2 Project Profile

This chapter presents the outline of Stage III Project, which is mainly based on the Design Report for Stage III of the Shenzhen River Regulation Project (hereafter Stage III Project).

2.1 Project Description

Stage III Project covers an area from the starting point of Stage I Project (Chainage 9+416.963) to the Ping Yuen River (River Ganges) mouth (Chainage 13+465.136) with a new river channel of 4.05 km. Stage III of the Project is divided into two phases. The design, management and construction for the first phase will be carried out by Shenzhen and Hong Kong governments on their resource, while the second phase will be implemented jointly by the two governments.

The phase I of the Project mainly includes the following items:

New patrol roads and fences will be constructed before removing the existing patrol roads and fences on both sides of the border which will be affected by Stage III Project.

According to the agreement between the two governments, foundation and construction of the retaining wall upstream of Man Kam To Border Crossing on the Hong Kong side will be included into the phase I of the Project, and the Hong Kong government will be responsible for its design and construction.

The phase I of the Project includes the following items:

(1) Channel construction

1) Widen, deepen and straighten the existing river course from the starting point of Stage I of the Project to the Ping Yuen River (River Ganges)mouth and the connections to the tributaries, such as the Ng Tung River (River Indus), the Sha Wan River and the Ping Yuen River (River Ganges).

2) Protect the slope and banks of the 4.05 km long new river course.

3) Adopt effective measures to protect the riverbed in some sections with severe

scouring.

(2) Embankment construction

Construct new dykes on both sides of the new river course and soil-retaining structure.

(3) Bridge construction

The bridges affected by Stage III Project are Lo Wu Railway Bridge, the Old Lo Wu Footbridge, the New Lo Wu Footbridge, the Old Man Kam To Vehicle Bridge and the New Man Kam To Vehicle Bridge. All five bridges will be strengthened or reconstructed during the second phase of Stage III Project.

The reconstruction scheme will be adopted for the Lo Wu Railway Bridge. At the place of the existing Railway Bridge, a new steel truss bridge will be built.

The Old Lo Wu Footbridge has been used only for crossing by boundary inspection staff and farmers on both sides. The daily passengers are about 20 to 30. Due to serious water backup by the piers, the designed water surface is high, which diminishes the flood control capability. In order to meet the flood protection standard of Stage III Project, spoil transportation and the passage of maintenance dredger, the Old Lo Wu Footbridge will be replaced by a new steel truss bridge with a span of 41 m.

The foundation of the New Lo Wu Footbridge will be strengthened. On the Shenzhen side, concrete will be grouted to strengthen the foundation around the piers, and the exposed gaps will be filled with infiltration-proof concrete. On the Hong Kong side, concrete will be grouted to strengthen the base, and the pile cap will be widened and thickened by using infiltration-proof concrete.

The old and new Man Kam To vehicular bridge will be removed, and a new vehicular bridge will be built at 1.5 m distance to the new bridge.

(4) Reprovisioning work

1) The reprovision of the drainage system along both sides of the river

The drainage systems on the Shenzhen side affected by the Project include Luofang drainage pipes, Huangbeiling flood discharge pipes, Kouan drainage culvert, the outlet pipes of Man Kam To Pumping Station, Man Kam To pipe channel, the drainage

pipes of switching well and the outlet pipes of pumping station in East Square, the drainage pipes of switching well in Lo Wu Bridge, and the outlet pipes of pumping station in Lo Wu Bridge, etc.. The reprovisioning of the drainage system on the Shenzhen side will concentrate on extending the existing drainage pipes and culverts to the new river course. Some new drainage culverts will also be built incorporating the existing drainage system, to meet the drainage requirement along the bank.

There are 9 outlets on the Hong Kong side. The reprovisioning of the drainage system on the Hong Kong side will focus on the rearrangement of the existing outlets. Also, some new drainage pipes and culverts will be built to meet the drainage requirements.

2) Reprovisioning of Dong-Shen water supply pipes

There are 5 Dongjiang water mains across the Shenzhen River at the upstream of Man Kam To (12+349). Two of the pipes at the downstream side will not be affected as they are deep buried. However, the other 3 are not buried deep enough and are higher than the designed river bed level. So diversion is necessary for flood protection and pipe protection can be ensured.

3) Other reprovisioning works

Other facilities affected by Stage III Project on the Shenzhen side are the hydrological station at Sha Wan River mouth, the power tower near the Water Affairs Bureau quarters and other boundary-crossing facilities.

The layout plan of Stage III of the Shenzhen River Regulation Project is shown in Figure 2. 1.

2. 2 Design

(1) Design flood standard

According to the Report of Flood Control Planning for the Shenzhen River Regulation jointly proposed by Shenzhen and Hong Kong governments, the flood control capability standard of the Shenzhen River is 50-year return period.

(2) Layout plan of river course

From the preliminary design, the setting out co-ordinates of the centre line and cen-

ters of river bends are shown in Table 2. 1.

The layout plan of river course is shown in Figure 2. 1.

To meet the requirement of environmental protection, the following principles were observed in determining the layout plan of river course.

1) Avoid or reduce occupation of the site with important ecological value as much as possible.

There are some fishponds, marshes, and woodland with important ecological value, for which occupation should be avoided if possible when the layout plan of river course is determined.

2) Reduce demolition as much as possible

The demclished building and facilities need to be rebuilt, which would cause new environmental impact and occupy land.

3) Decrease spoil as much as possible

The spoil would bring many environmental problems. The layout that will minimise spoil generation should be adopted.

4) Avoid any adverse impact on future development of the surrounding area

The construction site involved Lo Wu Village and Muk Wu Village in Hong Kong and Futian District in Shenzhen. Adverse effects on future development of these areas should be avoided in selecting layout of river course for the Project.

In addition to fulfilling the objective of the Project and other aspects, the following requirements should be met in determining of the layout plan of the river course.

1) Smooth joining to Stage I Project, river mouth of the tributaries, and river course in upper reach of the River.

2) The radius of river bend should not be too small in order to maintain smooth joining to upper reach and lower reach.

3) Land acquisition should be within the area shown in the preliminary report of the Project by the governments of Shenzhen and Hong Kong.

