ECONOMIC ANALYSIS

A. Introduction

1. **Karnataka**. Karnataka is one of the top ten states in India by gross domestic product and has achieved an average gross domestic product growth rate of over 8% per annum since FY2005. The state's rapid economic growth is from the tertiary sector, which is centered around Bangalore in the southern part of Karnataka. Economic activities are heavily concentrated in Bangalore, with the city contributing more than 30% to the state gross domestic product. Karnataka's urbanization rate of 38% makes it the fourth most urbanized state in India, which has a national urbanization rate of 28%. Bangalore, the single largest urban center in the state, houses almost 90% of the state's urban population. As urbanization in the state continues to grow rapidly, by 2030 half of the state population will live in urban areas. This will put severe pressures on Bangalore as there are limited alternative urban locations that offer competitive basic urban services for businesses and residents.

2. Recognizing the long-term impact from the uneven economic development in the state, the Government of Karnataka has initiated many urban infrastructure development projects outside Bangalore, in particular in North Karnataka, through various programs with national and international support, including the Karnataka Urban Infrastructure Development Project, the Karnataka Urban Development and Coastal Environment Management Project, and the North Karnataka Urban Sector Improvement Program financed by the Asian Development Bank (ADB). The Karnataka Integrated Urban Water Management Investment Program will further assist the government to realize its infrastructure needs through an integrated approach to water resource management and water supply and sewerage service delivery.

B. Economic Analysis of the Investment Program and Project 1

3. The government envisages investing approximately $2 billion by 2030 to establish and improve basic water supply and sewerage infrastructure and services, reduce non-revenue water, increase service delivery and coverage, treat wastewater to national standards, and promote commercial use of recycled wastewater in the state. The infrastructure investment plan is consistent with the national urban development framework and urban reform initiatives. The multitranche financing facility modality is the most suitable modality to support the state's long-term sector development agenda.

4. **Rationale for Government Involvement**. The Karnataka Integrated Urban Water Management Investment Program is based on sound economic rationale as its interventions are aimed to improve the provision of basic civic services, which are a public good. Under the program, the government interventions are limited to basic urban services where (i) there is a natural monopoly and (ii) integrated and coordinated management by the government is required due to interdependence of water and sanitation sectors, and externalities. As a result of improved public services, positive externalities in public health, human capital development, environmental protection, and resource management will be created and better managed. Through enhanced institutional capacity, the urban local bodies (ULBs) will also be able to execute their constitutional mandate more efficiently.

5. **Goals of Government and Investment Program**. The goals of the government for the water and sanitation sector are (i) 100% coverage of 24-hour water supply through metered connections and (ii) 100% sewerage coverage with 100% sewage treatment. The current service level in the state does not meet the goals of the government, which has prepared a

sector road map in line with its integrated water resources management vision to promote coordinated planning, development, and management of water resources that will enhance economic and social benefits without compromising environmental sustainability. The sector road map identified the current service levels and service gaps as well as the physical and non-physical investments required to bridge these gaps by 2020. Of the total infrastructure investment plan of $2 billion, less than 33% of the funds are currently committed. The Karnataka Integrated Urban Water Management Investment Program will provide $227 million to finance investment plan and project 1 of the program will improve service levels at three ULBs in the Upper Tungabhadra subbasin (Byadagi, Davanagere and Harihar).

6. **Investment Program**. The government has prepared an investment program for 2013–2030 to enable the implementation of the sector road map. The investment program associated with the infrastructure investment plan includes short- and medium-term financing requirements and investment activities in the water and sanitation sector for 213 ULBs across the state.

7. **Associated Economic Policies**. The 74th amendment to the Constitution reaffirmed the democratic local governance structure by creating responsibilities and management authorities at the local level to accelerate the pace of urban sector reforms in India. The state government recognizes the critical contribution from the urban sector to economic growth and poverty reduction as well as the importance of ULBs in executing the reform agendas. To achieve operational sustainability, various national and state policies recommended the introduction of user charges:

(i) The National Water Policy (2002) suggests recovery of at least the operation and maintenance (O&M) cost of initial service provision as well as a part of the subsequent capital costs, linking the user charges with the quality of service provided.

(ii) The National Urban Sanitation Policy (2008) emphasizes O&M cost recovery through the introduction of user charge to ensure accountability and financial sustainability.

(iii) The Ministry of Urban Development issued the Handbook of Service Level Benchmark (2008), which encourages user charges to achieve 100% O&M cost recovery and 90% collection efficiency.

(iv) The National Water Mission (2009) of the Government of India calls for appropriate pricing based on cost recovery principle.

(v) Jawaharlal Nehru National Urban Renewal Mission also encourages O&M cost recovery at the initial state and gradual full cost recovery ultimately leading to self-sustaining delivery.

