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# 13 Construction: Progress, Modalities and Lessons Learnt

From Blue Gold Program Wiki

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This chapter describes the [progress of construction](#) over the eight construction seasons from

2013/14 to 2020/21, analyses the [nature of the works](#) and the [contractors](#), the contracting modalities, makes some general observations on [construction quality](#), and draws the lessons learnt.

Six BWDB divisions in three Circles are responsible for tendering, the award of contracts and the day-to-day monitoring and quality control of the works:

<b>Zone</b>	<b>Circle</b>	<b>Division</b>
<b>South-West</b>	Khulna O&M	Satkhira O&M-2
	Jashore O&M	Khulna O&M-1
	Khulna O&M	Khulna O&M-2
<b>South</b>	Patuakhali WD	Patuakhali O&M
		Barguna O&M
		Kalapara

A map of the Circles and Divisions is provided [here](#).

The role of the Technical Assistance (TA) team during construction is to assist in occasional monitoring and quality control of implementation works, to carry out site checks and surveys prior to certifying payments, and to process all bills submitted by BWDB field offices for reimbursement by EKN.

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# Analysis of Progress [\[edit | edit source\]](#)

Table 13.1 sets out the quantity and value of certified works for each of the construction seasons against each of the RDPP budget heads.

Table 13.1 Expenditure by construction season against RDPP Budget Heads

Sl. No	Work Items	FY 2013/14			FY 2014/15			FY 2015/16			FY 2016/17			FY 2017/18			FY 2018/19			FY 2019/20			FY 2020/21			FY 2021/22 to end-Sep 2021			TOTAL cost adj RDPP (as revised September 2020)		
		Qty (Full)	Qty (Part)	Total Cost	Qty (Full)	Qty (Part)	Total Cost	Qty (Full)	Qty (Part)	Total Cost	Qty (Full)	Qty (Part)	Total Cost	Qty (Full)	Qty (Part)	Total Cost	Qty (Full)	Qty (Part)	Total Cost	Qty (Full)	Qty (Part)	Total Cost	Qty (Full)	Qty (Part)	Total Cost	Qty (Full)	Qty (Part)	Total Cost	Cum Total	Qty	Cost
1	Re-sectioning of Embankment (km)	2.80	63.42	220.88	68.93	82.98	947.49	89.31	27.25	781.83	45.80	44.35	804.39	57.86	30.61	778.8	51.82	13.76	565.11	8.48	79.83	5.12	12.37				4,190.70	330.12	4,232.67	99%	
2	Retired Embankment (km)	0.60	0.99	0.60	2.24	190.97	2.24	1.47	123.90	1.08	24.57	1.71	168.95	0.40	1.31	70.32	9.86	305.04	5.21	170.01	0.33	19.47	1,074.22	20.34	1,252.01	86%	19.47	1,074.22	20.34	1,252.01	86%
3	Re-excavation of khals (km)	6.63	0.55	47.27	21.36	17.42	365.30	21.59	33.35	267.33	50.14	33.04	798.57	78.30	30.10	924.37	152.13	47.25	2,692.27	82.07	24.02	1,237.74	106.98	2.29	1,156.72	2.29	7.94	7,497.51	521.48	8,675.96	86%
4	Repair of Regulator/Sluice with gate (nos.)	-	2	5	27.98	19	27	664.81	27	12	610.02	27	3	610.69	26	24	605.70	55	5	1,336.47	14	551.19	6	235.10	4,641.96	176	5,025.24	92%			
5	Repair of Inlets/Outlets (nos.)	-	4	20.42	139	49	207.12	72	41.70	5	4.91	-	-	-	-	-	-	2	4.61			278.76	218	276.03	101%						
6	Construction of Drainage Regulator/ Sluice (nos.)	-	-	-	2	88.29	7	464.99	3	5	480.74	3	12	1,476.63	6	13	3,279.51	11	6	1,104.53	6	116.01	7,010.71	29	7,220.47	97%					
7	Construction of Drainage Outlet (nos.)	-	-	-	-	-	-	-	-	-	-	-	7	286.08	5	11	782.25	10	2	207.97	2	160.65	1,436.95	17	1,480	97%					
8	Construction of Irrigation Inlet (nos.)	-	-	-	-	2	54.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	54.59	8	192	28%						
9	Construction of culvert (nos.)	-	-	-	-	-	-	-	-	-	-	3.42	6	126.13	-	1	12.86	2	34.02	7.56	183.99	4	302	61%							
10	Pump shed (nos.)	-	-	-	-	-	-	-	-	-	-	-	3	8.49	3	1	26.24	1	3.00	37.73	6	48.43	78%								
11	Low cost Bank Protection work (km)	-	-	-	-	-	-	-	-	-	-	19.21	0.74	0.51	119.81	0.80	0.09	159.49	0.61	87.02	385.53	LS	620	62%							
12	Rehabilitation of Interior Dike (km)	-	-	-	-	-	-	-	-	-	-	-	-	0.60	-	32.03	3.95	12.25	213.75	17.69	124.37	370.15	21	419.36	88%						
13	Closure/ Cross-bundh (km)	-	-	-	-	-	-	-	-	-	-	-	-	0.14	20.58	-	-	-	0.14	0.53	21.11	LS	20	106%							
14	Supply of Drain pipe (m)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,168	1,314	139.62	4,609.34	87.86	198	5.17	232.65	9,000	256	91%					
15	Flood damage repair / Breach Closing	-	-	-	-	-	-	-	-	-	-	-	0.72	0.12	104.35	13.58	8.59	482.22	10.78	161.09	0.40	0.22	747.88	LS	800	93%					
16	GoB O&M	-	-	-	-	-	-	-	1.19	2.18	173.28	10.27	0.03	265.59	0.44	28.98			35.44	18.35	521.64	LS	600	87%							
	<b>Total</b>		<b>269.14</b>		<b>1,552.16</b>		<b>2,133.28</b>		<b>2,798.82</b>		<b>3,164.38</b>		<b>6,373.09</b>		<b>8,084.00</b>		<b>3,740.20</b>		<b>571.00</b>		<b>28,686.08</b>										

