

Chapter - II

Performance Audits of Government Companies

Chapter - II

2. Performance Audits relating to Government Companies

2.1 Performance Audit on ‘The Performance of Raichur Thermal Power Station Unit-8 of Karnataka Power Corporation Limited’

Executive Summary

Introduction

Karnataka Power Corporation Limited (KPCL; hereinafter referred to as the Company) was incorporated (July 1970) as a wholly owned State Government Company, with the main objective of planning, promoting and organising development of power including construction, generation and maintenance of power stations in the State. In pursuit of these objectives, the Company commissioned (1985-2002), a coal based thermal power station at Raichur with seven units of 210 Mega Watt (MW) each. Besides, Hydel, Solar and Wind generating stations were also commissioned by the Company over the years.

Raichur Thermal Power Station: Unit-8

The Company informed (October 2002) the Government of Karnataka (GoK) that the annual demand for power was showing an increasing trend of 9 *per cent* to 12 *per cent* and in order to meet the increasing demand, the 210 MW was to be expanded. In this backdrop, establishment of a new unit with 210 MW was approved (June 2003) by GoK for implementation by the Company at an estimated cost of ₹ 673.49 crore. Subsequently, the Board of Directors of the Company decided (August 2006) to go in for the more efficient upgraded version of 250 MW plant, considering the phasing out of 210 MW class of Turbine and Generator by the manufacturers and the continued need for technical support, spares and maintenance support during the life of the plant. The Estimated Project Cost was revised to ₹ 925 crore (August 2006), comprising mainly of Boiler, Turbine and Generator (BTG) Package, Mechanical Package, Electrical Package, Civil Package and others, including finance cost. The BTG Package was awarded (March 2007) to M/s. Bharat Heavy Electricals Limited based on approval of GoK (April 2006). The Unit was to be commissioned by September 2009. Though the Unit was synchronised in April 2010 at a cost of ₹ 1,044.57 crore, it was commissioned only in December 2010, *i.e.* after a delay of 15 months. The Company got an assurance (July 2006) from Mahanadi Coalfields Limited for supply of 10.11 lakh tonnes per annum of ‘F’ grade coal starting supply from 2010 and entered into an agreement for the same in March 2013.

Audit Objectives

The objectives of the Performance Audit were to assess whether:

- Operational efficiency of the Unit-8 of Raichur Thermal Power Station (RTPS) was achieved, leading to optimal output; and
- The Unit was able to keep associated environmental pollution levels within permissible limits through appropriate remedial steps.

Audit Findings

- The performance was quite sub-optimal during the first four years upto 2014-15 and the shortfall in generation during this period was 4,077.71 MU. (*Paragraphs 2.1.9.3, 2.1.10.1 and 2.1.10.4*)
- The loss of generation due to failure of equipment was 3,856.784 MU during the said period. (*Paragraphs 2.1.10.1 to 2.1.10.4*)
- The Management could have avoided much of the loss of generation due to failure of equipments (*viz.*, Electrostatic Precipitator, Coal Handling Plant and Air Pre-Heater) and ensured that the Unit lived upto the expectation of the State, which was reeling under severe power crisis. (*Paragraphs 2.1.10.1 to 2.1.10.4*)
- The auxiliary consumption of the Unit was above nine *per cent* till 2014-15 as against the norm of 8.5 *per cent* prescribed by Karnataka Electricity Regulatory Commission. (*Paragraph 2.1.11.1*)
- Heavy Fuel Oil (HFO), a start-up fuel, recorded very high consumption owing to repeated failure of equipment in the initial four years. (*Paragraph 2.1.11.3*)
- Consumption of coal was a big concern for the Unit as not only was the consumption very high, but there were concerns about the system of recording coal consumption, as it was not accurate. (*Paragraphs 2.1.11.4 and 2.1.11.5*)
- Consumption beyond limit not only resulted in financial loss but also impacted the environment as HFO and coal have a direct negative effect on the environment. The excess water consumption also adversely affects water conservation policy of the Government. (*Paragraphs 2.1.11.2, 2.1.11.3 and 2.1.11.4*)
- The Unit could not achieve 100 *per cent* disposal of fly ash and did not comply with the guidelines issued by MoEF in the interest of protecting the environment. (*Paragraph 2.1.12.1*)
- The Ash Pond, meant for only bottom ash (20 *per cent* of total ash), was filled with fly ash too (in the form of slurry). That, as well as the fact that slurry from neighbouring plant (YTPS) was also proposed for disposal in the same Ash Pond, was liable to cause it to be full before

its envisaged life-span, thereby endangering the neighbourhood and threatening premature closure of the plant. There was no Action Plan in place to handle this crisis on a timely basis. (Paragraph 2.1.12.1)

- The Unit was responsible for higher Heat Rate and thus, prevented the Station from achieving Perform Achieve and Trade norms, thereby causing extra expenditure owing to purchase of Energy Saving Certificate (ESCerts) worth ₹ 107.39 crore. (Paragraph 2.1.12.2)
- The Stack Emission, though within the limits prescribed by KSPCB, was beyond the design of ESP. (Paragraphs 2.1.12.3 and 2.1.12.4)

Introduction

2.1.1. Power is an essential requirement and a critical infrastructure on which, the socio-economic development of a country depends. The availability of power at competitive rates is crucial to sustain growth of all sectors of the economy.

Karnataka Power Corporation Limited (Company) was incorporated (July 1970) as a wholly owned State Government Company, with the main objective of planning, promoting and organising development of power including construction, generation and maintenance of power stations in the State. In pursuit of these objectives, the Company commissioned (1985-2002), a coal based thermal power station at Raichur with seven units of 210 Mega Watt (MW) each. Besides, Hydel, Solar and Wind generating stations were also commissioned by the Company over the years.

Raichur Thermal Power Station Unit-8

2.1.2. The Company informed (October 2002) the Government of Karnataka that the annual demand for power showed an increasing trend at about 9 *per cent* to 12 *per cent* and in order to meet the increasing demand, there was need for a 210 MW expansion. In this backdrop, establishment of a new unit with 210 MW was approved (June 2003) by Government of Karnataka (GoK) for implementation at an estimated cost of ₹ 673.49 crore²⁶. Subsequently, the Board of Directors of the Company decided (August 2006) to go in for the more efficient upgraded version of 250 MW plant, considering the phasing out of 210 MW class of Turbine and Generator by the manufacturers and the continued need for technical support, spares and maintenance support during the life of the plant. The Estimated Project Cost was revised (August 2006) to ₹ 925²⁷ crore, comprising mainly Boiler, Turbine and Generator (BTG) Package, Mechanical Package, Electrical Package, Civil Package and others, including finance cost. BTG Package was awarded (March 2007) to M/s. Bharat Heavy Electricals Limited based on approval of GoK (April 2006). Unit-8 was to be commissioned by September 2009. The Company got an assurance (July 2006) from Mahanadi Coalfields Limited for supply of 10.11 lakh tonnes per annum of 'F' grade coal and entered into an agreement for the same in March 2013. Though Unit-8 was constructed at a cost of ₹ 1,044.57 crore and synchronised²⁸ in April 2010, it was commissioned only in December 2010, *i.e.* after a delay of 15 months from the scheduled date of commissioning.

Organisational Structure

2.1.3. The affairs of the Company are managed by a Board of Directors comprising a Chairman, a Managing Director (MD) and three functional

²⁶ At ₹ 3.21 crore per MW.

²⁷ At ₹ 3.70 crore per MW.

²⁸ Connecting to grid power supply equating the parameters like magnitude, phase and frequency of the both power sources and connecting the generator with the power system network.

Directors. The Chief Minister of the State is the ex-officio Chairman of the Board. The MD is the Chief Executive of the Company. The Executive Director (Thermal) is assisted by three Chief Engineers, one each for Operation and Maintenance, Fuel Management and Civil Maintenance. Two Superintending Engineers are responsible for Operation and Maintenance of the plant. The Superintending Engineer (Thermal Construction) is the Task Force leader for implementation of the Unit.

Audit Objectives

2.1.4. The objectives of the Performance Audit were to assess whether:

- Operational efficiency of Unit 8 of Raichur Thermal Power Station (RTPS) was achieved, leading to optimal output; and
- The Unit was able to keep associated environmental pollution levels within permissible limits through appropriate remedial steps.

Scope and Methodology of Audit

2.1.5. The current Performance Audit covered the operational performance of the Unit-8 and its efforts to keep environmental pollution within permissible limits by meeting applicable environmental norms during 2011-12 to 2016-17. Audit scrutinised records at the Corporate Office and Design Office at Bengaluru and Plant (RTPS) at Shakthinagar, Raichur.

The methodology adopted for meeting the audit objectives involved explaining the audit objectives to the top management through an Entry Conference, scrutiny of records, interaction with the personnel of the audited entity, analysis of data, collection of information through audit requisitions, issue of audit queries and issue of Draft Performance Audit Report to the Management and the Government. The Audit Report was discussed with the Government in the Exit Conference held on 9 October 2017 and the views of the Government are included in the Report at the appropriate places.

Audit was conducted in conformity with the Auditing Standards issued by the Comptroller and Auditor General of India.

Audit Criteria

2.1.6. The following sources of audit criteria were adopted for assessing the achievement of audit objectives:

- Guidelines/Norms/Orders of Central Electricity Regulatory Commission (CERC), Central Electricity Authority (CEA), Karnataka Electricity Regulatory Commission (KERC) and Southern Regional Power Committee (SRPC);
- Instructions of the Ministry of Power, Government of India (GoI) and Government of Karnataka (GoK);
- Detailed Project Report, Design specifications;

- Targets of the Company, Manuals/Guidelines of the Company, data on achievement of parameters by other thermal stations in India; and
- Acts relating to Environmental laws, like the Environment (Protection) Act, 1986, the Air (Prevention and Control of Pollution) Act, 1981, the Water (Prevention and Control of Pollution) Act, 1974, Guidelines issued by Ministry of Environment and Forests and norms fixed by Pollution Control Boards.

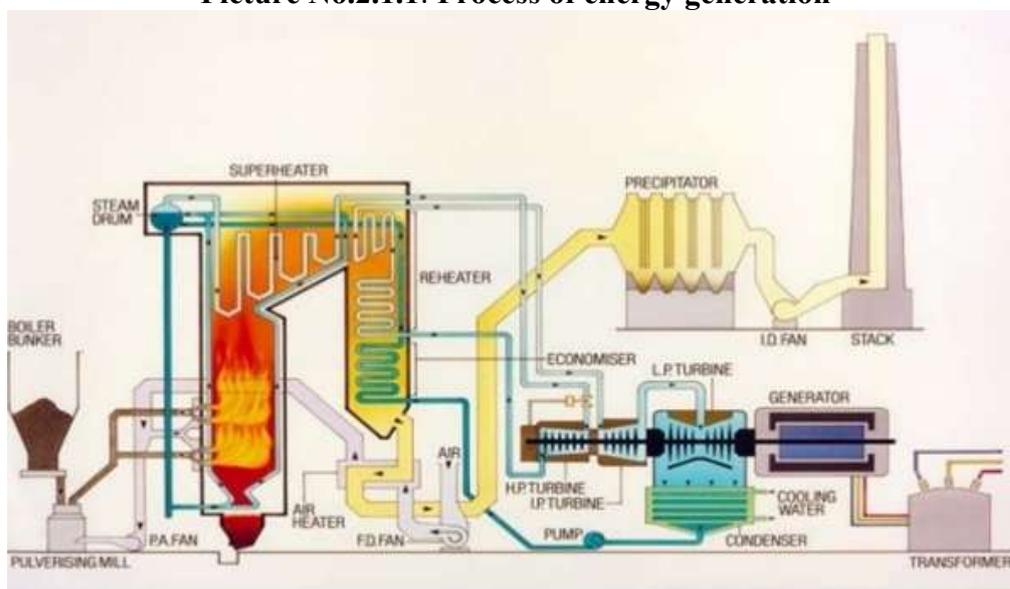
Acknowledgment

2.1.7. Audit acknowledges the co-operation extended by the Energy Department of GoK and the Management of the Company in facilitating the conduct of the Performance Audit.

Operational Performance

2.1.8. Thermal power plants use steam energy for the generation of electricity. Coal is burnt in the boiler to generate hot flue gases, which are used to heat the feed water. A superheated steam is, thus, generated which, under high pressure, is expanded in the steam turbine to rotate the turbine. The turbine is coupled with generator. When the turbine rotates, the generator also rotates and produces electricity. A schematic diagram and the process of energy generation in a thermal power station is given below:

Picture No.2.1.1: Process of energy generation



Optimum generation of electricity depends on the efficient functioning of various equipment, like boiler, turbine, generator and their accessories.

While submitting the application to Karnataka Electricity Regulatory Commission (KERC) for approval of Power Purchase Agreement and determination of tariff, the Company proposed the following operational norms, which were approved by KERK:

Table No. 2.1.1: Operational parameters of the Unit as approved by KERC

Sl. No.	Parameter	Operational norm
1	Plant Availability Factor (PAF)	85 per cent
2	Gross Calorific Value of Design Fuel	3,500 kcal/kg
3	Unit Heat Rate (UHR)	2,399 kcal/kWh
4	Auxiliary Consumption	8.5 per cent
5	Specific Fuel (oil) Consumption	1.00 ml/kWh
6	Energy at 85 per cent PAF for full year	1,862 million units
7	Declared capacity	250 MW

Source: Power Purchase Agreement as approved by KERC.

The table below indicates the operational performance of the Unit for the period 2011-12 to 2016-17:

Table No. 2.1.2: Table showing operational performance of the Unit

Sl. No.	Particulars	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
1	Annual Generation Capacity (MU)	2,196♦	2,190	2,190	2,190	2,196♦	2,190
2	No. of hours available	8,784♦	8,760	8,760	8,760	8,784♦	8,760
3	Planned outage in hours (in per cent)	837 (9.53)	1,080 (12.33)	0	1862 (21.23)	463 (5.27)	0
4	Forced outage in hours (in per cent)	2,825 (32.16)	4,240 (48.40)	2,085 (23.80)	651 (7.43)	469 (5.34)	324 (3.70)
5	Hours lost due to no load demand	177	0	531	376	289	1,034
6	Planned and forced outages (3+4) in hours (in per cent)	3,662 (41.69)	5,320 (60.73)	2,085 (23.80)	2,513 (28.69)	932 (10.61)	324 (3.70)
7	Actual running hours	4,945	3,440	6,144	5,871	7,563	7,402
8	Plant Availability Factor (PAF) (7x100/2)	56.30	39.27	70.14	67.02	86.10	84.50
9	Possible Generation in actual running hours(MU) ²⁹	1,236.25	860.00	1,536.00	1,467.75	1,890.75	1,850.50
10	Actual generation(MU)	951.27	630.52	805.78	987.72	1,661.50	1,745.00
11	Shortfall in generation (MU) (9-10)	284.98	229.48	730.22	480.03	229.25	105.50
12	Capacity utilisation (in per cent) (10/9) × 100	76.95	73.32	52.46	67.29	87.88	94.30
13	Plant Load Factor (PLF) (Sl. No. 10/Sl. No. 1 × 100)	43.32	28.79	36.79	45.10	75.66	79.68
14	UHR (kcal/kWh)	2,623	2,706	2,982	2,689	2,501	2,474
15	Thermal efficiency ³⁰ (in per cent)	32.78	31.78	28.83	31.98	34.38	34.76

♦ Due to 366 days in the year, being leap years.

Source: Monthly Progress Reports of the Unit-8.

²⁹ Actual running hours × 250 MW × 1,000/10,00,000.³⁰ Thermal Efficiency of a power station is an index, which measures the efficiency of conversion of thermal energy to electrical energy. It is the output of electrical energy denoted as a percentage of heat energy contained in the fuel used in generation; 1 kWh equals 859.8452 kcal.

An analysis of the operational performance of the Unit-8 from the above table indicates that the performance of the unit was below the optimum level in the first four years and improved in the succeeding years.

Audit Findings

2.1.9. The first objective of this Performance Audit was to assess whether operational efficiency of the Unit was achieved leading to optimal output. Accordingly, the performance of the unit was analysed with reference to applicable norms and audit observed that the Unit-8 could not reach the milestones in the four-year period from 2011-12 to 2014-15. The Plant Load Factor (PLF) achieved by the Unit during this period varied from 28.79 *per cent* to 45.10 *per cent*. It was only from 2015-16 that the Unit picked up its performance. None of the operational parameters, *i.e.* PAF, UHR, Auxiliary consumption, *etc.* was achieved upto 2014-15.

Audit findings on the operational efficiency are discussed in the succeeding paragraphs.

Working of Efficiency Section

2.1.9.1. Each section of RTPS was assigned with particular jobs and Efficiency Section was one among them. This section, headed by an Executive Engineer, was assigned with the job of monitoring performance parameters, boiler efficiency, interacting with O&M staff for complying with performance parameters.

Audit observed that the Efficiency Section did not monitor the performance parameters and interact with O&M staff on regular basis.

Total outages

2.1.9.2. Outages refer to the period for which the plant remains closed for attending to planned/forced maintenance. Audit observed that the total outages of the Unit to total available hours gradually reduced from a high percentage of 60.73 in 2012-13 to 3.7 in 2016-17 (**refer Sl. No. 6 of Table No. 2.1.2**). This was due to action initiated, though belatedly, to rectify machine related problems.

Non-achievement of minimum generation

2.1.9.3. The annual targets for generation were fixed by the Company after considering the planned outages during the year. The targets so fixed were forwarded to Central Electricity Authority (CEA), which were approved as proposed.

The table below depicts the details of installed capacity, target fixed, actual generation and shortfall in generation for the period from 2011-12 to 2016-17:

Table No. 2.1.3: Installed capacity vis-à-vis actual generation
(in million units)

Sl. No.	Particulars	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	Total
1	Installed capacity	2,196	2,190	2,190	2,190	2,196	2,190	13,152
2	Minimum generation required to recover the fixed charges (85 per cent PAF)	1,867	1,862	1,862	1,862	1,867	1,862	11,182
3	Targets fixed by the company	1,760.00	1,509.00	1,657.00	1,200.00	1,674.00	1,640.64	9,440.64
4	Deficit in target (Sl. No. 2 - Sl. No.3)	107.00	353.00	205.00	662.00	193.00	221.36	1,741.36
5	Actual generation	951.27	630.52	805.78	987.72	1,661.50	1,745.00	6,781.84
6	Shortfall in generation to targets fixed (Sl. No. 5 - Sl. No.3)	808.73	878.48	851.22	212.28	12.50	-104.36	2,658.80
7	Percentage of generation to minimum generation required (Sl. No. 5/Sl. No. 2)x100	50.95	33.86	43.28	53.05	88.99	93.72	60.65

Source: Monthly Progress Reports of the Unit-8.

