KINGDOM OF THAILAND

ROYAL IRRIGATION DEPARTMENT
MINISTRY OF AGLICULTURE AND COOPERATIVES

TENDER AND CONTRACTING DOCUMENTS
FOR
THE FLOOD PREVENTION PROJECT OF
EAST SIDE OF THE PASAK RIVER IN AYUTTHAYA

VOLUME II

TENDER DRAWINGS

OCTOBER 2012

CTI ENGINEERING INTERNATIONAL CO., LTD.
TOKYO, JAPAN

THE FLOOD PREVENTION PROJECT OF EAST SIDE OF THE PASAK RIVER IN AYUTTHAYA
LIST OF DRAWINGS

TITLE	DWG NO.
GENERAL PLAN	
GENERAL MAP	GP-001
GENERAL NOTE	GP-002
KRA MANG FLOODGATE	
OVERALL LAYOUT (1/2)	KM-FG-001
OVERALL LAYOUT (2/2)	KM-FG-002
PLAN	KM-FG-003
FRONT VIEW AT PASAK RIVER SIDE (1/3)	KM-FG-004
FRONT VIEW AT PASAK RIVER SIDE (2/3)	KM-FG-005
FRONT VIEW AT PASAK RIVER SIDE (3/3)	KM-FG-006
FRONT VIEW AT KRA MANG CANAL SIDE (1/2)	KM-FG-007
FRONT VIEW AT KRA MANG CANAL SIDE (2/2)	KM-FG-008
LONGITUDINAL SECTION (1/2)	KM-FG-009
LONGITUDINAL SECTION (2/2)	KM-FG-010
MAIN STRUCTURE PLAN AND SECTIONS (1/5)	KM-FG-011
MAIN STRUCTURE PLAN AND SECTIONS (2/5)	KM-FG-012
MAIN STRUCTURE PLAN AND SECTIONS (3/5)	KM-FG-013
MAIN STRUCTURE PLAN AND SECTIONS (4/5)	KM-FG-014
MAIN STRUCTURE PLAN AND SECTIONS (5/5)	KM-FG-015
DRAINAGE GATE (1/2)	KM-FG-016
DRAINAGE GATE (2/2)	KM-FG-017
CONFIGURATION OF FOUNDATION PILES AND IMPERVIOUS STEEL SHEET PILES	KM-FG-018
BOREHOLE LOGS	KM-FG-018A
STAIRCASE (1/4)	KM-FG-019
STAIRCASE (2/4)	KM-FG-020
STAIRCASE (3/4)	KM-FG-021
STAIRCASE (4/4)	KM-FG-022
FLOODWALL (1/4)	KM-FG-023
FLOODWALL (2/4)	KM-FG-024
FLOODWALL (3/4)	KM-FG-025
FLOODWALL (4/4)	KM-FG-026
SLOPE PROTECTION OF APPROACH WAY	KM-FG-027
FLOOR PROTECTION CONCRETE (1/2)	KM-FG-027A
FLOOR PROTECTION CONCRETE (2/2)	KM-FG-027B
CONFIGURATION OF HANDRAILS AND FENCES	KM-FG-027C
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 1/18)	KM-FG-028
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 2/18)	KM-FG-029
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 3/18)	KM-FG-030
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 4/18)	KM-FG-031
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 5/18)	KM-FG-032
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 6/18)	KM-FG-033
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 7/18)	KM-FG-034
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 8/18)	KM-FG-035
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 9/18)	KM-FG-036
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 10/18)	KM-FG-037
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 11/18)	KM-FG-038
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 12/18)	KM-FG-039
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 13/18)	KM-FG-040
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 14/18)	KM-FG-041
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 15/18)	KM-FG-042
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 16/18)	KM-FG-043
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 17/18)	KM-FG-044
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 18/18)	KM-FG-045
BAR ARRANGEMENT (SERVICE BRIDGES)	KM-FG-046
BAR ARRANGEMENT (CURTAIN WALL & SLAB)	KM-FG-047
BAR ARRANGEMENT (STAIRCASE)	KM-FG-048
BAR ARRANGEMENT (PART - U-SHAPED FLOODWALL LEFT 1/4)	KM-FG-049
BAR ARRANGEMENT (PART - U-SHAPED FLOODWALL LEFT 2/4)	KM-FG-050
BAR ARRANGEMENT (PART - U-SHAPED FLOODWALL LEFT 3/4)	KM-FG-051
BAR ARRANGEMENT (PART - U-SHAPED FLOODWALL LEFT 4/4)	KM-FG-052
BAR ARRANGEMENT (PART - U-SHAPED FLOODWALL RIGHT 1/4)	KM-FG-053
BAR ARRANGEMENT (PART - U-SHAPED FLOODWALL RIGHT 2/4)	KM-FG-054
BAR ARRANGEMENT (PART - U-SHAPED FLOODWALL RIGHT 3/4)	KM-FG-055
BAR ARRANGEMENT (PART - U-SHAPED FLOODWALL RIGHT 4/4)	KM-FG-056
BAR ARRANGEMENT (PART - DRAINAGE GATE 1/3)	KM-FG-057
BAR ARRANGEMENT (PART - DRAINAGE GATE 2/3)	KM-FG-058
BAR ARRANGEMENT (PART - DRAINAGE GATE 3/3)	KM-FG-059
BAR ARRANGEMENT (PART - WING WALL LEFT)	KM-FG-060
BAR ARRANGEMENT (PART - WING WALL RIGHT)	KM-FG-061
BAR ARRANGEMENT (PART - UPSTREAM APRON 1/3)	KM-FG-062
BAR ARRANGEMENT (PART - UPSTREAM APRON 2/3)	KM-FG-063
BAR ARRANGEMENT (PART - UPSTREAM APRON 3/3)	KM-FG-064
BAR ARRANGEMENT (PART - DOWNSTREAM APRON 1/4)	KM-FG-065
BAR ARRANGEMENT (PART - DOWNSTREAM APRON 2/4)	KM-FG-066
BAR ARRANGEMENT (PART - DOWNSTREAM APRON 3/4)	KM-FG-067
BAR ARRANGEMENT (PART - DOWNSTREAM APRON 4/4)	KM-FG-068
TEMPORARY WORKS OF KRA MANG FLOODGATE	
LAYOUT PLAN	KM-TW-001
DETAIL OF TEMPORARY DAM 2	KM-TW-002
PLAN OF TEMPORARY EXCAVATION WORKS	KM-TW-003
DETAIL OF TEMPORARY WORKS (1/2)	KM-TW-004
DETAIL OF TEMPORARY WORKS (2/2)	KM-TW-005
HAN TRA FLOODGATE AND CANAL	
OVERALL LAYOUT	HT-FG&BP-001
LAYOUT (1/3)	HT-FG&BP-002
LAYOUT (2/3)	HT-FG&BP-003
LAYOUT (3/3)	HT-FG&BP-004
HAN TRA FLOODGATE	
PLAN	HT-FG-001
FRONT VIEW AT PASAK RIVER SIDE (1/2)	HT-FG-002
FRONT VIEW AT PASAK RIVER SIDE (2/2)	HT-FG-003
FRONT VIEW AT HAN TRA CANAL SIDE (1/2)	HT-FG-004
FRONT VIEW AT HAN TRA CANAL SIDE (2/2)	HT-FG-005
LONGITUDINAL SECTION (1/2)	HT-FG-006
LONGITUDINAL SECTION (2/2)	HT-FG-007
MAIN STRUCTURE PLAN AND SECTIONS (1/5)	HT-FG-008
MAIN STRUCTURE PLAN AND SECTIONS (2/5)	HT-FG-009
MAIN STRUCTURE PLAN AND SECTIONS (3/5)	HT-FG-010
MAIN STRUCTURE PLAN AND SECTIONS (4/5)	HT-FG-011
MAIN STRUCTURE PLAN AND SECTIONS (5/5)	HT-FG-012
CONFIGURATION OF FOUNDATION PILES AND IMPERVIOUS STEEL SHEET PILES	HT-FG-013
BOREHOLE LOGS	HT-FG-013A
STAIRCASE (1/4)	HT-FG-014
STAIRCASE (2/4)	HT-FG-015
STAIRCASE (3/4)	HT-FG-016
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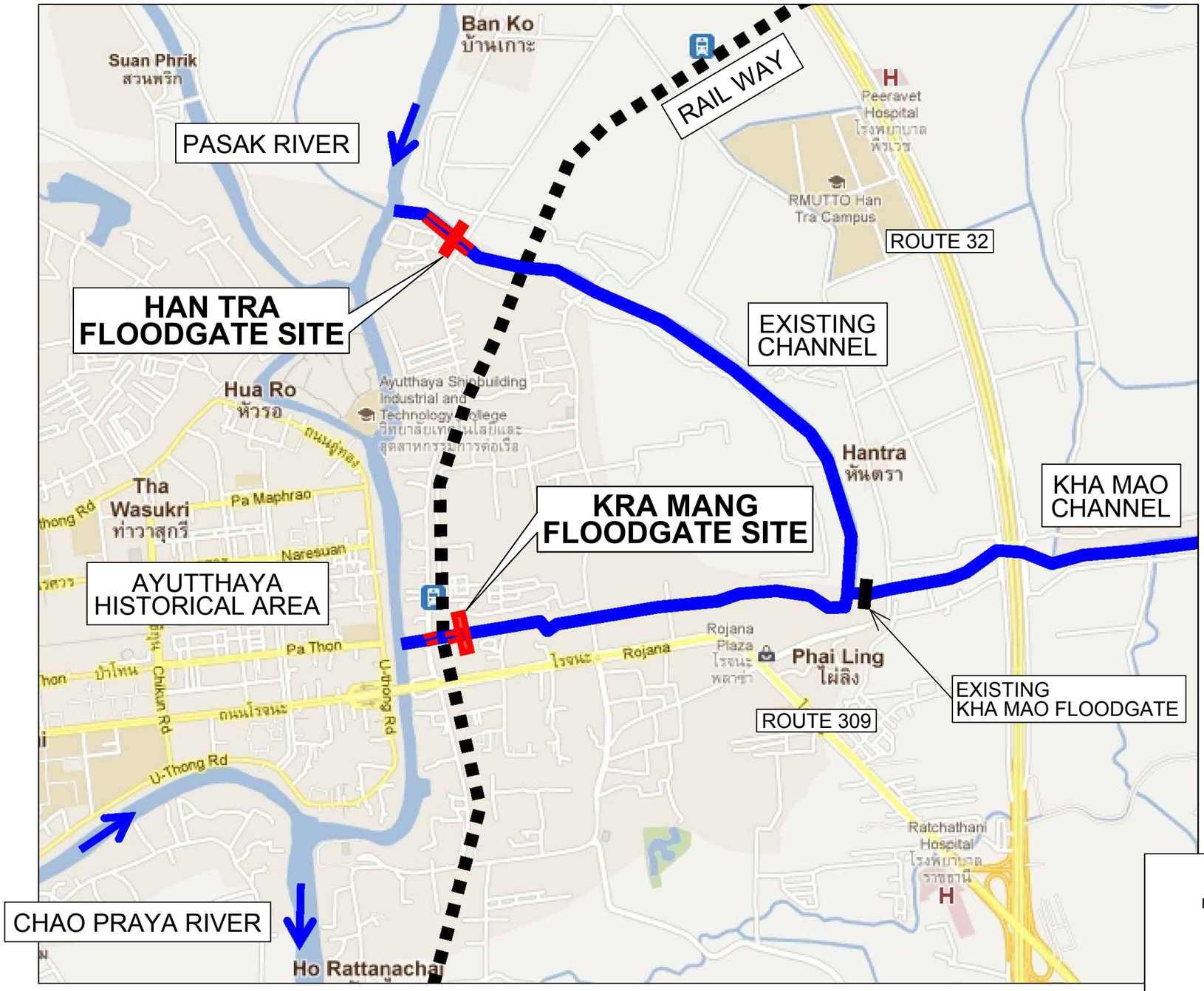
FLOODWALL (2/4)	HT-FG-019
FLOODWALL (3/4)	HT-FG-020
FLOODWALL (4/4)	HT-FG-021
FLOOR PROTECTION CONCRETE (1/2)	HT-FG-021A
FLOOR PROTECTION CONCRETE (2/2)	HT-FG-021B

