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Report No. 9022

PROJECT COMPLETION REPORT

NEPAL

**MAHAKALI IRRIGATION PROJECT (STAGE I)
(CREDIT 1055-NEP)**

SEPTEMBER 28, 1990

**Agriculture Operations Division
Country Department I
Regional Office**

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CURRENCY EQUIVALENTS

1 Nepalese Rupee (NRs)	= US\$0.04
NRs 28.0	= US\$1.00
NRs 100	= US\$3.57

WEIGHTS AND MEASURES EQUIVALENTS

1 m	= meter (3.28 feet)
1 m ³ /sec	= cubic meter (35.3 cubic ft) per second
1 km	= kilometer (0.62 mile)
1 ha	= hectare (2.47 acres)
1 liter	= 61.02 cubic inches
M	= million
1 ton	= 2,205 pounds (lbs)

ABBREVIATIONS AND ACRONYMS

CFRID	- Committee for Forest, Resettlement and Irrigation Development in Kanchanpur District
DCA	- Development Credit Agreement
DIHM	- Department of Irrigation, Hydrology and Meteorology (renamed the Department of Irrigation 12/87)
DOA	- Department of Agriculture
DOI	- Department of Irrigation
EC&D	- Engineering Construction and Design
ERR	- Economic Rate of Return
HMGN	- His Majesty's Government of Nepal
ICB	- International Competitive Bidding
IDA	- International Development Association
LCB	- Local Competitive Bidding
LRD	- Land Revenue Department
MIDB	- Mahakali Irrigation Development Board
MIP	- Mahakali Irrigation Project (Stage I)
PCR	- Project Completion Report
RWS	- Rotational Water Supply
SAR	- Staff Appraisal Report
UNDP	- United Nations Development Program
WUG	- Water Users' Group

FISCAL YEAR

July 16 - July 15

Office of Director-General
Operations Evaluation

September 28, 1990

MEMORANDUM TO THE EXECUTIVE DIRECTORS AND THE PRESIDENT

SUBJECT: Project Completion Report on Nepal Mahakali
Irrigation Project (Stage I) (Credit 1055-NEP)

Attached, for information, is a copy of a report entitled "Project Completion Report on Nepal - Mahakali Irrigation Project (Stage I) (Credit 1055-NEP)" prepared by the Asia Regional Office with Part II of the report contributed by the Borrower. No audit of this project has been made by the Operations Evaluation Department at this time.

Attachment

A handwritten signature in black ink, appearing to be 'R. P. ...', is written over the word 'Attachment'.

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MAHAKALI IRRIGATION PROJECT (STAGE I)
(CREDIT 1055-NEP)

PROJECT COMPLETION REPORT

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MAHAKALI IRRIGATION PROJECT - STAGE I
(CREDIT 1055-NEP)

PROJECT COMPLETION REPORT

PREFACE

This is a Project Completion Report (PCR) for the Mahakali Irrigation Project, Stage I (Cr. 1055-NEP) in Nepal for which a Credit of US\$16.0 million was extended to His Majesty's Government of Nepal (HMGN) in September 1980. The Credit was closed December 31, 1988. The undisbursed balance of the Credit, US\$27,042.98, was cancelled on July 17, 1989.

Information sources used for the PCR include the Staff Appraisal Report (SAR), Development Credit Agreement (DCA), Supervision Reports, correspondence with the Borrower, Quarterly Project Progress Reports as submitted by the Borrower, and internal Bank memoranda on project issues as contained in relevant Bank files. Parts I and III of this PCR had been sent to the Borrower for their review and comments. IDA received their comments in January 1990 and incorporated them in the PCR. The Borrower contributed Part II of the report. The PCR was prepared by the Agriculture Division, Asia Technical Department. A specific field trip in connection with the PCR was not made.

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MAHAKALI IRRIGATION PROJECT (STAGE I)
(CREDIT 1055-NEP)

PROJECT COMPLETION REPORT

EVALUATION SUMMARY

i. Objectives. The Mahakali Irrigation Project (Stage I) was to improve and extend an existing irrigation system on the far western Terai. The objectives of the project were to: (a) improve the reliability of water deliveries, in the quantities required, to farmers within the existing system (3,400 ha); (b) extend irrigation facilities to an additional 3,200 ha; (c) improve communications and operating efficiency by providing all-weather roads; and (d) accelerate agricultural development and thus increase farm incomes. The project was designed to: (a) improve and extend irrigation and drainage works; (b) construct access roads, model farm and necessary buildings; (c) strengthen agricultural extension activities; and (d) provide fellowships for Nepali students to study engineering and agriculture.

ii. Implementation. Initially, project implementation lagged far behind schedule. There were changes in project scope and delays in procurement of a main civil works contractor. By January 1984, the project was two years behind schedule. In late 1984, the project was reassessed and the project area was reduced from 6,600 to 4,600 ha (Table 10) without reducing the estimated project costs. The area reduction resulted from: (a) a 1981 Government ban on forest clearing and (b) errors in the maps used at appraisal. The ban on forest clearing precluded clearing of over-mature trees, brush and stumps from about 900 ha. The mapping error resulted in an additional 1,100 ha reduction in project area. The fellowship component was removed from the project at reassessment. HMGN had resisted the use of credit proceeds for training, and difficulties had been encountered in placing students in appropriate institutions. Through a grant to HMGN, UNDP assumed responsibility for a fellowship program in engineering and agriculture.

iii. After a civil works contract was signed in late 1984, implementation proceeded rapidly, and civil works were completed by June 30, 1987. Because of the delay in award of contract, however, the project closing date was extended twice. It was further extended through December 31, 1988, to allow formation of a Water User Group (WUG) in the command area, and to provide continuity of agricultural extension activity until the November 1988 effective date of Cr. 1924-NEP (for the follow-on Stage II project).

iv. The project was unable to achieve physical targets set at appraisal, but all revised targets were fully met (Table 4), and the civil works constructed are of internationally acceptable quality. The pilot farm has accomplished much in the areas of agricultural training and cropping trials (para. 13). The Project Organization performed well and developed strong institutional capacities under Stage I (para. 18). A most noteworthy characteristic of this project is the level of cost recovery achieved. Water charge collection rates in the

Mahakali Irrigation Project command area are the highest of any HMCN-managed irrigation system (para. 23).

