FINANCIAL AND ECONOMIC ANALYSIS

A Project Rationale

1. **Macroeconomic context.** Nepal's population of 28.9 million has been increasing at 2.2% per annum since 1983.[1] Rapid migration to the capital, Kathmandu has resulted in the city's population increasing from 422,237 in 1981 to 1,704,160 by 2011, an average annual increase of 4.8%, more than twice the national average. As a result, the population density in Kathmandu increased from 1,259 per square kilometer (km^2) in 1981 to 5,080/km^2 by 2011, whereas the national population density increased from 102/km^2 to 197/km^2.

2. Agriculture accounts for 35% of Nepal's gross domestic product (GDP), industry 15%, and services including tourism the balance of 50%. GDP growth[2] was 3.9% in 2011, down from 4.8% in 2010; the economy grew by an annual average of 4.5% during 2007–2011. This was led by 6% annual growth in the service sector, while growth in the agriculture sector was only 2.6%. Inflation, as measured by the GDP deflator, averaged 7.6% from 2007 to 2011, up from 5.1% during 2002–2006.

3. **Sector context.** The Bagmati River Basin (BRB) lies in central Nepal and covers an area of 3,750 km^2 to the Nepal–India border. The BRB can be divided into upper, middle, and lower basins. The project will contribute to (i) establishing systems and capacity for integrated and participatory river basin management, (ii) improving the riverbank environment in urban areas, (iii) increasing water availability in the basin during dry season and watershed conservation, (iv) installing functional flood forecasting and an early warning system in the basin, and (v) ensuring efficient project management and stakeholder coordination.

4. Many temples, shrines, and ghats line the banks of the Bagmati River. The Pashupathinath Temple, a UNESCO (United Nations Educational, Scientific and Cultural Organization) World Heritage Site, one of the most important sacred temples for Hindus, is situated along the riverbank, adding to the spirituality of its waters. Devotees have traditionally used the river water to purify themselves before entering the temple. The river is a source of drinking water for Kathmandu and further downstream is a source water for sustaining irrigated agriculture in the valley.

5. Rapid urbanization in the valley has resulted in deterioration of the water quality; it is now a dumping site for all forms of urban waste. During the dry season, 80% of its waters are diverted for drinking water, resulting in little or no natural flow, exacerbating the situation. This leads to further extraction from groundwater sources. The middle basin is characterized by steep slopes and degraded watersheds prone to landslides and an increased source of sedimentation downstream. This has resulted in flooding and riverbank erosion.

6. **Rationale for public sector investment**. Public sector investment is recommended when the financial returns are less than cost recovery or as in this case with nonexistent revenues. A river is a public good, which is not priced by markets. Therefore markets tend to over utilize public goods and create negative externalities, such as negative environmental impacts. Strong public sector intervention is justified to manage such public goods and reduce environmental impacts.

7. **The project.** The project will provide the following nonstructural measures: (i) legal and institutional strengthening for integrated water resources management (IWRM); (ii) support for

[1] Government of Nepal. Year. *District Development Profile of Nepal 2010/11.* Kathmandu: Mega Publication and Research Centre.
[2] World Bank. 2012. *World Development Indicators*. Washington.

formulation of a river basin organization (RBO); (iii) capacity building and technical training for developing RBO competence; (iv) legal support for allocating water from the Shivapuri reservoirs; (v) preparation of an integrated river basin development and management plan; (vi) establishment of a central water resources information and modeling decision support system, including water quality monitoring and flood forecasting and warning; and (vii) preparation of design guidelines for land development (land pooling) that introduces sustainable international best practices for stormwater, wastewater, and solid-waste management.

8. The project will (i) construct a small dam with storage capacity of 850,000 m^3 a short distance downstream from the existing small dam in Shivapuri Nagarjun National Park (SNNP), (ii) provide watershed enhancement and income-generating activities for all 296 households in SNNP, (iii) construct 11 1-meter-high check dams and/or weirs, (iv) construct 14 kilometers (km) of river walls, (v) rehabilitate two existing regulators, (vi) upgrade and protect two ghats, (vii) construct 1.2 km of gabion walls for riverbank stabilization, (viii) develop 12.2 km of linear green zone with foot and bicycle paths, and (ix) develop 1.8 km of green zone parks with foot paths and amenities.