As per the Tariff Order of the Unit-8, the fixed charges are recoverable at 85 per cent Plant Availability Factor (PAF)³¹, which works out to 11,182 Million Units (MU) for the period 2011-12 to 2016-17. The lower target fixed at 9,440.64 MU resulted in shortfall of 1,741.36 MU. The Unit-8 could not achieve even this lower target till 2015-16.

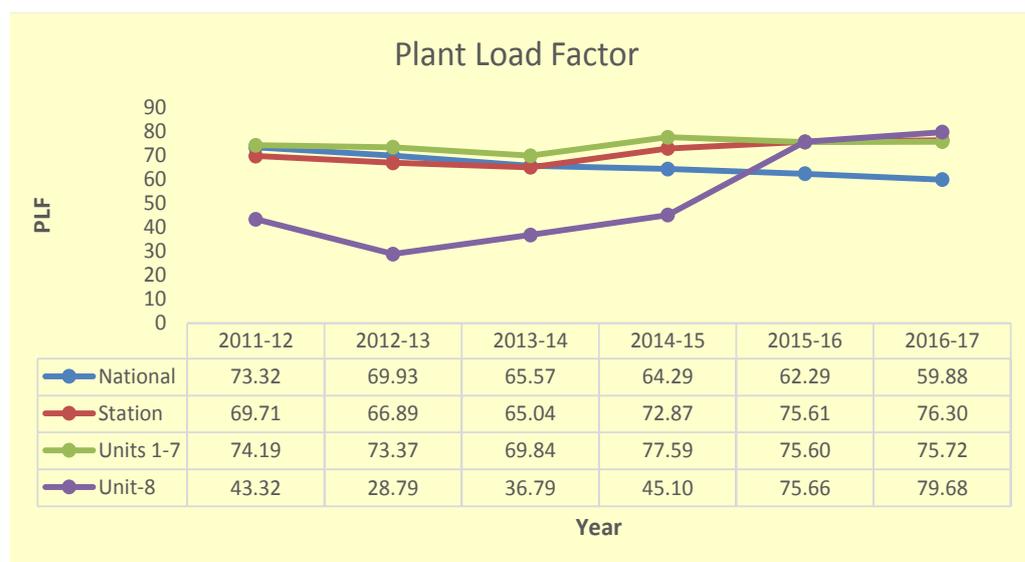
As a result of this sub-optimal performance, the anticipated demand of power in the State as envisaged by CEA was not achieved, notwithstanding the gradual improvement in generation from 2015-16.

2.1.9.4. The Company commissioned the Unit with a projection of operating the unit at 80 per cent PLF³². The average PLF of the country, that of the station as a whole and that of the Unit for the period from 2011-12 to 2016-17 are depicted graphically in Chart No. 2.1.1:

³¹ PAF means the average of the Declared Capacities expressed as a percentage of the installed capacity in MW.

³² The Plant Load Factor (PLF) is the ratio of the actual generation to generation at installed capacity.

Chart No. 2.1.1: Actual PLF of the Unit vis-à-vis national and station averages



Audit observed that the PLF was low upto 2014-15 and was below the national average. This indicated under-utilisation of its capacity.

The reasons for low generation as analysed by Audit are discussed below:

Generation loss due to machinery constraints

Failure of Barring Gear and turbine modules

2.1.10.1. Barring Gear is the mechanism provided to rotate the turbine generator shaft at a very low speed after stoppage of generation. When it stops completely, there is a tendency for the turbine shaft to deflect or bend (by millionths of inches) if allowed to remain in one position for too long. This is due to the heat inside the turbine casing tends to concentrate in the top half of the casing, making the top half portion of the shaft hotter than the bottom half. This small shaft deflection (only detectable by eccentricity meters) would be enough to cause damaging vibrations to the entire steam turbine generator unit when it is restarted.

Table No. 2.1.4: Generation loss due to failure of Barring Gear

Sl. No.	Year	No. of failures		Outage hours for major failures	Generation loss in MU
		Minor	Major		
1	2010-11	24	1	461	115.250
2	2011-12	8	4	2,230	557.491
3	2012-13	0	1	3,473	868.182
	Total		38	6,164	1,540.924

Source: Trip Analysis Report provided by the Company

During the period from September 2010 to May 2012, the Barring Gear failed at least 38 times. The first such instance of Barring Gear being out of service

was in September 2010 (before Commercial Operation Date) and subsequently, major failures occurred on six occasions, along with eight occasions, which were minor in nature, between March 2011 and May 2012. BHEL rectified the defects on all occasions, and final failure was rectified on 12 November 2012. The equipment was failing since beginning and the Managing Director of the Company took up the matter with the top management of BHEL to replace the model only in December 2011 (after at least 33 failures between September 2010 and November 2011).

The Company waited for so many failures to happen without insisting on an in-depth study at the initial stage itself, when there was evidently an inherent problem in the model. This indicated a lack of commitment by the top management towards ensuring maximum efficiency of the Unit. The failure was due to latent defects³³ observed in the Intermediate and High Pressure modules of the turbine supplied by BHEL.

Due to failure of Barring Gear, 6,164 hours (257 days) were not available for generation during the period from March 2011 to November 2012 and in the process, it lost potential generation of 1,540.924 MU. As aforesaid in **paragraph 2.1.9.3**, PAF of 85 *per cent* was required for full recovery of fixed charges. Non-availability of 257 days for generation lowered the PAF (**refer Sl. No. 8 of Table 2.1.2**), thereby affecting recovery of fixed charges to the extent of ₹ 223.21³⁴ crore.

Collapse of Electrostatic Precipitator (ESP)

2.1.10.2. Electrostatic Precipitator (ESP) is used to remove fly ash dust from gas streams. ESP works on the principle that dust laden gas passes into a chamber containing electrode wires at high negative Direct Current (DC) voltage. The dust particles become negatively charged and are deflected out of the gas stream onto positively charged electrodes (collecting plates) and are retained by them. Then by rapping, the particles fall into the dust hopper below and are transferred by blowers to silos for disposal.

ESP of Unit-8 consists of two passes, *viz.* Pass A and Pass B, each pass consisting of seven fields and four hoppers in each field (total of 28 hoppers in each Pass). ESP was designed to operate with both passes in service under normal operating condition.

Pass A got damaged when it fell from its position (16th February 2013) due to a huge collection of fly ash in the hoppers, resulting in minor damages to Pass B as well. The Company restored Pass B by carrying out minor modifications and synchronised (March 2013) the Unit-8. Pass A was replaced and synchronised (October 2014) after a lapse of 20 months, incurring an expenditure of ₹ 33.00 crore.

³³ A defect, which is not visible upon ordinary inspection, but which materially affects the machinery's performance or value.

³⁴ Difference between fixed charges to be recovered and actual recovery for the period from 2010-11 to 2012-13 (₹ 680.38 crore *minus* ₹ 457.17 crore).

The Unit had to run on partial load during March 2013 to August 2014 on account of only one Pass being operational during that period. From the following, it was clear that the Company had enough scope to prevent this from happening:

- Audit observed that fields in 15 to 17 hoppers of ESP out of 28 hoppers were not functioning during February 2013. BHEL informed the Company way back in July 2010 itself that Collecting Rapping Drives in field Nos. 1, 2 and 3 tripped on the Overload Protection of ESP and that overflow of ash from casing door in large quantity was observed. It warned that this might result in blowing off of the collecting electrodes and bending of Rapping Shaft. Hence, BHEL informed the Company to arrange for ash evacuation from Pass A and Pass B expeditiously and stated that it would not be responsible for any deformation and damages later.
- The Chief Engineer (O&M) of the station noticed (November 2010) that the Electronic Controllers were not functioning and dry fly ash was not being evacuated (manually or automatically) from Economiser Hopper.
- BHEL, while assessing the damage to ESP as explained above, reported (February 2013) that the damage was due to high ash accumulation in both passes of ESP beyond Hopper top level. The reason being that the ash handling system was operated manually depending upon the alarm received from individual Hoppers and ash was being evacuated accordingly.
- Central Power Research Institute (CPRI), appointed to report on the same issue, attributed the collapse to failure of fields in 10 of the 28 hoppers. It also stated that the effectiveness of ash evacuation process from the Hoppers was compromised due to malfunctioning of ash evacuation system and allowing ash to accumulate inside the hoppers due to malfunctioning of the system, which in turn overloaded the Hoppers, resulting in their detachment.
- The instruction manual of ESP too contained enough directions on how to maintain ESP. It stated that improper/incomplete Hopper evacuation may lead to precipitator malfunction. Though the Hoppers have adequate storage provision, they should be used only in the case of emergency and should not be used for collection of dust. Failure to evacuate ash from the system may lead to build-up of the ash above the Hopper top level, resulting in build-up of ash in the chamber and ultimately leading to the failure of the supporting structure. The Company ignored all these warnings leading to loss of generation was evident from the facts stated above.

The Operation and Maintenance division (O&M) of the Unit, assigned with the job of maintenance of ESP among other things, knew about the accumulation of ash and non-maintenance of Ash Handling System (AHS) by M/s. Lafarge India Pvt. Ltd. (contractor). The contractor had an agreement with the Company for lifting fly ash and maintaining AHS as well. Having noticed the problem, the O&M division should have rectified the same. Taking shelter under the fact that AHS was not handed over to the Division and that it

was the duty of the contractor to maintain AHS, the Division did not rectify the defects. In fact, it was only through oral instructions of Executive Director (Thermal), the O&M Division was overseeing AHS and ESP operations. The contractor did not maintain AHS on the plea that the required quantity of fly ash was not being made available to him. The Management did not intervene in time to clear the confusion.

Considering the above facts, it was apparent that the Unit ignored maintenance of the ash evacuation system, which led to collapse of the ESP, resulting in loss of generation of 2,148 MU³⁵. The Company operated the Unit during this period on partial load with one Pass only by consuming huge quantity of Heavy Fuel Oil (HFO) (refer Paragraph 2.1.11.3), which resulted in additional expenditure of ₹ 153.32³⁶ crore.

Installation of under-rated gear boxes for Coal Handling Plant

2.1.10.3. The Raichur Thermal Power Station had two Coal Handling Plants (CHP-I & II) to feed coal into the Bunkers. The CHP-I was meant for Units 1 to 4 and CHP-II was meant for Units 5 to 7. The work of extension of Coal Handling Plant - II from Unit-7 to Unit-8, along with Repair & Maintenance works of CHP-I & II, was awarded (October 2008) to M/s. Techpro Systems Ltd., Chennai (TSL) at a cost of ₹ 46 crore. Based on the designs approved (January 2009) by the Company, TSL executed the work. On synchronisation of Unit-8 (April 2010), the failure of gear boxes was noticed.

It was only when the accumulated cost towards maintenance of gear box failures increased to ₹ 2.44 crore that the Company contacted (April 2015) the original manufacturer, Premium Transmission Ltd (PTL) for remedy. PTL opined that service factor³⁷ of gear boxes for coal handling applications should be more than two but the actual service factor was 1.3. The capacity of the gear box provided was inadequate compared to load on the particular Conveyors. Therefore, PTL suggested upgrading of the existing gear boxes. The Company upgraded gear boxes (March 2016) and did not notice any problem.

Audit observed that having approved the design, it was the duty of the Company to assess the requirement. However, it did not assess the capacity of gear boxes required to suit the modifications to the existing coal handling plant to cater to the requirement of the Unit. The fact that the Company did not approach the supplier to sort out the problem and took five years to approach the original equipment manufacturer for rectification shows the lethargy of the Company towards achieving its goals.

³⁵ 17.02.2013 to 19.03.2013 = 31 days × 6 MU = 186 MU
21.03.2013 to 02.08.2014 = 500 days × 3 MU = 1,500 MU
03.08.2014 to 18.10.2014 = 77 days × 6 MU = 462 MU
Total = 2,148 MU.

³⁶ 2013-14 – excess HFO used per unit (27.67 ml/kWh - 1 ml/kWh) × units generated
80,57,84,000 kWh × cost of HFO per ml ₹ 0.05001615/ml plus
2014-15 - excess HFO used per unit (32.28 ml/kWh - 1ml/kWh) × units generated
30,57,98,000 kWh × cost of HFO per ml ₹ 0.04792029/ml.

³⁷ Safety co-efficient for gear boxes.

As a result, generation of 107.86 MU valued ₹ 39.17 crore was lost between April 2011 and March 2016.

Failure of gear boxes of Air Pre-Heater

2.1.10.4. Air Pre-Heater (APH) is an important auxiliary of the boiler, where flue gas with fly ash continuously passes through the heating elements (**refer Picture No. 2.1.1**). It is a slow speed rotating equipment driven by electrical motors, which are connected to gear boxes. It recovers the waste heat from the outgoing flue gas of a boiler and transfers the same to the combustion air, heating the pulverised coal. It increases boiler efficiency, ensures stable combustion in furnace, hastens load variations and dries coal effectively for easy pulverization and combustion.

BHEL supplied and erected (April 2010) APH (with gear boxes APH-A and B) along with the boiler package. The APH-A and B gear boxes had problems of heavy noise and vibration since beginning. The Company carried out repair works on its own between September 2011 and November 2015 for nine times without referring the issue to the supplier. It was only in November 2015 that it intimated BHEL about the problems and sought free replacement.

The request of the Company was turned down by BHEL as it came after five years of supply of the equipment.

As a result of the Company's failure to refer the matter to the supplier in time, and its tardy approach towards maintenance of its equipment, the Unit was shut down for 10 days³⁸, resulting in loss of generation of 60 MU.

Consumption Parameters

Excess Auxiliary Power Consumption

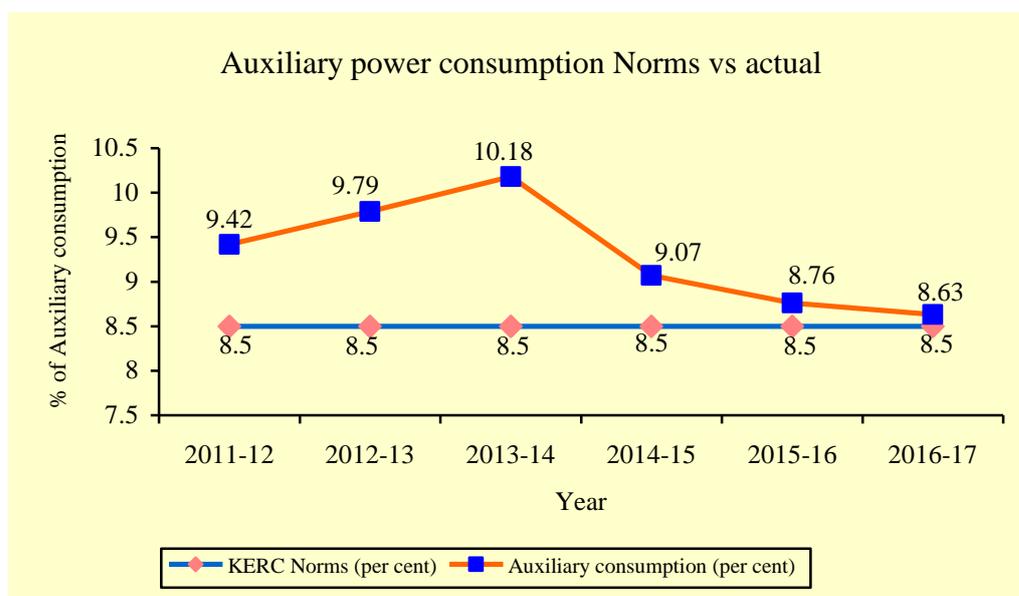
2.1.11.1. The auxiliary power is the quantum of energy consumed by auxiliary equipment of the generating station and transformer losses within the generating station, expressed as a percentage of the gross energy generated at the generator terminal.

The Karnataka Electricity Regulatory Commission (KERC), in its tariff order (February 2015), approved normative auxiliary consumption of energy for the Unit-8 at 8.5 *per cent* of generation from its date of commercial operations (December 2010). Audit observed that the Unit did not adhere to the normative auxiliary consumption of 8.5 *per cent* as allowed by the KERC in any of the years. Conversion of dry ash into wet ash for letting it to ash pond and lower cycles of concentration of water discussed in subsequent paragraphs were assessed as some of the reasons for excess auxiliary consumption.

The graphical representation of norms and actual auxiliary power consumption for the years 2011-12 to 2016-17 are given in Chart No. 2.1.2:

³⁸ January 2012– 4 days, August 2013 – 2 days, December 2015 – 3 days and January 2016 – 1 day.

Chart No. 2.1.2: Auxiliary consumption – actual vis-à-vis norms



The continuous higher auxiliary consumption resulted in depriving the consumers of the State of energy to the extent of 42.64 MU for the period from 2011-12 to 2016-17, as the same was consumed by auxiliary equipment of the generating Unit. Considering the gradual improvement recorded in recent years, the Unit may achieve the norm in the coming years. However, in the first four years it did not limit its consumption, resulting in loss of ₹ 11.37³⁹ crore to the Company.

Excess consumption of water

2.1.11.2. Water is one of the key input requirements for thermal power generation. Water is required for cooling the condenser, removal of heat generated in plant auxiliaries, ash disposal and various other captive uses. More than 80 *per cent* of input water is required for the cooling tower in coal-based thermal power stations.