In 2019/20, the most active construction season (as judged by the value of certified payments), there were a total of 332 active contracts: comprising 167 new contracts which started in the season and 165 contracts for carried-over works. Within the total of 332, there were 64 contracts for miscellaneous works (ie low cost bank protection, rehabilitation of interior dykes, flood damage repair, etc). The 167 new contracts included 87 for earthworks (or 11% of the total number of earthworks contracts awarded), 30 for the rehabilitation of structures (25% of the total number of the contracts awarded for the rehabilitation of structures) and 9 for the construction of new structures (15% of the total number of the contracts awarded for new structures).

Table 13.2 sets out the cumulative quantity and value of certified works for each of the construction seasons against each of the RDPP budget heads.

Table 13.2 Cumulative Expenditure against RDPP Budget Heads

Sl. No	Work Items	Cumulative progress upto June 2014			Cumulative progress upto June 2015			Cumulative progress upto June 2016			Cumulative progress upto June 2017			Cumulative progress upto June 2018			Cumulative progress upto June 2019			Cumulative progress upto June 2020			Cumulative progress upto June 2021			Cumulative Progress to end-Sep 2021			TOTAL cost adj RDPP (as revised September 2020)		
		Qty (Full)	Qty (Part)	Total Cost	Qty (Full)	Qty (Part)	Total Cost	Qty (Full)	Qty (Part)	Total Cost	Qty (Full)	Qty (Part)	Total Cost	Qty (Full)	Qty (Part)	Total Cost	Qty (Full)	Qty (Part)	Total Cost	Qty (Full)	Qty (Part)	Total Cost	Qty (Full)	Qty (Part)	Total Cost	Qty (Full)	Qty (Part)	Total Cost	Qty	Cost	%age
1	Re-sectioning of Embankment (km)	2.80	63.42	220.88	71.73	82.98	1,168.37	161.04	27.25	1,950.20	206.84	44.35	2,754.59	264.70	30.61	3,533.39	316.52	13.76	4,098.50	325.00	4,178.33	330.12	4,190.70	330.12	4,190.70	330	4,233	99%			
2	Retired Embankment (km)	0.60	0.99	0.60	2.24	191.96	2.84	1.47	315.86	2.84	1.08	340.43	4.55	509.38	4.95	1.31	579.70	14.81	884.74	20.01	1,054.75	20.34	1,074.22	21	1,252	86%					
3	Re-excavation of khals (km)	6.63	0.55	47.27	27.98	17.42	412.57	49.57	33.35	679.90	99.71	33.04	1,478.47	178.01	30.10	2,402.84	330.14	47.25	5,095.11	412.21	24.02	6,332.85	519.19	2.29	7,489.57	521.48	7,497.51	545	8,676	86%	
4	Repair of Regulator/Sluice with gate (nos.)	-	2	5	27.98	21	27	692.79	48	12	1,302.81	75	3	1,913.50	101	24	2,519.20	156	5	3,855.67	170	4,406.86	176	4,641.96	186	5,025	92%				
5	Repair of Inlets/Outlets (nos.)	-	4	20.42	139	49	227.54	211	269.24	216	274.15	216	274.15	216	274.15	216	274.15	218	278.56	218	278.56	218	278.76	235	276	101%					
6	Construction of Drainage Regulator/ Sluice (nos.)	-	-	-	2	88.29	7	553.28	3	5	1,034.02	6	12	2,510.65	12	13	5,790.17	23	6	6,894.70	29	7,010.71	31	7,220	97%						
7	Construction of Drainage Outlet (nos.)	-	-	-	-	-	-	-	-	-	-	-	7	286.08	5	11	1,068.33	15	2	1,276.30	17	1,436.95	8	1,480	97%						
8	Construction of Irrigation Inlet (nos.)	-	-	-	-	2	54.59	2	54.59	2	54.59	2	54.59	2	54.59	2	54.59	2	54.59	2	54.59	2	54.59	17	1,480	28%					
9	Construction of culvert (nos.)	-	-	-	-	-	-	-	-	-	-	3.42	6	129.55	6	1	142.41	8	176.43	8	183.99	32	302	61%							
10	Pump shed (nos.)	-	-	-	-	-	-	-	-	-	-	-	-	3	8.49	3	1	34.73	4	37.73	4	37.73	6	48	78%						
11	Low cost Bank Protection work (km)	-	-	-	-	-	-	-	-	-	-	19.21	0.74	0.51	139.02	1.54	0.09	298.51	2.15	385.53	2.15	385.53	LS	620	62%						

12	Rehabilitation of Interior Dike (km)	-	-	-	-	-	-	0.60	-	32.03	4.55	12.25	245.78	22.23	370.15	22.23	370.15	21	419	88%	
13	Closure/ Cross-budh (km)	-	-	-	-	-	-	0.14	20.58	-	20.58	-	-	-	20.58	0.14	21.11	LS	20	106%	
14	Supply of Drain pipe (m)	-	-	-	-	-	-	-	-	4,168	1,314	139.62	8,777	227.48	8,975	232.65	9,000	256	91%		
15	Flood damage repair / Breach Closing	-	-	-	-	-	-	0.720	0.12	104.35	14.30	8.59	586.57	25.09	747.66	25.49	747.88	LS	800	93%	
16	GoB O&M	-	-	-	-	-	1.19	2.18	173.28	11.46	0.03	438.87	11.89	467.85	11.89	503.29	11.89	521.64	LS	600	87%
	Re-excavation of ponds	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	<b>Total</b>	<b>269.14</b>	<b>1,821.30</b>	<b>3,954.58</b>	<b>6,753.40</b>	<b>9,917.78</b>	<b>16,290.87</b>	<b>24,374.87</b>	<b>28,115.08</b>	<b>28,686.08</b>	<b>31,420</b>	<b>91%</b>									

