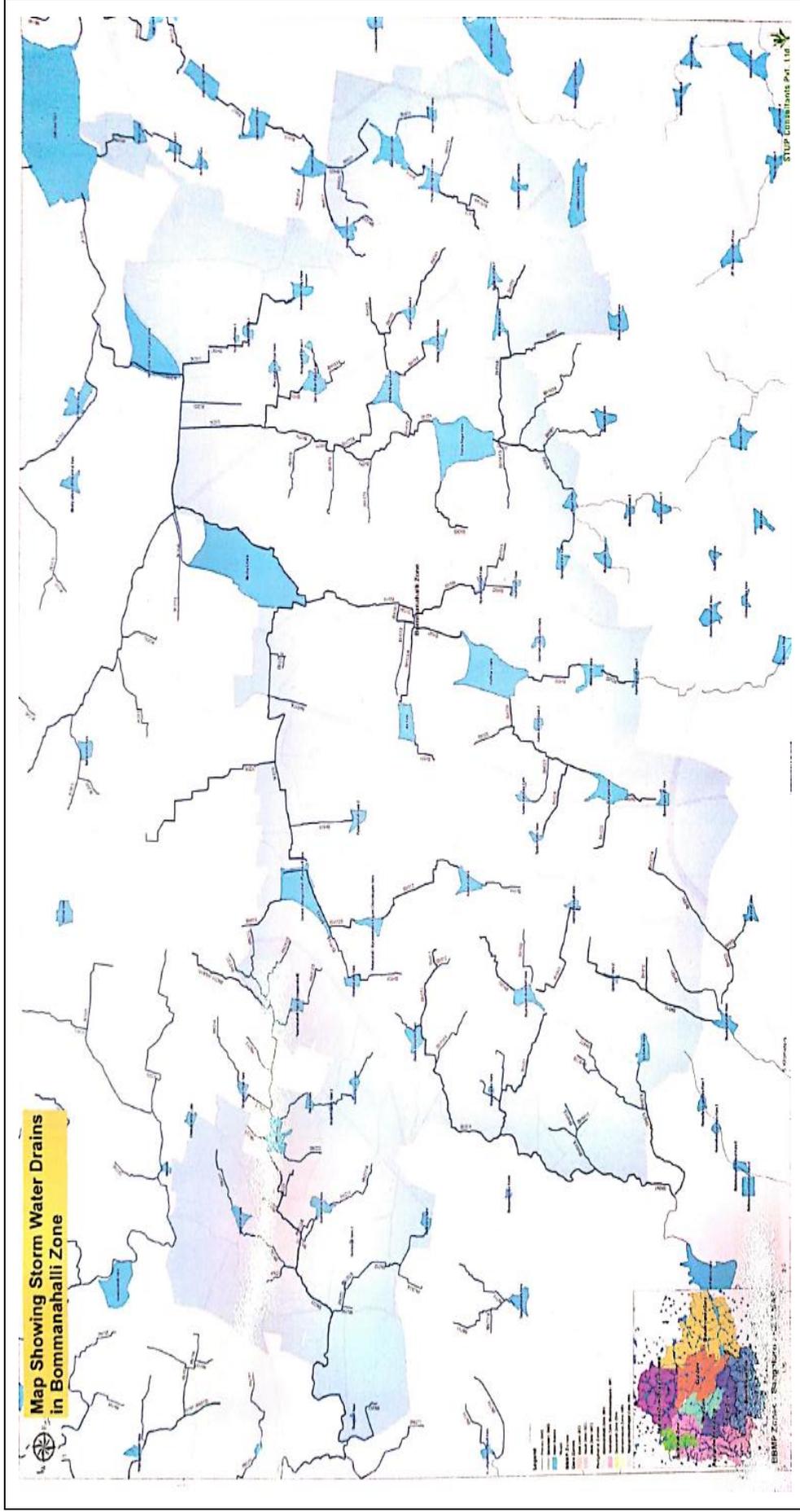


## Appendix 1.1

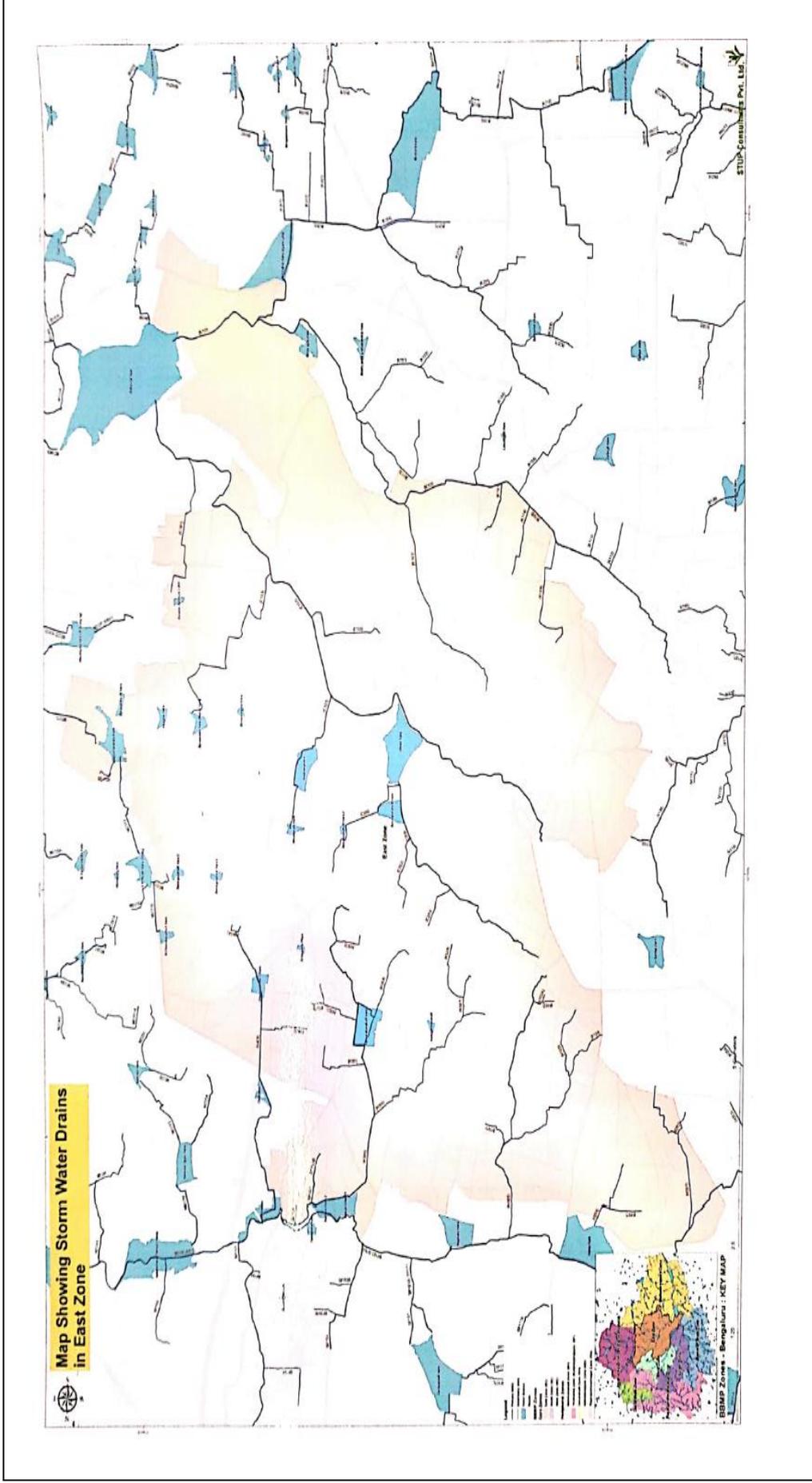
(Reference: Paragraph 1.3/Page 2)