B. Financial Analysis

9. Since no project components generate revenue, a financial analysis was conducted to assess financial sustainability. This analysis determines the capacity of implementing agencies to sustain project-related recurrent expenditure and the impact of the project's debt service cost on government finances.

10. In 2011/12 the recurrent expenditure of the Water and Energy Commission Secretariat Department of Irrigation, and the High Powered Committee on Integrated Development of Bagmati Civilization was NRs97 million (Table 1). The estimate of annual project recurrent expenditure, in terms of operation and maintenance for the project, is NRs6.2 million, which accounts for 6% of the recurrent expenditure for project institutions. Therefore the project will not impose a significant burden on the budgets of the relevant institutions.

11. The maximum debt service cost for the project is estimated at NRs103 million. This accounts for 0.7% of the total debt service cost of multilateral borrowing for the government and 0.2% of its total debt service cost. Therefore, the project debt service cost is financially sustainable for the government.

C. Economic Analysis Methodology

12. Economic analysis was conducted in accordance with ADB guidelines.[3] Financial costs were adjusted to their border price equivalent values to reflect impact on the national economy. The economic analysis uses the world price numeraire to adjust to the border price equivalent values.

13. The main assumptions for the economic analysis are (i) costs and benefits are expressed in 2013 constant prices; (ii) an exchange rate of NRs87 = $1; (iii) project economic life of 30 years with no residual value; (iv) taxes and subsidies excluded; (v) physical contingencies included and price contingencies excluded; and (vi) standard conversion factor of 0.9, and a shadow wage rate factor of 0.7 for unskilled labor and 1.0 for skilled labor, consistent with recent projects in Nepal.

[5] ADB. 1997. *Guidelines for the Economic Analysis of Projects.* Manila.

Table 1: Financial Sustainability of the Project
(NRs '000)

Item	2010/11 Actual[a]	2011/12 Provisional	2012/13 Budget
Recurrent Expenditure			
WECS	10,898	13,349	13,340
DOI	47,870	70,215	62,373
HPCIDBC	10,609	13,521	12,765
Total Expenditure	**69,377**	**97,085**	**88,478**
% Project O&M	9	6	7
Domestic Debt Service	16,417,630	18,956,796	29,902,505
Multilateral Debt Service	10,540,992	12,809,106	15,768,270
Bilateral Debt Service	2,999,039	3,554,188	4,419,421
Total Debt Service	**29,957,661**	**35,320,090**	**50,090,206**
Maximum Project Debt Service Cost			
Capital			69,328
Interest			33,278
TOTAL			**102,606**
Project debt service as a % of total debt service			0.7
Project debt service as a % of multilateral debt service			0.2

DOI = Department of Irrigation, HPCIDBC = High Powered Committee on Integrated Development of Bagmati Civilization, O&M = operation and maintenance. WECS = Water and Energy Commission Secretariat.
[a] Government of Nepal, Ministry of Finance. Estimates of Expenditure Fiscal Year 2012/13.
Source:

D. Estimation of Economic Costs

14. **Cost stream for economic analysis.** The financial costs were converted to economic costs using the assumptions (Table 2).

15. **Land**. The project does not require any land acquisition, permanent or temporary. Given the scale of the physical works, temporary land acquisition is not deemed necessary during construction.

16. **Labor.** The economic price of labor is measured through its supply price. Variations are large for various types of labor depending on a number of factors including skills, regions, economic sector, and even individual jobs. The shadow wage rate factor is assumed at 0.7 for unskilled labor and 1.0 for skilled labor.

E. Estimation of Economic Benefits

17. **Output 1: Established systems and capacity for integrated and participatory river basin management.** An RBO will be established according to IWRM principles. The benefits are not quantifiable and would flow from good river basin governance, orderly water allocation, provision of reliable data for basin planning and regulation, and improved solid waste management.

