4-4 Technical Notes (Field Survey I)

TECHNICAL NOTES

PREPARATORY SURVEY (FIELD SURVEY 1)
ON
THE PROJECT FOR IMPROVEMENT OF PRIMARY AND SECONDARY SCHOOLS IN ULAANBAATAR CITY
IN MONGOLIA

After signing of the Minuit of Discussions dated December 6, 2016, the Consultant's team (the Team) continued the field survey and had discussions on the technical matters of the Project with the Education Department of Ulaanbaatar City (UBC-ED). The followings are the points which are confirmed by both sides:

(1) Project Sites

1) Preliminary screening of the candidate sites

Based on the statistical and general information, the Team identified 7 sites to be excluded from the list (original list of 28 candidate sites which was submitted by UBC-ED during the official mission) in the light of the agreed criteria. The name of sites are as follows:

• Nalaikh	No. 4 Khoroo	: Permafrost soil is common in Nalaikh area
• Nalaikh	Erdmin orgil C.S.	: Ditto
• Nalaikh	Terelj School	: Ditto
• Chingeltei	No. 112 School	: Not a general school (religious school)
• Songinokhairkhan	No. 121 School	: Not so much demand expected
• Bagakhangai	No. 2 Khoroo	: Canceled by UBC-ED
• Baganur	New residential area	: Location of the site is uncertain

2) Result of site investigations

The Team visited all the existing schools and 3 new school sites in the revised list of 10 schools which was submitted at Dec. 8, 2016 by UBC-ED to JICA Mongolian Office, and made a preliminary evaluation on each site. The result of the evaluation is described in ANNEX I attached hereto.

After explanation of the result, the Team made a recommendation to UBC-ED to replace 3 sites which do not meet the minimum requirements with other candidates having positive evaluation.

3) Selection of the site will be finalized after the field survey 2, among 10 candidate sites finally listed in the revised list.

(2) Basic Conditions for Facility Planning

Through the discussion, both sides confirmed the items shown on ANNEX II as basic conditions for facility planning. The Team will develop a schematic plan of the Project facilities based on the agreed conditions for further discussions during the field survey 2.

(3) Documents and Information to be submitted by Mongolian side

UBC-ED promised to submit the following documents and information requested by the Team by e-mail or other measures to the address below:

Tomohiro Osawa

osawa@matsucon.co.jp

- Breakdown of construction cost for recent construction project, such as School No.3, School and School No. 125.

END

Ulaanbaatar, December 13, 2016

Mr. J. Gantulga

Director,
Education Department of Ulaanbaatar City
Mongolia

Mr. Tomohiro Osawa

Managing Director
Matsuda Consultants International
Co., Ltd.

ANNEX-I Preliminary Result of the site investigations

10 Sites with first priority selected by UBC Education Department

No.	District	Site	Request for:	Preliminary evaluation	
1	Chingeltei	No. 7 Khoroo	New school	○	The proposed land is moderately sloped and reclamation will be necessary for construction, located in the edge of ger area being not far from city center. Enough enrollment will be expected by the current number of children who attend the kindergarten next to the site. No public utility is available besides electricity.
2	Khan-Uul	No. 75 School	Re-build after demolition of existing buildings	△	Demolition of existing building which were built in 1959, including its substructure, will be required to be done by the Mongolian side before the notice of tender for construction. Capital budget needs to be secured for the demolition work in the budget for FY2018.
3	Songinokhairkhan	No. 32 Khoroo	New school	○	The proposed land is located in the Khoroo at the west end of UBC. It will be good for establishment of new school with sufficient flat land alongside the national road in spite of being far from the city center. High growth will be expected even though current population is not sufficient. No public utility is available besides electricity.
4	Khan-Uul	No. 10 Khoroo	New school	×	The proposed land occupies one of the plot in the new housing development area called "New Yarmag" where houses for 2,910 families are under development by the private investment company jointly funded by the Chinese bank. No inhabitant is in the area that means the planned school will be dedicated only for the development. It is not appropriate for Japan's Grant Aid. In addition, it is less likely to be filled with new inhabitants considering current economic situation in Mongolia.
5	Khan-Uul	No. 59 School	Transfer to the new plot by building a school with full-grades	△	The school's main building was built originally for a kindergarten and accommodates middle and high grades. Branch building was built for primary grades in the place approximately 3km from the main building this year as a complex with a kindergarten. The proposed land, just opposite to the current plot, is far from the city center and no public utility is available besides electricity though it is flat with sufficient area. Careful analysis will be required for future enrollment considering the branch school.
6	Bayanzurkh	No. 53 School	Expansion	○	No major obstacle is expected.
7	Songinokhairkhan	No. 42 School	Expansion	○	Demolition of an existing building has been ordered by the specialized agency and will be required before the notice of the tender for the Project. Current enrollment is not so much in average but

					from the municipal network. Heating is supplied from the private boiler behind the school. The school has football court which is served for community use as well as for evacuation place.
17	Chingeltei	No. 112 School	Expansion	×	It is specialized religious school.
18	Songinokhairkhan	No. 29 Khoroo	New school		Not visited.
19	Songinokhairkhan	No. 121 School	Expansion	×	The school was built by Japan's Grant Aid and has enough classrooms for the target area.
21	Bagakhangai	No. 2 Khoroo	New school	×	Canceled by UBC-ED
22	Songinokhairkhan	No. 1 Khoroo	New school		Not visited.
25	Khan-Uul	No. 118 School	Expansion	△	The school was built by Japan's Grant Aid
26	Baganur	New residential area	New school	×	The request is based on future development of new housing zone. Under recent difficult condition of Mongolian economy, such a development will not likely be realized as planned.
27	Bayanzurkh	No. 14 Khoroo	New school		Not visited.
28	Songinokhairkhan	No. 28 Khoroo	New school		Not visited.

Recommendation:

In order to widen range of site selection at the time of the Field Survey 2, we recommend UBC Education Department to replace the following sites from the list of top 10 sites with the site of more positive evaluation.

1) Khan-Uul No. 10 Khoroo
2) Bayanzurkh Bayanzurkh C.S (Primary branch school).
3) Bayanzurkh No. 120 School

					increasing rapidly. Private boiler system is available for heating. Special classroom for students with disabilities had been in operation for 6 years, 3 years by World Vison's assistance and 3 years upon their parents' request, with 10 to 8 students.
8	Bayanzurkh	Bayanzurkh C.S (Primary branch school).	Re-build after demolition of existing buildings	×	The area of the school plot is approximately 2,600 sq.m, which is too small for a school building with full grades, for example, the minimum type with full grades of standard design occupies more than 2,000 sq.m of land. Therefore, it is impossible to build a full grade school.
9	Chingeltei	No. 61 School	Expansion	△	The school's main building was built by Japan's Grant Aid (Phase III). Gym and kitchen/cafeteria block is under construction and will be opened next academic year. Only narrow space after demolition of the old classrooms is available for construction.
10	Bayanzurkh	No. 120 School	Expansion	×	The school was established by Japan's Grant Aid Project (Phase IV). The plot is surrounded by residential lots some of them being inhabited, excluding the military compound in the north of the school. It is likely impossible to extend the land without resettlement.

Other 18 sites nominated in the original list

No.	District	Site	Request for:	Preliminary evaluation	
4	Songinokhairkhan	No. 7 Khoroo	New school		Not visited.
6	Bayangol	No. 1 Khoroo	New school		Not visited.
7	Nalaikh	No. 4 Khoroo	New school	×	In Nalaikh, construction of buildings needs special attention to permafrost soil which are common in the area.
8	Nalaikh	Erdmin orgil C.S.		×	
9	Nalaikh	Terelj School		×	
12	Bayangol	No.11/12 Khoroo	New school		Not visited.
13	Bayanzurkh	No. 21 School	Re-build after demolition of existing buildings	△	Demolition of existing building built in 1958 will be required to be done by the Mongolian side before the notice of tender for construction. Although the situation of overcrowding is serious with 3 sift classes in primary section, existing buried pipes makes construction difficult.
15	Sukhbaatar	No. 16 School	Expansion	△	One of the target for START project. Overcrowding is moderate. Main part of the existing building is single story so that it can make barrier-free condition easily. Space is available for expansion.
16	Chingeltei	No. 57 School	Expansion	△	Overcrowding is moderate. Located in the middle of ger area, electricity, water, sewage is available

ANNEX-II Basic conditions for planning

1) Standard size of a classroom: 35-40 students per classroom
   Size of a classroom: 56-60 sq.m

2) Number of classrooms
   For new schools: 2 stream: 12 grades x 2 classes = 24 classrooms x 40=960 seats
   or 2 stream for basic, 1 stream for high grades:
   9 grades x 2 + 3 grades x 1 21 classrooms x 40=840 seats
   For expansion basically new building will be designed to accommodate primary section

3) Components
   Principle to design the project components:
   - To keep necessary function while pursuing efficiency as much as possible,

   General classrooms

   Special classrooms

   - Following functions (activities) will be taken into account for designing special classrooms
     Science laboratory for physics and chemistry
     Technical subject for male and female students
     Informatics and computer technology
     Music room (to store music instruments)
     * Preparation room will be attached to each of the room

   Teachers' and staff's room

   - Following rooms will be designed as a separate room:
     Teachers' room
     Education manager's office (for primary/secondary grades)
     Social worker's office
     Doctor's office
     Principal's office
     Accountant's office
     Maintenance staff's room (cleaner, plumber, electrician, etc.)

   Cloak

   - Cloak is not necessary in case lockers for storing cloths are provided in each classroom

   Gymnasium

   Library

   - Following functions will be taken into account for Library space
     Librarian's work space
     Book store
     Reading space

Kitchen/Pantry and Cafeteria (Dining Hall)

- Following functions will be taken into account for kitchen and cafeteria
  To cook hot meals for primary students which will be served at each classroom
  To cook and serve meals for teaching/supporting staff
  To cook and serve light meals for secondary students
- Cafeteria is mainly designed for staff and students of upper grades (G9-G12)
- Kitchen and cafeteria will be designed to be outsourced to a private firm.
- UBC-ED may provide kitchen equipment as a apart of the recipient's work.

Other components to be taken into consideration:

- Children development center: the room may be designed as a place to develop each children's talents to provide individual guidance to their special needs under management by a social worker.
- The function to promote community's use of school facilities may be taken into consideration.