Storm water drains as mapped in master plan of BBMP under Bommanahalli Zone



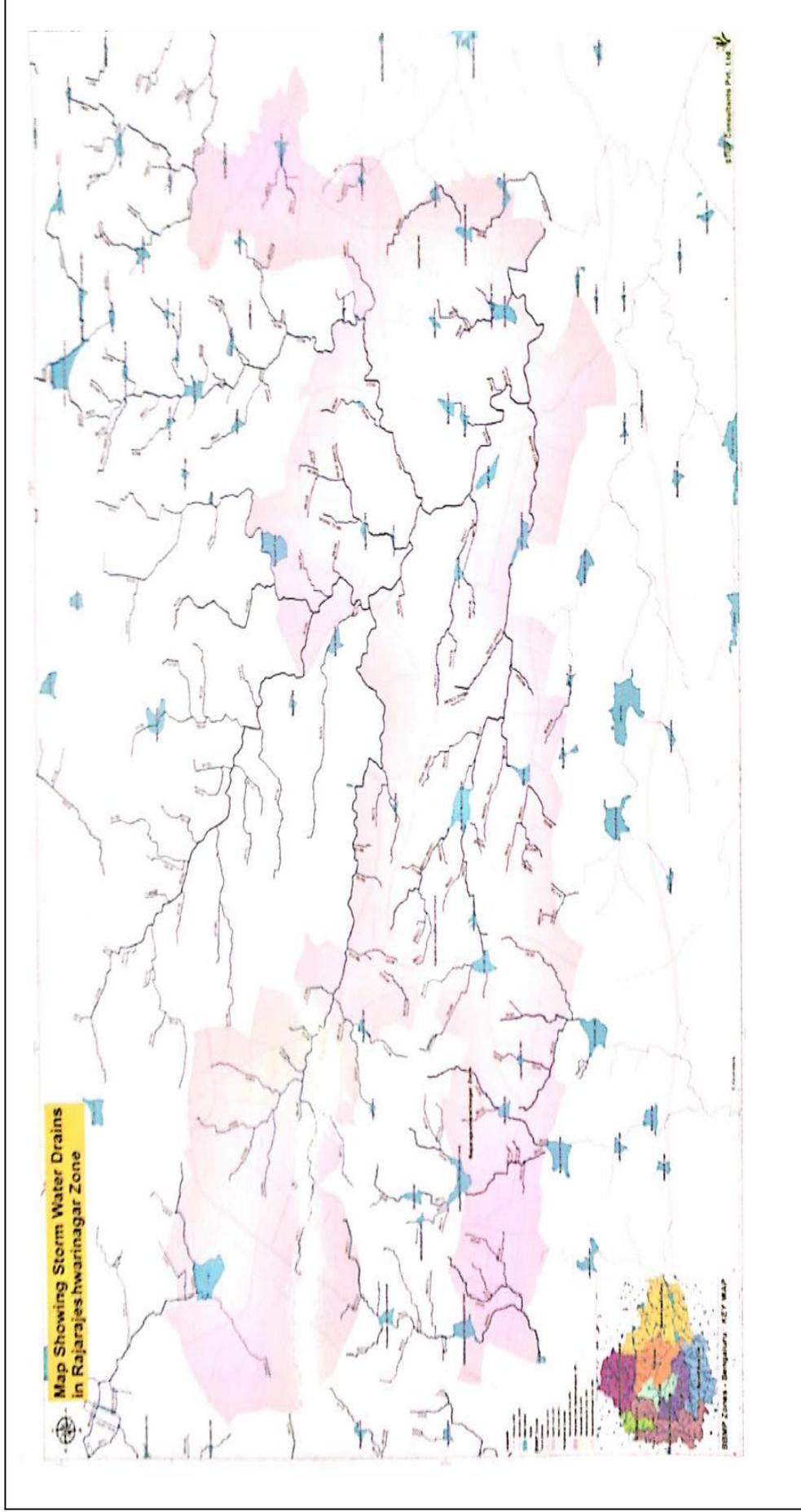
Appendix 1.1 contd...

Storm water drains as mapped in master plan of BBMP under East Zone



Appendix 1.1 contd...

