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R2019-0027/1

February 8, 2019

Closing Date: Thursday, February 28, 2019 at 6:00 p.m.

FROM: Vice President and Corporate Secretary

India - Dam Rehabilitation & Improvement Project

Additional Financing and Restructuring

Project Paper

Attached is the Project Paper regarding a proposed additional loan and restructuring to India for the Dam Rehabilitation and Improvement (R2019-0027), which is being processed on an absence-of-objection basis.

Distribution:
Executive Directors and Alternates
President
Bank Group Senior Management
Vice Presidents, Bank, IFC and MIGA
Directors and Department Heads, Bank, IFC, and MIGA

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The World Bank

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Report No: PAD2874

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT PAPER

ON A

PROPOSED RESTRUCTURING AND ADDITIONAL FINANCING

IN THE AMOUNT OF
US$137 MILLION

TO THE

REPUBLIC OF INDIA

FOR A

DAM REHABILITATION AND IMPROVEMENT PROJECT

February 5, 2019

Water Global Practice
South Asia Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective August 31, 2018)

Currency Unit =	India Rupee (INR)
INR 70.92 =	US$1

FISCAL YEAR
April 1 – March 31

ABBREVIATIONS AND ACRONYMS

AF	Additional Financing
APF	Annual Probability of Failure
BCR	Benefit-Cost Ratio
CAAA	Controller of Aid, Audit, and Accounts
CDSO	Central Dam Safety Organization
CE	Chief Engineer
CPMU	Central Project Management Unit
CWC	Central Water Commission
DEA	Department of Economic Affairs
DHARMA	Dam Health and Rehabilitation Monitoring Application
DPS	Designated Procurement Specialist
DRIP	Dam Rehabilitation and Improvement Project
DSO	Dam Safety Organization
DSRP	Dam Safety Review Panel
DVC	Damodar Valley Corporation
EA	Environmental Assessment
E&S	Environment and Social
EFA	Economic and Financial Analysis
EIRR	Economic Internal Rate of Return
EMP	Environmental Management Plan
ESA	Environmental and Social Assessment
ESHS	Environment, Social, Health, and Safety
ESMF	Environmental and Social Management Framework
FIRR	Financial Internal Rate of Return
FM	Financial Management
GBV	Gender-Based Violence
GIS	Geographic Information System
GoI	Government of India
GoO	Government of Odisha
GRS	Grievance Redress Service
IA	Implementing Agency

IBRD	International Bank for Reconstruction and Development
ICB	International Competitive Bidding
IDA	International Development Association
IP	Implementation Progress
IUFR	Interim Unaudited Financial Report
KSEB	Kerala State Electricity Board
M&E	Monitoring and Evaluation
MIS	Management Information System
MoWR, RD&GR	Ministry of Water Resources, River Development and Ganga Rejuvenation
MP	Madhya Pradesh
NCB	National Competitive Bidding
NLSC	National Level Steering Committee
NRLD	National Register for Large Dams
O&M	Operations and Maintenance
PDO	Project Development Objective
PESA	Panchayat Raj Extension to Scheduled Areas
PIU	Project Implementation Unit
PMU	Project Management Unit
POF	Possibility of Failure
R&R	Resettlement and Rehabilitation
RAP	Resettlement Action Plan
SDSO	State Dam Safety Organization
SEB	State Electricity Board
SMF	Social Management Framework
SoO	State of Odisha
SPMU	State Project Management Unit
STEP	Systematic Tracking of Exchanges in Procurement
TA	Technical Assistance
TANGEDCO	Tamil Nadu Generation and Distribution Corporation
ToR	Terms of Reference

Regional Vice President:	Hartwig Schafer
Country Director:	Junaid Kamal Ahmad
Senior Global Practice Director:	Jennifer J. Sara
Practice Manager:	Michael Haney
Task Team Leader(s):	Chabungbam Rajagopal Singh/ Arun Kumar Kolsur

BASIC INFORMATION – PARENT (IN Dam Rehabilitation and Improvement Project - P089985)

Country	Product Line	Team Leader(s)		
India	IBRD/IDA	Chabungbam Rajagopal Singh		
Project ID	Financing Instrument	Resp CC	Req CC	Practice Area (Lead)
P089985	Investment Project Financing	GWA06 (9396)	SACIN (347)	Water

Implementing Agency: Central Water Commission under the Ministry of Water Resources, Damodar Valley Corporation (DVC), Uttarakhand Jal Vidyut Nigam Limited, Odisha Water Resource Department, Tamil Nadu Water Resources Department, Kerala State Electricity Board, Karnataka Water Resources Development Organisation, Madhya Pradesh Water Resources Department, TANGEDCO Tamil Nadu, Kerala Water Resources Department

Is this a regionally tagged project?	

Bank/IFC Collaboration

No

Approval Date	Closing Date		Original Environmental Assessment Category	Current EA Category
29-Jun-2010	29-Jun-2020		Partial Assessment (B)	Partial Assessment (B)

Financing & Implementation Modalities

[ ] Multiphase Programmatic Approach [MPA]	[ ] Contingent Emergency Response Component (CERC)
[ ] Series of Projects (SOP)	[ ] Fragile State(s)
[ ] Disbursement-Linked Indicators (DLIs)	[ ] Small State(s)
[ ] Financial Intermediaries (FI)	[ ] Fragile within a Non-fragile Country
[ ] Project-Based Guarantee	[ ] Conflict
[ ] Deferred Drawdown	[ ] Responding to Natural or Man-made disaster

[ ] Alternate Procurement Arrangements (APA)

Development Objective(s)

To improve the safety and operational performance of selected existing dams in the territory of the participating states.The PDO will be achieved through rehabilitation and improvement of dams and improvement in central and state-level institutionalcapacity to sustainably manage dam safety administration and operation and maintenance.

Ratings (from Parent ISR)

	Implementation				
	21-Apr-2016	09-Dec-2016	08-Jun-2017	18-Jan-2018	25-Jul-2018
Progress towards achievement of PDO	MS	MS	MS	MS	MS
Overall Implementation Progress (IP)	MS	MS	MS	MS	S
Overall Safeguards Rating	MS	MS			MS
Overall Risk	M	M	M	M	M

BASIC INFORMATION – ADDITIONAL FINANCING (Dam Rehabilitation & Improvement Project - Restructuring and Additional Financing - P166977)

Project ID	Project Name	Additional Financing Type	Urgent Need or Capacity Constraints
P166977	Dam Rehabilitation & Improvement Project - Restructuring and Additional Financing	Cost Overrun, Restructuring	No
Financing instrument	**Product line**	**Approval Date**	
Investment Project Financing	IBRD/IDA	28-Feb-2019	

Projected Date of Full Disbursement	Bank/IFC Collaboration		
29-Jun-2020	No		
Is this a regionally tagged project?			
No			

Financing & Implementation Modalities

[ ] Series of Projects (SOP)	[ ] Fragile State(s)
[ ] Disbursement-Linked Indicators (DLIs)	[ ] Small State(s)
[ ] Financial Intermediaries (FI)	[ ] Fragile within a Non-fragile Country
[ ] Project-Based Guarantee	[ ] Conflict
[ ] Deferred Drawdown	[ ] Responding to Natural or Man-made disaster
[ ] Alternate Procurement Arrangements (APA)	
[ ] Contingent Emergency Response Component (CERC)	

Disbursement Summary (from Parent ISR)

Source of Funds	Net Commitments	Total Disbursed	Remaining Balance	Disbursed
IBRD	139.65	69.16	70.49	50 %
IDA	139.65	130.17		100 %
Grants				%

PROJECT FINANCING DATA – ADDITIONAL FINANCING (Dam Rehabilitation & Improvement Project - Restructuring and Additional Financing - P166977)

FINANCING DATA (US$, Millions)

SUMMARY (Total Financing)

	Current Financing	Proposed Additional Financing	Total Proposed Financing
Total Project Cost	437.50	113.56	551.06

Total Financing	350.00	201.06	551.06
of which IBRD/IDA	279.30	137.00	416.30
Financing Gap	87.50	-87.50	0.00

DETAILS - Additional Financing

World Bank Group Financing

International Bank for Reconstruction and Development (IBRD)	137.00

Non-World Bank Group Financing

Counterpart Funding	64.06
Borrowing Agency	64.06

COMPLIANCE

Policy

Does the project depart from the CPF in content or in other significant respects?

[ ] Yes [✓] No

Does the project require any other Policy waiver(s)?