TITLE	DWG NO.
CONFIGURATION OF HANDRAILS AND FENCES	HT-FG-021C
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 1/24)	HT-FG-022
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 2/24)	HT-FG-023
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 3/24)	HT-FG-024
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 4/24)	HT-FG-025
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 5/24)	HT-FG-026
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 6/24)	HT-FG-027
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 7/24)	HT-FG-028
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 8/24)	HT-FG-029
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 9/24)	HT-FG-030
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 10/24)	HT-FG-031
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 11/24)	HT-FG-032
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 12/24)	HT-FG-033
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 13/24)	HT-FG-034
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 14/24)	HT-FG-035
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 15/24)	HT-FG-036
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 16/24)	HT-FG-037
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 17/24)	HT-FG-038
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 18/24)	HT-FG-039
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 19/24)	HT-FG-040
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 20/24)	HT-FG-041
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 21/24)	HT-FG-042
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 22/24)	HT-FG-043
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 23/24)	HT-FG-044
BAR ARRANGEMENT (MAIN BODY OF FLOODGATE 24/24)	HT-FG-045
BAR ARRANGEMENT (SERVICE BRIDGES)	HT-FG-046
BAR ARRANGEMENT (CURTAIN WALL & SLAB)	HT-FG-047
BAR ARRANGEMENT (STAIRCASE)	HT-FG-048
BAR ARRANGEMENT (PART - WING WALL 1/3)	HT-FG-049
BAR ARRANGEMENT (PART - WING WALL 2/3)	HT-FG-050
BAR ARRANGEMENT (PART - WING WALL 3/3)	HT-FG-051
BAR ARRANGEMENT (PART - APRON 1/3)	HT-FG-052
BAR ARRANGEMENT (PART - APRON 2/3)	HT-FG-053
BAR ARRANGEMENT (PART - APRON 3/3)	HT-FG-054
TEMPORARY WORKS OF HAN TRA FLOODGATE	
LAYOUT PLAN	HT-TW-001
PLAN OF TEMPORARY EXCAVATION WORKS	HT-TW-002
DETAIL OF TEMPORARY WORKS (1/2)	HT-TW-003
DETAIL OF TEMPORARY WORKS (2/2)	HT-TW-004
BANK PROTECTION OF HAN TRA CANAL	
TYPICAL CROSS SECTION	HT-BP-001
TRANSVERSE SECTIONS (1/8) NO.0 TO NO.0+20.00	HT-BP-002
TRANSVERSE SECTIONS (2/8) NO.0+40.00 TO NO.0+60.00	HT-BP-003
TRANSVERSE SECTIONS (3/8) NO.0+80.00 TO NO.1	HT-BP-004
TRANSVERSE SECTIONS (4/8) NO.1+20.00 TO NO.1+40.00	HT-BP-005
TRANSVERSE SECTIONS (5/8) NO.1+60.00 TO NO.1+80.00	HT-BP-006
TRANSVERSE SECTIONS (6/8) NO.2 TO NO.2+20.00	HT-BP-007
TRANSVERSE SECTIONS (7/8) NO.2+40.00 TO NO.2+60.00	HT-BP-008
TRANSVERSE SECTIONS (8/8) NO.2+80.00 TO NO.3	HT-BP-009
DETAILS (1/2)	HT-BP-010
DETAILS (2/2)	HT-BP-011
U-SHAPED DITCH	HT-BP-012
STAIRS AT REVETMENT (1/4)	HT-BP-013
STAIRS AT REVETMENT (2/4)	HT-BP-014
STAIRS AT REVETMENT (3/4)	HT-BP-015
STAIRS AT REVETMENT (4/4)	HT-BP-016
SLUICE PIPE (1/3)	HT-BP-017
SLUICE PIPE (2/3)	HT-BP-018
SLUICE PIPE (3/3)	HT-BP-019
CONCRETE PAVEMENT (1/2)	HT-BP-020
CONCRETE PAVEMENT (2/2)	HT-BP-021
COMMON WORK FOR FLOODGATES	
SHED (1/4)	FG-A-001
SHED (2/4)	FG-A-002
SHED (3/4)	FG-A-003
SHED (4/4)	FG-A-004
HANDRAIL	FG-A-005

N



SCALE

0 0.5 1.0 1.5 2.0

KILOMETERS

ROYAL IRRIGATION DEPARTMENT

The Flood Prevention Project of
East Side of the Pasak River in Ayutthaya
in the Kingdom of Thailand

GENERAL PLAN

GENERAL MAP

CONSULTING FIRMS :

CTI ENGINEERING INTERNATIONAL CO., LTD.

DESIGNED	Masaki ISHII	ROYAL IRRIGATION DEPARTMENT			
DRAWN	Masaki ISHII	PROPOSED	P. SIRION	CHIEF	
CHECKED	Akio SHICHIJUGARI	VERIFIED	S. INTARAPRACHA	DIRECTOR	
APPROVED	T. MISHINA DATE	APPROVED	L. KOWATTANA	D.G.	

REV. NO.	LOCATION	DESCRIPTION	DATE	CHECKED / PRESENT	APPROVED / APPROVED	APPROVED

OFFICE OF ENGINEERING DESIGN & ARCHITECTURE
IRRIGATION SYSTEM DESIGN GROUP DATE

GP-001

Parameters for Concrete Structural Design

The parameters for the design of concrete structures are tabulates as follows.

1) Unit weight of materials

Unit weight of construction materials *(KN/m³){kgf/m³}*

Materials	Unit weight
Steel	77.0 {7,850}
Stainless steel (SUS304)	77.8 {7,930}
Reinforced concrete	24.5 {2,500}
Plain concrete	23.0 {2,350}
Cement mortar	21.0 {2,150}
Sand・Gravel・Crushed stone	18.6 {1,900}
Water	9.8 {1,000}
Timber	8.0 {800}

2) Reinforcement

The reinforcement for concrete based on TIS-24-2527 (for deformed bars) and TIS-20-2527 (for round bars) will be used. The design parameters are tabulates as follows.

