Appendix 3-1

Extraction of JBIC Guidelines and Comparison of JBIC Guideline and Vietnamese Requirement for Environmental Impact Assessment

Principles of JBIC Guideline on Environmental and Social Consideration (Extract)

Principles	JBIC Policy
Underlying Principles	· Environmental impact which may be caused by a project must be assessed and examined from the earliest planning stage possible. Alternative proposals or minimization measures to prevent or reduce adverse impact must be examined and incorporated into the project plan: · Such examination must include analysis of environmental costs and benefits in as quantitative terms as possible and be conducted in close harmony with economic, financial, institutional, social and technical analysis of the project; · The findings of the examination of environmental and social considerations must include alternative proposals, mitigation measures and be recorded as separate documents or as a part of other documents. Environmental Impact Assessment (EIA) reports must be produced for projects in which there is a reasonable expectation of particularly large adverse environmental impact; and · For projects that have particularly large potential adverse impact or are highly contentious, a committee of experts may be formed to seek their opinions, in order to increase accountability.
Examination of Measures	· Multiple alternative proposals must be examined to prevent or minimize adverse impact and to choose a better project option in terms of environmental and social considerations. In examination of measures, priority is to be given to the prevention of environmental impact, and when this is not possible, minimization and reduction of impact must be considered next. Compensation measures must be examined only when impact cannot be prevented by any of the aforementioned measures; and · Appropriate follow-up plans and systems, such as monitoring plans and environmental management plans, must be prepared; and costs of implementing such plans and systems, and financial methods to fund such costs, must be determined. Plans for projects with particularly large potential adverse impact must be accompanied by detailed environmental management plans.
Scope of Impact to be Examined	· Environmental impact to be investigated and examined includes factors that impact human health and safety as well as the natural environment, such as: air, water, soil, waste, accidents, water usage, ecosystems, and biota. Social concerns include: involuntary resettlement of the population, the indigenous people, cultural heritage, landscape, gender, children's rights and communicable diseases such as HIV/AIDS and impact that may lead to trans-boundary and global environmental problems; and · In addition to the direct and immediate impact of projects, derivative, secondary and cumulative impact are also to be examined and investigated to a reasonable extent. It is also desirable that the impact which can occur at any time during the duration of the project be continuously considered throughout the life cycle of the project.
Compliance with Laws, Standards and Plans	· Projects must comply with laws, ordinances and standards relating to environmental and social considerations established by the governments that have jurisdiction over the project site (including both national and local governments). They are also to conform to environmental and social consideration policies and plans of the governments that have jurisdiction over the project site; and · Projects must, in principle, be undertaken outside protected areas that are specifically designated by laws or ordinances of the government for the conservation of nature or cultural heritage (excluding projects whose primary objectives are to promote the protection or restoration of such designated areas). Projects are also not to impose significant adverse impact on designated conservation areas.
Social Acceptability and Social Impacts	· Projects must be adequately coordinated so that they are accepted in a manner that is socially appropriate to the country and locality in which the project is planned. For projects with a potentially large environmental impact, sufficient consultations with stakeholders, such as local residents, must be conducted via disclosure of information from an early stage where alternative proposals for the project plans may be examined. The outcome of such consultations must be incorporated into the contents of the project plan; and · Appropriate consideration must be given to vulnerable social groups, such as women, children, the elderly, the poor, and ethnic minorities, all of whom are susceptible to environmental and social impact and who may have little access to the decision-making process within society.

Principles	JBIC Policy
Involuntary Resettlement	· Involuntary resettlement and loss of means of livelihood are to be avoided where feasible, exploring all viable alternatives. When, after such examination, it is proved unfeasible, effective measures to minimize impact and to compensate for losses must be agreed upon with the people who will be affected; · People to be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported by the project proponents, etc. in timely manner. The project proponents, etc. must make efforts to enable the people affected by the project, to improve their standard of living, income opportunities and production levels, or at least to restore them to pre-project levels. Measures to achieve this may include: providing land and monetary compensation for losses (to cover land and property losses), supporting the means for an alternative sustainable livelihood, and providing the expenses necessary for relocation and the re-establishment of a community at relocation sites; and · Appropriate participation by the people affected and their communities must be promoted in planning, implementation and monitoring of involuntary resettlement plans and measures against the loss of their means of livelihood.
Indigenous People	· When a project may have adverse impact on indigenous peoples, all of their rights in relation to land and resources must be respected in accordance with the spirit of the relevant international declarations and treaties. Efforts must be made to obtain the consent of indigenous peoples after they have been fully informed.
Monitoring	· It is desirable that, after a project begins, the project proponents monitor: (i) whether any situations that were unforeseeable before the project began have arisen, (ii) the implementation situation and the effectiveness of the mitigation measures prepared in advance, and that they then take appropriate measures based on the results of such monitoring; · In cases where sufficient monitoring is deemed essential for the achievement of appropriate environmental and social considerations, such as the projects for which mitigation measures should be implemented while monitoring their effectiveness, project proponents must ensure that project plans include monitoring plans which are feasible; · It is desirable that project proponents make the results of the monitoring process available to project stakeholders; and · When third parties point out, in concrete terms, that environmental and social considerations are not being fully undertaken, it is desirable that a forum for discussion and examination of countermeasures be established based on sufficient information disclosure and include the participation of stakeholders in the relevant project. It is also desirable that an agreement be reached on procedures to be adopted with a view to resolving the problem.

Comparison of JBIC Guideline and Viet Nemeses Requirement for Environmental Impact Assessment

JBIC Guide Line	Vietnam Law and Regulation
JBIC Guideline for Confirmation of Environmental and Social Considerations, April 2002 **2. Appendix Illustrative Environmental Impact Assessment Report for Category A Projects NB** ● An EIA's scope and level of detail should be decided in accordance with the project's potential impacts. ● The EIA report should include the following items (not necessarily in the order shown) ● This Appendix is based on the World Bank Operational Policy - OP 4.01, Annex B.	Circular 08/2006/TT-BTNMT* of the Ministry of Natural Resources and Environment providing guidelines on strategic environmental assessment, environmental impact assessment and environmental protection undertakings **APPENDIX 4. Structure and Requirements of Contents of Environmental Impact Assessment Reports** * Circular No.05/2008/TT-BTNMT repealed Circular 08/2006/TT-BTNMT. However, the contents of the EIA report are still applicable for effective law and regulations.
● Executive Summary: Concisely discusses significant findings and recommended actions.	CONCLUSION AND PROPOSALS 1. Conclusion Making conclusions regarding issues such as whether or not impact is identified and assessed in full, unclear issues; general assessment in terms of the level and scale of defined impact; the feasibility of measures minimizing such impact; negative impact for which there is no measure to minimize the impact because it is beyond the permissible capacity of the project owner and proposal for resolution. 2. Proposal Making proposals to relevant bodies or authorities for their assistance in resolution of matters which are beyond the capacity of the project.
● Policy, legal and administrative framework: Discusses the policy, legal and administrative framework within which the EIA report is to be carried out.	FOREWORD 1. Origination of the project. 2. Legal and technical bases for implementation of the environmental impact assessment (EIA) 3. Organization of implementation of EIA
● Project description: Describes the proposed project and its geographic, ecological, social and temporal context, including any off-site investments that may be required (e.g. dedicated pipelines, access roads, power plants, water supply, housing, and raw material and product storage facilities). Indicates the need for any resettlement or social development plan. Normally includes a map showing the project site and the area affected by the project.	CHAPTER I: Summarized Description of Project 1.1 Name of the project 1.2 Project owner 1.3 Geographical location of the project 1.4 Main contents of the project
● Baseline data: Assesses the dimensions of the study area and describes relevant physical, biological and socio-economic conditions, including all changes anticipated before the project commences. Additionally, takes into account current and proposed development activities within the project area but not directly connected to the project. Data should be relevant to decisions about project site, design, operation, or mitigatory measures; the section	CHAPTER II: Natural, Environmental and Socio-economic Conditions 2.1 Natural and environmental conditions: Geographical and geological conditions/Meteorological - hydrographical conditions/Current status of components of the natural environment(air, water and land environment) 2.2 Socio-economic conditions: Economic conditions(industries, agriculture, communication, transportation, mining, tourism, commerce, provision of services and other sectors)/

JBIC Guide Line	Vietnam Law and Regulation
indicates accuracy, reliability and sources of the data.	Social conditions(cultural, social, religious or belief works, historical relicts, residential areas, urban areas and other relevant works in the area of the project and in adjacent areas affected by the project) with referring to sources of used or reference documents and data.
● Environmental Impacts: Predicts and assesses the project's likely positive and negative impacts, in quantitative terms to the extent possible. Identifies mitigation measures and any negative environmental impacts that cannot be mitigated. Explores opportunities for environmental enhancement. Identifies and estimates the extent and quality of available data, essential data gaps and uncertainties associated with predictions, and specifies topics that do not require further attention.	CHAPTER III. Assessment of Environment Impacts 3.1 Impact causing sources Impact causing sources relating to wastes/Impact causing sources not relating to wastes/Forecasting risks regarding environmental incidents caused by the project 3.2 Effected objects and extent of impact Listing all natural, economic, cultural, social, religious or belief objects, historical relics and other objects in the area of the project and in adjacent areas which will be affected by wastes, by elements other than wastes or by risks regarding environmental incidents during implementation of the project; making a detailed or specific description of the scale of space and time to be effected. 3.3 Impact assessment 3.4 Assessment of used methods
● Analysis of alternatives: Systematically compares feasible alternatives to the proposed project site, technology, design and operation including the "without project" situation in terms of their potential environmental impacts; the feasibility of mitigating these impacts; their capital and recurrent costs; their suitability under local conditions; and their institutional, training and monitoring requirements. For each of the alternatives, quantifies the environmental impacts to the extent possible, and attaches economic values where feasible. States the basis for selecting the particular project design proposed and offers justification for recommended emission levels and approaches to pollution prevention and abatement.	<Partially Applicable> CHAPTER IV: Measures to Minimize Adverse Impact and to Prevent and Deal with Environmental Incidents ● With respect to each defined type of adverse impact, there must be relevant measures to minimize it, clear explanation on advantages, weaknesses, feasibility, efficiency/effectiveness of such measures. Where no measure is available or even through there are such measures but they are unfeasible within the framework of the project, specifying causes therefore and giving specific proposals in order for relevant bodies to resolve and decide on the matter. ● Proving that after such measures are taken, the adverse impact will be reduced to a specific level which is compared with the standards, compulsory regulations on limits and regulations currently in force. In the case of failure to satisfy the stipulated requirements, specifying causes therefore and giving specific proposals in order for relevant bodies to resolve and decide on the matter. ● With respect to environmental incidents: Proposing a general plan for preventing and dealing with incidents, specifying: ● Items or measures that the project owner will take on its own initiative within its own capacity; its comments and assessment of the feasibility and effectiveness; ● Items or measures which require co-operation or assistance from State bodies and other parties; ● Force majeure and proposals for resolution. CHAPTER V: Undertakings to Take Environmental

JBIC Guide Line	Vietnam Law and Regulation
	Protection Measures Specifying the project owner's undertakings to take measures to minimize the above-mentioned adverse impact as well as undertakings to take all measures and to perform general regulations on environmental protection related to the process of commencement and implementation of the project.
● Environmental Management Plan (EMP): Describes mitigation, monitoring and institutional measures to be taken during construction and operation to eliminate adverse impacts, offset them, or reduce them to acceptable levels.	CHAPTER VI: Environmental Treatment Facilities and Programs of Environmental Management and Supervision. 6.1 List of environmental treatment facilities 6.2 Programs of environmental management and supervision 6.2.1 Program of environmental management Formulating a program to manage issues regarding environmental protection during construction and actual operation including organizational structure and personnel for environmental management; management of wastes, including hazardous waste; prevention and dealing with environmental incidents (except for the item of fire prevention and fighting which will be subject to the laws on fire prevention and fighting); and other items on environmental management related to the project. 6.2.2 Program of environmental supervision (a)Supervision of wastes, (b)Supervision of surrounding environment, (c)Other supervision CHAPTER VII: Estimated Budget for Environmental Facilities Estimated budgets for construction and operation of environmental facilities during the process of construction and operation of the project should be provided for.
● Consultation: Record of consultation meetings, including consultations for obtaining the informed views of the affected people, local non-governmental organizations (NGOs) and regulatory agencies.	CHAPTER VIII: Seeking Opinions from Communities 8.1 Opinions of people's committees at the commune level 8.2 Opinions of the Fatherland Front's committees at the commune level (Both clauses 8.1 and 8.2 will be presented in accordance with the requirements set out in Section 2 of Part III of this Circular).
● Not specified	CHAPTER IX: Reference to Sources of Figures and Data, and to Methods of Assessment 9.1 Sources of figures and data 9.2 Methods applied during EIA 9.3 Comments on the extent to which assessments are detailed or reliable

Appendix 3-2

Survey data on Natural Environment

1) Vibration

Table 1 Result of Vibration Measurement

Time	11h -12h	12h -13h	13h -14h	14h -15h	15h -16h	16h -17h	17h -18h	18h -19h
Vibration (dB)	**60**	**62**	**60**	**61**	**60**	**60**	**60**	**58**
Time	19h -20h	20h -21h	21h -22h	22h -23h	23h -24h	24h 1h	1h -2h	2h -3h
Vibration (dB)	**58**	**58**	**59**	**58**	**59**	**58**	**58**	**58**
Time	3h -4h	4h -5h	5h -6h	6h -7h	7h -8h	8h -9h	9h -10h	10h -11h
Vibration (dB)	**58**	**58**	**59**	**59**	**60**	**61**	**60**	**60**
QCVN 27: 2010/BTMT (Technical regulation on vibration)	**75 dB**							

2) Water Quality

Table 2 Details of Survey Method and Equipment

NO.	Items	Sample	Equipment used	Method used	Analysis Equipment
I. Air Quality					
1	Temperature	TCVN 5949:1998	Bioblock scientific 50517-Japan	Quick Test	Bioblock scientific 50517-Japan
2	Wind speed		DANTEC, Danish		DANTEC, Dani
3	Humidity		Bioblock scientific 50517-Japan		Bioblock scientific 50517-Japan
4	TSP	TCVN 5067:1995	Sibata C20 - Japan	TCVN 5067:1995	**Electronic Precision Balances** 1mg - 250g AEP 250G, ADAM - Anh
5	CO	TCVN 5972:1995	KIMOTO – Japan	TCVN 5972:1995	UV - VIS 2450 Shimadzu – Japan
6	NO_2	TCVN 6137:1996		TCVN 6137:1996	
7	SO_2	TCVN 5971:1995		TCVN 5971:1995	Gas chromato-graphy IC – Japan
8	VOC	gas chromato-graphy		Gas chromato-graphy	GCMS, Shimazu, Japan
II. Noise					
1	L_{eq}	TCVN 7878-2-2010	ORION-NL21, Japan	Quick Test	ORION-NL21, Japan
2	L10				
3	L90				
III. Coastal Water Quality					
1	Temperature	TCVN 5992:1995& TCVN 5993:1995& TCVN 5998:1995&	Batomet	TCVN 4457:88	Water temperature meNoer
2	pH			TCVN 6492:1999	pH meNoer pH/ISE 710A^{+}
3	Sality			SMEWW 2520 B*	EC, Sality (INOLAB CONDLEVEL 2)
4	BOD_5			TCVN 6001-1:2008	Incubator, DO meNoer
5	DO			TCVN 5499:1995	Buret
6	TSS			TCVN 6625:2000	Filter Paper, Analytical Balance
7	NH_3			SMEWW 4500 NH_3-F*	Atomic absorption spectroscopy (UV-VIS)
8	Toal Phosphorus			TCVN 6202:2008	
9	Total Nitrogen			SMEWW 4500 N.C	
10	Cr^{3+}			SMEWW 3113*	

NO.	Items	Sample	Equipment used	Method used	Analysis Equipment
11	Cr^{6+}			TCVN 7939:2008	
12	Zn			TCVN 6193:1996	Atomic absorption spectroscopy (AAS)
13	Cd				
14	Pb				
15	Total-Fe			TCVN 6177:1996	Atomic absorption spectroscopy (UV-VIS)
16	Mn			SMEWW 3500 MnB	Atomic absorption spectroscopy (AAS)
17	As			TCVN 6626-2000	
18	Hg			TCVN 7877:2008	
19	Hydrocarbons/ mineral Oils			TCVN 5070:1995	Separatory funnel, Electric Balance
20	Coliform			TCVN 6187-2:1996*	Incubator
IV. Seabed Sediment Alluvium					
1	Cr	TCVN 6663-15:2004	sediment sampling	TCVN 6649:2000& TCVN 6496:1999	Atomic absorption spectroscopy (AAS)
2	Cu				
3	Zn				
4	Cd				
5	Pb				
6	As			TCVN 6649:2000& TCVN 6626:2000	
7	Hg			TCVN 6649:2000& TCVN 7877:2008	
8	Fe			TCVN 6649:2000& TCVN 6177:1996	Atomic absorption spectroscopy (UV-VIS)
9	Hydrocarbons/mineral Oils			TCVN 5070:1995	Soxhlet extractor, Separatory funnel, Electric Balance
10	PCBs			EPA 617 – 1996	GC 2010
11	DDT			TCVN 7876 – 2008	
12	Dioxin			TCQS 01:2010/NĐVN	Máy sắc kí khối phổ HewleNo Packard GC6890/MSD5972A

Table 3 (1) Coastal Water Quality (NM02)

No	Items	Units	Test Results at NM02					
			High tide			Low tide		
			Surface	Middle	Bottom	Surface	Middle	Bottom
1	Temperature	^{o}C	24.0	24.0	24.0	24.0	24.0	23.0
2	pH	-	7.93	7.86	7.87	7.83	7.62	7.85
3	Sality	‰	16.7	25.2	28.1	9.9	22.5	26.2
4	BOD_5	mg/l	2.2	2.0	1.8	2.4	2.2	2.3
5	DO	mg/l	5.25	5.10	4.98	5.10	4.98	4.27
6	TSS	mg/l	23.1	21.5	37.8	14.3	12.5	22.6
7	NH_3	mg/l	0.848	0.812	0.536	0.724	0.687	0.453
8	Toal Phosphorus	mg/l	2.240	2.054	1.963	2.128	1.984	1.765
9	Total Nitrogen	mg/l	2.745	2.462	1.879	2.110	1.876	1.543
10	Cr^{3+}	mg/l	0.016	0.009	0.005	0.003	0.003	0.002
11	Cr^{6+}	mg/l	0.012	0.007	0.005	0.002	0.002	0.002
12	Zn	mg/l	0.0020	0.0027	0.0031	0.0035	0.0030	0.0041
13	Cd	mg/l	0.0007	0.0005	0.0004	0.0007	0.0005	0.0006
14	Pb	mg/l	0.001	0.001	0.002	0.001	0.002	0.001
15	Total-Fe	mg/l	1.740	1.863	1.468	0.860	0.817	0.895
16	Mn	mg/l	0.0030	0.0041	0.0022	0.0032	0.0029	0.0037
17	As	mg/l	0.002	0.003	0.002	0.004	0.003	0.004
18	Hg	mg/l	0.0009	0.0007	0.0006	0.0002	0.0002	0.0001
19	Hydrocarbons/ mineral Oils	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
20	Coliform	MPN/100ml	360	330	310	290	270	310

Table 3 (2) Coastal Water Quality (WS03)

No	Items	Units	Testing Result at WS03			
			High tide		Low tide	
			Surface	Bottom	Surface	Bottom
1	Temperature	^{o}C	25.0	25.0	25.0	25.0
2	pH	-	7.85	7.81	7.67	7.24
3	Sality	‰	9.7	15.5	8.1	8.7
4	BOD_5	mg/l	1.9	1.6	2.1	1.8
5	DO	mg/l	5.34	5.06	5.06	4.27
6	TSS	mg/l	48.3	77.4	32.3	33.1
7	NH_3	mg/l	0.805	0.561	0.737	0.643
8	Total Phosphorus	mg/l	2.148	2.182	2.267	2.196
9	Total Nitrogen	mg/l	2.192	2.067	2.004	2.067
10	Cr^{3+}	mg/l	0.007	0.004	0.007	0.006
11	Cr^{6+}	mg/l	0.004	0.011	0.009	0.007
12	Zn	mg/l	0.0026	0.0029	0.0029	0.0023
13	Cd	mg/l	0.0007	0.0005	0.0006	0.0007
14	Pb	mg/l	0.001	0.002	0.001	0.001
15	Total-Fe	mg/l	1.015	1.270	1.680	1.130
16	Mn	mg/l	0.0023	0.0027	0.003	0.0047
17	As	mg/l	0.003	0.004	0.002	0.003
18	Hg	mg/l	0.0009	0.0002	0.0001	0.0001
19	Hydrocarbons/ mineral Oils	mg/l	<0.1	<0.1	<0.1	<0.1
20	Coliform	MPN/100ml	330	310	290	330

Table 3 (3) Coastal Water Quality (WS05)

No	Items	Units	Testing Result at WS05				
			High tide			Low tide	
			Surface	Middle	Bottom	Surface	Bottom
1	Temperature	^{o}C	25.0	25.0	25.0	25.0	25.0
2	pH	-	7.89	7.69	7.85	7.50	7.69
3	Sality	%o	7.3	8.9	15.1	6.9	11.9
4	BOD_5	mg/l	1.5	1.4	1.8	1.7	1.5
5	DO	mg/l	5.85	5.31	5.17	5.82	5.31
6	TSS	mg/l	20.2	28.1	20.1	28.2	31.2
7	NH_3	mg/l	0.822	0.803	0.524	0.667	0.570
8	Toal Phosphorus	mg/l	2.192	1.988	2.070	2.281	2.192
9	Total Nitrogen	mg/l	2.511	2.011	1.517	2.214	2.314
10	Cr^{3+}	mg/l	0.019	0.008	0.005	0.003	0.004
11	Cr^{6+}	mg/l	0.008	0.006	0.005	0.006	0.005
12	Zn	mg/l	0.0016	0.0015	0.0017	0.0038	0.0049
13	Cd	mg/l	0.0006	0.0007	0.0005	0.0007	0.0006
14	Pb	mg/l	0.001	0.002	0.002	0.001	0.001
15	Total-Fe	mg/l	1.110	1.876	1.220	1.165	1.355
16	Mn	mg/l	0.0023	0.0026	0.0052	0.0062	0.0015
17	As	mg/l	0.005	0.004	0.002	0.001	0.005
18	Hg	mg/l	0.0002	0.0003	0.0005	0.0004	0.0003
19	Hydrocarbons/mineral Oils	mg/l	0.1	<0.1	<0.1	<0.1	<0.1
20	Coliform	MPN/100ml	200	190	230	390	360

Table 3 (4) Coastal Water Quality (WS06)

No	Items	Units	Test Results at WS06					
			High tide			Low tide		
			Surface	Middle	Bottom	Surface	Middle	Bottom
1	Temperature	^{o}C	25.0	25.0	25.0	25.0	25.0	25.0
2	pH	-	7.95	7.84	7.89	7.37	7.40	7.43
3	Sality	%o	12.4	15.2	22.7	7.1	10.2	11.9
4	BOD_5	mg/l	1.9	1.8	1.7	2.2	2.1	2.0
5	DO	mg/l	5.86	5.56	5.31	5.55	5.31	5.29
6	TSS	mg/l	11.7	52.3	82.6	31.1	29.8	62.4
7	NH_3	mg/l	0.560	0.550	0.755	0.554	0.548	0.537
8	Toal Phosphorus	mg/l	2.135	2.070	2.206	1.141	1.762	2.393
9	Total Nitrogen	mg/l	2.012	1.922	1.764	1.210	1.087	1.319
10	Cr^{3+}	mg/l	0.005	0.004	0.005	0.004	0.003	0.004
11	Cr^{6+}	mg/l	0.010	0.008	0.006	0.004	0.005	0.005
12	Zn	mg/l	0.0018	0.0029	0.0030	0.0034	0.0032	0.0037
13	Cd	mg/l	0.0006	0.0007	0.0006	0.0005	0.0005	0.0006
14	Pb	mg/l	0.002	0.002	0.001	0.001	0.002	0.002
15	Total-Fe	mg/l	0.905	1.945	1.265	1.515	1.412	1.395
16	Mn	mg/l	0.0047	0.002	0.0026	0.0022	0.0018	0.0012
17	As	mg/l	0.006	0.004	0.003	0.002	0.003	0.004
18	Hg	mg/l	0.0002	<0.0001	<0.0001	<0.0001	0.0001	0.0001
19	Hydrocarbons/mineral Oils	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
20	Coliform	MPN/100ml	450	360	390	300	230	270

Table 3 (5) Coastal Water Quality (WS07)

No	Items	Units	Test Results at WS07					
			High tide			Low tide		
			Surface	Middle	Bottom	Surface	Middle	Bottom
1	Temperature	^{o}C	25.0	25.0	25.0	25.0	25.0	25.0
2	pH	-	7.86	7.73	7.94	7.65	7.52	7.43
3	Sality	%o	17.0	16.5	25.6	16.4	17.6	19.1
4	BOD_5	mg/l	1.8	1.7	1.5	2	1.8	1.7
5	DO	mg/l	6.21	5.51	4.98	5.97	5.56	5.40
6	TSS	mg/l	4.7	16.4	35.3	18.7	19.5	49.0
7	NH_3	mg/l	0.587	0.567	0.500	0.538	0.435	0.492
8	Toal Phosphorus	mg/l	2.169	1.999	2.131	2.339	2.179	2.910
9	Total Nitrogen	mg/l	1.962	1.147	1.632	1.924	1.703	2.743
10	Cr^{3+}	mg/l	0.007	0.006	0.005	0.002	0.017	0.068
11	Cr^{6+}	mg/l	0.015	0.012	0.011	0.003	0.006	0.011
12	Zn	mg/l	0.0035	0.0015	0.0024	0.0055	0.0032	0.0038
13	Cd	mg/l	0.0005	0.0006	0.0007	0.0006	0.0005	0.0006
14	Pb	mg/l	0.001	0.002	0.001	0.001	0.001	0.001
15	Total-Fe	mg/l	0.910	0.845	1.990	1.275	0.982	1.295
16	Mn	mg/l	0.0031	0.0032	0.0037	0.0011	0.0008	0.0007
17	As	mg/l	0.005	0.003	0.003	0.004	0.003	0.001
18	Hg	mg/l	0.0005	0.0002	0.0005	0.0008	0.0004	0.0001
19	Hydrocarbons/ mineral Oils	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
20	Coliform	MPN/100ml	330	290	360	440	360	390

Table 3 (6) Coastal Water Quality (WS08)

No	Items	Units	Testing Result at WS08					
			High tide			Low tide		
			Surface	Middle	Bottom	Surface	Middle	Bottom
1	Temperature	^{o}C	25.0	25.0	25.0	24.0	24.0	24.0
2	pH	-	7.87	7.66	7.87	7.72	7.78	7.86
3	Sality	‰	17.4	26.4	29.2	14.3	18.0	23.5
4	BOD_5	mg/l	2.1	2	1.8	2.3	2	1.9
5	DO	mg/l	6.26	5.53	5.31	5.95	5.43	5.29
6	TSS	mg/l	18.4	15.0	41.8	6.8	8.1	9.3
7	NH_3	mg/l	0.769	0.843	0.649	0.644	0.634	0.541
8	Toal Phosphorus	mg/l	2.216	2.379	2.495	2.376	2.264	2.298
9	Total Nitrogen	mg/l	1.914	2.245	1.910	2.253	2.610	2.147
10	Cr^{3+}	mg/l	0.006	0.006	0.005	0.009	0.007	0.008
11	Cr^{6+}	mg/l	0.003	0.002	0.004	0.007	0.005	0.005
12	Zn	mg/l	0.0030	0.0024	0.0038	0.0026	0.0022	0.0020
13	Cd	mg/l	0.0008	0.0006	0.0006	0.0006	0.0005	0.0007
14	Pb	mg/l	0.001	0.001	0.001	0.003	0.002	0.002
15	Total-Fe	mg/l	0.995	0.855	1.415	1.180	1.077	1.010
16	Mn	mg/l	0.003	0.0025	0.004	0.0019	0.0029	0.0018
17	As	mg/l	0.001	0.004	0.003	0.001	0.003	0.003
18	Hg	mg/l	0.0006	0.0006	0.0001	0.0002	0.0004	0.0002
19	Hydrocarbons/ mineral Oils	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
20	Coliform	MPN/100ml	310	290	270	310	270	360

Table 3 (7) Coastal Water Quality (WS09)

No	Items	Units	Testing Result at WS09					
			High tide			Low tide		
			Surface	Middle	Bottom	Surface	Middle	Bottom
1	Temperature	^{o}C	28.6	26.8	25.4	25.7	25.7	25.5
2	pH	-	7.82	8.04	8.05	7.93	7.98	7.95
3	Sality	‰	22.0	28.0	30.9	21.7	22.4	27.8
4	BOD_5	mg/l	2.1	1.9	1.8	2.3	2.1	2
5	DO	mg/l	6.31	5.94	5.70	6.59	6.19	5.76
6	TSS	mg/l	3.2	3.5	4.3	6.7	10.4	30.8
7	NH_3	mg/l	0.423	0.326	0.260	0.720	0.470	0.450
8	Toal Phosphorus	mg/l	2.053	1.989	2.240	2.366	1.975	2.247
9	Total Nitrogen	mg/l	1.317	1.412	1.206	1.214	1.620	1.813
10	Cr^{3+}	mg/l	0.004	0.005	0.002	0.007	0.011	0.015
11	Cr^{6+}	mg/l	0.014	0.011	0.010	0.006	0.011	0.012
12	Zn	mg/l	0.0012	0.0012	0.0012	0.0077	0.0027	0.0036
13	Cd	mg/l	0.0005	0.0004	0.0005	0.0006	0.0006	0.0005
14	Pb	mg/l	0.001	0.002	0.002	0.003	0.004	0.004
15	Total-Fe	mg/l	1.140	0.975	0.990	1.385	1.440	1.375
16	Mn	mg/l	0.0007	0.0024	0.0014	0.0026	0.0003	0.0003
17	As	mg/l	0.002	0.001	0.002	0.002	0.002	0.003
18	Hg	mg/l	0.0001	<0.0001	0.0005	0.0002	0.0002	<0.0001
19	Hydrocarbons/ mineral Oils	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
20	Coliform	MPN/100ml	230	190	210	230	200	270

Table 3 (8) Coastal Water Quality (WS11)

No	Items	Units	Testing Result at WS11					
			High tide			Low tide		
			Surface	Middle	Bottom	Surface	Middle	Bottom
1	Temperature	^{o}C	27.5	25.4	24.9	26.8	26.8	26.7
2	pH	-	8.09	8.11	8.06	7.74	7.90	7.98
3	Sality	%o	23.2	30.6	31.3	13.4	18.5	21.3
4	BOD_5	mg/l	1.6	1.4	1.2	1.7	1.6	1.8
5	DO	mg/l	6.12	5.43	5.29	5.87	5.53	4.98
6	TSS	mg/l	0.8	<0.1	2.4	14.3	28.1	16.6
7	NH_3	mg/l	0.331	0.286	0.289	0.451	0.403	0.409
8	Toal Phosphorus	mg/l	2.274	2.635	2.519	2.114	2.352	2.448
9	Total Nitrogen	mg/l	1.701	1.623	1.610	2.136	1.974	1.662
10	Cr^{3+}	mg/l	0.010	0.019	0.025	0.009	0.014	0.015
11	Cr^{6+}	mg/l	0.024	0.013	0.011	0.009	0.011	0.007
12	Zn	mg/l	0.0022	0.0014	0.0039	0.0028	0.0033	0.0030
13	Cd	mg/l	0.0004	0.0004	0.0002	0.0005	0.0007	0.0006
14	Pb	mg/l	0.002	0.002	0.002	0.003	0.001	0.001
15	Total-Fe	mg/l	0.842	0.862	1.061	1.345	1.335	1.320
16	Mn	mg/l	0.0023	0.0017	0.0019	0.0013	0.0001	0.0002
17	As	mg/l	0.003	0.006	0.005	0.002	0.002	0.005
18	Hg	mg/l	0.0002	0.0001	0.0001	<0.0001	0.0001	0.0001
19	Hydrocarbons/ mineral Oils	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
20	Coliform	MPN/100ml	310	270	290	310	230	360

Table 3 (9) Coastal Water Quality (WS12)

No	Items	Units	Testing Result at WS12					
			High tide			Low tide		
			Surface	Middle	Bottom	Surface	Middle	Bottom
1	Temperature	^{o}C	27.6	25.7	25.2	25.8	25.8	25.4
2	pH	-	8.07	8.10	8.12	7.85	7.91	7.83
3	Sality	%o	26.1	31.0	31.2	22.5	25.6	30.9
4	BOD_5	mg/l	2.2	1.9	1.7	2.3	2.1	2.2
5	DO	mg/l	6.46	6.21	6.08	6.08	5.44	5.06
6	TSS	mg/l	1.3	<0.1	3.4	5.7	11.7	47.6
7	NH_3	mg/l	0.376	0.323	0.286	0.404	0.398	0.391
8	Toal Phosphorus	mg/l	2.475	2.774	2.254	2.526	2.335	2.478
9	Total Nitrogen	mg/l	1.397	1.614	1.423	2.106	1.872	2.694
10	Cr^{3+}	mg/l	0.003	0.008	0.022	0.008	0.014	0.019
11	Cr^{6+}	mg/l	0.021	0.021	0.011	0.008	0.008	0.014
12	Zn	mg/l	0.0044	0.0025	0.0029	0.0021	0.0016	0.0012
13	Cd	mg/l	0.0003	0.0004	0.0006	0.0007	0.0006	0.0006
14	Pb	mg/l	0.003	0.003	0.003	0.001	0.001	0.001
15	Total-Fe	mg/l	0.895	1.035	0.990	1.184	1.215	1.175
16	Mn	mg/l	0.002	0.0028	0.0016	0.0007	0.0013	0.0025
17	As	mg/l	0.003	0.007	0.007	0.004	0.006	0.003
18	Hg	mg/l	0.0003	0.0001	0.0001	<0.0001	0.0001	0.0002
19	Hydrocarbons/mineral Oils	mg/l	<0.1	<0.1	<0.1	0.1	<0.1	<0.1
20	Coliform	MPN/100ml	330	290	360	300	360	390

Table 3 (10) Coastal Water Quality (WS13)

No	Items	Units	Testing Result at WS13					
			High tide			Low tide		
			Surface	Middle	Bottom	Surface	Middle	Bottom
1	Temperature	^{o}C	26.0	26.0	24.0	24.5	24.5	24.5
2	pH	-	8.13	8.09	8.16	8.02	8.12	8.06
3	Sality	%o	30.2	30.5	31.5	26.4	30.6	31.2
4	BOD_5	mg/l	1	0.9	0.8	1.2	1.1	1
5	DO	mg/l	6.28	6.06	4.62	6.46	6.05	5.71
6	TSS	mg/l	<0.1	3.1	<0.1	5.1	1.2	6.3
7	NH_3	mg/l	0.277	0.682	0.451	0.449	0.502	0.657
8	Toal Phosphorus	mg/l	2.152	2.230	2.397	2.396	2.278	2.152
9	Total Nitrogen	mg/l	3.014	2.726	2.211	1.206	1.297	1.702
10	Cr^{3+}	mg/l	0.007	0.016	0.009	0.008	0.009	0.007
11	Cr^{6+}	mg/l	0.005	0.011	0.006	0.011	0.007	0.005
12	Zn	mg/l	0.0016	0.0038	0.0089	0.0031	0.0041	0.0063
13	Cd	mg/l	0.0005	0.0005	0.0006	0.0006	0.0006	0.0005
14	Pb	mg/l	0.001	0.001	0.002	0.002	0.002	0.002
15	Total-Fe	mg/l	0.465	0.630	0.478	0.545	0.589	0.612
16	Mn	mg/l	0.0004	0.0015	0.0014	0.0011	0.0023	0.0011
17	As	mg/l	0.003	0.003	0.007	0.003	0.003	0.005
18	Hg	mg/l	0.0002	0.0006	0.0001	<0.0001	<0.0001	0.0002
19	Hydrocarbons/mineral Oils	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
20	Coliform	MPN/100ml	290	230	190	230	200	210

Table 3 (11) Coastal Water Quality (WS16)

No	Items	Units	Testing Result at WS16					
			High tide			Low tide		
			Surface	Middle	Bottom	Surface	Middle	Bottom
1	Temperature	^{o}C	24.5	24.5	24.0	24.0	24.0	24.0
2	pH	-	8.09	8.10	8.12	8.15	8.04	8.11
3	Sality	%o	31.6	31.8	31.9	31.1	31.6	32.1
4	BOD_5	mg/l	0.6	0.5	0.7	0.7	0.6	0.6
5	DO	mg/l	6.42	6.26	6.00	6.00	5.62	5.49
6	TSS	mg/l	<0.1	<0.1	2.2	<0.1	<0.1	<0.1
7	NH_3	mg/l	0.376	0.605	0.945	0.558	0.501	0.537
8	Toal Phosphorus	mg/l	1.982	1.961	2.159	1.798	2.604	1.594
9	Total Nitrogen	mg/l	1.172	1.566	1.804	2.415	2.306	2.160
10	Cr^{3+}	mg/l	0.021	0.018	0.022	0.014	0.017	0.005
11	Cr^{6+}	mg/l	0.012	0.011	0.007	0.011	0.016	0.008
12	Zn	mg/l	0.0053	0.0049	0.0037	0.0036	0.0045	0.0049
13	Cd	mg/l	0.0005	0.0006	0.0004	0.0006	0.0005	0.0006
14	Pb	mg/l	0.001	0.001	0.002	0.002	0.001	0.001
15	Total-Fe	mg/l	0.467	0.558	0.530	0.379	0.420	0.389
16	Mn	mg/l	0.0019	0.0023	0.0012	0.0029	0.0018	0.0018
17	As	mg/l	0.004	0.006	0.004	0.005	0.005	0.004
18	Hg	mg/l	<0.0001	0.0002	0.0002	0.0003	<0.0001	<0.0001
19	Hydrocarbons/mineral Oils	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
20	Coliform	MPN/100ml	270	230	310	290	210	330

Table 3 (12) Coastal Water Quality (WS17)

No	Items	Units	Testing Result at WS17					
			High tide			Low tide		
			Surface	Middle	Bottom	Surface	Middle	Bottom
1	Temperature	^{o}C	25.0	24.5	24.0	24.0	24.0	24.0
2	pH	-	8.13	8.17	8.11	8.12	8.16	8.13
3	Sality	%o	27.1	30.6	31.8	28.6	30.9	31.7
4	BOD_5	mg/l	0.6	0.6	0.5	0.7	0.6	0.8
5	DO	mg/l	5.74	6.00	6.51	6.13	4.98	4.85
6	TSS	mg/l	5.2	5.1	5.4	<0.1	<0.1	<0.1
7	NH_3	mg/l	0.605	0.352	0.557	0.489	0.371	0.385
8	Toal Phosphorus	mg/l	2.155	2.444	2.444	2.164	1.968	2.699
9	Total Nitrogen	mg/l	2.003	1.769	1.514	2.010	1.769	1.617
10	Cr^{3+}	mg/l	0.011	0.026	0.009	0.022	0.016	0.013
11	Cr^{6+}	mg/l	0.006	0.015	0.008	0.013	0.011	0.009
12	Zn	mg/l	0.0016	0.0021	0.0013	0.0076	0.0054	0.0054
13	Cd	mg/l	0.0004	0.0006	0.0005	0.0005	0.0006	0.0006
14	Pb	mg/l	0.002	0.001	0.002	0.003	0.003	0.002
15	Total-Fe	mg/l	0.468	0.535	0.785	0.439	0.459	0.505
16	Mn	mg/l	0.0006	0.0062	0.0034	0.0013	0.0019	0.0014
17	As	mg/l	0.003	0.004	0.002	0.004	0.005	0.003
18	Hg	mg/l	<0.0001	0.0005	0.0004	0.0002	0.0004	0.0001
19	Hydrocarbons/mineral Oils	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
20	Coliform	MPN/100ml	310	220	300	320	290	360

Table 3 (13) Coastal Water Quality (Dump Site 01)

No	Items	Units	Testing Result at Dump Site 01					
			High tide			Low tide		
			Surface	Middle	Bottom	Surface	Middle	Bottom
1	Temperature	^{o}C	28.0	26.0	25.6	26.0	26.0	25.8
2	pH	-	7.69	8.03	7.97	7.87	7.89	7.95
3	Sality	%o	19.8	29.5	30.2	11.1	14.6	19.3
4	BOD_5	mg/l	1.6	1.5	1.3	1.8	1.6	1.5
5	DO	mg/l	5.93	5.76	5.62	5.68	5.36	5.13
6	TSS	mg/l	9.1	3.2	4.1	15.7	20.1	26.3
7	NH_3	mg/l	0.527	0.287	0.334	0.743	0.481	0.457
8	Toal Phosphorus	mg/l	2.176	2.087	2.427	2.325	2.614	2.692
9	Total Nitrogen	mg/l	1.243	1.069	1.402	2.011	1.966	1.703
10	Cr^{3+}	mg/l	0.001	0.009	0.010	0.013	0.011	0.017
11	Cr^{6+}	mg/l	0.014	0.010	0.009	0.006	0.004	0.008
12	Zn	mg/l	0.0048	0.0010	0.0012	0.0049	0.0055	0.0047
13	Cd	mg/l	0.0003	0.0004	0.0004	0.0005	0.0006	0.0005
14	Pb	mg/l	0.003	0.004	0.004	0.003	0.005	0.004
15	Total-Fe	mg/l	1.995	2.170	1.903	1.881	1.770	1.960
16	Mn	mg/l	0.0014	0.0005	0.0015	0.0018	0.0011	0.0041
17	As	mg/l	0.004	0.003	0.004	0.005	0.002	0.005
18	Hg	mg/l	0.0001	0.0001	<0.0001	0.0005	<0.0001	0.0002
19	Hydrocarbons/mineral Oils	mg/l	<0.1	<0.1	<0.1	0.1	<0.1	<0.1
20	Coliform	MPN/100ml	270	210	230	310	270	360

Table 3 (14) Coastal Water Quality (Dump Site 02)

No	Items	Units	Testing Result at Dump Site 02					
			High tide			Low tide		
			Surface	Middle	Bottom	Surface	Middle	Bottom
1	Temperature	^{o}C	28.3	25.6	25.3	25.8	25.8	25.6
2	pH	-	8.02	8.07	8.11	7.93	7.86	7.92
3	Sality	%o	19.5	22.6	30.8	16.8	19.5	20.6
4	BOD_5	mg/l	1.6	1.6	1.5	1.9	1.8	1.6
5	DO	mg/l	6.29	9.95	5.86	6.44	6.04	5.68
6	TSS	mg/l	6.2	5.7	3.9	8.9	12.1	16.3
7	NH_3	mg/l	0.317	0.301	0.299	0.384	0.508	0.380
8	Toal Phosphorus	mg/l	2.230	2.146	2.441	2.325	2.380	2.327
9	Total Nitrogen	mg/l	1.764	1.508	1.472	1.213	1.406	1.313
10	Cr^{3+}	mg/l	0.004	0.005	0.006	0.014	0.016	0.008
11	Cr^{6+}	mg/l	0.011	0.014	0.016	0.007	0.005	0.016
12	Zn	mg/l	0.0013	0.0012	0.0013	0.0019	0.0039	0.0024
13	Cd	mg/l	0.0007	0.0006	0.0005	0.0006	0.0006	0.0007
14	Pb	mg/l	0.003	0.003	0.003	0.002	0.002	0.001
15	Total-Fe	mg/l	0.972	0.896	0.960	1.405	1.387	1.295
16	Mn	mg/l	0.0022	0.0017	0.0014	0.001	0.0013	0.0021
17	As	mg/l	0.002	0.003	0.003	0.004	0.006	0.003
18	Hg	mg/l	0.0004	0.0003	0.0001	0.0003	0.0002	0.0001
19	Hydrocarbons/mineral Oils	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
20	Coliform	MPN/100ml	290	230	310	230	190	270

Table 3 (15) Coastal Water Quality (Dump Site 03)

No	Items	Units	Testing Result at Dump Site 03					
			High tide			Low tide		
			Surface	Middle	Bottom	Surface	Middle	Bottom
1	Temperature	^{o}C	24.5	24.5	24.0	24.0	24.0	24.0
2	pH	-	8.13	8.17	8.17	8.10	8.14	8.11
3	Sality	%o	28.6	30.7	31.6	30.1	31.7	31.9
4	BOD_5	mg/l	0.7	0.6	0.9	0.8	0.7	0.7
5	DO	mg/l	6.23	6.13	5.74	5.87	5.10	4.85
6	TSS	mg/l	1.3	1.9	<0.1	<0.1	<0.1	<0.1
7	NH_3	mg/l	0.614	0.391	0.386	0.367	0.377	0.371
8	Toal Phosphorus	mg/l	2.556	2.318	2.213	2.363	2.312	1.788
9	Total Nitrogen	mg/l	1.923	2.179	2.267	1.811	1.963	2.107
10	Cr^{3+}	mg/l	0.016	0.015	0.011	0.004	0.003	0.003
11	Cr^{6+}	mg/l	0.013	0.011	0.007	0.008	0.005	0.003
12	Zn	mg/l	0.0051	0.0047	0.0061	0.0039	0.0036	0.0036
13	Cd	mg/l	0.0004	0.0004	0.0003	0.0006	0.0006	0.0005
14	Pb	mg/l	0.002	0.002	0.003	0.001	0.002	0.003
15	Total-Fe	mg/l	0.549	0.610	0.602	0.488	0.493	0.511
16	Mn	mg/l	0.0019	0.0021	0.0012	0.0014	0.003	0.0014
17	As	mg/l	0.003	0.004	0.004	0.003	0.004	0.006
18	Hg	mg/l	0.0001	0.0001	0.0007	0.0002	0.0003	0.0005
19	Hydrocarbons/mineral Oils	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
20	Coliform	MPN/100ml	200	190	270	220	190	200

Table 3 (16) Coastal Water Quality (WS19)

No	Items	Units	Testing Result at WS19	
			High tide	Low tide
			Surface	Surface
1	Temperature	^{o}C	28.5	26.5
2	pH	-	7.67	7.53
3	Sality	%o	14.7	15.2
4	BOD_5	mg/l	2.3	2.5
5	DO	mg/l	6.45	5.81
6	TSS	mg/l	11.6	6.8
7	NH_3	mg/l	1.056	0.822
8	Toal Phosphorus	mg/l	2.543	2.325
9	Total Nitrogen	mg/l	2.064	1.811
10	Cr^{3+}	mg/l	0.021	0.008
11	Cr^{6+}	mg/l	0.009	0.006
12	Zn	mg/l	0.0013	0.0015
13	Cd	mg/l	0.0007	0.0005
14	Pb	mg/l	0.003	0.001
15	Total-Fe	mg/l	1.630	0.965
16	Mn	mg/l	0.0031	0.0016
17	As	mg/l	0.006	0.004
18	Hg	mg/l	0.0001	0.0005
19	Hydrocarbons/mineral Oils	mg/l	<0.1	<0.1
20	Coliform	MPN/100ml	360	390

Table 4 Sediment Quality

Unit: mg/kg

No	Name	Results								
		Cr	Cu	Zn	Cd	Pb	Fe	As	Hg	Hydrocarbons/ mineral Oils
1	NM-02	0.147	10.05	51.60	0.024	28.55	1770	3.48	0.104	<10
2	WS-03	0.121	42.4	78.65	0.012	37.15	1786	2978	0.111	<10
3	WS-05	0.099	12.50	45.95	0.016	23.55	1741	2753	0.121	10
4	WS-06	0.174	65.70	106.81	0.017	73.80	1823	3866	0.173	<10
5	WS-07	0.118	19.90	55.70	0.019	34.01	1759	3015	0.124	<10
6	WS-08	0.108	39.01	55.01	0.016	20.70	1761	2595	0.097	<10
7	WS-09	0.144	19.45	60.60	0.027	37.35	1766	2775	0.194	10
8	WS-11	0.119	26.45	66.35	0.029	40.25	1775	2681	0.107	20
9	WS-12	0.158	24.35	71.75	0.018	36.80	1802	2.812	0.186	20
10	WS-13	0.148	31.10	83.75	0.028	50.85	1818	2.922	0.171	40
11	WS-16	0.093	15.20	47.75	0.024	29.05	1742	2.148	0.122	10
12	WS-17	0.125	20.75	66.50	0.022	42.45	1796	2.287	0.158	<10
13	Dump site 01	0.132	23.15	55.71	0.023	29.01	1768	2.652	0.091	10
14	Dump site 02	0.145	29.10	77.05	0.022	45.95	1811	3.393	0.199	<10
15	Dump site 03	0.147	16.95	60.55	0.027	37.20	1791	1.821	0.135	<10

Table 5 (1) Result of STD Measurement (High Tide)

Depth (m)	NM02		WS08		WS09		WS12		WS13		WS16		WS17		Dump site 03	
	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)
0.00	27.60	19.20	27.92	18.76	27.92	22.08	28.39	24.50	28.32	22.96	26.33	25.90	26.68	26.67	27.11	26.35
0.50	27.18	20.40	27.89	18.90	27.79	22.31	27.39	26.77	26.61	28.10	26.34	30.61	26.64	26.82	27.10	26.42
1.00	26.66	22.14	27.81	19.07	27.07	25.41	26.52	29.35	26.00	30.09	26.33	30.62	26.09	29.39	25.61	30.07
1.50	26.57	22.69	27.66	19.49	27.01	26.01	26.35	29.92	25.92	30.09	25.80	30.94	26.16	30.39	24.89	31.28
2.00	26.42	25.07	26.91	23.51	26.20	29.43	25.83	30.67	25.60	30.25	24.87	31.45	26.14	30.48	24.78	31.61
2.50	26.43	25.28	25.64	29.79	25.50	30.72	25.51	30.95	25.44	30.57	24.71	31.49	26.09	30.65	24.73	31.70
3.00	26.43	25.37	25.59	29.87	25.34	30.84	25.28	31.12	25.26	31.04	24.60	31.59	25.92	30.75	24.65	31.75
3.50	26.42	25.56	25.49	29.95	25.31	30.87	25.26	31.13	25.14	31.24	24.58	31.72	25.82	30.77	24.61	31.79
4.00	26.43	25.63	25.46	29.98	25.30	30.88	25.24	31.12	25.08	31.32	24.54	31.74	25.77	30.77	24.60	31.80
4.50	26.42	25.59	25.46	30.01	25.29	30.89	25.23	31.12	25.06	31.35	24.55	31.76	25.72	30.75	24.61	31.84
5.00	26.38	25.98	25.45	30.01	25.28	30.89	25.23	31.12	25.05	31.39	24.54	31.76	25.57	30.73	24.60	31.85
5.20	26.39	25.96	25.45	30.00	25.28	30.89	25.22	31.12	25.03	31.41	24.55	31.76	25.48	30.71	24.60	31.85
5.50	26.15	27.37			25.28	30.90	25.22	31.12	25.01	31.44	24.55	31.77	25.36	30.68	24.59	31.86
6.00	25.99	28.41			25.25	30.92	25.22	31.12	24.91	31.56	24.55	31.78	25.17	30.84	24.59	31.86
6.20	25.97	28.44			25.25	30.52	25.22	31.12	24.84	31.64	24.56	31.78	25.08	30.98	24.59	31.86
6.50	25.94	28.59					25.21	31.11	24.71	31.71	24.57	31.79	25.00	31.13	24.59	31.86
7.00	25.91	28.68					25.21	31.12	24.53	31.75	24.58	31.79	24.84	31.40	24.59	31.86
7.50	25.83	28.93					25.21	31.11	24.45	31.74	24.58	31.79	24.74	31.57	24.58	31.87

Depth (m)	NM02		WS08		WS09		WS12		WS13		WS16		WS17		Dump site 03	
	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)
7.60	25.82	28.97					25.21	31.11	24.42	31.74	24.58	31.79	24.72	31.60	24.58	31.87
8.00	25.76	29.12							24.41	31.74	24.62	31.82	24.64	31.72	24.59	31.87
8.50	25.67	29.35							24.38	31.74	24.62	31.82	24.62	31.79	24.58	31.87
9.00	25.66	29.36							24.38	31.73	24.63	31.82	24.61	31.87	24.58	31.87
9.50	25.66	29.38							24.36	31.73	24.62	31.82	24.60	31.91	24.58	31.87
10.00	25.64	29.46							24.36	31.73	24.61	31.82	24.61	31.94	24.58	31.88
10.50	25.63	29.50							24.34	31.73	24.60	31.82	24.63	31.96	24.57	31.88
11.00	25.59	29.61							24.33	31.73	24.61	31.84	24.65	31.97	24.56	31.90
11.50	25.56	29.67							24.33	31.73	24.60	31.86	24.66	31.99	24.57	31.91
12.00	25.55	29.71							24.32	31.72	24.57	31.88	24.66	32.00	24.58	31.94
12.50	25.55	29.71							24.31	31.72	24.51	31.89	24.55	32.01	24.61	31.97
13.00	25.54	29.72							24.31	31.73	24.50	31.89	24.46	31.99	24.63	32.00
13.50	25.54	29.72							24.31	31.72	24.48	31.90	24.35	31.99	24.68	32.04
13.90	25.54	28.94							24.31	31.72	24.48	31.91	24.32	31.98	24.63	32.03
14.00									24.31	31.72	24.48	31.91	24.29	31.98	24.63	32.03
14.50									24.31	31.72	24.50	31.92	24.20	31.98	24.54	32.01
14.70									24.30	31.72	24.50	31.92	24.15	31.97	24.53	32.02
15.00											24.50	31.92	24.12	31.97	24.50	32.01
15.50											24.49	31.93	24.09	31.96	24.48	31.99

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Depth (m)	NM02		WS08		WS09		WS12		WS13		WS16		WS17		Dump site 03	
	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)
16.00											24.36	31.92	24.06	31.95	24.43	31.99
16.50											24.27	31.90	24.05	31.95	24.41	31.98
17.00											24.24	31.89	24.03	31.94	24.39	31.98
17.50											24.20	31.88	24.03	31.94	24.34	31.96
18.00											24.15	31.87	24.01	31.94	24.33	31.96
18.50											24.15	31.87	24.00	31.94	24.32	31.96
19.00											24.14	31.87	23.99	31.94	24.32	31.96
19.50											24.13	31.87	23.99	31.94	24.31	31.97
20.00											24.13	31.87	23.98	31.93	24.27	31.97
20.10											24.11	31.86	23.96	26.20	24.26	31.97
20.50											24.12	31.86			24.25	31.97
21.00											24.11	31.86			24.25	31.98
21.50											24.11	31.86			24.24	31.97
22.00											24.11	31.86			24.24	31.98
22.50											24.11	31.86			24.24	31.98
23.00											24.11	31.86			24.23	31.98
23.30											24.11	31.87			24.06	25.26
23.50											24.11	31.87				
24.00											24.11	31.86				

Depth (m)	NM02		WS08		WS09		WS12		WS13		WS16		WS17		Dump site 03	
	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)
24.50											24.11	31.86				
24.60											24.11	31.86				

Table 5 (2) Result of STD Measurement (Low Tide)

Depth (m)	NM-02		WS08		WS-09		WS-12		WS-13		WS-16		WS-17		Dump site 03	
	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)
0.00	26.79	6.34	26.52	14.26	25.77	21.68	25.86	22.14	25.36	24.67	24.98	31.59	25.79	28.25	25.43	30.71
0.50	26.90	6.84	26.62	16.86	25.82	21.72	25.94	22.24	25.38	24.70	24.98	31.62	25.79	28.25	25.43	30.75
1.00	26.88	6.94	26.61	18.38	25.95	21.94	26.41	23.62	26.01	26.65	24.98	31.62	25.80	28.25	25.43	30.75
1.50	26.87	8.03	26.61	21.50	26.07	22.18	26.27	25.20	26.27	27.55	24.98	31.62	25.87	28.29	25.43	30.75
2.00	26.82	13.98	26.51	23.97	26.48	23.63	26.15	25.93	26.37	27.74	24.98	31.62	25.95	28.42	25.43	30.78
2.20	26.79	15.30	26.44	24.31	26.32	24.16	26.11	26.27	26.38	28.00	24.98	31.62	25.98	28.45	25.25	31.07
2.50	26.59	21.32			26.02	26.70	26.02	26.80	26.32	28.38	24.98	31.62	25.97	28.55	25.08	31.27
3.00	26.54	22.79			25.74	28.81	25.52	29.94	26.42	28.74	24.98	31.62	26.02	28.92	24.96	31.32
3.50	26.55	23.03			25.66	29.77	25.28	30.83	26.27	29.22	24.98	31.62	26.09	29.08	24.90	31.34
4.00	26.57	23.29					25.26	30.95	26.06	29.95	24.99	31.62	26.08	29.32	24.81	31.44
4.50	26.53	23.67					25.25	31.00	25.85	30.34	24.99	31.62	26.06	29.41	24.82	31.46
5.00	26.51	24.06					25.24	31.01	25.77	30.61	24.99	31.62	26.04	29.51	24.88	31.49
5.30	26.51	24.10					25.24	31.02	25.56	30.81	24.99	31.62	26.00	29.58	24.91	31.51
5.50	26.51	24.16							25.50	30.85	24.98	31.62	25.97	29.67	24.91	31.50
6.00	26.48	24.45							25.41	30.91	24.98	31.62	25.82	30.11	24.95	31.54
6.50	26.47	24.72							25.36	30.95	24.98	31.62	25.64	30.65	24.98	31.55
7.00	26.47	24.85							25.34	30.96	24.98	31.62	25.45	30.88	24.99	31.55

Depth (m)	NM-02		WS08		WS-09		WS-12		WS-13		WS-16		WS-17		Dump site 03	
	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)
7.50	26.45	25.14							25.25	31.06	24.98	31.62	25.39	31.04	24.95	31.57
8.00	26.43	25.34							25.09	31.25	24.97	31.62	25.27	31.12	24.92	31.57
8.50	26.43	25.36							24.92	31.35	24.96	31.62	25.17	31.19	24.91	31.57
9.00	26.43	25.37							24.83	31.38	24.95	31.62	25.05	31.30	24.91	31.57
9.50	26.40	25.43							24.75	31.42	24.93	31.62	24.95	31.38	24.91	31.57
10.00	26.35	25.59							24.69	31.45	24.92	31.62	24.63	31.59	24.89	31.57
10.50	26.33	25.67							24.67	31.46	24.90	31.62	24.39	31.70	24.88	31.57
11.00	26.17	26.17							24.66	31.46	24.79	31.67	24.30	31.76	24.87	31.56
11.50	26.15	26.36							24.65	31.47	24.48	31.75	24.26	31.79	24.86	31.57
11.60	26.13	26.40							24.65	31.47	24.43	31.76	24.25	31.80	24.86	31.57
12.00									24.64	31.47	24.34	31.79	24.24	31.81	24.86	31.58
12.40									24.64	31.47	24.32	31.79	24.23	31.82	24.85	31.59
12.50											24.31	31.79	24.23	31.82	24.85	31.59
13.00											24.29	31.79	24.22	31.83	24.85	31.59
13.50											24.29	31.79	24.21	31.84	24.83	31.60
14.00											24.29	31.79	24.21	31.84	24.70	31.68
14.50											24.28	31.79	24.21	31.84	24.53	31.79
15.00											24.27	31.79	24.21	31.84	24.48	31.83
15.50											24.27	31.79	24.21	31.84	24.45	31.85

Depth (m)	NM-02		WS08		WS-09		WS-12		WS-13		WS-16		WS-17		Dump site 03	
	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)	Temp (^{O}C)	Salinity (‰)
16.00											24.26	31.79	24.21	31.84	24.44	31.85
16.50											24.26	31.79	24.21	31.85	24.43	31.86
17.00											24.26	31.79	24.21	31.84	24.42	31.86
17.50											24.25	31.79	24.21	31.84	24.42	31.87
18.00											24.25	31.79			24.41	31.87
18.50											24.25	31.79			24.41	31.87
19.00											24.24	31.79			24.42	31.87
19.50											24.23	31.79			24.41	31.87
20.00											24.23	31.79			24.41	31.87
20.50											24.22	31.79			24.41	31.87
20.90											24.22	31.79			24.41	31.87
21.00											24.22	31.80				
21.50											24.22	31.80				
22.00											24.21	31.79				
22.50											24.21	31.79				
22.70											24.21	30.95				

Appendix 3-3

Environment impact assessment on biological environment

1. Introduction

The main focus of this Appendix will be to assess the impacts of dredging and dredged-material disposal activities, as these activities are likely to have significant adverse impacts on the local biological environment. While the location and method of disposal are not yet decided, impacts were assessed for two likely disposal scenarios namely: offshore ocean disposal and nearshore disposal (i.e. disposal in landfill area south of Cat Hai Island). Following are the type of impacts that will be assessed in detail in the ensuing sections:

- Impacts generated through direct loss of benthic habitat and organisms distributed along the dredging and disposal sites
- Impacts of turbidity and sedimentation generated from dredging and disposal activities

2. Impact assessment

1) Impacts generated through direct loss of benthic habitat and organisms distributed along the dredging and disposal sites

a) Background information

The physical removal and smothering of seabed associated with dredging and disposal activities will inevitably result in loss of benthic habitat and species that are near the dredging and disposal sites. According to the field survey, the dredging and disposal sites primarily consist of silty-sandy habitat, which is also the predominant habitat type of the local area. There appears to be no coral reef or seagrass/seaweed beds in the dredging and disposal sites, as the water column has naturally high turbidity levels. Typical benthic organisms were crustaceans (e.g. crabs, prawns, mantis shrimp), polychaetes, gastropods and demersal fish, which are typical of silty-sandy habitats. While impacts are unavoidable, they could be minimized by selecting the disposal site with lower ecological value, or in other words, the site with less severe consequences to the local ecosystem upon its loss. Hence, the ecological value of the two candidate disposal sites were compared by referring to the results of the field survey, taking into account factors such as biodiversity, species abundance, ecological function and so on.

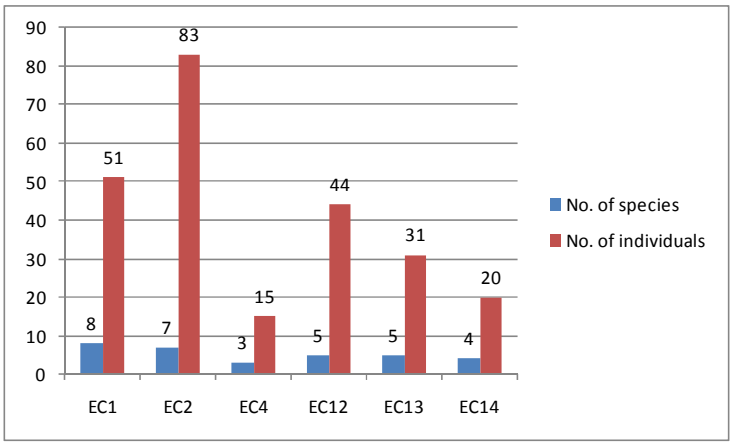
b) Assessment results

The ecological value of the two candidate disposal sites was compared by focusing on the following aspects:

- Species diversity and abundance of zoobenthos and demersal fish
- Ecological function

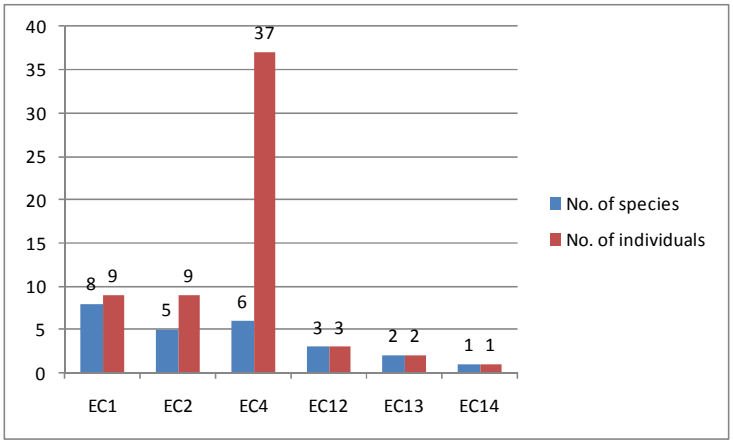
(1) Species diversity and abundance of zoobenthos and demersal fish

To understand the trend of species diversity and abundance of zoobenthos and demersal fish at the two disposal sites, three representative survey sites were selected for each disposal site, which were selected based on their proximity to the disposal sites. EC1, EC2 and EC4 were selected for the nearshore disposal site, and EC12, EC13 and EC14 were selected for the offshore disposal site. Figures 1 and 2 compare the species diversity and abundance of zoobenthos and demersal fish, respectively.



Source: JICA Study Team

Figure 1 Comparison of species diversity and abundance of zoobenthos



Source: JICA Study Team

Figure 2 Comparison of species diversity and abundance of demersal fish

Zoobenthos show similar species diversity between the nearshore survey sites (average of 6 species) and offshore survey sites (average of approx. 5 species). However, species abundance was significantly higher in the nearshore survey sites (total of 149 individuals) compared to the offshore survey sites (total of 95 individuals). Species abundance was particularly high at EC2 (83 individuals), which is

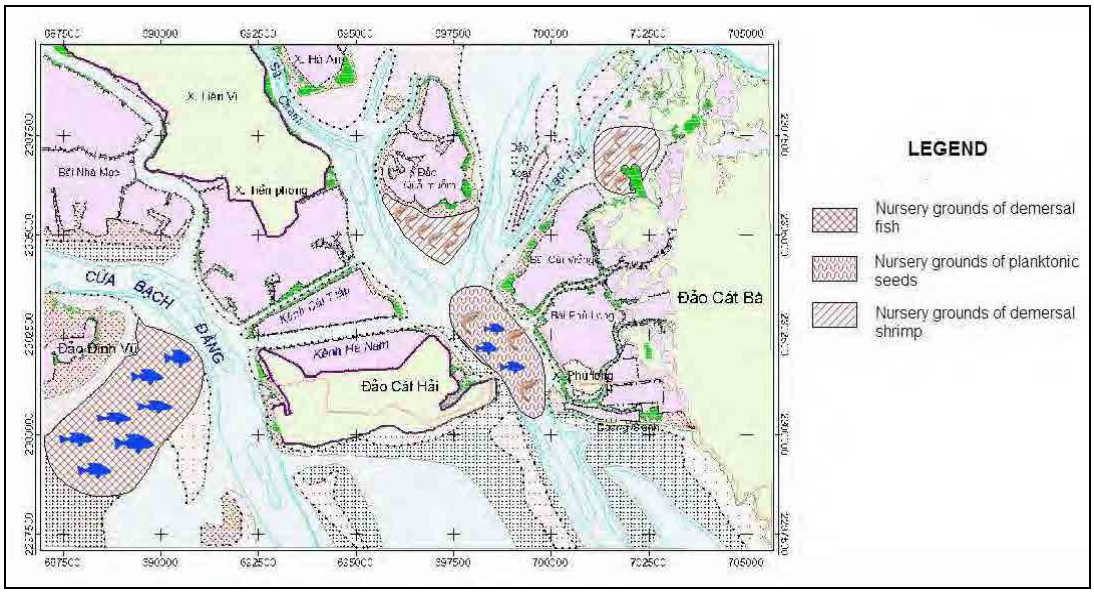
located right at the nearshore disposal site.

Demersal fish show higher species diversity at the nearshore survey sites (average of approx. 6 species) compared to the offshore survey sites (average of 2 species). Species abundance was significantly higher in the nearshore survey sites (total of 55 individuals) compared to the offshore survey sites (total of 6 individuals).

Based on the above results, it can be concluded that species diversity and abundance of zoobenthos and demersal fish are generally higher at the nearshore disposal site compared to the offshore disposal site.

(2) Ecological function

According to past studies of Nguyen Thi Thu et al. (2008) and interview surveys with the local fishermen, the shallow coastal areas in the Lach Huyen area are important nursery grounds for various commercial fish and shrimp species, especially near were mangroves are distributed. The zooplankton/larvae survey also supported the above findings, as several species of fish larvae were found at the shallow survey sites. On the other hand, no fish larvae were found at the offshore sites. Figure 3 shows the distribution of the main nursery grounds in the shallow coastal areas of the Lach Huyen area, which was prepared by IMER.



Source: IMER

Figure 3 Distribution of main nursery grounds around the shallow coastal areas of the Lach Huyen area

It is also important to note that two fish species (*Bostrichthys sinensis* and *Anodontostoma chacunda*) listed under Vietnam Red Book were found in the shallow survey sites (EC1 and EC2).

In conclusion, the nearshore disposal site appears to have more significant ecological function than the offshore disposal site.

c) Conclusion

On the basis of the above findings, it can be concluded that the nearshore disposal site has greater ecological values than the offshore disposal site. Hence from an environmental perspective, the offshore disposal site should have less impact on the local biological environment.

2) Impacts of turbidity and sedimentation generated from dredging and disposal activities

a) Background information

One of the most significant impacts on the biological environment will arise from increased turbidity and sedimentation generated from dredging and disposal activities. Although tolerance of marine organisms to turbidity and sedimentation will vary with species and life stages, it is generally understood that elevated levels of turbidity and sedimentation could result in stress (e.g. growth inhibition, modification of behavior, physiological damage) or in extreme cases mortality (e.g. smothering) of marine organisms. Therefore, to assess the impacts of dredging and disposal induced turbidity/sedimentation, the dispersion range of suspended solids (SS) was predicted through numerical simulation model. Since the method of dredging and location of disposal site were not fixed at the time of this reporting, the simulation was conducted for five possible dredging/disposal scenarios. Note also that there are some uncertainties in the results of the simulation as some inputs applied in the simulation (e.g. SS load from overflow) may not be accurate, which will be revised as the dredging/disposal plan becomes more refined in the ensuing study phases. Brief descriptions of each scenario are shown in Table 1 (see Chapter 12.3 for details of the numerical simulation).

Table 1 Brief descriptions of the SS dispersion simulation scenarios

	Dredging method	Dumping site
Scenario 1	- Dredging with ten (10) TSHD (capacity: 2,400 PS) - With overflow	Offshore
Scenario 2	- Dredging with two (2) TSHD (capacity: 8,000 PS) - With overflow	Offshore
Scenario 3	- Dredging with two (2) cutter suction dredger - With overflow	Offshore
Scenario 4	- Dredging with two (2) cutter suction dredger - With overflow	Landfill area south of Cat Hai Island (temporary ocean disposal required at south of the landfill area)
Scenario 5	- Dredging with three (3) grab dredger - No overflow	Offshore

b) Assessment results

Impacts on the biological environment were assessed by referring to Japanese and Canadian water quality guidelines that are aimed to protect fishery resources and aquatic life respectively. Table 2 shows the water quality standard of SS for the Japanese and Canadian guidelines.

Table 2 Japanese and Canadian water quality standards for SS

Title of guideline	SS standard
Water quality standards for the protection of fishery resources (2005 version)	Anthropogenic activities should not increase SS concentration by more than **2 mg/l** over background levels.
Canadian water quality guidelines for the protection of aquatic life	Anthropogenic activities should not increase SS concentration by more than **5 mg/l** over background levels (for long term exposure).

Source of Japanese guideline: Japan Fisheries Resource Conservation Association
Source of Canadian guideline: Canadian Council of Ministers of the Environment (http://ceqg-rcqe.ccme.ca/)

Since the Japanese standard (2 mg/l) is slightly stricter than the Canadian standard (5 mg/l), the Japanese standard was applied to habitats or organisms that are sensitive to turbidity, such as coral reefs and seagrass. The Canadian standard on the other hand was applied to habitats or organisms that are relatively less sensitive to turbidity. Following are the main findings of the assessment:

Impacts on habitats sensitive to turbidity (coral and seagrass)

- Scenarios 1, 2 and 5 are unlikely to affect the corals/seagrass distributed in the east of Cat Ba Island and Long Chao Islands, as SS increase was predicted to be less than 1 mg/l at these sites.
- Scenarios 3 and 4 are likely to affect the corals and seagrass distributed in the east of Cat Ba Island and Long Chao Islands, as SS increase in the depth of coral/seagrass distribution was predicted to be higher than 2 mg/l at these sites. Although scenarios 3 and 4 use the same dredging method, the dispersion and concentration of SS in the depth of coral/seagrass distribution were predicted to be greater with scenario 4. This shows that disposal activities at south of Cat Hai will have greater impact than the offshore disposal activities, even though the offshore disposal site is located closer to the corals/seagrass sites.

Impacts on tidal flat organisms and nearshore nursery grounds

- Tidal flats are distributed along the west coast of Cat Ba Island and Cat Hai Island, which supports various benthic organisms including clams that are commercially harvested. While all scenarios are predicted to increase SS levels at these areas, SS increase by scenarios 3 and 4 are significantly greater compared to the other scenarios and will easily exceed 5 mg/l. This as a result may affect the clam farming operation by hindering clam growth or in extreme cases may lead to moratlity. When comparing scenarios 3 and 4, SS increase by scenario 4 will be greater than scenario 3,

which is probably due to the high SS load contribution from the disposal activities at south of Cat Hai.

- For similar reasons as above, scenario 4 will have the greatest impact on the nearshore nursery grounds distributed around the Lach Huyen area.

c) Conclusion

While all scenarios are likely to have some impacts on the biological environment, impacts of scenarios 3 and 4 are likely to be greatest. Therefore from an environmental perspective, it is desirable to select scenarios 1, 2 or 5 for dredging/disposal activities. However, if the use of cutter suction dredger is unavoidable as in scenarios 3 and 4, it is highly desirable to dispose at the offshore disposal site (i.e. scenario 3) to lessen impacts from SS dispersion.

3. Recommendations

Although the degree of impacts from dredging and disposal activities will differ with the dredging methodology and disposal location, all options if conducted in an uncontrolled manner, will inevitably have moderate to major impacts on the biological environment both temporally and spatially. Therefore, it will be extremely important to implement effective mitigation measures (e.g. installation of silt curtain) and monitoring programs (e.g. water quality monitoring) to minimize impacts, especially for areas that support endangered species and have high ecological values (e.g. coral reefs in Long Chau Islands and Cat Ba National Park). A detailed environmental management plan will be proposed in the draft final report.

Appendix 5-1

Changing of the bathymetry conditions of the existing channel

Km 26+000

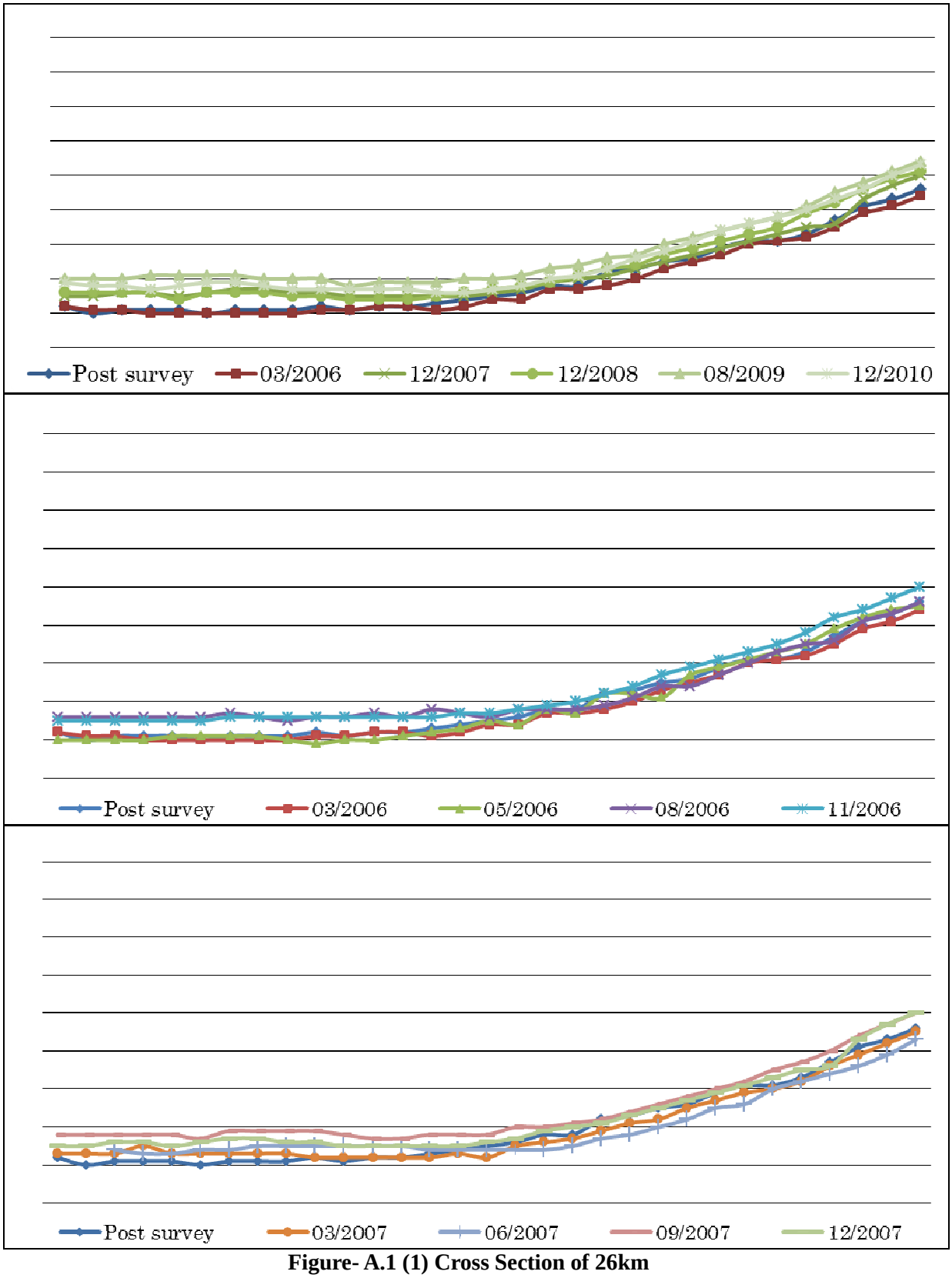


Figure- A.1 (1) Cross Section of 26km

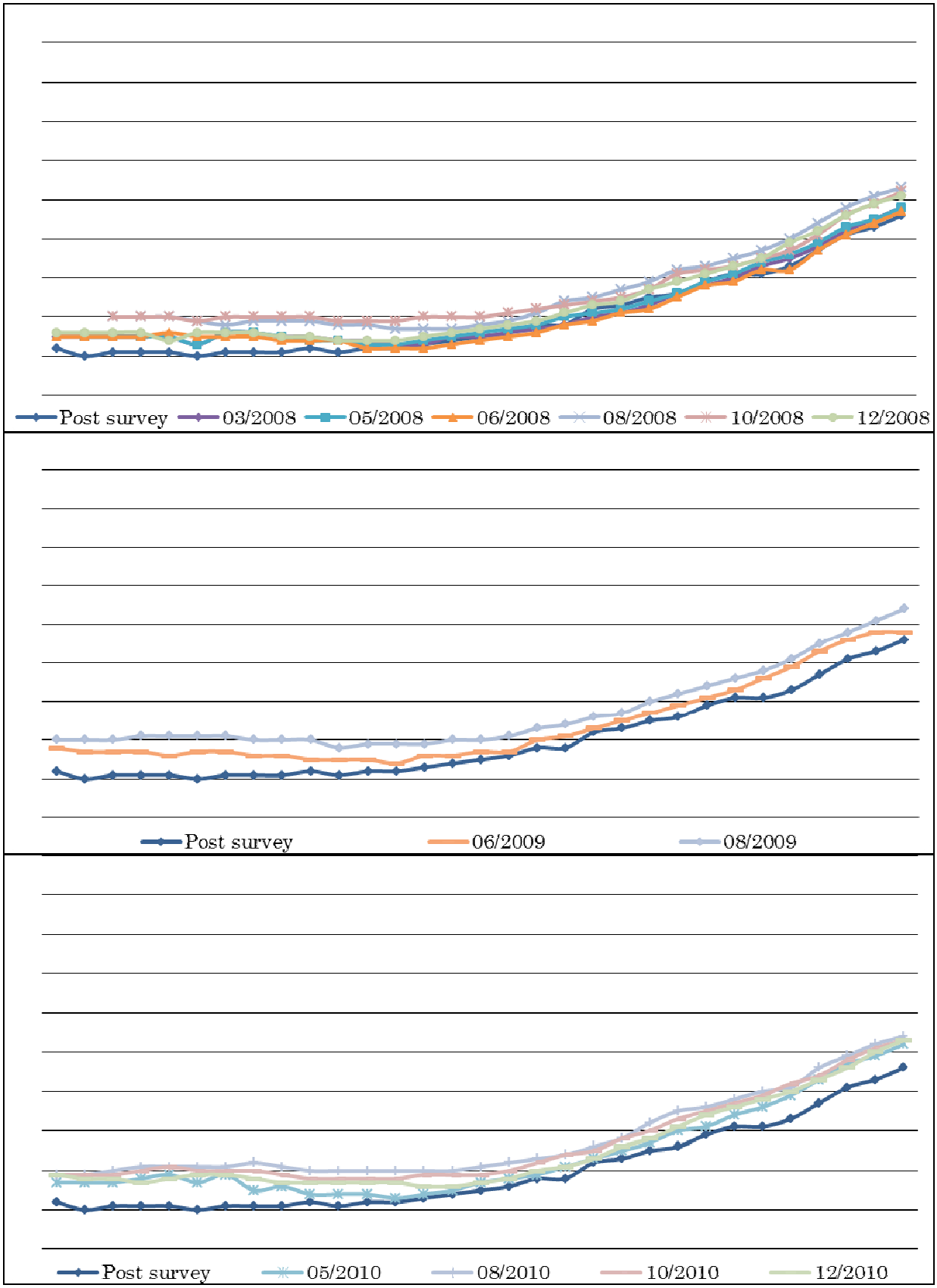


Figure-A.1 (2) Cross Section of 26km

Km 27+000

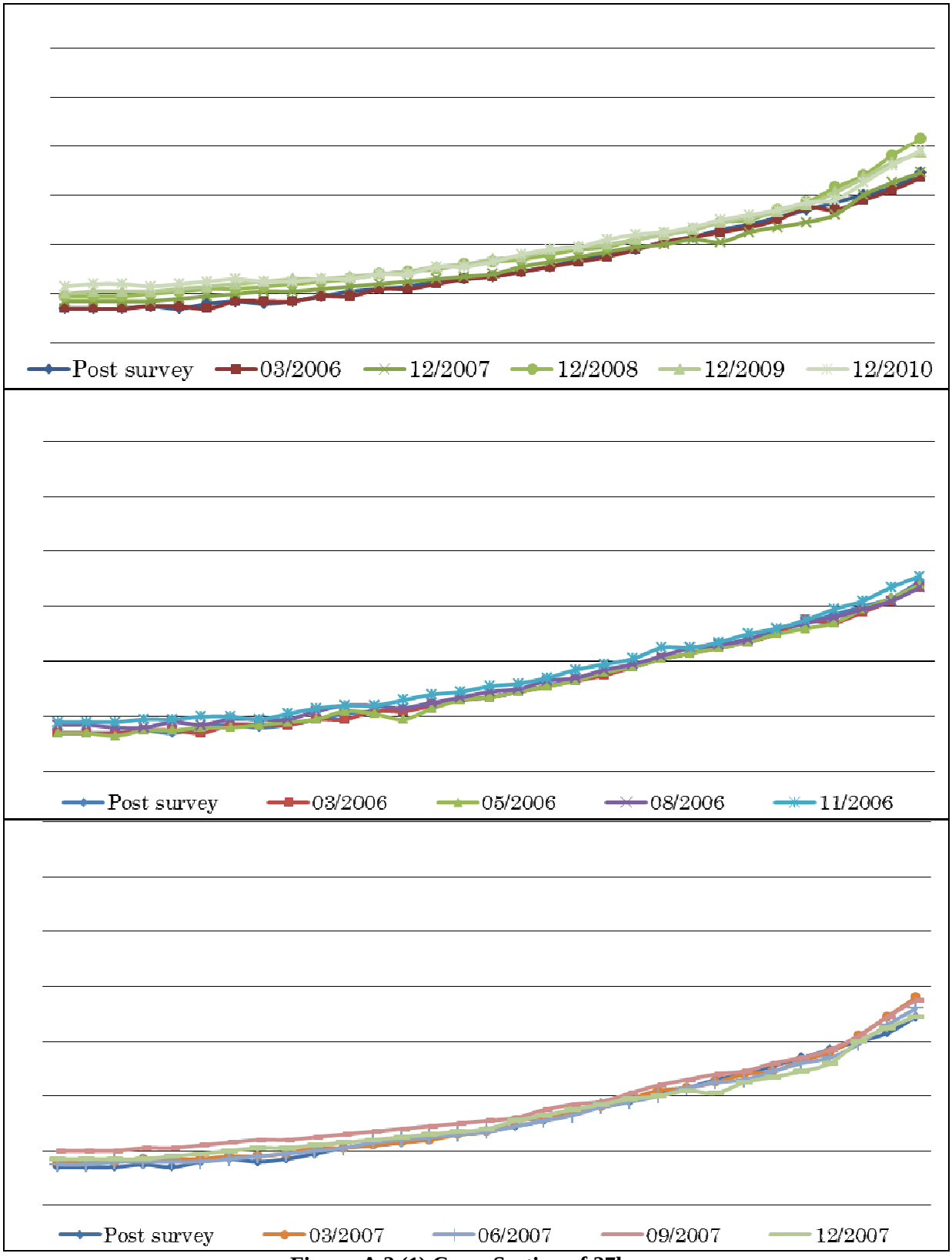


Figure-A.2 (1) Cross Section of 27km

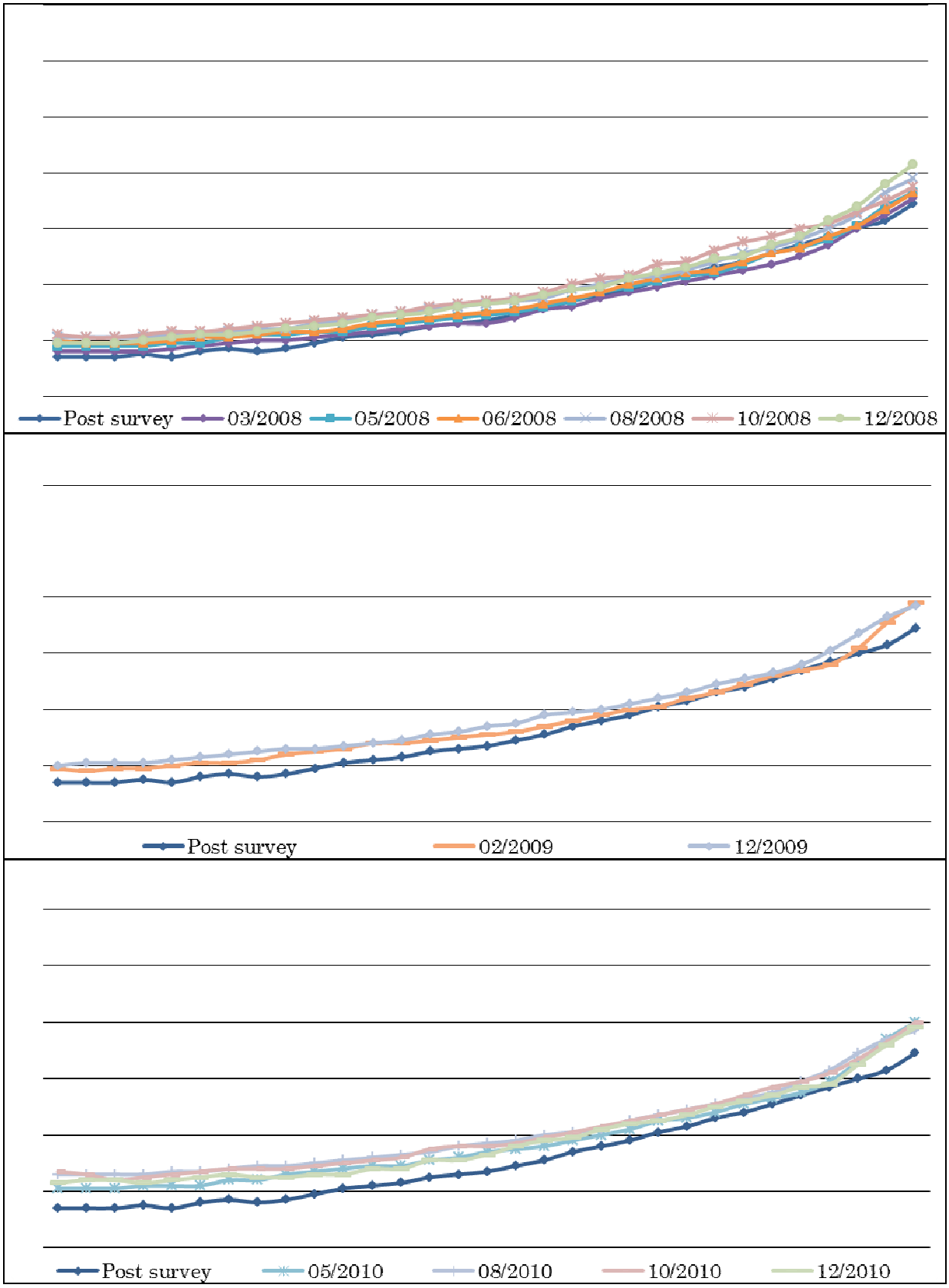
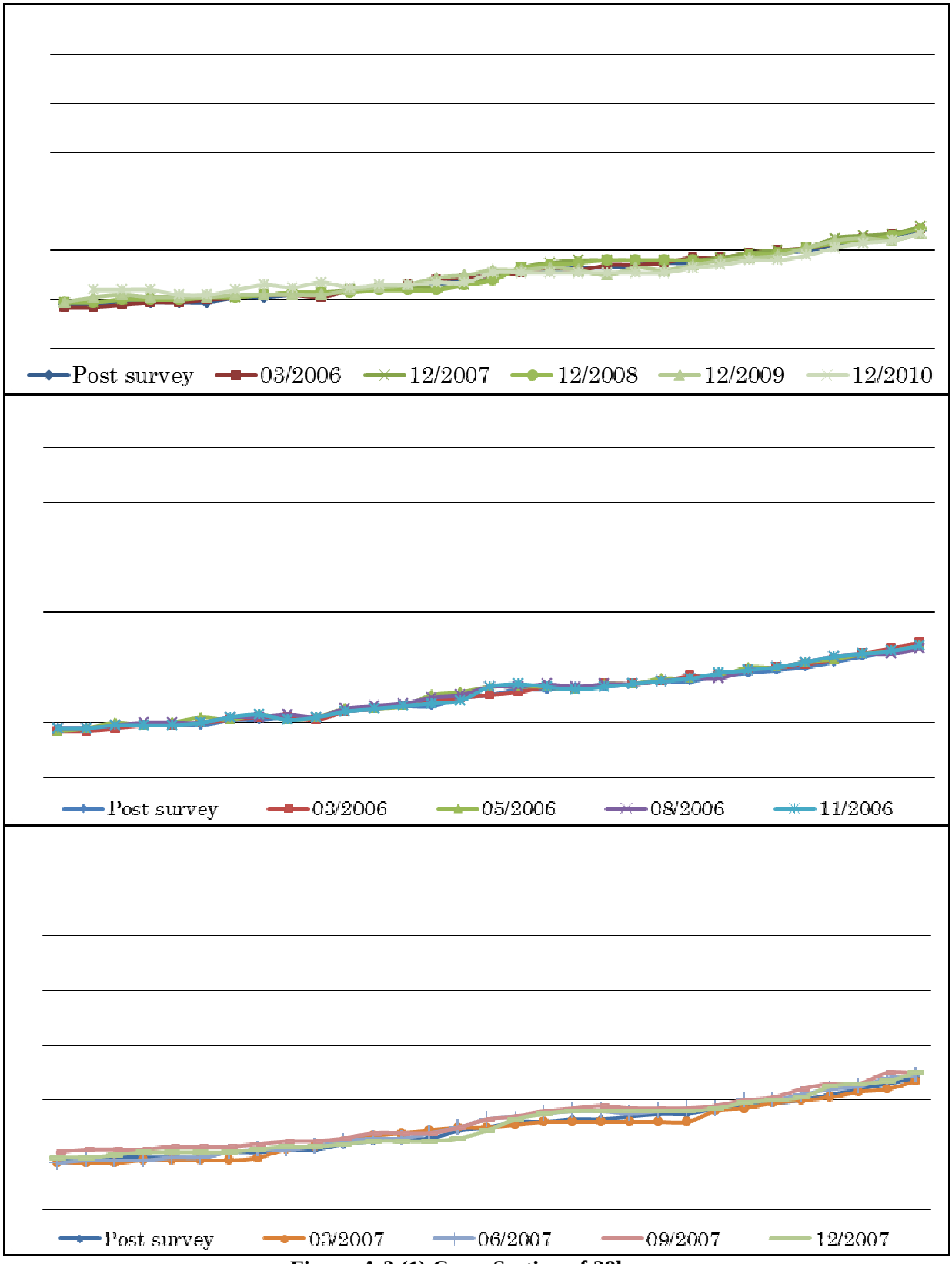


Figure-A.2 (2) Cross Section of 27km

Km 28+000



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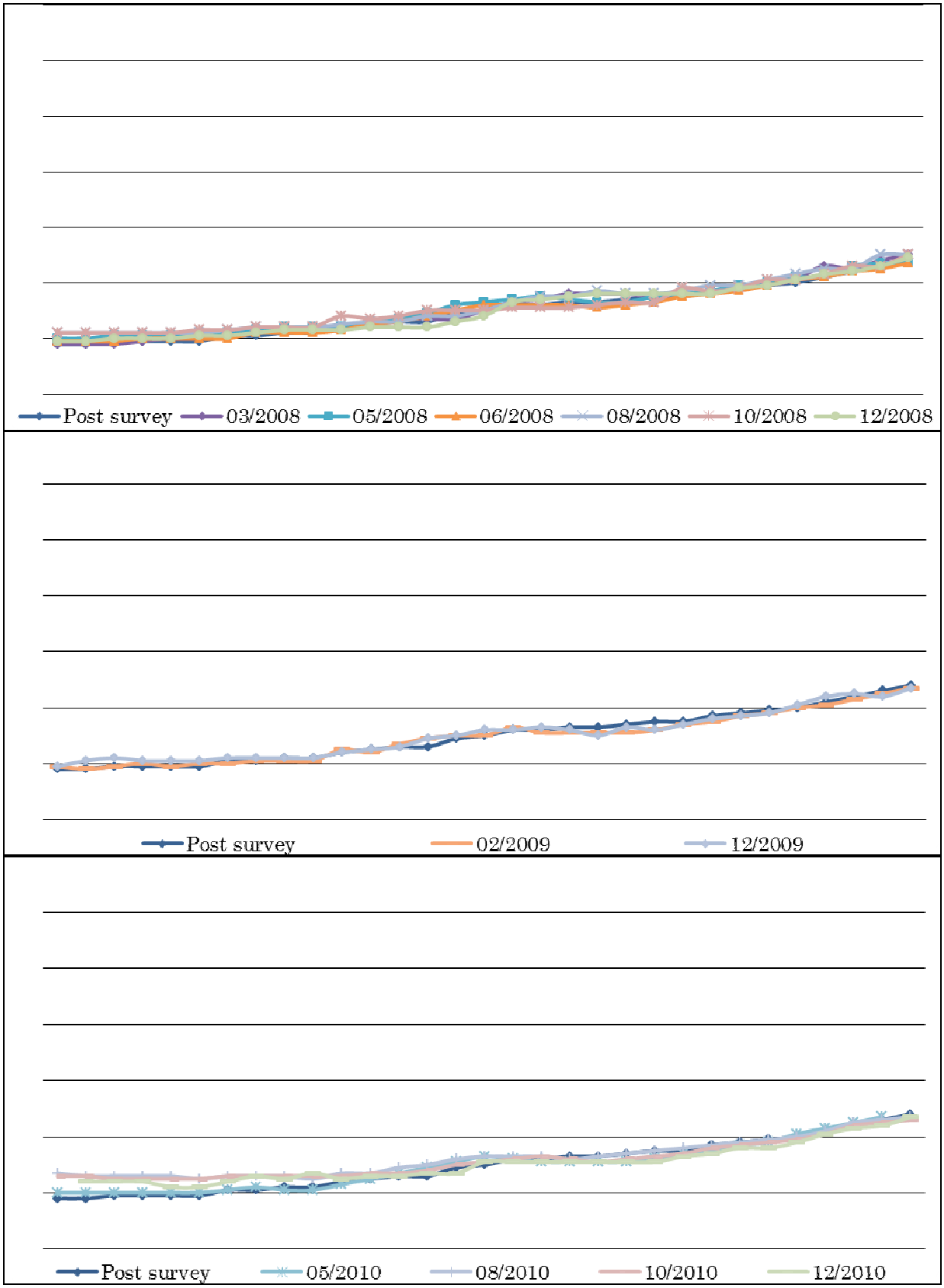
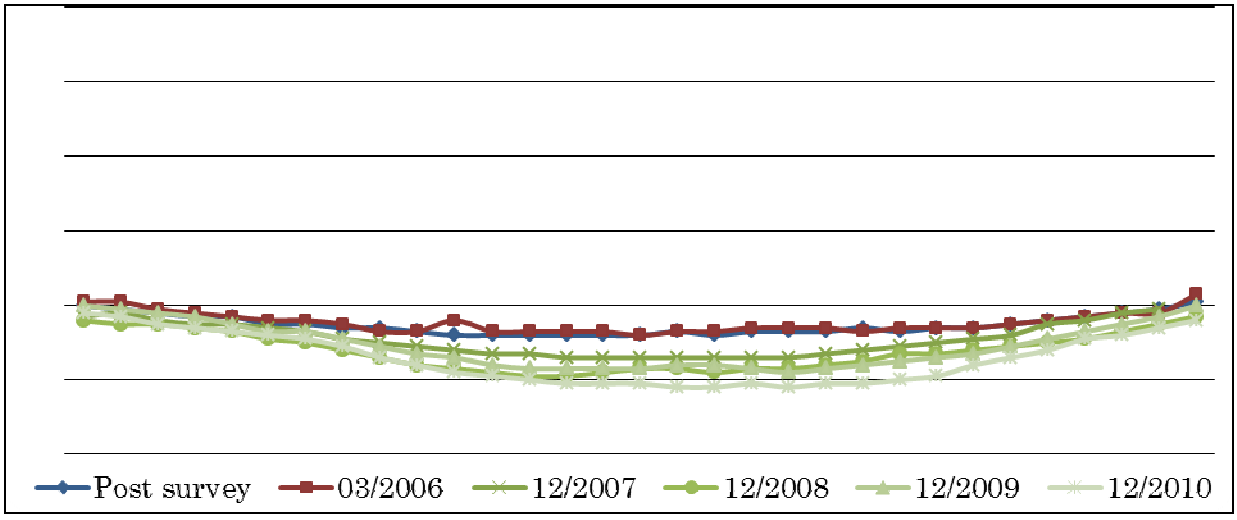
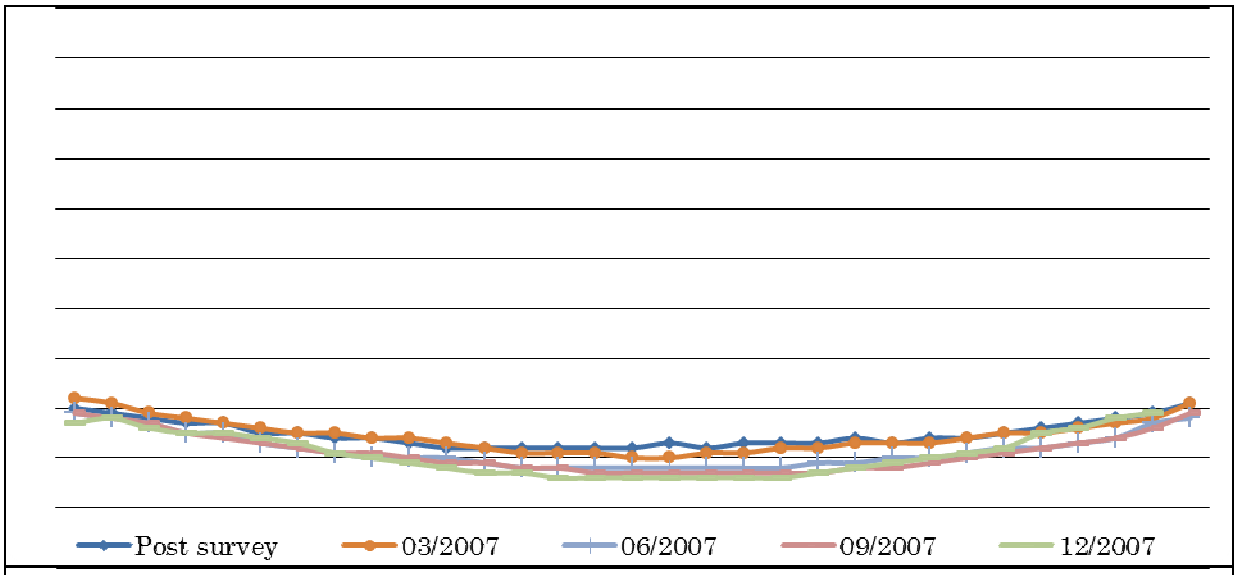
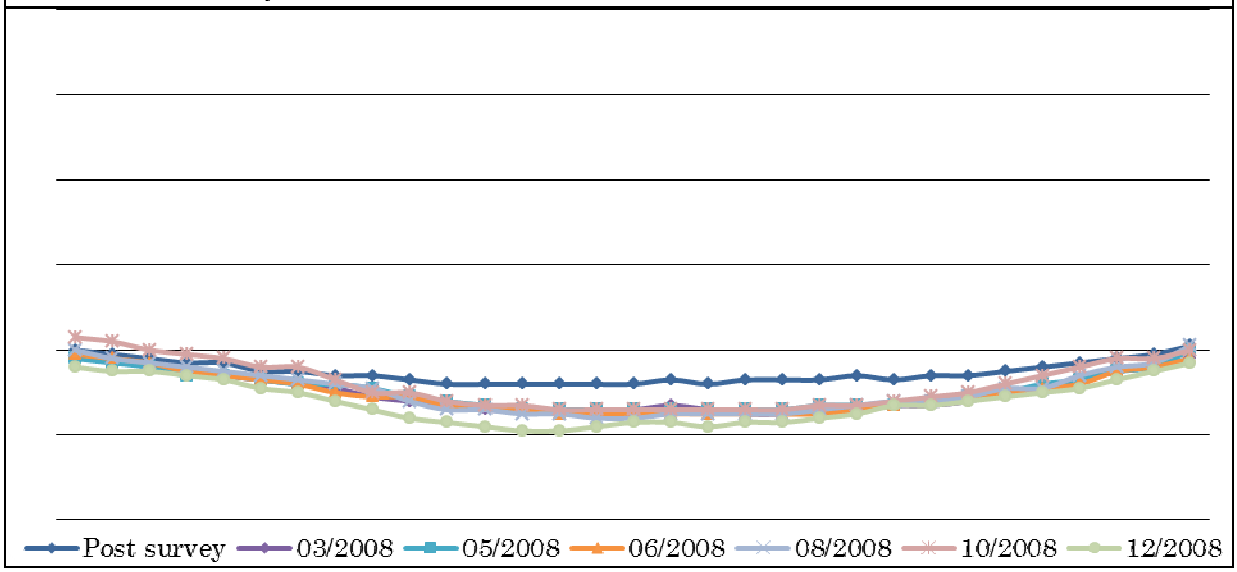