Water was drawn from river Krishna through raw water intake pump house. The station deployed re-circulating cooling water system to meet the cooling water requirement by adopting natural draft cooling towers (**refer Picture No. 2.1.1**). Government of Karnataka made an allocation of 2.8 Thousand Million Cubic feet (TMC) of raw water to meet cooling and consumptive water requirement of RTPS. The Detailed Project Report (DPR) of the Unit envisaged bringing down the consumption level to 2.01 TMC for RTPS by adopting 2.5 Cycles of Concentration (COC)⁴⁰. It also envisaged reduction of consumption to 1.64 TMC by increasing COC to four from the date of operation (December 2010). The consumption of water, thus, works out to 3.08 cum/MWh for RTPS⁴¹. The MoEF also gave (2006) environment clearance subject to adherence with the above norms.

³⁹ Excess consumption × cost of energy sold.

⁴⁰ The water was re-circulated 2.5 times in the cooling towers.

⁴¹ One TMC = 2,83,16,846.59 m³, therefore 1.64 TMC = 1.64 × 2,83,16,846.59/1,720 MW × 24 hours × 365 days.

Audit observed from the Water Analysis Report of the Unit for the period from April 2012 to February 2017 that the Unit did not achieve its adopted COC of 2.5, let alone achieving the required COC of four in any of the years. Average COC achieved during the period ranged between 1.5 and 2.3. The actual consumption of water per MWh was in the range of 5.1 to 7.9 cum as against the norm of 3.08 cum/MWh during the years 2013-14 to 2016-17⁴².

The lower levels of COC were attributed to higher blow downs⁴³ and loss arising due to evaporation. The Company’s failure to increase COC as per the environmental clearance and also as envisaged in DPR has resulted in non-reduction of raw water usage to 1.64 TMC. As the consumption of water was maintained for the whole station, actual water consumption of the Unit-8 alone (only Water Analysis Report was available separately) could not be ascertained. However, the lesser COC indicated high consumption of water.

Further, the consumption of water per MWh was almost double the norms prescribed by MoEF. This was mainly due to conversion of dry ash into wet ash for pumping into ash pond and ineffectiveness of the Cooling Tower. As against the norm of 69.38 per cent, the percentage of effectiveness⁴⁴ of cooling tower was between 22.22 and 64.29 (on a test-check of 12 days of hourly data between December 2014 and February 2015, for which details of temperature were available).

Excess consumption of Heavy Fuel Oil

2.1.11.3. The Heavy Fuel Oil (HFO) is used as a start-up fuel in thermal power stations and generally little oil is consumed for flame support. KERC, in its tariff order (February 2015), while approving Power Purchase Agreement and determining tariff for a period of 25 years from commercial operation date, *i.e.* from 11.12.2010, allowed Specific Fuel Consumption (SFC)⁴⁵ of 1 ml/kWh for coal-fired stations. The graphical representation of the consumption of HFO in the Unit, as against the norms is given below:

Chart No. 2.1.3: HFO consumption - actual vis-à-vis norms



⁴² Data not available for 2011-12 and 2012-13.

⁴³ Water was pulled from cooling towers to remove mineral build up caused by evaporation in this process. Also used for removing scales.

⁴⁴ It is the difference between cooling water inlet temperature and ambient wet bulb temperature.

⁴⁵ Refers to oil consumption, *i.e.* HFO.

Audit observed that during the period from 2011-12 to 2015-16, the SFC remained more than the norms fixed by KERC with instances of HFO consumption reaching as high as 56.279 ml/kWh in October 2014. The HFO consumption was, however, within the norms in 2016-17. Further, Plant Load Factor during the period indicated that the Unit was not even running at half of its capacity, indicating that the number of interruptions in generations were more. The Unit consumed excess HFO to the extent of 49,726 KL during the period 2011-12 to 2015-16, resulting in a loss of ₹ 234.75⁴⁶ crore.

Audit observed that the reasons mainly attributed for excess consumption of HFO were running the Unit under partial load on many occasions due to system constraints and the problems faced with its equipment.

Excess consumption of coal due to excess Station Heat Rate

2.1.11.4. Station Heat Rate (SHR) is one of the parameters for assessing the efficiency of thermal power station representing the heat energy required in Kilo Calorie (kcal) to generate one kilo watt hour (kWh) of electrical energy. The Unit-8 was designed with a SHR of 2,253 kcal/kWh. However, Karnataka Electricity Regulatory Commission (KERC) fixed the SHR at 2,399 kcal/kWh for tariff purpose. Heat rate increases due to under-performance of equipment, leading to more consumption of coal, as it uses more energy than required to produce one unit of power.

The SHR at which the Unit was operated and the deviation from design and norm during the period from 2011-12 to 2016-17 are given in Table below:

Table No.2.1.5: Actual Station Heat Rate vis-à-vis norm

		(in kcal/kWh)					
Sl. No.	Particulars	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
1	Heat Rate at which the Unit was operated	2,623	2,706	2,982	2,689	2,501	2,449
2	Deviation of Heat Rate against KERC norm	224	307	583	290	102	50

Source: Monthly Progress Reports of the Unit-8.

Audit observed that the deviation in SHR varied between 50 kcal to 583 kcal above the norm fixed by KERC. The excess SHR resulted in excess consumption of coal by 4.22 lakh MT amounting to ₹ 153.45 crore during the period 2011-12 to 2016-17. The main reasons for the high SHR were deviations from key operational parameters and not running the Unit at the optimum load from March 2013 to August 2014 due to reasons explained in **Paragraph 2.1.10.2.**

Unexplained consumption of coal

2.1.11.5. The Company received raw coal from various sources through rail. Coal received was tippled and conveyed to primary and secondary crushers

⁴⁶ At weighted average landed cost of HFO.

through conveyors before storing in the bunkers for station operations. Coal required for generation was drawn from bunkers to coal mills and then fed in to boilers. In order to measure the quantity of coal fed in to the boiler, the Company installed gravimetric coal feeders⁴⁷ for this Unit.

The boiler was designed to feed coal at 160 Tonnes Per Hour (TPH). However, as per the coal consumption records, the average coal feeding ranged between 169 TPH and 176 TPH, which was beyond prescribed limits. As the Unit was not using gravimetric system, coal feeding was not recorded in the Unit Control Board in Coal Handling Plant Control Room. Therefore, recording the consumption of coal requires a relook as it was not accurate.

The Company assured⁴⁸ that efforts would be made to ensure accuracy of coal consumption figures.

Conclusion of Audit Objective 1:

Operational Performance - The performance of Unit-8 was sub-optimal during the first four years upto 2014-15, the shortfall in generation being 4,077.71 MU⁴⁹. The loss of generation due to failure of equipment was 3,856.784 MU⁵⁰ during the said period. The Unit did not meet the operational parameters during any of these four years. The Management could have avoided much of the loss of generation due to failure of equipment, like Electrostatic Precipitator, Coal Handling Plant and Air Pre-Heater, and ensured that the Unit lived upto the expectation of the State, which was reeling under severe power crisis.

Consumption Parameters - The auxiliary consumption of the Unit was above nine *per cent* till 2014-15 as against the norm of 8.5 *per cent*. Though the Unit steadily improved the consumption pattern thereafter, it could not limit the consumption within the norm. Water consumption was high, almost double the limit, owing to conversion of dry ash into wet and ineffective functioning of cooling tower. Heavy Fuel Oil also recorded high consumption owing to repeated failure of equipment in the initial four years. Consumption beyond limit resulted in financial loss and impacted the environment as HFO and Coal have a direct negative effect on it. Excess water consumption affected water conservation policy of the Government. These variations happened owing to lack of internal control mechanism.

Recommendation 1: The Company may consider ensuring strict compliance to operation and maintenance requirements, as recommended by the manufacturers, through a robust internal control mechanism, so that any defect noticed can be brought to the notice of the manufacturers immediately.

⁴⁷ Gravimetric Feeders provide verification of the “as used” fuel to assist in the compliance with established standards. Accurate weights are especially useful in performance testing.

⁴⁸ In the Exit Conference held on 9 October 2017.

⁴⁹ Minimum generation required 7,453 MU less actual generation 3,375.294 MU for first four years.

⁵⁰ Barring Gear failure 1,540.924 MU + ESP failure 2,148 MU + Gear Boxes failure 107.86 MU + Air Pre Heater failure 60 MU = 3,856.784 MU.

Recommendation 2: The Company may consider strengthening the Efficiency Section of the Unit-8, which was responsible to monitor the performance parameters.

Recommendation 3: The Company may reduce blow-downs to achieve the envisaged norm to reduce consumption of water.

Environmental Issues

2.1.12. The second audit objective was to assess whether the Unit-8 was able to keep associated environmental pollution levels within the permissible limits through appropriate remedial measures. Audit observed that the Unit had separate data only in respect of stack emission. Since all other environmental parameters were recorded for the Station as a whole, it was practically not possible to have data for each Unit. In the absence of such separate data, Audit could analyse only stack emission and ash management for the Unit. Audit observations are discussed below:

Absence of long-term plan for ash disposal

2.1.12.1. The by-product of combustion, *i.e.* coal combustion residues, is called ash. *Bottom ash* was collected at the bottom of the boiler units while fly ash was collected in electrostatic precipitators and economiser hoppers. Normally, in a fossil-fired boiler, 20 *per cent* of the total ash was bottom ash and the balance 80 *per cent* was fly ash.

Indigenous coal in India, having diverse quality of coal reserves, contains 30 to 45 *per cent* ash. Disposal of huge quantity of fly ash was a critical issue in our country. It was detrimental to animal and plant life, polluted environment and required large areas of land as well as water, which are scarce now-a-days, for its disposal in the form of slurry. Ministry of Environmental and Forests (MoEF) notification (November 2009) stipulated 100 *per cent* ash utilisation within four years from the date of its operation. The environmental aspects were to be considered while planning and designing the Ash Pond. The main environmental concerns related to ash were air pollution, ground water contamination and surface contamination. Therefore, planning disposal of ash was a significant activity, which a thermal plant management should consider. An Ash Pond is an engineered structure for the disposal of bottom ash and fly ash. The wet disposal of ash into Ash Pond was the most common ash disposal method. The Detailed Project Report of Unit-8 contemplated 100 *per cent* utilisation of fly ash and as such Ash Ponds were meant for only bottom ash and designed likewise.

RTPS had two Ash Ponds for the purpose of disposal of ash generated from the station. Ash Pond No.1 was fully filled up in 2002 and Ash Pond No.2 was filled upto 81 *per cent* of its capacity by June 2016 itself, though it was expected to serve for the life of the Unit (25 years from date of COD - till December 2035). The Company, in joint venture with BHEL, put up the Yeramaras Thermal Power Plant (YTPS), a 2 × 800 MW plant near RTPS. The Ash Pond of RTPS was also to be used for the disposal of ash from

YTPS. However, the Ash Pond-2 was sufficient to take care of the requirements of the two plants (RTPS and YTPS) only till the end of 2017, as:

- YTPS was established (in March 2017) without an Ash Pond. The Company allowed ash from YTPS to be disposed of to its own Ash Pond, *i.e.* Ash Pond-2.
- The agency, which had an agreement (August 2009) with the Unit-8 to lift 3.5 lakh tonnes of fly ash per annum, could not fully lift the ash as the dry ash handling system was not ready till November 2011. The agreement with the agency was cancelled (September 2014) as the agency did not fulfil the conditions of contract by selling ash to a third party. As a result, fly ash too was discharged to the Ash Pond in slurry form, filling the pond pre-maturely.
- The Unit could not completely evacuate fly ash during the period from December 2010 to February 2013 due to malfunctioning of fly ash evacuation system (**refer Paragraph 2.1.10.2**).

A total of 9,24,750.15 MT of ash was disposed of by the Company in wet form from the date of commercial operation till November 2016 due to non-commissioning of silo (dry fly ash evacuation system), cancellation of agreement and non-finalisation of agency to collect the fly ash in dry form.

In case the disposal of ash from YTPS also was considered, the existing Ash Pond would be filled up by the end of December 2017. The Ash Pond was sufficient to cater to the requirement of RTPS upto April 2019. The Company, however, was planning augmentation of existing Ash Pond for a higher holding capacity. Even with this higher capacity, the Ash Pond will last⁵¹ only till October 2021 (if Ash is disposed from RTPS only) and till February 2019 (if Ash is disposed from both RTPS and YTPS).

Based on the report of the Committee formed (June 2015) to study ash disposal, the Technical Director of the Company proposed three options in January 2016, which was referred to the Technical Advisory Committee in March 2017. The Board approved it in April 2017. Accordingly, out of three proposed options, the option of raising the height of the Ash Pond by five meters and the length by 3.20 kms was taken up. The Company opened the bids for this work in November 2017 and was yet (November 2017) to approve the bidder.

Considering that a minimum of one month would be taken to finalise the bidder and thereafter, nine months would be required to complete the work, the earliest time by which the work can be completed, if immediately started, is only September 2018. With the likelihood of the Ash Pond being filled up in December 2017, the action plan for disposal of ash between December 2017 and September 2018 was still absent. In the absence of any viable plan for ash disposal, the generation of electricity in RTPS was liable to be stopped for this period, which may lead to loss of production of 30.50 MU of energy per day.

⁵¹ Generation from YTPS was yet to be started (November 2017) though COD was 29th March 2017.

In the event that the augmentation of the Ash Pond is not completed by September 2018 as aforesaid and there being no viable action plan for ash disposal still in place by then, this loss will continue to mount, also severely affecting power supply to this power deficit State.

Considering the life of the power plant as 25 years, it was evident that the Company did not have any long term plan for disposal of ash. As a result, there is likelihood of the Company stopping its operation by October 2021 on account of this issue.

By converting fly ash into slurry, the Unit was using excessive water, which was scarce. Added to this, by filling the Ash Pond at a faster pace than planned, there was every likelihood of the ash spilling over to neighbouring places and causing pollution of water, agricultural lands, *etc.* at a high human cost.

The Company, during the Exit Conference, stated that action would be initiated to ensure 100 *per cent* disposal of fly ash to prevent ash pond from being filled up by 2019.

Failure to achieve Bureau of Energy Efficiency Norms

2.1.12.2. The Bureau of Energy Efficiency (BEE)⁵² introduced (March 2012) Perform Achieve and Trade (PAT) as one of the initiatives towards enhancing energy efficiency in Thermal Power Plants. These targets were to be achieved by the Units by 2014-15.

PAT is a market-based mechanism to enhance cost-effectiveness of improvements in energy efficiency in energy-intensive large industries through certification of energy savings that could be traded. Designated Consumers would receive such certificates based on their performance and the under-performers are penalised by making them buy such certificates. Thus, the achiever and the non-achiever are benefited and penalised respectively.

The BEE set a target of Net Heat Rate of 2,743 kcal/kWh for RTPS to be achieved for the year 2014-15. As against this target, the station achieved a higher net heat rate of 2,881.72 kcal/kWh and was liable to purchase 97,914 Energy Saving Certificates (ESCs) worth ₹ 107.39⁵³ crore. Increased heat rate induces more consumption of coal, which in turn pollutes the air. The performance of RTPS was marred by that of the Unit-8, which maintained a higher net heat rate throughout the period of PAT cycle⁵⁴ and as a result, the consumption of coal increased overall (**refer Paragraph 2.1.11.4**).

⁵² A statutory body under Ministry of Power, Government of India, set up under the provisions of the Energy Conservation Act, 2001.

⁵³ One ESCert = One MT of oil equivalent of energy, *i.e.* ₹ 10,968 as notified by MOP.

⁵⁴ First PAT cycle: 2012-13 to 2014-15.

Higher Stack Emission

2.1.12.3. The Karnataka State Pollution Control Board (KSPCB), the State regulating authority to ensure compliance with the provisions of Acts relating to Environmental Laws, fixed norms for air pollution, trade effluents, noise and stack emission. As the recordings of values of all these elements, except stack emission, were maintained for the station as a whole, analysis of other elements for the Unit could not be carried out separately.

2.1.12.4. KSPCB fixed the Suspended Particulate Matter (SPM) level for stack emission in respect of the Unit at 100 mg/Nm³. Audit observed that the Unit recorded stack emission level between 74 mg/Nm³ and 123 mg/Nm³ beyond the level of 50 mg/Nm³ as per the design of ESP in all the months during the period 2013 to 2017 and exceeded the KSPCB norms only in three months (2013-14), mainly due to poor performance of ESP.

Conclusion regarding Environmental issues

Audit observed that the Unit could not achieve 100 *per cent* disposal of fly ash and comply with the guidelines issued by the Ministry of Environment and Forests in the interest of protecting environment. The Ash Pond, meant for only bottom ash (20 *per cent* of total ash), was filled with fly ash (in the form of slurry). Besides, slurry from neighbouring Yeramara Thermal Power Station was also planned to be disposed of in the same Ash Pond. This would fill the Ash Pond before its envisaged life-span, thereby endangering the neighbourhood and threatening premature closure of the plant. The Unit was responsible for higher Heat Rate, which prevented the Station from achieving the Perform Achieve and Trade norms. This caused extra expenditure owing to purchase of Energy Saving Certificates (ESCerts) worth ₹ 107.39 crore. The Stack Emission, though within the limits prescribed by Karnataka State Pollution Control Board, was beyond the design of the ESP.

Recommendation 4: The Company may ensure that all avenues for use of ash like in building construction, road works, paint industry, etc. are tapped to make sure that 100 *per cent* disposal of fly ash is achieved.

Recommendation 5: The Company may mandatorily enforce the conditions in the ash disposal contract to ensure 100 *per cent* disposal of fly ash. This would enable the Company to overcome the crisis of Ash Pond being filled up much earlier than planned and avoid stoppage of generation in the near future.

Recommendation 6: The Company may regularly monitor emission to ensure that emission is within the design parameters of Electrostatic Precipitator.

The Performance Audit Report was issued to the Government in September 2017. The reply of the Government was yet to be received (November 2017).

Conclusions

The Audit Objectives were designed to assess whether the operational efficiency of the Unit was achieved, leading to optimal output, and whether the Unit was able to keep associated environmental pollution level within prescribed limits.

The Unit was expected to go on full throttle from the date of commissioning by maintaining norms as prescribed by Karnataka Electricity Regulatory Commission. The performance was sub-optimal during the first four years upto 2014-15. The major reasons attributed towards this were failure of equipment and the same could have been avoided by an alert management.