Physical constant of reinforcement *(N/mm²){kgf/cm²}*

Material	Unit weight
Young's modulus	2.0×10^5 {2.1×10^6}
Shear elastic modulus	7.7×10^4 {8.1×10^5}
Linear expansion coefficient	12×10^{-6}
Poisson's ratio	0.30

Allowable stress of deformed rebars *(N/mm²){kgf/cm²}*

kind of stress and component \ Kind of rebar			SD30
Tensile stress	In case influence of impact load or an earthquake is not included in the combination of load	General component	150{1,500}
		The component prepared in underwater or below the groundwater level	150{1,500}
	The basic value in the case of including the influence of impact load or an earthquake in the combination of load		150{1,500}
Compressive stress			150{1,500}

3) Concrete

Design strength of concrete *(N/mm²){kgf/cm²}*

Kind of component	Design strength f'c
Plain concrete	18 {180}
Reinforced concrete	21 {210}

Young's modulus of concrete *(N/mm²){kgf/cm²}*

Design strength	21 {210}
Young's modulus	2.35×10^4 {2.35×10^5}
Young's modulus ratio	15
Linear expansion coefficient	10×10^{-6}

Classes of Concrete

Class	End-Usage	Characteristic Compressive Strength (N/mm²)	Max. Diameter of Aggregates (mm)	Maximum Water-Cement Ratio	Slump (cm)	Air Content (%)
A	Reinforced concrete, Concrete pavement with wire mesh	21	25	0.60	8±2.5	4.5±1.5
B	Lean(Leveling) concrete under structure, Leveling concrete with wire mesh	18	25	0.60	8±2.5	4.5±1.5
C	Mass Concrete	21	38	0.60	8±2.5	4.5±1.5

Allowable stress of concrete for reinforced concrete *(kgf/cm²)*

Design strength	f'c	-	210
Extreme fiber stress in compression	fc	0.45f'c	94.5
Shear stress :			
Plain concrete at beam	Vc	$0.29(f'c)^{1/2}$	4.2
Plain concrete at joist	Vc	$0.32(f'c)^{1/2}$	4.6
With reinforcement at shear stress	Vc	$1.32(f'c)^{1/2}$	19.1
Slabs and foundations, along the edge	Vc	$0.53(f'c)^{1/2}$	7.7
Bearing stress :			
On full area	fc	0.25f'c	52.5
On one-third area or less	fc	0.37f'c	77.7
Bond stress :			
Deformed bars without special anchorage	U	0.05f'c	10.5

Allowable stress of plain concrete *(N/mm²){kgf/cm²}*

The kind of stress	Allowable stress	Comment
Extreme fiber stress in compression	f'c/4 ≦ 5.5 {55}	f'c: Design strength of concrete
Bending tensile stress	f'c/80 ≦ 0.3 {3}	
Shear stress	f'c/100 + 0.15 {1.5}	
Bearing stress	0.3f'c ≦ 6.0 {60}	

Premium coefficient of allowable stress

Combination of loads		Premium coefficient
Primary load except live load and impact load + Influence of an earthquake		1.5
Combination of loads during construction	In case the stress at the time of completion becomes remarkably low	1.5
	In case the stress at the time of completion becomes comparable as allowable stress	1.25

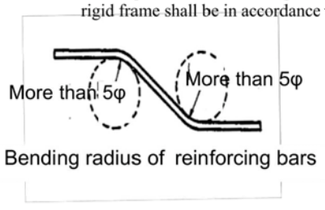
4) Seismic coefficient

Horizontal coefficient $k_h = 0.1$
Vertical coefficient Not considered
At the project sites of Ayutthaya

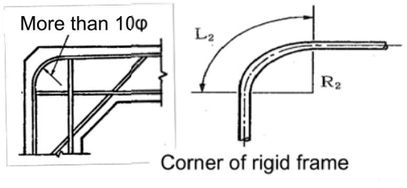
Bending and Cutting

Bar reinforcement shall be bent to the shapes shown on the approved Shop Drawings. All bars shall be bent cold without applying heat. Cutting and bending of reinforcement bars may be done in a shop or at the job site. All bending shall be in accordance with standard practice and by approved machine methods. No bar partially embedded in concrete shall be bent in place without the express approval of the Consultant. Bar reduced in section or with kink or twist will not be accepted.

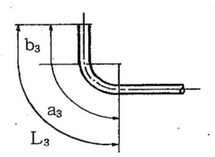
The inside radius of the bend shall be as specified in American Concrete Institute Building Code for Reinforced Concrete ACI 318 Section 7.1.2 or equivalent.
Bending radius of reinforcing bars and that of outside reinforcing bars at the corner for the rigid frame shall be in accordance with the following figure and table.



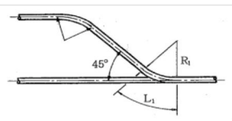
Bending radius of reinforcing bars



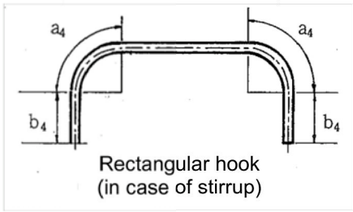
Corner of rigid frame



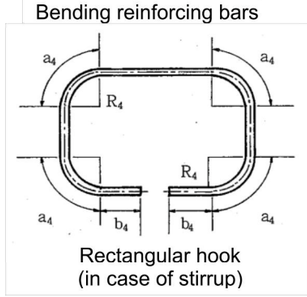
Rectangular hook



Bending reinforcing bars



Rectangular hook (in case of stirrup)



Rectangular hook (in case of stirrup)

Wrought dimension table of deformed bars and plain reinforcing bars

Unit: mm

Item \ Dia	Symbol	DB10	DB12	DB16	DB20	DB22	DB25	DB28	DB32
Joint Length	L 1)	100	120	160	200	220	250	280	320
	L_0 2)	300	360	480	600	660	750	840	960
Bending Bars (45°)	R_1	50	60	80	100	110	130	140	160
	R_1'	60	70	90	110	120	140	160	180
	L_1'	50	60	70	90	100	110	130	140
Corner of rigid frame	R_2	100	120	160	200	220	250	280	320
	R_2'	110	130	170	210	240	270	300	340
	L_2	170	210	270	320	380	420	480	530
Rectangular hook	R_3	30	40	40	50	60	70	80	80
	R_3'	30	40	50	60	70	80	90	100
	a_3	50	60	80	100	110	130	140	160
	b_3	120	150	200	240	270	300	340	390
	L_3	170	210	270	320	380	420	480	530
Rectangular hook (in case of stirrup)	R_4	20	30	40	40	50	50	60	70
	R_4'	30	40	40	50	60	70	80	80
	a_4	50	60	60	80	90	110	120	130
	b_4	60	80	100	120	140	150	170	200
semi-circular hook	R_5	30	40	40	50	60	70	80	80
	R_5'	30	40	50	60	70	80	90	100
	a_5	100	120	160	200	220	250	280	320
	b_5	50	60	60	80	90	110	120	130
	L_5	150	180	230	280	310	350	390	440

Note: "L" shows arc welded joint length (L=10D).

Remarks:

1) **All units in the Tender Drawings unless otherwise specified are in mm.**

2) **All design responsibility lies with CTI Engineering International Co.,Ltd. and is observed by Royal Irrigation Department.**

ROYAL IRRIGATION DEPARTMENT
The Flood Prevention Project of
East Side of the Pasak River in Ayutthaya
in the Kingdom of Thailand

GENERAL PLAN
GENERAL NOTE

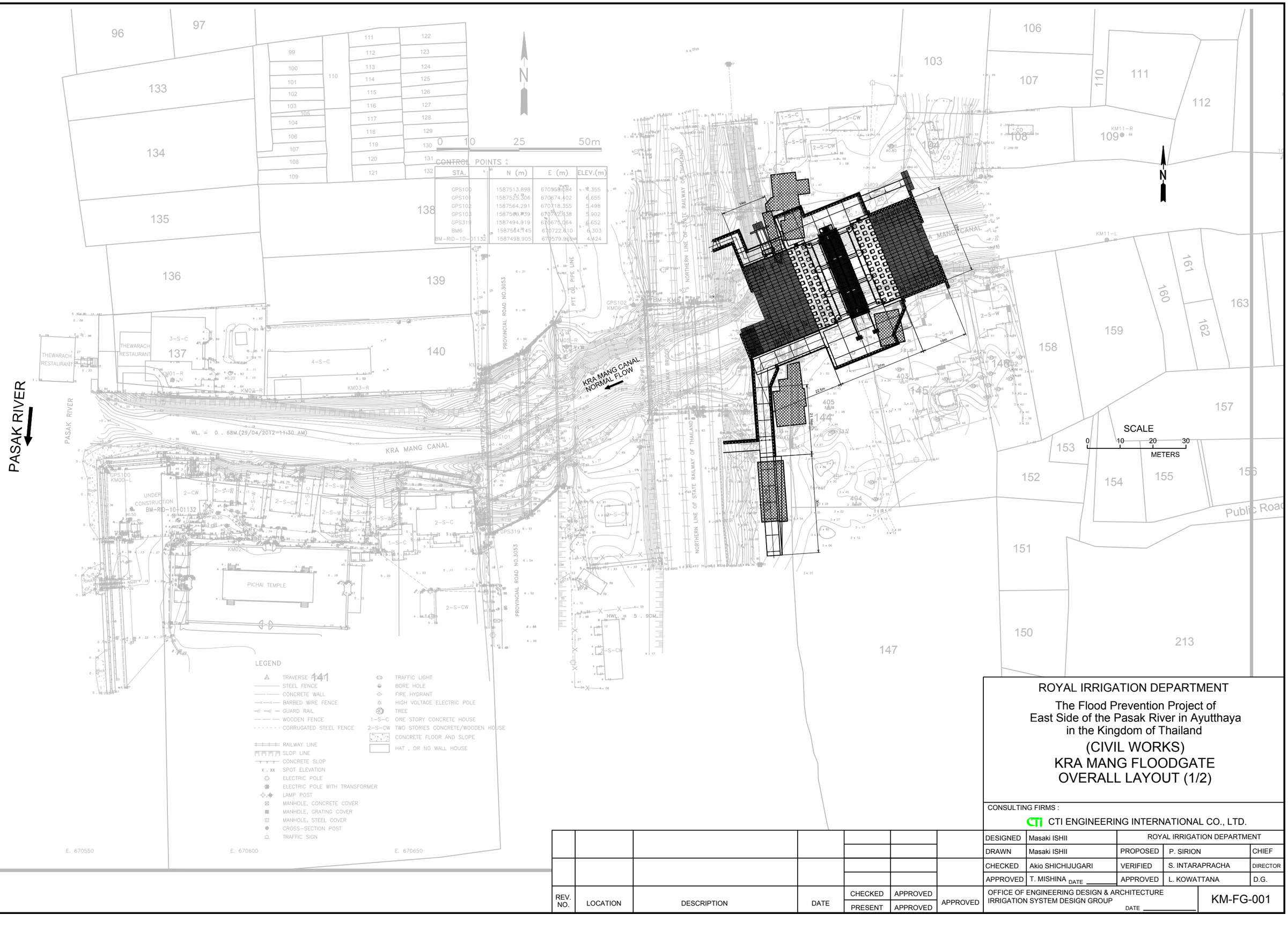
CONSULTING FIRMS :
CTI ENGINEERING INTERNATIONAL CO., LTD.