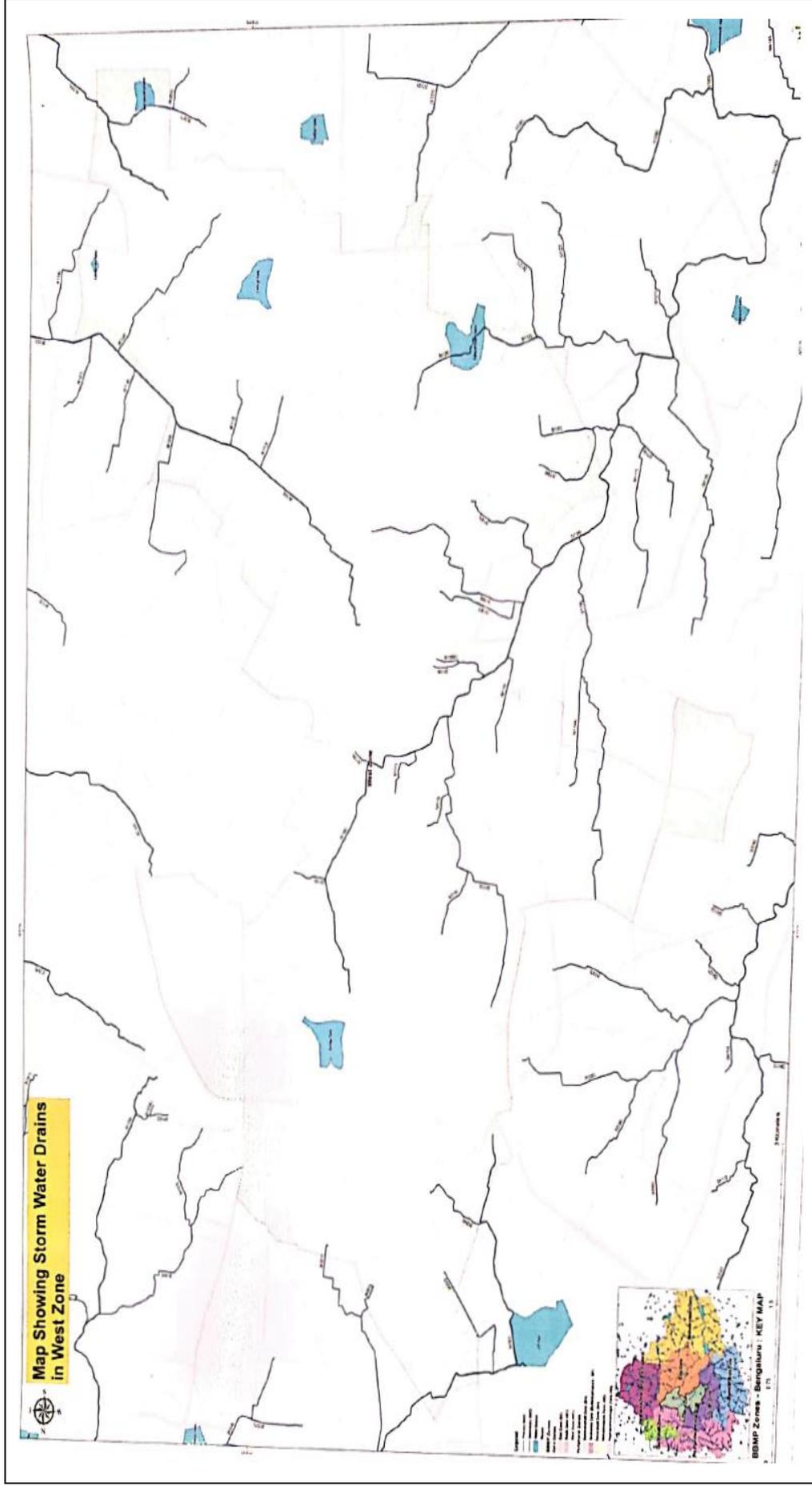
Storm water drains as mapped in master plan of BBMP under Rajarajeshwarinagar Zone





Appendix 1.1 contd...

Storm water drains as mapped in master plan of BBMP under West Zone





## Appendix 2.1

(Reference: Paragraph 2.7/Page 12)

**Statement showing the gist of audit observations and recommendations of Committee on Local Bodies and PRIs pertaining to storm water drainage works executed under JnNURM (Para 4.1 of Report no. 6 of 2013, Government of Karnataka)**

Sl. No.	Paragraph No.	Gist of audit observation	Recommendations	Compliance
1	4.1.7	Delay in completion of projects	Initiate disciplinary action on officials for the dereliction of duty causing loss of financial assistance	Not complied
2	4.1.9.2	Diversion of funds towards interior works of the Office of CE, SWD	Initiate disciplinary action on engineers responsible for diversion of funds in contravention of the financial rules.	Not complied
3	4.1.9.4	Non-renewal of Bank Guarantees	The bank guarantees should be compulsorily renewed on expiry to ensure quality of works executed by the contractors.	Not complied
4	4.1.11.1	Execution of additional / supplementary works	Initiate disciplinary action on erring officers/officials.	Not complied
5	4.1.11.2	Irregularities in awarding contracts	Initiate disciplinary action on officials responsible for flouting KTPP norms.	Not complied
6	4.1.11.3	Irregularities in holding negotiations with contractors	The Committee taking serious note of the non-submission of information sought for by it, directed the department for submission of a detailed report.	Not complied
7	4.1.11.4	Avoidable expenditure on diversion of water course	The Committee opined that the original estimates included all items required for construction of coffer dams and incurring expenditure as a separate item was not permitted.	Not complied
8	4.1.11.5	Excess payments on: Item of Back filling Adoption of rates for 'manual means' though works executed mechanically Lead charges for earth	Disciplinary action to be taken against the officials and to recover the financial loss of ₹5.98 crore from the officials found responsible. Blacklist the contractors Instructed the Principal Secretary, UDD to submit the details of action taken in this regard to the Committee	Not complied
9	4.1.11.7	Defective estimates in chain link fencing works	All the factors should be taken into consideration while preparing the estimates and payments for other than the estimated works should be avoided. The practice of making payments towards extra works should be avoided so that there is no scope for suspicion.	Not complied

## Appendix 3.1

(Reference: Paragraph 3.1.1/Page 13)