The Unit failed to keep various parameters, *viz.* Auxiliary Power Consumption (APC), Station Heat Rate, Coal Consumption, Heavy Fuel Oil Consumption and Water Consumption, within norms. The main reasons were adoption of derived figures for APC, auxiliary equipment working below their rated capacity, operating the Unit at sub-optimal load and ineffectiveness of Cooling Tower.

The Company also did not have a provision for disposal of Ash in wet form for the entire life of the plant.

2.2 Performance Audit on ‘Implementation of Projects by Cauvery Neeravari Nigama Limited’

Executive Summary

Introduction

The Cauvery river originates at Talakaveri in Kodagu district of Karnataka and finally flows into the Bay of Bengal. The Cauvery river basin extends over the States of Karnataka, Kerala, Tamil Nadu and the Union Territory of Puducherry. The Cauvery water-sharing dispute existed amongst these States since the 19th century. The Inter-State Water Disputes Tribunal on the directions of the Hon’ble Supreme Court, in its Award (February 2007) allocated 270 tmc of water to Karnataka in a year and also specified quantum of water to each project. It also specified the area to be cultivated under each project, which totalled to 18.85 lakh acres (approx. 7,628 sq. km.). As the States did not agree to the Award of the Tribunal, they filed appeals before the Hon’ble Supreme Court, on which the final judgement was awaited (November 2017).

State Water Policy

The Government of Karnataka (GoK) formulated the State Water Policy, 2002 (SWP), for creation of irrigation potential by 2005 (target year) and construction of Field Irrigation Channels (FICs) by 2006 to achieve the ultimate irrigation potential of 45 lakh hectares (ha) in the State. The State Water Policy also emphasised Participatory Irrigation Management.

Cauvery Neeravari Nigama Limited (CNNL)

The Cauvery Neeravari Nigama Limited (Company) was incorporated in June 2003 under the Companies Act, 1956, to complete the works of and to maintain, operate, improve or modernise on-going Major and Medium Irrigation Projects including Lift Irrigation Works and Minor Irrigation and such works entrusted to the Command Area Development Authority (CADA) in the Cauvery basin.

The Company, under its jurisdiction, executes and maintains four Major Irrigation Projects, 19 Medium Irrigation Projects and 25 *Anicut* canals. It also executes works of Lift Irrigation Schemes, Drinking Water Schemes (DWS) and Restoration and Rejuvenation of rivers and tanks, and other works, which fall in the command area of the irrigation projects. Of the 18.85 lakh acres of land allowed to be cultivated under various projects, as per the Award of the Inter-State Water Disputes Tribunal, an area of 15.55 lakh acres fell in the jurisdiction of projects of the Company and the remaining 3.30 lakh acres (of the 18.85 lakh acres) fell under the jurisdiction of the Minor Irrigation Department of the Government of Karnataka.

Audit Objectives

The Audit Objectives were to assess whether:

- Proper planning was in place while taking up the projects; and
- The works were executed within the stipulated time frame and the implementation was effective in achieving the objectives set out in the Project Reports.

Out of the 19 projects selected for review, the works in respect of:

- Three projects were completed in time;
- Seven projects were completed after delays ranging from three months to four years from their scheduled date of completion;
- Seven projects are delayed upto four years from their scheduled date of completion and are yet to be completed; and
- One project, though delayed, its date of completion was yet to be due (as of November 2017) and another project was yet to be taken up.

Audit Findings

- Lacunae in planning as the Company was not preparing Zone-wise Annual Works Programmes, not having a database for selection of projects and carrying over 3,427 number of spillover works (57 per cent of total works) in its Annual Works Programmes. (Paragraphs 2.2.11.2, 2.2.11.3 and 2.2.11.4)
- Lack of priority in planning for potential oriented works and creation of Field Irrigation Channels (FICs) resulted in a total of 5,968 ha of potential oriented work and 42,400.68 ha of FICs remaining incomplete even after a lapse of more than 12 years, which should have been completed by 2005 and 2006 respectively as per State Water Policy. (Paragraphs 2.2.11.6 and 2.2.11.7)
- Deficiencies were noticed while preparing the estimates of the projects due to non-compliance with Karnataka Public Works Department Code. (Paragraph 2.2.11.10)
- Implementation of the projects suffered due to land acquisition problems, delays in approval of designs, non-synchronisation of associated works with main works and other administrative reasons, all of which were avoidable factors. (Paragraph 2.2.12.1 to 2.2.12.4)
- Adequate attention was not given to Inspection Reports of the Quality Control Divisions. (Paragraph 2.2.12.6)
- Monitoring of projects was inadequate due to lack of proper reporting system to the Board of Directors. (Paragraph 2.2.12.7)
- Benefits envisaged in the Project Reports of filling up of 81 tanks for providing drinking water to 310 villages, providing water to suffering *achkat* of 3,200 acres and efforts to restore and rejuvenate the Arkavathy river, were delayed and the objectives were not realised in time. A total expenditure of ₹ 560.32 crore was incurred on this. (Paragraph 2.2.12 and Appendix-4)

Introduction

2.2.1. The geographical area of Karnataka is 1.92 lakh square kilometres (sq. km.) with a cultivable area of 1.41 lakh sq. km. Cauvery river basin is one of the seven river basins in Karnataka. It extends over the States of Karnataka (42 per cent), Kerala (4 per cent), Tamil Nadu and the Union Territory of Puducherry (54 per cent), encompassing an area of 85,115 sq. km. The Cauvery river originates at Talakaveri in Kodagu district of Karnataka and finally flows into the Bay of Bengal. The location of the Cauvery basin and its spread in the different States is given below:

Chart 2.2.1: Map of the Cauvery basin



Source: Records of the Company.

The Cauvery basin in Karnataka is 34,273 sq. km. spread across 11 districts. The major rivers and tributaries of Karnataka flowing in this basin in Karnataka are Harangi (50 km.), Hemavathy (245 km.), Lakshmantirtha (131 km.), Kabini (230 km.), Shimsha (221 km.), Suvarnavathi (88 km.), Arkavathy (161 km.) and the main river Cauvery (381 km.).

2.2.2. The Cauvery water-sharing dispute existed amongst the southern States (the present States of Karnataka, Tamil Nadu, Kerala and Union Territory of Puducherry) since the 19th century. The Inter-State Water Disputes Tribunal (ISWDT) constituted (June 1990) on the directions of the Hon'ble Supreme Court, in its Award (February 2007) allocated 270 tmc of water to Karnataka in a year and also specified quantum of water to each project. The Inter-State Water Disputes Tribunal also specified the area to be cultivated under each project, which totalled to 18.85 lakh acres (approx. 7,628 sq. km.). As the States did not agree to the Award of the Tribunal, they filed appeals before the

Hon'ble Supreme Court, on which the final judgement was awaited (November 2017).

State Water Policy

2.2.3. The Government of Karnataka (GoK) formulated the State Water Policy, 2002 (SWP) for creation of irrigation potential by 2005 (target year) and construction of Field Irrigation Channels (FICs) by 2006 to achieve the ultimate irrigation potential of 45 lakh hectares (ha) in the State. The State Water Policy also emphasised on Participatory Irrigation Management, which envisaged creating a sense of ownership of water sources and irrigation systems among the users of water for promoting economy in water use and preservation of the system, achieving optimum utilisation of available resources, equity in distribution *etc.*

Cauvery Neeravari Nigama Limited (CNNL)

2.2.4. The Cauvery Neeravari Nigama Limited (Company), a Public Sector Undertaking, was incorporated in June 2003 under the Companies Act, 1956. The main objectives of the Company are:

- (i) to complete the works of on-going Major and Medium Irrigation Projects⁵⁵;
- (ii) to include Lift Irrigation Works⁵⁶ and such works of Minor Irrigation and Command Area Development Authority (CADA)⁵⁷; and
- (iii) to maintain, operate, improve or modernise the Irrigation Projects including Lift Irrigation Works and such works of Minor Irrigation and CADA, in the Cauvery basin entrusted to it by the State Government.

The Company, under its jurisdiction, executes and maintains four Major Irrigation Projects, 19 Medium Irrigation Projects and 25 *Anicut*⁵⁸ canals. It also executes works of Lift Irrigation Schemes, Drinking Water Schemes (DWS) and Restoration and Rejuvenation of rivers and tanks, and other works⁵⁹, which fall in the command area of the irrigation projects. Of the 18.85 lakh acres of land allowed to be cultivated under various projects, as per the Award of the Tribunal, an area of 15.55 lakh acres fell in the jurisdiction of projects of the Company and the remaining 3.30 lakh acres (of the 18.85 lakh acres) fell under the jurisdiction of the Minor Irrigation Department of the Government of Karnataka.

⁵⁵ A Project, which envisages only irrigation, is called an 'Irrigation Project'.

⁵⁶ Lift Irrigation Works/Lift Irrigation Schemes are schemes where pumping machinery was installed on the banks of rivers, streams, canals, foreshore of storage reservoirs, *etc.* for pumping water and transporting it through a Rising Main to higher elevations where water cannot be supplied by gravity, for purposes of irrigation of land, filling up of tanks, drinking water *etc.*

⁵⁷ CADA functions separately under the Water Resources Department (WRD). Refer Glossary.

⁵⁸ A structure across the river (like a barrage).

⁵⁹ The Company also executes works in the nature of construction of roads, drilling of borewells and other works, under Schedule Castes Plan and Tribal Sub Plan of the State in the Command Area.

Organisational Structure of the Company

2.2.5. The Chief Minister of the State and the Minister for Water Resources are the ex-officio Chairman and Deputy Chairman respectively of the Company. The administrative control of the Company is with the Water Resources Department (WRD), headed by the Principal Secretary, who is also a Director in the Company.

The Company is headed by the Managing Director who monitors the day-to-day activities. The Government gives administrative approvals for the major projects. The projects/works are scrutinised by the Technical Sub-committee (TSC) and Estimates Review Committee (ERC) and approved by the Board of Directors or by Chief Engineer based on Financial delegations. The tenders for the works are scrutinised by the Tender Scrutiny Committee. The projects/works taken up are monitored at the field level by the Chief Engineers at three Zonal Offices, Superintending Engineers at six Circle Offices and a Design, Quality Control and Technical Vigilance Wing and Executive Engineers at 28 Divisions.

Audit Objectives

2.2.6. With the formulation of State Water Policy in 2002, creation of the Company as a Special Purpose Vehicle in 2003 and the Award of the Tribunal in 2007, it was imperative that the Company had a vision for development of irrigation projects in the Command Area of the Cauvery basin.

Preliminary assessment revealed deficiencies in the planning and implementation of projects leading to non-achievement of objectives set out in the Policy documents and respective Project Reports. In this backdrop, the Performance Audit on ‘Implementation of Projects by CNNL’ was undertaken to assess whether:

- Proper planning was in place while taking up the projects; and
- The works were executed within the stipulated time frame and the implementation was effective in achieving the objectives set out in the Project Reports.

Scope of Audit and Audit Methodology

2.2.7. The total expenditure incurred by the Company during the period 2012-13 to 2016-17 was ₹ 6,884.59 crore (₹ 4,035.46 crore towards major capital expenditure and ₹ 2,849.13 crore on other expenditure⁶⁰). Under major capital expenditure, ₹ 2,781.96 crore was incurred on four categories⁶¹ viz. Potential

⁶⁰ Includes expenditure on maintenance (₹ 302.18 crore), establishment (₹ 527.88 crore), creation of Field Irrigation Channel (₹ 16.45 crore), Land acquisition (₹ 390.07 crore), other minor capital expenditure works (₹ 451.63 crore), Scheduled Castes Plan/Tribal Sub-Plan/Special Development Plan (₹ 738.99 crore), Dam Rehabilitation and Improvement Programme (₹ 41.66 crore) and other finance and debt serving charges (₹ 380.27 crore).

⁶¹ Expenditure incurred on two categories was excluded from scope of the review viz. Modernisation of Anicut canals (₹ 1,210.13 crore) as it was not possible to evaluate the objectives in view of deficit rainfall during 2015-17 and Restoration and Rejuvenation of tanks (₹ 43.37 crore) considering materiality of individual works in them.

oriented works, modernisation and improvement of works, Drinking Water Scheme/Tank Filling Scheme and Restoration and Rejuvenation of rivers.

Audit adopted the method of Stratified Sampling based on expenditure under these four categories and a total of 19 out of 72 projects (26 per cent), covering an expenditure of ₹ 1,433.41 crore out of the total ₹ 2,781.96 crore (52 per cent).

The Performance Audit was conducted between April and June 2017 and covered the review of selected works executed by 14⁶² out of 28 divisions of the Company during 2012-17. The records maintained at the Company, Water Resources Department and Command Area Development Authority in relation to the selected projects were reviewed.

2.2.7.1. The methodology adopted for achieving the Audit Objectives involved explaining the audit objectives, criteria and scope of audit to the Government and Management during an Entry Conference, which was held on 18 April 2017. During the course of audit, audit observations were issued to the Management seeking their views. The Performance Audit Report was issued to the Government and the Management and the Exit Conference was held on 16 October 2017 with the Government. The Government furnished its replies on 16 November 2017. The views of the Government/Management were suitably incorporated in the Report.

Audit was conducted in conformity with the Auditing Standards issued by the Comptroller and Auditor General of India.

Audit Criteria

2.2.8. The Audit Criteria adopted for achieving the Audit Objectives are derived from the following sources:

- State Water Policy 2002, Award of the Inter-State Water Dispute Tribunal, Guidelines and Circulars issued by the Planning Commission, GoI, Ministry of Water Resources, GoI and Central Water Commission, GoI, and also the Government of Karnataka (GoK) and the Committees formed by GoK;
- The Karnataka Irrigation Act, 1965, and Rules, Karnataka Financial Code, 1958, Karnataka Public Works Department Code, 1965, and 2014, Karnataka Transparency in Public Procurement Act, 1999, and Rules, 2000;
- Land Acquisition Act, 1894, The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013; and
- Project Reports, Contract Agreements, Circulars and directions issued by the Company.

⁶² Belur, Channarayapatna, Turuvekere, Gorur, Hebbur, Yedyur, Nagavalli, Tumakuru, Hunsur, Kushalnagar, Nanjangudu, Krishna Raja Sagar, VC Division and Ramnagar.

Acknowledgment

2.2.9. Audit acknowledges the cooperation extended by the Water Resources Department of the GoK, the Management of the Company and the Command Area Development Authority in facilitating the conduct of the Performance Audit.

Audit Findings

Status of the Projects

2.2.10. The status of the 19 test-checked projects and achievement of the objectives envisaged in their Project Reports are given in **Appendix-4**. The summary of their status is given below:

Out of the 19 projects selected for review, the works in respect of:

- Three projects⁶³ were completed in time;
- Seven projects⁶⁴ were completed after delays ranging from three months to four years from their scheduled date of completion;
- Seven projects⁶⁵ were delayed upto four years from their scheduled date of completion and were yet to be completed; and
- One project,⁶⁶ though delayed, its date of completion was yet to be due (as of November 2017) and another project⁶⁷ was yet to be taken up.

In order to assess the causes for the delay, Audit analysed the Planning and Implementation of the projects under two Audit Objectives.

Objective 1: Whether proper planning was in place while taking up the projects.

Planning

2.2.11. Planning is a vital process for taking up a project. For efficient and effective utilisation of water, the need for a Comprehensive Plan for the river basin, duly considering the State Water Policy, was of vital importance. Similarly, individual projects also required to be planned so as to implement them effectively and in consonance with the overall Comprehensive Plan.

Audit examined the planning process of the Company and the findings are given below:

The planning processes of the Company

2.2.11.1. As per the procedure in vogue, pre-Budget discussions were held by the Minister for Major and Medium irrigation with the Department heads in

⁶³ Sl.No.10,15 and 17 of **Appendix-4**.

⁶⁴ Sl.No.4,5,7,12,13,14 and 16 of **Appendix-4**.

⁶⁵ Sl.No.1,2,3,6,8,11 and 18 of **Appendix-4**.

⁶⁶ Sl.No.9 of **Appendix-4**.

⁶⁷ Sl.No.19 of **Appendix-4**.

December/January before each ensuing financial year. Thereafter, the Company prepared a tentative budget requirement in the form of Annual Plan, for the different projects proposed to be undertaken during the ensuing year and submitted the same to the State Government for providing Budget allocation.

The State Government provided the Budget allocation (lump-sum) to the Company. The Company apportioned the same to the three Zones with directions to prepare the Annual Works Programme (AWP)⁶⁸. Each of the Divisions (under the Zones) prepared a separate AWP (total: 28 AWPs) incorporating the works that are intended to be taken up during the year. Pronouncements⁶⁹ made in the State Budget were also considered while preparing AWP. Upon approval of AWP by the Managing Director, individual projects were taken up for tendering and execution.

The deficiencies in the Planning process are given below:

Absence of comprehensive Annual Works Programme (AWP)

2.2.11.2. The Company did not have an Internal Control Manual detailing the procedure for preparation of plans, authorities for approval of plans, role of Managing Director, Board of Directors, etc. This was despite the directions of Principal Secretary, WRD in March 2005 to prepare an Internal Control Manual on the lines of the manual prepared by another Nigam viz. Krishna Bhagya Jala Nigam Limited (KBJNL).

Audit compared the stipulations in the Internal Control Manual of KBJNL with the practice followed by the Company in the preparation of AWPs.

Audit observed that:

- The Internal Control Manual of KBJNL stipulated (Chapter XV-Capital Works) that the Chief Engineers should prepare AWP for each Zone based on the budget allocation. However, the Company's Chief Engineers did not prepare Zone-wise AWP. Each of the 28 Divisions prepared separate AWPs, which were approved by the Managing Director. As a result, a comprehensive outlook of the projects for its implementation was absent.
- The Internal Control Manual of KBJNL also stipulated that the Budget for capital expenditure be approved by the Board of Directors. The AWPs prepared in the Company, however, did not have the approval of the Board of Directors. As a result, the Board of Directors were not kept informed of the plans undertaken by the Company.

⁶⁸ Annual Works Programme is a document, which consists of amounts allocated for (a) making payments for pending bills, (b) taking up spillover works, and (c) taking up fresh works, i.e. those to be taken up during the ensuing year. Spillover works are those, which are tendered in earlier years and are under progress.

⁶⁹ The Chief Minister/Finance Minister of the State pronounces projects proposed to be undertaken while presenting the State Budget for the year.