The tables show the relatively slow start to the construction effort. The five-year duration assumed in the original DPP would have meant an average rate of implementation of BDT 5,350 lakh per annum (ie BDT 21,390 lakh over an effective four-year period<sup>[Notes 1]</sup>). By the end of the construction season in FY 2015/16 – just over half-way through the original 69 month project period – only 18% (a cumulative value of BDT 3,954 lakh against a total provision of BDT 21,390 lakh in the DPP of May 2013) had been disbursed, and Blue Gold was classified by MoWR/BWDB as a “sick project”.

To compensate for the numerous vacancies within the BWDB Division and Design Offices, the 2016 Annual Review Mission (Recommendation 1.1) allocated a € 500,000 budget for additional resources to BWDB. The fund was channelled through the TA team and used for additional junior professional staff in the BWDB Design Circles, field and technical support staff in Khulna and Patuakhali, and the appointment of survey firms to carry out surveys and design data collection under contract to the Executive Engineer of the responsible BWDB Division.

**Design staff:** Four junior design engineers were identified and selected by BWDB and subsequently contracted through the TA Team in April 2017 and appointed to Design Circles 2 and 5 in BWDB’s Green Road complex – and provided with computers and office furniture. In October 2017, a junior mechanical engineer for ME Khulna was appointed. These staff were recruited through the TA team but were accountable to BWDB line managers.

**Survey and design data collection (SDDC):** After appreciating the range of support likely to be required by BWDB if survey teams were recruited locally (ie recruitment of trained staff, provision of survey equipment, transport, field allowances etc), and the complexity of managing and obtaining transparent financing procedures, preference was instead given to contracting local survey firms to conduct survey and design data collection. Survey contracts were therefore outsourced to local service companies instead of hiring additional staff.

**Procurement and quality control staff:** Additional staff have yet to be appointed in field offices in field offices for the preparation of estimates and tendering, and quality control. With respect to estimates and tendering, there was understandable reluctance within BWDB about providing confidential and sensitive information on prices and tendering procedures to part-time staff – for fear of collusion with contractors.

These measures and the efforts of the incoming BWDB Program Coordinating Director (who started in March 2016) resulted in a steady increase in the construction during FY 2017/18 followed by significant year-on-year increases in both FY 2018/19 and FY 2019/20.<sup>[Notes 2]</sup>

## Nature of Works[[edit](#) | [edit source](#)]

Blue Gold infrastructure works comprise simple, relatively low-value, but scattered construction activities for which expertise in earthworks and reinforced concrete structures is required, as well as experience in working in, and alongside, tidal rivers.

Over the eight-year lifetime of Blue Gold (2013 to 2021), some 1,157 contracts have been awarded (excluding those awarded for GoB O&M works) for the fifteen main work items defined in RDPP in

Table 12.1 as well as to BWDB's Mechanical Engineering (ME) Division.

For each of the fifteen main RDPP work items, Table 13.3 presents the numbers and values of contracts awarded to Labour Contracting Societies (LCSs) and to general contractors.

Table 13.3 Number and Values of Infrastructure Contracts Awarded under Blue Gold

SI. No	Work Items	Re- Adjustment (approved 1 September 2020)		No. of Contracts			Contract Value (BDT lakh)					
		Quantity	Cost (BDT lakh)	LCS	Contractor	TOTAL	LCS			Contractor		
				Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
1	Re-sectioning of Embankment (km)	330.13	4,233	228	104	332	3.0	13.7	7.7	4.8	132.3	28.2
2	Retired Embankment (km)	20.58	1,252	14	33	47	7.3	9.9	8.9	2.8	259.5	35.1
3	Re-excavation of khals (km)	545.0	8,676	218	228	446	4.2	14.0	7.6	3.4	332.3	29.8
4	Repair of Regulator/Sluice with gate (nos.)	186	5,025		108	108				1.7	95.9	24.2
5	Repair of Inlets/Outlets (nos.)	235	276		13	13				1.6	43.8	15.8
6	Construction of Drainage Regulator/ Sluice (nos.)	31	7,220		29	29				101.9	515.8	241.7
7	Construction of Irrigation inlet (nos.)	8	192		2	2				26.7	28.8	27.7
8	Construction of Drainage Outlet (nos.)	17	1,480		17	17				52.6	139.6	86.1
9	Construction of culvert (nos.)	32	302		8	8				14.3	28.6	23.0
10	Pump shed (nos.)	6	48		4	4				9.3	9.7	9.5
11	Low cost Bank Protection work (km)	LS	620		24	24				2.3	40.5	16.7
12	Rehabilitation of Interior Dike (km)	21.02	419		17	17				2.3	63.9	24.5
13	Closure/ Cross-budh (km)	LS	20		1	1				21.4	21.4	21.4
14	Supply of Drain pipe (m)	9,000	256		13	13				7.8	37.2	16.7

<b>15 Flood damage repair / Breach Closing</b>	LS	800	49	49	0.8	76.5	16.7
<b>ME Works</b>			47	47			
<b>Total</b>		<b>31,420</b>	<b>460</b>	<b>697</b>	<b>1,157</b>		

A summary of the information in Table 13.3 is provided below in Table 13.4.