v. Results. The primary results of this project are: (i) increased water management efficiency; (ii) increased cropping intensities; (iii) increased crop yields; and (iv) increases in incomes as well as in training and employment opportunities. Installation of water flow control structures and organization of WUGs have resulted in increased water management efficiency (paras. 20-21).

vi. Average cropping intensities in the command area increased by 40% and average yield of improved paddy and wheat rose 48% and 64%, respectively, between 1980 and 1989 (Table 15). Programs designed to train farmers in optimal cultivation practices were instituted under Stage I, and contributed to the large increases in agricultural production. Farm incomes rose by a minimum of 100%, (Table 6(a)). Agricultural employment in the project area rose by 76% (Table 18). Both of these increases are higher than was projected at appraisal. The appraisal estimate of the economic rate of return (ERR) was 14%; the estimate at the time of reassessing the project was 17%. The present estimate of the ERR is 20%, which is particularly impressive in light of the substantial reduction in project scope.

vii. Sustainability. The achievements of this project have had substantial positive impact on agricultural development in the project area. Two factors will contribute significantly to continuing the project's objectives after closing: (a) the institutional development that occurred during implementation (which is continuing under Stage II); and (b) the high rate of water charge collection efficiency.

viii. Findings and Lessons. The project achieved its goals even though the physical targets were revised during project implementation due to changes in both the scope of the project (para. 10) and the procurement mode for the main civil works contract (para. 12). The weaknesses identified in project implementation were: (a) lack of structured incentives for farmers to be more involved in the project cycle from an early stage; for example, formation of effective WUGs and construction of field channels by farmer groups were less effective before a timely and reliable water supply was provided (para. 22); and (b) inadequate project preparation as evidenced by the mapping error (para. 10) and lack of a realistic assessment of the relative feasibility of Local Competitive Bidding (LCB) and International Competitive Bidding (ICB) civil works contracts (para. 12). The lessons derived from this experience have been incorporated in the formulation of the follow-on project.

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MAHAKALI IRRIGATION PROJECT (STAGE I)

PROJECT COMPLETION REPORT

PART I. PROJECT REVIEW FROM IDA'S PERSPECTIVE

Project Identity

Name	:	Mahakali Irrigation Project (Stage I)
Credit No.	:	Cr. 1055-NEP
RVP Unit	:	Asia Region
Country	:	Nepal
Sector	:	Agriculture (Subsector, Irrigation)

Background

1. At the time of project appraisal in 1979/80, farm production and related activities comprised more than 60% of Nepal's GDP. The sector engaged almost 90% of the labor force and provided more than 80% of all exports. Of the 24,500 sq km (17% total land area) available for cultivation, at most 15% was irrigated. About 90% of the cropped area was sown with foodgrains, which then largely determined agricultural growth. During the period 1970/71 to 1977/78, the trend in production of major foodgrains, except wheat, was rather disappointing. Production grew at about 1.1% annually due to expansions in acreage, while yields, except for wheat, fell at a rate of about 0.8% per year. Cash crops, however, fared much better partially due to favorable prices. Production growth in cash crops, too, was derived from expanded cultivation and not from increasing yields.

2. In the late 1970s, HMGN strategy was to develop the Terai for generation of domestic and exportable foodgrain surpluses as a resource for further development. Since possibilities for area expansion are limited in the Terai, emphasis was given to increasing yields, mainly by expansion and upgrading of existing irrigation infrastructure and inputs. Initial results from the first IDA-assisted irrigation project in Nepal - Narayani Zone Irrigation Project (Stage I) (Cr. 373-NEP) - indicated that substantial yield improvements could be expected from improved irrigation water supply combined with increased agricultural inputs and effective extension services. HMGN's strategy stressed diversification into cash crops whose performance had been promising and whose marketing prospects were good.

3. The Bank Group's strategy in Nepal placed major emphasis upon the directly-productive sectors (particularly agriculture) and the development of complementary infrastructure. Since IDA's first involvement with irrigation in Nepal in 1973, there has been continuing IDA assistance to the irrigation subsector in Nepal (See Part III, 1). The main objective of Bank involvement in irrigation in the Terai was to improve the reliability of water distribution to the farm through both technical improvements and more effective organization of water users.

4. Improvement of the existing Mahakali irrigation system in the Far Western Region of Nepal was initiated by HMGN in the early 1970s. In 1976, the Mahakali Irrigation Project (MIP) was identified by IDA and in 1978, its preparation for IDA finance was undertaken by an international consulting firm.

At appraisal in January 1980, the system had three major problems: (a) there was severe siltation; (b) the number of tertiary outlets and the length of tertiary canals were insufficient for proper water distribution; and (c) field channels serving individual farms were lacking.

5. The SAR estimated total project costs for system improvement and extension at US\$19.5 M. Negotiations were held in Washington, D.C. on May 20-23, 1980. An IDA Credit (1055-NEP) in the amount of US\$16.0 M (15.1 M SDR equivalent) was approved by the Board on June 9, 1980. The DCA was signed September 29, 1980, with an effective date of December 30, 1980. The project had a five-year implementation period, with a completion date of June 30, 1985.

Project Objectives and Description

6. Objectives. The objectives of the project were to: (a) improve the reliability of water deliveries to farmers within the 3,400 ha existing system; (b) extend irrigation facilities to an additional 3,200 ha; (c) improve communications and operating efficiency by providing all-weather roads; and (d) accelerate agricultural development and thus increase farm incomes. To accelerate agricultural development, the project was also designed to: (a) improve water control through installation of additional control structures, and through the extension of the distribution system to outlets serving 7-8 ha parcels of land; (b) intensify agricultural extension and training; and (c) develop technical staff by providing fellowships for Nepali students.

7. Description. Nine project components were specified in the SAR: (a) improvements to the existing irrigation and drainage system on about 3,400 ha; (b) extension of irrigation and drainage systems by 3,200 ha to 6,600 ha, including about 30 km of new distributaries and 115 km of tertiary canals; (c) construction of an interconnected network of all-weather public roads (about 40 km) and canal service roads (about 65 km); (d) construction of buildings for engineering and agricultural activities and staff quarters; (e) strengthening agricultural extension, research and training activities, including construction of a pilot demonstration farm-cum-training center; (f) procurement of materials, equipment and vehicles for construction, survey and laboratory activities and project operation and maintenance; (g) provision of technical services, including foreign and local consultants for project implementation and aerial photography and mapping; (h) fellowships for Nepali students to study civil and mechanical engineering and agriculture; and (i) undertaking agricultural development activities in the Bhairawa-Lumbini Groundwater Project (Cr. 654-NEP).