The Government replied that the Company would prepare an internal control manual with detailed procedure for preparation of plans and designs by forming a subcommittee, as per the guidelines of KBJNL manual.

Large quantum of spillover works

2.2.11.3. The Annual Works Programmes (AWPs) of the Divisions were continuous ‘work in process’ documents, as they were approved three to twelve months after the commencement of the financial year (during the last five years in the test-checked 14 Divisions). The technical approval was accorded and the tenders for the works were invited after the approval of the AWPs.

Due to delay in approval of AWPs⁷⁰, the plans for tendering and awarding were running almost a year behind schedule with the result that there was accumulation of spillover works year after year.

On an analysis of the spillover works of three⁷¹ (Hebbur, Turuvekere and Tumakuru Divisions) out of 14 test-checked divisions for the last five years (2012-17), it was observed that at the end of March 2017, there were 211 spillover works, which were included in AWP 2017-18. The year-wise numbers of spillover works were 2016-17 (90), 2015-16 (28), 2014-15 (33), 2013-14 (22), 2012-13 (26) and prior to 2012 (12). These included 65 works under progress, 50 works completed (pending for want of completion reports to assess actual completion), 52 works stopped, 4 works rescinded/proposed to be rescinded, 39 tenders under progress and one work was pending as payment for land acquisition was not done. The Company provided allocation of only ₹ 52.54 crore (17 per cent) against ₹ 310.02 crore required for completion of spillover works in respect of these three divisions. However, these divisions took up 212 fresh works costing ₹ 55.15 crore and provided a budget allocation of ₹ 16.92 crore (31 per cent) for these works in AWP 2017-18.

At the end of March 2017⁷², the Company, as a whole, had 3,427 spillover works with estimated balance cost of ₹ 4,441.79 crore. The Company, however, provided budget allocation (2017-18) for ₹ 627.59 crore (14 per cent) towards the spillover works. The Company, moreover, proposed (for 2017-18) to undertake 2,580 fresh works valued ₹ 2,635.30 crore and allotted ₹ 590.72 crore (22 per cent).

From the foregoing paragraphs, it could be seen that the allocation for spillover and fresh works was 17 and 31 per cent of the cost of the project for the test-checked divisions and 14 and 22 per cent for the Company. Seen from the context that time given for executing majority of the works ranged from 1 to 1½ years as per contract agreements, such reduced allocations might result in a situation where:

⁷⁰ As per procedure in vogue, the approval of works in AWP was considered as administrative approval for taking up the works. Project-wise administrative approvals were obtained separately from the GoK, where the estimated cost exceeded ₹ five crore.

⁷¹ Divisions where potential oriented works were taken up.

⁷² Source: AWPs of the 28 Divisions. The AWPs were yet to be approved by the Managing Director.

- (a) majority of spillover works continue to remain as such; and
- (b) most of fresh works become spillovers.

The cumulative effect of such allocations was that at the end of March 2017, there were spillover works valued at ₹ 4,441.79 crore, including works, which were pending for more than five years. On a test-check of works in the 14 divisions, it was observed that works were pending for want of approval to the estimates, non-inviting of tenders for rescinded works, work pending for awarding, finalisation of tenders and land acquisition problems. The Company, did not analyse the reasons for their pendency. Not analysing the reasons for their pendency and not making suitable allocations to such works made the current Annual Works Programmes impractical documents. This resulted in the objectives of the project not being realised in time.

The Government replied that instructions were issued to complete all the pending works, particularly those pending for more than two years.

Absence of a database for selection of projects

2.2.11.4. There was no database of the status of various irrigation assets, with reference to hydrological aspects of the river basin, canals requiring improvement/modernisation, project-wise extent of *suffering achkat*⁷³, etc. so as to identify and prioritise works needed to be executed in the short and long-term. In the absence of the database, it could not be ascertained whether the projects/works included in Annual Works Programmes by the divisions were truly a priority item or whether any priority items were excluded. It was seen that projects which did not satisfy the prescribed Benefit Cost Ratio were also taken up for execution (**refer Paragraph 2.2.11.9**).

The Government replied that the Company was planning to evolve a Project Management System software, which will contain the database of all works undertaken by the Company. The reply was, however, silent about maintaining information about the status of various irrigation assets and not just details of works.

Planning for creation of irrigation potential and Field Irrigation Channels (FICs)

2.2.11.5. The State Water Policy 2002 (SWP), mentioned that prioritisation for incurring expenditure in respect of Major and Medium irrigation projects⁷⁴ would be as follows:

- a) Completion of ongoing projects and committed projects;
- b) Participatory Irrigation Management (PIM);
- c) Operation and Maintenance; and
- d) Renovation and Modernisation.

⁷³ *Suffering achkat* refers to an area, in which, FICs are created, but land does not receive adequate water supply for irrigation.

⁷⁴ A scheme having Cultivable Command Area more than 10,000 hectares is a Major Irrigation Project while a scheme having Cultivable Command Area between 2,000 hectares and 10,000 hectares is a Medium Irrigation Project.

Also, in irrigation projects, where reservoirs were already completed, top priority would be given to the construction of the canals and field irrigation channels in the shortest possible time and steps taken to utilise the potential created.

The SWP also stated that for implementing the above, the action agenda was to complete all on-going and committed water resource development projects by 2005 and complete the Command Area Development works by 2006.

The shortfall in creation of irrigation potential under the test-checked project (Hemavathy) is given below:

Creation of irrigation potential

2.2.11.6. The four Major Projects⁷⁵ of the Cauvery Basin were transferred to the Company upon its formation. Of this, as at the end of March 2012 (*i.e.* beginning of the Performance Audit period), irrigation potential was already created in three projects⁷⁶. Irrigation potential was pending creation under Hemavathy Project⁷⁷ in the last stretches of Tumakuru Branch Canal (from km. 200 to km. 240) to an extent of 11,706 ha⁷⁸. Against this, the actual achievement during 2012-13 to 2016-17 was 5,738 ha leaving a balance of 5,968 ha to be created. The main reasons for the shortfall were:

- **Fixing of lower targets:** The Company fixed annual targets for potential creation (for the Company as a whole) in the range of 1,000 ha to 3,000 ha during the last five years. The achievements were even lower⁷⁹ and ranged from ‘Nil’ in 2015-16 to a maximum of 2,723 ha in 2013-14 during audit period of 2012-13 to 2016-17.

In the past, between the years 2005-06 and 2007-08, the Company created potential of about 24,000 ha every year, which included about 10,000 ha⁸⁰ under Hemavathy Project (Tumakuru Zone). Hence, creation of the balance potential of 11,706 ha under Hemavathy Project in one or two years (2012/2013) was not a daunting task. As the State Water Policy envisaged completion of projects by 2005, the Company was supposed to give top priority to this with adequate fund allocation.

⁷⁵ Krishna Raja Sagar, Kabini, Harangi and Hemavathy.

⁷⁶ Krishna Raja Sagar (79,308 ha), Kabini (44,222 ha) and Harangi (53,520 ha).

⁷⁷ Hemavathy Project was executed by two Zones (Gorur and Tumakuru). The Project at Tumakuru consists of Tumakuru Branch Canal, Nagamangala Branch Canal and Bagur Navile Tunnel Exit Canal.

⁷⁸ 1,18,618 ha was completed by 2012 against the ultimate irrigation potential of 1,57,755 ha of which 27,431 ha was identified as area with high mounds (Source: Annual Report of the Company 2014-15). The irrigation potential that could be created under Tumakuru Branch Canal from km. 200 to km. 240 was stated to be 12,218 ha in the documents submitted under Resource Framework Document.

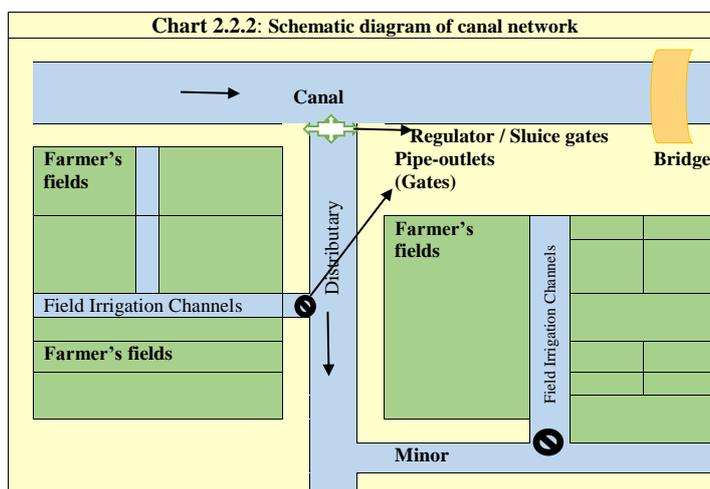
⁷⁹ Year (Targets/Achievement): 2012-13 (2,500 ha/518 ha); 2013-14 (3,000 ha/2,723 ha); 2014-15 (3,008 ha/2,000 ha); 2015-16 (1,008 ha/Nil); and 2016-17 (1,008 ha/497 ha). This included 485 ha under Malalur LIS, which was declared as potential created (2013-14), though project was not completed.

⁸⁰ Year (Targets/Achievement) under Hemavathy Project: 2005-06 (11,126 ha/10,624 ha); 2006-07 (12,136 ha/11,964 ha); and 2007-08 (8,000 ha/7,804 ha).

The pattern of funds requested from the Government, the funds allocated by the Company for different categories and the actual expenditure incurred under different categories (including their ratios) are given in **Appendix-5**. It would be observed that instead of fast-tracking the creation of remaining irrigation potential, by allocation of funds required, the Company reduced allocation in proportion to Budget allocation under different categories (*i.e.* potential oriented works, modernisation and improvement of canals, drinking water schemes, *etc.*).

The average allocation for potential oriented works during the period 2012-13 to 2016-17 was 12 *per cent* while the average allocation for modernisation, improvements and other capital works was 35 *per cent*, of the total allocation. The system of proportionate allocation without giving priority for completion of potential oriented works (creation of canals, distributaries and minors) was not a good practice especially when it was a priority area as per State Water Policy and should have been completed by 2005.

Audit analysed the effect of this allocation pattern on the potential oriented works in Hebbur Division, where major potential creation was pending under Tumakuru Branch Canal of Hemavathy Project.



While the works of earthwork excavation along with construction of Cross Drainage works⁸¹ in km. 201 to km. 236 were included in Annual Works Programmes of 2012-13, works related to creation of distributaries (No. 29, 30) of these reaches and further canal construction (beyond km. 236)⁸² and pipe-outlets for km. 201 to 220 were included in the Annual Works Programmes for 2013-14 and 2014-15. Pipe-outlets of km. 221 to 228 and construction of Minors⁸³ in km. 221 to km. 228 were included in Annual Works Programmes for 2014-15 and 2015-16. As could be seen, the works in only certain stretches of canals could be taken up in one year with the allocation provided, while the remaining stretches and its connected distributaries got deferred to subsequent years. By not giving priority to potential oriented works, especially in

⁸¹ Culverts, cart bridges, under tunnels, syphons, cross regulators *etc.* A Schematic diagram of canal network is shown in **Chart 2.2.2**.

⁸² Distributary no.31 starts from km. 228 and tails off upto km. 240.

⁸³ Canals in which discharge varies from 0.25 to 3 cubic metre *per second*.

completing the distributaries, canals and minors, the creation of potential got delayed. Till July 2017, the potential pending to be created in respect of Hemavathy Project was 5,968 ha.

- **Absence of planning for land acquisition:** Land acquisition is a tedious process and it takes about three years to acquire land, as notifications are to be issued and finalised in two years as per Land Acquisition Act, 1894. Further, extant orders and Karnataka Public Works Department Code mandate initiation of tender process only after acquisition of land.

Therefore, it was evident that acquisition of land was to be completed before the works were taken up.

However, the Company did not take any action to acquire land in advance with the result that there were land acquisition problems in five of the 19 test-checked projects, which resulted in delay in completion of projects (refer Paragraph 2.2.12.1).

Due to above mentioned reasons, the creation of irrigation potential was slow under Hemavathy Project. A total of 5,968 ha of irrigation potential was pending creation (July 2017) even after a lapse of 12 years from the date of completion of projects envisaged in State Water Policy, *i.e.* by 2005.

The Government replied that there were land acquisition problems in intermittent stretches in km. 201 to km. 228 and compensation (₹ 5.34 crore) for land acquisition was yet to be paid. It was also informed that the Company proposed to create balance irrigation potential of 511 ha under Distributary no.31 during 2017-18.

Creation of Field Irrigation Channels (FICs)

2.2.11.7. The State Water Policy, 2002, acknowledged that there were gaps in the utilisation of created irrigation potential due to delays in the construction of field irrigation channels (FICs). The Policy, therefore, envisaged that top priority would be given to the construction of field irrigation channels, so as to complete them in the shortest possible time (by 2006) and steps taken to utilise the potential created.

FIC programme for the projects in the Cauvery basin was done in its entirety by the Company upto 2013-14. After 2013-14, in addition to the Company, the Command Area Development Authority (CADA Directorate was formed in November 2011), also took up works of FIC creation.

It was observed in audit that:

- **Fixing of lower targets:** The total Field Irrigation Channels (FIC) created by the Company for the projects under its jurisdiction during 2013-14 to 2016-17⁸⁴ irrigated an area of 16,344 ha⁸⁵, by expending

⁸⁴ Information for 2012-13 not available.

⁸⁵ Year (Targets and Achievement): 2013-14 (10,667 ha/7,121.14 ha); 2014-15 (10,067.53 ha/4,232.25 ha); 2015-16 (10,935 ha/3,598 ha); and 2016-17 (686.68 ha/1,393.45 ha).

₹ 16.45 crore. The created FIC irrigated an area, which ranged from 7,121.14 ha in 2013-14 to 1,393.45 ha during 2016-17. This included FICs created to provide irrigation to 12,252.23 ha⁸⁶ in the test-checked project (Hemavathy) and the achievement ranged from 6,555.10 ha in 2013-14 to Nil in 2016-17.

The targets and achievements for creation of FICs dwindled by the year. Though there were no reported constraints to complete the work of creation of FICs, the targets for FIC creation, which was in the range of 10,000 ha per annum during 2013-14 to 2015-16 was drastically reduced to 687 ha in 2016-17 without citing any valid reasons. This resulted in FIC pending creation increasing by the year. As creation of ultimate irrigation by 2006 was a priority item, more importance was to be given for creation of FICs in AWP. At the end of March 2017, FICs pending creation in respect of Hemavathy Project was 42,400.68 ha coming under 50 distributaries⁸⁷ and included 36,663 ha for which, the main work of construction of distributaries and canals were completed prior to 2012.

- **Not providing data to CADA:** The other reason for shortfall in achievement of FICs was that even after the responsibility of creation of FICs was transferred (2015-16) to CADA, based on directions of the Government, the Company was yet (June 2017) to provide details of 'canal through including pipe-outlets'⁸⁸ of the canals, which CADA authorities requested (September/October 2016) to make available.

The Company did not give due importance for the creation of FICs, though the target year for completion of FIC was 2006 as per the State Water Policy and FIC to provide irrigation to an area of 42,400.68 ha was pending.

During the Exit Conference (October 2017), the Principal Secretary emphasised that it was the responsibility of the Company to execute FIC works and stated that not providing last mile connectivity was a serious issue. The Government replied that 6,627.97 ha of FIC was pending with CADA, 4,850.70 ha was proposed to be created under drip irrigation while 1,043.55 ha could not be created due to various limitations⁸⁹. The Government also stated that 29,878.46 ha could not be created due to non-payment of land compensation.

⁸⁶ Year (Targets and Achievement) under Hemavathy Project: 2013-14 (7,753 ha/6,555.10 ha); 2014-15 (5,334 ha/2,314 ha); 2015-16 (8,135 ha/3,383.13 ha); and 2016-17 (Nil/Nil).

⁸⁷ Major areas of Hemavathy Project were under Tumakuru Branch Canal: Nine distributaries (D-1 to D-10) totalling 960.61 ha in Turuvekere Division; 8 distributaries (D-10A to D-23) totalling 3,643.82 ha in Tumakuru Division; 15 distributaries (D-24 to D-31) totalling 13,412.06 ha in Hebbur Division; one distributary (D-26) for 2,323 ha in Yedyur Division; Nagamangala Branch Canal: Four distributaries (D-1 to D-8) totalling 359.52 ha in Turuvekere Division; 13 distributaries (D-9 to D-20) of 20,237.96 ha in Yedyur Division and BNT Exit Canal: 1,463.71 ha.

⁸⁸ Point in the Distributary/Lateral/Minor, from which water is drawn to FICs.

⁸⁹ 30.97 ha could not be created due to high mounds, 84.20 ha was overlapping achnat, 71.26 ha could not be considered as layouts were formed, 857.12 ha could not be created due to railway and national highway crossings.

Unless last mile connectivity is provided by creating FICs, the lands cannot be irrigated defeating the objective of creating the entire infrastructure of canals, distributaries and minors. The Company should, therefore, have ensured prompt payment of land compensation.

Absence of plans for Participatory Irrigation Management (PIM)

2.2.11.8. PIM creates a sense of ownership of water sources and irrigation systems among the users for promoting economy in water use and equity in distribution. This is achieved through the creation of Water Users Co-operative Societies (WUCS) and Federations. The functions of WUCS were to procure water in bulk on volumetric basis from the Irrigation Department or Company and distribute it to the land holders amongst its area of operation.

As per the State Water Policy, 2002, the management of water resources was to be done by adopting a participatory approach. As per Sections 2 and 62 of the Karnataka Irrigation Act, 1965, formation of the four-tier structure in irrigation projects was made mandatory with effect from June 2000. These were Water Users Cooperative Societies (WUCS)-at Sluice point⁹⁰; Water User Distributary Level Federation (WUDL)-at Distributary level; Water Users Project Level Federation (WUPL)-at Project level; and Water Users Apex Level Federation (WUALF)-at State level.