**Table 13.4 Summary of Contracts Awarded**

<b>Grouping</b>	<b>Work Items (Ref Table 12.1)</b>	<b>No. of contracts</b>
<b>Earthworks</b>	1, 2, 3,	825: 460 LCSs, 365 contractors
<b>Rehabilitation of structures</b>	4, 5	121
<b>New structures</b>	6, 7, 8, 9, 10	60
<b>Others</b>	11, 12, 13, 14, 15	151 (including ME works)
<b>TOTAL</b>		1,157

### **Earthworks**[\[edit | edit source\]](#)

The scope of earthworks contracts includes the re-sectioning of embankments (Item 1), the construction of retired embankments (Item 2) and the re-excavation of khals (Item 3).

For earthworks, the value of contract varies depending on whether it is awarded to a contractor or a Labour Contracting Society (LCS). The value of earthworks contracts awarded to a contractor varied between BDT 2.8 lakh (for a retired embankment) and BDT 332.3 lakh (for re-excavation of khals). The value of an earthworks contract awarded to an LCS varied from BDT 3.0 lakh (for re-sectioning of an embankment) to BDT 14.0 lakh (for re-excavation of a khal).

The total value of the 460 earthworks contracts awarded to LCSs amounted to BDT 3,532 lakh, which was just under 25% of the total value of 825 earthworks contracts of BDT 14,447 lakh.

### **Structures - Rehabilitation**[\[edit | edit source\]](#)

The description 'rehabilitation of structures' covers contracts for the repair of regulators (Item 4), and the repair of outlets and inlets (Item 5). The analysis of 120 repair contracts is provided in Table 13.5.

Table 13.5 Analysis of Contracts for Repair of Structures

Item	No. of contracts	No of structures	Contract Value (BDT lakh)		
			Max	Min	Avg
4. Repair of regulator	108	148	95.91	1.70	24.95
5(a) Repair of outlet	5	20	36.74	1.61	23.26
5(b) Repair of inlet	8	172	43.78	3.08	20.93
	121	340			24.13

Table 13.5 shows that the value of contracts for the rehabilitation of existing structures varies from an average of BDT 24.95 lakh for the repair of a regulator or sluice structure (based on 108 contracts for 148 structures) to an average of BDT 23.26 lakh for the repair of an outlet (based on 5 contracts for 20 structures) and an average of BDT 20.93 lakh for the repair of an outlet (based on 8

contracts for 172 structures).

## **Structures - New**[\[edit | edit source\]](#)

The description 'new structures' covers contracts for the construction of regulators (Item 6), irrigation inlets (Item 7) and drainage outlets (Item 8), construction of culverts (Item 9), as well as the erection of pump sheds (Item 10).

The purpose of a regulator or drainage sluice is principally to allow the drainage of water from the polder into the tidal river when there is a differential head across the regulator (ie when the polder or country-side water level exceeds the level in the tidal river). The regulator is provided with a lift gate on the country-side (to allow freshwater to be held in the khal for irrigation during the dry season) and a flap gate on the river-side (to prevent water entry to the polder during high tide conditions). A frame is provided on the river-side so that the flap gate can be lifted when there is freshwater in the river (during the monsoon flood season) so that water can be stored in the khal within the polder and used for irrigation during the dry season. The size of the culvert is determined from the drainage area served by the structure.

An irrigation inlet or flushing sluice is a single barrelled 0.6m diameter piped structure provided with a lift gate on the country-side and a flap gate on the river-side. The purpose of the inlet is to allow freshwater to enter the polder during the monsoon period when there is freshwater in the tidal river, for storage for irrigation purposes during the dry season. Only two inlets were constructed under Blue Gold.

A drainage outlet comprises a single barrelled box culvert of one of three dimensions (0.6 x 0.9, 0.9 x 1.2, and 1.2 x 1.2m) and provided with lift gate on the country-side and a flap gate on the river-side. There is no provision for a frame to allow the flap gate to be raised to admit freshwater from the river.

A typical contract for the construction of a new regulator involves the closure of the area of works from tidal river/khal and arrangements for the pumping out of water, excavation for the structural foundation, sand piling across the foundation, construction of the reinforced concrete structure, and - after the installation of gates and associated equipment by a nominated contractor - the removal of the cross-bundhs and the commissioning and handing over of the completed structure to the BWDB Executive Engineer. The installation of gates is the responsibility of the BWDB's Mechanical Engineering (ME) Department (see below).

Because a contract for a new regulator (for example) is in one location, it can be readily managed. But there are many technical complexities to be managed - the variable nature of ground conditions during excavation, and whilst excavations remain open, the presence of unrecorded abandoned structures below original ground level, heavy inflows into the excavation due to monsoonal rainfall, tidal river conditions as well as the threat of breaches to the cross-bundhs due to river erosion or cyclonic storms.

From an analysis of the 29 contracts awarded for new sluices, Table 13.6 presents the contract values against the number of vents. The first contracts were awarded in 2015/16 and the most recent in 2020/21, so the comparison is indicative as no account is taken of annual increases in the BWDB schedule of rates.

**Table 13.6 Contract Values for Regulators**

**Contract Value  
(BDT lakh)**

<b>Size</b>	<b>No</b>	<b>Max</b>	<b>Min</b>	<b>Avg</b>
<b>4-V</b>	1	515.83	515.83	515.83
<b>3-V</b>	6	430.09	225.21	332.58
<b>2-V</b>	6	285.83	159.64	245.10
<b>1-V</b>	16	299.00	101.89	191.9

From an analysis of 17 contracts awarded for drainage outlets (as of end-November 2020), Table 13.7 presents the contract values against the size of the box culvert. The first contracts were awarded in 2018/19 and the most recent in 2019/20, so the comparison is indicative as no account is taken of annual increases in the BWDB schedule of rates.