8. Consistent with the development plan for Kanchanpur District, HMGN assumed responsibility for two activities integral to the MIP. First, the Timber Corporation of Nepal, by authority of the Forest Products Development Board, was to complete clearing work on about 2,200 ha of over-mature trees, brush and tree stumps from within the project area. Second, in order to unite two sections of the Suklaphanta Wildlife Reserve and reduce river bank erosion, HMGN planned to move farm families living along the Mahakali and Chaudar Rivers to the project area. Responsibility for moving the farmers rested with the Resettlement Department of the Ministry of Forests. Both activities were to be coordinated through the Committee for Forests, Resettlement and Irrigation Development in Kanchanpur District.

Project Implementation

9. General. The Credit became effective February 27, 1981. Initially, project implementation lagged behind schedule. This was mainly due to changes in project scope and delays in procurement of the main civil works. Actual project area available for development was lower than estimated at appraisal for two reasons. First, a 1981 Government ban on all forest clearing precluded clearing the wildlife reserve area originally included in the project. Second, the maps used at appraisal proved to be inaccurate when checked against fully-controlled project mapping completed in 1982. By January 1984, the project was two years behind schedule; the contract for civil works construction had yet to be finalized, and disbursements were low: only 10% of the Credit had been disbursed, as compared with an appraisal estimate of 70%. After the signing of a civil works contract in September 1984, however, implementation proceeded rapidly. Following reassessment (para. 10), and with two extensions of the closing date, civil works were completed by June 30, 1987, six months ahead of the agreed contract schedule. A third extension through December 31, 1988 allowed: (a) completion of WUG formation in the Stage I area; (b) continuity of agricultural extension activities through the model farm and training programs; and (c) finalization of preparation and design work for Stage II (Cr. 1924-NEP, which became effective 11/18/88). The project was completed without cost overrun because: (a) the civil works contract was let at 78% of the engineer's estimate; and (b) funds initially allocated to fellowships were re-allocated to the civil works category.

10. Revision. In light of implementation delays and reductions in scope, the project was reassessed in February 1984. Reassessment was carried out to revise the project scope, and to determine the economic viability of a reduced-scope project. The forest clearing ban and mapping error resulted in reduction of overall project area by about 2,000 ha net (900 and 1,100 ha, respectively). The amended physical targets reflected the 30% reduction in overall project area (Table 10). Work on improvement to the main canal including the construction of sediment ejectors, was dropped because the original design capacity was adequate to deliver the required water to the Stage I area. It was determined that the project was still viable (estimated ERR of 17%), and an amendment to the DCA revising physical targets was issued by IDA in October 1984. The amendment was formally agreed to by HMG in November 1985.

11. Construction. Although the project was unable to meet the initial physical targets set at appraisal, all revised targets were fully met. Both the area of extension and the number of pilot scheme buildings constructed exceeded targets (Table 11).

12. Procurement. Initially, there was some difficulty in securing a contractor for main project works. It was agreed at appraisal that LCB would be utilized for the civil works contract. However, there were no suitable responses to the LCB tender and it became clear that local contractors possessed neither the expertise nor the experience. In mid-1982, a decision was made to use ICB. Contractor performance was satisfactory, and works were constructed to internationally acceptable quality. All pilot facilities were constructed by local contractors with satisfactory results.

13. Agricultural Extension and Training. Agricultural extension activities under the MIP have been important to project success. This component was thus

expanded and strengthened under the follow-on project (Cr. 1924-NEP). The pilot farm was established in 1982, but only became fully operable in mid-1986. At IDA urging, a full-time agricultural consultant was hired in May 1986 to guide training and cropping trials. Performance of the pilot scheme is noteworthy. Cropping intensity in the 13.2 ha farm is very high (225%) and yields of major crops exceeded appraisal estimate. A vetiver grass nursery was started in the command area in 1988 to aid soil and moisture conservation work. Between June 1986 and March 1989, training sessions totalling 224 course-days^{1/}, with a total attendance of 1,848^{2/}, were held at the pilot farm.

14. Many farmers in the project area had inadequate knowledge of water management and irrigated farming practices. Work on the pilot farms and dissemination of the results were thus important factors in improving farming practices in the command area. Courses in vegetable growing techniques, important because of HMGN's emphasis on diversification into cash crops, generated an unanticipated level of interest, especially by women. While women constituted only 8% of total participants in training sessions not related to vegetable-growing, they comprised 94% of the participants in vegetable-growing courses.

15. Fellowships. A major constraint to implementation of irrigation projects in Nepal has been the shortage of well-trained technical personnel. Fellowships were thus an important part of the project. HMGN agreed during credit negotiations to implement a fellowship program. However, shortly after the credit effectiveness, HMGN established a policy of not using Credit proceeds for training, and was reluctant to start the program. The Bank emphasized the importance of the fellowship component, but attempts to arrange for the requisite number of university placements were not successful. In 1983, through a grant to HMGN, UNDP assumed responsibility for a fellowship program in engineering and agricultural sciences. At project closing, UNDP had funded 47 engineering and agricultural fellowships for Nepali students.

16. Reporting. As with other projects in Nepal, the performance of HMGN in fulfilling the IDA audit and accounting requirements was weak. The Bank repeatedly stressed the importance of timely reporting, but the required submission of reports within six months after the end of the fiscal year did not prove to be possible. The DCA was revised in 1988 to extend the submission of accounts and audits to 12 months after the end of each fiscal year, while still requiring unaudited accounts to be submitted within six months of the fiscal year end.

Institutional Performance

17. Coordination; Land Clearing and Settlement. Land clearing and settlement functions proved to be problematic throughout the project period. The Committee for Forests, Resettlement, and Irrigation Development (CFRID) in Kanchanpur District did not function and was replaced by a higher committee from the Land Settlement Department in December 1985. In spite of this, both tree

^{1/} Length of duration ranges from one to thirty days.

^{2/} Includes farmers (men and women), lead farmers, WUG leaders, and field extension workers.

clearing and final settlement proceeded slower than anticipated, and clearing was not completed until 1988. The Timber Corporation of Nepal did not have sufficient capacity for the task, and brush and stump removal was slow throughout project implementation. Settlement and assignment of land titles was delayed. At project closing in December 1988, title to 980 ha of land still remained to be assigned although the entire command area has been cultivated by settlers. This affected the level of water charge collections (para. 23).