REV. NO.	LOCATION	DESCRIPTION	DATE	CHECKED / PRESENT	APPROVED / APPROVED	APPROVED

DESIGNED	Masaki ISHII	ROYAL IRRIGATION DEPARTMENT		
DRAWN	Masaki ISHII	PROPOSED	P. SIRION	CHIEF
CHECKED	Akio SHICHIJUGARI	VERIFIED	S. INTARAPRACHA	DIRECTOR
APPROVED	T. MISHINA DATE	APPROVED	L. KOWATTANA	D.G.

OFFICE OF ENGINEERING DESIGN & ARCHITECTURE
IRRIGATION SYSTEM DESIGN GROUP DATE

GP-002



ROYAL IRRIGATION DEPARTMENT

The Flood Prevention Project of
East Side of the Pasak River in Ayutthaya
in the Kingdom of Thailand

(CIVIL WORKS)
KRA MANG FLOODGATE
OVERALL LAYOUT (1/2)

CONSULTING FIRMS :

CTI ENGINEERING INTERNATIONAL CO., LTD.

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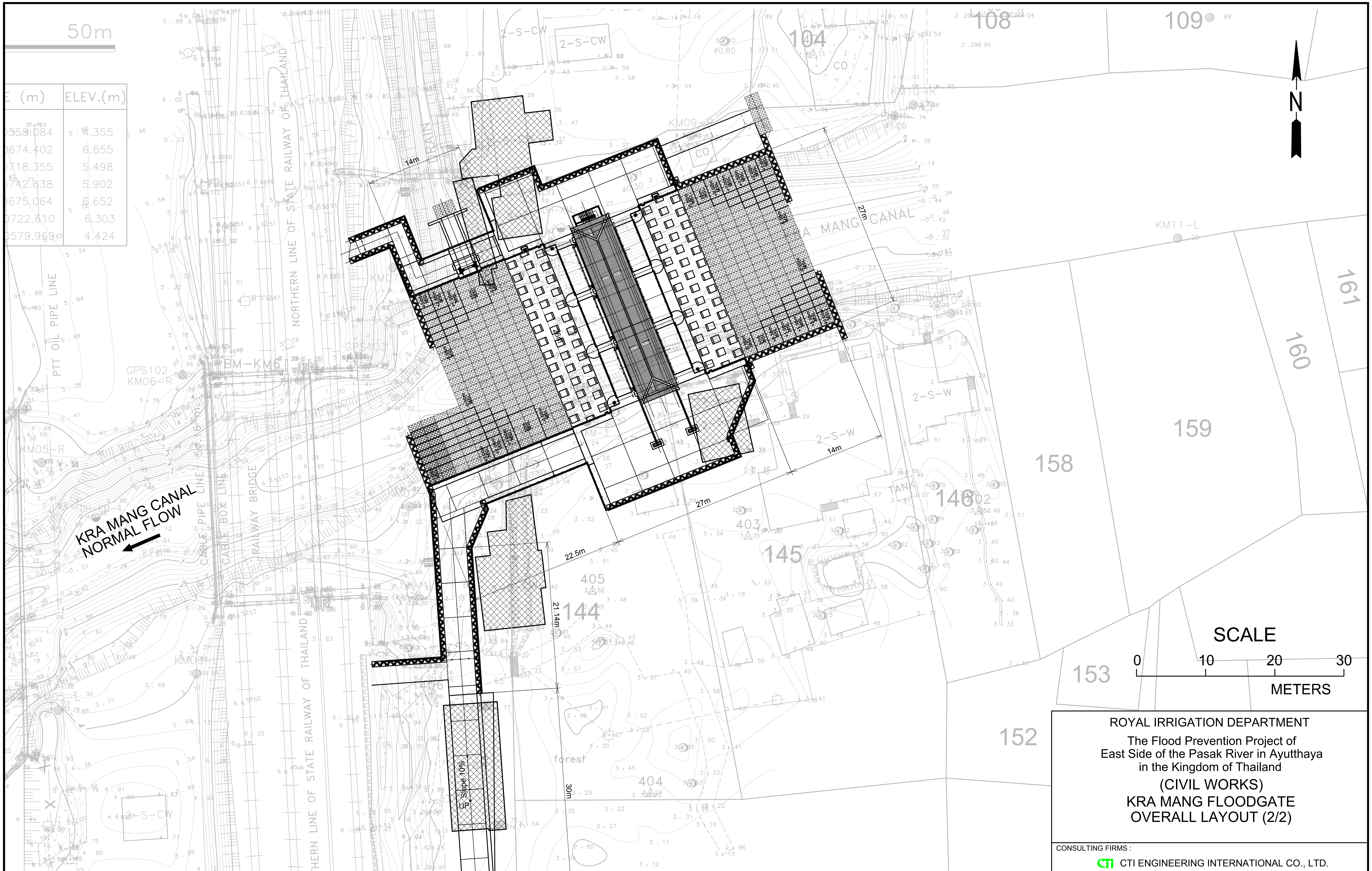
DESIGNED	Masaki ISHII	ROYAL IRRIGATION DEPARTMENT		
DRAWN	Masaki ISHII	PROPOSED	P. SIRION	CHIEF
CHECKED	Akio SHICHIJUGARI	VERIFIED	S. INTARAPRACHA	DIRECTOR
APPROVED	T. MISHINA DATE ____	APPROVED	L. KOWATTANA	D.G.

OFFICE OF ENGINEERING DESIGN & ARCHITECTURE
IRRIGATION SYSTEM DESIGN GROUP
DATE _____

KM-FG-001



ROYAL IRRIGATION DEPARTMENT

The Flood Prevention Project of
East Side of the Pasak River in Ayutthaya
in the Kingdom of Thailand

(CIVIL WORKS)

KRA MANG FLOODGATE
OVERALL LAYOUT (2/2)

CONSULTING FIRMS :