Figure2-1 Zoning And Plan Layout of Stage III Project

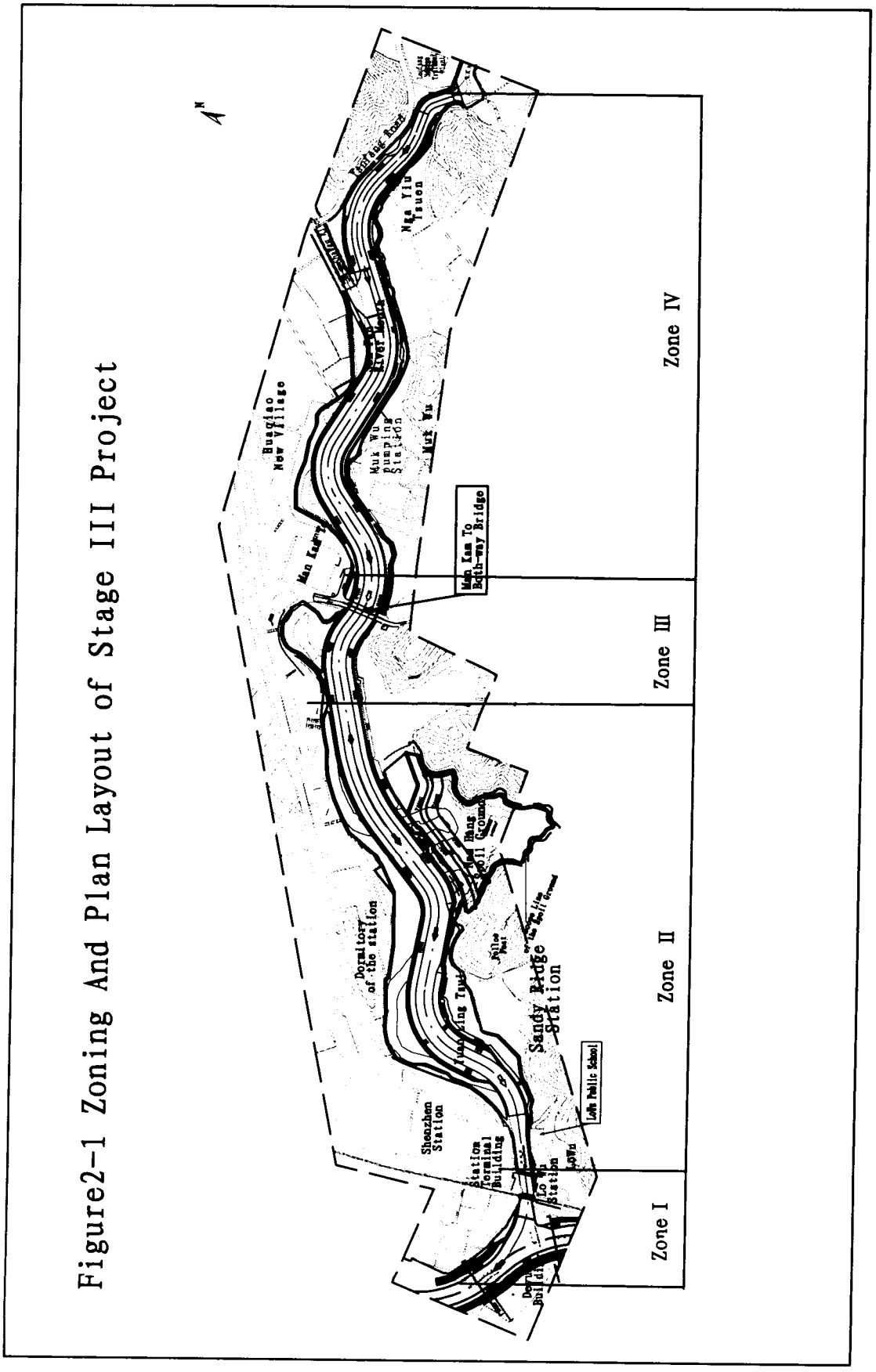

Table 2. 1 Control Points of Axis and Circle Centers of River Bends

No.	Independent Coordinates of the Shenzhen River		Center	Independent Coordinates of the Shenzhen River		Radius
	X	Y		X	Y	(m)
A00	11145. 2425	55775. 8887	H0	11281. 9357	55928. 0891	198. 32
A01	11117. 2650	55817. 5770	H1	11306. 1762	55976. 0095	229. 65
A02	11085. 9876	55897. 5321	H2	11389. 4474	56189. 4985	199. 10
A03	11079. 0117	56009. 7137	H3	11429. 8618	56576. 9414	182. 97
A04	11096. 3457	56069. 3414	H4	11788. 9650	56714. 3710	146. 99
A05	11096. 3457	56069. 3414	H5	11611. 3428	57406. 1356	535. 38
A06	11105. 1430	56087. 0290	H6	12044. 8794	57409. 2019	165. 42
A07	11182. 2810	56226. 7100	H7'	12411. 5868	57546. 9534	150. 46
A08	11215. 4916	56286. 3561	H8	12297. 0939	57929. 8764	226. 31
A09	11371. 1070	56387. 7550	H9	12611. 2771	58203. 8595	213. 86
A10	11446. 7162	56394. 7495	H10	12408. 5057	58644. 6334	214. 34
A11	11610. 0800	56545. 3280	H11	12767. 6090	58907. 6313	221. 11
A12	11644. 1880	56739. 7674	H12	12494. 2593	58967. 0248	51. 64
A13	11712. 0070	56839. 6020	H13	12457. 8828	59006. 6018	29. 50
A14	11891. 6520	56949. 9990	H14	12510. 5777	59078. 0083	29. 20
A15	12070. 1708	57130. 2545				
A16	12186. 6430	57323. 9635				
A17	12199. 9728	57466. 7219				
A18	12278. 1243	57729. 7246				
A19	12385. 8219	57808. 3672				
A20	12444. 2388	57961. 2696				
A21	12402. 0082	58159. 2125				
A22	12441. 0025	58333. 5508				
A23	12579. 0212	58514. 7586				
A24	12603. 9228	58732. 6969				
A25	12566. 0272	58816. 7896				
A26	12546. 5150	58905. 4210				
A27	12545. 8937	58967. 5410				
A28	12527. 0640	59006. 9025				
A29	12497. 7880	59030. 9860				
A30	12482. 3060	59043. 6570				
A31	12465. 0920	59057. 8244				

4) The requirements for border crossings of both in Shenzhen and Hong Kong should be statisfied.

5) The border crossing at Lo Wu and Man Kam To would not be affected and the border crossing for people and vehicles would not be affected during construction.

6) The normal operation of the Muk Wu Pumping Station would not be affected.

7) The limitation of the topography and buildings on both sides of the River should be observed.

8) It is required to find a cost effective solution.

The layout plan of the river course is determined according to the principles and requirements mentioned above.

(3) The river cross-section

The compound cross-section is normally used for the river course of Stage III Project if geometrically possible. But vertical or mixed cross-section will also be adopted locally if buildings or mountains along the banks restrict the river course. The detailed layout is:

1) The connection section to Stage 1 Project (9+416.963—9+667.593):

The compound cross-section is applied for smooth connection to Stage I Project.

2) Lo Wu Bridge Section (9+667.593—10+113.082)

The vertical cross-section is to be used here due to the restriction from three bridges and the Control Building.

3) 10+113.082—10+518.647 section

The compound cross-section is used.

4) The downstream of the mouth of River Ganges(13+186.664—13+465.848)

The mixed cross-section will be adopted because of the restriction from the Luofang Patrol Road and Luofang Water Purification Works on the Shenzhen side, and mountain and roads on the Hong Kong side. The vertical wall is used on the Shenzhen side while the compound cross-section with retaining wall above the platform is applied on the Hong Kong side.

The dimension of the river are shown in Table 2. 2.

A typical cross-section is given by Figure 2. 2.

(4) The designed water level

The designed water level used in preliminary design is shown in Table 2. 3.

(5) The designed elevation of the embankment top

The designed water level is 50-year return period flood tide. The verification water level is 200-year return period with an enveloping curve for 10-year return period flood tide.

The designed crest levels of the embankment is shown in Table 2. 3.

2. 3 Construction of the Project

For environmental protection, the following principles should be observed to meet the requirements of the construction, in determination of the construction scheme.

(1) Reduce site area as much as possidle in order to minimize the impact of the construction on ecology, landscape, water and soil conservation and land usage, etc..

(2) Avoid using areas with important ecology value or special landscape as much as possible.

(3) Arrange construction to reduce the impact on the residential areas, schools, offices and other sensitive receivres near the construction site. For example, mechanical equipment producing noise should be arranged far away from the sensitive receivers. Besides warehouses, material piled ground, main traffic road which are liable to produce dusts should also be as far away as possible form the sensitive receivers.

(4) Make rational construction plan and apply suitable construction method to reduce the impact of construction on water quality, air and noise.

2. 3. 1 *Constructional Zonation*

In light of the layout of border crossing bridges and construction site, the construction of Stage III Project is divided into four zones (I-IV).