[ ] Yes [✓] No

INSTITUTIONAL DATA

Practice Area (Lead)

Water

Contributing Practice Areas

Climate Change and Disaster Screening

This operation has been screened for short and long-term climate change and disaster risks

Gender Tag

Does the project plan to undertake any of the following?

a. Analysis to identify Project-relevant gaps between males and females, especially in light of country gaps identified through SCD and CPF

Yes

b. Specific action(s) to address the gender gaps identified in (a) and/or to improve women or men's empowerment

Yes

c. Include Indicators in results framework to monitor outcomes from actions identified in (b)

Yes

PROJECT TEAM

Bank Staff

Name	Role	Specialization	Unit
Chabungbam Rajagopal Singh	Team Leader (ADM Responsible)		GWA06
Sreenivas Devarakonda	Procurement Specialist (ADM Responsible)		GGOPZ
Krishnamurthy Sankaranarayanan	Financial Management Specialist (ADM Responsible)		GGOIS
Pyush Dogra	Environmental Specialist (ADM Responsible)		GENSA
Ankan De	Team Member		GENDR
Arun Kumar Kolsur	Team Member	Co-TTL	GGOPZ
Deepak Singh	Peer Reviewer		GSU18
Evarist F. Baimu	Counsel		LEGES
Gopalaswamy Srihari	Social Specialist		GSU06
Halla Maher Qaddumi	Team Member		GWA06
IJsbrand Harko de Jong	Team Member		GWA06
Jai Mansukhani	Team Member		SACIN
Jorge Luis Alva-Luperdi	Counsel		LEGAM
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Marcus J. Wishart	Peer Reviewer	GWA02
Satoru Ueda	Team Member	GWAGS
Stuti Sharma	Team Member	GWA06
Suryanarayana Satish	Social Specialist	GSU03
Victor Manuel Ordonez Conde	Team Member	WFACS
Ximing Zhang	Peer Reviewer	GWAGS

Extended Team

Name	Title	Organization	Location
Anish Bansal	Hydrologist and Instrumentation Expert		
Avanish Kant	Hydro-geologist		
Radheyshyam Pathak	Senior Water Resources Expert		

INDIA
DAM REHABILITATION AND IMPROVEMENT PROJECT - RESTRUCTURING AND ADDITIONAL FINANCING

TABLE OF CONTENTS

I. BACKGROUND AND RATIONALE FOR ADDITIONAL FINANCING

A. Background

1. Water resources development is a key focus area for the Government of India (GoI) and state governments in the country given increasing water scarcity and growing, competing demands for water. India is home to some of the world's most significant river diversion infrastructure and ranks third after China and the United States in terms of the number of large dams. These dams have played a key role in fostering sustained growth in the agricultural and rural economies, which are development priorities for the GoI. Irrigated agriculture has been a major pillar of the government's strategy to improve livelihoods and ensure food security.

2. In India, rainfall occurs mainly in intense and unpredictable downpours during short monsoon seasons. As a result of this high temporal and spatial variability, rainfall cannot meet the needs of year-round irrigation and other water demands. In addition, climate change induced impacts on meteorological parameters are likely to compound the issue of water availability. Over the last 65 years, India has invested heavily in infrastructure to store surface runoff in reservoirs formed by large, medium, and small dams with associated appurtenances. According to the National Register for Large Dam (NRLD 2018), there were about 5,264 completed large dams[1] in India, with another 437 under construction. The total storage capacity of these dams is about 304 billion cubic meters. The reservoirs formed by large dams are either single- or multi-purpose, including water supply, power generation, flood control, irrigation, and/or recreation. Most of these dams were constructed and are maintained by state governments through their irrigation and water resources departments. A few are owned and operated by central and state public entities. India is also home to tens of thousands of medium and small dams that have been constructed and are maintained by various agencies.

3. As a result of population growth and development in downstream areas of dams, existing flood protection measures are often below acceptable standards and pose serious risks. Additionally, in most cases there has been minimal investment in operations and maintenance (O&M) of structures since dam commissioning. High safety standards for large dams are imperative to prevent failure, which may cause devastating damage to environment and property, leading to economic hardship, and, in extreme cases, loss of life. An ever-increasing number of people are living and working in areas that would face sudden and severe flooding in the event of a dam failure. In rural areas, the value of the property at risk is affected by increasing values of buildings, irrigation and drainage facilities and other infrastructure. Similarly, in urban areas, the value of property, buildings, and infrastructure at risk has also significantly increased and will continue to increase due to ongoing urbanization, economic growth, industrialization and climate change.

4. Many dams are ageing (605 dams are over 50 years old and another 3,095 dams are over 25 years old) and exhibit various structural deficiencies and shortcomings in operation and monitoring facilities. In most states, budget allocations for dam O&M are part of overall irrigation system maintenance budgets, which are typically decided based on irrigated area rather than on preventative and scheduled

[1] The International Commission on Large Dams (ICOLD) defines a large dam as a dam with a height of 15 m or greater from lowest foundation to crest or a dam between 5 m and 15 m impounding more than 3 million m^3.

maintenance needs. In practice, irrigation canal maintenance tends to be prioritized over dam maintenance, which has contributed to their structural deterioration. Allocations for O&M should be more in line with need-based assessments and India is beginning to adopt modern asset management planning to guide this process. Most large dams are considered "high-hazard".[2] Structural integrity and safety are necessary in risk mitigation, ensuring sustainability and full operational capacity of existing storage. Action is required to (a) ensure rehabilitation and modernization of dams to bring them back to acceptable standards of safety and operation; (b) develop and implement adequate O&M programs; (c) ensure regular safety reviews at dams, both by operator and independent review panels; and (d) formulate standards, guidelines and asset management systems to minimize future risks of dam failures.

5. GoI is cognizant of the need for large-scale renovation of the country's dams and since 2010 has been implementing the World Bank-funded Dam Rehabilitation and Improvement Project (DRIP). With support from DRIP, the federal authority entrusted with dam oversight, the Central Water Commission (CWC), has recently adopted the Dam Health and Rehabilitation Monitoring Application (DHARMA) tool and introduced seven new dam safety guidelines aimed at helping the country focus on dam rehabilitation using a variety of best practices.

6. The CWC has prepared a comprehensive National Dam Safety Bill 2018 (first drafted in 2002, updated in 2008 and 2016), which has recently been approved by the Union Cabinet. This will be presented in the Parliament for approval. All states with Dam Safety Organizations (DSOs) are already in general compliance with the provisions outlined in the draft Dam Safety Bill, including regular inspections of all large dams and functional independent Dam Safety Review Panels (DSRP).

7. Given the considerable number of dams in India, DRIP acts as a "lighthouse", showcasing how best to make dams fully operational and safe again in a technically sound and financially sustainable manner, in addition to building much needed capacity for monitoring performance. The recent failure of the Xe-Pian Xe-Namnoy Saddle Dam (Laos, July 2018) is a reminder of the importance of assuring the safety of dams. The spillway chute failure of the Oroville Dam (California, February 2017), resulting in the erosion of the auxiliary spillway which led to the evacuation order of around 200,000 people downstream, also highlighted the importance of comprehensive dam safety review and emergency preparedness.[3] The spillway gate failure incident of the Krishnagiri Dam (Tamil Nadu, November 2017), though minor in terms of negative impacts, also provided GoI with important lessons for enhancing the quality control mechanism of the DRIP.

8. **Climate change.** Through the proposed Additional Financing (AF), the World Bank is well placed to link project activities to issues related to climate change and disaster management, which are important in determining O&M needs. Optimization of water storage is important, not only to satisfy a growing population and rapidly developing economy, but also to prepare for possible negative impacts of climate change (both extreme flood and drought events). Taking advantage of its experience with disaster

[2] High-hazard is a term used by a majority of dam safety programs. While the definition varies from place to place, in India it generally refers to a substantial potential loss of life and high property damage if failure of a high-hazard dam occurs.

[3] The Emergency Preparedness Plan (EPP) considered the main dam failure event and downstream flooding area but did not consider the auxiliary dam failure case; hence, there was no targeted flooding area prediction and emergency preparedness.

risk management, the World Bank has assisted state governments with better management of extreme weather events including flooding.

9. The current climate risk profile for DRIP sub-projects/activities includes overflow; downstream inundation; and structural failure due to sudden inflow of high quantum of water because of cloud bursts, as witnessed in the Himalayan region; and cyclonic rainfall, as witnessed in peninsular India. The project activities are designed to rehabilitate dams to withstand such climate-change-induced risks.

B. Project Design

10. The Project Development Objective (PDO) is to improve the safety and operational performance of selected existing dams in the territory of the participating states.

11. **Key results.** The PDO is being achieved through rehabilitation and improvement of dams and institutional capacity strengthening for dam safety administration and O&M both at the federal and state levels. The key performance indicators to measure the achievement of the PDO include:

- Number of project dams with (a) improved ability (structural or non-structural) to safely cater for design floods and (b) acceptable stability and seepage. Dams are thus returned to full operational condition, with reduced risk of failure;
- Number of project dams with need-based O&M plans operationalized. Specific measurements to measure this indicator include availability of detailed operation and maintenance manuals, regular inspections, and development of information technology and analytical tools to generate, collect, evaluate, monitor, and disseminate data on dam safety and operations;
- Number of project dams with basic dam safety facilities in place;
- Percentage of required budget per state for adequate O&M of dams; and
- Number of project dams where emergency response plans have been prepared and disseminated to the population.

12. DRIP includes interventions targeted toward (a) physical and technical dam rehabilitation and improvement and (b) managerial upgrading of dam operation and maintenance, with accompanying institutional reforms and strengthening regulatory measures pertaining to safe and financially sustainable dam operations. DRIP also supports the restoration of the capacity of a few dams to their full reservoir capacity, achieving effective utilization of the stored water, and managing and monitoring the long-term performance of the dams and reducing climate-change-induced risks.