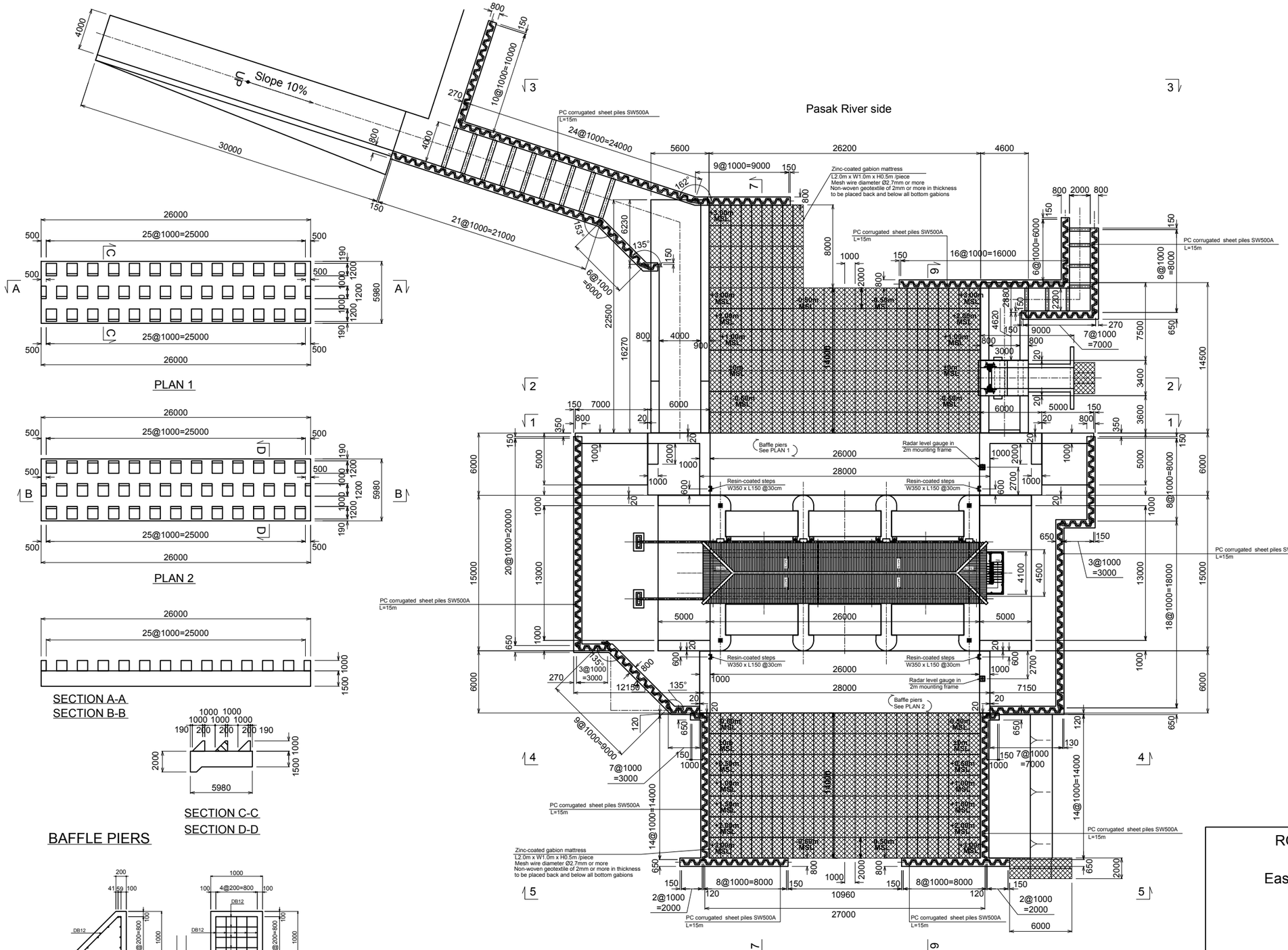
CTI ENGINEERING INTERNATIONAL CO., LTD.

DESIGNED	Masaki ISHII	ROYAL IRRIGATION DEPARTMENT	
DRAWN	Masaki ISHII	PROPOSED	P. SIRION	CHIEF
CHECKED	Akio SHICHIJUGARI	VERIFIED	S. INTARAPRACHA	DIRECTOR
APPROVED	T. MISHINA DATE	APPROVED	L. KOWATTANA	D.G.

OFFICE OF ENGINEERING DESIGN & ARCHITECTURE
IRRIGATION SYSTEM DESIGN GROUP
DATE

KM-FG-002

REV. NO.	LOCATION	DESCRIPTION	DATE	CHECKED / PRESENT	APPROVED / APPROVED	APPROVED



PLAN OF KRA MANG FLOOD GATE

ROYAL IRRIGATION DEPARTMENT

The Flood Prevention Project of
East Side of the Pasak River in Ayutthaya
in the Kingdom of Thailand

(CIVIL WORKS)
KRA MANG FLOODGATE
PLAN

CONSULTING FIRMS :

CTI ENGINEERING INTERNATIONAL CO., LTD.

REV. NO.	LOCATION	DESCRIPTION	DATE	CHECKED / PRESENT	APPROVED / APPROVED	APPROVED

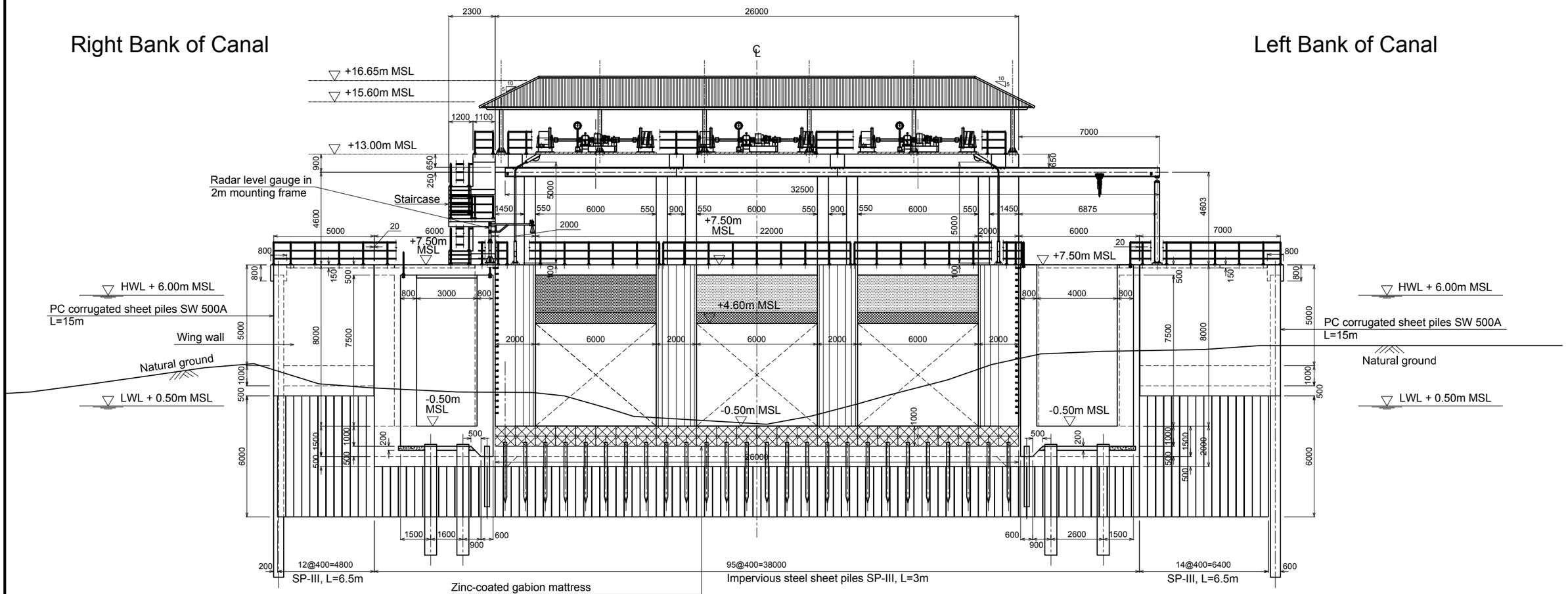
DESIGNED	Masaki ISHII	ROYAL IRRIGATION DEPARTMENT		
DRAWN	Masaki ISHII	PROPOSED	P. SIRION	CHIEF
CHECKED	Akio SHICHIJUGARI	VERIFIED	S. INTARAPRACHA	DIRECTOR
APPROVED	T. MISHINA DATE	APPROVED	L. KOWATTANA	D.G.

OFFICE OF ENGINEERING DESIGN & ARCHITECTURE
IRRIGATION SYSTEM DESIGN GROUP DATE

KM-FG-003

Right Bank of Canal

Left Bank of Canal



Zinc-coated gabion mattress
L2.0m x W1.0m x H0.5m /piece
Mesh wire diameter Ø2.7mm or more
Non-woven geotextile of 2mm or more in thickness
to be placed back and below all bottom gabions

SCALE

0 2 4 6 8 10 15

METERS

ROYAL IRRIGATION DEPARTMENT

The Flood Prevention Project of
East Side of the Pasak River in Ayutthaya
in the Kingdom of Thailand

(CIVIL WORKS)

KRA MANG FLOODGATE

FRONT VIEW AT PASAK RIVER SIDE (1/3)

CONSULTING FIRMS :

CTI ENGINEERING INTERNATIONAL CO., LTD.

