

Appendix XI: Other Relevant Data

11-1 Environment and Social Consideration Data

1) Exemption Letter for EIA from MOA



الرقم ١٠٢٢ / ٧ / ٤
التاريخ
الموافق ٢٠١٥ / ١٢ / ١٢

معالي وزير المياه والري

تحية طيبة وبعد ،،،

إشارة لكتاب معاليكم رقم pmu/14/2375 تاريخ 2014/12/2 ومرفقه دراسة تقييم الأثر البيئي المبدئي لمشروع إنشاء خط ناقل لمياه الشرب من حوفا الى بيت راس وتأهيل شبكات مياه شرب في حوارة والصريح والممول من الوكالة اليابانية للتعاون الدولي (JICA).
أوافق على تقرير الدراسة أعلاه شريطة:
1- ضمان عدم تجاوز مستويات الضجيج للحدود المسموح بها.
2- إعادة تأهيل مواقع العمل.
3- اتخاذ اجراءات السلامة والحماية للسكان والعاملين في مناطق العمل.
4- الإلتزام بالإجراءات الوقائية الواردة في الدراسة.
وذلك استناداً إلى توصية اللجنة الفنية لمراجعة دراسات تقييم الأثر البيئي للمشاريع.

وتفضلوا بقبول فائق الاحترام ،،،

الدكتور طاهر راضي الشخشير

وزير البيئة

المستشار العام
المستشار العام

The Hashemite Kingdom of Jordan
Ministry of Environment
P.O.B 1408 Amman 11941
Tel: +96265560112
Fax: +96265516277
Jordan

H.E. Minister of Water & Irrigation

Greetings:

With reference to Your Excellency's, letter No. pmu/14/2375 dated 2/12/2014 together with its attachment of the Evaluation Study of initial environmental impact for the construction of drinking water carrying line project from Hoofa to Bait Ras and prequalify the drinking water networks in Huwwarah and Sareeh which is financed by the Japanese International Cooperation Agency (JICA).

I approve the above study report provided:

1. Ensuring that noise levels do not exceed the permitted levels.
2. Prequalify the work sites again.
3. Take the safety and protection measures for the population work areas.
4. Adhere with the preventive measures stated in the study.

Pursuant to the recommendations of the Technical Committee for reviewing the studies of evaluation of environmental impact of projects.

With kind regards

Dr.Taher Radhi Shakhshir
(Signed)
Minister of Environment

2) Monitoring Form (draft)

Monitoring Form

Construction Phase

1. Response /Actions to Comments and Guidance from Government Authorities and the Public

Monitoring Item	Monitoring Results during Report Period
Number and contents of formal comments made by the public	
Number and contents of responses from Government agencies	

2 . Pollution

-Air Quality (Ambient Air Quality)

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standards	Standards for Contract	Referred International Standards	Measurement Point	Frequency
TSP	mg/cm3			0.26 (24h)				Quarterly
CO	ppm			26 (1h)				
NO2	ppm			0.21 (1h)				
SO2	ppm			0.15 (1h)				

- Noise

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standards	Standards for Contract	Referred International Standards	Measurement Point	Frequency
Noise Level	dB			Urban; 65 (Day), 55 (Night)				Daily

Remarks; Urban commercial area

- Vibration

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standards	Standards for Contract	Referred International Standards	Measurement Point	Frequency
Traffic Vibration Level	dB					Urban ; 70 (Day), 65 (Night)		Daily

Remarks; Urban commercial area

- Soil Contamination

Monitoring Item	Monitoring Results during Report Period	Measures to be Taken
Treatment of oil leakage	Details of survey results, such as findings.	

3 .Natural Environment

- No Monitoring Items

4.Social Environment

- Livelihood

Monitoring Item	Monitoring Results during Report Period	Measures to be Taken
Interference of approach to commercial places	Details of survey results, such as findings.	

- Cultural Heritage

Monitoring Item	Monitoring Results during Report Period	Measures to be Taken
Unearthing of monument and relic	Details of survey results, such as findings.	

- Work Environment

Monitoring Item	Monitoring Results during Report Period	Measures to be Taken
<ul style="list-style-type: none"> • Safety measures for labor • Safety measures for inhabitant 	Details of survey results, such as findings.	

- Accident

Monitoring Item	Monitoring Results during Report Period	Measures to be Taken
<ul style="list-style-type: none"> • Measures for traffic safety • Crossing guard situation 	Details of survey results, such as findings.	

3) Environmental Check List

Classification	Environmental Item		Major Check Items	Yes: Y No: N	Specific Environmental & Social Considerations (Reason for the Yes / No, basis, mitigation, etc.)
1 Licensing and explanation	(1)EIA and Environmental licensing	(a)	Environmental assessment report (EIA report), etc. was created?	Y	The Ministry has exempted EIA based on the Project Report.
		(b)	EIA report was either approved by the country's government?	N	Not Applicable.
		(c)	Approved EIA report has collateral condition? If there is a collateral condition, the conditions are satisfied?	N	Not Applicable.
		(d)	In the case other than the above, if necessary, environmental licensing from the competent authority of the local was acquired?	N	Not Applicable.
	(2)Explanation to local stakeholders	(a)	About the impact and the contents of the project, an appropriate description to local stakeholders including information disclosure was carried out, and the understanding was gained?	Y	The project was explained to the concerned Ministries.
		(b)	The comments from the residents were reflected on project content ?	Y	
	(3) Consideration of alternatives		Multiple alternatives of the project plan (when studying, and including items related to environmental and social) were considered?	N	There is no alternatives because pipes need to be laid along almost every road.
2.Pollution measures	(1) Air quality	(a)	Is there the air pollution caused by chlorine from the injection equipment and storage facility for chlorine disinfection?	N	
		(b)	Chlorine in the work environment is consistent with the occupational safety standards of the country?	Y	
	(2) Water quality		SS, BOD, COD, pH, and the like item of wastewater generated in accordance with the facility operation are consistent with drainage standards of the country?	N	Not Applicable.
	(3) Waste		Waste sludge generated in accordance with the facility operation is either treated and disposed of properly in accordance with the provisions of the country?	N	Not Applicable.
	(4) Noise and vibration		Noise and vibration from the pump facility, etc., are consistent with the standards of the country?	N	Not Applicable.
	(5) Land subsidence		When performing the pumping large amounts of groundwater, is there a possibility that the land subsidence occurs?	N	Since the project is installation of water pipes and the renovation of the water supply network, the project does not concern increase of groundwater intake.
3 Natural environment	(1) Protected areas		Site is located in protected areas designated by laws of the country or international treaties and conventions? Project affects the protected areas?	N	The project area has more than 20km away from the Reserves that the country specify so that the project does not affect the Reserves.
	(2) Ecosystem	(a)	Site includes virgin forest, tropical natural forest, habitat ecologically important (coral reefs, mangrove swamps, tidal flats, etc.) ?	N	
		(b)	Site includes the habitats of endangered species required protection by law of the country or international treaties and conventions?	N	
		(c)	If a significant impact on the ecosystem is concerned, measures to reduce the impacts on the ecosystem is conducted?	N	
		(d)	Water intake (surface water, underground water) by the project affects the aquatic environment such as rivers? Measures to reduce the impacts on the aquatic organisms, etc., are carried out?	N	Water intake is not included in the project.
	(3) Hydrology		Water intake (groundwater, surface water) by the project affects an adverse effect on the flow of surface water and ground water?		

Classification	Environmental Item		Major Check Items	Yes: Y No: N	Specific Environmental & Social Considerations (Reason for the Yes / No, basis, mitigation, etc.)
4. Socila Environment	(1) Resettlement	(a)	With the implementation of the project, involuntary resettlement occurs ? If that occurs, efforts to minimize the impact of relocation is conducted?	N	Pipe laying is the projeect component. All pipes are laid under the public roads, hence the project will not have resettlement.
		(b)	For residents to transfer , appropriate description of compensation and life reconstruction measures would be done before the transfer ?	N	
		(c)	Search for residents relocation was carried out, and the resettlement plan including compensation by the replacement cost and the recovery of livelihoods after relocation is conducted ?	N	
		(d)	Payment of compensation is either carried out in the pre-transfer ?	N	
		(e)	Compensation policy has been developed in the document ?	N	
		(f)	The plan, among the relocated residents, in particular for socially vulnerable such as women, children, the elderly, the poor, ethnic minorities, indigenous peoples, etc. has been made with appropriate consideration ?	N	
		(g)	For relocated residents, the pre-transfer agreement can be gotten ?	N	
		(h)	The organizational framework established to properly implement the resettlement is considered ? Enough capacity to implement the plan and budget measures can be secured ?	N	
		(i)	Monitoring for the impacts of resettlement is planned ?	N	
		(j)	System for the complaint process is built ?	N	
	(2) Life and livelihood	(a)	Adverse effect results to the life of residents by the project? Adequate measures is considered to reduce the impacts, if necessary?	N	The project will improve the life of residents.
		(b)	Water intake (surface water, underground water) by the project affects existing water use ?	N	Water intake is not included in the project.
	(3) Cultural heritage		(a) Is there risk by the project to heritages and historical sites which are archeologically, historically, culturally, and religiously precious ? In addition, measures that have been stipulated in accordance with the country's laws are taken into account ?	Y	Ruins and relics that were found in the past may exist in the project area. Ministry of Tourism and Antiquities are requested to observe the pipe laying works. If ruins and relics are found, instructions of the Ministry shall be followed.
	(4) Landscape		(a) When the landscape to be considered particularly presents, the project adversely affects to it? If it is affected, necessary precautions is taken?	N	
	(5) Ethnic minorities, indigenous	(a)	Consideration to reduce the impact to minority of the country, indigenous cultures and lifestyle have been made?	N	There are no minorities. The project will contribute to improvement of Jordanian as well as refugees of Palestine, Iraqi and Syria.
		(b)	Rights related to land and resources of ethnic minorities and indigenous people are respected?	N	
	(6) Working environment	(a)	In the project, the Act on the working environment of the country which must be observed is kept?	Y	The contract agreement should include the Act and should be monitored.
		(b)	Safety considerations in the hard part of the individuals involved in the project such as installation of safety equipment according to industrial accident prevention, management of hazardous substances, etc. are being measures?	Y	Measures should be taken to follow the safety considerations.

Classification	Environmental Item		Major Check Items	Yes: Y No: N	Specific Environmental & Social Considerations (Reason for the Yes / No, basis, mitigation, etc.)
4. Social Environment	(6) Working environment	(c)	Support implementation in the soft part of the individuals involved in the project such as the establishment of safety and health plan and safety training for workers (including public health and traffic safety) is planned and implemented?	Y	Should be implemented.
		(d)	Appropriate measures that security personnel involved in the project make sure not to violate the safety of the project stakeholders and local residents are taken ?	Y	Should be implemented.
5. Others	(1) Impact under construction	(a)	Mitigation measures are prepared against pollution during construction (noise, vibration, turbid water, dust, exhaust gas, waste, etc.) ?	Y	Avoid pipe laying works at night as much as possible. Sprinkling water to reduce dust. Wastes should be designated dump sites.
		(b)	The construction adversely affects the natural environment (ecosystem) ? In addition, adequate measures considered to reduce impacts is prepared?	N	The project area is the settled areas so that pipe laying works will not affect ecosystem.
		(c)	The construction adversely affects the social environment construction ? In addition, adequate measures considered to reduce impacts is prepared?	Y	Temporary access and approach should be constructed to secure routes to shops and residences.
		(d)	The construction causes road congestion? Adequate measures considered to reduce impacts are prepared?	Y	Detour routes should be planned with consultation of the police.
	(2) Monitoring	(a)	For items that are considered to have potential impacts of the above environment items, monitoring of project operators are planned and implemented?	Y	
		(b)	How item of the plan, method, frequency, etc. are determined?	Y	Periodical (weekly or monthly) patrolling should be conducted.
		(c)	Monitoring system of the project operator (Continuity of the organization, personnel, equipment, and adequate budget) or be established?	Y	
		(d)	The reporting procedure or the frequency, etc. from the project operator to the competent authority are stipulated?	Y	Once a month
6 Points to note	(1) Reference of other checklist		If necessary, it should be evaluated also add the appropriate checks in check list according dam, the river.	N	
	(2) Notes on using environmental checklist		If necessary, check the influence of environmental problems on a global scale or cross-border. (If such an element related to cross-border problems processing of waste, acid rain, ozone layer depletion, global warming can be considered).	N	

Note 1) For the "standard of the country concerned" in the table, when there is a significant deviation as compared to the baseline which is internationally recognized, countermeasures are examined, if necessary. Items, which are not yet to be established in the local environmental

Note 2) Environmental Checklist is intended only to show the standard environment check items. Depending on the condition of the project



DAI NIPPON CONSTRUCTION

The Programme For Urgent Improvement of Water Sector For The Host Communities of Syrian Refugees In Northern Governorates

Date: 29 June, 2015

Letter No. DNC / IRB / D006

To: Eng. Tawfiq Habashneh
Secretary General of Water Authority

57 2015
2015-1768
51419

Subject: The Programme For Urgent Improvement of Water Sector For The Host Communities of Syrian Refugees In Northern Governorates (under the E/N signed on 13th March 2014)

Sub: Cabinet Letter Amendment

Dear Sir,

With reference to the captioned subject, please be informed that the awarded contractor DAI NIPPON CONSTRUCTION received the attached Cabinet letter No. 56/10/6/8442 dated 10/March/2014, and the attached Minutes of the contract negotiation for the above-mentioned project dated 26/May/2015.

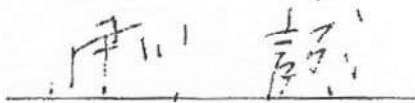
In accordance with Article 7. Client's responsibilities, Sub-Clause 7.3 and 7.4 in the contract and Article 1.27 Taxes and other charges in the contract documents and with reference to the attached signed exchange of notes No 5/2/15/2127 dated 13/03/2014, and following the attached minutes of the contract negotiation in the contract for the above mentioned project, you are kindly requested to issue the necessary supporting letter to the cabinet to amend and clarify clearly the following subjects which are mentioned in details in the contract documents and generally in the cabinet letter 56/10/6/8442 dated 10/March/2014 :

1. The contractor shall be exempted from submitting Bank Guarantee for the project cargo to custom department or any other authorities in the client's country.
[With reference to contract article 1.27, Taxes and other charges]
2. The contractor shall be exempted from submitting Bank Guarantee for the road use (Excavation work permission) concerning the project to the Ministry of Public works and Housing, Irbid Municipality and any other authorities in the client's country.
[With reference to contract article 1.27, Taxes and other charges]
3. The contractor shall be exempted from all Taxes and fiscal levies including the general and the private sales taxes for material, equipment, services, and preparations up to zero percent.
[With reference to contract article 1.27, and the minutes of the contract negotiation]

Therefore, you are kindly requested to take the appropriate measure to expedite getting the above exemptions to help the contractor to import the needed material and start the work as soon as possible.

Your prompt action will be highly appreciated.

Yours faithfully,



Company Representative

Makoto Ikawa

DAI NIPPON CONSTRUCTION



Attached:

- Contract, Article 7
- Contract Document, Article 1.27
- Minutes of the contract negotiation
- Exchange Note. Ref No.5/2/15/2127, Dated 13/03/2014
- Cabinet Letter Ref No. 56/15/6/7442, Dated 15/03/2014

The Prime Ministry

Number: 56 / 10 / 6 / 52202

Date: 29 / 11 / 2015

HE The Minister of Public Works and Housing

Referring to your letter number 5/roads' /48855 dated 31/10/2015

The Ministries' council has reviewed your above letter, and the recommendation of services and infrastructures and social affairs' committee which was issued in their session on 16/11/2015 about exempt the contractor who is executing (the conveyor water line from Hofa reservoir to Bait Ras town and rehabilitation of the water network in Hawwara area in Irbid / phase one) project from submitting guarantees to get the Public Works' required permissions, the council decided in his session on 25/11/2015 the approval to commission the ministry of water and irrigations not to release the performance bond for the above project unless they receive a written approval from the ministry of public works' and housing about returning the roads affected by this project as it was before starting the project.

Yours Sincerely,
The Prime Minister

Copy: HE The minister of water and irrigation

Copy: HE The minister of finance

Copy: Services and infrastructures and social affairs' Committee

وزارة الصحة العامة - الدewan العام
2922S
الموارد
التاريخ 2015/12/01
الوقت: 10:45
يحول إلى: معالي وزير الصحة

عطوفة الأمين العام

الرقم ٥٢ / ١٠١٠ / ٢٢٠٢
التاريخ ١٢٢٧ / ١٢ / ٢٤
الموافق ٢٤ / ١٢ / ٢٠١٥

معالي وزير الأشغال العامة والإسكان

أشير إلى كتابكم رقم ٥ / تصاريح طرق / ٤٨٨٥٥ تاريخ ٢٠١٥/١٠/٣١.

استعرض مجلس الوزراء كتاب معاليكم المشار إليه أعلاه، وتوصية
المنعقدة بتاريخ ٢٠١٥/١١/١٦ بخصوص إعفاء المقاول المنفذ لأعمال
مشروع خط نقل المياه من خزان حوفا إلى بلدة بيت راس وإعادة تأهيل شبكة
مياه بلدة حوارة في منطقة أريد/ المرحلة الأولى من تقديم كفالات تصاريح
العمل الخاصة بوزارة الأشغال العامة والإسكان، وقرر المجلس في جلسته
المنعقدة بتاريخ ٢٠١٥/١١/٢٥ الموافقة على تكليف وزارة المياه والري بعدم
الإفراج عن كفالة حسن التنفيذ المتعلقة بالمشروع أعلاه إلا بعد موافقة خطية
من وزارة الأشغال العامة والإسكان فيما يخص إعادة الطرق المتأثرة بمشروع
المياه / الخط الناقل إلى وضعها الذي كانت عليه.

واقبلوا فائق الاحترام.

لا تفسد السموات

11-4 Result of Test Pit Survey

(1) Geological Aspect

The geology of surface layers in the Project area consists mainly of a distribution of Paleogene strata from the Cretaceous upper strata, and consists of limestone, Dolomite type limestone, and chalk. According to test boring study results, the pipe laying route has gravel mixed with limestone (silt and sand) and limestone ground (soft rock). From the geological status, the ground has adequate bearing capacity to resist structures, and generally, no foundation work is required.

Geological Formation

ERA	PERIOD	EPOCH	Group	Formation	Symbol	Lithology	Aquifer Characteristics	Aquifer Cond. (m/s)							
CENOZOIC	Quarter-nary	Holocene	Alluvium	Fuviatile	Rc	Soil, sand, and gravel	Poor to Good (Aquifer)	Not Available							
		Pleistocene	Diluvium	Laest and Eolian											
	Tertiary	Neogene	Pliocene	J. Valley	Jafer – Azraq	Ja-Az	Marl, clay, and evaporites conglomerate with siliceous sand, gravel, and basalt	Poor Fair	Not Available						
			Miocene	Volcanics	Basalts	Ba	Basalt	Good (Aquifer)	4.0 E -04 *						
		Paleogene	Oligocene	Volcanics	Basalts	Ba	Basalt								
			Eocene	Balqa	Wadi Shallah	B5	Limestone, chalk, and marl	Good (Aquifer)	5.0 E -05 *						
			Rijam		B4	Chert, limestone, chalk, and marl	Good (Aquifer)	5.0 E -05 *							
			Muwaqqar		B3	Marly limestone, and shale	Poor (Aquifer)	1.0 E -09 **							
		Upper	Meastrichtian	Campanian	Santonian	Ajlun	Wadi Sir Shueib	A7 A5, A6	Limestone, dolomite, and chert Limestone, and marly limestone Dolomite, and dolomitic limestone	Very Good (Aquifer) Poor (Aquitard) Fair to Good (Aquifer)	2.0 E -05 * 1.0 E -09 ** 2.0 E -05 *				
												Cenomanian	Fuheis	Naur	A3 A1, A2
Lower	Albian	Kurnub													
			Aptian												
				Neocomian											
					Berriasian										
Jurassic	Malm	Tithonian	Aarda	K1	Sandstone, marl and shale										
		Kimmeridgian													
		Oxfordian													

(Source; Northern Governorates Water Transmission System Feasibility Study Final Report CDM International Inc. 2005, Modified from JICA 2001 and BGR 2001)

(2) Test Pit Survey

MPWH does not permit open-cut method for pipe crossing national roads under jurisdiction of MPWH, but requires trenchless method. For designing trenchless works, specifically collection of soil data of roads, test pit survey was conducted in January 2016 using boring exploration method for the national roads as below.