18. Project Management. Overall, the project organization performed successfully. The Engineering Construction and Design (EC&D) unit, although not part of project organization at the appraisal stage, functioned particularly well. The unit was formed during civil works design review and construction processes. Project engineers received on-the-job training by working with supervising engineers from the project consultant. The EC&D unit developed into one of the strongest components in project management.

19. Water Management. The project contributed to improved water management in the command area. New and improved physical works constructed under the project, and standardized operation and maintenance procedures both played a role. The two most significant elements, however, were:
(a) implementation of Rotational Water Supply (RWS) in blocks III and IV; and
(b) formation of WUGs throughout the command area.

20. In 1985, the Bank advocated a redesign of the water distribution system in MIP to allow the use of RWS. The recommendation was based on review of a wide range of irrigation experience in both India and Nepal, and the results of a system design study conducted in India by a Bank consultant. That review prompted a decision to adopt a structured, gateless fixed supply system, which incorporates elements of the warabandi system which has operated successfully in Northwest India. The cost of these improvements was relatively small (US\$200/ha) but the improvements in manageability of the system and the reliability of water supply were spectacular. With RWS design, chaks were to be between 20 and 30 ha, as opposed to the 40 ha approximation determined at appraisal. Blocks I and II will be converted to the RWS system as part of the Stage II works.

21. Water Users' Groups (WUGs). WUGs play an important role in dissemination of appropriate farming techniques, as well as canal maintenance and other water management issues. Without effective and functional WUGs, the RWS system will not be able to achieve design efficiency. The project had a target of forming 915 WUGs; 802 WUGs, or 88%, were achieved by project closing (Annex A, III). The shortfall is mainly due to delays in land settlement and title assignment (para. 17).

22. During appraisal it was agreed that water would only be regularly available to a tertiary unit after: (a) the WUG had been formed for the unit; (b) field channels had been constructed; and (c) satisfactory distribution routines had been established. Implementation proved this condition to be inappropriate, as it is difficult to form WUGs prior to the availability of reliable water deliveries at the farm level. Once water was available on a

reliable basis, however, WUGs become important participants in the irrigation system. MIP Stage II has taken account of this.^{3/}

23. Cost Recovery. The DCA required HMGN to recover from beneficiaries: (a) the full cost of operation and maintenance; and (b) in progressive steps over a reasonable period of time, the investment cost of the project. At appraisal, annual charges were levied on each crop sown (NRs 60/crop/ha). In 1986, this system was changed to a flat rate (NRs 100/ha/year). The rate was insufficient to allow recovery of maintenance costs. At IDA urging, it was raised to NRs 200/ha/year for 1987 collections, which is still insufficient to cover operation and maintenance cost. Actual irrigation operation and maintenance cost was estimated at NRs 280 per ha per year.

24. Water charge collection efficiency for the MIP is the highest of all HMGN-managed surface irrigation projects. For fiscal year 1987/88, a collection rate of 78% was realized (Table 14). This performance is particularly impressive given the fact that cost recovery under the project was impeded by: (a) the rate of settlement and land title assignment; and (b) weak linkages in the assessment/collection system. Measures were taken to correct both problems. Supervision missions emphasized the importance of timely settlement and title assignment. By project closing all land was settled, although land titling in approximately 30% of project area land was outstanding. As collection procedures are based on lists of currently registered land owners, untitled and newly settled lands are not captured in the water charge process.

Project Results

25. There are four primary results from the project: (a) increased cropping intensities; (b) increased yields; (c) increases in incomes as well as in training and employment opportunities; and (d) increased water management efficiency. Increased efficiency of water management will be important over the long run, as efficient use of water resources is crucial to HMGN's policy of agricultural intensification.

26. Agricultural Production. An agricultural impact study carried out in 1989 revealed that production in the project area was 89% higher than SAR projections of production without the project (Table 15). Both cropping intensity and average crop yields rose in the project area. Average cropping intensity increased by 40%, and average yields of paddy (improved), wheat and oilseeds rose by 48%, 64% and 40%, respectively (Table 16). These increases are attributable inter alia to successful implementation of the farmer training program at the pilot farm assisted by the agricultural consultant on irrigated farming and on-farm water management (paras. 13, 14 and 19). Estimates of future production in the project area (1992/93) are based on yield levels already obtained by many ordinary farmers in the project area.

27. Employment and Farm Incomes. The project created construction and agricultural employment. Short-term employment of 1,050 laborers during construction generated current benefits, but the agricultural employment will have longer-term impacts. The agricultural labor requirement in the command

^{3/}For example, intensive training will be focused on WUG leaders who will teach/demonstrate water management techniques to other farmers in their respective groups.

area in 1988/89 was 76%, or 322,100 man-days higher than in 1982/83 (Table 18). The most recent estimate of farm family on-farm incomes is US\$130 per year for small farms, and an average of US\$192 for all three farm sizes (Table 6). This represents a 100% and 192% increase, respectively, over incomes estimated at appraisal. The average increment to net benefits is currently estimated to be NRs 591 per family member per annum (Table 17).

28. Economic Rate of Return (ERR) . The appraisal estimate of the ERR from this project was 14%, assuming five years for command area build-up, and seven years for yield build-up. Although initially there were concerns that a reduced-scope project would not be economically viable, the 1984 revised estimate was a 17% ERR, or 13% assuming ten years (instead of five) for command area build-up, and seven years (instead of five) for yield build-up. The project ERR at PCR preparation time was estimated to be 20%, higher than projected under the most optimistic scenario at reassessment (Table 6(b)). This rate of return is particularly impressive in light of the reduced project scope, and is largely attributable to the high levels of incremental agricultural production achieved in the project area. The increase in crop production is mainly attributable to a reliable irrigation water supply. This created confidence and motivation for farmers to participate in farmer training conducted at the pilot farm, and to follow guidance provided by extension workers. The project management throughout the project period, conscientiously supported all aspects of agricultural activities.

Project Sustainability

29. The project had a significant positive impact on agricultural development and farm incomes. The institutional strengthening that took place during implementation (paras. 13 and 18), particularly the establishment of effective WUGs, facilitated sustained project operations under public sector management with increased users involvement. Strengthening both the pilot farm and the Project Authority under the Stage II project will ensure that local institutions are in place to maintain the original project momentum. The high level of water charge collection efficiency (para. 24) should also aid the Stage II project.