4) Principles for the outline design
   - Construction system
     : External wall insulation system will be applied to external walling.
   - Stories
     : Buildings will be designed with 4 stories and a basement for efficient use of the land.
   - Structural design
     : Structural design will be in accordance with the revised standards and regulation in Mongolia which scheduled to be published at January, 2017.

5) Request from Mongolian side
   UBC-ED requested following items to be considered in the facility design.
   - To provide space for cultural and extra-curricular activities
   - To improve acoustic environment of classrooms and gymnasium
   - To follow UBC's policy of "ECO Buildings" to save the cost for maintenance by use of natural energy and/or reuse of resources.

4-5 Technical Notes (Field Survey III)

TECHNICAL NOTES

PREPARATORY SURVEY (FIELD SURVEY 3)
ON
THE PROJECT FOR IMPROVEMENT OF PRIMARY AND SECONDARY SCHOOLS
IN ULAANBAATAR CITY
IN MONGOLIA

From April 10, 2017, the Consultant's team (the Team), to whom Japan International Cooperation Agency (JICA) entrusted implementation of a preparatory survey on the captioned project, has conducted the Field Survey 3 (the FS3) for the purpose of technical surveys on the candidate sites for the project and other incidental surveys including a series of discussions with concerned officials from the Education Department of Ulaanbaatar City (UBC). The followings are the points which are confirmed by both sides through discussions:

(1) Equipment

1) Items, quantities and specifications
Mongolian side confirmed the items, their specifications and quantities to be distributed to each site, as listed in "ANNEX-1" attached hereto.

(2) Soft-component

1) Outline of planned "soft-component"
The Mongolian side basically agreed with the contents of the soft-component, explained by the Team. The outline of the component's plan is as attached in "ANNEX-2".

(3) Facility plan

The preliminary plan for outline design of the facilities was explained by the Team to UBC Education Department as well as other regulatory authorities. The followings are major instructions and/or requests which will be incorporated in the outline design:

1) Instructions by UBC Fire Department
- Between the first basement floor and the first floor shall be a fireproof compartment, and fire doors must be installed for that staircase.
- External escape stairs should be provided that can be accessed directly from the first basement floor to the first floor.
- Smoke exhaust system should be provided.

(4) Documents and Information to be submitted by Mongolian side

UBC Education Development promised to submit the following documents and information requested by the Team by e-mail or other measures to the address below by the end of April:

Tomohiro Osawa
osawa@matsucon.co.jp

- Land use permit and registration drawing for No. 75 school.
- Registration drawing for No. 53 school.

(5) Schedule of the Survey

After this Field Survey 3, the Team will continue to develop the outline design, to estimate the project cost, and prepare a draft Preparatory Survey Report by the end of August, 2017. The fourth survey mission to Mongolia will be dispatched around September, 2017 to explain the contents of the draft Preparatory Survey Report for finalizing the Survey with the consent of the Government of Mongolia.

END

Ulaanbaatar, April 25, 2017

Mr. J. Gantulga

Director,
Education Department of Ulaanbaatar City
Mongolia

Tatsuji Tsuchiya

Mr. Tatsuji Tsuchiya

Assistant Chief Consultant
The Preparatory Survey Team
Matsuda Consultants International
Co., Ltd.

Equipment List

Category	Item No.	Item Name	Qty. (per 1 room)	Type of Facility A-1	A-2	B-1	B-2	Qty. Total	
Primary Education									
Mathematics	PRM-01	Abacus for demonstrating	1	5	4	4	4	17	
	PRM-02	Geometric block models set	18	90	72	72	72	306	
	PRM-03	Measurement set for students	18	90	72	72	72	306	
	PRM-04	Time teaching set	1	5	4	4	4	17	
	PRM-05	Abacus for students	18	90	72	72	72	306	
	PRM-06	Scales set for teacher	1	5	4	4	4	17	
Mongolian Language	PRM-07	CD Audio system	1	5	4	4	4	17	
Human Environment	PRM-08	Zoological Map and Botanical Map of Mongolia	1	5	4	4	4	17	
	PRM-09	World Geographic Map	1	5	4	4	4	17	
Common Equipment	PRM-10	Chess set for demonstrating	1	5	4	4	4	17	
	PRM-11	Checker set for demonstrating	1	5	4	4	4	17	
	PRM-12	Chess set for students	9	45	36	36	36	153	
	PRM-13	Checker set for students	9	45	36	36	36	153	
Secondary Education									
Equipment for Gymnasium	GYM-01	Hurdle	20	20	20	20	0	60	
	GYM-02	Traffic cone	1	1	1	1	0	3	
	GYM-03	Basketball balls (Size 7)	9	9	9	9	0	27	
	GYM-04	Basketball balls (Size 6)	9	9	9	9	0	27	
	GYM-	Basket ball goal set	1	1	1	1	0	3	*1
	GYM-05	Movable scoreboard	1	1	1	1	0	3	
	GYM-06	Volleyball Balls	18	18	18	18	0	54	
	GYM-07	Volley ball pole set	1	1	1	1	0	3	
	GYM-08	Volley ball net	1	1	1	1	0	3	
	GYM-09	Gymnastics mat	6	6	6	6	0	18	
	GYM-10	Ropes for tug-of-war	1	1	1	1	0	3	
	GYM-11	CD Audio system	1	1	1	1	0	3	
	GYM-	Wall Bars	1	1	1	1	0	3	*1
	GYM-12	Futsal Balls	18	18	18	18	0	54	
	GYM-13	Table tennis table set	2	2	2	2	0	6	
	GYM-14	Table tennis racket	8	8	8	8	0	24	
	GYM-15	Badminton Shuttle	18	18	18	18	0	54	
	GYM-16	Badminton rackets	18	18	18	18	0	54	
	GYM-17	Badminton pole set	1	1	1	1	0	3	
	GYM-18	Badminton net	1	1	1	1	0	3	
Mongolian Language	MGL-01	CD Audio system	1	1	1	1	1	4	
Foreign Language	FLG-01	CD Audio system	1	1	1	1	1	4	
Physics Lab. Equipment	PHY-01	Experimental apparatus for dynamics	6	6	6	6	6	24	
	PHY-02	Pulley set	6	6	6	6	6	24	
	PHY-03	Mass with hanger	6	6	6	6	6	24	
	PHY-04	Dynamics movement apparatus	6	6	6	6	6	24	
	PHY-05	Spring set	6	6	6	6	6	24	
	PHY-06	Photovoltaic experiment set	6	6	6	6	6	24	
	PHY-07	Hand generator	6	6	6	6	6	24	
	PHY-08	Air column resonance apparatus	1	1	1	1	1	4	
	PHY-09	Light for learning three primary colors of light	6	6	6	6	6	24	
	PHY-10	Optical experiment set	1	1	1	1	1	4	
	PHY-11	DC low voltage power supply	6	6	6	6	6	24	
	PHY-12	Digital multi tester	6	6	6	6	6	24	
	PHY-13	Slide rheostat	6	6	6	6	6	24	
	PHY-14	Leads and crocodile clip	6	6	6	6	6	24	
	PHY-15	Oscilloscope	1	1	1	1	1	4	
	PHY-16	Magnet set	6	6	6	6	6	24	
Chemistry Lab. Equipment	CHE-	Fume hood (Lab Ductless Fume Hood)	1	1	1	1	1	4	*1
	CHE-01	Burette	12	12	12	12	12	48	
	CHE-02	Retort stand set	12	12	12	12	12	48	
	CHE-03	Watch glass	36	36	36	36	36	144	
	CHE-04	Molecular model set	6	6	6	6	6	24	
	CHE-05	Bulb pipette with teat	36	36	36	36	36	144	
	CHE-06	Measuring pipette	36	36	36	36	36	144	
	CHE-07	Digital pH meter	12	12	12	12	12	48	
	CHE-08	Thermometer	12	12	12	12	12	48	
	CHE-09	Crucible Tongues	12	12	12	12	12	48	
	CHE-10	Crucible with lid	12	12	12	12	12	48	
	CHE-11	Mortar set	12	12	12	12	12	48	
	CHE-12	Evaporating basin	12	12	12	12	12	48	
	CHE-13	Drying chamber	1	1	1	1	1	4	
	CHE-14	Test tube set	1	1	1	1	1	4	
	CHE-15	Volumetric flask, 1000ml	6	6	6	6	6	24	
	CHE-16	Volumetric flask, 100ml	6	6	6	6	6	24	
	CHE-17	Volumetric flask, 500ml	6	6	6	6	6	24	
	CHE-18	Measuring cylinder, 10 ml	6	6	6	6	6	24	