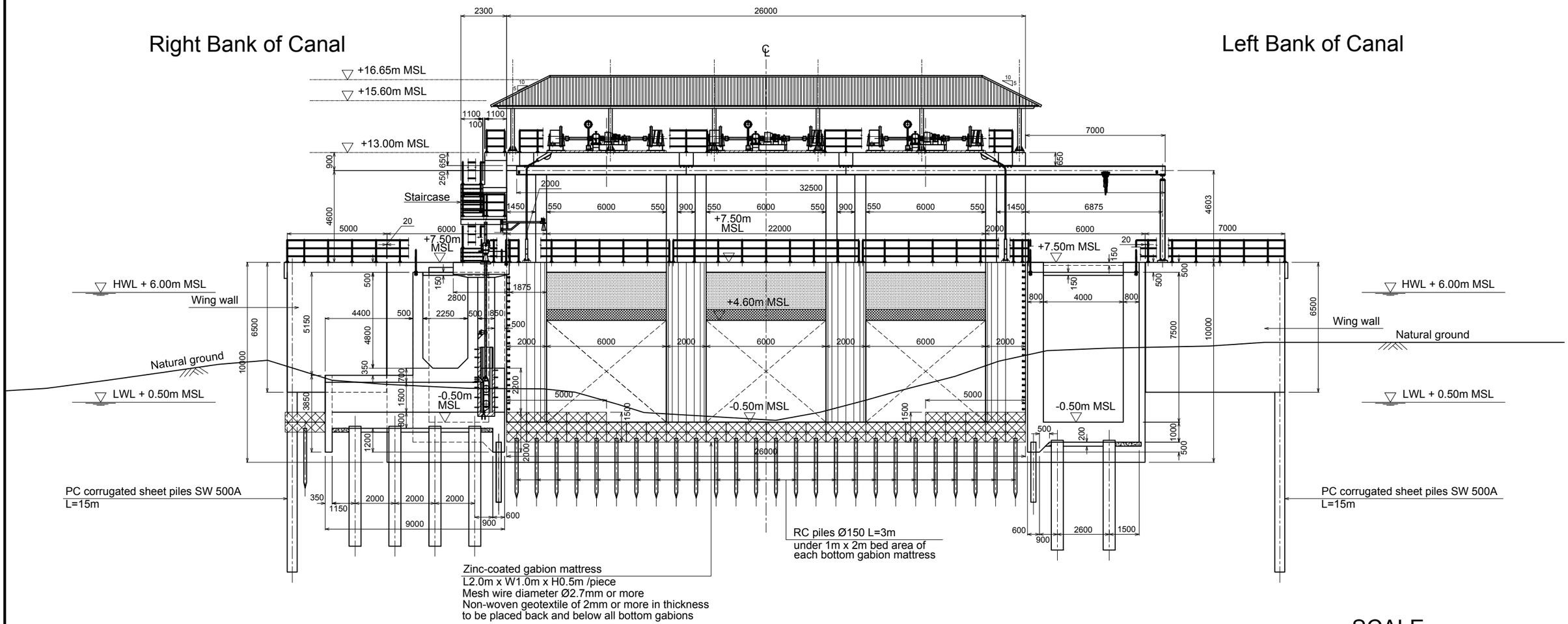
FRONT VIEW AT PASAK RIVER SIDE (1/3)
SECTION 1-1

REV. NO.	LOCATION	DESCRIPTION	DATE	CHECKED / PRESENT	APPROVED / APPROVED	APPROVED

DESIGNED	Masaki ISHII	ROYAL IRRIGATION DEPARTMENT			
DRAWN	Masaki ISHII	PROPOSED	P. SIRION	CHIEF	
CHECKED	Akio SHICHIJUGARI	VERIFIED	S. INTARAPRACHA	DIRECTOR	
APPROVED	T. MISHINA DATE	APPROVED	L. KOWATTANA	D.G.	

OFFICE OF ENGINEERING DESIGN & ARCHITECTURE
IRRIGATION SYSTEM DESIGN GROUP DATE

KM-FG-004



SCALE

0 2 4 6 8 10 15

METERS

FRONT VIEW AT PASAK RIVER SIDE (2/3)
SECTION 2-2

ROYAL IRRIGATION DEPARTMENT

The Flood Prevention Project of
East Side of the Pasak River in Ayutthaya
in the Kingdom of Thailand

(CIVIL WORKS)

KRA MANG FLOODGATE

FRONT VIEW AT PASAK RIVER SIDE (2/3)

CONSULTING FIRMS :

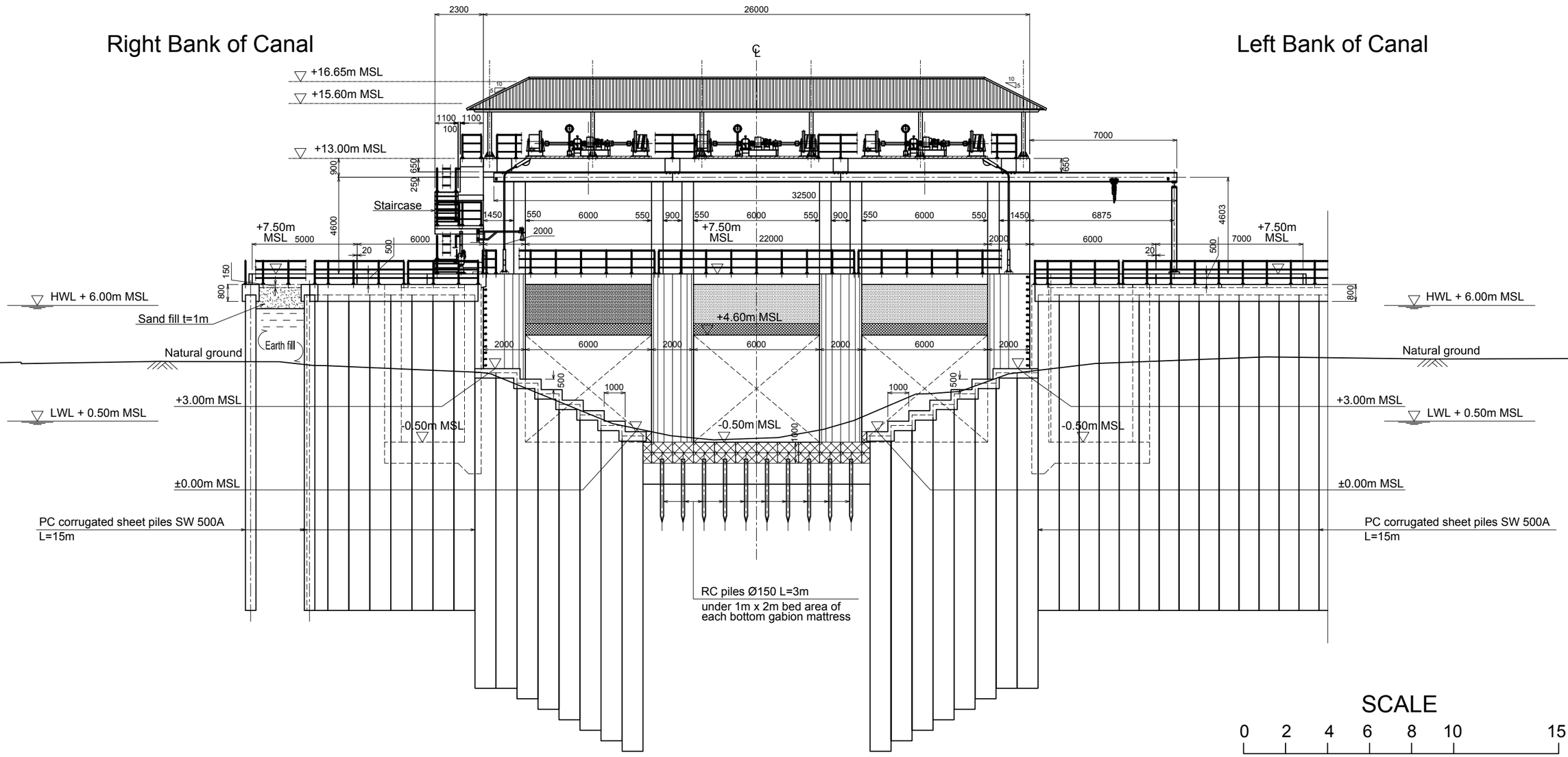
CTI CTI ENGINEERING INTERNATIONAL CO., LTD.

REV. NO.	LOCATION	DESCRIPTION	DATE	CHECKED / PRESENT	APPROVED / APPROVED	APPROVED

DESIGNED	Masaki ISHII	ROYAL IRRIGATION DEPARTMENT		
DRAWN	Masaki ISHII	PROPOSED	P. SIRION	CHIEF
CHECKED	Akio SHICHIJUGARI	VERIFIED	S. INTARAPRACHA	DIRECTOR
APPROVED	T. MISHINA DATE	APPROVED	L. KOWATTANA	D.G.

OFFICE OF ENGINEERING DESIGN & ARCHITECTURE
IRRIGATION SYSTEM DESIGN GROUP DATE

KM-FG-005



ROYAL IRRIGATION DEPARTMENT

The Flood Prevention Project of
East Side of the Pasak River in Ayutthaya
in the Kingdom of Thailand

(CIVIL WORKS)

KRA MANG FLOODGATE

FRONT VIEW AT PASAK RIVER SIDE (3/3)

CONSULTING FIRMS :

CTI ENGINEERING INTERNATIONAL CO., LTD.