Bank Performance

30. HMGN started preparing the project as early as 1977, with technical assistance from expatriate consultants. The project was not prepared in sufficient detail, which resulted in implementation delays (paras. 9-10). The SAR identified the key project components required to overcome deficiencies in the existing systems and confirmed the need for the installation of sufficient control structures to ensure efficient water delivery. The SAR also outlined a well-balanced development plan for overcoming constraints that could otherwise impede improvement of the agricultural performance. Eighteen supervision missions visited the project at an average interval of six months. Consistent Bank staff attention to the project was apparent in the supervision reports, and in the recommendations contained therein. Bank staff concentrated not only on assuring compliance with Credit covenants, but also on ensuring the quality of project implementation. The latter is evidenced in recommendations such as a shift to RWS and preparation of a crop manual for the command area. The following lessons may be learned from the project:

- (a) Appropriate farmer motivation and incentives are crucial to project success. Formation of WUGs is not possible until reliable delivery of irrigation water has occurred. It is important to form effective WUGs in time for farmers to be involved in planning and design at the tertiary level. This early involvement results in a greater sense of ownership, and a higher level of participation by farmers.
- (b) The following weaknesses encountered under the project: (i) deficiencies in project preparation as evidenced by the mapping error, which resulted in project revision (para. 10); (ii) overoptimistic implementation plan which resulted in extension of the closing date by three years; (iii) inadequate assessment of the relative feasibility of LCB and ICB civil works contracts (para. 12). The latter two can, however, be related to the short experience, at appraisal time, with implementation of large civil works in Nepal.

Borrower's Performance

31. Except for the initial delays due to changes in the project scope and the mode of procurement for the main civil works contract, the project authority has been successful in implementing the project works. Table 7 contains the review of performance of the Borrower. Except for delays in submitting audited accounts and audited reports, the Borrower's compliance with the Credit covenants was satisfactory. During project preparation and appraisal, the project authority provided all the support needed. After project revisions in late 1984, project organization was considerably strengthened. The revised organization played a major role in assuring the project's successful implementation of the project.

Project Relationships

32. Bank relationships with HMGN, local government and the Project Authority have been good.

Consulting Services

33. The project consultants employed by the Mahakali Irrigation Development Board (MIDB) provided in-service training, advice and guidance to project engineering staff in all cycles of the project implementation, as well as preparation of bid documents and evaluation. Their performance was exceptionally good, particularly for engineering supervision, developing an irrigation system operation manual for the command area, publishing a crop manual for the farmers, and guiding the field staff in conducting the impact study of the project. It is noteworthy that the consultants have maintained a good working relationship with the Project Authority and project management, and also worked closely with the beneficiaries. The success of the project implementation could not have been attained without the quality of consultant inputs that were provided during the project.

Project Documentation and Data

34. Although there were some weaknesses in preparation (para. 30), preparation and appraisal concentrated on the appropriate issues. The SAR provided a useful framework for the Project Authority to implement the project, and for Bank review of project progress. As stated earlier, the submission of the project accounts and audits within six months after the end of each fiscal year (para. 16), and the formation of WUGs and construction of field channels prior to release of irrigation water (para. 30a) stipulated in the DCA were actually difficult for HMGN to comply with. The data relevant to the preparation of the PCR were readily available.

PART II. PROJECT REVIEW FROM BORROWER'S PERSPECTIVE

Evaluation of Performance

Bank's Performance

35. Consistent IDA attention to the project contributed to its success. While the supervision mission personnel were highly qualified in their respective disciplines, absence of an agriculturalist on early missions was not optimum from a project perspective. Despite initial delays in implementing civil works, the project area already under cultivation could well have benefited from agricultural expertise. This was rectified in later IDA missions, after 1984. The project appreciated the prompt response and quick action of IDA in helping solve problems encountered during the implementation, and providing suggestions for improvement of the system. Without this level of support the project would not have been able to achieve its revised targets.

Borrower's Own Performance

36. Overall performance of institutions participating in the project was satisfactory. During project implementation, the project organization developed into a strong and competent institution. Coordination of project management with other institutions was good. To achieve the revised targets, project staff, consultant and main contractor coordinated their efforts to work as a single team. This enabled the civil works to be completed six months ahead of schedule, to international quality standards. To achieve the level of collection of water tax, the project staff have coordinated their efforts with the Land Revenue Department (LRD), and have convinced farmers to pay the charges. A major factor in convincing the farmers has been the reliable supply of irrigation water. The agricultural impact to date has been ahead of the targets, as detailed in the Agricultural Impact Study Report. This is due to the level of agricultural training, extension and demonstrations at the pilot farm. Production of vetiver grass is underway, as suggested by IDA: vetiver will help in developing low cost, appropriate protection for drains and canal embankments.

Lessons Learned

37. In Nepal, any sizeable construction contract should be let under ICB procedures to ensure quality, price and timely completion. However, to assist the development of the local contracting industry, maximum use of local firms as sub-contractors should be encouraged so that local contractors will be able to rapidly gain the necessary experience.

38. Participation of the farmers to the extent possible in the planning, design and implementation of the project is vital to the achievement of the objectives. In Stage I, farmer participation was initially minimal, and certain problems arose, which would not have arisen if farmers had actively been involved at all stages. Farmer participation in planning, design and implementation is an integral part of Stage II.

39. Reporting requirements should be reasonable within the domestic administrative context; requirements which conflict with local practices and timetables should be avoided if possible. Agreement to unrealistic covenants

in the DCA for the submission of project accounts and audits to IDA can distract supervision and project management attention from more urgent issues directly related to project implementation.