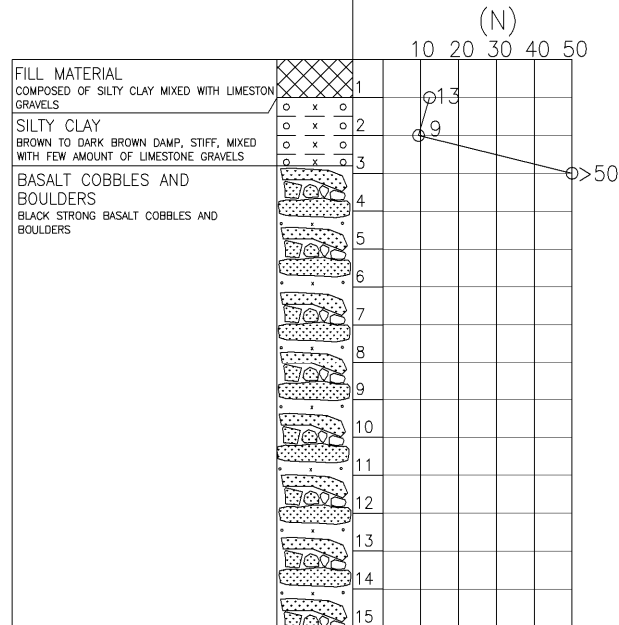
Boring Locations

National Road	Road Crossing No.	Boring Location (1st)		Boring Location (2nd)	
		No.	N Value	No.	N Value
Bagdaddat Road	BJM-1	BBH-1.1	13~50	BBH-1.2	19~50
	BJM-2	BBH-2.1	8~41	BBH-2.2	14~32
	BJM-3	BBH-3.1	10~17	BBH-3.2	10~17
	BJM-4	BBH-4.1	18~30	BBH-4.2	16~20
Petra Road	PJM-1	PBH-1.1	8~18	PBH-1.2	8~20
Sarieh Road	SJM-1	SBH-1.1	10~23	SBH-1.2	9~28
	SJM-2	SBH-2.1	12~32	SBH-2.2	23~30
	SJM-3	BH-11	9~26	BH-12	9~27



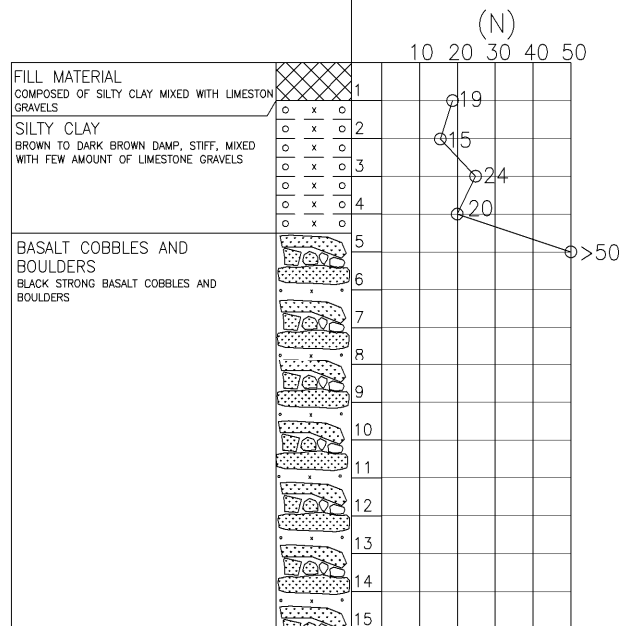
BBH-1.1(G.L.)

DEPTH=15m
S.W.L. = NOWATER
Static Water Level
January 2016



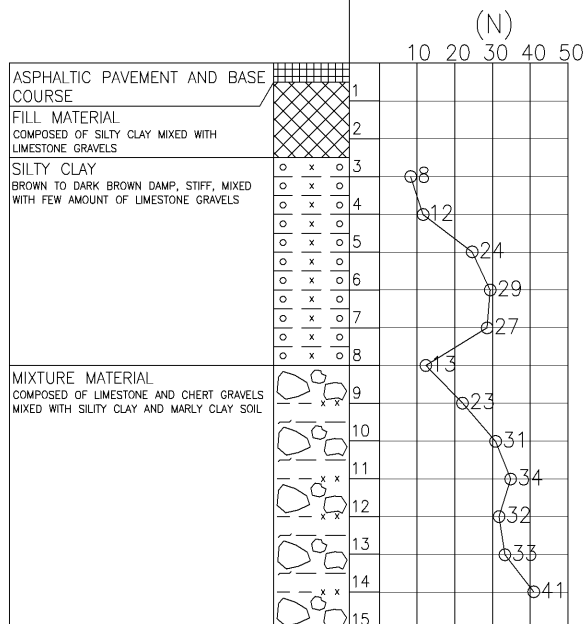
BBH-1.2(G.L.)

DEPTH=15m
S.W.L. = NOWATER
Static Water Level
January 2016



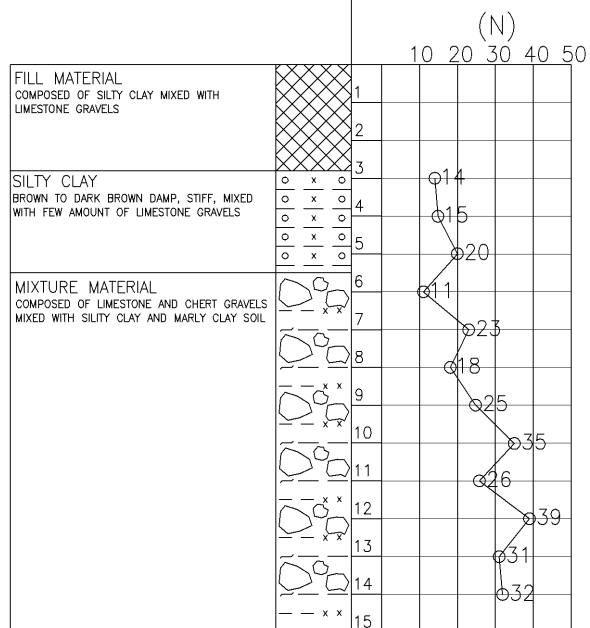
BBH-2.1(G.L.)

DEPTH=15m
S.W.L. = NOWATER
Static Water Level
January 2016



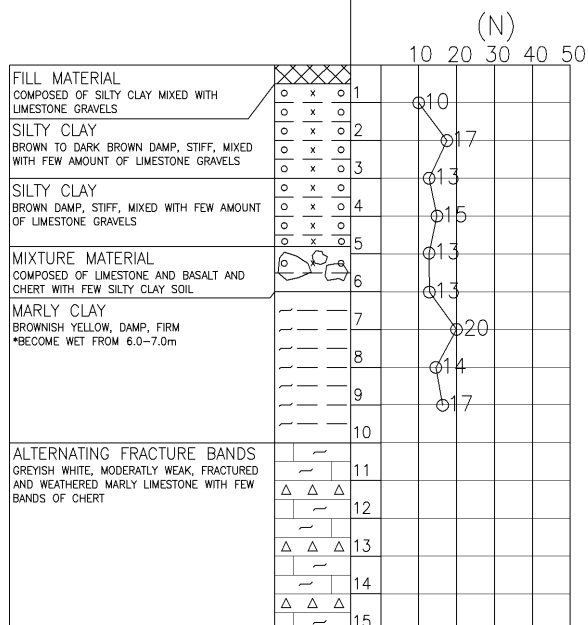
BBH-2.2(G.L.)

DEPTH=15m
S.W.L. = NOWATER
Static Water Level
January 2016



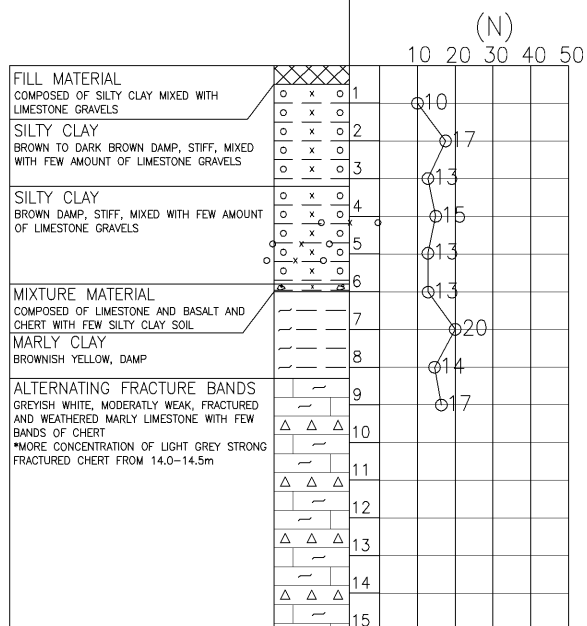
BBH-3.1(G.L.)

DEPTH=15m
 S.W.L. = NOWATER
 Static Water Level
 January 2016

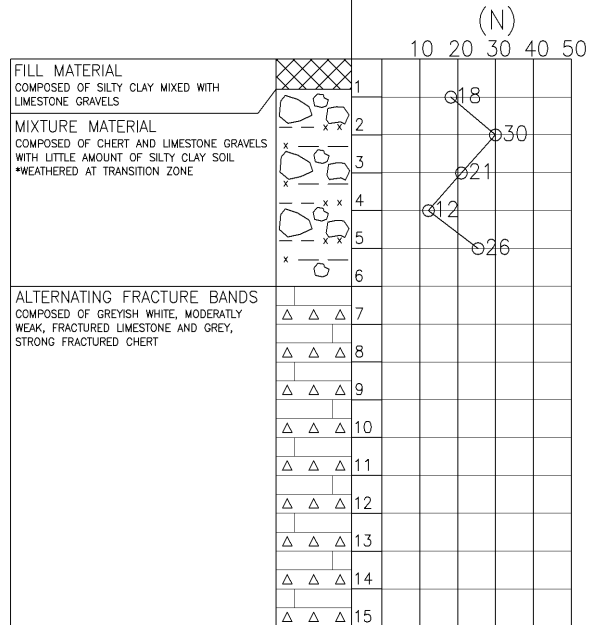


BBH-3.2(G.L.)

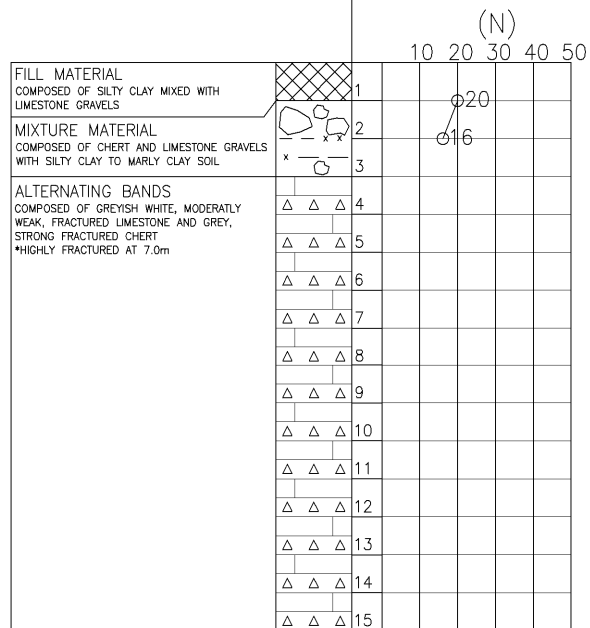
DEPTH=15m
 S.W.L. = NOWATER
 Static Water Level
 January 2016



DEPTH=15m
S.W.L. = NOWATER
Static Water Level
January 2016

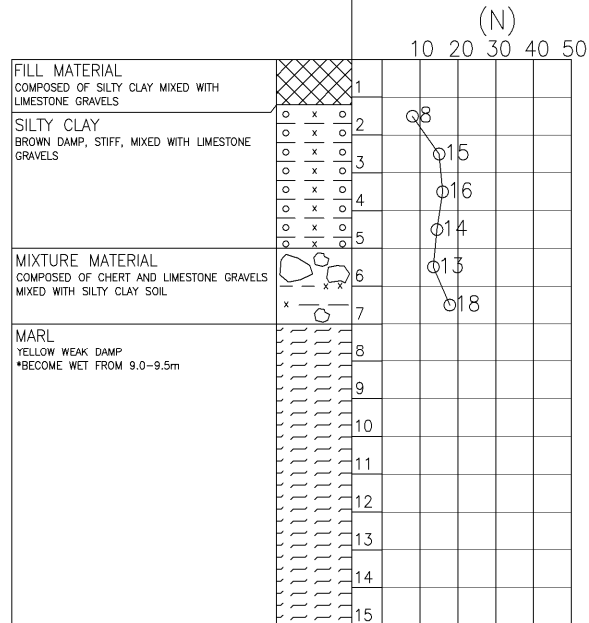


DEPTH=15m
S.W.L. = NOWATER
Static Water Level
January 2016



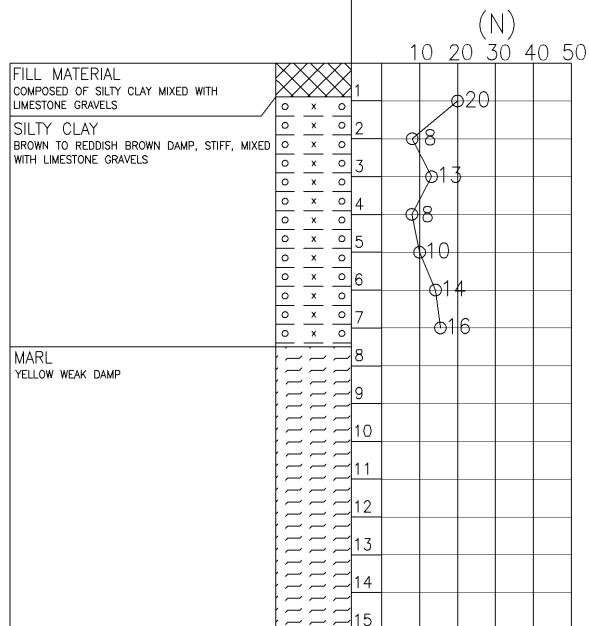
PBH-1.1(G.L.)

DEPTH=15m
 S.W.L. = NOWATER
 Static Water Level
 January 2016



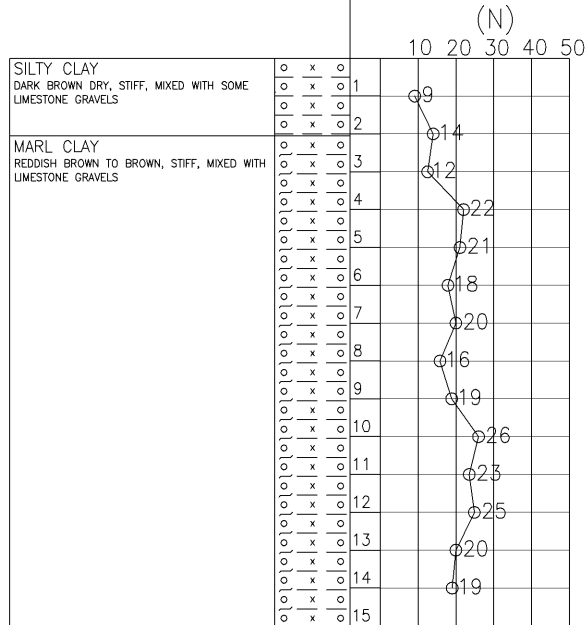
PBH-1.2(G.L.)

DEPTH=15m
 S.W.L. = NOWATER
 Static Water Level
 January 2016



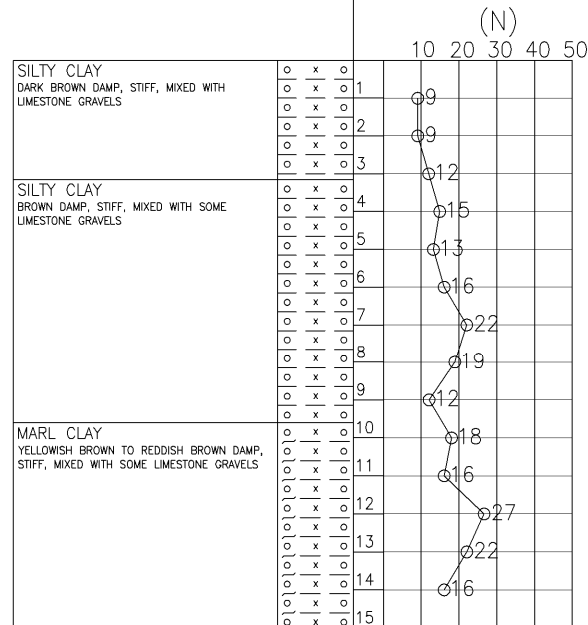
BH-11(G.L.)

DEPTH=15m
S.W.L. = NOWATER
Static Water Level
February 2014



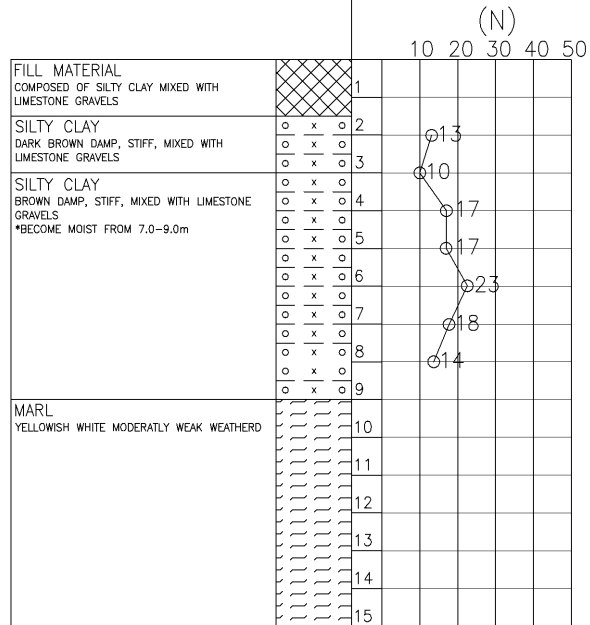
BH-12(G.L.)

DEPTH=15m
S.W.L. = NOWATER
Static Water Level
February 2014



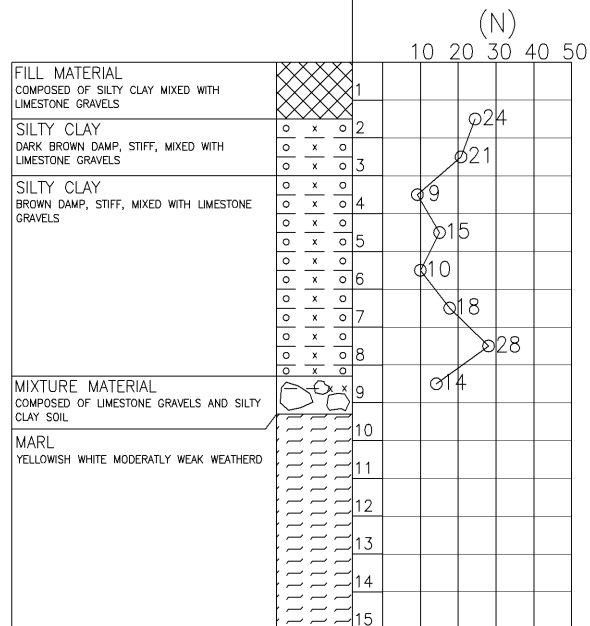
SBH-1.1(G.L.)