13. The project has three components:

(a) **Rehabilitation and Improvement of Dams and Associated Appurtenances**: DRIP is financing rehabilitation of 223 project dams, many of which are more than 25 years old and for which the current risk profile with respect to climate-change-induced impacts is a matter of

significant concern. The ongoing interventions include structural strengthening of dams, treating leakages through masonry and concrete dams and reduction of seepage through earthen dams; improving dam drainage; improving spillways, head regulators, draw-off gates, including their enlargement where necessary, as well as enhancing their operating mechanisms, stilling basins, and downstream spillway channels; improving approach roads, office and housing accommodation; improving dam safety instrumentation, and building flood control retention basins upstream, as required. The project also supports hydrological assessments (including inflow assessments to understand the changes in the hydrological inflow regimes as well the future flow scenarios in light of climate change) and specialized consulting services to formulate strategy for the long-term management of these changing hydrological regimes. In addition, preparation and implementation of asset management plans, dam-wise Emergency Action Plans (EAPs), including long-term action plans to mitigate climate change induced risks), emergency warning systems, public awareness campaigns, and flood inundation mapping are ongoing in all participating states.

(b) **Dam Safety Institutional Strengthening**: With a focus on regulatory and technical frameworks for dam safety assurance, the activities supported by this component include customized training nationally and internationally for the Central Dam Safety Organizations (CDSO) and the State Dam Safety Organizations (SDSO); participation in dam safety courses; study tours and linking with foreign country agencies that have advanced dam safety programs such as the United States and Australia; development of Management Information Systems (MIS) and other programs to capture and analyze data for long-term planning including future climate change scenarios using the DHARMA tool that allows for systematic presentation and interpretation of data for effective monitoring of dam health; training in hazard and vulnerability assessment and dam-break analysis, development of emergency action plans, O&M manuals for each dam, seismic hazard mapping of the whole country along with development of Seismic Hazard Assessment Information System (SHAIS), infrastructure facilities to various State Dam Safety Organizations, and so on.

(c) **Project Management.** Establishment and operation of project monitoring and management units at central (Central Project Management Unit - CPMU) and state (State Project Management Units - SPMUs) levels.

14. **Project scope.** The DRIP includes investments in selected 223 dams in six states (Tamil Nadu, Kerala, Karnataka, Madhya Pradesh, Odisha, and Uttarakhand), in addition to dams managed by the Damodar Valley Corporation in Jharkhand. The activities/interventions included under the project are (a) physical and technical dam rehabilitation and improvement; (b) upgrading of managerial capacities for better dam O&M, with accompanying institutional reforms; and (c) strengthened regulatory measures pertaining to safe and financially sustainable dam operations. The interventions are being implemented by 10 implementing agencies (IAs): Central Water Commission (CWC) under the Ministry of Water Resources, River Development and Ganga Rejuvenation (MoWR, RD&GR); Damodar Valley Corporation (DVC); Uttarakhand Jal Vidyut Nigam Limited (UJVNL); Odisha Water Resources Department; Tamil Nadu Water Resources Department; Tamil Nadu Generation and Distribution Corporation (TANGEDCO); Karnataka Water Resources Development Organization; Madhya Pradesh Water Resources Department; Kerala Water Resources Department; and Kerala State Electricity Board.

15. **Implementation arrangements.** Given the complexity and nature of risks involved in the successful delivery of the PDO, multi-tiered implementation arrangements as described below were put in place.

- The organizational structure for day-to-day project coordination and management of DRIP consists of a Project Management Unit (PMU) at the central level in the CWC and one state-level PMU for each of the nine state-level implementing agencies. All PMUs are staffed with qualified personnel, supplemented with consultants so that the needed technical, safeguard, monitoring and evaluation (M&E), and fiduciary (procurement and financial management) capacity is available. A multidisciplinary management and engineering consulting firm assists the CWC with the overall implementation of the project.

- A multidisciplinary Dam Safety Review Panel (DSRP) has been constituted by the nine state-level IAs, with experts from various technical fields including hydrology, dam civil structural works, and mechanical works including gates and instrumentation. The DSRPs have overall performed effectively and will continue to perform the same roles and responsibilities under the project along under an enhanced quality assurance mechanism. The DSRPs have the following mandate and responsibilities:

    i. Conduct site visits to each dam covered under DRIP (223 dams) to review the existing hydrological baseline, the structural integrity, and other non-structural measures in place contributing to dam safety;

    ii. Recommend remedial measures and additional interventions to ensure safety of the dam based on these reviews;

    iii. Ensure that rehabilitation works are carried out in adherence to their recommendations through periodic site visits during implementation.

- Implementation and Monitoring: The arrangements for implementation and monitoring described in the PAD will continue under the AF. Operators of dams, state design organizations, and engineering cells in WRDs and SEBs provide design services and day-to-day construction supervision. Consulting services for the more complicated design and third-party supervision services and specialized tasks are recruited to assist WRDs and SEBs, as needed. A National Level Steering Committee (NLSC) exercises oversight of dam safety assurance and rehabilitation and disaster management. The NLSC is headed by the Secretary MOWR, RD&GR and includes senior representatives from CWC and participating states. The NLSC addresses the policy matters supported under DRIP. A separate Technical Committee (TC) is also in place to address technical issues arising under DRIP as well as to provide technical inputs to the NLSC, coordinate with implementing committees of state governments, and review progress of development projects.

C. Implementation Status

16. DRIP was approved by the Board on June 29, 2010 and declared effective on April 18, 2012. The financing provided by the Bank consisted of an IBRD loan and an IDA credit of US$ 175 million each for a total of US$ 350 million. During the initial three years of implementation, the focus was on screening dams

and preparing safety plans and their approval. In February-April 2014, the IDA credit and the IBRD loan were reduced by US$ 35.35 million each through a partial cancelation. This partial cancellation was carried out in part because of slow implementation of the project and the need to reallocate IDA resources to other projects, as well as to account for exchange rate fluctuation. The project scope did not change following the partial cancellation (hence, the partial cancellation created a financing gap of $87.5 million, including the associated Government contribution).

17. Over the past three years, physical implementation has accelerated, and the project has seen noteworthy progress in the awarding of capital works contracts, initiation of the remaining procurement packages, and a strong uptake in disbursements by all 10 IAs. As of December 2018, 702 contracts amounting to US$255 million were committed through awarded contracts. As of September 2018, the project had disbursed 75 percent of the total project amount. The IDA component of the funding (US$139.65 million) has been fully disbursed and the IBRD funding (US$139.65 million) is 50 percent disbursed (September 2018).

18. Progress has also been good in implementation of the institutional strengthening component. An annual training program focusing on various dam safety aspects including instrumentation, dam break analysis, asset management, project management and construction supervisory, and so on is under implementation. So far, 104 training programs (five international and 99 national) have been carried out, benefiting more than 3,300 central and state government officials. In addition, guidelines have been prepared for (a) dam instrumentation and monitoring and (b) dam safety operations after seismic events and five other selected topics relevant to dam safety and management.

19. Based on the significant achievement made in the progress of activities, currently the PDO and Implementation Progress are rated Moderately Satisfactory (MS) and Satisfactory (S), respectively. The project is fully compliant with its legal covenants.

II. DESCRIPTION OF ADDITIONAL FINANCING

20. **PDO:** No change from the original PDO.

21. The AF is being processed alongside a project restructuring of the project due to the revision in the Environmental Category from “B” to “A”.

22. **Rationale for borrower to request additional financing.** GoI has requested additional financing in the form of an IBRD loan of US$137 million to help finance the additional project cost of US$113.5 million as well as the $87.5 million gap created by the earlier cancellation. The largest part of the additional cost arose from design changes that were anticipated at the time of the appraisal of the project and that were detailed during implementation through additional studies, including safety enhancements recommended by various Dam Safety Review Panels. The details of the additional costs by component are described below.

i. **Component 1**: Rehabilitation and Improvement of Dams and Associated Appurtenances (additional cost $66.2 million), of which:

(a) **Hirakud Dam** (US$58.5 million). Hirakud Dam in Odisha is the longest dam in the world and the fourth largest dam in India in terms of capacity and has been part of DRIP since the project was conceived. During project preparation, based on the limited information in the existing available hydrology report, the GoO, in consultation with the CWC, prepared a tentative rehabilitation plan. Subsequently, under DRIP, a detailed investigation of the dam was carried out and a comprehensive rehabilitation plan developed. The hydrological review carried out provided a revised design flood, estimated at 69,623 m^3/s as compared to the original project design flood of 42,450 m^3/s (an increase of 27,182 m^3/s). It may be noted that in the past, a flood discharge of 43,183 m^3/s was observed in the year 1961, which was above the existing original design flood. The flood routing analysis indicated that a flood peak attenuation of 6,000 m^3/s is possible through reservoir routing itself and for the remaining 21,000 m^3/s, spillway capacity needs to be enlarged. Site investigations concluded that two spillways, one on the left bank and one on the right bank, with flood discharge capacities of 9,000 m^3/s and 12,000 m^3/s, respectively, need to be developed. Based on the findings of this detailed assessment, the construction of the left bank spillway was taken up on a priority basis and will be supported under DRIP along with the associated supervision and quality assessment works and related safety measures and studies.