Figure-A.3 (2) Cross Section of 28km

Km 29+000







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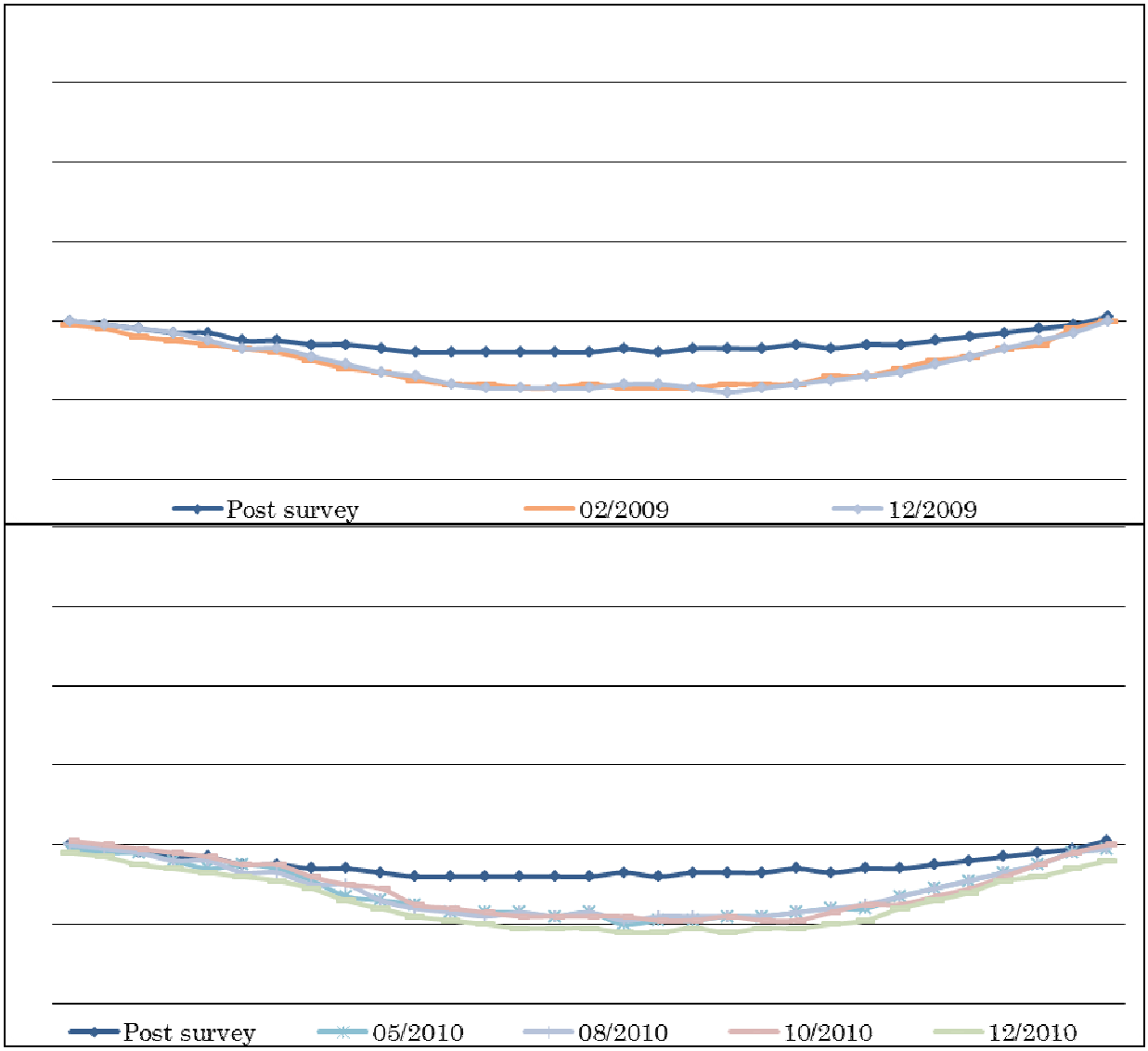

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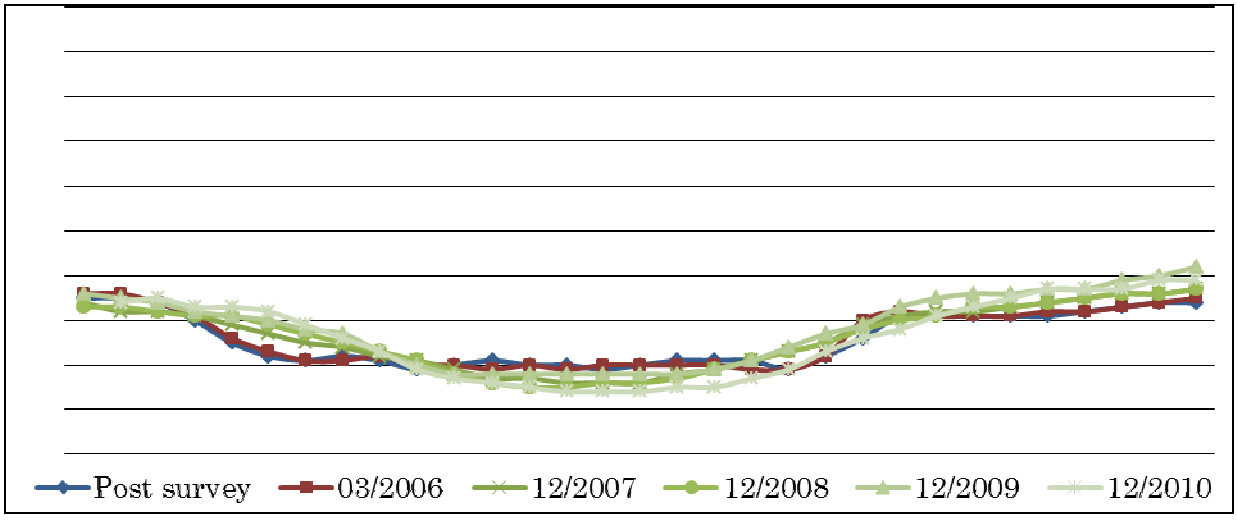
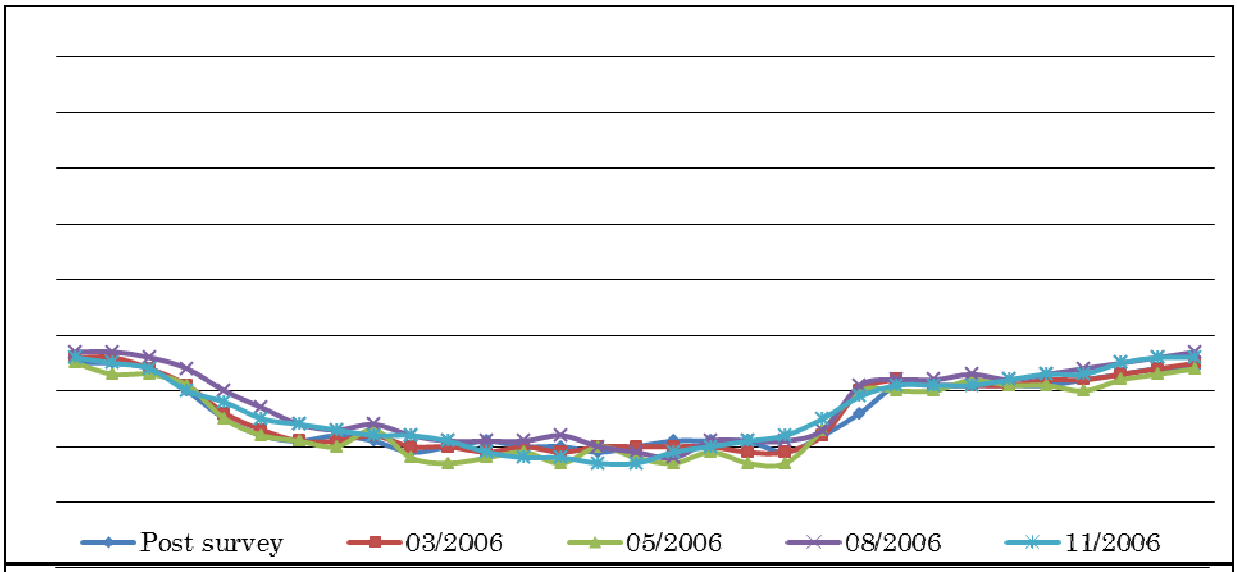
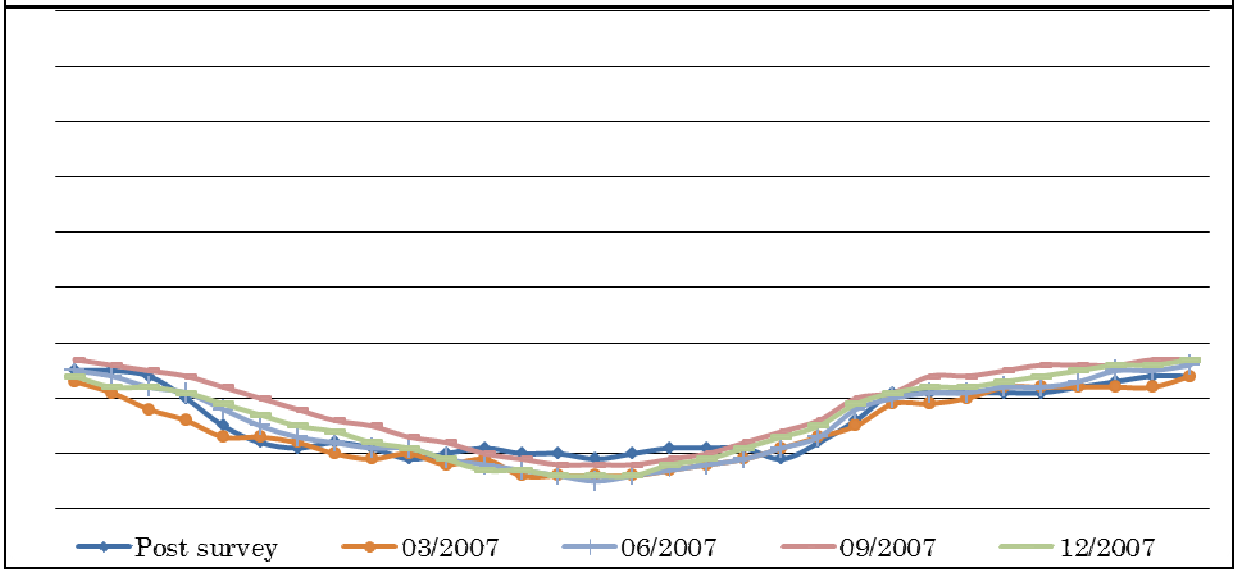
Km 30+000







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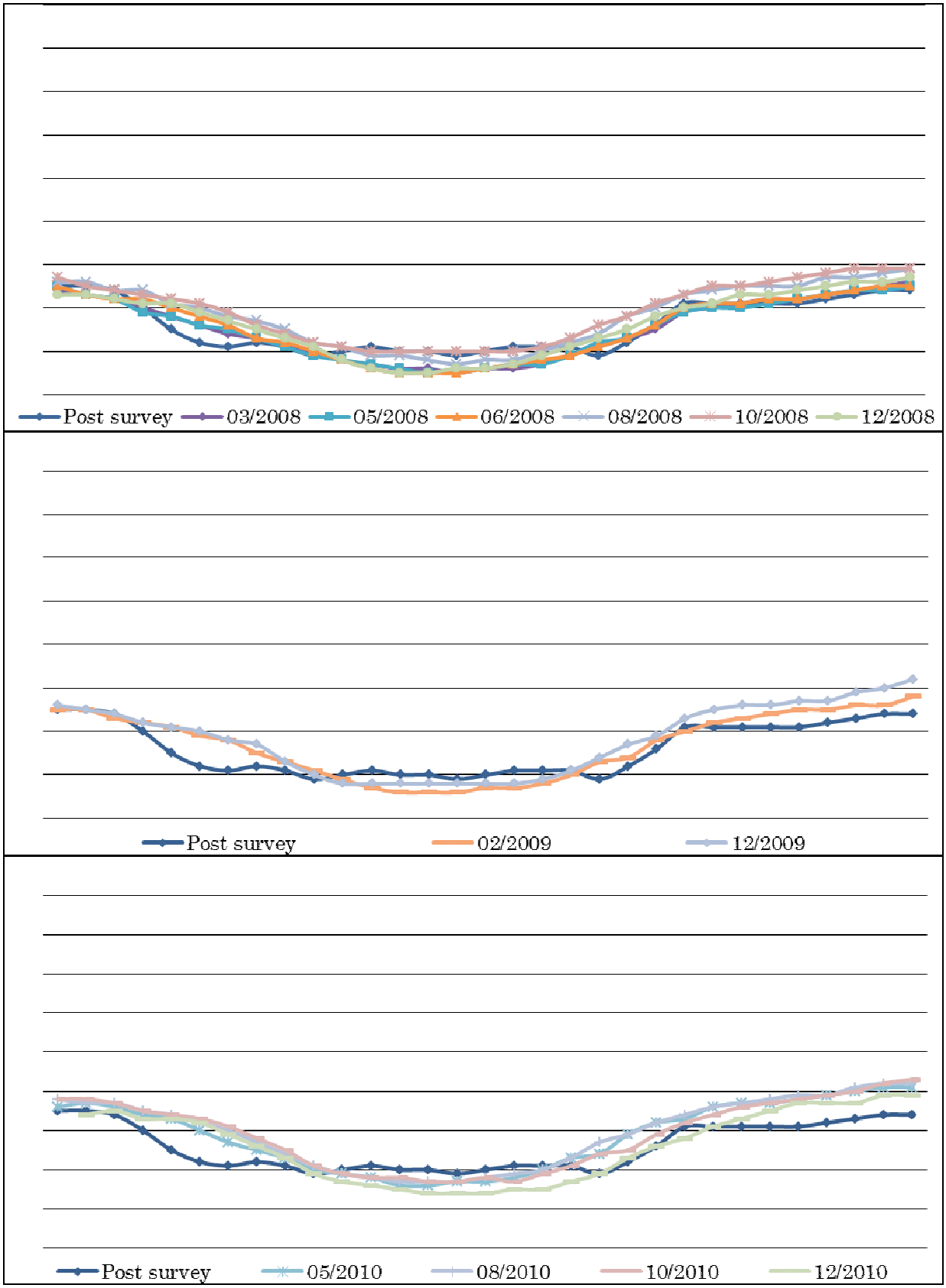
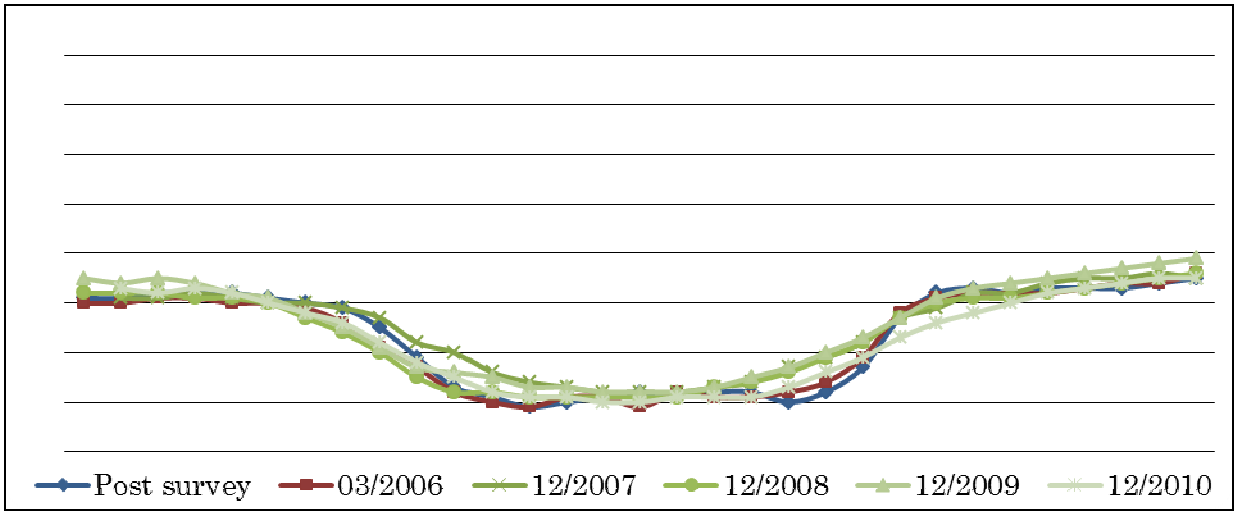
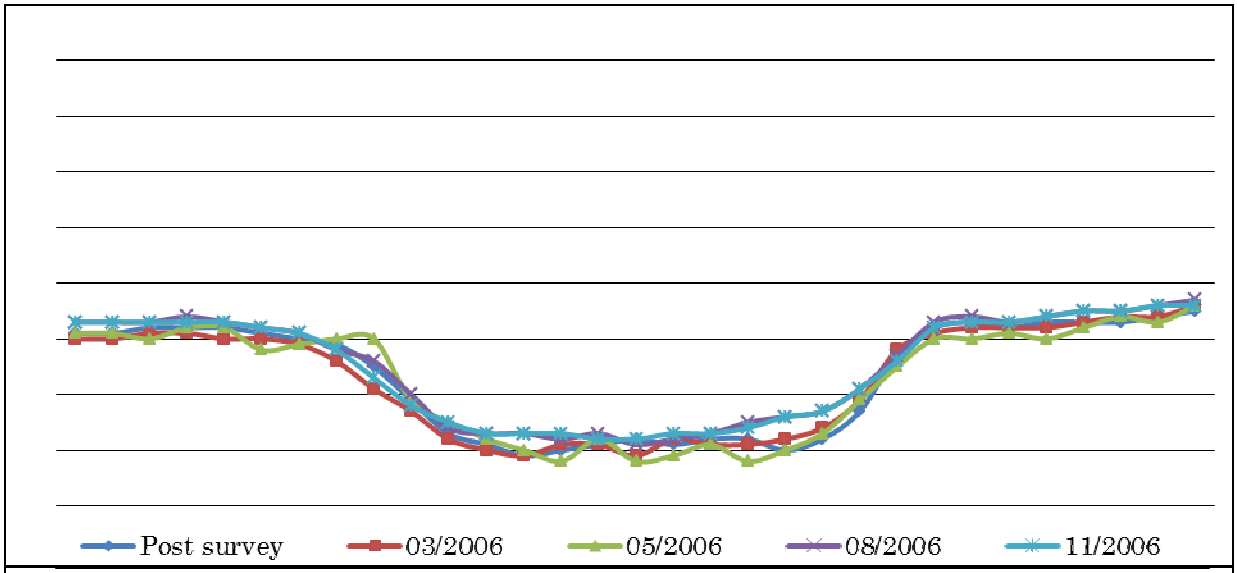
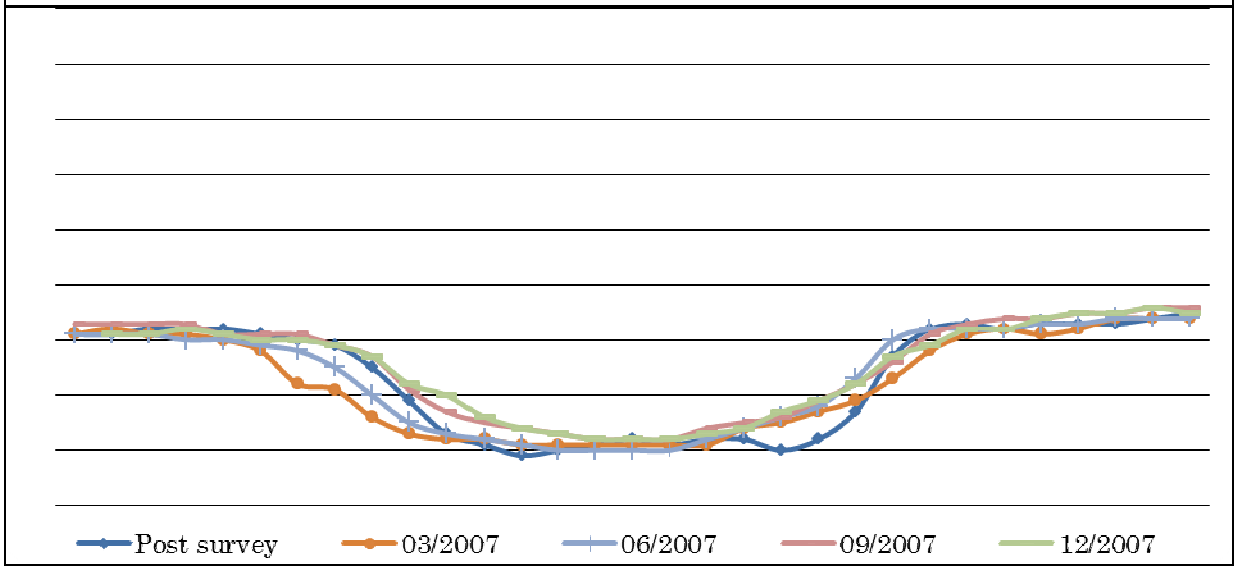


Figure-A.5 (2) Cross Section of 30km

Km 31+000







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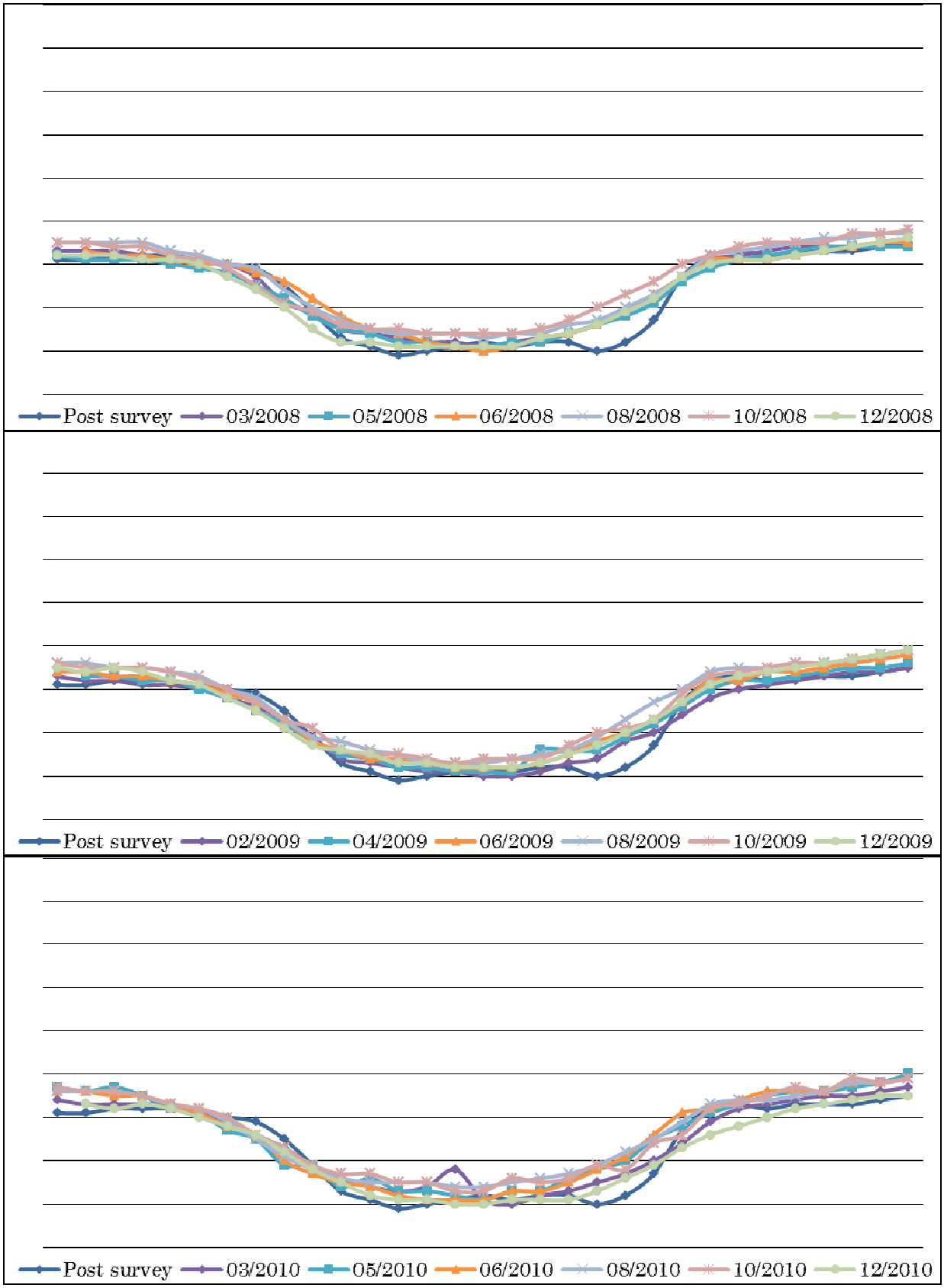
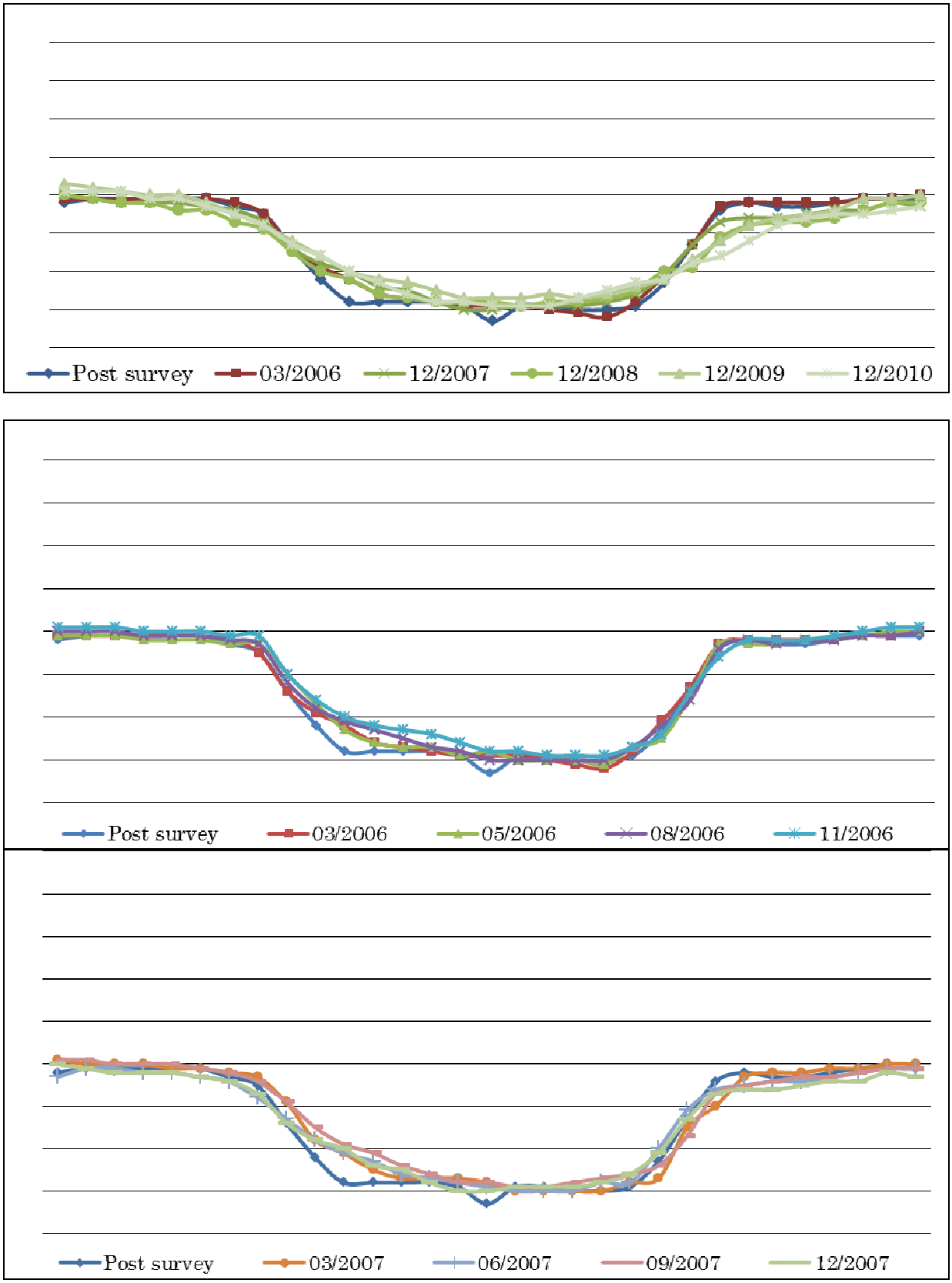


Figure-A.6 (2) Cross Section of 31km

Km 32+000



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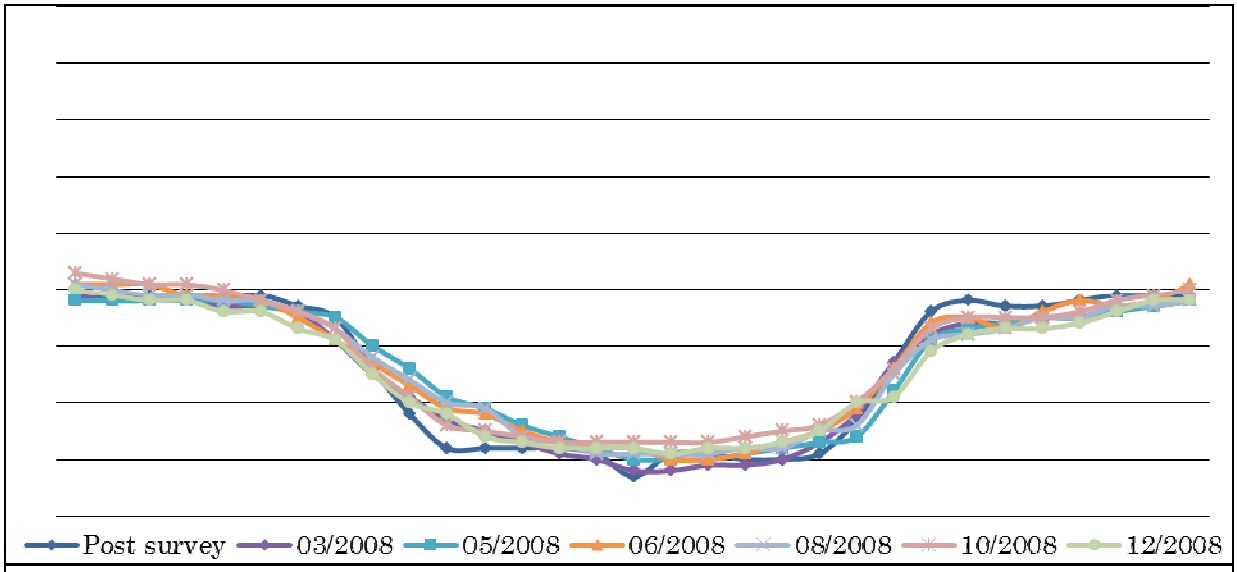

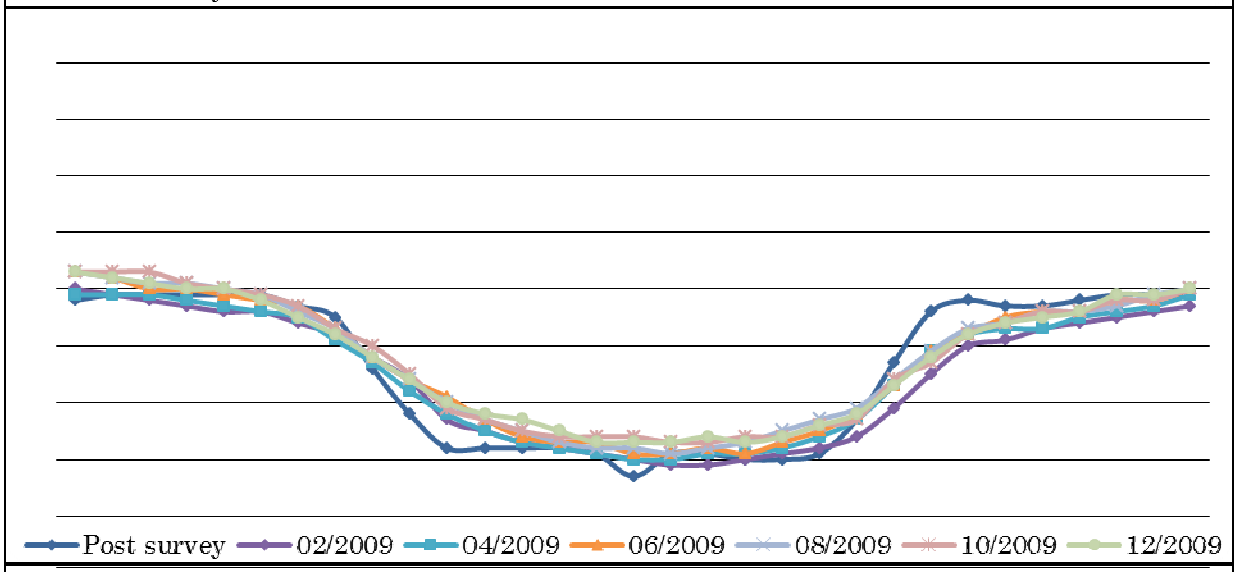

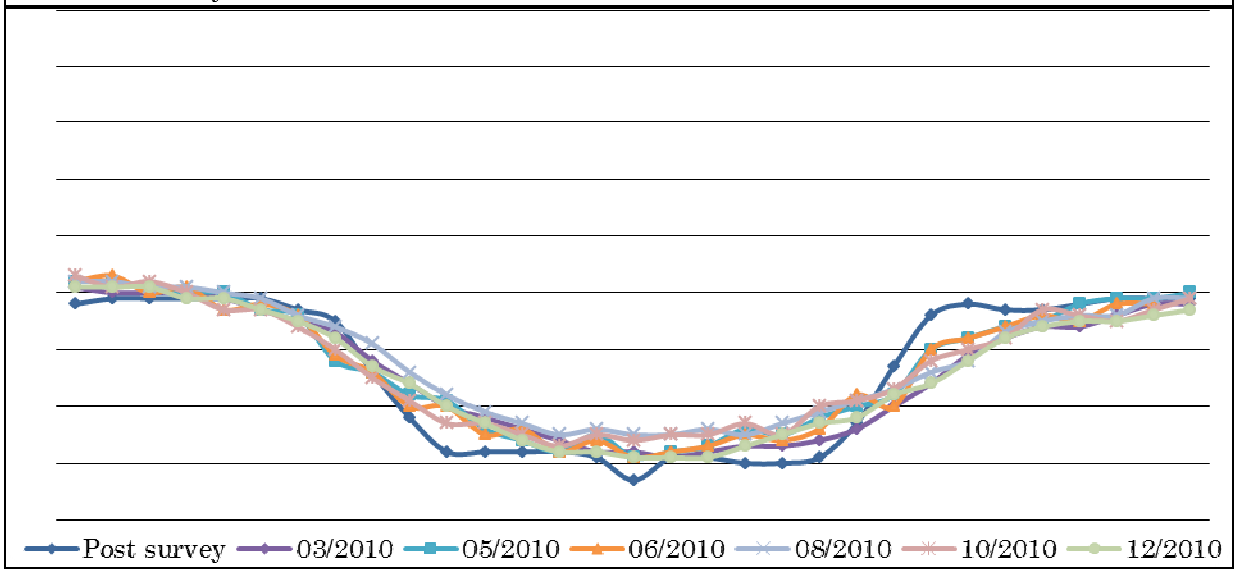

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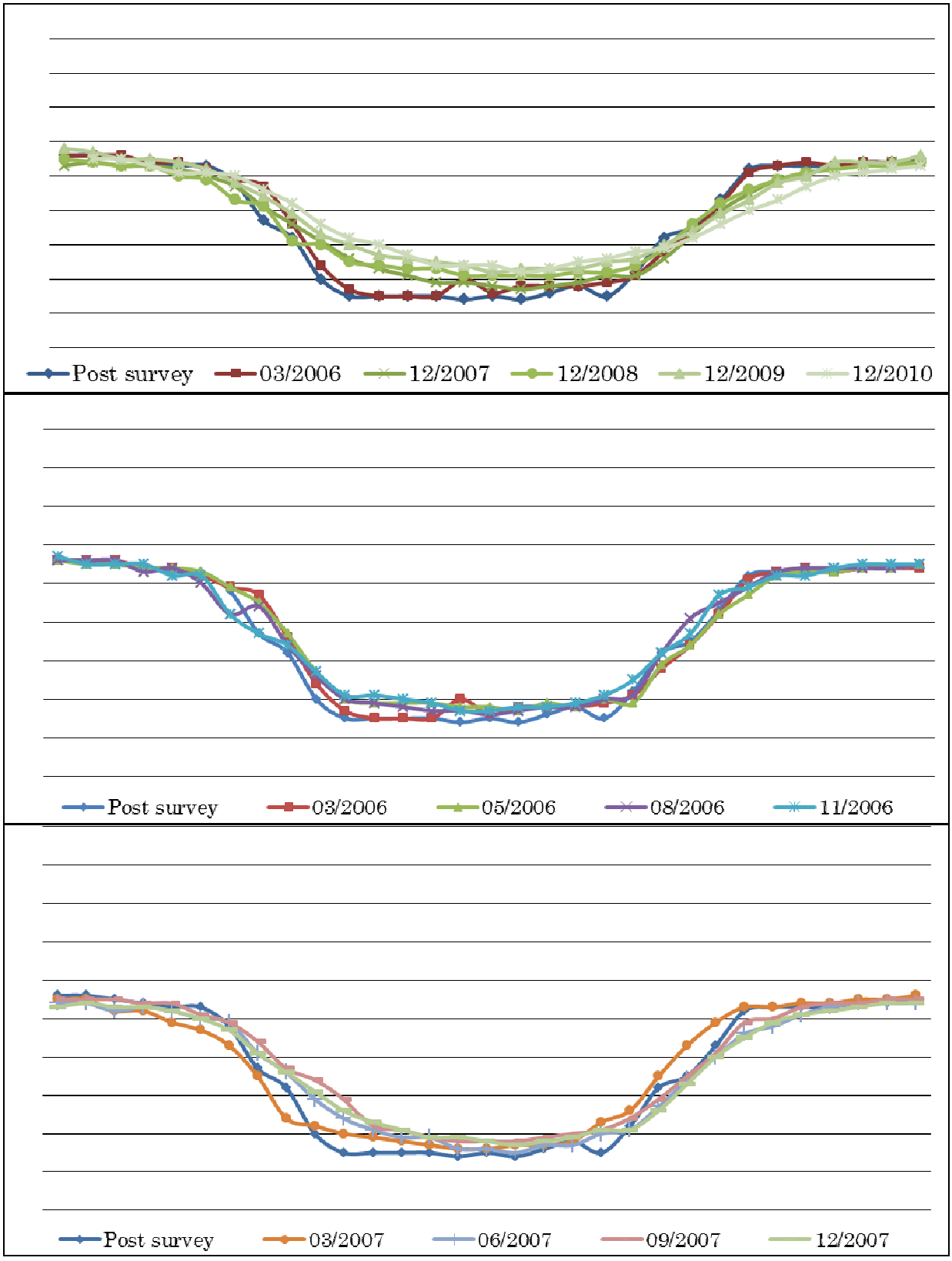
Km 33+000



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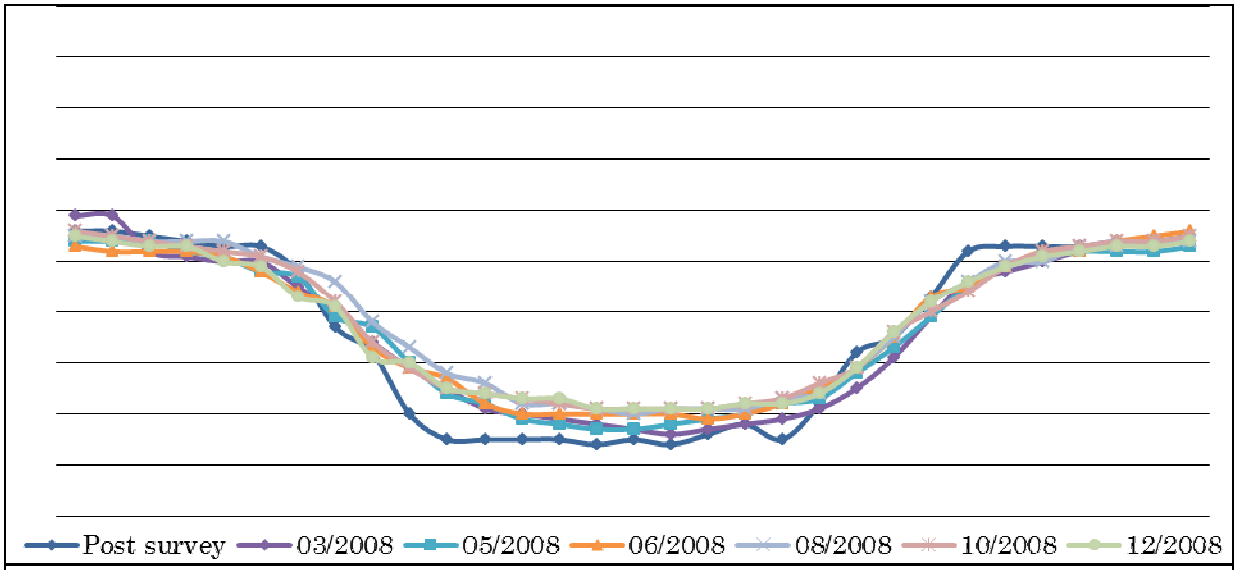

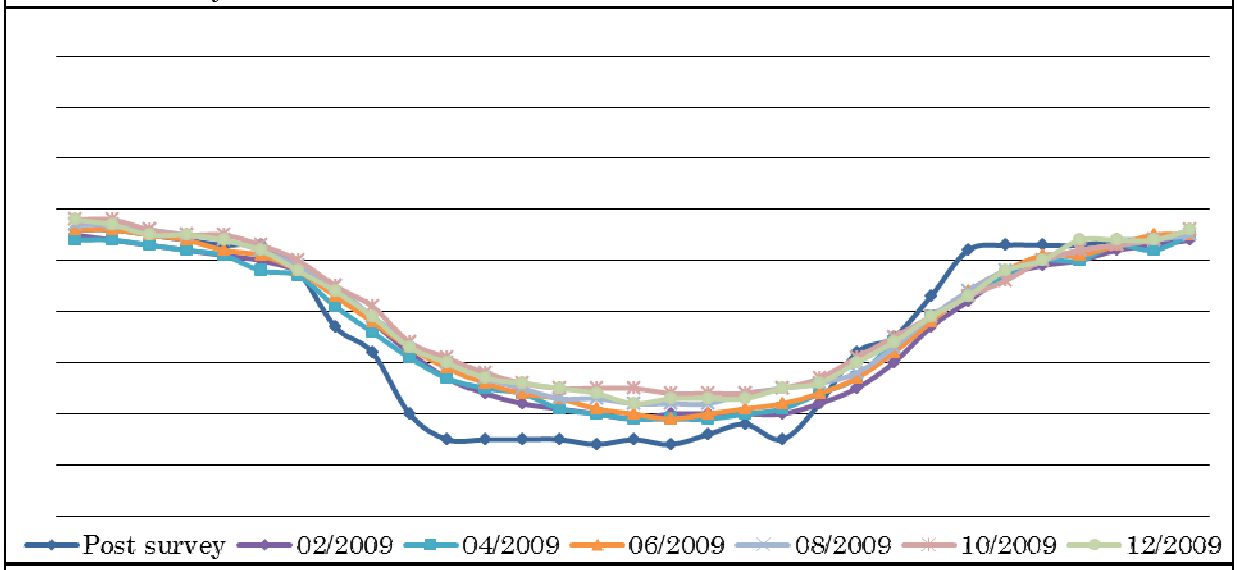

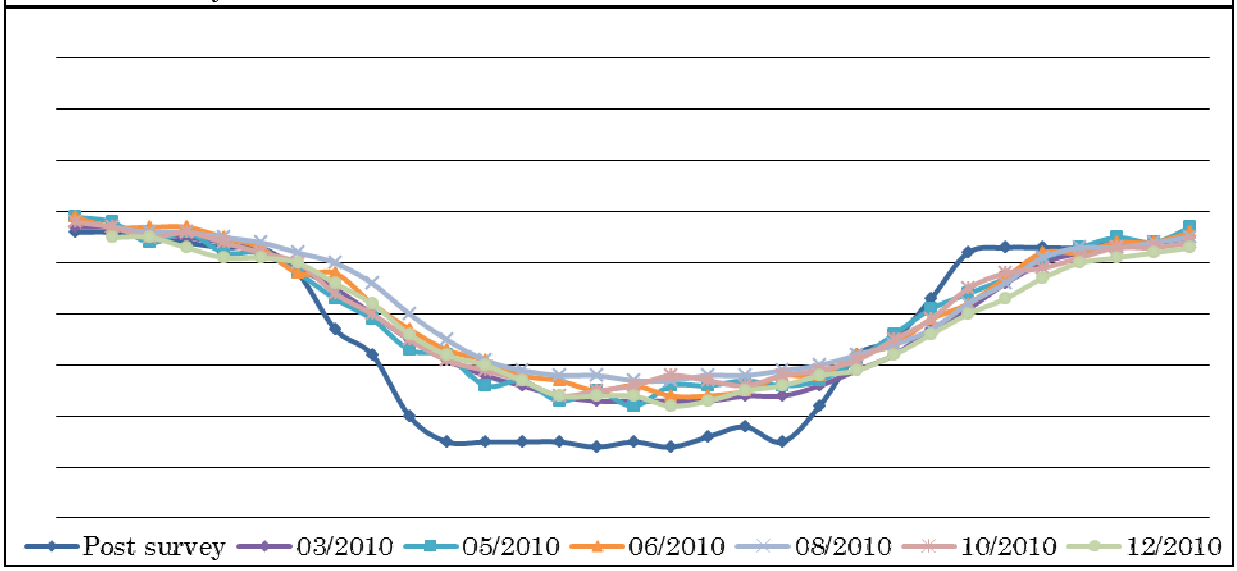

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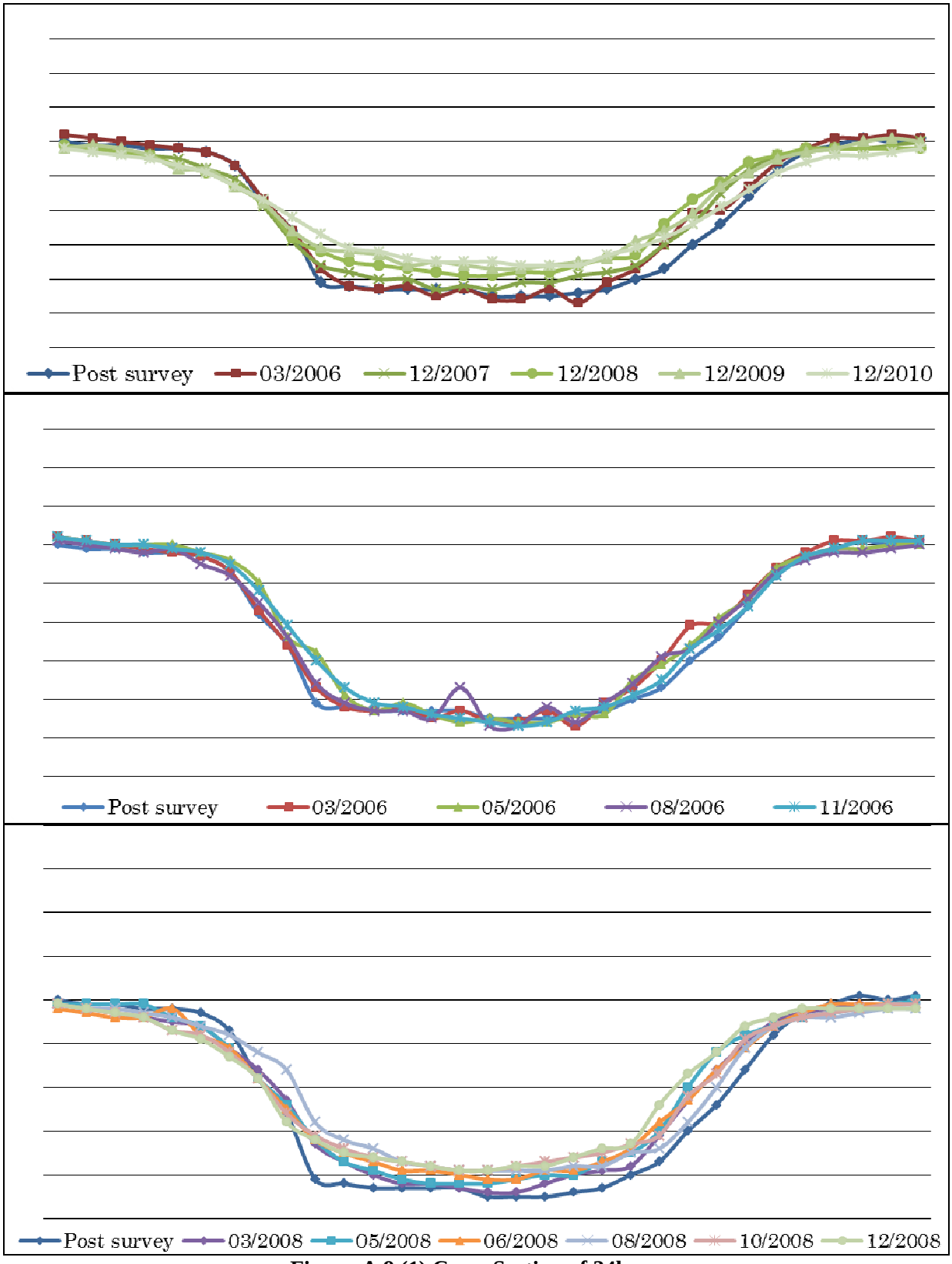
Km 34+000



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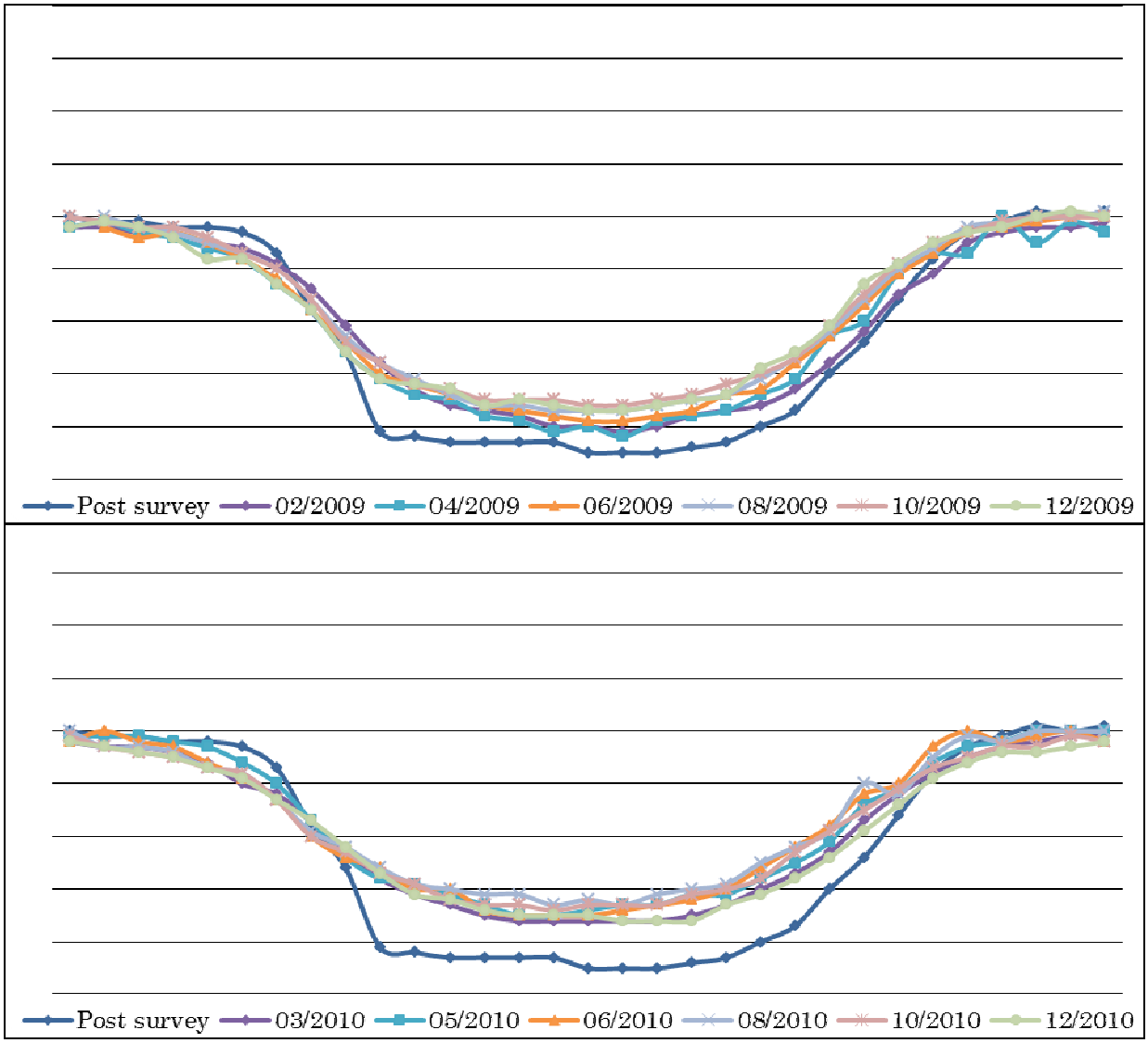
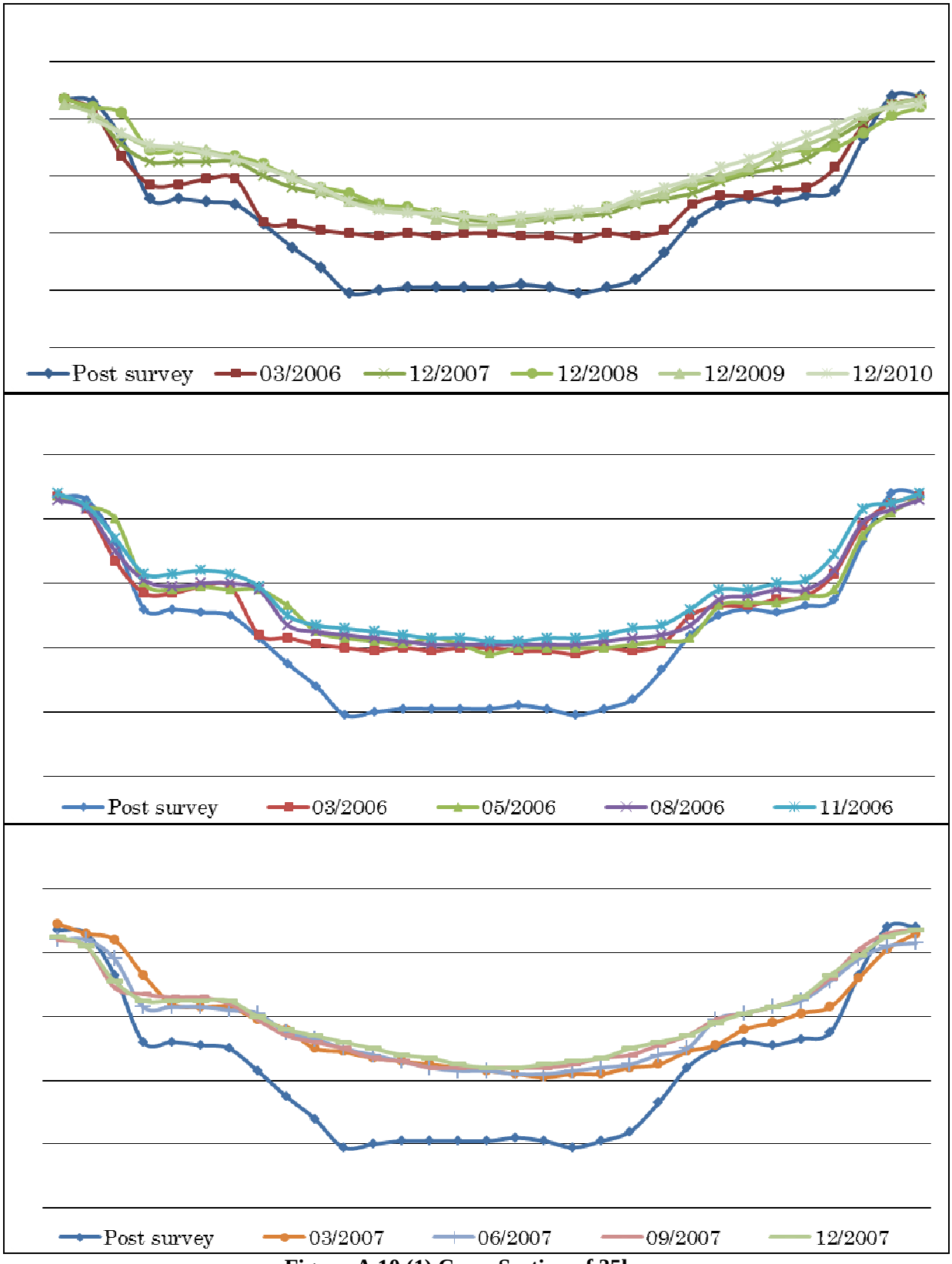


Figure-A.9 (2) Cross Section of 34km

Km 35+000



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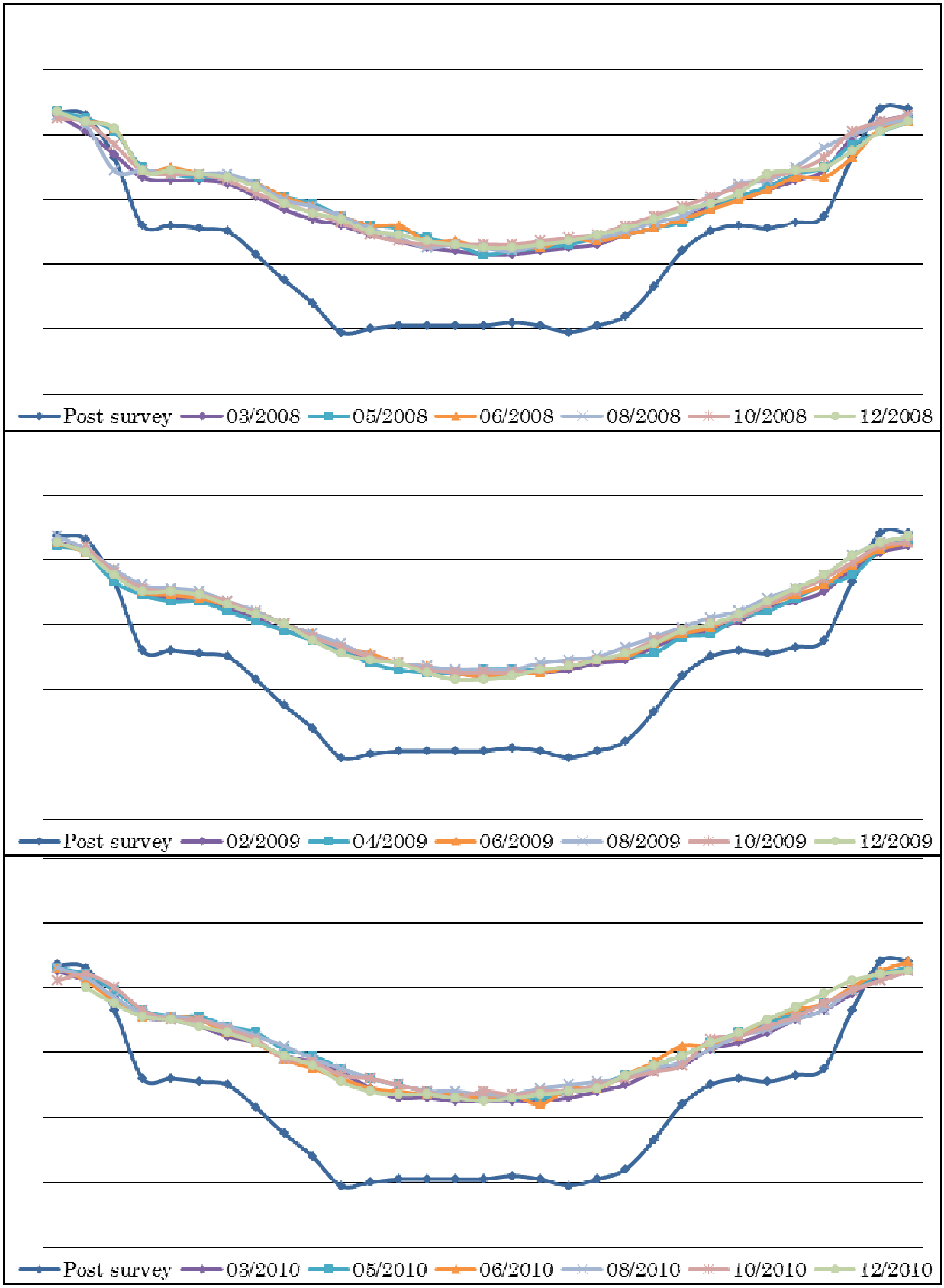

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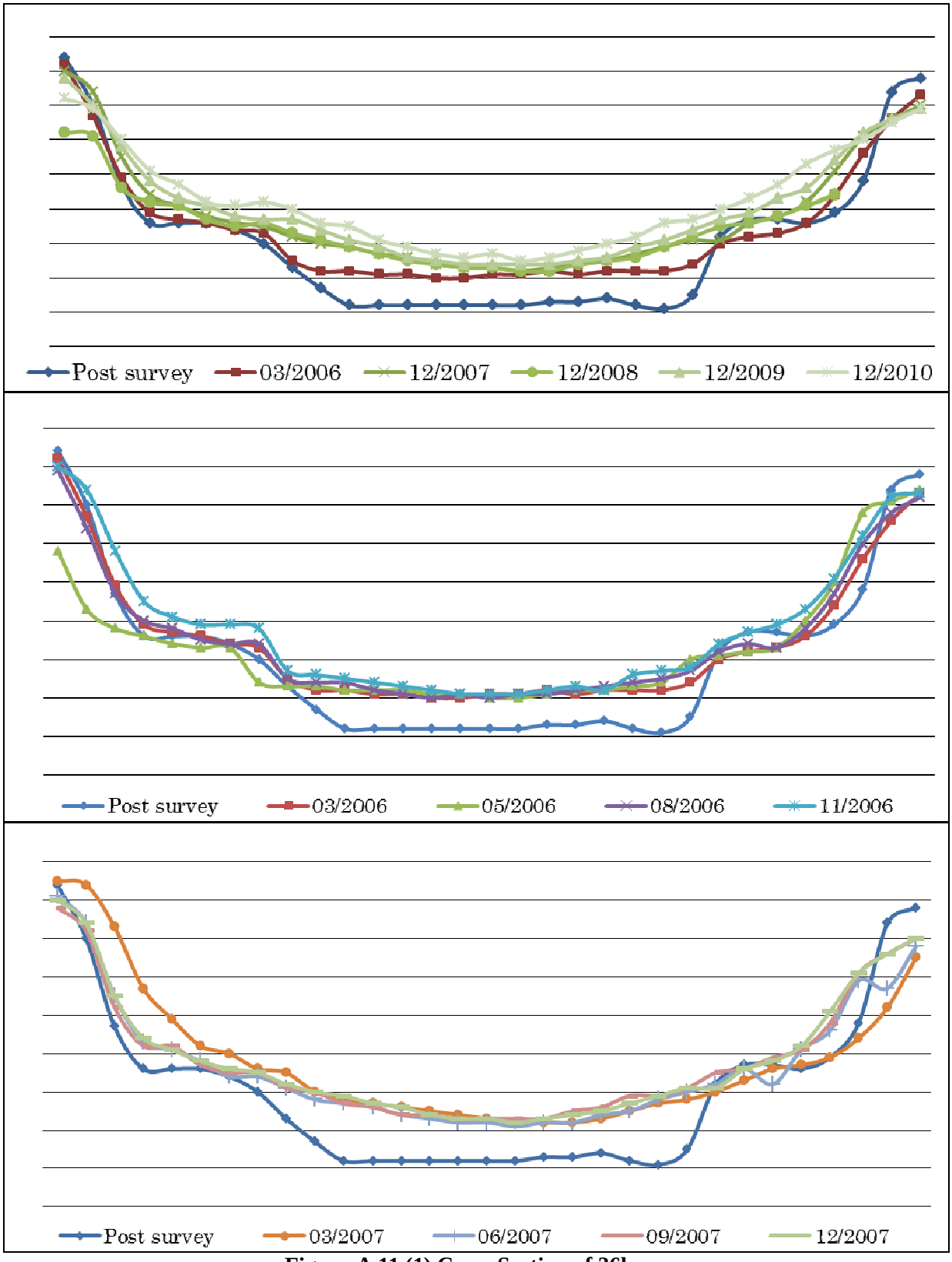
Km 36+000



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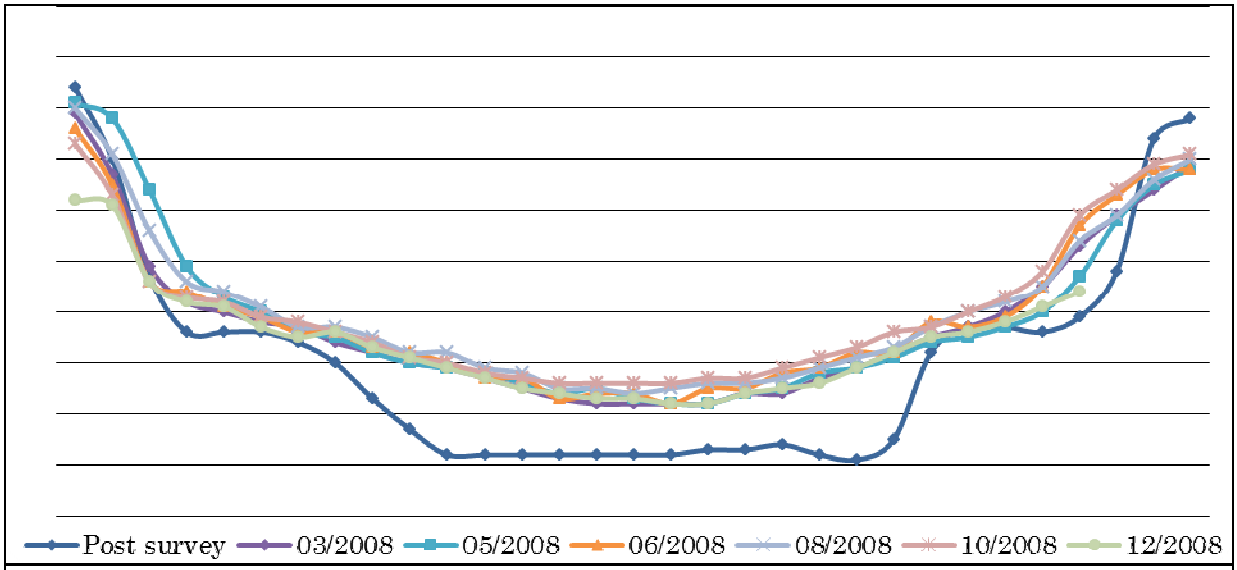

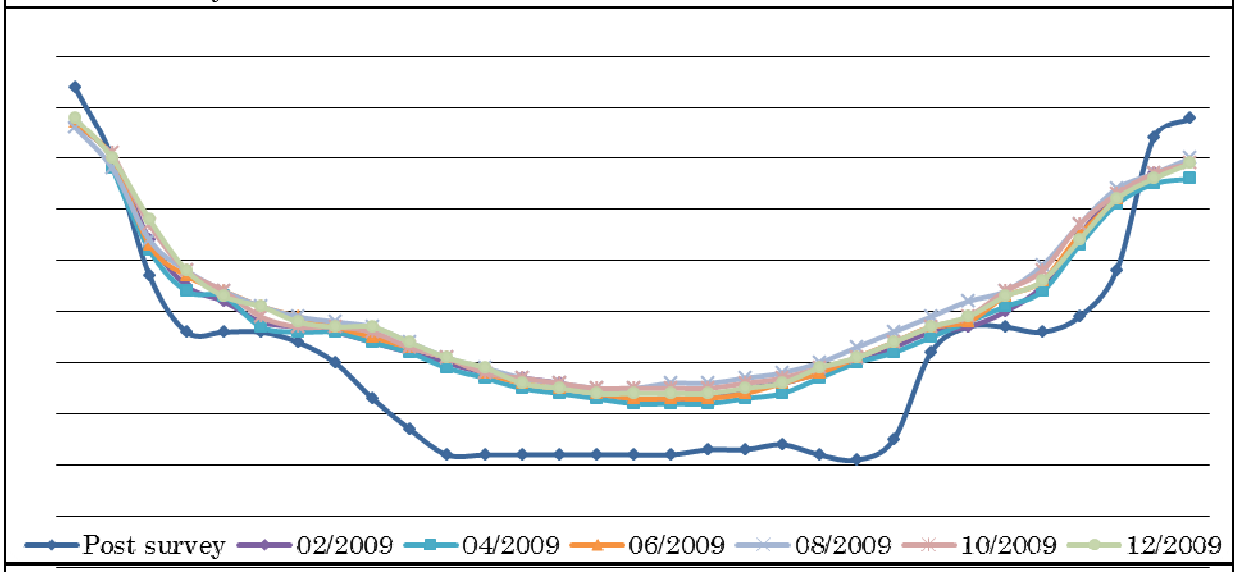

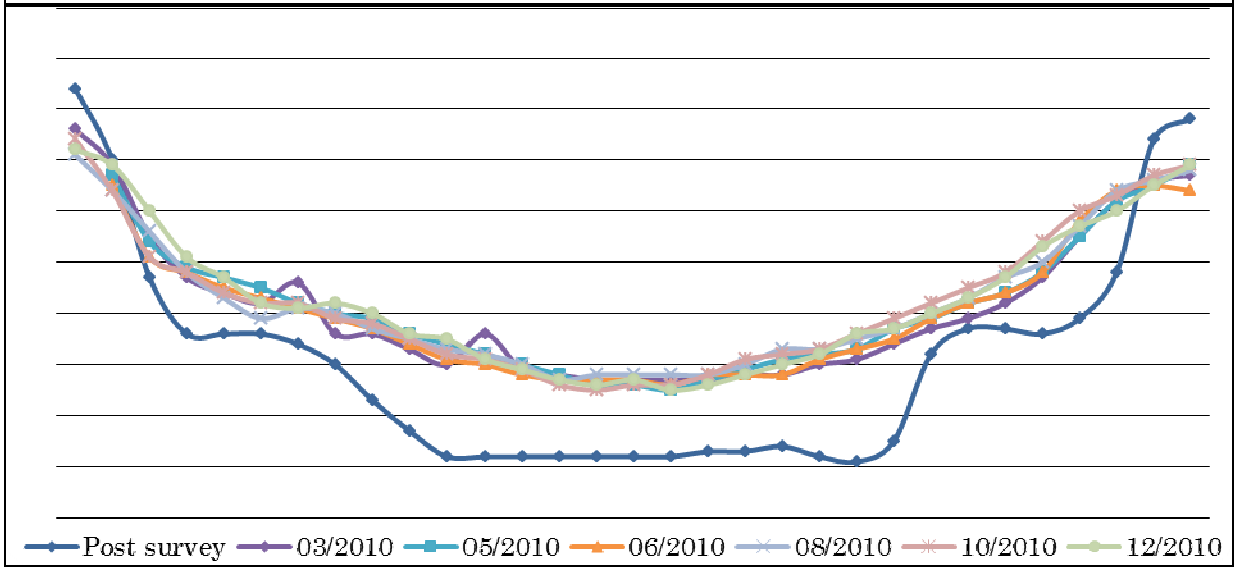

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Km 37+000

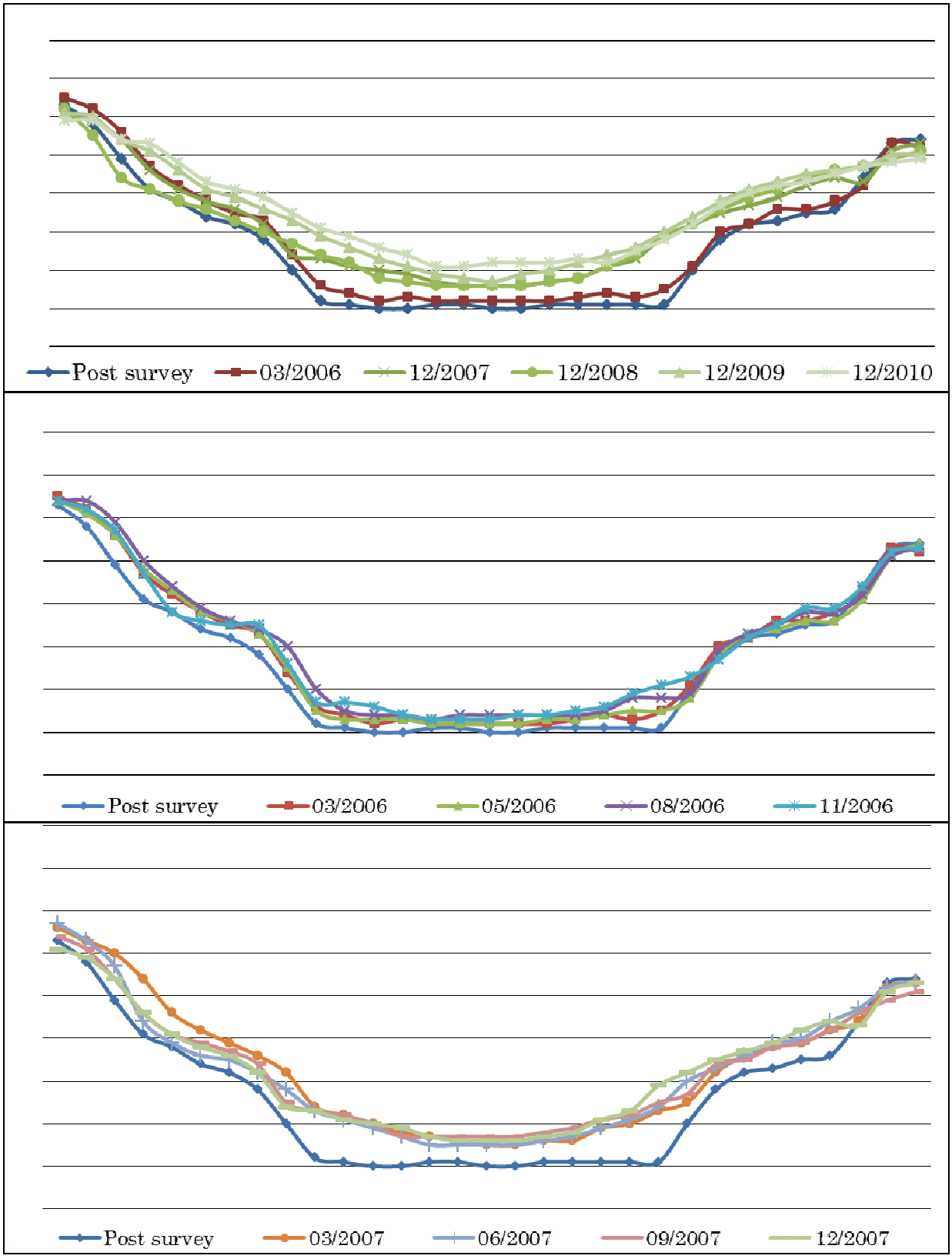
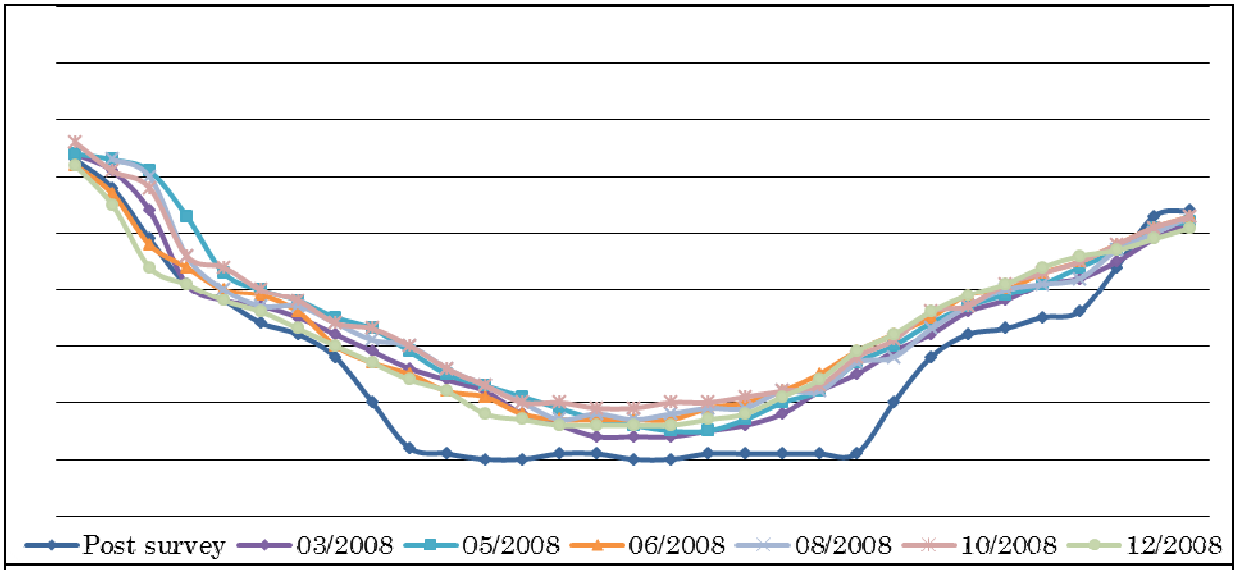
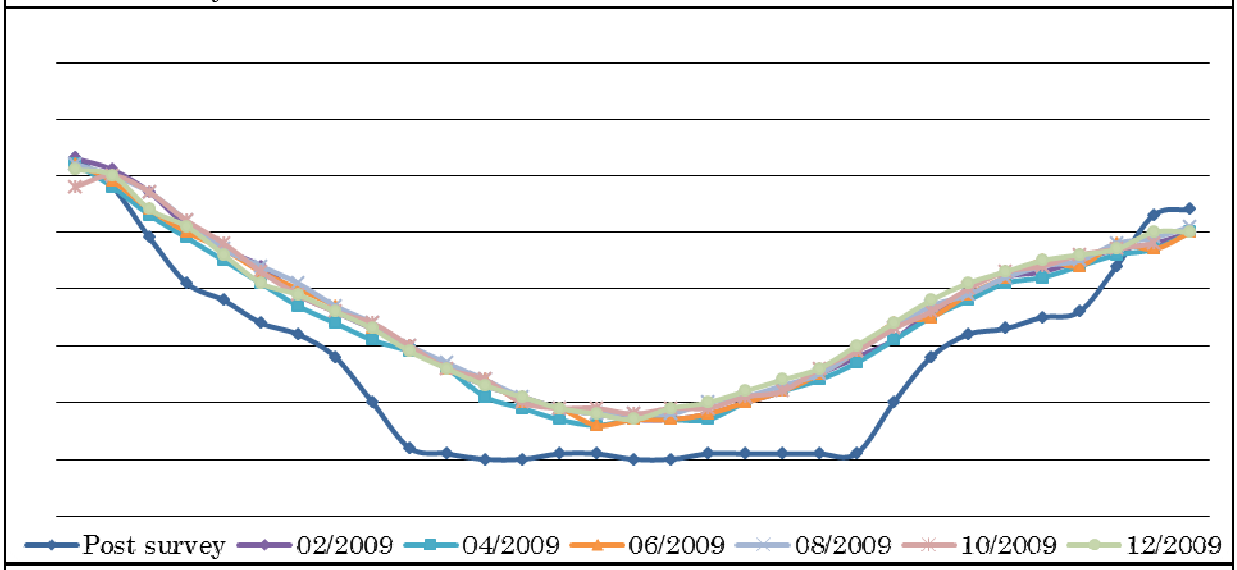


Figure-A.12 (1) Cross Section of 37km





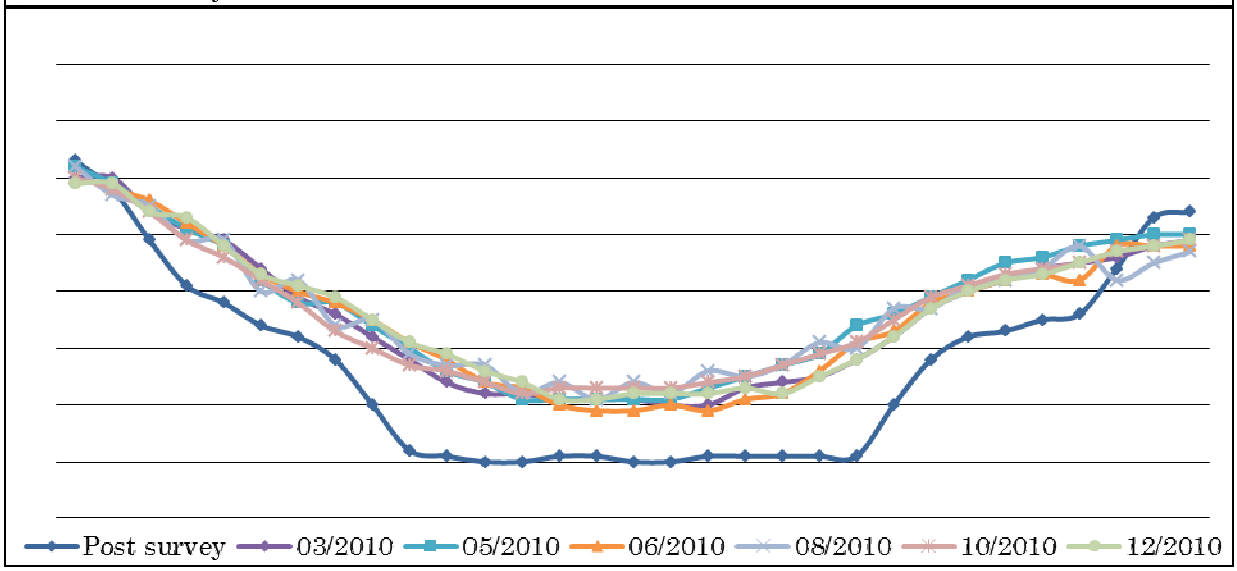


Figure-A.12 (2) Cross Section of 37km

Km 38+000

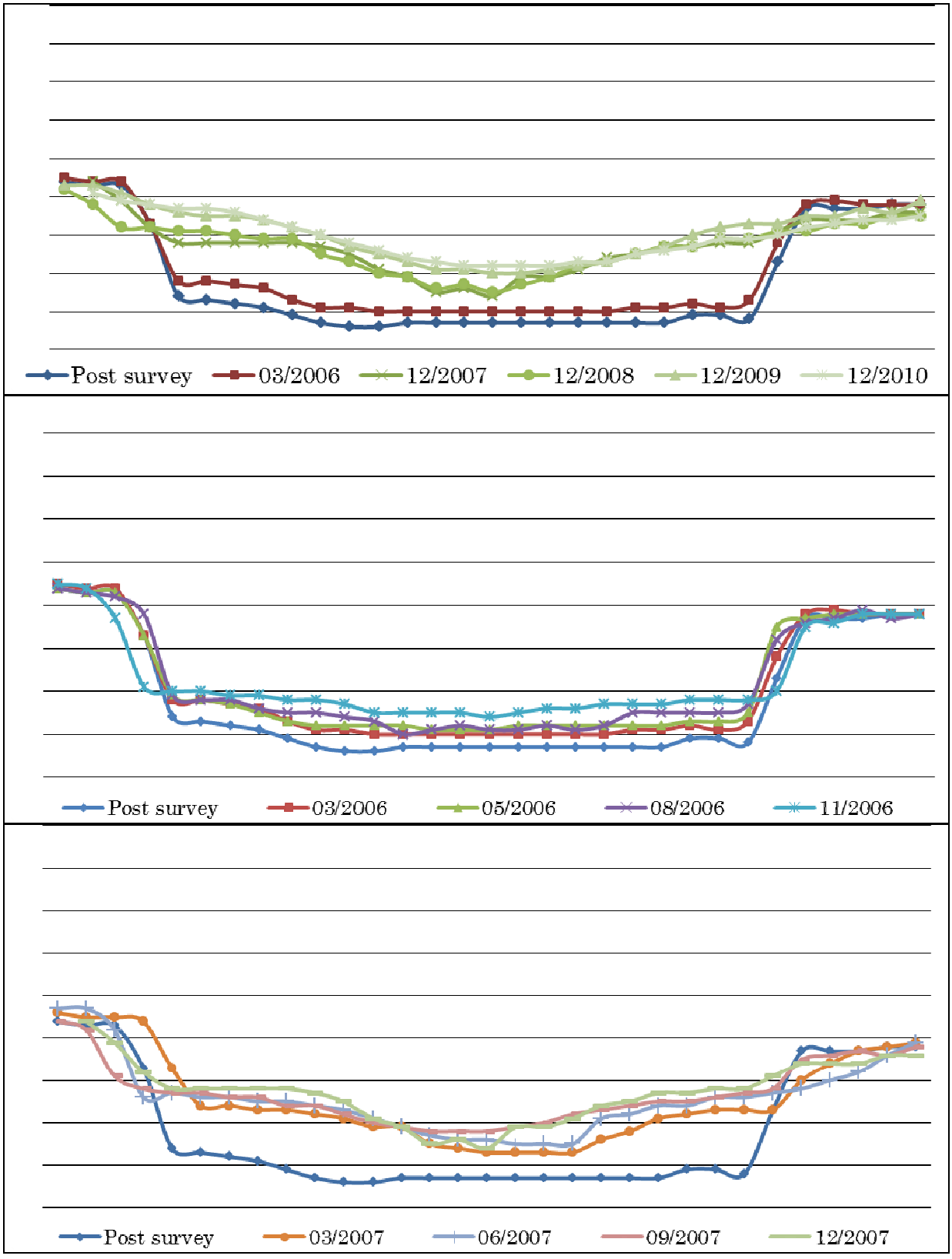


Figure-A.13 (1) Cross Section of 38km

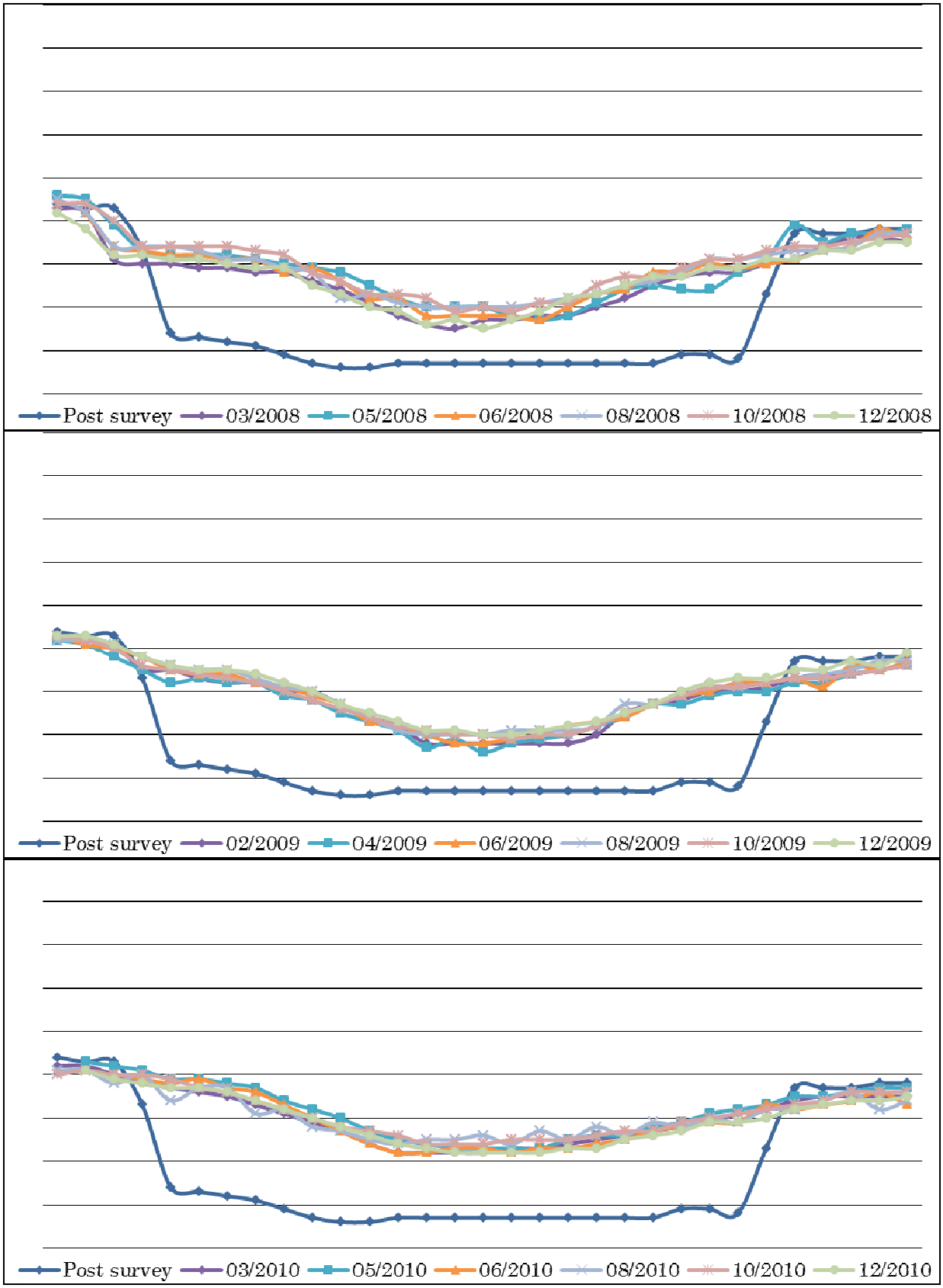


Figure-A.13 (2) Cross Section of 38km

Km 39+000

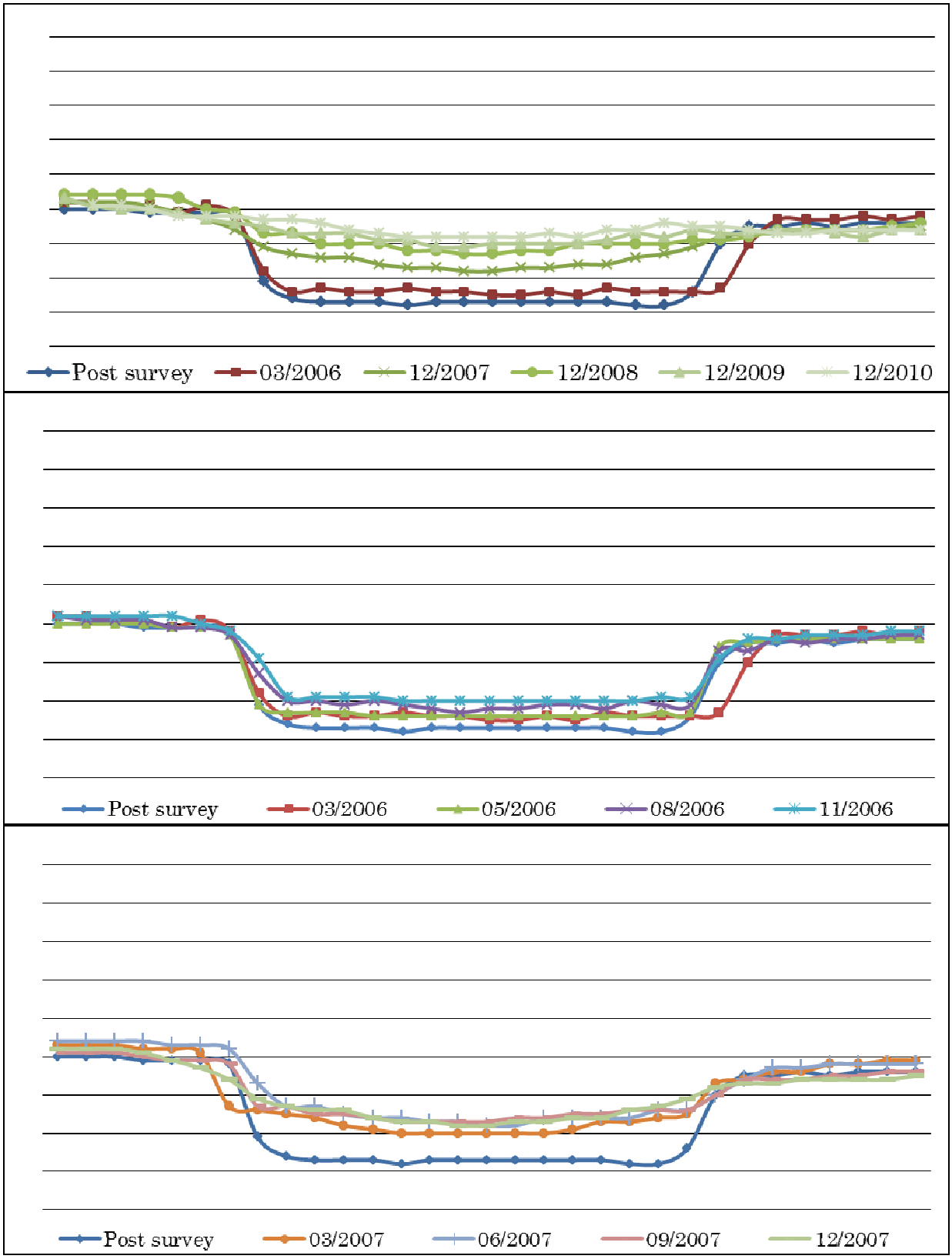
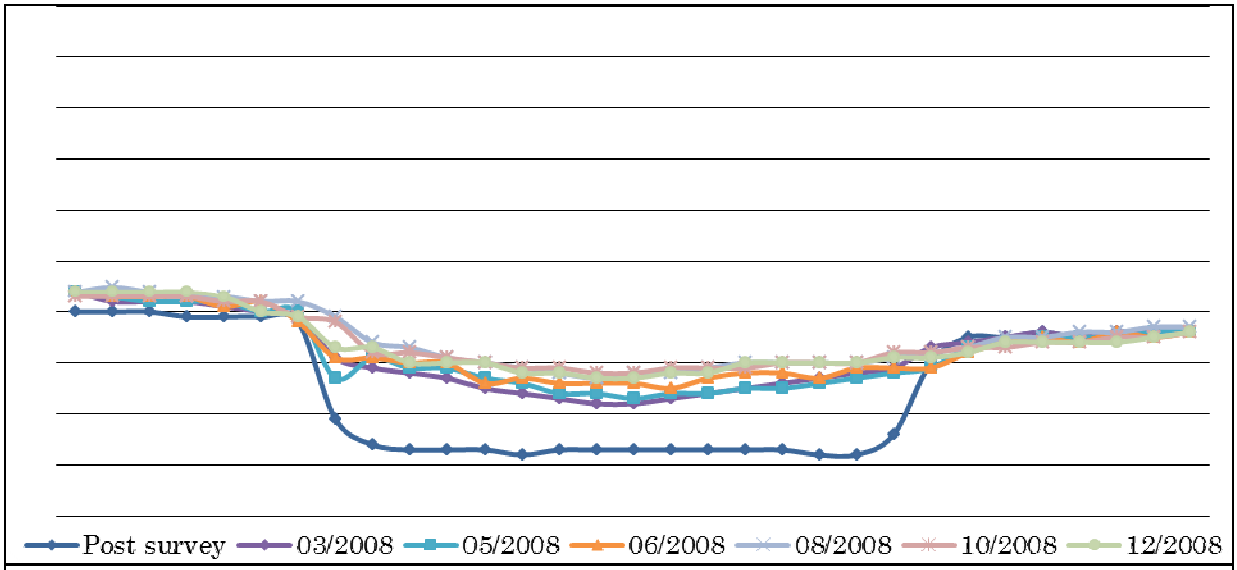
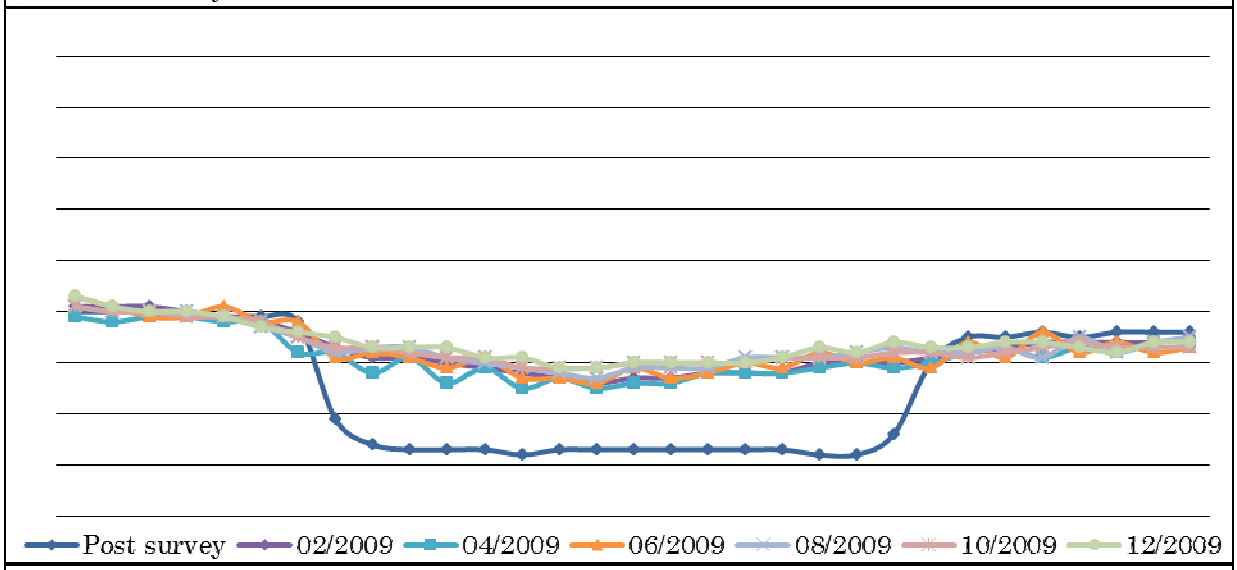