Table 2. 2 Dimension of the Cross—Sections in Preliminary Design Phase of Stage Ⅲ Project

Corresponding Chainage	Length (m)	Distance (m)	Section Type	Width of (m) Riverbed	Riverbed Level (m)	Design Water Level (m)	Crown Level (m)	Notes
9+416.963			trapezoid	55.640	−3.990	4.110	4.695	Jumping—off Point of Stage Ⅰ Project
9+467.1691	50.206	50.206	trapezoid	55.639	−3.980	4.136	4.708	
9+535.3587	118.396	68.190	trapezoid	64.096	−3.966	4.170	4.720	
9+553.714	136.751	18.355	compound	74.282	−3.963	4.182	5.055	
9+582.3238	165.361	28.610	compound	91.963	−3.957	4.194	5.390	
9+597.327	180.364	15.003	compound	102.907	−3.954	4.208	5.425	Ng Tung River Mouth
9+713.000	296.037	115.673	vertical	34.726	−3.931	4.260	5.460	Lo Wu Bridge
9+748.7244	331.761	35.724	vertical	31.785	−3.924	4.415	5.560	
9+908.2896	491.327	159.565	vertical	36.000	−3.892	4.670	5.870	
9+976.5582	559.595	68.269	vertical	51.126	−3.878	4.682	5.880	
10+111.4427	694.480	134.885	vertical	51.126	−3.851	4.708	5.900	
10+169.7879	752.825	58.345	compound	51.126	−3.839	4.720	6.009	
10+245.7236	828.761	75.936	compound	51.126	−3.824	4.726	6.015	
10+484.4805	1067.518	238.757	compound	51.126	−3.776	4.746	6.036	
10+532.5402	1115.577	48.060	compound	50.032	−3.767	4.750	6.041	
10+562.4064	1145.443	29.866	mixed	56.638	−3.761	4.751	6.044	
10+681.8889	1264.926	119.482	mixed	55.053	−3.737	4.757	6.055	No. 1 squadron
10+709.3392	1292.376	27.450	mixed	55.053	−3.732	4.758	6.056	
10+731.469	1314.506	22.130	compound	48.054	−3.727	4.760	6.058	
10+806.2567	1389.294	74.788	compound	48.054	−3.712	4.767	6.061	
11+017.1117	1600.149	210.855	compound	46.042	−3.670	4.790	6.072	
11+273.2434	1856.280	256.132	compound	46.042	−3.619	4.806	6.099	
11+499.2738	2082.311	226.030	compound	43.149	−3.574	4.836	6.127	Man Kam To
11+647.5692	2230.606	148.295	compound	43.149	−3.544	4.857	6.146	
11+942.3355	2525.373	294.766	compound	43.149	−3.485	4.903	6.198	
12+075.6902	2658.727	133.355	compound	40.815	−3.458	4.921	6.218	
12+248.7559	2831.793	173.066	compound	39.680	−3.424	4.942	6.235	Muk Wu Pumping Station
12+451.1535	3034.191	202.398	compound	37.106	−3.383	4.965	6.263	Sha Wan River Mouth
12+635.4439	3218.486	184.295	compound	48.905	−3.346	4.987	6.300	
12+674.4795	3257.517	39.031	compound	54.560	−3.338	4.993	6.301	
12+721.4996	3304.537	47.020	mixed	80.147	−3.329	5.000	6.302	
12+776.201	3359.238	54.701	mixed	49.349	−3.318	5.008	6.304	
12+806.2012	3389.238	30.000	compound	30.000	−3.312	5.012	6.304	
12+863.2188	3446.256	57.018	compound	30.000	−3.301	5.020	6.306	
12+943.7221	3526.759	80.503	compound	30.000	−3.285	5.031	6.313	
12+961.3436	3544.381	17.621	compound	30.000	−3.281	5.034	6.315	
13+093.4897	3676.527	132.146	compound	30.000	−3.255	5.049	6.326	
13+185.7261	3768.763	92.236	mixed	30.000	−3.236	5.058	6.342	Conveying belt
13+277.1292	3860.166	91.403	mixed	30.000	−3.218	5.066	6.348	
13+339.2523	3922.289	62.123	mixed	30.000	−3.206	5.070	6.355	
13+384.3006	3967.338	45.048	mixed	30.000	−3.197	5.081	6.361	
13+422.2097	4005.247	37.909	connecting	30.000	−3.189	5.090	6.365	Connecting section
13+442.2159	4025.253	20.006		30.000	−3.185	5.095	6.367	
13+465.1358	4048.173	22.920		57.447	1.400	5.100	6.370	

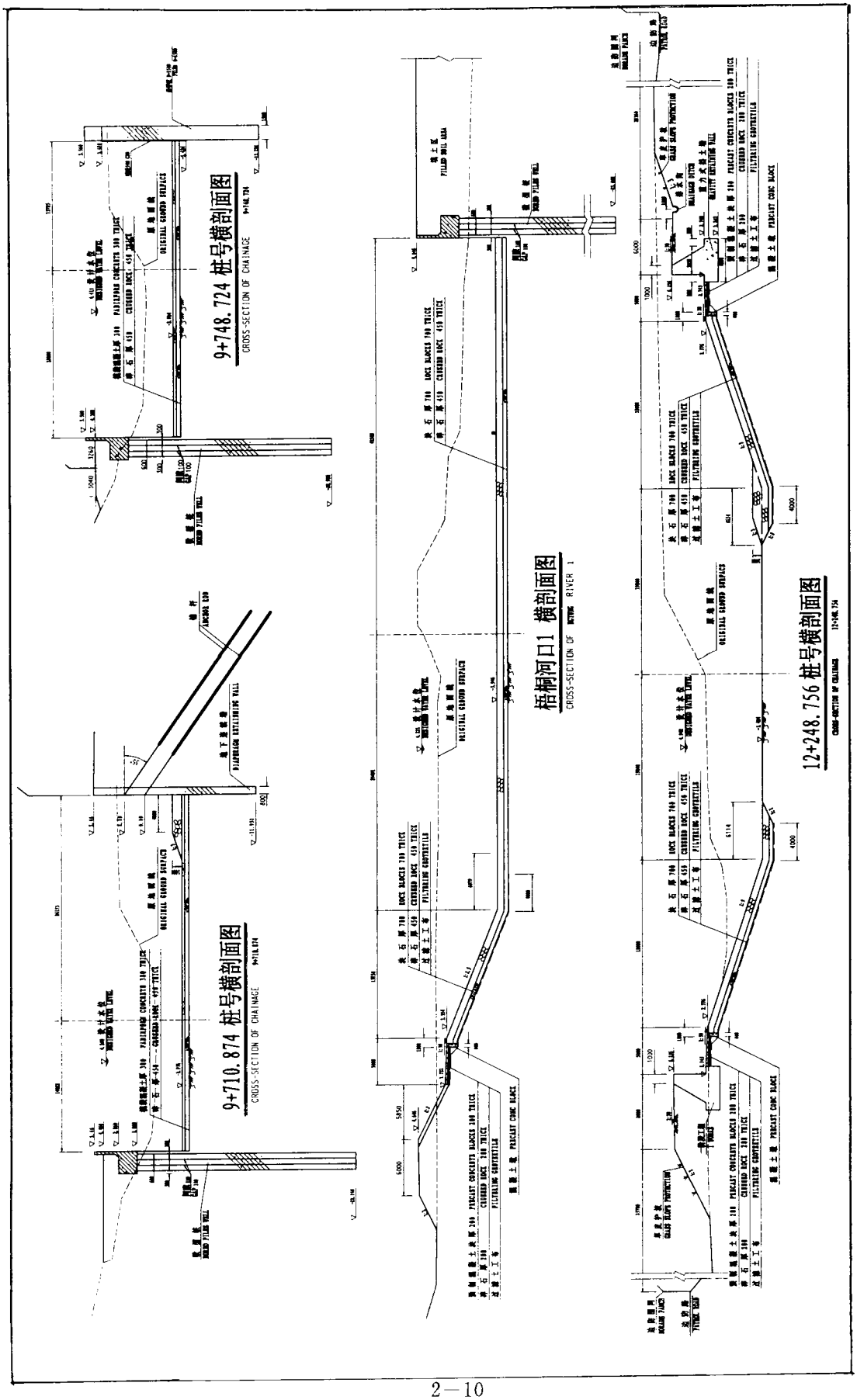

FIGURE 2.2 TYPICAL CHANNEL CROSS-SECTION OF STAGE Ⅱ PROJECT

Table 2. 3 Calculated Result of Crown Elevation

Item	Design Water Surface Curve	Check Water Surface Curve	Crown Level(m)
Corresponding Chainage	p=2%+10% Enveloping Curve for Flood Tide (m)	p=0. 5%+10% Enveloping Curve for Flood Tide (m)	
9+417	4. 11	4. 60	5. 51
9+713	4. 26	4. 76	5. 46
9+800	4. 62	5. 26	5. 82
9+900	4. 67	5. 31	5. 87
10+000	4. 69	5. 34	5. 89
10+169	4. 72	5. 38	5. 92
10+182	4. 72	5. 38	6. 01
10+300	4. 73	5. 39	6. 02
10+530	4. 75	5. 41	6. 04
10+733	4. 76	5. 43	6. 06
11+000	4. 79	5. 45	6. 07
11+200	4. 80	5. 47	6. 09
11+442	4. 83	5. 50	6. 12
11+755	4. 87	5. 55	6. 16
12+000	4. 91	5. 60	6. 21
12+400	4. 96	5. 65	6. 25
12+600	4. 98	5. 68	6. 29
12+700	5. 00	5. 70	6. 29
13+000	5. 04	5. 74	6. 32
13+300	5. 07	5. 78	6. 34
13+466	5. 10	5. 80	6. 36

The distribution of the four construction zones is shown in Figure 2. 1.