Of note are the proposed safety studies for Hirakud Dam, including (i) comprehensive hydrological assessment and flood routing simulation; hydro-met monitoring and flood forecasting system with decision support system of the reservoir / spillway gate operation, flood management (1:200 to 1:1,000 years) taking into account downstream hydraulic constraints and reservoir sedimentation assessment / effective management plan, (ii) a review of its existing structures and facilities, including the stability of the main dam and earthen dikes and reliable operations of 64 under-sluices and 34 spillway gates, as well as safety and resilience enhancement measures under extreme hydraulic/seismic loads, (iii) assessment and upgrading of the dam safety monitoring instruments, (iv) conducting a Hazard and Operability Study on the spillway gates /hoists and control systems, and assessing alternative gate types/ configurations with due consideration to the reliability of the electrical-mechanical system and human operations,(v) undertaking Probable Failure Mode Analysis (PFMA), which requires a qualitative risk assessment and workshop to identify potential failure modes and to assess required remedial works, monitoring instrumentation system, etc., (vi) developing a risk reduction profile (RRP), including a sequence of implementation of the prioritized safety-improvement measures contributing to the reduction of the RRP, and (vii) technical consultancy for designing the right bank spillway. The PFMA is expected to identify and prioritize additional dam safety enhancements including advanced flood forecasting, optimal reservoir operation, more reliable gates design and control system, options for spillway capacity augmentation, etc. that will be considered for investment under the DRIP. The PFMA will also be an opportunity to identify options to make the Hirakud Dam and downstream flood management system more resilient to extreme hydrological conditions.

(b) Small-scale rehabilitation at other dams (US$7.7 million) as detailed in the Procurement Plan.

ii. **Component 2**: Dam Safety Institutional Strengthening (additional cost $25.7 million). Additional funds for completing ongoing activities including strengthening of regulatory and technical frameworks for dam safety assurance; customized trainings (national and international) and participation in dam safety courses; study tours and linking with foreign country agencies that have advanced dam safety programs (including Australia, United States, Japan and Netherlands); training in hazard and vulnerability assessment and dam-break analysis; development of emergency action plans, O&M manuals for each dam; and assessment and upgrading of the dam safety monitoring instruments. The component will also support studies of climate-change-induced risk in dam safety and management and development of strategies to mitigate these risks and Probable Failure Mode Analysis for a few selected dams. In addition, the additional funds will support technical assistance for the risk assessment of large dams in India including (a) development of a framework for safety-related risk assessment of large dams in India and (b) preparation by CWC in collaboration with the states of a prioritized list of large dams at risk in India, based on the framework.

iii. **Component 3:** Project Management (additional cost US$21.6 million): Project management consultancies and the management and supervision of the project by the 7 project implementing agencies will require additional financing.

23. Table 1 summarizes the original project costs and the additional costs by component and indicates the financing gap (created by the partial cancellation of financing in 2014) which is to be closed through the proposed AF and additional Borrower resources. The total need for funding is $201.0 million of which the proposed AF will finance $137 million.

Table 1. Original and Additional Project Costs by Component and Financing (in million US$)

	Original cost (2010)	Additional cost (2018)	Total revised cost (2018)
Component 1: Dam Rehabilitation and Improvement	385.7	66.2	451.9
Component 2: Institutional Strengthening	22.6	25.7	48.3
Component 3: Project Management	29.2	21.6	50.8
TOTAL	437.5	113.5	551.0
Financing gap		87.5	
Total additional cost + financing gap		**201.0**	

24. Table 2 summarizes the state-wise allocation of funds under the AF.

Table 2. Allocation of Funds by State and Implementing Agency (in million US$)

	Total
Kerala	28.7
Odisha	84.3
Tamil Nadu	7.7
Karnataka	41.5
UJVNL	12.8
DVC	0.2
CWC	25.8
TOTAL	**201.0**

*Out of the Total, World Bank will finance US$137 million.

25. **Project timeline.** The original financing of DRIP as well as the proposed AF will close on June 29, 2020.

III. KEY RISKS

26. Table 3 provides an overview of the risks as assessed under the current project and for the AF.

Table 3. Risks

Sl. No.	Risk Category	Last ISR Rating	With AF
1	Political and Governance	Low	Low
2	Macroeconomics	Low	Low
3	Sector Strategies and Policies	Low	Low
4	Technical Design of Project	Moderate	High
5	Institutional Capacity and Sustainability	Moderate	Substantial
6	Fiduciary	Moderate	Substantial
7	Environment and Social	High	High
8	Stakeholders	Low	Low
9	Overall	Moderate	Substantial

27. The Project risk ratings for three categories—Technical Design, Institutional Capacity and Sustainability and Fiduciary—have been increased as has been the Overall rating.

28. The rating of technical design risk has been increased from Moderate to High as the enlarged spillway capacity for Hirakud Dam requires substantial technical inputs and complex construction techniques. Consultancies for construction supervision and quality assessment; risk assessment; and design review are expected to contribute to improved implementation efficiency of this under the AF.

29. The fiduciary risk rating has been increased from Moderate to Substantial due to potential delays

in submission of audit reports and delays in the fund flows to two IAs (DVC and TANGEDCO). Appointment of financial management staff and internal auditor, along with timely budget provisions and release, would mitigate this risk.

30. The rating of Environmental and Social risks has been retained as High as the development of an additional spillway at Hirakud Dam will require resettlement of 716 households. The environmental category of the project has been changed from B to A due to the increased environmental and social risk, mainly due to the additional spillway, connecting dikes and spill channel, and so on at the left bank of Hirakud Dam and environmental and social impacts arising from clearance of reserve forest (9.441 ha) and more than 3,000 trees in non-forest area, high occupational health and safety (OHS) risks associated with construction activities, and displacement of squatters (716 households/ 3,022 Project Affected Persons - PAPs). The change of the environmental category from B to A is being processed as part of the project restructuring subject to approval of the proposed AF. To address these safeguard issues, detailed environment and social assessments have been conducted and the EMP and RAP prepared accordingly.

31. The rating for Institutional Capacity and Sustainability has been increased from Moderate to Substantial due to attenuation of project staff and inadequate and un-timely allocation of funds for O & M. This is further compounded by shortage of multi-disciplinary staff. The risk related to institutional capacity will be mitigated through detailed planning, full technical support, adjustable work programs, and a large capacity-building program.

32. Based on the above, the Overall risk rating has been increased from Moderate to Substantial.

IV. APPRAISAL SUMMARY

A. Economic and Financial (if applicable) Analysis

33. An Economic and Financial Analysis (EFA) was conducted to assess the economic soundness of the project and the expected impact of the project on beneficiaries. The revised EFA follows a rigorous methodological approach that was enhanced relative to the 2010 appraisal. This modified approach takes advantage of additional information on the dams that was not available in 2010, that is, details on costs and impacts for 198 dams (such details were not available for the remaining dams under the project).

34. The EFA uses a simplified risk-based approach to analyze the rehabilitation investments for the portfolio of 198 dam projects. The risk-based analysis considers the structural safety of the dam, as well as the impacts of dam failure in downstream reaches and command areas. The structural safety of the dam was quantified in terms of Annual Probability of Failure (APF). The APF was calculated using multiple characteristics of the dams, including year of construction; dam type (earthen, masonry, rockfill, concrete); seismic activity; and dam classification (small, medium, large in terms of gross reservoir storage and static head at full reservoir level).

35. The benefits of dam rehabilitation in the downstream reaches and command areas were assessed by developing the flood inundation extent using a generalized dam breach modeling algorithm and Geographic Information System (GIS) processing. The impacts were quantified in two categories: (a) population at risk and (b) economic consequences. The economic benefits included avoided economic losses from (a) structural damages, (b) hydropower revenue loss, (c) fisheries revenue loss, and (d)

agricultural loss. The economic analysis compared the annualized estimates of benefits (calculated as the expected value of reductions in annualized economic consequences after dam rehabilitation) against the proposed annual cost of dam rehabilitation, including maintenance over a 25-year period.

36. The results of the updated economic analysis show that the project is economically attractive across the range of dams supported under the project. The median value of the economic internal rate of return (EIRR) is 32.9 percent and the median value of the benefit-cost ratio (BCR) is 1.47.

37. Sensitivity analysis was conducted for three scenarios: (a) costs increase by 20 percent, (b) benefits decrease by 20 percent, and (c) costs increase by 20 percent and benefits decrease by 20 percent. In the worst case (third scenario), the EIRR remains high, at 28.5 percent. To analyze the effect of changes in APF on the results, sensitivity analysis was also conducted on the reduction factor that was used to calculate the chances of dam failure after dam rehabilitation. Even in the case where dam failure reduces by only 10 percent, the EIRR remains over 14 percent.

38. **Hirakud Dam.** A separate and more in-depth economic analysis of Hirakud Dam, which stands out in terms of its physical size and cost of rehabilitation, was conducted. The economic analysis included additional benefits that are significant in the case of Hirakud, that is, avoided costs from the loss of tourism, the loss of public and industrial water supply, and the loss of lives. The EIRR was found to be 15 percent and the BCR 1.3.

39. **Financial analysis.** A financial analysis was carried out for 90 percent of the dams in the portfolio that generate revenue from hydropower generation; other services provided by the dams were treated as public goods. To estimate the financial internal rate of return (FIRR) for these hydropower dams, the price of hydropower was adjusted to account for government subsidies to the sector. The median value of the FIRR was found to be 33 percent. The FIRR for Hirakud Dam was estimated separately and found to be 15 percent.

B. Technical

40. Project activities include repair works of existing gates, spillways, stilling basin, roller bucket, cracks on piers, abutment eroded concrete, and so on, which will not adversely change the quality or quantity of water flows to riparian states nor adversely affect riparian states' possible water use.