### Status of compliance to NDMA Guidelines by the State Government/BBMP

Sl. no.	Paragraph no.	Actionable item	Action taken by State Government / BBMP	Audit observations
1	4.5.1	All ULBs/States/UTs shall prepare an inventory of the existing storm water drainage system on a Geographic Information System (GIS) platform. The inventory was to be both watershed based and ward based with clear mapping of the major as well as minor systems.	BBMP got prepared the inventory of drains under its jurisdiction, as a Master Plan of drains which identified only the Primary and Secondary drains.	The tertiary drains, which are substantially contributing components of drainage system were not identified and mapped. This rendered the Master Plan deficient.
2	4.7.1	Catchment will be the basis for planning and designing the storm water drainage systems in all ULBs.	Master Plan of Drains adopted catchment and watershed basis	
3	4.12.4.3	Pre-monsoon desilting of all major drains will be completed by March 31 each year; Besides the pre-monsoon desilting of drains, the periodicity of cleaning drains should be worked out, based on the local conditions. The roster of cleaning of such drains should be worked out and strictly followed	Neither periodic action plan prepared for desilting of drains before onset of monsoon nor roster of cleaning worked out and followed	The works for desilting of drains, at various different stretches, entrusted to contractors during the monsoon period
4	4.12.4.3	Suitable interventions in the drainage system like traps, communitors, trash racks can reduce the amount of solid waste going into the storm sewers.	Not adopted for any of the drains	Floating debris and sewage observed continuously in all types of drains during joint verification
5	4.12.4.3	Ageing systems will be replaced on an urgent basis	Not adopted	
6	4.12.4.3	A master plan will be prepared to improve the coverage of the sewerage system so that sewage will not be discharged into storm water drains	Master Plan of Drains recommended for taking measures to evade sewage mixing into storm water drains	No measures taken to avoid mixing of sewage into storm water drains. Instead, audit observed damaged/open manholes, direct discharge of sewage into drains contaminating the flow in storm water drains.
7	4.13.3.1	All road re-leveling works or strengthening/overlay works	Not followed	Repeated relaying of roads on existing surfaces

		will be carried out by milling the existing layers of the road and recycling of materials obtained as a result of the milling so that the road levels will be not be allowed to increase.		led to increase in elevation of roads than level of houses in the street over a period of time
8	4.13.4.1	Inlets should be provided on the roads to drain water to the roadside drains and these should be designed, based on current national and international practices.	Generally complied with	Audit observed variations in levels of road and inlets leading to stagnation of water on the roads. No provision was made to drain out water at many road humps. Absence of monitoring led to clogging of inlets.
9	4.16.1	Every building in an urban area will have rainwater harvesting as an integral component of the building utility. ULBs will ensure that this is implemented.	Rain water harvesting made (May 2011) mandatory for houses constructed on a plot measuring 1200 square feet	Instead of BBMP (which has a database of more than 20 lakh properties), the authority which sanctions plan for construction of buildings, the responsibility of implementing RWH entrusted to BWSSB, which is having very limited coverage, compared to total number of properties under the jurisdiction of BBMP. 40 per cent of the buildings under the purview of BWSSB have not adopted the rain water harvesting units
10	4.17.2	Concept of Rain Gardens will be incorporated in planning for public parks and on-site storm water management for larger colonies and sites that are to be developed. People will be encouraged to adopt this concept even for sites already developed.	Not complied with	
11	4.18.1	All urban water bodies will be protected. Efforts will also be made to restore water bodies by de-silting and taking other measures. Efforts will also be made to revive water bodies that have been put to other uses. Water bodies will be an integral part of the storm water system.	Lakes/water bodies under the jurisdiction of BBMP, headed by a Chief Engineer is responsible maintenance and development of lakes.	As many as 89 lakes in the city are directly connected to storm water drains which carry high level of sewage and chemical contaminants

12	4.19.1	Urban storm water management systems will include detention and retention facilities to mitigate the negative impact of urbanization on storm water drainage.	Not adopted	
13	4.21.1	Integrated planning and coordination will be ensured to take into account all components of the urban water systems, and Best management practices should be adopted by all ULBs to reduce the load on the major drainage system.	Department/stakeholder functioning independently	
14	4.22.6.2	Low-lying areas should be reserved for parks and other low-impact human activities; Wherever unavoidable, buildings in low-lying areas should be constructed on stilts above the High Flood Level (HFL)/Full Tank Level (FTL).	Not complied with	
15	4.23.1	Encroachments on nallahs / drains / watercourses will be removed by providing alternative accommodation to the Below Poverty Line (BPL) people and appropriate rehabilitation package for other categories of people; The nallahs/ drains/ watercourses/ flood plains should be clearly delineated and boundaries fixed in new developments. There will be strict enforcement of the relevant byelaws/regulations in the new layouts, and Any encroachment on the drain will attract penal action and be treated as a cognizable offence, both against the encroachers and the officials responsible for enforcement of the byelaws/ regulations.	Survey conducted, with the office of Land Records to identify encroachments on storm water drains.  Boundary marks not fixed in respect of any of the drains  No penal action on either encroachers or the of officials responsible for enforcement of the byelaws/regulations for their dereliction	Action towards clearance of encroachments is apparently too sluggish  Buildings allowed to construct abutting the drains and without allowing the buffer zone for drains  Data of encroachments with BBMP is deficient as audit observed large number of encroachments on drains, for which no action has been taken.

### Appendix 3.2

(Reference: Paragraph 3.3.1/Page 16)

#### List of disused lakes under BBMP

Sl. No.	Zone	Name of the lake	Village and survey number	Area	
				Acres	Guntas
1	Bangalore	Tavarekare	Tavarekere -74	10.00	16.00
2	South	Karisandra Lake	Karisandra - 7	13.00	0.00
3		Nandi Shettappa Lake	Jaraganahalli-53	0.00	0.00
4		Chikkalsandra Lake	Chikkalasandra-76	12.00	26.00
5		Ittmadu	Ittamadu-17	4.00	0.00
6		Bommanahalli	Belakahalli (Lingannana Kere)	Belakahalli-172/2A	7.00
7	East	Doresani Palya	Belakahalli-167	56.00	37.00
8		Konena Agrahara lake	Konena Agrahara -60	20.00	10.00
9		Byatagunte Palya Lake	Byatagunte palya-14	5.00	25.00
10		Geddalahalli Lake	Geddalahalli-03	21.00	18.00
11		Lingarajapura Lake	Lingarajapura-49	16.00	14.00
12	Mahadevapura	Vijanapura Lake	Vijanapura-42	29.00	15.00
13	RR Nagar	Bovimaranahalli	Halagevaderahalli - 124	22.00	34.00
14	West	Gundopanth Lake	Pantharapalya-59	2.00	1.00
15		Anche ramana kere (Gangondanahalli)	Gangondana halli-8	0.00	17.00
16		Sanigoruvahalli	Sanigoruvahalli-120	15.00	24.00
17		Shivanahalli (Agrahara Dasarahalli)	Agrahara dasarahalli- 72	9.00	25.00
18		Kamakshi palya	Sanegoruvanahalli-60	6.00	35.00
	Total			247.00	297.00