PART III. SUMMARY OF STATISTICAL DATA

Table 1: Related IDA Credits

Credit Number/ Project Title	Year of Approval	Purpose of Project	Status
373-NEP Birganj Irrigation (Narayani Zone)	1973	To complete and upgrade 28,700 ha of the Nepal Eastern Canal command area and to provide tubewells north of the canal	Completed. Followed by Stage II
617-NEP First Rural Development	1976	One component provided for improvements to small-scale irrigation schemes in the Hills	Completed
654-NEP Bhairawa-Lumbini Stage I	1976	Development of 64 public tube-well systems and strengthening of agricultural support services in the western Terai	Completed. Followed by Stage II
812-NEP Sunsari-Morang Stage I	1978	Improvement of Chatra Canal command area, including drainage, river training and sediment control works (12,000 ha)	Completed. Followed by Stage II
856-NEP Narayani Stage II	1978	Follow-on to Birganj Project, completed deferred work	Completed. Followed by Stage III
939-NEP Second Rural Development	1979	Included a component for improving hill irrigation in the Mahakali Zone	Completed
1101-NEP Hill Food Production	1981	Improvement of small farmer managed schemes totalling about 3,000 ha	In progress. To be completed in 1990
1316-NEP Bhairawa-Lumbini Stage II	1983	Completion of Stage I works and introduction of improved designs for construction of 38 new tubewell systems	Nearing completion. To be followed by Stage III
1715-NEP Narayani Stage III	1986	Rehabilitation of early blocks for improved (i) water management capacity and (ii) dry season agricultural production	In progress. To be completed in 1994

Credit Number/ Project Title	Year of Approval	Purpose of Project	Status
1727-NEP Third Rural Development	1986	Includes construction of 32 and rehabilitation of 18 existing schemes in the Hills	In progress. To be completed in 1993
1814-NEP Sunsari-Morang Stage II	1987	Follow-on to Stage I, continuing work on 23,000 ha	In progress. Will be completed in 1994
1924-NEP Mahakali Stage II	1988	Follow-on to Mahakali I, to extend command area	In progress. To be completed in 1995.

Table 2: Project Timetable

Item	Date Planned	Date Revised	Date Actual
Identification (Executive Project Summary)	02/75		02/75
Preparation	03/77		03/77-11/78
Appraisal Mission	01/80		01/08-28/80
Credit Negotiations	05/80		05/20-23/80
Board Approval	06/09/80		06/09/80
Credit Signature	09/29/80		09/29/80
Credit Effectiveness	12/31/80	03/31/81	02/27/81
Credit Closing	12/31/85	12/31/88	12/31/88
Credit Completion	06/30/86	06/30/89	06/30/89

Table 3: Cumulative Disbursements

	FY81	FY82	FY83	FY84	FY85	FY86	FY87	FY88	FY89
Appraisal Estimate (US\$M)	0.3	3.8	7.7	11.1	14.6	16.0	-	-	-
Actual (US\$ M)	0.1	0.5	1.2	1.7	3.2	5.2	11.5	13.7	16.0
Actual as % of SAR estimate	33	13	16	15	22	33	72	86	100

Table 4: Physical Achievements

Item	Appraisal Target	Revised Target	Actual Achieved	Achievement as % of Appraisal	as % of Revised
<u>IMPROVEMENTS TO EXISTING SYSTEM:</u>					
delivery (ha)	3,400.0	2,700.0	2,700.0	79	100
canals (km)					
tertiary	-	35.8	35.8	-	100
distributary	-	37.0	37.0	-	100
drainage	200.0	219.0	219.0	110	100
<u>EXTENSION OF SYSTEM:</u>					
delivery (ha)	3,200.0	1,900.0	2,100.0	66	111
canals (km)					
tertiary	115.0	170.0	170.0	148	100
distributary	30.0	14.6	14.6	49	100
<u>ROADS:</u>					
public (km)	40.0	15.0	15.0	38	100
service (km)	65.0	56.0	56.0	86	100

Table 5: Project Costs and Financing

(a) Project Costs
(US\$ thousand)

Category	<u>Appraisal Estimate</u>			<u>Revised Estimate</u>			Actual Total
	Local	Foreign	Total	Local	Foreign	Total	
Civil Works							
Vehicles & Equipment	5,421	4,003	9,424	2,662	7,832	10,494	12,872
Project Administration	1,136	159	1,295	720	180	900	68
Technical Services	300	1,218	1,518	865	1,635	2,500	3,033
Fellowships	50	934	984	0	0	0	0
Contingencies	<u>3,140</u>	<u>3,140</u>	<u>6,280</u>	<u>893</u>	<u>2,085</u>	<u>2,978</u>	<u>0</u>
TOTAL	10,047	9,454	19,501	5,140	11,732	16,872	15,973
						Total Disbursement	15,973
						Credit Amount	16,000
						Amount Cancelled	27

(b) Project Financing
(US\$ million)

Source	Agreement	Actual	Actual as % of Agreement
IDA Expenditure Categories	16.0	16.0	100
Domestic	3.5	3.4	97
TOTAL	19.5	19.4	99.5

Table 6: Project Results

(a) Direct Benefits

Item	Benefit Estimated at Appraisal	Actual Benefit Achieved
Farm families to benefit:	2,600-2,800	3,100 ^{a/}
Changes in irrigated area:		
(a) improvement to existing system	3,400 ha	2,700 ha
(b) increase in command area	+3,200 ha	+2,100 ha
Increase in production:		
(a) foodgrains	+120% (+7,500 tons)	+181% (+10,040 tons)
(b) all crops	+173%	+167%
Incremental farm and self employment:	+53%	+76%
Average increase in per capita income:		
Est. from US\$65 to US\$118 per year	+82%	
Achieved from US\$65 to:		
US\$ 130 per year for small farms		+100%
US\$ 190 per year average all farm sizes		+192%

^{a/} Agricultural impact study (1989) reveals that there are more smaller farm size than assumed in SAR.

(b) Economic Cost and Benefit Streams
(NRs 000)

BENEFITS	YEAR	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94
With Project Benefits		18301	16980	17419	22551	44258	48061	46229	58758	70754	83826	121379	181671
Without Project Benefits		17329	17329	17329	17329	17329	17329	17329	18628	21727	23824	26128	28908
Incremental Agricultural Benefits		-1028	-448	84	15221	26929	28732	27800	39210	49027	59901	95256	102864
COSTS													
Capital Expenditure		30087	7089	41083	62088	94893	33144	48225	0	0	0	0	0
Estimated O&M Costs		0	0	0	0	0	0	0	1500	1500	1500	1500	1500
Total Economic Costs		30087	7089	41083	62088	94893	33144	48225	1500	1500	1500	1500	1500
INCREMENTAL NET ECONOMIC BENEFITS		-31086	-7518	-41779	-47446	-67464	-4412	-17825	37710	47827	58401	93756	101764
BENEFITS													
YEAR		1984/85	1985/86	1986/87	1987/88	1988/89	2000	2000/01	2010/11				
With Project Benefits		148083	144144	148321	149500	150888	182933	182808	182808				
Without Project Benefits		30558	30930	31548	31788	32185	32578	32687	32687				
Incremental Agricultural Benefits		111626	113214	114873	116734	118601	120257	120228	120228				
COSTS													
Capital Expenditure		0	0	0	0	0	0	0	0				
Estimated O&M Costs		1500	1500	1500	1500	1500	1500	1500	1500				
Total Economic Costs		1500	1500	1500	1500	1500	1500	1500	1500				
INCREMENTAL NET ECONOMIC BENEFITS		110026	111714	114873	115234	117001	118757	118728	118728				