41. Development of a spillway at Hirakud Dam requires detailed assessment of the hydrology, geotechnical investigations, and engineering design. The details of the Hirakud Dam Spillway are as follows:

(a) The hydrological review carried out for Hirakud Dam (salient features are given in Annex 1) provided a revised design flood, estimated at 69,623 m^3/s, as compared to the original project design flood of 42,450 m^3/s (an increase of 27,182 m^3/s). In the past, a flood discharge of 43,183 m^3/s was observed in the year 1961, which was higher than the existing original design flood. The flood routing analysis indicated that through reservoir routing, a flood peak attenuation of 6,000 m^3/s can be achieved and for the remaining 21,000 m^3/s, additional spillways need to be constructed. Site investigations concluded that it would not be possible to safely pass the additional discharge of 21,000 m^3/s by constructing one

spillway. Instead, two spillways, one on the left bank and one on the right bank, with flood discharge capacities of 9,000 m^3/s and 12,000 m^3/s, respectively, would need to be constructed. Considering the nature and extent of land acquisition required for constructing the two spillways, it was determined that only the left bank spillway could be completed in three years and hence was proposed to be taken up under the project.

(b) Additional spillway on the left bank consists of 5 radial gates with a total discharge capacity of 9,122 m^3/s in the left dike. Earlier, the spillway control structure was planned to be in the saddle portion of the hillock. However, after detailed geological investigation, it has been shifted 700 m upstream (details are provided in Annex 2). Hydraulic design for passing design flood has been carried out along with the stability analysis of the concrete dam. Structural designs of the spillway dam components, stilling basin, spill channel, and earthen connecting dikes were also carried out. The spill channel will join with Mahanadi River downstream of Hirakud Dam. An additional Risk-Informed study will be conducted. The physical modeling of the additional spillway is being done by the Central Water and Power Research Station to further enhance the reliability of design.

42. For Hirakud Dam, the project also includes additional assessment, investigation, and studies including a comprehensive hydrological assessment and flood routing simulation with a clear set of spillway gates operation procedures, hydro-met monitoring and flood forecasting system for decision support system of the reservoir/spillway gate operation, hazard and operability assessment of existing gates, undertaking of Probable Failure Modes Analyses (PFMA), and creation of the Risk Reduction Profile (RRP).

43. The following institutional arrangements have already been, or are agreed to be, put in place for quality enhancement of construction of the additional spillway as well as additional dam safety review and enhancement:

(a) The design of the additional spillway has been carried out by the international consultant hired under DRIP and the Central Project Management Unit (CPMU)-CWC, in close collaboration with the Odisha Water Resources Department (OWRD).

(b) The design has been reviewed and evaluated by the Design Wing of the CWC. This organization is highly technically competent and is the nodal authority, mandated by the GoI, for providing approvals for all dam designs in India. The CWC has been involved in planning, designing, and quality assurance of large dams.

(c) In addition, a technical consultant will be engaged under the project for construction supervision and to provide any additional technical support to the SoO, with due consideration to the local site conditions. Any detailed revised designs at construction stage will again follow the same route of approval by the SoO and the CWC Design Wing as well as the PoE to be established under the project.

(d) The SoO, in consultation with the World Bank task team, has further agreed to initiate the selection of technical consultancy services for designing the Right Bank Additional Spillway which will be financed under the project. In addition to this, there is a proposal submitted

by MoWR, RD & GR for financing Phase-II of the DRIP project through which the Odisha Government seeks to cover the construction of the right bank spillway. Thus, the SoO is fully committed to the construction of Right Bank Additional Spillway.

C. Financial Management

44. There is no change to the IAs, and existing financial management systems and procedures will be continued. The Financial Management (FM) arrangements for the project are adequate to meet fiduciary requirements of the Bank.

45. The FM rating for the project has been Satisfactory. However, the delay in audit reports submission, fund flow issues, staff shortage at the CWC, and compliance with internal audit are issues that need to be addressed by the project. Therefore, the risk rating is being revised to Substantial.

46. As most of the agencies are core departments, the project will continue to follow country systems for budgeting, fund flow and payments, accounting and reporting, and auditing for the project. In case of companies, their respective entity systems will be used for payments, accounting and reporting, and auditing, while the government system would be used for budgeting and funds transfer from government to the companies.

47. **Budget, fund flow, and accounting.** The budget head for the project will continue to be used. As per the DEA circular for central components, 50 percent contribution would be made by the Centre and for state components, 30 percent contribution would be made by the states. Uttarakhand being considered a “special category state” will contribute 20 percent. All agencies would use budget funds initially and claim reimbursement from the World Bank. Existing fund flow and project accounting arrangements would be used for the AF.

48. **Reporting and disbursements.** Interim Unaudited Financial Reports (IUFR) will be prepared by all agencies, consolidated by the CWC, and submitted to the Controller of Aid, Audit, and Accounts (CAAA) for disbursement as well as to the World Bank for information and review within 45 days from the end of the quarter. The IUFR formats in use for original financing will be used for the AF. The World Bank will reimburse the project upon submission of IUFRs based on actual expenditure. While this is the minimum requirement, the project can submit IUFRs to claim disbursements. There will be no designated advance for the project.

49. **External audit.** External audit for the project will be carried out by CAG as per the agreed ToRs. For companies (e.g. KSEB), audits will be carried out by a Chartered Accounting (CA) firm. The audit reports will be submitted within six months from the end of the financial year.

50. **Internal audit.** This audit will be conducted by the financial consultant on a regular basis. If required, a CA firm will be hired to carry out the internal audit. An audit committee will be constituted at project director level and the audit reports and compliance reviewed every six months.

51. **Staffing.** FM staffing will be augmented at the CWC as this has been an area of weakness in the project. Currently, the CWC is supported by the consultant. However, government staff should also be

posted to fill current vacancies. The CWC can consider the option of hiring such services through outsourcing from the market in consultation with the World Bank.

52. **Disbursement categories.** There are three broad categories, in addition to the standard categories for front end fees and premia for interest rate cap/collar

Table 4. Disbursement Categories

Category	Amount in US$	Percentage inclusive taxes
Goods, works, consultancies, non-consulting services and IOC for CWC and DVC	12,800,000	50%
Goods, works, consultancies, non-consulting services and IOC for Orissa, Tamil Nadu, Kerala and Karnataka	113,657,500	70%
Goods, works, consultancies, non-consulting services and IOC for Uttarakhand	10,200,000	80%
Front-end fee	342,500	-
TOTAL	137,000,000	-

D. Procurement

53. There are no new implementing agencies proposed under the project and the existing procurement arrangements and systems will be maintained. The procurement arrangements for the project are adequate to meet the fiduciary requirements of the World Bank.

54. The CPMU in the Dam Safety Rehabilitation Directorate in the CWC will continue to have overall responsibility for project oversight and coordination, assisted by a management and engineering consulting firm, which will include procurement expertise. The Water Resources Departments (WRDs) in the six states, state electricity boards in two states and the IA Damodar Valley Corporation (DVC) will be responsible for procurement of activities. This will be coordinated and overseen by the SPMUs, which will have procurement cells with the needed capacity.

55. Procurement for the project will be carried out in accordance with the World Bank's Procurement Regulations for Borrowers for Goods, Works, Non-Consulting and Consulting Services, dated July 1, 2016 and revised November 2017, applicable to Investment Project Financing (IPF), hereinafter referred to as "Regulations". The project will be subject to the World Bank's Anticorruption Guidelines, dated October 15, 2006, and revised in January 2011 and as of July 1, 2016.

56. **Procurement capacity.** There is no change in the agencies implementing the project. Adequate capacity has been built and the CPMU is well equipped to handle the procurement proposed under the project. Most officials involved in procurement have undergone training in World Bank-funded procurement and are fully aware of World Bank procurement procedures. Despite this, delays in the decision-making process are a major cause of concern. Based on these factors, the risk is considered Substantial.

57. For procurement of works following national competitive bidding (NCB), the bidding documents, as agreed with the GoI taskforce and as amended from time to time, will be used. For procurement following international competitive bidding (ICB) and for consultant services, the World Bank's standard

bidding documents and standard requests for proposals will be used. The Project has prepared a Project Procurement Strategy for Development (PPSD) for the activities supported by the AF, based on the experience of the implementation of the project activities and the market analysis and vendor conferences conducted. For all contracts to be financed by the loan/credit, the different procurement methods or consultant selection methods, estimated costs, prior review requirements, and so on are agreed between the borrower and the World Bank in the Procurement Plan. The Procurement Plan will cover the complete period of project implementation and will be updated by each state at least annually or as required to reflect the actual project implementation needs and improvements in procurement capacity.

58. The World Bank has introduced and is implementing STEP (Systematic Tracking of Exchanges in Procurement). The officials of the SPMU have undergone the training for STEP. The SPMU would include all activities still to be carried out in STEP.

59. **Procurement.** Large contracts supported by the AF include (a) construction of additional spillway of Hirakud Dam; (b) hiring of dam safety assessment, design, and supervision consultant for Hirakud Dam; and (c) TA for the risk assessment of large dams in India. Of these, the procurement process for hiring of consultant for supervision of construction work of left bank additional spillway is ongoing, and the contract for the construction of the left bank additional spillway for Hirakud dam has been awarded following Bank procurement procedures. Based on the results of the ongoing geotechnical investigations at the concrete weir site for the gated spillway as well as other studies, the contract for the construction of the left bank spillway may require modifications (which is common practice in the implementation of infrastructure projects). To address this, adequate allocations will be made for variation orders and unforeseen expenditures under the civil works contracts. There are also procurements of goods and equipment and small works. The timeliness of the contracting process will be closely monitored in view of the procurement delays experienced under the project. To enable closer monitoring by the World Bank, the PMU will submit bimonthly progress reports (in the format of the procurement plan).