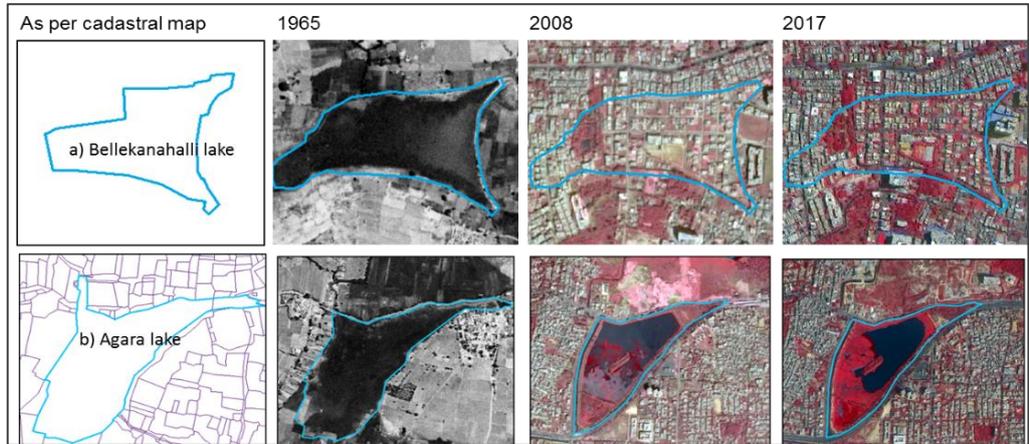
Source: Information furnished by CE, Lakes Division, BBMP

### Appendix 3.3

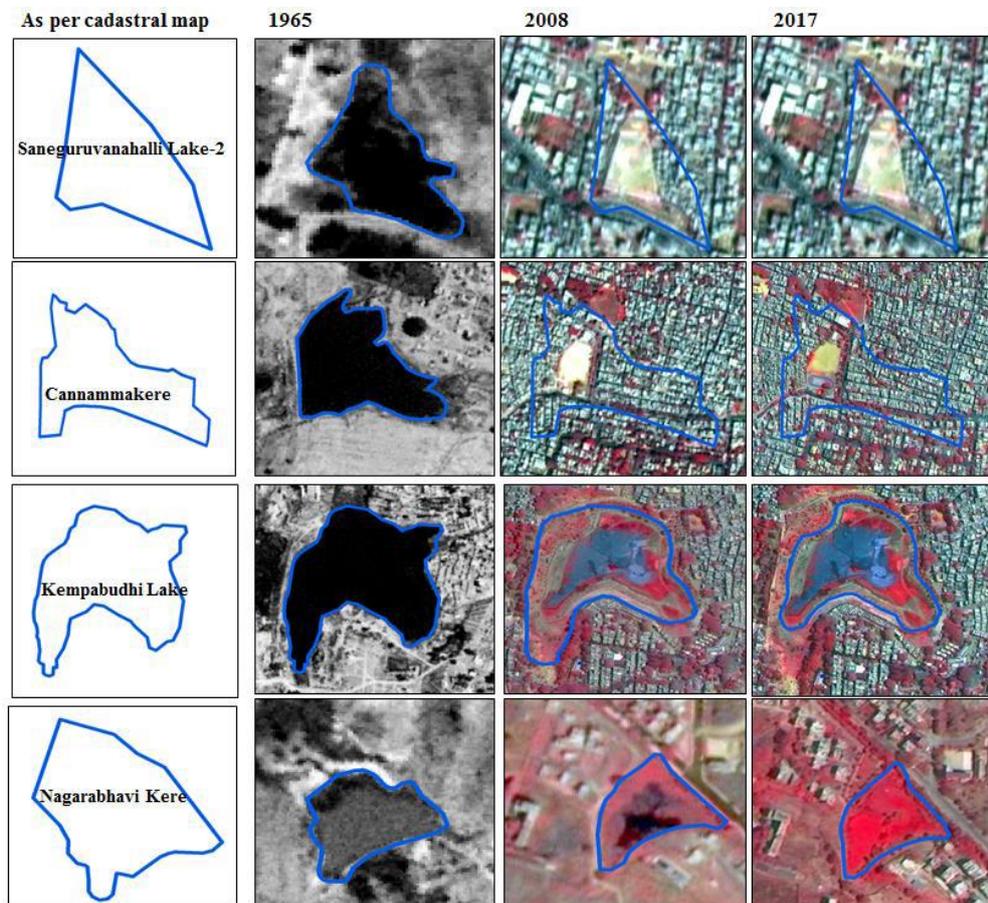
(Reference: Paragraph 3.3.2, Page 20)

### Typical changes (change in size and shape) noticed in lakes

#### Koramangala valley



#### Vrishabhavathi valley



## Appendix 3.4

(Reference: Paragraph 3.3.2, Page 20)