Figure-A.14 (1) Cross Section of 39km





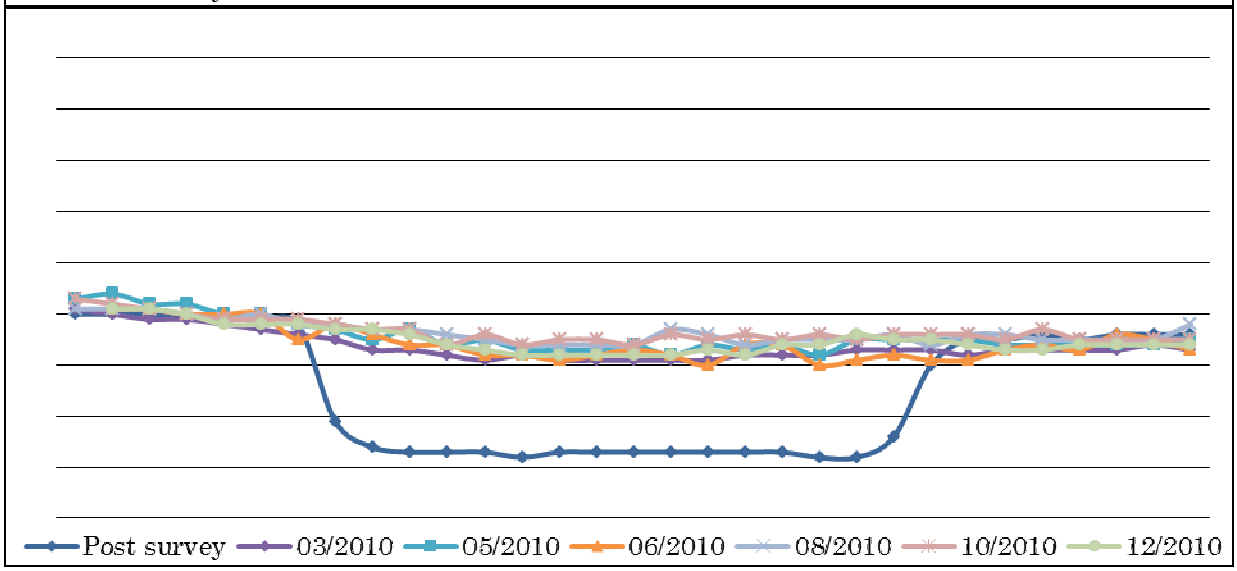


Figure-A.14 (2) Cross Section of 39km

Km 40+000

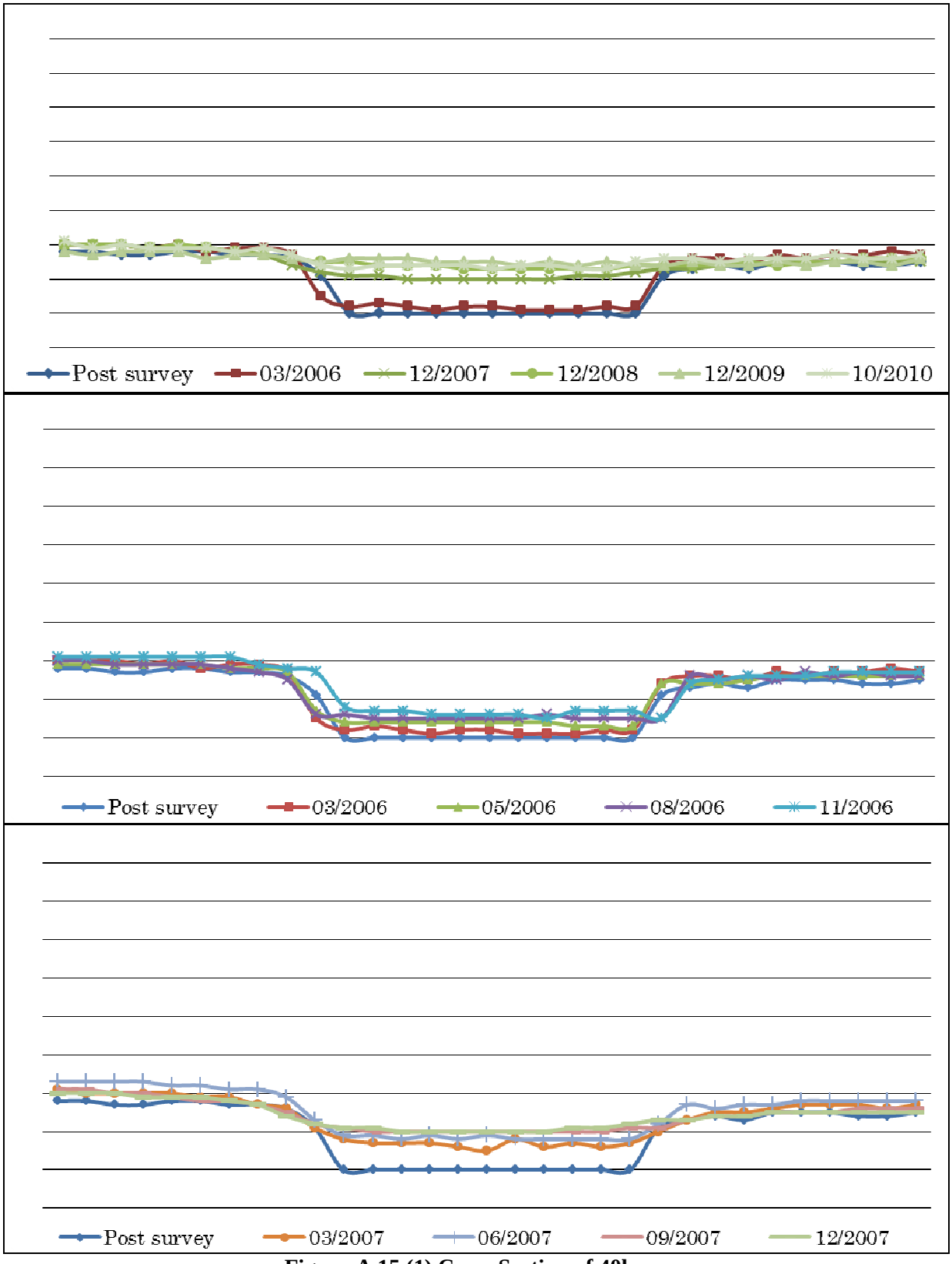


Figure-A.15 (1) Cross Section of 40km

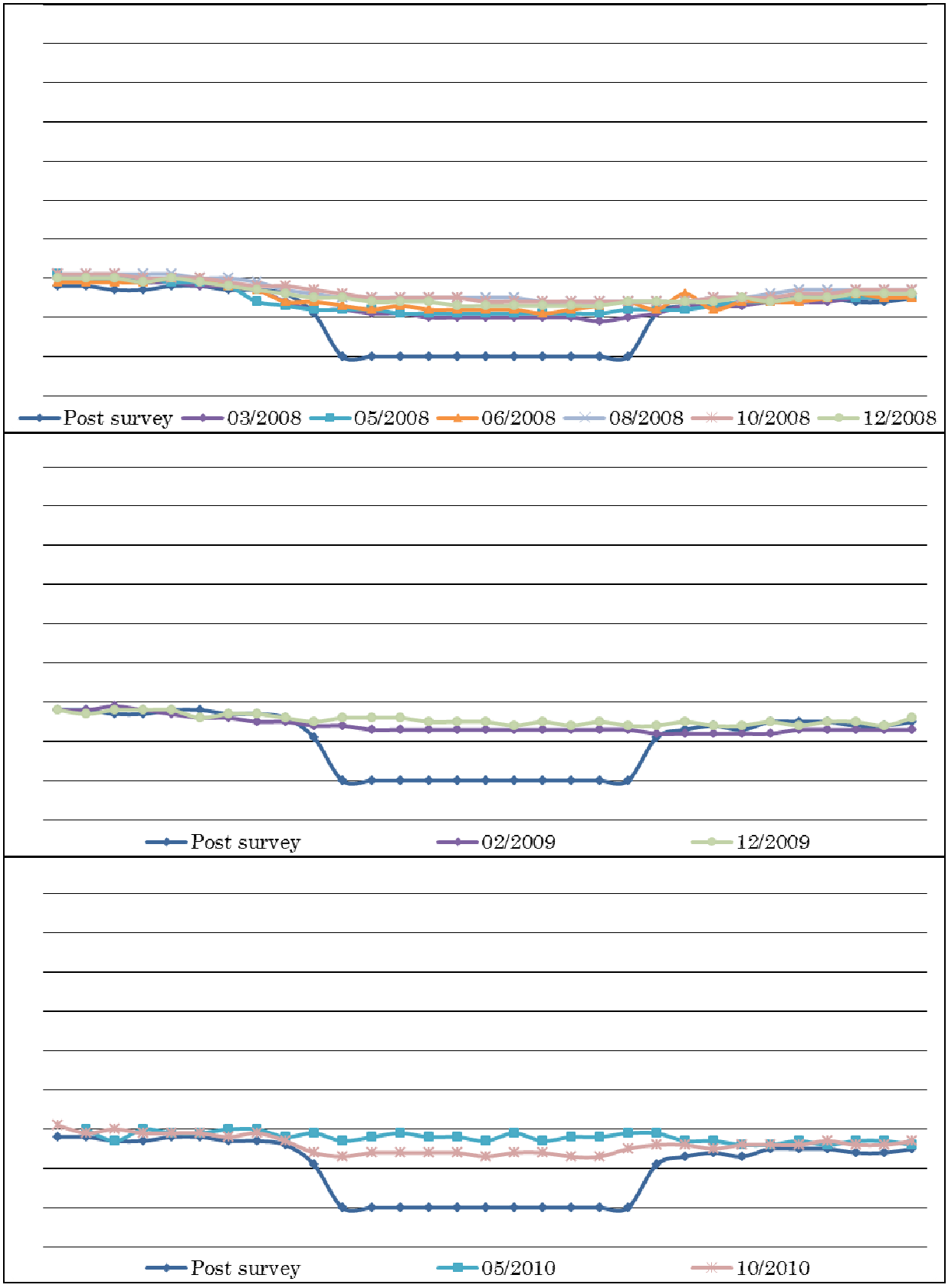
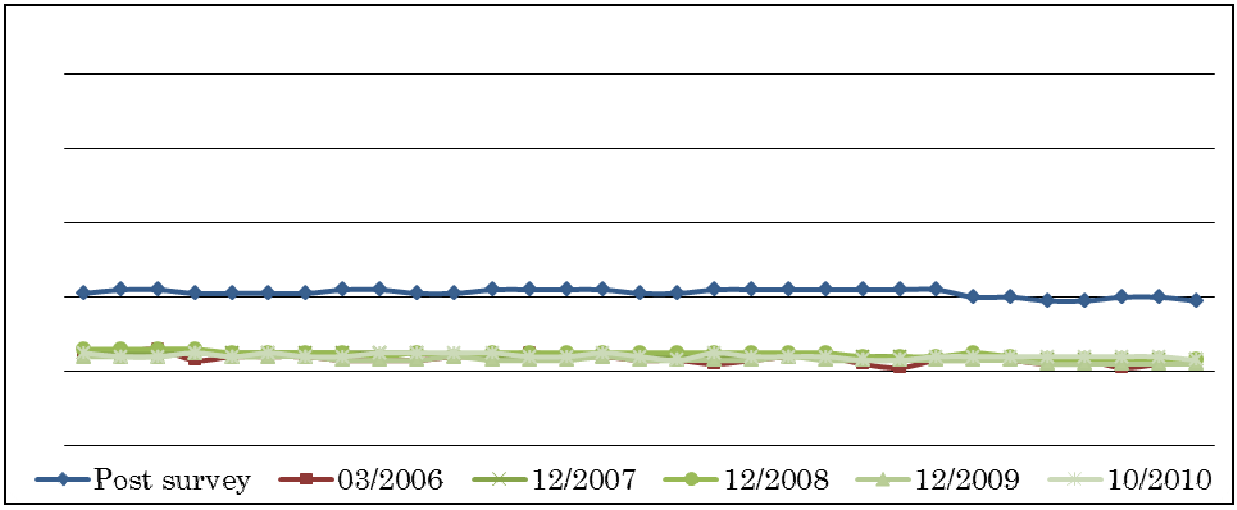
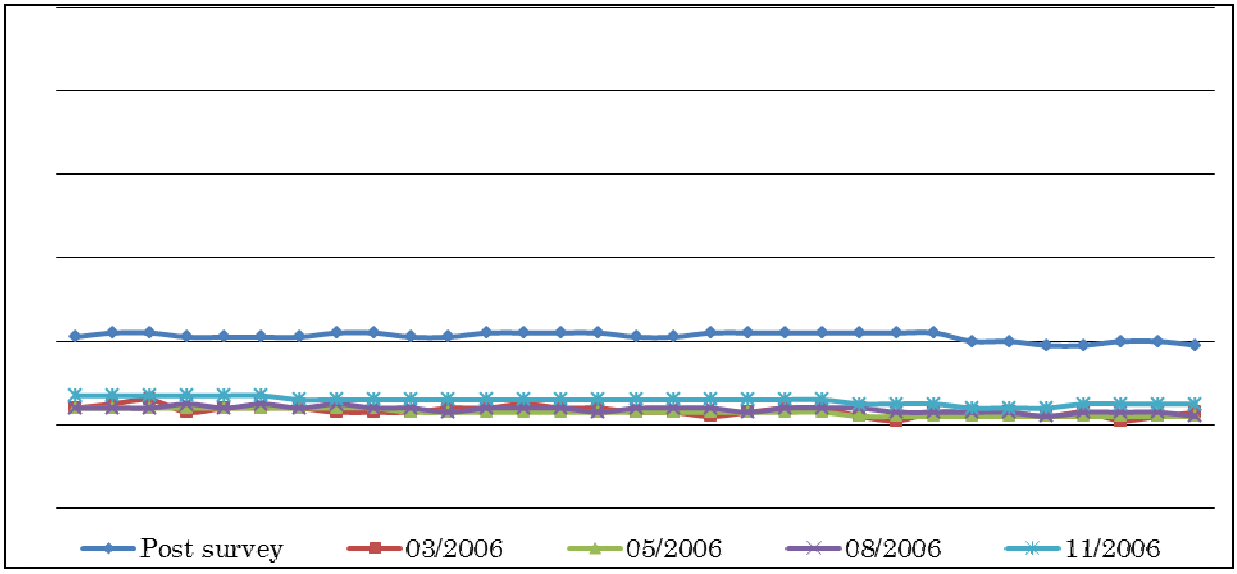


Figure-A.15 (2) Cross Section of 40km

Km 42+000





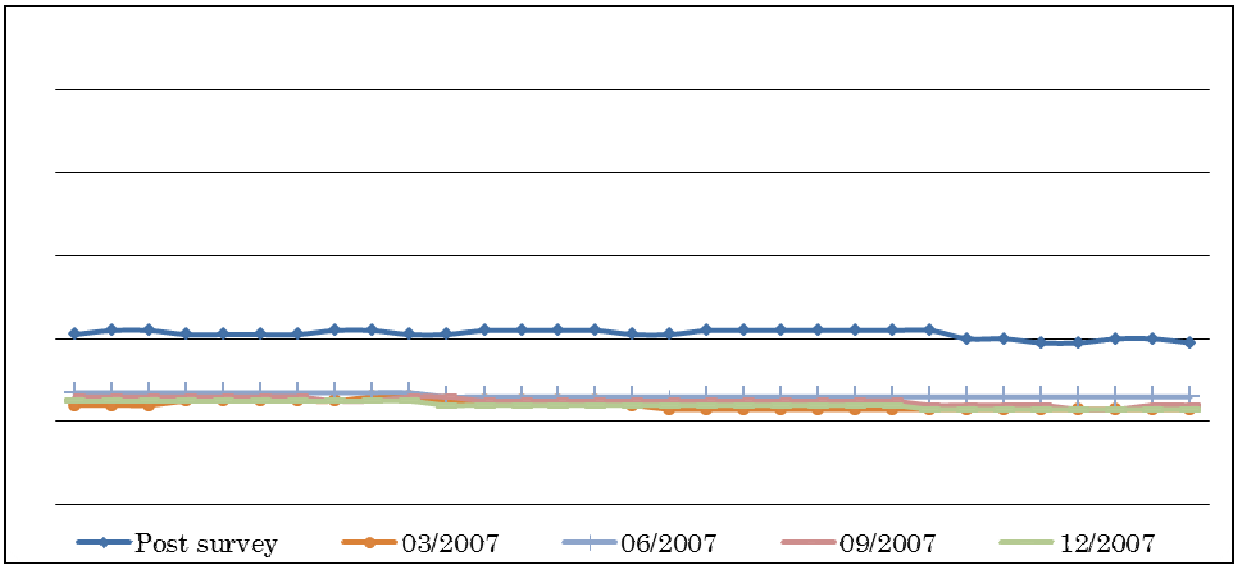


Figure-A.16 (1) Cross Section of 42km

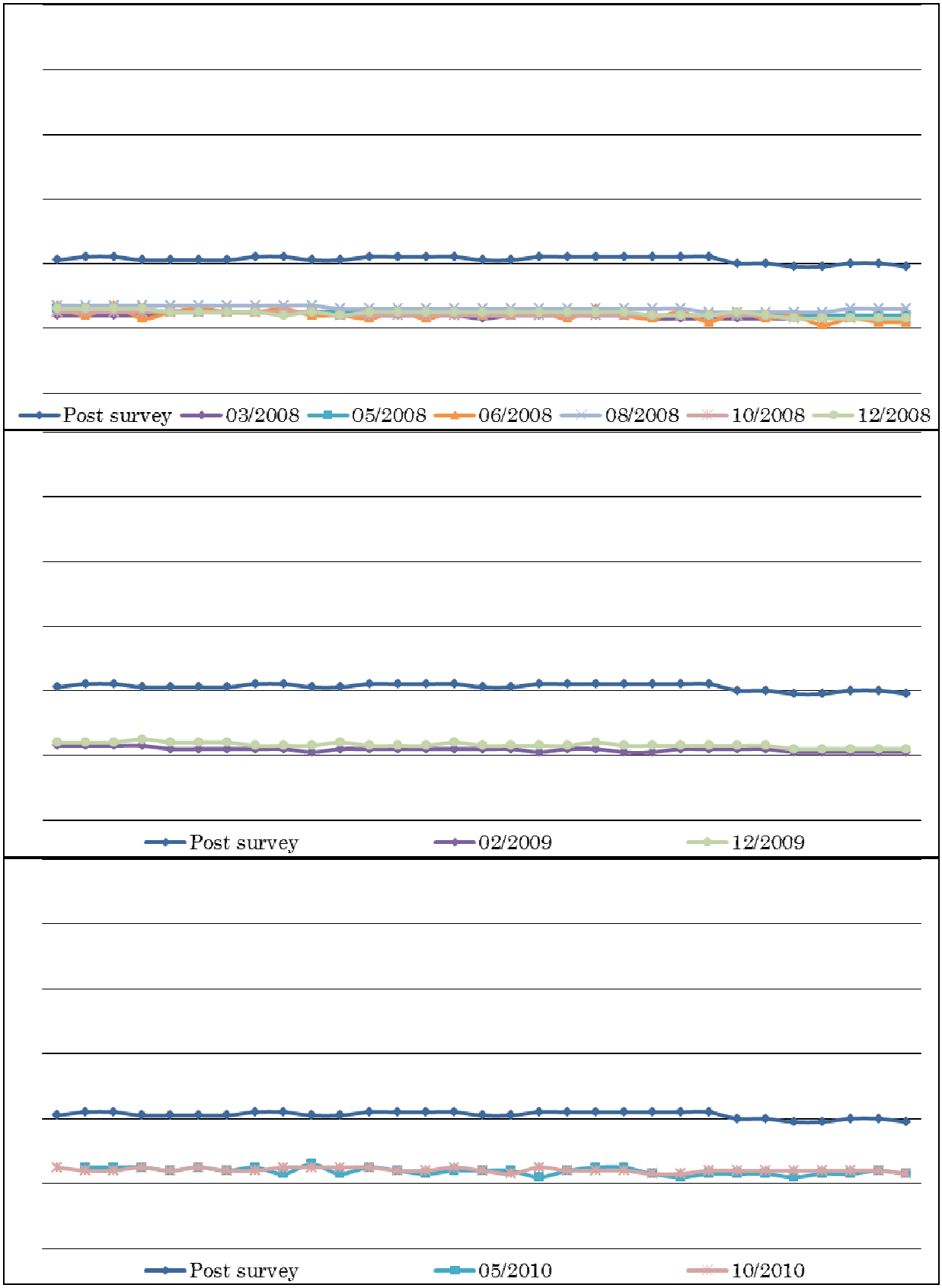


Figure-A.16 (2) Cross Section of 42km

Appendix 7-1

Calculation Result of Soil Improvement for Container Terminal Area and Access Road Area

Appendix 7-1

1) Required Embankment Height Calculation Result

2) Settlement-Time Curves with PVD for Reclamation Area
(Block 1 to 16)

3) Economical Comparison Tables by PVD Spacing
for Terminal Area (Block 1 to 12)

4) Slope Stability Analysis Result during Filling at Reclamation Area
(Required Average Slope Gradient between Seabed and First Fill (CD+5.0m))

1) Required Embankment Height Calculation Result

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.174	0.480	0.654
0.016	0.073	0.089
0.036	0.075	0.111
0.040	0.174	0.214
0.032	0.148	0.179
0.297	0.950	1.247
l Ground Level (m)		4.753

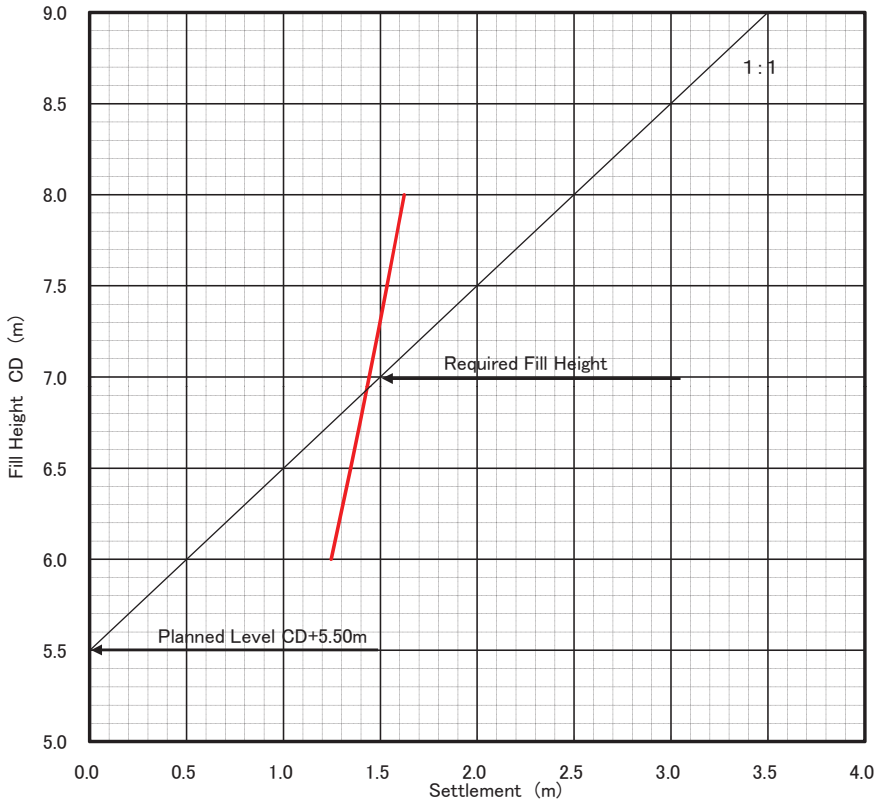
n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.174	0.518	0.691
0.016	0.079	0.095
0.036	0.091	0.128
0.040	0.195	0.235
0.032	0.166	0.198
0.297	1.050	1.347
l Ground Level (m)		5.153

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.174	0.553	0.727
0.016	0.084	0.100
0.036	0.107	0.143
0.040	0.216	0.256
0.032	0.185	0.216
0.297	1.146	1.443
l Ground Level (m)		5.557

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.174	0.588	0.761
0.016	0.089	0.105
0.036	0.122	0.158
0.040	0.237	0.276
0.032	0.202	0.234
0.297	1.238	1.535
l Ground Level (m)		5.965

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.174	0.620	0.794
0.016	0.094	0.110
0.036	0.137	0.173
0.040	0.256	0.296
0.032	0.220	0.251
0.297	1.327	1.624
l Ground Level (m)		6.376

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.174	0.553	0.727
0.016	0.084	0.100
0.036	0.107	0.143
0.040	0.216	0.256
0.032	0.185	0.216
0.297	1.146	1.443
l Ground Level (m)		5.557



esult for【+5.50m：Block-1(Container Terminal Area)】

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.036	0.072	0.108
0.047	0.304	0.351
0.020	0.086	0.105
0.023	0.025	0.048
0.031	0.100	0.131
0.026	0.087	0.113
0.182	0.674	0.857
l Ground Level (m)		5.143

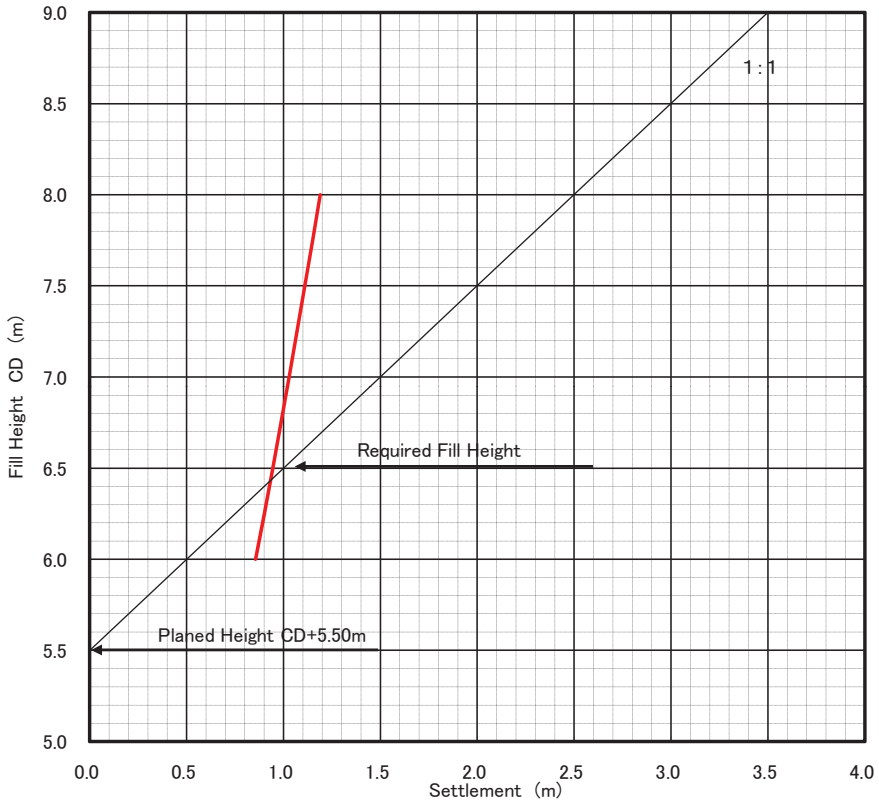
n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.036	0.080	0.116
0.047	0.327	0.374
0.020	0.095	0.114
0.023	0.037	0.060
0.031	0.119	0.150
0.026	0.104	0.130
0.182	0.763	0.945
l Ground Level (m)		5.555

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.036	0.088	0.123
0.047	0.348	0.395
0.020	0.104	0.123
0.023	0.049	0.072
0.031	0.138	0.169
0.026	0.120	0.146
0.182	0.847	1.030
l Ground Level (m)		5.970

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.036	0.095	0.130
0.047	0.369	0.416
0.020	0.112	0.132
0.023	0.061	0.084
0.031	0.156	0.187
0.026	0.136	0.162
0.182	0.929	1.111
l Ground Level (m)		6.389

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.036	0.101	0.137
0.047	0.389	0.436
0.020	0.120	0.140
0.023	0.072	0.095
0.031	0.174	0.205
0.026	0.152	0.178
0.182	1.007	1.190
l Ground Level (m)		6.810

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.036	0.080	0.116
0.047	0.327	0.374
0.020	0.095	0.114
0.023	0.037	0.060
0.031	0.119	0.150
0.026	0.104	0.130
0.182	0.763	0.945
l Ground Level (m)		5.555



esult for【+5.50m：Block-2(Container Terminal Area)】

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.055	0.089	0.145
0.060	0.394	0.454
0.013	0.056	0.069
0.009	0.012	0.021
0.036	0.126	0.162
0.032	0.117	0.149
0.204	0.795	0.999
l Ground Level (m)		5.001

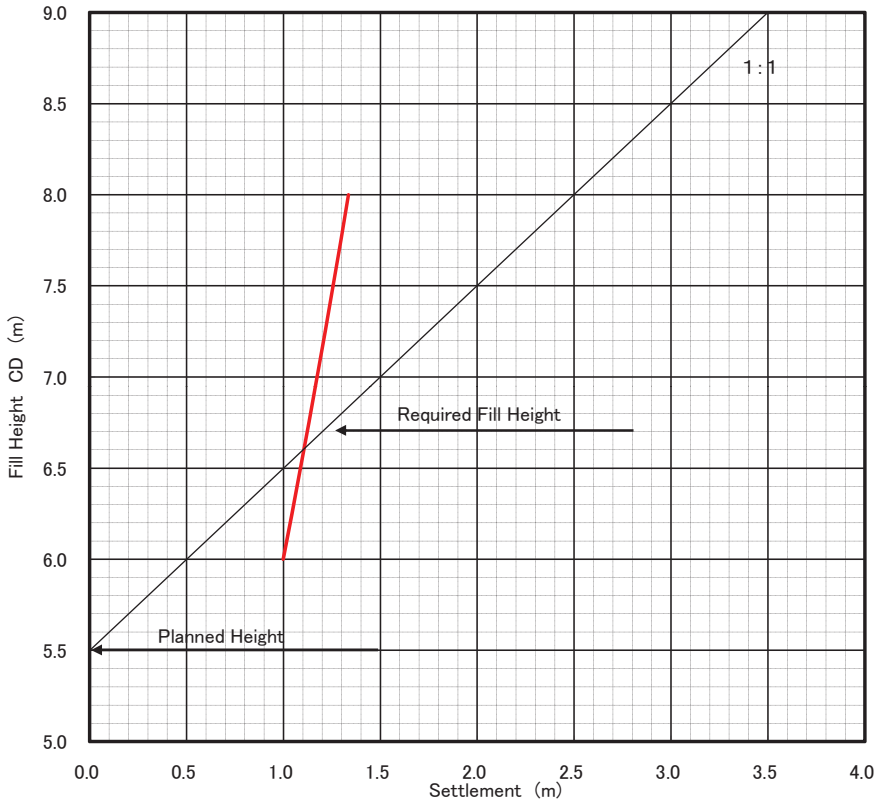
n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.055	0.099	0.155
0.060	0.422	0.482
0.013	0.062	0.074
0.009	0.016	0.025
0.036	0.148	0.184
0.032	0.137	0.169
0.204	0.884	1.088
l Ground Level (m)		5.412

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.055	0.109	0.164
0.060	0.448	0.508
0.013	0.067	0.080
0.009	0.021	0.029
0.036	0.168	0.204
0.032	0.157	0.188
0.204	0.970	1.174
l Ground Level (m)		5.826

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.055	0.117	0.173
0.060	0.474	0.534
0.013	0.072	0.085
0.009	0.025	0.034
0.036	0.189	0.224
0.032	0.176	0.208
0.204	1.052	1.256
l Ground Level (m)		6.244

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.055	0.126	0.181
0.060	0.498	0.558
0.013	0.077	0.089
0.009	0.029	0.038
0.036	0.208	0.244
0.032	0.195	0.226
0.204	1.132	1.336
l Ground Level (m)		6.664

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.055	0.103	0.158
0.060	0.433	0.493
0.013	0.064	0.077
0.009	0.018	0.027
0.036	0.156	0.192
0.032	0.145	0.177
0.204	0.919	1.123
l Ground Level (m)		5.577



esult for【+5.50m：Block-3(Container Terminal Area)】

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.134	0.492	0.626
0.017	0.078	0.095
0.015	0.021	0.036
0.040	0.140	0.180
0.034	0.127	0.161
0.241	0.858	1.099
l Ground Level (m)		4.901

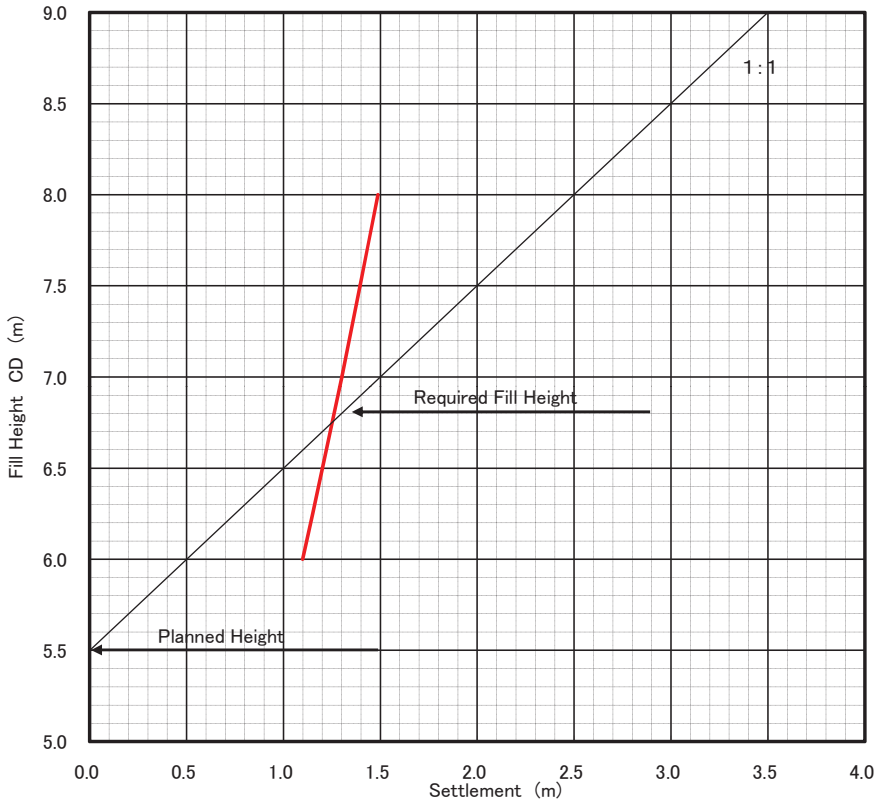
n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.134	0.534	0.668
0.017	0.086	0.103
0.015	0.029	0.044
0.040	0.164	0.204
0.034	0.149	0.183
0.241	0.961	1.202
l Ground Level (m)		5.298

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.134	0.574	0.708
0.017	0.093	0.110
0.015	0.036	0.052
0.040	0.187	0.227
0.034	0.170	0.204
0.241	1.060	1.301
l Ground Level (m)		5.699

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.134	0.612	0.746
0.017	0.100	0.117
0.015	0.044	0.059
0.040	0.209	0.249
0.034	0.191	0.225
0.241	1.156	1.396
l Ground Level (m)		6.104

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.134	0.648	0.782
0.017	0.107	0.124
0.015	0.051	0.066
0.040	0.231	0.271
0.034	0.211	0.245
0.241	1.247	1.488
l Ground Level (m)		6.512

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.134	0.558	0.692
0.017	0.090	0.107
0.015	0.033	0.049
0.040	0.178	0.218
0.034	0.162	0.196
0.241	1.021	1.262
l Ground Level (m)		5.538



esult for【+5.50m：Block-4(Container Terminal Area)】

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.058	0.056	0.113
0.106	0.391	0.497
0.026	0.139	0.165
0.045	0.194	0.239
0.035	0.162	0.197
0.270	0.942	1.212
l Ground Level (m)		4.788

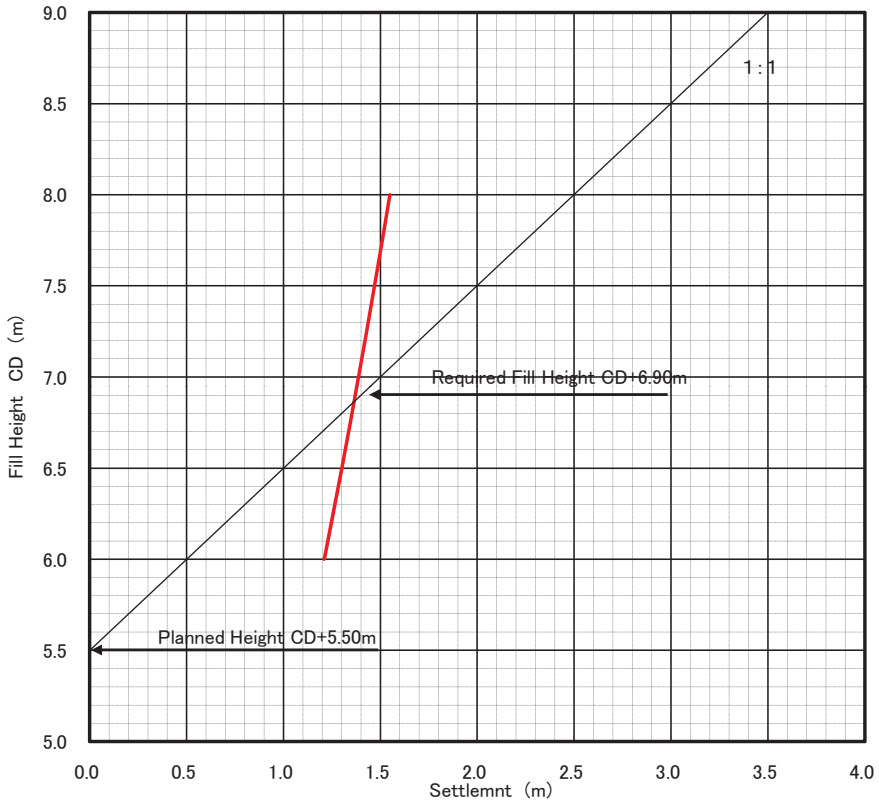
n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.058	0.061	0.119
0.106	0.419	0.525
0.026	0.150	0.176
0.045	0.218	0.263
0.035	0.183	0.218
0.270	1.031	1.301
l Ground Level (m)		5.199

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.058	0.067	0.125
0.106	0.446	0.552
0.026	0.160	0.187
0.045	0.242	0.287
0.035	0.203	0.238
0.270	1.117	1.387
l Ground Level (m)		5.613

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.058	0.072	0.130
0.106	0.471	0.577
0.026	0.171	0.197
0.045	0.264	0.309
0.035	0.222	0.257
0.270	1.200	1.470
l Ground Level (m)		6.030

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.058	0.077	0.135
0.106	0.495	0.601
0.026	0.180	0.207
0.045	0.286	0.331
0.035	0.241	0.276
0.270	1.280	1.549
l Ground Level (m)		6.451

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.058	0.066	0.123
0.106	0.440	0.546
0.026	0.158	0.185
0.045	0.237	0.282
0.035	0.199	0.234
0.270	1.100	1.370
l Ground Level (m)		5.530



esult for【+5.50m：Block-5(Container Terminal Area)】

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.039	0.054	0.093
0.077	0.341	0.418
0.026	0.120	0.147
0.034	0.130	0.165
0.031	0.123	0.154
0.207	0.769	0.976
l Ground Level (m)		5.024

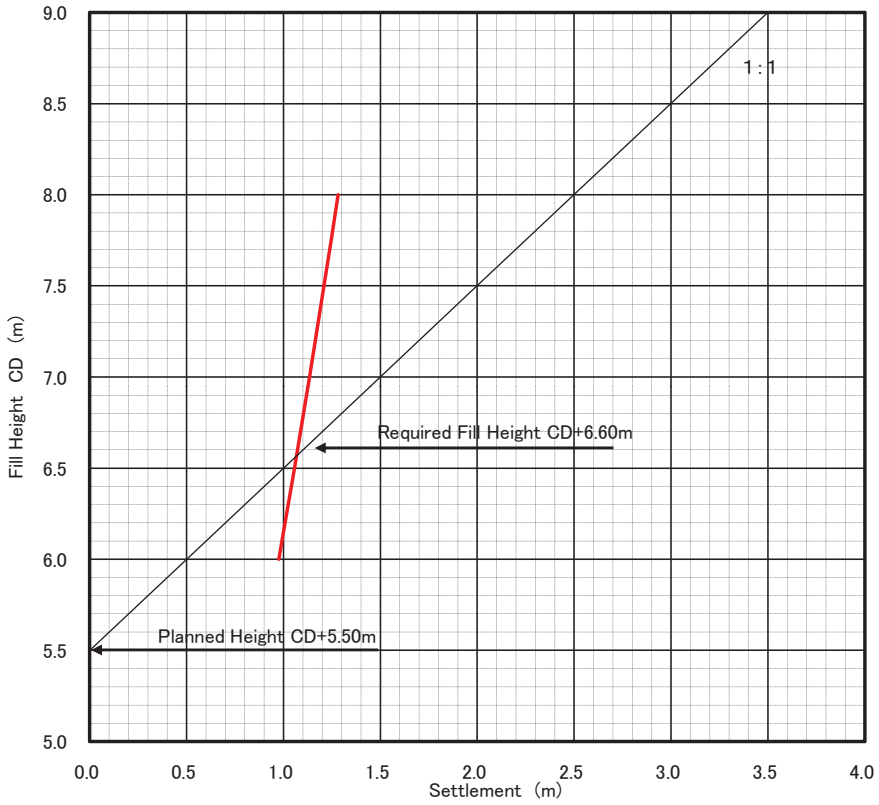
n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.039	0.060	0.099
0.077	0.367	0.444
0.026	0.131	0.157
0.034	0.150	0.184
0.031	0.142	0.173
0.207	0.850	1.057
l Ground Level (m)		5.443

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.039	0.066	0.104
0.077	0.391	0.468
0.026	0.142	0.168
0.034	0.169	0.204
0.031	0.160	0.191
0.207	0.928	1.135
l Ground Level (m)		5.865

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.039	0.071	0.110
0.077	0.414	0.491
0.026	0.151	0.178
0.034	0.188	0.222
0.031	0.178	0.209
0.207	1.003	1.210
l Ground Level (m)		6.290

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.039	0.076	0.115
0.077	0.437	0.514
0.026	0.161	0.187
0.034	0.206	0.240
0.031	0.196	0.226
0.207	1.075	1.282
l Ground Level (m)		6.718

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.039	0.061	0.100
0.077	0.372	0.449
0.026	0.133	0.160
0.034	0.154	0.188
0.031	0.146	0.176
0.207	0.866	1.073
l Ground Level (m)		5.527



esult for【+5.50m：Block-6(Container Terminal Area)】

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.087	0.458	0.545
0.011	0.009	0.020
0.029	0.082	0.111
0.027	0.079	0.106
0.153	0.628	0.782
l Ground Level (m)		5.218

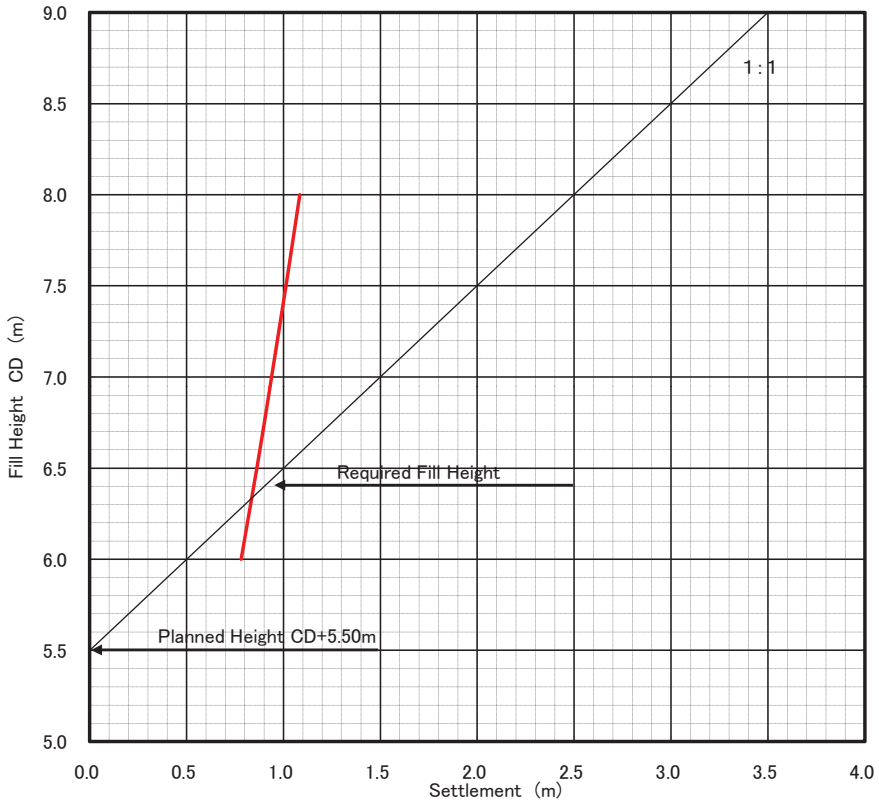
n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.087	0.497	0.584
0.011	0.015	0.026
0.029	0.100	0.129
0.027	0.097	0.124
0.153	0.709	0.862
l Ground Level (m)		5.638

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.087	0.534	0.620
0.011	0.021	0.032
0.029	0.117	0.146
0.027	0.114	0.141
0.153	0.786	0.940
l Ground Level (m)		6.060

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.087	0.569	0.655
0.011	0.027	0.038
0.029	0.134	0.163
0.027	0.131	0.158
0.153	0.861	1.014
l Ground Level (m)		6.486

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.087	0.602	0.689
0.011	0.032	0.043
0.029	0.151	0.179
0.027	0.147	0.174
0.153	0.932	1.085
l Ground Level (m)		6.915

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.087	0.489	0.576
0.011	0.014	0.025
0.029	0.096	0.125
0.027	0.094	0.120
0.153	0.693	0.846
l Ground Level (m)		5.554



esult for【+5.50m：Block-7(Container Terminal Area)】

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.048	0.065	0.113
0.072	0.408	0.480
0.023	0.100	0.124
0.018	0.019	0.037
0.036	0.114	0.150
0.029	0.098	0.127
0.226	0.805	1.031
l Ground Level (m)		4.969

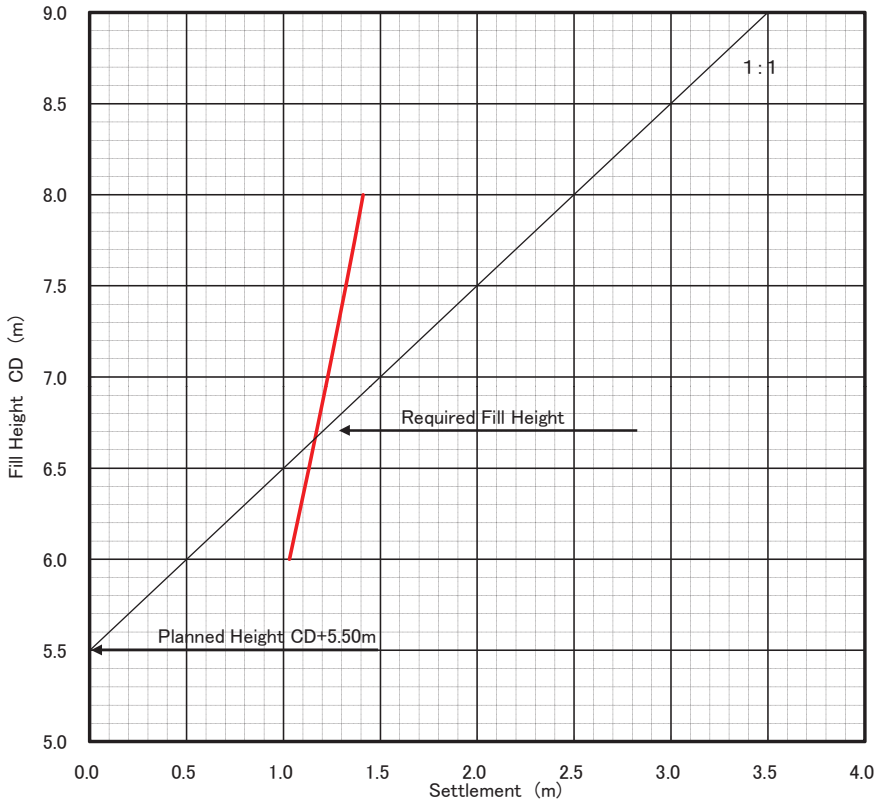
n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.048	0.073	0.121
0.072	0.440	0.512
0.023	0.111	0.135
0.018	0.029	0.047
0.036	0.136	0.172
0.029	0.117	0.146
0.226	0.906	1.132
l Ground Level (m)		5.368

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.048	0.081	0.129
0.072	0.470	0.542
0.023	0.121	0.145
0.018	0.038	0.056
0.036	0.157	0.193
0.029	0.135	0.164
0.226	1.003	1.229
l Ground Level (m)		5.771

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.048	0.088	0.136
0.072	0.499	0.571
0.023	0.131	0.155
0.018	0.047	0.065
0.036	0.178	0.214
0.029	0.153	0.182
0.226	1.096	1.322
l Ground Level (m)		6.178

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.048	0.095	0.143
0.072	0.526	0.598
0.023	0.141	0.164
0.018	0.055	0.073
0.036	0.198	0.234
0.029	0.170	0.200
0.226	1.186	1.412
l Ground Level (m)		6.588

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.048	0.076	0.124
0.072	0.452	0.524
0.023	0.115	0.139
0.018	0.033	0.051
0.036	0.145	0.181
0.029	0.124	0.153
0.226	0.945	1.171
l Ground Level (m)		5.529



esult for【+5.50m：Block-8(Container Terminal Area)】

n. Conso. Settle. Sf		Sub
O.C.	N.C.	Total
(m)	(m)	(m)
0.058	0.029	0.087
0.106	0.266	0.372
0.033	0.110	0.142
0.022	0.003	0.025
0.036	0.077	0.113
0.027	0.060	0.087
0.281	0.544	0.826
l Ground Level (m)		5.174

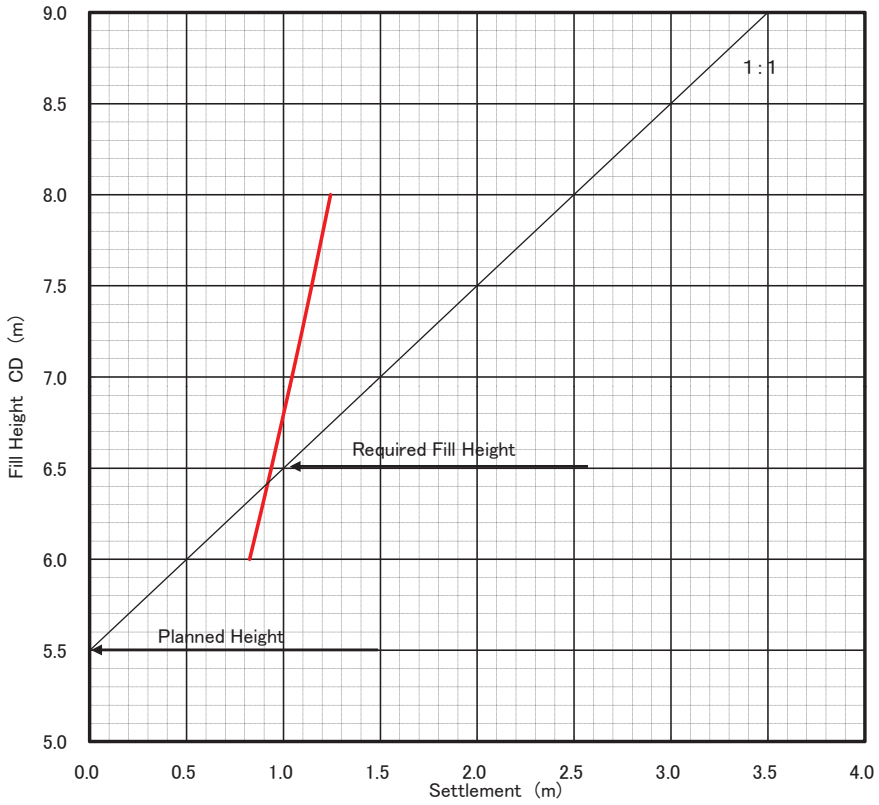
n. Conso. Settle. Sf		Sub
O.C.	N.C.	Total
(m)	(m)	(m)
0.058	0.037	0.094
0.106	0.301	0.407
0.033	0.125	0.158
0.022	0.015	0.037
0.036	0.100	0.137
0.027	0.078	0.105
0.281	0.656	0.938
l Ground Level (m)		5.562

n. Conso. Settle. Sf		Sub
O.C.	N.C.	Total
(m)	(m)	(m)
0.058	0.044	0.101
0.106	0.334	0.440
0.033	0.140	0.172
0.022	0.027	0.049
0.036	0.123	0.159
0.027	0.096	0.123
0.281	0.763	1.044
l Ground Level (m)		5.956

n. Conso. Settle. Sf		Sub
O.C.	N.C.	Total
(m)	(m)	(m)
0.058	0.050	0.108
0.106	0.365	0.471
0.033	0.154	0.186
0.022	0.038	0.060
0.036	0.144	0.181
0.027	0.113	0.140
0.281	0.864	1.146
l Ground Level (m)		6.354

n. Conso. Settle. Sf		Sub
O.C.	N.C.	Total
(m)	(m)	(m)
0.058	0.056	0.114
0.106	0.394	0.500
0.033	0.167	0.200
0.022	0.049	0.070
0.036	0.166	0.202
0.027	0.130	0.157
0.281	0.962	1.243
l Ground Level (m)		6.757

n. Conso. Settle. Sf		Sub
O.C.	N.C.	Total
(m)	(m)	(m)
0.058	0.037	0.094
0.106	0.301	0.407
0.033	0.125	0.158
0.022	0.015	0.037
0.036	0.100	0.137
0.027	0.078	0.105
0.281	0.656	0.938
l Ground Level (m)		5.562



esult for【+5.50m：Block-9(Container Terminal Area)】

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.028	0.028	0.056
0.093	0.320	0.412
0.034	0.134	0.167
0.009	0.007	0.016
0.038	0.107	0.145
0.031	0.091	0.121
0.233	0.686	0.919
l Ground Level (m)		5.081

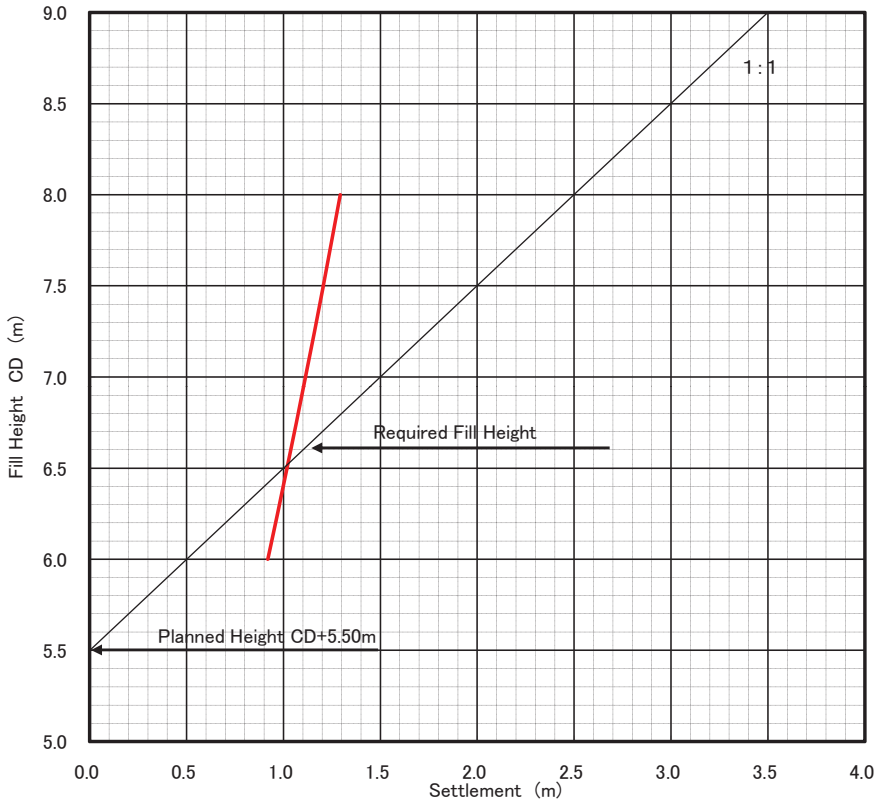
n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.028	0.032	0.061
0.093	0.351	0.444
0.034	0.149	0.183
0.009	0.012	0.021
0.038	0.130	0.169
0.031	0.111	0.141
0.233	0.786	1.019
l Ground Level (m)		5.481

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.028	0.037	0.065
0.093	0.381	0.474
0.034	0.164	0.198
0.009	0.017	0.026
0.038	0.153	0.191
0.031	0.130	0.161
0.233	0.882	1.115
l Ground Level (m)		5.885

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.028	0.041	0.069
0.093	0.410	0.502
0.034	0.178	0.212
0.009	0.021	0.031
0.038	0.175	0.213
0.031	0.149	0.180
0.233	0.973	1.206
l Ground Level (m)		6.294

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.028	0.044	0.072
0.093	0.437	0.529
0.034	0.192	0.225
0.009	0.026	0.035
0.038	0.196	0.234
0.031	0.167	0.198
0.233	1.061	1.294
l Ground Level (m)		6.706

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.028	0.033	0.061
0.093	0.358	0.450
0.034	0.152	0.186
0.009	0.013	0.022
0.038	0.135	0.173
0.031	0.114	0.145
0.233	0.805	1.038
l Ground Level (m)		5.562



esult for【+5.50m：Block-10(Container Terminal Area)】

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.062	0.305	0.366
0.020	0.053	0.073
0.035	0.036	0.071
0.029	0.030	0.059
0.146	0.423	0.569
l Ground Level (m)		5.431

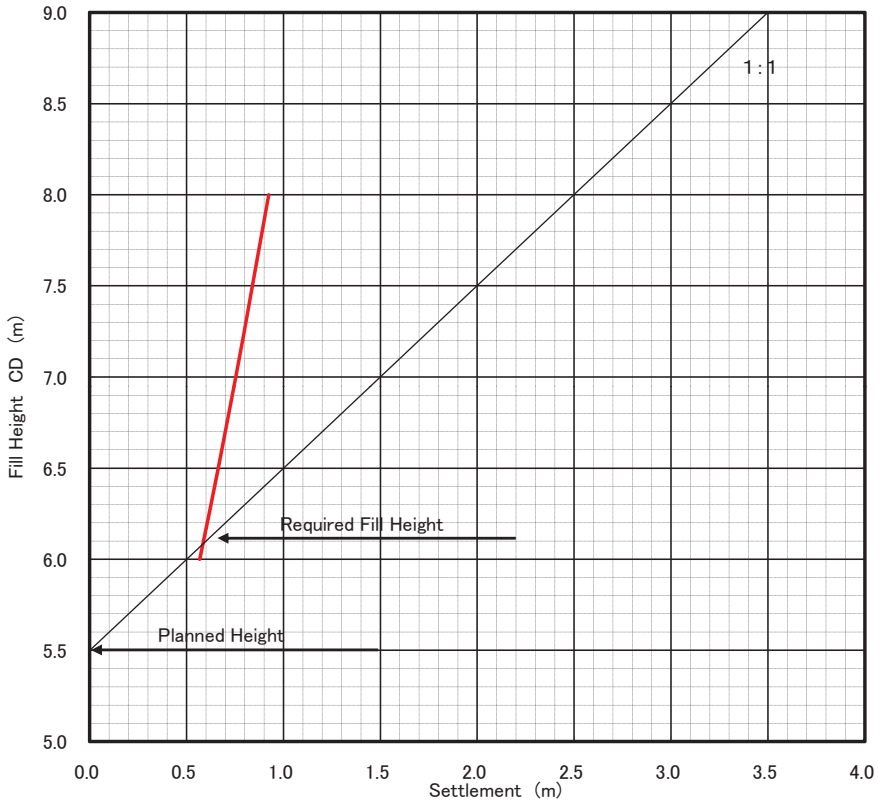
n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.062	0.342	0.404
0.020	0.063	0.084
0.035	0.061	0.096
0.029	0.051	0.080
0.146	0.518	0.664
l Ground Level (m)		5.836

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.062	0.378	0.440
0.020	0.074	0.094
0.035	0.085	0.120
0.029	0.072	0.101
0.146	0.608	0.754
l Ground Level (m)		6.246

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.062	0.411	0.473
0.020	0.084	0.104
0.035	0.108	0.143
0.029	0.092	0.121
0.146	0.695	0.841
l Ground Level (m)		6.659

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.062	0.443	0.505
0.020	0.093	0.113
0.035	0.130	0.166
0.029	0.111	0.140
0.146	0.778	0.924
l Ground Level (m)		7.076

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.062	0.312	0.374
0.020	0.055	0.075
0.035	0.041	0.076
0.029	0.034	0.063
0.146	0.442	0.588
l Ground Level (m)		5.512



esult for【+5.50m：Block-11(Container Terminal Area)】

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.085	0.350	0.435
0.028	0.091	0.119
0.012	0.000	0.012
0.050	0.088	0.138
0.038	0.071	0.108
0.213	0.599	0.812
l Ground Level (m)		5.188

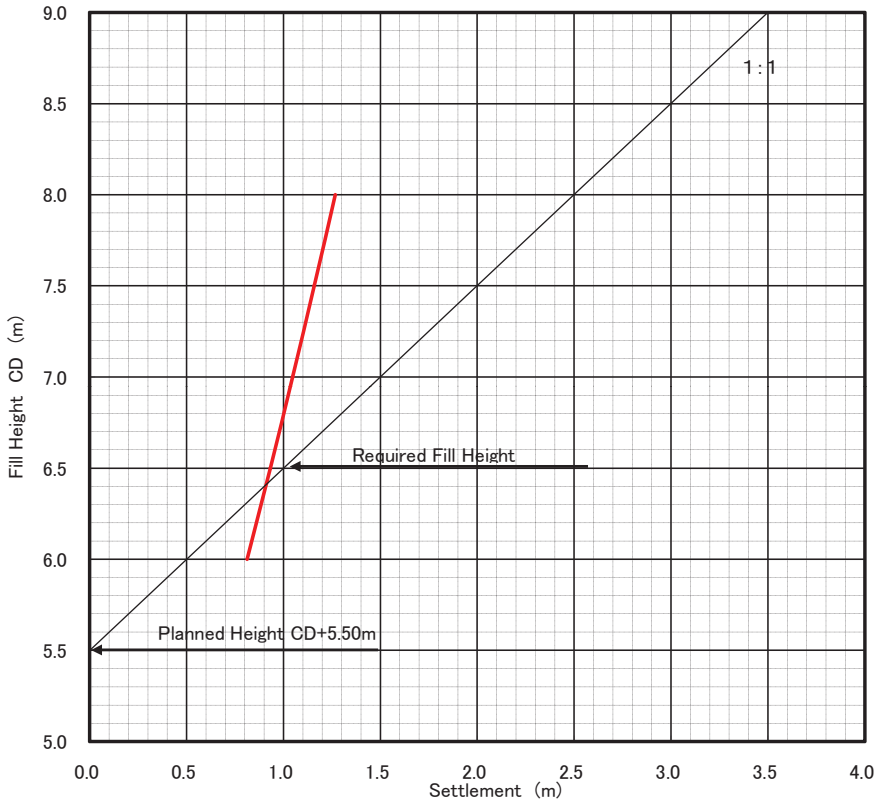
n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.085	0.390	0.475
0.028	0.106	0.134
0.012	0.005	0.016
0.050	0.121	0.171
0.038	0.097	0.135
0.213	0.719	0.932
l Ground Level (m)		5.568

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.085	0.428	0.513
0.028	0.120	0.148
0.012	0.011	0.023
0.050	0.153	0.203
0.038	0.124	0.161
0.213	0.836	1.048
l Ground Level (m)		5.952

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.085	0.464	0.549
0.028	0.133	0.161
0.012	0.018	0.029
0.050	0.184	0.234
0.038	0.149	0.187
0.213	0.947	1.160
l Ground Level (m)		6.340

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.085	0.497	0.583
0.028	0.146	0.174
0.012	0.024	0.035
0.050	0.214	0.264
0.038	0.174	0.212
0.213	1.055	1.267
l Ground Level (m)		6.733

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.085	0.390	0.475
0.028	0.106	0.134
0.012	0.005	0.016
0.050	0.121	0.171
0.038	0.097	0.135
0.213	0.719	0.932
l Ground Level (m)		5.568



esult for【+5.50m：Block-12(Container Terminal Area)】

n. Conso. Settle. Sf		Sub
O.C.	N.C.	Total
(m)	(m)	(m)
0.077	0.054	0.131
0.068	0.194	0.261
0.033	0.119	0.152
0.031	0.067	0.099
0.024	0.053	0.076
0.233	0.486	0.720
l Ground Level (m)		5.280

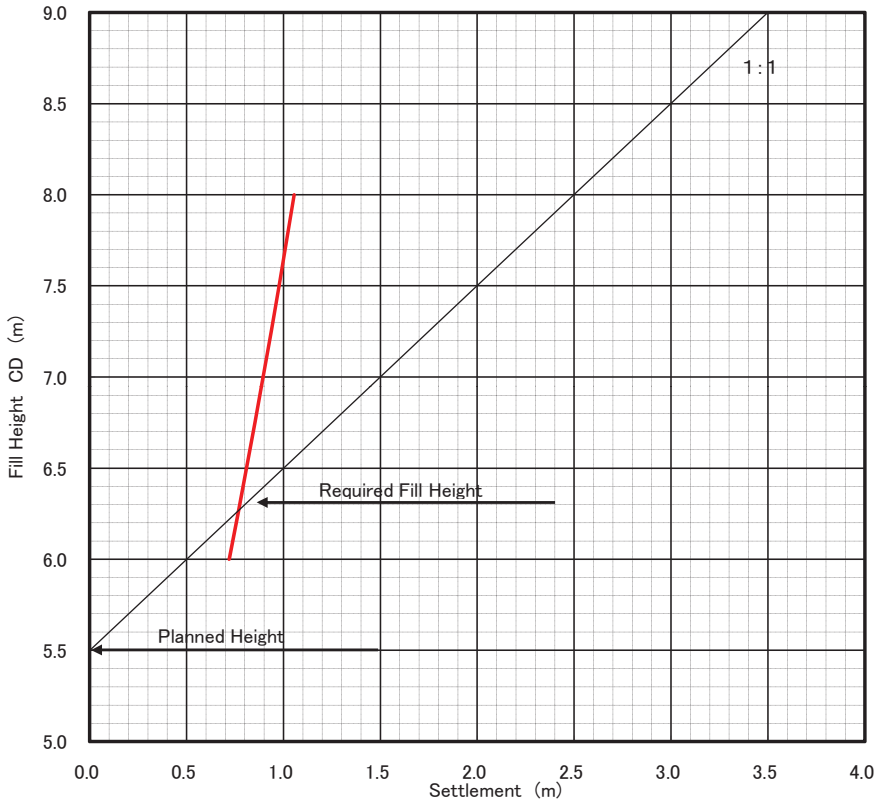
n. Conso. Settle. Sf		Sub
O.C.	N.C.	Total
(m)	(m)	(m)
0.077	0.066	0.143
0.068	0.218	0.286
0.033	0.136	0.169
0.031	0.088	0.119
0.024	0.069	0.093
0.233	0.576	0.810
l Ground Level (m)		5.690

n. Conso. Settle. Sf		Sub
O.C.	N.C.	Total
(m)	(m)	(m)
0.077	0.078	0.155
0.068	0.241	0.308
0.033	0.152	0.185
0.031	0.107	0.139
0.024	0.085	0.108
0.233	0.662	0.896
l Ground Level (m)		6.104

n. Conso. Settle. Sf		Sub
O.C.	N.C.	Total
(m)	(m)	(m)
0.077	0.088	0.165
0.068	0.262	0.329
0.033	0.167	0.201
0.031	0.127	0.158
0.024	0.100	0.124
0.233	0.744	0.977
l Ground Level (m)		6.523

n. Conso. Settle. Sf		Sub
O.C.	N.C.	Total
(m)	(m)	(m)
0.077	0.098	0.175
0.068	0.282	0.350
0.033	0.182	0.216
0.031	0.145	0.177
0.024	0.115	0.139
0.233	0.822	1.056
l Ground Level (m)		6.944

n. Conso. Settle. Sf		Sub
O.C.	N.C.	Total
(m)	(m)	(m)
0.077	0.061	0.139
0.068	0.208	0.276
0.033	0.129	0.162
0.031	0.080	0.111
0.024	0.062	0.086
0.233	0.541	0.774
l Ground Level (m)		5.526



Result for【+5.50m : Block-13(Access Road Area)】

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.110	0.342	0.452
0.042	0.173	0.215
0.028	0.081	0.109
0.026	0.079	0.105
0.207	0.675	0.882
l Ground Level (m)		5.118

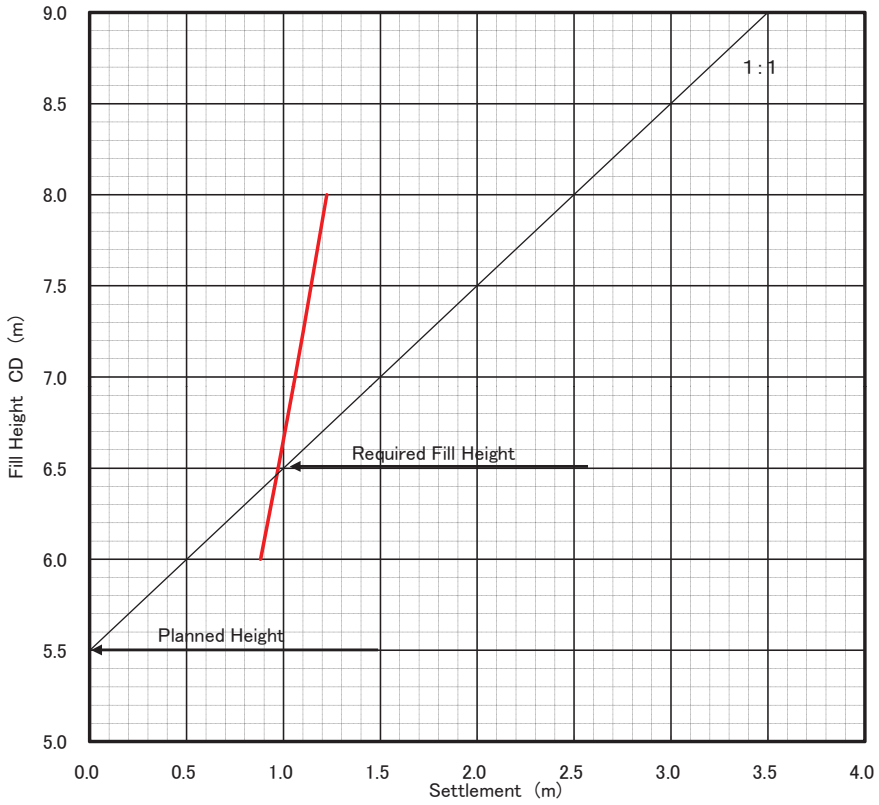
n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.110	0.378	0.488
0.042	0.193	0.235
0.028	0.099	0.127
0.026	0.096	0.123
0.207	0.766	0.973
l Ground Level (m)		5.527

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.110	0.411	0.521
0.042	0.212	0.254
0.028	0.116	0.144
0.026	0.113	0.139
0.207	0.853	1.060
l Ground Level (m)		5.940

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.110	0.443	0.553
0.042	0.231	0.273
0.028	0.133	0.161
0.026	0.129	0.156
0.207	0.936	1.143
l Ground Level (m)		6.357

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.110	0.473	0.583
0.042	0.249	0.291
0.028	0.149	0.177
0.026	0.146	0.172
0.207	1.016	1.223
l Ground Level (m)		6.777

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.110	0.378	0.488
0.042	0.193	0.235
0.028	0.099	0.127
0.026	0.096	0.123
0.207	0.766	0.973
l Ground Level (m)		5.527



Result for【+5.50m : Block-14(Access Road Area)】

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.101	0.405	0.507
0.022	0.000	0.022
0.049	0.085	0.134
0.035	0.065	0.100
0.207	0.555	0.763
l Ground Level (m)		5.237

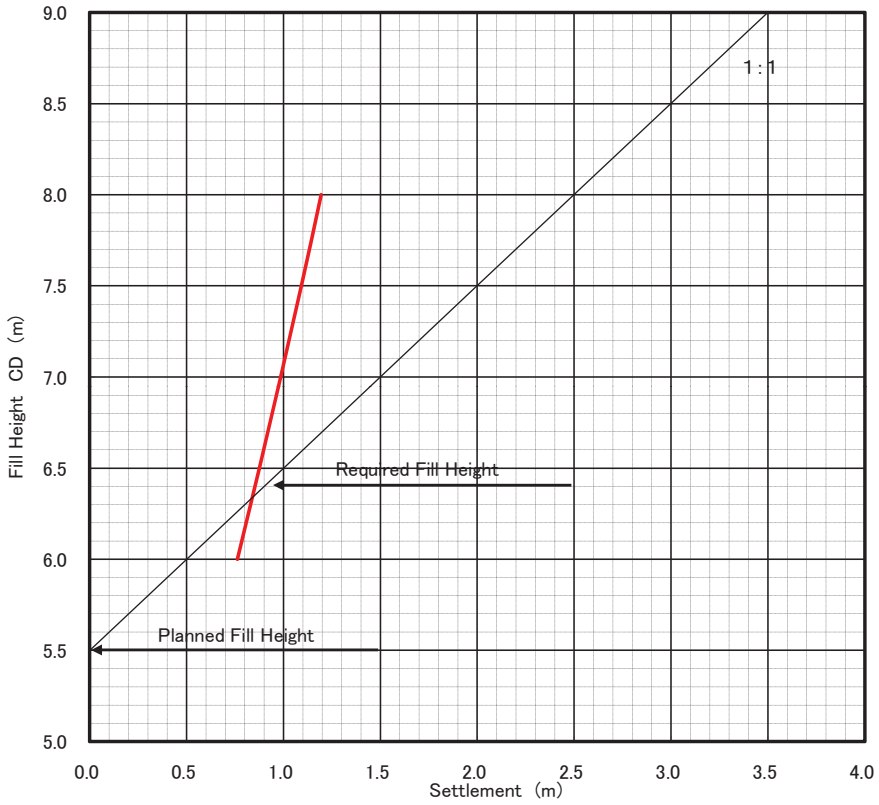
n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.101	0.452	0.554
0.022	0.009	0.031
0.049	0.117	0.166
0.035	0.089	0.124
0.207	0.668	0.875
l Ground Level (m)		5.625

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.101	0.497	0.598
0.022	0.021	0.043
0.049	0.148	0.197
0.035	0.113	0.148
0.207	0.779	0.987
l Ground Level (m)		6.013

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.101	0.539	0.640
0.022	0.033	0.055
0.049	0.178	0.227
0.035	0.136	0.171
0.207	0.886	1.093
l Ground Level (m)		6.407

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.101	0.578	0.679
0.022	0.044	0.066
0.049	0.207	0.256
0.035	0.159	0.194
0.207	0.988	1.195
l Ground Level (m)		6.805

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.101	0.443	0.545
0.022	0.006	0.029
0.049	0.111	0.160
0.035	0.084	0.119
0.207	0.645	0.853
l Ground Level (m)		5.547



Result for【+5.50m : Block-14(Access Road Area)】

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.042	0.062	0.104
0.040	0.245	0.285
0.023	0.067	0.090
0.006	0.000	0.006
0.057	0.078	0.135
0.044	0.064	0.108
0.212	0.517	0.729
l Ground Level (m)		5.271

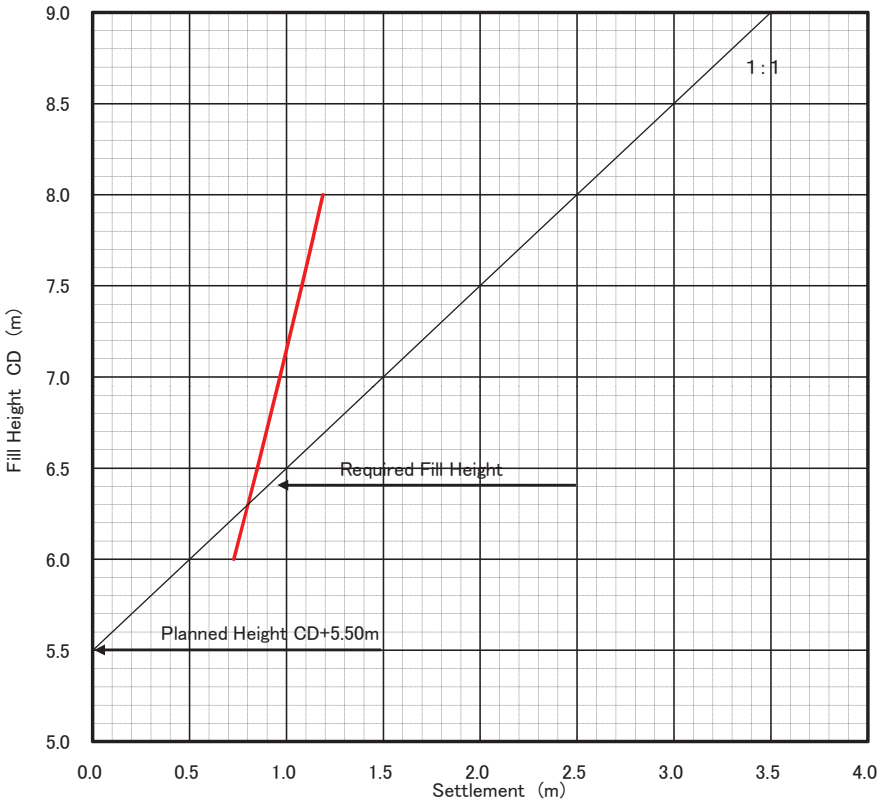
n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.042	0.074	0.116
0.040	0.271	0.311
0.023	0.079	0.102
0.006	0.001	0.007
0.057	0.116	0.173
0.044	0.096	0.140
0.212	0.637	0.849
l Ground Level (m)		5.651

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.042	0.085	0.126
0.040	0.296	0.336
0.023	0.091	0.114
0.006	0.004	0.010
0.057	0.153	0.210
0.044	0.126	0.170
0.212	0.755	0.967
l Ground Level (m)		6.033

n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.042	0.095	0.137
0.040	0.319	0.359
0.023	0.102	0.125
0.006	0.007	0.014
0.057	0.188	0.246
0.044	0.156	0.200
0.212	0.868	1.080
l Ground Level (m)		6.420

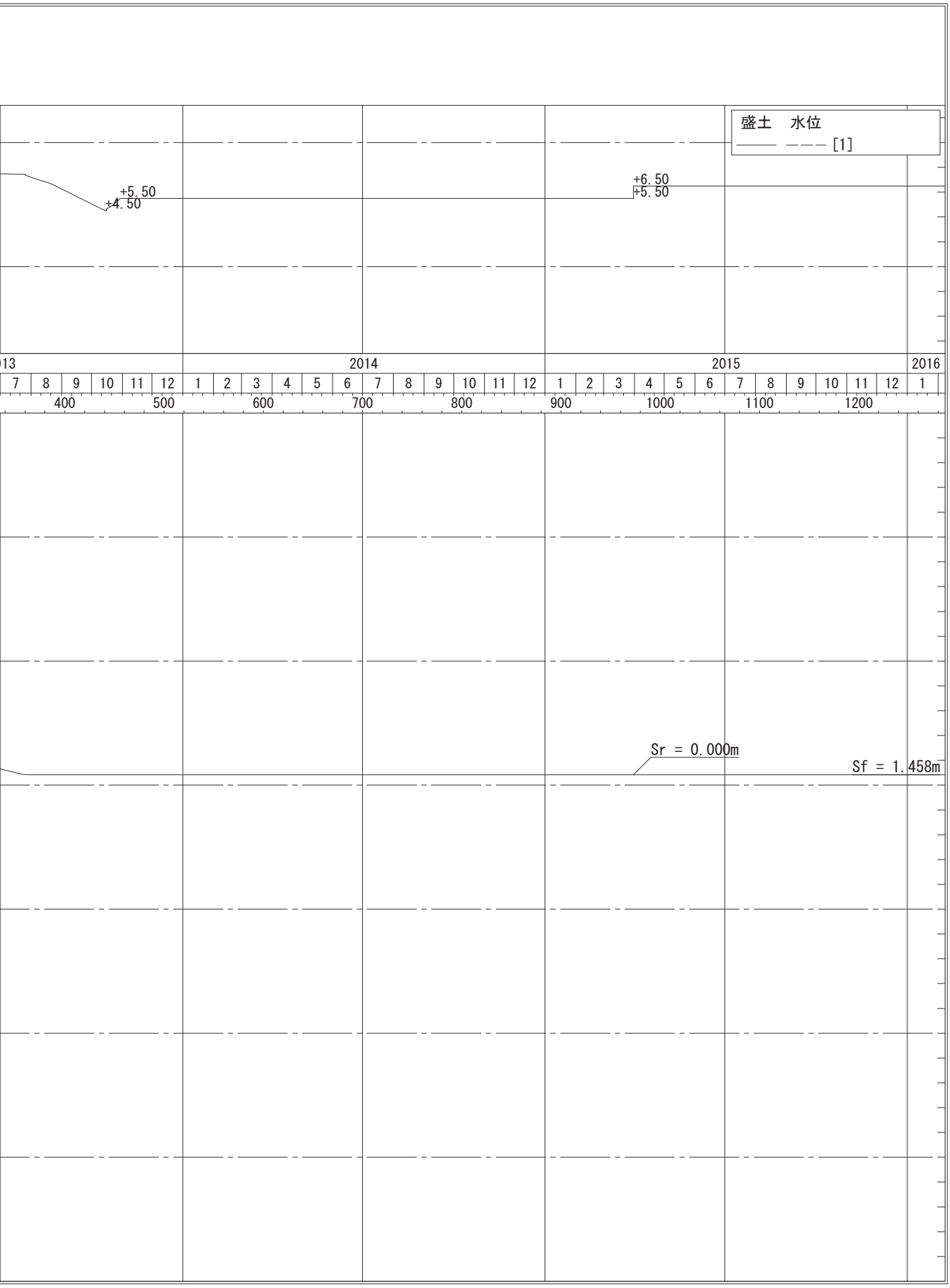
n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.042	0.104	0.146
0.040	0.341	0.381
0.023	0.112	0.135
0.006	0.011	0.017
0.057	0.223	0.280
0.044	0.185	0.229
0.212	0.977	1.189
l Ground Level (m)		6.811

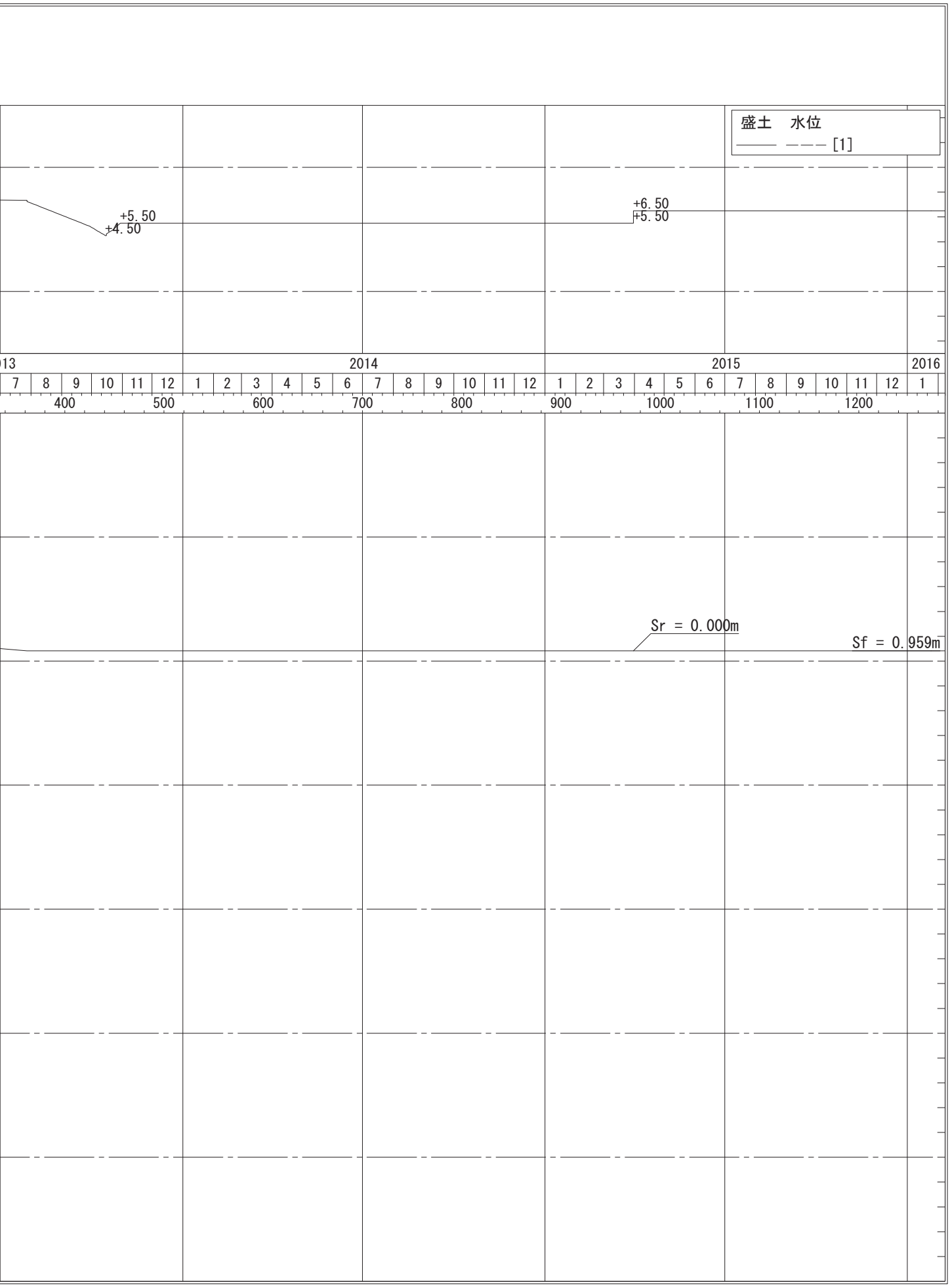
n. Conso. Settle. Sf		Sub
O.C. (m)	N.C. (m)	Total (m)
0.042	0.072	0.113
0.040	0.266	0.306
0.023	0.077	0.100
0.006	0.000	0.006
0.057	0.109	0.166
0.044	0.089	0.133
0.212	0.613	0.825
l Ground Level (m)		5.575

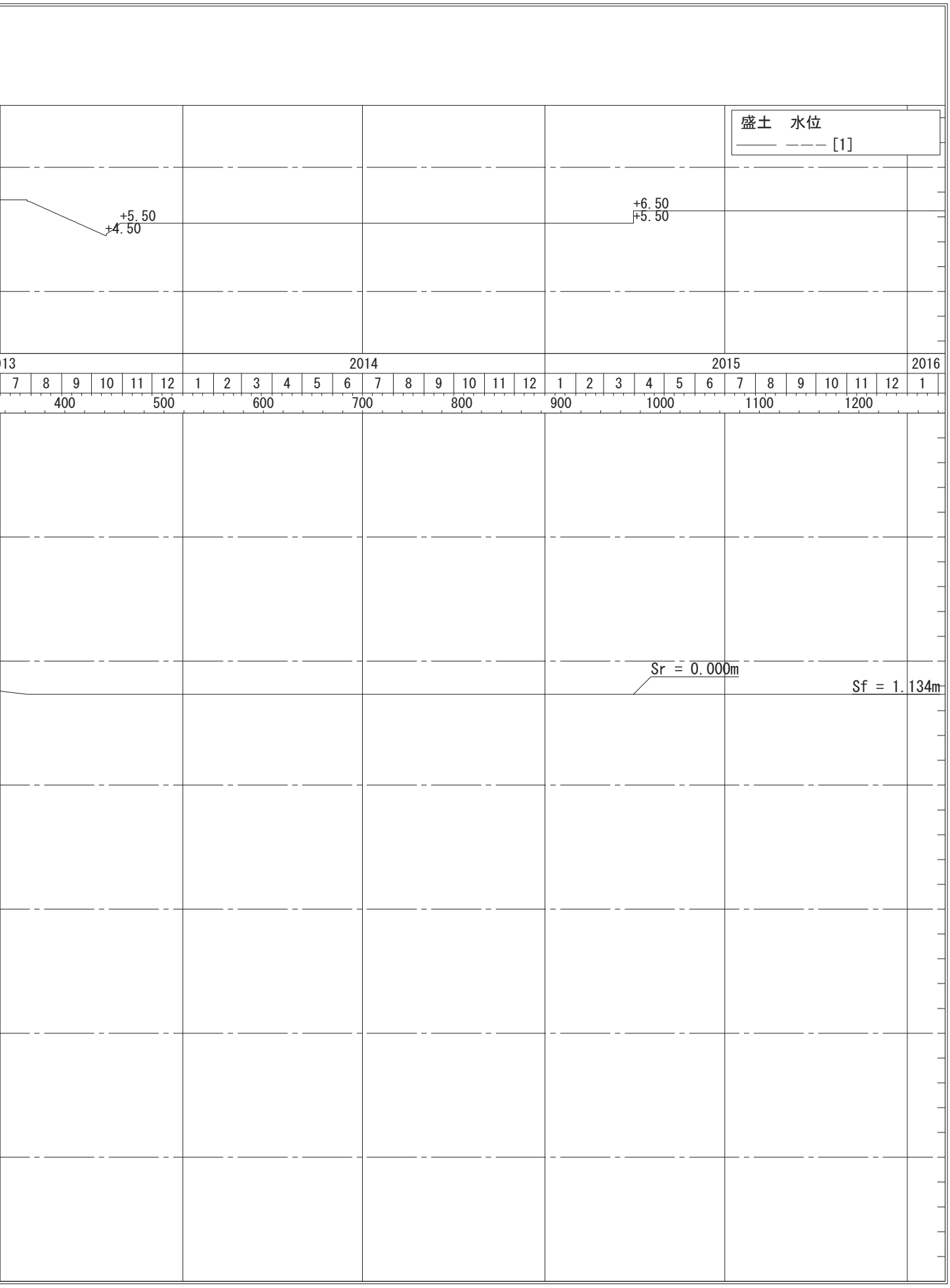


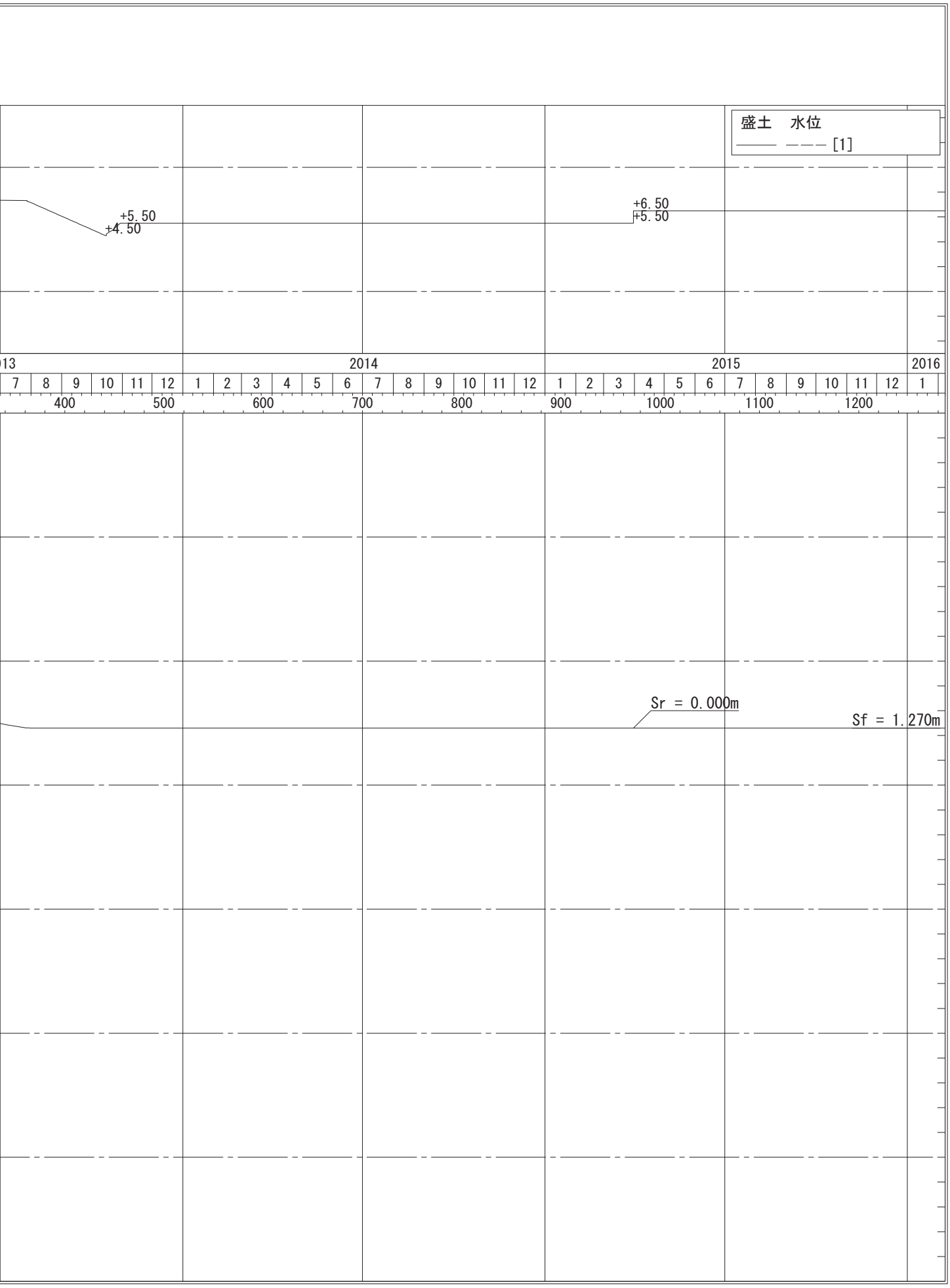
Result for【+5.50m：Block-16(Access Road Area)】

2) Settlement-Time Curves with PVD for Reclamation Area
(Block 1 to 16)


盛土　水位
[1]
+5.50
+4.50
+6.50
+5.50
13
2014
2015
2016
7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1
400
500
600
700
800
900
1000
1100
1200
Sr = 0.000m
Sf = 1.458m


盛土　水位
[1]
+5.50
+4.50
+6.50
+5.50
2013
2014
2015
2016
7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1
400
500
600
700
800
900
1000
1100
1200
Sr = 0.000m
Sf = 0.959m