Table 2: Conversion of Financial Costs to Economic Costs ($ million)

Item	Financial Cost	Conversion Factor	Basis	Economic Cost
Output 1: Established systems and capacity for integrated and participatory river basin management	2.3	0.96	Local costs X SCF + foreign costs	2.2
Output 2: Improved riverbank environment in urban areas	15.9	0.80	50% non-labor X SCF + 10% skilled labor X SCF + 40% unskilled labor X SWRF X SCF	12.7
Output 3: Increased water availability in the basin during dry season and watershed conservation	6.6	0.86	Local costs X SCF + foreign costs	5.7
Output 4: Functioning flood forecasting and early warning system for the Bagmati River Basin	0.5	0.96	Local costs X SCF + foreign costs	0.5
Output 5: Efficient project management with effective stakeholder communication	3.7	0.95	Local costs X SCF + foreign costs	3.5
TOTAL	**32.4**			**24.6**

SCF = standard conversion factor, SWRF = shadow wage rate factor.
Source: Asian Development Bank estimates.

18. **Output 2: Improved riverbank environment in urban areas**. Physical works will relate to riverbank improvement, weirs, green zones, and beautification. Benefits were quantified using willingness-to-pay (WTP) surveys in the project area and the Pashupathinath temple area. The weirs combined with phyto-remediation will result in re-aeration and treatment of river water resulting in water quality improvement.

19. **Output 3: Increased water availability in the basin during the dry season and watershed conservation.** The Dhap dam reservoir will be constructed for storage and strategic release of water during religious festivals in the dry season. The benefits were quantified; increased flow during the dry season and in particular during festivals at the temple will result in higher river water quantity and quality. Similarly, the project will support watershed conservation of SNNP and management of communities living inside the park. To ensure no double counting of benefits under outputs 2 and 3, WTP for the temple area was quantified only during the three major temple festivals when water will be released.

20. **Output 4: Functioning flood forecasting and early warning system in the Bagmati River Basin.** Benefits from flood forecasting and warning are tangible although not quantified.

21. **Estimation of willingness-to-pay.** The markets do not price the river, as it is a public good. Therefore, river quality improvements have to be priced using nonmarket valuation methodologies to determine the net economic benefit (consumer surplus) or WTP. The contingent valuation method, which directly elicits WTP responses from survey respondents, was used as the direct valuation method.

22. **Focus group discussions.** Focus group discussions were carried out in 10 wards of three village development councils representing 3,200 households. The weighted average WTP for river cleaning is NRs265/household/month; they are also willing to pay extra for the greening

of riverbanks and establishment of recreation parks along the riverbanks. This figure was cross-checked with average monthly household expenditure on water supply,[4] which is approximately NRs200. In this regard, WTP resulting from the focus group discussions seems to be very high and may have been influenced by dominant members within the group.

23. **Interviews for determining WTP based on distance from the river.** Given the unrealistic WTP from focus group discussions, individual interviews were carried out in Batisputali (24), Gaurighat (36), Gokarna (12), Guheshwori (24) and Joorpati (60), based on the respondents' distance from the river, starting from 0–100 meters (m) and up to 400 m. The highest WTP of NRs43/household/month was recorded in the immediate vicinity of the river, in the 0–100 m band. This is expected as these residents see and smell the polluted river on a daily basis. WTP then starts to reduce in the 101–200 m and 201–300 m distance bands. However, in Batisputali, Gauri Nagar, Khari Bot and Udaya Margh, WTP increases in the 301–400 m band, contrary to expectations. The reason for this is the presence of a main road with many commercial establishments in this area, which apparently distorts the result. These establishments, including restaurants, are willing to pay more than households for a cleaner river. It can also be seen that in areas such as Gokarna and Gotha Tar, upstream of the river, WTP remains unchanged given the distance from the river; these are more rural agricultural areas where the river is less polluted. WTP is also lower.