(vi) The National Water Policy (2013), focuses on the principle of integrated water resources management in improving water use efficiency through planning, development, and management of water resources. Water scarcity should be addressed through appropriate pricing of water supply and sewerage management by a water regulatory authority in each state.

(vii) The Government of Karnataka has taken up initiatives under the State Urban Agenda for Karnataka to advance priority projects and governance reforms.

(viii) The State Water Policy (2002) and the Karnataka Urban Drinking Water and Sanitation Policy (2002) set the following principles on water tariff setting: (a) establishment of an appropriate cost recovery mechanism through tariff to recover O&M costs, debt service, and a reasonable return on capital; (b) achievement of 100% metering and volumetric pricing based on the long-run marginal costs; (c) structuring of tariffs to discourage excessive consumption and water wastage; and (d) ensuring a lifeline supply to the poor.

(ix) The state has also issued Government Order No. NAE o7 UWS 2011, Bangalore dated 21 July 2011 to provide guidance on implementing volumetric water tariffs and flat sewer tariffs by the ULBs.

8. In Karnataka, many ULBs have adopted flat water tariffs and some, including Bellary and Ranebennur, have adopted flat sewerage tariffs. In Bangalore, a sewerage tariff is levied as a surcharge to the water tariff. The three ULBs under project 1 have recently increased their water tariffs in accordance with the 2011 government order. These ULBs are in the process of adopting the sewerage tariff rates endorsed by the state. The Karnataka Integrated Urban Water Management Investment Program will require the ULBs undertaking water supply subprojects to move from flat water tariffs to volumetric water tariffs. The ULBs undertaking sewerage subprojects are also required to introduce sewer tariffs at levels that will allow full recovery of O&M costs .

9. **Economic Risks**. The economic risks include the uncertainty in introducing and enforcing volumetric water tariffs and flat sewerage tariffs since the ULBs responsible for implementing these tariffs have been historically reluctant to increase user charges. The initiative by the Government of Karnataka to combine reform effectiveness with resource allocation will incentivize the ULBs to adopt recommended tariff rates. As the sewer subprojects will not recover the O&M costs in the first few years, the ULBs will need to better manage their municipal resources to support the operation of the sewer system. The program has included a capacity strengthening component to assist the ULBs in assessing the current financial status and initiating measures to stabilize and enhance both tax and non-tax revenues.

10. **Government Capacity**. The state government, through its nodal agency the Karnataka Urban Infrastructure Development and Finance Corporation (KUIDFC) acting as the executing agency, is fully capable of executing the investment program. The KUIDFC has implemented and is still handling several externally aided projects, including the first three tranches under the North Karnataka Urban Sector Investment Program, the Karnataka Urban Development and Coastal Environmental Management Project, two World Bank projects in the urban sector, and other national schemes. The annual operating cash flow towards the implementation of these externally aided projects was approximately $78 million for FY2012 and $58 million for FY2011. The KUIDFC has developed sufficient capacity in project appraisal, project management, procurement, safeguards, and project financial management and reporting.

11. **Government Commitment**. The government commitment to support urban development is firm, as demonstrated by increased budgetary allocation to the sector. From FY2008 to FY2010, state development expenditures on water, sanitation, and urban development more than doubled. When combined, water and urban development comprised almost 5% of total development expenditures of the state for FY2010, up from 2.9% in FY2008. For FY2011, the government projected an annual increase of 50% in development expenditures in the water and sanitation sector.

12. **Coordination with Foreign Aid**. The $227 million provided by the program is approximately 11% of the infrastructure investment plan for the sector. An additional $518 million need to be identified to fully execute the plan, potentially from state or external aid agencies. Effective coordination between ADB and other foreign aid agencies will ensure efficient use of external funds. Regardless of whether a joint or parallel financing mechanism will be employed, the KUIDFC would be the single focal point in managing externally aided projects and ensuring the most efficient and prioritized use of funds.

13. **Conditions Attached to the Loan.** The introduction of and periodic adjustment to the volumetric water tariff rates as well as the introduction of flat sewer tariff rate are conditions to be implemented by the Government of Karnataka.

C. Economic Analysis of Subprojects

14. An economic analysis has been conducted for all six subprojects under project 1 in accordance with ADB's Guidelines for the Economic Analysis of Projects (1997) and Guidelines for the Economic Analysis of Water Supply Projects (1998).

15. **Demand and Rationale**. Water supply services for all three ULBs are inadequate in terms of the supply quantity, service coverage, and service hours. The average supply quantity ranges from 56 to 80 liters per capita per day, the service coverage is under 50%, and the average service hours for most areas are under 2 hours a day. After implementation of project 1, the supply quantity will increase to 135 liters per capita per day, with 90% service coverage and 24-hour supply. Except for some parts of Davangere, there are no piped sewer systems in all three ULBs. On average, less than 30% of the population relies on septic tanks while many have to resort to open defecation. Sewerage is discharged directly into open drainage, polluting water courses and underground aquifers. After implementation of project 1, 80% of the population will have access to the sewerage system, centrally treated, and discharged meeting national discharge requirements.