Category	Item No.	Item Name	Qty. (per 1 room)	Type of Facility				Qty. Total
				A-1	A-2	B-1	B-2	
	CHE-19	Measuring cylinder, 50 ml	6	6	6	6	6	24
	CHE-20	Measuring cylinder, 100 ml	6	6	6	6	6	24
	CHE-21	Measuring cylinder, 500 ml	6	6	6	6	6	24
	CHE-22	Centrifuge	1	1	1	1	1	4
	CHE-23	Beaker, 50ml	12	12	12	12	12	48
	CHE-24	Beaker, 100ml	12	12	12	12	12	48
	CHE-25	Beaker, 250ml	12	12	12	12	12	48
	CHE-26	Beaker, 500ml	12	12	12	12	12	48
	CHE-27	Conical beaker, 500ml	12	12	12	12	12	48
	CHE-28	Desiccator	1	1	1	1	1	4
	CHE-29	Electronic balance	1	1	1	1	1	4
	CHE-30	Conical flask (Erlenmeyer flask), 100ml	12	12	12	12	12	48
	CHE-31	Conical flask (Erlenmeyer flask), 300ml	12	12	12	12	12	48
	CHE-32	Funnel, caliber 75mm	12	12	12	12	12	48
	CHE-33	Funnel, caliber 120mm	12	12	12	12	12	48
Biology Lab.	BIO-01	Compound microscope	18	18	18	18	18	72
Equipment	BIO-02	Hand lens	18	18	18	18	18	72
	BIO-03	Water distiller	1	1	1	1	1	4
	BIO-04	Water bath	1	1	1	1	1	4
	BIO-05	Various thermometers	6	6	6	6	6	24
	BIO-06	Dissecting kit	12	12	12	12	12	48
	BIO-07	Petri dish	36	36	36	36	36	144
	BIO-08	Syringes set	36	36	36	36	36	144
	BIO-09	Immersion specimen	1	1	1	1	1	4
	BIO-10	Anatomical model of human body	1	1	1	1	1	4
	BIO-11	Human skeleton	1	1	1	1	1	4
	BIO-12	Prepared slide set	1	1	1	1	1	4
	BIO-13	Various specimens	1	1	1	1	1	4
	BIO-14	Skeletal of vertebrate	1	1	1	1	1	4
	BIO-15	DNA model	1	1	1	1	1	4
	BIO-16	Human brain and head models	1	1	1	1	1	4
	BIO-17	Human eye model	1	1	1	1	1	4
	BIO-18	Human ear model	1	1	1	1	1	4
	BIO-19	Human teeth model	1	1	1	1	1	4
	BIO-20	Human heart model	1	1	1	1	1	4
	BIO-21	Lung model with larynx	1	1	1	1	1	4
Technology								
① Sewing	WTE-01	Electric sewing machine	9	9	9	0	9	27
	WTE-02	Over locker sewing machine	1	1	1	0	1	3
	WTE-03	Steam iron	2	2	2	0	2	6
	WTE-04	Ironing board	2	2	2	0	2	6
	WTE-05	Shears for sewing	18	18	18	0	18	54
	WTE-06	Crochet hook set for knitting	18	18	18	0	18	54
	WTE-07	Embroidery frame	18	18	18	0	18	54
② Metal work	MET-01	Metal cutting saw	18	18	18	0	18	54
	MET-02	Vernier calliper	9	9	9	0	9	27
	MET-03	Metallic file	9	9	9	0	9	27
	MET-04	Cold chisel for metalwork	9	9	9	0	9	27
	MET-05	Center punch	9	9	9	0	9	27
	MET-06	Pliers	9	9	9	0	9	27
	MET-07	End Cutting Nippers	9	9	9	0	9	27
	MET-08	Longnose pliers	9	9	9	0	9	27
	MET-09	Vise	12	12	12	0	12	36
	MET-10	Soldering iron	9	9	9	0	9	27
	MET-11	Digital multi tester	3	3	3	0	3	9
	MET-12	Metal lathe	1	1	1	0	1	3
	MET-13	Grinder	1	1	1	0	1	3
	MET-14	Compressor airbrush set	1	1	1	0	1	3
③ Wood work	WOD-01	Plane	9	9	9	0	9	27
	WOD-02	Chisel set	9	9	9	0	9	27
	WOD-03	Saw for woodwork	9	9	9	0	9	27
	WOD-04	Wooden hammer	9	9	9	0	9	27
	WOD-05	Clamp	6	6	6	0	6	18
	WOD-06	Small axe	6	6	6	0	6	18
	WOD-07	Cross slot screwdriver	9	9	9	0	9	27
	WOD-08	Tape measure	6	6	6	0	6	18
	WOD-09	Hammer	9	9	9	0	9	27
	WOD-10	Thicknesser (Planer)	1	1	1	0	1	3
	WOD-11	Drill press	1	1	1	0	1	3
	WOD-12	Wood lathe	1	1	1	0	1	3
	WOD-13	Scroll saw	1	1	1	0	1	3
	WOD-14	Hammer drill	1	1	1	0	1	3

Category	Item No.	Item Name	Qty. (per 1 room)	Type of Facility A-1	A-2	B-1	B-2	Qty. Total	
	WOD-15	Electric drill	1	1	1	0	1	3	
	WOD-16	Power planer	1	1	1	0	1	3	
	WOD-17	Orbit sander	1	1	1	0	1	3	
	WOD-18	Jig saw	1	1	1	0	1	3	
	WOD-19	Milling machine (Router)	1	1	1	0	1	3	
	WOD-20	Electric circular saw	1	1	1	0	1	3	
④ Fine Art	ART-01	Wood chisel	36	36	36	0	0	72	
	ART-02	Clay scraper spatula	36	36	36	0	0	72	
	ART-03	Easel	36	36	36	0	0	72	
	ART-04	Portable drawing board	36	36	36	0	0	72	
Music	MUS-01	Smart board for music	1	1	1	0	0	2	
	MUS-02	Stereo system	1	1	1	0	0	2	
	MUS-03	Morin khuur	9	9	9	0	0	18	
	MUS-04	Yatga 120cm	5	5	5	0	0	10	
	MUS-05	Yatga 180cm	5	5	5	0	0	10	
	MUS-06	Shanz 110cm	3	3	3	0	0	6	
	MUS-07	Shanz 140cm	3	3	3	0	0	6	
	MUS-08	Khuuchir	2	2	2	0	0	4	
	MUS-09	Flute (Bamboo)	1	1	1	0	0	2	
	MUS-10	Flute (Iron)	1	1	1	0	0	2	
	MUS-11	Yoochin	3	3	3	0	0	6	
	MUS-12	Electronic keyboard	1	1	1	0	0	2	
	MUS-13	Keyboard harmonica	36	36	36	0	0	72	
ICT	ICT-01	Desk top computer	37, 19	37	37	19	37	130	
	ICT-02	Complex type printer, monochrome	1	1	1	1	1	4	
	ICT-03	Switching hub 24 ports	1	1	1	1	1	4	
Kitchen Equipment	KIT-	Electric Steam Oven, 8 level trays	1	1	1	0	0	2	*1
	KIT-	Electric oven, 2 Comparments	2	2	2	0	0	4	*1
	KIT-	Electric 4-Hot plate Cooker with Oven	2	2	2	0	0	4	*1
	KIT-	Electric Indirect Jacketed Boiling Pan	1	1	1	0	0	2	*1
	KIT-	Electric Tilting Braising Pan	1	1	1	0	0	2	*1
	KIT-	Electric Instant storage water heater /geyser	1	1	1	0	0	2	*1
	KIT-	Electric Rice Cooker	1	1	1	0	0	2	*1
	KIT-	4-Door Fan cooling reach-In Kitchen refrigerator	1	1	1	0	0	2	*1
	KIT-	360L Single Door Upright Cooler	1	1	1	0	0	2	*1
	KIT-	8kg Potato Peeler	1	1	1	0	0	2	*1
	KIT-	Fruit and Vegetable Cutter	1	1	1	0	0	2	*1
	KIT-	Mincer	1	1	1	0	0	2	*1
	KIT-	Chest Freezer	1	1	1	0	0	2	*1
	KIT-	Dough Mixer	1	1	1	0	0	2	*1
	KIT-	Electric sterilizer	1	1	1	1	1	4	*1
	KIT-	700mm Triple Sinks Bench	1	1	1	1	1	4	*1
	KIT-	700mm Single Sink Bench With Under Shelf	1	1	1	0	0	2	*1
	KIT-	700mm Work Bench With Splashback	3, 1	3	3	1	1	8	*1
	KIT-	1.8m Work Bench With Slotted Undershelf	2	2	2	2	2	8	*1
	KIT-	Water Filter Dispenser RO Purification System	1	1	1	1	1	4	*1
	KIT-	Water Filter Dispenser RO Purification System	1	1	1	0	0	2	*1
	KIT-	4-Layer Shelf	4, 1	4	4	1	1	10	*1
Equipment for Medical office	DOC-01	UV lam disinfection trolley	1	1	1	1	1	4	
	DOC-02	Weight scale	1	1	1	1	1	4	
	DOC-03	Height measuring scale	1	1	1	1	1	4	
	DOC-04	Sphygmomanometer	1	1	1	1	1	4	
	DOC-05	Spirometer	1	1	1	1	1	4	
Equipment for CWDs	CWD-01	Book stand (book holder)	5	5	5	5	5	20	
	CWD-02	Desktop electronic magnifier for reading assistance	5	5	5	5	5	20	
	CWD-	Partition wall	2	2	2	2	2	8	*1
	CWD-	White board small	5	5	5	5	5	20	*1
	CWD-	Cushion Chair	2	2	2	2	2	8	*1
	CWD-03	Triangle Cushion	2	2	2	2	2	8	
	CWD-04	Mat	2	2	2	2	2	8	
Common	COM-01	Projector 1 (fixed)	2	2	2	2	2	8	
	COM-02	Projector 2 (fixed)	1	1	1	0	0	2	
	COM-03	Screen	1	1	1	0	0	2	
	COM-04	Sound equipment	1	1	1	0	0	2	
	COM-05	Portable projector (Portable)	2	2	2	2	2	8	

*1: These items are included in "Building work"

Preparatory Survey on the Project for
Improvement of Primary and Secondary Schools in Ulaanbaatar City

Soft Component Plan

1. Background

This project aims at constructing quality schools, as models for new schools to be constructed by the Government of Mongolia (GoM) in future, with due consideration of children with disabilities (CWD) and the issue of Disaster Prevention based on principles of "universal design". To achieve such an aim, two prerequisite must be emphasized, i.e., 1) school staff should use the facilities properly and effectively according to its purpose, with full understanding on what the point of the design is and why it is adopted there, 2) the design, accompanying technical information, should be disseminated into persons who concern to improve physical school environment in Mongolia, by whom an element of the design may be introduced and materialized. This "soft component" is to assist the initial stage of dissemination to make sure that the project contribute to improvement of the quality in school construction in Mongolia.

2. Purpose of the Component

The purpose of the soft component is to improve educational environment by increase of quality schools with "consideration of disabilities" and "consideration of disaster prevention" in Mongolia.

3. Planned Activities

Activities of assistance by the soft component will be the following three (3) items:

1) To prepare and distribute the booklet and other material for publicity.

To compile the following publicity material as handouts of the seminars and guided tour of the new facilities. The material also will be used as tools for continuous activities for dissemination by the implementing agency in Mongolia:

a. Booklet to introduce the points of universal designs incorporated in the facility design in view of "consideration of disabilities" and "consideration of disaster prevention". Items for school-level activities are to be distinguished.