**Table showing a few lakes converted for other purposes**

<i>Name of Lake</i>	<i>Status now</i>
<i>Akkithimmanhalli Lake</i>	Hockey Stadium
<i>B.Channasandra Lake</i>	BDA Layout - East of NGEF Layout
<i>Baalayyana Lake</i>	Sports Ground
<i>Bagalagunte Hosa Lake</i>	Residential Layout
<i>Challaghatta Lake</i>	Golf ground - Karnataka Golf Association
<i>Challakere Lake</i>	BDA Layout - HBR 2nd Block
<i>Channasandra-2 Lake</i>	BDA Layout - HRBR 1st Block
<i>Chennamma Lake</i>	BDA Layout - Banashankari 2nd Stage
<i>Dasarahalli Lake</i>	Dr. B.R Ambedkar Stadium
<i>Dharmambudhi Lake</i>	Majestic Bus Stand
<i>Domlur Lake</i>	BDA Layout - Domlur 2nd Stage
<i>Government Lake</i>	BDA Layout - Nagarabhavi 2nd Stage
<i>Government Lake</i>	BDA Layout - RMV 2nd Stage
<i>Government Lake</i>	BDA Layout - HBR 1st Block
<i>Government Lake</i>	BDA Layout - Banashankari 6th Phase
<i>Hennur-Nagavara Lakes</i>	BDA Layout - HBR Layout 1st Stage, 5th Block
<i>Jakkarayana Lake</i>	Sports Ground
<i>Kadugondanahalli Lake</i>	Ambedkar Medical College
<i>Kamakshipalya Lake</i>	Sports Ground
<i>Karanji Lake</i>	Gandhi Bazar Residential area
<i>Kempambudhi Lake</i>	Sewerage collection tank
<i>Kethmaranahalli Lake</i>	BDA Layout - Rajajinagar 1st Block
<i>Kodihalli Lake</i>	Residential Layout
<i>Koramangala Lake</i>	National Games Village housing complex
<i>Krishnarajapuram Lake</i>	BDA Layout - East of NGEF Layout
<i>Kurubarahalli lake</i>	Residential Layout
<i>Lingannana Lake</i>	BDA Layout - Sarakki Dollars Colony
<i>Manganahalli Lake</i>	BDA Layout - Sir MV Layout 6th Block
<i>Marenahalli Lake</i>	Residential Layout
<i>Miller's Tank</i>	Guru Nanak Bhavan, Badminton Stadium
<i>Nagashettihalli Lake</i>	Space Department
<i>Sampangi Lake</i>	Sports Stadium
<i>Shivanahalli Lake</i>	Playground, Bus stand
<i>Shoolay Lake</i>	Football Stadium
<i>Siddikatte Lake</i>	KR Market
<i>Srinivagalu Lake</i>	BDA Layout - ST Bed Layout Koramangala
<i>Subhashnagar Lake</i>	Residential Layout
<i>Thippasanda Lake</i>	BDA Layout - HAL 2nd and 3rd Stage
<i>Venkatarayana Lake</i>	BDA Layout - Banashankari 6th Phase
<i>Yellugunte Lake</i>	BDA Layout - HSR 3rd Sector

Source : Sri Koliwad Committee Report, <http://parisaramahiti.kar.nic.in/lostlakes.html>, and [https://en.wikipedia.org/wiki/Lakes\\_in\\_Bangalore](https://en.wikipedia.org/wiki/Lakes_in_Bangalore)

### Appendix 3.5

(Reference: Paragraph 3.3.2, Page 25)

#### Results of verification of few drains in Vrishabhavathi valley

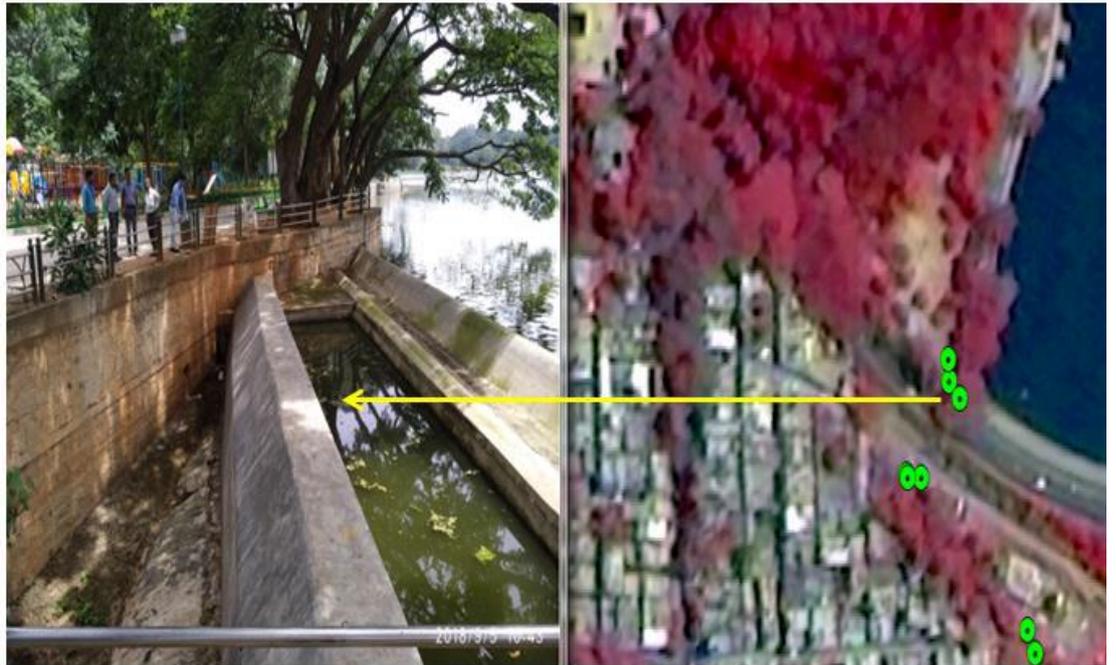


**Covered drain in Sheshadripuram**



**Drain encroached and covered by an apartment**

Appendix 3.5 contd.



Outlet of Sankey tank



Covered drain adjacent to Sankey tank

Appendix 3.5 concld.



Discharge of sewage into SWD through fractured manhole



Covered drain

## Appendix 4.1

(Reference: Paragraph 4.3.9, Page 66)

### Statement showing the details of SWD works executed under Package 2 of Nagarothana Yojane

Sl. No.	Name of the Work	Estimated cost (₹ in lakh)	Financial Progress (as per estimate)	Physical Progress		Remarks	Percentage of excess/savings over estimated cost		
				Tackled Length	Balance Length				
1	Construction of SWD behind Old Age Home near Voddrapalya at Geddalahalli in KR Puram ward no:25	100.00	24.75	40.00	40.00	0.00	0.00	Completed	(-) 75
2	Construction of Box Drain to SWD near outlet of Horamavu Agara tank and U Shape drain in ward no:25	250.00	395.86	600.00	600.00	0.00	0.00	Completed	58
3	Construction of drain to SWD from Poojarappa layout to Chelekere main road joining glass factory and Construction of drain to SWD from Nagreshwara-Nagenahalli to Geddalahalli ward no:25	200.00	247.99	253.00	253.00	0.00	0.00	Completed	24
4	Construction of RCC drain to SWD near Kothanur village and Hennur main road ward no:25	100.00	125.78	134.00	134.00	0.00	0.00	Completed	26
5	Construction of RCC drain to SWD from bank avenue layout via Papatah layout joining Horamavu kere .	100.00	128.34	265.00	265.00	0.00	0.00	Completed	28
6	Construction of RCC drain to SWD joining Bennis Satya layout in Geddalahalli village ward no:25	100.00	189.45	213.00	213.00	0.00	0.00	Completed	89
7	Remodelling of SWD near Kothanur and B.Narayanapura in ward no:25	250.00	186.09	307.00	307.00	0.00	0.00	Completed	(-) 26
8	Remodelling of SWD near Yarranapalya Madakari Nayaka road Muneshwara nagar to Arun ice cream in ward no:25	200.00	240.02	130.00	130.00	0.00	0.00	Completed	20
9	Construction of Box Drain at 1st cross Ramamurthy nagar near Arun ice cream behind ITI compound ward no :51	100.00	42.11	75.00	75.00	0.00	0.00	Completed	(-) 58
10	Remodelling of SWD near Ambedkar slum of R.R.Layout ward no:51	150.00	194.33	291.00	291.00	0.00	0.00	Completed	30
11	Construction of culverts to SWD and allied works in Vijinapura ward no:51	200.00	280.06	271.00	271.00	0.00	0.00	Completed	40