24. In addition, responses were elicited from residents of Kathmandu not in the vicinity of the river; they also indicated WTP and therefore indicate an economic benefit for all Kathmandu residents by cleaning the Bagmati River. The average WTP was NRs54/month.

25. **Pashupathinath Temple area**. The Pashupathinath Temple is a UNESCO World Heritage Site. The temple receives approximately 4,500 devotees per day, 3,000 local and 1,500 international.[5] It also receives approximately 130,000 non-Hindu international visitors annually; the latter are charged an entrance fee of NRs500 per entry. The major festival is Shivarathri (during March), where approximately 700,000 devotees visit the temple during a 24-hour period. During the festival period of Theei (July/August) and Balachathurdashi (November/December), more than 200,000 devotees enter the temple premises daily.

26. A sample of 40 devotees at the Pashupathinath and nearby Guheshwori temple areas were interviewed regarding their WTP for a clean river and the availability of bathing quality water at least during the major festivals. The sample included devotees from Kathmandu, outside Kathmandu, and out-of country (mainly Indian); WTP ranged from a low of NRs50/year to NRs200/year with an average of NRs62. The economic benefit was estimated using this WTP during the three main festivals where water will be released from the Dhap dam.

27. **Other quantified economic benefits**. In addition to WTP, the economic analysis includes benefits due to increased water resources within the river basin. The project will also provide rainwater-harvesting facilities for 2,500 households, which will result in annual safe water supply of 18 cubic meters (m^3) and a groundwater recharge of 64 m^3 per household. The groundwater recharge will contribute to the increased water resources and thus contribute to the prevention of environmental degradation in the basin. This is valued based on the capital cost of the Melamchi interbasin water transfer–water supply project, which is $1.128 million per 1 million liters/day, supplying Kathmandu Valley.

28. The weirs to be constructed under the project and phyto-remediation provided by introducing specialized river plants will result in improved water quality from both re-aeration

[4] 2011. *Technical Assistance to Nepal for the Kathmandu Valley Urban Environmental Improvement Project.* Manila (TA 7936-NEP).

[5] Pashupathinath Area Development Trust.

and bio-remediation. The provision of in-river treatment will have an effect on water quality equal to the treatment of wastewater effluents entering the river. The benefits of in-river treatment was assessed based on the costs of the construction and operation of wastewater treatment plants (WWTPs) providing the same level and amount of treatment.[6] The cost of a WWTP is $330,000/1 million liters per day with operating costs at 3%. A WWTP will treat biochemical oxygen demand (BOD) of 330 milligrams (mg)/liter resulting in BOD removal of 285 mg/liter. The dry season flow of the Bagmati River is 400 liters per second and the project will construct 11 weirs resulting in BOD removal of 6.6 mg/liter.

F. Results of the Economic Analysis

29. The economic internal rate or return for the project is 14.5%, which satisfies the economic opportunity cost of capital criteria of 12%. Therefore the project is economically viable.

30. **Sensitivity analysis.** The analysis indicates the project's resilience to adverse impacts (Table 3).

Table 3: EIRR Base Case and Sensitivity Analysis

Scenario	EIRR (%)	ENPV ($ million)	Switching Value
Base Case	14.5	393	
10% increase in costs	13.5	242	30%
10% decrease in benefits	13.4	204	22%
10% increase in costs and 10% decrease in benefits	12.4	68	NPV reduces by 83%
1-year delay in implementation	14.4	327	NPV reduces by 17%
1-year delay in implementation with 10% cost overrun	13.4	205	NPV reduces by 48%
All of the above	12.4	51	NPV reduces by 88%

EIRR = economic internal rate of return, ENPV = economic net present value, NPV = net present value.
Source: Asian Development Bank estimates.

[6] ADB. 2013. *Report and Recommendation of the President to the Board of Directors: Proposed Loan and Grant and Administration of Loan and Grant to Nepal for the Kathmandu Valley Wastewater Management Project*. Manila (Loan 3000, Grant 0342, and Loan 8269).