60. **World Bank's review.** Implementation support missions will continue to be carried out at least once every six months, on average, and the Designated Procurement Specialist (DPS) will be part of the implementation supervision missions. All other procurement provisions applicable to the parent loan will also be applicable to the additional loan, including the prior review thresholds which are stated in the Procurement Plan.

E. Social (including Safeguards)

61. An integrated Environmental and Social Assessment (ESA) was undertaken during project preparation to identify the nature and extent of impacts likely to occur as a result of the project interventions. This informed preparation of an Environmental and Social Management Framework (ESMF) to help assess the nature and extent of impacts with respect to each subproject and draw mitigatory measures thereof. Further, it detailed the responsibilities of entities in implementation of the proposed mitigation measures along with their monitoring mechanism. The ESMF, among others, had described the process to be followed for the preparation of a Resettlement Action Plan (RAP) in the case of involuntary resettlement and Indigenous Peoples Development Plan, if required, and communication and capacity-building measures. Further to that under the project, no land acquisition has taken place.

62. The design changes following the detailed technical studies significantly increased the scope of the envisaged interventions for the Hirakud Dam, and this will have significant social and environmental impacts. Hirakud Dam, one of the first multipurpose dams in the country, was constructed in 1957 and serves 30 million people and several towns, cities, and villages. Enlarged spillway capacity is necessary to ensure the safety of the dam and the surrounding environment and to avoid the significant human and economic losses as well as losses to flora and fauna that would result from dam failure. Spillway construction will affect an estimated 716 households (1,415 families and 3,022 persons), leading to their physical displacement and impacts on their assets and livelihoods. An RAP has been prepared to address this involuntary resettlement. The RAP is unique as none of the 3,022 persons have land title and are considered "squatters". The RAP, which was prepared based on extensive consultations, has been approved by the World Bank. The project-affected people will be resettled and rehabilitated as per the entitlement package provided in the RAP. The package provides each project-affected family with: a) residential housing/house site/or cash assistance in lieu; b) house building assistance; c) shifting allowance; d) subsistence allowance/rental allowance; e) full replacement cost of the lost asset; and f) livelihood support assistance for the poor and vulnerable. In addition, the project will provide financial assistance to female-headed households for income-generation activities and will encourage the civil works contractor to provide work opportunities on a preferential basis to at least one able-bodied member of the other vulnerable affected households. Project authorities have identified a total of six resettlement sites (four in urban areas and two in rural areas) for these displaced families. All these sites are within a radius of 2-5 km from affected peoples' present habitations, thereby ensuring that project-affected people can continue their livelihoods without disruption. These sites belong to the Revenue Department and other government departments and have been allotted for resettlement of the displaced persons. Project authorities have already initiated works for development of resettlement sites.

63. While the ongoing project has made efforts at adopting the ESMF, significantly more was expected in terms of site visits and regular monitoring and documentation of environmental and social issues. The ongoing project has also witnessed inadequate capacity-building as well as requisite staff support. In addition to addressing these issues, the ESMF was updated to consider the country's latest legislative developments relating to Resettlement and Rehabilitation (R&R) as well as World Bank's requirements for labor influx, gender-based violence (GBV), and citizen engagement. With respect to labor influx and GBV, the bidding documents provide for these under the umbrella Environment, Social, Health, and Safety (ESHS) conditions. The implementing agency is expected to prepare and seek approval from the World Bank for a contractor ESMP (CESMP), which, among others, will include measures such as sourcing unskilled labor locally to the extent possible, control of HIV/AIDS and other sexually transmitted diseases, and training and awareness raising for the workforce about code of conduct as well as national/state laws on PESA and GBV.

64. The PIUs and CPMU will be further strengthened with specialists who are familiar with environmental and social issues. All PIUs have designated one person as the E&S focal point. These officials, as part of the M&E cell within the SPMU, will review screening forms, RAPs, and other related documents and monitor compliance with the agreed actions. Further, a dedicated Social Expert will be deployed at Hirakud Dam and will be supported by a specialized agency to implement the RAP. Trainings provided to these officials at the PIUs will focus on how to effectively mainstream ESMF requirements in subproject activities, emphasize the role of the Nodal E&S officers to prepare and implement mitigation measures, and ensure periodic reporting to the CPMU and World Bank. Also, the Project Management Consultants supporting the CPMU will include a Social Specialist who will provide detailed progress review

through increased site visit based reporting, besides imparting trainings to concerned officials at all IAs. The World Bank team will assist IAs that are overseeing major works by conducting intensive training on the ESMF provisions, followed by periodic refresher trainings. It will also undertake site visits to review activities such as implementation of the RAP at Hirakud and other mitigation measures at other locations.

65. Citizen Engagement: Citizen engagement is built in through Communication, Consultation, and Information Disclosure which includes *suo moto* disclosure of general information in compliance with the Right to Information Act. As per the Act, all authorities must have a Public Information Officer (PIO). These arrangements lay the foundation for appropriate communication, consultation, and information disclosure regarding project activities, thereby enabling citizens and stakeholders to potentially influence project problems and/or remedies regarding near-term project implementation and long-term sustainability. Further, during project implementation, farmers in the command areas of the dams will be informed of alterations, if any, in the irrigation delivery schedule because of the rehabilitation works. Populations living downstream of dams will be made aware of the provisions of draft Emergency Action Plans (EAPs) prepared for specific dams, including their own responsibilities in this regard vis a vis those of the dam management and local authorities, with a view to elicit their feedback and finalize the EAPs. In addition, several brochures, pamphlets, posters and videos depicting activities under DRIP as well as dam safety aspects are being prepared by CPMU for wider circulation to all stakeholders and the general public for awareness. Several workshops have been conducted in Odisha, Uttarakhand and Kerala for local communities and students and such events will be scaled up under the AF. The project will also include independent monitoring and evaluation by external, third-party agencies, particularly in dams such as Hirakud Dam where displacement and rehabilitation of PAPs will take place. Finally, the project will utilize the existing grievance redressal mechanism at SPMUs and CPMU. The receipt and redressal of grievances by the GRMs at each State Project Implementation Unit will be monitored.

66. Identified gender gap: the project will attempt to address the low female labor force participation in STEM-related job roles, which was identified as a key gender gap. Participating states have an overall female labor participation rate ranging from 18% - 35%, with Kerala at 18% and Uttarakhand at 26%. These numbers are likely to be substantially lower if disaggregated further by high-skilled job roles. STEM sectors are perceived to be restrictive to women's sustained participation and reflect a high level of attrition. Specifically, women's participation in high-skilled STEM jobs such as dam operations and management covered under the project's scope has been sub-optimal across states, with minimal inter-state variation. In the context of the dam sites in Kerala and Uttarakhand the constraints faced by women professionals include social pressure, difficult terrain, lack of vehicular access given remote site-locations, male-dominated work environment, lack of accommodations, etc.

67. Gender actions: the project will undertake specific actions to improve the participation of skilled female professionals in operations and management of dam sites in Kerala and Uttarakhand. In Uttarakhand, UJVNL (PIU) will start with a baseline of 5% female engineers in the first year of implementation. Similarly, the Kerala Water Resources Department will start with a baseline of 22 % female engineers in the first year of implementation. The PIUs in Kerala and Uttarakhand will sustainably improve participation and retention of skilled female professionals. Given the social and geographical context of these two states, the suggested action areas are three-fold. One, on-site facilities will include clean and separate sanitation units for women. Second, since certain sites are difficult to access, restricting mobility, vehicles will be provided. Third, given that the sector traditionally faces a retention

challenge especially with respect to female professionals, the project will also invest in capacity building of associated female professionals through exposure visits and on-the-job training facilities.

F. Environment (including Safeguards)

68. The project restructuring being processed in this Project Paper includes the change of the project environmental category from B to A. The design changes following the detailed technical studies significantly increased the scope of the envisaged interventions at Hirakud Dam, and this will have significant social and environmental impacts. Additionally, the restructuring includes the triggering of three additional safeguards policies: Natural Habitats OP/BP 4.04, Forests OP/BP 4.36, and Pest Management OP 4.09.

69. The project adopted the ESMF approach to assess environmental impacts of the interventions undertaken for each dam. The approach is based on a screening exercise at each dam which identified environmental issues and the subsequent development of a mitigation plan for enhancing the positive impacts of the interventions. Based on the screening criteria described in the ESMF, each dam was categorized depending on the sensitivity of the level of intervention required. The screening template was used in the ESMF to review and provide final categorization for each of the dams. The categories are C - no environmental and social issues and designs can be finalized and tendered immediately; B - requiring a brief dam-specific EMP to be prepared by the concerned state implementation agency and approved by the SPMU before the start of the works; and A - requiring a well-defined EMP before implementation prepared by the concerned state implementation team, with the assistance of consultants, as needed, with approval to be provided by the CPMU and the World Bank.

70. As detailed in the PAD, the ESMF was based on the ESA conducted for a sample of ten major dams in four states and a tentative list of activities proposed by each participating state. As part of the preparation of the AF, the ESMF has been updated based on the lessons learnt during the past eight years of project implementation. As noted above, the ESMF has been updated into two separate sections on Environmental Management Framework (EMF) and Social Management Framework (SMF). Lessons learned from ongoing ESMF implementation were also included to update the current the EMF and SMF.