盛土　水位
[1]
+5.50
+4.50
+6.50
+5.50
13
2014
2015
2016
7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1
400
500
600
700
800
900
1000
1100
1200
Sr = 0.000m
Sf = 1.134m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+5.50
013
2014
2015
2016
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700
800
900
1000
1100
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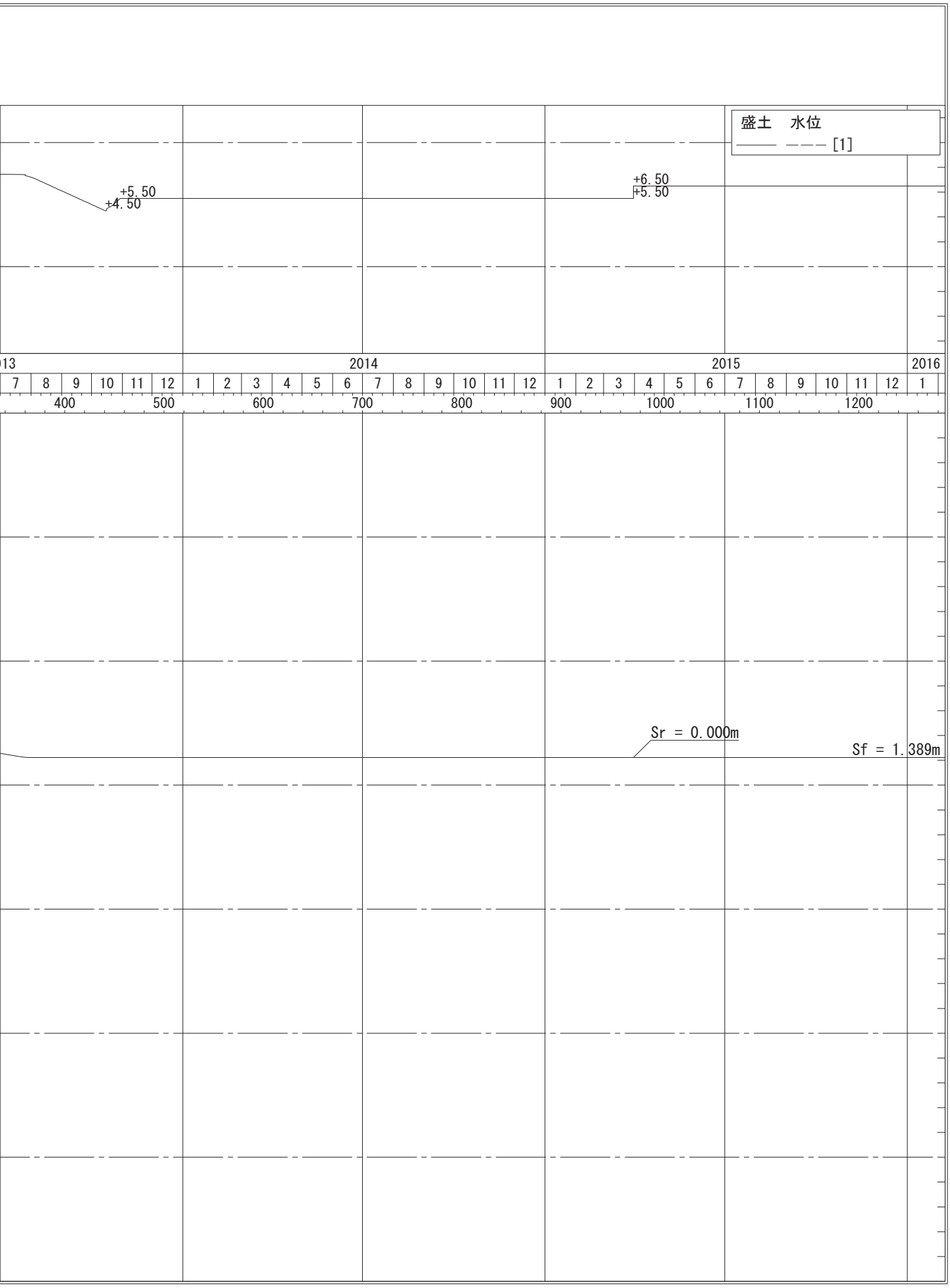
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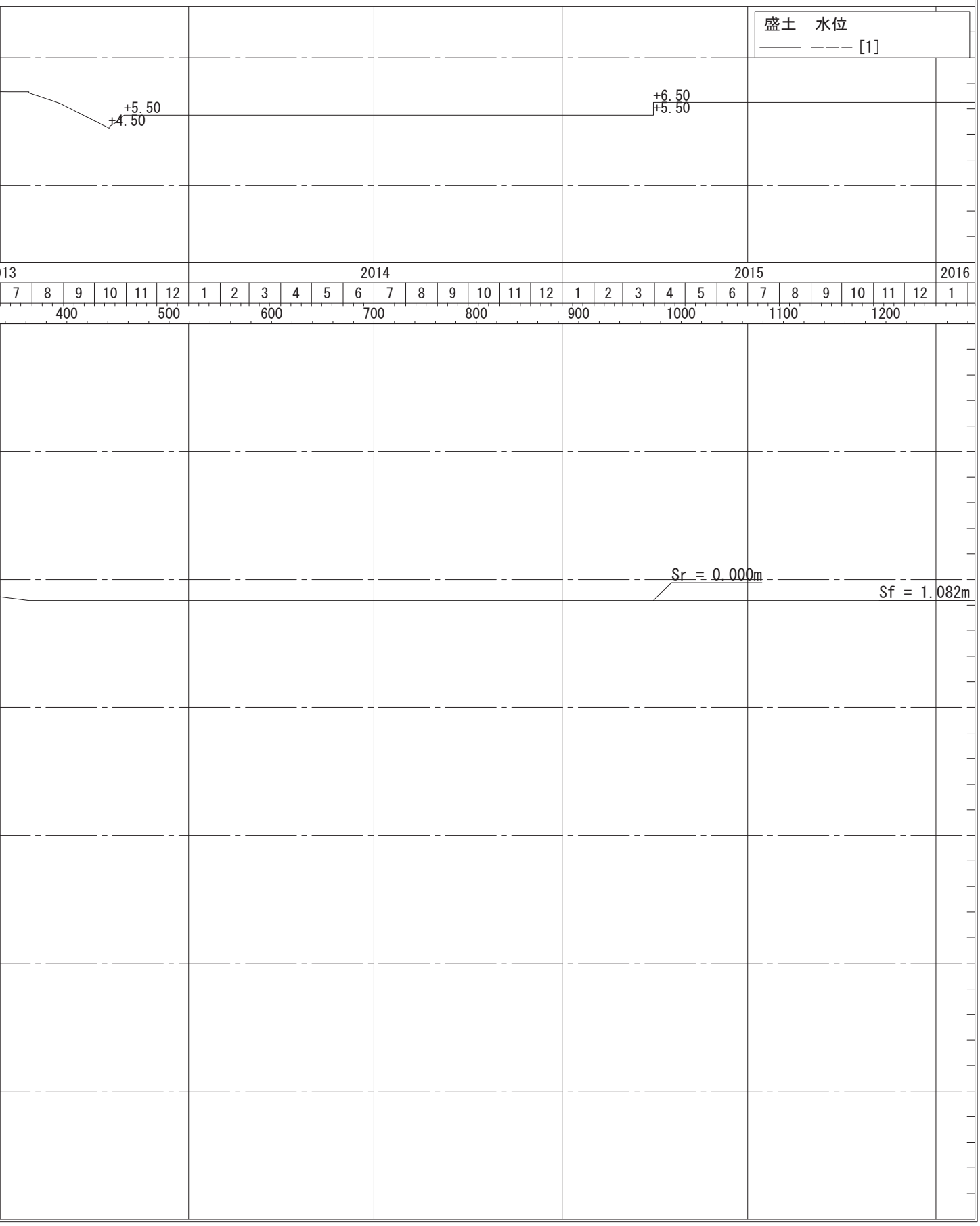
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2014
2015
2016
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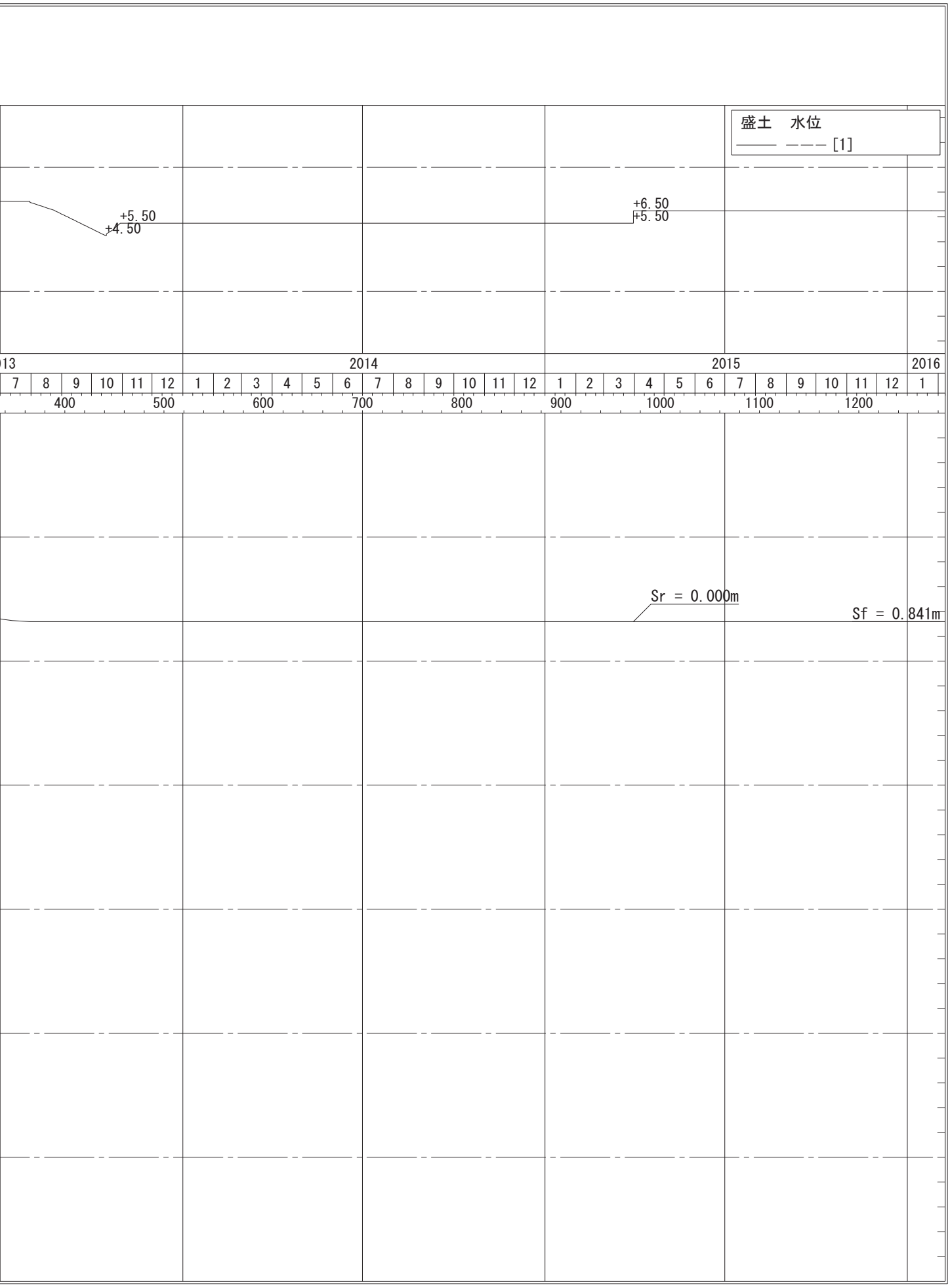
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2015
2016
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800
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1000
1100
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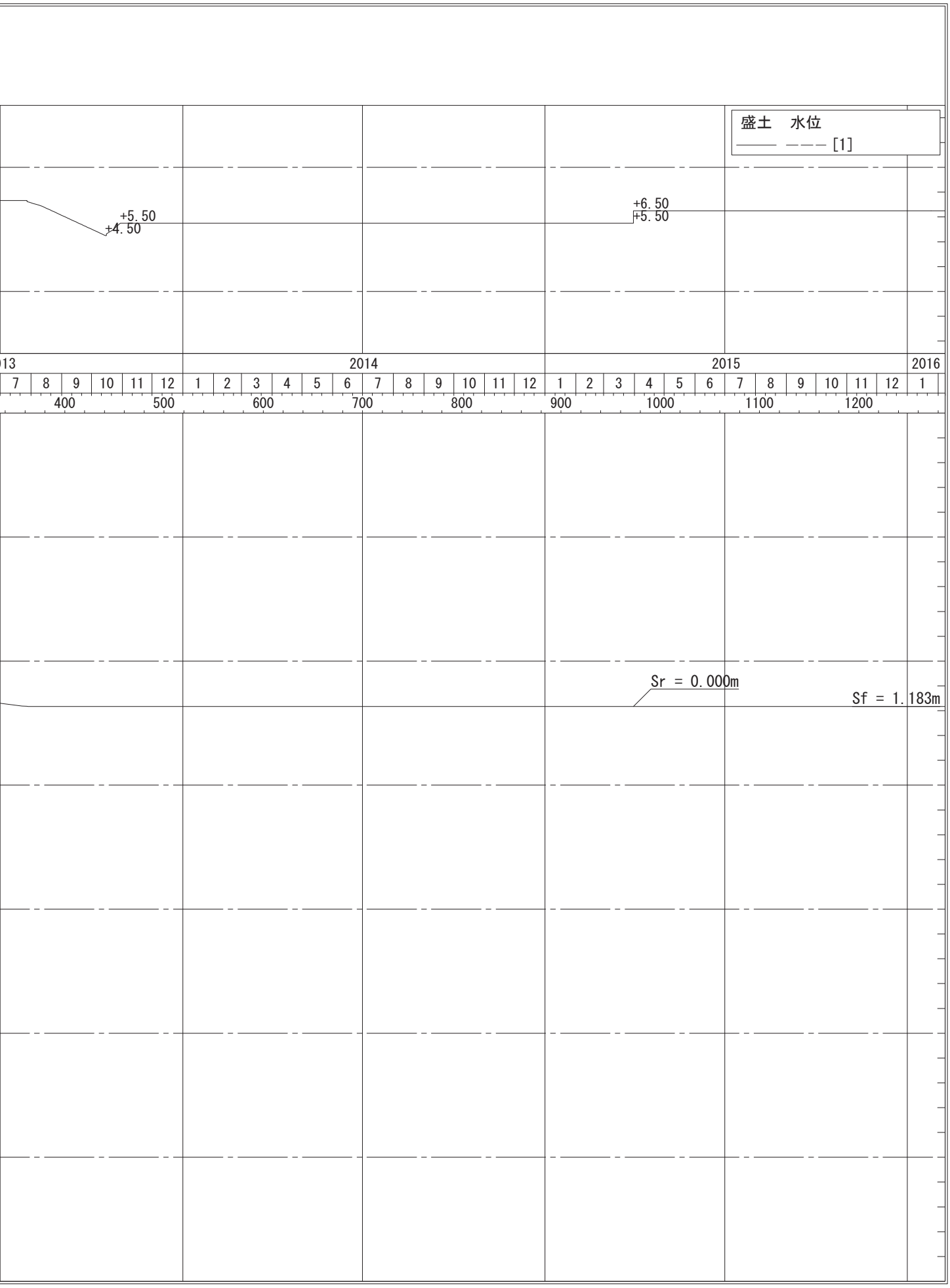
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2015
2016
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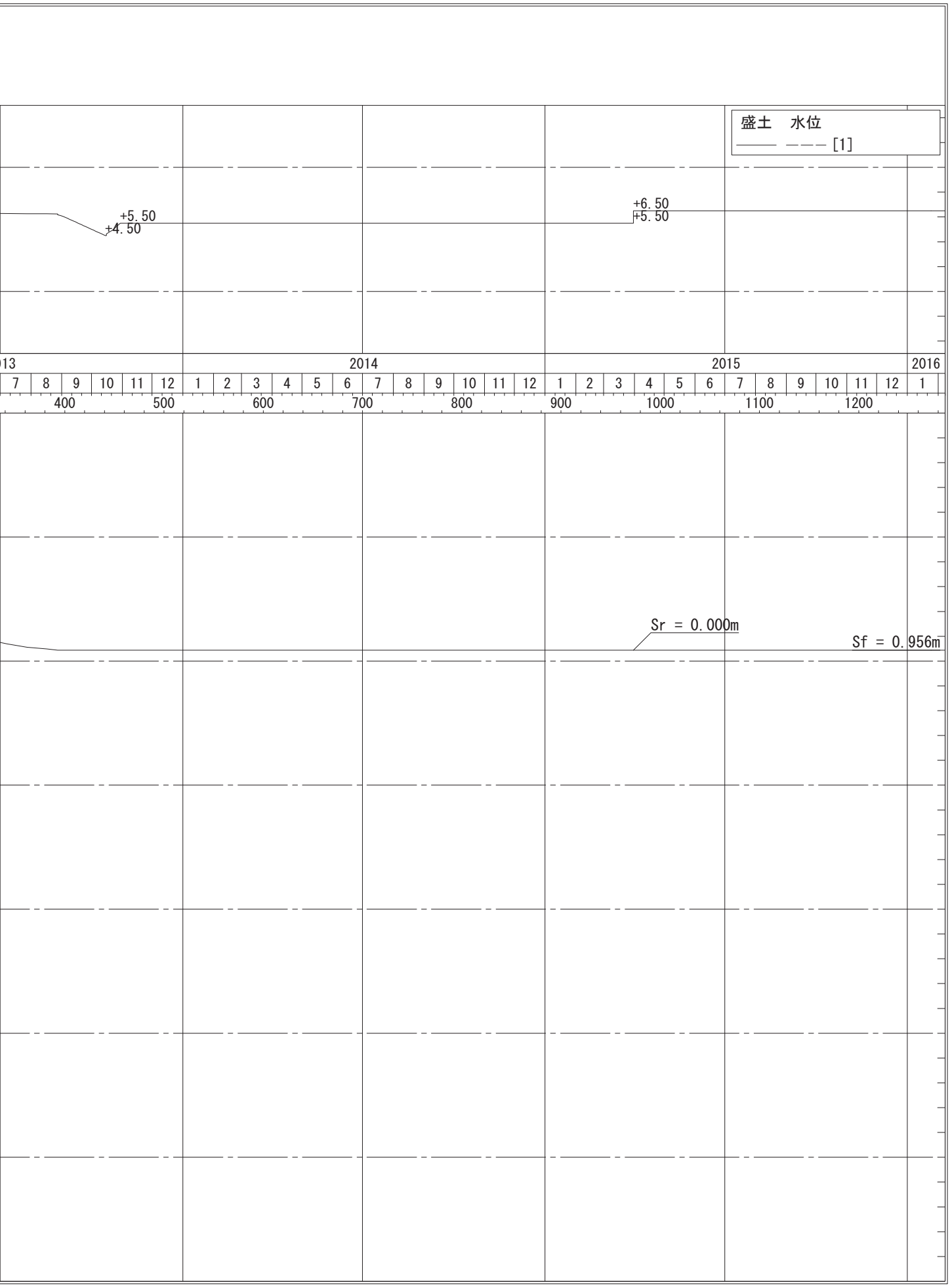
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2016
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700
800
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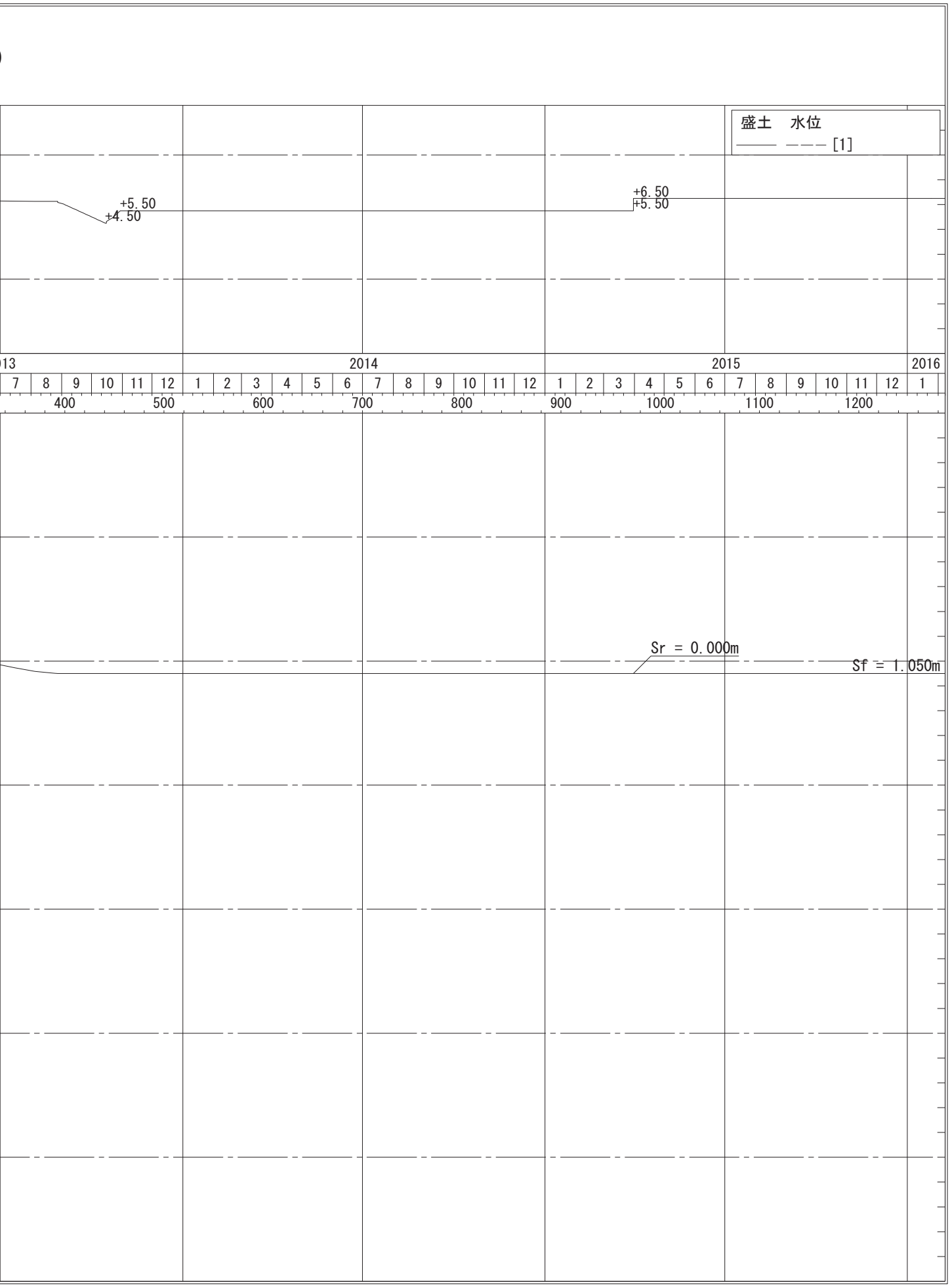
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2014
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2016
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600
700
800
900
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1100
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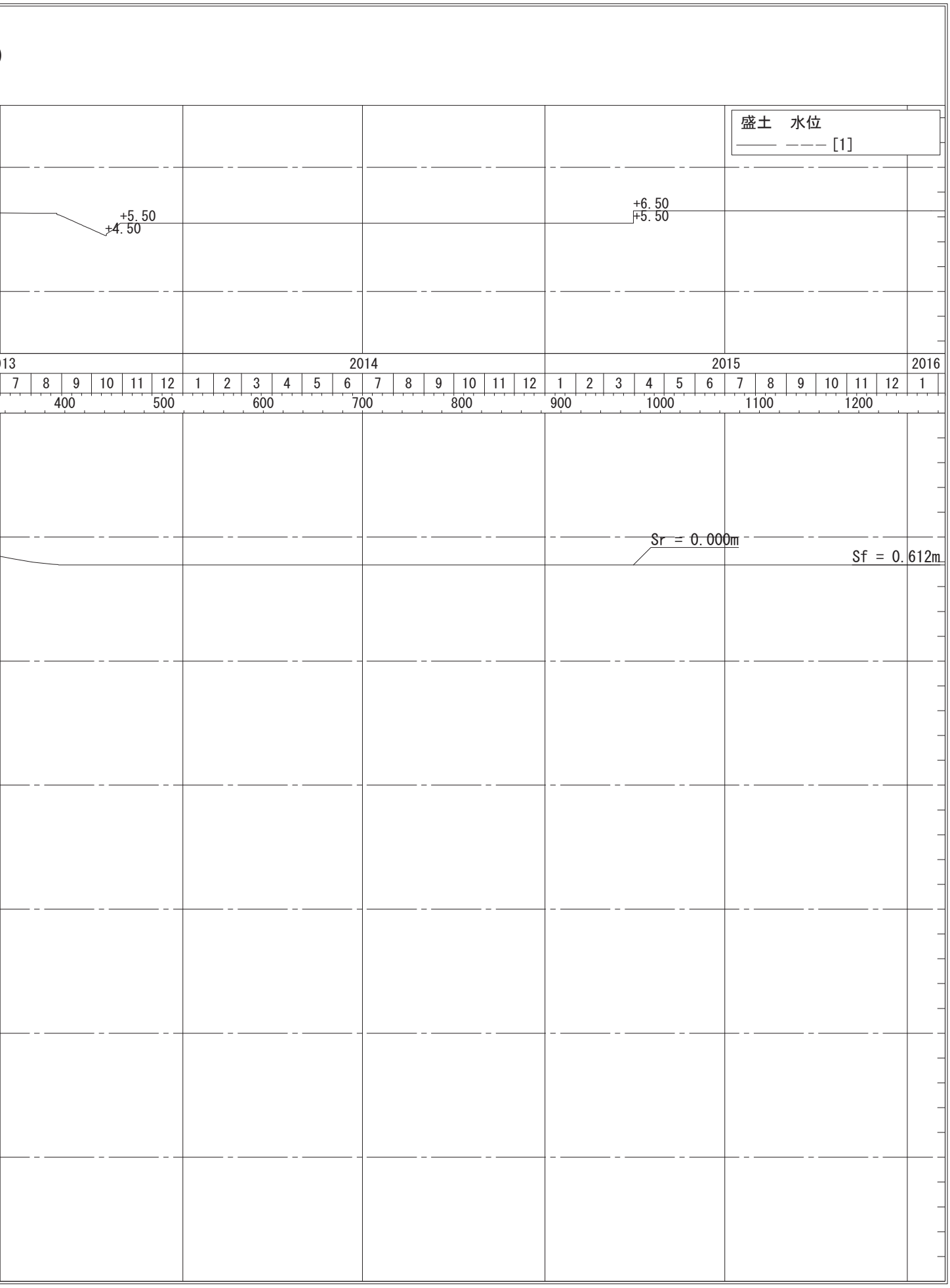
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2015
2016
7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1
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600
700
800
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1000
1100
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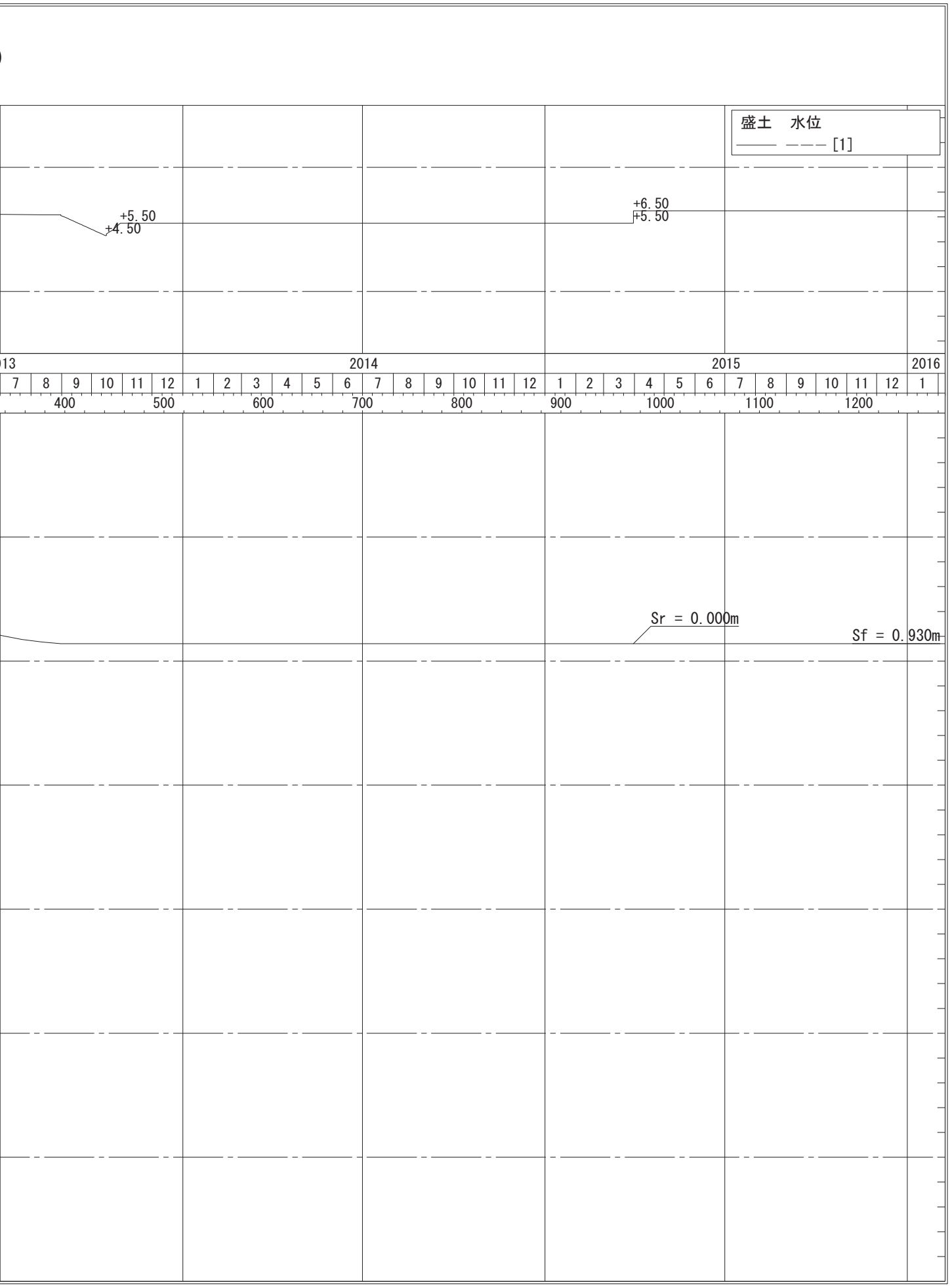
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+6.50
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2013
2014
2015
2016
7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1
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500
600
700
800
900
1000
1100
1200
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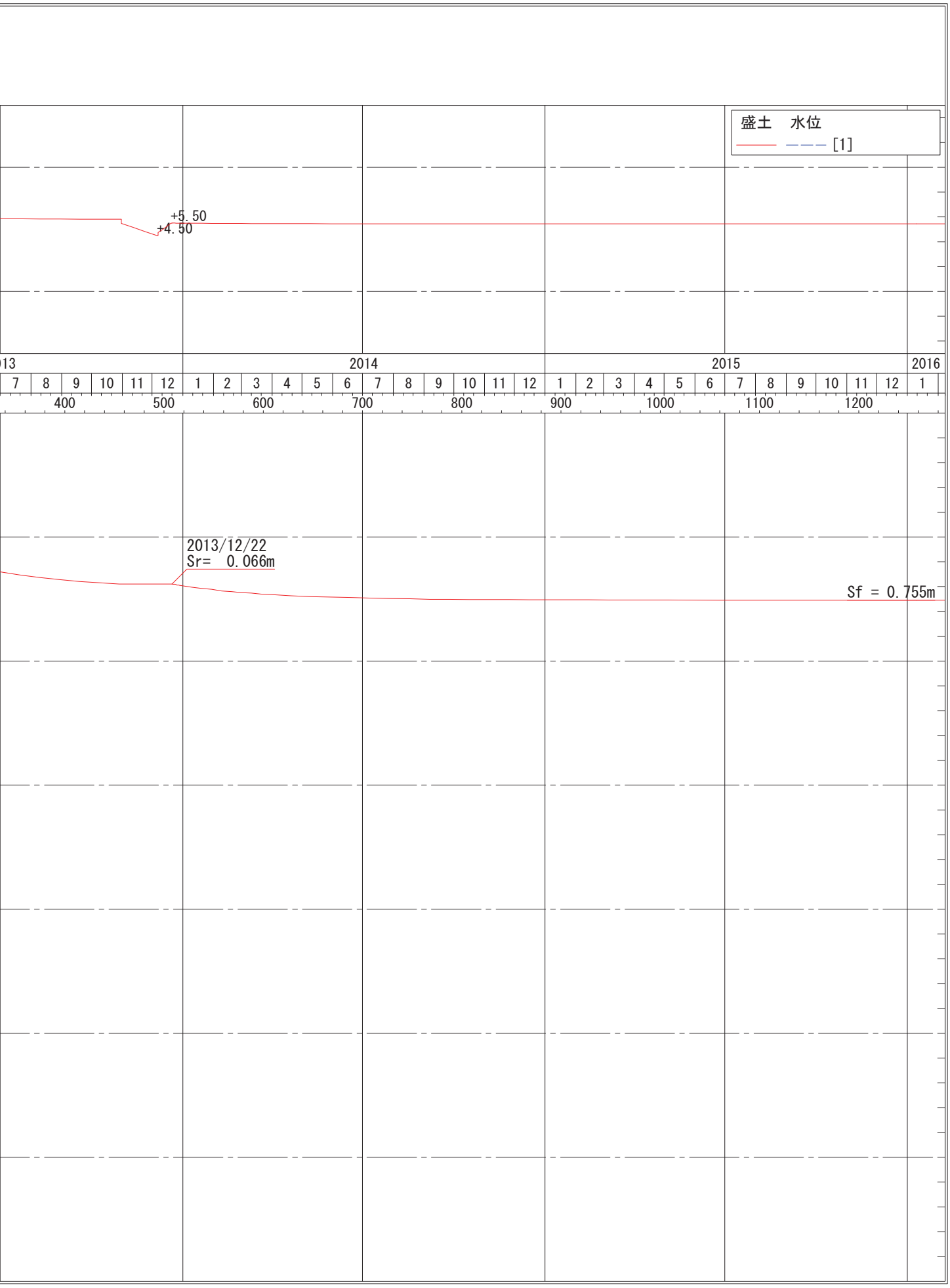
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13
2014
2015
2016
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400 500 600 700 800 900 1000 1100 1200
2013/12/22
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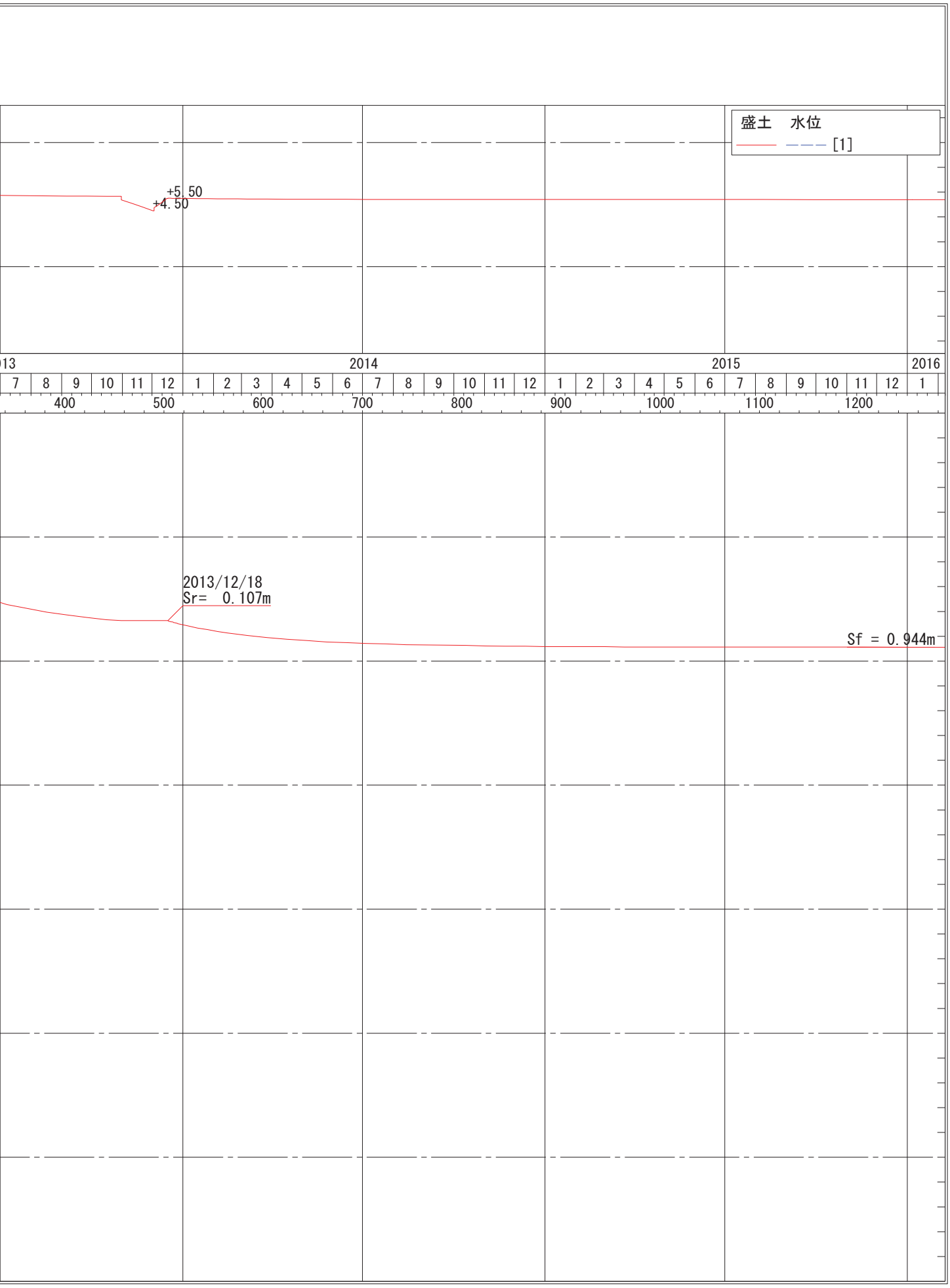
Sf = 0.755m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2014
2015
2016
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400 500 600 700 800 900 1000 1100 1200
2013/12/18
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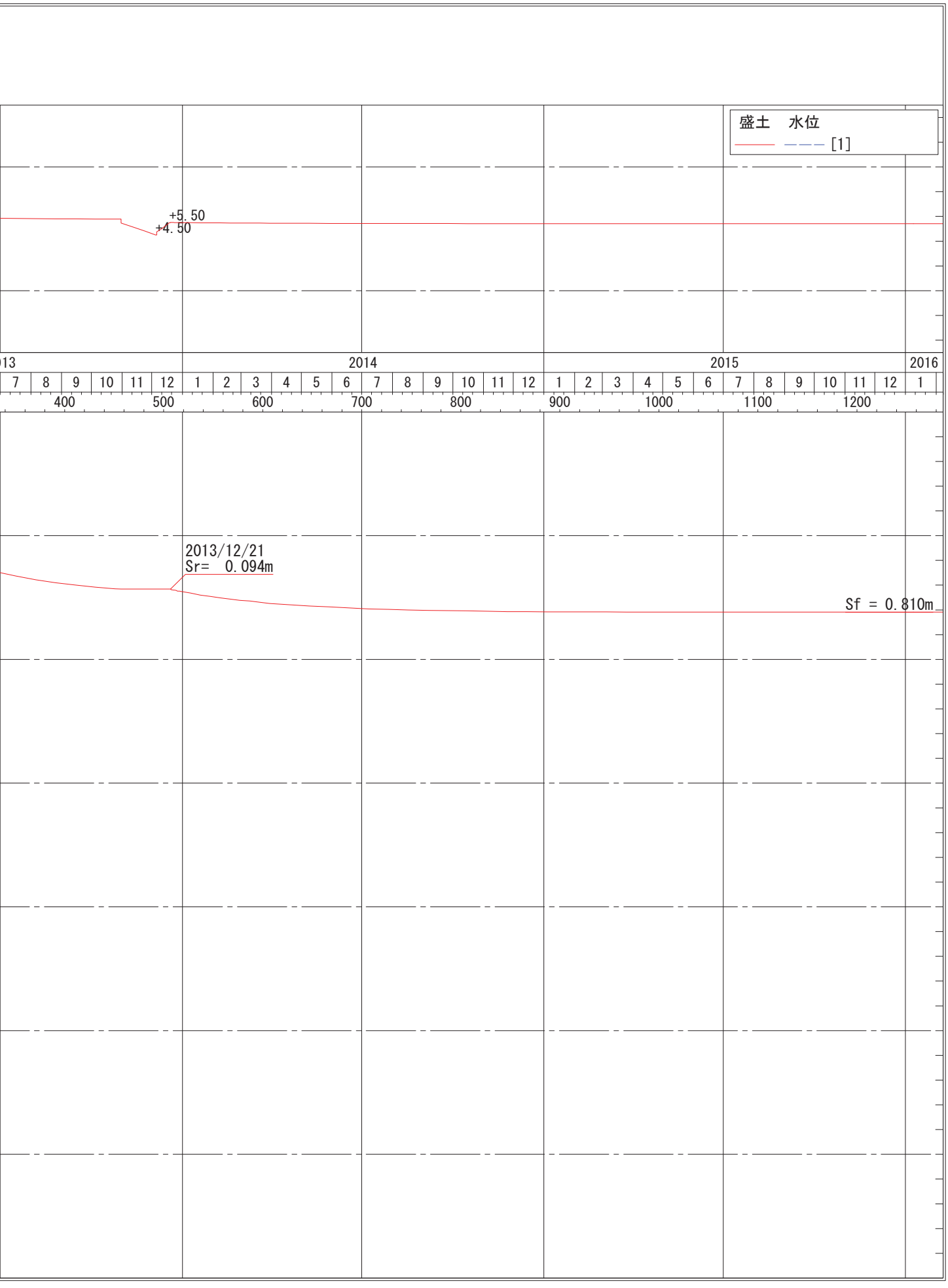
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2014
2015
2016
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400 500 600 700 800 900 1000 1100 1200
2013/12/21
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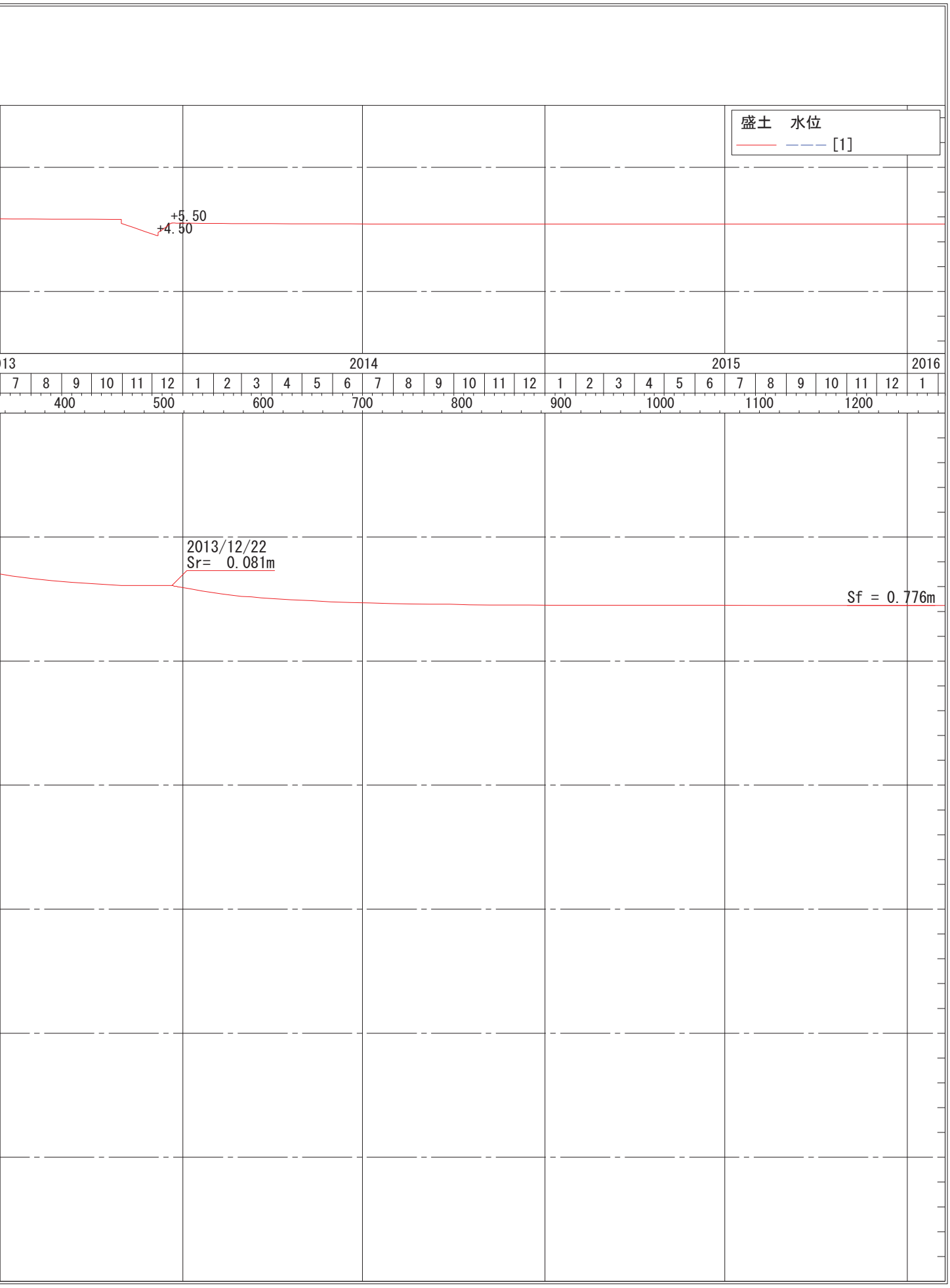
Sf = 0.810m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2014
2015
2016
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400 500 600 700 800 900 1000 1100 1200
2013/12/22
Sr= 0.081m
Sf = 0.776m

3) Economical Comparison Tables by PVD Spacing for Terminal Area (Block 1 to 12)

Economical Comparison Tables with Several PVD Installation Intervals (1/4)

	Block No.	1			
	Sea Bed Level (CD; m)	-1.5			
	Top Level of First Fill (CD; m)	5.0			
	Top Level of PVD Installation (CD; m)	4.5			
	Bottom Level of Clay (CD; m)	-26.0			
	PVD Spacing (m)	1.0	1.1	1.2	1.3
	PVD Length (m)	30.5	30.5	30.5	30.5
	1st Fill Thickness (m)	6.5	6.5	6.5	6.5
	Preloading Fill Thickness (m)	3.7	3.9	4.5	5.4
	Removal Thickness of Preload (m)	2.763	2.948	3.519	4.472
	Consolidation Degree U (%)	100.0	100.0	100.0	98.5
	Consolidation Settlement (m)	1.444	1.458	1.488	1.435
	Consolidation Periods (days)	261	256	242	213
Unit Price	Cost Total (V Dong; per m2)	2,199,647.9	2,197,070.3	2,296,539.4	2,475,413.5
171,756	Filling Sand	1,116,414.0	1,116,414.0	1,116,414.0	1,116,414.0
191,271	Preload	707,702.7	745,956.9	860,719.5	1,032,863.4
36,632	Removal of Preload	101,214.2	107,991.1	128,908.0	163,818.3
8,994	PVD	274,317.0	226,708.3	190,497.9	162,317.8
	Economical Comparison	2	1	3	4

	Block No.	2			
	Sea Bed Level (CD; m)	0.5			
	Top Level of First Fill (CD; m)	5.0			
	Top Level of PVD Installation (CD; m)	4.5			
	Bottom Level of Clay (CD; m)	-26.0			
	PVD Spacing (m)	1.0	1.1	1.2	1.3
	PVD Length (m)	30.5	30.5	30.5	30.5
	1st Fill Thickness (m)	4.5	4.5	4.5	4.5
	Preloading Fill Thickness (m)	3.2	3.3	3.6	4.7
	Removal Thickness of Preload (m)	2.754	2.854	3.122	4.178
	Consolidation Degree U (%)	100.0	100.0	100.0	100.0
	Consolidation Settlement (m)	0.948	0.959	0.980	1.025
	Consolidation Periods (days)	275	272	265	235
Unit Price	Cost Total (V Dong; per m2)	1,760,170.7	1,735,352.3	1,766,340.6	1,987,241.9
171,756	Filling Sand (m3)	772,902.0	772,902.0	772,902.0	772,902.0
191,271	Preload (m3)	612,067.2	631,194.3	688,575.6	898,973.7
36,632	Removal of Preload (m3)	100,884.5	104,547.7	114,365.1	153,048.5
8,994	PVD (m)	274,317.0	226,708.3	190,497.9	162,317.8
	Evaluation	2	1	3	4

	Block No.	3			
	Sea Bed Level (CD; m)	0.0			
	Top Level of First Fill (CD; m)	5.0			
	Top Level of PVD Installation (CD; m)	4.5			
	Bottom Level of Clay (CD; m)	-27.0			
	PVD Spacing (m)	1.0	1.1	1.2	1.3
	PVD Length (m)	31.5	31.5	31.5	31.5
	1st Fill Thickness (m)	5.0	5.0	5.0	5.0
	Preloading Fill Thickness (m)	3.4	3.5	3.8	5
	Removal Thickness of Preload (m)	2.777	2.871	3.156	4.321
	Consolidation Degree U (%)	100.0	100.0	100.0	99.7
	Consolidation Settlement (m)	1.127	1.134	1.148	1.181
	Consolidation Periods (days)	271	269	261	229
Unit Price	Cost Total (V Dong; per m2)	1,894,139.5	1,867,540.3	1,897,964.1	2,141,061.5
171,756	Filling Sand (m3)	858,780.0	858,780.0	858,780.0	858,780.0
191,271	Preload (m3)	650,321.4	669,448.5	726,829.8	956,355.0
36,632	Removal of Preload (m3)	101,727.1	105,170.5	115,610.6	158,286.9
8,994	PVD (m)	283,311.0	234,141.3	196,743.8	167,639.6
	Evaluation	2	1	3	4

Economical Comparison Tables with Several PVD Installation Intervals (2/4)

	Block No.	4			
	Sea Bed Level (CD; m)	0.0			
	Top Level of First Fill (CD; m)	5.0			
	Top Level of PVD Installation (CD; m)	4.5			
	Bottom Level of Clay (CD; m)	-27.5			
	PVD Spacing (m)	1.0	1.1	1.2	1.3
	PVD Length (m)	32.0	32.0	32.0	32.0
	1st Fill Thickness (m)	5.0	5.0	5.0	5.0
	Preloading Fill Thickness (m)	3.5	3.6	4	5.3
	Removal Thickness of Preload (m)	2.739	2.833	3.27	4.483
	Consolidation Degree U (%)	100.0	100.0	100.0	99.6
	Consolidation Settlement (m)	1.265	1.27	1.297	1.319
	Consolidation Periods (days)	272	270	259	224
Unit Price	Cost Total (V Dong; per m2)	1,916,371.5	1,888,991.9	1,943,517.3	2,207,038.1
171,756	Filling Sand (m3)	858,780.0	858,780.0	858,780.0	858,780.0
191,271	Preload (m3)	669,448.5	688,575.6	765,084.0	1,013,736.3
36,632	Removal of Preload (m3)	100,335.0	103,778.5	119,786.6	164,221.3
8,994	PVD (m)	287,808.0	237,857.9	199,866.7	170,300.6
	Evaluation	2	1	3	4

	Block No.	5			
	Sea Bed Level (CD; m)	-1.5			
	Top Level of First Fill (CD; m)	5.0			
	Top Level of PVD Installation (CD; m)	4.5			
	Bottom Level of Clay (CD; m)	-26.0			
	PVD Spacing (m)	1.0	1.1	1.2	1.3
	PVD Length (m)	30.5	30.5	30.5	30.5
	1st Fill Thickness (m)	6.5	6.5	6.5	6.5
	Preloading Fill Thickness (m)	3.6	3.8	4.4	5
	Removal Thickness of Preload (m)	2.735	2.917	3.485	4.131
	Consolidation Degree U (%)	100.0	100.0	100.0	98.6
	Consolidation Settlement (m)	1.373	1.389	1.422	1.375
	Consolidation Periods (days)	261	256	240	222
Unit Price	Cost Total (V Dong; per m2)	2,179,495.1	2,176,807.6	2,276,166.8	2,386,413.5
171,756	Filling Sand (m3)	1,116,414.0	1,116,414.0	1,116,414.0	1,116,414.0
191,271	Preload (m3)	688,575.6	726,829.8	841,592.4	956,355.0
36,632	Removal of Preload (m3)	100,188.5	106,855.5	127,662.5	151,326.8
8,994	PVD (m)	274,317.0	226,708.3	190,497.9	162,317.8
	Evaluation	2	1	3	4

	Block No.	6			
	Sea Bed Level (CD; m)	-0.5			
	Top Level of First Fill (CD; m)	5.0			
	Top Level of PVD Installation (CD; m)	4.5			
	Bottom Level of Clay (CD; m)	-25.5			
	PVD Spacing (m)	1.0	1.1	1.2	1.3
	PVD Length (m)	30.0	30.0	30.0	30.0
	1st Fill Thickness (m)	5.5	5.5	5.5	5.5
	Preloading Fill Thickness (m)	3.3	3.4	3.8	4.9
	Removal Thickness of Preload (m)	2.728	2.823	3.196	4.281
	Consolidation Degree U (%)	100.0	100.0	100.0	99.5
	Consolidation Settlement (m)	1.076	1.082	1.108	1.124
	Consolidation Periods (days)	269	266	256	225
Unit Price	Cost Total (V Dong; per m2)	1,945,604.4	1,921,383.3	1,975,938.7	2,198,364.3
171,756	Filling Sand (m3)	944,658.0	944,658.0	944,658.0	944,658.0
191,271	Preload (m3)	631,194.3	650,321.4	726,829.8	937,227.9
36,632	Removal of Preload (m3)	99,932.1	103,412.1	117,075.9	156,821.6
8,994	PVD (m)	269,820.0	222,991.7	187,375.0	159,656.8
	Evaluation	2	1	3	4

Economical Comparison Tables with Several PVD Installation Intervals (3/4)

	Block No.	7			
	Sea Bed Level (CD; m)	1.0			
	Top Level of First Fill (CD; m)	5.0			
	Top Level of PVD Installation (CD; m)	4.5			
	Bottom Level of Clay (CD; m)	-25.0			
	PVD Spacing (m)	1.0	1.1	1.2	1.3
	PVD Length (m)	29.5	29.5	29.5	29.5
	1st Fill Thickness (m)	4.0	4.0	4.0	4.0
	Preloading Fill Thickness (m)	3.1	3.1	3.4	4.1
	Removal Thickness of Preload (m)	2.753	2.761	3.044	3.726
	Consolidation Degree U (%)	100.0	100.0	100.0	100.0
	Consolidation Settlement (m)	0.849	0.841	0.858	0.877
	Consolidation Periods (days)	279	279	271	252
Unit Price	Cost Total (V Dong; per m2)	1,646,135.0	1,600,380.3	1,633,105.3	1,764,721.8
171,756	Filling Sand (m3)	687,024.0	687,024.0	687,024.0	687,024.0
191,271	Preload (m3)	592,940.1	592,940.1	650,321.4	784,211.1
36,632	Removal of Preload (m3)	100,847.9	101,141.0	111,507.8	136,490.8
8,994	PVD (m)	265,323.0	219,275.2	184,252.1	156,995.9
	Evaluation	3	1	2	4

	Block No.	8			
	Sea Bed Level (CD; m)	0.5			
	Top Level of First Fill (CD; m)	5.0			
	Top Level of PVD Installation (CD; m)	4.5			
	Bottom Level of Clay (CD; m)	-26.0			
	PVD Spacing (m)	1.0	1.1	1.2	1.3
	PVD Length (m)	30.5	30.5	30.5	30.5
	1st Fill Thickness (m)	4.5	4.5	4.5	4.5
	Preloading Fill Thickness (m)	3.4	3.5	3.8	5
	Removal Thickness of Preload (m)	2.728	2.82	3.098	4.245
	Consolidation Degree U (%)	100.0	100.0	100.0	99.8
	Consolidation Settlement (m)	1.175	1.183	1.206	1.258
	Consolidation Periods (days)	276	272	265	233
Unit Price	Cost Total (V Dong; per m2)	1,797,472.5	1,772,361.0	1,803,715.7	2,047,077.6
171,756	Filling Sand (m3)	772,902.0	772,902.0	772,902.0	772,902.0
191,271	Preload (m3)	650,321.4	669,448.5	726,829.8	956,355.0
36,632	Removal of Preload (m3)	99,932.1	103,302.2	113,485.9	155,502.8
8,994	PVD (m)	274,317.0	226,708.3	190,497.9	162,317.8
	Evaluation	2	1	3	4

	Block No.	9			
	Sea Bed Level (CD; m)	0.0			
	Top Level of First Fill (CD; m)	5.0			
	Top Level of PVD Installation (CD; m)	4.5			
	Bottom Level of Clay (CD; m)	-25.5			
	PVD Spacing (m)	1.0	1.1	1.2	1.3
	PVD Length (m)	30.0	30.0	30.0	30.0
	1st Fill Thickness (m)	5.0	5.0	5.0	5.0
	Preloading Fill Thickness (m)	2.1	2.1	2.2	2.4
	Removal Thickness of Preload (m)	1.66	1.662	1.75	1.934
	Consolidation Degree U (%)	100.0	100.0	100.0	100.0
	Consolidation Settlement (m)	0.945	0.943	0.956	0.971
Unit Price	Consolidation Periods (days)	271	286	300	295
Unit Price	Cost Total (V Dong; per m2)	1,591,078.2	1,544,323.2	1,531,057.2	1,548,333.5
171,756	Filling Sand (m3)	858,780.0	858,780.0	858,780.0	858,780.0
191,271	Preload (m3)	401,669.1	401,669.1	420,796.2	459,050.4
36,632	Removal of Preload (m3)	60,809.1	60,882.4	64,106.0	70,846.3
8,994	PVD (m)	269,820.0	222,991.7	187,375.0	159,656.8
	Evaluation	4	2	1	3

Economical Comparison Tables with Several PVD Installation Intervals (4/4)

	Block No.	10			
	Sea Bed Level (CD; m)	−1.0			
	Top Level of First Fill (CD; m)	5.0			
	Top Level of PVD Installation (CD; m)	4.5			
	Bottom Level of Clay (CD; m)	−26.0			
	PVD Spacing (m)	1.0	1.1	1.2	1.3
	PVD Length (m)	30.5	30.5	30.5	30.5
	1st Fill Thickness (m)	6.0	6.0	6.0	6.0
	Preloading Fill Thickness (m)	2.2	2.2	2.3	2.6
	Removal Thickness of Preload (m)	1.659	1.663	1.755	2.032
	Consolidation Degree U (%)	100.0	100.0	100.0	100.0
	Consolidation Settlement (m)	1.046	1.043	1.050	1.075
	Consolidation Periods (days)	273	288	293	285
Unit Price	Cost Total (V Dong; per m2)	1,786,421.7	1,738,959.5	1,725,246.4	1,764,594.6
171,756	Filling Sand (m3)	1,030,536.0	1,030,536.0	1,030,536.0	1,030,536.0
191,271	Preload (m3)	420,796.2	420,796.2	439,923.3	497,304.6
36,632	Removal of Preload (m3)	60,772.5	60,919.0	64,289.2	74,436.2
8,994	PVD (m)	274,317.0	226,708.3	190,497.9	162,317.8
	Evaluation	4	2	1	3

	Block No.	11			
	Sea Bed Level (CD; m)	1.5			
	Top Level of First Fill (CD; m)	5.0			
	Top Level of PVD Installation (CD; m)	4.5			
	Bottom Level of Clay (CD; m)	−28.0			
	PVD Spacing (m)	1.0	1.1	1.2	1.3
	PVD Length (m)	32.5	32.5	32.5	32.5
	1st Fill Thickness (m)	3.5	3.5	3.5	3.5
	Preloading Fill Thickness (m)	1.7	1.7	1.8	1.9
	Removal Thickness of Preload (m)	1.606	1.609	1.695	1.79
	Consolidation Degree U (%)	100.0	100.0	100.0	100.0
	Consolidation Settlement (m)	0.595	0.593	0.606	0.612
	Consolidation Periods (days)	266	281	302	0.309
Unit Price	Cost Total (V Dong; per m2)	1,277,442.7	1,226,822.0	1,210,514.6	1,203,093.7
171,756	Filling Sand (m3)	601,146.0	601,146.0	601,146.0	601,146.0
191,271	Preload (m3)	325,160.7	325,160.7	344,287.8	363,414.9
36,632	Removal of Preload (m3)	58,831.0	58,940.9	62,091.2	65,571.3
8,994	PVD (m)	292,305.0	241,574.4	202,989.6	172,961.5
	Evaluation	4	3	2	1

* Considering the continuity of soft soil treatment with surrounding areas, PVD installation interval 1.2m is selected.

	Block No.	12			
	Sea Bed Level (CD; m)	0.5			
	Top Level of First Fill (CD; m)	5.0			
	Top Level of PVD Installation (CD; m)	4.5			
	Bottom Level of Clay (CD; m)	−31.0			
	PVD Spacing (m)	1.0	1.1	1.2	1.3
	PVD Length (m)	35.5	35.5	35.5	35.5
	1st Fill Thickness (m)	4.5	4.5	4.5	4.5
	Preloading Fill Thickness (m)	2.1	2.1	2.1	2.4
	Removal Thickness of Preload (m)	1.662	1.666	1.674	1.936
	Consolidation Degree U (%)	100.0	100.0	100.0	100.0
	Consolidation Settlement (m)	0.941	0.937	0.930	0.968
	Consolidation Periods (days)	271	286	306	298
Unit Price	Cost Total (V Dong; per m2)	1,554,740.5	1,499,473.6	1,457,620.2	1,491,799.2
171,756	Filling Sand (m3)	772,902.0	772,902.0	772,902.0	772,902.0
191,271	Preload (m3)	401,669.1	401,669.1	401,669.1	459,050.4
36,632	Removal of Preload (m3)	60,882.4	61,028.9	61,322.0	70,919.6
8,994	PVD (m)	319,287.0	263,873.6	221,727.1	188,927.2
	Evaluation	4	3	1	2

4) Slope Stability Analysis Result during Filling at Reclamation Area

(Required Average Slope Gradient between Seabed and First Fill (CD+5.0m))

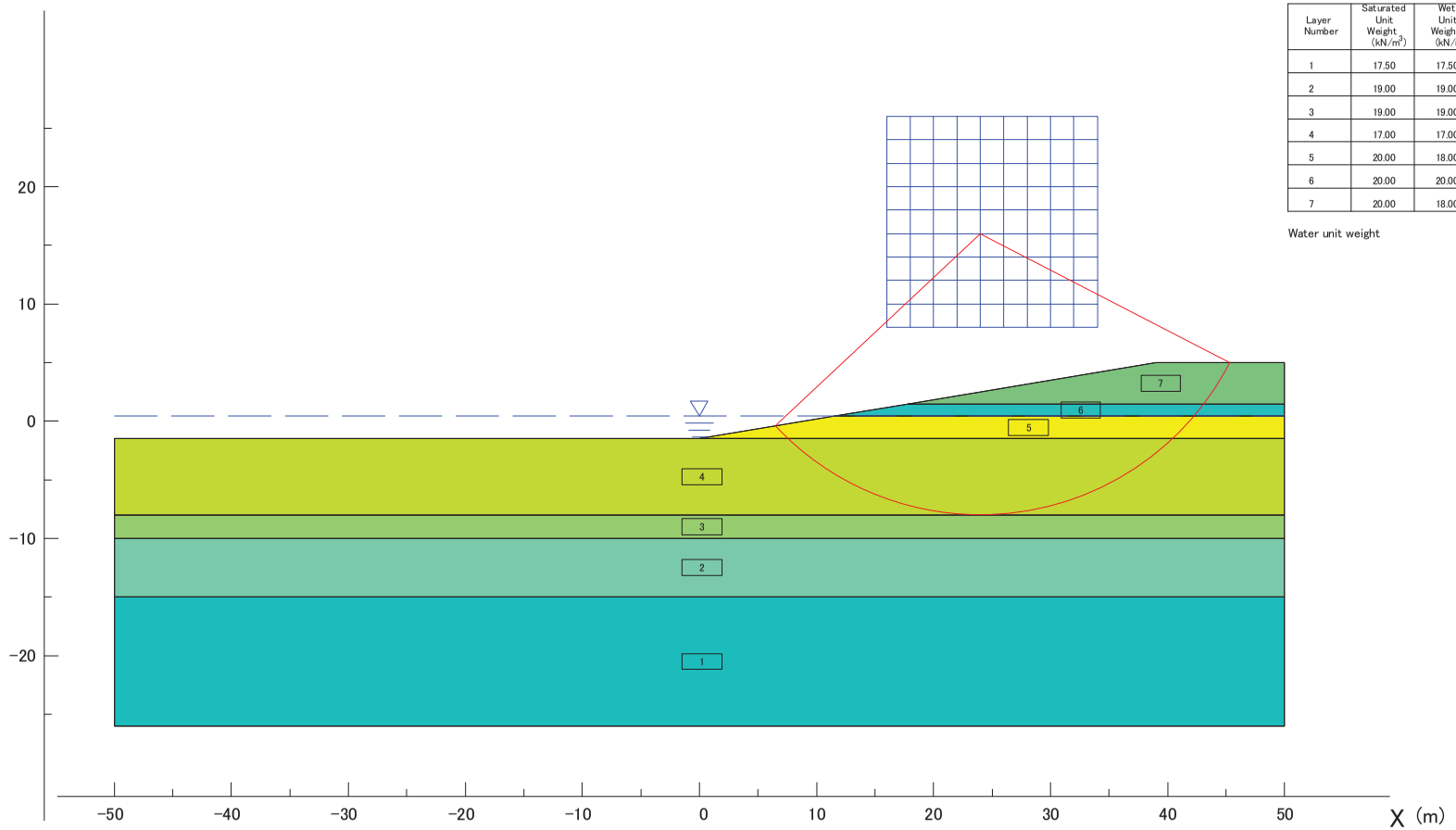
【Block-1】

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.104	
Center of arc	X	=	24.00	(m)
	Y	=	16.00	(m)
Radius	R	=	24.00	(m)
Resisting moment	M_R	=	15880.4	(kNm)
Sliding moment	M_D	=	14381.4	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	17.50	17.50	0.00	40.00	0.00	0.000	0.000
2	19.00	19.00	0.00	50.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.00	17.00	0.00	15.00	0.00	0.000	0.000
5	20.00	18.00	30.00	0.00	0.00	0.000	0.000
6	20.00	20.00	30.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

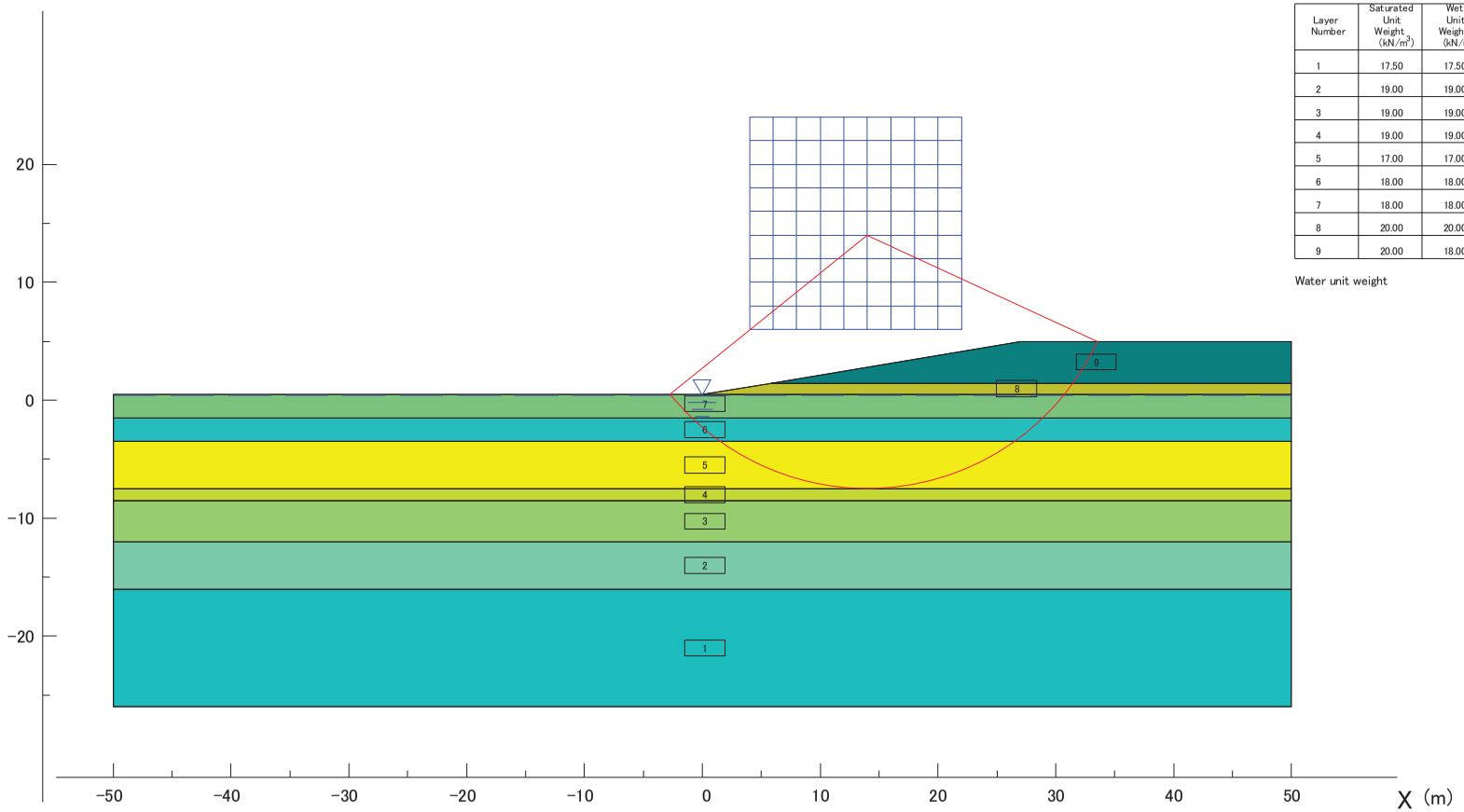
【Block-2】

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.136	
Center of arc	X	=	14.00	(m)
	Y	=	14.00	(m)
Radius	R	=	21.50	(m)
Resisting moment	M_R	=	12747.1	(kNm)
Sliding moment	M_D	=	11216.7	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	17.50	17.50	0.00	40.00	0.00	0.000	0.000
2	19.00	19.00	0.00	50.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	19.00	19.00	25.00	0.00	0.00	0.000	0.000
5	17.00	17.00	0.00	15.00	0.00	0.000	0.000
6	18.00	18.00	0.00	15.00	0.00	0.000	0.000
7	18.00	18.00	25.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

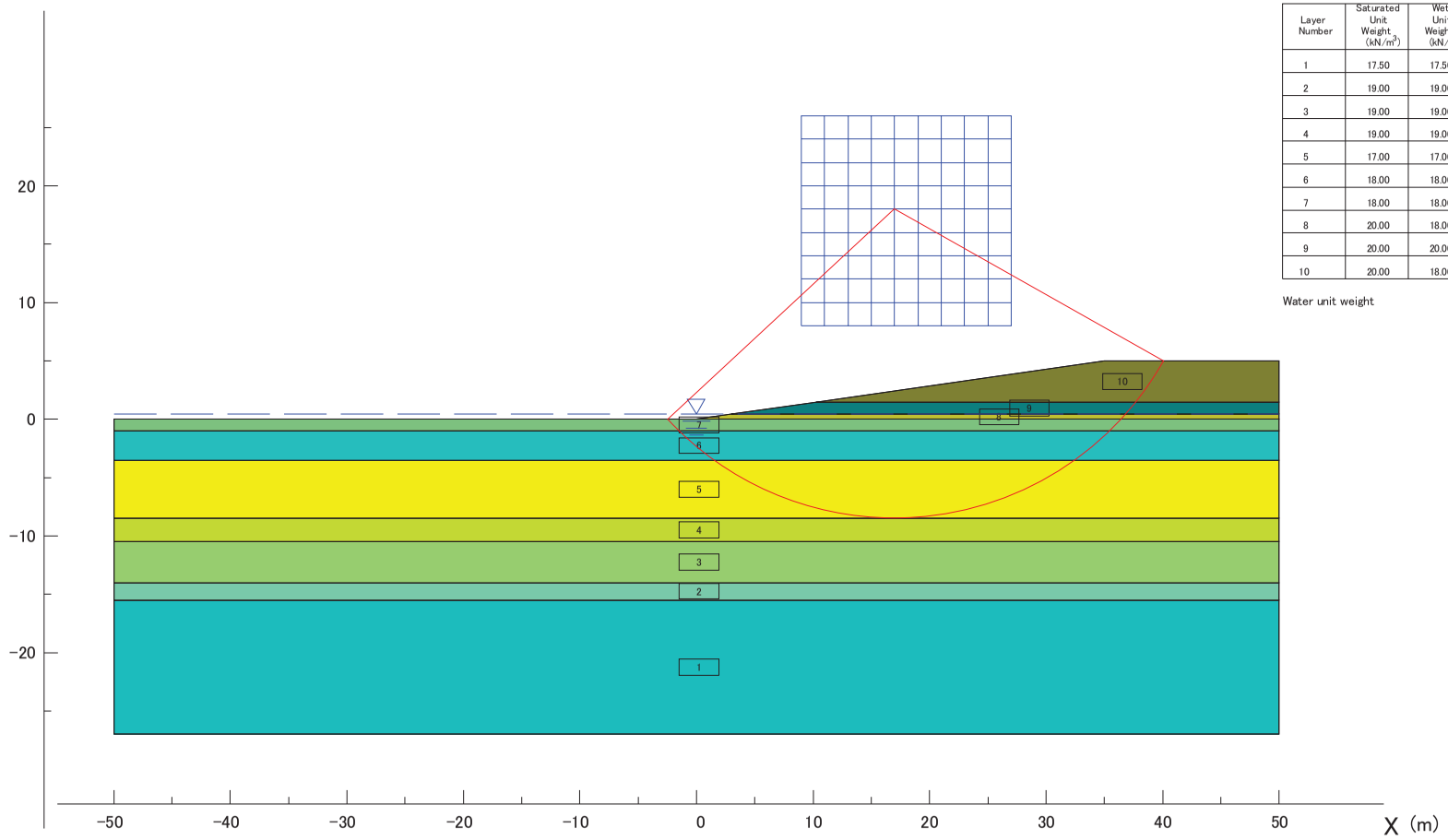
【Block-3】

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.162	
Center of arc	X	=	17.00	(m)
	Y	=	18.00	(m)
Radius	R	=	26.50	(m)
Resisting moment	M_R	=	18761.1	(kNm)
Sliding moment	M_D	=	16151.3	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	17.50	17.50	0.00	40.00	0.00	0.000	0.000
2	19.00	19.00	0.00	50.00	0.00	0.000	0.000
3	19.00	19.00	25.00	0.00	0.00	0.000	0.000
4	19.00	19.00	0.00	25.00	0.00	0.000	0.000
5	17.00	17.00	0.00	15.00	0.00	0.000	0.000
6	18.00	18.00	0.00	15.00	0.00	0.000	0.000
7	18.00	18.00	25.00	0.00	0.00	0.000	0.000
8	20.00	18.00	30.00	0.00	0.00	0.000	0.000
9	20.00	20.00	30.00	0.00	0.00	0.000	0.000
10	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

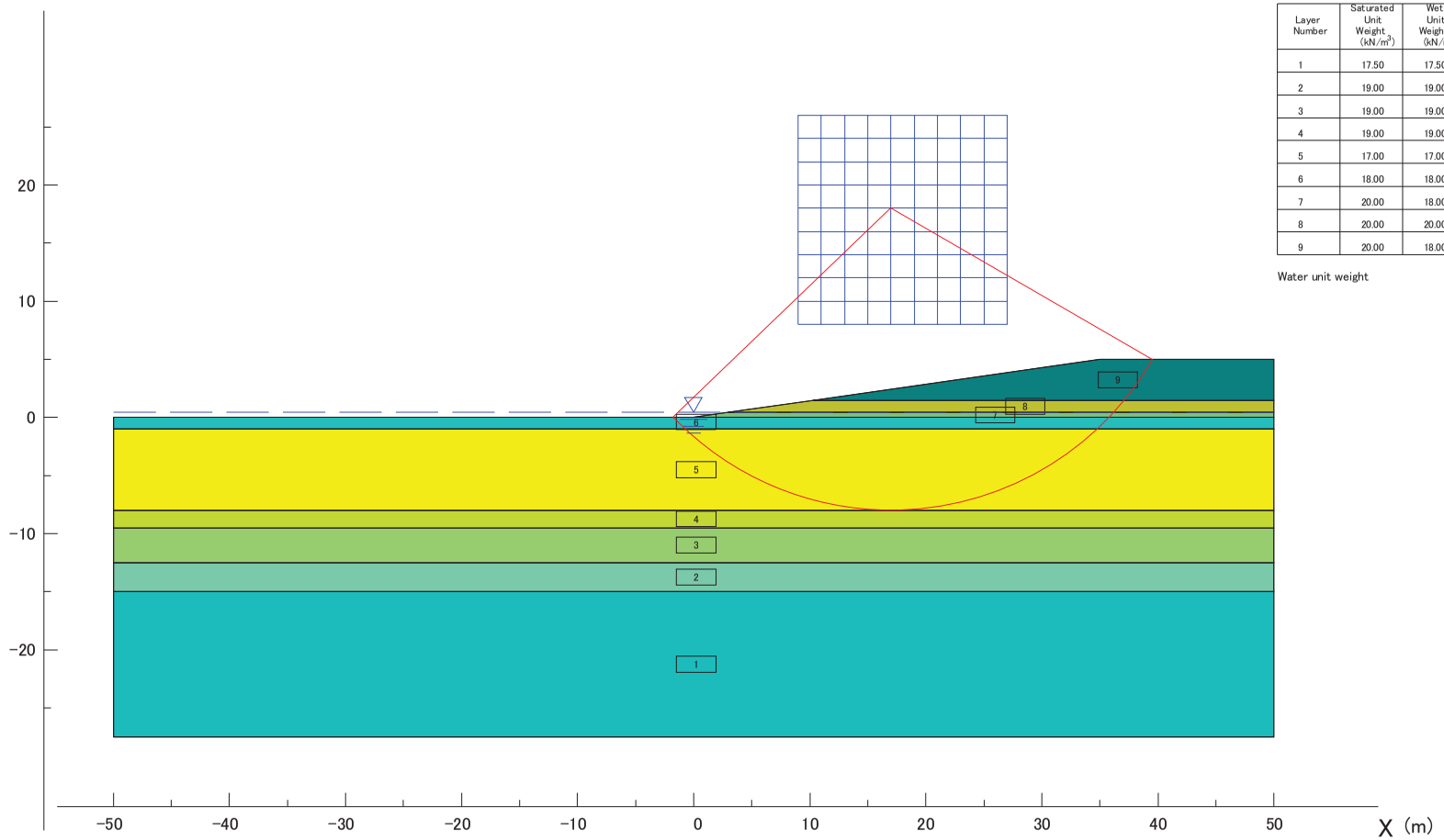
【Block-4】

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.190	
Center of arc	X	=	17.00	(m)
	Y	=	18.00	(m)
Radius	R	=	26.00	(m)
Resisting moment	M_R	=	17834.3	(kNm)
Sliding moment	M_D	=	14987.9	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	17.50	17.50	0.00	40.00	0.00	0.000	0.000
2	19.00	19.00	0.00	50.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	19.00	19.00	25.00	0.00	0.00	0.000	0.000
5	17.00	17.00	0.00	15.00	0.00	0.000	0.000
6	18.00	18.00	25.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

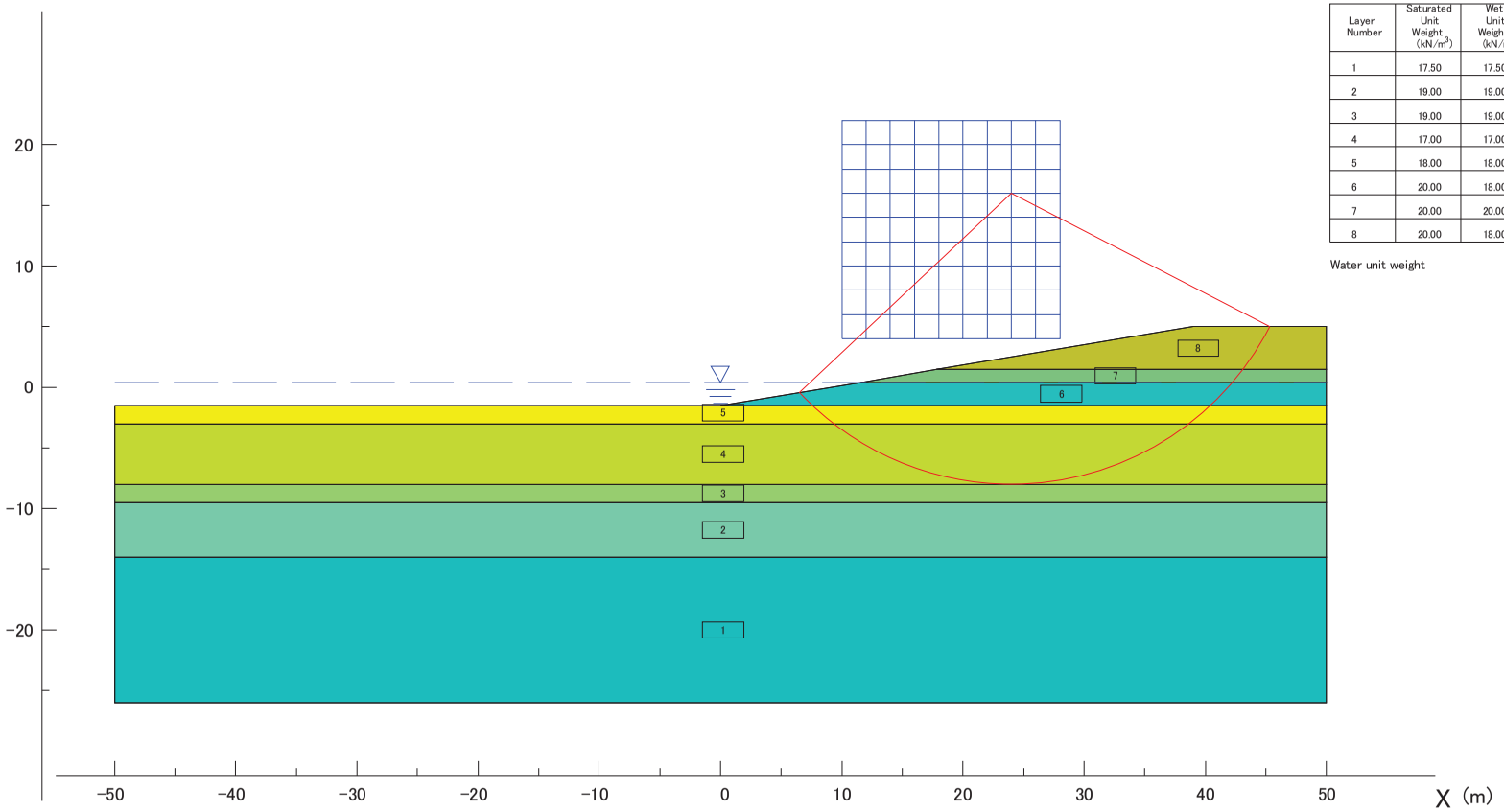
【Block-5】

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.104	
Center of arc	X	=	24.00	(m)
	Y	=	16.00	(m)
Radius	R	=	24.00	(m)
Resisting moment	M_R	=	15880.4	(kNm)
Sliding moment	M_D	=	14381.4	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	17.50	17.50	0.00	40.00	0.00	0.000	0.000
2	19.00	19.00	0.00	25.00	0.00	0.000	0.000
3	19.00	19.00	25.00	0.00	0.00	0.000	0.000
4	17.00	17.00	0.00	15.00	0.00	0.000	0.000
5	18.00	18.00	0.00	15.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	20.00	30.00	0.00	0.00	0.000	0.000
8	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

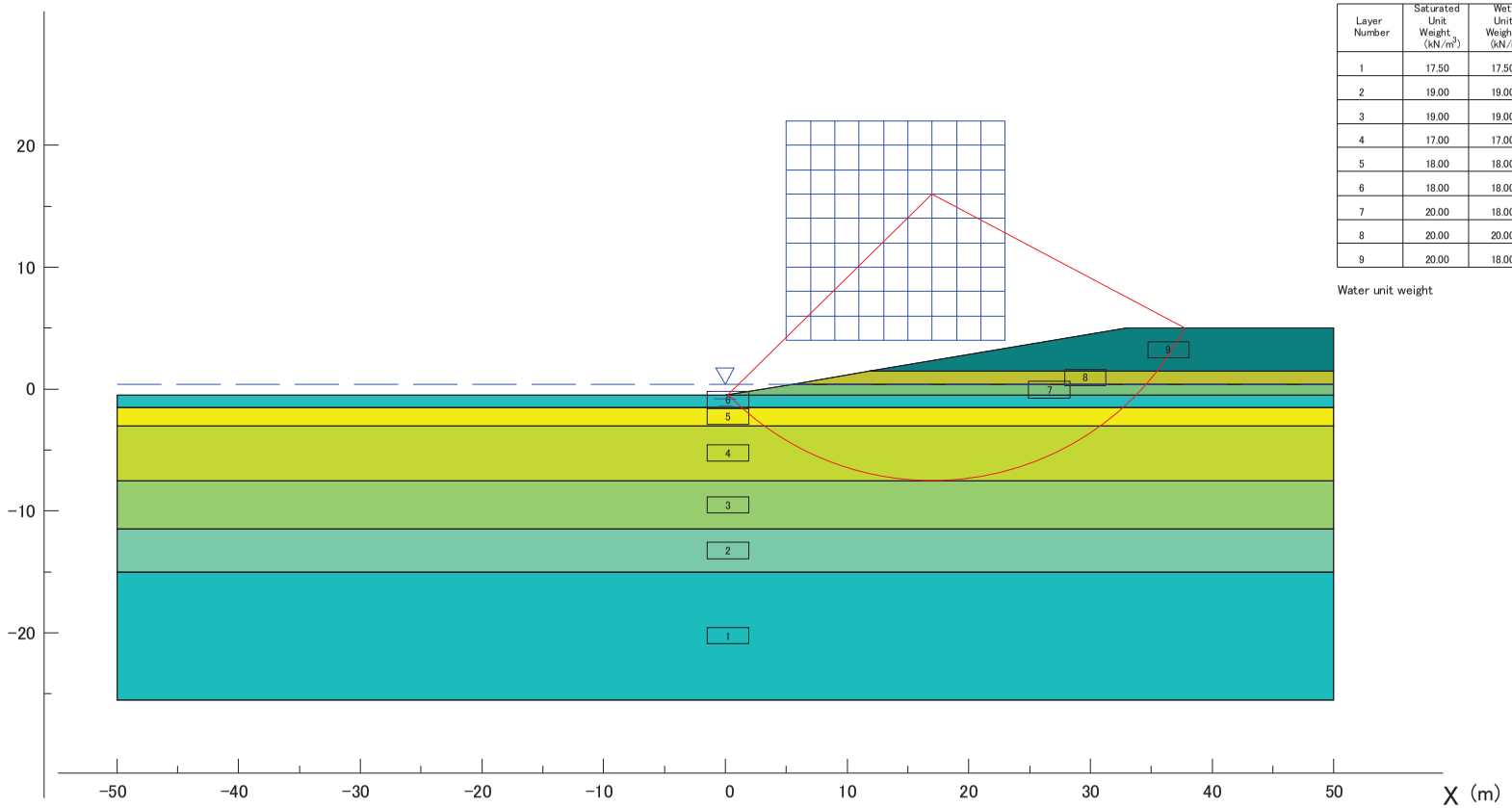
【Block-6】

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.118	
Center of arc	X	=	17.00	(m)
	Y	=	16.00	(m)
Radius	R	=	23.50	(m)
Resisting moment	M_R	=	14842.6	(kNm)
Sliding moment	M_D	=	13274.0	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	17.50	17.50	0.00	40.00	0.00	0.000	0.000
2	19.00	19.00	25.00	0.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.00	17.00	0.00	15.00	0.00	0.000	0.000
5	18.00	18.00	0.00	15.00	0.00	0.000	0.000
6	18.00	18.00	25.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

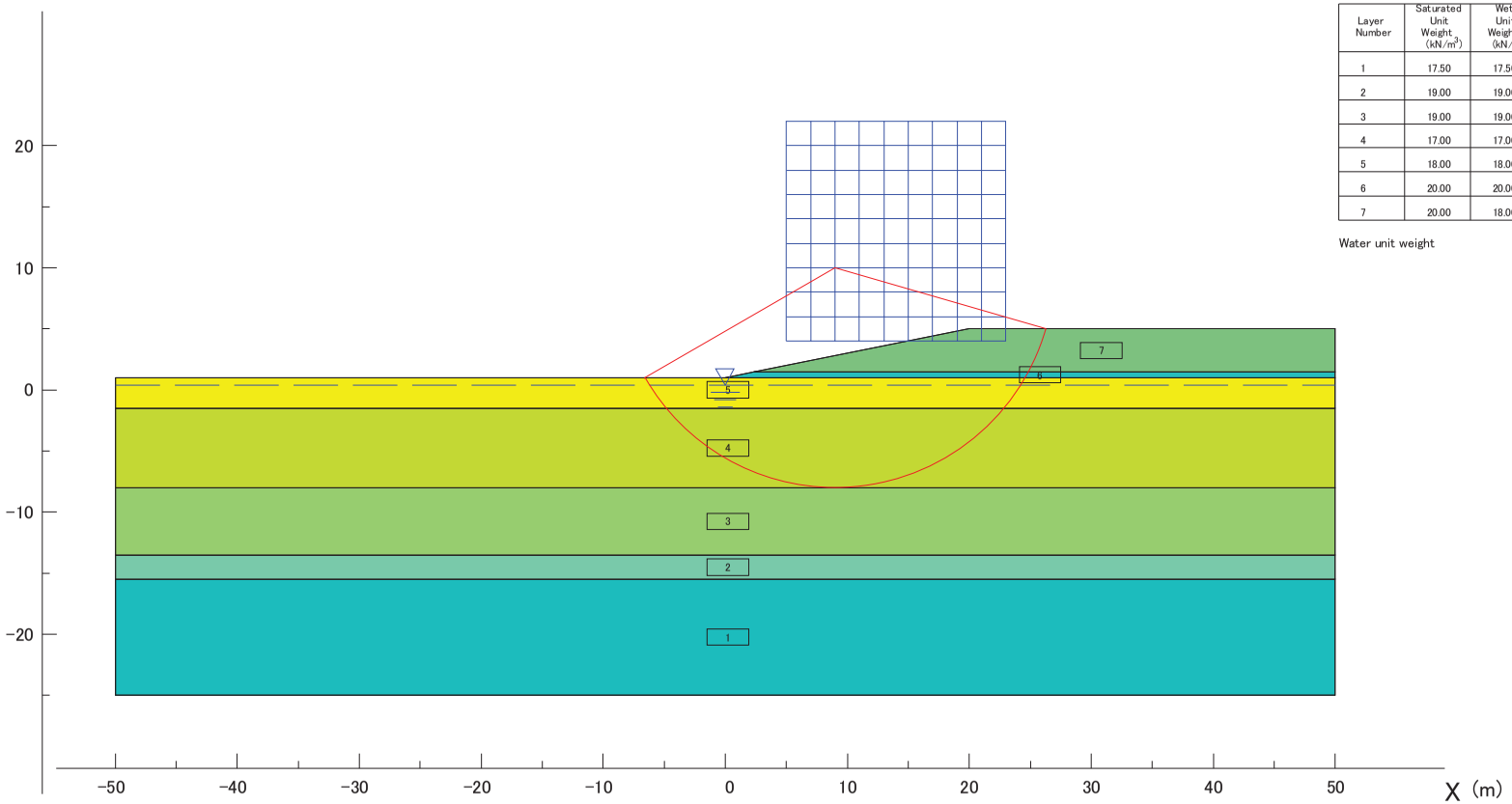
【Block-7】

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.117	
Center of arc	X	=	9.00	(m)
	Y	=	10.00	(m)
Radius	R	=	18.00	(m)
Resisting moment	M_R	=	9721.5	(kNm)
Sliding moment	M_D	=	8701.9	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	17.50	17.50	0.00	40.00	0.00	0.000	0.000
2	19.00	19.00	0.00	50.00	0.00	0.000	0.000
3	19.00	19.00	25.00	0.00	0.00	0.000	0.000
4	17.00	17.00	0.00	15.00	0.00	0.000	0.000
5	18.00	18.00	25.00	0.00	0.00	0.000	0.000
6	20.00	20.00	30.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

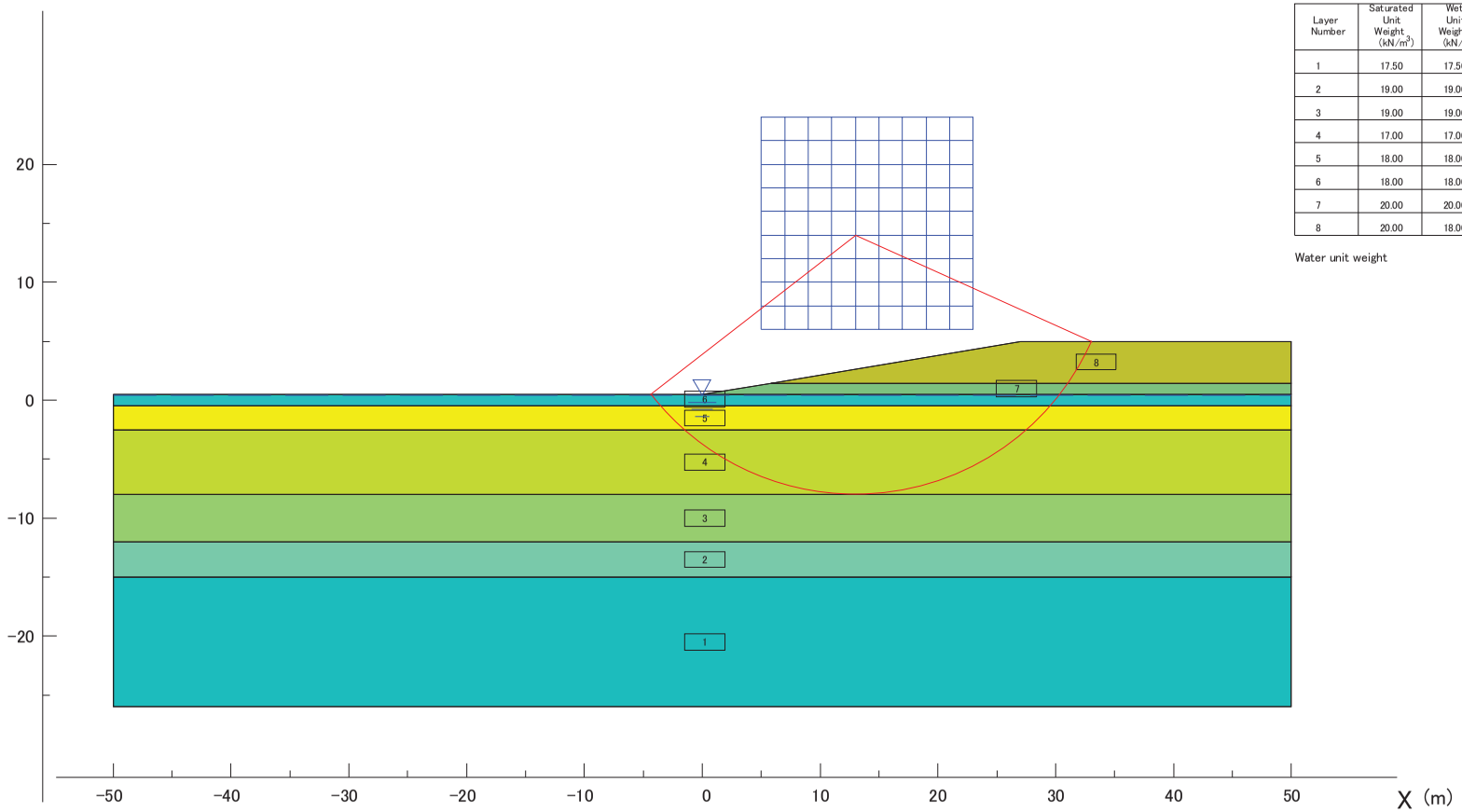
【Block-8】

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.128	
Center of arc	X	=	13.00	(m)
	Y	=	14.00	(m)
Radius	R	=	22.00	(m)
Resisting moment	M_R	=	13698.4	(kNm)
Sliding moment	M_D	=	12139.2	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	17.50	17.50	0.00	40.00	0.00	0.000	0.000
2	19.00	19.00	0.00	50.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.00	17.00	0.00	15.00	0.00	0.000	0.000
5	18.00	18.00	0.00	15.00	0.00	0.000	0.000
6	18.00	18.00	25.00	0.00	0.00	0.000	0.000
7	20.00	20.00	30.00	0.00	0.00	0.000	0.000
8	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

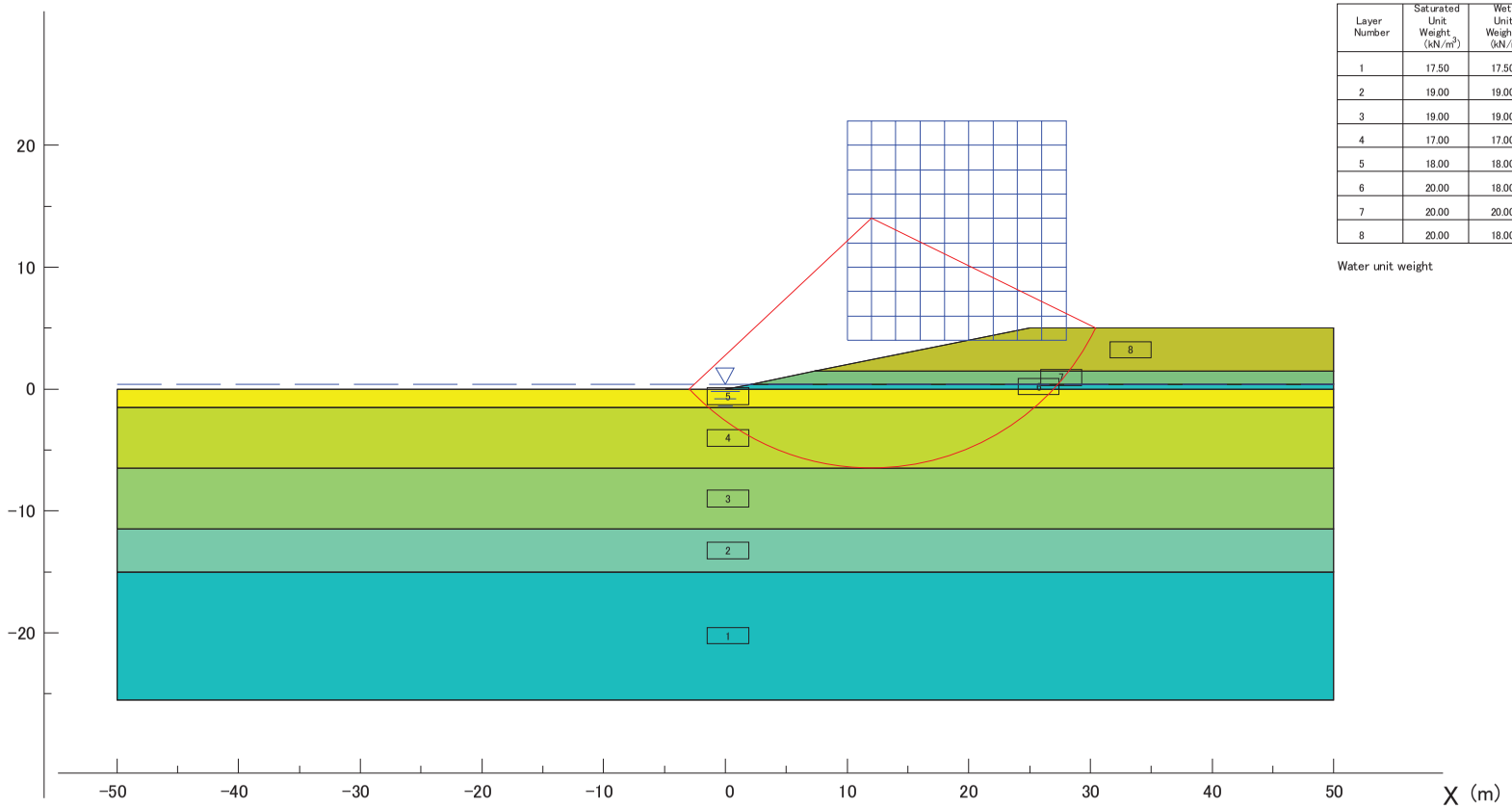
【Block-9】

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.100	
Center of arc	X	=	12.00	(m)
	Y	=	14.00	(m)
Radius	R	=	20.50	(m)
Resisting moment	M_R	=	11570.2	(kNm)
Sliding moment	M_D	=	10522.3	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	17.50	17.50	0.00	40.00	0.00	0.000	0.000
2	19.00	19.00	0.00	50.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.00	17.00	0.00	15.00	0.00	0.000	0.000
5	18.00	18.00	0.00	15.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	20.00	30.00	0.00	0.00	0.000	0.000
8	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