Audit observed that:

- No emphasis was given in the plan documents of the Company for Participatory Irrigation Management. Out of 630 registered WUCS⁹¹, only 357 WUCS were functional⁹² of which, only 54 WUCS⁹³ were active. Similarly, of the three WUPL formed (Kabini, Krishna Raja Sagar and Harangi Projects), only two were active⁹⁴. WUDL and WUALF were yet to be formed (July 2017). Also, only 10 WUCS approached for one time grants during the last five years, for which, grant of ₹ five lakh each was provided for creating basic infrastructure of the WUCS.
- There were no action plans to:
 - a) Vitalise the WUCS by ensuring that Memorandum of Understanding (MoU) are entered with all registered WUCS and make them active. Further, there were no directions to the Executive Engineers of the project divisions to have better co-ordination with the WUCS and Federations.

⁹⁰ An outlet point for letting water from the canals to the fields for irrigation.

⁹¹ Project-wise WUCS given in **Appendix-8**.

⁹² 'Functional' WUCS are those, which are registered under the Societies Registration Act, 1980, and whose registrations are not yet cancelled or WUCS are not liquidated. 'Active' WUCS are those that have complied with the Regulations of the Societies Act, by holding elections, AGMs and Board meetings periodically and submitting reports to the CADA, Administrator, as mandated under the Act.

⁹³ Source: Information obtained from Command Area Development Authority at Mysuru.

⁹⁴ WUPL at Kabini was inactive since April 2015 as it did not satisfy conditions stipulated under the Societies Registration Act.

- b) Hand over the activities of water management to the WUCS.
- c) Allocate funds for maintenance of projects after handing over the projects to the WUCS.

As a result, the present arrangement of the Company raising demand for the water charges and maintaining the canals continued, instead of handing these activities over to the respective WUCS as envisaged.

The Government replied that constant efforts were made to ensure that all the registered WUCS enter into MoUs with the Company. The reply was not correct as there was no substantial progress in this regard and only 54 of the 630 WUCS were currently active.

Improper workings of the Benefit Cost Ratio

2.2.11.9. Benefit Cost (BC) Ratio is the ratio between the net annual benefit (incremental) to the net annual cost of the project, which indicates whether the proposed project gives value for money invested in it or not. It is a measure to assess the economic criteria for taking up an irrigation project. As per the guidelines (2010) of Planning Commission/Central Water Commission, the BC Ratio should be more than 1.5 in normal areas and more than 1.0 in scanty/drought prone areas. Audit observed that the Company worked out incorrect BC Ratios in three projects⁹⁵ as under:

- In the work of Modernisation of Hemavathy Left Bank Canal, the BC Ratio was worked out as 2.05 (as against the correct assessment of 0.92) by overestimating the 'gross value from farm produce' in the calculations and considering the area (lands) which were already being irrigated.
- In the work of Modernisation of Nugu High Level Canal, the BC Ratio was worked out as 1.3 (as against the correct assessment of 0.49) by overestimating the agricultural production per ha as 5.10 tonnes instead of 3.40 tonnes and also considering the entire area of 5,261 ha instead of limiting it to *suffering achkat* of 1,310 ha.

In the absence of a database of projects pending to be taken up (**refer Paragraph 2.2.11.4**), whether alternative projects, which satisfy the BC Ratio were available for execution instead of the above projects, could not be ascertained.

The Government replied that emphasis was on improving the efficiency of the canals system and not the Benefit Cost (BC) Ratio. Moreover, those were only components of the project and BC ratio should be worked out for the project as a whole. The Government also stated that it recomputed the BC

⁹⁵ Of the 19 test-checked projects, BC Ratios were computed for only two of the modernisation works and one potential oriented work. BC Ratio was not computed for Drinking Water Schemes as there was no specific computation prescribed in the CWC Guidelines. In the remaining cases, the Project Reports were prepared prior to issue of the Guidelines.

Ratio of modernisation of Hemavathy Left Bank Canal, which worked out to 1.04.

Audit opined that the Company should have worked out the correct BC Ratio of the project as per the guidelines of Central Water Commission /Planning Commission and then taken a decision on its implementation by comparing it with other projects which required to be executed.

Preparation of incomplete estimates delayed the projects

2.2.11.10. The Company did not prepare proper estimates in four of the 19 selected projects, in spite of provisions in the Karnataka Public Works Department Code and circular instructions. The details of codal provisions and the deviation there against are given in **Appendix-6**. As a result of the deviations, the objectives envisaged in the projects of Chikkaballi Pickup Canal, Garakahalli LIS and Restoration and Rejuvenation of Arkavathy river were not achieved in time. In respect of work of Modernisation of Hemavathy Left Bank Canal, though circular instructions (July 2004 and November 2009) mandated that estimates be prepared after visit to site and controlled blasting be considered only where certain conditions existed, it was observed that after award of contract there was increase in cost due to incorrect classification of strata, incorrect length of the perimeter in the embankment reaches and insufficient provision for controlled blasting resulting in Extra Financial Implication (EFI) of ₹ 145.05 crore above the contract amount of ₹ 620.62 crore.

Conclusion of Audit Objective 1: There were lacunae in planning as the Company was not preparing Zone-wise Annual Works Programmes. The Company did not have a database for selection of projects and carried 3,427 number of spillover works (57 per cent of total works) in its Annual Works Programmes. Lack of priority in planning for potential oriented works and creation of Field Irrigation Channels (FICs) resulted in a total of 5,968 ha of potential oriented work and 42,400.68 ha of FICs for irrigation, remained incomplete even after a lapse of more than 12 years. These works were to be completed by 2005 and 2006 respectively as per State Water Policy, 2002. There were also instances of failure to prepare proper estimates due to non-compliance to Karnataka Public Works Department Code.

Recommendation 1: The Company may prepare the comprehensive Annual Works Programme for effective water utilisation of Cauvery water.

Recommendation 2: Before taking up fresh works, the Company may prioritise completion of all the spillover works pending since many years.

Recommendation 3: The Company may accord greater priority in its plan documents for potential creation and Field Irrigation Canals (FIC), acquisition of land in advance and sharing information with Command Area Development Authority, so that the irrigation potential and FIC are created at the earliest.

Objective 2: Whether the works were executed within the stipulated time frame and the implementation was effective in achieving the objectives as set out in the Project Reports.

With regard to the second audit objective, observations are detailed below:

Project Implementation

2.2.12. Efficient implementation of irrigation projects involves timely award of contracts, ensuring availability of encumbrance-free land, approval of drawings without delays, synchronisation of associated works and coordination with various Departments of the Government. Any delay in implementation of projects would result in time/cost overruns and more importantly would have an effect on the realisation of the objectives, for which, the projects are taken up.

Our examination of the 19 selected projects revealed that 14 projects were delayed beyond their scheduled completion dates and consequently, the achievement of the objectives envisioned in the Project Reports were either delayed or were yet to be achieved (October 2017). Audit, however, observed that most of the delays were due to avoidable factors. The summary of the various deficiencies that caused the delay, project-wise, is given in the table No. 2.2.1.

Table No. 2.2.1: Deficiencies noticed in the selected Projects

Sl. No.	Test Checked projects -->	Potential oriented works		Drinking Water Schemes							Modernisation, improvements and other capital expenditure						Audit observations covered under paragraph no.		
		Hemavathy Project	Malatur LIS	Etechakanahalli	Alambur	Shivasandra	Alilughata and other tanks	Kanva	Nuggehalli	Sriranga	Doddaguni	Garakahalli LIS	Chicklihole	Iggalur barrage project	Chickballi Pickup Canal	Modernisation of Nugu High Level Canal		Hangodu series	Modernisation of HLBC
1	Delay on account of land acquisition	○	○	○							○	○							2.2.12.1
2	Delay in submission and approving the drawings		○		○		○	○	○	○									2.2.12.2
3	Delay due to non-synchronisation of associated work with main work				○	○	○												2.2.12.3
4	Delay due to administrative reasons of the Company													○					2.2.12.4
5	Delay by the contractor (due to non-availability of skilled labour, material)											○	○				○		2.2.12.5
6	Non-compliance to observations of Quality Control Wing / Non-appointment of Third Party Inspectors			○	○	○		○		○				○	○			○	2.2.12.6
7	Poor monitoring of projects					○	○				○	○	○	○					2.2.12.7

As could be seen, a multitude of factors affected the implementation of the projects. Delay on account of land acquisition process, submission and approval of drawings, and non-synchronisation of associated work had the greatest impacts in terms of delay. The analysis of each of the above mentioned factors are detailed below:

Delays on account of land acquisition

2.2.12.1. Whenever private land was required to be acquired for public works, such land was to be acquired as per the provisions of the Land Acquisition Act, 1894. With effect from January 2014, the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013, came into force.

The Assistant Commissioners or Special Land Acquisition Officers (SLAOs) were appointed as the Land Acquisition Officers under the Acts. Presently, five SLAOs⁹⁶ functioned under the jurisdiction of the Company. The SLAOs reported to the Deputy Commissioners of the Revenue Department in land acquisition matters. The administrative expenditure of SLAOs were borne by the Company, as SLAOs were mainly involved in the acquisition of land for the Company.

The Company identified, surveyed and informed SLAOs about the extent of the land required for acquisition. The SLAOs then acquired the land after following the procedures under the Land Acquisition Acts.

Audit observed that five projects⁹⁷ were delayed due to problems in land acquisition.

These key issues are elaborated below:

Table No. 2.2.2: Key issues noticed in land acquisition process

Sl. No.	Extant Orders	Audit Observation
1	Delay in submission of proposals	
	<ul style="list-style-type: none"> As per Para 209 of KPWD Code, 1965, directions of the Chief Secretary in June 2007 and KPWD Code, 2014, (Chapter on 'Budget'- Paragraph 81, Land 	<ul style="list-style-type: none"> The Company did not have plans to acquire land before award of works. Land acquisition proposals in two Projects (Elechakanahalli, Sriranga)⁹⁸ were submitted to SLAOs after award of work, while in another Project (Nuggehalli) ⁹⁹, it was sent partly before and partly after the work was awarded.

⁹⁶ SLAOs at Ramanagara, Mandya, Hassan, Mysuru and Tumakuru.

⁹⁷ Hemavathy, Malalur LIS, Elechakanahalli, Sriranga and Nuggehalli.

⁹⁸ Elechakanahalli: Work was awarded in July 2014 and Land Acquisition (LAQ) proposal submitted to SLAO in September 2014.

Sriranga: Work was awarded in December 2015 and LAQ proposals were submitted upto April 2017.

⁹⁹ Nuggehalli: Work was awarded in March 2013 and LAQ proposal submitted to SLAO between September 2012 and April 2014.

Sl. No.	Extant Orders	Audit Observation
	Acquisition), the work should be commenced, after acquisition of land.	<p>In another two Projects (Hemavathy, Malalur LIS)¹⁰⁰, the extent of land to be acquired was under-assessed. The requests for acquisition of additional land were made during the execution of the works. Submission of proposals after award of work delayed the land acquisition, causing delays in implementation of projects.</p> <ul style="list-style-type: none"> • Audit observed that there was shortage of surveyors in the Company to conduct surveys for the land identified for acquisition. As against the sanctioned strength of 62 Surveyors, the working strength was only 14, representing a 77 per cent shortage (at end of March 2017). However, the Company stated (July 2017) that though there was shortage of surveyors, the process of survey was undertaken with the help of revenue authorities by working on holidays.
2	Delay in making payments	
	<ul style="list-style-type: none"> • Para 153 (a) and (b) of Karnataka Financial Code 1958, mandate that in cases of acquisition of land for public purposes, Departmental Officers should see that compensation was settled before possession or compensation was not delayed. 	<ul style="list-style-type: none"> • In one test-checked Project (Hemavathy)¹⁰¹, there was non-payment to existing land owners after award of land compensation (April/August 2016) in spite of request (August 2016/May 2017) for ₹ 5.22 crore by SLAOs. <p>Reason: Failure of the Company to allot funds for land acquisition under potential oriented works, despite receiving additional funds of ₹ 247.68 crore toward land acquisition during January 2017. The funds released were used for making payments to cases where amounts were long overdue (refer row below) and where Execution Petitions were ordered by the Courts.</p>
3	Contractor unable to get consent from land owner and execute the work	
	<ul style="list-style-type: none"> • One of the conditions (Notes: Point 13 and Clause 1 of the Additional conditions of contract) of tender notification was that if any land, either in parts or in whole, required for the work was not acquired by the Company, it shall be the responsibility of the bidder (contractor) to take possession of such land and start the work by consent of the land 	<ul style="list-style-type: none"> • In the test-checked Project of Hemavathy, for potential creation in the stretch from km. 201 to km. 240¹⁰² of Tumakuru Branch Canal, audit observed that out of 9 packages of earthwork excavation awarded, 6 packages were rescinded as the land owners objected to the work without payment of compensation. As a result, potential creation in these stretches is getting delayed. <p>Reason:</p> <ul style="list-style-type: none"> • Non-payment of land compensation. • Due to non-settlement of land compensation in earlier cases, the Contractors were finding it difficult to convince the new land owners to give up their lands. For the Company as a whole, the

¹⁰⁰ Hemavathy: km. 201 to km. 210 of Tumakuru Branch Canal–Work was awarded in September 2012. LAQ for additional land/left over cases (34 acres 7 guntas) were submitted to SLAO in April/May 2016.

Malalur LIS: Work was awarded in August 2012 and LAQ proposal for additional land (7.12 acres) was submitted in November 2014 and for another 11.31 acres in June 2016.

¹⁰¹ Hemavathy: Land acquisition under km. 201 to km. 210 of Tumakuru Branch Canal.

¹⁰² Including Distributary no.31, which starts from km. 228 of Tumakuru Branch Canal.

Sl. No.	Extant Orders	Audit Observation
	owners or by negotiations before commencement of work at no extra cost to the Company.	land compensation pending, at end of August 2017, amounted to ₹ 534.28 crore ¹⁰³ , which included cases pending since 2006 ¹⁰⁴ . The amount included ₹ 136.70 crore where Execution Orders were issued by the Courts. The scenario is difficult and with such a background, the chances that the contractors would get consent of the land owners without payment of compensation, are bleak.

Thus, lack of planning for taking advance action for acquisition of land, non-compliance with extant orders and directions and diversion of funds allocated for land acquisition for other capital works, delayed the completion of the projects. The objectives envisaged in the Project Reports of potential creation (Malalur LIS: 1,200 acres, Hemavathy: 5,968 ha) and filling up of 17 tanks to provide drinking water under the Projects (Nuggehalli: 15 villages, Elechakanahalli: 28 villages) were not achieved even after a lapse of two to four years.

The Government replied that it was the usual practice of the Company to entrust the work for execution and carry on the land acquisition process parallelly in order to freeze the cost of the project. The cost of the project would increase if the Company waited for the completion of the land acquisition process, which usually requires a minimum of three years. The reply further stated that in respect of the Hemavathy Project, potential creation was pending in intermittent stretches in km. 201 to km. 228 as land compensation was not paid and fresh proposals were sent under Land Acquisition Act, 2013, for such cases of acquisitions. In respect of Malalur LIS, it was accepted that land acquisition proposals were sent to SLAOs after award of work due to shortage of surveyors.

The reply should be viewed from the point that works awarded were to be completed in one year's time. If it was an accepted fact that land acquisition takes about three years' time and due to shortage of surveyors, payment of compensation for awarded cases would be delayed, it was a known fact that there would inevitably be delays. Freezing of costs for the project was for an administrative action of approval of the project. As land costs are not part of awarded cost, it was not justified to cite freezing of cost of project as a reason for not taking action to acquire land in advance. The fact remained that the Company did not comply with KPWD Code and extant orders mandating acquisition of land before award of contracts. The issues related to land acquisition faced in the projects, mentioned in the audit observation, could have been avoided.

Recommendation 4: The Company may take action for making payment towards land compensation, which were overdue since many years.

¹⁰³ In the absence of age-wise details, the interest component was not quantified.

¹⁰⁴ In test-checked Office of the Special Land Acquisition Officer at Tumakuru.

Delays in submission and approving the drawings

2.2.12.2. The Design, Quality Control and Technical Vigilance Wing of the Company, headed by a Superintending Engineer, was formed (September 2003) with the aim of bringing out uniform design procedures for various types of irrigation structures and to have proper quality control over the quality of works. The Design Wing cleared the drawings, which were then approved by the Chief Engineer and the Technical Subcommittee, before the works were awarded. For the works in which the preparation of designs and drawings were in the scope of the contractor, the timelines for submission were mentioned in the Activity Chart/Bar Chart forming part of the agreement.

Audit observed that in five Drinking Water Schemes (DWS) and one potential oriented work¹⁰⁵ there were delays in submission of drawings by the contractor for periods upto a year. The Company also delayed the approval of drawings from periods ranging from one month to 13 months as detailed in **Appendix-7**. The overall delay in approval of drawings, when compared to the dates committed in the activity charts in these six projects, ranged from four months to 22 months.

One of the main reasons for the delay on the part of the Company was the long process time at various levels (official hierarchy) while approving the drawings. There were no time limits fixed for approval of drawings at each level of hierarchy.

An illustrative case indicating the time taken at various levels in respect of Sriranga DWS is given in the **Chart No. 2.2.3** alongside.

The other aspect was the shortage of staff in the Design Wing, which did not have dedicated sanctioned strength. The Design

Chart No. 2.2.3: Time taken for approval of Longitudinal Section and Raising Main drawings of Sriranga DWS.

Sl. No.	Process flow	Dates	Time taken (days)
1	Contractor submits drawings	16.1.2016	-
2	Opinion of the Consultant	23.1.2016	7
3	Chief Engineer approved the drawings subject to modifications	30.1.2016	7
4	EE requests contractor for modifying drawings	6.2.2016	7
5	Contractor submits drawings to AEE	7.4.2016	60
6	AEE forwards to EE	16.4.2016	9
7	EE to SE	20.4.2016	4
8	SE to CE	20.4.2016	-
9	CE to Consultant	31.5.2016	40
10	Recommendation to CE for approval by Consultant	6.6.2016	6
11	CE to SE intimating approval	12.9.2016	96
Total time taken for approval		8 months	
Due date for submission and approval of drawings as per contract		February 2016	
Delay		6 months	

AEE: Assistant Executive Engineer; EE: Executive Engineer; SE: Superintending Engineer; CE: Chief Engineer.