- Mongolian edition, printed and bound, approx. 40 pages
- Japanese or English edition, simplified using photocopy, approx. 40 pages

To be distributed to:

- Concerned sections of MECSS, UBC Education Department,
- Governmental organs responsible for construction, urban planning, disaster prevention and persons with disabilities,
- Schools (Directors of public schools in Ulaabaatar),
- Non-governmental organizations such as union for disables, parents, etc., and

- Private firms who are concerning to school constructions.

b. Leaflet, a summary of the booklet, which gives more concise explanations for the public

- Mongolian edition, in folio, 8 pages
- Japanese or English edition, using photocopy, 8 pages

To be distributed to participants of the workshop, seminars and guided tours in addition to the above.

c. Presentation slides for Powerpoint

2) Workshop to introduce the new facilities to the staff at the target schools

To hold a workshop for teachers at the target schools on how to use the new facility effectively upon sound comprehension of basic points of considerations.

- Participants: Directors, training managers, social workers and general teachers. Selected members (approx. 15 persons per school, i.e. 60 persons in total) will be invited
- Program: Introduction, presentation of the Project, lectures from the facility designers, session to experience completed facility and discussions (a half day for the whole program)
- Place: the art hall of the new school (A-1 type)

3) Seminar to introduce the new facilities to whom concerned to school construction

To hold the seminar for the persons concerned to school construction in Mongolia. Two seminars, which have the same program for a half day will be held one for persons in education sector and another for persons in construction sector as the target. The aim is to achieve wide recognition on the design and the function of the model which will be constructed by the Project focusing on "consideration of disabilities" and "consideration of disaster prevention." Tours guided by the project's consultants also will be planned.

- Participants: [For persons in education fields] Officials from MECSS/UBC Education Department, persons concerned to inclusive education and directors in the public schools, [For persons in building/construction fields] Officials in charge of construction and in charge of disaster prevention and private consulting firms having records of school construction.
- Program: Introduction, explanation of the Project, presentation by the facility designers, guided tours of the completed facility, presentation by a party related to person with disabilities and an officer in charge of disaster management (a half day for the whole program)
- Place: the art hall of the new school (A-1 type)

4. Implementation Schedule

Activity 1). 10 weeks for compiling, translating, printing and binding of material

Activity 2). and 3). 2 weeks for preparation and implementation of seminars and a workshop

PREPARATORY SURVEY REPORT

ON

THE PROJECT FOR IMPROVEMENT OF PRIMARY AND SECONDARY EDUCATION FACILITIES IN ULAANBAATAR CITY

IN

MONGOLIA

SOFT COMPONET PLAN

AUGUST 2017

MATSUDA CONSULTANTS INTERNATIONAL CO., LTD.

KOEI RESEARCH & CONSULTING INC.

1. Background of Planning Soft Component

While Mongolia has already achieved high enrollment rates, the educational environments have been acutely deteriorating. This is primarily due to population growth accelerating in urban areas which continue to expand around the capital Ulaanbaatar city (UBC), and a resulting increase in the number of students there. To address this situation, the Government of Mongolia (GOM) has been working on a broader coverage of educational infrastructure that simultaneously offers quality learning environments. As the country recognizes shared needs to address inter-sectoral challenges, namely, specific accommodations for children with disabilities (CWD), disaster preparedness, and environmental friendliness, schools are now tasked with incorporating such functional considerations into their facilities.

Under these circumstances, the Project for Improvement of Primary and Secondary Education Facilities in Ulaanbaatar City (the Project) intends to build quality model schools applying universal design principles, which are accessible for CWD and prepared against natural disasters. These models call for GOM's adoption to its school construction projects in the future, which requires the following two-faceted endeavors;

(1) Key functional arrangements included in the architectural design and construction are understood correctly by administrators and staff in the target schools so that they use their facilities to meet the intended purposes; and,

(2) The said arrangements accommodated in the facilities and actual benefits are acknowledged, together with technical know-how, among different groups of people involved in school construction in Mongolia. This should actuate their attempt to improve specific physical environments in their own schools, which will enhance the quality of educational settings as a whole.

Furthermore, in accordance with a request of GOM taking the Green Development initiative, the Project adopts energy-saving, resource-efficient solutions to make school facilities environmentally friendly, particularly cost-reducing in maintenance, which is crucial features to be mainstreamed in the future. Four types of models are thus proposed with the optimal building installations suitable for their sites having different sets of physical conditions and available utilities. Mongolia is developing guidelines to insulate school buildings and their mechanical systems, use energy-saving devices and renewable energy. The Project's models will put more values when they are able to show numerated differences resulting from its energy- and cost-saving strategies. To this end, the target schools should develop energy management schemes that employ measured data to help efficient heating operations.

Central to the main contributions of the Project, considerations for persons with disabilities or disaster preparedness have gained attentions recently in Mongolia as what should be addressed in the society. Relatively new for teachers and staff in general education schools, these issues are less familiarized among them, who will be managing and operating the facilities constructed by the Project. In term of making students with special needs accessible to education, all of the existing three target schools accommodate CWD in their regular classes. However, without allocating teachers specialized in inclusive education, these

schools probably do not have as much knowledge and understanding as they should regarding how to instruct CWD. Their regular-class teachers thus need to obtain essential know-how and understand what each functional arrangement made in the Project's school facilities is intended and what benefits it delivers. This is critical for them to exercise and disseminate good practices in accessible education, using better-equipped learning settings. As for efforts to prepare against disaster risks, they are currently under the initiative of National Emergency Management Agency. School staff and other potential stakeholders do not always know about functions of schools expected in the event of natural disaster. Again, it is of vital importance that they should have essential disaster-related knowledge and understanding in order to respond appropriately to emergency situations, fully utilizing prepared resources. Environmental considerations involve building installations recently developed and applied in Mongolia. Obtaining enough benefits from them will require not only operational training on the systems, but also a deeper understanding of school staff on energy conservation. Technical staff should also learn about practical schemes to efficiently operate the building installations.

Although the above-mentioned thematic issues are acknowledged little by little in the Mongolian society, a core understanding is crucially lacking among engineers, municipal personnel, and school staff involved in school construction. Consequently, the building components are often missing the key elements of how they should be, for instance, ramps unclimbable with wheelchairs, and "accessible" toilets with the entrances allowing no wheelchair passage, eventually left disused. Similarly, people are generally less concerned with saving energy. Heated room temperature is adjusted by manually opening and closing windows, which is deemed wasting thermal energy. The Project will therefore exert on presenting coherent models that exemplify appropriate approaches to those problems. The soft component will be started with activities to foster thorough understanding of such approaches among school staff and other potential stakeholders, so that this leads to specific suggestion for other schools based on the benefits they feel.

It should be noted that the soft component will be implemented in partnership with JICA's ongoing technical cooperation known as the Project for Strengthening Teachers' Ability and Reasonable Treatments for Children with Disabilities (to be closed in July 2019). This is primarily for the sake of capacity development for staff of the target schools (including the Director, administrators, and teachers) who need basic know-how and understanding on inclusive education, which will require a longer period of time for training than a soft component timetable would allow.

2. Objective and Outputs of Soft Component

Objective: Staff at the target schools (school staff) fully understand key features of their educational facilities and installations integrating disability-related accommodations, disaster preparedness, and environmental friendliness as well as regular methods of operations and maintenance of the school facilities. Such guiding models are shared among stakeholders in education so that they suggest applying the good practices to their own educational settings.

Output 1: School staff understand purposes and benefits of universally designed facilities that incorporate disability-related accommodations and disaster preparedness.

Output 2: Booklet is prepared and distributed as a tool that helps policy makers and school construction personnel to understand key features of functional arrangements and resultant benefits, which include universal design, disability-related accommodations, disaster preparedness, and environmental friendliness. Practical examples complied in the booklet are used in their education projects.

Output 3: School staff learn effective energy-saving schemes that lower maintenance costs through their operations of building installations, and a set of such know-how is included in General Operation Manual.

Output 4: Policy makers and school staff better understand energy conservation and energy efficiency schemes, learning from numerated differences obtained from energy-saving operations.

3. Means of Verification for the Achieved Outputs

Output 1: With interviews with and a questionnaire for school staff, it is ensured or planned that new facility components will be used as intended, including Child Development Center, stockpile warehouse for emergency relief, node (conjunction space), and energy-saving heating system.

Output 2: Booklet and other PR tools are prepared and distributed to relevant organizations to increase publicity of the quality schools equipped with functional arrangements. A questionnaire evaluates the degree of which recipients of the booklet, seminar participants, and on-site visitors deem the models are useful for their future work and services.

Output 3: General Operation Manual is prepared to compile numerated energy-saving efficiency in the target schools and enabling schemes.

Output 4: With interviews with and a questionnaire for participants after the verification seminar, it is ensured that they understand energy-saving operations leading to numerated benefits and that such operations will be continued on a long-term basis.

4. Activities in Soft Component (Input planning)

Soft component will include the following activities;

1) Providing school staff with a model case study that enables their hands-on understanding of the concepts underlying guiding practices (functional arrangements) in the target schools and how to use each function equipped:

2) Organizing a seminar on the purposes of functional arrangements and key technical features included in the target schools. Preparing a booklet as an illustrative aid during 1) and 2), which also serves as a regular tool to publicize the model schools in the seminar planned in 2): and,

3) Organizing a seminar on energy management schemes and practices for facility managers and operation staff in the target schools, together with quantitative evaluation on energy-saving efficiency.

The Project will support these publicity activities and verification of energy efficiency in which the implementing agency will be the lead organizer. There, the models are used to demonstrate how to apply the functional arrangements to school construction projects.

(1) Preparation and distribution of booklet

The following publicity materials will be prepared to carry out activities 1) and 2) mentioned above and to aid the implementing agency to run its continuous publicity and dissemination events on the model schools.

a. Booklet (A collection of functional arrangements made in the Project's model schools, which features disability-related accommodations incorporating universal design, disaster preparedness, and environmental friendliness. This tool chiefly targets people who are involved in school construction) - in Mongolian and Japanese or English

b. Brochure (A simplified version of the booklet so as to prompt readers to understand highlights of the specific considerations given to the model schools. This tool chiefly targets teachers and people who are not much involved in building school facilities.) - in Mongolian and Japanese or English

c. PowerPoint (PPT) slides for a presentation: in Mongolian and Japanese or English

Booklet and brochure in Mongolian will be printed and bound form, and Japanese or English counterpart, copied in color with simple binding. Including what the architect originally intended to achieve, the contents must be edited with involvement of the Mongolian side so as to foster their project ownership, for instance, putting comments from the implementing agency, and various groups and agencies working on the particular areas of issues addressed in the Project.