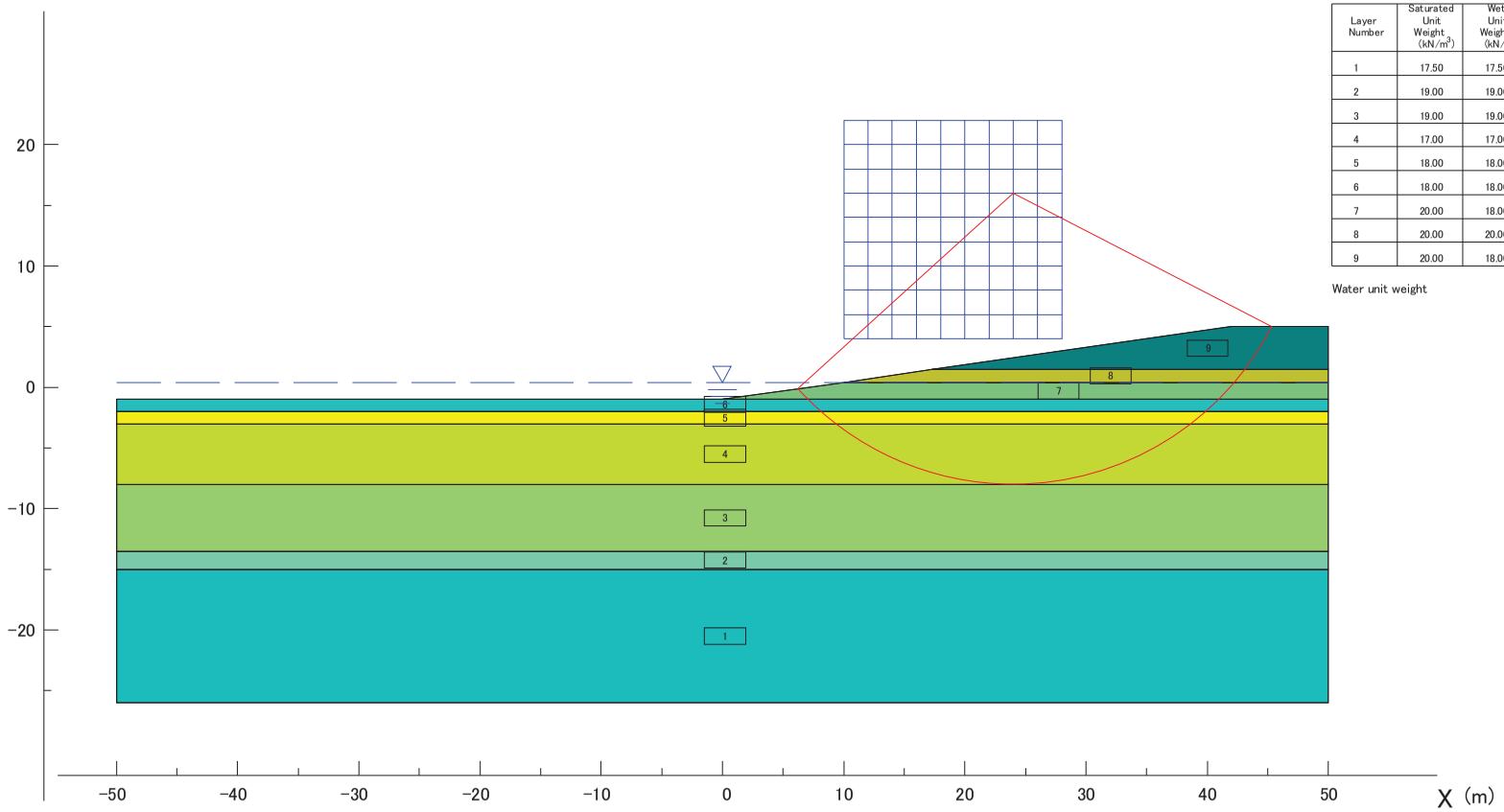
【Block-10】

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.174	
Center of arc	X	=	24.00	(m)
	Y	=	16.00	(m)
Radius	R	=	24.00	(m)
Resisting moment	M_R	=	15412.9	(kNm)
Sliding moment	M_D	=	13126.1	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	17.50	17.50	0.00	40.00	0.00	0.000	0.000
2	19.00	19.00	0.00	50.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.00	17.00	0.00	15.00	0.00	0.000	0.000
5	18.00	18.00	15.00	0.00	0.00	0.000	0.000
6	18.00	18.00	25.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

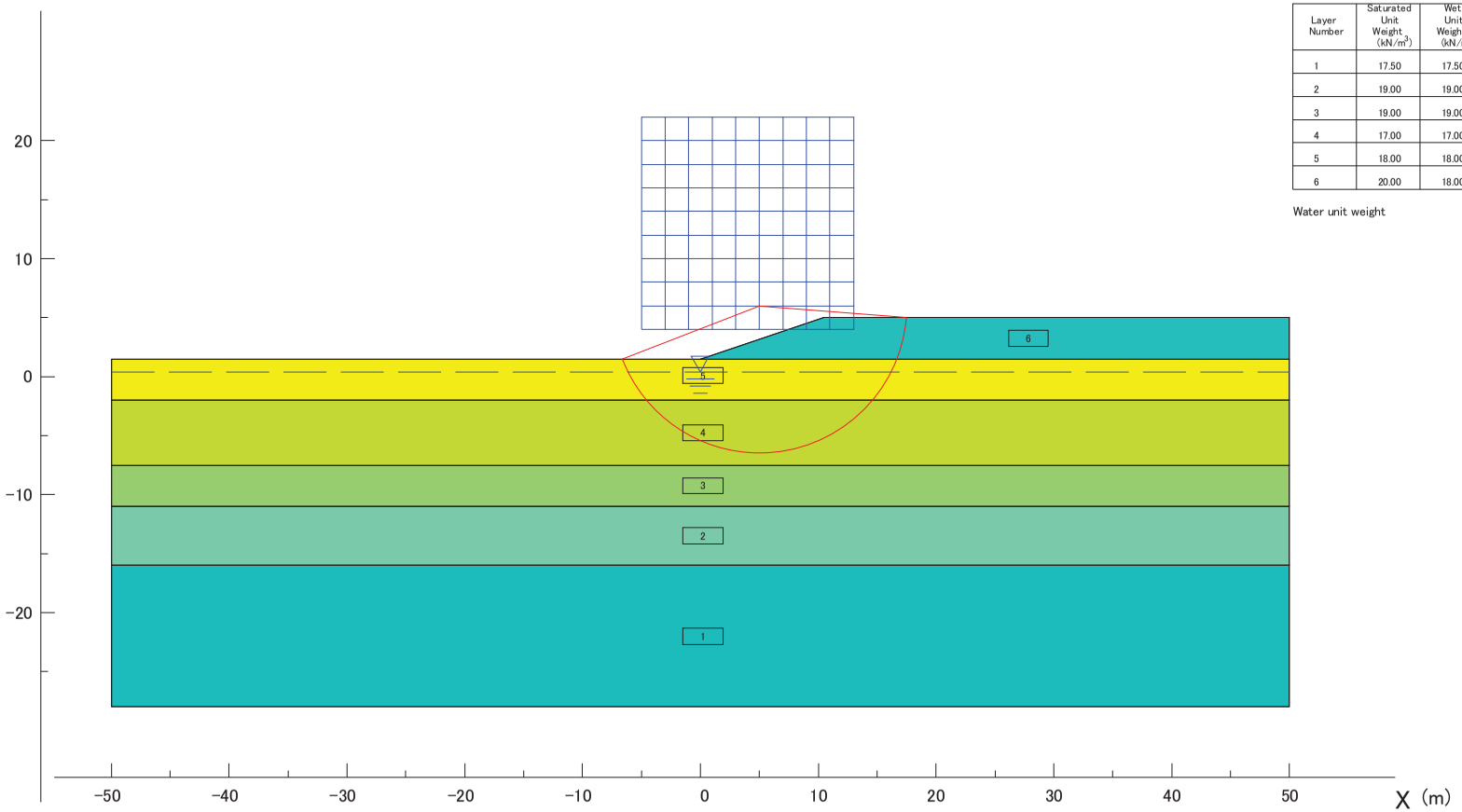
【Block-11】

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.122	
Center of arc	X	=	5.00	(m)
	Y	=	6.00	(m)
Radius	R	=	12.50	(m)
Resisting moment	M_R	=	4893.1	(kNm)
Sliding moment	M_D	=	4359.3	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	17.50	17.50	0.00	40.00	0.00	0.000	0.000
2	19.00	19.00	25.00	0.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.00	17.00	0.00	15.00	0.00	0.000	0.000
5	18.00	18.00	25.00	0.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

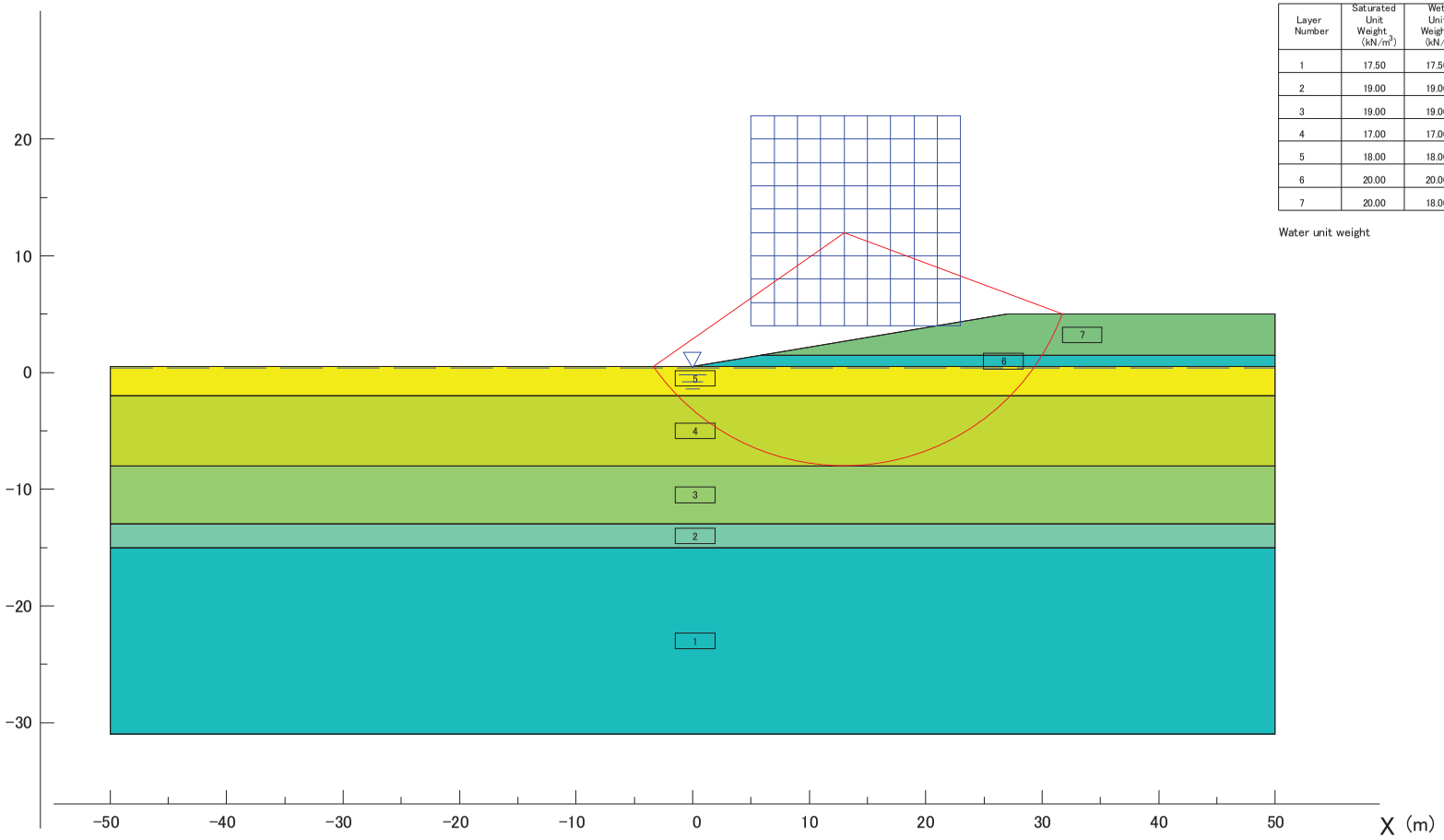
【Block-12】

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.109	
Center of arc	X	=	13.00	(m)
	Y	=	12.00	(m)
Radius	R	=	20.00	(m)
Resisting moment	M_R	=	11487.4	(kNm)
Sliding moment	M_D	=	10363.0	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	17.50	17.50	0.00	40.00	0.00	0.000	0.000
2	19.00	19.00	0.00	50.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.00	17.00	0.00	15.00	0.00	0.000	0.000
5	18.00	18.00	25.00	0.00	0.00	0.000	0.000
6	20.00	20.00	30.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

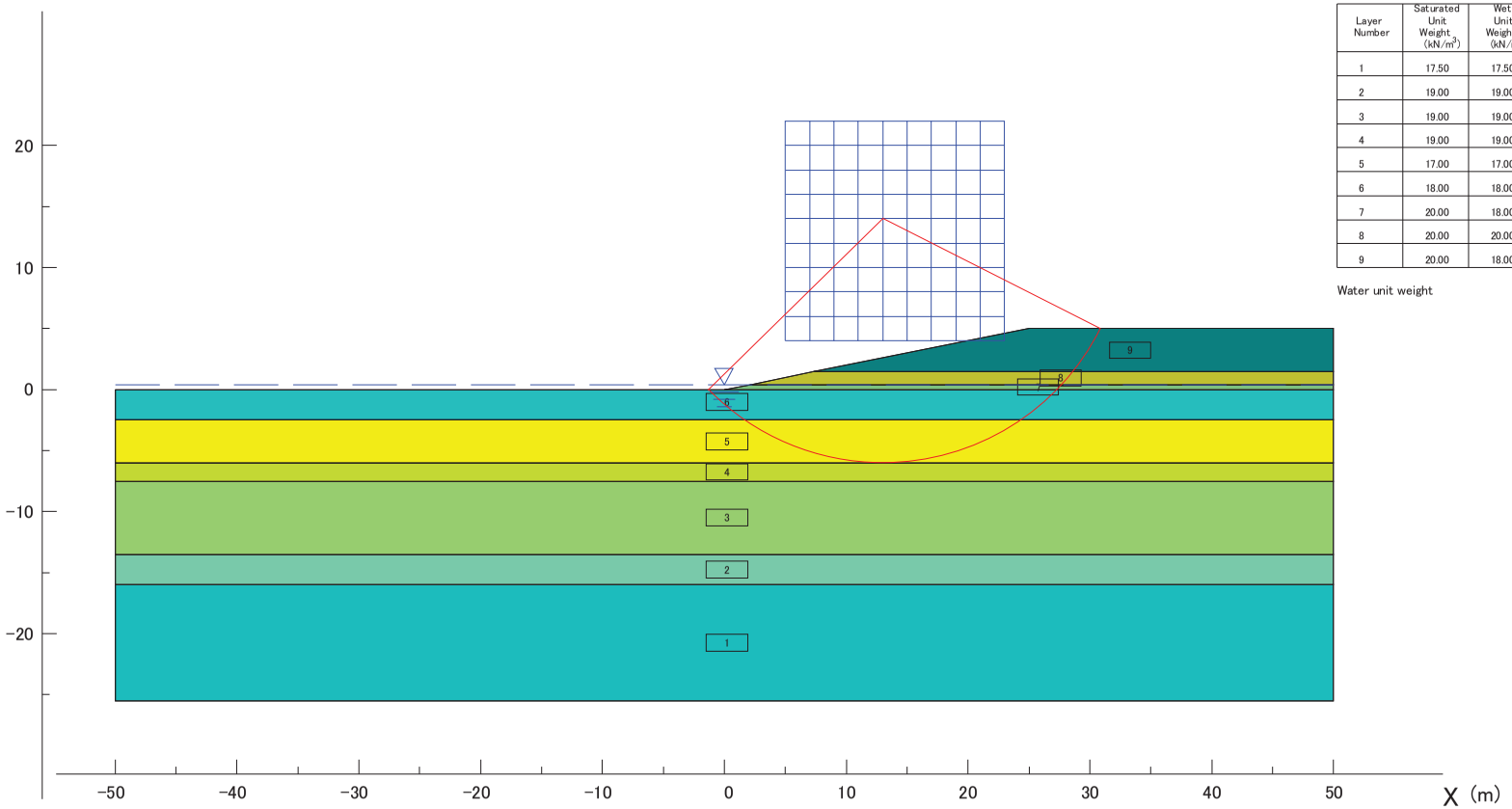
【Block-13】

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.124	
Center of arc	X	=	13.00	(m)
	Y	=	14.00	(m)
Radius	R	=	20.00	(m)
Resisting moment	M_R	=	10841.2	(kNm)
Sliding moment	M_D	=	9648.0	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	17.50	17.50	0.00	40.00	0.00	0.000	0.000
2	19.00	19.00	25.00	0.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	19.00	19.00	25.00	0.00	0.00	0.000	0.000
5	17.00	17.00	0.00	15.00	0.00	0.000	0.000
6	18.00	18.00	0.00	15.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

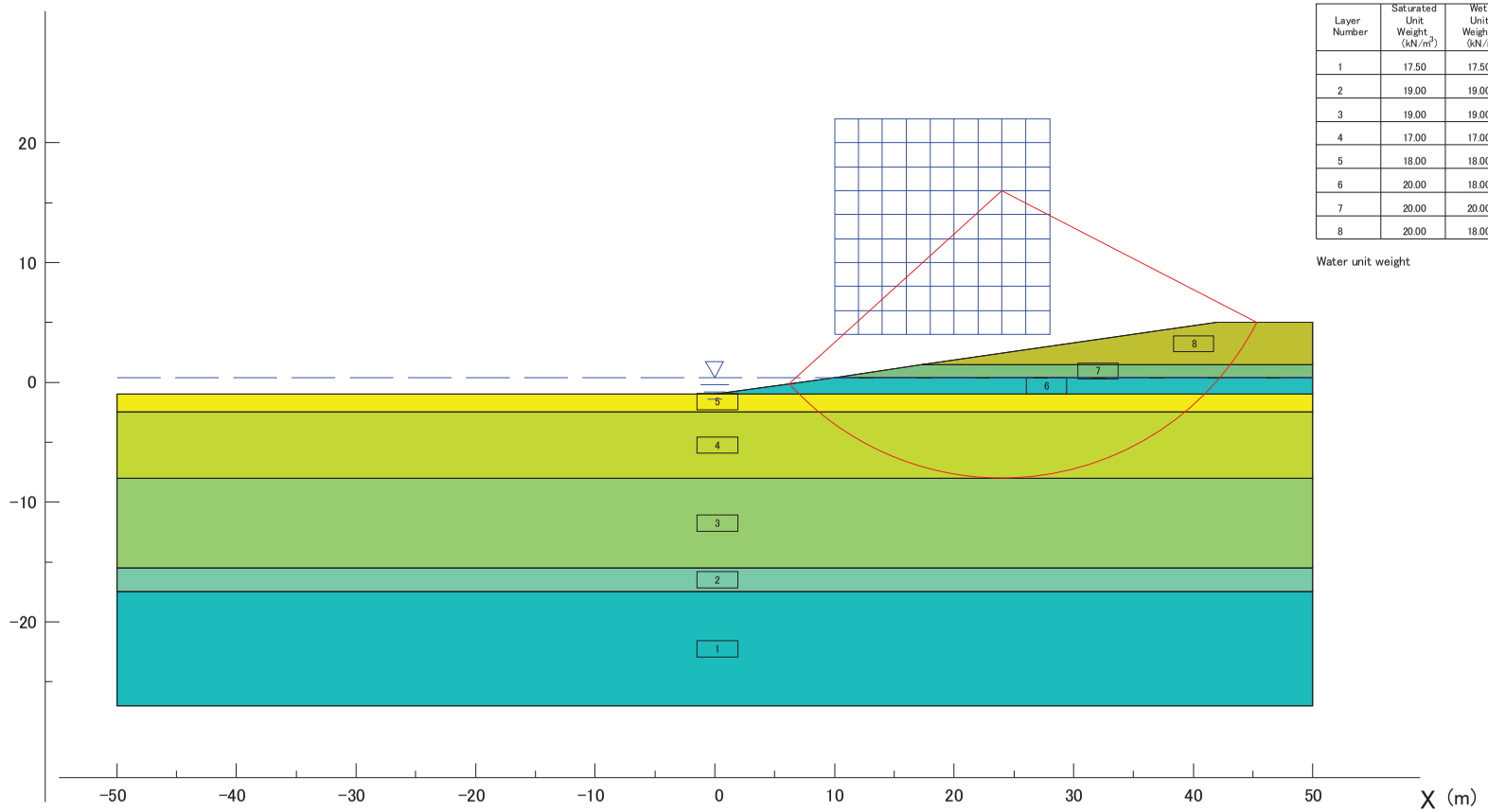
【Block-14】

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.207	
Center of arc	X	=	24.00	(m)
	Y	=	16.00	(m)
Radius	R	=	24.00	(m)
Resisting moment	M_R	=	15839.1	(kNm)
Sliding moment	M_D	=	13126.1	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	17.50	17.50	0.00	40.00	0.00	0.000	0.000
2	19.00	19.00	25.00	0.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.00	17.00	0.00	15.00	0.00	0.000	0.000
5	18.00	18.00	25.00	0.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	20.00	30.00	0.00	0.00	0.000	0.000
8	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

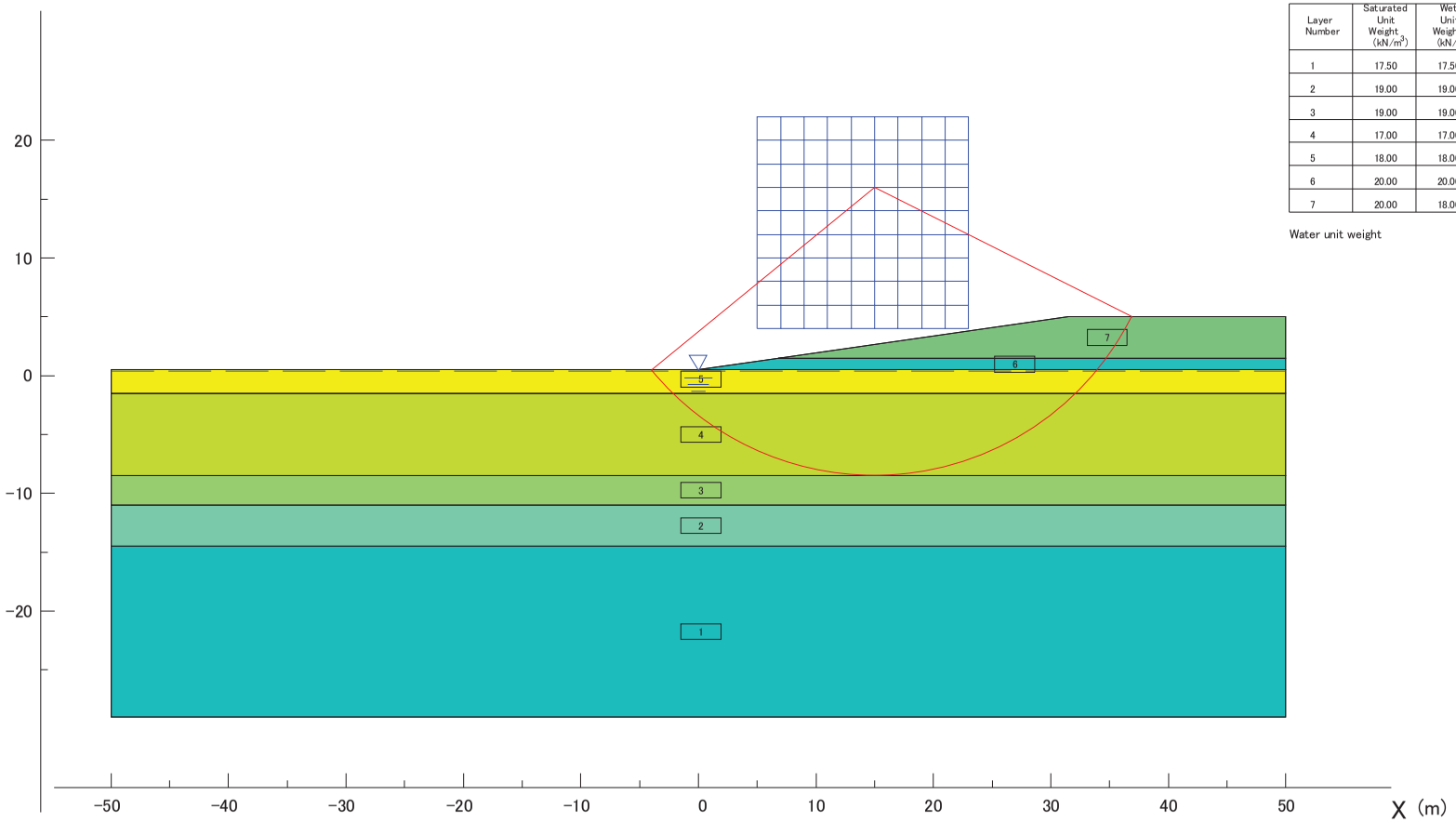
【Block-15】

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.175	
Center of arc	X	=	15.00	(m)
	Y	=	16.00	(m)
Radius	R	=	24.50	(m)
Resisting moment	M_R	=	16431.0	(kNm)
Sliding moment	M_D	=	13987.0	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	17.50	17.50	0.00	40.00	0.00	0.000	0.000
2	19.00	19.00	0.00	50.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.00	17.00	0.00	15.00	0.00	0.000	0.000
5	18.00	18.00	25.00	0.00	0.00	0.000	0.000
6	20.00	20.00	30.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

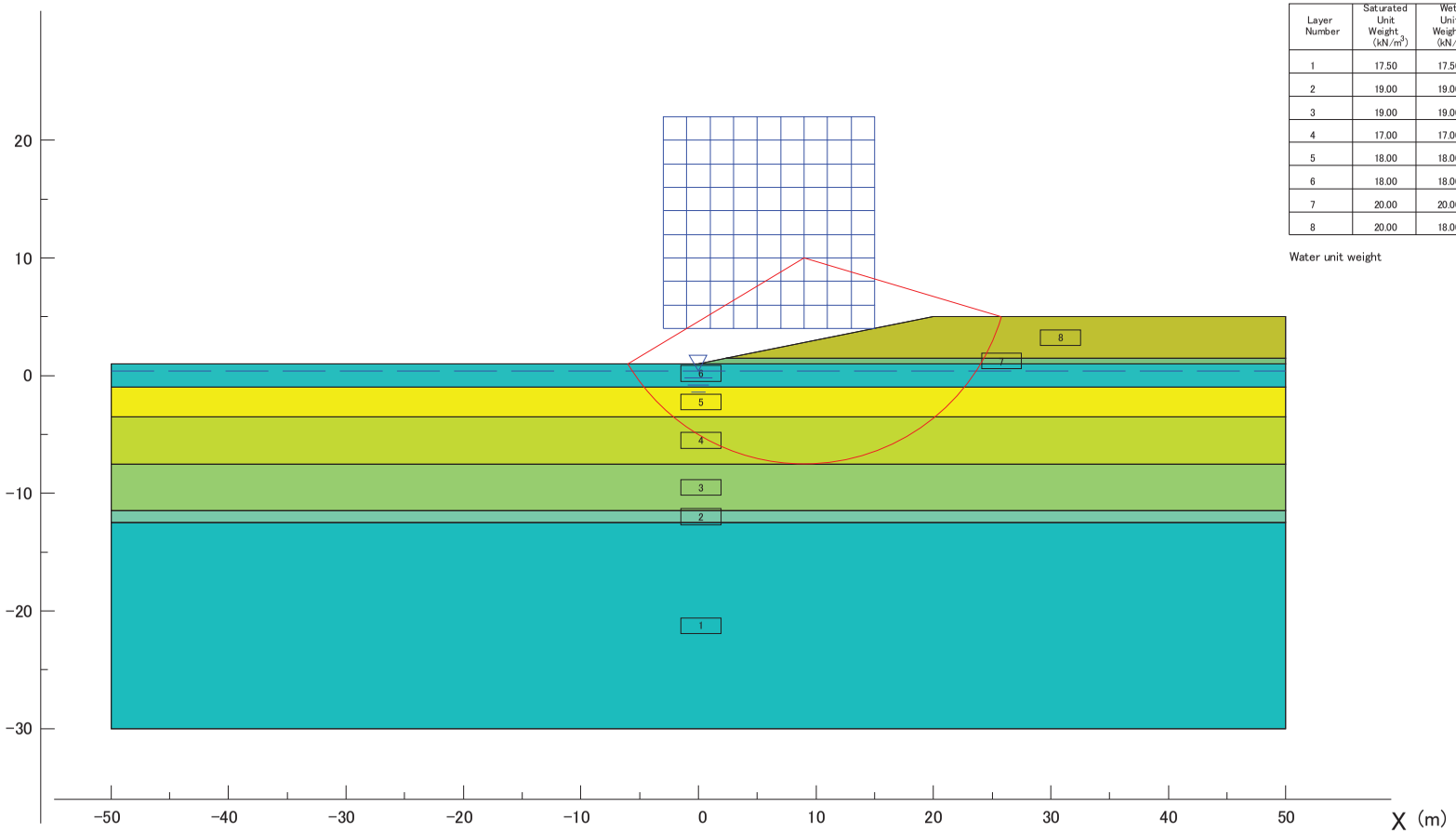
【Block-16】

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.137	
Center of arc	X	=	9.00	(m)
	Y	=	10.00	(m)
Radius	R	=	17.50	(m)
Resisting moment	M_R	=	9161.8	(kNm)
Sliding moment	M_D	=	8054.6	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	17.50	17.50	0.00	40.00	0.00	0.000	0.000
2	19.00	19.00	0.00	50.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.00	17.00	0.00	15.00	0.00	0.000	0.000
5	18.00	18.00	0.00	15.00	0.00	0.000	0.000
6	18.00	18.00	25.00	0.00	0.00	0.000	0.000
7	20.00	20.00	30.00	0.00	0.00	0.000	0.000
8	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

Appendix 7-2

Calculation Result of Soil Improvement for Inner Revetment Area and Outer Revetment Area

Appendix 7-2

1) Location Map of Sections for Slope Stability and Consolidation Settlement Analysis at Inner Revetment and Outer Revetment A

2) Slope Stability Analysis Result for Inner Revetment

3) Settlement-Time Curves with PVD for Inner Revetment

4) Subsoil Improvement Procedure with PVD and Preload Method for Inner Revetment

5) Economical Comparison between PVD+Preload Method and Sand Replacement Method for Outer Revetment A

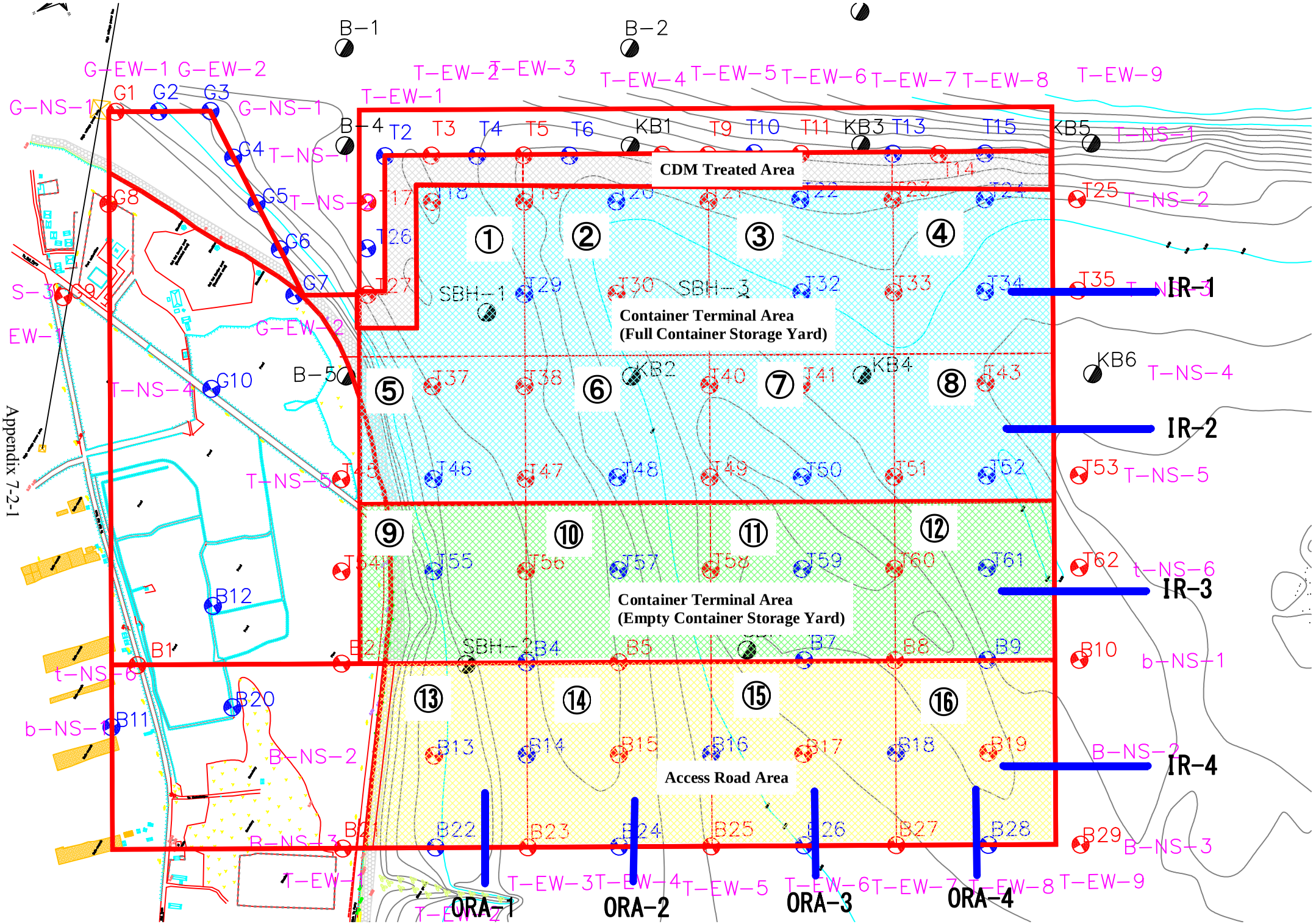
6) Slope Stability Analysis Result and Settlement-Time Curves with Sand Replacement Method for Outer Revetment A

7) Slope Stability Analysis Result for Outer Revetment A

8) Settlement-Time Curves with PVD for Outer Revetment A

9) Subsoil Improvement Procedure with PVD and Preload Method for Outer Revetment A

1) Location Map of Sections for Slope Stability and Consolidation Settlement Analysis at Inner Revetment and Outer Revetment A


CDM Treated Area
Container Terminal Area
(Full Container Storage Yard)
Container Terminal Area
(Empty Container Storage Yard)
Access Road Area
IR-1
IR-2
IR-3
IR-4
ORA-1
ORA-2
ORA-3
ORA-4
Appendix 7-2-1

2) Slope Stability Analysis Result for Inner Revetment

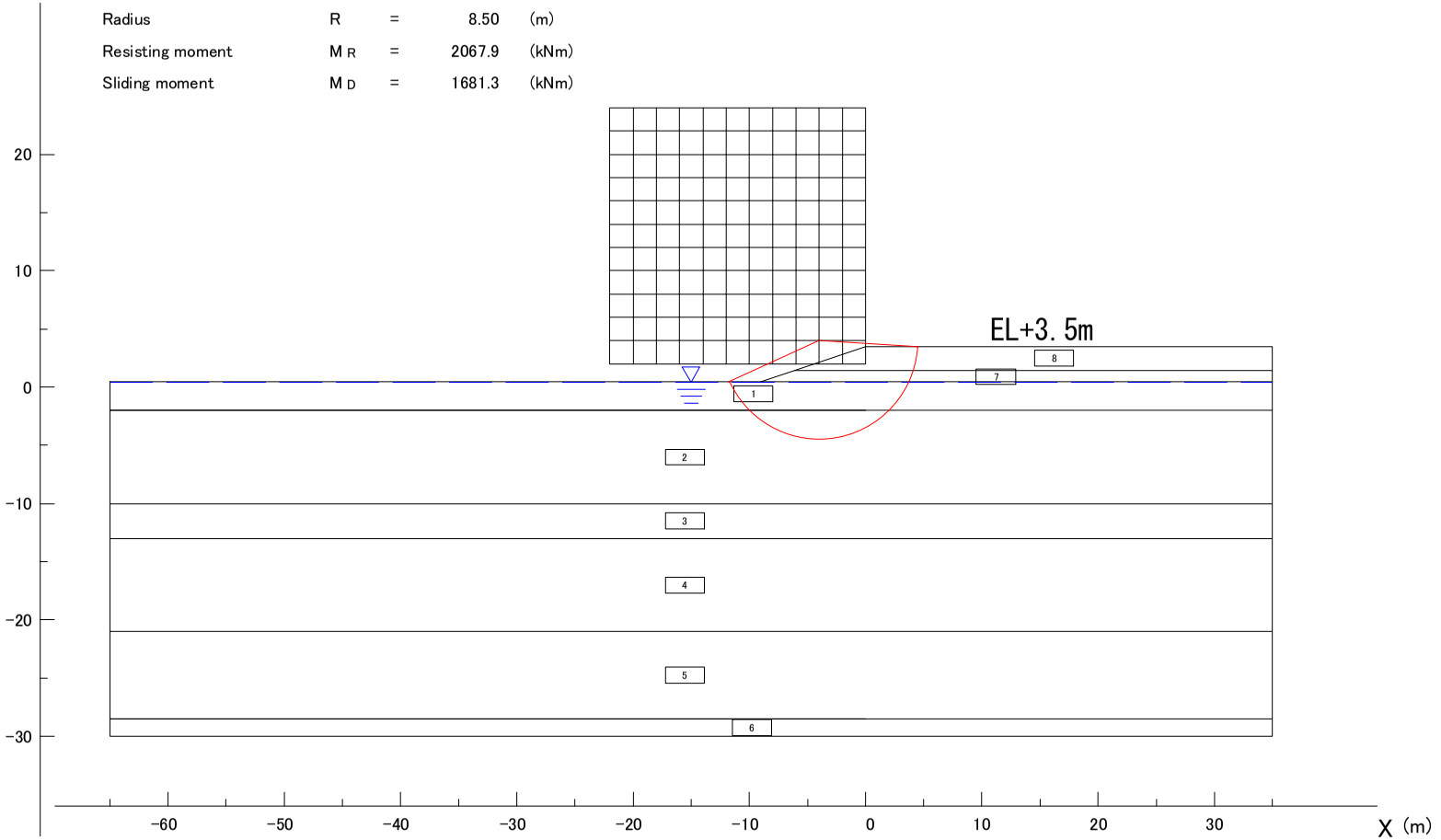
Inner Revetment-1 (1st)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.230	
Center of arc	X	=	-4.00	(m)
	Y	=	4.00	(m)
Radius	R	=	8.50	(m)
Resisting moment	M_R	=	2067.9	(kNm)
Sliding moment	M_D	=	1681.3	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	25.00	0.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	20.00	30.00	0.00	0.00	0.000	0.000
8	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

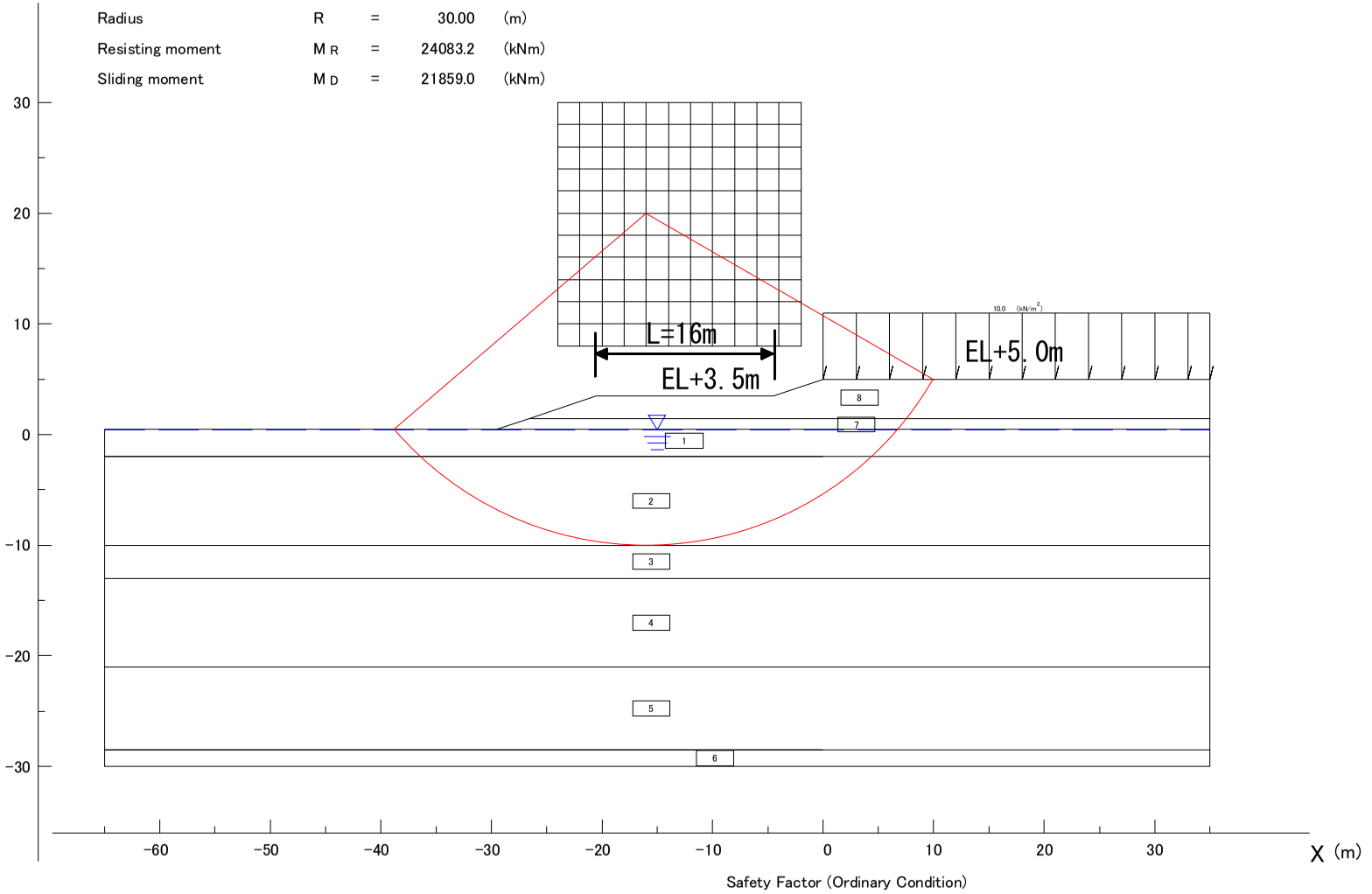
Inner Revetment-1 (2nd)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.102	
Center of arc	X	=	-16.00	(m)
	Y	=	20.00	(m)
Radius	R	=	30.00	(m)
Resisting moment	M_R	=	24083.2	(kNm)
Sliding moment	M_D	=	21859.0	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	25.00	0.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	20.00	30.00	0.00	0.00	0.000	0.000
8	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

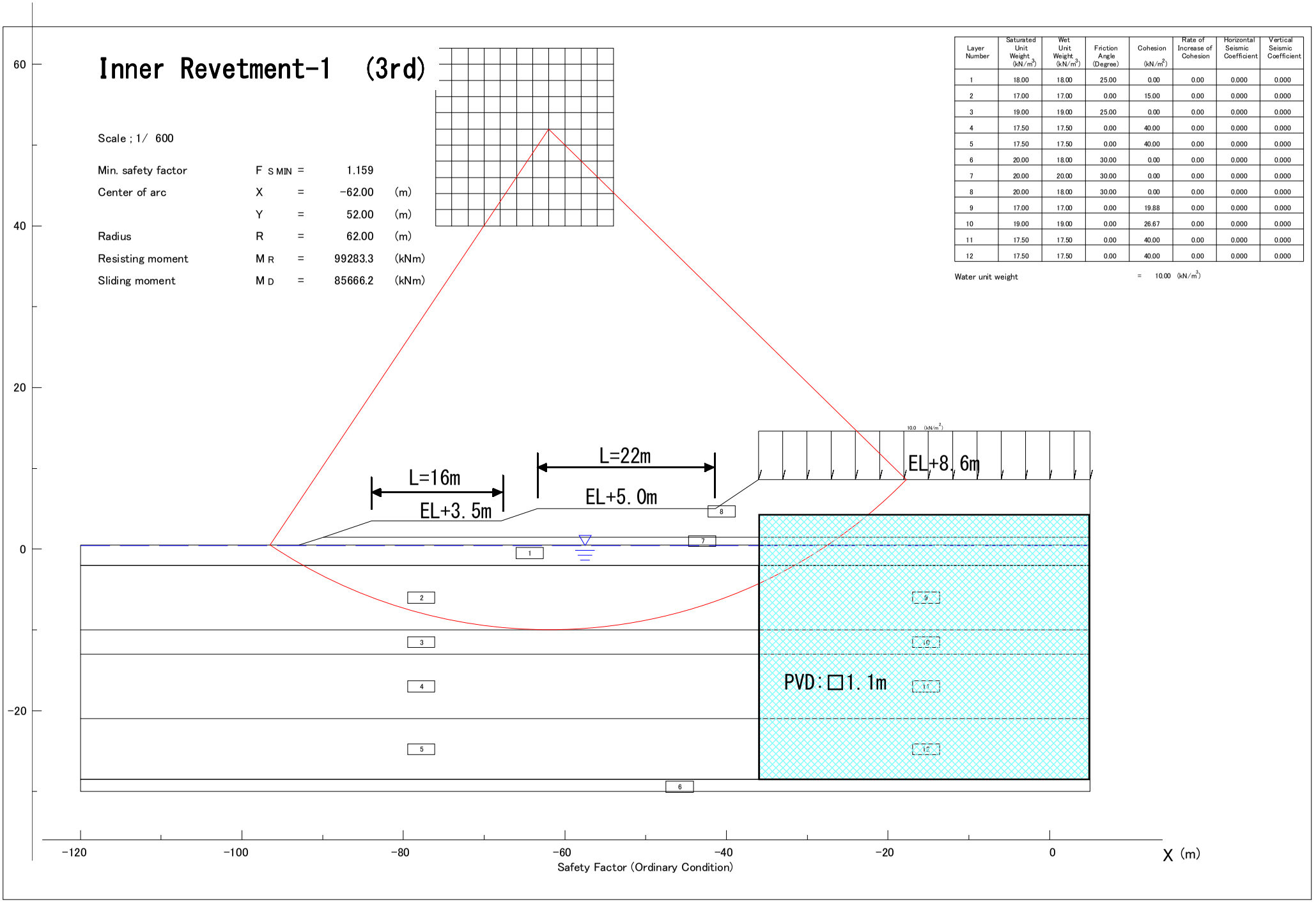
Inner Revetment-1 (3rd)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.159	
Center of arc	X	=	-62.00	(m)
	Y	=	52.00	(m)
Radius	R	=	62.00	(m)
Resisting moment	M_R	=	99283.3	(kNm)
Sliding moment	M_D	=	85666.2	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	25.00	0.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	20.00	30.00	0.00	0.00	0.000	0.000
8	20.00	18.00	30.00	0.00	0.00	0.000	0.000
9	17.00	17.00	0.00	19.88	0.00	0.000	0.000
10	19.00	19.00	0.00	26.67	0.00	0.000	0.000
11	17.50	17.50	0.00	40.00	0.00	0.000	0.000
12	17.50	17.50	0.00	40.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

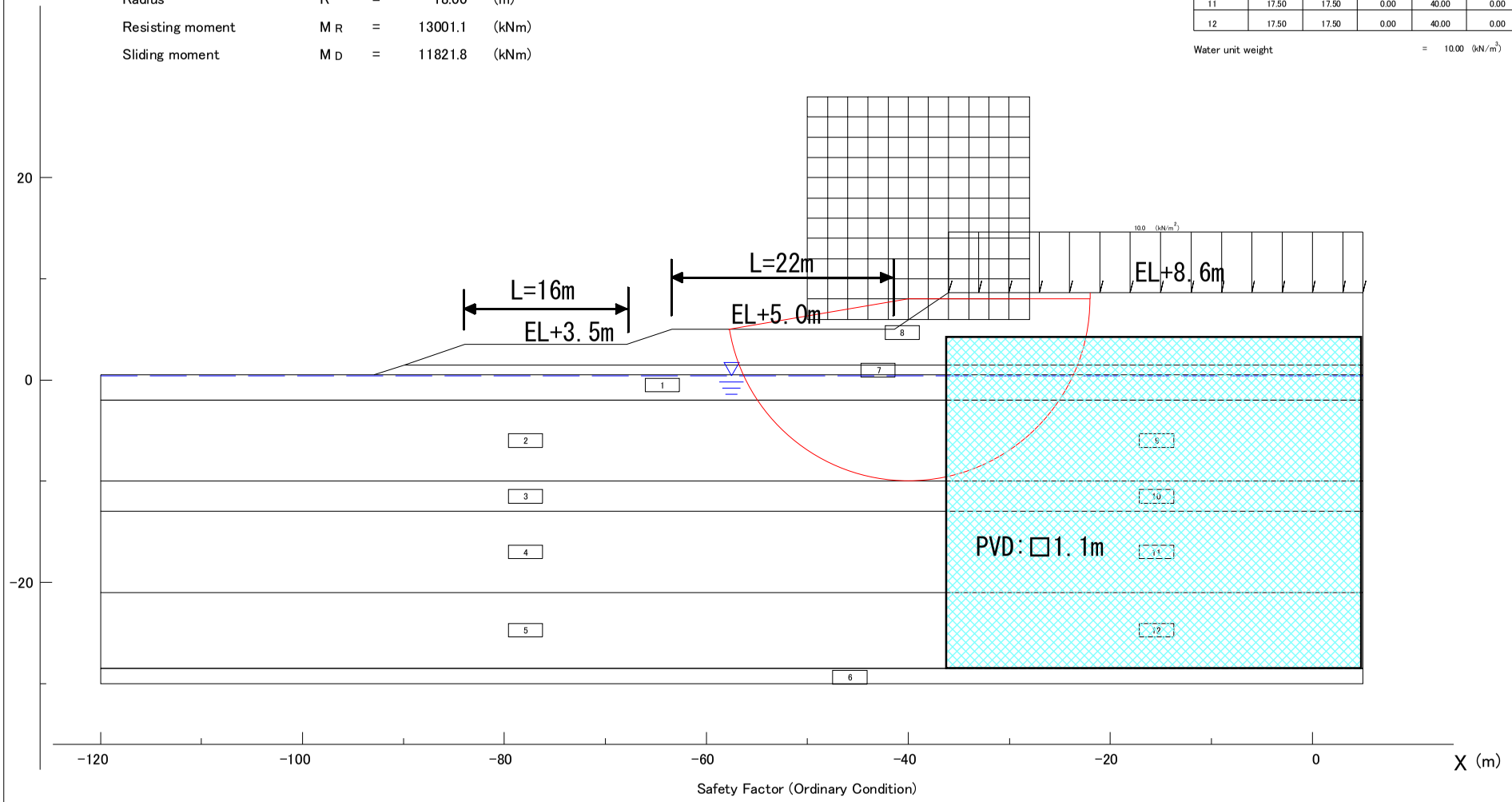
Inner Revetment-1 (3rd)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.100	
Center of arc	X	=	-40.00	(m)
	Y	=	8.00	(m)
Radius	R	=	18.00	(m)
Resisting moment	M_R	=	13001.1	(kNm)
Sliding moment	M_D	=	11821.8	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	25.00	0.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	20.00	30.00	0.00	0.00	0.000	0.000
8	20.00	18.00	30.00	0.00	0.00	0.000	0.000
9	17.00	17.00	0.00	19.88	0.00	0.000	0.000
10	19.00	19.00	0.00	26.67	0.00	0.000	0.000
11	17.50	17.50	0.00	40.00	0.00	0.000	0.000
12	17.50	17.50	0.00	40.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

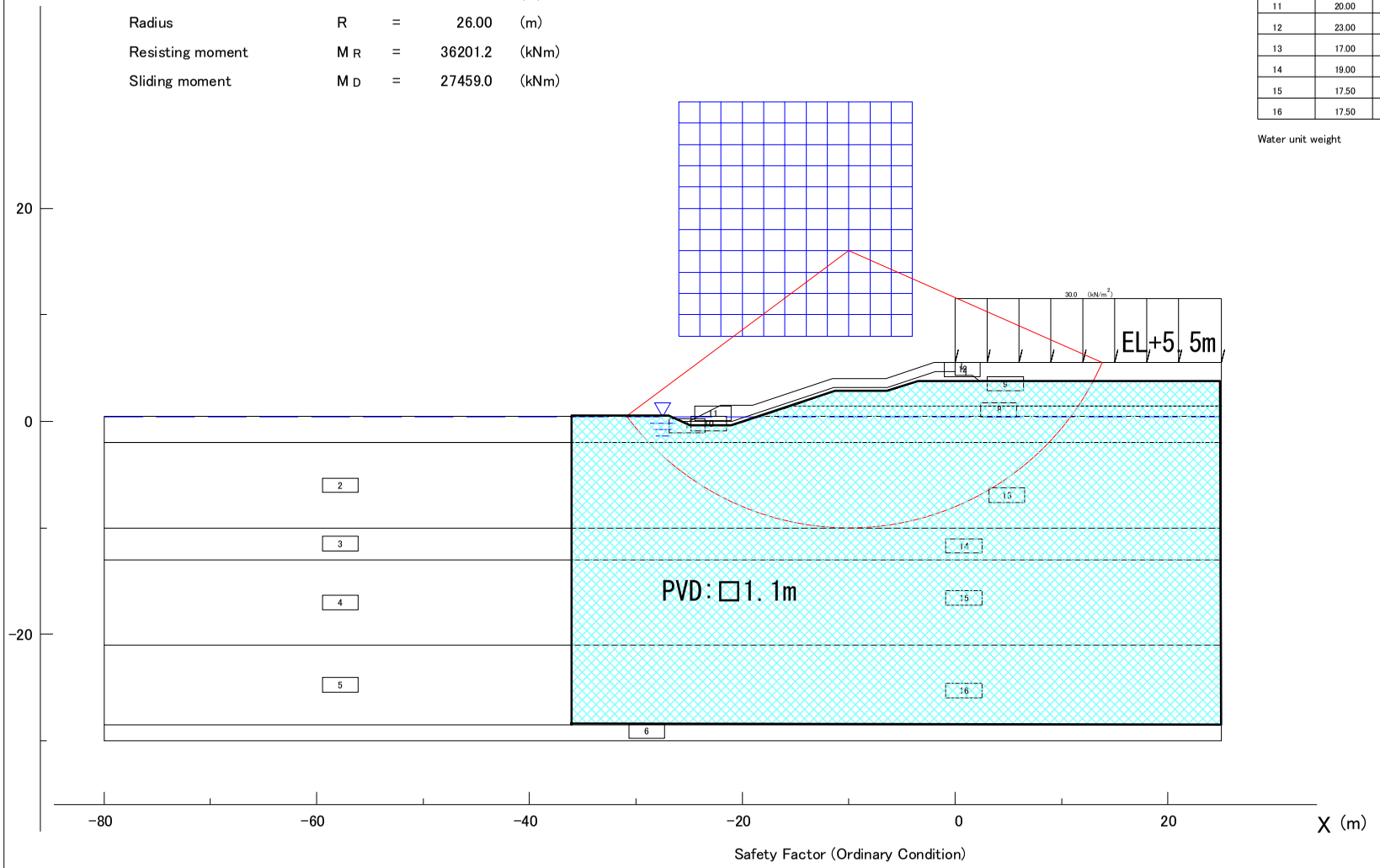
Inner Revetment-1 (After completion of Revetment Construction)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.318	
Center of arc	X	=	-10.00	(m)
	Y	=	16.00	(m)
Radius	R	=	26.00	(m)
Resisting moment	M_R	=	36201.2	(kNm)
Sliding moment	M_D	=	27459.0	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000
10	20.00	18.00	40.00	0.00	0.00	0.000	0.000
11	20.00	18.00	40.00	0.00	0.00	0.000	0.000
12	23.00	23.00	40.00	0.00	0.00	0.000	0.000
13	17.00	17.00	0.00	30.42	0.00	0.000	0.000
14	19.00	19.00	0.00	35.22	0.00	0.000	0.000
15	17.50	17.50	0.00	44.38	0.00	0.000	0.000
16	17.50	17.50	0.00	43.46	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

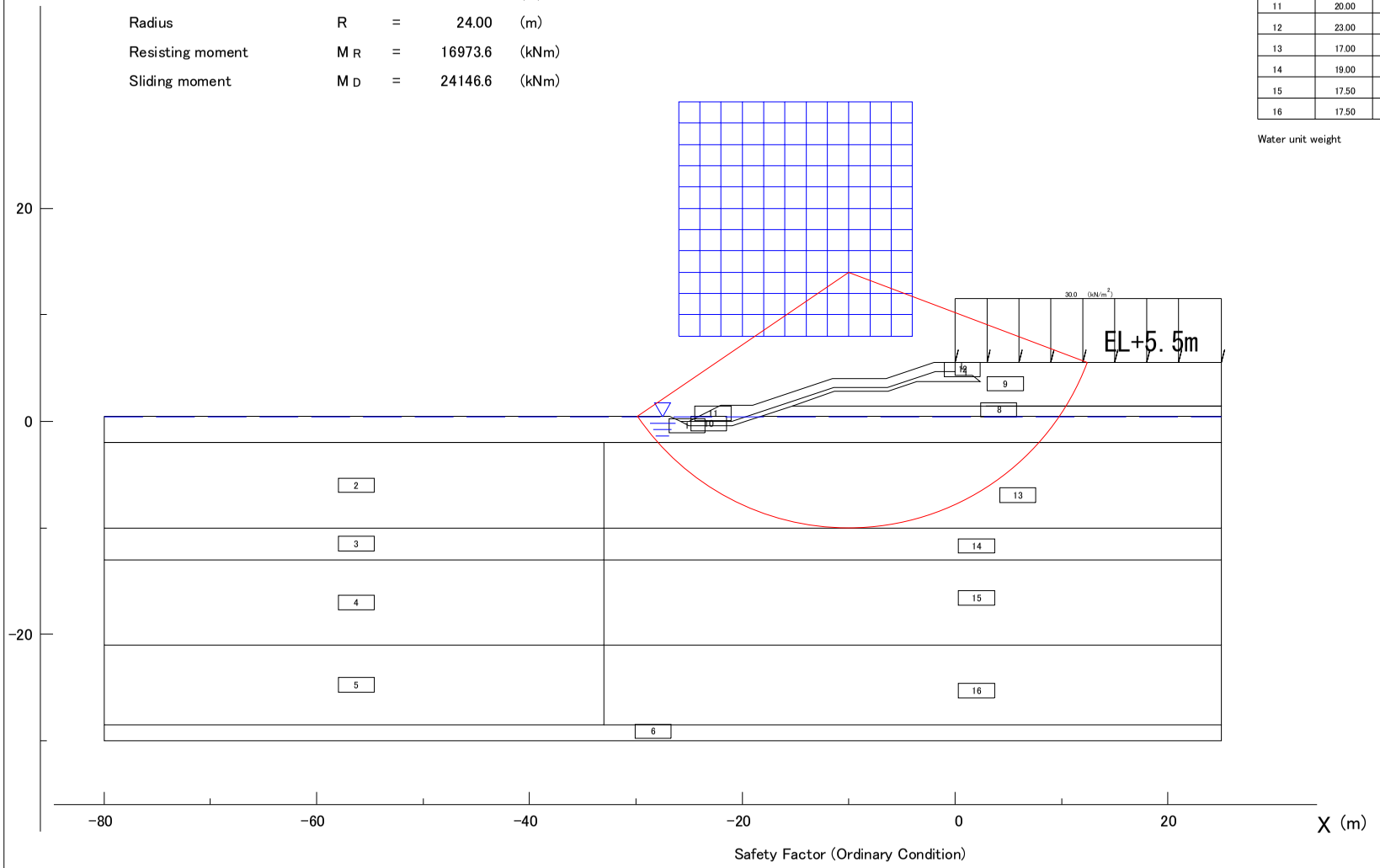
Inner Revetment-1 (Without Subsoil Improvement)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	0.703	
Center of arc	X	=	-10.00	(m)
	Y	=	14.00	(m)
Radius	R	=	24.00	(m)
Resisting moment	M_R	=	16973.6	(kNm)
Sliding moment	M_D	=	24146.6	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000
10	20.00	18.00	40.00	0.00	0.00	0.000	0.000
11	20.00	18.00	40.00	0.00	0.00	0.000	0.000
12	23.00	23.00	40.00	0.00	0.00	0.000	0.000
13	17.00	17.00	0.00	15.00	0.00	0.000	0.000
14	19.00	19.00	0.00	25.00	0.00	0.000	0.000
15	17.50	17.50	0.00	40.00	0.00	0.000	0.000
16	17.50	17.50	0.00	40.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



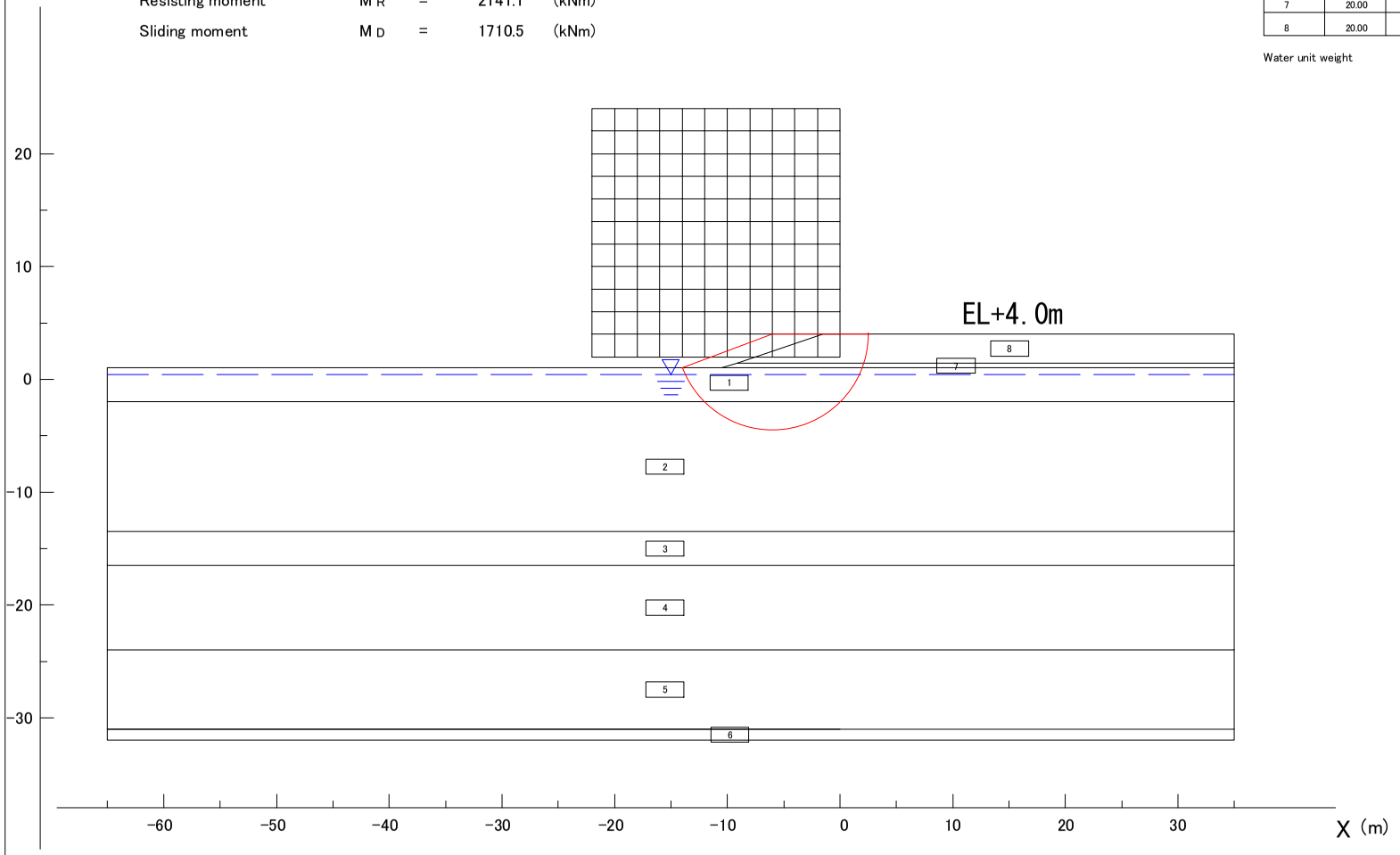
Safety Factor (Ordinary Condition)

Inner Revetment-2 (1st)

Min. safety factor	$F_{S\,MIN}$	=	1.252	
Center of arc	X	=	−6.00	(m)
	Y	=	4.00	(m)
Radius	R	=	8.50	(m)
Resisting moment	M_R	=	2141.1	(kNm)
Sliding moment	M_D	=	1710.5	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	0.00	50.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	20.00	30.00	0.00	0.00	0.000	0.000
8	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



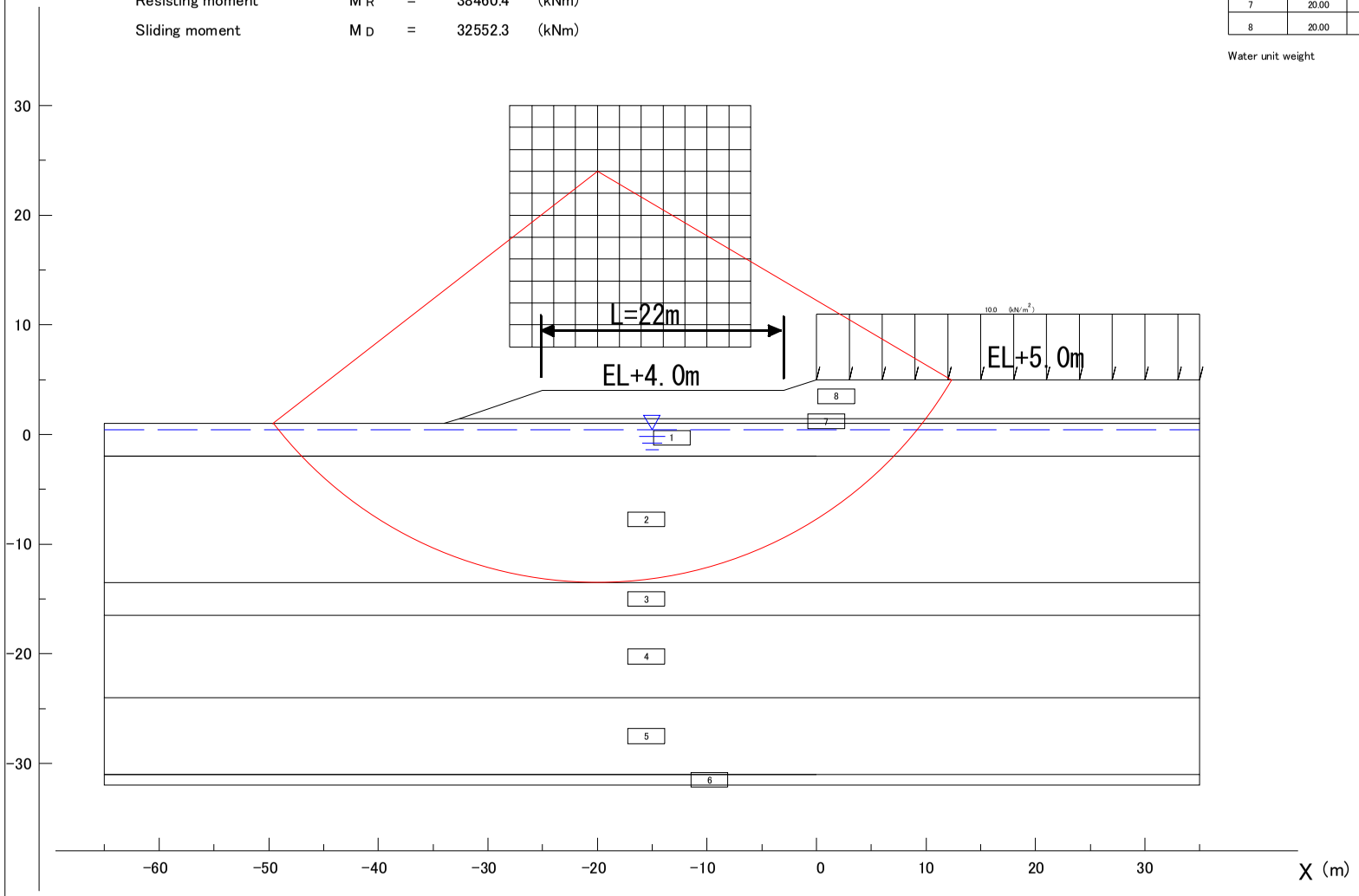
Safety Factor (Ordinary Condition)

Inner Revetment-2 (2nd)

Min. safety factor	$F_{S\,MIN}$	=	1.181	
Center of arc	X	=	-20.00	(m)
	Y	=	24.00	(m)
Radius	R	=	37.50	(m)
Resisting moment	M_R	=	38460.4	(kNm)
Sliding moment	M_D	=	32552.3	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	0.00	50.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	20.00	30.00	0.00	0.00	0.000	0.000
8	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



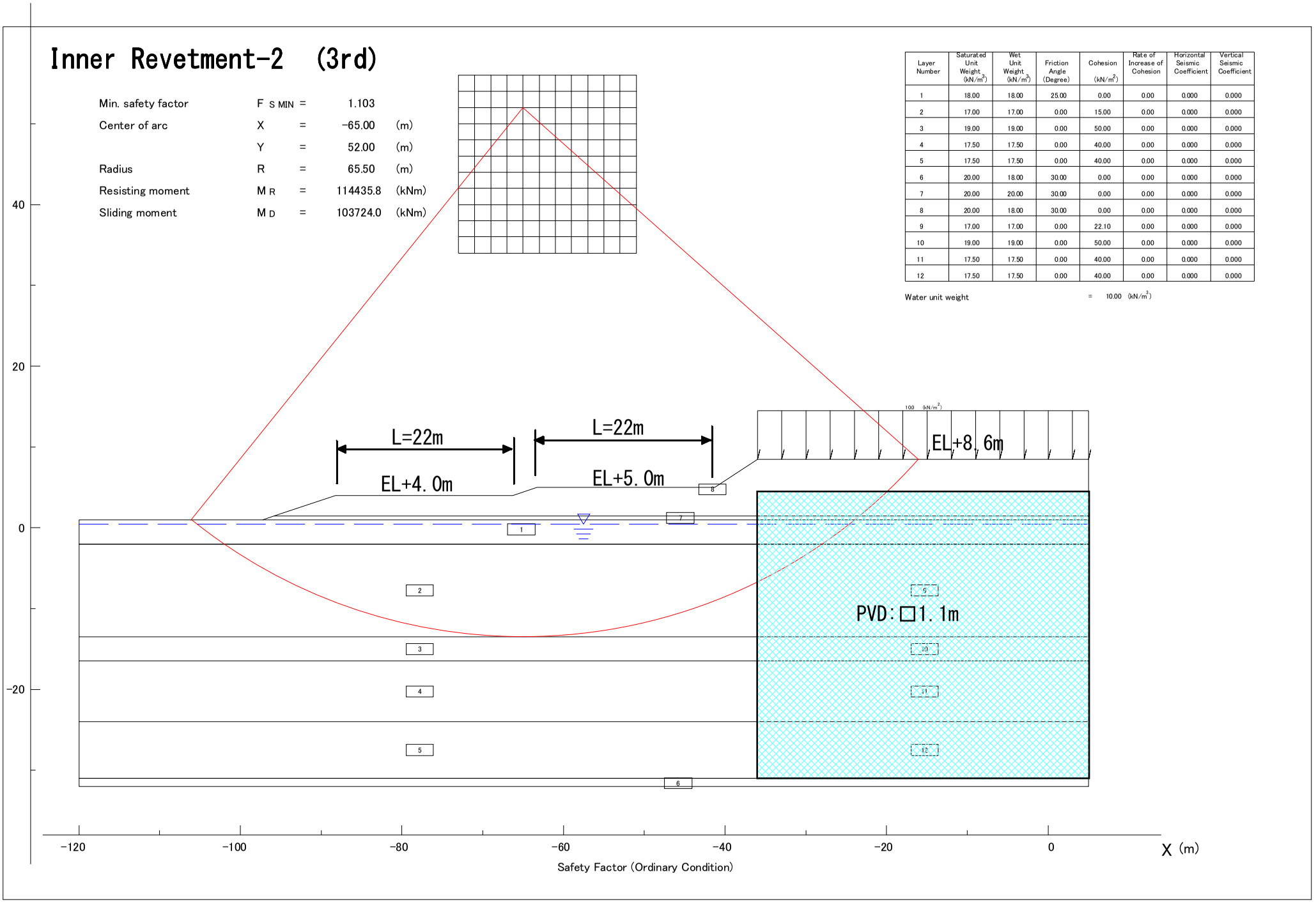
Safety Factor (Ordinary Condition)

Inner Revetment-2 (3rd)

Min. safety factor	$F_{S\,MIN}$	=	1.103	
Center of arc	X	=	-65.00	(m)
	Y	=	52.00	(m)
Radius	R	=	65.50	(m)
Resisting moment	M_R	=	114435.8	(kNm)
Sliding moment	M_D	=	103724.0	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	0.00	50.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	20.00	30.00	0.00	0.00	0.000	0.000
8	20.00	18.00	30.00	0.00	0.00	0.000	0.000
9	17.00	17.00	0.00	22.10	0.00	0.000	0.000
10	19.00	19.00	0.00	50.00	0.00	0.000	0.000
11	17.50	17.50	0.00	40.00	0.00	0.000	0.000
12	17.50	17.50	0.00	40.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)

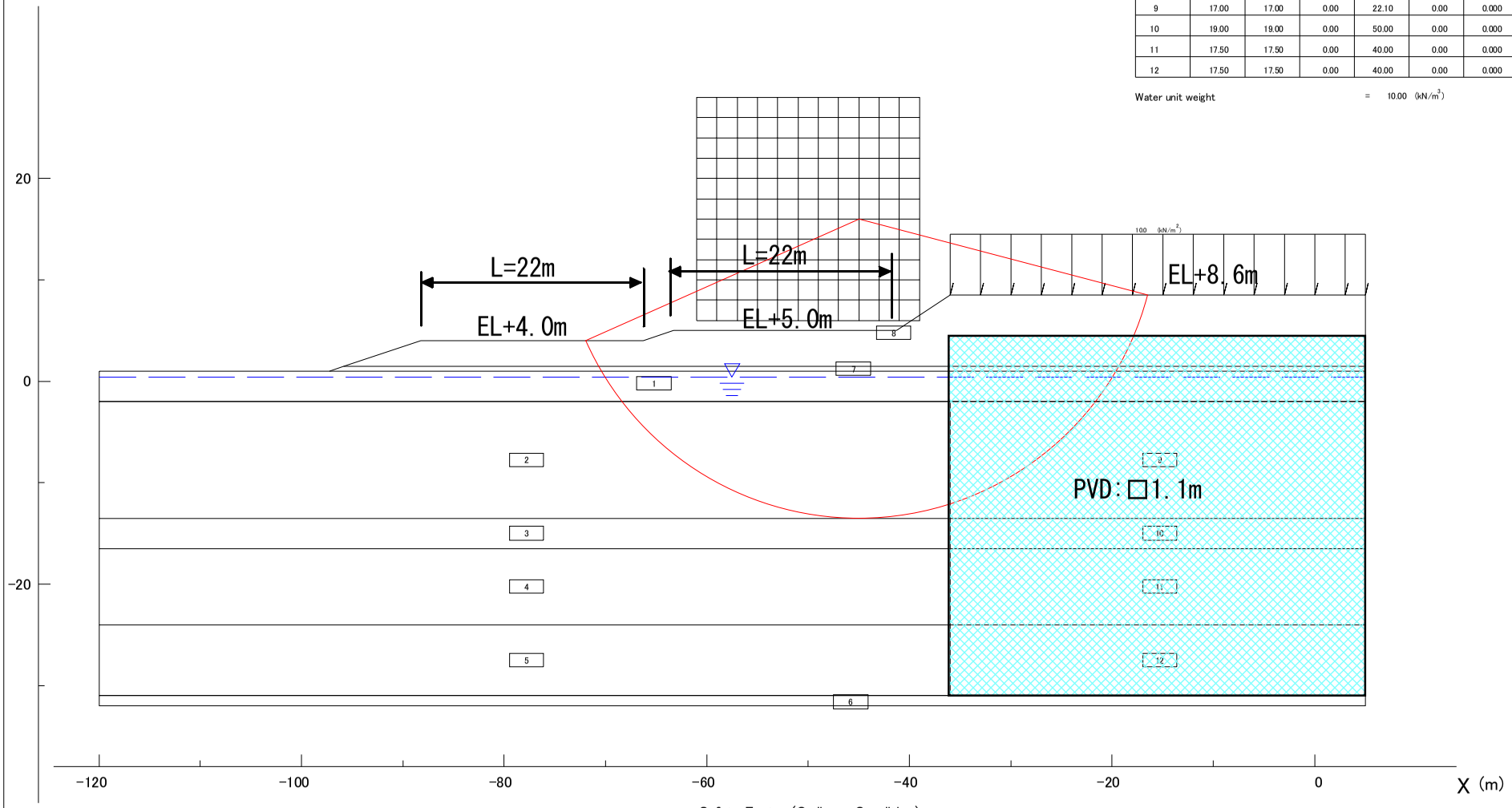


Inner Revetment-2 (3rd)

Min. safety factor	$F_{S\,MIN}$	=	1.105	
Center of arc	X	=	-45.00	(m)
	Y	=	16.00	(m)
Radius	R	=	29.50	(m)
Resisting moment	M_R	=	33290.7	(kNm)
Sliding moment	M_D	=	30119.2	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	0.00	50.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	20.00	30.00	0.00	0.00	0.000	0.000
8	20.00	18.00	30.00	0.00	0.00	0.000	0.000
9	17.00	17.00	0.00	22.10	0.00	0.000	0.000
10	19.00	19.00	0.00	50.00	0.00	0.000	0.000
11	17.50	17.50	0.00	40.00	0.00	0.000	0.000
12	17.50	17.50	0.00	40.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



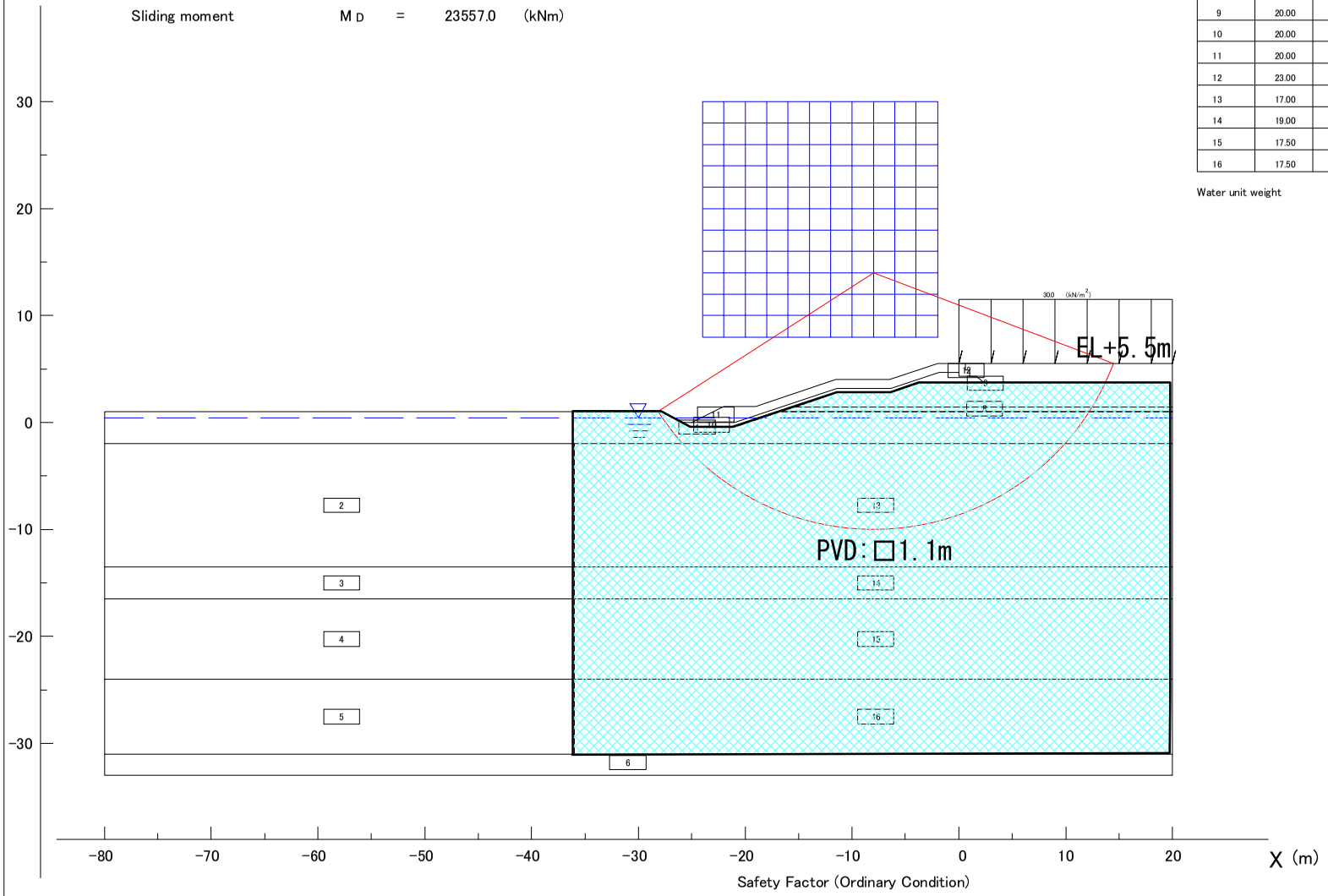
Safety Factor (Ordinary Condition)

Inner Revetment-2 (After completion of Revetment Construction)

Min. safety factor	$F_{S\,MIN}$	=	1.430	
Center of arc	X	=	-8.00	(m)
	Y	=	14.00	(m)
Radius	R	=	24.00	(m)
Resisting moment	M_R	=	33682.1	(kNm)
Sliding moment	M_D	=	23557.0	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	0.00	50.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000
10	20.00	18.00	40.00	0.00	0.00	0.000	0.000
11	20.00	18.00	40.00	0.00	0.00	0.000	0.000
12	23.00	23.00	40.00	0.00	0.00	0.000	0.000
13	17.00	17.00	0.00	32.28	0.00	0.000	0.000
14	19.00	19.00	0.00	50.00	0.00	0.000	0.000
15	17.50	17.50	0.00	43.66	0.00	0.000	0.000
16	17.50	17.50	0.00	42.95	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)

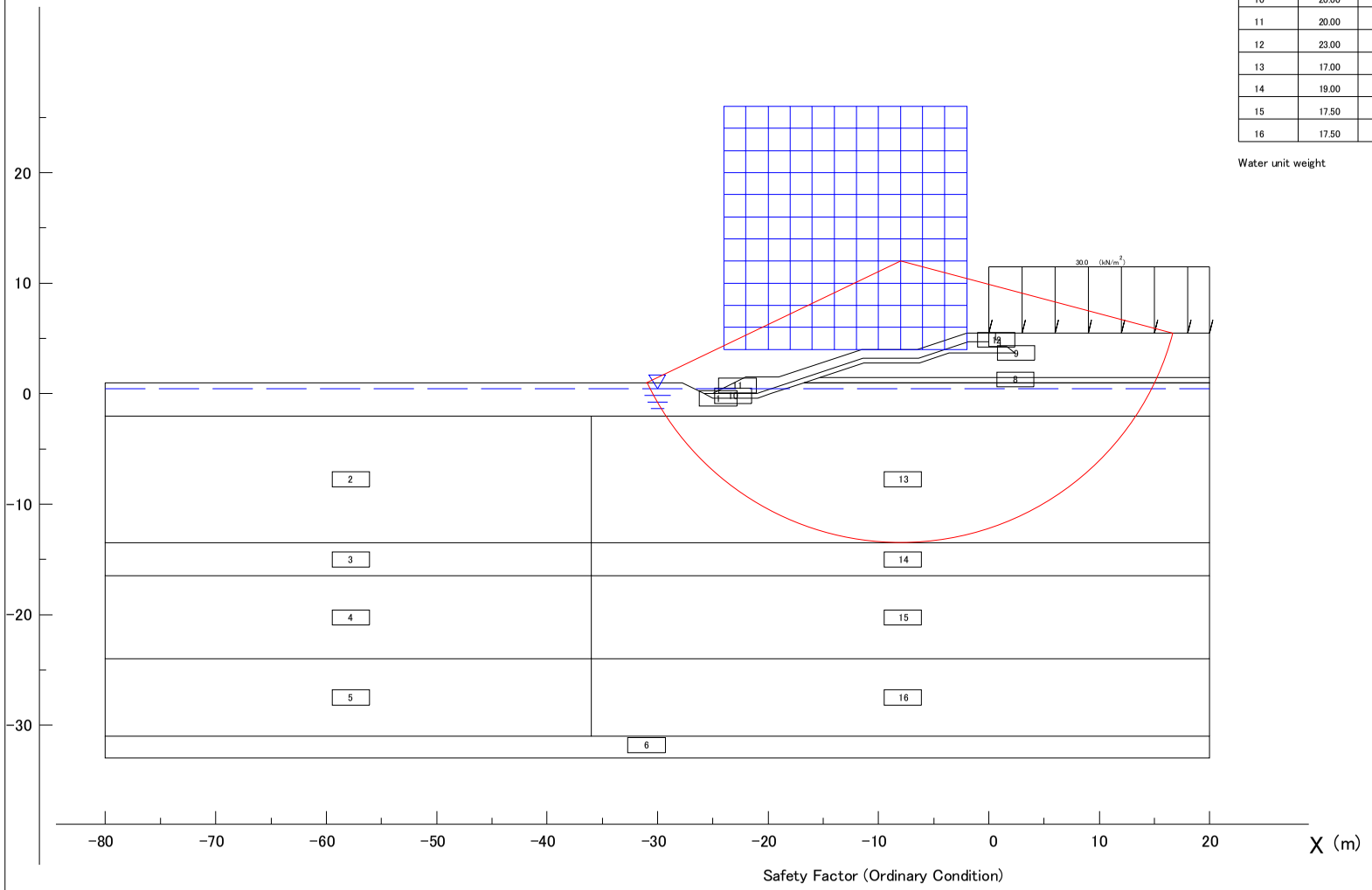


Inner Revetment-2 (Without Subsoil Improvement)

Min. safety factor	$F_{S\,MIN}$	=	0.702	
Center of arc	X	=	-8.00	(m)
	Y	=	12.00	(m)
Radius	R	=	25.50	(m)
Resisting moment	M_R	=	20890.3	(kNm)
Sliding moment	M_D	=	29764.2	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	0.00	50.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000
10	20.00	18.00	40.00	0.00	0.00	0.000	0.000
11	20.00	18.00	40.00	0.00	0.00	0.000	0.000
12	23.00	23.00	40.00	0.00	0.00	0.000	0.000
13	17.00	17.00	0.00	15.00	0.00	0.000	0.000
14	19.00	19.00	0.00	50.00	0.00	0.000	0.000
15	17.50	17.50	0.00	40.00	0.00	0.000	0.000
16	17.50	17.50	0.00	40.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

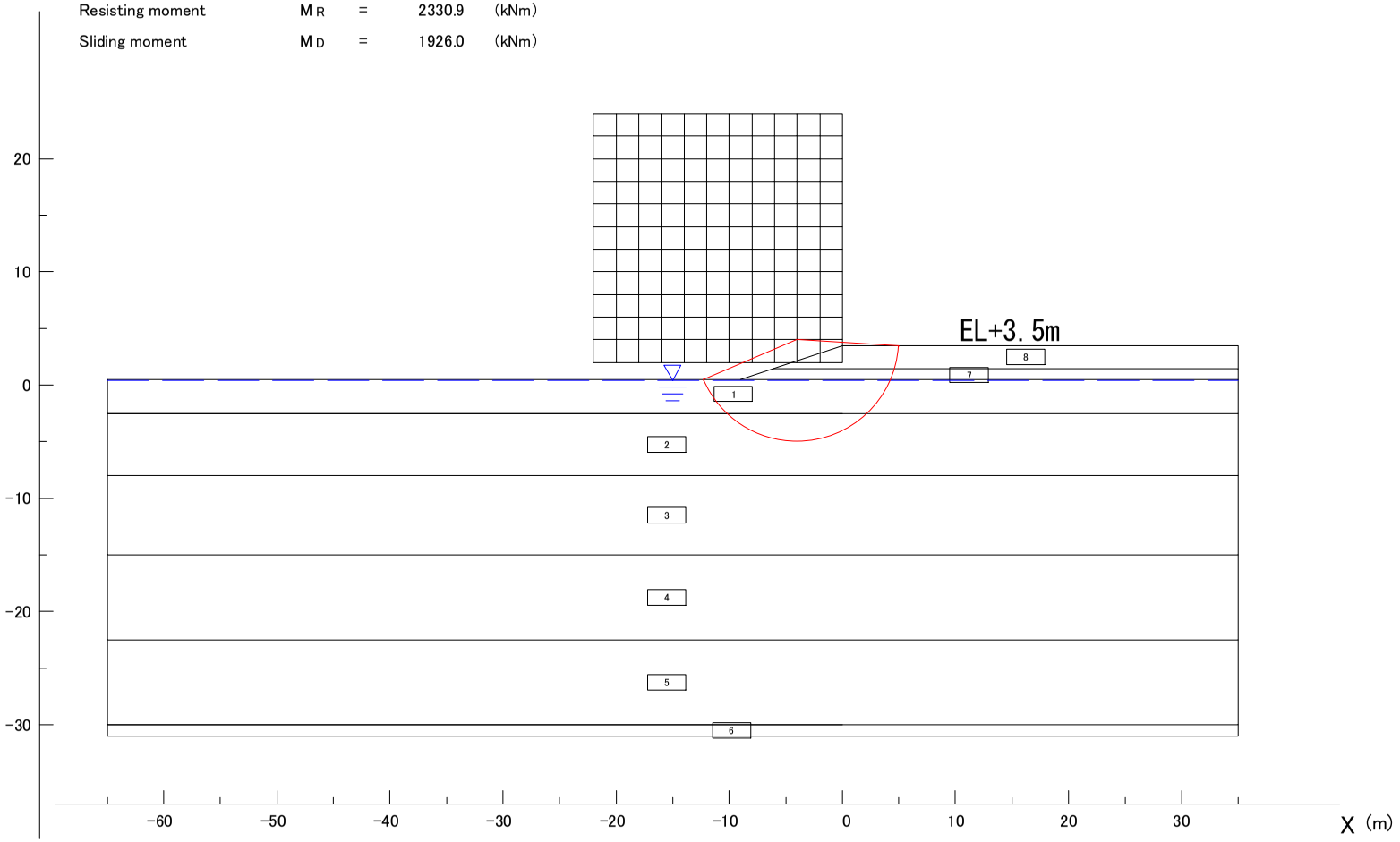
Inner Revetment-3 (1st)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.210	
Center of arc	X	=	-4.00	(m)
	Y	=	4.00	(m)
Radius	R	=	9.00	(m)
Resisting moment	M_R	=	2330.9	(kNm)
Sliding moment	M_D	=	1926.0	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	20.00	30.00	0.00	0.00	0.000	0.000
8	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

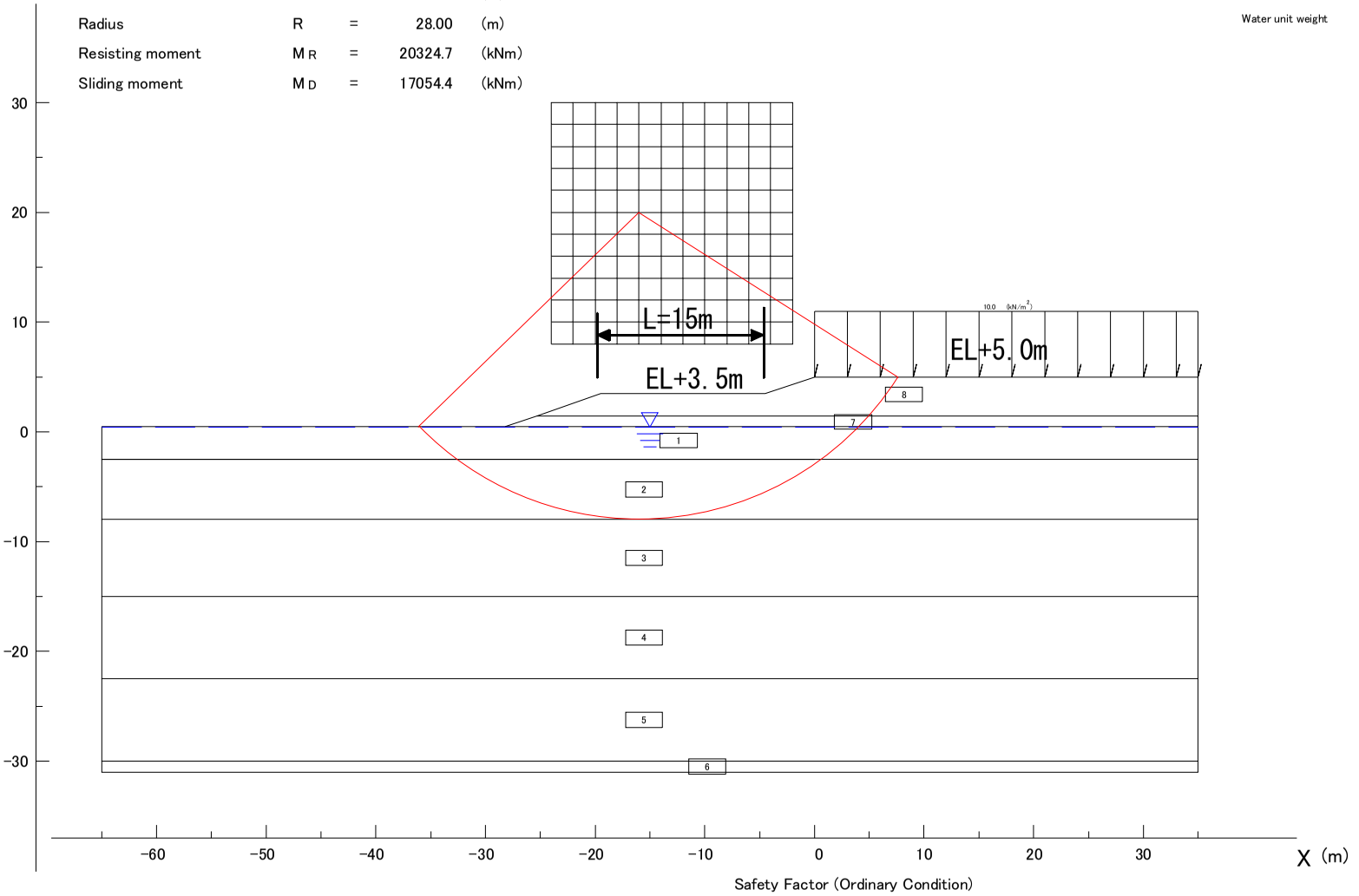
Inner Revetment-3 (2nd)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.192	
Center of arc	X	=	−16.00	(m)
	Y	=	20.00	(m)
Radius	R	=	28.00	(m)
Resisting moment	M_R	=	20324.7	(kNm)
Sliding moment	M_D	=	17054.4	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	20.00	30.00	0.00	0.00	0.000	0.000
8	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

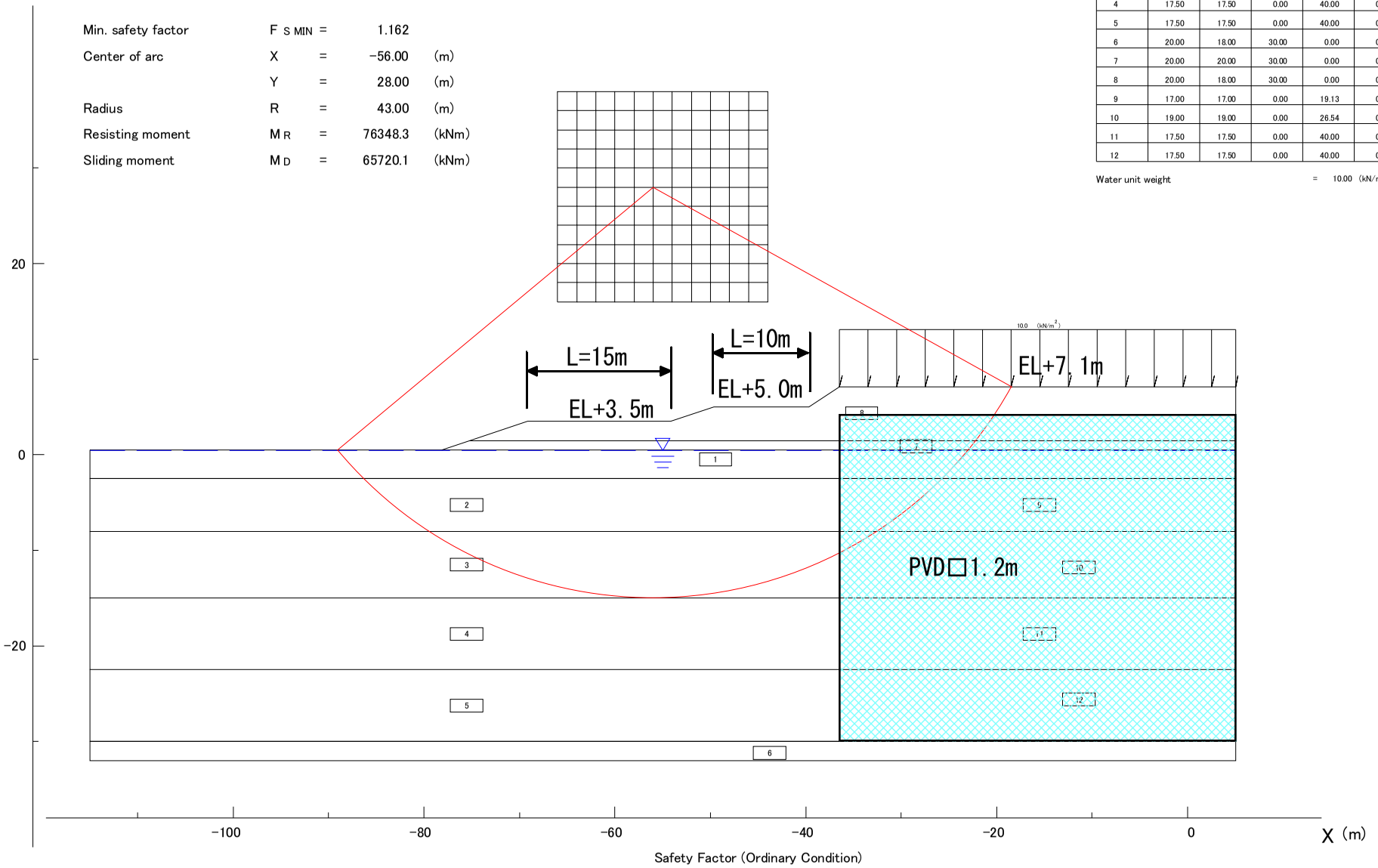
Inner Revetment-3 (3rd)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.162	
Center of arc	X	=	-56.00	(m)
	Y	=	28.00	(m)
Radius	R	=	43.00	(m)
Resisting moment	M_R	=	76348.3	(kNm)
Sliding moment	M_D	=	65720.1	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	20.00	30.00	0.00	0.00	0.000	0.000
8	20.00	18.00	30.00	0.00	0.00	0.000	0.000
9	17.00	17.00	0.00	19.13	0.00	0.000	0.000
10	19.00	19.00	0.00	26.54	0.00	0.000	0.000
11	17.50	17.50	0.00	40.00	0.00	0.000	0.000
12	17.50	17.50	0.00	40.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