FRONT VIEW AT PASAK RIVER SIDE (3/3)
SECTION 3-3

REV. NO.	LOCATION	DESCRIPTION	DATE	CHECKED / PRESENT	APPROVED / APPROVED	APPROVED

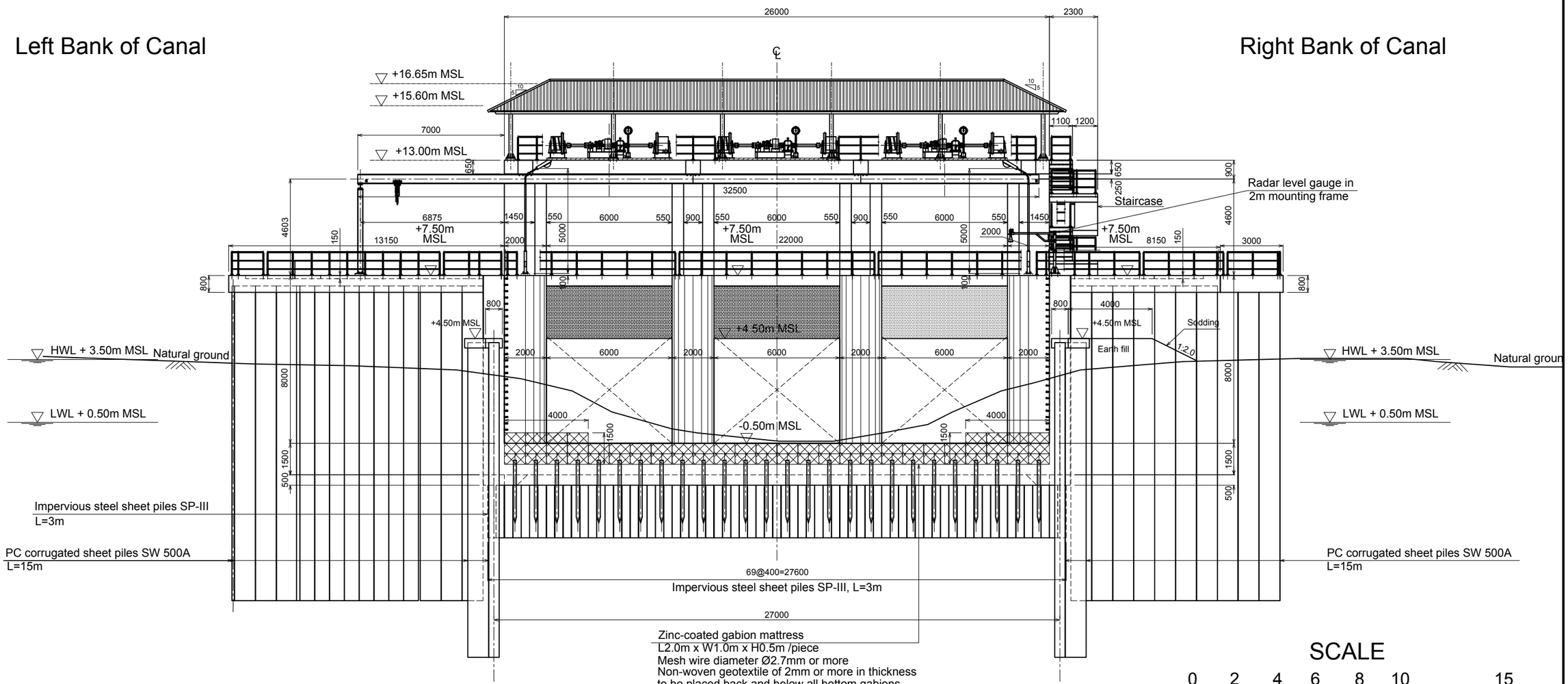
DESIGNED	Masaki ISHII	ROYAL IRRIGATION DEPARTMENT		
DRAWN	Masaki ISHII	PROPOSED	P. SIRION	CHIEF
CHECKED	Akio SHICHIJUGARI	VERIFIED	S. INTARAPRACHA	DIRECTOR
APPROVED	T. MISHINA DATE	APPROVED	L. KOWATTANA	D.G.

OFFICE OF ENGINEERING DESIGN & ARCHITECTURE
IRRIGATION SYSTEM DESIGN GROUP DATE

KM-FG-006

Left Bank of Canal

Right Bank of Canal



SCALE

0 2 4 6 8 10 15

METERS

ROYAL IRRIGATION DEPARTMENT

The Flood Prevention Project of
East Side of the Pasak River in Ayutthaya
in the Kingdom of Thailand

(CIVIL WORKS)

KRA MANG FLOODGATE

FRONT VIEW AT KRA MANG CANAL SIDE (1/2)

CONSULTING FIRMS :

CTI ENGINEERING INTERNATIONAL CO., LTD.

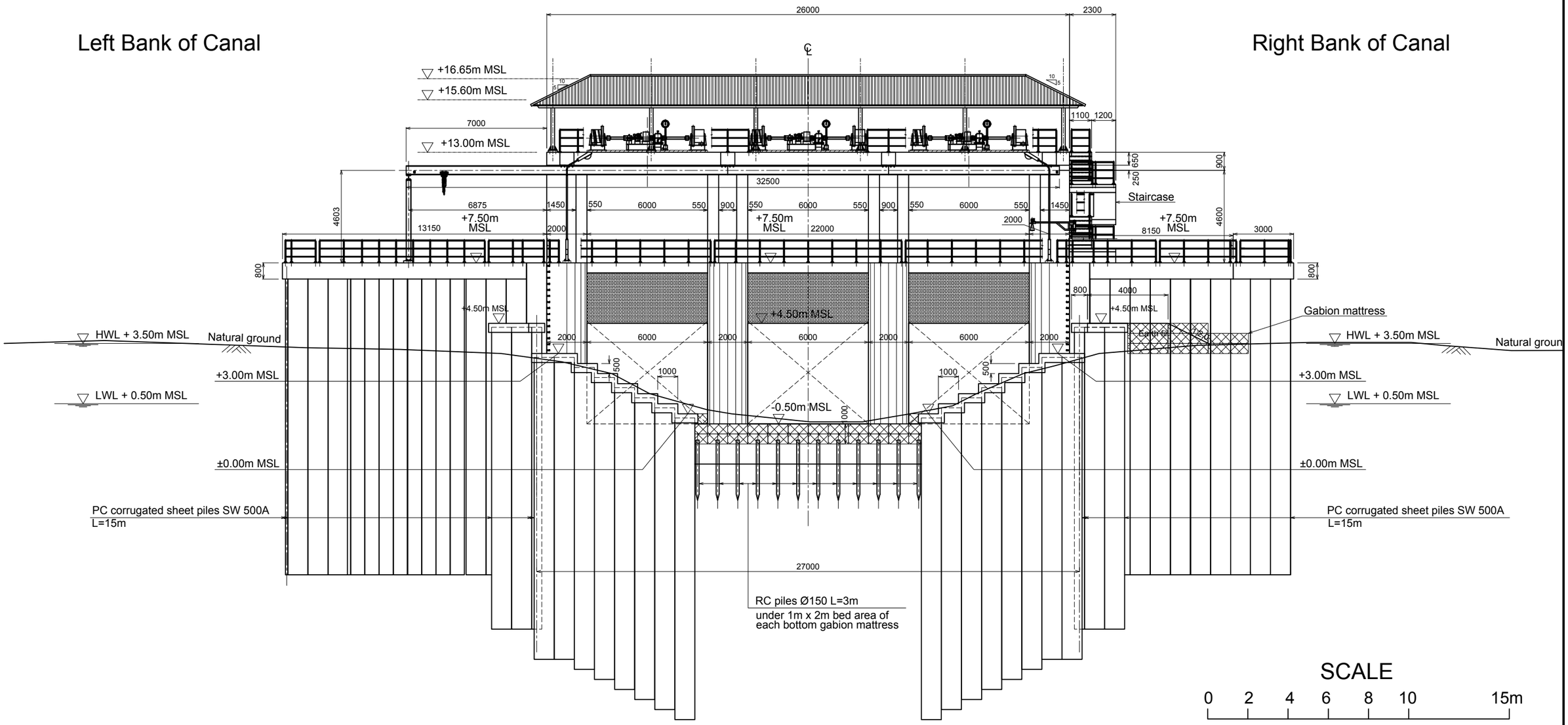
FRONT VIEW AT KRA MANG CANAL SIDE (1/2)
SECTION 4-4

REV. NO.	LOCATION	DESCRIPTION	DATE	CHECKED / PRESENT	APPROVED / APPROVED	APPROVED

DESIGNED	Masaki ISHII	ROYAL IRRIGATION DEPARTMENT		
DRAWN	Masaki ISHII	PROPOSED	P. SIRION	CHIEF
CHECKED	Akio SHICHIJUGARI	VERIFIED	S. INTARAPRACHA	DIRECTOR
APPROVED	T. MISHINA DATE	APPROVED	L. KOWATTANA	D.G.

OFFICE OF ENGINEERING DESIGN & ARCHITECTURE
IRRIGATION SYSTEM DESIGN GROUP
DATE

KM-FG-007



SCALE

0 2 4 6 8 10 15m

METERS

ROYAL IRRIGATION DEPARTMENT

The Flood Prevention Project of
East Side of the Pasak River in Ayutthaya
in the Kingdom of Thailand

(CIVIL WORKS)

KRA MANG FLOODGATE

FRONT VIEW AT KRA MANG CANAL SIDE (2/2)

CONSULTING FIRMS :

CTI CTI ENGINEERING INTERNATIONAL CO., LTD.