DEPTH=15m
S.W.L. = NOWATER
Static Water Level
January 2016



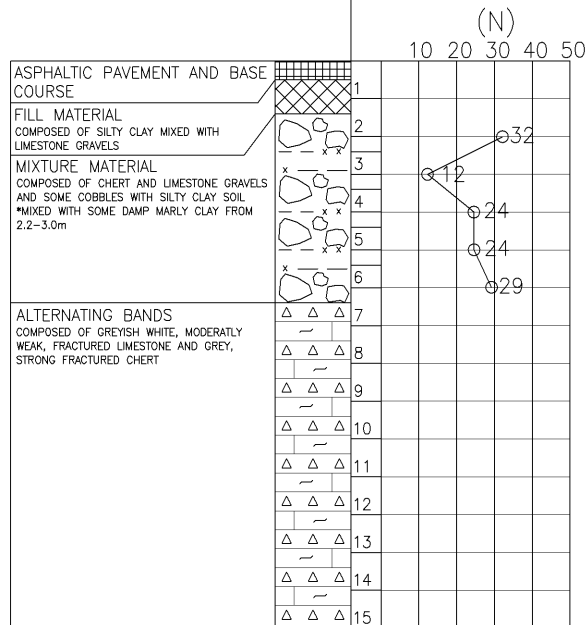
SBH-1.2(G.L.)

DEPTH=15m
S.W.L. = NOWATER
Static Water Level
January 2016



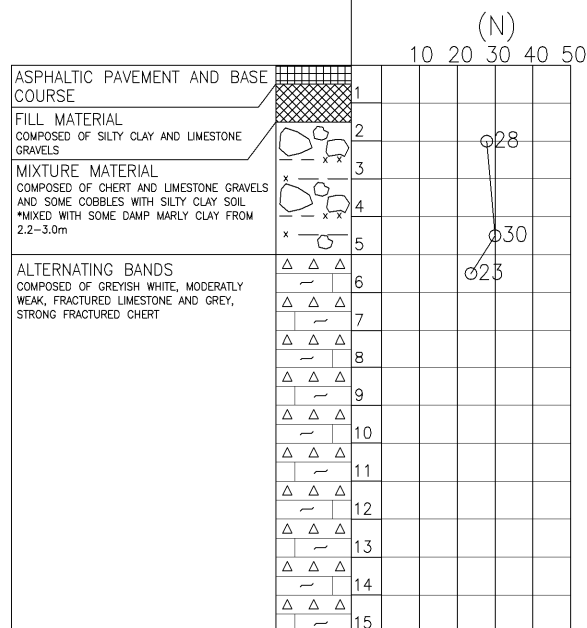
SBH-2.1(G.L.)

DEPTH=15m
S.W.L. = NOWATER
Static Water Level
January 2016



SBH-2.2(G.L.)

DEPTH=15m
S.W.L. = NOWATER
Static Water Level
January 2016

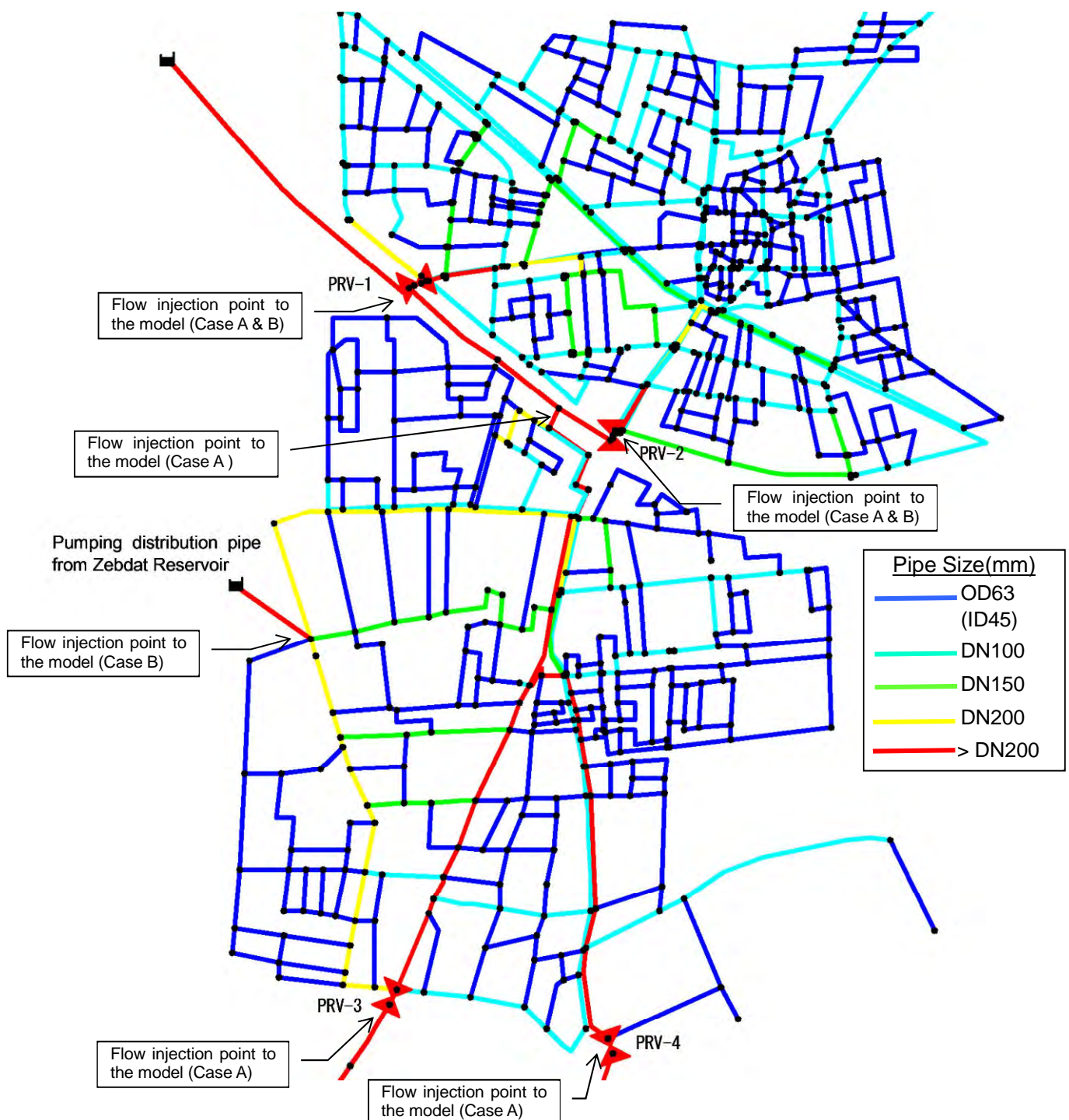


11-5 Result of Network Analysis

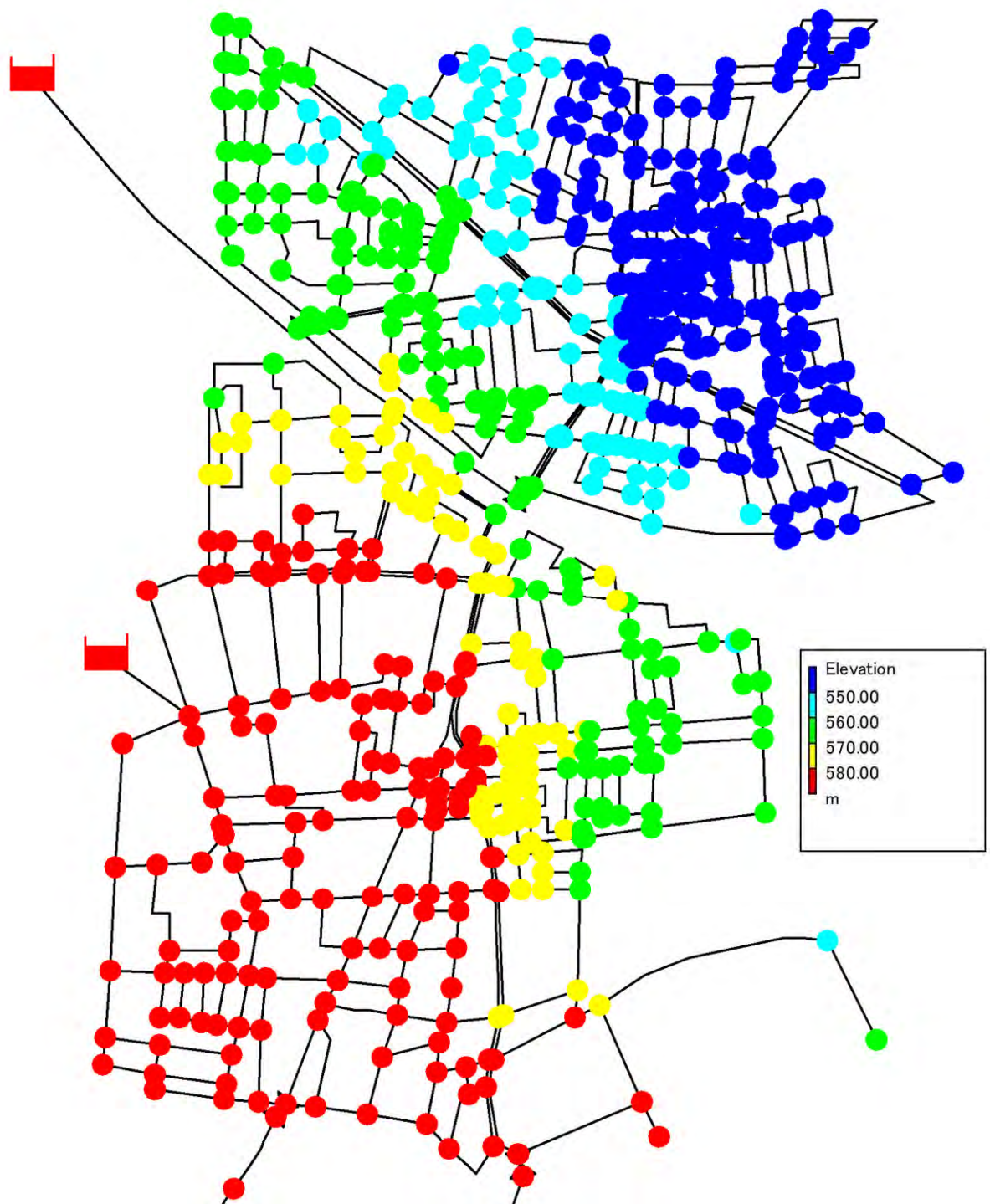
(1) Computation Conditions

- Program code: EPANET (open code published by EPA, United States Environment Protection Agency)
- Algorithm: Node energy potential method, Multi reservoirs application
- Formula: Hazen-Williams Formula
- C Value: 110
- Criteria of Pipe Diameter: Pressures range between 0.25 and 0.75MPa

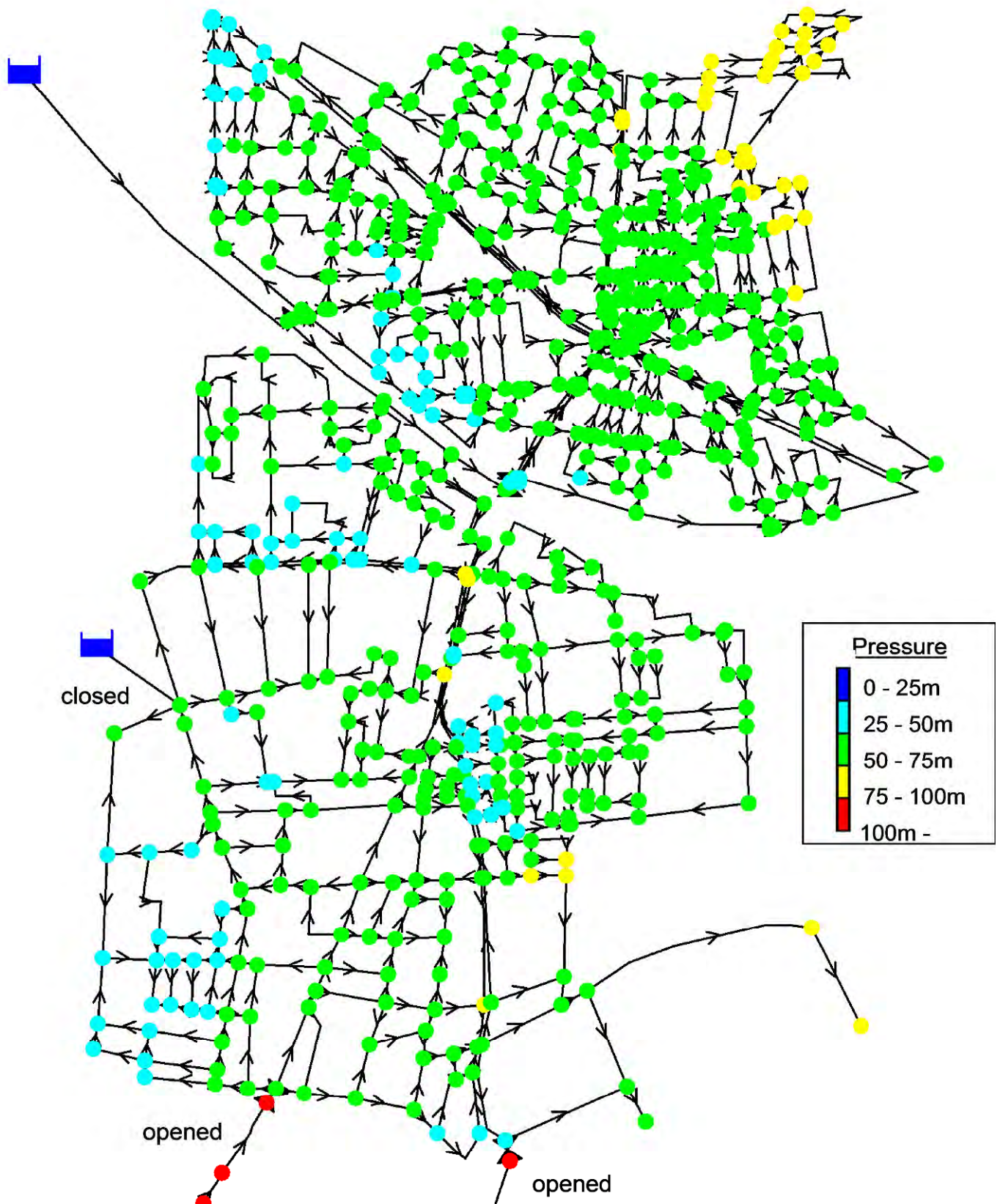
(2) Network Model



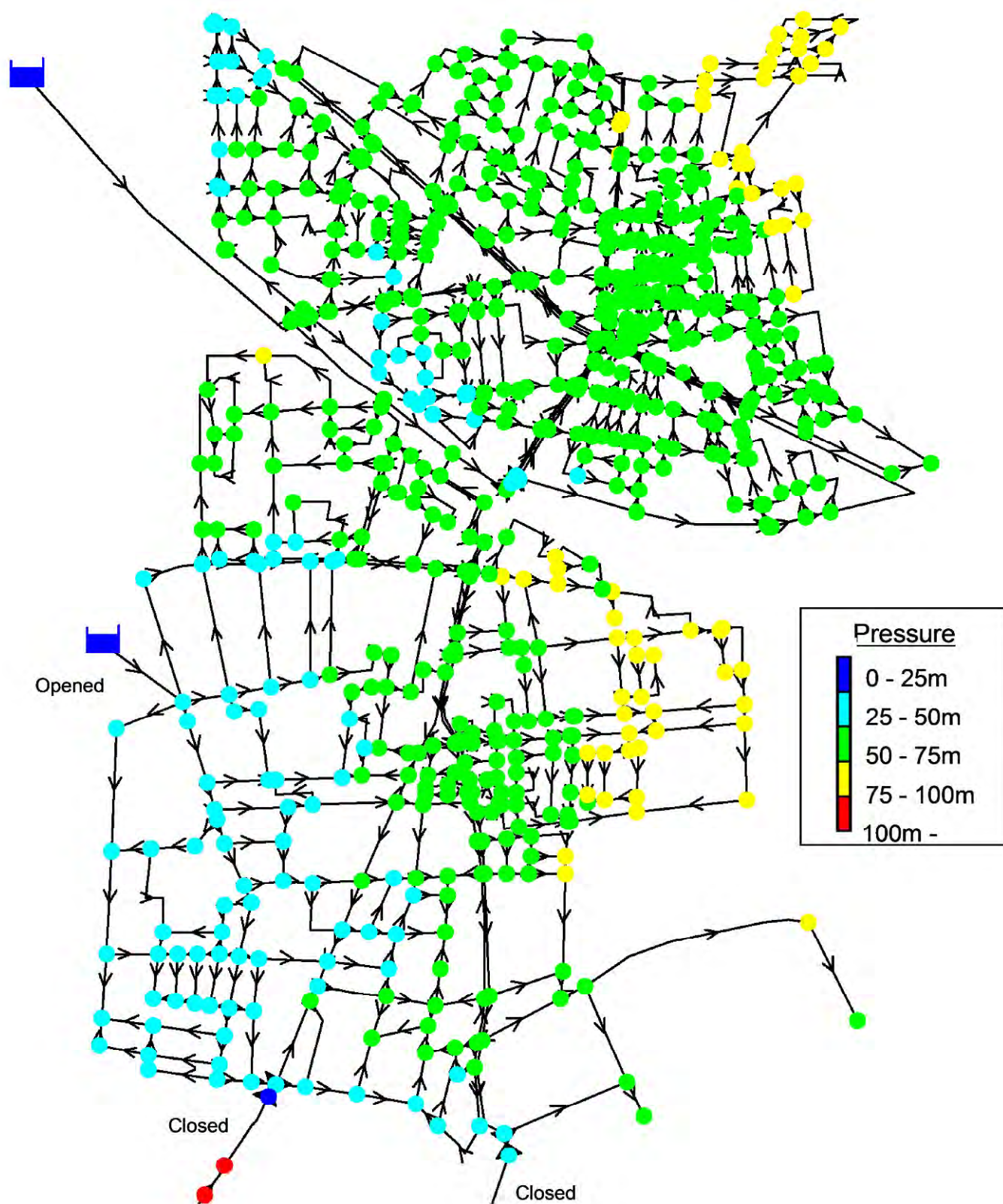
(3) Land Elevation



(4) Analysis result



Dynamic Water Pressure Distribution (Case-A)



Dynamic Water Pressure Distribution (Case-B)

11-6 Letter on Explanation on the Selection of Pipe Materials

The Preparatory Survey on the Project for Urgent Improvement of Water Sector for the Host Communities of
Syrian Refugees in Northern Governorates in the Hashemite Kingdom of Jordan Phase 2


December 28, 2016

Engineer Tawfiq Z. Habashneh,
Secretary General
Water Authority of Jordan

Supplementary Explanation on the Selection of Pipe Materials

We are pleased to inform you that we are now at the final stage of the captioned survey with your kind cooperation. The remaining issue is the selection of pipe materials, for which the technical notes dated November 17, 2016 were concluded by JICA Study Team and WAJ. In order to support the technical notes, further discussions were made between the JICA mission and WAJ in a series of meetings held on December 4 and 5. Both parties confirmed WAJ's intention to use High Density Poly-Ethylene (HDPE) for OD63mm pipe of pressure class PN25 in Hawwara and Sarieh as the same conclusion of the technical notes of November 17, 2016. However, a risk was pointed out that some areas might be subjected to high pressure exceeding the allowable internal pressure of HDPE pipe of grade PN25 unless the pressure reducing valves are properly functioning. For minimizing the risk, WAJ assured intensive maintenance of the pressure reducing valves governing the pressure of said areas. Since a technical justification of using HDPE pipe was not described in the technical notes, we have prepared a study summarizing the technical justification of using HDPE pipe as attached notes. We would appreciate your confirmation in writing of the attachment and your subsequent decision of using HDPE pipe in said areas. Upon your confirmation reaching us, we will prepare the draft final report within December 2016 as agreed in the meeting.