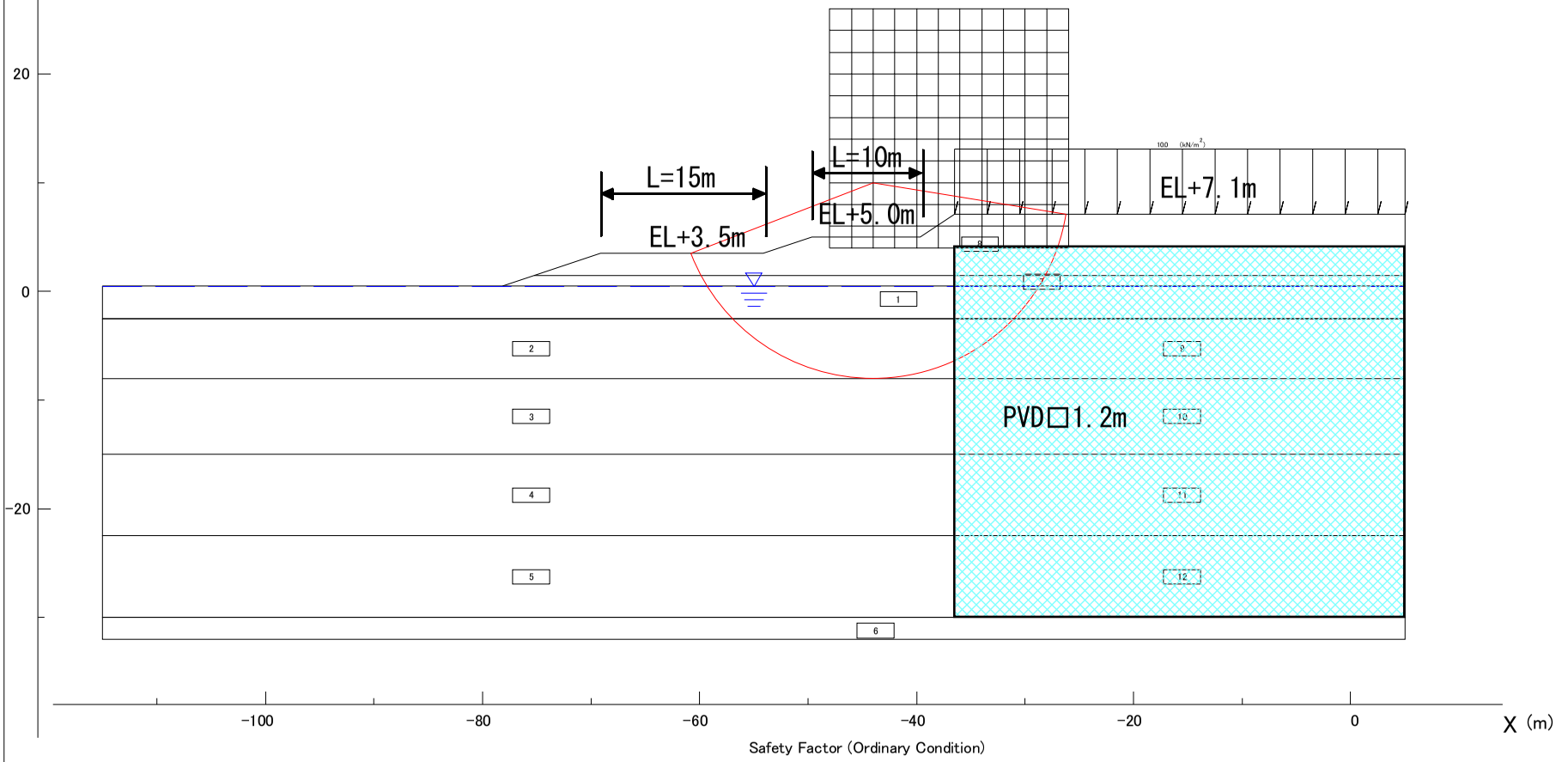
Inner Revetment-3 (3rd)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.241	
Center of arc	X	=	-44.00	(m)
	Y	=	10.00	(m)
Radius	R	=	18.00	(m)
Resisting moment	M_R	=	11790.5	(kNm)
Sliding moment	M_D	=	9497.8	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	20.00	30.00	0.00	0.00	0.000	0.000
8	20.00	18.00	30.00	0.00	0.00	0.000	0.000
9	17.00	17.00	0.00	19.13	0.00	0.000	0.000
10	19.00	19.00	0.00	26.54	0.00	0.000	0.000
11	17.50	17.50	0.00	40.00	0.00	0.000	0.000
12	17.50	17.50	0.00	40.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

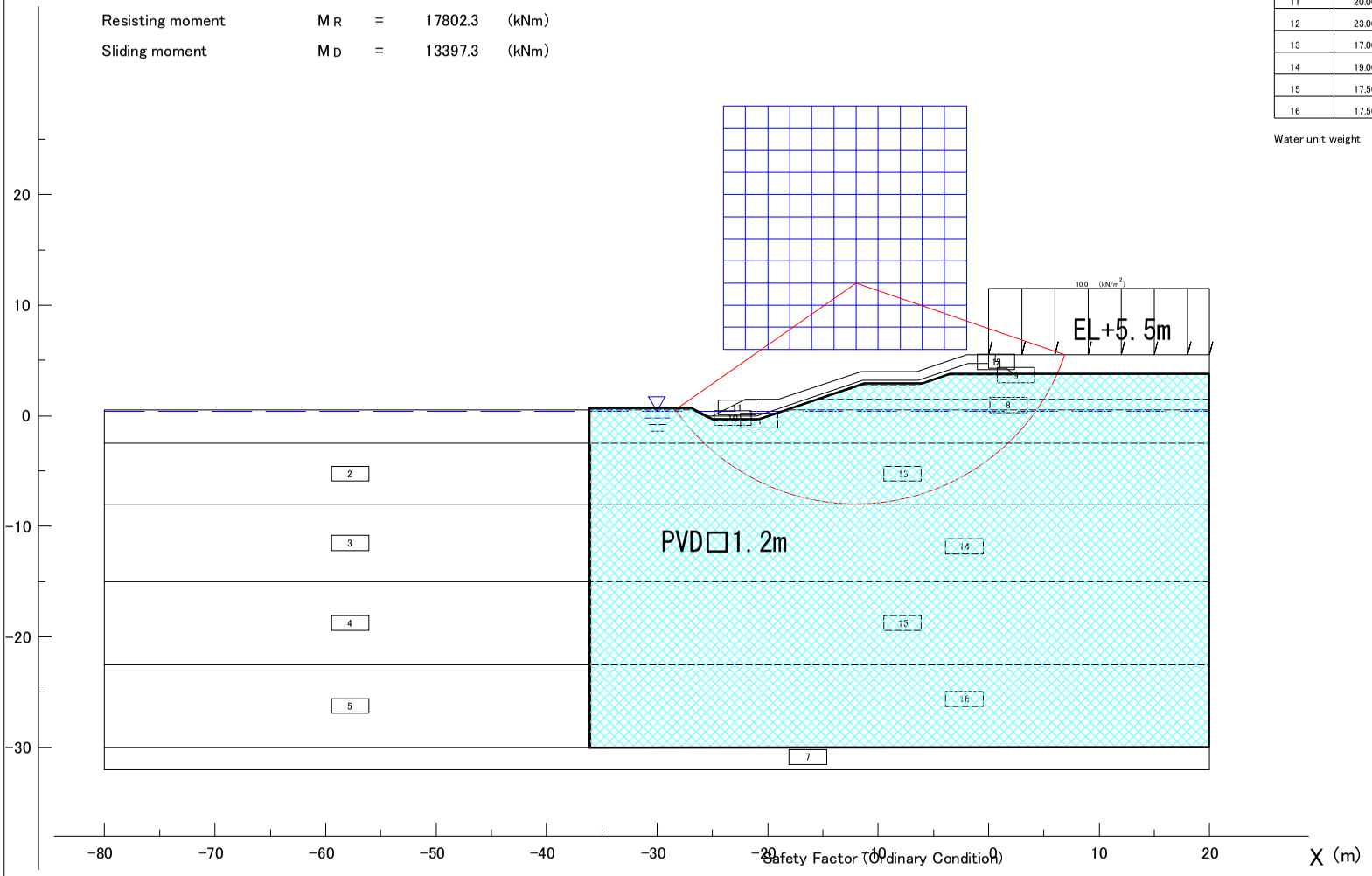
Inner Revetment-3 (After completion of Revetment Construction)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.329	
Center of arc	X	=	-12.00	(m)
	Y	=	12.00	(m)
Radius	R	=	20.00	(m)
Resisting moment	M_R	=	17802.3	(kNm)
Sliding moment	M_D	=	13397.3	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000
10	20.00	18.00	40.00	0.00	0.00	0.000	0.000
11	20.00	18.00	40.00	0.00	0.00	0.000	0.000
12	23.00	23.00	40.00	0.00	0.00	0.000	0.000
13	17.00	17.00	0.00	24.98	0.00	0.000	0.000
14	19.00	19.00	0.00	31.19	0.00	0.000	0.000
15	17.50	17.50	0.00	40.44	0.00	0.000	0.000
16	17.50	17.50	0.00	40.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

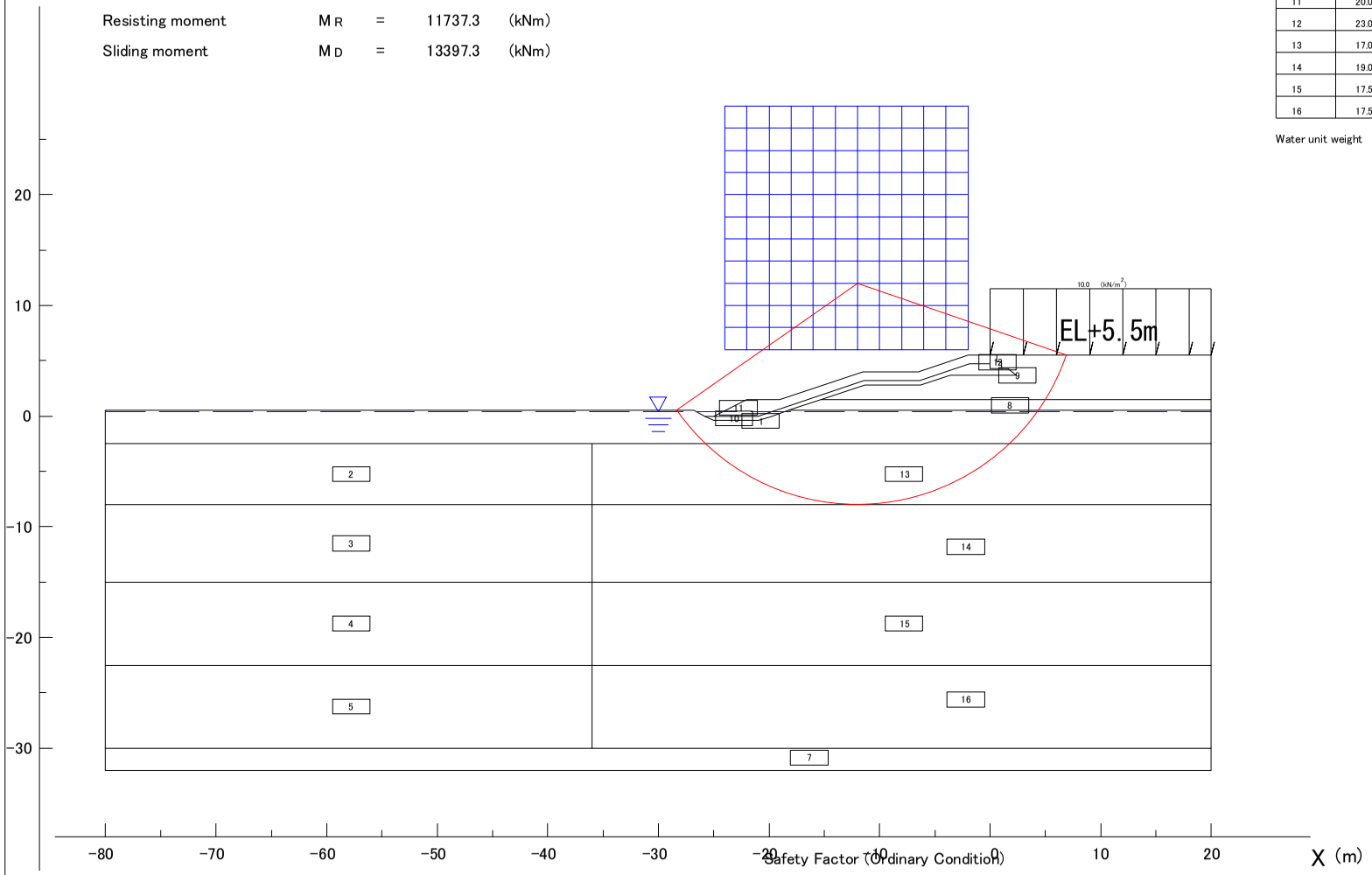
Inner Revetment-3 (Without Subsoil Improvement)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	0.876	
Center of arc	X	=	−12.00	(m)
	Y	=	12.00	(m)
Radius	R	=	20.00	(m)
Resisting moment	M_R	=	11737.3	(kNm)
Sliding moment	M_D	=	13397.3	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000
10	20.00	18.00	40.00	0.00	0.00	0.000	0.000
11	20.00	18.00	40.00	0.00	0.00	0.000	0.000
12	23.00	23.00	40.00	0.00	0.00	0.000	0.000
13	17.00	17.00	0.00	15.00	0.00	0.000	0.000
14	19.00	19.00	0.00	25.00	0.00	0.000	0.000
15	17.50	17.50	0.00	40.00	0.00	0.000	0.000
16	17.50	17.50	0.00	40.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

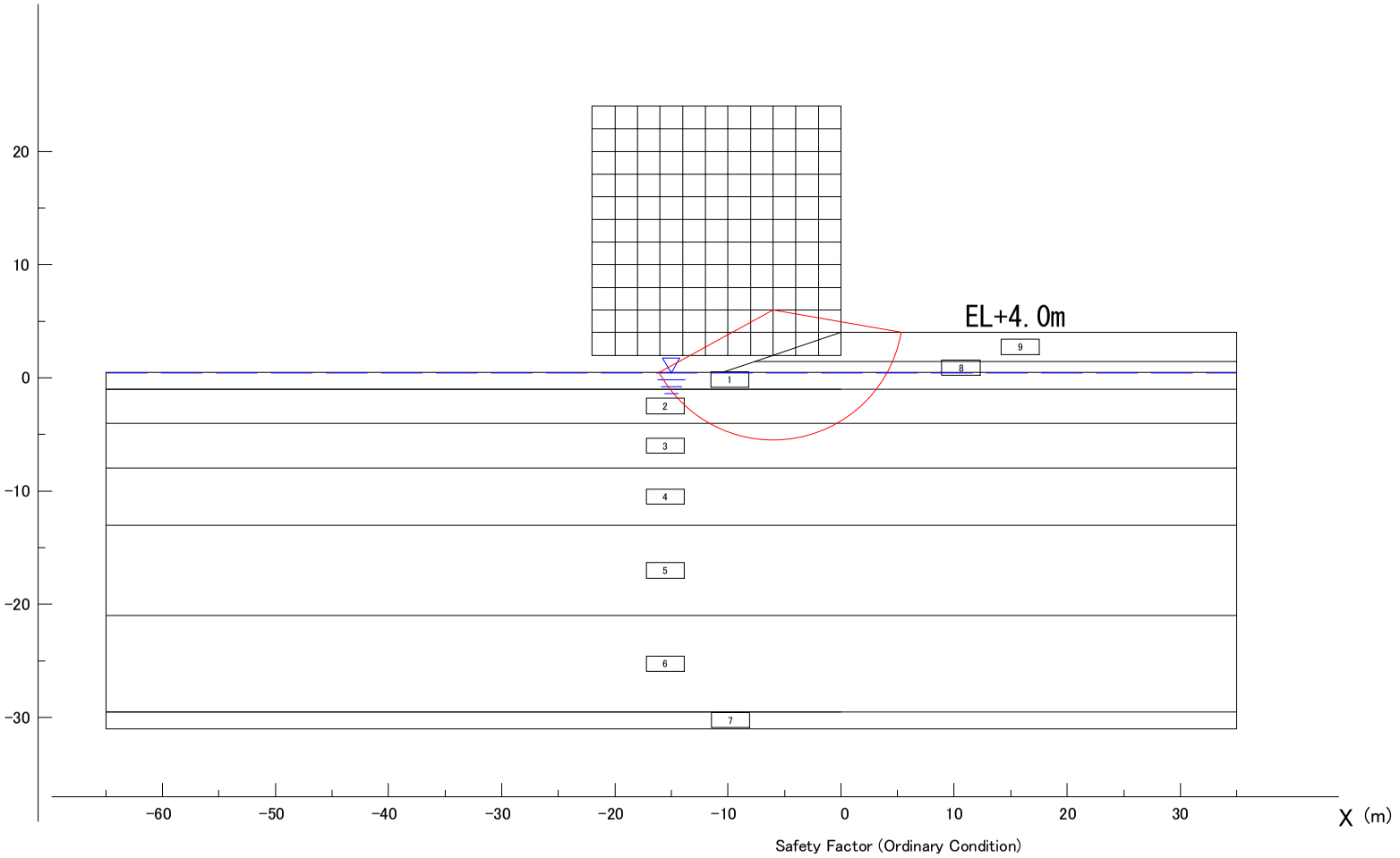
ラックフェン港-内側護岸-4 1段目:限界盛土H=+4.10m

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.145	
Center of arc	X	=	-6.00	(m)
	Y	=	6.00	(m)
Radius	R	=	11.50	(m)
Resisting moment	M_R	=	3981.8	(kNm)
Sliding moment	M_D	=	3477.0	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	18.00	18.00	0.00	15.00	0.00	0.000	0.000
3	17.00	17.00	0.00	15.00	0.00	0.000	0.000
4	19.00	19.00	0.00	25.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	17.50	17.50	0.00	40.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

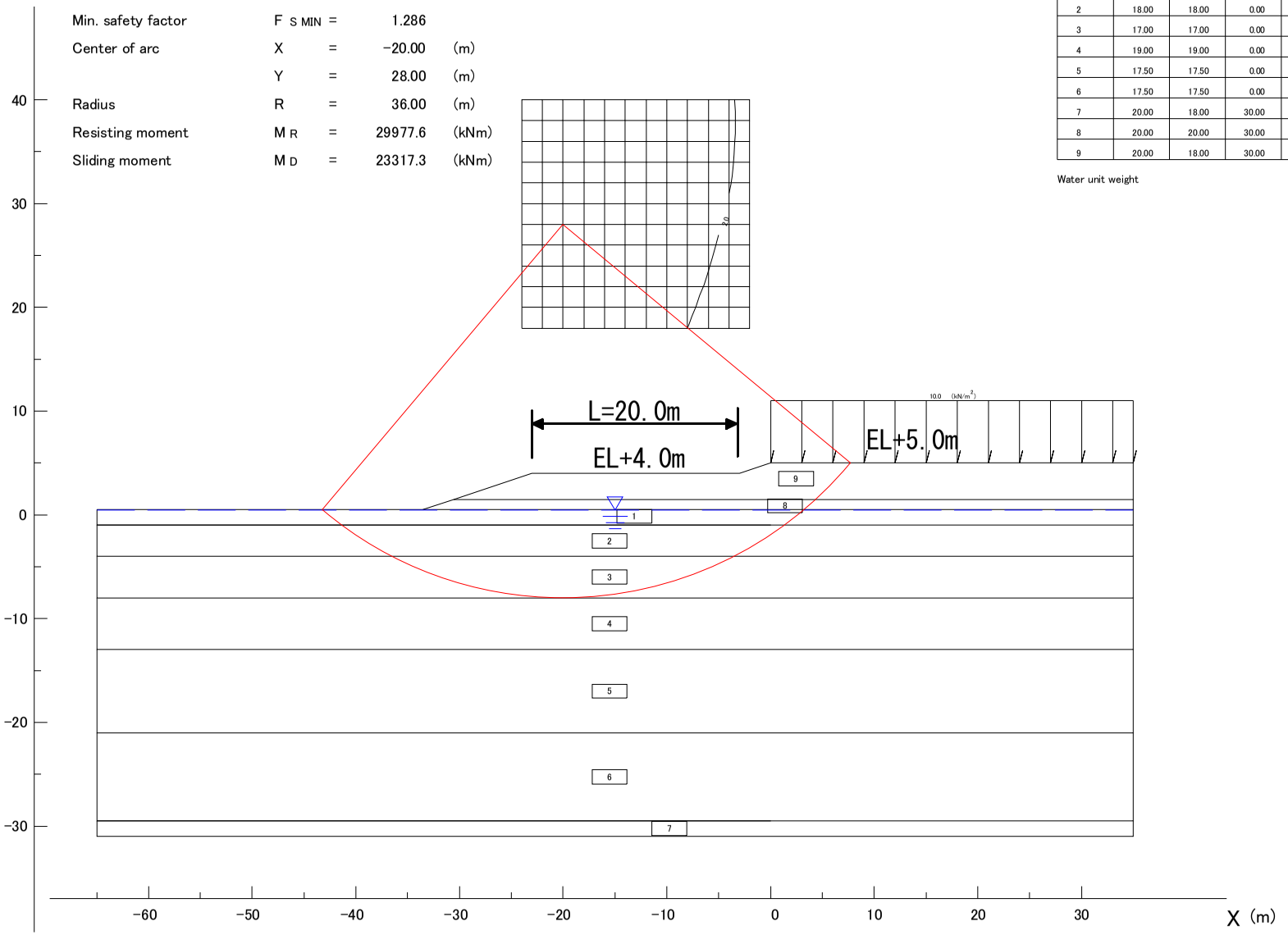
ラックフェン港-内側護岸-4 1段目:+5.00m(小段H=4.1m L=14m)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.286	
Center of arc	X	=	-20.00	(m)
	Y	=	28.00	(m)
Radius	R	=	36.00	(m)
Resisting moment	M_R	=	29977.6	(kNm)
Sliding moment	M_D	=	23317.3	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	18.00	18.00	0.00	15.00	0.00	0.000	0.000
3	17.00	17.00	0.00	15.00	0.00	0.000	0.000
4	19.00	19.00	0.00	25.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	17.50	17.50	0.00	40.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Contour Diagram (Ordinary Condition)

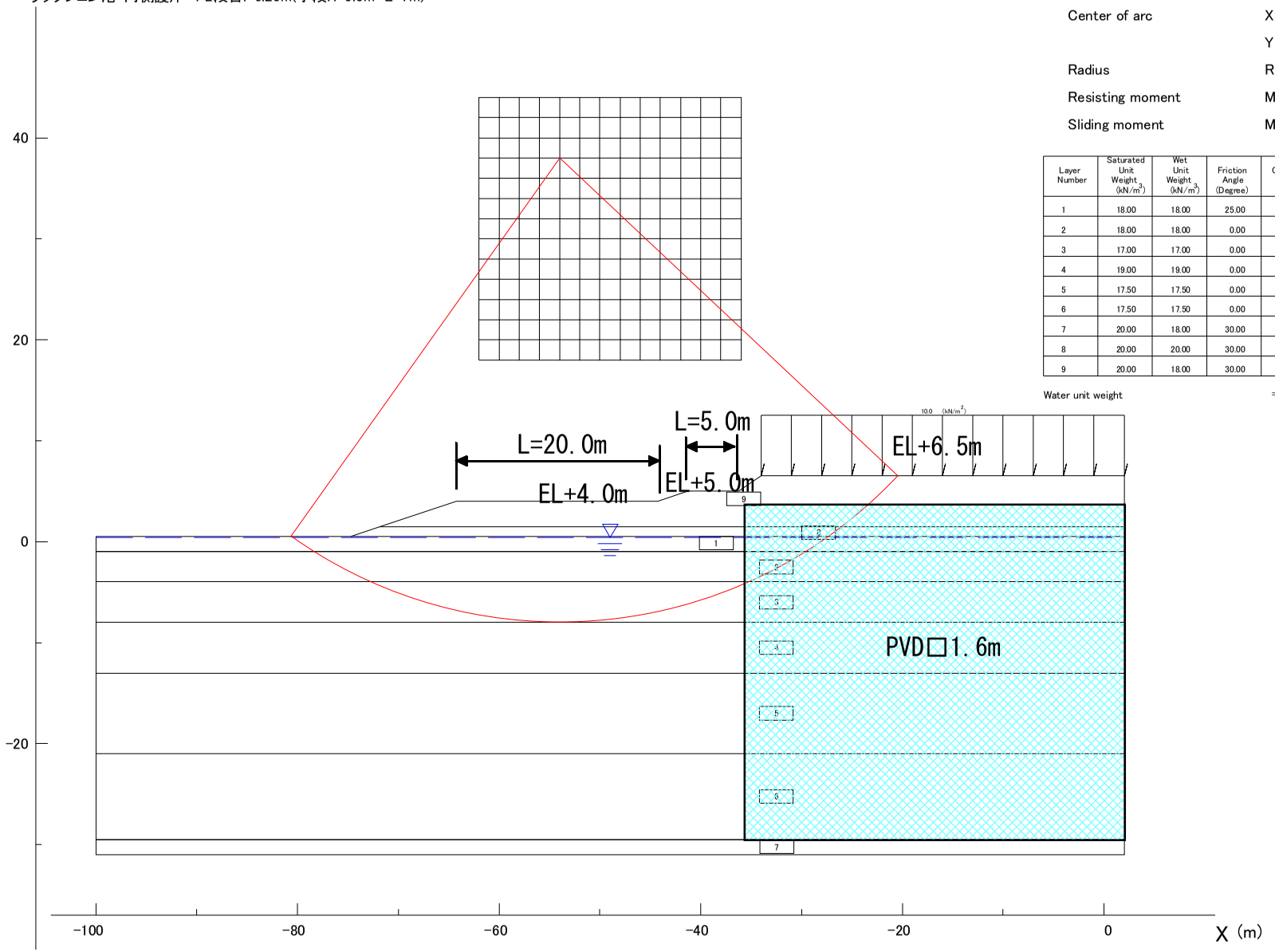
ラックフェン港-内側護岸-4 2段目:+6.20m(小段H=5.0m L=7m)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.216	
Center of arc	X	=	-54.00	(m)
	Y	=	38.00	(m)
Radius	R	=	46.00	(m)
Resisting moment	M_R	=	48622.9	(kNm)
Sliding moment	M_D	=	39985.0	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	18.00	18.00	0.00	15.00	0.00	0.000	0.000
3	17.00	17.00	0.00	15.00	0.00	0.000	0.000
4	19.00	19.00	0.00	25.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	17.50	17.50	0.00	40.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Contour Diagram (Ordinary Condition)

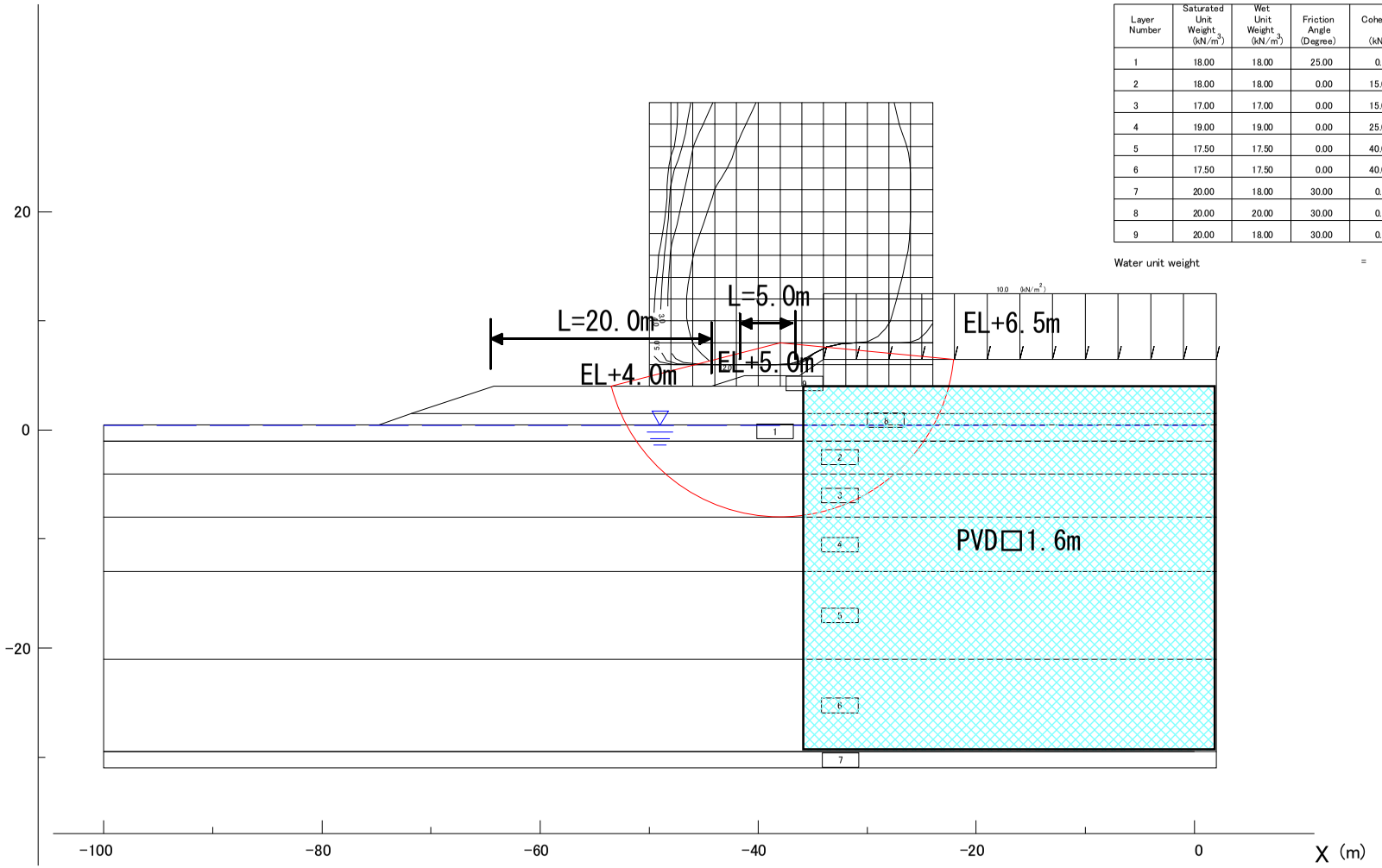
ラックフェン港-内側護岸-4 2段目:+6.20m(小段H=5.0m L=7m)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.355	
Center of arc	X	=	-38.00	(m)
	Y	=	8.00	(m)
Radius	R	=	16.00	(m)
Resisting moment	M_R	=	8727.0	(kNm)
Sliding moment	M_D	=	6438.9	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	18.00	18.00	0.00	15.00	0.00	0.000	0.000
3	17.00	17.00	0.00	15.00	0.00	0.000	0.000
4	19.00	19.00	0.00	25.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	17.50	17.50	0.00	40.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Contour Diagram (Ordinary Condition)

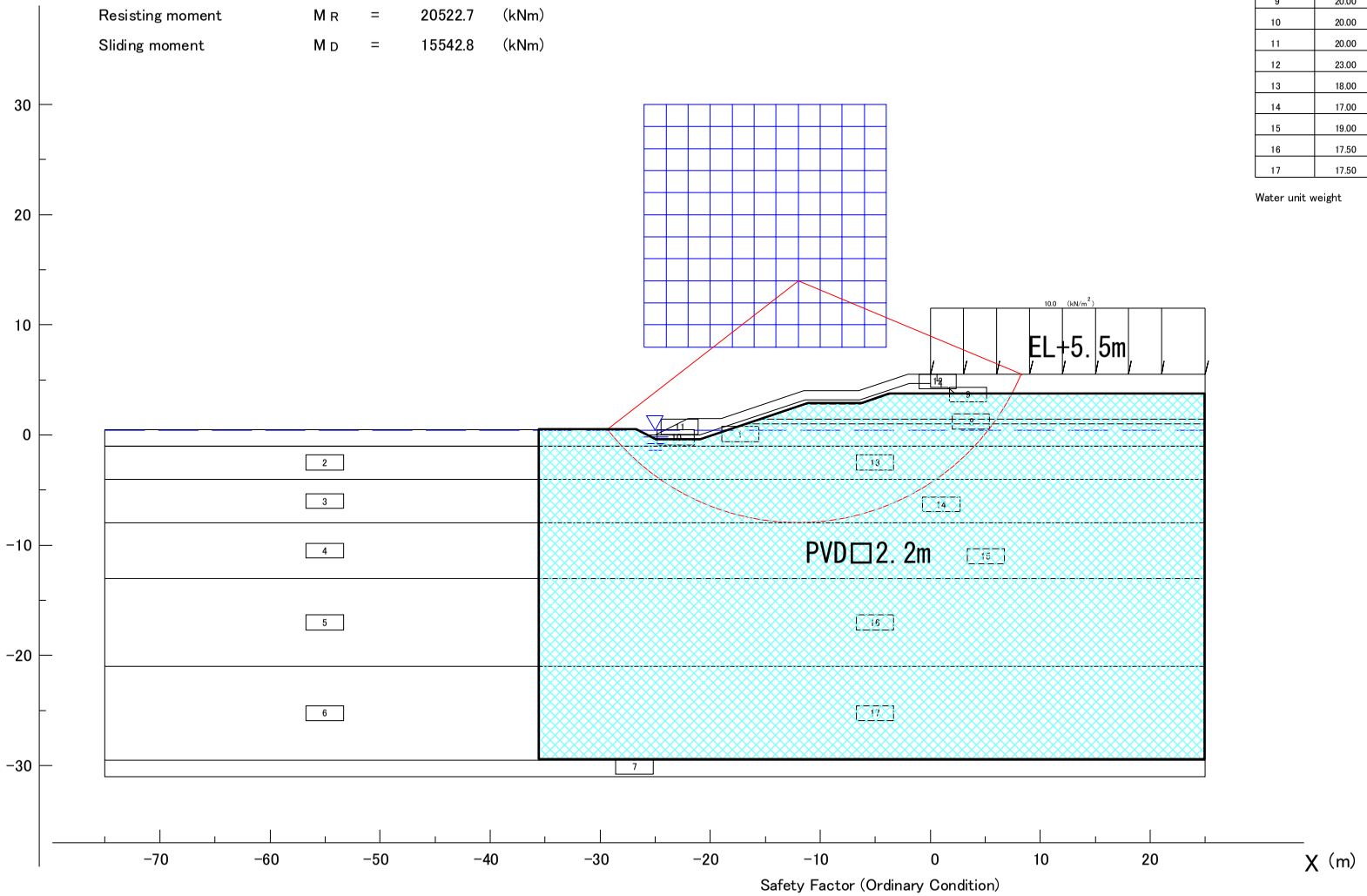
ラックフェン港-内側護岸-4 完成時(1段+2段:+6.2m)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.320	
Center of arc	X	=	-12.00	(m)
	Y	=	14.00	(m)
Radius	R	=	22.00	(m)
Resisting moment	M_R	=	20522.7	(kNm)
Sliding moment	M_D	=	15542.8	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	18.00	18.00	0.00	15.00	0.00	0.000	0.000
3	17.00	17.00	0.00	15.00	0.00	0.000	0.000
4	19.00	19.00	0.00	25.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	17.50	17.50	0.00	40.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000
10	20.00	18.00	40.00	0.00	0.00	0.000	0.000
11	20.00	18.00	40.00	0.00	0.00	0.000	0.000
12	23.00	23.00	40.00	0.00	0.00	0.000	0.000
13	18.00	18.00	0.00	20.22	0.00	0.000	0.000
14	17.00	17.00	0.00	24.63	0.00	0.000	0.000
15	19.00	19.00	0.00	30.46	0.00	0.000	0.000
16	17.50	17.50	0.00	40.19	0.00	0.000	0.000
17	17.50	17.50	0.00	40.19	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



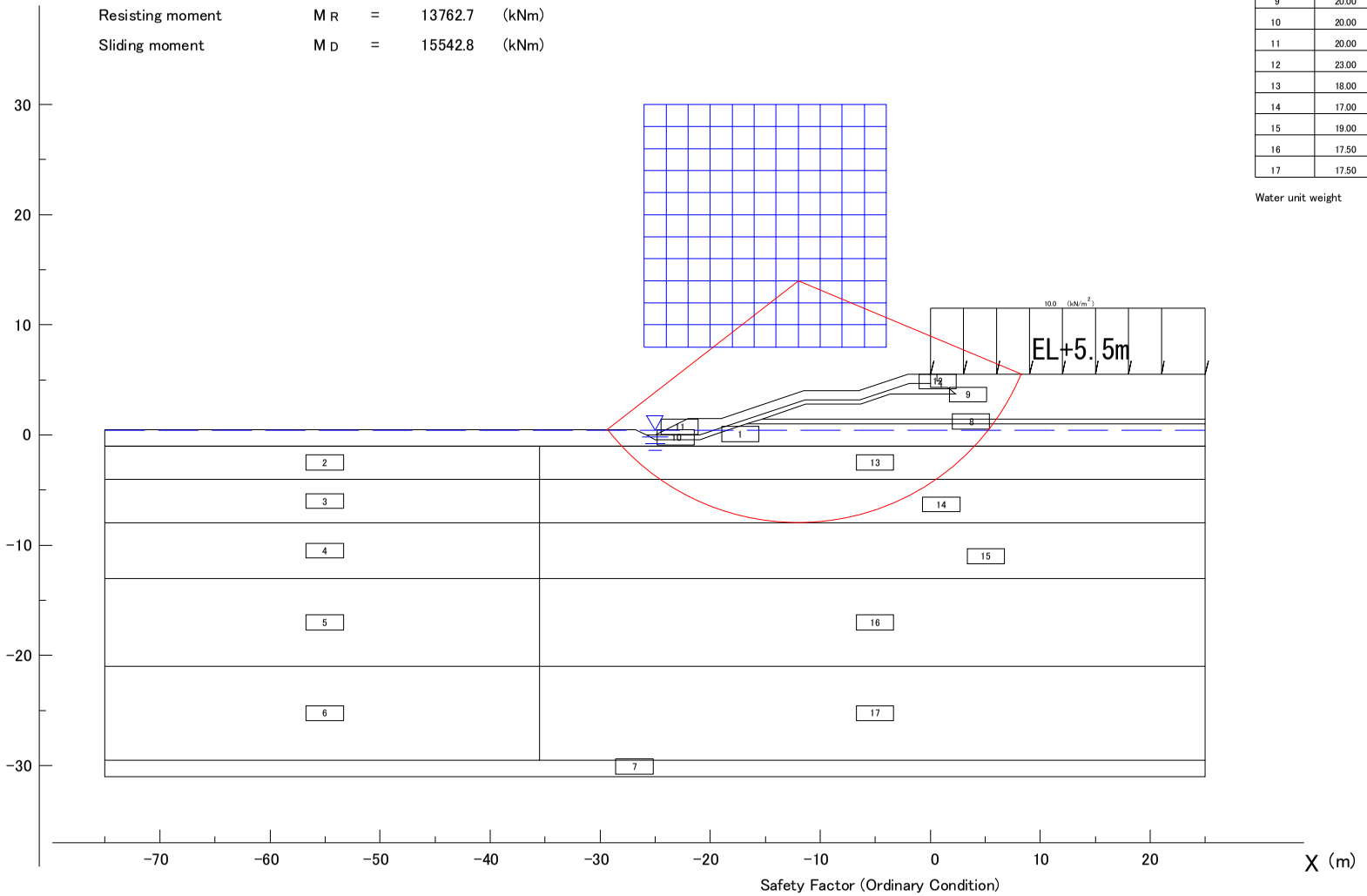
ラックフェン港-内側護岸-4 完成時(無対策)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	0.885	
Center of arc	X	=	-12.00	(m)
	Y	=	14.00	(m)
Radius	R	=	22.00	(m)
Resisting moment	M_R	=	13762.7	(kNm)
Sliding moment	M_D	=	15542.8	(kNm)

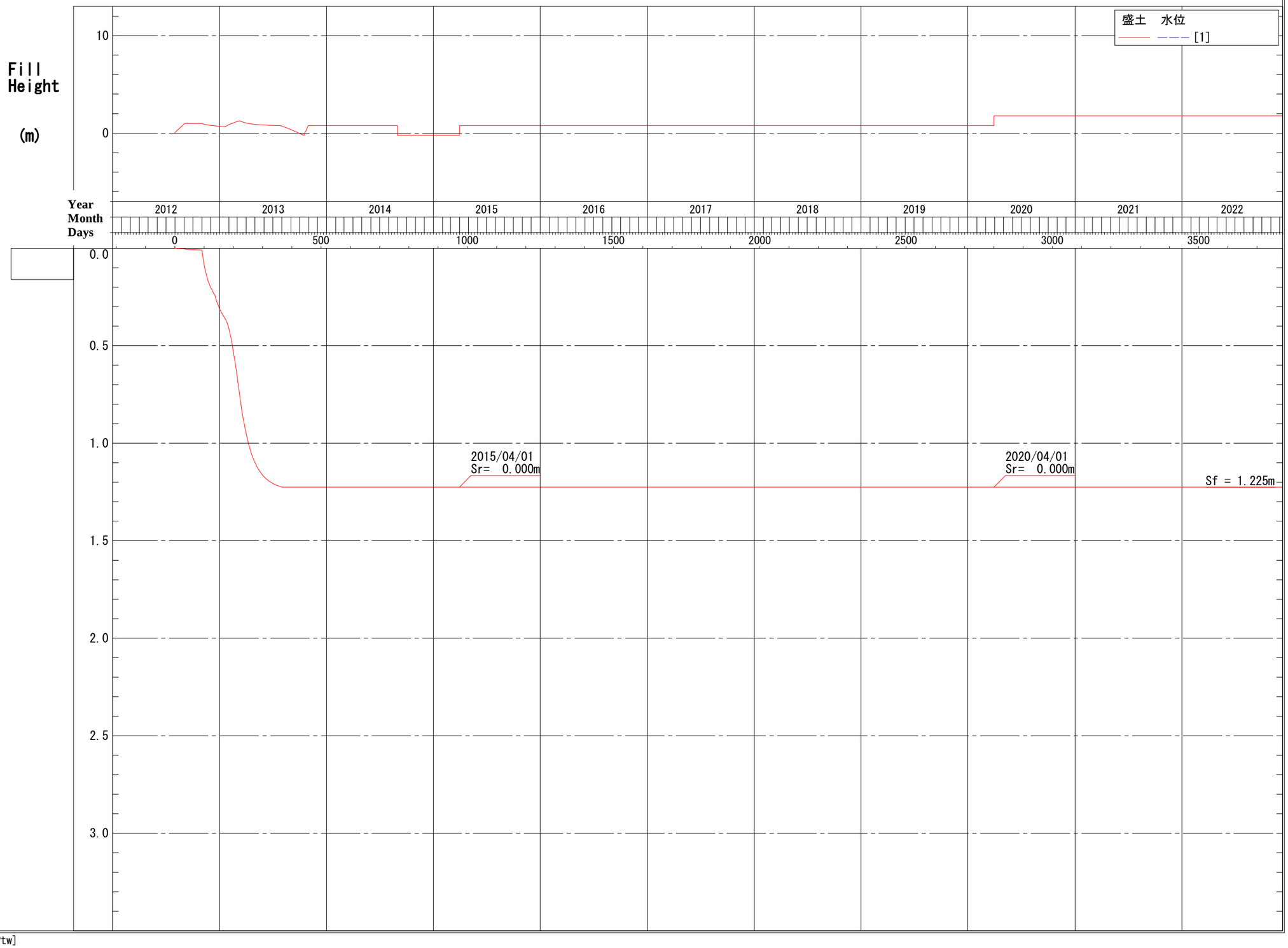
Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	18.00	18.00	0.00	15.00	0.00	0.000	0.000
3	17.00	17.00	0.00	15.00	0.00	0.000	0.000
4	19.00	19.00	0.00	25.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	17.50	17.50	0.00	40.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000
10	20.00	18.00	40.00	0.00	0.00	0.000	0.000
11	20.00	18.00	40.00	0.00	0.00	0.000	0.000
12	23.00	23.00	40.00	0.00	0.00	0.000	0.000
13	18.00	18.00	0.00	15.00	0.00	0.000	0.000
14	17.00	17.00	0.00	15.00	0.00	0.000	0.000
15	19.00	19.00	0.00	25.00	0.00	0.000	0.000
16	17.50	17.50	0.00	40.00	0.00	0.000	0.000
17	17.50	17.50	0.00	40.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



3) Settlement-Time Curves with PVD for Inner Revetment

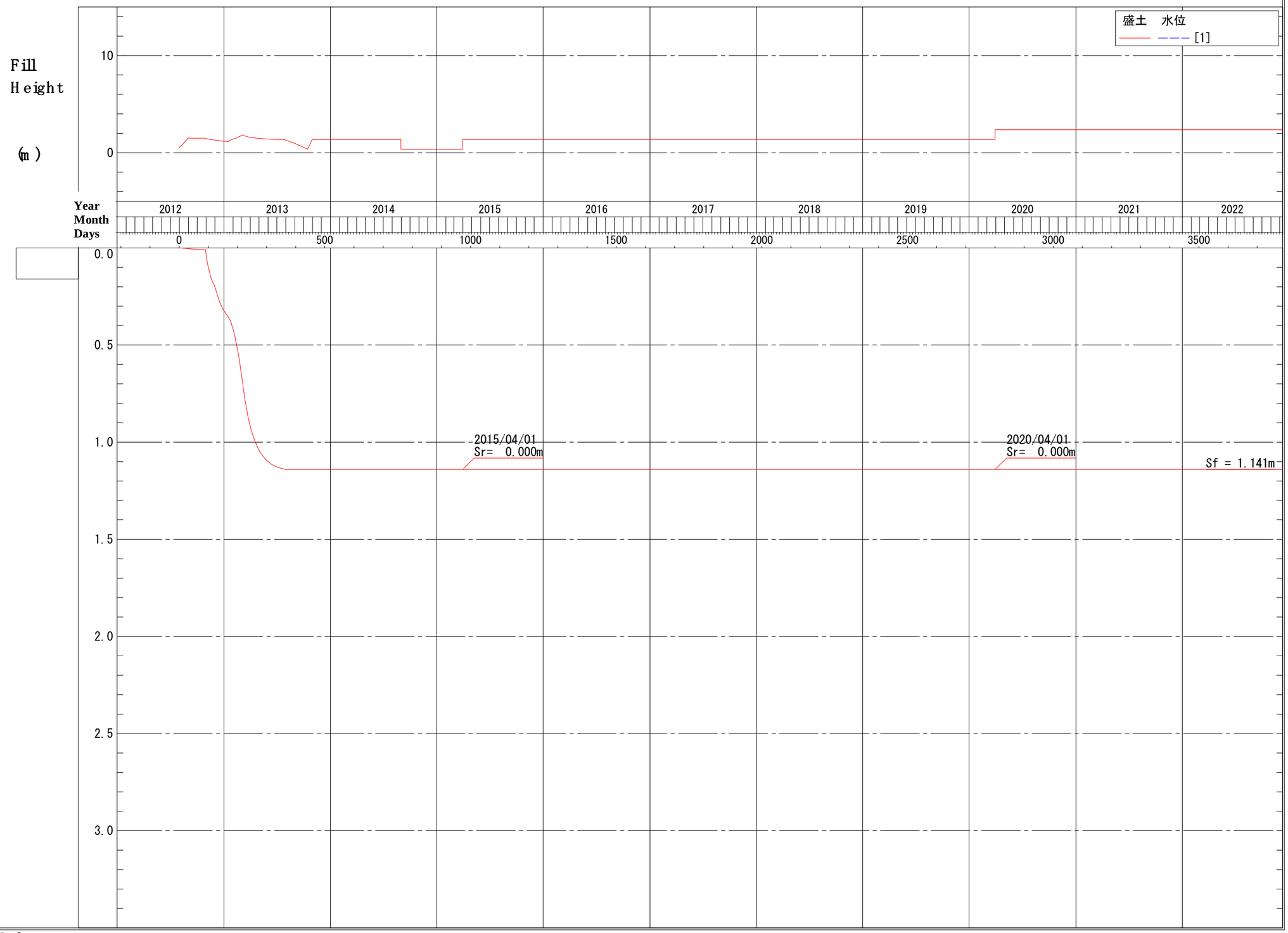
Settlement - Time Curve　　Inner Revetment IR-1 (PVD d=1.1m at face line of Revetment)



種　類	縮　尺
年月日	0.075mm/d
盛土高	2.500mm/m
沈下量	50.000mm/m

ファイル名 1:[IR-1-d □=1.1m-法線.Ptw]

Settlement-Time Curve　　Inner Revetment IR-2 (PVD d=1.1m at face line of Revetment)

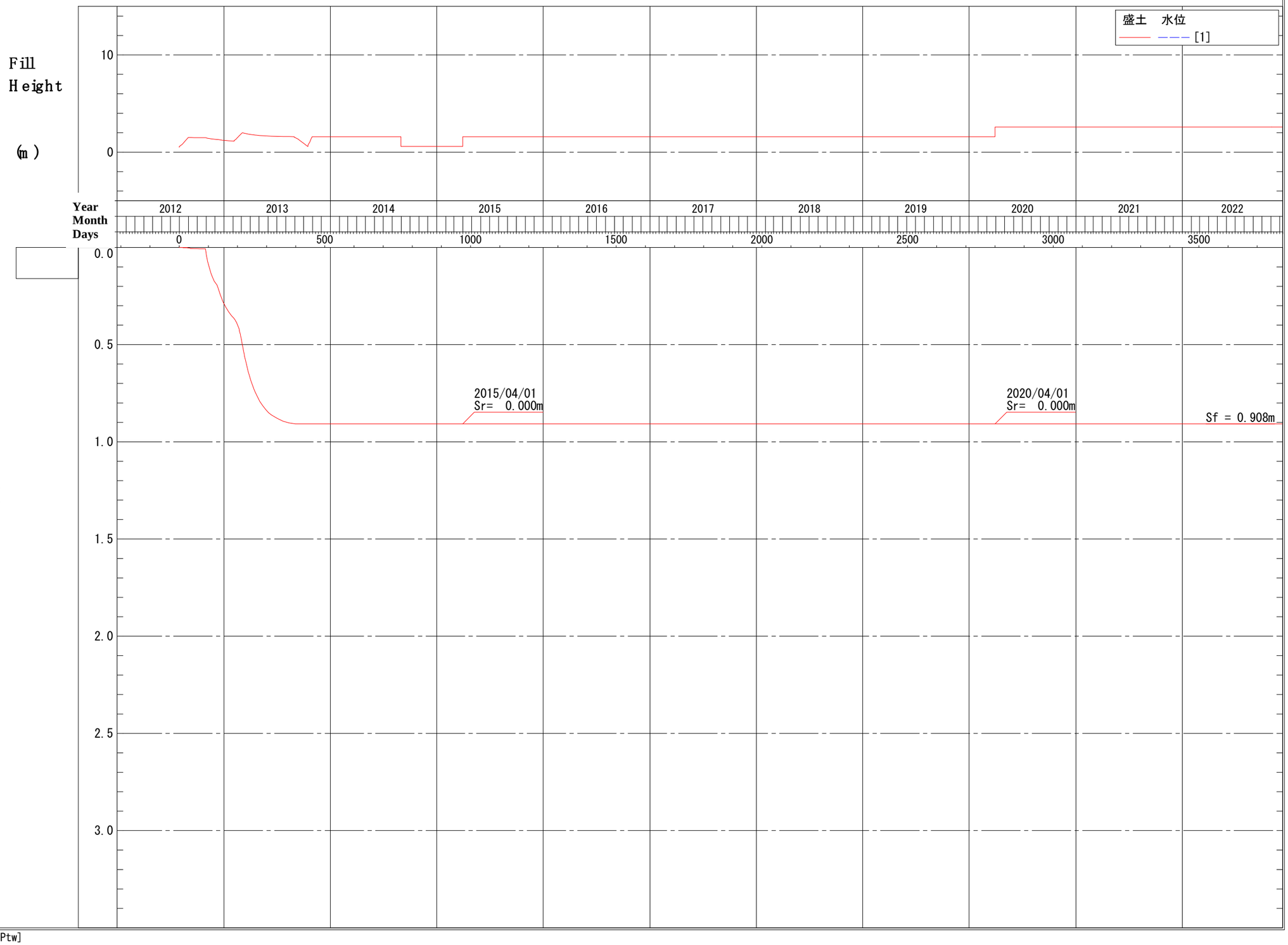


種　類	縮　尺
年月日	0.075mm/d
盛土高	2.500mm/m
沈下量	50.000mm/m

ファイル名 1:[IR-2-d口=1.1m-法線.Ptw]

Settlement-Time Curve

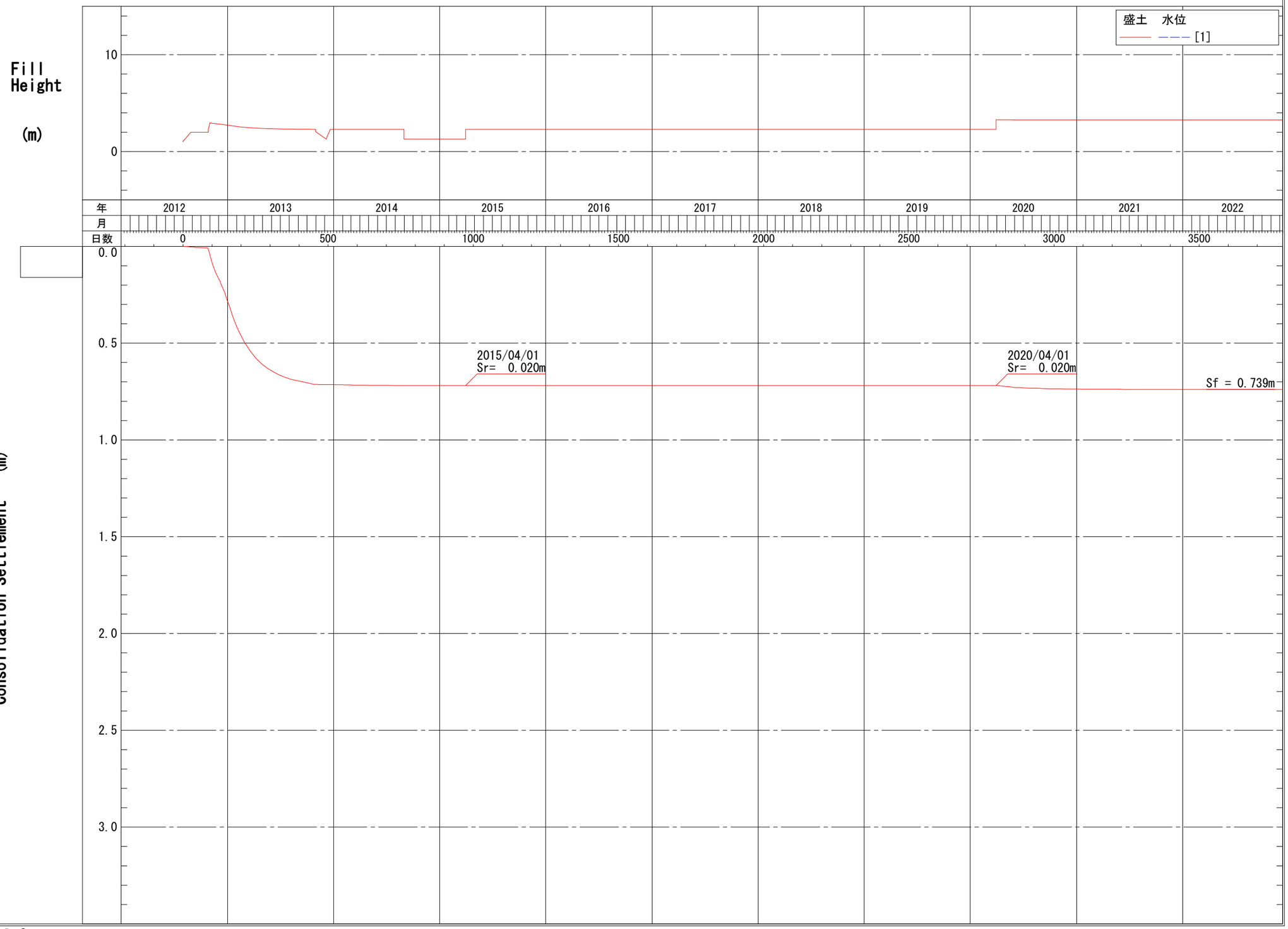
Inner Revetment IR-3 (PVD d=1.2m at face line of Revetment)



種　類	縮　尺
年月日	0.075mm/d
盛土高	2.500mm/m
沈下量	50.000mm/m

ファイル名 1:[IR-3-ｄ口=1.2m-法線.Ptw]

Settlement - Time Curve　Inner Revetment IR-4 (PVD d=1.6m at face line of Revetment)

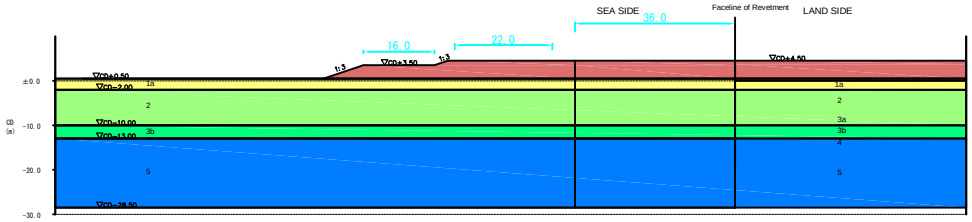


種　類	縮　尺
年月日	0.075mm/d
盛土高	2.500mm/m
沈下量	50.000mm/m

ファイル名 1:[IR-4-ｄ□=1.6m-法線.Ptw]

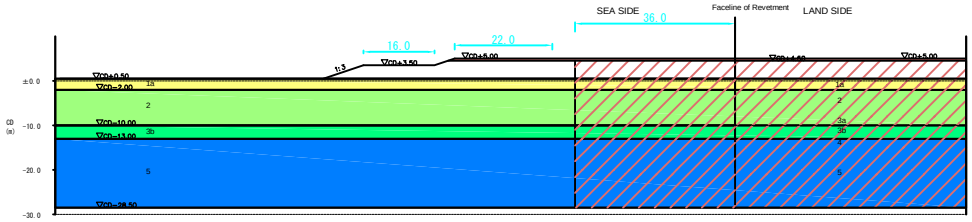
4) Subsoil Improvement Procedure with PVD and Preload Method for Inner Revetment

Inner Revetment IR-1



Step 1 (1.5 months)

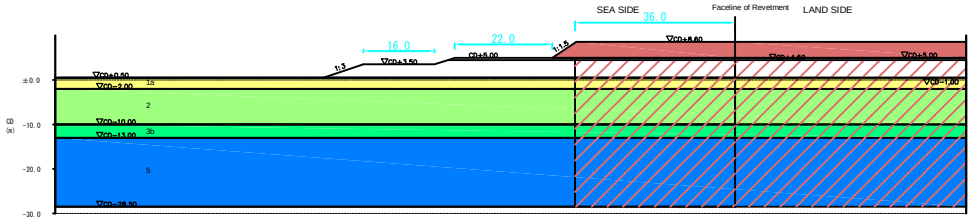
Fill and Sand Mat. (+4.0 ~ +4.5m)



Step 2 (2 months)

Soil Improvement (PVD d=□1.1m)
Cover sand (+4.5m ~ 5.0m)

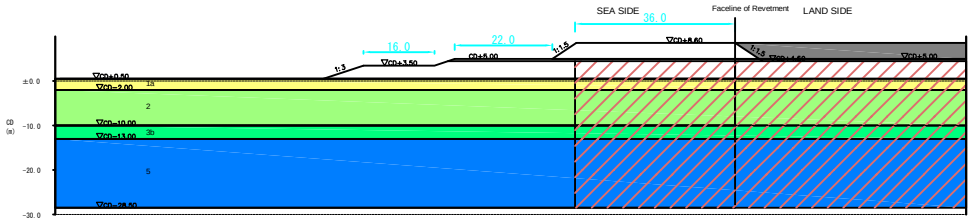
Retaining period (4 months)



Step 3 (1.5 months)

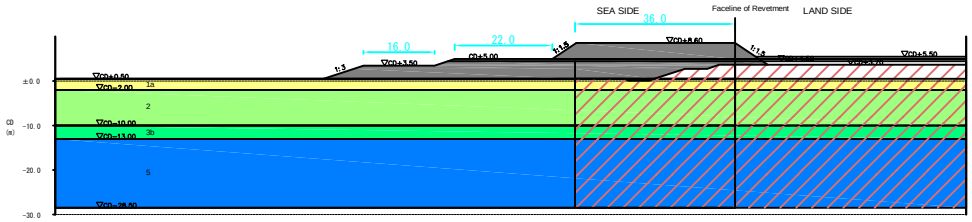
Preload (+8.6m)

Retaining period (4.0 months)



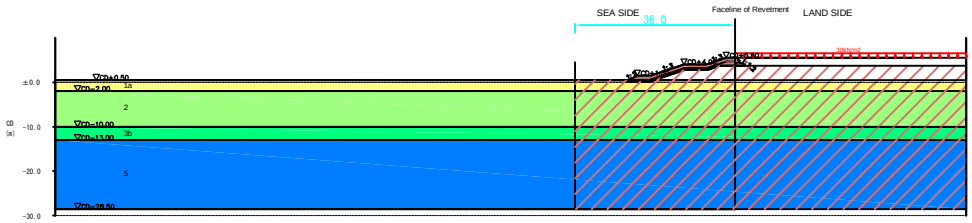
Step 4 (1 month)

Removal of preload (Only Lanside)



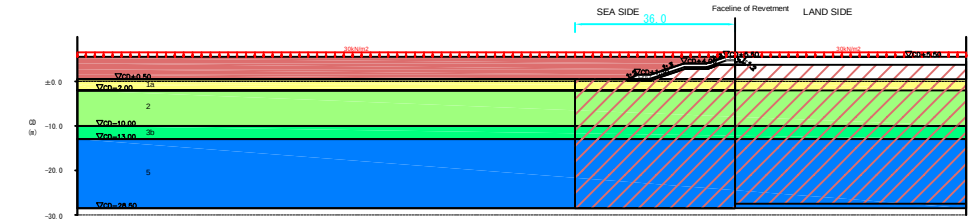
Step 5 (1 month)

Removal of Fill and Preload



Step 6 (6 months)

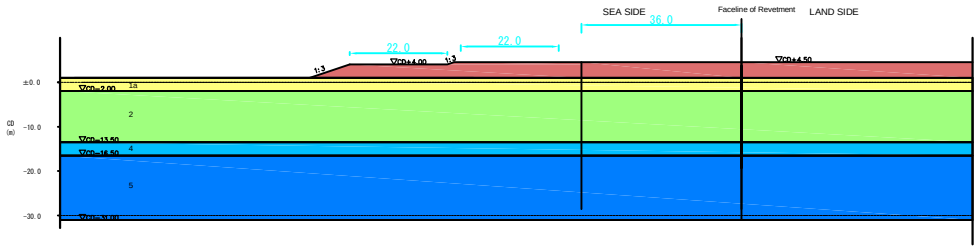
Pavement and Inner Revetment construction



Step 7 (5 years later)

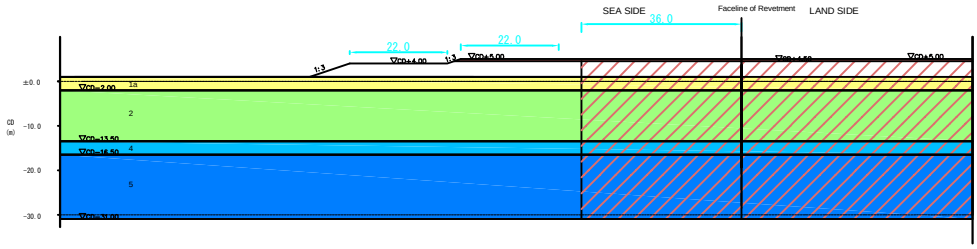
Fill for Port extension area

Inner Revetment IR-2



Step 1 (1.5 months)

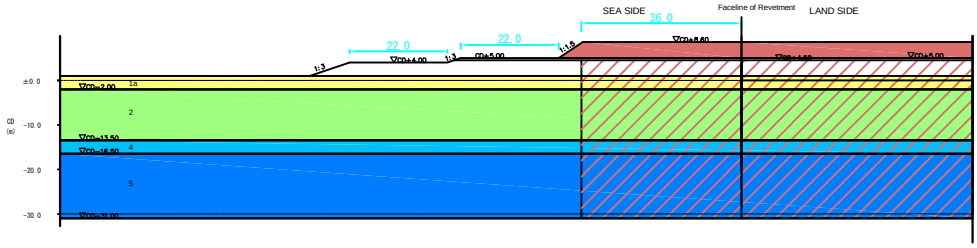
Fill and Sand Mat.(+4.0 ~ +4.5m)



Step 2 (2 months)

Soil Improvement (PVD d=□1.1m)
Cover sand (+4.5m ~ 5.0m)

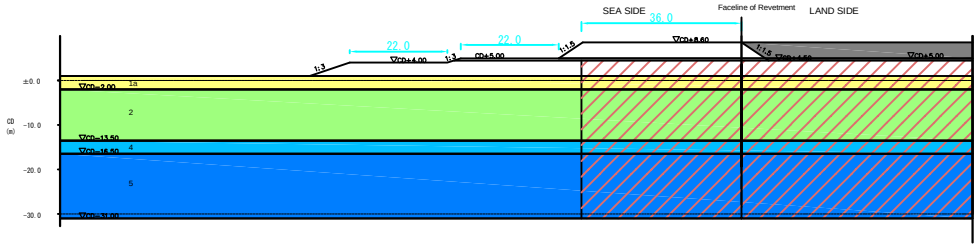
Retaining period (4 months)



Step 3 (1.5 months)

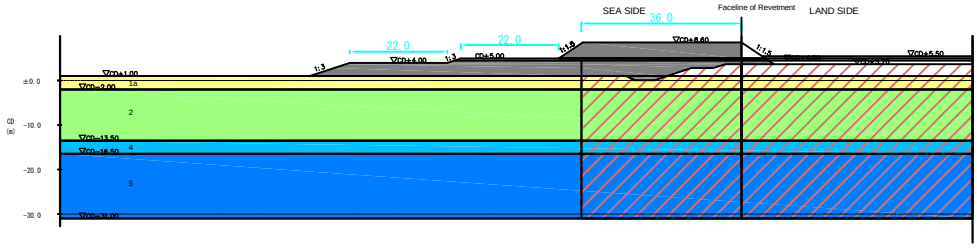
Preload (+8.6m)

Retaining period (4.0 months)



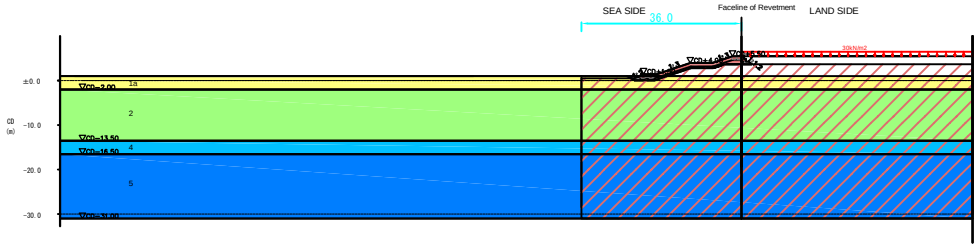
Step 4 (1 month)

Removal of preload (Only Lanside)



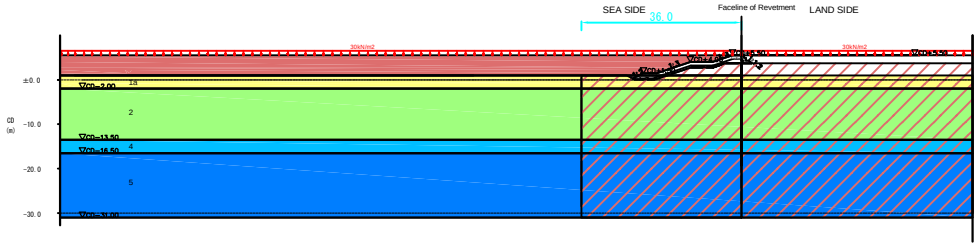
Step 5 (1 month)

Removal of Fill and Preload



Step 6 (6 months)

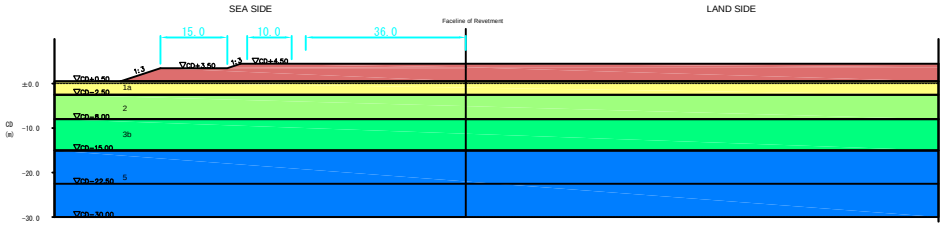
Pavement and Inner Revetment construction



Step 7 (5 years later)

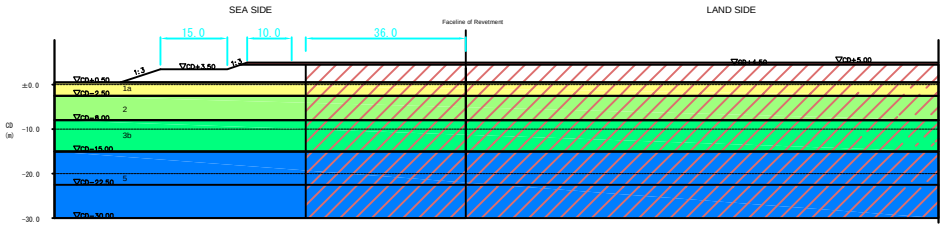
Fill for Port extension area

Inner Revetment IR-3



Step 1 (1.5 months)

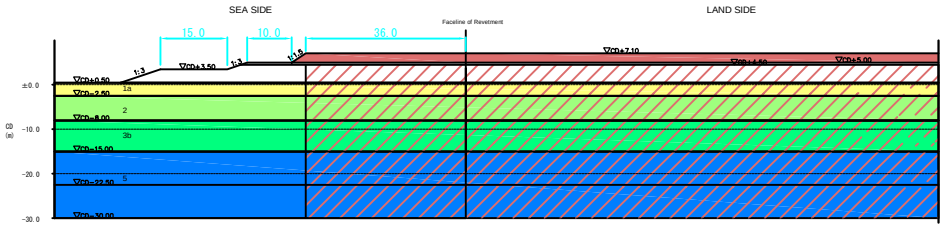
Fill and Sand Mat. (+4.0 ~ +4.5m)



Step 2 (2 months)

Soil Improvement (PVD d=□1.2m)
Cover sand (+4.5m ~ 5.0m)

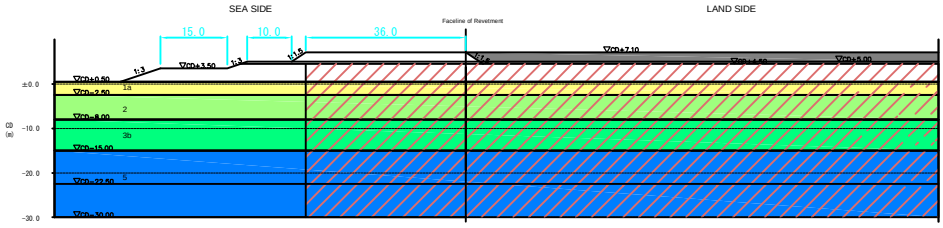
Retaining period (4 months)



Step 3 (1.5 months)

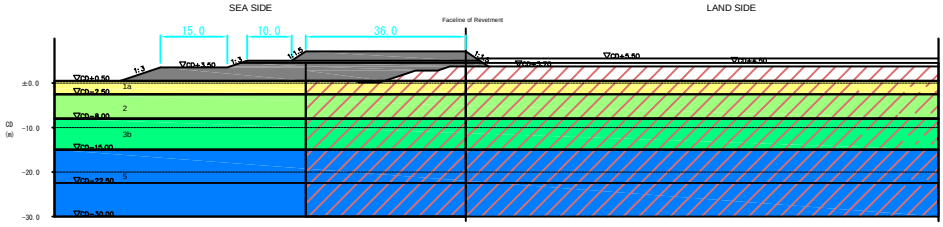
Preload (+7.1m)

Retaining period (4.0 months)



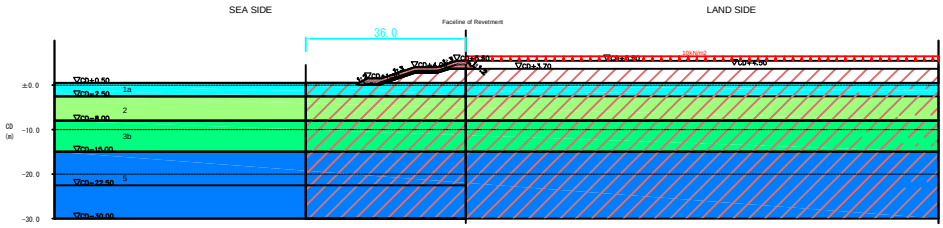
Step 4 (1 month)

Removal of preload (Only Lanside)



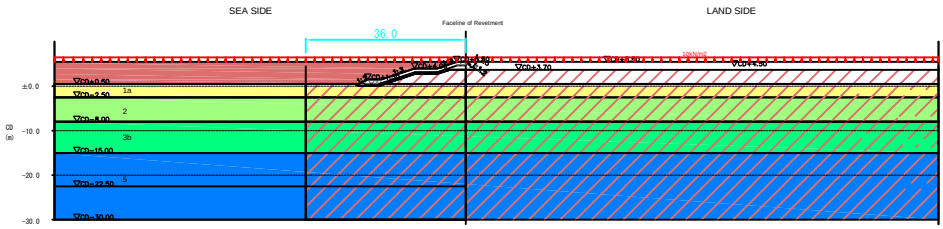
Step 5 (1 month)

Removal of Fill and Preload



Step 6 (6 months)

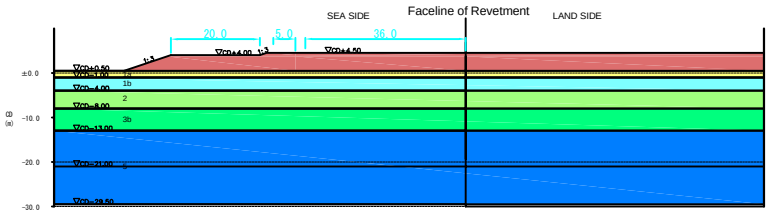
Pavement and Inner Revetment construction



Step 7 (5 years later)

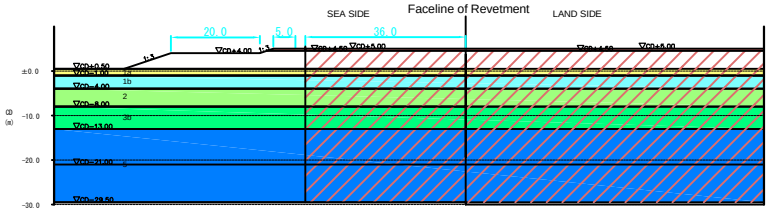
Fill for Port extension area

Inner Revetment IR-4



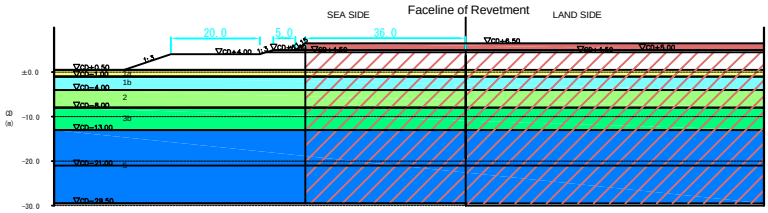
Step 1 (1.5 months)

Fill and Sand Mat. (+4.0 ~ +4.5m)



Step 2 (2 months)

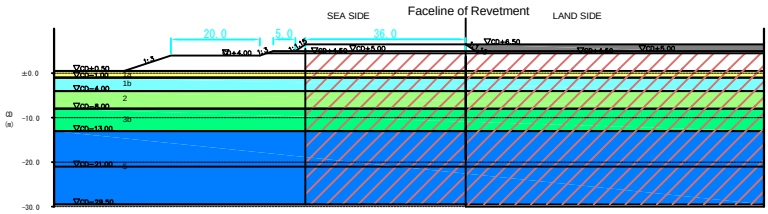
Soil Improvement (PVD d=□2.2m)
Cover sand (+4.5m ~ 5.0m)



Step 3 (0.5 months)

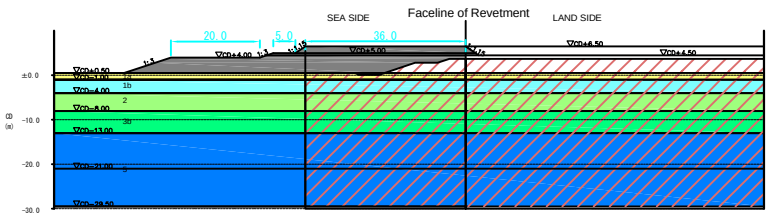
Preload (+6.5m)

Retaining period (12 months)



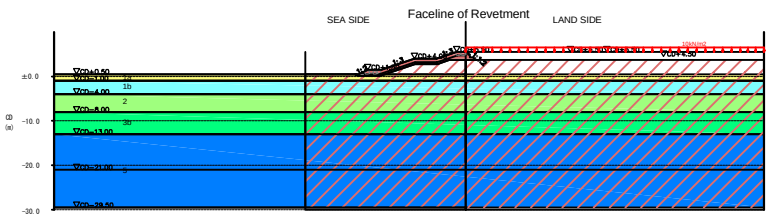
Step 4 (0.5 month)

Removal of preload (Only Lanside)



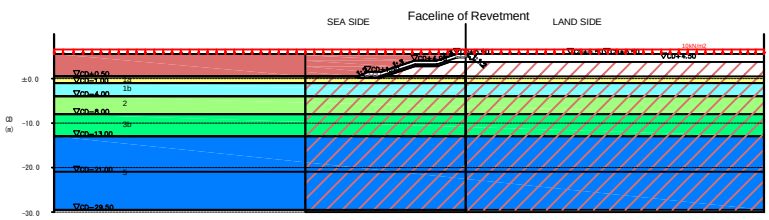
Step 5 (1 month)

Removal of Fill and Preload



Step 6 (6 months)

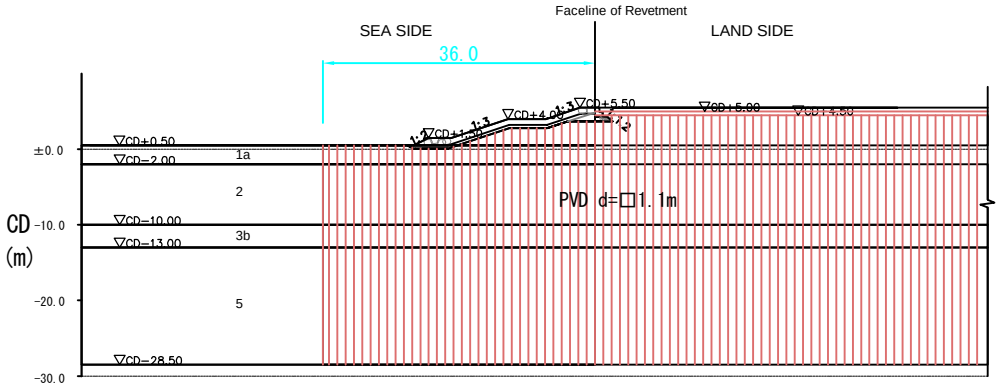
Pavement and Inner Revetment construction



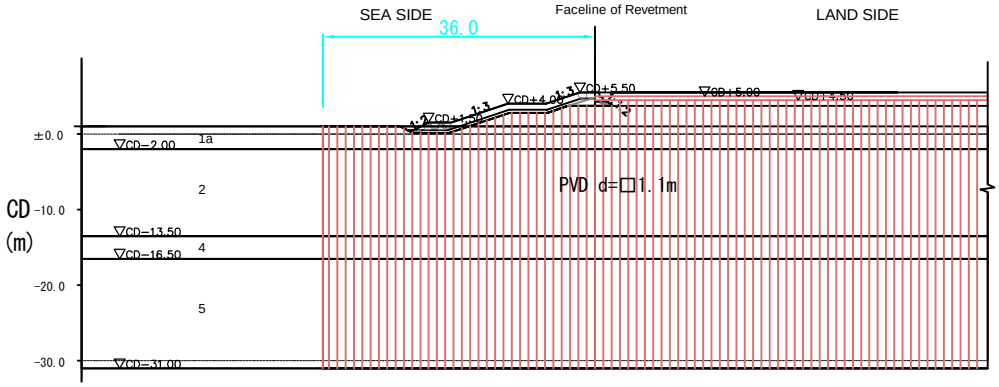
Step 7 (5 years later)

Fill for Port extension area

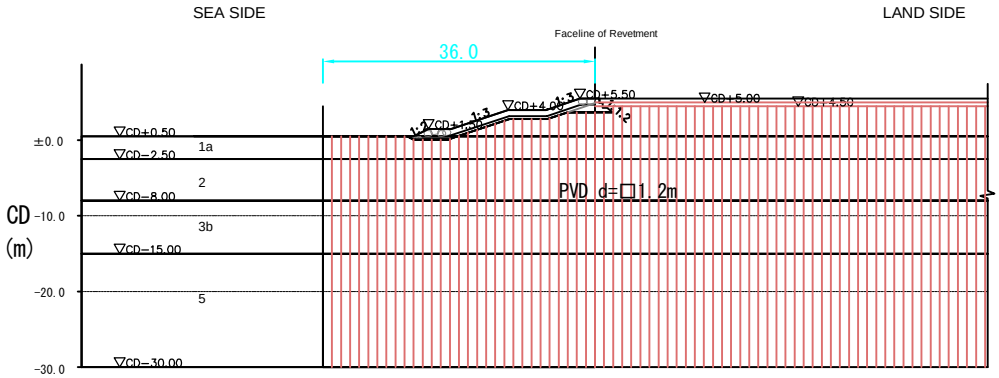
Inner Revetment IR-1



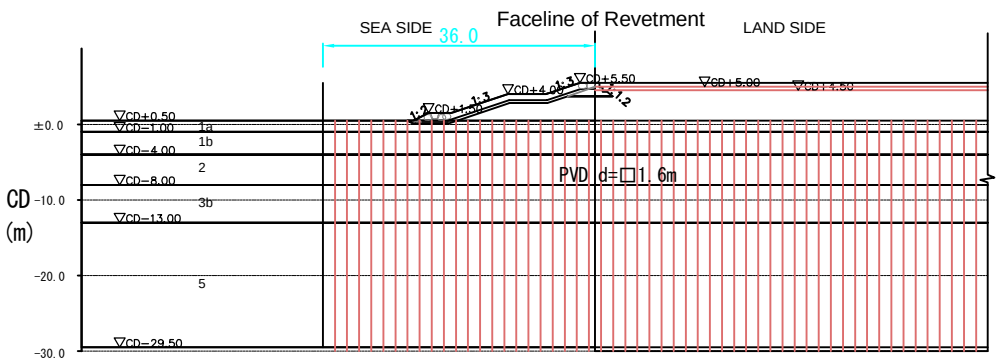
Inner Revetment IR-2



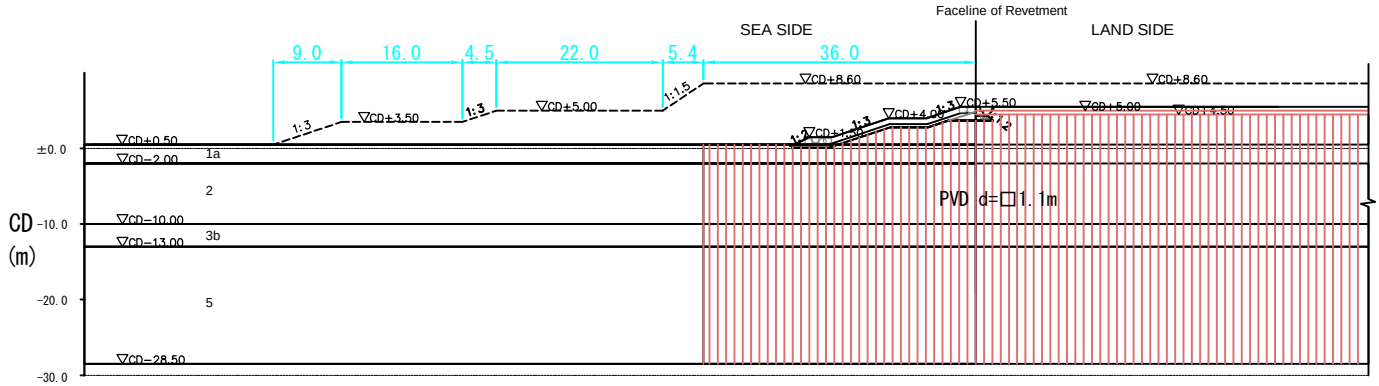
Inner Revetment IR-3



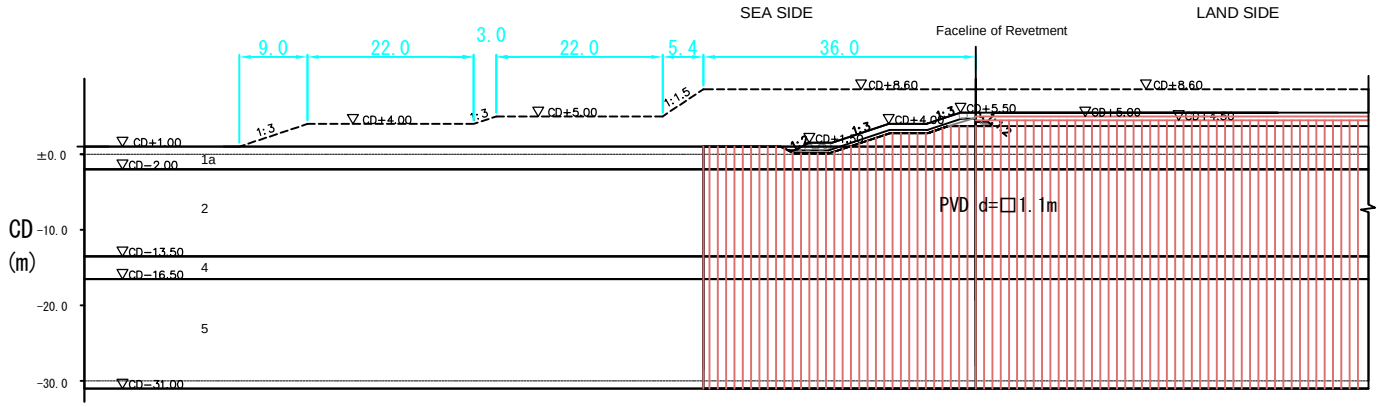
Inner Revetment IR-4



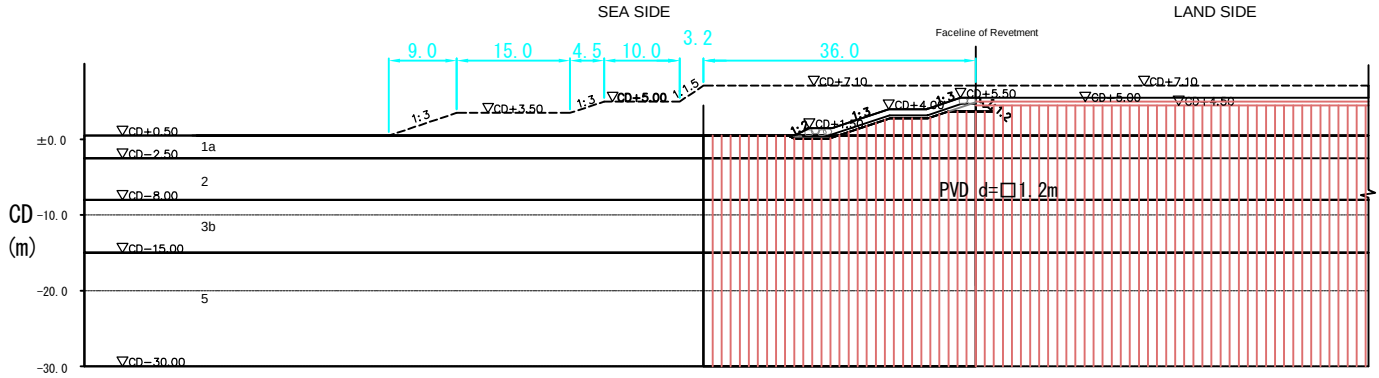
Inner Revetment IR-1



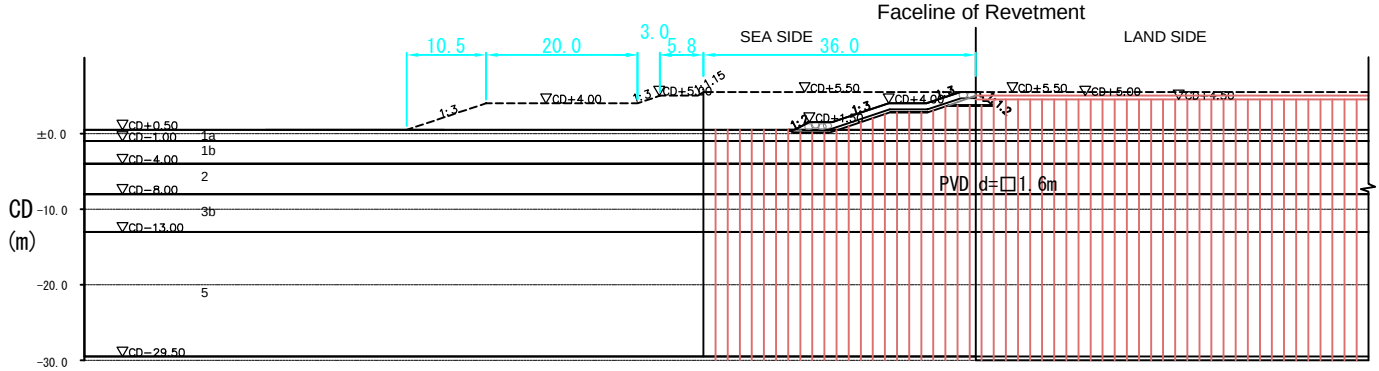
Inner Revetment IR-2



Inner Revetment IR-3



Inner Revetment IR-4



5) Economical Comparison between PVD+Preload Method and Sand Replacement Method for Outer Revetment A

Economical Comparison between PVD+Preload and Sand Replacement Method for Outer Revetment A

Outer Revetment A PVD(□1.6m) per 1m

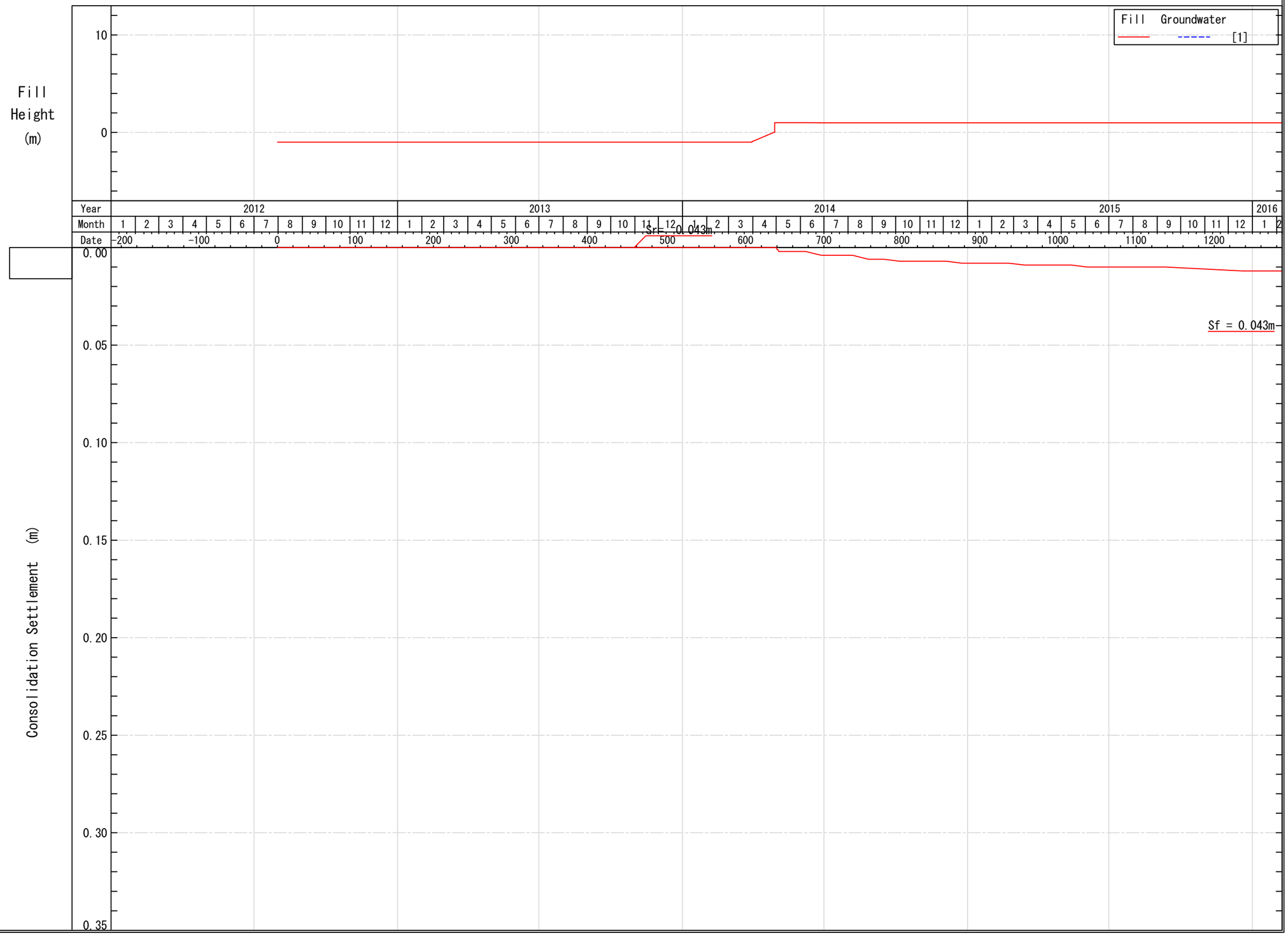
Item	Spec.	Unit	Quantity	Unit Price (VND)	Price (VND)	Remarks
Fill	CD+5.00	m3	450.0	171,756	77,290,200	
Preload	CD+8.00 (H=3.00m)	m3	150.2	191,271	28,728,904	
Removal of Preload		m3	562.0	36,632	20,587,184	
Installation of PVD	d□=1.6m	m	375.0	8,994	3,372,750	32m/point
Total					129,979,038	

Outer Revetment A Sand Replacement per 1m

Item	Spec.	Unit	Quantity	Unit Price (VND)	Price (VND)	Remarks
Sand replacement	Excavation and Fill	m3	691.2	196,948	136,130,458	
Total					136,130,458	

6) Slope Stability Analysis Result and Settlement-Time Curves with Sand Replacement Method for Outer Revetment A

Settlement - Time Curve　　Outer Revetment A improved by by Sand Replacement Method



Type	Scale
Date	0.200mm/d
Fill	2.500mm/m
Setllement	500.000mm/m

File Name 1:[14-置換(護岸法線).Ptw]

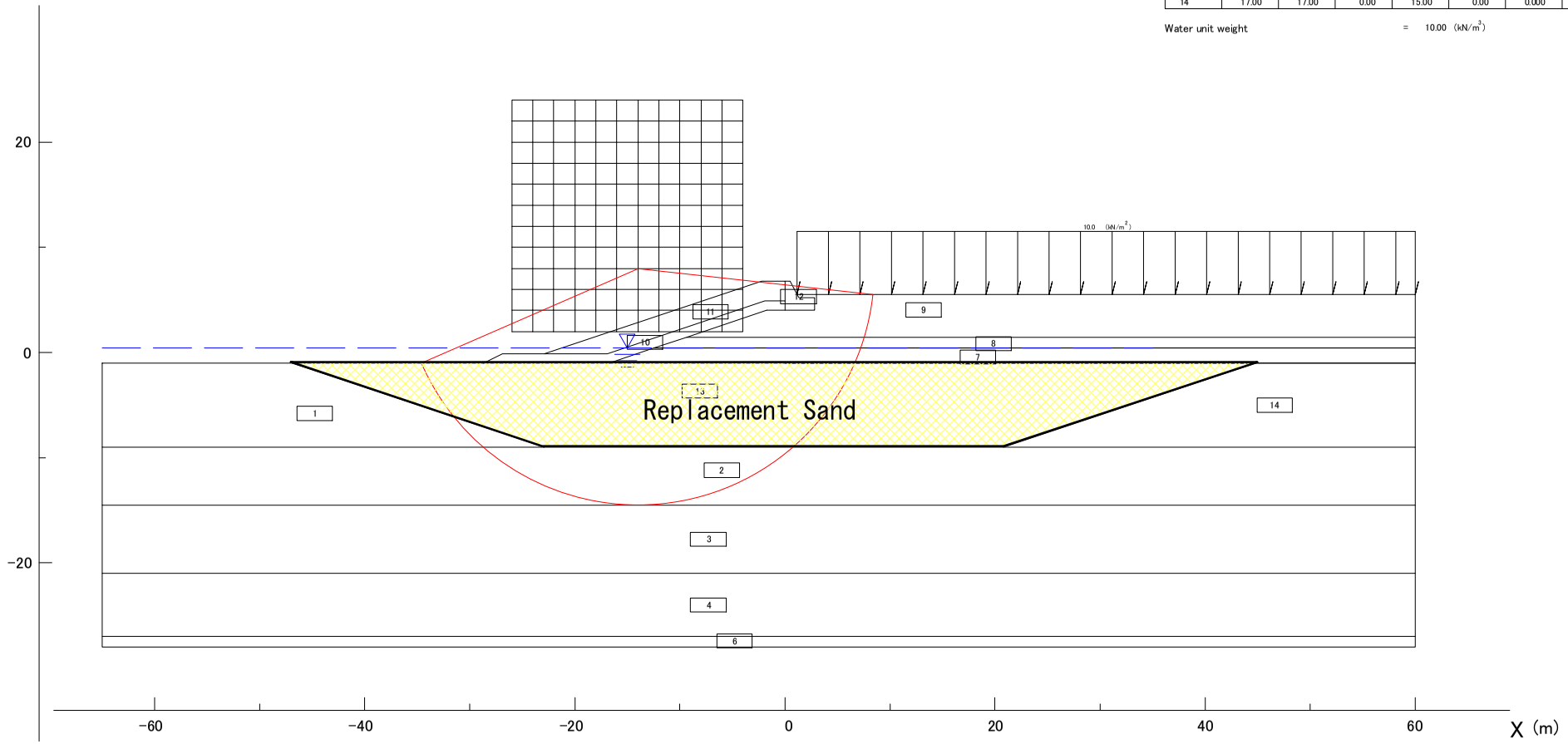
Outer Revetment A (Sand Replacement Method)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.080	
Center of arc	X	=	−14.00	(m)
	Y	=	8.00	(m)
Radius	R	=	22.50	(m)
Resisting moment	M_R	=	28018.1	(kNm)
Sliding moment	M_D	=	25950.2	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	17.00	17.00	0.00	15.00	0.00	0.000	0.000
2	19.00	19.00	0.00	25.00	0.00	0.000	0.000
3	17.50	17.50	0.00	40.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000
10	20.00	18.00	40.00	0.00	0.00	0.000	0.000
11	16.50	11.50	40.00	0.00	0.00	0.000	0.000
12	23.00	23.00	40.00	0.00	0.00	0.000	0.000
13	20.00	18.00	30.00	0.00	0.00	0.000	0.000
14	17.00	17.00	0.00	15.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)