■ Description

【Target】

a. Booklet	Distribution to MECSS[1], UBC[2]-ED	20 copies
	Distribution to organizations related to architecture and construction, persons with disabilities, and disaster prevention	30 copies
	Distribution to directors of public schools in UBC	130 copies
	Distribution to participants in on-site tours and PR seminars	120 copies＋200 copies, 500 copies in total

1 Ministry of Education, Culture, Science and Sports

2 Ulaanbaatar City

b. Brochure	The same number of copies are distributed, and reprinted, as required, with financing of the Mongolian side	500 copies in total
c. PPT slides	Sending data to MECSS and UBC-ED subdivisions related to school construction projects	5 copies of DVD-R

【Structure of contents】

a. Booklet	・ Project summary (including key components related to disability-related accommodations, disaster preparedness, and environmental friendliness) ・ Universal design concept ・ Detailed functional arrangements (1) (requiring relatively high costs) ・ Detailed functional arrangements (2) (requiring affordable costs for schools) (Notes) ・ Visual images are chief materials to help intuitive understanding of the key messages ・ Clear illustration of technical know-how and functional arrangements that are actually applied to the school facilities ・ The preparation process will involve the implementing agency to foster its ownership of the soft-component implementation, for instance, by including a preface in the booklet written by the State Secretary of MECSS.
b. Brochure	・ Briefly explain examples of considerations given to disability-related accommodations, disaster preparedness, and environment. ・ Contain pages each presenting the four models

■ Implementation resources

【Japanese consultant】

・Activities in Japan		
-Leader (Architectural planning)	Layout planning, drafting	5 man-days (40p x 1h/p=40 hours)
-Building designer	Collection of resource materials and editing of visual images	10 man-days (40p x 2h/p=80 hours)
-Editor	Preparation of a block copy and PPT slides	5 man-days (40p x 0.5h/p＋0.5h/p=40 hours)
・Activities in Mongolia	* Activities in Mongolia are pursued by UBC-ED, the project implementer, under the supervision of Japanese resident engineer, and therefore no budget is allocated for Japanese consultant.	
-Resident engineer	Supervision of procurement and order placement	(No project budget is allocated)
-	Supervision of acceptance and distribution	(No project budget is allocated)

【Local contract】

・Translation	A4 20 p (about half the volume of 40 p) Japanese or English to Mongolian
・Printing and binding	Local printing/book binding agency (procured from one of three agencies or more submitting the lowest quotations, shortlisted mainly from those

Contractor/Procurement	previously involved in projects of JICA or other international organizations)
Contracted services	1) Booklet (in Mongolian) Adjusted A4-size, saddle-stitched, 40 p 500 copies in full color 2) Booklet (in Japanese or English) Colored 30 copies with simple binding 3) Brochure (in Mongolian) A4-sized in folio, 8p 500 copies in full color 4) Brochure (in Japanese or English) Colored 30 copies in folio 5) Printing envelops for distribution
【Local resource】	Management of procurement and order placement: UBC-ED Acceptance and distribution: UBC-ED Distribution to organizations and personnel concerned: UBC-ED

(2) Implementation of an on-site model case study (focusing on functional arrangements)

The following session will be organized so that administrators, teachers and other staff in the target schools will be able to operate their facilities effectively based on their basic and proper understandings of what all kinds of accommodations are to serve for. The session will be organized by UBC-ED implementing the Project, where participants learn at first hand various functions equipped in their school facilities.

■ Description

【Target】	Directors, Training Managers, Social Workers, and teachers in the target schools	A total of 60 people, 15 each from the target school
【Structure of contents】	・Envisioned contributions of the completed models ・Universal design concept ・Strategies to integrate disability-related accommodations, disaster preparedness, and environmental friendliness (energy conservation) into school facilities ・On-site briefing and discussion	Japanese consultant on architectural design Staff in the implementing agency Tool: PR brochure Site tour participants: 20 people x 3 groups
【Venue and schedule】	Newly constructed school (tentatively A-1) -Lecture: Art Hall -Site tour: as designated	Half a day to cover a lecture and site tour

■ Implementation resource

【Japanese consultant】

・Activities in Mongolia		Schedule applicable both to Activity (2) and (3)
-Leader (Architectural planning)	Training planner and manager, lecturer	10 man-days, trip to Mongolia (including Activity (3)) The trip also includes a completion inspection and thus is not allocated with additional traveling expenses, except for 10-days accommodations. 【Details】

		Coordination and schedule management (1day) On-site preparation and program check (1day Tutorial direction (MC), seminar direction (MC), site tour guide (6 days, of which 3 days are spent on the seminar and other tasks) Debrief and wrap-up (1 day) Day off (1day)
-Building design	MC and instructor	12 man-days, trip to Mongolia (including Activity(3)) 【Details】 Travel (1 days)＋coordination and schedule management (1day) Direction of venue setting and coordination of presenters (1 day) Seminar presentation, attendance and presentation in the seminar, site tour guide (6 days, of which 3 days are spent on the seminar and other tasks) Debrief and wrap-up (1 day) + travel (1 day) Day off (1day)
【Local contractor】		
・Translator	From Japanese or English to Mongolian	7 man-days x 1 person (including Activity (3)) Translating the tutorial 1/2 day
【Local resource】	Main host, lead coordinator	UBC-ED
	Venue setting and preparation	School staff in the target schools

(3) Implementation of on-site model case seminar for school construction staff

The model schools are intended to be a catalyst for improving the quality of educational infrastructure through which functional arrangements are learned by potential stakeholders, and then adopted in future school construction projects in Mongolia. To this end, key features, including technical know-how, purposes and benefits, must become known to and understood by as many professionals involved in school construction as possible. It is also important for them to see actual facilities and learn directly examples of what desirable school environments should be as whole. As a part of supporting an initial stage of publicity activities regarding the model schools, the Project will distribute a booklet to various related organizations and personnel and organize a site tour of the completed facilities, open to the public, as well as a seminar inviting architects, users, and various stakeholders. The components of these events are planned as below.

The seminar will be held twice, each for a different group of participants. It should avoid a one-sided presentation style and must have remarks on how Mongolian participants (disability-related organizations and disaster-prevention administrators) evaluate the model schools. The seminar should be such an opportunity that the models will be broadly replicated across Mongolia to achieve quality educational settings. During activities mentioned in (2) and (3), the model facilities will be open to the public, allowing

wide-ranging groups of people to visit and look around. Including the Japanese architects, tour guides will be assigned to describe key design features and receive comments and ideas from visitors.

■ Description

【Target】	(1) Stakeholders in education: MECSS, UBC-ED administrators, officers in special needs education, and directors in public schools in UBC	A total of 60 people per seminar x twice
	(2) Private-sector consultants involved in architecture and construction, school construction projects, and disaster-prevention administrators	A total of 120
【Structure of contents】	・Site tour in the completed facilities (for all participants) ・Project brief (for all participants) ・Key environmental consideration (energy conservation) (for all participants) ・Key features of disability-related accommodations (1) ・Evaluation of persons with disabilities (1) ・Key features of disaster preparedness (2) ・Evaluation of disaster-prevention manager (2) ・Discussion (for all participants)	20 people at maximum x 3 to 4 groups Tool: PR booklet Lecturers: Japanese consultant on architectural design Representatives of disability-related groups, disaster-prevention administration, and MECSS/UBC-ED
【Venue and schedule】	Newly constructed school (tentatively A-1) -Lecture: Art Hall -Site tour: as designated	2 days (for the seminar) 6 days (for the site tour)

■ Implementation resources

【Japanese consultant】		
・Activities in Japan		
-Leader (Architectural planning)	Training planner and manager, lecturer	(Included in Activity (2))
-Building design	MC and lecturer	Same as above
【Local contract】		
・Translator	From Japanese or English to Mongolian	Translating the seminar 1/2 day x 2 days
【Local resource】	Main host, lead coordinator	UBC-Ed
	Venue setting and preparation	School staff in the target schools
	Lecturer	Representatives of local disability-related groups and (school) disaster-prevention administration

(4) Implementation of on-site energy management training in the target schools

Facility managers in the target schools are expected to learn and practice energy-efficient heating operations based on measured data. This should lead to creating good practices in energy management suitable for different heat sources, and eventually reducing maintenance costs. The first step is to foster understanding of school staff on energy conservation and management, and to provide hands-on learning on procedures and schemes required for actual heating system operations. It specifically involves: 1) a group seminar highlighting energy conservation and management, and 2) an on-site training using completed systems. The latter contains three major components: common items applicable to all heat sources and systems provided, system-specific items, and hands-on system operations. This training will focus on practical learning, targeting facility operators in the target schools. The group seminar will include participants from policy makers and school facility managers involved in school construction so that they become keen about reducing maintenance costs and saving energy.