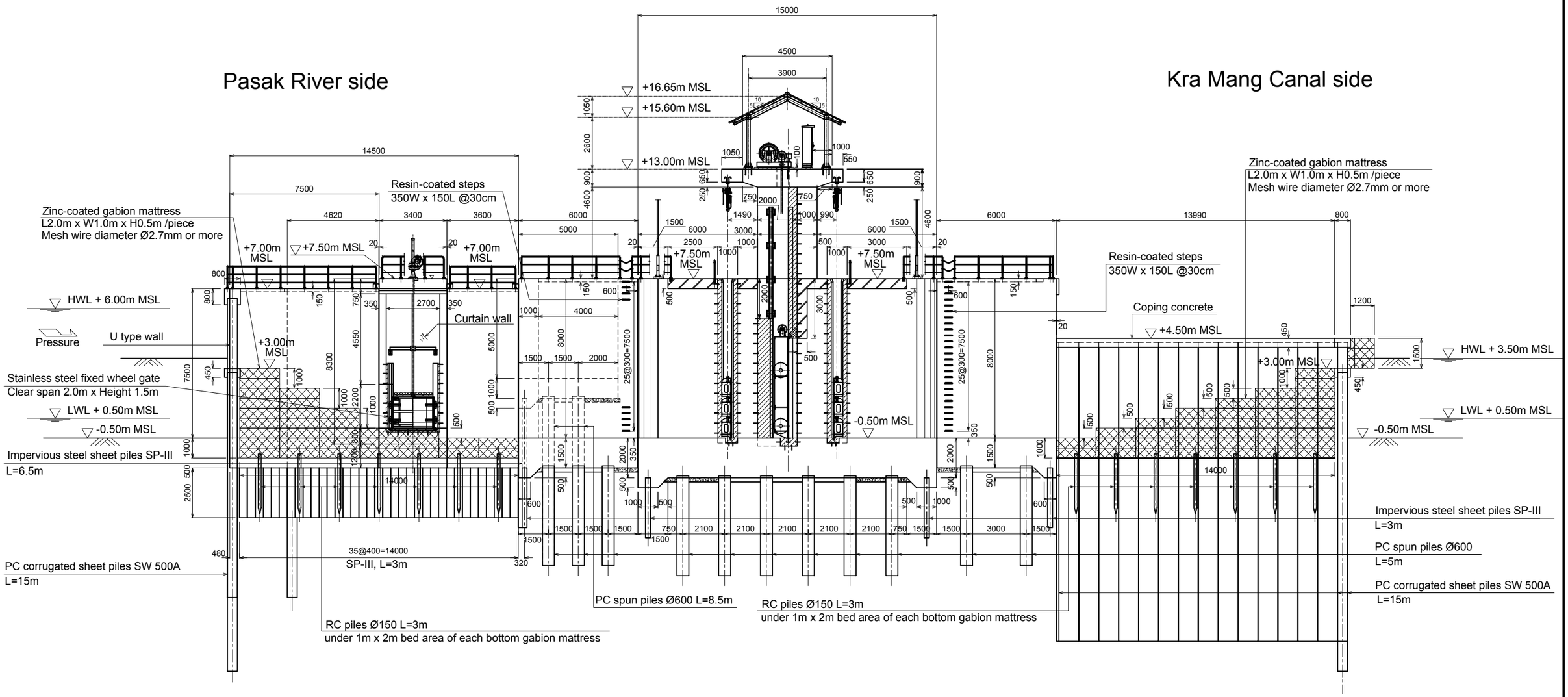
FRONT VIEW AT KRA MANG CANAL SIDE (2/2)
SECTION 5-5

REV. NO.	LOCATION	DESCRIPTION	DATE	CHECKED / PRESENT	APPROVED / APPROVED	APPROVED

DESIGNED	Masaki ISHII	ROYAL IRRIGATION DEPARTMENT		
DRAWN	Masaki ISHII	PROPOSED	P. SIRION	CHIEF
CHECKED	Akio SHICHIJUGARI	VERIFIED	S. INTARAPRACHA	DIRECTOR
APPROVED	T. MISHINA DATE	APPROVED	L. KOWATTANA	D.G.

OFFICE OF ENGINEERING DESIGN & ARCHITECTURE
IRRIGATION SYSTEM DESIGN GROUP
DATE

KM-FG-008



SCALE

0 2 4 6 8 10 15

METERS

LONGITUDINAL SECTION (1/2)
SECTION 6-6

REV. NO.	LOCATION	DESCRIPTION	DATE	CHECKED / PRESENT	APPROVED / APPROVED	APPROVED

ROYAL IRRIGATION DEPARTMENT

The Flood Prevention Project of
East Side of the Pasak River in Ayutthaya
in the Kingdom of Thailand

(CIVIL WORKS)
KRA MANG FLOODGATE
LONGITUDINAL SECTION (1/2)

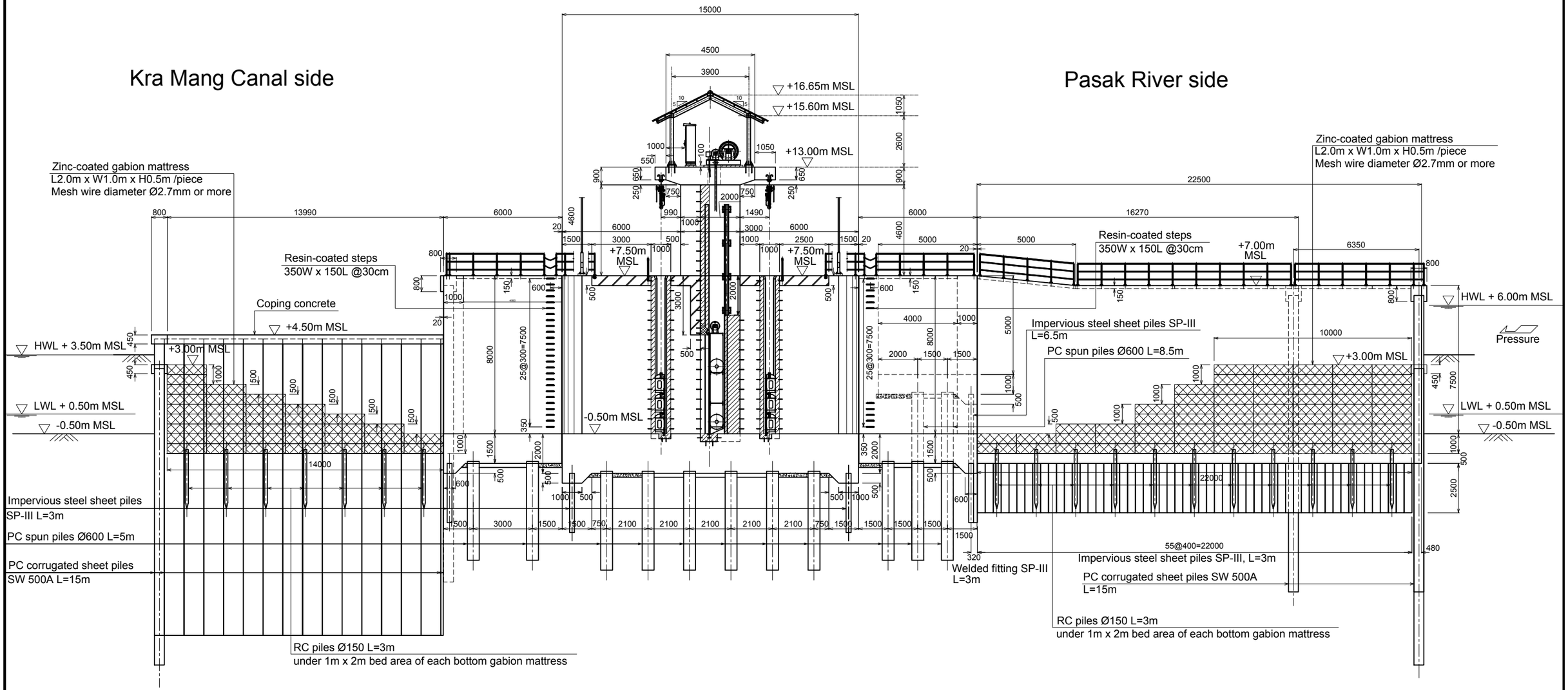
CONSULTING FIRMS :

CTI CTI ENGINEERING INTERNATIONAL CO., LTD.

DESIGNED	Masaki ISHII	ROYAL IRRIGATION DEPARTMENT		
DRAWN	Masaki ISHII	PROPOSED	P. SIRION	CHIEF
CHECKED	Akio SHICHIJUGARI	VERIFIED	S. INTARAPRACHA	DIRECTOR
APPROVED	T. MISHINA DATE	APPROVED	L. KOWATTANA	D.G.

OFFICE OF ENGINEERING DESIGN & ARCHITECTURE
IRRIGATION SYSTEM DESIGN GROUP
DATE

KM-FG-009



SCALE

0 2 4 6 8 10 15

METERS

LONGITUDINAL SECTION (2/2)
SECTION 7-7

ROYAL IRRIGATION DEPARTMENT

The Flood Prevention Project of
East Side of the Pasak River in Ayutthaya
in the Kingdom of Thailand

(CIVIL WORKS)

KRA MANG FLOODGATE
LONGITUDINAL SECTION (2/2)

CONSULTING FIRMS :

CTI ENGINEERING INTERNATIONAL CO., LTD.

REV. NO.	LOCATION	DESCRIPTION	DATE	CHECKED / PRESENT	APPROVED / APPROVED	APPROVED

DESIGNED	Masaki ISHII	ROYAL IRRIGATION DEPARTMENT		
DRAWN	Masaki ISHII	PROPOSED	P. SIRION	CHIEF
CHECKED	Akio SHICHIJUGARI	VERIFIED	S. INTARAPRACHA	DIRECTOR
APPROVED	T. MISHINA DATE	APPROVED	L. KOWATTANA	D.G.

OFFICE OF ENGINEERING DESIGN & ARCHITECTURE
IRRIGATION SYSTEM DESIGN GROUP
DATE

KM-FG-010