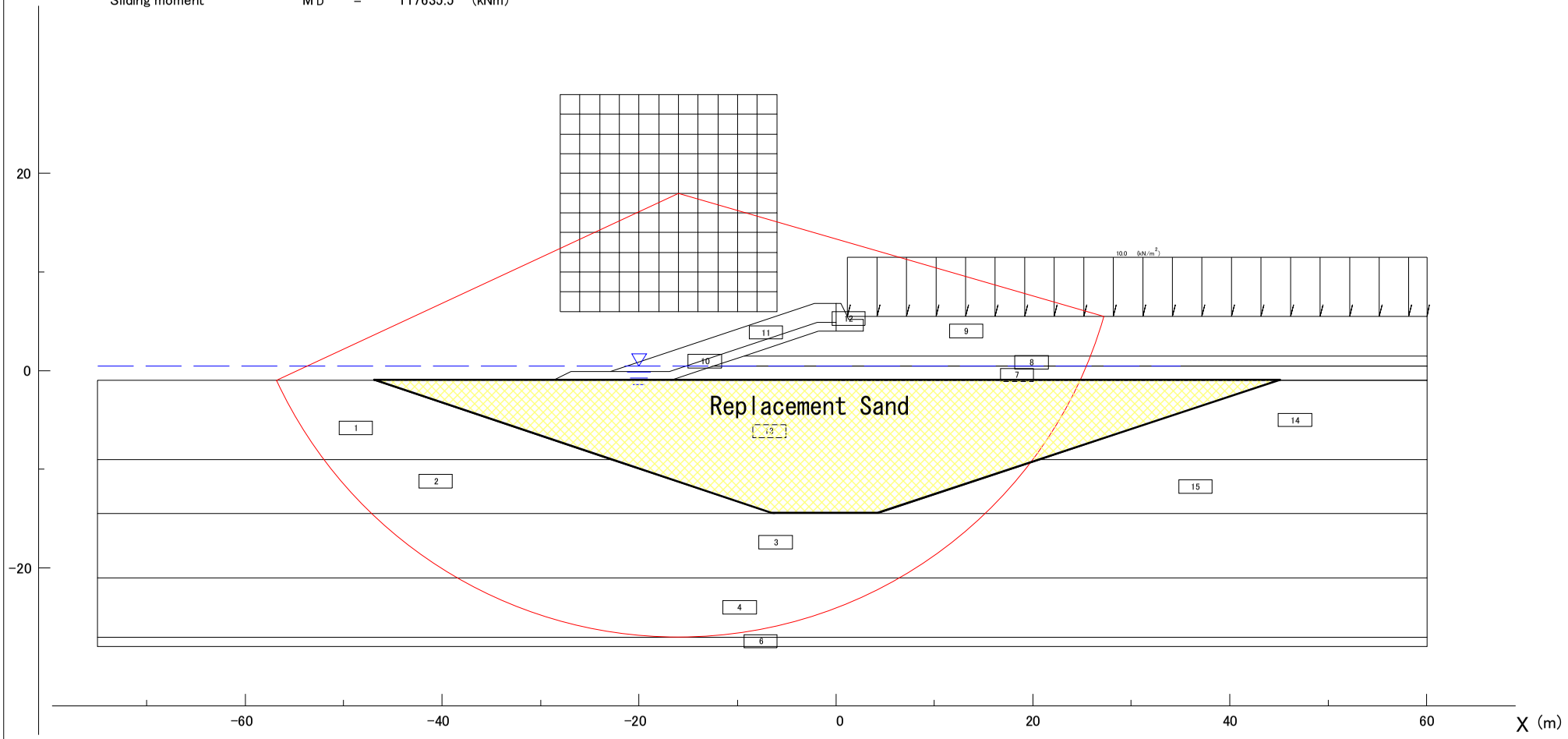


Safety Factor (Ordinary Condition)

Outer Revetment A (Sand Replacement Method)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.345	
Center of arc	X	=	−16.00	(m)
	Y	=	18.00	(m)
Radius	R	=	45.00	(m)
Resisting moment	M_R	=	158245.5	(kNm)
Sliding moment	M_D	=	117635.5	(kNm)



Safety Factor (Ordinary Condition)

7) Slope Stability Analysis Result for Outer Revetment A

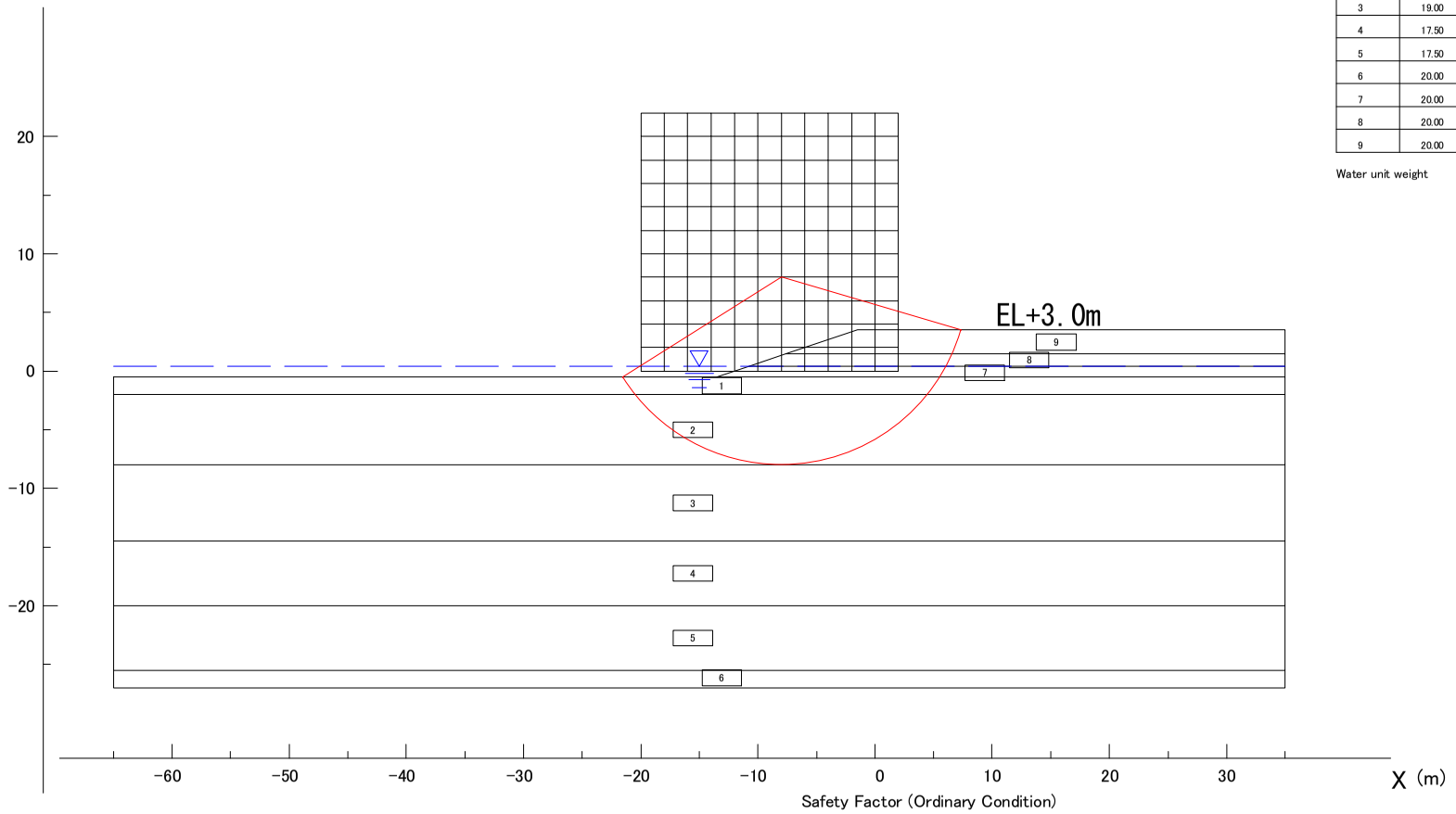
ラックフェン港-外側護岸-1 1段目:+5.0m(小段 h=3.8m L=16m)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.191	
Center of arc	X	=	-8.00	(m)
	Y	=	8.00	(m)
Radius	R	=	16.00	(m)
Resisting moment	M_R	=	8066.0	(kNm)
Sliding moment	M_D	=	6770.4	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	0.00	15.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

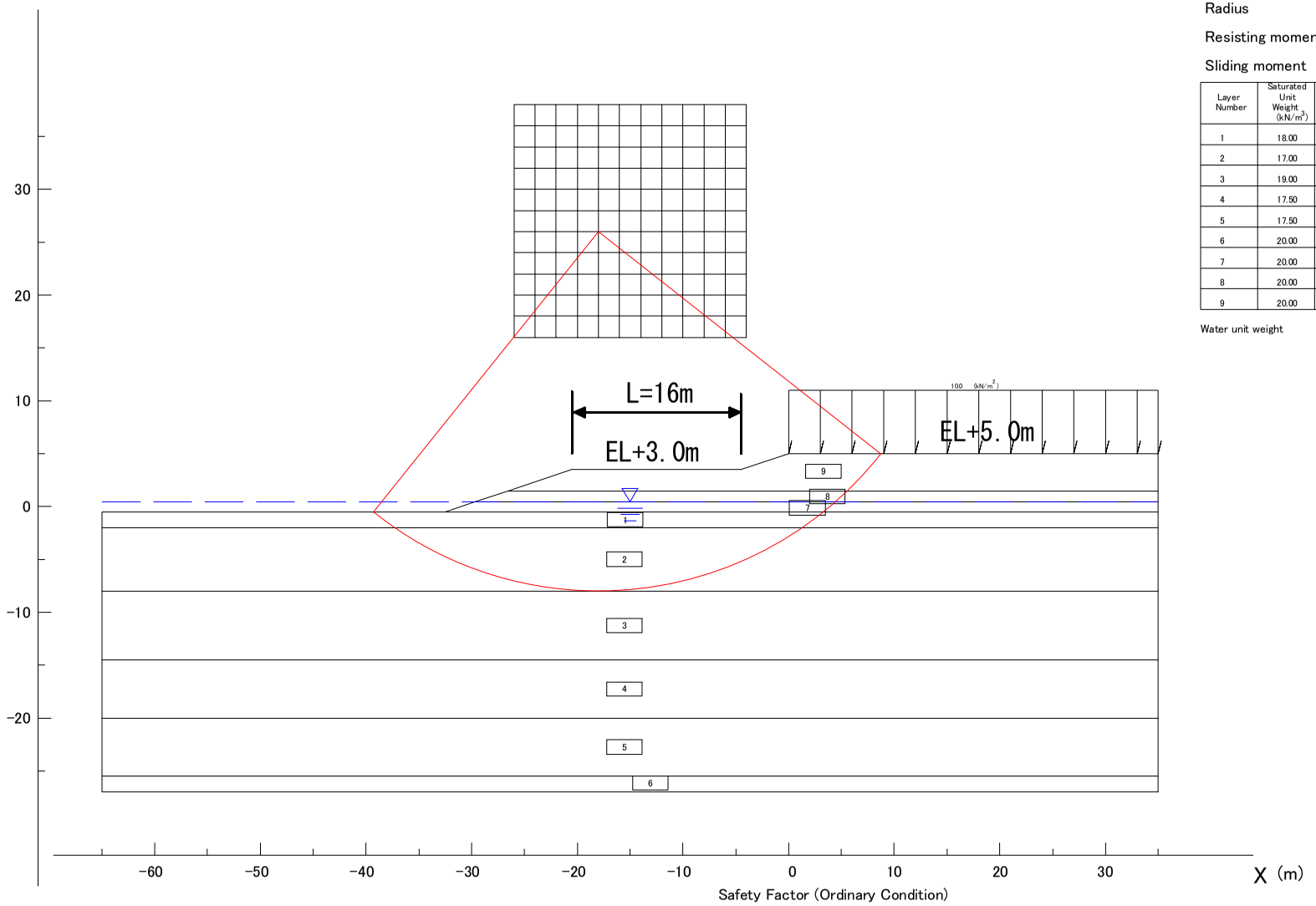
ラックフェン港-外側護岸-1 1段目:+5.0m(小段 h=3.8m L=16m)

Scale ; 1/ 600

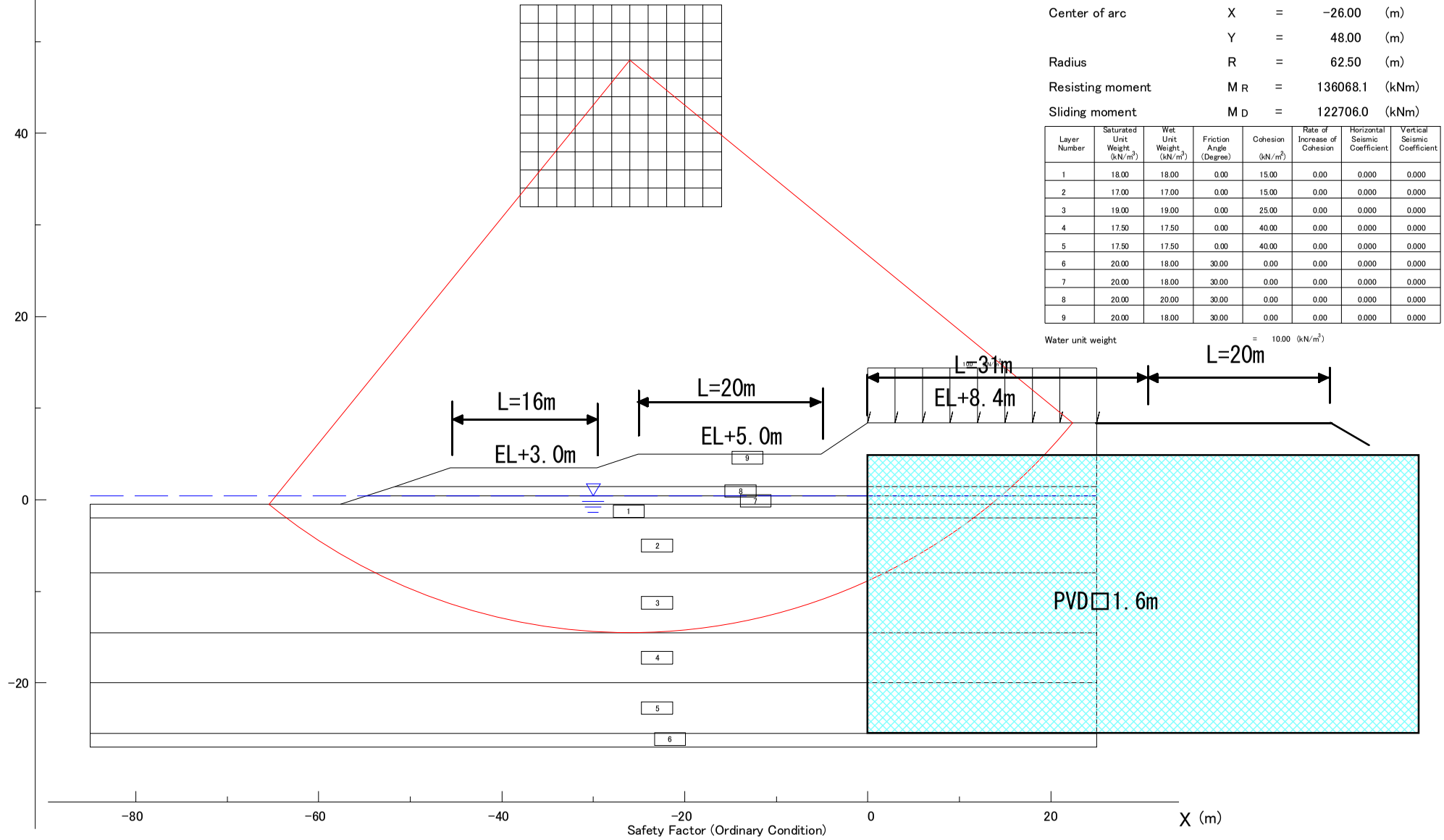
Min. safety factor	$F_{S\,MIN}$	=	1.149	
Center of arc	X	=	-18.00	(m)
	Y	=	26.00	(m)
Radius	R	=	34.00	(m)
Resisting moment	M_R	=	27615.8	(kNm)
Sliding moment	M_D	=	24027.3	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	0.00	15.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



ラックフェン港-外側護岸-1 2段目:+8.4m(小段 h=5.0m L=20m)



Layer Number	Saturated Unit Weight (kN/m³)	Wet Unit Weight (kN/m³)	Friction Angle (Degree)	Cohesion (kN/m²)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	0.00	15.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000

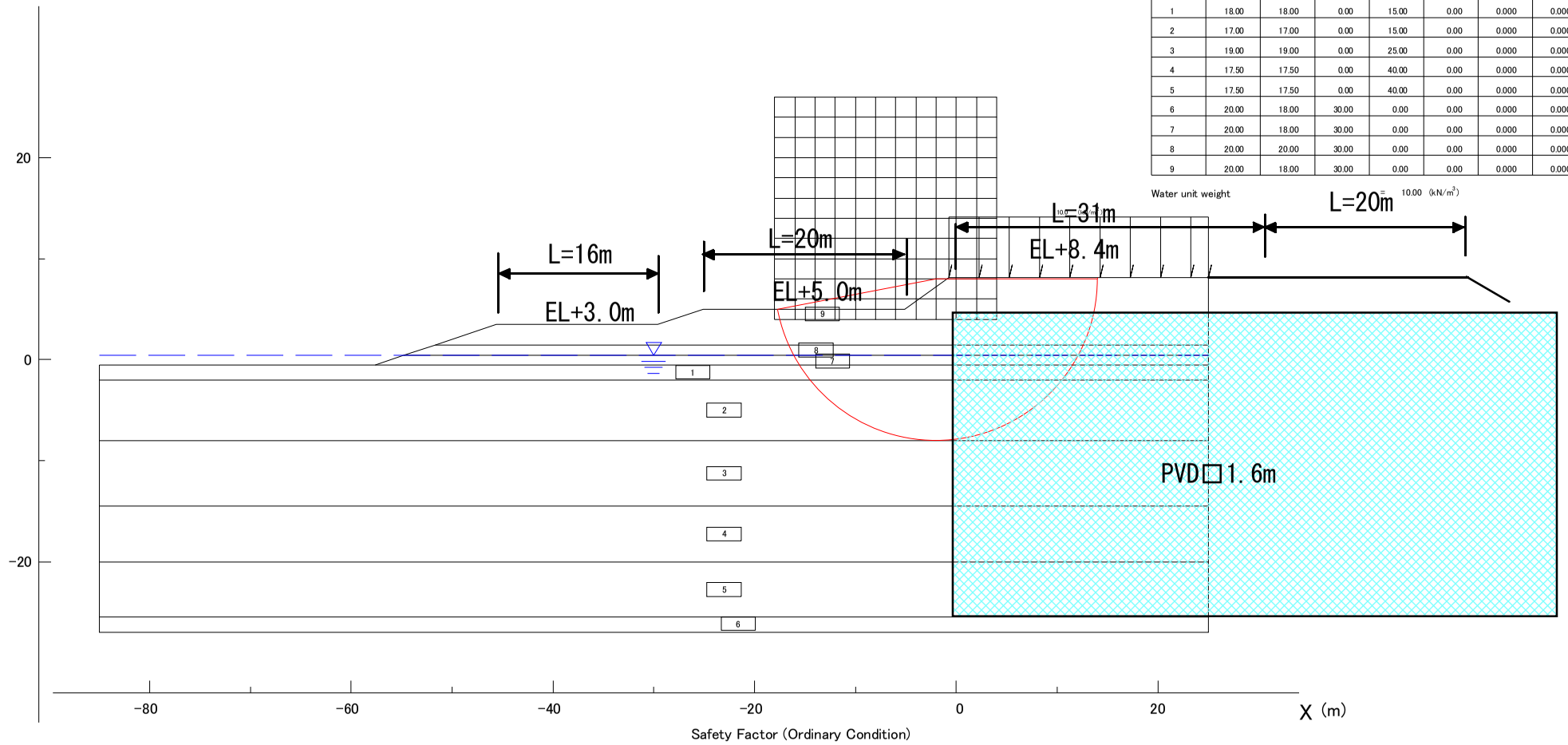
ラックフェン港-外側護岸-1 2段目:+8.4m(小段 h=5.0m L=20m)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.102	
Center of arc	X	=	-2.00	(m)
	Y	=	8.00	(m)
Radius	R	=	16.00	(m)
Resisting moment	M_R	=	9230.2	(kNm)
Sliding moment	M_D	=	8378.8	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	0.00	15.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

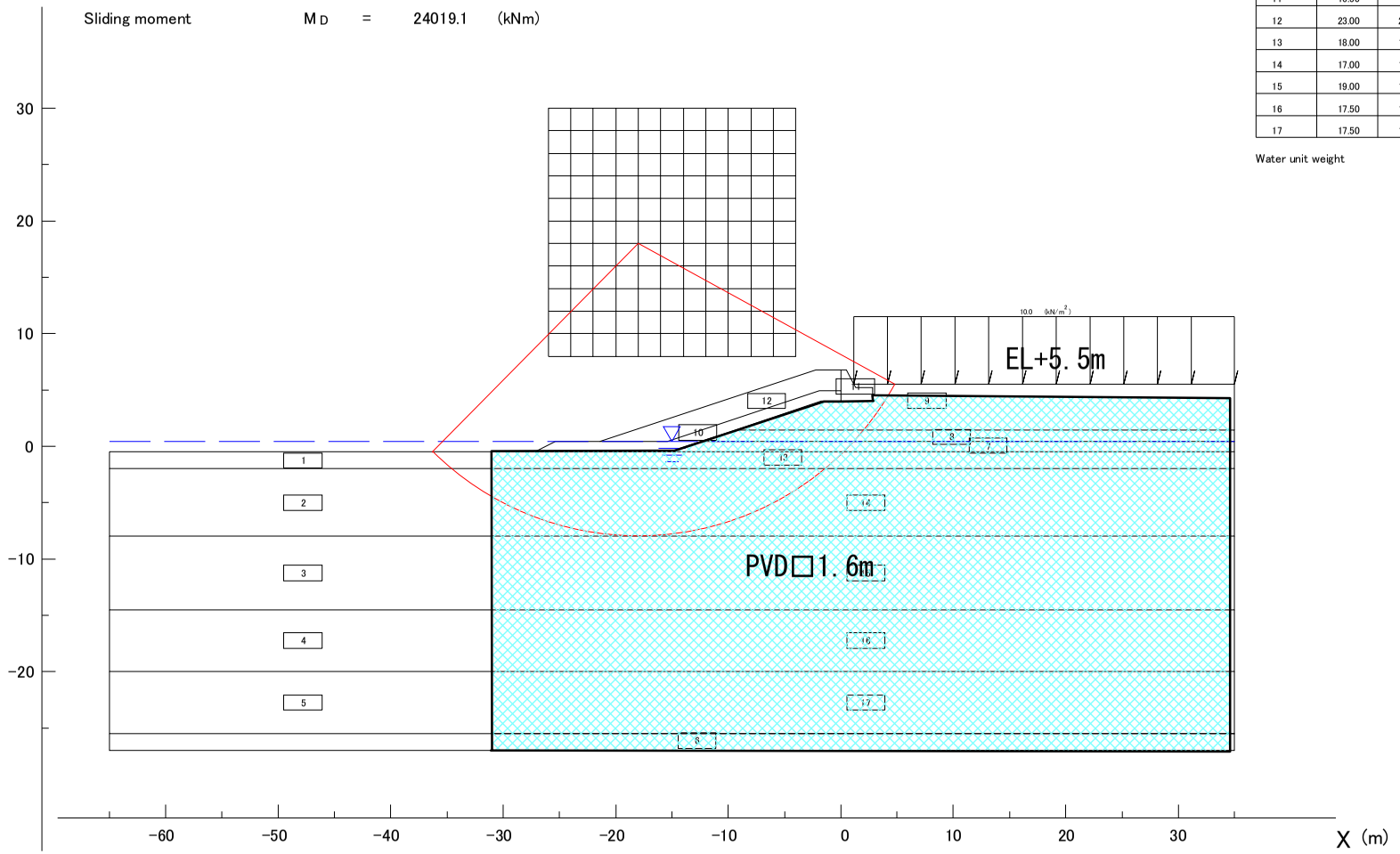
ラックフェン港-外側護岸-1 完成形(改良幅=31m)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.303	
Center of arc	X	=	-18.00	(m)
	Y	=	18.00	(m)
Radius	R	=	26.00	(m)
Resisting moment	M_R	=	31286.9	(kNm)
Sliding moment	M_D	=	24019.1	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	0.00	15.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000
10	20.00	18.00	40.00	0.00	0.00	0.000	0.000
11	16.50	11.50	40.00	0.00	0.00	0.000	0.000
12	23.00	23.00	40.00	0.00	0.00	0.000	0.000
13	18.00	18.00	0.00	27.02	0.00	0.000	0.000
14	17.00	17.00	0.00	29.99	0.00	0.000	0.000
15	19.00	19.00	0.00	37.85	0.00	0.000	0.000
16	17.50	17.50	0.00	47.38	0.00	0.000	0.000
17	17.50	17.50	0.00	46.81	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

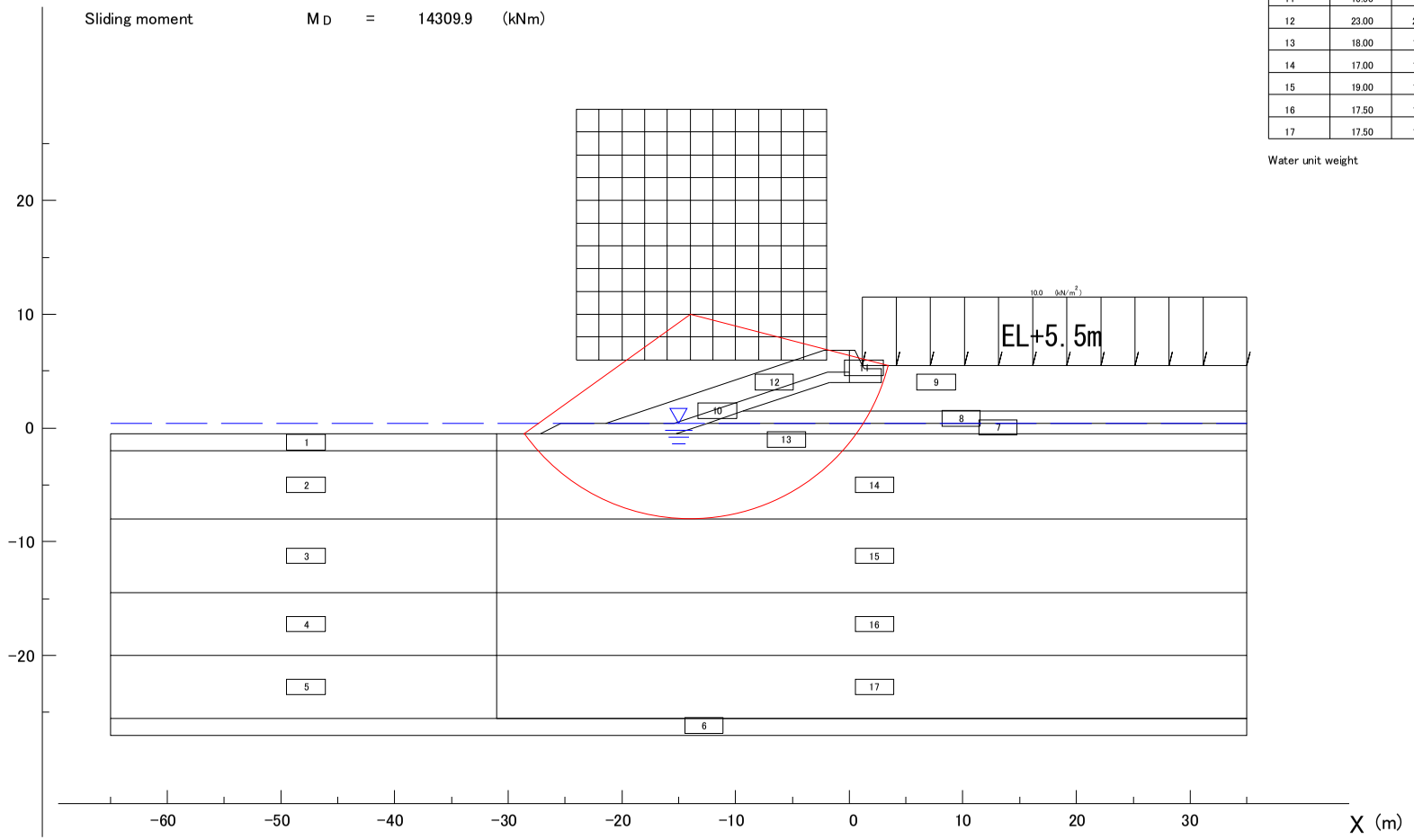
ラックフェン港-外側護岸-1 完成形(無処理)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	0.701	
Center of arc	X	=	-14.00	(m)
	Y	=	10.00	(m)
Radius	R	=	18.00	(m)
Resisting moment	M_R	=	10031.0	(kNm)
Sliding moment	M_D	=	14309.9	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	0.00	15.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	0.00	25.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000
10	20.00	18.00	40.00	0.00	0.00	0.000	0.000
11	16.50	11.50	40.00	0.00	0.00	0.000	0.000
12	23.00	23.00	40.00	0.00	0.00	0.000	0.000
13	18.00	18.00	0.00	15.00	0.00	0.000	0.000
14	17.00	17.00	0.00	15.00	0.00	0.000	0.000
15	19.00	19.00	0.00	25.00	0.00	0.000	0.000
16	17.50	17.50	0.00	40.00	0.00	0.000	0.000
17	17.50	17.50	0.00	40.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

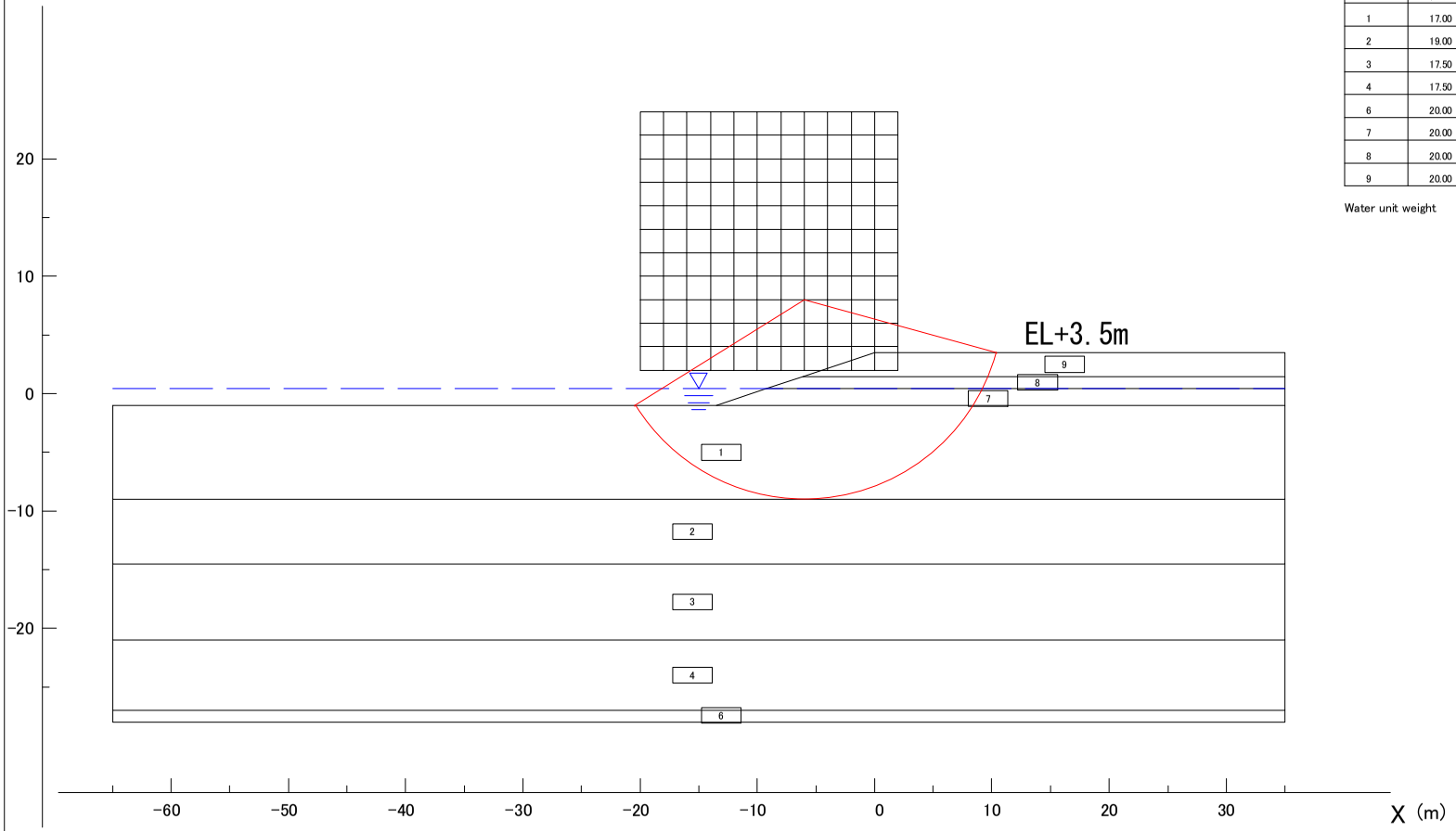
ラックフェン港-外側護岸-2 1段目:限界盛土H=+3.5m

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.103	
Center of arc	X	=	-6.00	(m)
	Y	=	8.00	(m)
Radius	R	=	17.00	(m)
Resisting moment	M_R	=	9167.9	(kNm)
Sliding moment	M_D	=	8310.2	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	17.00	17.00	0.00	15.00	0.00	0.000	0.000
2	19.00	19.00	0.00	25.00	0.00	0.000	0.000
3	17.50	17.50	0.00	40.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

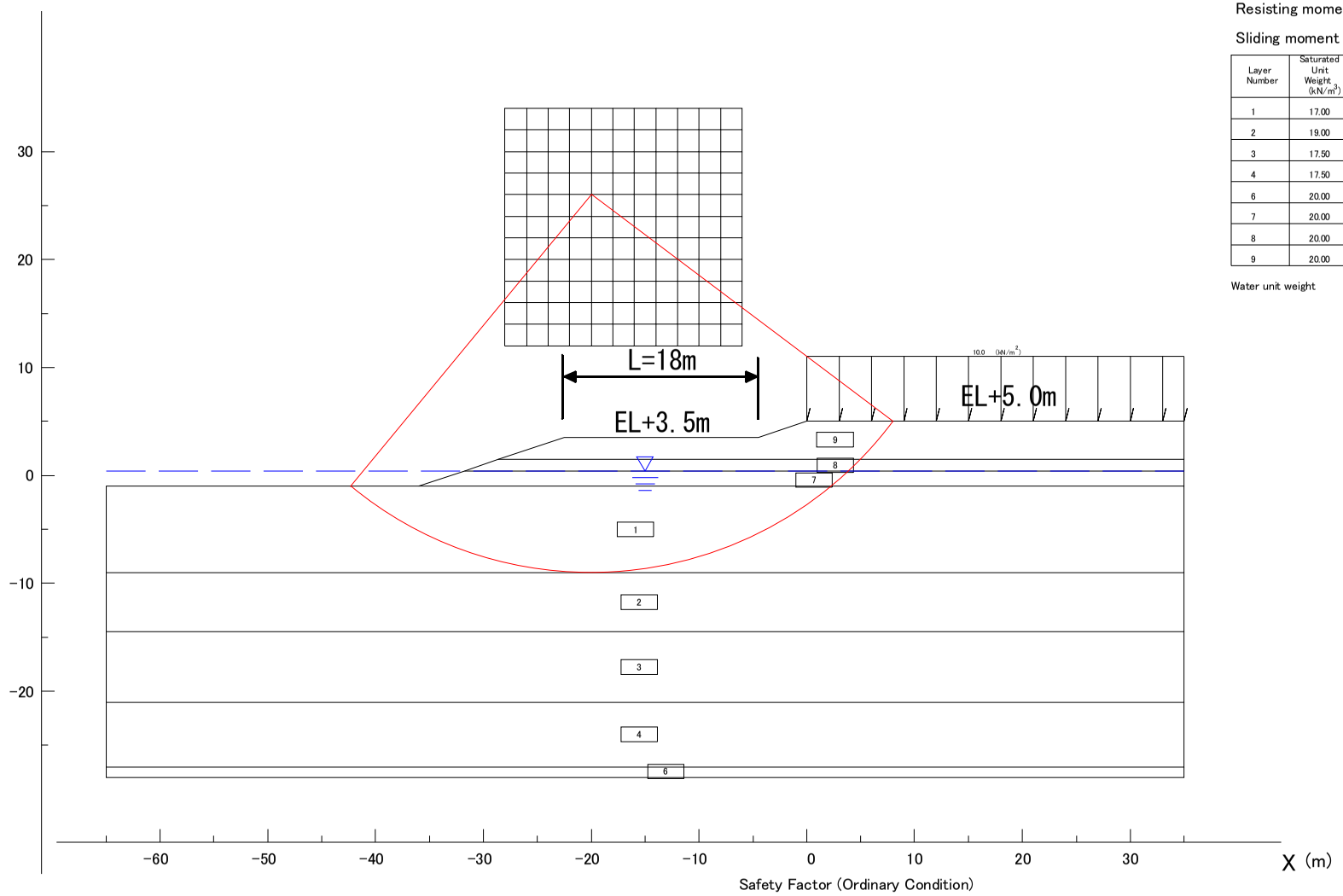
ラックフェン港-外側護岸-2 1段目:+5.0m(小段+3.5m L=18m)

Scale ; 1/ 600

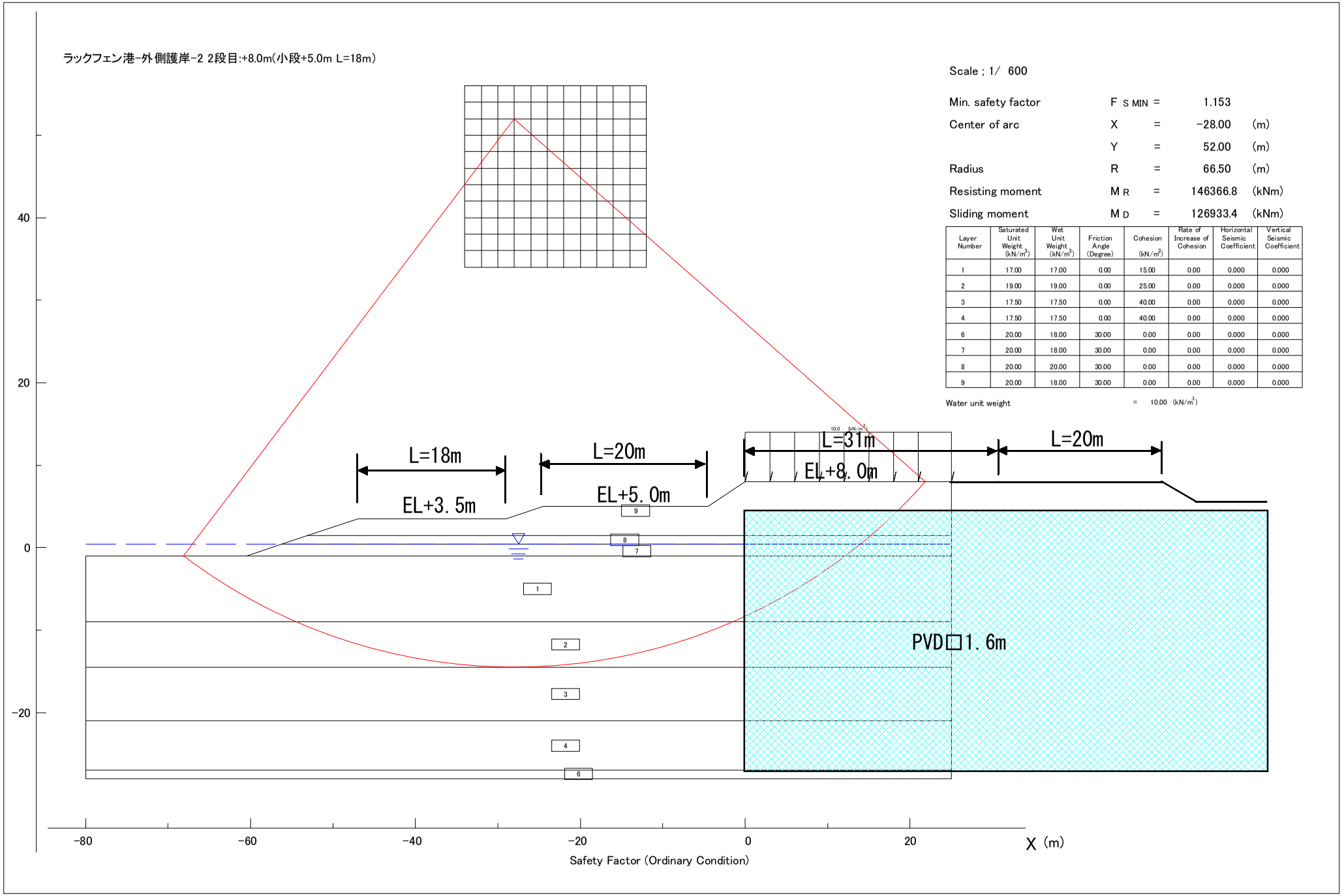
Min. safety factor	$F_{S\,MIN}$	=	1.115	
Center of arc	X	=	-20.00	(m)
	Y	=	26.00	(m)
Radius	R	=	35.00	(m)
Resisting moment	M_R	=	30116.9	(kNm)
Sliding moment	M_D	=	27009.7	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	17.00	17.00	0.00	15.00	0.00	0.000	0.000
2	19.00	19.00	0.00	25.00	0.00	0.000	0.000
3	17.50	17.50	0.00	40.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



ラックフェン港-外側護岸-2 2段目:+8.0m(小段+5.0m L=18m)



Layer Number	Saturated Unit Weight (kN/m3)	Wet Unit Weight (kN/m3)	Friction Angle (Degree)	Cohesion (kN/m2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	17.00	17.00	0.00	15.00	0.00	0.000	0.000
2	19.00	19.00	0.00	25.00	0.00	0.000	0.000
3	17.50	17.50	0.00	40.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000

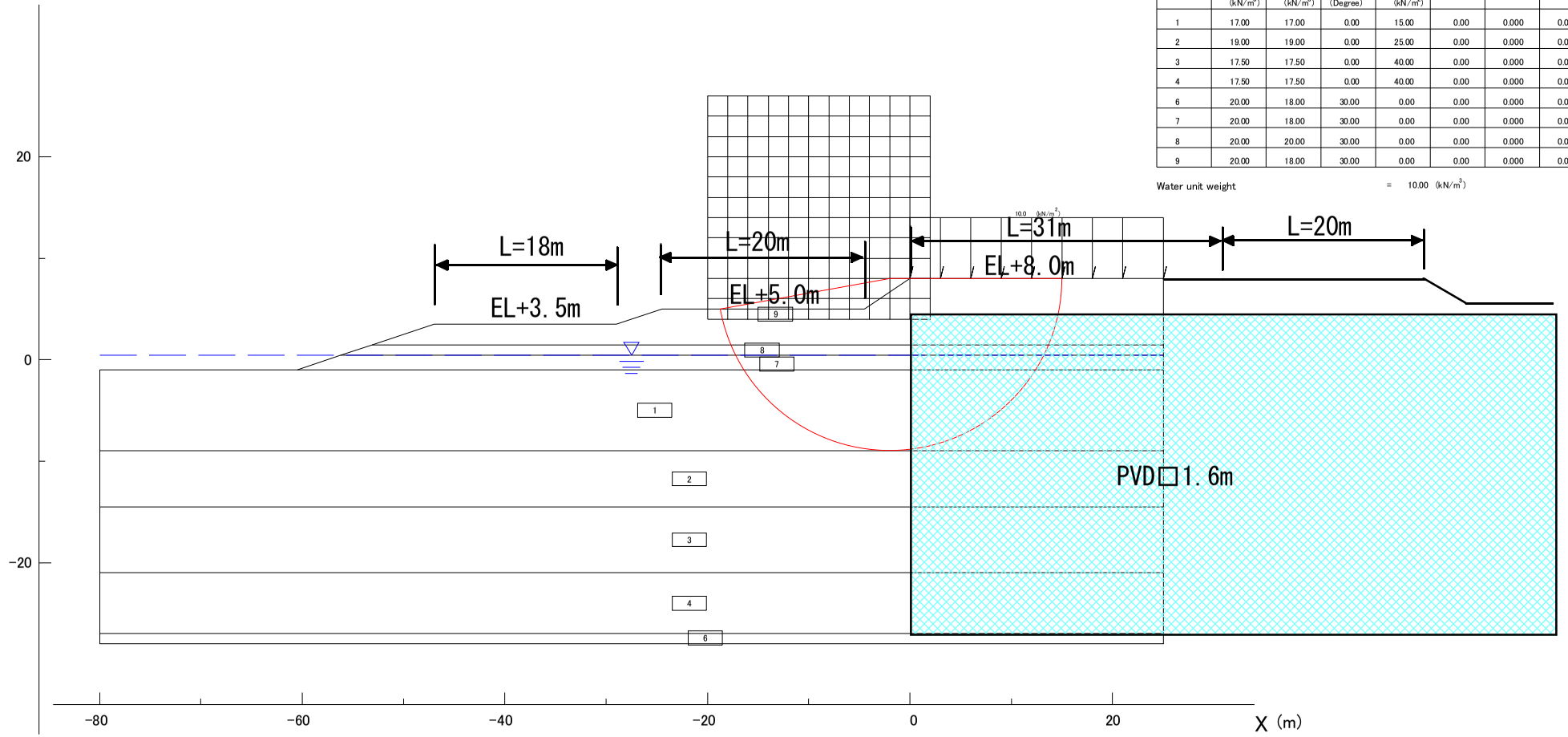
ラックフェン港-外側護岸-2 2段目:+8.0m(小段+5.0m L=18m)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.154	
Center of arc	X	=	-2.00	(m)
	Y	=	8.00	(m)
Radius	R	=	17.00	(m)
Resisting moment	M_R	=	10497.3	(kNm)
Sliding moment	M_D	=	9098.7	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	17.00	17.00	0.00	15.00	0.00	0.000	0.000
2	19.00	19.00	0.00	25.00	0.00	0.000	0.000
3	17.50	17.50	0.00	40.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

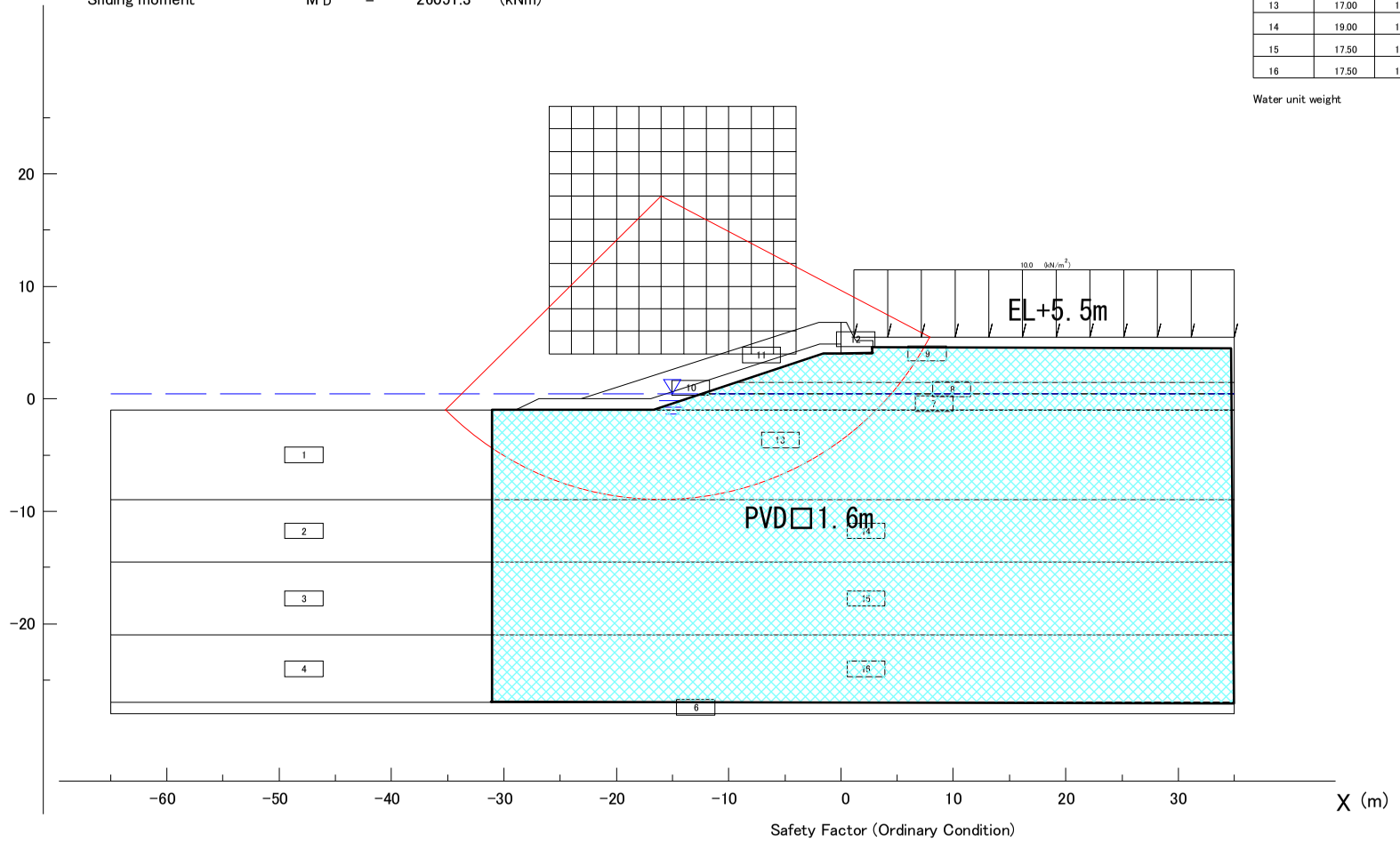
ラックフェン港-外側護岸-2 完成形(改良幅=30m)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.315	
Center of arc	X	=	-16.00	(m)
	Y	=	18.00	(m)
Radius	R	=	27.00	(m)
Resisting moment	M_R	=	34252.3	(kNm)
Sliding moment	M_D	=	26051.3	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	17.00	17.00	0.00	15.00	0.00	0.000	0.000
2	19.00	19.00	0.00	25.00	0.00	0.000	0.000
3	17.50	17.50	0.00	40.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000
10	20.00	18.00	40.00	0.00	0.00	0.000	0.000
11	16.50	11.50	40.00	0.00	0.00	0.000	0.000
12	23.00	23.00	40.00	0.00	0.00	0.000	0.000
13	17.00	17.00	0.00	28.92	0.00	0.000	0.000
14	19.00	19.00	0.00	37.74	0.00	0.000	0.000
15	17.50	17.50	0.00	47.36	0.00	0.000	0.000
16	17.50	17.50	0.00	46.75	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

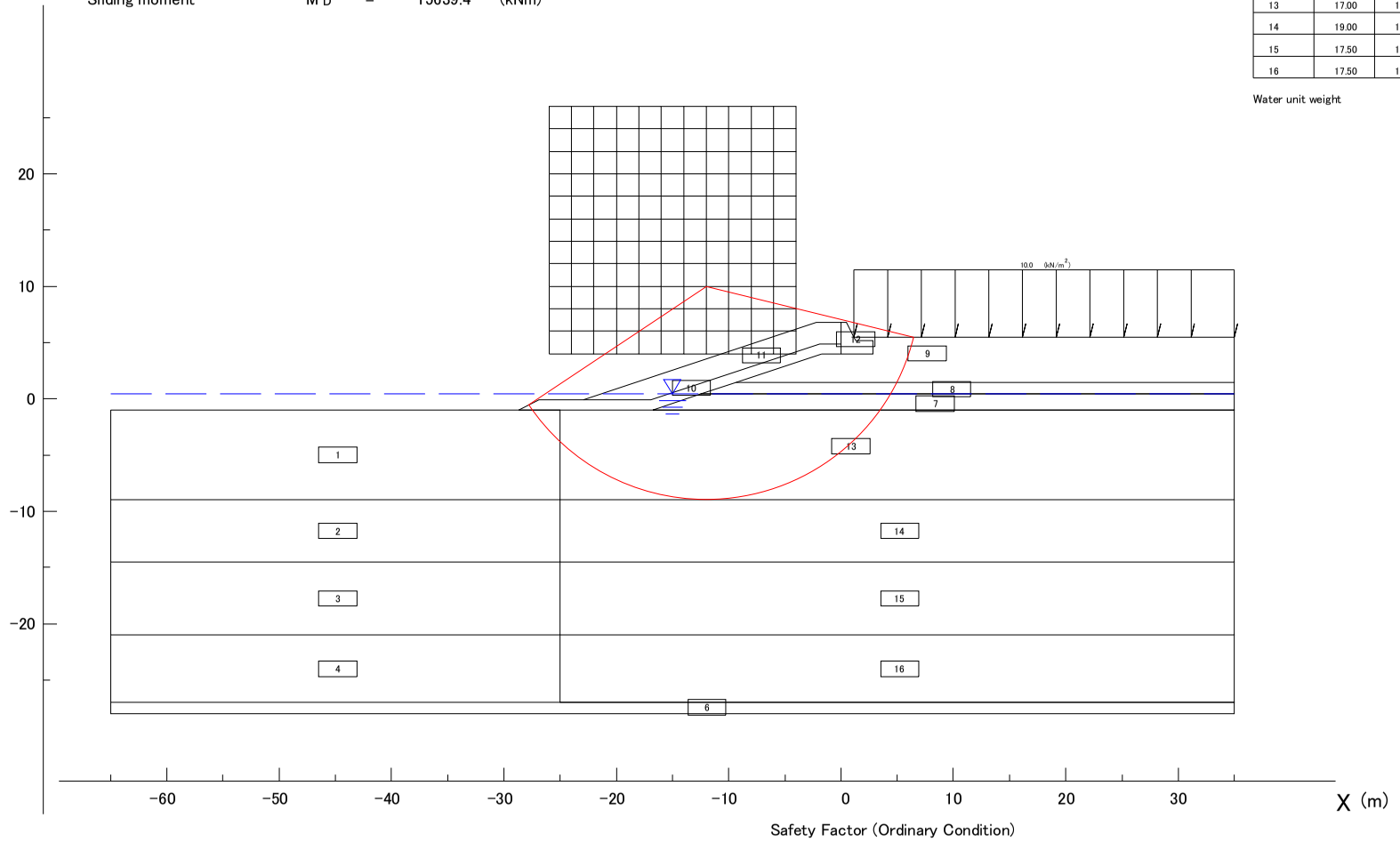
ラックフェン港-外側護岸-2 1段目:+5.0m(小段+3.5m L=18m)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	0.728	
Center of arc	X	=	−12.00	(m)
	Y	=	10.00	(m)
Radius	R	=	19.00	(m)
Resisting moment	M_R	=	11385.6	(kNm)
Sliding moment	M_D	=	15639.4	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	17.00	17.00	0.00	15.00	0.00	0.000	0.000
2	19.00	19.00	0.00	25.00	0.00	0.000	0.000
3	17.50	17.50	0.00	40.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000
10	20.00	18.00	40.00	0.00	0.00	0.000	0.000
11	16.50	11.50	40.00	0.00	0.00	0.000	0.000
12	23.00	23.00	40.00	0.00	0.00	0.000	0.000
13	17.00	17.00	0.00	15.00	0.00	0.000	0.000
14	19.00	19.00	0.00	25.00	0.00	0.000	0.000
15	17.50	17.50	0.00	40.00	0.00	0.000	0.000
16	17.50	17.50	0.00	40.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

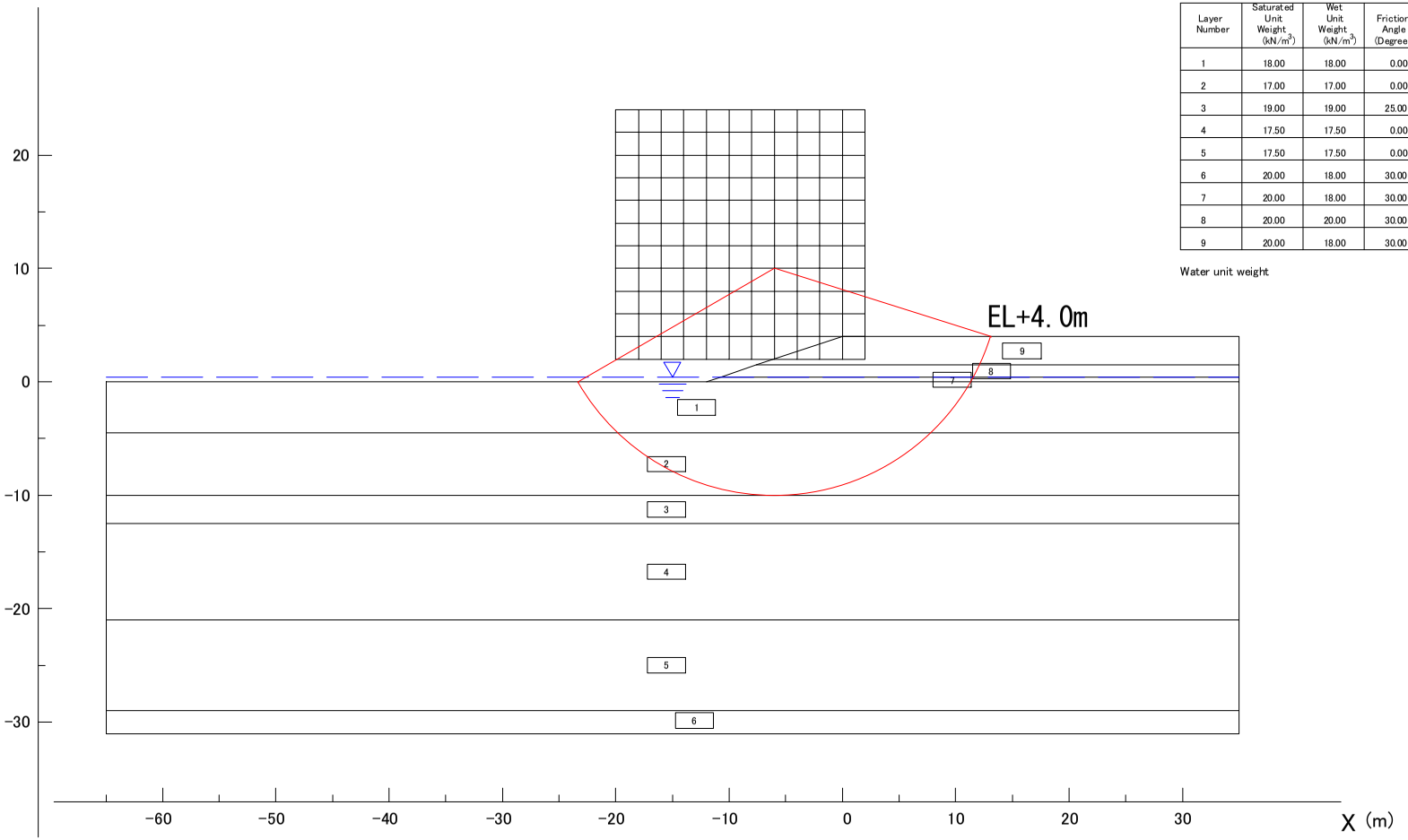
ラックフェン港-外側護岸-3 1段目:限界盛土H=+4.10m

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.127	
Center of arc	X	=	-6.00	(m)
	Y	=	10.00	(m)
Radius	R	=	20.00	(m)
Resisting moment	M_R	=	12921.4	(kNm)
Sliding moment	M_D	=	11460.4	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	0.00	15.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	25.00	0.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

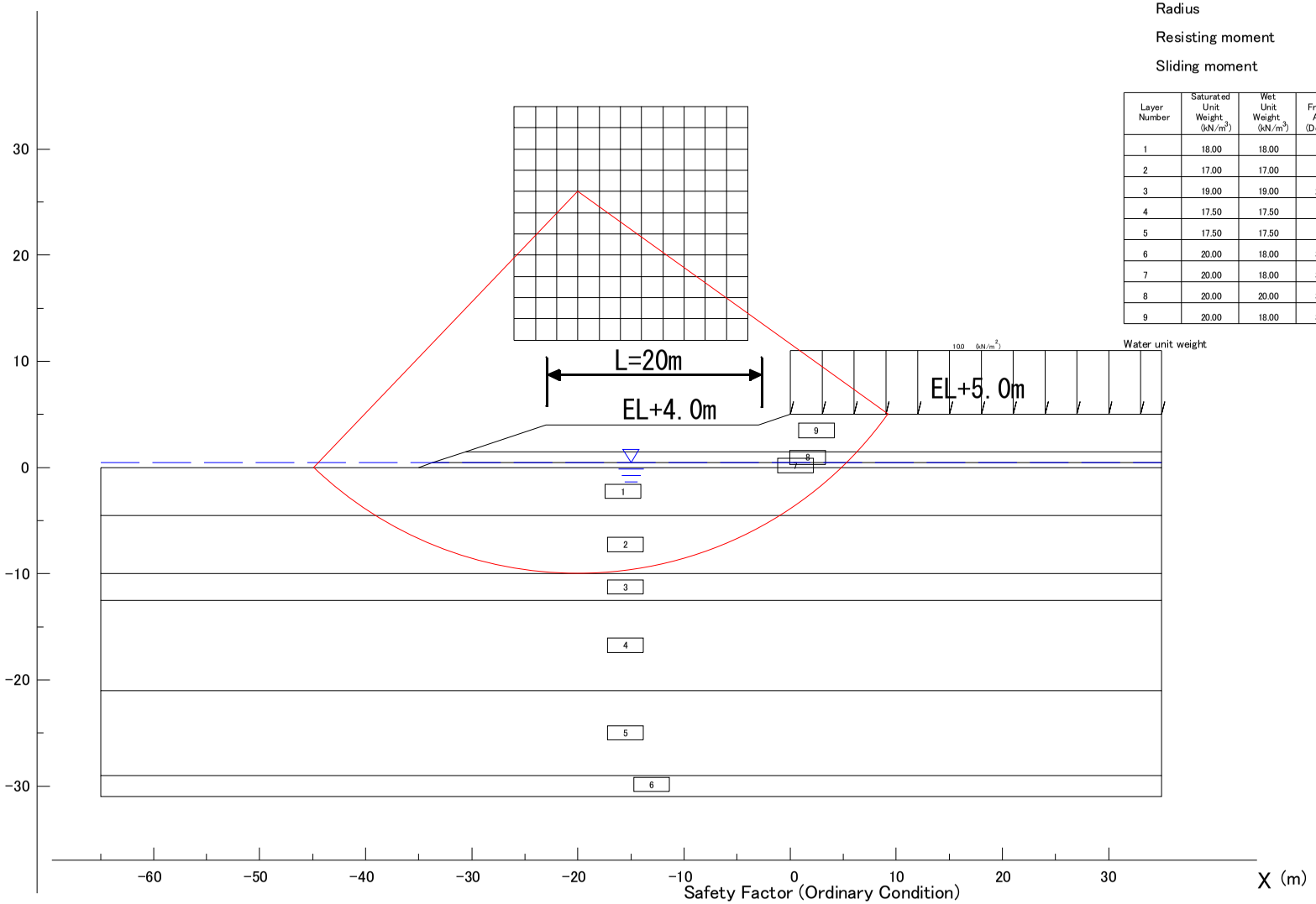
ラックフェン港-外側護岸-3 1段目:+5.00m(小段h=4.1m L=20m)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.125	
Center of arc	X	=	-20.00	(m)
	Y	=	26.00	(m)
Radius	R	=	36.00	(m)
Resisting moment	M_R	=	32637.8	(kNm)
Sliding moment	M_D	=	29021.4	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	0.00	15.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	25.00	0.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



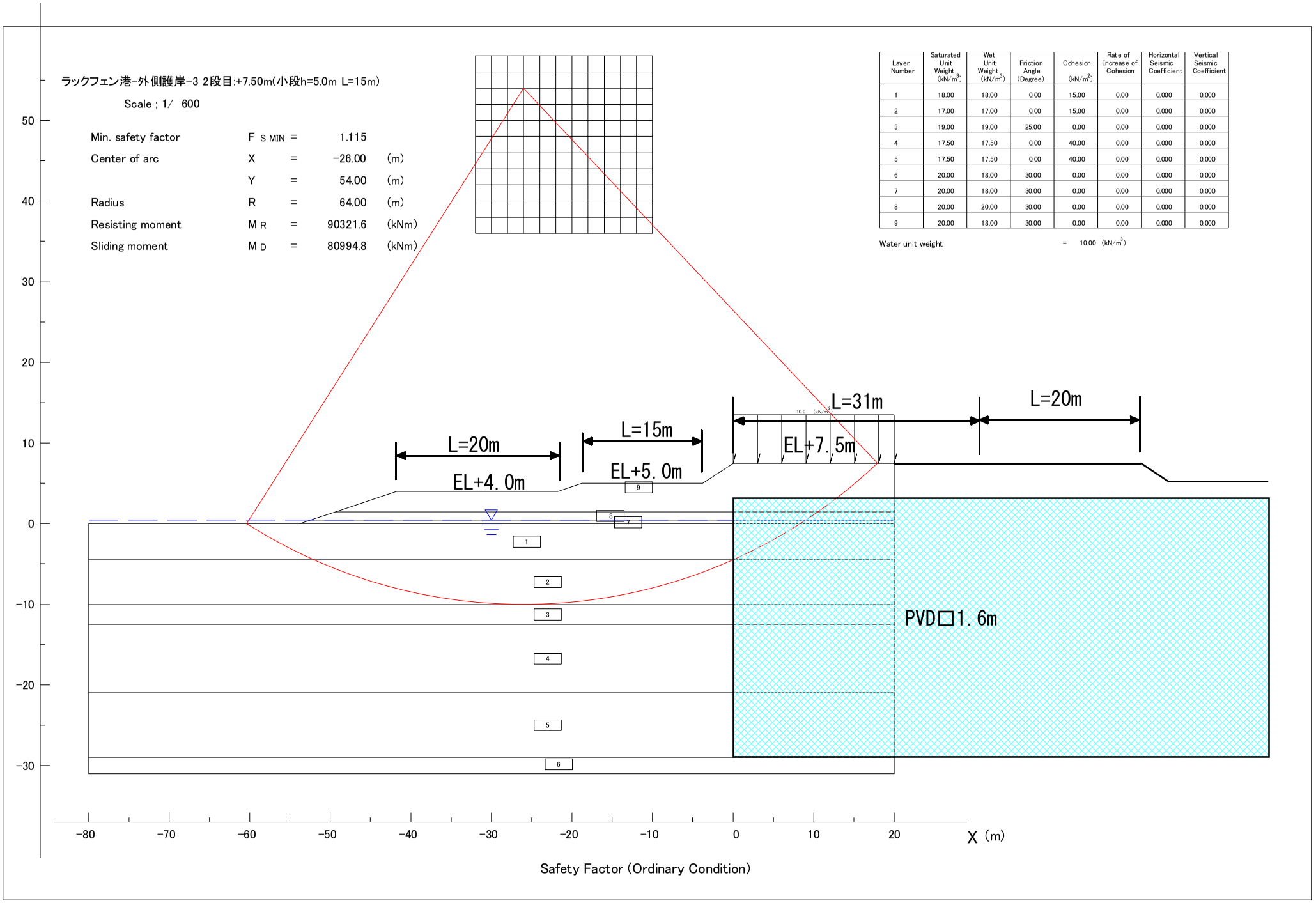
ラックフェン港-外側護岸-3 2段目:+7.50m(小段h=5.0m L=15m)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.115	
Center of arc	X	=	-26.00	(m)
	Y	=	54.00	(m)
Radius	R	=	64.00	(m)
Resisting moment	M_R	=	90321.6	(kNm)
Sliding moment	M_D	=	80994.8	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	0.00	15.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	25.00	0.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

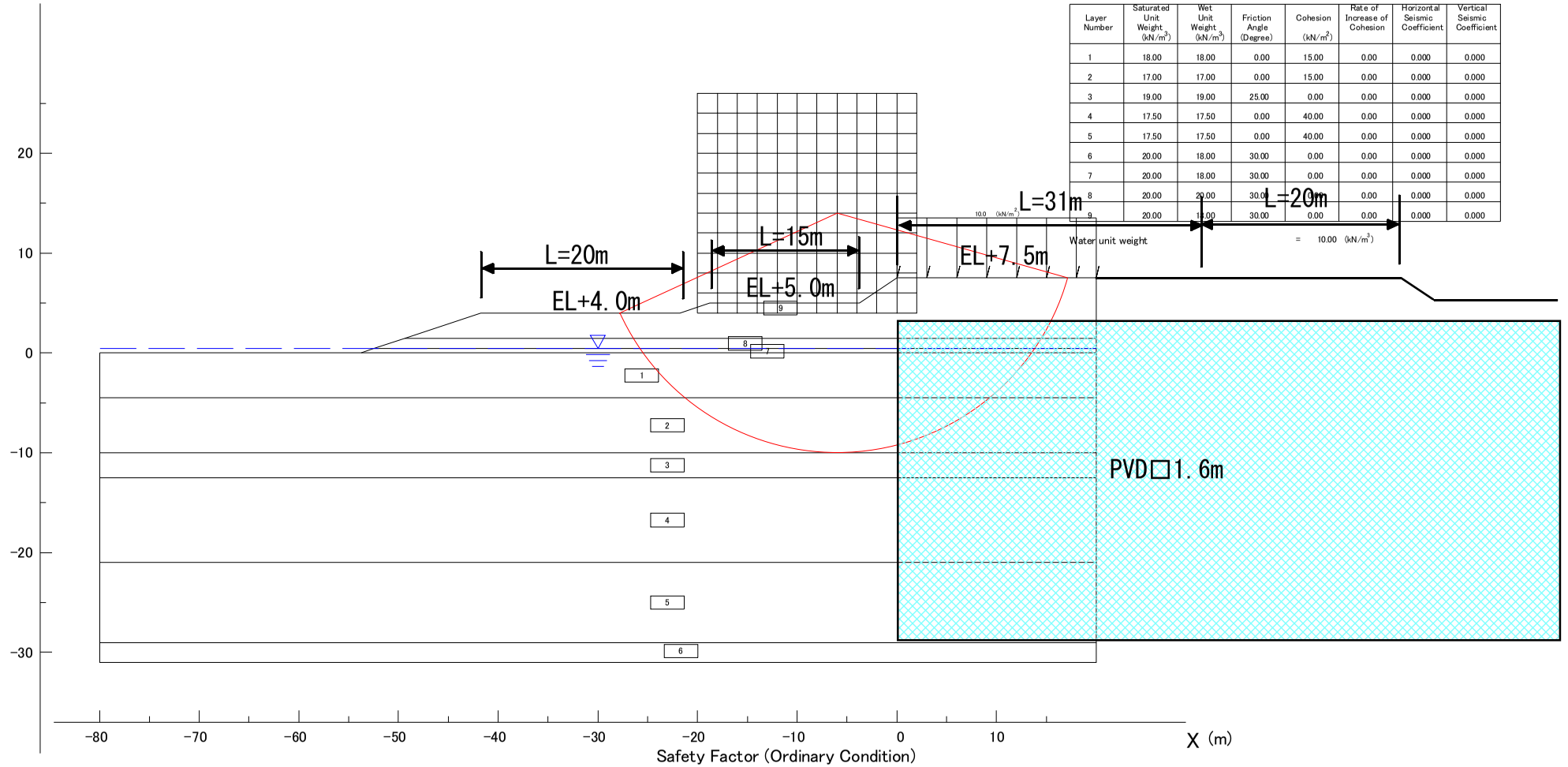
ラックフェン港-外側護岸-3 2段目:+7.50m(小段h=5.0m L=15m)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.170	
Center of arc	X	=	-6.00	(m)
	Y	=	14.00	(m)
Radius	R	=	24.00	(m)
Resisting moment	M_R	=	18968.1	(kNm)
Sliding moment	M_D	=	16211.3	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	0.00	15.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	25.00	0.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



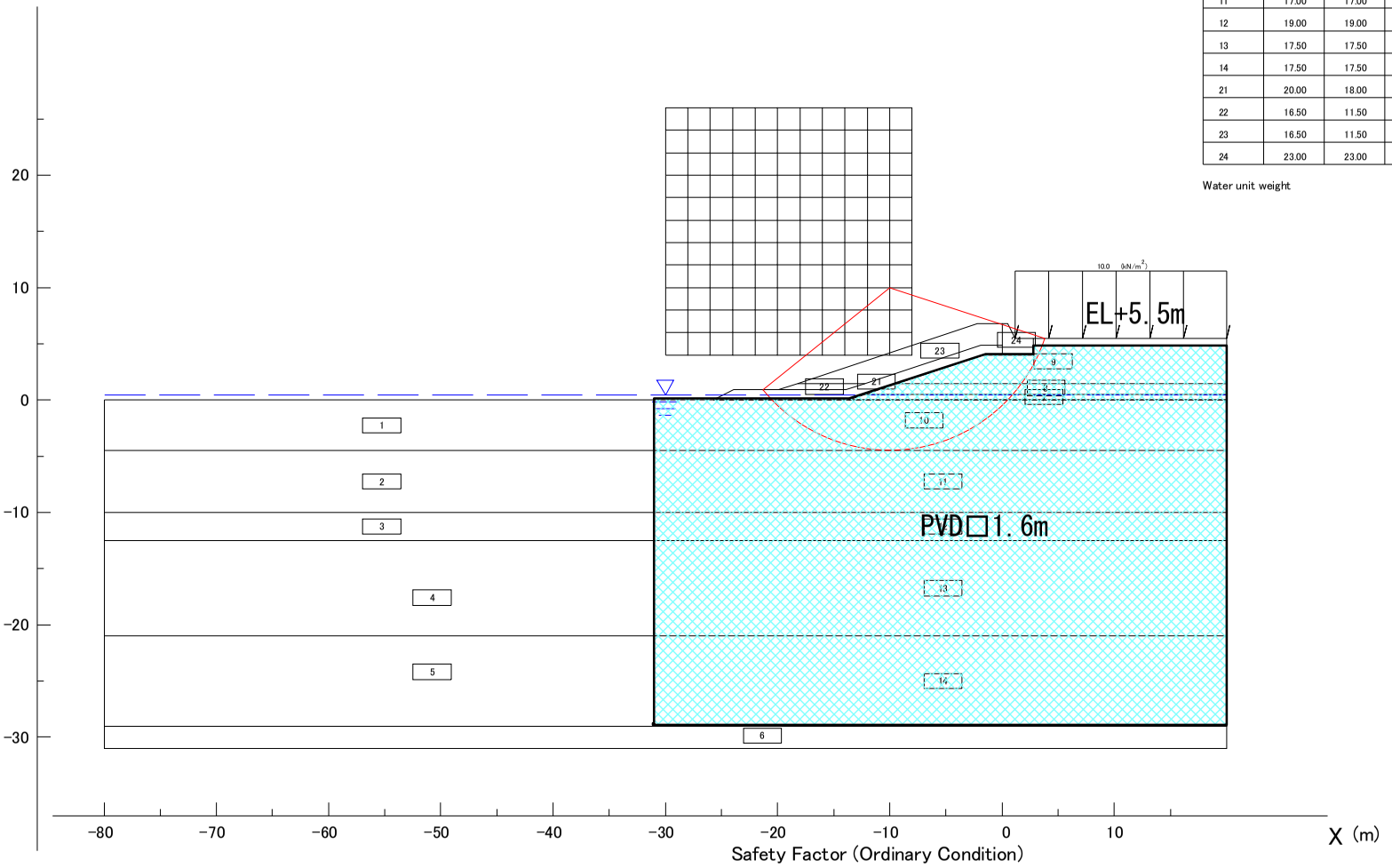
ラックフェン港-外側護岸-3 完成形(改良幅=25m)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.331	
Center of arc	X	=	−10.00	(m)
	Y	=	10.00	(m)
Radius	R	=	14.50	(m)
Resisting moment	M_R	=	9418.1	(kNm)
Sliding moment	M_D	=	7076.9	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	0.00	15.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	25.00	0.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000
10	18.00	18.00	0.00	24.37	0.00	0.000	0.000
11	17.00	17.00	0.00	29.87	0.00	0.000	0.000
12	19.00	19.00	25.00	0.00	0.00	0.000	0.000
13	17.50	17.50	0.00	44.31	0.00	0.000	0.000
14	17.50	17.50	0.00	43.55	0.00	0.000	0.000
21	20.00	18.00	40.00	0.00	0.00	0.000	0.000
22	16.50	11.50	40.00	0.00	0.00	0.000	0.000
23	16.50	11.50	40.00	0.00	0.00	0.000	0.000
24	23.00	23.00	40.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

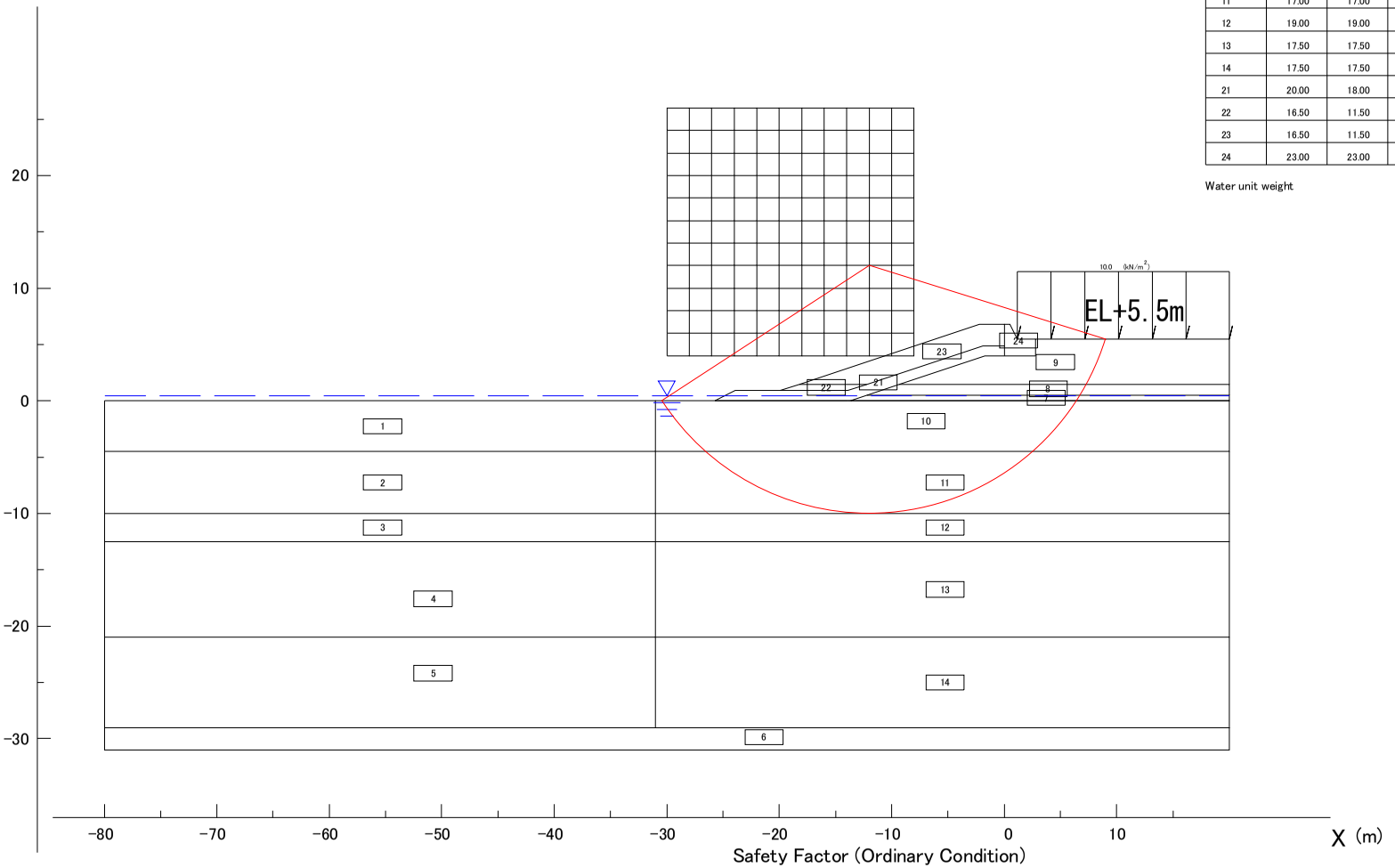
ラックフェン港-外側護岸-3 完成形(改良幅=25m)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	0.774	
Center of arc	X	=	−12.00	(m)
	Y	=	12.00	(m)
Radius	R	=	22.00	(m)
Resisting moment	M_R	=	15290.1	(kNm)
Sliding moment	M_D	=	19760.7	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	0.00	15.00	0.00	0.000	0.000
2	17.00	17.00	0.00	15.00	0.00	0.000	0.000
3	19.00	19.00	25.00	0.00	0.00	0.000	0.000
4	17.50	17.50	0.00	40.00	0.00	0.000	0.000
5	17.50	17.50	0.00	40.00	0.00	0.000	0.000
6	20.00	18.00	30.00	0.00	0.00	0.000	0.000
7	20.00	18.00	30.00	0.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000
10	18.00	18.00	0.00	15.00	0.00	0.000	0.000
11	17.00	17.00	0.00	15.00	0.00	0.000	0.000
12	19.00	19.00	25.00	0.00	0.00	0.000	0.000
13	17.50	17.50	0.00	40.00	0.00	0.000	0.000
14	17.50	17.50	0.00	40.00	0.00	0.000	0.000
21	20.00	18.00	40.00	0.00	0.00	0.000	0.000
22	16.50	11.50	40.00	0.00	0.00	0.000	0.000
23	16.50	11.50	40.00	0.00	0.00	0.000	0.000
24	23.00	23.00	40.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



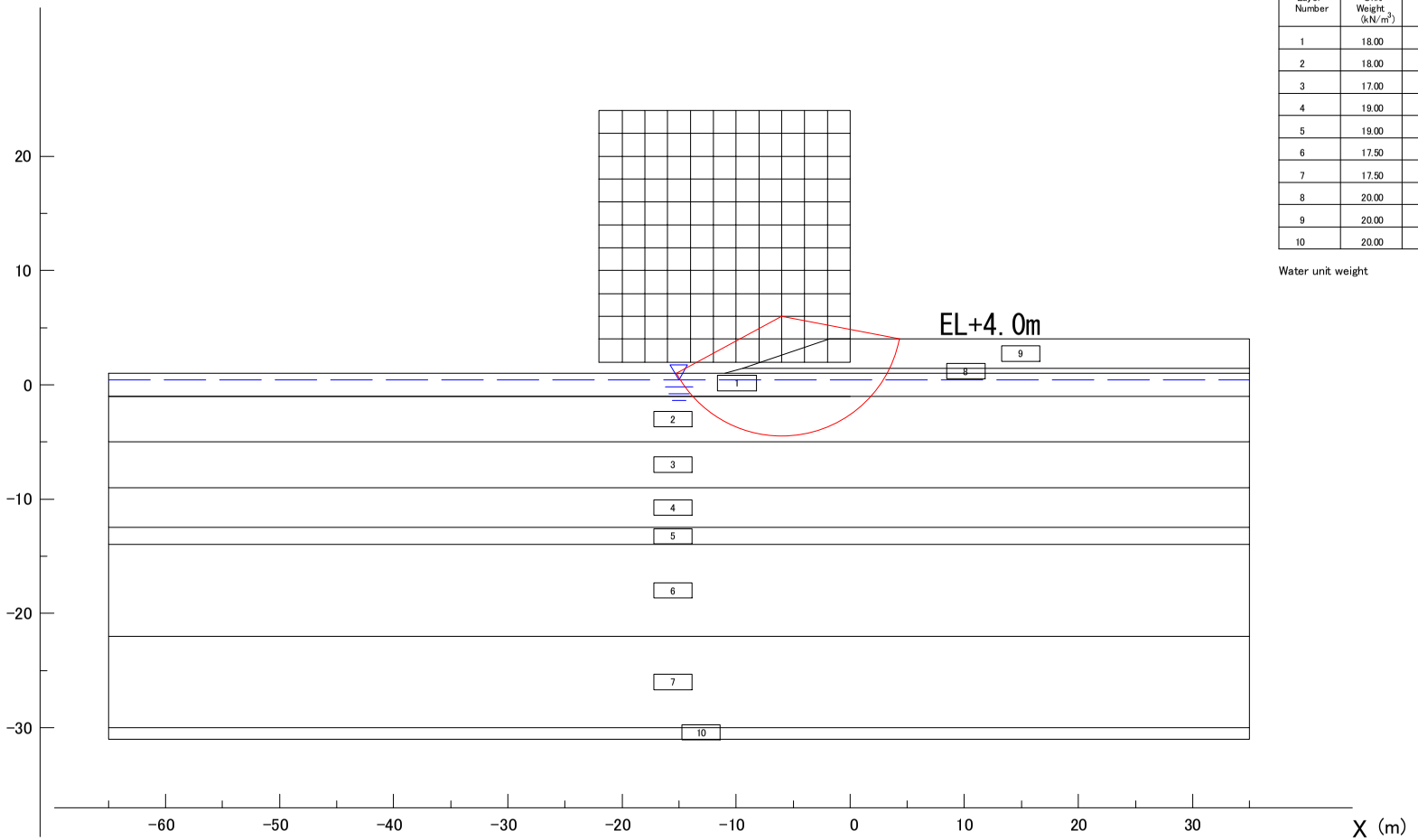
ラックフェン港-外側護岸-4 1段目:+5.00m(小段 h=4.6m L=15m)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.294	
Center of arc	X	=	-6.00	(m)
	Y	=	6.00	(m)
Radius	R	=	10.50	(m)
Resisting moment	M_R	=	3194.8	(kNm)
Sliding moment	M_D	=	2469.5	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	18.00	18.00	0.00	15.00	0.00	0.000	0.000
3	17.00	17.00	0.00	15.00	0.00	0.000	0.000
4	19.00	19.00	0.00	25.00	0.00	0.000	0.000
5	19.00	19.00	0.00	50.00	0.00	0.000	0.000
6	17.50	17.50	0.00	40.00	0.00	0.000	0.000
7	17.50	17.50	0.00	40.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000
10	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

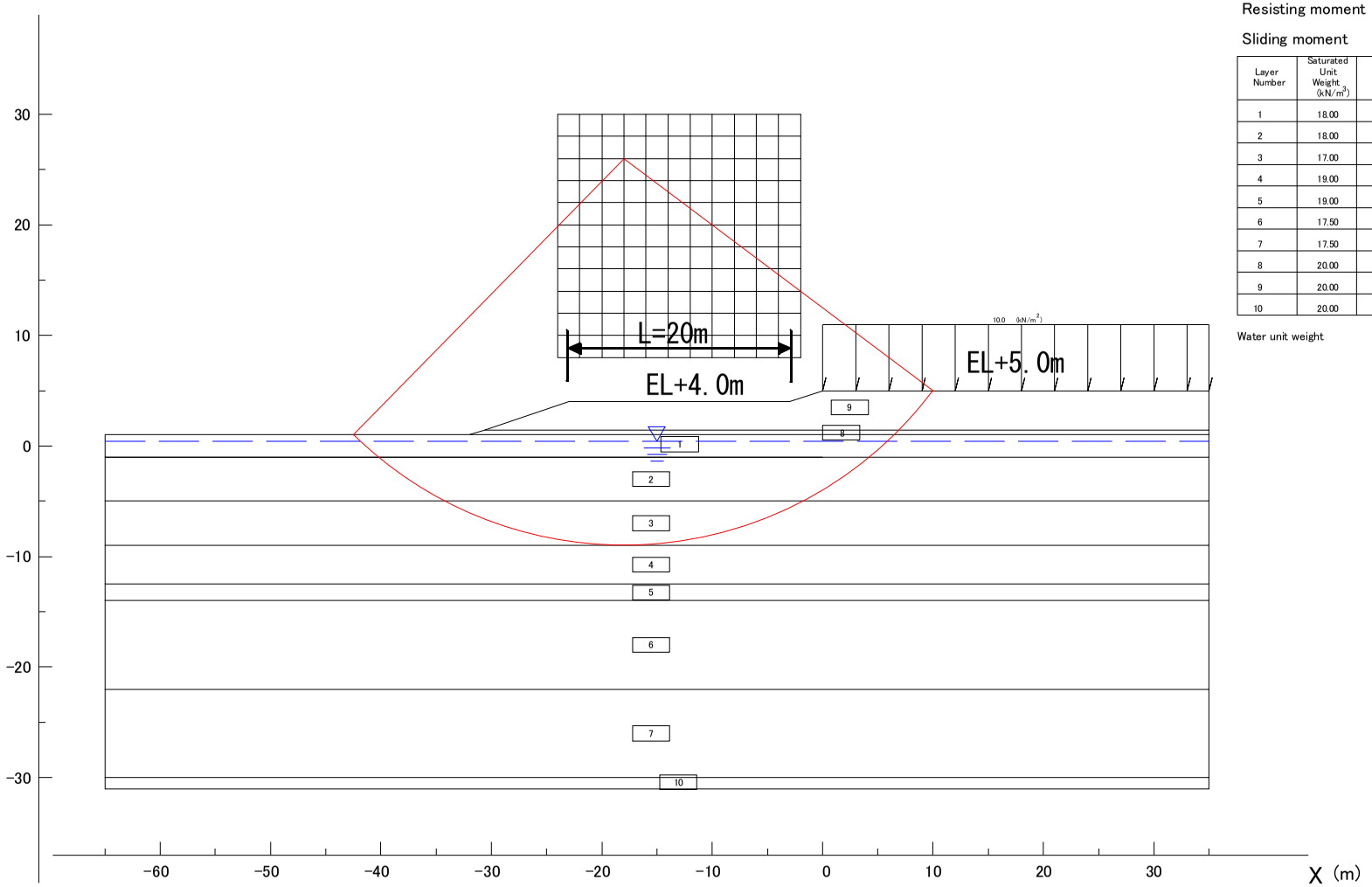
ラックフェン港-外側護岸-4 1段目:+5.00m(小段 h=4.6m L=15m)

Scale ; 1/ 600

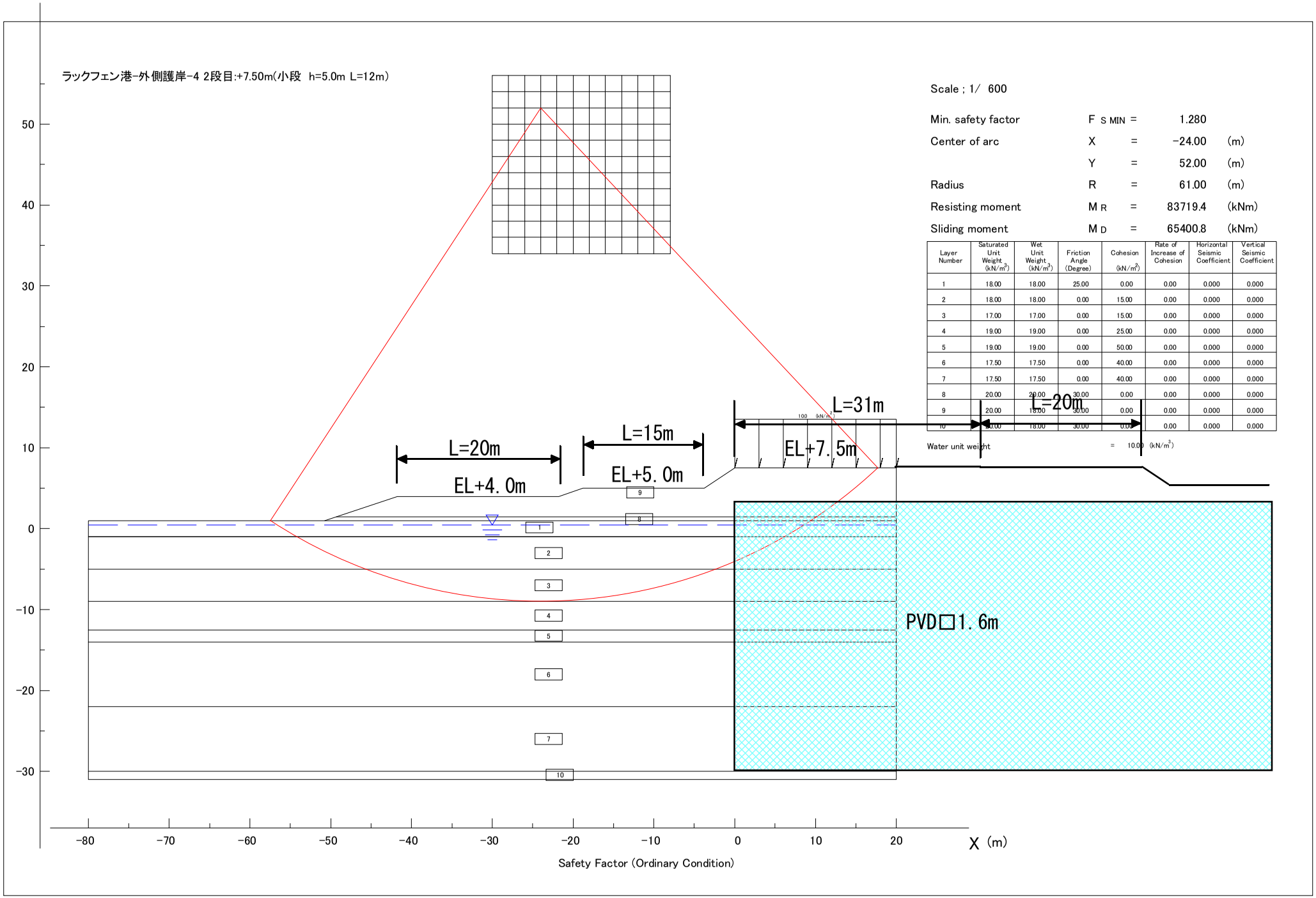
Min. safety factor	$F_{S\,MIN}$	=	1.331	
Center of arc	X	=	-18.00	(m)
	Y	=	26.00	(m)
Radius	R	=	35.00	(m)
Resisting moment	M_R	=	29852.0	(kNm)
Sliding moment	M_D	=	22433.4	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	18.00	18.00	0.00	15.00	0.00	0.000	0.000
3	17.00	17.00	0.00	15.00	0.00	0.000	0.000
4	19.00	19.00	0.00	25.00	0.00	0.000	0.000
5	19.00	19.00	0.00	50.00	0.00	0.000	0.000
6	17.50	17.50	0.00	40.00	0.00	0.000	0.000
7	17.50	17.50	0.00	40.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000
10	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)



Layer Number	Saturated Unit Weight (kN/m³)	Wet Unit Weight (kN/m³)	Friction Angle (Degree)	Cohesion (kN/m²)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	18.00	18.00	0.00	15.00	0.00	0.000	0.000
3	17.00	17.00	0.00	15.00	0.00	0.000	0.000
4	19.00	19.00	0.00	25.00	0.00	0.000	0.000
5	19.00	19.00	0.00	50.00	0.00	0.000	0.000
6	17.50	17.50	0.00	40.00	0.00	0.000	0.000
7	17.50	17.50	0.00	40.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	19.00	30.00	0.00	0.00	0.000	0.000
10	20.00	18.00	30.00	0.00	0.00	0.000	0.000

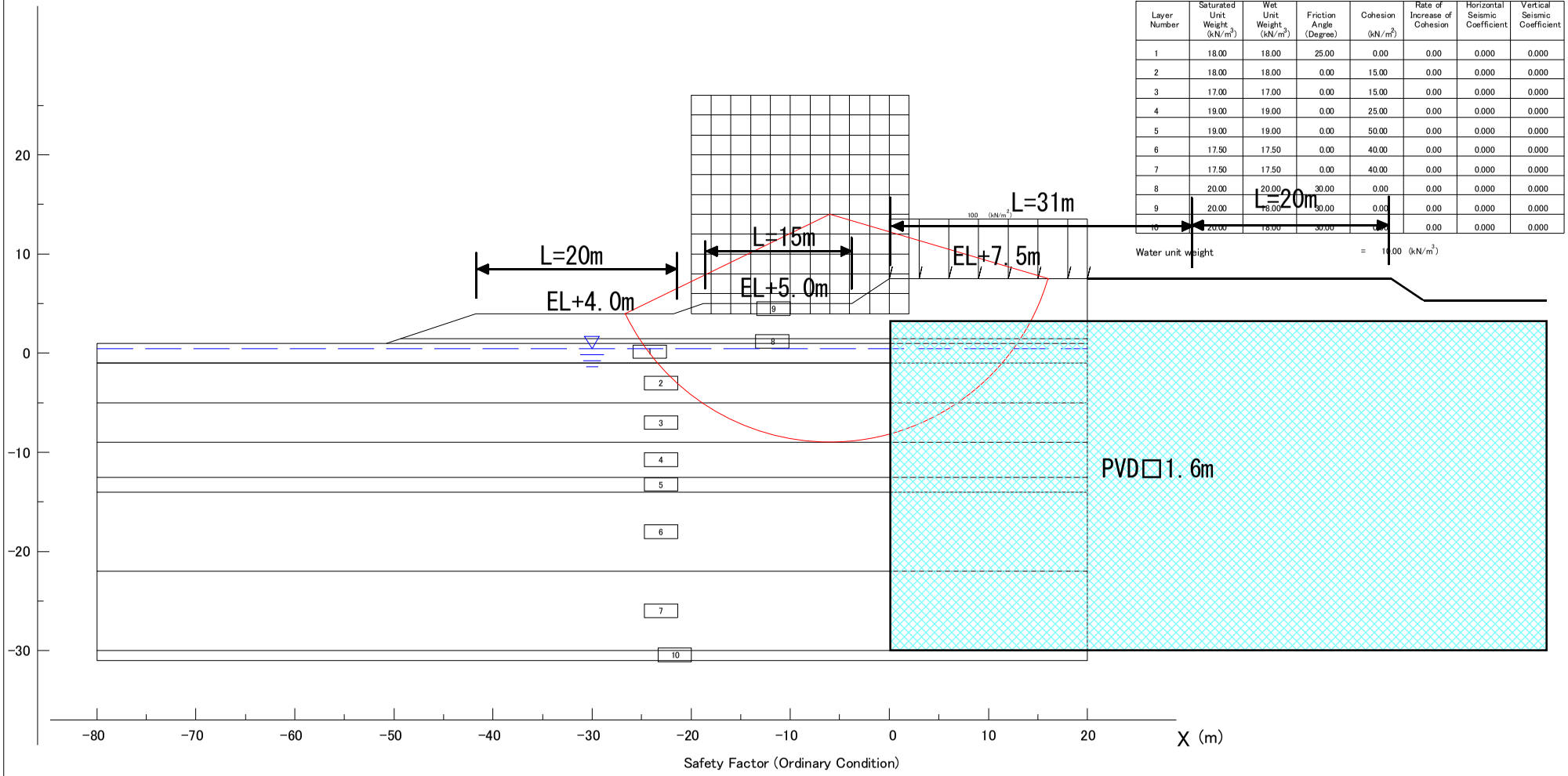
ラックフェン港-外側護岸-4 2段目:+7.50m(小段 h=5.0m L=12m)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.195	
Center of arc	X	=	-6.00	(m)
	Y	=	14.00	(m)
Radius	R	=	23.00	(m)
Resisting moment	M_R	=	17327.8	(kNm)
Sliding moment	M_D	=	14495.9	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	18.00	18.00	0.00	15.00	0.00	0.000	0.000
3	17.00	17.00	0.00	15.00	0.00	0.000	0.000
4	19.00	19.00	0.00	25.00	0.00	0.000	0.000
5	19.00	19.00	0.00	50.00	0.00	0.000	0.000
6	17.50	17.50	0.00	40.00	0.00	0.000	0.000
7	17.50	17.50	0.00	40.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000
10	20.00	18.00	30.00	0.00	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