12	Construction of SWD near NRI layout and providing chain link fencing to SWD in KR Puram ward no:26	100.00	109.85	200.00	200.00	200.00	0.00	Completed	10
13	Remodelling of SWD near Gayathri layout and Basavanapura main road MD272 Ward no:52	100.00	165.36	214.00	214.00	214.00	0.00	Completed	65
14	Construction of RCC drain near TC Palya back side of Assidan School behind Garden City College (balance portion) ward no:52	90.00	79.42	180.00	180.00	180.00	0.00	Completed	(-)12
15	Remodelling of SWD from Koudenahalli tank to Vengiahana kere near Brundavananagar and Anandapura ward no:52	150.00	203.85	225.00	225.00	225.00	0.00	Completed	36
16	Remodelling of SWD near Vengiahana kere in ward no:52	250.00	317.35	397.00	397.00	397.00	0.00	Completed	27
17	Construction of RCC Bridge and SWD at KV Layout	60.00	105.56	110.00	110.00	110.00	0.00	Completed	76
18	Construction of RCC drain and culvert to SWD near Pai layout Ward no:56	100.00	115.25	136.00	136.00	136.00	0.00	Completed	15
19	Construction of RCC drain near Darga Mahal (balance portion) ward no:56	100.00	14.82	95.00	95.00	95.00	0.00	Completed	(-) 85
20	Construction of RCC drain from Seggahalli lake towards Medahalli ward no:53	150.00	174.19	146.00	146.00	146.00	0.00	Completed	16
21	Remodelling of SWD to MD 271 from Chikkadevasandra lake to Gokula and near Cambridge College ward no:53	200.00	201.05	231.00	231.00	231.00	0.00	Completed	1
22	Construction of culverts and drain at Medahalli to Yellamallappa chetty lake ward no:53	150.00	185.60	328.00	328.00	328.00	0.00	Completed	24
23	Remodelling of SWD from Koudenahalli tank via Manjunatha layout and Priyadarshini layout.ward no:53	150.00	141.36	365.00	365.00	365.00	0.00	Completed	(-) 6
24	Construction of RCC drain from Mahadevapura lake to join Doddanekkundi lake ward no: 81	90.00	183.30	184.00	184.00	184.00	0.00	Completed	104
25	Construction of RCC drain near SCT college (balance portion) ward no: 81	50.00	80.07	91.00	91.00	91.00	0.00	Completed	60
26	Construction of SWD and providing chain link fencing to SWD near Chinnapa layout in K.R.Puram constituency	100.00	120.80	97.00	97.00	97.00	0.00	Completed	21
27	Construction of RCC drain to SWD near Choice Bakery in Mahadevapura old village ward no: 81	50.00	69.23	100.00	100.00	100.00	0.00	Completed	38
28	Construction of RCC culvert to Vibuthipura lake outlet and Remodelling of SWD in ward no: 81	200.00	0.00	130.00	130.00	0.00	130.00	Yet to commence	

29	Remodelling of SWD near Kalappa block in ward no: 81	150.00	175.82	206.00	206.00	0.00	Completed	17
30	Remodelling of SWD near Kumbarkote via Abbaiah Reddy layout and Nagappa Reddy layout in ward no: 81	200.00	231.13	370.00	370.00	0.00	Completed	16
31	Construction of RCC U drain to SWD from Gangashetty lake to Nethravathi layout	90.00	113.56	250.00	250.00	0.00	Completed	26
32	Construction of RCC box drain and Remodelling of SWD near Annasandrapalya in ward no:87	200.00	329.90	513.00	513.00	0.00	Completed	65
33	Constructing RCC boundary markings in Mahadevapura zone	50.00	Details not furnished					

Source: Progress reports furnished by CE, SWD as of October 2019

## Appendix 4.2

(Reference: Paragraph 4.3.9, Page 66 & 67)

### Statement showing the details of SWD works executed under Nagarothana Yojane

(₹ in crore)

Package	Number of works	Estimated cost	Agreed cost	Date of work order	Stipulated date for completion	Completed	Ongoing	Yet to start	Execution more than estimated length		Execution less than estimated length in completed works	
									No. of works	Up to	No. of works	Up to
1	43	128.57	158.49	30-03-2017	30-11-2018	21	20	2	21	196%	6	(-) 52%
3	86	155.00	191.32	03-04-2017	03-12-2018	73	10	3	20	234%	18	(-) 94%
4	138	176.95	219.24	20-03-2017	20-03-2019	128	2	8	63	587%	63	(-) 71%
5	39	95.00	116.38	23-03-2017	23-09-2018	37	0	2	12	113%	22	(-) 68%
6	20	71.00	86.83	23-03-2017	23-09-2018	20	0	0	8	63%	10	(-) 46%
<b>Total</b>	<b>326</b>					<b>279</b>	<b>32</b>	<b>15</b>				

Source: Progress reports furnished by CE, SWD as of October 2019

Note: The progress report in respect of Package-2 submitted to audit by CE, SWD was grossly incorrect as all the works were shown to have been completed with estimated quantity and executed quantity being the same while there were huge variations in financial progress. Hence, audit could not analyse the actual progress achieved.