Thanking you for your continuous cooperation,
Sincerely,



Eng. Kazufumi Momose
Team Leader
JICA Study Team
TEC International Co., Ltd.

cc:

Eng. Iyad Dahiyat, Secretary General of Ministry of Water and Irrigation
Eng. Salame Mahasneh, Project Manager, Project Management Unit
Eng. Bashar Bataineh, Project Manager, Project Management Unit

Mr. Tsutomu Kobayashi, Senior Representative, JICA Jordan Office

Ms. Eriko Tamura, Head of Water Resources Group, Global Environmental Department, JICA

Attachment:

Maximum Water Pressure and Material Selection for diameter 63 mm pipe in Hawwara and Sarieh

Summary

WAJ and JICA Study Team have mutually understood on the captioned issues as follows:

- Maximum water pressure in the target area in case of supplying water from Hofa reservoir (**Case A**, refer to the Detailed Evaluation) might exceed 250 m or the allowable water pressure of High Density Poly-Ethylene (HDPE) pipe with class PN25, in case 3 Pressure Reducing Valves (PRVs) are out of order simultaneously.
- Ductile cast Iron (DCI) pipe with class K9, which possess much higher allowable water pressure than HDPE pipe, should be used in the target area in case 3 PRVs are out of order simultaneously. However, the period of water supply system for Case A will be short; about 1 year at most because supplying water from Zebdat reservoir (**Case B**, refer to the Detailed Evaluation) is expected to start in 2020 assuming that this Project requires at least 3 years from 2017 for completion and will start its operation in 2020.
- In Case B, maximum water pressure is less than 250 m, which is less than the allowable water pressure of HDPE (PN25) pipe, and the HDPE (PN25) pipe can be used for the target area.
- Scope of the Project will be reduced if DCI pipe is used instead of HDPE pipe because price of DCI pipe is much higher than HDPE pipe.
- The suitable diameter of DCI pipe is 75mm in this case. This diameter is not used in Jordan and special pipe maintenance is required only for this area.
- Alternately, HDPE (PN25) pipe can be used for the target area even for Case A if WAJ maintains PRVs periodically and properly, and thus simultaneous out of order of 3 PRVs can be avoided.

Based on the understanding above, WAJ has decided to use HDPE with class PN25 committing that WAJ will make periodical and proper maintenance of PRVs.

Detailed Evaluation

1. Maximum Water Pressure

Maximum water pressure (static water pressure and water hammer pressure) in the target area depends on the water distribution systems (Cases A and B) in this Project.

- Case A: Water is supplied from **Hofa reservoir** (water level is 790 m) **up to 2019**- See Figure 1 (3 PRVs are installed under the 1st stage grant aid project.)
- Case B: Water is supplied from **Zebdat reservoir** (water level is 630 m) **from 2020** –see figure 2

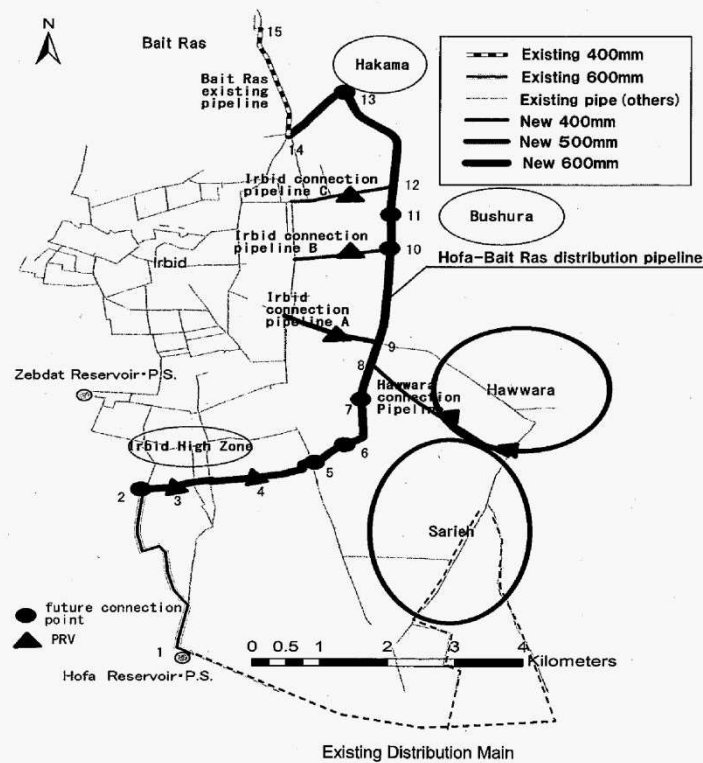


Figure 1: Water Supply to Hawwara and Sarih (Case A: from Hofa reservoir)

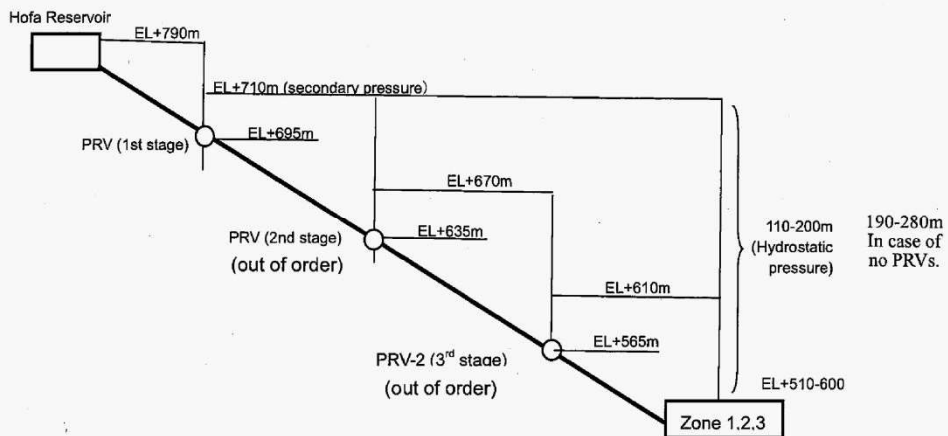


Figure 2: Maximum Working Pressure during Out of Order of Two PRVs

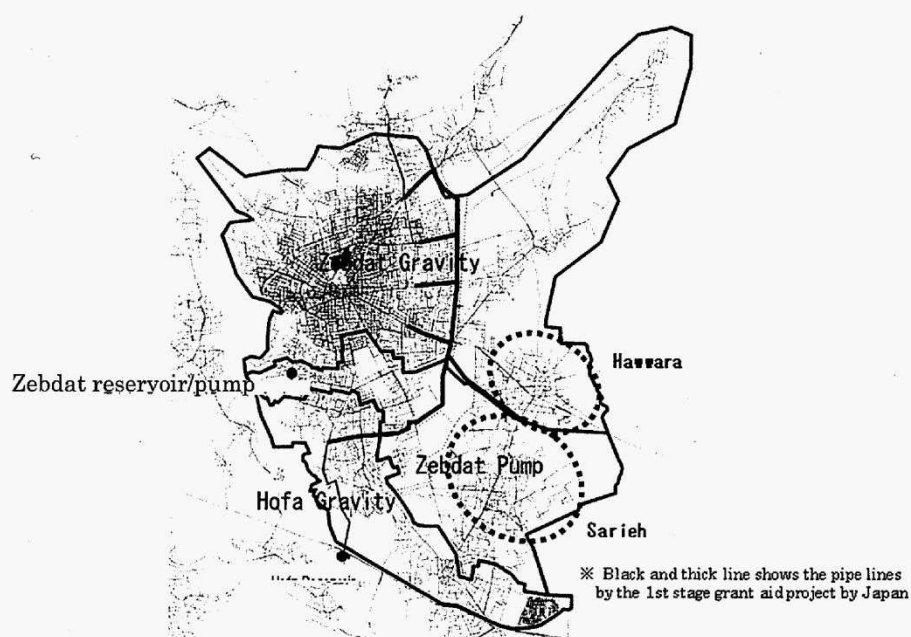


Figure 3: Water Supply to Hawwara and Sarieh (Case B: from Zebdat reservoir or pump)

The possible maximum water pressures by distribution system, by zone and by number of PRVs simultaneous out of order are shown below. The maximum water pressure is estimated as sum of maximum static pressure (difference between Hofa reservoir and the elevation of target area) plus water hammer pressure (55 m for DCI and 25 m for plastic pipe) calculated based on “The Design Guideline for Water Supply Facilities 2012” in Japan.

Table 1: Maximum Water Pressure for HDPE pipe

Distribution system case	Zone 1 and 2	Zones 3	No. of PRVs simultaneous out of order among 3 PRVs
A	305m	255m	3
	225m	175m	2
	185m	135m	1
B	146m	146m	n.a.
	138m	138m	n.a.

Note: Zones are shown in Figure 3. Zone 4 is located in higher altitude area so that PN 25 pipe can satisfy the maximum water pressure in this Zone. Therefore, Zone 4 is not mentioned in the table.

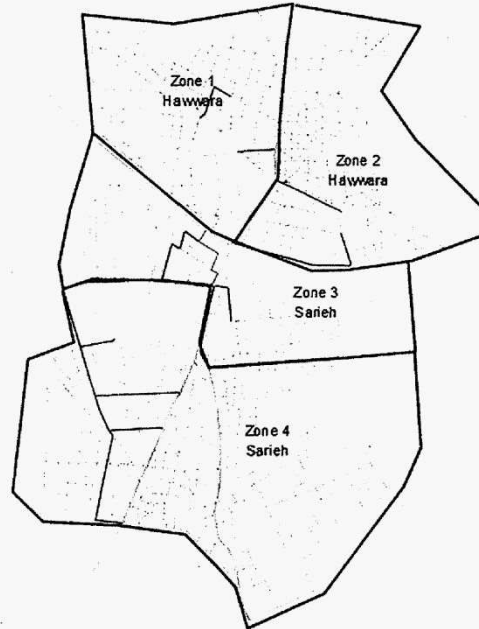


Figure 3: Zones 1 to 4 in Hawwara and Sarieh

2. Pipe Material according to Maximum Water Pressure

WAJ always uses HDPE pipe for diameter 63 mm pipe. The HDPE pipe has 3 classes against pressure; PN10 (100 m, maximum tolerate pressure, used widely in Japan), PN16 (160 m, normally used in Jordan) and PN25 (250 m). HDPE (PN25) pipe is applicable to the most cases in the target area except the case that 3 PRVs are out of order simultaneously in case A, in which Ductile Cast Iron (DCI) pipe (K9) should be used for 3 zones to tolerate the maximum water pressure as shown in table below.

Table 2: Pipe Material Selection against Maximum Water Pressure by distribution system and by zone and by PRVs simultaneous out of order

Distribution system case	Zone 1 and 2	Zones 3	No. of PRVs simultaneous out of order among 3 PRVs
A	DCI (K9)	DCI (K9)	3
	HDPE (PN25)	HDPE (PN25)	2
	HDPE (PN25)	HDPE (PN16)	1
B	HDPE (PN16)	HDPE (PN16)	n.a.
	HDPE (PN16)	HDPE (PN16)	n.a.

Note: Ductile Cast Iron pipe, DCI pipe
High Density Polyethylene Pipe, HDPE pipe

3. Conditions of Occurrence of Maximum Water Pressure

The maximum water pressure may occur only when the following incidents (3 PRVs out of order simultaneously and maximum water pressure plus water hammer pressure) occurs at the same time in Case A distribution system. These incidents may rarely occur at the same time.

- Case A distribution system from Hofa reservoir
The period of this distribution system will be 1 year at most because;
 - This Project will be in operation in 2020 at the earliest (1 year for detailed design and tendering and 2 years for pipe laying from 2017).
 - Wadi Arab 2nd stage (Case B distribution system) is expected to be operational in 2020.
- Three (3) PRVs are out of order simultaneously; 2 PRVs along the Hofa – Bait Ras main pipeline and 1 PRV at the inlets of zones are already installed.
- Maximum static pressure (it happens when water flow is zero) plus water hammer pressure (25 m for HDPE pipe estimated based on the “The Design Guideline for Water Supply Facilities 2012” in Japan. Water hammer may occur when flow velocity in pipe is quickly changed e.g. all valves in the network are closed quickly.

4. Possibility of HDPE Pipe Burst

If the conditions above are all met, maximum water pressure may exceed 250 m water pressure (2.5 Mpa) in some areas. With these conditions, if HDPE (PN25) pipe is used, burst may occur in the area where the maximum water pressure exceeds 2.5 Mpa. The following table shows possibility of pipe burst by pipe material and pressure type.

Table 3: Possibility of Pipe Burst

Distribution system case	No. of PRV, out of order	DCI (K9)	HDPE (PN25)
A	3	No	Yes
A	2	No	No.
A	1	No	No
B	n.a.	No	No

5. Comparison of HDPE pipe and DCI pipe

As per above discussion, DCI (K9) and HDPE (PN25) pipes may be selected for the pipe materials for the target area. The following table shows comparison of HDPE (PN25) and DCI (K9) pipes.

Table 4: Comparison of HDPE (PN25) pipe and DCI (K9) pipe

Item	HDPE pipe 63mm (PN25)	DCI pipe 75mm (K9)
Materials availability	○ Commonly available material in Jordan	× Not used in Jordan
Maintenance of pipe	○ Repair works can be quickly conducted using the common stock	× Not kept in stock. A separate stock is required only for this area and special Saddle for service connection is required for only this project
PRV maintenance	△ Periodical inspection of PRVs is strongly recommended to prevent 3 PRVs out of order simultaneously that may lead to pipe burst in Case A distribution system.	△ Periodical inspection of PRVs is recommended.
Suitability with Case A distribution system	× Maximum water pressure exceeds pipe tolerance level in Case A distribution system.	○ Maximum water pressure is within the pipe tolerance level.
Suitability with Case B distribution system	○ If Case B distribution system is in operation in 2020, maximum water pressure is less than 2.5 Mpa and HDPE (PN25) pipe is suitable.	△ If Case B distribution system comes in operation in 2020, DCI (K9) is over specification.
Pipe Laying Cost	○ Pipe laying cost (1.1 billion Japanese Yen) is lower than DCI pipe.	× Pipe laying cost (1.3 billion Japanese Yen) is higher than HDPE pipe.
Overall evaluation	○	△

Note: ○: good, △: fair, ×: bad

As a result of comparison in table above, HDPE (PN25m) has been selected for the following main reasons.

- Suitability with Case B distribution system which will be completed and come in operation in 2020
- Easiness in pipe maintenance
- Pipe burst will be prevented by periodical and proper maintenance of PRVs even in Case A distribution system

6. Requirement of PRV maintenance

When HDPE pipe is selected, PRVs should be maintained periodically and properly in order to avoid PRVs going out of order.

The following are the main causes of PRV going out of order.

- Small objects like small stones, woodchips and debris enter into the PRV
- Copper tubes for drawing water from upstream and downstream main pipes to the PRV actuator are clogged with small objects.

To avoid PRV going out of order, following maintenance is required and WAJ has to ensure this maintenance.

- Strainer and filters at the copper tubes both equipped with the PRV should be cleaned periodically (every 3 months or less).
- Regular measurement of the downstream pressure at the PRV. In case the downstream pressure of PRV is out of the value set initially, it should be adjusted to the initial value.
- Spare parts of PRV should be kept always.
- After-service system for PRV should be established in case of the damage of PRV.

11-7 Cost Comparison between PE Pipes and DCI Pipes (Supplement to 11-6)

Regarding cost comparison between PE Pipes and DCI Pipes as supplement to the Table 4 of previous Appendix 9.6, its details are shown as below. The cost of DCI pipes is 1.22 times as higher as that of PE pipes.

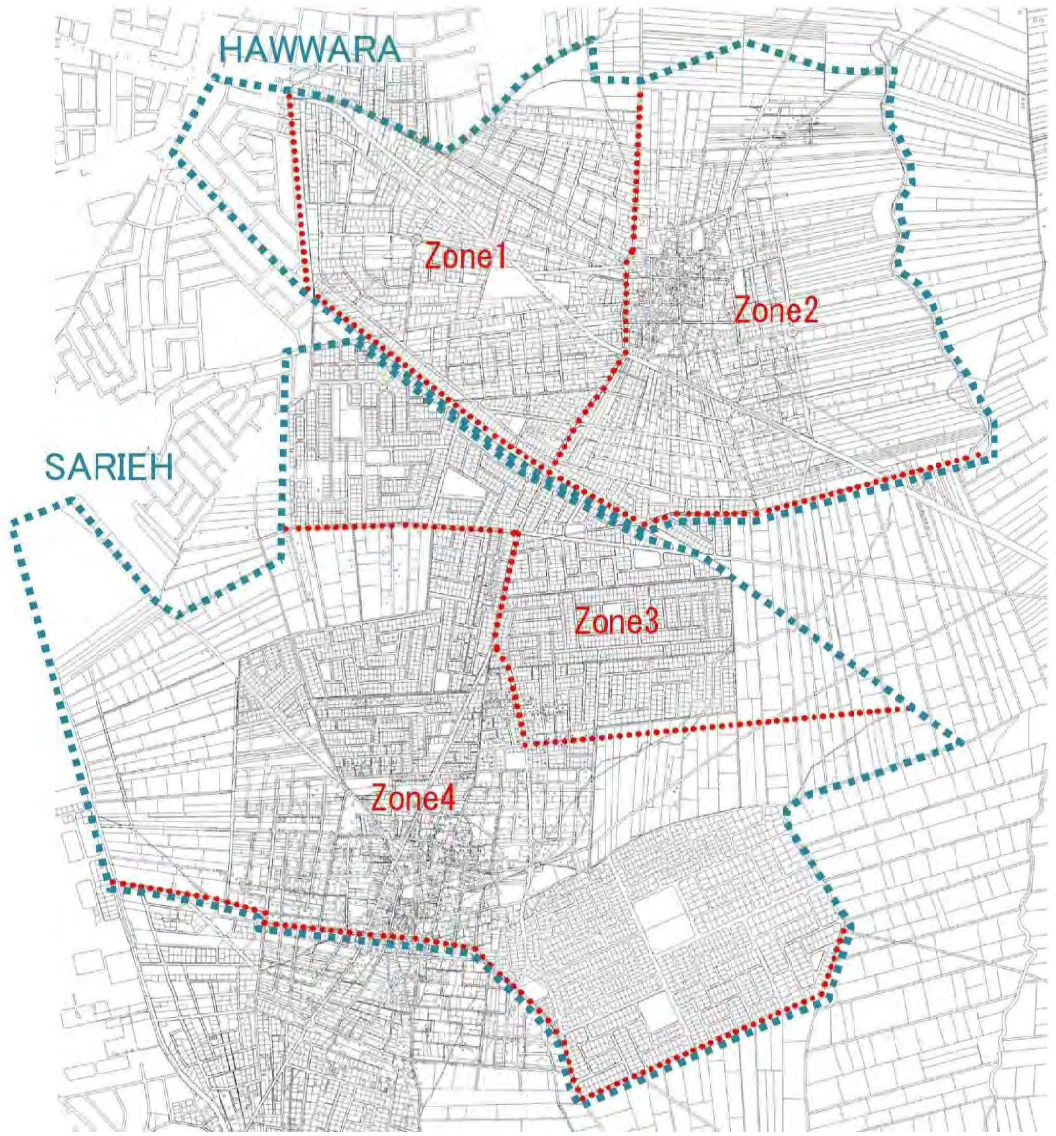
Cost Comparison between PE Pipes and DCI Pipes