■ Description

【Target】	(1) Directors in the target schools (2) Facility managers and operators (3) Administrators involved in school construction	
【Structure of contents】	[Group seminar] (1)+(2)+(3)	
	・Envisioned contributions of the completed models	Japanese expert on energy management
	・Energy-saving strategies planned in the Project	
	・Energy management schemes and institutionalization	Tool: General Operation Manual
	[On-site training] (1) + (2)	
	・Control scheme of heating water ; e.g. adjusted to the differences between the external and internal temperatures, and those between the ground and upper levels	
【Venue and schedule】	[Group seminar] Newly constructed school (tentatively A-1) -Lecture: Art Hall	1 day to cover the whole program
	[On-site training]	
	1. Instruction on basic and common items	2 days in total for general session
	2. Site-specific instruction using different heat sources	2 days for item-specific session
	3. Training on heating operations in all four target schools	6 days in total

■ Implementation resources

【Japanese consultant】

・Activities in Japan		
-Energy management	Support for preparing seminar materials	10 man-days Details ・5 days for preparing materials for urban schools (A4 20p) ・5 days for preparing materials for rural schools (A4 20p)
・Activities in Mongolia		
-Energy management	Lecturer, on-site training	16 man-days, trip to Mongolia 【Details】 ・Travel, preparation, and meeting: 1day each ・Adjustment of instrumentation: 1 day per target school, totaling 4 days ・Updating General Operation Manual: 1 day ・Instruction on basic matters common to the target schools: 1 day ・Heating operation training in all the target schools : 4 days in total ・Wrap-up and debrief: 1 day ・Day off (Sunday): 2 days ・Travel: 1 day
【Equipment】	Supply data recording device Thermometer with data recording device (for measuring room temperature)	* New equipment needed is built in the system (included in the Project's construction contract) in advance.
【Local contract】		
・Translator (including conference interpreting)	Japanese or English to Mongolian	4.0 man-days
・Local energy engineer	Preparing seminar materials on energy management Seminar and operation instruction	6 man-days: Preparing seminar materials under supervision of a Japanese engineer 8 man-days: Adjustment of instrumentation, operational training in the target schools
・Translation	Prepared seminar materials (English to Mongolian) are translated by a local energy engineer.	
【Local resource】	Main host and lead coordinator Venue setting and preparation, Presentation	UBC-ED School staff in the target school Facility managers in the target school

(5) Establishment of maintenance schemes through energy-saving practices and quantifying increased efficiency

With respect to the energy-saving schemes learned in Activity (4), it is crucial to be trained in efficient heating operations properly adopted to seasonal temperature differences in Mongolia. Therefore, a local energy engineer will be assigned to supervise appropriate operation procedures over eight months from a start of heating in October through the end in May. With this, the operators will practice heating operations in an efficient manner and make them established on site. The established procedures will be described in the General Operation Manual as a tutorial applicable to other schools to enable their energy-saving practices to continue.

As the same time, differences resulting from energy-saving practices (less coal consumption and running costs and reduction in air pollutants and greenhouse gases which is co-benefit) will be quantified (into numbers) to promote understanding on importance of appropriate use of energy.

■ Description

【Target】	(1) Directors in the target schools (2) Facility managers and operators (3) Administrators involved in school construction	
【Structure of contents】	[On-site demonstration] (1) + (2)	
	1) Instruction on recording of heating operations (external and internal temperatures and heat consumption at a scheduled period)	Local energy engineer Tool: General Operation Manual
	2) Training on data check and efficient room-temperature control schemes	
	3) Optimization of the schemes (higher efficiency and feasibility) and incorporation into a manual to ensure continuous practices	
	[Verification seminar] (1) + (2) + (3)	Facility managers in the targets schools
	1) Implementation of the energy-efficiency verification seminar based on data analysis, numerated increase in energy efficiency, modeling of appropriate schemes for heating system operations	Japanese expert on energy management Tool: Verification report (slides), General Operation Manual
【Venue and schedule】	1) Target schools (1 session in every two weeks, totaling 32 weeks, 0.5 day per school x 4 schools)	Local energy engineer
	2) Same as above	Local energy engineer
	3) 1 month prior to a defection inspection (June when heating is terminated)	1 day
	Newly constructed school (tentatively A-1) -Lecture: Art Hall	Japanese expert on energy management and local energy engineer local energy engineer

■ Implementation resource

【Japanese consultant】

・Activities in Japan		
-Energy management	Support for analysis of verified data	10 man-days 【Details】 ・Review and data entry of monitoring results on heating systems and temperature data: 1 day ・Data analysis and on-site operation training: 5 days ・Review of verified results: 2 days ・Preparation of presentation materials for the energy-efficiency verification seminar: 2 days
・Activities in Mongolia		
-Energy management	Discussion on verified results with school staff MC for the verification seminar, lecturer	6 man-days, trip to Mongolia 【Details】 ・Travel + preparation: 1day* ・Verification seminar: 1 day ・Check and supplementary operation training: 2 days (0.5 days for 4 schools)** ・Wrap-up and debrief at UBC-ED: 1 day ・Travel: 1 day**
【Local contract】		
・Translator (including conference interpreting)	Japanese or English to Mongolia	2.5 man-days (*above requires 0.5 days, **above entails no budget)
・Local energy engineer	Training on efficient room temperature control	32 man-days in total-check analyzed data quality and efficiency, requiring a 0.5 day-visit each to the target schools in every two weeks. Monitor and instruct the four schools to obtain comparable data (0.5 day per school*4 sites*0.5 session/week*32 weeks)
	Support for analysis of verified data	5 man-days in total
	Assistant in the verification seminar	3 man-days
【Local resource】	Main host and lead coordinator	UBC-ED
	Venue setting and preparation	School staff in the target school
	Presentation	Facility managers in the target school

5. Procurement of Resources Required for Implementation of Soft Component

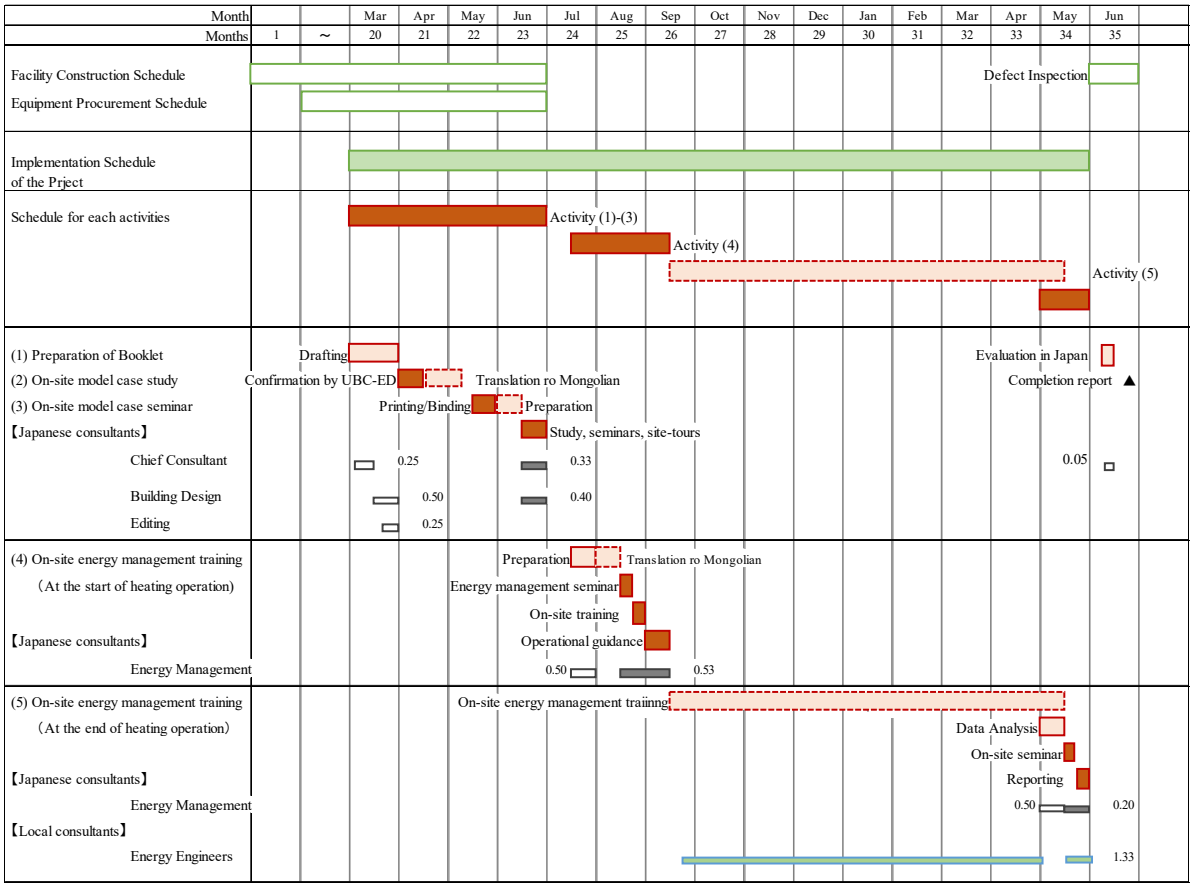
The soft component described here is intended to make designed physical components broadly known and disseminated. The main activities are integral to assistance provided by the Project where the implementing agency will carry out publicity activities and energy-saving practices. The Japanese

consultant involved in the detailed design of the school facilities will mobilize relevant local resources to the possible extent. Responsibilities are assigned as below.

- Preparation of booklet and other tools: The Japanese consultant will complete drafting, including input from the implementing agency (Translation into Mongolian will be outsourced to a local translator). Upon delivery of a block copy, printing and bookbinding will be contracted to one of three or more agencies selected with their competitive quotations. Potential agencies are invited from those who have previously worked for JICA projects.
- On-site model case study (focusing on functional arrangements): With the implementing agency hosting the model case study, the Japanese consultant will pursue overall management jointly, direct a site tour, and make a presentation. During the site tour, a resident engineer assigned by the Japanese consultant will be assisting
- Model case seminar for school construction staff: With the implementing agency hosting the model case seminar, the Japanese consultant will pursue overall management jointly, direct a site tour, and make a presentation. During the site tour, a resident engineer assigned by the Japanese consultant will be assisting
- On-site energy management training: The Japanese consultant will be tasked with an entire process from preparation of training materials to on-site practices. Because this requires technical expertise, the Project will assign a person who has previously worked for an energy efficiency project in UBC funded by Japan.
- Energy-saving practices and verification of increased efficiency: Under the guidance of Japanese consultant, a hands-on training will be provided in the target schools, instructed by a local energy engineer. Because such engineer must be knowledgeable of theoretical understanding, and have practical skills in installing, operating and maintaining a boiler system, the Project will assign a person who has first-hand experiences in similar projects.

6. Implementation Schedule of Soft Component

Activities (1), (2), and (3) that constitute the soft component are scheduled in a period between the facility completion and handover. Prior to this, a booklet and other tools modifying it (brochure and presentation slides) will be completed. As for Activity (4), an on-site training will be held after September 15 when a district heating system starts to operate. Activity (5) is scheduled in late June prior to a defect inspection of the completed facilities, after continuous thermal monitoring is completed over a heating period from October through May.



7. Deliverables of Soft Component

Deliverables will include a completion report on the soft component submitted to the Government of Mongolia and Japan, a booklet, brochure, PPT presentation slides, lists of participants in the publicity events, their responses to questionnaires, training materials on energy management (General Operation Manual and others), verified data on energy management, finalized General Operation Manual, and so on.