**Table 13.7 Contract Values for Drainage Outlets**

<b>Contract Value (BDT lakh)</b>				
<b>Size (m)</b>	<b>No</b>	<b>Max</b>	<b>Min</b>	<b>Avg</b>
0.6 x 0.9	5	60.73	52.59	54.77
0.9 x 1.2	9	139.55	65.93	106.70
1.2 x 1.2	3	92.22	61.81	76.56

For the smaller structures:

- Average value of the 2 contracts awarded for 0.6m diameter flushing inlets was BDT 27.7 lakh
- Average value of the 8 contracts awarded for the construction of culverts was BDT 23 lakh
- Average value of the 4 contracts awarded for the construction of pump sheds was BDT 9.5 lakh.

## **Gates**[\[edit | edit source\]](#)

The manufacture and installation of gates is contracted separately to BWDB's Mechanical Engineering (ME) Department.

For all new structures, the installation of gates requires close coordination with the civil engineering contractor since gates are installed in dry conditions ie when earth bundhs are in position. Gates can only be manufactured when measurements have been taken after the construction of the regulator. There is therefore a limited window for the ME Department to survey, design, manufacture and instal the gates after the completion of the reinforced concrete regulator structure and before the contractor finalises the works for handover to BWDB/WMA.

## **Contractors**[\[edit | edit source\]](#)

### **General Contractors**[\[edit | edit source\]](#)

BWDB adheres to the Public Procurement Act 2006 and Public Procurement Rules 2008 in identifying contractors, preparing tenders and awarding contracts. For Blue Gold contracts, the Open Tendering Method (OTM) is the preferred modality and this specifically excludes the process of pre-qualification. Tenders are therefore invited from all eligible Tenderers through public advertisement. The eligibility criteria from a typical tender data sheet (TDS) are as follows:

**15 Experience Criteria:** *Tenderers shall have the following minimum level of construction experience to qualify for the performance of the Works under the Contract:*



(a) a minimum number of years of general experience in the construction of works as Prime Contractor or Subcontractor or Management Contractor as specified in the TDS; and

(b) specific experience as a Prime Contractor or Subcontractor or Management Contractor in construction works of a nature, complexity and methods/construction technology similar to the proposed Works in at least a number of contract(s) and of a minimum value over the period, as specified in the TDS.

(c) The minimum number of years of general experience of the Tenderer in the construction works as Prime Contractor or Subcontractor or Management Contractor shall be 3 (three) years.

(d) The minimum specific experience as a Prime Contractor or Subcontractor or Management Contractor in construction works of at least 1 (one) contract(s) of similar nature (repair/re-sectioning/construction of embankment), complexity and methods/construction technology successfully completed within the last 3 (three) years, each with the value specified in the TDS [years counting backward from the date of publication of IFT in the e-gp website/newspaper]

**16. Financial Criteria:** Tenderers shall have the following minimum level of financial capacity to qualify for the performance of the Works under the Contract:

(a) Average annual construction turnover i.e total certified payments received for contracts in progress or completed under public sector for a period as stated under ITT Sub Clause 16.1(a), substantiated by Statement(s) of Receipts, from any scheduled Bank of Bangladesh, issued not earlier than twenty-eight (28) days prior to the day of the original deadline for submission of Tenders;

(b) Availability of minimum liquid assets i.e. working capital or credit line(s) from any Scheduled Bank, net of other contractual commitments of the amount specified in the TDS;

(c) Satisfactory resolution of all claims, arbitrations or other litigation cases and shall not have serious negative impact on the financial capacity of Tenderer.

(d) The required average annual construction turnover shall be greater than the amount specified in the TDS over the last 3 (three) years. [years counting backward from the date of publication of IFT in the e-gp website/newspaper]

(e) The minimum amount of liquid assets or working capital or credit facilities of the Tenderer shall be as specified in the TDS. Note: The tenderer shall be submitted liquid asset by bank credit facilities as STD prescribed form is provided in Section 7 (General Specifications).

(f) Satisfactory resolution of all claims, arbitrations or other litigation cases and shall not have serious negative impact on the financial capacity of Tenderer.

**17. Personnel Capacity:** Tenderers shall have the minimum level of personnel capacity to qualify for the performance of the Works under the Contract consisting of a Construction Project Manager, Engineers, and other key staff with qualifications and experience as specified in the TDS:

1. Project Manager (B.Sc. in Civil Eng) 5 years' total experience, 3 years' experience with similar works
2. Site Engineer (Diploma in Civil Eng) 10 years' total experience, 5 years' experience with similar works
3. Site Supervisor (Diploma in Civil Eng) 5 years' total experience, 3 years' experience with similar works

**18. Equipment Capacity:** *Tenderers shall own suitable equipment and other physical facilities or have proven access through contractual arrangement to hire or lease such equipment or facilities for the desired period, where necessary or have assured access through lease, hire, or other such method, of the essential equipment, in full working order, as specified in the TDS. Tenderer shall own or have proven access to hire or lease of the major construction equipment, in full working order as follows:*

1 Levelling Machine with Staff 1 nos

2 Tape (30m) 2 nos

## **Labour Contracting Societies** <sup>[Notes 3]</sup> [\[edit | edit source\]](#)

A Labour Contracting Society (LCS) is a group of disadvantaged rural people who are organised to carry out small-scale earthworks. Since the early-1980s, LCS construction activities have provided an important source of income for large numbers of rural poor men and women in Bangladesh. The inclusion of LCSs in development projects has aimed to provide some of the poorest households, particularly women from these households, with an income that could set them on a pathway out of poverty.