Unit: thousand Japanese Yen

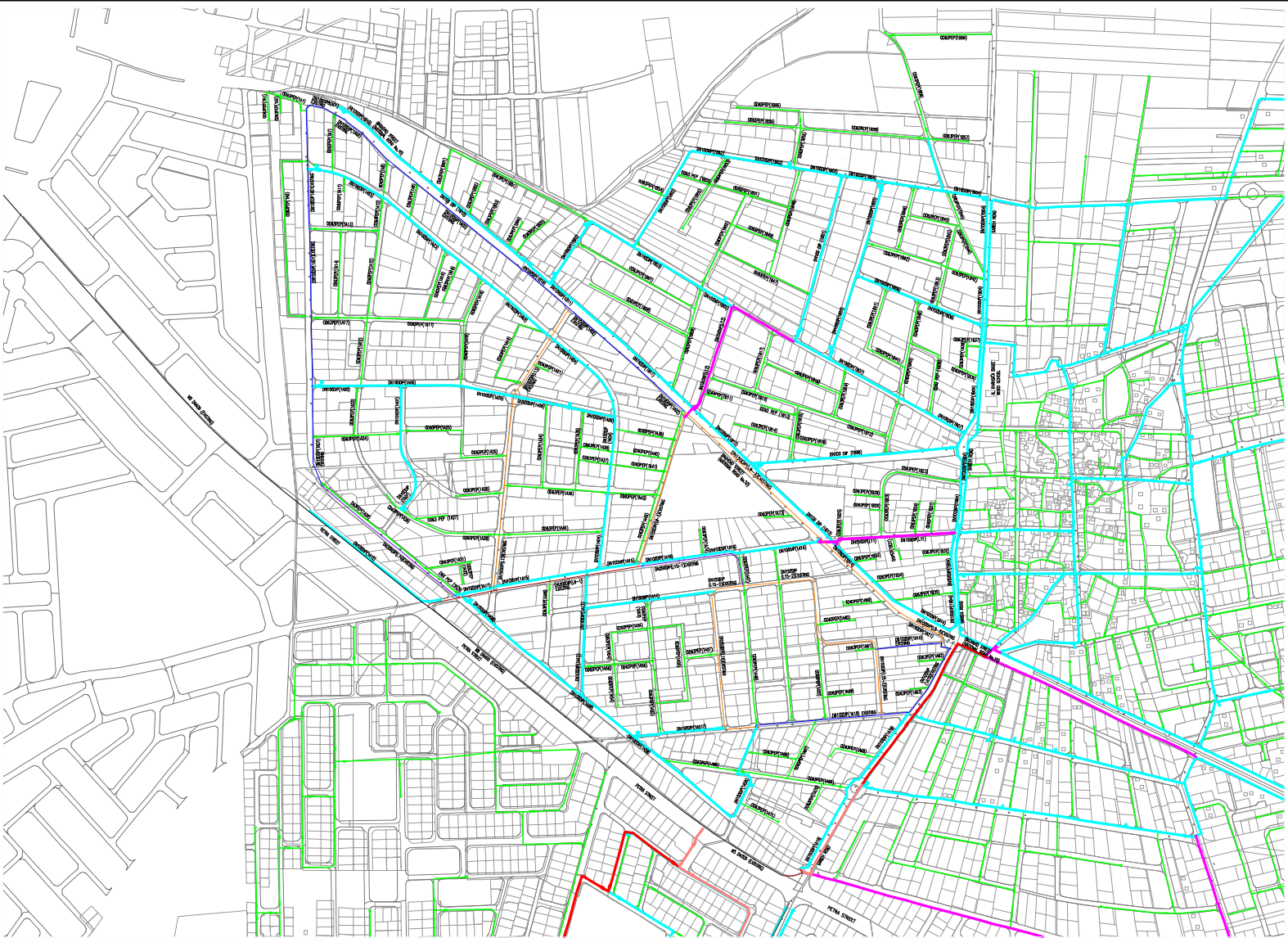
Item		PE Pipe (OD63mm)	DCI Pipe (DN80mm)
Zone 1	Material Cost	26,800	83,100
	Pipe Installation Cost	29,100	42,300
	Civil Works Cost	259,830	259,830
	Sub Total	315,730	385,230
Zone 2	Material Cost	36,300	110,400
	Pipe Installation Cost	37,000	55,100
	Civil Works Cost	336,780	336,780
	Sub Total	410,080	502,280
Zone 3	Material Cost	24,900	78,300
	Pipe Installation Cost	26,600	39,600
	Civil Works Cost	253,260	253,260
	Sub Total	304,760	371,160
Total		1,030,570	1,258,670
Cost Ratio		1.00	1.22

Note: Civil works mainly consists of restoration of road surface.

11-8 Outline Design Drawings



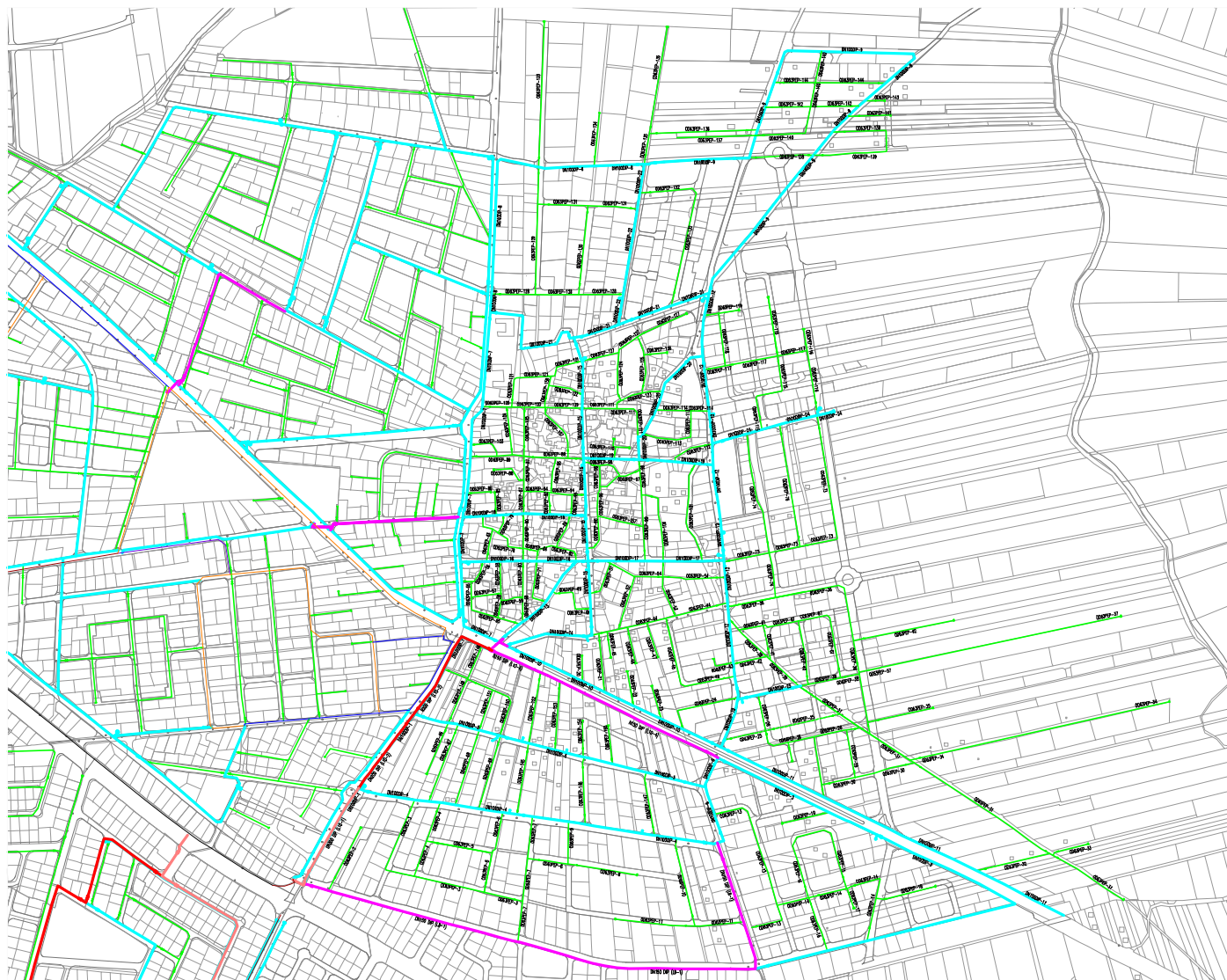
No. 1	ZONE DIVIDED PLAN
ゾーン区分図	



No. 2

ZONE1 GENERAL SITE PLAN

ゾーン1 全体計画図



No. 3

ZONE2 GENERAL SITE PLAN

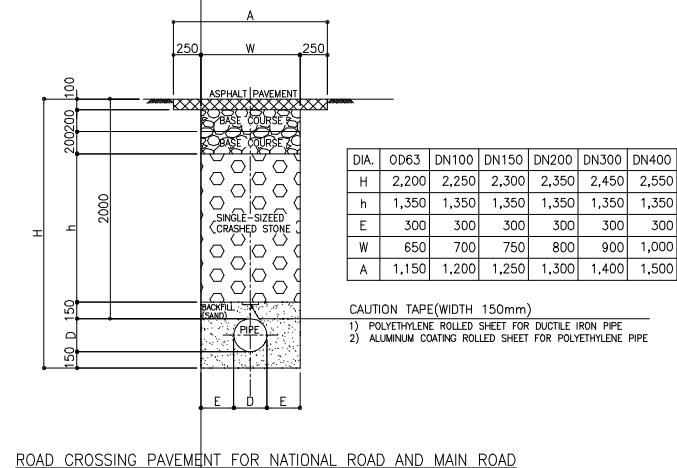
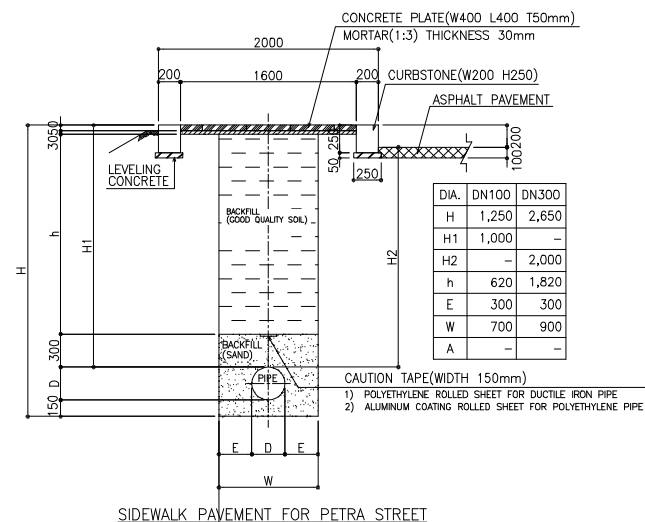
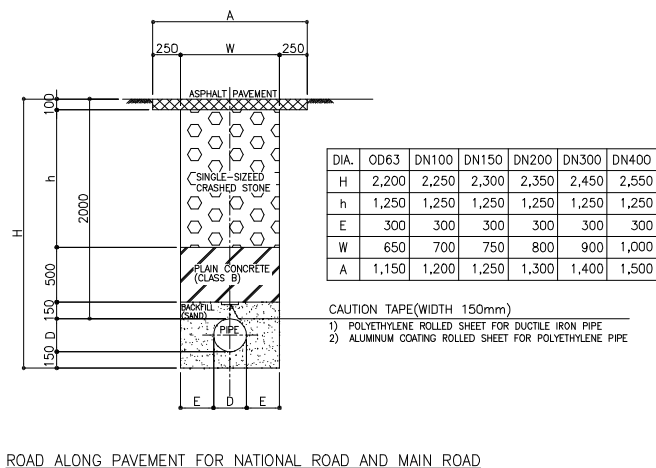
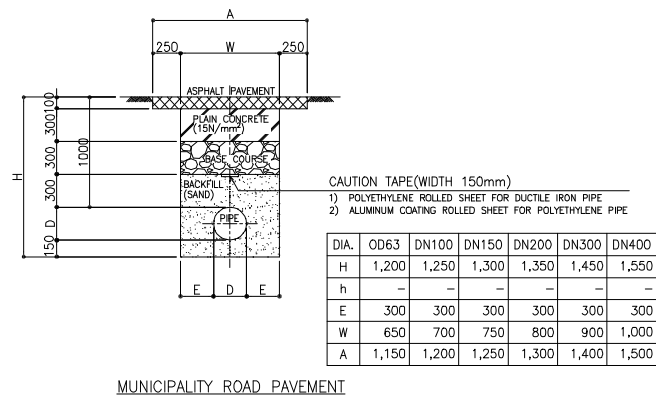
ゾーン2 全体計画図



No. 4

ZONE3 GENERAL SITE PLAN(1)

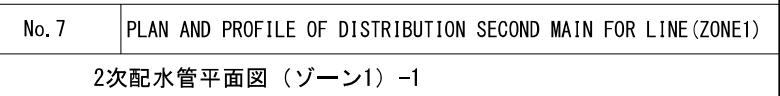
ゾーン3 全体計画図(1)

