sewerage system. There are also economic benefits (increased efficiency and improved service delivery) to the Djizzak Regional Water Supply and Sewerage Enterprise from merging the water supply and wastewater service companies in Djizzak city and the province that are not captured in the analysis.

16. The economic return is relatively insensitive to changes in the capital cost-benefit parameters (Table 2). The effective and sustainable operation of the sewerage network and WWTP will be crucial to ensuring that the anticipated benefits materialize.

³ Epidemiological information is included in the Detailed Economic Analysis (Supplementary Appendix C, available from the list of linked documents in Appendix 2 of the main text).

⁴ The average WTP value of is SUM1,829/person/month (about 1.5 times the current tariff), estimated to be equivalent to SUM339/m³, or \$0.149/m³.

Table 1: Summary Cost–Benefit Analysis
(\$'000)

Year	Economic Costs			Non Incremental	Incremental Benefits	Total Benefits	Net Benefit
	Capital	O&M Cost	Total				
2016	7,637	0	7,637				(7,637)
2017	26,475	0	26,475				(26,475)
2018	18,669	0	18,669				(18,669)
2019	10,688	0	10,688	840	610	1,450	(9,238)
2020	3,006	651	3,657	4,340	4,858	9,198	5,541
2021	199	1,181	1,380	6,948	4,873	11,821	10,441
2022	0	1,151	1,151	7,960	4,873	12,833	11,682
2023	0	1,912	1,912	9,404	4,873	14,277	12,365
2024	0	2,172	2,172	9,434	4,873	14,307	12,135
2025	0	2,342	2,342	9,463	4,873	14,336	11,994
2026	0	2,342	2,342	9,655	4,873	14,528	12,185
2027	0	2,342	2,342	9,682	4,873	14,555	12,212
2028	0	2,342	2,342	9,708	4,873	14,581	12,238
2029	0	2,342	2,342	9,733	4,873	14,606	12,264
2030	0	2,342	2,342	9,758	4,873	14,631	12,289
2031	0	2,342	2,342	9,783	4,873	14,656	12,314
2032	0	2,342	2,342	9,809	4,873	14,682	12,339
2033	0	2,342	2,342	9,834	4,873	14,708	12,365
2034	0	2,342	2,342	9,860	4,873	14,733	12,391
2035	0	2,342	2,342	9,887	4,873	14,760	12,417
2036	0	2,342	2,342	9,887	4,873	14,760	12,417
2037	0	2,342	2,342	9,887	4,873	14,760	12,417
2038	0	2,342	2,342	9,887	4,873	14,760	12,417
2039	0	2,342	2,342	9,887	4,873	14,760	12,417
2040	0	2,342	2,342	9,887	4,873	14,760	12,417
2041	0	2,342	2,342	9,887	4,873	14,760	12,417
2042	0	2,342	2,342	9,887	4,873	14,760	12,417
2043	0	2,342	2,342	9,887	4,873	14,760	12,417
2044	0	2,342	2,342	9,887	4,873	14,760	12,417
2045	0	2,342	2,342	9,887	4,873	14,760	12,417
NPV @ 12%	\$49,811	\$9,431	\$59,243	\$43,888	\$24,832	\$68,720	\$9,477
EIRR							14.12%
Total	\$66,674			\$244,963	\$127,297	\$372,260	\$249,329

() = negative, EIRR = economic internal rate of return, NPV = net present value, O&M = operation and maintenance cost

Source: Asian Development Bank estimates.

Table 2: Sensitivity Analysis

Sensitivity Parameters	Variable	EIRR
Base Cost		14.12%
Project Capital Cost	+10%	12.94%
Benefits	-10%	12.60%
Operation and Maintenance	+10%	13.90%
Delay in Project Construction	1 year	12.35%

EIRR = economic internal rate of return.

Source: Asian Development Bank.