¹⁰⁵ Drinking Water Schemes: Alambur, Nugehalli, Kanva, Sriranga, Alilughatta and other tanks. Potential oriented work: Malalur LIS.

Wing, which hitherto (before formation of Company) had three separate wings in each Zone with Technical Assistants and Engineers totaling 14 Officers, currently functioned with 6 Officers only. The Design Wing requested for additional staff and they were yet to be posted (November 2017).

The delay in submission and approval of designs and drawings by the Contractor and the Company resulted in delay in completion of the projects, thereby delaying the achievement of providing irrigation (Malalur LIS: 1,200 acres) as well as filling up of 56 tanks (for providing drinking water to 248 villages¹⁰⁶) under four Drinking Water Schemes, on which, cumulatively an expenditure of ₹ 496.02 crore was incurred (March 2017).

The Government replied that approval for designs and drawings were delayed owing to scrutiny at various levels (Alambur), delay by the contractor in not submitting the drawings of the pump house as per Detailed Project Report (Nuggehalli), change in location of pump house (Sriranga) and clarifications submitted several times (Malalur LIS).

The fact remained that delays on the part of the Company and contractor delayed the approval of the drawings, which in turn affected the realisation of the objectives envisioned in the Project Reports.

Recommendation 5: The Company may fix timeline for approval at various levels for clearance/approval of drawings, so that the process time for granting approvals is regulated.

Non-synchronisation of associated work with main work

2.2.12.3. Proper synchronisation of all the associated works are essential for timely completion of a project. While the Company awards the main work of implementation of the projects, certain components of works, viz. field survey, providing electrical infrastructure, etc. are separated from the main work and tenders are invited separately for these associated works.

Audit observed that there were deficiencies in synchronisation of associated works with the main work and as a result the completion of the project as a whole was hampered. The cases noticed in test-checked projects are given below:

Table No. 2.2.3: Non-synchronisation of associated works with the main work

Sl. No.	Project name and details of the Main work	Details of associated work(s), which affected the main work	Cause and impact of the non-synchronisation of associated work(s)
1	Alambur: The main work for filling up tanks for providing drinking water was awarded in February 2012 and was to be	As per the activity chart of the main work, work of construction of sub-station and lines were to be undertaken from September 2012 and	<ul style="list-style-type: none"> Delay in initiating tender for associated work. As per activity chart of the main work, the electrical work was to commence from September 2012. Therefore, the tenders should have been invited in July 2012. Instead, the estimates for the associated work was approved in February 2013 and tender called for in

¹⁰⁶ Alambur: 20 tanks/52 villages, Nuggehalli: 11 tanks/15 villages, Kanva: 17 tanks/115 villages and Alilughatta: 8 tanks/66 villages.

Sl. No.	Project name and details of the Main work	Details of associated work(s), which affected the main work	Cause and impact of the non-synchronisation of associated work(s)
	completed by August 2013. The Project, with three lift works were commissioned in August 2014, December 2014 and April 2015.	completed by August 2013. The Company, however, invited tenders for the work of providing sub-station and electrical connection for pumping machinery in March 2013. As sole bidder did not qualify technically, tenders were re-invited in May 2013. After negotiation with the bidder, the work was finally awarded in December 2013, after five months.	March 2013, after delay of eight months. <ul style="list-style-type: none"> • Delay of two months (March 2013 to May 2013) for payment of supervision charges of ₹ 52.50 lakh after it was demanded by the State Transmission Utility. • Holding negotiations for five months (August 2013 to December 2013) for works with scheduled completion time of four to six months. Due to delay in commissioning of the main work, the objective of filling 20 tanks to supply water to 52 villages was delayed. The Government replied that the rates quoted by the contractor were high (20 per cent above the estimated cost) and due to negotiations, the work was awarded in December 2013. The reply was not correct as there was no justification for not inviting tenders for sub-station works by July 2012 to complete the work as envisaged in the Activity Chart. The Company negotiated with the contractor for five months and awarded the works at 19 per cent above the estimate cost, as against the offer of 20 per cent above the estimated cost.
2	Shivasandra: The main work for filling up tanks for providing drinking water was awarded to contractor in March 2015 and was scheduled to be completed by April 2016. The work was completed in July 2016.	The work of installing 11 kV Breaker was awarded (November 2016) to contractor for ₹ 14.30 lakh. The work was to be completed in thirty days, which was still ongoing (July 2017) for want of Breakers.	Though the main work was completed in July 2016, absence of Breaker delayed the operationalization of the lift irrigation works of the project. As a result, the objective of filling up seven tanks to supply drinking water to 19 villages was not achieved in spite of incurring ₹ 8.59 crore on the project. The Government replied that due to delay in supply of breaker by Mysore Electricals Limited (a State PSU), the work could not be completed in time and was completed in August 2017. The reply does not address to the audit observation on delay of six months in awarding the associated work.
3	Alilughatta and other tanks: The main work for filling up tanks for providing drinking water was awarded in May 2015 and was to be completed by August 2016. The work was still pending (July 2017).	The work of survey and preparation of land acquisition proposals (an associated work) required for laying of pipes, was tendered only in August 2016 and the work awarded only in December 2016. The work, which was to be completed in two months (February 2017) was yet to be completed (July 2017) due to delay on the part of the contractor.	The associated work was awarded in December 2016 (i.e. four months after the scheduled date for completion of main work in August 2016). The completion of the main work by August 2016 was affected due to non-completion of the work of survey for land acquisition. As a result, the objective of filling eight tanks (to provide water to 66 villages) was not achieved. The Government replied that original land records of the proposals were missing from the Deputy Commissioner's Office, Tumakuru and fresh land acquisition proposals were submitted in June 2017 and that there were delays due to non-approval of Extra Financial Implications. The reply does not address the reason for delay in inviting tenders for survey work, in the first place.

It could be noticed that in the above three projects, the associated works were awarded after the scheduled completion date of the main work, without recording any reasons for such delays. This resulted in non-synchronisation

with the main work and affected the completion of the project as a whole. As a result, the objective envisaged in the three projects of filling up of 35 tanks (to provide drinking water to 137 villages), on which, an amount of ₹ 294.87 crore was expended, was not realised.

Recommendation 6: The Company may ensure that the associated works are awarded in synchronisation with the main work.

Delay due to administrative reasons of the Company

2.2.12.4. Chikkaballi Pickup Canal (Mandya Division) acts as a feeder channel to Keragodu Branch Canal, which provides water to 3,200 acres. The work of construction of modernisation of Chikkaballi Pickup Canal was awarded in January 2010 for ₹ 5.83 crore and was to be completed by March 2011.

As a result of omission of the work of fixing crossover pipes in the estimate (refer Paragraph 2.2.11.10 and Appendix-6), the Contractor had to execute extra quantities/items of excavation resulting in Extra Financial Implication (EFI). The request (November 2011) of the contractor for the then prevailing Schedule of Rates for extra quantities were not accepted, and hence, the contractor was not willing to execute the work. The division proposed (August 2012) EFI, which was not agreed to (October 2012) by higher authorities as it was a clear case of omission/error in estimate and not technically justifiable.

Meanwhile, the contractor stopped (April 2013) the work after executing work valued at ₹ 2.31 crore. Finally, a Third Party Scrutiny Team was formed (April 2013) to examine the EFI proposal. The Officers of the Company did not provide details of the work to the Team until March 2014, which further delayed the execution of the work. Thereafter, after receipt of details, the Third Party Scrutiny Team submitted its Report in April 2014. Upon submission of the Report, the contractor took up the work and completed the same in June 2015. The EFI of ₹ 70.06 lakh was approved in November 2015.

Thus, delay in approval of EFI, and delay by the officials of the Company to provide details to the Third Party Scrutiny Team resulted in delay in completion of the project by four years (July 2011 to June 2015). The objective of providing water to 3,200 acres of *achkat* of Keragodu Branch Canal suffered.

The Government replied that there was no delay on the part of the contractor or Company. The delay was attributable to seepage in the canal. Furthermore, the reply stated that water was given to farmers without interruption.

The reply was not correct as the contractor communicated that he would not proceed with the work until the EFI was approved. It was also seen that the Company provided documents after one year to the Third Party Scrutiny Team. Moreover, taking up the work itself remains unjustified, as water could be given to the farmers even without completion of the project.

Delay by the contractor

2.2.12.5. Audit observed that in three projects¹⁰⁷, the delay was on the part of the contractor due to non-availability of labour and sand and also due to presence of water in the canal.

Procurement of materials and sourcing of labour was the sole responsibility of the contractor. Presence of water in the canal was due to the reason that the contractor did not complete the work within the stipulated non-monsoon period. These delays attributed to the contractor were avoidable.

The Government accepted (November 2017) the reasons pointed out by Audit as the factors that contributed to the delay and stated that nominal penalty was levied.

Quality Control and Third Party Inspections

2.2.12.6. Quality Control (QC) Wing with two divisions assisted the Executive in discharging their primary responsibility of ensuring the quality of work as stipulated in the specifications of the work.

As per the Order (February 2005) of the GoK, independent Third Party Inspectors-TPI (also called Quality Supervision Consultant-QSC) were to be mandatorily appointed for all the works with estimated cost of more than ₹ two crore. The Managing Director also issued (December 2015) circular mandating appointment of Third Party Inspectors for all works costing above ₹ two crore and Project Management Consultants for works costing above ₹ five crore.

Audit observed that:

- The Executive Engineer of Quality Control Divisions inspected the projects and issued Inspection Notes. However, in respect of 33 Inspection Notes of six test-checked projects¹⁰⁸, the divisions, which were executing the work did not submit Action Taken Reports (ATRs). The ATRs were pending for five months to six years from the date of Inspection till date (May 2017). The nature of the observations of Quality Control wing included use of sand after sieving to meet the Indian Standard Codes, directions to get sand and cement checked before putting to use, and covering the pipes as the 'in-lining and guniting'¹⁰⁹, of pipes were exposed to sun, *etc.* Failure to comply with the directions mentioned in the Inspection Notes of Quality Control Wing raises doubts on the quality of work executed.

The Government replied that the Quality Control tests were conducted regularly by the Company and the results were satisfactory

¹⁰⁷ Iggalur Barrage Project, Chiklihole and Hanagodu series.

¹⁰⁸ Name of the Project (No. of inspection notes issued/Action Taken Report pending receipt): Chikkaballi Pickup Canal (3/1), Alambur (11/6), Kanva (15/15), Elechakanahalli (3/2), Modernisation of Nugu High Level Canal (7/6) and Modernisation of HLBC (20/3).

¹⁰⁹ Watering the pipes.

(Chikkaballi, Alambur). It further stated that ATRs were given (Kanva, Elechakanahalli).

The reply was not factually correct as the Quality Control Inspection Wing continues to indicate in their records that ATRs to the Inspection Notes of these projects are pending.

- The Company did not appoint Third Party Inspectors in all except four of the 16 test-checked projects, where awarded costs were more than ₹ 2 crore. In the four cases too, they were belatedly engaged as detailed below:
 - In the work of modernisation of Hemavathy Left Bank Canal, by the time Third Party Inspectors were appointed (March 2016), about 50 *per cent* of the main work was already completed.
 - In the work of Shivasandra Drinking Water Scheme (DWS), the majority of the main work of the project was already completed by July 2016. Thus, the appointment of Third Party Inspectors in December 2016 did not serve its envisaged purpose.
 - In Sriranga DWS, by the time the Third Party Inspectors was engaged (October 2016), several items of work like earthwork excavation for foundation and sump structure, plain cement concrete for foundation, *etc.* were already completed.
 - In the work of Modernisation of Nugu High Level Canal, though the main work was awarded (June 2016) at a cost of ₹ 109.11 crore, no Third Party Inspectors were engaged to conduct QC tests.

By delaying the appointment/not appointing the Third Party Inspectors, the essence of the Government Order of February 2005 to ensure adherence to quality standards, check corrupt practices and instill public confidence in the system was not achieved.

Further, it was also observed that the Third Party Inspection Reports were not routed through the Quality Control Divisions of the Company, thereby keeping the QC Divisions uninformed about the findings and action taken by the work executing divisions.

The Government replied that the Company had Quality Control Officers and without third party inspection also, the Company executed quality work as per specifications. It was further stated that in future, Quality Control and Third Party tests would be done independently and results of Third Party Inspection would be routed through the Quality Control Divisions.

Recommendation 7: The Company may monitor Action Taken Reports in the meetings and act upon them promptly.

Monitoring

2.2.12.7. Monitoring was recognised as a useful management tool for ensuring timely completion of projects. The State Water Policy, 2002, stipulates close

monitoring of planning, execution and performance of water resources projects to identify bottlenecks and to obviate time and cost overruns.

Audit observed that:

- The Board of Directors (BoD) did not discuss the progress of work of any of the projects during 2012-13 to 2016-17 as it was not submitted to BoD.
- Only eight¹¹⁰ out of 14 projects, which were delayed of the 19 test-checked projects (**Appendix-4**), were discussed by the Managing Director during the nine meetings held with the Chief Engineers/Superintending Engineers/Executive Engineers during the last five years. Further, no specific instructions were issued to the Officers for taking remedial or proactive action to resolve issues.

The Government replied that action would be taken to evolve a suitable system to discuss the progress and problems involved in delay in completion of projects in regular intervals.

Manpower

2.2.12.8. At the end of March 2017, the Company had a sanctioned strength of 2,928 employees under 76 different cadres, of which, men-in-position were 1,904, leaving a vacancy of 1,024 employees, representing about 35 *per cent* vacancy. The main shortage was in the cadre of Assistant/Junior Engineers, Assistants, Surveyors, *Sowdies*¹¹¹ and Watchmen.

The effect of the shortage of surveyors in land acquisition process is brought out in **Paragraph 2.2.12.1**, while the effect of shortage of other staff/officers (35 *per cent* shortage) on the implementation of projects could not be quantified.

The Government replied that action would be taken to recruit necessary staff.

Conclusion of Objective 2: The implementation of the projects suffered due to land acquisition problems, delays in approval of designs, non-synchronisation of associated works with main works and other administrative reasons, all of which, were avoidable factors. Adequate attention was not being given to Inspection Reports of the Quality Control Divisions. Monitoring of projects was inadequate due to lack of proper reporting system to the Board of Directors.

All these factors have resulted in 14 out of 19 test-checked projects being delayed, resulting in partial achievement of the objectives of creation of irrigation potential and filling up of tanks for providing drinking water to

¹¹⁰ *Discussed:* Hemavathy Project, Malalur LIS, Elechakanahalli, Alambur, Kanva, Nuggehalli, Hanagodu series and Arkavathy river rejuvenation; and

Not-discussed: Alilughatta and other tanks, Shivasandra, Chiklihole, Iggalur Barrage Project, Chikkaballi Pickup Canal, Garakahalli.

¹¹¹ Whose duties included Water management of the canals.

villages envisaged in the Project Reports, and non-achievement of objectives of modernisation of canals. The total amount expended on these delayed projects was ₹ 560.32 crore¹¹².

Conclusions

Of the 19 Projects test-checked in audit, three projects were completed in time, 14 projects were delayed, while the remaining two were under progress.

The main reasons for the delay in completion of the projects were deficiencies in planning and implementation. There was non-compliance with Karnataka Public Works Department Code/Extant orders on land acquisition and delay in payment of compensation for land acquired. Further, delays in approval of designs and drawings, non-synchronisation of associated works and insufficient monitoring, all of which, were avoidable factors also led to delay in completion of works.

As a result, a total of 5,968 ha of potential oriented work and 42,400.68 ha of Field Irrigation Canals were pending completion even after 12 years of the target years of completion as envisioned in the State Water Policy, 2002. In addition, the benefits envisaged in the Project Reports of filling up of 81 tanks (for providing drinking water to 310 villages), providing water to *suffering achkat* of 3,200 acres and efforts to restore and rejuvenate the Arkavathy river were delayed and the objectives were not realised in time. A total expenditure of ₹ 560.32 crore was incurred on this.

¹¹² Expenditure on Hemavathy Project was not considered as it represents test-checked cases only.

Appendix-4

(Referred to in Paragraphs 2.2.10, 2.2.12.7)

Details of selected Projects and status of achievement of the objectives in Cauvery Neeravari Nigama Limited

(₹ in crore)

Category/ Project	Awarded cost	Date(s) of Award of work	Expendi- ture incurred ¹⁵⁵ (March 2017)	Scheduled date of completion	Status of the project as on June 2017 with month of completion (per cent completed)	Status of achievement of the objectives envisaged in the Project Reports
Potential oriented works						
1.Hemavathy (77 works test- checked)	73.68	September 2012 to March 2017	54.93	March 2013 to June 2017	Yet to be completed	Creation of 5,968 ha of irrigation potential out of 11,706 ha ¹⁵⁶ in km 201 to km 240 of Tumakuru Branch Canal under the Project has not been achieved, as works in these stretches have not been completed (November 2017).
2.Malalur Lift Irrigation Scheme (LIS)	6.31	August 2012	2.25	August 2013	Yet to be completed (35.66)	Providing irrigation to 1,200 acres (485 ha) of land has not been achieved. In spite of non-completion of the project, 485 ha have been declared as created with irrigation potential.
Drinking Water Schemes (DWS)						
3.Elechakana- halli	17.75	July 2014	7.51	May 2015	Yet to be completed (42.31)	Filling up of six tanks (to provide drinking water to 28 villages) has not been achieved.
4.Alambur	253.58	February 2012	260.43	August 2013	Delayed but completed (April 2015)¹⁵⁷ (100)	Filling up of 20 tanks (to provide drinking water to 52 villages) was achieved belatedly, after delay of 1½ years.
5.Shivasandra	12.43	March 2015	8.59	April 2016	Delayed but completed (July 2016) (100)	Project was yet to be operationalised for last one year for want of power connection, resulting in not filling up seven tanks (to supply drinking water to 19 villages).

¹⁵⁵ The expenditure incurred mentioned here differs from the values adopted for purpose of sampling, as the values mentioned therein represents expenditure incurred only during the last five years (2012-17), while the expenditure mentioned here represents total expenditure on the work, including those prior to 2012.

¹⁵⁶ The potential was stated to be 12,218 ha from km 201 to km 240 in certain other documents of the Company.