Recent legislation has formalised contracting arrangements for LCSs. To stimulate the engagement of the local poor in the construction and maintenance of small-scale earthworks, the Public Procurement Act 2006, and Public Procurement Rules 2008, endorsed 'Direct Contracts' with Labour Contracting Societies (LCSs) consisting of a group of landless men and/or women from the local community 'under Direct Procurement Method'. The aim is to bypass traditional modes of contracting so that poorer members of the community can directly benefit from development projects.

BWDB's Participatory Water Management Rules of 2014 (PWMR 2014) <sup>[Notes 4]</sup> set out the mechanisms for the formation of LCSs by WMGs and the contractual arrangements. PWMR 2014 Clause 44.1 stipulates that 'at least 25 percent of the earthwork of a project should be given to related WMGs which will implement the earthwork through LCSs'. In Blue Gold, this was increased to 50%. <sup>[Notes 5]</sup>

Under PWMR 2014 Clause 44, BWDB contracts a WMG to execute the earthwork, and the WMG in turn enters into a contract with an LCS. However, the WMG is responsible to BWDB for the proper execution of the earthworks. Payments for the earthwork are made in three equal instalments to the bank account of the WMG, each with a 10% deduction for the security deposit: first instalment, after the start of work; second, on completion of 50% of the work; and the third and final instalment, after completion of all works. The WMG is entitled to deduct 5% from the bills as a management fee. The security deposit is disbursed six months after the completion of work if any defects have been made good. Because of the transient nature of the LCSs, there is often some uncertainty as to whether this payment reaches individual LCS members.

Under the PWMR 2014 processes, BWDB has no direct dealings with the LCSs. Prior to PWMR 2014, LCSs were directly contracted by BWDB.

## **BWDB Mechanical Engineering Department** [\[edit | edit source\]](#)

For Blue Gold, all gates and ancillary items are fabricated and installed by BWDB's Mechanical Engineering (ME) Department. ME workshops in Tejgaon (for Patuakhali O&M, Barguna O&M and Kalapara) and in Khulna (for Khulna O&M-1, Khulna O&M-2 and Satkhira O&M-2) are assigned to carry out the manufacture and installation of the gates.

## Construction quality[[edit](#) | [edit source](#)]

This section comments on the quality of construction of earthworks, repair of structures, new structures and the gates installed in repaired and new structures.

### Earthworks[[edit](#) | [edit source](#)]

Earthworks constructed in the coastal zone are generally of poor quality, and particularly vulnerable to settlement and gulying by rain before the turfing, and river erosion immediately after construction especially if there has been no compaction.

For Blue Gold earthworks, BWDB initially adopted an arrangement in which an allowance of 10% surcharge above crest design level was made to allow for consolidation settlement. Thus, an additional quantity of earthwork was provided in lieu of compaction. This arrangement was withdrawn in 2017 by the BWDB Task Force and replaced by BWDB's Schedule of Rates Item Code 16-140 which included for placing earth in layers, breaking down of clods and manual ramming of earthwork with a 7kg hammer.<sup>[[Notes 6](#)]</sup> This method has been found to be ineffective in coastal areas where the fill material has a high moisture content and is almost impossible to compact if it hasn't been first laid out to dry. The increasing use of mechanical excavators for earthworks has resulted in large clods of earth placed in layers which are many more times the 150mm thickness of layers specified in Item Code 16-140, and this results - conversely - in embankments constructed using mechanical equipment being of even lower density than those prepared by manual labour.

If there is no compaction during construction, the resultant embankments are particularly susceptible to rainfall and erosion damage until "natural consolidation" takes place. Because there is no compaction, the settlement is non-uniform, and a certain amount of compensatory filling should be expected along embankment sections which settle below the design level. Embankments constructed without compaction should be subject to repair by contractors before final survey to check that the design crest level has been achieved along its full length before acceptance by BWDB and the WMG.

### Earthworks - Alternative Modalities[[edit](#) | [edit source](#)]

In order to address the concerns about earthwork compaction, consideration could be given to including:

(a) Multi-year earthworks contracts so that consolidation settlement of earthworks during monsoon is made up to design levels in the subsequent construction season before final payment is made. However, Field XENs consider that there is no clear provision in the Public Procurement Rules 2008 (PPR 2008) for such multi-year contracts specifying yearly progress for earthwork, and therefore, is difficult to enforce in the field. In practice, however, most Blue Gold earthwork contracts are not completed in a single season and are inevitably extended - so they are in fact "unofficial multi-year contracts".

(b) "Build, operate and transfer" (BOT) contracts in which the contractor would be responsible for all works completed under the contract - for maintenance, and for any breach or damage to the embankment or structures - for a period of (say) five years.

### Structures - Rehabilitation[[edit](#) | [edit source](#)]

The rehabilitation of structures can include repairs to the reinforced concrete structure, the railing and posts, head wall and abutment pier, to the concrete block revetment and to the gates (see

below). For repairs to the concrete structure, the durability of the repair can be affected by the quality of the original concrete work to which the new work is bonded.

The successful replacement of gates in an existing structure requires careful investigation and measurement, ensuring that all silt is removed from the bed slab before the dimensions of the gates are determined, and that the installed gates are checked for full and complete closure. Where gates are to be replaced by ME Department without a civil contractor, experience has shown that detailed investigations required by the contractor before manufacture of the gate can reveal complexities which require assistance from a civil engineering contractor - for instance, the construction of cross-bundhs so that work on the sluice or regulator can be done in the dry, to remove silt from the invert base slab to ensure an effective gate seal, and to fix the gate frame securely into the concrete structure (for more on this, see below under 'Gates').