Economic Rate of Return: 20.19%

Underlying Assumptions:

1. The benefit period of the project extends from 1989/90 to 2011/12.
2. All cost streams have been expressed in 1989 constant prices.
3. Actual capital costs incurred from 1982/83-1988/89, adjusted to 1989 constant prices, are the basis for the capital cost stream.
4. Without the project, cropping patterns and agricultural production are assumed to remain constant at 1982/83 levels, because (a) farmers in the project area consist mainly of tharu caste who are only moderately open to change; (b) most project areas had deeply rooted tree stumps; and (c) the area is most backward and isolated that hardly any changes could be expected without the project.
5. Benefits and operating costs are constant after the year 2000.

(c) Studies

Title	Purpose as Defined at Appraisal	Status
Agricultural and Economic Evaluation (#1)	To provide a reliable benchmark for future developments in the project area (SAR paragraph 5.13)	Submitted 12/83
Agricultural and Economic Evaluation (#2)	To provide initial information on project impact, including approximate number of farmers provided with improved or first irrigation	Submitted 05/89

Table 7: Compliance with Credit Covenants

Section	Description of Covenant	Status/Comment
3.02	Recruit an engineering firm and an agricultural consultant to assist in project implementation.	In compliance.
3.03	Appoint project staff in accordance with a staffing plan acceptable to IDA.	In compliance.
3.04	Carry out a training program for engineering and agricultural students.	Deleted, UNDP assumed training.
3.05	Coordinate land clearing and settlement, complete land clearing.	In compliance.
3.07	Carry out two project evaluation studies and submit PCR within six months after final disbursement.	In compliance.
4.01	Maintain separate project accounts, audit same annually and furnish audit reports not later than six months after the end of each fiscal year.	In compliance. (See Section I, para. 4.08)
4.02	Establish and collect water charges to cover O&M costs and recover, in progressive steps, the investment cost of the project. Charges to be reviewed and adjusted at regular intervals.	In compliance.
4.03	Prepare and furnish O&M manuals for irrigation and drainage systems.	In compliance.
6.01	Establish a project board and appoint a Project Manager, senior roads engineer and Agricultural Development Officer.	In compliance.

Table 8: Staff Input (Staff Weeks)

Task	FY78	FY78	FY79	FY80	FY81	FY82	FY83	FY84	FY85	FY86	FY87	FY88	FY89	FY90	Total
Preappraisal	7.3	1.9	1.3	21.8											32.3
Appraisal				70.5											70.5
Negotiation				4.9											4.9
Supervision				.9	4.0	6.2	8.2	12.7	10.0	14.8	12.6	8.8	6.8		85.0
Others	.5	1.0	.5	5.2	.2	.1	.2	.1	.0	.6			.3	.3	9.1
TOTAL	7.8	2.9	1.8	103.3	4.2	6.2	8.4	12.8	10.1	15.5	12.6	8.8	7.1	.3	201.8

Table 9: Mission Data

Mission	Date (mo/yr)	Number of persons	Man-days in field	Specializations represented <u>a/</u>	Overall status <u>b/</u>
Appraisal	01/80	5	55.0	2E,C,A,F	N/A
Supervision 1	11/80	1	0.5	E	N/A
Supervision 2	03/81	2	4.0	C,E	2
Supervision 3	06/81	1	3.0	E	2
Supervision 4	12/81	1	1.0	E	2
Supervision 5	06/82	2	3.0	2E	3
Supervision 6	11/82	4	16.0	E,C,L,J	2
Supervision 7	06/83	1	3.0	E	3
Reassessment	02/84	3	15.0	2E,A	N/A
Supervision 8	03/84	3	18.0	2E,A	3
Supervision 9	11/84	2	12.0	E,A	2
Supervision 10	07/85	1	3.0	E	1
Supervision 11	12/85	3	9.0	E,2A	2
Supervision 12	05/86	2	8.0	E,A	2
Supervision 13	01/87	4	20.0	2E,2A	1
Supervision 14	05/87	1	4.0	A	1
Supervision 15	10/87	1	5.0	A	1
Supervision 16	02/88	1	10.0	A	1
Supervision 17	11/88	1	5.0	A	1
Supervision 18	04/89	1	5.0	A	1

/a A - Agriculturalist; C - Economist; E - Engineer; L - Loan Officer
J - Legal Specialist; and F - Forestry Specialist.

/b 1 - Problem free or minor problems; 2 - Moderate Problems;
3 - Major Problems.

Table 10: Reassessment

Item	Original (09/29/80)	Revision/ <u>a</u> (11/18/85)	% Reduction
A) Improvements (ha served)	3,400	2,700	21
B) Extension (ha served)	<u>3,200</u>	<u>1,900</u>	<u>41</u>
Net Project Area	6,600	4,600	30
C) Roads (km)			
Public	40	15	63
Service	65	56	14

/a Reassessment actually took place in February, 1984. Changes in scope were proposed by the Bank in October, 1984, but were not officially accepted by HMGN until November, 1985.

Table 11: Physical Works by Block

Block Number	Revised Target (ha)	Area Developed (ha)	Achieved as % of Target
I	1,337	1,525	114
II	695	695	100
III	1,500	1,501	100
IV	1,068	1,079	101
TOTAL	4,600	4,800	104

Table 12: Pilot Scheme Buildings

Building	Unit Specified at Appraisal	Unit Actually Constructed	Percent Target Achieved
Office	1	1	100
Classroom	1	2	200
Housing	3	4	133
Quarters for Trainees	1	2	200
Storage	1	1	100
Warehouse (1,000 mt)	1	1	100
Threshing Floor	1	1	100

Table 13: Water User Group Formation

Block No.	Initial Target	Revised/a Target	Actual Achievement			Achievement as % of	
			May 87	Oct 87	Feb 88	Initial Target	Revised Target
I	221	225	196	210	210	93	95
II	110	130	61	125	130	100	116
III	232	336	131	202	238	71	103
IV	234	224	28	130	224	100	96
TOTAL	797	915	416	667	802	88	101

Table 14: Cost Recovery Performance

Year	Assessment (NRs)	Rate	Area Assessed	Collections NRs	Collections as % of Assessment
1984/85	113,159	NRs60/ha/crop	-	111,345	98
1985/86	113,150	NRs60/ha/crop	-	110,172	97
1986/87	256,728	NRs100/ha	2,720	112,607	44
1987/88	544,512	NRs200/ha	2,720	425,673	78
1988/89	735,998	NRs200/ha	3,680	Collection in Progress	

/a Revised May, 1987.