16. The economic analysis is based on the following assumptions:
    (i) The analysis is based on domestic numeraire in January 2014 constant prices.
    (ii) The population growth in each town was projected based on historical trends.
    (iii) Subprojects were analyzed over 20 years, excluding the 4 years of project implementation. Assets established by the subprojects were assumed to have a useful life of 30 years. Salvage values were assumed at the end of the analysis period.
    (iv) The economic costs included base costs and physical contingency and excluded price contingency, financing charges, and taxes and duties. The shadow wage factor of 0.75 and the shadow exchange factor of 1.03 were applied to convert financial values to economic values.
    (v) The economic benefits from the water supply subprojects included time savings in procuring water and household expenditure savings on the purchase, installation, and maintenance of storage tanks as well as the procurement of bottled water.
    (vi) The economic benefits from the sewerage subprojects included medical expenditure savings; household expenditure savings on the purchase, installation, and maintenance of septic tanks; and savings in productivity loss due to water borne diseases.

17. Based on the above assumptions, the economic internal rate of return (EIRR) was calculated and compared to the economic opportunity cost of capital estimated at 12%. A summary of the subprojects is in Table 1.

Table 1: Summary of Subprojects

Subproject	Beneficiaries		Connections		User Charge (Rs.)		EIRR (%)	
	2013	2016	2013	2016	2013[a]	2016[b]	Base	Worst
Water Supply								
Byadagi	14,800	20,200	2,962	4,030	80/month	11/kl	17.3	14.8
Davangere	214,350	437,500	42,870	87,500	175/month	11/kl	23.6	19.8
Harihar	33,000	66,781	6,705	13,356	120/month	10/kl	22.0	18.7
Sewerage								
Byadagi	0	13,433	0	4,000	Nil	125/month	12.9	10.7
Davangere	180,507	368,307	36,100	73,700	Nil	75/month	17.7	16.1
Harihar	0	57,380	0	11,500	Nil	50/month	15.4	13.1

EIRR = economic internal rate of return, kl = kiloliter; R = Indian rupee.
[a] Existing user charges prior to the issuance of Government Order No. NAE o7 UWS 2011.
[b] Proposed water charges based on Government Order No. NAE o7 UWS 2011. Proposed sewer charges based on operation and maintenance cost recovery.
Source: KUIDFC estimates.

18. The EIRRs of the three water supply subprojects and three sewerage subprojects range from 12.9% to 23.6%, higher than the economic opportunity cost of capital of 12%. A sensitivity analysis was also undertaken under various assumptions. The results are satisfactory against downside risk, including a 10% increase in capital expenditure, 10% increase in operation cost, 10% decrease in benefits, and 1-year delay in project completion. The EIRRs are summarized in Table 2. The EIRRs are above the 12% cost of capital, except for Byadagi where a reduction in benefits yielded an EIRR of 11.7%, which can be easily compensated by other ULBs. Furthermore, all three ULBs under project 1 experienced population growth above the national population growth rate. The rapid urbanization in the state will ensure sufficient demand for improved water supply and sanitation services in the urban centers, hence the risk of unrealistic economic benefits from project 1 is minimal

Table 2: EIRR and Sensitivity Analysis

Description		Byadagi	Davangere	Harihar
Water Supply Subprojects				
Base case	EIRR %	17.3	23.6	22.0
Capital overrun by 10%	EIRR %	16.3	21.8	20.6
	Switching value	211.0	150.0	177.0
O&M overrun by 10%	EIRR %	16.9	23.4	21.8
	Switching value	654.0	2127.0	1002.0
Reduction in benefits by 10%	EIRR %	15.9	21.5	20.2
	Switching value	142.0	125.0	134.0
1-year delay in completion	EIRR %	16.9	22.6	21.8
Worst case scenario	EIRR %	14.8	19.8	18.7
Sewer Subprojects				
Base case	EIRR %	12.9	17.7	15.4
Capital overrun by 10%	EIRR %	12.0	16.7	14.4
	Switching value	161	190	168
O&M overrun by 10%	EIRR %	12.7	17.5	15.3
	Switching value	674.0	972.0	1352.0
Reduction in benefits by 10%	EIRR %	11.7	16.4	14.1
	Switching value	115.0	142.0	133.0
1-year delay in completion	EIRR %	12.6	16.1	14.0
Worst case scenario	EIRR %	10.7	15.2	13.1

EIRR = economic internal rate of return, O&M = operation and maintenance.
Source: Asian Development Bank estimates.