Zone I:Lo Wu Bridge section to the section of Stage I Project from chainage No. 9+559 to 9+841 with a length of 282 m, and No. 9+417 to 9+559 with a length of 142 m. The main work is channel widening and dredging. Due to restriction from the Lo Wu Railway Bridge, the Old Lo Wu Footbridge and the New Lo Wu Footbridge, the cross-section is to be constructed as vertical wall type on both sides of the River. The total excavation volume is 159,600 m^3, of which 49,100 m^3 is contaminated soil and 110,500 m^3 is uncontaminated soil. In addition, 16,500 m^3 of stone pitched wall will be removed.

Zone II: It is the section from Lo Wu Bridge to Man Kam To (No. 9+844—11+387) with a length of 1,546 m. The main work for this section is river channel widening, deepening and straightening. The total excavation volume is 877,500 m^3 of which 64,900 m^3 is contaminated soil, and 812,600 m^3 is uncontaminated soil. Three kinds of cross-sections, namely vertical wall type, compound type and mixed type will be applied in this section.

Zone III: This section is located between Lo Wu Bridge and Man Kam To Border Crossing (No. 11+387—11+735) with a length of 348 m. The total excavation is 219,800 m^3, of which 19,300 m^3 is contaminated soil and 200,500 m^3 is uncontaminated soil. This section will be vertical wall type and mixed type and the main work is river course straightening and construction of Man Kin To Border Crossing Bridge.

Zone IV: It is the section from the Man Kin To Border Crossing to the mouth of River Ganges (No. 11+735—13+466) with a length of 1731 m. The cross section here is mixed type and the main construction work is widening. The total excavation is 762,600 m^3, of which 68,500 m^3 is contaminated soil and 694,100 m^3 is uncontaminated soil.

2.3.2 *River Diversion*

The following method will be adopted for diversion during construction:

(1) Both sides of the central line of the designed river course will be excavated first, while the river course along the central line is kept as "diversion dike". When the excavation and placement of embankment foundation is carried out on one side, the river course on the other side will be used as diversion channel. After the construction of the embankment has been completed, the "diversion dike" will then be removed.

(2) Straightening of the section of the Man Kam To (zone II) and the section from Lo Wu Bridge to Man Kam To (zone III) should be carried out in dry by using cofferdam during dry season. The original river course will be used for carrying water, and the original bank in this section is re-established or raised to form the cofferdam. Then excavation of the channel and construction of the banks can be carried out. After completion, the original river course will be cut off and the new river course will be put into used after removing the cofferdam.

2.3.3 *Spoil Dispisal*

Except for construction of embankment and refilling, the spoil to be disposed of is 201,800 m^3 of contaminated soil and 1,401,800 m^3 of uncontaminated soil. It is estimated that, among the uncontaminated soil, there are about 700,000 m^3 from dry excavation and 701,800 m^3 from wet excavation.

It is estimated that 201,800 m^3 of the contaminated soil should be placed in the East Sha Chau (in Hong Kong) Marine Dumping Ground, and part of uncontaminated soil be placed in Nam Hang valley adjacest to the Project area, with a total of 500,000 m^3. For dry excavation, the remained 901,800 m^3 of uncontaminated soil is to be placed in Neilingding Island (Shenzhen) Marine Dumping Ground.

2.3.4 *Borrow Area*

Only part of the excavated materiel can be used for embankment construction due to strict requirements of the Project for earthworks. So it is necessary to import material from other places. According to site investigation report, the soil in Shuijingdaliang Village of Buji Town meets the standard for embankments. Therefore, 113,200 m^3 of filling material is to be taken from there and imported to the construction site, which is 17-19 km away. Backhoe of 2 m^3 capacity in combination of 10 t loading trucks will be used for excavation and transportation.

2.3.5 *Construction of Main Chanrel*

(1) The excavation of river course and embankment

With a view to the characteristics of the Project, excavation will be carried out on widening, deepening and straighteming of the river courses. For the earth below the water surface in the existing river course, under-water or wet excavation are more suitable for the section where the bank slope are water retaining. Dry excavation should be adopted as much as possible, especially for the staighteaing section.

1) General construction methods

Both dry excavation and wet excavation are to be applied in the construction.

Wet excavation: clamshell dredger and long boom backhoe are used for channel dredging, and mud barge and tilting trucks are used for transporting the excavated

material. The suction dredger, which has better environmental performance than the clamshell dredge, could also be used in excavation. When the suction dredging is used, the excavated material will be directly placed to the ships in downstream of Lo Wu Bridge and no reloading basin will be set up in the construction site.

Dry excavation: the backhoe or long boom backhoe is used in the excavation of new river course, and self-loading trucks are used for transportation.

2) The construction method for different zones

Only one group of dredgers can be operated in the same construction zone for wet excavation.

Zone I: The work includes river course excavation and removal of the concrete lined bed and stone slope protection of the Stage I work.

As the construction site here is narrow, dredger and backhoe will be used for excavation. As excavation is underwater, suction dredger or clamshell dredgers are applied in the excavation. The excavated material is then directly transported away by mud barges.

Dry excavation is mainly used on the side slope in widening section and cutting section. The excavated spoil from side slope, if suitable for embankment construction, will be used directly or temporarily stored in nearby area.

Zone II: Both wet excavation and dry excavation are used in this section. Part of the dry excavated spoil can be used for embankment.

In the cutting section (chainage No. 10 + 169-10 + 484, and 11 + 016-11 + 500 section), dry excavation is used by using the original bank as cofferdam. For the other sections, relevant excavation methods are introduced according to the real construction condition.

Zone III: Due to the restriction of Man Kam To Border Crossing Bridge, excavation in this zone is divided into two parts. One is the meander between the bridges, and the other is the site downstream of the bridge.

Suction dredges and clamshell dredges are to be used in wet excavation for the two parts.

The bend section under the bridge is excavated by long boom backhoe of 2 m^3 capaci-

ty, and the excavated spoil will be placed in Nam Hang.

Downstream of the bridge is excavated by boom backhoe of 2 m^3 capacity, and the spoil is put in Nam Hang. The other wet excavation is carried out by clamshell dredgers and suction dredgers.

Zone IV: Dry excavation will be conducted after completion of Man Kam To bridge and navigation in downstream is available. Boom backhoe of 2 m^3 capacity is used for the excavation and the excavated material will be transported off site by mud barges for disposal.

Clamshell dredgers and suction dredgers will be used for wet excavation, and mud barges will be used to transport excavated material off site for disposal.

(2) Construction of the embankment

Wheel loaders with capacity of 2-3 m^3 are used for earth moving for embankment, and 10 t self-loading trucks for transportation, 120 hp bulldozers for paving, and 10 t vibrating rollers for compacting. After excavation of the foundation has been completed, placement of filling material will be carried out according to the embankment construction schedule.

(3) Construction of other walls along river course and embankment

Construction methods for paving underwater riprap:

The riprap rocks will be transported by 100 m^3-rock scow, then dumped by clamshell boat. Divers are required for underwater flattening.

The crushed rock will be transported by 100 m^3-rock scow, then dumped by using conveyor belt and levelled manually.

The precast concrete panel used above water surface will be supplied by specialized manufacturers in Shenzhen City.

Commercial concrete will be used, which will be transported by trucks with capacity of 6 m^3. On site, rubber wheel carts will be used for distribution on construction site, and vibration method will be used. Temporary mixing sites (0.4 m^3) will be established on site to support manually operated the construction.