71. According to the ESMF, the construction of the additional spillway at Hirakud Dam falls under category A impacts; accordingly, an independent Environmental Assessment (EA) was completed. The ESMP prepared under the EA of Hirakud will be implemented under the project following approval of the AF. Construction interventions may produce impacts on the communities in the proximity of the construction, and the EMP provides for addressing construction phase interventions, which have been included in the technical specifications of the bidding documents. Following the completion of the Hirakud EA, OP 4.04, 4.09, and 4.36 were triggered (a) due to removal of trees in the reserved forest area, (b) to protect habitat which will be degraded due to removal of these trees in the reserved forest area, and (c) to ensure that no pesticide is procured and used in the project activities. The impacts include diversion of (a) degraded forest land and felling of 115 trees in this tract of forest; (b) felling of 3,595 trees in non-forest land. Compensatory afforestation (plantation of two trees for each tree cut) will be carried out to mitigate the impacts. The EA/ESMP has been approved by the World Bank.

72. The CPMU and SPMUs have been strengthened with dedicated specialists familiar with environmental and social issues. An Environmental Expert will be designated to review screening forms,

EMPs, and other related documents and to monitor compliance with the agreed documents. Adequate reporting on compliance with the ESMF will be included in progress reports. This information will be compiled at the CPMU level in regular progress reports. The management and engineering consulting firm to be appointed at CPMU level will include environmental specialists. Its ToR includes tasks related to environmental (and social) compliance. Some of the relevant tasks are provision of formal and on-the-job training to project staff at district, state, and central level to ensure that there is full awareness about environmental and social issues and the implementation of the ESMF and related EMP; provision of guidance and support to collect sufficient data at the investigation stage to determine the environmental and social impacts, if any, including stand-alone EMPs; setting up and monitoring a reporting system that will show in a clear and transparent way whether there are any social and environmental issues related to the rehabilitation of the dams and the mitigation actions; and as part of the third-party construction supervision efforts, ensuring that actions agreed to minimize environmental impact are being implemented.

73. At the state level, senior engineers of Water Resources Departments and other dam operating agencies will be targeted to create awareness of the relevance and importance of environmental issues in general, as well as specific to the dam-related activities. The staff will also be exposed to the application of the ESMF and ESMP to enable them to effectively supervise the ESMP activities. Finally, senior-level officials will also be identified in the SPMUs and DSOs to be given exposure to environmental and social issues of projects. The ESMF includes a budget estimate for the proposed training and awareness activities.

74. **Disclosure of safeguard documents.** The draft RAP and EIA/EMP documents of Hirakud Dam were disclosed by the borrower (CWC and SPMU, DOWR, GoO) on February 28, 2018. The final documents were updated and disclosed on these agencies' websites in June 2018 after incorporating all the comments and suggestions. In addition, the ESMF was updated and disclosed by CWC on their website (*www.damsafety.in*) in February 2018 and subsequently in June 2018, incorporating all the comments and suggestions. All IAs are in the process of disclosing the updated ESMF along with the Executive Summary translated into local languages.

G. Dam Safety Safeguards

75. OP/BP 4.37 Safety of Dams was triggered from the start of project implementation in 2010 and remains at the center of the project development objective. The dam safety practices in place under the project are robust. The AF will include some measures to further enhance the dam safety arrangements at Hirakud Dam. The SoO will establish an independent POE, which will include two international experts, that will be responsible for performing periodic reviews of methodology, designs and drawings of additional spillway of the Hirakud Dam, subject to prior review of the TOR of the said panel by the Bank. Four additional specific safety plans will be prepared including Construction Supervision & Quality Assurance Plan, Instrumentation Plan, Operation & Maintenance Plan and Emergency Preparedness Plan or Emergency Action Plan. A consulting firm for dam safety review, design and construction supervision: two competent consulting firms will be recruited under the project to undertake: i) overall assessment of the dam safety risk and priority safety improvement measures including the PFMA and ii) review of design and drawings, construction supervision and quality control of the left bank spillway construction.

V. WORLD BANK GRIEVANCE REDRESS

76. Communities and individuals who believe that they are adversely affected by a World Bank (WB) supported project may submit complaints to existing project-level grievance redress mechanisms or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project-affected communities and individuals may submit their complaint to the WB's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit http://www.worldbank.org/en/projects-operations/products-and-services/grievance-redress-service.
For information on how to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org.

VI. SUMMARY TABLE OF CHANGES

	Changed	Not Changed
Results Framework	✓	
Components and Cost	✓	
Disbursements Arrangements	✓	
Safeguard Policies Triggered	✓	
EA category	✓	
Procurement	✓	
Implementing Agency		✓
Project's Development Objectives		✓
Loan Closing Date(s)		✓
Cancellations Proposed		✓
Reallocation between Disbursement Categories		✓
Legal Covenants		✓
Institutional Arrangements		✓
Financial Management		✓
APA Reliance		✓

VII. DETAILED CHANGE(S)

COMPONENTS

Current Component Name	Current Cost (US$, millions)	Action	Proposed Component Name	Proposed Cost (US$, millions)
Rehabilitation and Improvement of Dams and Associated Appurtenances	302.00	Revised	Rehabilitation and Improvement of Dams and Associated Appurtenances	451.96
Dam Safety Institutional Strengthening	20.00	Revised	Dam Safety Institutional Strengthening	48.30

	0.00	Revised	Project Management	50.80
TOTAL	**322.00**			**551.06**

DISBURSEMENT ARRANGEMENTS

Change in Disbursement Arrangements

Yes

Expected Disbursements (in US$)

Fiscal Year	Annual	Cumulative
2010	0.00	0.00
2011	1,904,078.00	1,904,078.00
2012	5,000,000.00	6,904,078.00
2013	500,000.00	7,404,078.00
2014	4,000,000.00	11,404,078.00
2015	10,000,000.00	21,404,078.00
2016	22,000,000.00	43,404,078.00
2017	59,000,000.00	102,404,078.00
2018	77,000,000.00	179,404,078.00
2019	141,000,000.00	320,404,078.00
2020	95,898,422.00	416,302,500.00
2021	0.00	416,302,500.00
2022	0.00	416,302,500.00

SYSTEMATIC OPERATIONS RISK-RATING TOOL (SORT)

Risk Category	Latest ISR Rating	Current Rating
Political and Governance	Low	Low
Macroeconomic	Low	Low
Sector Strategies and Policies	Low	Low

Technical Design of Project or Program	Moderate	High
Institutional Capacity for Implementation and Sustainability	Moderate	Substantial
Fiduciary	Moderate	Substantial
Environment and Social	High	High
Stakeholders	Low	Low
Other	Low	Low
Overall	Moderate	Substantial

COMPLIANCE

Change in Safeguard Policies Triggered

Yes

Safeguard Policies Triggered	Current	Proposed
Environmental Assessment OP/BP 4.01	Yes	Yes
Performance Standards for Private Sector Activities OP/BP 4.03	No	No
Natural Habitats OP/BP 4.04	No	Yes
Forests OP/BP 4.36	No	Yes
Pest Management OP 4.09	No	Yes
Physical Cultural Resources OP/BP 4.11	Yes	Yes
Indigenous Peoples OP/BP 4.10	Yes	Yes
Involuntary Resettlement OP/BP 4.12	Yes	Yes
Safety of Dams OP/BP 4.37	Yes	Yes
Projects on International Waterways OP/BP 7.50	Yes	Yes

Projects in Disputed Areas OP/BP 7.60	No	No

Environmental Assessment (EA) Category

Change of EA Category	Original EA Category
Yes	Partial Assessment (B)
Current EA Category	**Proposed EA Category**
Partial Assessment (B)	Full Assessment (A)

LEGAL COVENANTS – Dam Rehabilitation & Improvement Project - Restructuring and Additional Financing (P166977)

Sections and Description
No later than three (3) months after Effective Date, the State of Odisha shall: a) Establish and maintain, an independent Panel of Experts - including at least two international experts - with qualifications, and under the terms of reference, satisfactory to the Bank and thereafter: (i) ensure that the Panel of Experts performs periodic reviews of methodology, design and drawings of additional spillway of Hirakud Dam pursuant to the terms of reference, and in a manner, satisfactory to the Bank; (ii) promptly provide to the Bank a copy of each report prepared by the Panel of Experts; and thereafter (iii) unless otherwise agreed by the Bank, promptly and diligently implement dam safety measures recommended by the Panel of Experts; b) engage a consulting firm - under terms of reference satisfactory to the Bank - for conducting a comprehensive risk profile and remedial measures /safety improvement options assessment of Hirakud Dam and, upon its completion, promptly submit to the Bank a copy of the report of such assessment; c) shall revise an operation and maintenance manual for the Hirakud Dam and prepare an emergency preparedness plan, both in form and substance satisfactory to the Bank; and d) engage a consulting firm - under the terms of reference satisfactory to the Bank - to undertake a review of design and drawings of the left bank spillway of Hirakud Dam, construction supervision and quality assessment of works.
No later than twelve (12) months after Effective Date, the State of Odisha shall prepare an instrumentation plan and a construction supervision and quality assurance plan for the Hirakud Dam, all in form and substance satisfactory to the Bank.