8. Responsibilities of the Recipient Country

As leading organizers of publicity events on the completed schools, MECSS and UBC-ED must be prepared to decide on and invite potential participants and receive as many visitors. With outcomes obtained in energy-related training sessions, these agencies are expected to encourage other schools to practice energy-efficient management schemes for the sake of their appropriate spending of maintenance costs.

The soft component is planned as a minimum essential endeavor to make the model schools used as intended and known broadly among people involved in education, particularly regarding what functions they serve for. UBC-ED, the project implementer, should continue to gain publicity of those model schools, using a booklet and other available tools. In particular, they are expected to understand key features to be applied to their school construction, namely, disability-related accommodations, disaster preparedness, and environmental friendliness. The guiding models in the Project should be also a design foundation on which further improvements are made.

6. Other Relevant Data

6-1 Topographic Survey Map

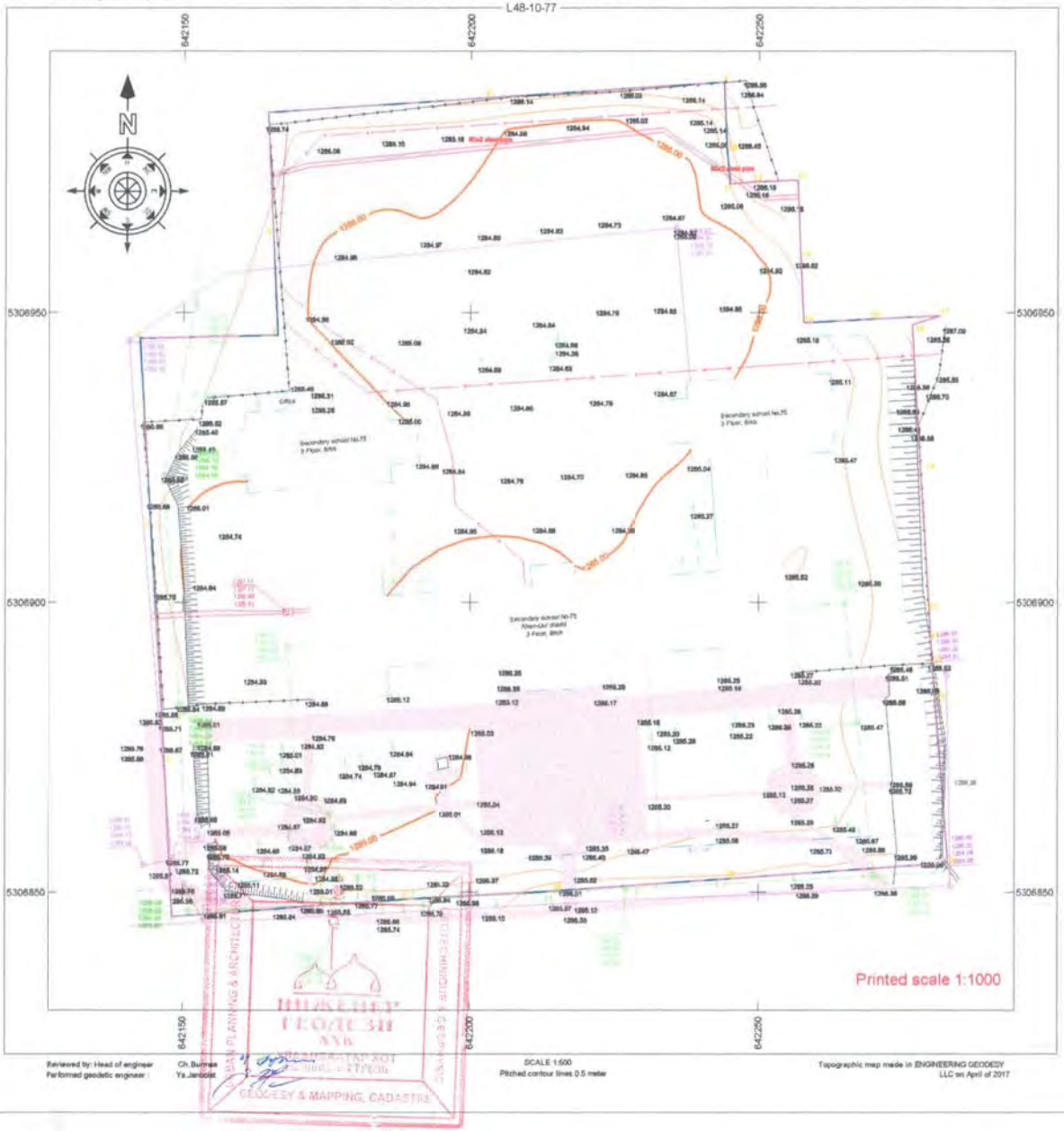
- No. 75 School (A-1) construction site, Khan-Uul District
- Chingeltei No. 7 Khoroo (A-2) construction site
- No. 53 School (B-1) construction site, Bayanzurkh District
- No. 109 School (B-2) construction site, Nalaikh District

Ulaanbaatar city, Mongolia
Coordinate system: UTM WGS-84

TOPOGRAPHIC MAP AT SCALE 1:500 OF 75th SCHOOL IN HAN-UUL DISTRICT

Han-Uul district, No.2 khoroo

L48-10-77



COORDINATES OF CADASTRAL BOUNDARY

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2	X=642146.73 Y=5306873.28
3	X=642144.35 Y=5306913.61
4	X=642142.40 Y=5306945.56
5	X=642166.39 Y=5306946.16
6	X=642165.56 Y=5306964.08
7	X=642164.64 Y=5306984.59
8	X=642204.31 Y=5306987.20
9	X=642243.98 Y=5306989.82
10	X=642244.41 Y=5306978.40
11	X=642244.99 Y=5306972.24
12	X=642249.29 Y=5306972.58
13	X=642256.70 Y=5306972.87
14	X=642257.18 Y=5306980.61
15	X=642257.80 Y=5306948.29
16	X=642269.66 Y=5306948.89
17	X=642281.65 Y=5306949.50
18	X=642278.73 Y=5306947.89
19	X=642278.19 Y=5306923.71
20	X=642279.64 Y=5306895.53
21	X=642279.94 Y=5306884.56
22	X=642280.23 Y=5306880.59
23	X=642280.67 Y=5306883.41
24	X=642282.94 Y=5306855.03
25	X=642244.90 Y=5306852.33
26	X=642214.76 Y=5306850.19
27	X=642188.24 Y=5306848.72

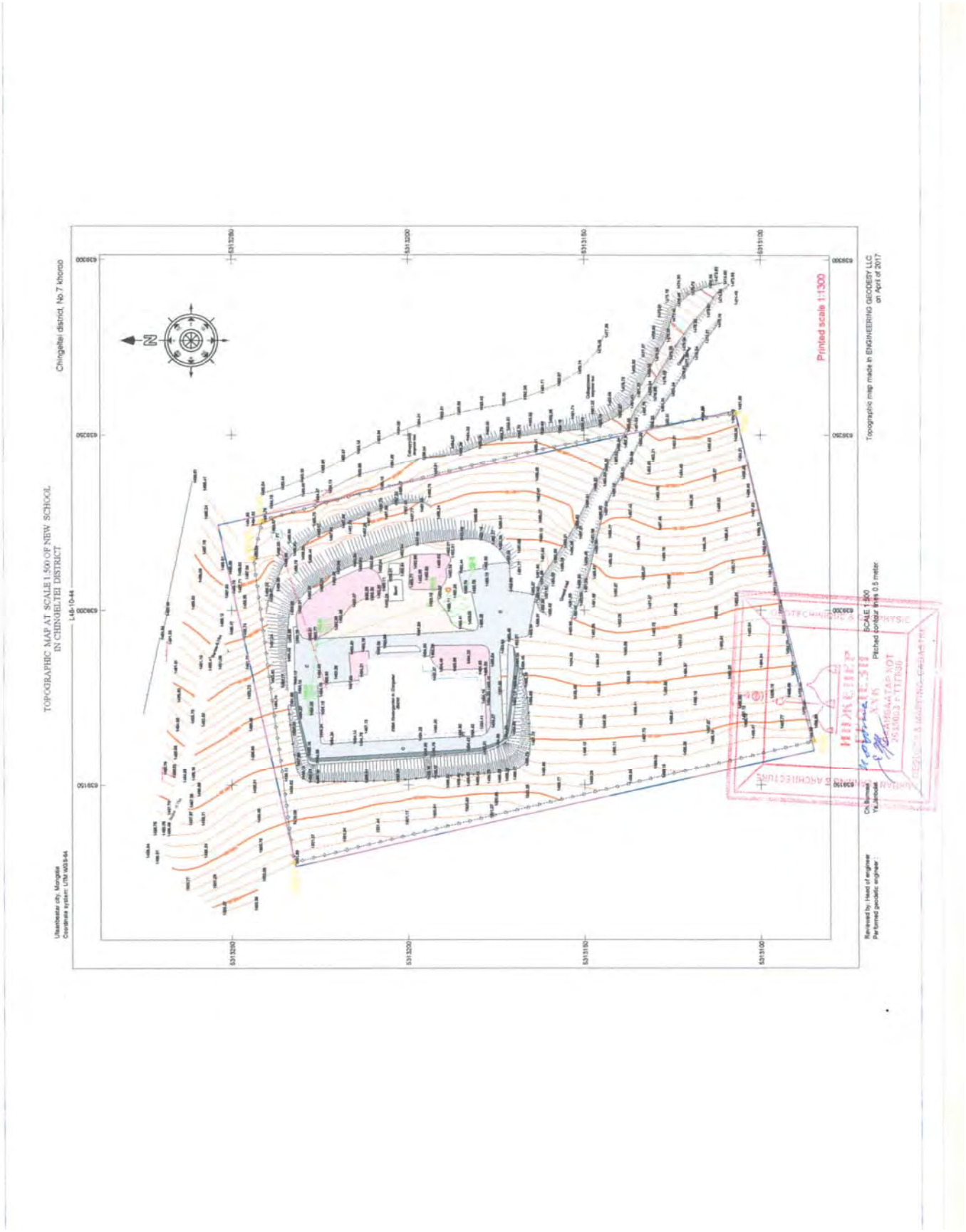
Reviewed by: Head of engineer Ch.Burmaa
Performed geodetic engineer: Ya.Jerodol