(4) Construction of vertical wall

1) The construction of diaphragm wall

HS843HD hydraulic clamshell will be used for the construction, which is supported by a derrick car with capacity about 5-10 t. Because the wall must penetrate through gravel layer, percussion drill is applied when boulder and rock are met.

2) Construction of bored pile with large diameter

HD205P auger drill will be used for the construction, and bentonite slurry for wall supporting. Cranes with capability about 5-15 t are used.

The bored piles well are constructed by rotary drill. Cranes with capability about 5-10t are used.

(5) Construction of the border crossing bridges

1) Lo Wu Railway Bridge

The procedure for reconstruction are:

Erect temporary bridge;

Pave temporary rail for traffic;

Reconstruct Lo Wu Railway Bridge;

Replace the railway, test for reopening;

Remove all temporary structure and original piers of the railway bridge. Removing of the Lo Wu Railway Bridge will be based on the recommendation in Chapter 11, namely, employ specialist to study and conduct before the commencement of construction.

2) The reconstruction of the Old Lo Wu Footbridge

Demolition of the old bridge

Deck demolition: the cover on the deck will be demolished manually. The paving layer on the deck and concrete between the beams are then removed by using pneumatic driller to dismantle the beam. Central T-beam is then demolished from the abutment by using two crane trucks at two sides of the abutment separately (temporary bearing is needed), and the abutment T-beam is demolished finally.

Demolition of the bridge pier: using manual labour or controlled blasting to demolish two reinforced concret piers. Static blasting is drilling hole on the bridge piers, in-

stalling expansion agent, splitting the bridge piers through expansion stress, then demolishing the bridge. This method which will not produce noise and dust is different from the blasting with common detonator.

Construction and installation of the new bridge

The new bridge is a steel braced girder and weight about 70 t. Main parts are fabricated and fixed to 3 m long standard elements (the weight is about 4.5 t) in factory, which are transported by trucks along zone Ⅱ to the bridge construction site on the Shenzhen side. The scaffold construction platforms are set up in the bridge site. The stage installation is processed on the Hong Kong side by using traction and crane equipment. After the steel truss installation is completed, the deck construction can commence.

3) Improvement of Lo Wu New Footbridge

Grouting on scaffolding above water is applied in strengthening the bridge pier foundation. The spigot method or cast built-in pipes is applied in the construction. The bridge is in dry condition by steel sleeve.

Small equipment and manual labour is used to complete the foundation. The small-davit and manual labour are used to transporting the reinforcement and formwork to the construction site. Concrete pump and other ancillary equipment are adopted to complete the concrete construction.

4) Man Kam To Vehicular Bridge

Design scheme

The design scheme is to build the new two-way vehicular bridge, and demolish the existing old bridge and new bridge in Man Kin To. The newly built two-way vehicular bridge is a separate structure with total span of 96 m, comprising of three spans prestressed simply supported beam. The reinforced concrete abutment are set up on both sides of the bank. The bridge pier is composed of pile foundation, bearing, pier shaft and coping. The diameter of the pile foundation is 1.5 m, and each pier has four piles.

Construction scheme

Foundation construction: it is conducted in two phases of dry land construction. The

foundation on the Hong Kong side will be constructed in phase I, and river water is them drained from the existing river course. The construction of the foundation on the Shenzhen side is phase II(protected by cofferdam), and river water is discharged through the river course on the Hong Kong side where the construction of the foundation has been completed.

Superstructure: prestressed concrete T-beams will be erected starting from Hong Kong side.

Construction method

Bored pile: boring hole, inserting steel sleeve to protect the wall, concrete pump casting.

Abutment bear, bridge pier and coping: using scaffold as construction platform, using small rubber-type crane for assistant operation on the platform, erecting framework, fixing reinforcement casting concrete in each section.

Span: precasted concrete beam.

Demolition of the old bridge: same as the demolition of the Lo Wu Footbridge.

2.3.6 *Main Construction Equipment*

Refer to Table 2.4.

Table 2.4 Summary Sheet of the Major Construction Machines

Number	Equipment	Unit	Specs	Quantity
1	WY712 crawler back shovel	set	$2m^3$	4
2	Crawler back shovel	set	$1m^3$	4
3	Long-boom back shovel	set	$2m^3$	4
4	TS120 Bulldozer	set	100-120 horsepower	10
5	Wet land Bulldozer	set		4
6	Wheeled loader	set	$3m^3$	5
7	YZ10P vibratory grinder	set	10t	3
8	Self discharging wagon	set	10t	28
9	Autotruck	set	8t	6
10	Closed self discharging wagon	set	7.5t	8
11	Grab dredger	set	$2m^3$	1
12	Self-navigation stone barge	set	$100m^3$	5

Number	Equipment		Unit	Specs	Quantity
13	Self-navigation mud barge	single	set	$80m^3$	6
		double		$290m^3$	10
14	Power pump			100/20	2
15	Fluid pressure grab bucket		set	HS843HD	4
16	Mechanism grab bucket		set		2
17	Large-diameter spiral drill		set	HP205P	1
18	Rotary drill		set		2
19	Action drill		set	CZ-30	1
20	Deep mixer		set	SJB series	1
21	Crane		set	150t	1
22	Portal crane		set		1
23	Trunk crane		set	40t	2
24	Trunk crane		set	5-15t	8
25	Rail crane		vehicle		2
26	Mixer		set	$0.4m^3$	4
27	Concrete mixing trunk		set	$3\text{-}6m^3$	14
28	Concrete pump		set	$30m^3/h$	8
29	Plate trunk		set		
30	Water pump		set	5-15t	22

2.4 Construction Programme

With a view to the river course layout, structure type, and the situation of the border crossing, etc., Stage III Project is divided into four independent zones.

Zone I - Lo Wu Railway Bridge Section.

Zone II - from Lo Wu Bridge to Man Kam To

Zone III - Man Kam To section.

Zone IV - from Man Kam To to the mouth of River Ganges

(1) Construction programme for phase I

The main work in phase I is the construction of border patrol facilities (site fence, road, lighting) on both sides. It will start in Nov. 2001 and complete in March 2003.

(2) Construction of preparative work

In order to meet the requirements of main construction in phase II of Stage III Pro-

ject, the progress of major proeparative work is scheduled as follows:

1) Land acquisition on both sides should be completed during the period from April to July in 2001.

2) The construction fence (including temporary security fence) on both sides must be constructed during the period from April 2001 to December 2002.

3) The hard road, site formation, temporary housing for construction workers, water and electricity supply and so on in construction site will start in April 2001, and is to be completed before December 2002 as the condition for main construction.

(3) Construction programme for main work

The construction period of the main structures will last for 39 months, from July 2001 to September 2004. All construction work of the river course, embankment and reprovisioning work (bridge, drainage pipe, Dongjiang watermains river-crossing, border-crossing communication and power supply,etc.)must be completed during this period.

1) Construction in Zone I (9+417—9+841) will start in July 2001 and complete by end of December 2003 with a total construction period of 30 months. Earthworks in different construction sites at the same time are prohibited.

2) The construction period in Zone Ⅱ (9+841—11+387) is 30 months from July 2001 to December 2003. Earthworks in different construction sites at the same time are prohibited.

3) The construction period in Zone Ⅲ (11+387—11+735) is from 1 July 2001 to 30 September 2003, totally 27 months. Earthworks in different construction sites at the same time are prohibited.

4) The construction period in Zone Ⅳ (11+735—13+466) is from 1 July 2001 to 30 September 2004, lasting for 39 months. Earthworks in different construction sites at the same time are prohibited.

(4) Construction completion

After completion of construction, site clearance, removal of temporary facilities, and afforestation should be conducted. These works will be carried out during construc-

tion in each zone.

The construction schedule is shown in Table 2.5.

It has long time to the actual construction date. The commencement date will be affected by many factors, such as bidding, legal and administrative process of both sides, etc. and therefore cannot be confirmed.