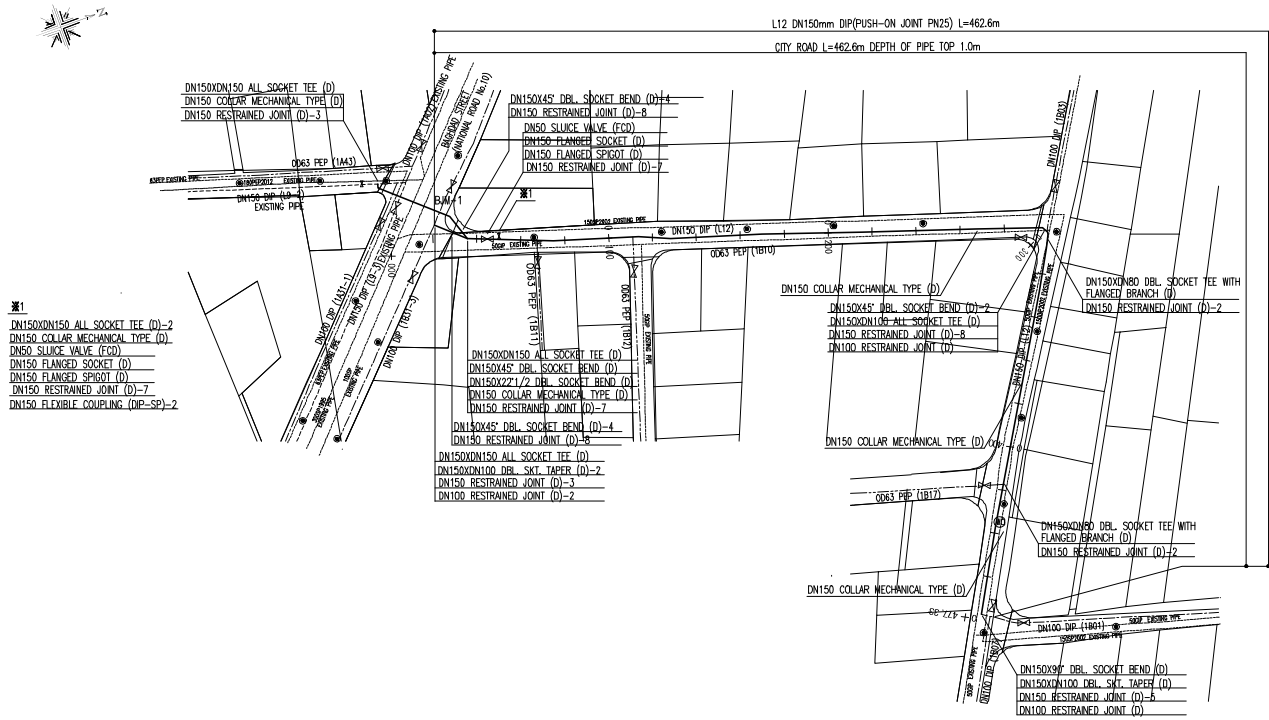


No. 6

TYPICAL TRENCH CROSS SECTION FOR PIPELINE IN THE ROAD UNDER WP WH

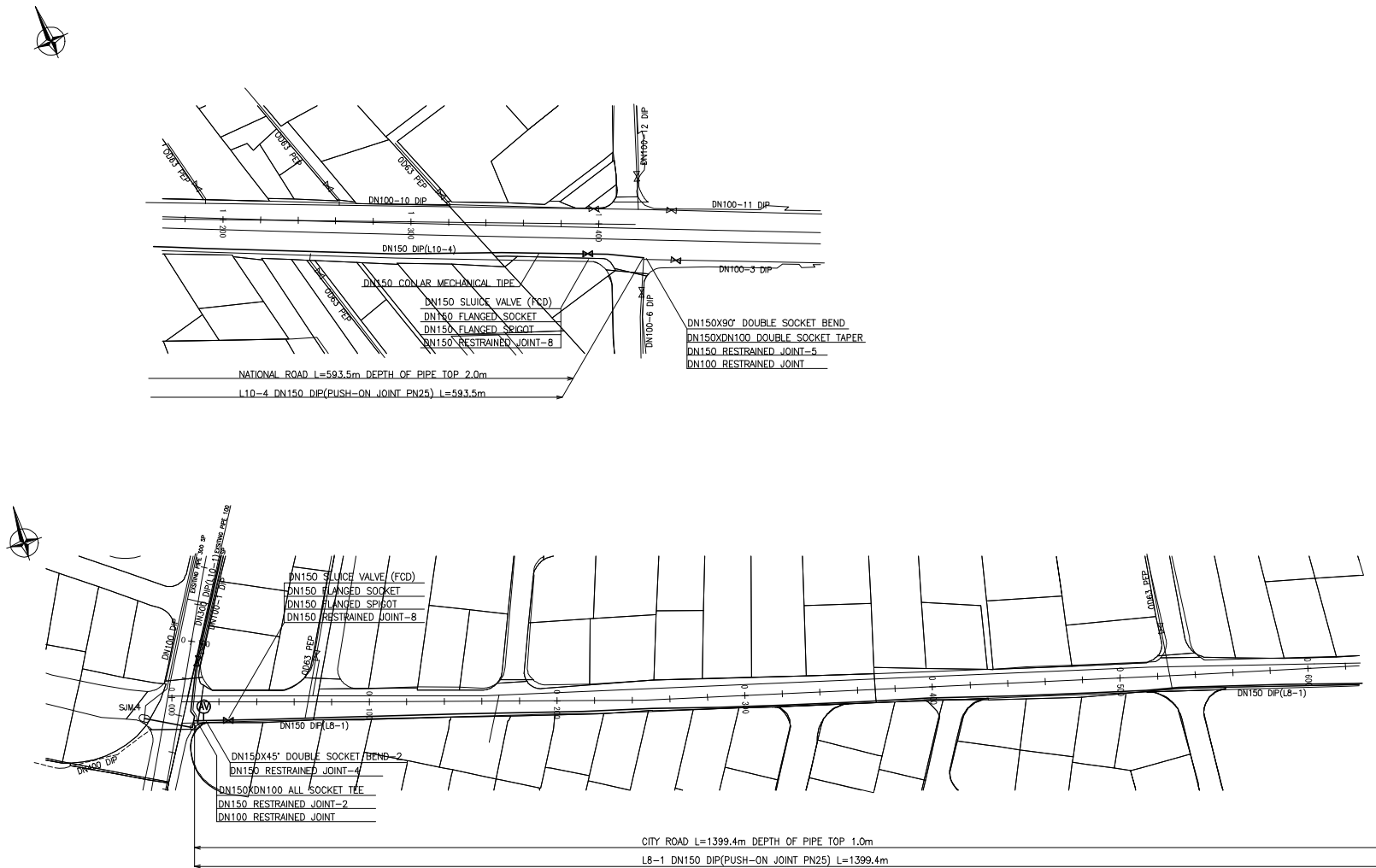
配水管路掘削標準断面図



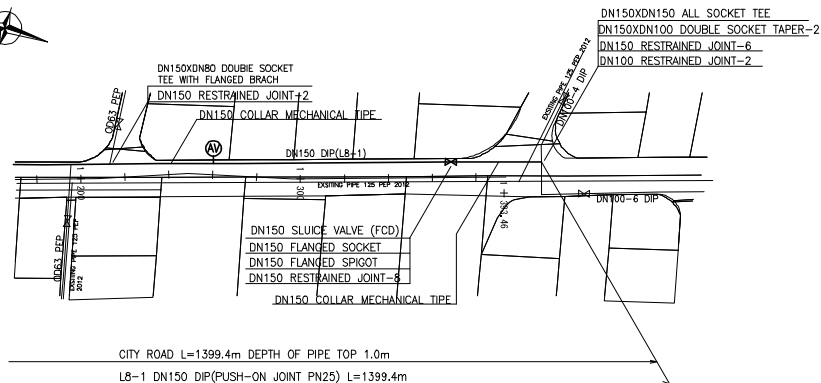
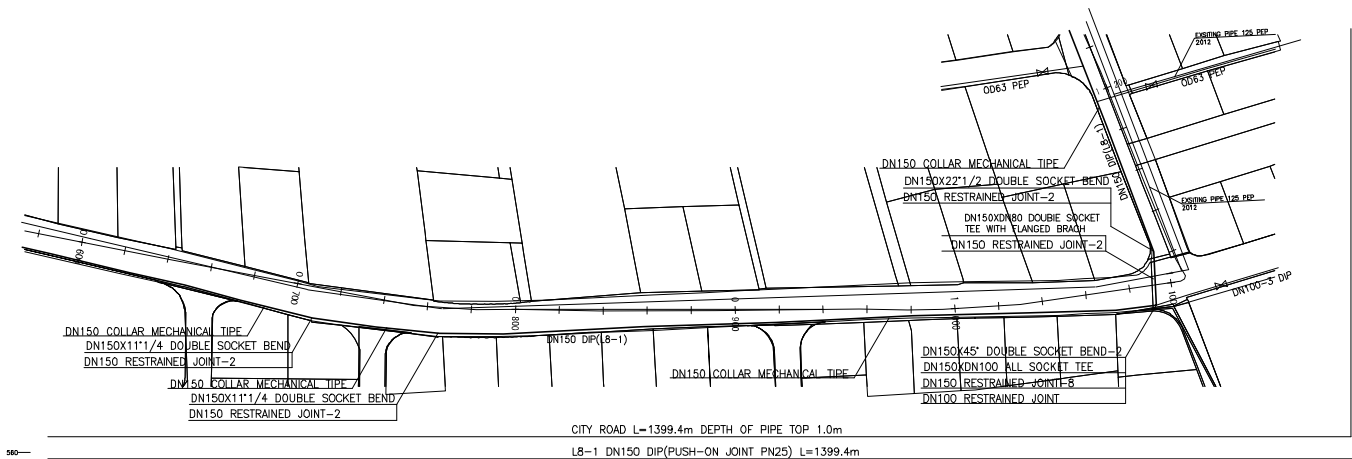


No.8	PLAN AND PROFILE OF DISTRIBUTION SECOND MAIN FOR LINE (ZONE1)
------	---

2次配水管平面図（ゾーン1）-2

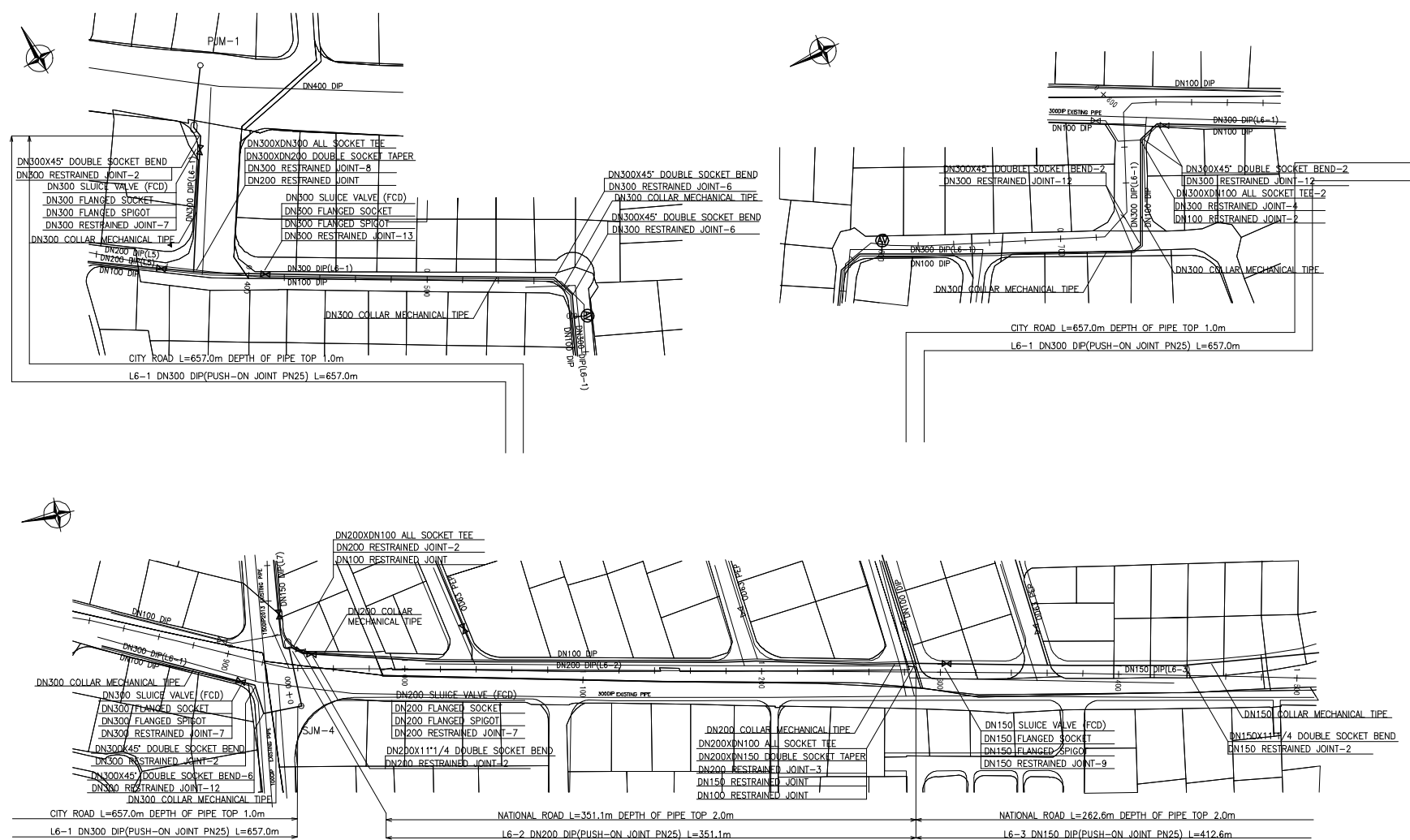


No. 10	PLAN AND PROFILE OF DISTRIBUTION SECOND MAIN FOR LINE (ZONE2)
2次配水管平面図 (ゾーン2) -2	



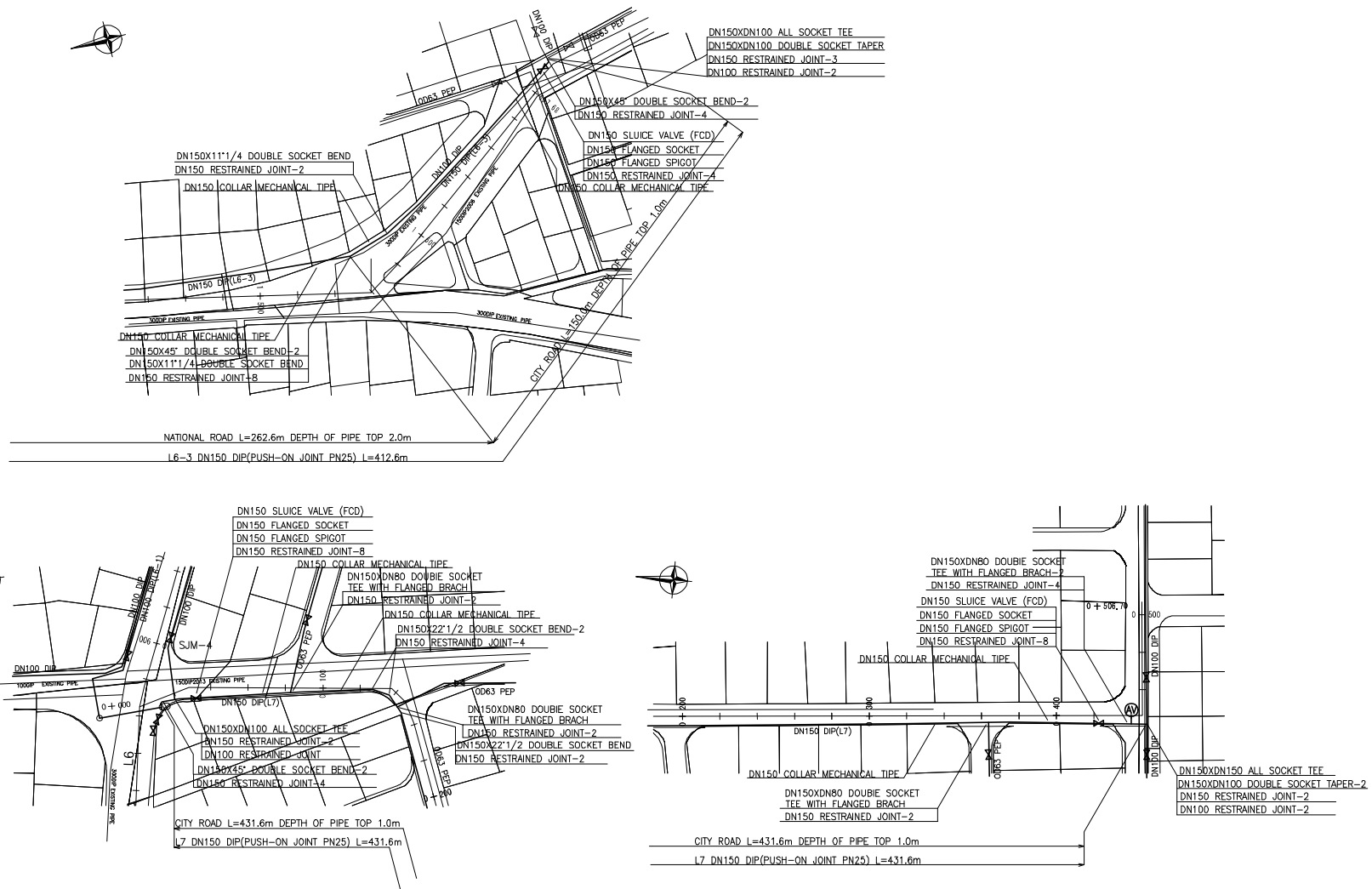
No. 11 PLAN AND PROFILE OF DISTRIBUTION SECOND MAIN FOR LINE (ZONE2)

2次配水管平面図（ゾーン2）-3



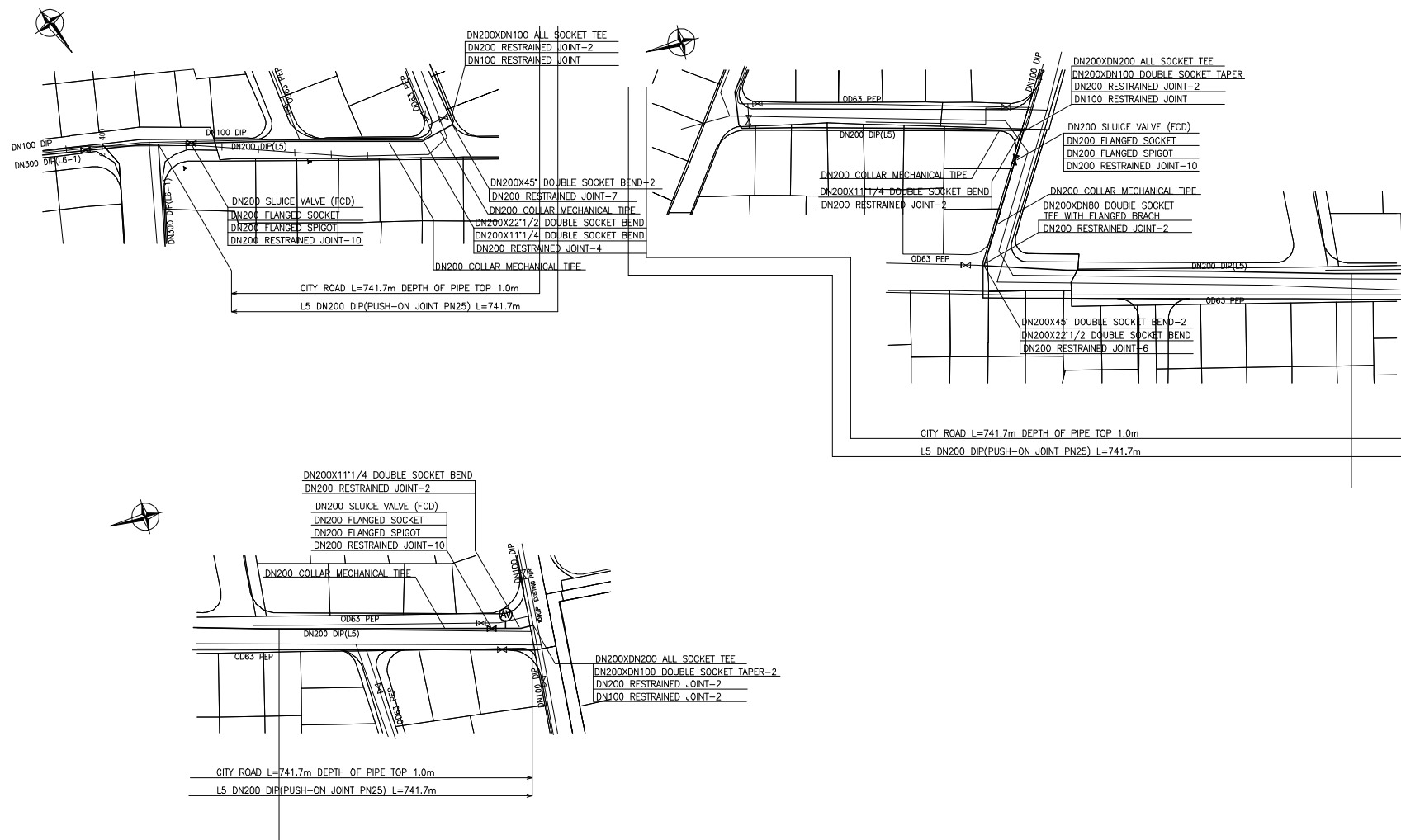
No. 12	PLAN AND PROFILE OF DISTRIBUTION SECOND MAIN FOR LINE (ZONE3)
--------	---

2次配水管平面図（ゾーン3）-1



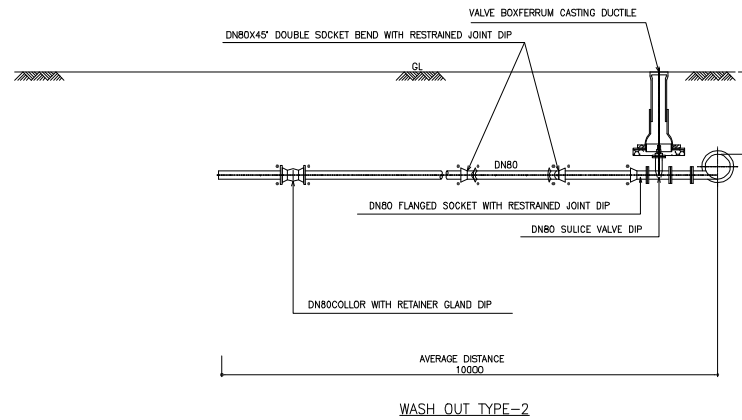
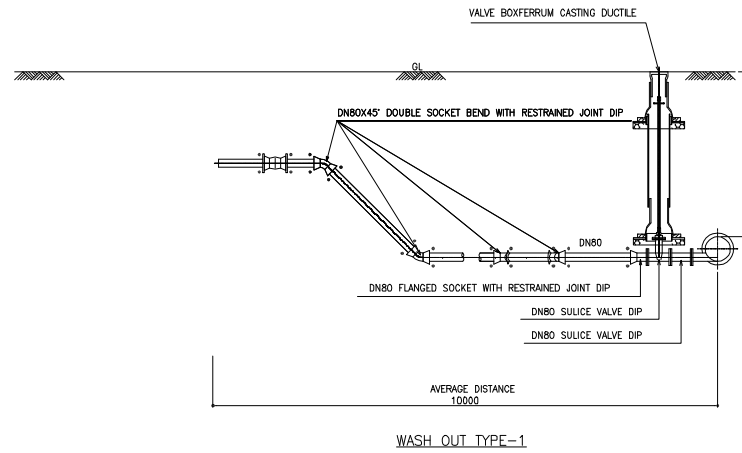
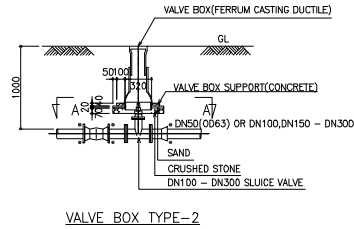
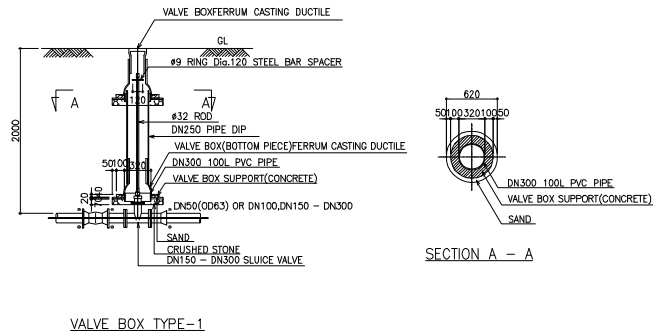
No. 13	PLAN AND PROFILE OF DISTRIBUTION SECOND MAIN FOR LINE (ZONE3)
--------	---

2次配水管平面図（ゾーン3）-2

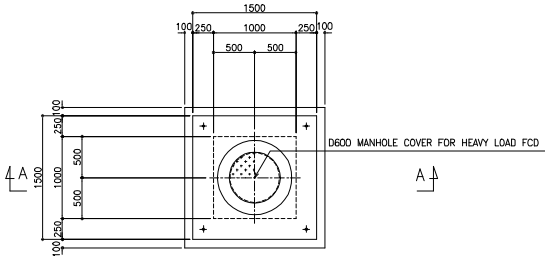


No. 14	PLAN AND PROFILE OF DISTRIBUTION SECOND MAIN FOR LINE (ZONE3)
--------	---

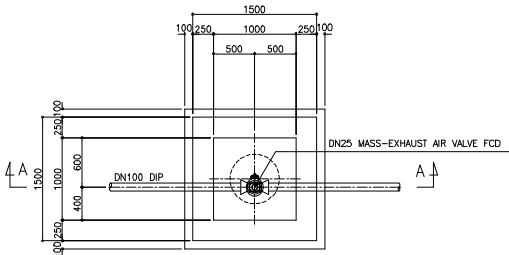
2次配水管平面図 (ゾーン3) -3



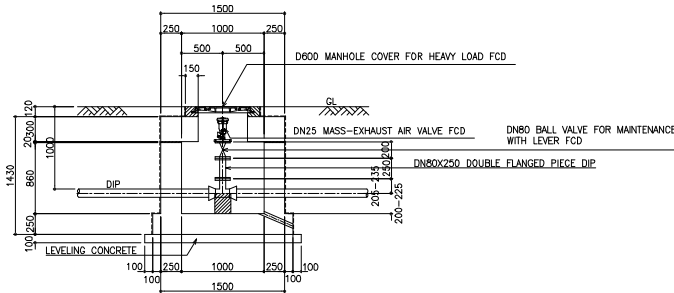
No. 15	STRUCTURAL DRAWING OF CHAMBER 1
弁室構造図 1	