Conditions

VIII. RESULTS FRAMEWORK AND MONITORING

Results Framework

COUNTRY: India

Dam Rehabilitation & Improvement Project - Restructuring and Additional Financing

Project Development Objective(s)

To improve the safety and operational performance of selected existing dams in the territory of the participating states.The PDO will be achieved through rehabilitation and improvement of dams and improvement in central and state-level institutionalcapacity to sustainably manage dam safety administration and operation and maintenance.

Project Development Objective Indicators by Objectives/ Outcomes

Indicator Name	DLI	Baseline	End Target
To improve the safety and operational performance of selected existing dams in participating states. ***(Action: This Objective is New)***			
Number of project dams with the improved ability (structural or non-structural) to safely cater for the design floods. (Number)		40.00	198.00
Action: This indicator has been Revised			
Number of project dams with basic dam safety facilities in place. (Number)		69.00	198.00
Action: This indicator has been Revised			
Number of project dams with acceptable stability and seepage. (Number)		100.00	198.00
Action: This indicator has been Revised			
Number of project dams with need-based O&M plans operationalized. (Number)		50.00	150.00

Indicator Name	DLI	Baseline	End Target
Action: This indicator has been Revised			
Required budget per state for adequate O&M. (Percentage)		50.00	80.00
Action: This indicator has been Revised			
Number of project dams where emergency response plans have been prepared and disseminated to the population. (Number)		0.00	150.00
Action: This indicator has been Revised			

Intermediate Results Indicators by Components

Indicator Name	DLI	Baseline	End Target
Component 1 : Rehabilitation and Improvement of Dams and Associated Appurtenances *(Action: This Component is New)*			
Project dams with revised dam flood hydrology assessed and actions agreed to address changes in design parameters. (Number)		40.00	198.00
Action: This indicator has been Revised			
Project dams registered and uploaded data in Dam Assest Management System. (Number)		0.00	198.00
Action: This indicator has been Revised			

Indicator Name	DLI	Baseline	End Target
Project dams with updated and approved dam operational manuals. (Number)		0.00	150.00
Action: This indicator has been Revised			
Number of project dams for which necessary remedial measures have been reviewed and addressed. (Number)		0.00	198.00
Action: This indicator is New			
Number of emergency response plans prepared and approved by the responsible authorities. (Number)		0.00	150.00
Action: This indicator is New			
Component 2: Dam Safety Institutional Stregthening *(Action: This Component is New)*			
DSO offices strengthened to carry out mandated functions adequately. (Number)		0.00	9.00
Action: This indicator has been Revised			
Project dams with adequately trained staff that can implement the approved operation manuals. (Number)		50.00	150.00
Action: This indicator has been Revised			
Percentage of grievances satisfactorily resolved by the project level GRC (Percentage)		0.00	75.00
Action: This indicator is New			
% of skilled women professionals in dam operations and management - Kerala -WRD (Percentage)		22.00	25.00

Indicator Name	DLI	Baseline	End Target
Action: This indicator is New			
Number of skilled women professionals in dam operations and management under DRIP - Uttarkhand (Number)		5.00	10.00
Action: This indicator is New			

Monitoring & Evaluation Plan: PDO Indicators

Indicator Name	Definition/Description	Frequency	Datasource	Methodology for Data Collection	Responsibility for Data Collection
Number of project dams with the improved ability (structural or non-structural) to safely cater for the design floods.		Once every 6 month	Central and State Implementing Agencies	Field verification and update by SPMUs	SPMUs and CPMU
Number of project dams with basic dam safety facilities in place.		Once every 6 month	Central and State Implementing Agencies	Field verifications and updates by SPMUs	SPMUs and CPMU
Number of project dams with acceptable stability and seepage.		Once every 6 months	Central and State Implementing Agencies	Field verifications and updates by SPMUs	SPMUs and CPMU
Number of project dams with need-based		Once every	States and	Field verifications and	SPMUs and CPMU

O&M plans operationalized.		6 months	Central Implementing Agencies	updates by SPMUs	
Required budget per state for adequate O&M.		Once every 6 months	Central and States implementing agencies	Field verifications and updates by SPMUs	SPMUs and CMPU
Number of project dams where emergency response plans have been prepared and disseminated to the population.		Once every 6 months	Central and State Implementing Agencies	Field verifications and updates by SPMUs	SPMUs and CPMUs

Monitoring & Evaluation Plan: Intermediate Results Indicators					
Indicator Name	**Definition/Description**	**Frequency**	**Datasource**	**Methodology for Data Collection**	**Responsibility for Data Collection**
Project dams with revised dam flood hydrology assessed and actions agreed to address changes in design parameters.		Once every 6 months	Central and State implementing agencies	Field verifications and updates by SPMUs	SPMUs and CPMU
Project dams registered and uploaded data in Dam Assest Management System.		Once every six months	Central and State government agencies	Field Verifications and reports from SPMUs	SPMUs and CPMU
Project dams with updated and approved		Once every	Central and	Field verification and	SPMUs and CPMU

dam operational manuals.		six month	state government agencies	reports from SPMUs	
Number of project dams for which necessary remedial measures have been reviewed and addressed.		Once every six months	Central and state government agencies	Field verifications and reports from SPMUs	SPMUs and CPMU
Number of emergency response plans prepared and approved by the responsible authorities.		Once every six months	Central and state government agencies	Field Verifications and reports from SPMUs	SPMUs and CPMU
DSO offices strengthened to carry out mandated functions adequately.		Once in every six month	Central and state agencies	Field verifications and reports from SPMUs	SMPUs and CPMU
Project dams with adequately trained staff that can implement the approved operation manuals.		Once very six months	Central and state government agencies	Field verifications and reports from SPMUs	SPMUs and CPMU
Percentage of grievances satisfactorily resolved by the project level GRC	This indicator measures the percentage of grievances that have been received formally, recorded and redressed by the GRM of SPMUs	Once every six month	Central and state agencies	Field verification and reports from SPMUs, Project Management Consultant, Independent M&E agency for impact evaluation	SPMUs and CPMU
% of skilled women professionals in dam		Once in	Implementing	Survey by SPMUs and	SPMUs and CPMU

operations and management - Kerala - WRD		every six months	Agencies	CPMU	
Number of skilled women professionals in dam operations and management under DRIP - Uttarkhand		Once in every six months	Implementing Agencies	Surveys by SPMU and CPMU	SPMU and CPMU

ANNEX 1: HIRAKUD DAM – SALIENT FEATURES AND SCOPE OF WORK

1. Table A provides the salient features of Hirakud Dam.

Table A. Salient features of Hirakud Dam.

Dam Location	
State	Odisha
District	Sambalpur
River	Mahanadi
Location of Dam and powerhouse	Burla
Hydrology	
Catchment area at diversion site	83,300 km^2
Main Dam	
Type	Composite Dam of Earth Masonry and Concrete
Dam top	195.68 m
Dam height above deepest foundation	60.96 m
Length of dam at top	4,800 m
Hydropower	
Installed capacity	347.86 MW
Spillway	
Type	Solid gravity with ogee profile and flip bucket
Design flood	42,450 cumecs
No. of crest gates	34
Size of radial gates	15.54 m (W) x 6.10 m (H)
Crest level of spillway	185.928 m
Reservoir	
FRL	192.024 m
Reservoir area at FRL	743 km^2
Gross storage at FRL	5,896 million cubic meters
Live storage	4,823 million cubic meters
Revised Hydrology	
Revised peak flood	69,632 cumecs
Proposed additional spillway on left bank (Phase 1)	
Type	Concrete gravity
Height	33 m
Length	203 m
No. of bays	5
Size of radial gates	15 m (W) X 15 m (H)
Spillway capacity (Phase 1)	9,122 cumecs

2. Following a review of the design flood of the project, the peak value of design flood of the project (PMF) was revised to 69,632 m^3/s as against original design flood of 42,450 m^3/s. Additional spillways (one on the left bank and another on the right bank) have been proposed to accommodate the additional

potential flood. The left bank spillway with five radial gates of size 15 m (W) x 15 m (H) each is planned to be taken up in Phase-I in the left dike.

3. Based on the flood routing studies, overall layout of Phase-I and Phase-II, as brought out above have been finalized. Earlier the Spillway Control Structure of Phase-1 was originally proposed to be located in the saddle portion of the hillock. However, due to geological considerations, it was shifted 700 m upstream along the same spill channel alignment in order to situate the spillway control structure and the stilling basin on good granite gneiss. The new dam axis location has been designated as RD 0.00 m in the tender drawings. Hydraulic design for passing a 9,122 m^3/s design flood has been carried out along with stability analysis of the concrete dam and structural designs of the spillway dam components, stilling basin, spill channel, and earthen connecting dikes. The spill channel will join with River Mahanadi on the downstream of Hirakud Dam. Suitable connection with existing flood embankments will also need to be provided.

4. Table B provides the salient features of the proposed left bank spillway.

Table B. Salient features of the proposed left bank spillway at Hirakud Dam.

SPILLWAY	
No of Bays	5
Size	15 m (W) x 15 m (H)
Type of Gates	Radial Gates
Energy Dissipation	Stilling basin - 91 m wide, 71m long
Spill Channel	D/s of stilling basin up to RD 1,896 m, with concrete lining and gravity training walls on both sides including construction of its structures.
New Left and Right Connecting Earthen Dikes	Combined length of 1,020 m (Approx.), maximum height 33 m (Approx.)
Probable foundation level	163.00 m or as decided after excavation by Geological Survey of India
Landscape Development	Creation of amusement park, landscape work guide bunds, and so on