2.5 Environmental Benefit of the Project

The construction of Stage III of the Shenzhen River Regulation Project possesses the following environmental benefits:

(1) Reducing and avoiding the environmental pollution caused by flood

The area along the Shenzhen River often suffers during flooding. The pollutants carried by floodwater often lead to environmental pollution in flooded area as the Shenzhen River is seriously polluted.

Implementation of the Project can greatly enhance the flood control capability of the Shenzhen River against fifty-year return period flood and environmental pollution caused by flood will be greatly reduced.

(2) Improving the water quality of the Shenzhen River

As both the storage capacity and the volume of the river channels during the tide period will considerably increase, and the time needed for the river water flowing into the sea will significantly decrease, pollutants in the river can be better diluted, decomposed and transformed. As a result, the quality of existing polluted river water will be improved to some extent after implementation of the Project.

The clearance of the polluted river sediment in the river course will improve the water quality of the Shenzhen River.

Moreover, the improved flood discharge and hydraulic condition of the river provides a favourable conditions to control the water pollution of the Shenzhen River.

(3) Protecting and improving ecological system

表2－5 治理深圳河第三期工程施工计划时间表(1/5)

TAB. 2－5 Regulation of Shenzhen River Stage III Construction Schedule of Globle(1/5)

工程项目 ITEM		工程量 WORK QUANTITY 单位 UNIT	数量 QUANTITY
第一阶段工程 PHASE I WORKS			
第二阶段工程 PHASE II WORKS			
一、准备工程 PREPARATION WORKS			
	1 施工围网 GUARD GRILLE AROUND THE JOB SITE	项 ITEM	1
	2 场内交通 SITE ACCESS	项 ITEM	1
	3 场地平整 LAND LEVELING AND DRAINING	项 ITEM	1
	4 施工企业 AUXILIARY FACTORY FOR CONSTRUCTION	项 ITEM	1
	5 临时房屋 TEMPORARY HOUSING	项 ITEM	1
	6 水电通讯系统 WATER AND POWER SUPPLY AND TELCOMMUNICATION SYSTEM	项 ITEM	1
二、第I区工程 I AREA WORKS (9+417—9+841)			
	重配工程：深方1#涵（9+588.7） MATCH WORKS: NORTH 1# DRANNING	座	1
钢平台 STEEL PLATFORM	1 D325钢管桩（7—10m） STEEL TUBE PILES	根	25
	2 平台土石填筑 COFFERDAM FILLING	项	1
	3 基础开挖 FOUNDION EXCAVATION	m^3	50
	4 基础混凝土 CONCRETE FOR FOUNDATION	m^3	26
	5 基础土石填筑 FOUNDION FILLING	m^3	30
	6 钢平台安装 STEEL PLATFORM CONSTRUCTION	t	233
	7 拆除钢平台 CUT OFF STEEL PLATFORM	项	1
	8 拆除施工围堰 CUT OFF CONFFERDAM	项	1
罗湖铁路桥 LU WO RAILWAY BRIDGE	1 地基加固灌浆 GRUTING	项	1
	2 人工挖孔桩（18—21m） MANUAL CONCRETE PILE	根	8
	3 基础开挖 FOUNDION EXCAVATION	m^3	760
	4 桥墩、桥台混凝土 CONCRETE FOR FOUNDATION	m^3	596
	5 基础土石填筑 CUT OFF STEEL PLATFORM	m^3	550
	6 新钢桥拼装 MAKING NEW STEEL BRIDGE	t	341
	7 横移 MOVING	项	1
	8 拆除旧桥墩 CUT OFF FOUNDATION OF OLD BRIDGE	项	1

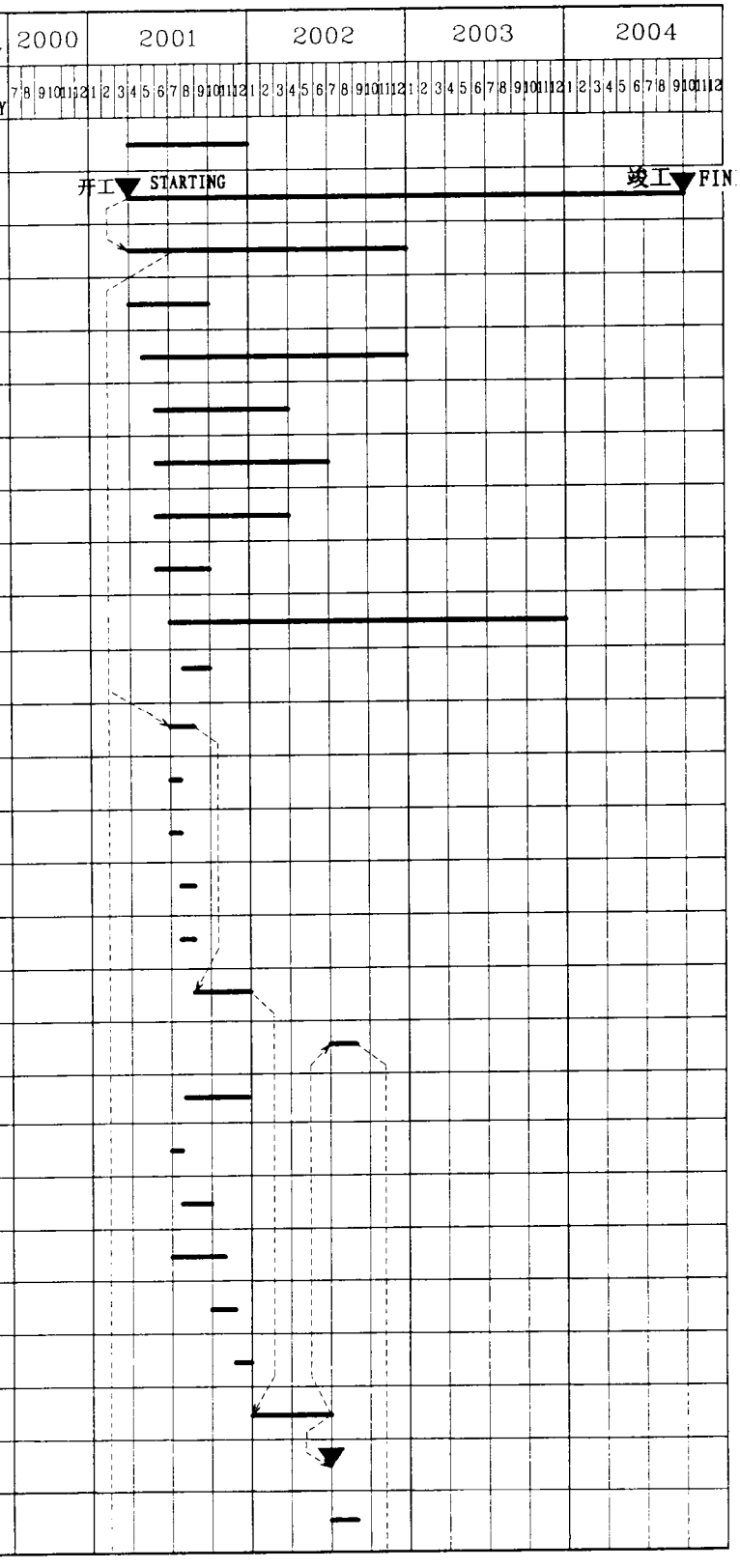

表2－5 治理深圳河第三期工程施工计划时间表(2/5)

TAB. 2－5 Regulation of Shenzhen River Stage III Construction Schedule of Globle(2/5)