/b 1,120 ha of newly settled command area is not included.

Source: Mahakali Irrigation Project.

Table 15: Incremental Crop Production
('000 tons)

Crop	SAR Estimate				Actual Achievement 4/		Percent Change	
	Actual 1978/79	FWOP 1/	FWP 2/	Increment	WP 3/	Increment	1979/1989	FWOP-Actual
Paddy	3.75	5.00	10.51	5.51	10.55	5.55	181	111
Wheat	0.80	1.10	3.30	2.20	4.49	3.39	461	308
Maize	1.00	1.60	2.80	1.20	0.55	-1.05	-45	-66
Pulses	0.30	0.50	1.00	0.40	0.33	-0.17	10	-34
Oilseeds	0.30	0.50	1.00	0.50	0.48	-0.02	60	-4
TOTAL	6.15	8.70	18.61	9.81	16.40	7.70	167	89

- 1/ Future without project
 2/ Future with project
 3/ With project
 4/ Source: Agricultural Impact Study (1989)

Table 16: Cropping Patterns and Yields

Crop	At Appraisal (1980/81)		Appraisal Est. of FWP		Actual and PCR Estimate c/					
	Area/a	Yield/b	Area	Yield	Actual WP (1988/89)		Est. FWP (1992/93)		Percent Change (1981-1989)	
					Area	Yield	Area	Yield	Area	Yield
Paddy										
Local	65	1.2	19	1.9	9	2.1	-	-	-86	75
Improved	3	2.1	37	3.3	73	3.1	81	3.5	2333	48
Maize	19	1.2	21	2.0	14	1.1	6	2.0	-26	-8
Cotton	-	-	10	1.1	-	-	5	1.7	-	-
Soybean	-	-	3	1.0	-	-	-	-	-	-
Groundnut	-	-	4	1.4	-	-	3	1.8	-	-
Wheat	16	1.1	24	2.1	55	1.8	59	2.6	244	64
Oilseeds	15	0.5	23	0.6	18	0.7	17	1.2	20	40
Pulses	12	0.6	21	0.7	12	0.7	11	1.0	0	17
Potatoes	-	-	-	-	1	8.0	1	20.0	-	-
Vegetable	1	7.0	3	11.0	1	6.3	2	22.0	0	-10
Sugarcane	-	-	-	-	1	30.0	2	-	-	-
Gram	-	-	-	-	-	-	8	1.0	-	-
OVERALL CROPPING INTENSITY	131%		165%		184%		195%		40%	

/a Area measured in percent area cropped.

/b Yield measured in tons per hectare.

/c Source: Agricultural Impact Study (1989) and Supervision Report (12/22/88).

Table 17: Incremental Benefits to Farm Families 1/
(NRs thousand)

Net Benefit	Small Farm			Medium Farm		
	FWOP	88/89	Increment	FWOP	88/89	Increment
Per Family	6.1	9.6	3.5	15.4	25.0	9.6
Per Hectare	5.8	9.1	3.3	4.8	7.8	3.0
Per Family Member	0.8	1.2	0.4	1.3	2.0	0.7

Table 17 (Continued)

Net Benefit	Large Farm			Overall		
	FWOP	88/89	Increment	FWOP	88/89	Increment
Per Family	32.2	51.4	19.2	7.3	12.3	5.0
Per Hectare	4.5	7.1	2.6	5.1	8.5	3.4
Per Family Member	2.0	3.2	1.2	0.9	1.5	0.6

1/ Farm sizes are defined as follows: small - less than 2.37 ha; medium - 2.58 to 5.10; and large - above 5.10 ha. Average household sizes are 7.7, 12.2 and 16.2 members, respectively.

Table 18: Incremental Agricultural Employment

Crop	<u>1982/83</u>			<u>1988/89</u>			Change in Area	Incremental Labor Required for Total Crops (mandays)
	<u>Area/a</u>	<u>mandays/b</u>	total	<u>Area</u>	<u>mandays</u>	total		
Paddy	2,268	104	235,872	3,569	128	456,832	1,301	220,960
Wheat	1,260	65	81,900	2,451	80	196,080	1,191	114,180
Maize	792	60	47,520	602	65	39,130	(190)	(8,390)
Oilseed	720	45	32,400	731	50	36,550	11	4,150
Pulses	792	35	27,720	473	40	18,920	(319)	(8,800)
TOTAL	5,832		425,412	7,826		747,512	1,994	322,100
Percent increase from 1982/83 level:								76

/a Hectares devoted to crop.

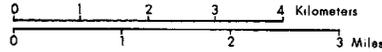
/b Mandays per hectare.

Source: Agricultural Impact Study (1989).

INDIA

NEPAL

MAHA KALI IRRIGATION PROJECT (STAGE I) General Plan



- PROJECT AREA BOUNDARY
- PROPOSED IRRIGATION CANALS
- PROPOSED PUBLIC ROADS
- DRAINAGE CANALS TO BE IMPROVED
- EXISTING IRRIGATION CANALS
- EXISTING HIGHWAYS
- EXISTING BARRAGE
- RIVERS
- TOWNSHIP OF MAHENDRANAGAR
- AIRPORT
- INTERNATIONAL BOUNDARIES

Sarda River Barrage

East - West Highway

Mahendranagar

To Dhangadhi

29°00'

29°00'

80°20'

INDIA

This map has been prepared by The World Bank's staff exclusively for the convenience of the readers and to accurately for the internal use of The World Bank and the International Finance Corporation. The interpretations used and the boundaries shown on this map do not imply, on the part of The World Bank and the International Finance Corporation, any judgement on the legal status of any territory or any endorsement or acceptance of such boundaries.

ROYAL SHUKLAPHANTA WILDLIFE RESERVE

80°10'

80°20'