## **Structures - New**[\[edit\]](#) | [\[edit source\]](#)

New structures discussed below are regulators/drainage sluices, flushing inlets and drainage outlets.

### ***New Regulators/Sluices (Item 6)***[\[edit\]](#) | [\[edit source\]](#)

An analysis of construction records for new regulators shows that the length of construction is not related to size of structure (ie number of vents). The length of contract (in construction seasons) for 29 regulators is presented in Table 13.8 below. As can be seen from the table, it is possible for the largest 4-V regulator (P55/2A Dharandi) to be completed in two seasons, and conversely the construction of a 1-V regulator can take 3 seasons (P26 Boro Beeler Khal, P43/2D Keshobpur and P47/4 Tulatali). Thus, the quality of the contractor can have a considerable influence.

Table 13.8 Contract Period for New Regulators

<b>Size</b>	<b>Nos.</b>	<b>Average Length (Seasons)</b>	<b>Range of Seasons</b>
4V	1	2.0	2
3V	6	2.7	2 to 4
2V	6	1.8	1 to 3
1V	16	1.9	1 to 3

Lessons learnt from construction experiences are: (a) To avoid differential settlement, ground treatments should not be mixed ie don't use bored piles and sand piles together as foundation treatment; and (b) ensure that checks are made on filter materials behind wing walls since piping failure can very quickly result in differential settlement and failure of the structure.

### ***New Flushing Inlets (Item 7)***[\[edit\]](#) | [\[edit source\]](#)

Only two flushing inlets were provided (P31-part and P22), so few general conclusions can be drawn from such a small sample. Both were completed in one season.

### ***New Drainage Outlets (Item 8)***[\[edit\]](#) | [\[edit source\]](#)

An analysis of construction records for new outlets shows that the length of construction is not related to size of structure. The length of contract (in construction seasons) for 17 outlets is presented in Table 13.9 below. As can be seen from the table, the average length of construction varies from 1.6 to 2.3 seasons with a range of 1 to 3 seasons. Thus, the construction of a relatively simply structure, such as a box culvert, can be affected by its proximity to a tidal river which, for

example, can require cross bundhs or coffer dams and pumping to allow working in the dry below (tidal) river level, installing upstream and downstream sheet piling, dealing with complex ground conditions, and providing temporary drainage from khals within the polder during the construction period. Nevertheless, the capability and experience of the contractor – and the range of equipment he has available for construction activities – can influence the length of construction.

Table 13.9 Contract Period for New Outlets

Size	Nos.	Average Length (Seasons)	Range of Seasons
0.6 x 0.9	5	1.6	1 to 3
0.9 x 1.2	9	1.9	1 to 2
1.2 x 1.2	3	2.3	2 to 3

## Gates [[edit](#) | [edit source](#)]

Given the critical importance of gates for water management (and that the sole function of the reinforced concrete structure is to provide support for the gates), insufficient emphasis has been given to the functionality and durability of gates.

There have been many examples in Blue Gold where installation work has been repeated because the fixing of the gates to the structure was insufficient, or because the gates never achieved full closure. Some examples are provided: (a) In P55/2C, the flap gates were installed on the country-side and the vertical gates on the river-side; (b) the gap between the vertical lift gate and the channels for the fall board provides insufficient workspace for any maintenance activity; and (c) rubber seals are often missing.

Most of the work on regulators and inlets/outlets is carried out by a civil works contractor. The BWDB ME (Mechanical Engineering) is responsible for the fabrication and installation of gates, and ancillary fixings. The timing of commissioning needs to be carefully coordinated between the civil contractor and ME – for example, the closure bundhs which have to be removed by the civil contractor before he receives a final payment.

For durability, the gate frame needs to be firmly fixed to the concrete structure. This involves cutting back the concrete work and welding lugs attached to the frame to reinforcing bars in the concrete structure before replacing the concrete using a dry mix to minimise shrinkage. If this process is not carried out (perhaps because a civil contractor has not been contracted), then the durability of the gate is severely compromised, and its operational lifetime can be limited – especially if the operators use excessive force to close the gates.

There is a historical justification for the role of ME – when relatively few private sector operators had access to raw materials, and the facilities for fabrication, sandblasting and painting to meet the specifications for gates to regulating structures. However, with the increasing number of private sector workshops, the justification for ME’s continued monopoly of BWDB gates work is questionable.

For simplicity, it would be preferable to allow the civil contractor to select a firm, from an approved list, to manufacture and install the gates, so that the responsibility for coordination between the civil and mechanical contractor is given under a single contract – rather than relying on ME, a semi-autonomous organisation coming under the BWDB umbrella, and whose payments are only occasionally withheld.

The importance of taking life cycle costing approach to the design of gates, fixings and ancillary

structures and the potential value of a fundamental design review has been emphasised elsewhere. [\[Notes 7\]](#)

## Notes [\[edit\]](#) | [edit source](#)

- [↑](#) The 'effective four-year period' is recognition that a project start date in March 2013 does not allow the development of contracts for award in the first construction season (from January to June 2013).
- [↑](#) The Increase in FY 2018/19 over FY 2017/18 was 100%+ (BDT 6,373 lakh cf BDT 3,164 lakh) followed by a 25% increase from FY 2019/20 over FY 2018/19 (BDT 8,084 lakh cf BDT 6,373 lakh).
- [↑](#) Refer to the Blue Gold Program report, "Impact of LCS Work on Poverty Reduction and Women's Empowerment" by Dr Sharmind Neelormi (May 2020) and to LLR Section F Chapter 24.2 for a thorough presentation of the role of LCSs.
- [↑](#) Refer to Chapter Six, Clauses 43 and 44 PWMR 2014
- [↑](#) Part B Clause 26 DPP (May 2013)
- [↑](#) Item Code 16-140 Earth work by manual labour in re-sectioning of embankment manually compacted by 7kg iron rammer to avoid any air pockets in clayey soil and all lifts including throwing the spoils to profile in layers not exceeding 150mm thickness with clod breaking to a max size of 100mm
- [↑](#) Section C Chapter 12