工程项目 ITEM			工程量 WORK QUANTITY 单位 UNIT	数量 QUANTITY
罗湖人行老桥 LO WU OLD FOOTINGBRIDGE	1	基础开挖 FOUNDION EXCAVATION	m^3	45
	2	填筑 PLACEMENT	m^3	420
	3	桥墩、桥台混凝土 CONCRETE FOR FOUNDATION	m^3	9
	4	钢桥制安 STEEL BRIGE ASSEMBLE	t	56
	5	旧桥拆除 OLD BRIGE CUT OFF	座	1
罗湖人行新桥 LO WU NEW FOOTINGBRIDGE	1	地基灌浆加固 FOUNDATION GRUTING	项	1
	2	钢套筒安装 STEEL PLATE STAKE	项	1
	3	基础加固混凝土 IMPERVIOUS CONCRETE FOR FOUNDATION	m^3	260
	4	钢套筒拆除 STEEL PLATE STAKE REMOVING	项	1
深圳堤防 NORTH EMBANKMENT	1	填筑施工平台 CONSTRUCTION PLACEMENT	项	1
	2.	开挖 EXCAVATION	m^3	1440
	3.	填筑 EMBANKMENT PLACEMENT	m^3	14260
	4	人工挖孔桩（14—17m） MANUAL CONCRETE PILE	根	62
	5	地下连续墙 UNDERGROUND CONTINOUS WALL	m^2	2074
	6.	现浇混凝土 PRECAST CONCRETE BLOCKS	m^3	2428
	7.	土锚 GROUND ANCHORAGES	m	3190
	8	拆除施工平台 REMOVE CONSTRUCTION PLACEMENT	项	1
香港堤防 SOURTH EMBANKMENT	1	填筑施工平台 CONSTRUCTION PLACEMENT	项	1
	2.	开挖 EXCAVATION	m^3	280
	3.	筑堤 EMBANKMENT PLACEMENT	m^3	1370
	4	D600灌注桩（16m） BORED PILE	根	2000
	5.	现浇混凝土 PRECAST CONCRETE BLOCKS	项	1
	6.	拆除施工平台 REMOVE CONSTRUCTION PLACEMENT	项	1
河道工程 RIVER WORKS	1.	河道开挖 RIVER EXCAVATION	万m^3	14.84
	2	土工布铺筑 GEOTEXTILE PLACEMENT	m^2	4255
	3	碎石垫层 CRUSHED ROCK	万m^3	1.42
	4.	抛石填筑 DUMPING RIPRAP	万m^3	1.70
	5.	混凝土块 PRECAST CONCRETE BLOCKS	m^3	133
	6	混凝土墩 CONCRETE	m^3	77
	7	模袋混凝土 FABRIC CONCRETE	m^3	2068
碎石路面 broken stone road surfase			项	1
草皮护坡 GRASS SLOPE PRETECTION			项	1

表2－5 治理深圳河第三期工程施工计划时间表(3/5)

TAB. 2－5 Regulation of Shenzhen River Stage III Construction Schedule of Globle(3/5)

工程项目 ITEM			工程量 WORK QUANTITY 单位 UNIT	数量 QUANTITY
三、第II区工程 II AREA WORKS (9+841—11+387)				
重配工程 REMATCH WORKS	深圳2—7#涵 NORTH 2---7# DRANNING		座	6
	香港7—12#涵 SOURTH 7---12# DRANNING		座	6
深圳堤防 NORTH EMBANKMENT	1.填筑施工平台 CONSTRUCTION PLACEMENT		项	1
	2.开挖 EXCAVATION		万m^3	4.21
	3.填筑 EMBANKMENT PLACEMENT		万m^3	19.06
	5 地下连续墙 UNDERGROUND CONTINOUS WALL		m^2	4138
	6.现浇混凝土 PRECAST CONCRETE BLOCKS		万m^3	2.21
	7.土锚 GROUND ANCHORAGES		m	7040
	8.拆除施工平台 REMOVE CONSTRUCTION PLACEMENT		项	1
香港堤防 SOURTH EMBANKMENT	1.填筑施工平台 CONSTRUCTION PLACEMENT		项	1
	2.开挖 EXCAVATION		万m^3	3.88
	3.筑堤 EMBANKMENT PLACEMENT		万m^3	8.76
	4 D600灌注桩（16m） BORED PILE		根	643
	5 D2500灌注桩（30m） BORED PILE		根	56
	6 现浇混凝土 PRECAST CONCRETE BLOCKS		万m^3	1.72
	7.拆除施工平台 REMOVE CONSTRUCTION PLACEMENT		项	1
河道工程 RIVER WORKS	1. 河道开挖 RIVER EXCAVATION		万m^3	76.94
	2. 填筑 PLACEMENT		m^3	6841
	3 土工布铺筑 GEOTEXTILE PLACEMENT		万m^2	7.26
	4. 碎石垫层 CRUSHED ROCK		万m^3	3.04
	5. 抛石填筑 DUMPING RIPRAP		万m^3	5.02
	6. 混凝土块 PRECAST CONCRETE BLOCKS		m^3	2124
	7 混凝土墩 CONCRETE		m^3	1112
	8 模袋混凝土 FABRIC CONCRETE		m^3	1769
碎石路面 broken stone road surfase			项	1
草皮护坡 GRASS SLOPE PRETECTION			项	1

表2－5 治理深圳河第三期工程施工计划时间表(4/5)

TAB. 2－5 Regulation of Shenzhen River Stage III Construction Schedule of Globle(4/5)

工程项目 ITEM			工程量 WORK QUANTITY 单位 UNIT	数量 QUANTITY
四、第III区工程 III AREA WORKS (11+387——11+735)				
重配工程 REMATCH WORKS	深圳8#涵 NORTH 8# DRANNING		座	1
	文锦渡排水管渠 WEN JIN DU DRAINING SYSTEM		座	2
	香港6、13—14#涵 SOURTH 6#13…14# DRANNING		座	3
深圳堤防 NORTH EMBANKMENT	1. 开挖 EXCAVATION		m^3	9420
	2. 筑堤 EMBANKMENT PLACEMENT		万m^3	10.89
	3. 现浇混凝土 PRECAST CONCRETE BLOCKS		m^3	6463
香港堤防 SOURTH EMBANKMENT	1. 开挖 EXCAVATION		万m^3	1.14
	2. 填筑 EMBANKMENT PLACEMENT		万m^3	1.75
	3. 现浇混凝土 PRECAST CONCRETE BLOCKS		m^3	8803
河道工程 RIVER WORKS	1. 河道开挖 RIVER EXCAVATION		万m^3	19.90
	2. 填筑 PLACEMENT		m^3	2406
	3 土工布铺筑 GEOTEXTILE PLACEMENT		万m^2	2.15
	4. 碎石垫层 CRUSHED ROCK		万m^3	0.82
	5. 抛石填筑 DUMPING RIPRAP		万m^3	1.47
	6. 混凝土块 PRECAST CONCRETE BLOCKS		m^3	574
	7 混凝土墩 CONCRETE		m^3	330
	碎石路面 broken stone road surfase		项	1
	草皮护坡 GRASS SLOPE PRETECTION		项	1
新建文锦渡至香港桥梁 CONSTRUCTION NEW BRIDGE TO HONGKONG	1.基础开挖 FOUNDION EXCAVATION		m^3	5150
	2. 填筑 PLACEMENT		m^3	11500
	3北岸桩基施工 NORTH BORED PILE		根	8
	4北岸承台施工 NORTH BEARING PLATFORM		项	1
	5北岸桥墩、桥台、墩帽、台帽施工 NORTH PIER•ABUTMENT		项	1
	6. 南岸围堰施工 SURTH COFFERDAM		项	1
	7南岸桩基施工 SOURTH BORED PILE		根	8
	8南岸承台施工 SOURTH BEARING PLATFORM		项	1
	9南岸桥墩、桥台、墩帽、台帽施工 SOURTH PIER•ABUTMENT		项	1
	10桥梁架设 ASSEMBLE BRIDGE		项	1
	11桥面铺装 BRIDGE SURFACE CONSTRUCTION		项	1
	12 试车 TRY		项	1
	拆除文锦渡旧桥梁 CUT OFF OLD BRIDGE TO SHENZHEN		座	2