¹⁵⁷ The work was commissioned in three Stages: Stage-1 in August 2014, Stage-2 in December 2014 and Stage-3 in April 2015.

Category/ Project	Awarded cost	Date(s) of Award of work	Expendi- ture incurred ¹⁵⁸ (March 2017)	Scheduled date of completion	Status of the project as on June 2017 with month of completion (per cent completed)	Status of achievement of the objectives envisaged in the Project Reports
6. Alilughatta and other tanks¹⁵⁸	32.71	May 2015	25.85	May 2016	Yet to be completed (79.03)	Filling up of eight tanks (to supply drinking water to 66 villages) has not been achieved, even after delay of one year.
7. Kanva	180.78 + 44.22 (Additional work)	February 2013 and November 2016	200.22	August 2014 and March 2017	Delayed but completed (May 2015) Additional work yet to be completed (88.99)	Filling up of 17 tanks (to supply drinking water to 115 villages) has been completed after delay of nine months. Additional work to fill 62 tanks in forest areas are pending.
8. Nuggehalli	16.68	March 2013	9.52	September 2014	Yet to be completed (57.07)	Filling up of 11 tanks (to provide drinking water to 15 villages) has not been achieved, even after lapse of three years.
9. Sriranga	324.68	December 2015	101.54	December 2017	Work delayed, but completion date was not due (31.27)	The work of creating infrastructure for filling up of 83 tanks (to supply drinking water to 277 villages) are not yet due for completion, and was behind schedule.
10. Doddaguni	3.69	July 2012	4.49*	August 2013	Completed in time (August 2013) (100)	The work of creating infrastructure to fill Doddaguni tank (to provide drinking water to the 15 villages) was completed on time.
Modernisation, improvement and other capital works						
11. Garakahalli LIS	11.31	July 1999/ January 2010/ January 2016	12.47*	June 2000/ March 2011/ April 2016	Yet to be completed (minor works pending)	Objective of filling up 11 tanks (15 villages) not achieved, even after delay of one year.
12. Chiklihohle	4.48	October 2015 to April 2016	4.83	March 2016/ August 2016	Delayed but completed (March 2017) (100)	Work of strengthening embankment and improvements has been completed after delay of six months, thereby resulting in difficulty to provide water to tail end for one season.
13. Iggalur Barrage: a) Rejuvenation of LIS D-point	1.76	March 2015	1.61	June 2015	Delayed but completed (March 2016) (100)	Filling up of Elethotadahalli tank has been achieved after delay of nine months.

¹⁵⁸ The project involved providing drinking water to villages by lifting water from different point of the Tumakuru Branch Canal (TBC) to fill Hagalwadi tank (from km 83.34), Alilughatta and Amanikere tanks (from km 88.35), Mathikere, Hosahalli and Shivanehalli tanks (from km 93.85), Kodyala tank (from km 98.95) Cheluru tank (from km 101.38).

Category/ Project	Awarded cost	Date(s) of Award of work	Expendi- ture incurred ¹⁵⁵ (March 2017)	Scheduled date of completion	Status of the project as on June 2017 with month of completion (per cent completed)	Status of achievement of the objectives envisaged in the Project Reports
<i>b)Replacement of starters of LIS C-point</i>	0.07	April 2015	0.07	May 2015	Delayed but completed (December 2015) (100)	Proper functioning of Pumps was affected for six months (one season).
14.Chikkaballi pickup canal	5.83	June 2010	6.70*	July 2011	Delayed but completed (June 2015) (100)	Objective of supplying water to 3,200 acres of <i>suffering achkat</i> to the tail end of Keragodu Branch canal was achieved after delay of four years.
15.Modernisat ion of Nugu High Level Canal	109.11	June 2016	107.73	January 2017	Completed in time (January 2017) (100)	Objective of supplying water to the <i>suffering achkat</i> of 1,310 ha has been achieved in time.
16.Hanagodu series (Five of the 36 packages test- checked)	1.19	February 2012 to March 2012	1.14	May 2012 to July 2012	Delayed but completed (June 2012 to June 2014) (100)	These were in the nature of protective works. The works were delayed up to two years, resulting in difficulty to fill water to 42 tanks.
17.Modernis- ation of Hemavathy Left Bank Canal (HLBC)	620.62	October 2015	428.71	July 2017	Completed major items of work in time (August 2016) (100)	The work of modernisation to enhance the capacity to discharge 4,000 cusecs water through the canal was achieved in time.
Restoration and Rejuvenation of Rivers						
18.Arkavathy	24.08 + 1.63 (Additio- nal work)	August 2012/ January 2017	19.13	May 2013/ April 2017	Package I, III delayed but completed (December 2013/March 2014) Additional work (package-II) yet to be completed (74.41)	The Company conducted impact study by visual method ¹⁵⁹ on 241 of the 582 tanks. It was found that 37 tanks filled up 100%, 48 tanks (80 % to 100 %), 73 tanks (60 % to 80 %) and 83 tanks (below 60 %). Further, it was also noticed that Hesarghatta and TG Halli reservoir received inflows after a long period.
19.Shimsha	The work not yet tendered and only cost on advertisements for tendering was incurred.					The work was yet to be taken up (June 2017).

Source: Compiled from the records of the Company

*In respect of these projects, there was Extra Financial Implication and hence the actual costs exceed initial awarded costs.

¹⁵⁹ Due to deficient rainfall in 2015-16 and 2016-17 and as no data (pre and post implementation) of the tanks was maintained by the Minor Irrigation Department for all the tanks, it was not possible to evaluate the impact in audit, nor verify the veracity of the Impact Study done by the Company.

Appendix-5

(Referred to in Paragraph 2.2.11.6)

Details of funds requested from Government, allocated by Cauvery Neeravari Nigama Limited and actual expenditure incurred during 2012-17

(A: ₹ in crore) and (B: in per cent)

Category	2012-13			2013-14			2014-15			2015-16			2016-17		
	Funds requested	Allotted for works	Actual Expenditure	Funds requested	Allotted for works	Actual Expenditure	Funds requested	Allotted for works	Actual Expenditure	Funds requested	Allotted for works	Actual Expenditure	Funds requested	Allotted for works	Actual Expenditure
A. In monetary terms ₹ in crore)															
Potential oriented works	632	265	198	291	248	182	Individual allocation not available	165	178	497	144	161	550	135	219
Field Irrigation Channels		29	8		8	5		7	2		9	1		1	1
Drinking Water Schemes/Tank filling	482	183	124	465	274	242		180	112	597	99	116	1032	260	262
Modernisation/improvements and other capital works	1129	465	289	1302	513	424		562	400	1735	596	581	1871	862	1060
Land acquisition	85	50	45	100	30	56		75	48	598	150	113	273	197	127
Maintenance	150	71	62	110	54	63		63	62	88	62	67	250	62	48
Establishment	100	90	94	110	80	101		126	108	138	137	109	150	125	103
Debt servicing and Guarantee commission	162	162	158	62	63	60		15	14	53	66	45	107	94	116
Accelerated Irrigation Benefit Programme, Scheduled Castes Plan, Tribal Sub-Plan, Special Development Plan (Others)	0	137	61	0	309	91		282	163	979	568	150	330	467	256
Total	2740	1452	1039	2440	1579	1224		3250	1475	1087	4685	1831	1343	4563	2202
B. In per cent (corresponding to above)															
Potential oriented works	23	18	19	12	16	15		11	16	11	8	12	12	6	10
Field Irrigation Channels		2	1		1	*			*	*	*	*		*	*
Drinking Water Schemes/Tank filling	18	13	12	18	17	20		12	10	13	5	9	23	12	12
Modernisation/ improvements of canals and other capital works	41	32	28	53	32	35		38	37	37	33	43	41	39	48
Land acquisition	3	3	4	4	2	5		5	4	13	8	8	6	9	6
Maintenance	5	5	6	5	3	5		4	6	2	3	5	5	3	2
Establishment	4	6	9	5	5	8		9	10	3	7	8	3	6	5
Debt servicing and Guarantee commission	6	11	15	3	4	5		1	1	1	4	3	2	4	5
Accelerated Irrigation Benefit Programme, Scheduled Castes Plan, Tribal Sub-Plan, Special Development Plan (Others)	0	10	6	0	20	7		0	20	16	20	32	12	21	12
	100	100	100	100	100	100		0	100	100	100	100	100	100	100

*less than one per cent (Source: MMR of the Company)

Appendix-6

(Referred to in Paragraphs 2.2.11.10, 2.2.12.4)

Deficiencies noticed in the preparation of estimates in Cauvery Neeravari Nigama Limited

Sl. No.	Requirement/Norms	Key deficiencies noticed in Audit	Cause and effect of the lapse
1	<ul style="list-style-type: none"> Paragraph 115 to 133 of PWD Code Volume-1 provides elaborate guidelines to be followed at the time of preparation and sanction of the estimate. As per Internal Control Manual of KBJNL (Chapter – VI - Preparation of Estimates-para 3.1 and 3.2 and Annexure-XIV, it was the responsibility of the concerned Executive Engineer to prepare the estimates and the estimates should have been prepared after detailed survey investigation and considering most economic technically feasible alignment. 	<ul style="list-style-type: none"> Chikkaballi Pickup Canal: The work of construction of 31 pipe crossovers was omitted while preparing estimate in 2009. 	<ul style="list-style-type: none"> Due to defective estimate, work was delayed. Water could not be provided to the suffering achkat of Keragodu Branch canal. The estimate was defective due to lapse on the part of the Company officials for which the Chief Engineer directed to take action on the Officers concerned. <p>The Government replied that the work was carried out as per instructions of Chief Engineer.</p> <p>The fact remained that the estimates were deficient to that extent.</p>
		<ul style="list-style-type: none"> Restoration and Rejuvenation of Arkavathy river: The work of removal of silt, which was in the form of liquid waste generated by the villages and cities and flowing along 70 km stream under Package-III, was not included in the estimate. <p>The contractor agreed to execute the work as an extra item at then prevailing Schedule of Rates, which was not agreed¹⁶⁰ by the Company.</p>	<ul style="list-style-type: none"> The Company did not access the field conditions and include the item of removal of liquid waste in the estimate. In the meeting held in June 2016, it was stated that the liquid waste flowing in the stream did not hamper the flow in the stream and hence the work was not executed. As a result of not ensuring the site conditions and non-inclusion of work of removal of liquid waste effected the quality of water flowing in the stream and was detrimental to the rejuvenation of the river flows. <p>The Government replied that item of removal of liquid waste was not included in the estimate as it did not cause obstruction to flow of water. However, subsequently, the farmers highlighted that the congestion in the main stream was causing submergence of agricultural land.</p> <p>The company failed to include this item in the estimate and has also failed to execute the work till date (September 2017) so as to ease the flow of water.</p>
		<ul style="list-style-type: none"> Garakahalli LIS: The main work of Lift 	<ul style="list-style-type: none"> Lapse on the part of the Company in not recording the reasons for excluding the item of linking of

¹⁶⁰ The original work was awarded at 11.57 per cent less than the updated cost.

Sl. No.	Requirement/Norms	Key deficiencies noticed in Audit	Cause and effect of the lapse
		<p>Irrigation was awarded in July 1999 and as it was not completed, it was again awarded in January 2010. The work was completed in March 2012.</p> <p>In both these tenders (1999/2010), the work of linking 11 tanks through pipes was not included while inviting tenders, though it was present in the estimate.</p>	<p>tanks, while inviting tenders in 1999/2010.</p> <ul style="list-style-type: none"> The objective of filling up 11 tanks (to provide drinking water to 15 villages) was delayed by four years. <p>The Government replied that higher authorities of the Company decided to take up the work of linking the tanks after completion of the scheme. The reply further stated that there was no delay and objective was achieved by letting out water in open canal from the last four years.</p> <p>The reply was not justified as the scheme was completed in 2012. However, the work of linking the canals with pipes were awarded in 2016, though the estimate prepared in 1997 contained provision for connecting the tanks with pipes.</p>
2	<ul style="list-style-type: none"> Circular instructions (November 2009) of the Company, mandate that the Competent Authority who accords technical sanction to the detailed estimate shall visit the site of work to ensure that the provisions made in the estimate are commensurate with the site conditions. Circular instructions (July 2004/June 2012) stipulated controlled blasting can be resorted keeping in view the danger zone of 300 metres radial distance from blasting site to the village limit, human habitation, permanent structure, National Highway and Railways. As per General conditions of contract (Clause 6), the contractor was also advised to visit the site, before making his offer. 	<p>Modernisation of Hemavathy Left Bank Canal:</p> <p>Incorrect classification of strata, incorrect length of the perimeter in the embankment reaches and insufficient provision for controlled blasting in the estimates led to Extra Financial Implications (EFI).</p>	<ul style="list-style-type: none"> This was an existing canal and its condition/strata and habitations were visible. Evidently, Competent Authorities did not conduct site inspections before preparation of estimates as per the extant orders. Preparation of defective estimates, led to the EFI of ₹ 145.05 crore in addition to the awarded cost of ₹ 620.62 crore. <p>The Government accepted (November 2017) that in the DPR, provisions for excavation was not as per actual and to avoid steeper slopes, it was decided to provide berms and flatter slopes during construction resulting in increased quantity. Further, it was also accepted in the reply that perimeter in some of the embankment reaches was computed wrongly by the consultant and escaped the attention during random inspection.</p>

Appendix-7

(Referred to in Paragraph 2.2.12.2)

Details of delay in submission of design and drawings in test checked projects in Cauvery Neeravari Nigama Limited

Project	Due date for submission and approval of drawings	Date of submission by the contractor	Delay in submission by contractor (months)	Date of approval by the company	Time taken by the company for approval from the date of submission by the contractor (months)	Overall delay in approval of drawings from the due date of approval (months)
Alambur	May 2012	February 2012 to June 2013	12	March 2012 to August 2013	1 to 6	15
Malalur LIS	October 2012	October 2012 to November 2012	nil	January 2013 to December 2013	3 to 13	13
Nuggehalli	August 2013	July 2013 to June 2014	11	August 2013 to May 2015	4 to 6	22
Kanva	July 2013	June 2013 to July 2014	12	August 2013 to October 2014	2 to 3	15
Sriranga	February 2016	January 2016	No delay	September 2016	8	9
Alilughatta and other tanks	Not available	November 2015	No delay	March 2016	4	4

Appendix-8

(Referred in Paragraph 2.2.11.8)

Details of achievement in respect of Water Users Co-operative Societies Registered, Memorandum of Understanding entered and Functioning, as at March 2017

(in ha)

Major Project	Area irrigated	Registered		MoU entered		Functioning	
		No. of WUCS	Corresponding area	No. of WUCS	Corresponding area	No. of WUCS	Corresponding area
Krishna Raja Sagar	85029	182	85029	98	51522	98	51522
Hemavathy	239362	227	239362	75	44060	75	44060
Kabini	47136	119	47136	89	45977	89	45977
Harangi	59883	102	59883	95	42187	95	42187
Total	431410	630	431410	357	183746	357	183746

Source: CADA Secretariat Monthly Meeting Review Reports

Glossary

Term	Definition
Achkat	Area to which water has been supplied. Also called as Ayacut in South Karnataka.
Anicut	A structure across the river (like a barrage).
Cultivable Command Area (CCA)	The Cultivable Command Area represents the geographical area which can be irrigated from an irrigation system and fit for cultivation.
Command Area Development Authority (CADA)	The State of Karnataka enacted Command Area Development Act, 1980, to empower the CADAs which were created in the state on the recommendation of Irrigation Commission Report of 1972. The main aim was to reduce the gap between potential created and potential utilised after the implementation of irrigation projects through several five year plans, to increase the water use efficiency by giving assistance for land levelling and to feed each and every survey number through a network of Field Irrigation Channels. In addition, the Act provides for the reclamation of the affected land due to ill effects of irrigation by cleaning the drainage in the command, creating link and subsurface drains to drain off excess subsurface water. The Agriculture Wing of the CADA was to assist the farmer to grow appropriate crops in the command, to make available those agricultural implements required for land levelling, also to build capacity among the stakeholders along with the co-operative wing of CADA. The Command Area Development Activities are being assisted by the Central Government in the State except in Cauvery basin because of interstate water dispute.
Command Area Development Programme/Water Management (CADP/CADWM)	A Centrally sponsored scheme implemented by State/Central Government for constructing field channels, drainage system and land leveling of undulating land, of the farmers.
Field Irrigation Channels (FICs)	A canal running at the Ridges or boundary of the land and carrying a discharge of less than one cusecs.
Irrigated Potential Created (IPC)	The total gross area proposed to be irrigated under different crops during a year by a project/scheme. The area proposed to be irrigated under more than one crop during the same year and counted as many times as the number of crops grown and irrigated.
Irrigated Potential Utilised (IPU)	The gross area actually irrigated during reference year out of the gross proposed area to be irrigated by the project/scheme during the year.
Major Irrigation projects	A scheme having Cultivable Command Area more than 10,000 hectares.
Medium Irrigation projects	A scheme having Cultivable Command Area more than 2,000 hectares and up to 10,000 hectares individually.
Minor Irrigation projects	A scheme having Cultivable Command Area up to 2,000 hectares individually.
Multipurpose Irrigation projects	A project which serves many purposes at a single time like acting as a hydroelectric power plant, providing a source of clean drinking water, providing irrigation to fields, checking floods and flow of river water <i>etc.</i>
Modernisation and Improvement of projects	Modernisation and improvement of projects envisages lining of existing canals, branches, distributaries, water courses and field channels and renewal of existing structures for reduction of conveyance and operational losses.
Other expenditure	Money spent on different instrument of expenditure in a fiscal year and not elsewhere are classified in specific component of expenditure and termed as Other expenditure. This includes money spent to acquire or upgrade physical assets such as construction of concrete and masonry dams, reservoirs, spillways, canals and distributary networks of the irrigation project during a financial year.
Potential oriented work	Works which create of irrigable area.
Participatory Irrigation Management	A term used so as to create a sense of ownership of water sources and irrigation systems among the users of water for promoting economy in water use and preservation of the system, achieving optimum utilisation of available resources, equity in distribution <i>etc.</i>
Suffering achkat	An area where FICs are created and does not receive adequate water supply for irrigation.