## Appendix 5.1

(Reference: Paragraph 5.1.3, Page 80)

### Instances of encroachments noticed during joint physical verification

<i>Drain-ID</i>	<i>Location</i>	<i>Encroached by</i>
V-201	Peenya	Surana College
K-100	JC Road	Cargo Tarpaulins Industries
K-100	JC Road	Private Property
K-100	Lalbagh Road	BBMP leased property
V-100	Near Dobhi Ghat	Vyalikaval Education Society
V-100	Adjacent to Magadi road railway bridge	Rank Nest Apartment
K-102	0.00 chainage	Private Property (Standard Chartered Bank)
K-102	0.00 chainage	Private Property
K-102	Next to Empire Hotel	BBMP waste segregation unit
K-102	KHB Colony, 5 <sup>th</sup> Block, Koramanagala	Private Property (Opposite to Nati Mane shop)
K-102	17 <sup>th</sup> B Main, 5 <sup>th</sup> Block, Koramanagala	Private Property No.97
K-102	4 <sup>th</sup> Cross, 5 <sup>th</sup> Block, Koramanagala	Private Property
K-102	6 <sup>th</sup> Block, Koramangala	Private properties between 17 <sup>th</sup> E and F main roads
K-102	5 <sup>th</sup> A cross, 6 <sup>th</sup> Block, Koramangala	No. 868, Sipani Grande Apartments (private property)
K-102	Koramangala 6 <sup>th</sup> Block	Koramangala Club
RN-193	RR Nagar	Padmavathi Kalyana Mantapa
V-301	Ittamadu	Terrace Garden apartments
--	Madivala	RO drinking water plant of BBMP
V-113	Okalipuram	RO drinking water plant of BBMP
BH-524	Gottigere	Himagiri Meadows Apartments complex
BH-554	Adjacent to Madivala lake, Hosur Road	Ansal Forte Apartments
BH-554	Hosur Road	Tirumal splendour Apartments
BH-554	Adjacent to Madivala lake, Hosur Road	Adithya Tussar Apartments

Source: Joint physical verifications

## Glossary

**ArcGIS:** *It is a geographic information system for working with maps and geographic information maintained by the Environmental Systems Research Institute (ESRI). It is used for creating and using maps, compiling geographic data, analyzing mapped information, sharing and discovering geographic information, using maps and geographic information in a range of applications, and managing geographic information in a database.*

**Cadastral map:** *A large-scale map showing the boundaries of subdivisions of land, usually with the directions and lengths thereof and the areas of individual tracts, compiled for the purpose of describing and recording ownership. It may also show culture, drainage, and other features relating to use of the land.*

**Chainage:** *Chainage is a measure of distance between two points (invented in 1620 by Edmund Gunter), which refers to a technique of measurement where steel chains of 100 links were once used to measure distances in surveying. While such equipment is no longer used for measurement, the term chainage is still commonly used particularly in relation to construction of roads, drains and irrigation channels.*

**Check dam:** *These are relatively small structures constructed to slow down the flow of water for controlling soil erosion. The purpose of check dam is to retain water up stream, so that the water percolates into the ground and recharges the ground water table.*

**Dependability:** *Dependable rainfall is defined as the rainfall, which can be expected in a set number of years out of a total number of years.*

**Detention ponds:** *These are temporary holding areas for storm water that store peak flows and slowly release them, reducing the demand on treatment facilities during storm events and prevent flooding.*

**Geographic information system (GIS):** *It is a framework (software/applications) for gathering, managing, and analyzing data. It analyzes spatial location and organizes layers of information into visualizations using maps and 3D scenes. For ex, when a road is laid, the alignment, length, classification of the road and location on earth can be maintained using a Geographical Information System. Distinctiveness – Maintain information of assets by inserting and updating records in a database using the software.*

**Global Positioning System (GPS):** *It is a radio navigation system that allows land, sea, and airborne users to determine their exact location, velocity, and time 24 hours a day, in all weather conditions, anywhere in the world.*

**Infiltration drains:** *Infiltration drains are the channels constructed with filter media adjacent to the pavement of the road and regular drains to facilitate water from pavement to enter infiltration drains for allowing recharging and in case of excess, will flow to regular drains.*

**Injection wells:** *Injection wells are structures similar to a tube well but with the purpose of augmenting the groundwater storage of a confined aquifer by pumping in treated surface water under pressure.*

**Percolation ponds/tanks:** *It is an artificially created surface water body, submerging in its reservoir a highly permeable land so that surface runoff is made to percolate and recharge the ground water storage.*

**Primary Drains:** *These are natural drainage systems connecting series of major water bodies' up to the disposal location in a particular catchment area. They originate as a tributary of a river basin and receive water from one or more watershed regions through secondary drainage network, tertiary drainage network or directly from road side drains during their course of flow.*

**Recharge pit:** *A recharge pit is a small well like structure which allows the rainwater to replenish groundwater by recharging the underground aquifers. It can be built just to help the water infiltration in an area.*

**Remote sensing:** *It is the process of detecting and monitoring the physical characteristics of an area by measuring its reflected and emitted radiation at a distance (typically from satellite or aircraft). Analysis of images of the earth continuously captured by various satellites as they travel in their orbits. Depending on the time and frequency of presence in the orbit over a particular region, the image will reveal absence or presence of objects at different points in time. For ex, it can help calculate the approximate area of a lake at different points in time. Distinctiveness - Help view places beyond easy reach, during floods, deep forests.*

**Retention facilities:** *These are basically extended detention facilities, infiltration basins and swales that could be used for water supply, recreation, pollutant removal, aesthetics and importantly recharging of ground water.*

**Return period:** *Probable time gap/frequency between two rainfall events of a particular magnitude.*

**Secondary Drains:** *These are natural or manmade network of drains connecting to a primary drain or a water body. They originate from a particular watershed region and receive water from one or more micro watershed regions through tertiary drainage network or from road side drains during their course of flow.*

**Swale:** *A swale is a shady spot, or a sunken or marshy place. A swale may be either natural or man-made. Artificial swales are often infiltration basins, designed to manage water runoff, filter pollutants, and increase rainwater infiltration.*

**Tertiary Drains:** *These are natural or manmade network of drains connecting to secondary drains or a water body. They originate from a network of road side drains and receive water from micro watershed regions directly or through road side drains or in combination of both. Any higher capacity road side drain when compared to a normal road side drain is also a tertiary*



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