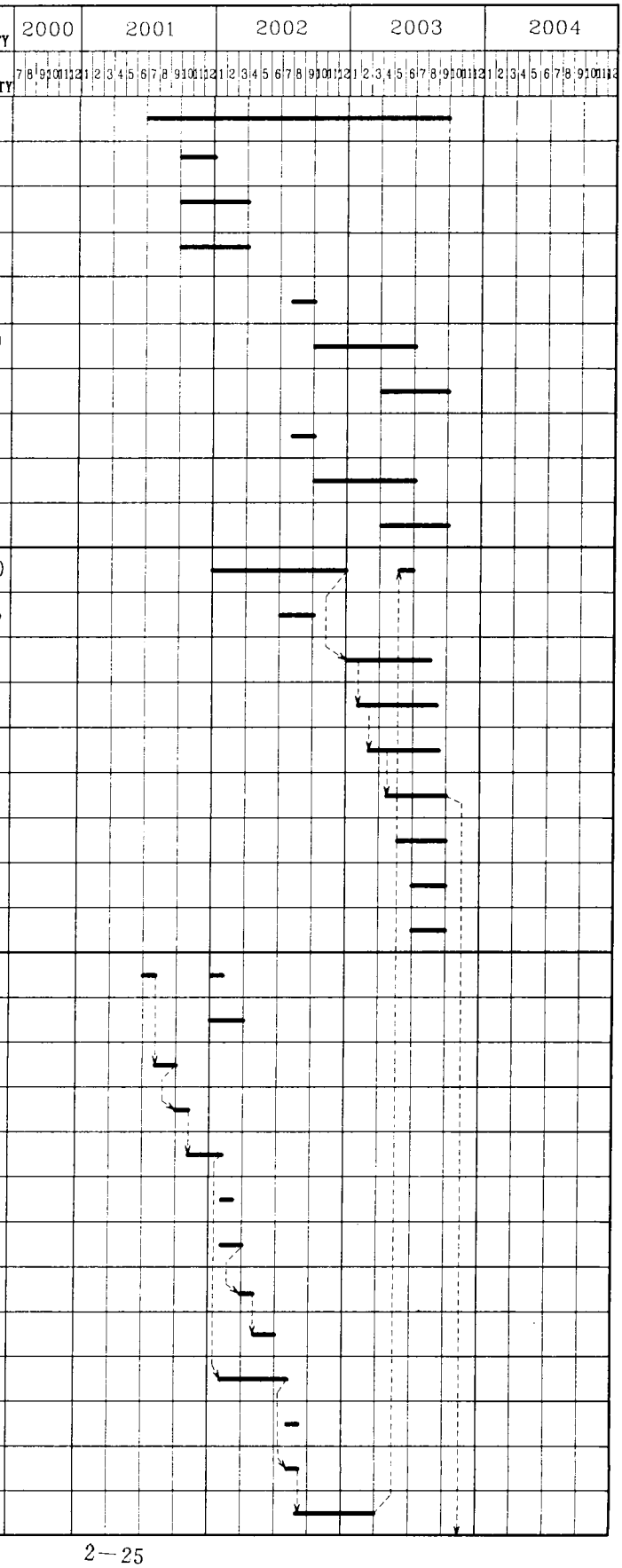

表2－5 治理深圳河第三期工程施工计划时间表(5/5)

TAB. 2－5 Regulation of Shenzhen River Stage III Construction Schedule of Globle(5/5)

工程项目 ITEM			工程量 WORK QUANTITY 单位 UNIT	数量 QUANTITY	2000	2001	2002	2003	2004
五、第IV区工程 I V AREA WORKS (11+735—13+467)									
	重配工程 REMATCH WORKS	深圳9—12#涵 NORTH 9···12* DRANNING	座	4					
		香港1—5#、15#、16#涵 SOURTH 1···5* *15**16*DRANNING	座	7					
		碎石转送带改建工程 CRUSHED ROCK CONVEYER EQUIPMENT	项	1					
		木湖泵站管道改建工程 MU HU STEEL TUBE CONSTRUCTION	项	1					
	深圳堤防 NORTH EMBANKMENT	1填筑施工平台 CONSTRUCTION PLACEMENT	项	1					
		2.开挖 EXCAVATION	万m^3	3.07					
		3. 填筑 EMBANKMENT PLACEMENT	万m^3	9.43					
		5 地下连续墙 UNDERGROUND CONTINOUS WALL	m^2	6616					
		6. 现浇混凝土 CONCRETE	万m^3	2.30					
		7.土锚 GROUND ANCHORAGES	m	4830					
		8拆除施工平台 REMOVE CONSTRUCTION PLACEMENT	项	1					
	香港堤防 SOUTH EMBANKMENT	1填筑 EMBANKMENT PLACEMENT	m^3	4800					
		2 现浇混凝土 CONCRETE	m^3	2762					
	河道工程 RIVER WORKS	1. 河道开挖 RIVER EXCAVATION	万m^3	72.75					
		2. 填筑 PLACEMENT	万m^3	0.29					
		3 土工布铺筑 GEOTEXTILE PLACEMENT	万m^2	8.74					
		4. 碎石垫层 CRUSHED ROCK	万m^3	4.11					
		5. 抛石填筑 DUMPING RIPRAP	万m^3	7.12					
		7. 混凝土块 PRECAST CONCRETE BLOCKS	m^3	3299					
		8 混凝土墩 CONCRETE	m^3	1192					
		沉井工程 MASON	项	1					
		碎石路面 broken stone road surfase	项	1					
		草皮护坡 GRASS SLOPE PRETECTION	项	1					
河道堤防工程量合计 QAUTITY TATOL		1. 开挖 RIVER EXCAVATION	万m^3	202		35	84	45	38
		2. 填筑 PLACEMENT	万m^3	53		4.5	19.2	19.7	9.6
		3 土工布铺筑 GEOTEXTILE PLACEMENT	万m^2	18.6			4.5	5.4	8.7
		4. 碎石垫层 CRUSHED ROCK	万m^3	9.4			2.0	3.3	4.1
		5. 抛石填筑 DUMPING RIPRAP	万m^3	15.3			2.5	7.1	5.7
		6. 混凝土 CONCRETE	万m^3	13.6		0.3	5.4	4.8	3.1

Once a flood comes, some wild animals are usually drown because there is not enough time for them to escape. They have to move to other places. As a result, their former habitats or feeding grounds are lost. Besides, all grassland and bushes grow slower or perish because of insufficient supply of sunlight and nutrients due to inundation and slow flood retreating. Implementation of the Project can greatly enhance flood control capability of the Shenzhen River, providing a more safe living environment for the wild animals and plants in the region.

Meanwhile, the reduction of the environmental pollution caused by flooding will also improve the ecological system in the region.

The improvement of the water quality of the Shenzhen River also improves the aquatic-ecological system of the River.

(4) Abating odour

When the Project is completed, because of improvement in water quality and silt clearance, the odour of the Shenzhen River will also decrease or diminish. As a result, the air quality in surrounding area will also improve.

(5) Landscape

After completion of the Project and implementation of the mitigation measures, original unpleasant scenes will totally disappear. The river channel will become wider and straighter with the bed sediment dredged and rows of trees and grasses along the river bank will be placed. As a result, the landscape along both banks will provide a scenic sight.

(6) Benefit to the public health

The frequent flooding provides a favourable breeding ground for mosquito and fly, which is adverse to public health. After completion of the Project, flooding will be eliminated, so that the breeding of the mosquito and fly, etc., will be greatly reduced and this benefit public health.

2.6 Potential Environmental Impact of the Projects

(1) Major works items

Major items include: reprovisioning of border fence and border road, constructing haul road; site preparation; dredging; slope protection; embankment construction; slope protection; earthwork at borrow area; spoil disposal; bridge reconstruction and other reprovising works.

(2) Potential environmental impact

Upon analysis, the potential environmental impacts of the above projects are listed in Table 2.6.

Table 2.6 Likely Potential Environmental Impact Caused by the Project

Item	Likely Potential Environmental Impact					
	Air	Noise	Water Quality	Ecology	Landscape and Vision	Cultural Heritage
Border fence	◎	○			◎	
Border road	◎	◎			○	
Construction traffic	◎	○			○	
Site formation	◎	○			○	
Dredging	●	●	●	●	●	
Bank protection	○	○	○	◎	◎	
Embankment construction	●	●		●	●	
Earthwork at borrowing area	●	◎		◎		
Spoil disposal	◎	●	◎	●	◎	
Bridge reconstruction	○	○	○	○	○	●
Reprovisioning						
Preparation work						

In Table: ○ It indicates that might have low impact.
◎ It indicates that might have moderate impact.
● It indicates that might have high impact.
Blank indicates that has no impact.