## See more [\[edit\]](#) | [edit source](#)

Previous chapter:

[Chapter 12: Survey, Design and Procurement](#)

[Blue Gold Lessons Learnt](#)

[Wiki](#)

**Section C: Water Infrastructure**

Next chapter:

[Chapter 14: Consultation and participation in planning](#)

Section C: Water Infrastructure		
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## Executive summary: A Call for Action

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Bangladesh Water Development Board, government agency which is responsible for surface water and groundwater management in Bangladesh, and lead implementing agency for the Blue Gold Program

Operation and Maintenance

Technical Assistance

Embassy of the Kingdom of the Netherlands, the contractual representative of the Minister of Foreign Trade and Development Cooperation of the Netherlands and signatory to the agreement for the Blue Gold Program with the External Resources Division of the Ministry of Finance as the signatory for the Government of Bangladesh

Revised Development Project Proforma

Financial Year

A culvert is a structure that allows water to flow beneath a road, railroad, trail, or similar obstruction from one side to the other.

small earthen embankment or dam

Government of Bangladesh; a donor to the Blue Gold Program

Development Project Proforma: a formal document which sets out the intention of a GoB organisation to invest in a development project, seeking approval for the investment and, if successful, a budget allocation. The DPP follows a prescribed format, including the project's financial and physical scope, benefits, and proposals for monitoring and internal and external audits. The approval of a development project proposal follows a number of stages: formation with preliminary studies, formulation to develop greater detail and with additional information to make the economic case for the project, scrutiny by the executing agencies and concerned ministries, appraisal by the Planning Commission, recommendation for approval by Project Evaluation Committee (PEC), Minister/ECNEC approval, and inclusion of a budgetary allocation in the Annual Development Plan (ADP).

Bangladesh Taka

Ministry of Water Resources

river whose flow and level are influenced by tides

Labour Contracting Societies - Groups of usually landless people who are contracted by an agency to



carry out a certain type and volume of earthwork within a given time period. For BWDB, the rules for engagement of an LCS are set down in PWMR 2014 Chapter 6

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Groups of usually landless people who are contracted by an agency to carry out a certain type and volume of earthwork within a given time period. For BWDB, the rules for engagement of an LCS are set down in PWMR 2014 Chapter 6

Structure designed to only admit (fresh or saline) water across an embankment.

Earthen dyke or bundh raised above surrounding ground level, for example so that roads or railway lines are above highest flood levels, or so that an area is empoldered to protect it from external floods and saline waters.

drainage channel or canal

the principal function of a regulator or drainage sluice is to allow the drainage of water from the polder into a peripheral river when there is a differential head across the regulator (ie when the polder or country-side water level exceeds the level in the tidal river). The regulator is provided with a lift gate on the country-side (to allow freshwater to be held in the khal for irrigation during the dry season) and a flap gate on the river-side (to prevent water entry from the river channel into the polder during high tide conditions). A frame is provided on the river-side so that the flap gate can be lifted when there is freshwater in the river (during the monsoon flood season), thus allowing freshwater to be stored in the khal within the polder and used for irrigation during the dry season. The size of the culvert is determined from the drainage area served by the structure.

A vertical gate to control the flow of water; also referred to as 'regulator'

An area of low-lying land surrounded by an earthen embankment to prevent flooding by river or seawater, with associated structures which are provided to either drain excess rainwater within the polder or to admit freshwater to be stored in a khal for subsequent use for irrigation.

vertical gate typically raised and lowered by operating a handwheel up and down a vertical screw, with the gate kept in position by means of steel channels set in the walls of a regulator.

Hinged gate on the river-side of a regulator vent which automatically closes when water rises above the country-side water level.

The practice of admitting (fresh or saline) water for irrigation (or shrimp production) through regulators or inlets.

Water Management Association - In Blue Gold, the polder-level representative of WMGs, and signatory to an O&M Agreement with BWDB

actions taken to prevent or repair the deterioration of water management infrastructure and to keep the physical components of a water management system in such a state that they can serve their intended function.

assumed in this report to operate up to 0.5 acres (0.2 ha)

A process by which the local stakeholders are directly and actively involved in identification, planning, design, implementation, operation & maintenance and evaluation of a water management project.

Participatory Water Management Rules (2014)

Water Management Group - The basic organizational unit in Blue Gold representing local stakeholders from a hydrological or social unit (para/village). Through Blue Gold, 511 WMGs have been formed and registered. The average WMG covers an area of around 230 ha has 365 households or a population of just over 1,500.

Water Management Group - The basic organizational unit in Blue Gold representing local stakeholders from a hydrological or social unit (para/village). Through Blue Gold, 511 WMGs have been formed and registered. The average WMG covers an area of around 230 ha has 365 households or a population of just over 1,500.

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## Namespaces

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## Variants

This page was last edited on 19 December 2021, at 06:00.

## Blue Gold Program Wiki

The wiki version of the Lessons Learnt Report of the Blue Gold program, documents the experiences of a technical assistance (TA) team working in a development project implemented by the Bangladesh Water Development Board (BWDB) and the Department of Agricultural Extension (DAE) over an eight+ year period from March 2013 to December 2021. The wiki lessons learnt report (LLR) is intended to complement the BWDB and DAE project completion reports (PCRs), with the aim of recording lessons learnt for use in the design and implementation of future interventions in

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