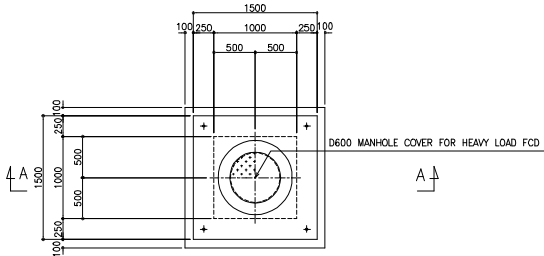
PLAN OF TOP



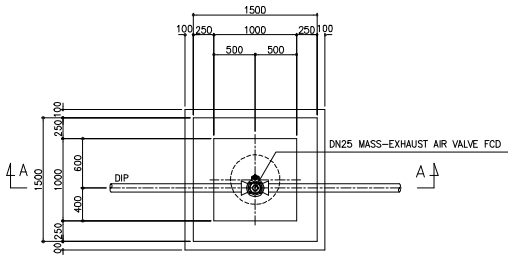
PLAN OF BASEMENT



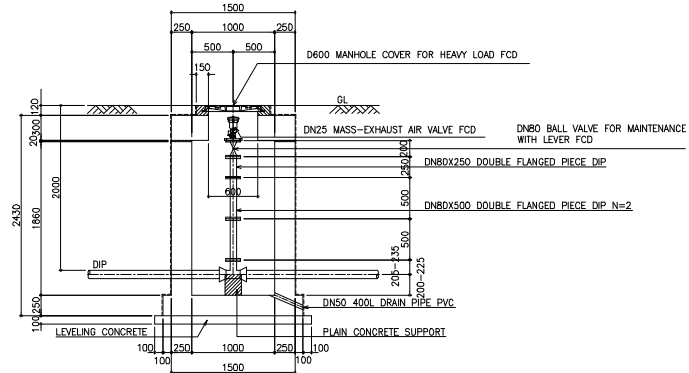
SECTION A - A DEPTH OF PIPE TOP 1.0m



PLAN OF TOP

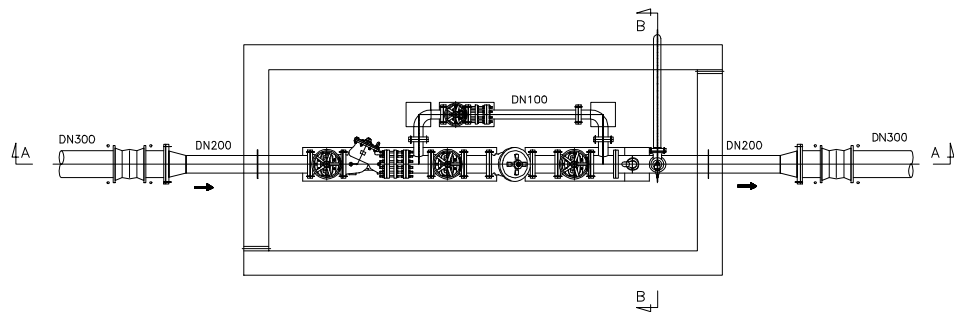


PLAN OF BASEMENT

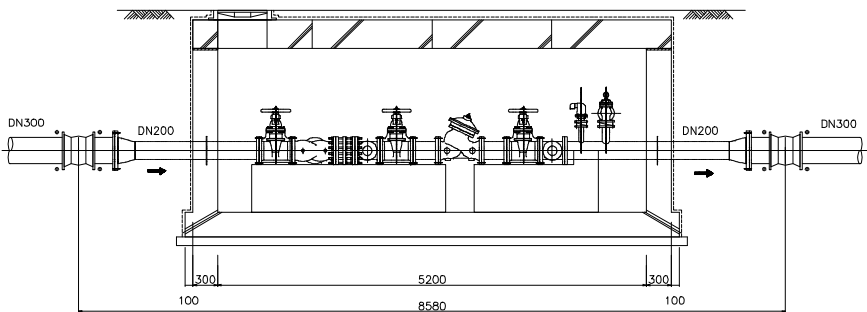


SECTION A - A DEPTH OF PIPE TOP 2.0m : TYPE1

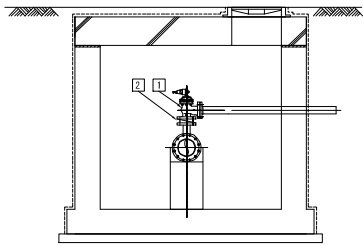
No. 16	STRUCTURAL DRAWING OF CHAMBER 2
弁室構造図 2	



PLAN



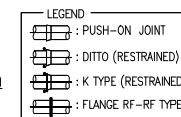
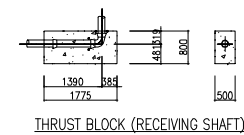
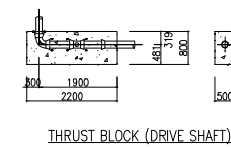
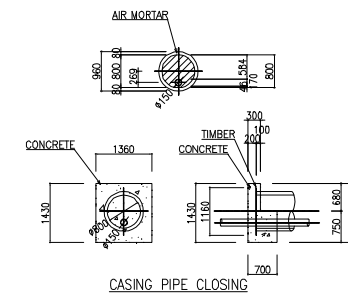
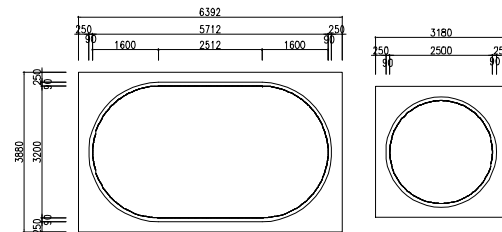
SECTION A-A



SECTION B-B

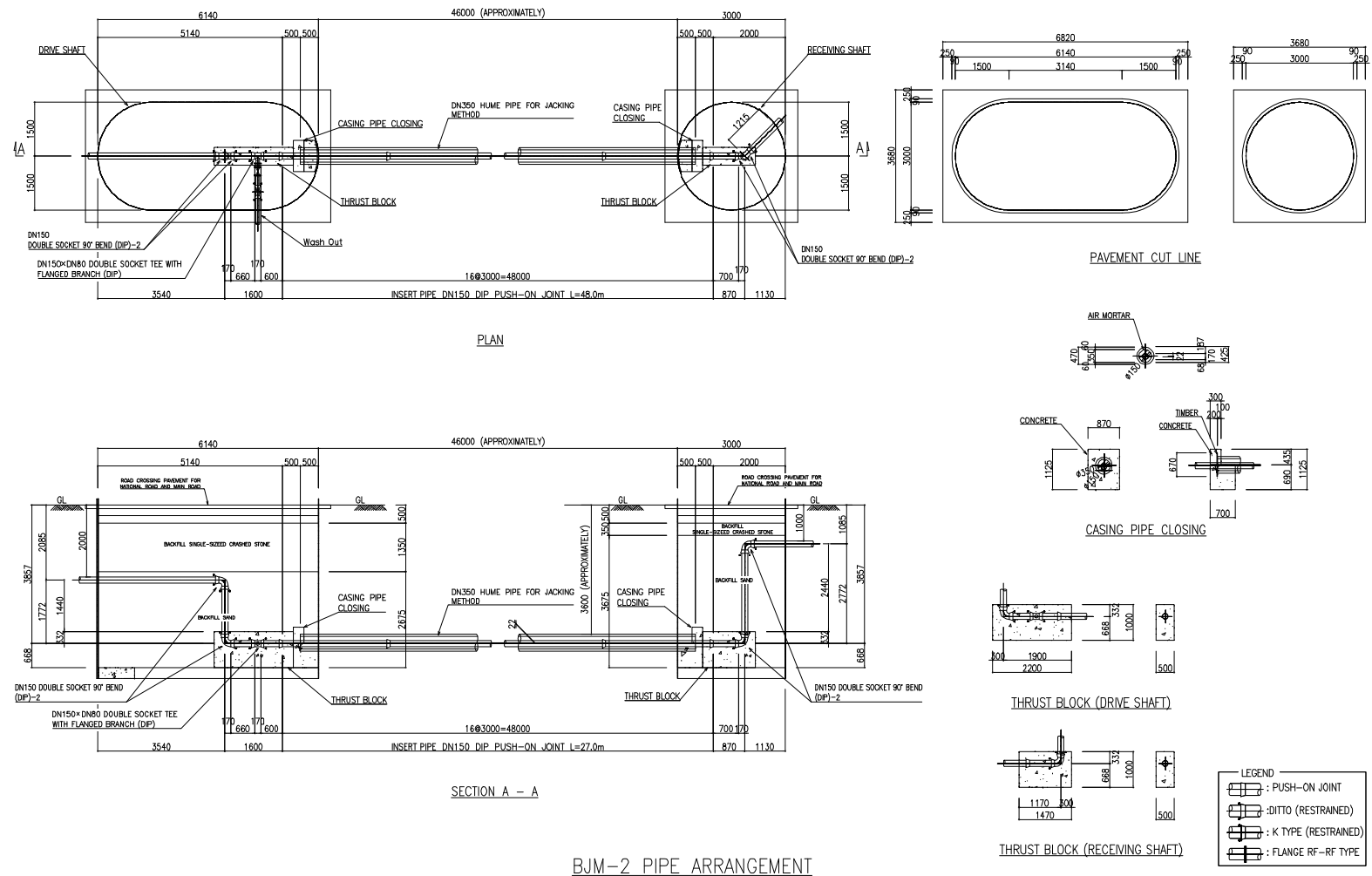
PRESSURE REDUCING VALVE

No. 17	STRUCTURAL DRAWING OF CHAMBER 3
弁室構造図 3	



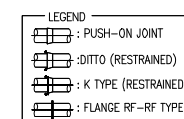
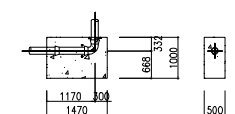
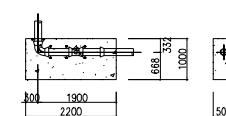
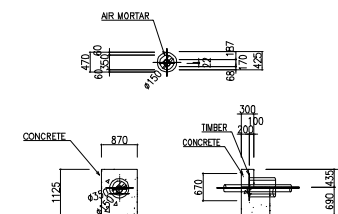
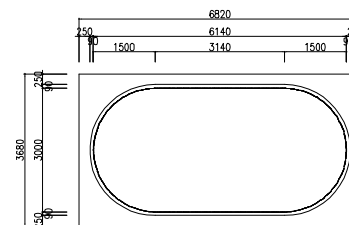
BJM-1 PIPE ARRANGEMENT

No. 19	BJM-1 PIPE ARRANGEMENT
BJM-1 推進工法位置 配管計画	



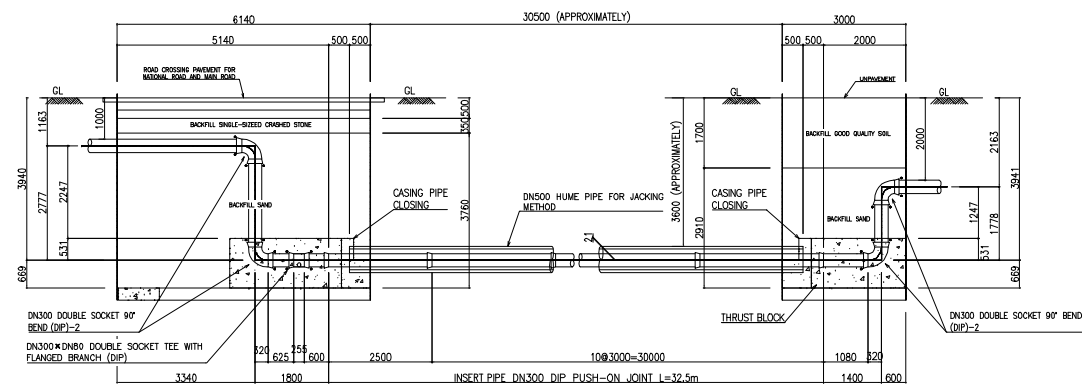
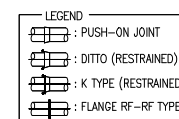
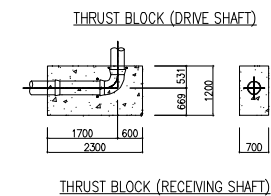
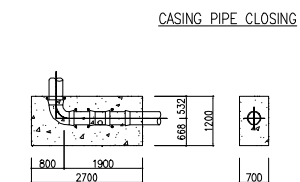
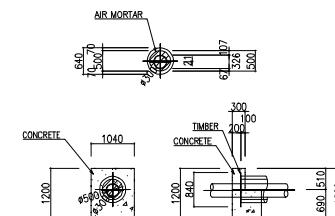
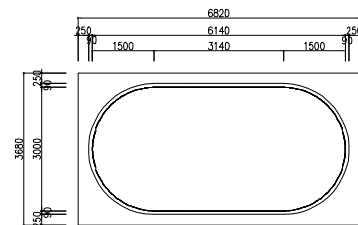
BJM-2 PIPE ARRANGEMENT

No. 20	BJM-2 PIPE ARRANGEMENT
BJM-2 推進工法位置 配管計画	



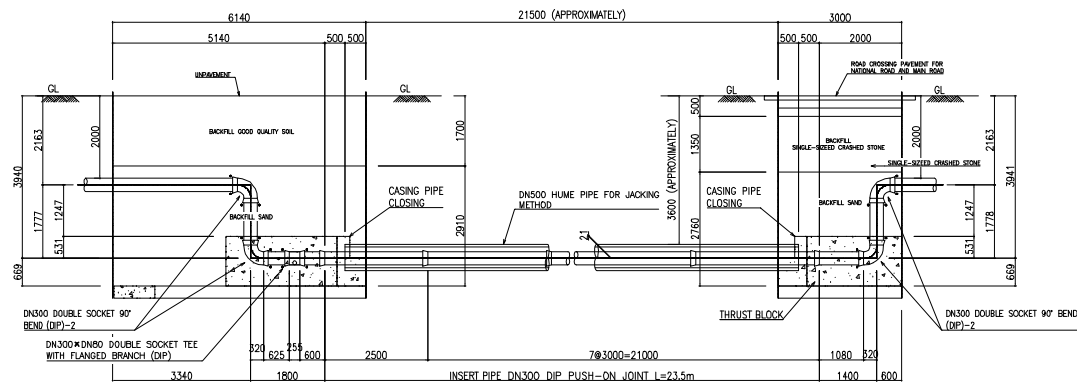
PIPE ARRANGEMENT BJM-3

No. 21	BJM-3 PIPE ARRANGEMENT
BJM-3 推進工法位置 配管計画	

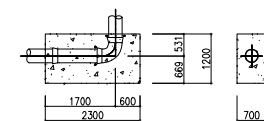
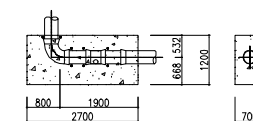
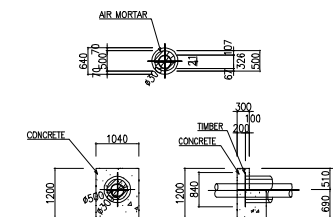
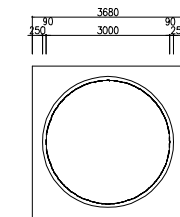






PJM-1 PIPE ARRANGEMENT

No. 22	PJM-1 PIPE ARRANGEMENT
PJM-1 推進工法位置 配管計画	

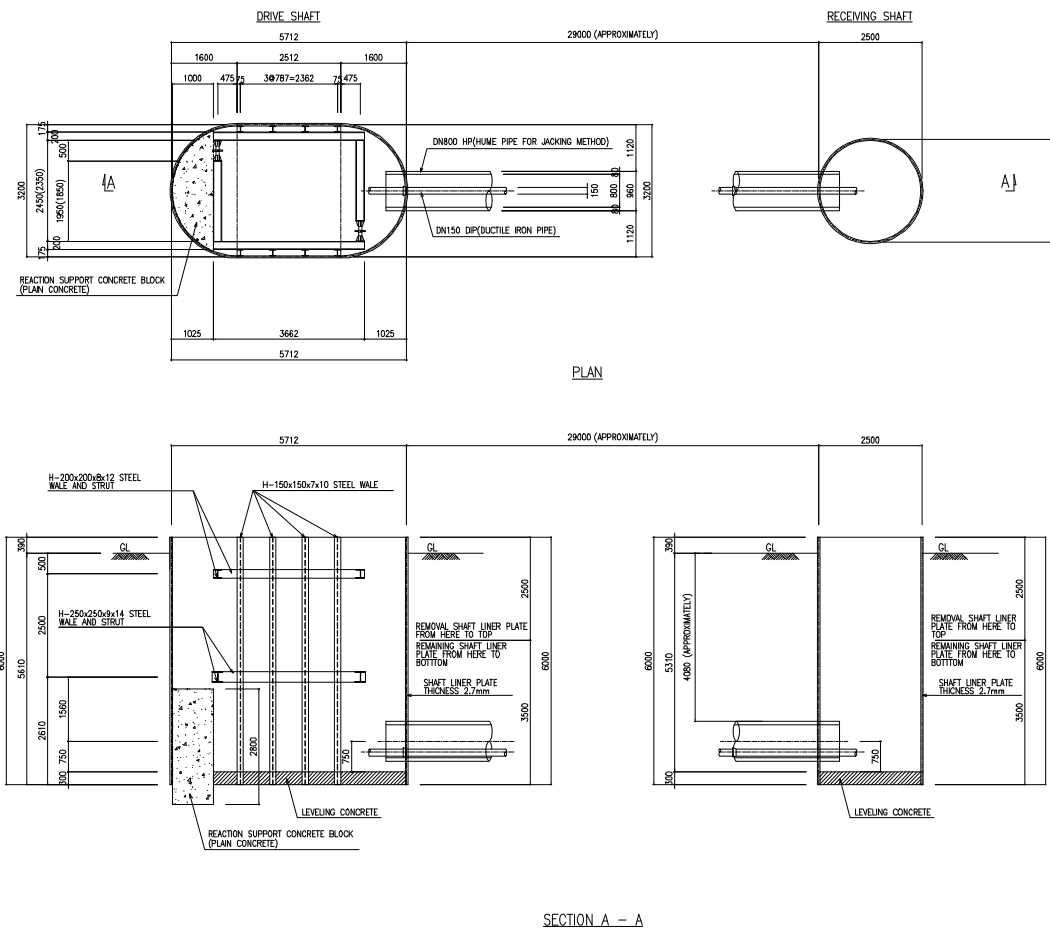


SJM-4 PIPE ARRANGEMENT



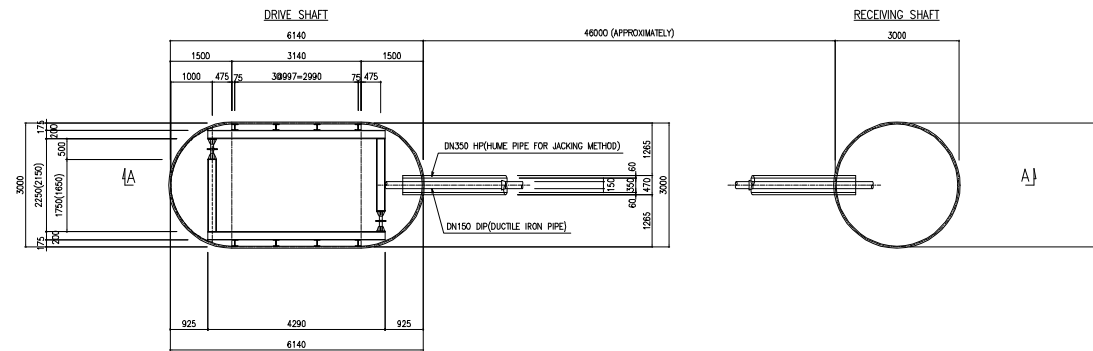
- LEGEND
-  : PUSH-ON JOINT
 -  : DITTO (RESTRAINED)
 -  : K TYPE (RESTRAINED)
 -  : FLANGE RF-RF TYPE