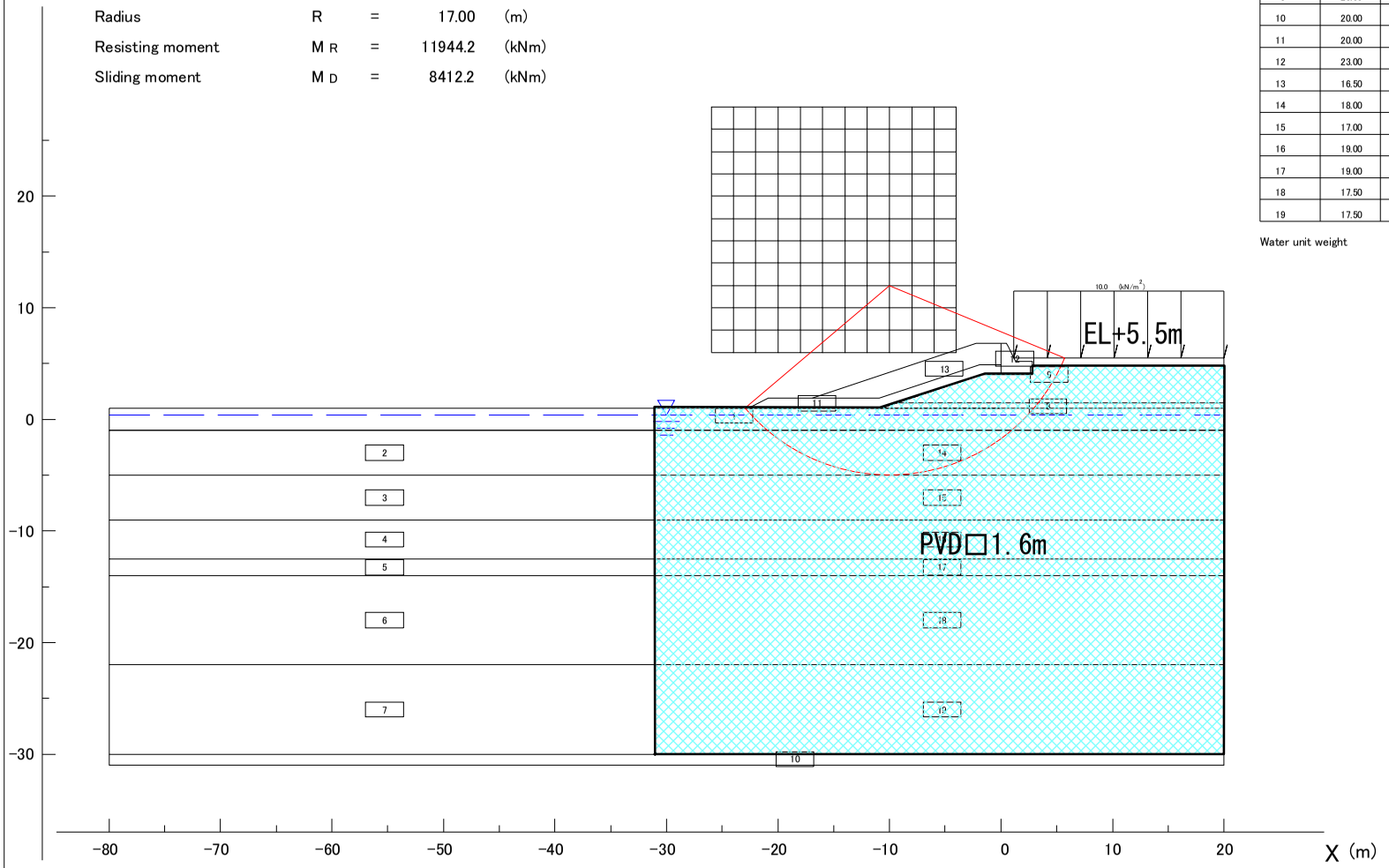
ラックフェン港-外側護岸-4 完成形(改良幅=18m)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	1.420	
Center of arc	X	=	-10.00	(m)
	Y	=	12.00	(m)
Radius	R	=	17.00	(m)
Resisting moment	M_R	=	11944.2	(kNm)
Sliding moment	M_D	=	8412.2	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	18.00	18.00	0.00	15.00	0.00	0.000	0.000
3	17.00	17.00	0.00	15.00	0.00	0.000	0.000
4	19.00	19.00	0.00	25.00	0.00	0.000	0.000
5	19.00	19.00	0.00	50.00	0.00	0.000	0.000
6	17.50	17.50	0.00	40.00	0.00	0.000	0.000
7	17.50	17.50	0.00	40.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000
10	20.00	18.00	30.00	0.00	0.00	0.000	0.000
11	20.00	18.00	40.00	0.00	0.00	0.000	0.000
12	23.00	23.00	40.00	0.00	0.00	0.000	0.000
13	16.50	11.50	40.00	0.00	0.00	0.000	0.000
14	18.00	18.00	0.00	24.38	0.00	0.000	0.000
15	17.00	17.00	0.00	29.14	0.00	0.000	0.000
16	19.00	19.00	0.00	32.63	0.00	0.000	0.000
17	19.00	19.00	0.00	50.00	0.00	0.000	0.000
18	17.50	17.50	0.00	42.22	0.00	0.000	0.000
19	17.50	17.50	0.00	41.46	0.00	0.000	0.000

Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

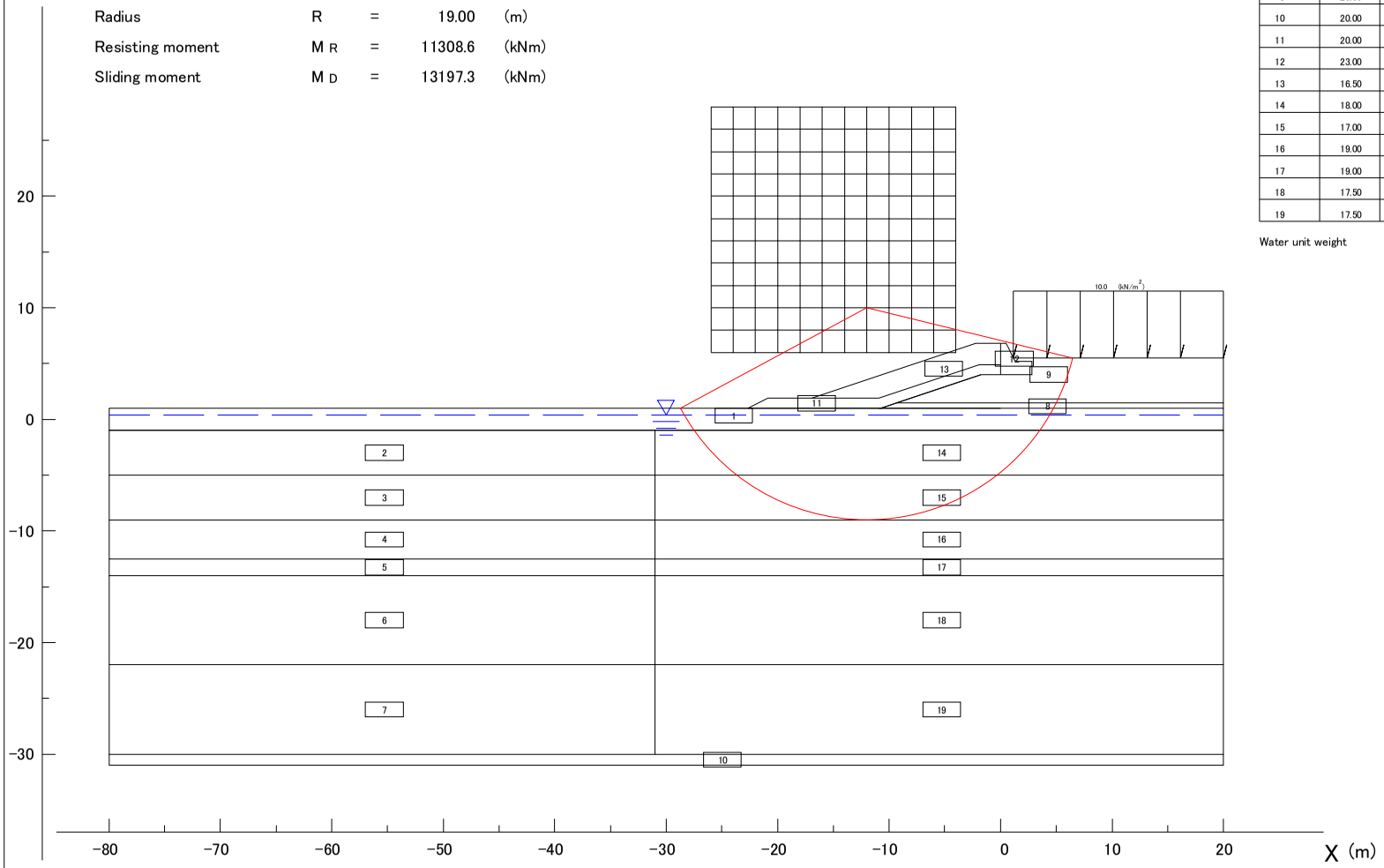
ラックフェン港-外側護岸-4 完成形(改良幅=18m)

Scale ; 1/ 600

Min. safety factor	$F_{S\,MIN}$	=	0.857	
Center of arc	X	=	-12.00	(m)
	Y	=	10.00	(m)
Radius	R	=	19.00	(m)
Resisting moment	M_R	=	11308.6	(kNm)
Sliding moment	M_D	=	13197.3	(kNm)

Layer Number	Saturated Unit Weight (kN/m^3)	Wet Unit Weight (kN/m^3)	Friction Angle (Degree)	Cohesion (kN/m^2)	Rate of Increase of Cohesion	Horizontal Seismic Coefficient	Vertical Seismic Coefficient
1	18.00	18.00	25.00	0.00	0.00	0.000	0.000
2	18.00	18.00	0.00	15.00	0.00	0.000	0.000
3	17.00	17.00	0.00	15.00	0.00	0.000	0.000
4	19.00	19.00	0.00	25.00	0.00	0.000	0.000
5	19.00	19.00	0.00	50.00	0.00	0.000	0.000
6	17.50	17.50	0.00	40.00	0.00	0.000	0.000
7	17.50	17.50	0.00	40.00	0.00	0.000	0.000
8	20.00	20.00	30.00	0.00	0.00	0.000	0.000
9	20.00	18.00	30.00	0.00	0.00	0.000	0.000
10	20.00	18.00	30.00	0.00	0.00	0.000	0.000
11	20.00	18.00	40.00	0.00	0.00	0.000	0.000
12	23.00	23.00	40.00	0.00	0.00	0.000	0.000
13	16.50	11.50	40.00	0.00	0.00	0.000	0.000
14	18.00	18.00	0.00	15.00	0.00	0.000	0.000
15	17.00	17.00	0.00	15.00	0.00	0.000	0.000
16	19.00	19.00	0.00	25.00	0.00	0.000	0.000
17	19.00	19.00	0.00	50.00	0.00	0.000	0.000
18	17.50	17.50	0.00	40.00	0.00	0.000	0.000
19	17.50	17.50	0.00	40.00	0.00	0.000	0.000

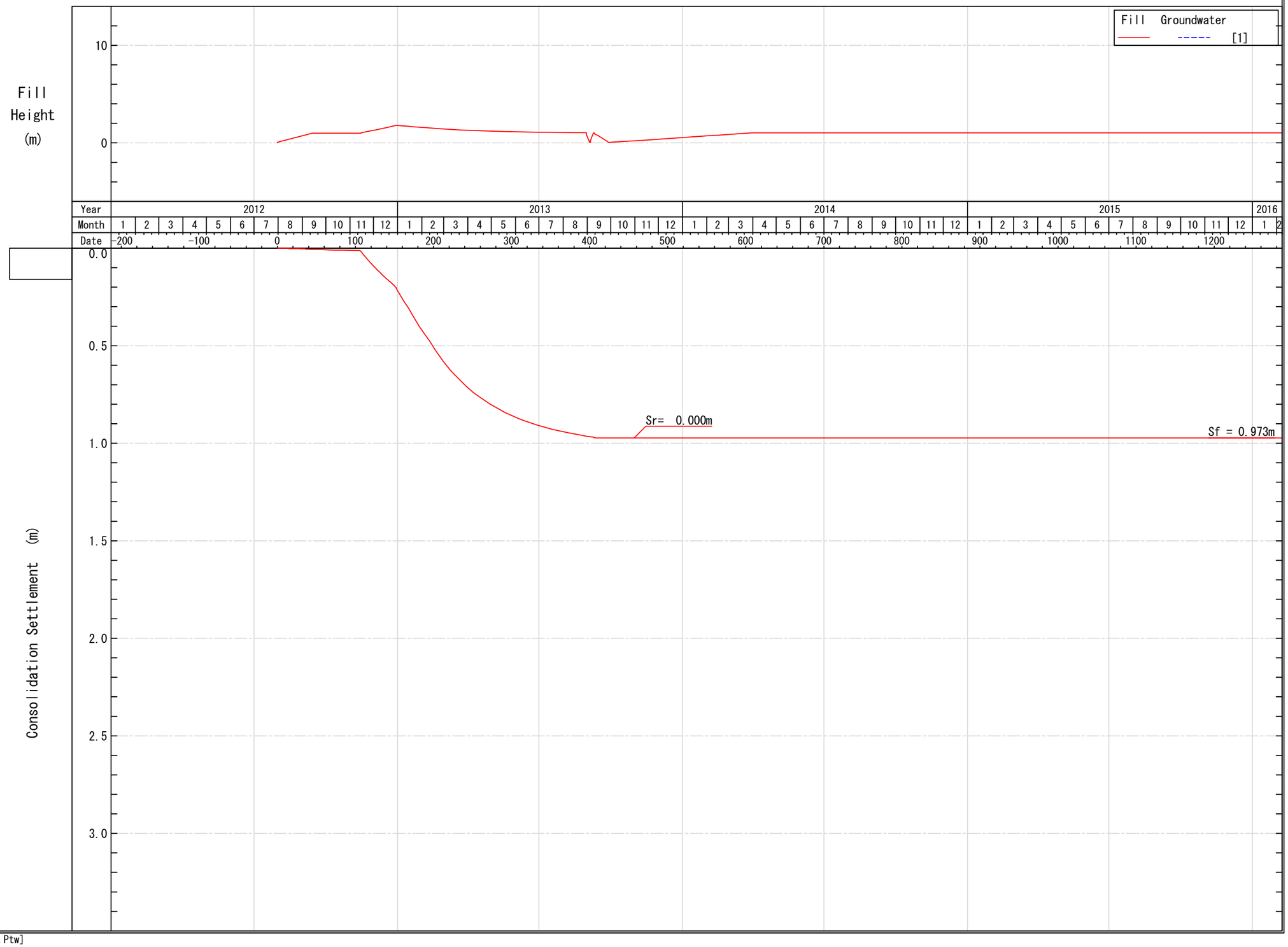
Water unit weight = 10.00 (kN/m^3)



Safety Factor (Ordinary Condition)

8) Settlement-Time Curves with PVD for Outer Revetment A

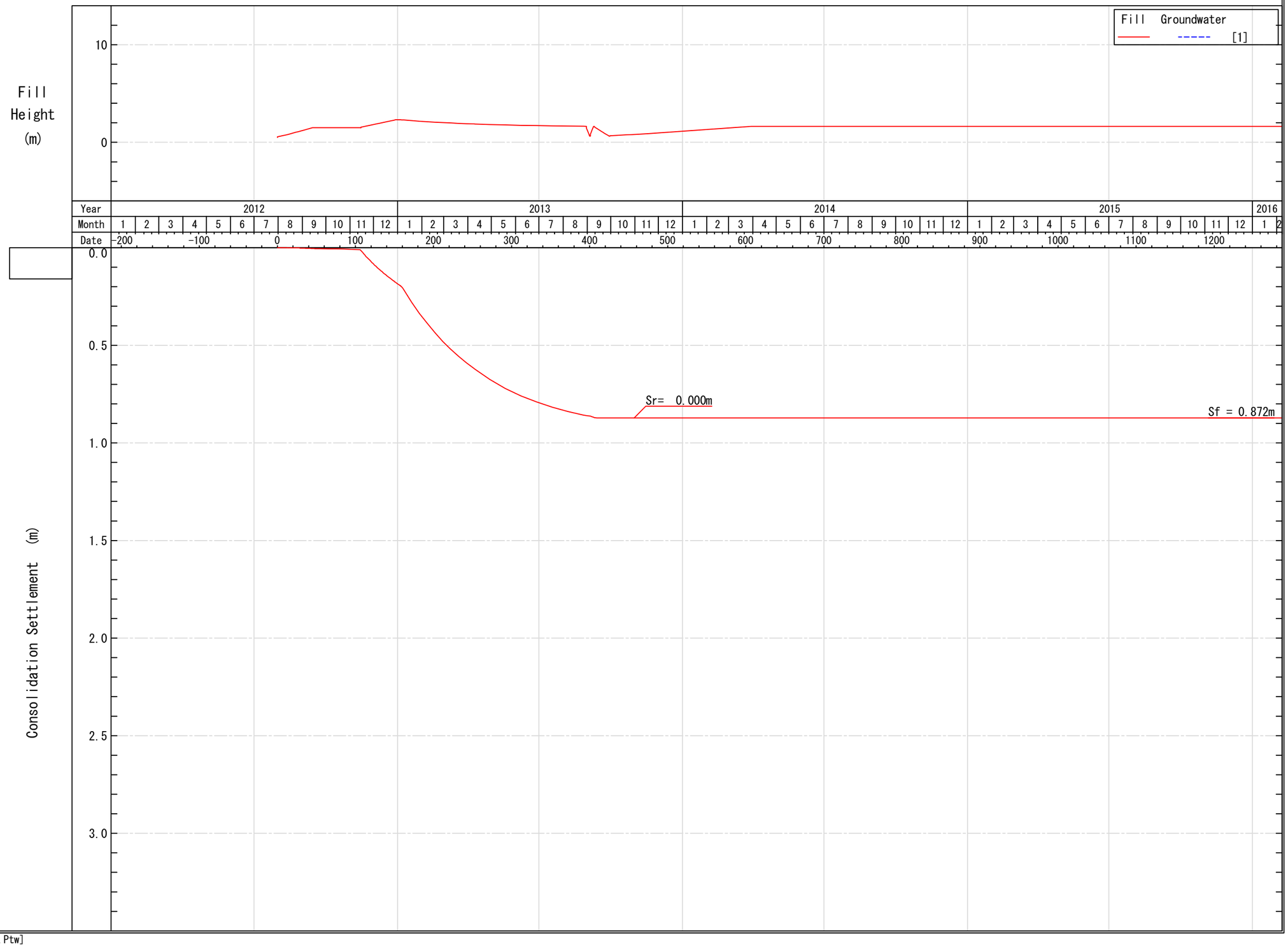
Settlement - Time Curve　　Outer Revetment A　ORA-1 (PVD d=1.6m at face line of Revetment)



Type	Scale
Date	0.200mm/d
Fill	2.500mm/m
Setllement	500.000mm/m

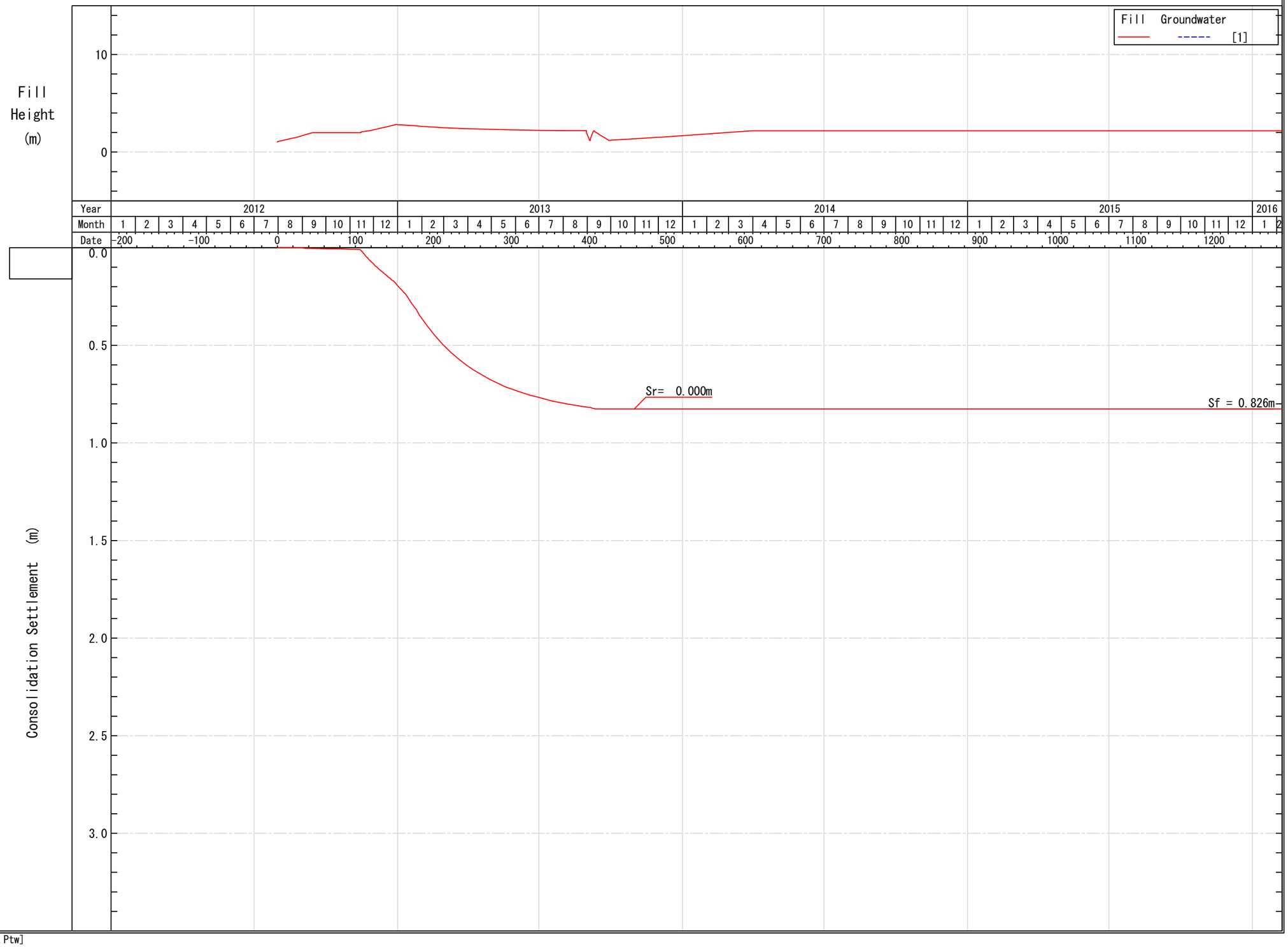
ファイル名 1:[13-ｄ口=1.6m-(護岸法線).Ptw]

Settlement - Time Curve　　Outer Revetment A　ORA-3 (PVD d=1.6m at face line of Revetment)



ファイル名 1:[15-d口=1.6m-(護岸法線).Ptw]

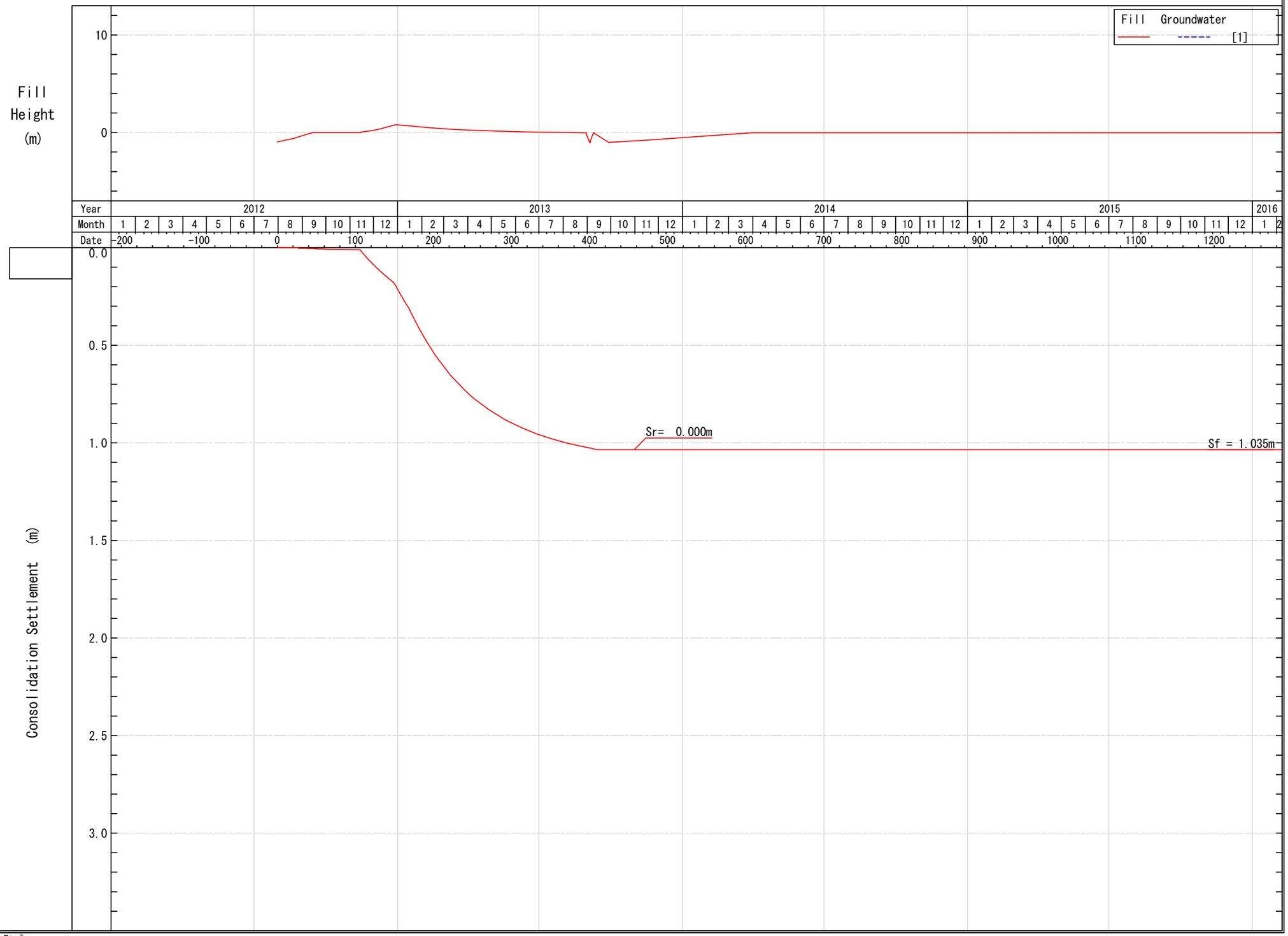
Settlement - Time Curve　　Outer Revetment A　ORA-4 (PVD d=1.6m at face line of Revetment)



Type	Scale
Date	0.200mm/d
Fill	2.500mm/m
Setllement	500.000mm/m

ファイル名 1:[16-d口=1.6m-(護岸法線).Ptw]

Settlement - Time Curve　　Outer Revetment A　ORA-2 (PVD d=1.6m at face line of Revetment)

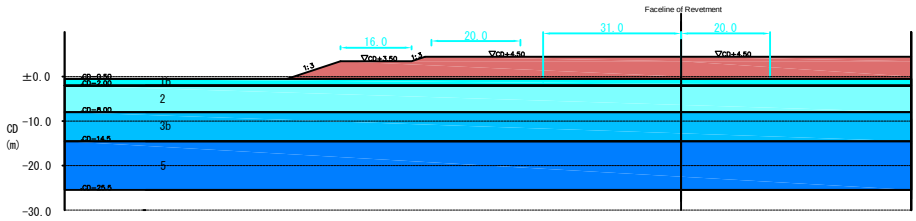


Type	Scale
Date	0.200mm/d
Fill	2.500mm/m
Setllement	500.000mm/m

ファイル名 1:[14-ｄ口=1.6m-(護岸法線).Ptw]

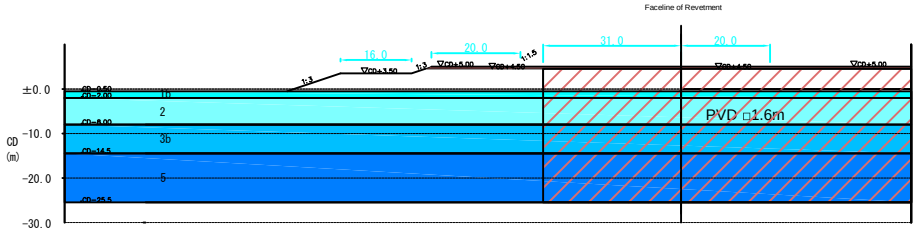
9) Subsoil Improvement Procedure with PVD and Preload Method for Outer Revetment A

Outer Revetment ORA-1



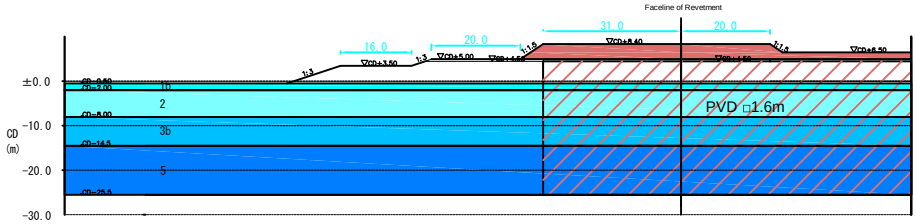
Step 1 (1.5 month)

Fill
(Including Sand Mat. (+4.0 ~ +4.5m))



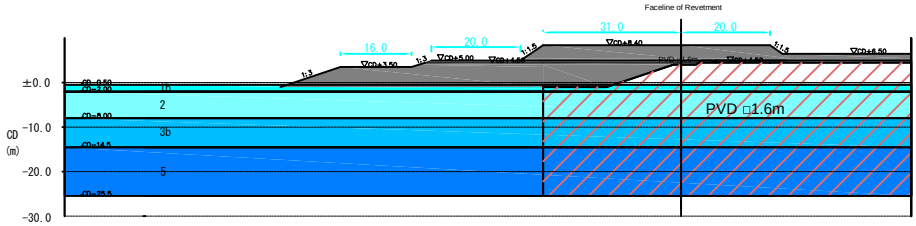
Step 2 (2.0 months)

Soil Improvement (PVD d=□1.6m)
Cover sand (+4.5 ~ +5.0m)



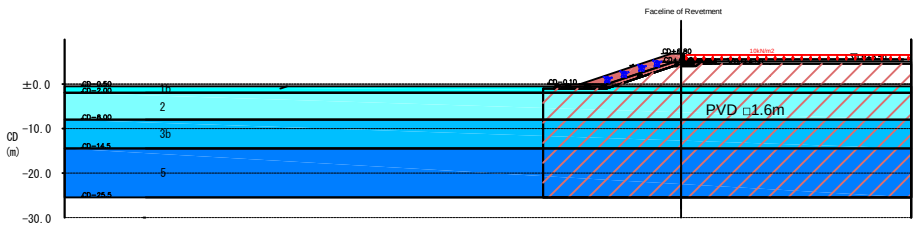
Step 3 (1.5 months)

Preload (+8.4m): Outer Revetment
Preload (+6.5): Access Road Area
Retaining period (8 months)



Step 4 (1 month)

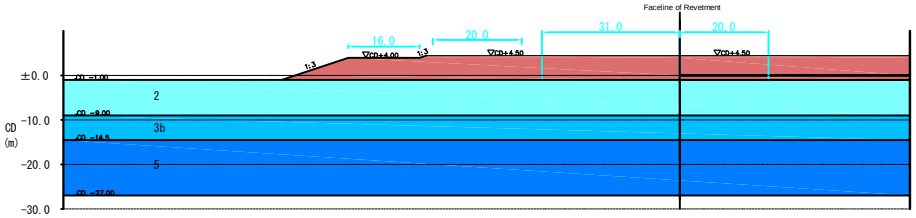
Removal of Filland excavation



Step 5 (6 months)

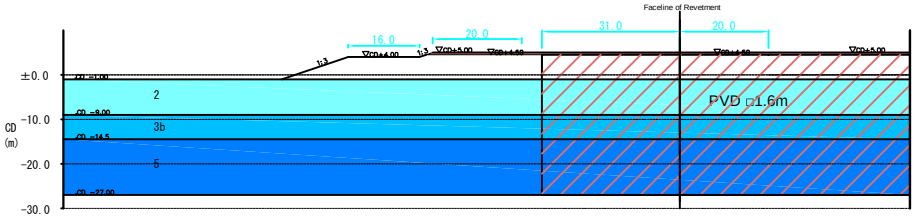
Pavement and Outer Revetment
construction

Outer Revetment ORA-2



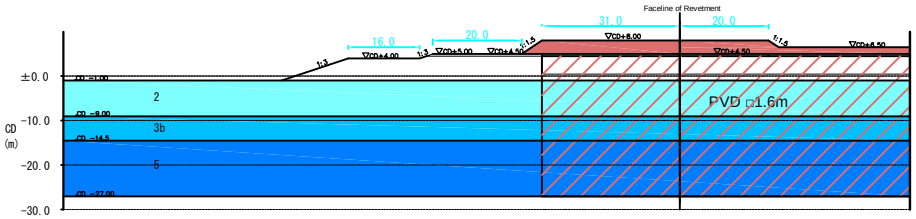
Step 1 (1.5 month)

Fill
(Including Sand Mat. (+4.0 ~ +4.5m))



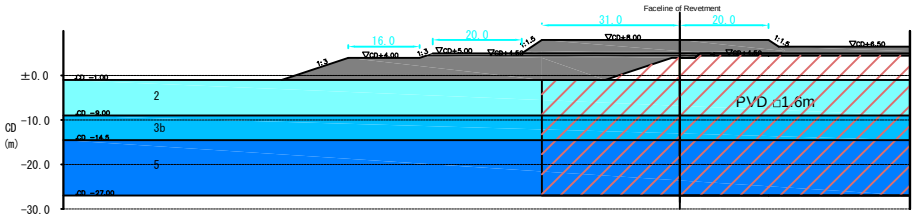
Step 2 (2.0 months)

Soil Improvement (PVD d=□1.6m)
Cover sand (+4.5 ~ +5.0m)



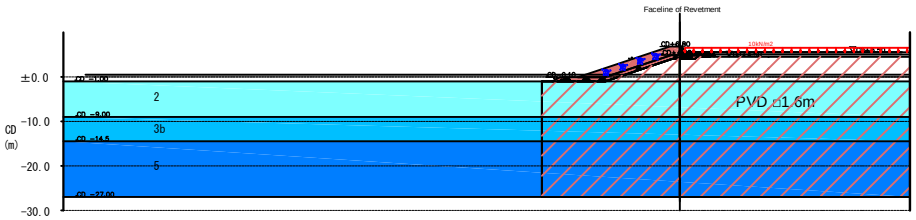
Step 3 (1.5 months)

Preload (+8.0m): Outer Revetment
Preload (+6.5): Access Road Area
Retaining period (8 months)



Step 4 (1 month)

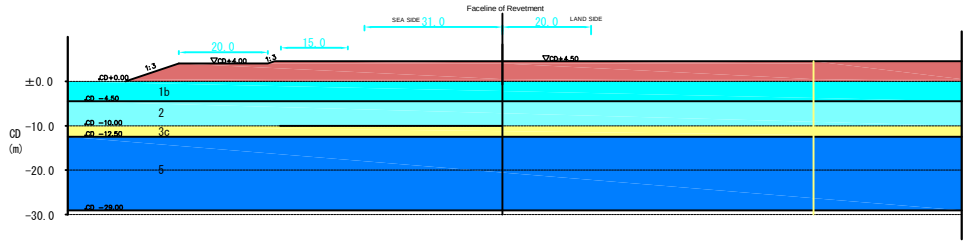
Removal of Filland excavation



Step 5 (6 months)

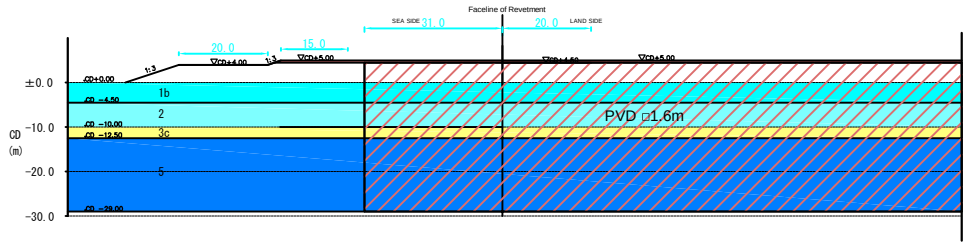
Pavement and Outer Revetment construction

Outer Revetment ORA-3



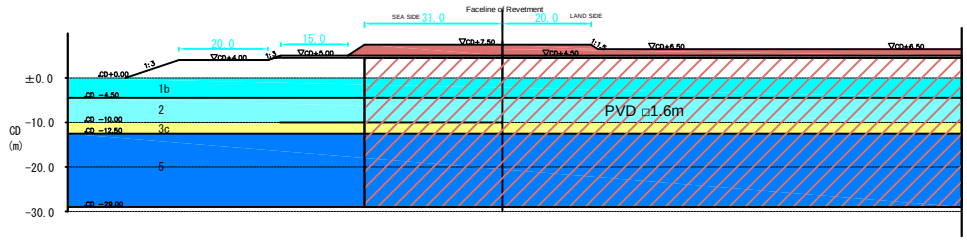
Step 1 (1.5 month)

Fill
(Including Sand Mat. (+4.0 ~ +4.5m))



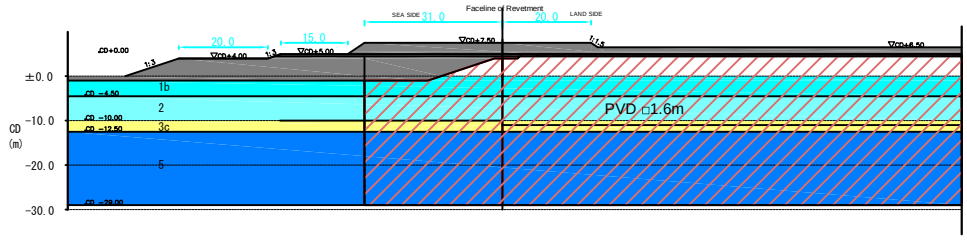
Step 2 (2.0 months)

Soil Improvement (PVD d=□1.6m)
Cover sand (+4.5 ~ +5.0m)



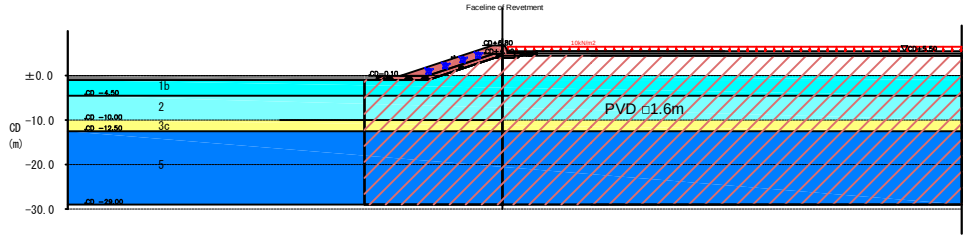
Step 3 (1.5 months)

Preload (+7.5m): Outer Revetment
Preload (+6.5): Access Road Area
Retaining period (8 months)



Step 4 (1 month)

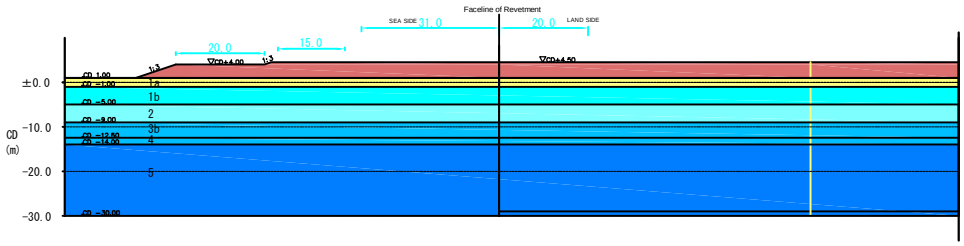
Removal of Filland excavation



Step 5 (6 months)

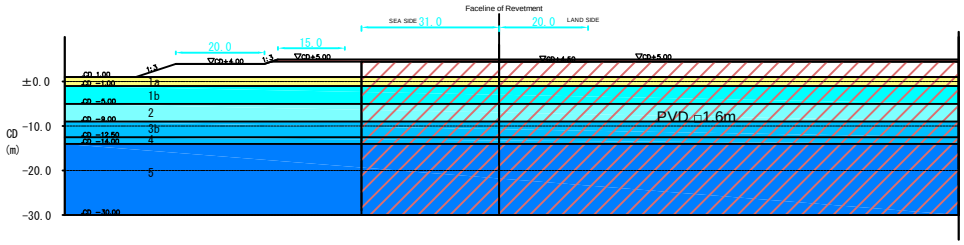
Pavement and Outer Revetment
construction

Outer Revetment ORA-4



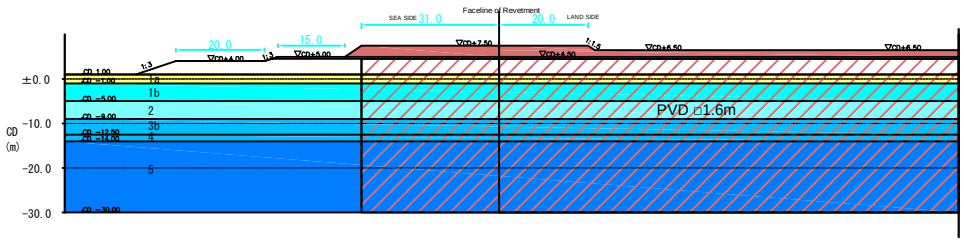
Step 1 (1.5 month)

Fill
(Including Sand Mat. (+4.0 ~ +4.5m))



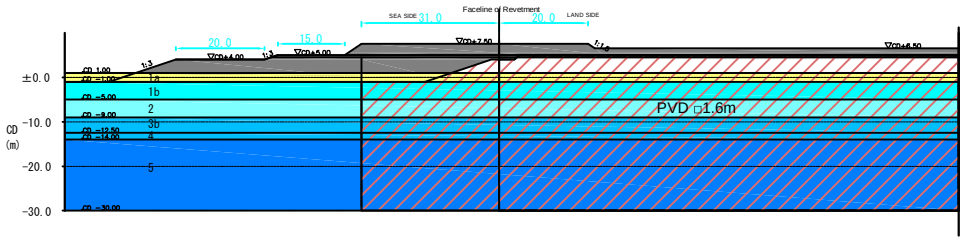
Step 2 (2.0 months)

Soil Improvement (PVD d=□1.6m)
Cover sand (+4.5 ~ +5.0m)



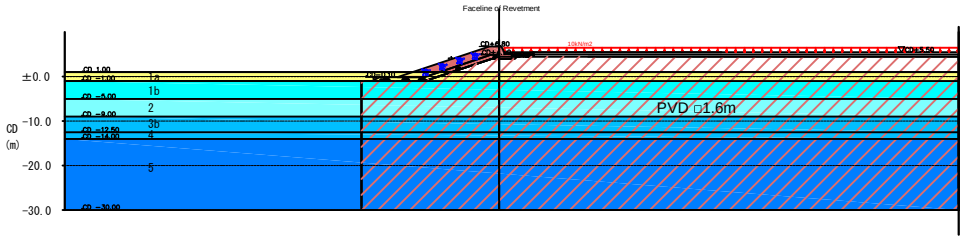
Step 3 (1.5 months)

Preload (+7.5m): Outer Revetment
Preload (+6.5): Access Road Area
Retaining period (8 months)



Step 4 (1 month)

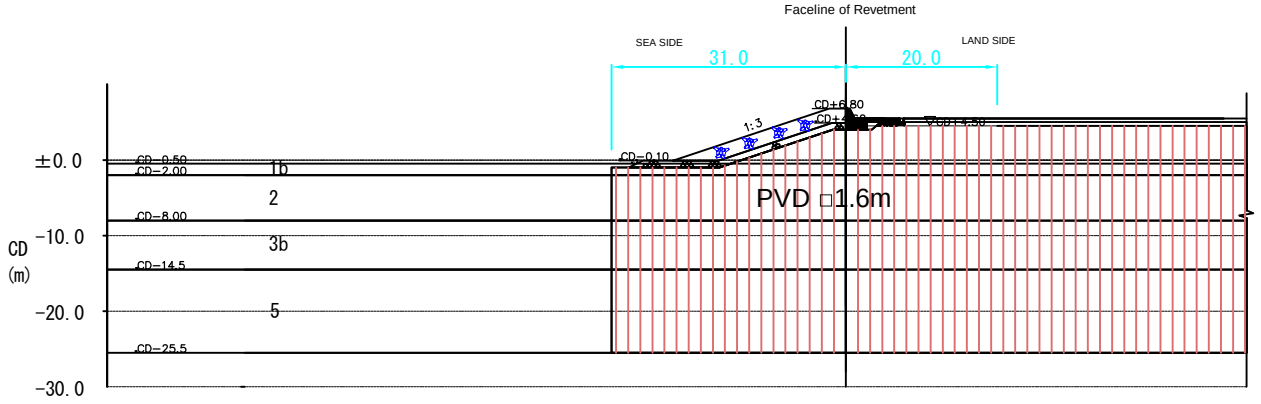
Removal of Filland excavation



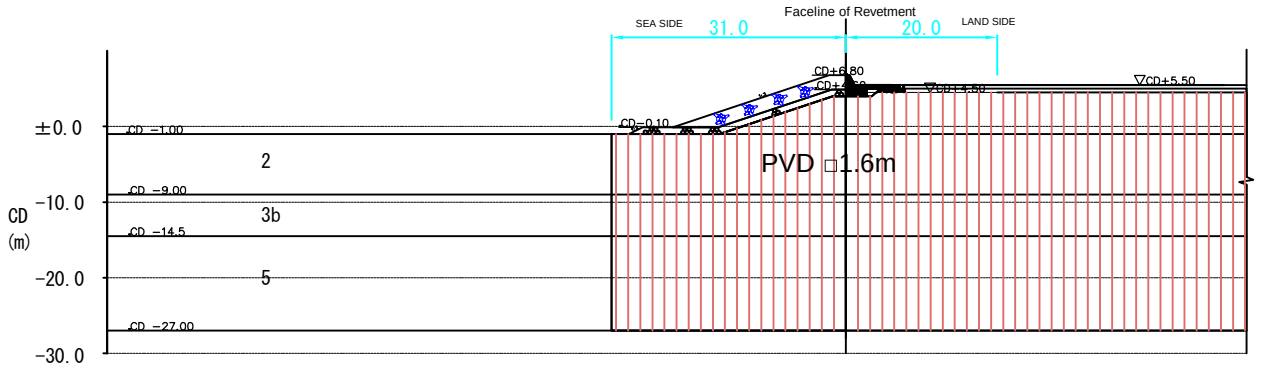
Step 5 (6 months)

Pavement and Outer Revetment
construction

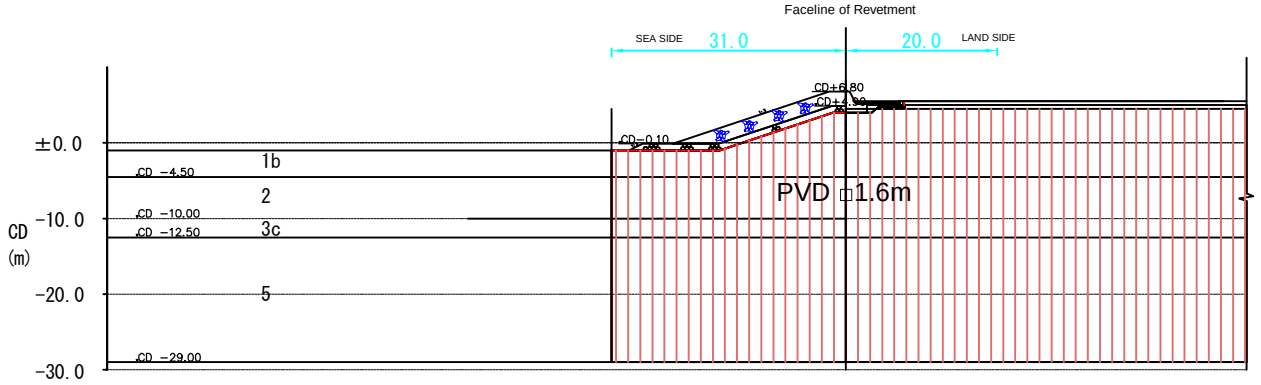
Outer Revetment ORA-1



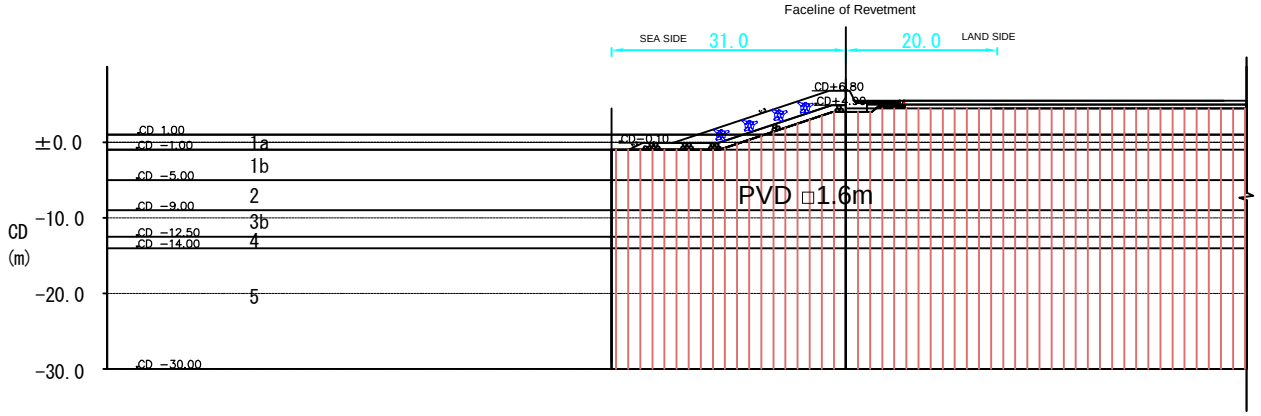
Outer Revetment ORA-2



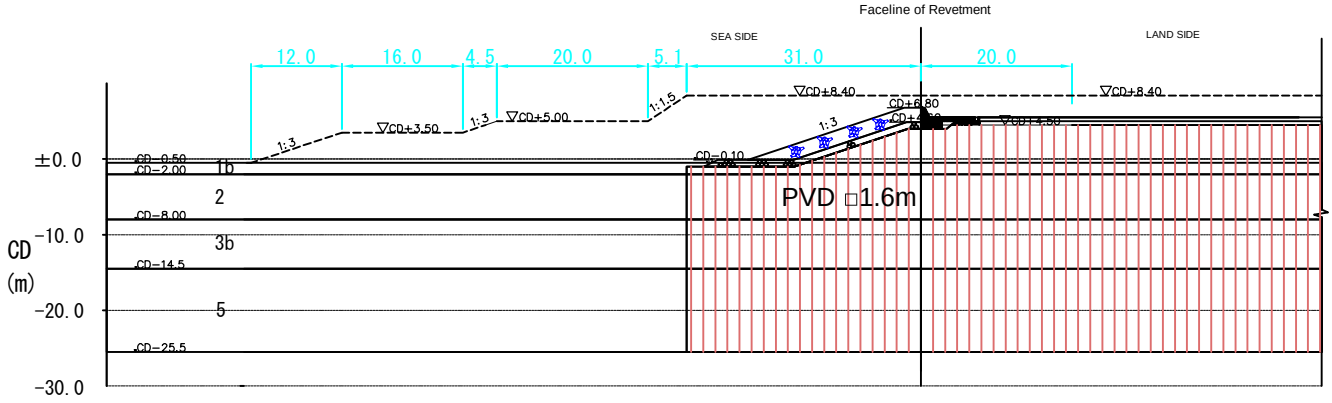
Outer Revetment ORA-3



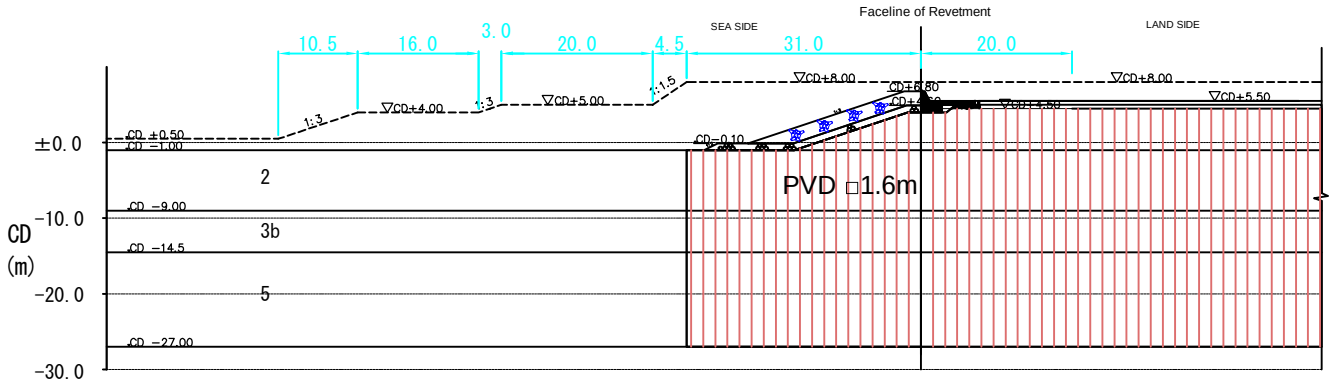
Outer Revetment ORA-4



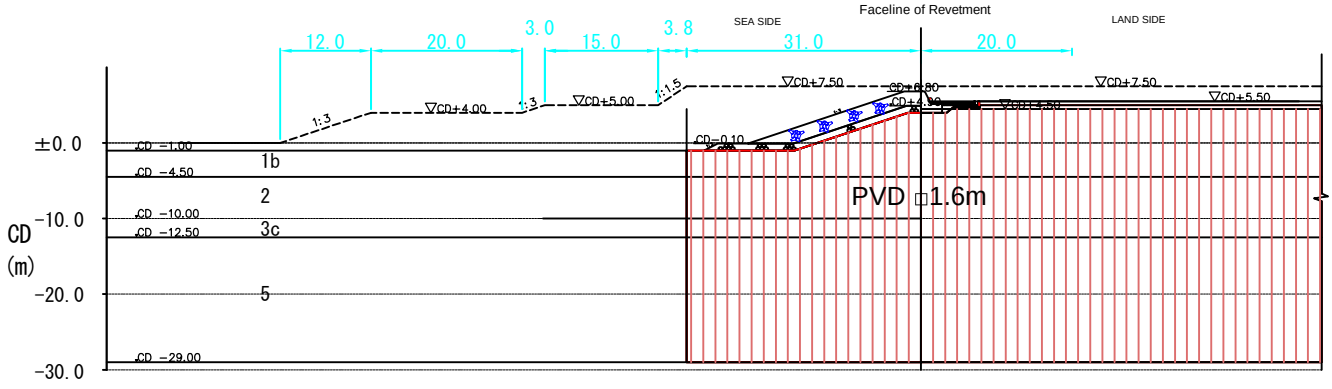
Outer Revetment ORA-1



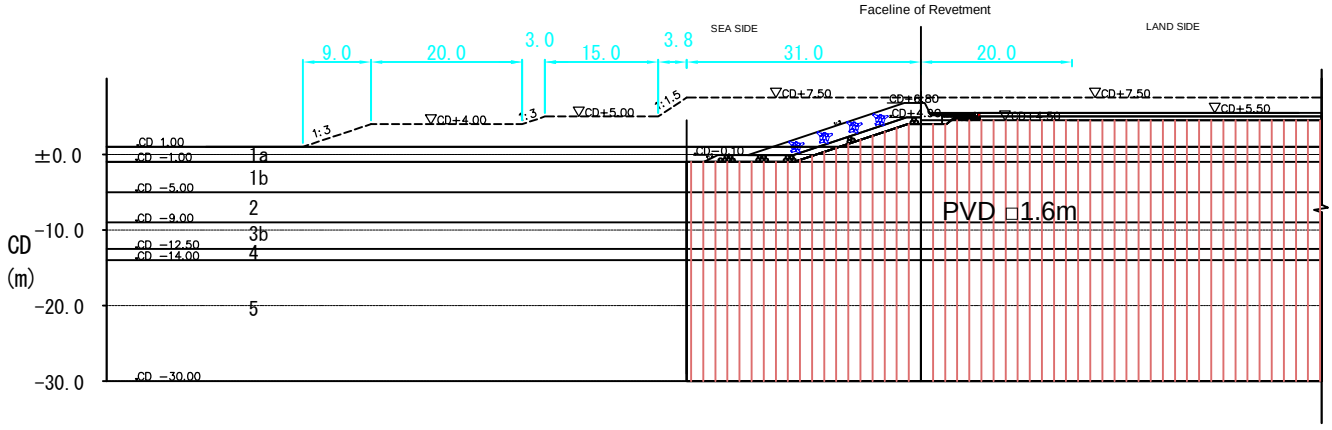
Outer Revetment ORA-2



Outer Revetment ORA-3



Outer Revetment ORA-4



Appendix 7-3

Stability Calculation Result against Sliding and Over-Turning
(Behind Earth Retaining Wall)

Examination for sliding　　Model:　Block-①

1. Calculation condition

(1) General condition

・Water level

Active side : D.L. 3.55 (m)

Passive side : D.L. 0.43 (m)

・Unit weight of wate : γ_w= 10.00 (kN/m^3)

・Surcharge

Active side w_1= 79.2 (kN/m^2) (Preload)

(2) Condition of bearing layer

Internal friction angle : ϕ_B= 35 (°) (μ =tanϕ_B= 0.700)

Cohesion : c_B= 0.0 (kN/m^2)

(3) Specification of improved column

Width : B= 38.1 (m)

Depth of upper end : -2.00 (m)

Depth of lower end : -26.00 (m)

Improvement rate 51.7 (%)

Design strength : q_u 600.0 (kN/m^2)

(4) Soil parameters of calculation

・Soil parameters of active side

Soil layer	Lower end of layer D.L. (m)	γ_t (kN/m^3)	γ' (kN/m^3)	γ_{sat} (kN/m^3)	c (kN/m^2)	ϕ (°)	δ (°)
	4.50						
Fill	3.55	18.00	10.00	20.00	0.00 0.00	30	15
Fill	-2.00	18.00	10.00	20.00	0.00 0.00	30	15
Layer-2	-8.00	17.00	7.00	17.00	15.00 15.00	0	0
Layer-3b	-10.00	19.00	9.00	19.00	25.00 25.00	0	0
Layer-4	-15.00	19.00	9.00	19.00	50.00 50.00	0	0
Layer-5	-26.00	17.50	7.50	17.50	40.00 40.00	0	0

2. Examination for sliding

(1)Calculation earth pressure

・Active earth pressure

Number	Calculated depth (m)	K_A	$\Sigma \gamma h+w_1$ (kN/m^2)	p_a (kN/m^2)	p_{ah} (kN/m^2)	p_{av} (kN/m^2)
1	4.50 (down)	0.301	79.20	23.87	23.06	6.18
2	3.55 (up)	0.301	96.30	29.03	28.04	7.51
3	3.55 (down)	0.301	96.30	29.03	28.04	7.51
4	-2.00 (up)	0.301	151.80	45.76	44.20	11.84
5	-2.00 (down)		151.80	121.80	121.80	0.00
6	-8.00 (up)		193.80	163.80	163.80	0.00
7	-8.00 (down)		193.80	143.80	143.80	0.00
8	-10.00 (up)		211.80	161.80	161.80	0.00
9	-10.00 (down)		211.80	111.80	111.80	0.00
10	-15.00 (up)		256.80	156.80	156.80	0.00
11	-15.00 (down)		256.80	176.80	176.80	0.00
12	-26.00 (up)		339.30	259.30	259.30	0.00

	P_{AH}		y_A	$P_{AH}・y_A$	P_{AV}		B	$P_{AV}・B$
	Calculation	(kN/m)	(m)	(kN/m･m)	Calculation	(kN/m)	(m)	(kN/m･m)
PA1	23.06 × 0.95 × 1／2	10.95	30.18	330.60	6.18 × 0.95 × 1／2	2.93	38.10	111.82
PA2	28.04 × 0.95 × 1／2	13.32	29.87	397.76	7.51 × 0.95 × 1／2	3.57	38.10	135.96
PA3	28.04 × 5.55 × 1／2	77.80	27.70	2,155.16	7.51 × 5.55 × 1／2	20.85	38.10	794.29
PA4	44.20 × 5.55 × 1／2	122.64	25.85	3,170.34	11.84 × 5.55 × 1／2	32.86	38.10	1,252.05
PA5	121.80 × 6.00 × 1／2	365.40	22.00	8,038.80	0.00 × 6.00 × 1／2	0.00	38.10	0.00
PA6	163.80 × 6.00 × 1／2	491.40	20.00	9,828.00	0.00 × 6.00 × 1／2	0.00	38.10	0.00
PA7	143.80 × 2.00 × 1／2	143.80	17.33	2,492.53	0.00 × 2.00 × 1／2	0.00	38.10	0.00
PA8	161.80 × 2.00 × 1／2	161.80	16.67	2,696.67	0.00 × 2.00 × 1／2	0.00	38.10	0.00
PA9	111.80 × 5.00 × 1／2	279.50	14.33	4,006.17	0.00 × 5.00 × 1／2	0.00	38.10	0.00
PA10	156.80 × 5.00 × 1／2	392.00	12.67	4,965.33	0.00 × 5.00 × 1／2	0.00	38.10	0.00
PA11	176.80 × 11.00 × 1／2	972.40	7.33	7,130.93	0.00 × 11.00 × 1／2	0.00	38.10	0.00
PA12	259.30 × 11.00 × 1／2	1,426.15	3.67	5,229.22	0.00 × 11.00 × 1／2	0.00	38.10	0.00
Total		4,457.17		50,441.51		60.21		2,294.12

・Residual Water Pressure

	P_W		y_W	$P_W・y_W$
	Calculation	(kN/m)	(m)	(kN/m･m)
Pw1	31.20 × 3.12 × 1／2	48.67	27.47	1,337.02
Pw2	31.20 × 26.43	824.62	13.22	10,897.30
Total		873.29		12,234.32

(2)Calculation of weight

Block	Base (m)	Height (m)	Unit weight (kN/m^3)	Weight (kN/m)	□OR△ △＝1	x (m)	y (m)
q1	0.00	0.00	0.0	0.00		0.00	0
WE1	38.10	0.95	18.0	651.51		19.05	0.0
WE2	38.10	5.55	10.0	2114.55		19.05	0.0

Block	Base (m)	Height (m)	Unit weight (kN/m3)	Weight (kN/m)	□OR△ △＝1	x (m)	y (m)
W1	38.1	6.00	7.0	1600.20		19.05	0.0
W2	38.1	2.00	9.0	685.80		19.05	0.0
W3	38.1	5.00	9.0	1714.50		19.05	0.0
W4	38.1	11.00	7.5	3143.25		19.05	0.0

・Weight on top of improved part

Block	W (kN/m)	x (m)	W・x (kN/m・m)
q1	0.00	0.00	0.00
WE1	651.51	19.05	12411.27
WE2	2114.55	19.05	40282.18
ΣWE	2766.06		52693.44

・Weight of improved part

Block	W (kN/m)	x (m)	W・x (kN/m・m)
ΣWE	2766.06		52693.44
W1	1600.20	19.05	30483.81
W2	685.80	19.05	13064.49
W3	1714.50	19.05	32661.23
W4	3143.25	19.05	59878.91
ΣW	9909.81		188781.88

(3)Result of external force

Part			Normal situation
Resultant force of weight	: ΣW	(kN/m)	9909.81
Horizontal component of active earth pressure	: ΣP_A	(kN/m)	4,457.17
Vertical component of passive earth pressure	: ΣP_{AV}	(kN/m)	60.21
Residual Water Pressure	: ΣP_w	(kN/m)	873.29
Horizontal component of active earth pressure	: ΣP_P	(kN/m)	0.00
Vertical component of active earth pressure	: ΣP_{PV}	(kN/m)	0.00
Moment by effective weight	: $\Sigma W \cdot x$	(kN/m･m)	188,781.88
Moment by horizontal component of active earth pressure	: $\Sigma P_A \cdot y_A$	(kN/m･m)	50,441.51
Moment by vertical component of active earth pressure	: $\Sigma P_v \cdot x_v$	(kN/m･m)	2,294.12
Moment by Residual Water Pressure	: $\Sigma P_w \cdot y_w$	(kN/m･m)	12,234.32

(4)Result of examination for sliding

(Safety factor : Fs≧1.10)

$F_{R1} = (\Sigma W + PV) \cdot \mu$

$= 6981.09$ (kN/m)

$F_{R2} = \tau \cdot B = (1/2 \cdot q_{uck} . a_p) \cdot B$

$= 5909.31$ (kN/m)

$F_R = F_{R2}$

$= 5909.31$ (kN/m)

$Fs = F_R / (\Sigma P_{AH} + \Sigma P_w)$

$= 1.109 > 1.1$ …… OK

(5)Result of examination

(Safety factor : Fs≧1.20)

$\Sigma M_R = \Sigma W \cdot x + \Sigma P_{AV} \cdot B + \Sigma P_{PH} \cdot y_P$

$= 191,076.00$ (kN･m/m)

$\Sigma M_A = \Sigma P_W \cdot y_W + \Sigma P_{AH} \cdot y_A$

$= 62,675.83$ (kN･m/m)

$Fs = \Sigma M_R / \Sigma M_A$

$= 3.049 > 1.1$ …… OK

Examination for sliding　　Model:　Block-a

1. Calculation condition

(1) General condition

・Water level

Active side : D.L. 3.55 (m)

Passive side : D.L. 0.43 (m)

・Unit weight of wate : γ_w= 10.00 (kN/m^3)

・Surcharge

Active side w_1= 79.2 (kN/m^2)

(2) Condition of bearing layer

Internal friction angle : ϕ_B= 35 (°) (μ =tanϕ_B= 0.700)

Cohesion : c_B= 0.0 (kN/m^2)

(3) Specification of improved column

Width : B= 33.9 (m)

Depth of upper end : -2.00 (m)

Depth of lower end : -25.00 (m)

Improvement rate 51.7 (%)

Design strength : q_u 600.0 (kN/m^2)

(4) Soil parameters of calculation

・Soil parameters of active side

Soil layer	Lower end of layer D.L. (m)	γ_t (kN/m^3)	γ' (kN/m^3)	γ_{sat} (kN/m^3)	c (kN/m^2)	ϕ (°)	δ (°)
	4.50						
Fill	3.55	17.00	7.00	17.00	0.00 0.00	30	15
Fill	-2.00	19.00	9.00	19.00	0.00 0.00	30	15
Layer-2	-7.50	17.00	7.00	17.00	15.00 15.00	0	0
Layer-4	-14.50	19.00	9.00	19.00	50.00 50.00	0	0
Layer-5	-25.00	17.50	7.50	17.50	40.00 40.00	0	0

2. Examination for sliding

(1)Calculation earth pressure

・Active earth pressure

Number	Calculated depth (m)	K_A	$\Sigma \gamma h+w_1$ (kN/m^2)	p_a (kN/m^2)	p_{ah} (kN/m^2)	p_{av} (kN/m^2)
1	4.50 (down)	0.301	79.20	23.87	23.06	6.18
2	3.55 (up)	0.301	95.35	28.74	27.76	7.44
3	3.55 (down)	0.301	95.35	28.74	27.76	7.44
4	-2.00 (up)	0.301	145.30	43.80	42.30	11.34
5	-2.00 (down)		145.30	115.30	115.30	0.00
6	-7.50 (up)		183.80	153.80	153.80	0.00
7	-7.50 (down)		183.80	83.80	83.80	0.00
8	-14.50 (up)		246.80	146.80	146.80	0.00
9	-14.50 (down)		246.80	166.80	166.80	0.00
10	-25.00 (up)		325.55	245.55	245.55	0.00

	P_{AH} Calculation		(kN/m)	y_A (m)	$P_{AH}\cdot y_A$ ($kN/m\cdot m$)	P_{AV} Calculation		(kN/m)	B (m)	$P_{AV}\cdot B$ ($kN/m\cdot m$)
PA1	23.06 ×	0.95 × 1／2	10.95	29.18	319.64	6.18 ×	0.95 × 1／2	2.93	33.90	99.49
PA2	27.76 ×	0.95 × 1／2	13.19	28.87	380.65	7.44 ×	0.95 × 1／2	3.53	33.90	119.78
PA3	27.76 ×	5.55 × 1／2	77.04	26.70	2,056.87	7.44 ×	5.55 × 1／2	20.64	33.90	699.76
PA4	42.30 ×	5.55 × 1／2	117.39	24.85	2,917.20	11.34 ×	5.55 × 1／2	31.46	33.90	1,066.33
PA5	115.30 ×	5.50 × 1／2	317.08	21.17	6,711.42	0.00 ×	5.50 × 1／2	0.00	33.90	0.00
PA6	153.80 ×	5.50 × 1／2	422.95	19.33	8,177.03	0.00 ×	5.50 × 1／2	0.00	33.90	0.00
PA7	83.80 ×	7.00 × 1／2	293.30	15.17	4,448.38	0.00 ×	7.00 × 1／2	0.00	33.90	0.00
PA8	146.80 ×	7.00 × 1／2	513.80	12.83	6,593.77	0.00 ×	7.00 × 1／2	0.00	33.90	0.00
PA9	166.80 ×	10.50 × 1／2	875.70	7.00	6,129.90	0.00 ×	10.50 × 1／2	0.00	33.90	0.00
PA10	245.55 ×	10.50 × 1／2	1,289.14	3.50	4,511.98	0.00 ×	10.50 × 1／2	0.00	33.90	0.00
Total			3,930.53		42,246.84			58.57		1,985.36

・Residual Water Pressure

	P_W Calculation		(kN/m)	y_W (m)	$P_W\cdot y_W$ ($kN/m\cdot m$)
Pw1	31.20 ×	3.12 × 1／2	48.67	26.47	1,288.35
Pw2	31.20 ×	25.43	793.42	12.72	10,088.28
Total			842.09		11,376.63

(2)Calculation of weight

Block	Base (m)	Height (m)	Unit weight (kN/m^3)	Weight (kN/m)	□OR△ △＝1	x (m)	y (m)
q1	0.00	0.00	0.0	0.00		0.00	0
WE1	33.90	0.95	18.0	579.69		16.95	0.0
WE2	33.90	5.55	10.0	1881.45		16.95	0.0

Block	Base (m)	Height (m)	Unit weight (kN/m^3)	Weight (kN/m)	□OR△ △＝1	x (m)	y (m)
W1	33.9	5.50	7.0	1305.15		16.95	0.0
W2	33.9	7.00	9.0	2135.70		16.95	0.0
W3	33.9	10.50	7.5	2669.63		16.95	0.0

・Weight on top of improved part

Block	W (kN/m)	x (m)	W・x (kN/m・m)
q1	0.00	0.00	0.00
WE1	579.69	16.95	9825.75
WE2	1881.45	16.95	31890.58
ΣWE	2461.14		41716.32

・Weight of improved part

Block	W (kN/m)	x (m)	W・x (kN/m・m)
ΣWE	2461.14		41716.32
W1	1305.15	16.95	22122.29
W2	2135.70	16.95	36200.12
W3	2669.63	16.95	45250.14
ΣW	8571.62		145288.87

(3)Result of external force

Part			Normal situation
Resultant force of weight	: ΣW	(kN/m)	8571.62
Horizontal component of active earth pressure	: ΣP_A	(kN/m)	3,930.53
Vertical component of passive earth pressure	: ΣP_{AV}	(kN/m)	58.57
Residual Water Pressure	: ΣP_w	(kN/m)	842.09
Horizontal component of active earth pressure	: ΣP_P	(kN/m)	0.00
Vertical component of active earth pressure	: ΣP_{PV}	(kN/m)	0.00
Moment by effective weight	: $\Sigma W \cdot x$	(kN/m·m)	145,288.87
Moment by horizontal component of active earth pressure	: $\Sigma P_A \cdot y_A$	(kN/m·m)	42,246.84
Moment by vertical component of active earth pressure	: $\Sigma P_v \cdot x_v$	(kN/m·m)	1,985.36
Moment by Residual Water Pressure	: $\Sigma P_w \cdot y_w$	(kN/m·m)	11,376.63

(4)Result of examination for sliding

(Safety factor : $Fs \geqq 1.10$)

$F_{R1} = (\Sigma W + PV) \cdot \mu$

$= 6042.92$ (kN/m)

$F_{R2} = \tau \cdot B = (1/2 \cdot q_{uck} . a_p) \cdot B$

$= 5257.89$ (kN/m)

$F_R = F_{R2}$

$= 5257.89$ (kN/m)

$Fs = F_R / (\Sigma P_{AH} + \Sigma P_w)$

$= 1.102 > 1.1$ …… OK

(5)Result of examination

(Safety factor : $Fs \geqq 1.20$)

$\Sigma M_R = \Sigma W \cdot x + \Sigma P_{AV} \cdot B + \Sigma P_{PH} \cdot y_P$

$= 147,274.23$ (kN·m/m)

$\Sigma M_A = \Sigma P_W \cdot y_W + \Sigma P_{AH} \cdot y_A$

$= 53,623.47$ (kN·m/m)

$Fs = \Sigma M_R / \Sigma M_A$

$= 2.746 > 1.1$ …… OK

Examination for sliding　　Model:　Block-b

1. Calculation condition

(1) General condition

・Water level

Active side : D.L. 3.55 (m)

Passive side : D.L. 0.43 (m)

・Unit weight of wate : γ_w= 10.00 (kN/m^3)

・Surcharge

Active side w_1= 70.2 (kN/m^2)

(2) Condition of bearing layer

Internal friction angle : ϕ_B= 35 (°) (μ =tanϕ_B= 0.700)

Cohesion : c_B= 0.0 (kN/m^2)

(3) Specification of improved column

Width : B= 36.0 (m)

Depth of upper end : -2.00 (m)

Depth of lower end : -25.00 (m)

Improvement rate 51.7 (%)

Design strength : q_u 600.0 (kN/m^2)

(4) Soil parameters of calculation

・Soil parameters of active side

Soil layer	Lower end of layer D.L. (m)	γ_t (kN/m^3)	γ' (kN/m^3)	γ_{sat} (kN/m^3)	c (kN/m^2)	ϕ (°)	δ (°)
	4.50						
Fill	3.55	18.00	10.00	20.00	0.00 0.00	30	15
Fill	-2.00	18.00	10.00	20.00	0.00 0.00	30	15
Layer-1b	-2.50	18.00	8.00	18.00	15.00 15.00	0	0
Layer-2	-9.00	17.00	7.00	17.00	15.00 15.00	0	0
Layer-3b	-13.00	19.00	9.00	19.00	25.00 25.00	0	0
Layer-4	-16.00	19.00	9.00	19.00	50.00 50.00	0	
Layer-5	-25.00	17.50	7.50	17.50	40.00 40.00	0	

2．Examination for sliding

(1)Calculation earth pressure

・Active earth pressure

Number	Calculated depth (m)	K_A	$\Sigma \gamma h+w_1$ (kN/m^2)	p_a (kN/m^2)	p_{ah} (kN/m^2)	p_{av} (kN/m^2)
1	4.50 (down)	0.301	70.20	21.16	20.44	5.48
2	3.55 (up)	0.301	87.30	26.31	25.42	6.81
3	3.55 (down)	0.301	87.30	26.31	25.42	6.81
4	-2.00 (up)	0.301	142.80	43.04	41.58	11.14
5	-2.00 (down)		142.80	112.80	112.80	0.00
6	-2.50 (up)		146.80	116.80	116.80	0.00
7	-2.50 (down)		146.80	116.80	116.80	0.00
8	-9.00 (up)		192.30	162.30	162.30	0.00
9	-9.00 (down)		192.30	142.30	142.30	0.00
10	-13.00 (up)		228.30	178.30	178.30	0.00
11	-13.00 (down)		228.30	128.30	128.30	0.00
12	-16.00 (up)		255.30	155.30	155.30	0.00
13	-16.00 (down)		255.30	175.30	175.30	0.00
14	-25.00 (up)		345.30	265.30	265.30	0.00

	P_{AH} Calculation		(kN/m)	y_A (m)	$P_{AH}\cdot y_A$ (kN/m･m)	P_{AV} Calculation		(kN/m)	B (m)	$P_{AV}\cdot B$ (kN/m･m)
PA1	20.44 ×	0.95 × 1／2	9.71	29.18	283.32	5.48 ×	0.95 × 1／2	2.60	36.00	93.65
PA2	25.42 ×	0.95 × 1／2	12.07	28.87	348.51	6.81 ×	0.95 × 1／2	3.23	36.00	116.46
PA3	25.42 ×	5.55 × 1／2	70.53	26.70	1,883.21	6.81 ×	5.55 × 1／2	18.90	36.00	680.37
PA4	41.58 ×	5.55 × 1／2	115.37	24.85	2,867.01	11.14 ×	5.55 × 1／2	30.91	36.00	1,112.90
PA5	112.80 ×	0.50 × 1／2	28.20	22.83	643.90	0.00 ×	0.50 × 1／2	0.00	36.00	0.00
PA6	116.80 ×	0.50 × 1／2	29.20	22.67	661.87	0.00 ×	0.50 × 1／2	0.00	36.00	0.00
PA7	116.80 ×	6.50 × 1／2	379.60	20.33	7,718.53	0.00 ×	6.50 × 1／2	0.00	36.00	0.00
PA8	162.30 ×	6.50 × 1／2	527.48	18.17	9,582.46	0.00 ×	6.50 × 1／2	0.00	36.00	0.00
PA9	142.30 ×	4.00 × 1／2	284.60	14.67	4,174.13	0.00 ×	4.00 × 1／2	0.00	36.00	0.00
PA10	178.30 ×	4.00 × 1／2	356.60	13.33	4,754.67	0.00 ×	4.00 × 1／2	0.00	36.00	0.00
PA11	128.30 ×	3.00 × 1／2	192.45	11.00	2,116.95	0.00 ×	3.00 × 1／2	0.00	36.00	0.00
PA12	155.30 ×	3.00 × 1／2	232.95	10.00	2,329.50	0.00 ×	3.00 × 1／2	0.00	36.00	0.00
PA13	175.30 ×	9.00 × 1／2	788.85	6.00	4,733.10	0.00 ×	9.00 × 1／2	0.00	36.00	0.00
PA14	265.30 ×	9.00 × 1／2	1,193.85	4.00	4,775.40	0.00 ×	9.00 × 1／2	0.00	36.00	0.00
Total			4,221.46		46,872.56			55.65		2,003.38

・Residual Water Pressure

	P_W Calculation		(kN/m)	y_W (m)	$P_W\cdot y_W$ (kN/m･m)
Pw1	31.20 ×	3.12 × 1／2	48.67	26.47	1,288.35
Pw2	31.20 ×	25.43	793.42	12.72	10,088.28
Total			842.09		11,376.63

(2)Calculation of weight

Block	Base (m)	Height (m)	Unit weight (kN/m^3)	Weight (kN/m)	□OR△ △＝1	x (m)	y (m)
q1	0.00	0.00	0.0	0.00		0.00	0
WE1	36.00	0.95	18.0	615.60		18.00	0.0
WE2	36.00	5.55	10.0	1998.00		18.00	0.0

Block	Base (m)	Height (m)	Unit weight (kN/m^3)	Weight (kN/m)	□OR△ △＝1	x (m)	y (m)
W1	36.0	0.50	8.0	144.00		18.00	0.0
W2	36.0	6.50	7.0	1638.00		18.00	0.0
W3	36.0	4.00	9.0	1296.00		18.00	0.0
W4	36.0	3.00	9.0	972.00		18.00	0.0
W5	36.0	9.00	7.5	2430.00		18.00	0.0

・Weight on top of improved part

Block	W (kN/m)	x (m)	W・x (kN/m・m)
q1	0.00	0.00	0.00
WE1	615.60	18.00	11080.80
WE2	1998.00	18.00	35964.00
ΣWE	2613.60		47044.80

・Weight of improved part

Block	W (kN/m)	x (m)	W・x (kN/m・m)
ΣWE	2613.60		47044.80
W1	144.00	18.00	2592.00
W2	1638.00	18.00	29484.00
W3	1296.00	18.00	23328.00
W4	972.00	18.00	17496.00
W5	2430.00	18.00	43740.00
ΣW	9093.60		163684.80

(3)Result of external force

Part			Normal situation
Resultant force of weight	: ΣW	(kN/m)	9093.60
Horizontal component of active earth pressure	: ΣP_A	(kN/m)	4,221.46
Vertical component of passive earth pressure	: ΣP_{AV}	(kN/m)	55.65
Residual Water Pressure	: ΣP_w	(kN/m)	842.09
Horizontal component of active earth pressure	: ΣP_P	(kN/m)	0.00
Vertical component of active earth pressure	: ΣP_{PV}	(kN/m)	0.00
Moment by effective weight	: $\Sigma W \cdot x$	(kN/m·m)	163,684.80
Moment by horizontal component of active earth pressure	: $\Sigma P_A \cdot y_A$	(kN/m·m)	46,872.56
Moment by vertical component of active earth pressure	: $\Sigma P_v \cdot x_v$	(kN/m·m)	2,003.38
Moment by Residual Water Pressure	: $\Sigma P_w \cdot y_w$	(kN/m·m)	11,376.63

(4)Result of examination for sliding

(Safety factor : $Fs \geqq 1.10$)

$F_{R1} = (\Sigma W + PV) \cdot \mu$

$= 6406.37$ (kN/m)

$F_{R2} = \tau \cdot B = (1/2 \cdot q_{uck} . a_p) \cdot B$

$= 5583.60$ (kN/m)

$F_R = F_{R2}$

$= 5583.60$ (kN/m)

$Fs = F_R / (\Sigma P_{AH} + \Sigma P_w)$

$= 1.103 > 1.1$ ····· OK

(5)Result of examination

(Safety factor : $Fs \geqq 1.20$)

$\Sigma M_R = \Sigma W \cdot x + \Sigma P_{AV} \cdot B + \Sigma P_{PH} \cdot y_P$

$= 165,688.18$ (kN·m/m)

$\Sigma M_A = \Sigma P_W \cdot y_W + \Sigma P_{AH} \cdot y_A$

$= 58,249.19$ (kN·m/m)

$Fs = \Sigma M_R / \Sigma M_A$

$= 2.844 > 1.1$ ····· OK

Examination for sliding　　Model:　Block-c

1. Calculation condition

(1) General condition

・Water level

Active side : D.L. 3.55 (m)

Passive side : D.L. 0.43 (m)

・Unit weight of wate : γ_w= 10.00 (kN/m^3)

・Surcharge

Active side w_1= 73.8 (kN/m^2)

(2) Condition of bearing layer

Internal friction angle : ϕ_B= 35 (°) (μ =tanϕ_B= 0.700)

Cohesion : c_B= 0.0 (kN/m^2)

(3) Specification of improved column

Width : B= 38.1 (m)

Depth of upper end : -2.00 (m)

Depth of lower end : -27.00 (m)

Improvement rate 51.7 (%)

Design strength : q_u 600.0 (kN/m^2)

(4) Soil parameters of calculation

・Soil parameters of active side

Soil layer	Lower end of layer D.L. (m)	γ_t (kN/m^3)	γ' (kN/m^3)	γ_{sat} (kN/m^3)	c (kN/m^2)	ϕ (°)	δ (°)
	4.50						
Fill	3.55	18.00	10.00	20.00	0.00 0.00	30	15
Fill	-2.00	18.00	10.00	20.00	0.00 0.00	30	15
Layer-2	-8.00	17.00	7.00	17.00	15.00 15.00	0	0
Layer-3a	-9.50	19.00	9.00	19.00	0.00 0.00	25	13
Layer-4	-15.50	19.00	9.00	19.00	50.00 50.00	0	0
Layer-5	-27.00	17.50	7.50	17.50	40.00 40.00	0	0

2．Examination for sliding

(1)Calculation earth pressure

・Active earth pressure

Number	Calculated depth (m)	K_A	$\Sigma \gamma h+w_1$ (kN/m^2)	p_a (kN/m^2)	p_{ah} (kN/m^2)	p_{av} (kN/m^2)
1	4.50 (down)	0.301	73.80	22.24	21.49	5.76
2	3.55 (up)	0.301	90.90	27.40	26.47	7.09
3	3.55 (down)	0.301	90.90	27.40	26.47	7.09
4	-2.00 (up)	0.301	146.40	44.13	42.62	11.42
5	-2.00 (down)		146.40	116.40	116.40	0.00
6	-8.00 (up)		188.40	158.40	158.40	0.00
7	-8.00 (down)	0.367	188.40	69.21	67.57	14.98
8	-9.50 (up)	0.367	201.90	74.17	72.41	16.05
9	-9.50 (down)		201.90	101.90	101.90	0.00
10	-15.50 (up)		255.90	155.90	155.90	0.00
11	-15.50 (down)		255.90	175.90	175.90	0.00
12	-27.00 (up)		342.15	262.15	262.15	0.00

	P_{AH} Calculation		(kN/m)	y_A (m)	$P_{AH}・y_A$ (kN/m･m)	P_{AV} Calculation		(kN/m)	B (m)	P_{AV}･B (kN/m･m)
PA1	21.49 ×	0.95 × 1／2	10.21	31.18	318.26	5.76 ×	0.95 × 1／2	2.73	38.10	104.19
PA2	26.47 ×	0.95 × 1／2	12.57	30.87	388.02	7.09 ×	0.95 × 1／2	3.37	38.10	128.34
PA3	26.47 ×	5.55 × 1／2	73.44	28.70	2,107.75	7.09 ×	5.55 × 1／2	19.68	38.10	749.75
PA4	42.62 ×	5.55 × 1／2	118.28	26.85	3,175.85	11.42 ×	5.55 × 1／2	31.69	38.10	1,207.51
PA5	116.40 ×	6.00 × 1／2	349.20	23.00	8,031.60	0.00 ×	6.00 × 1／2	0.00	38.10	0.00
PA6	158.40 ×	6.00 × 1／2	475.20	21.00	9,979.20	0.00 ×	6.00 × 1／2	0.00	38.10	0.00
PA7	67.57 ×	1.50 × 1／2	50.68	18.50	937.54	14.98 ×	1.50 × 1／2	11.24	38.10	428.05
PA8	72.41 ×	1.50 × 1／2	54.31	18.00	977.57	16.05 ×	1.50 × 1／2	12.04	38.10	458.73
PA9	101.90 ×	6.00 × 1／2	305.70	15.50	4,738.35	0.00 ×	6.00 × 1／2	0.00	38.10	0.00
PA10	155.90 ×	6.00 × 1／2	467.70	13.50	6,313.95	0.00 ×	6.00 × 1／2	0.00	38.10	0.00
PA11	175.90 ×	11.50 × 1／2	1,011.43	7.67	7,754.26	0.00 ×	11.50 × 1／2	0.00	38.10	0.00
PA12	262.15 ×	11.50 × 1／2	1,507.36	3.83	5,778.22	0.00 ×	11.50 × 1／2	0.00	38.10	0.00
Total			4,436.07		50,500.58			80.75		3,076.57

・Residual Water Pressure

	P_W Calculation		(kN/m)	y_W (m)	$P_W・y_W$ (kN/m･m)
Pw1	31.20 ×	3.12 × 1／2	48.67	28.47	1,385.69
Pw2	31.20 ×	27.43	855.82	13.72	11,737.52
Total			904.49		13,123.21

(2)Calculation of weight

Block	Base (m)	Height (m)	Unit weight (kN/m^3)	Weight (kN/m)	□OR△ △＝1	x (m)	y (m)
q1	0.00	0.00	0.0	0.00		0.00	0
WE1	38.10	0.95	18.0	651.51		19.05	0.0
WE2	38.10	5.55	10.0	2114.55		19.05	0.0

Block	Base (m)	Height (m)	Unit weight (kN/m^3)	Weight (kN/m)	□OR△ △＝1	x (m)	y (m)
W1	38.1	6.00	7.0	1600.20		19.05	0.0
W2	38.1	1.50	9.0	514.35		19.05	0.0
W3	38.1	6.00	9.0	2057.40		19.05	0.0
W4	38.1	11.50	7.5	3286.13		19.05	0.0

・Weight on top of improved part

Block	W (kN/m)	x (m)	W・x (kN/m・m)
q1	0.00	0.00	0.00
WE1	651.51	19.05	12411.27
WE2	2114.55	19.05	40282.18
ΣWE	2766.06		52693.44

・Weight of improved part

Block	W (kN/m)	x (m)	W・x (kN/m・m)
ΣWE	2766.06		52693.44
W1	1600.20	19.05	30483.81
W2	514.35	19.05	9798.37
W3	2057.40	19.05	39193.47
W4	3286.13	19.05	62600.68
ΣW	10224.14		194769.77

(3)Result of external force

Part			Normal situation
Resultant force of weight	: ΣW	(kN/m)	10224.14
Horizontal component of active earth pressure	: ΣP_A	(kN/m)	4,436.07
Vertical component of passive earth pressure	: ΣP_{AV}	(kN/m)	80.75
Residual Water Pressure	: ΣP_w	(kN/m)	904.49
Horizontal component of active earth pressure	: ΣP_P	(kN/m)	0.00
Vertical component of active earth pressure	: ΣP_{PV}	(kN/m)	0.00
Moment by effective weight	: $\Sigma W \cdot x$	(kN/m·m)	194,769.77
Moment by horizontal component of active earth pressure	: $\Sigma P_A \cdot y_A$	(kN/m·m)	50,500.58
Moment by vertical component of active earth pressure	: $\Sigma P_v \cdot x_v$	(kN/m·m)	3,076.57
Moment by Residual Water Pressure	: $\Sigma P_w \cdot y_w$	(kN/m·m)	13,123.21

(4)Result of examination for sliding

(Safety factor : Fs≧1.10)

$F_{R1} = (\Sigma W + PV) \cdot \mu$

$= 7215.56$ (kN/m)

$F_{R2} = \tau \cdot B = (1/2 \cdot q_{uck}.a_p) \cdot B$

$= 5909.31$ (kN/m)

$F_R = F_{R2}$

$= 5909.31$ (kN/m)

$Fs = F_R / (\Sigma P_{AH} + \Sigma P_w)$

$= 1.106 > 1.1$ ····· OK

(5)Result of examination

(Safety factor : Fs≧1.20)

$\Sigma M_R = \Sigma W \cdot x + \Sigma P_{AV} \cdot B + \Sigma P_{PH} \cdot y_P$

$= 197,846.35$ (kN·m/m)

$\Sigma M_A = \Sigma P_W \cdot y_W + \Sigma P_{AH} \cdot y_A$

$= 63,623.78$ (kN·m/m)

$Fs = \Sigma M_R / \Sigma M_A$

$= 3.110 > 1.1$ ····· OK

Examination for sliding　　Model:　Block-d

1. Calculation condition

(1) General condition

・Water level

Active side : D.L. 3.55 (m)

Passive side : D.L. 0.43 (m)

・Unit weight of wate : γ_w= 10.00 (kN/m^3)

・Surcharge

Active side w_1= 73.8 (kN/m^2)

(2) Condition of bearing layer

Internal friction angle : ϕ_B= 35 (°) (μ =tanϕ_B= 0.700)

Cohesion : c_B= 0.0 (kN/m^2)

(3) Specification of improved column

Width : B= 40.2 (m)

Depth of upper end : -2.00 (m)

Depth of lower end : -26.50 (m)

Improvement rate 51.7 (%)

Design strength : q_u 600.0 (kN/m^2)

(4) Soil parameters of calculation

・Soil parameters of active side

Soil layer	Lower end of layer D.L. (m)	γ_t (kN/m^3)	γ' (kN/m^3)	γ_{sat} (kN/m^3)	c (kN/m^2)	ϕ (°)	δ (°)
	4.50						
Fill	3.55	18.00	10.00	20.00	0.00 0.00	30	15
Fill	-2.00	18.00	10.00	20.00	0.00 0.00	30	15
Layer-2	-11.00	17.00	7.00	17.00	15.00 15.00	0	0
Layer-3b	-13.50	19.00	9.00	19.00	25.00 25.00	0	0
Layer-4	-16.00	19.00	9.00	19.00	50.00 50.00	0	0
Layer-5	-26.50	17.50	7.50	17.50	40.00 40.00	0	0

2．Examination for sliding

(1)Calculation earth pressure

・Active earth pressure

Number	Calculated depth (m)	K_A	$\Sigma \gamma h+w_1$ (kN/m^2)	p_a (kN/m^2)	p_{ah} (kN/m^2)	p_{av} (kN/m^2)
1	4.50 (down)	0.301	73.80	22.24	21.49	5.76
2	3.55 (up)	0.301	90.90	27.40	26.47	7.09
3	3.55 (down)	0.301	90.90	27.40	26.47	7.09
4	-2.00 (up)	0.301	146.40	44.13	42.62	11.42
5	-2.00 (down)		146.40	116.40	116.40	0.00
6	-11.00 (up)		209.40	179.40	179.40	0.00
7	-11.00 (down)		209.40	159.40	159.40	0.00
8	-13.50 (up)		231.90	181.90	181.90	0.00
9	-13.50 (down)		231.90	131.90	131.90	0.00
10	-16.00 (up)		254.40	154.40	154.40	0.00
11	-16.00 (down)		254.40	174.40	174.40	0.00
12	-26.50 (up)		333.15	253.15	253.15	0.00

	P_{AH} Calculation	P_{AH} (kN/m)	y_A (m)	$P_{AH}\cdot y_A$ (kN/m·m)	P_{AV} Calculation	P_{AV} (kN/m)	B (m)	$P_{AV}\cdot B$ (kN/m·m)
PA1	21.49 × 0.95 × 1／2	10.21	30.68	313.16	5.76 × 0.95 × 1／2	2.73	40.20	109.94
PA2	26.47 × 0.95 × 1／2	12.57	30.37	381.74	7.09 × 0.95 × 1／2	3.37	40.20	135.41
PA3	26.47 × 5.55 × 1／2	73.44	28.20	2,071.03	7.09 × 5.55 × 1／2	19.68	40.20	791.07
PA4	42.62 × 5.55 × 1／2	118.28	26.35	3,116.70	11.42 × 5.55 × 1／2	31.69	40.20	1,274.07
PA5	116.40 × 9.00 × 1／2	523.80	21.50	11,261.70	0.00 × 9.00 × 1／2	0.00	40.20	0.00
PA6	179.40 × 9.00 × 1／2	807.30	18.50	14,935.05	0.00 × 9.00 × 1／2	0.00	40.20	0.00
PA7	159.40 × 2.50 × 1／2	199.25	14.67	2,922.33	0.00 × 2.50 × 1／2	0.00	40.20	0.00
PA8	181.90 × 2.50 × 1／2	227.38	13.83	3,145.35	0.00 × 2.50 × 1／2	0.00	40.20	0.00
PA9	131.90 × 2.50 × 1／2	164.88	12.17	2,005.98	0.00 × 2.50 × 1／2	0.00	40.20	0.00
PA10	154.40 × 2.50 × 1／2	193.00	11.33	2,187.33	0.00 × 2.50 × 1／2	0.00	40.20	0.00
PA11	174.40 × 10.50 × 1／2	915.60	7.00	6,409.20	0.00 × 10.50 × 1／2	0.00	40.20	0.00
PA12	253.15 × 10.50 × 1／2	1,329.04	3.50	4,651.63	0.00 × 10.50 × 1／2	0.00	40.20	0.00
Total		4,574.74		53,401.22		57.47		2,310.49

・Residual Water Pressure

	P_W Calculation	P_W (kN/m)	y_W (m)	$P_W\cdot y_W$ (kN/m·m)
Pw1	31.20 × 3.12 × 1／2	48.67	27.97	1,361.36
Pw2	31.20 × 26.93	840.22	13.47	11,313.51
Total		888.89		12,674.86

(2)Calculation of weight

Block	Base (m)	Height (m)	Unit weight (kN/m^3)	Weight (kN/m)	□OR△ △＝1	x (m)	y (m)
q1	0.00	0.00	0.0	0.00		0.00	0
WE1	40.20	0.95	18.0	687.42		20.10	0.0
WE2	40.20	5.55	10.0	2231.10		20.10	0.0

Block	Base (m)	Height (m)	Unit weight (kN/m^3)	Weight (kN/m)	□OR△ △＝1	x (m)	y (m)
W1	40.2	9.00	7.0	2532.60		20.10	0.0
W2	40.2	2.50	9.0	904.50		20.10	0.0
W3	40.2	2.50	9.0	904.50		20.10	0.0
W4	40.2	10.50	7.5	3165.75		20.10	0.0

・Weight on top of improved part

Block	W (kN/m)	x (m)	W・x (kN/m・m)
q1	0.00	0.00	0.00
WE1	687.42	20.10	13817.14
WE2	2231.10	20.10	44845.11
ΣWE	2918.52		58662.25

・Weight of improved part

Block	W (kN/m)	x (m)	W・x (kN/m・m)
ΣWE	2918.52		58662.25
W1	2532.60	20.10	50905.26
W2	904.50	20.10	18180.45
W3	904.50	20.10	18180.45
W4	3165.75	20.10	63631.58
ΣW	10425.87		209559.99

(3)Result of external force

Part			Normal situation
Resultant force of weight	: ΣW	(kN/m)	10425.87
Horizontal component of active earth pressure	: ΣP_A	(kN/m)	4,574.74
Vertical component of passive earth pressure	: ΣP_{AV}	(kN/m)	57.47
Residual Water Pressure	: ΣP_w	(kN/m)	888.89
Horizontal component of active earth pressure	: ΣP_P	(kN/m)	0.00
Vertical component of active earth pressure	: ΣP_{PV}	(kN/m)	0.00
Moment by effective weight	: $\Sigma W \cdot x$	(kN/m･m)	209,559.99
Moment by horizontal component of active earth pressure	: $\Sigma P_A \cdot y_A$	(kN/m･m)	53,401.22
Moment by vertical component of active earth pressure	: $\Sigma P_v \cdot x_v$	(kN/m･m)	2,310.49
Moment by Residual Water Pressure	: $\Sigma P_w \cdot y_w$	(kN/m･m)	12,674.86

(4)Result of examination for sliding

(Safety factor : Fs≧1.10)

$F_{R1} = (\Sigma W + PV) \cdot \mu$

$= 7340.52$ (kN/m)

$F_{R2} = \tau \cdot B = (1/2 \cdot q_{uck} . a_p) \cdot B$

$= 6235.02$ (kN/m)

$F_R = F_{R2}$

$= 6235.02$ (kN/m)

$Fs = F_R / (\Sigma P_{AH} + \Sigma P_w)$

$= 1.141 > 1.1$ …… OK

(5)Result of examination

(Safety factor : Fs≧1.20)

$\Sigma M_R = \Sigma W \cdot x + \Sigma P_{AV} \cdot B + \Sigma P_{PH} \cdot y_P$

$= 211,870.48$ (kN･m/m)

$\Sigma M_A = \Sigma P_W \cdot y_W + \Sigma P_{AH} \cdot y_A$

$= 66,076.08$ (kN･m/m)

$Fs = \Sigma M_R / \Sigma M_A$

$= 3.206 > 1.1$ …… OK