No. 23	SJM-4 PIPE ARRANGEMENT
SJM-4 推進工法位置 配管計画	

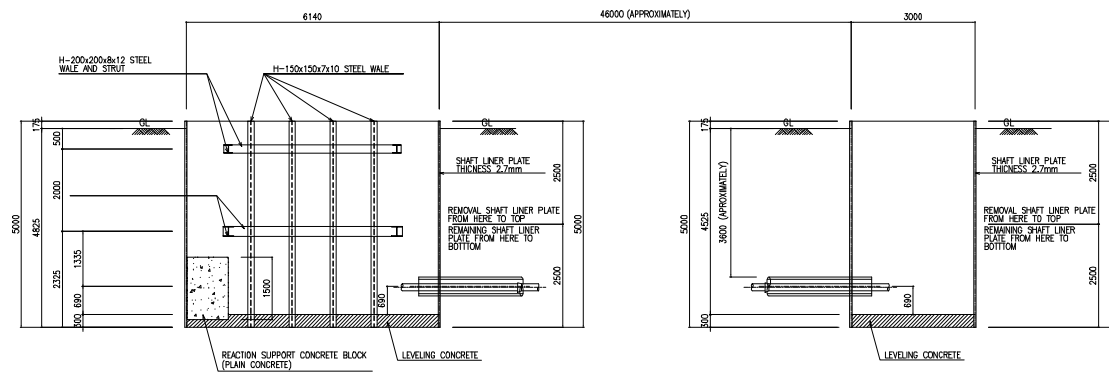


BJM-1 JACKING METHOD

No. 24	BJM-1 JACKING METHOD
BJM-1 推進工法	



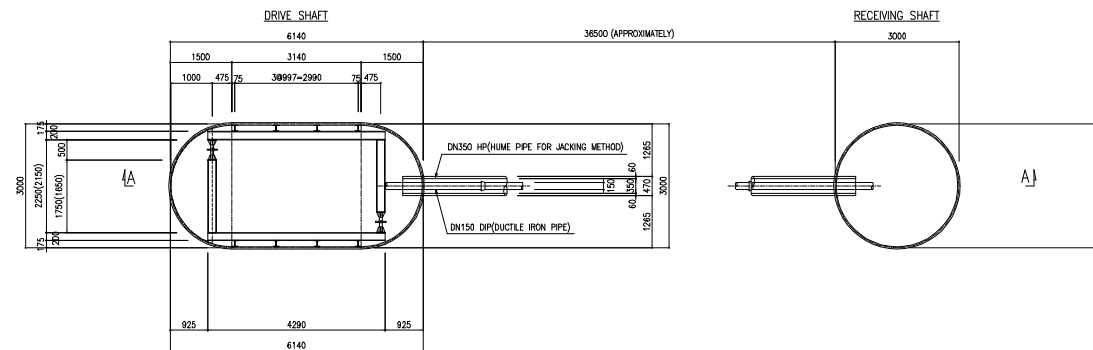
PLAN



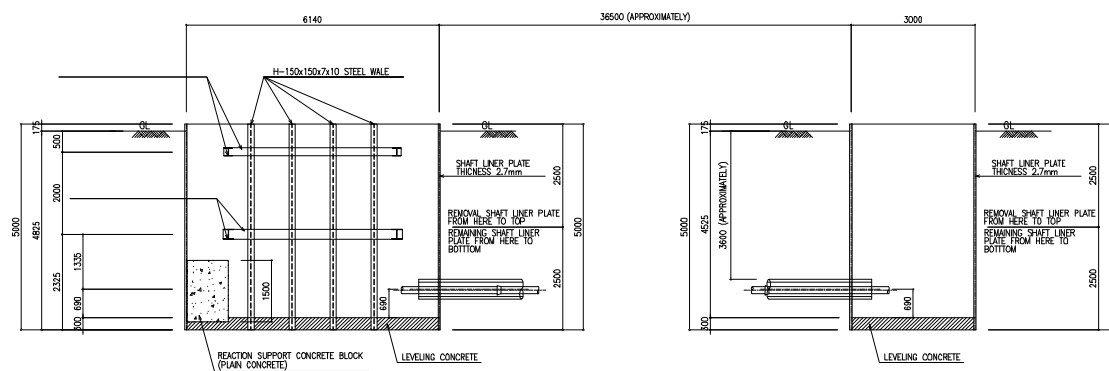
SECTION A - A

BJM-2 JACKING METHOD

No. 25	BJM-2 JACKING METHOD
BJM-2 推進工法	



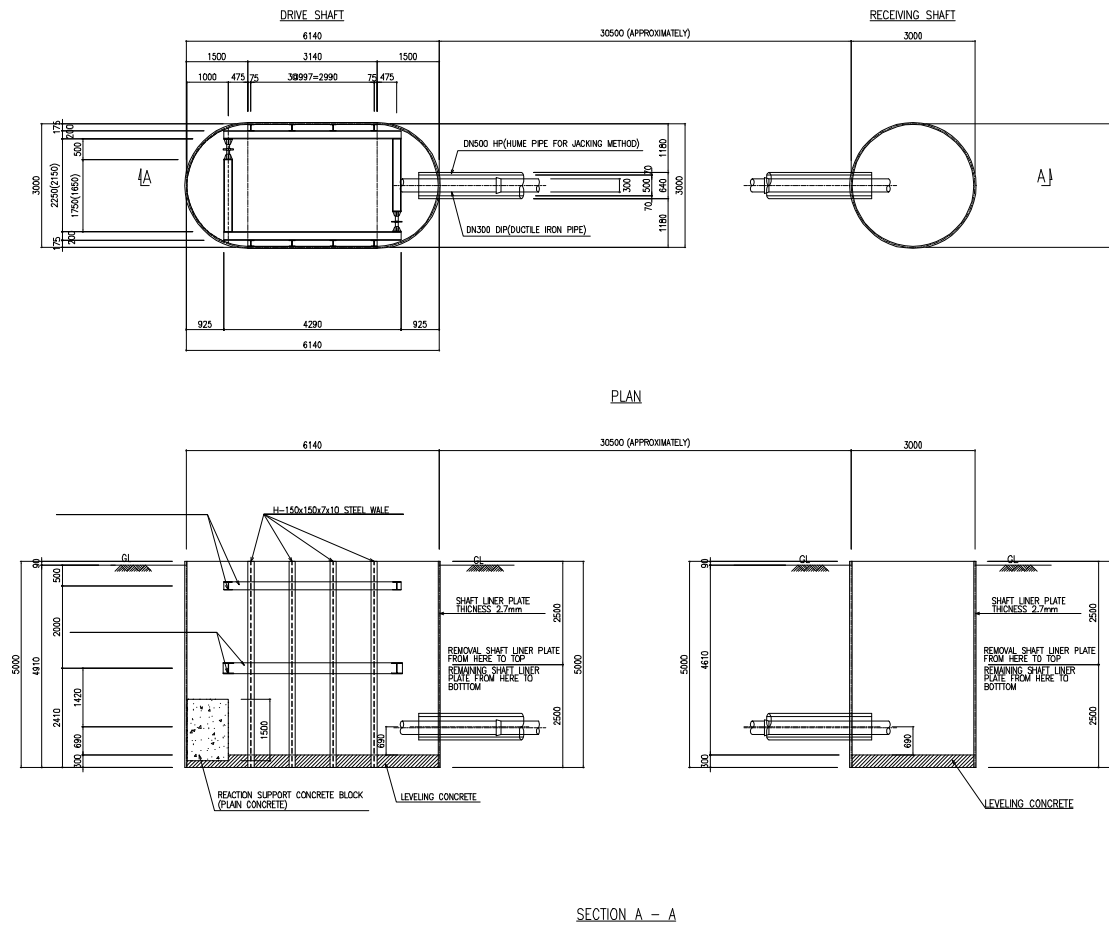
PLAN



SECTION A - A

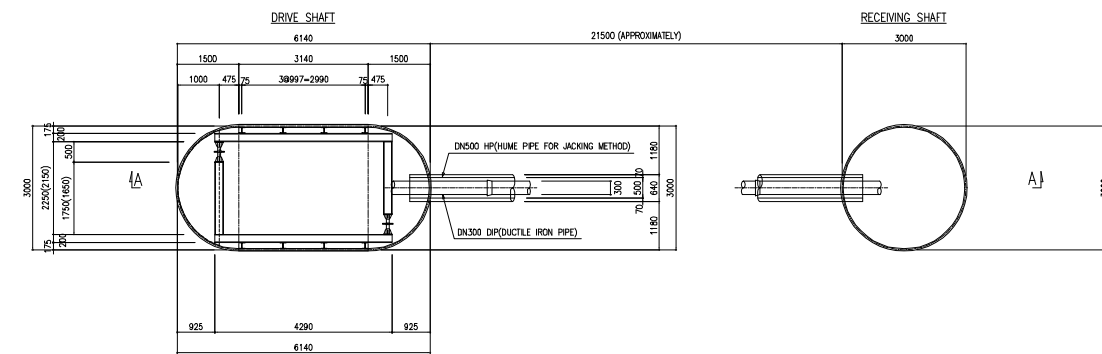
BJM-3 JACKING MTHOD

No. 26	BJM-3 JACKING METHOD
BJM-3 推進工法	

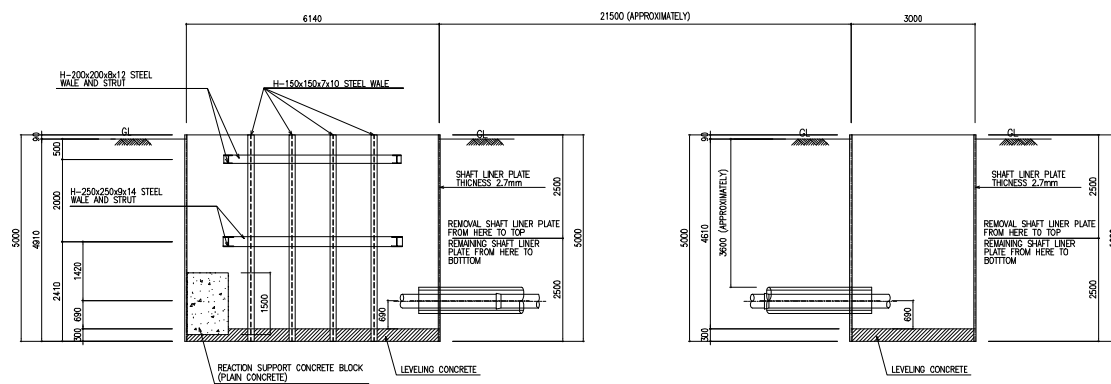


PJM-1 JACKING METHOD

No. 27	PJM-1 JACKING METHOD
PJM-1 推進工法	



PLAN



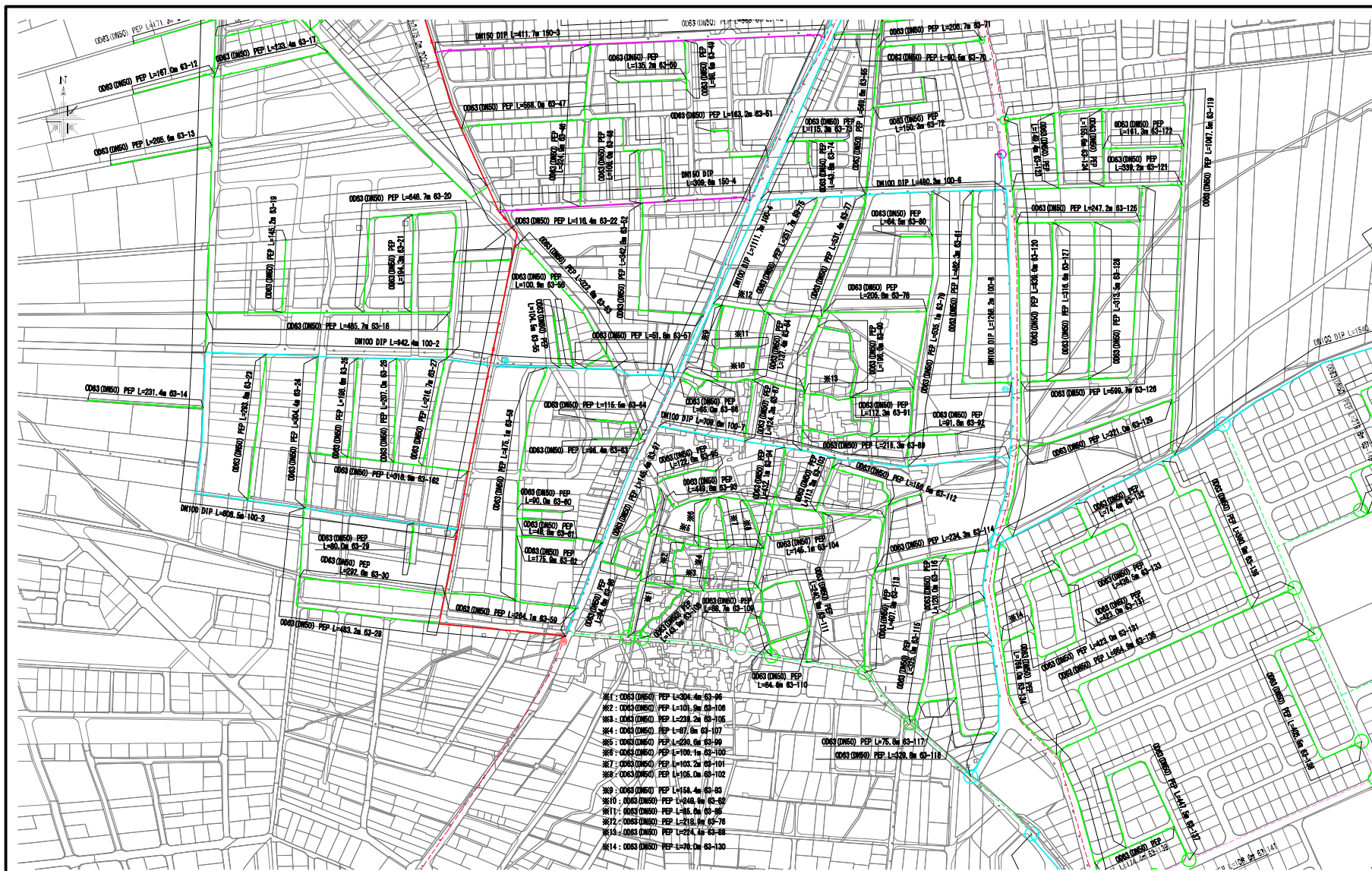
SECTION A - A

SJM-4 JACKING METHOD

No. 28	SJM-4 JACKING METHOD
SJM-4 推進工法	



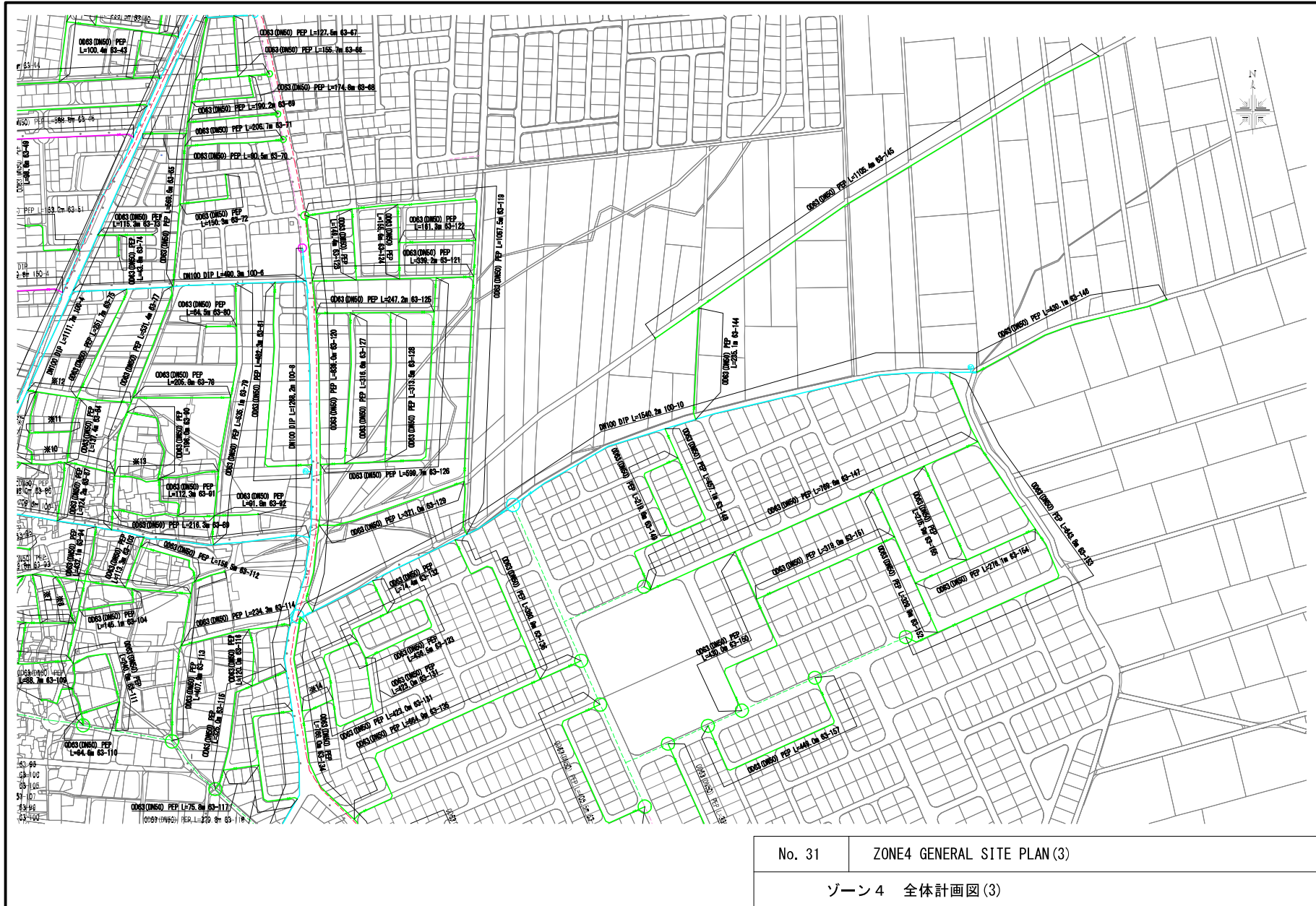
No. 29	ZONE4 GENERAL SITE PLAN(1)
ゾーン 4 全体計画図(1)	



No. 30

ZONE4 GENERAL SITE PLAN (2)

ゾーン4 全体計画図(2)





No. 32 ZONE4 GENERAL SITE PLAN (4)

ゾーン 4 全体計画図 (4)