SCALE 1:500
Pitched contour lines 0.5 meter

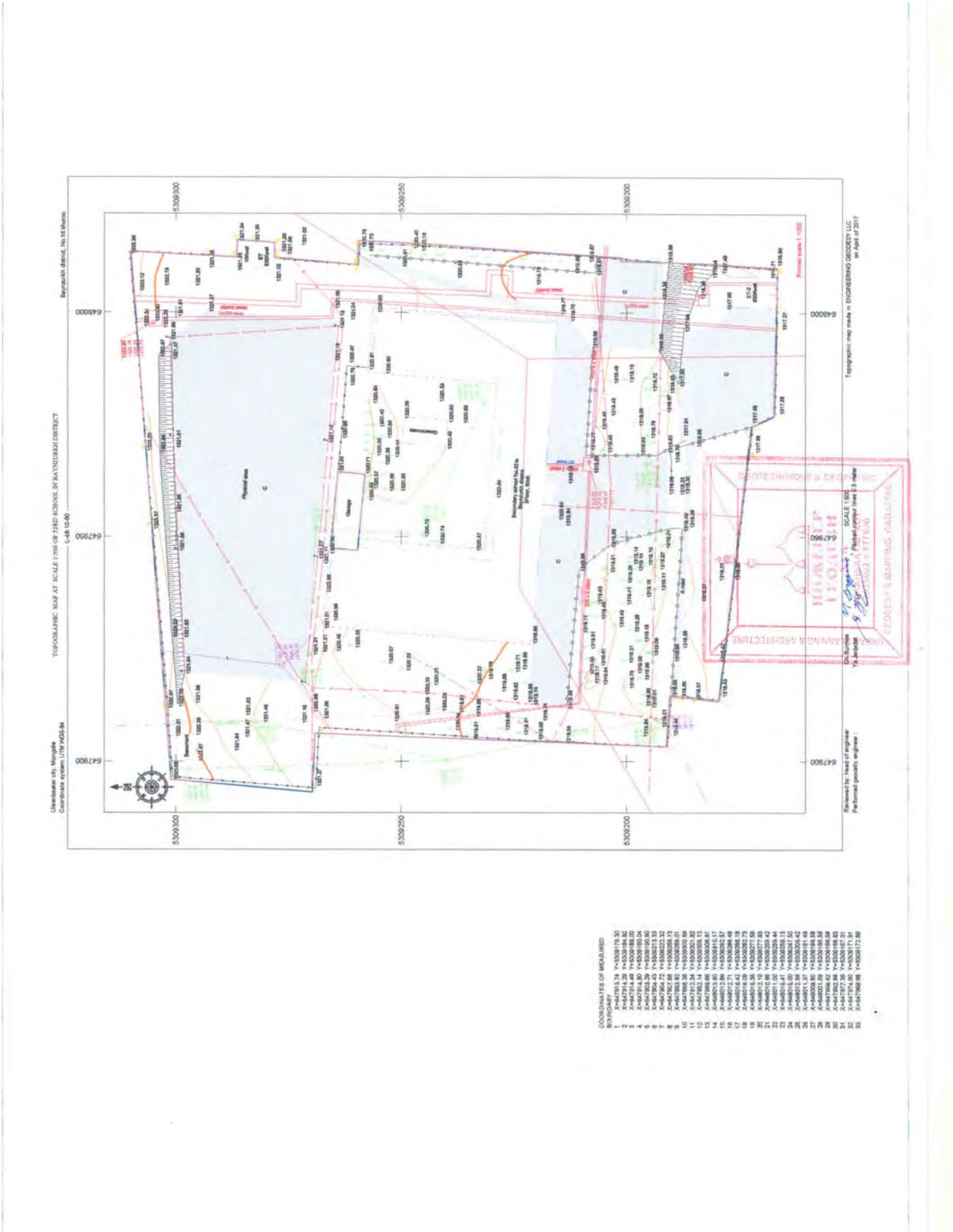
Topographic map made in ENGINEERING GEODESY LLC on April of 2017

ENGINEERING GEODESY & MAPPING, CADASTRE

・Chingeltei No. 7 Khoroo (A-2) construction site



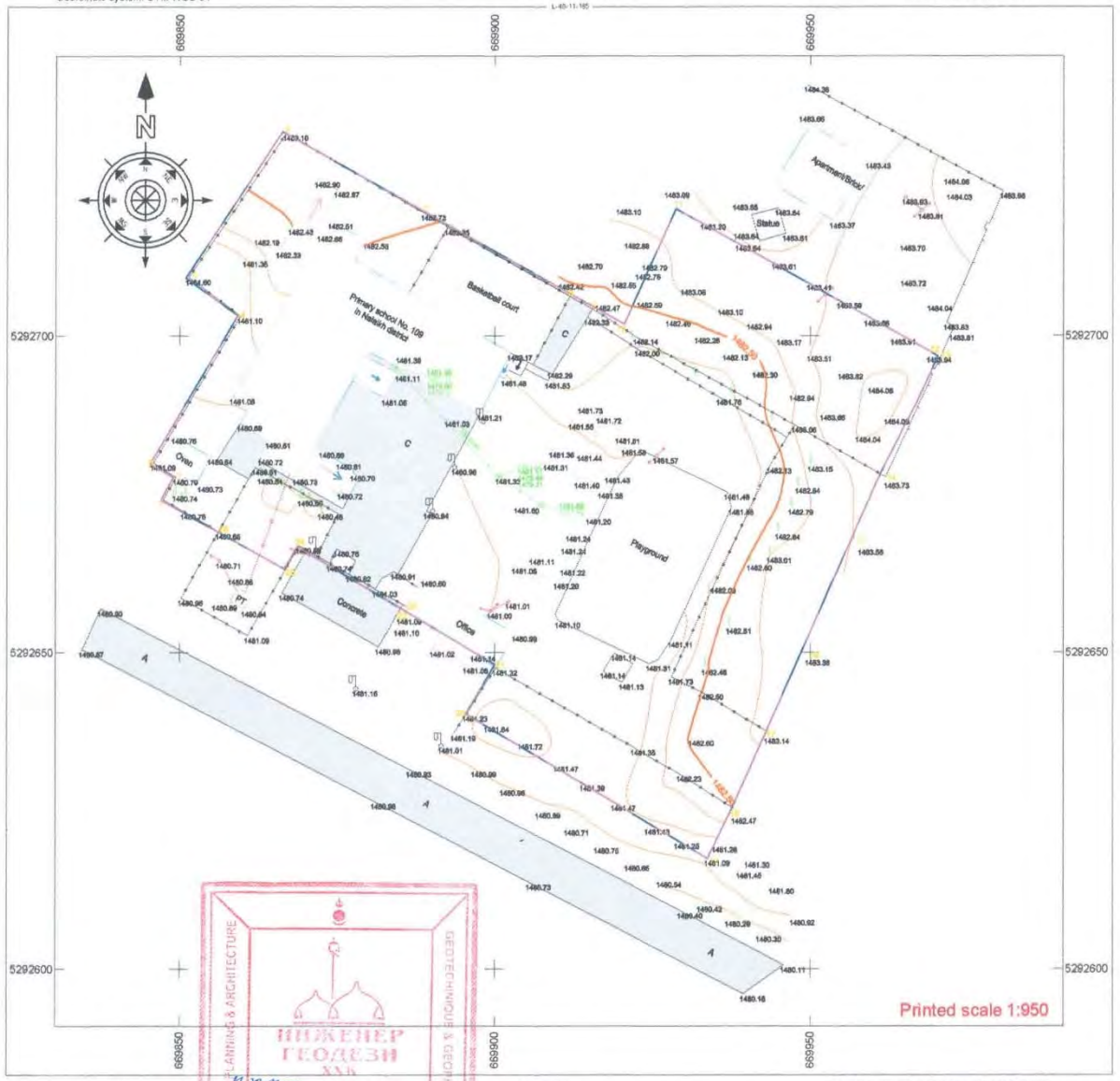
・No. 53 School (B-1) construction site, Bayanzurkh District



Ulaanbaatar city, Mongolia
Coordinate system: UTM WGS-84

TOPOGRAPHIC MAP ATSCALE 1:500 OF 109THSCHOOL
IN NALAIKH DISTRICT

Nalaikh district, No.3khoroo



Coordinates of measured boundary

1	X=669847.43	Y=5292674.11
2	X=669849.45	Y=5292677.64
3	X=669845.90	Y=5292679.93
4	X=669859.63	Y=5292703.15
5	X=669851.44	Y=5292709.26
6	X=669866.90	Y=5292732.02
7	X=669888.78	Y=5292719.40
8	X=669911.90	Y=5292706.25
9	X=669915.57	Y=5292704.17
10	X=669920.53	Y=5292701.80
11	X=669928.77	Y=5292720.02
12	X=669970.20	Y=5292696.79
13	X=669970.59	Y=5292696.61
14	X=669961.98	Y=5292677.66
15	X=669957.59	Y=5292667.61
16	X=669949.81	Y=5292650.00
17	X=669943.16	Y=5292637.44
18	X=669937.96	Y=5292625.28
19	X=669933.82	Y=5292617.41
20	X=669895.41	Y=5292640.31
21	X=669900.13	Y=5292647.52
22	X=669885.47	Y=5292656.42
23	X=669885.99	Y=5292657.23
24	X=669886.99	Y=5292666.84
25	X=669886.83	Y=5292663.11
26	X=669856.20	Y=5292669.12

Reviewed by: Head of engineer Ch.Burmaa
Performed geodetic engineer : Ya.Janbolat

SCALE 1:500
Pitched contour lines 0.5 meter

Topographic map made in ENGINEERING GEODESY LLC
on April of 2017

6-2 Geotechnical Survey Report (abstruct)

- No. 75 School (A-1) construction site, Khan-Uul District
- Chingeltei No. 7 Khoroo (A-2) construction site
- No. 53 School (B-1) construction site, Bayanzurkh District
- No. 109 School (B-2) construction site, Nalaikh District

" ENGINEERING GEODESY" LLC

Ulaanbaatar-16081
Bayangol district , 6-r khoroo
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Web: www.geo-mongol.mn

Archive 17/039

ZT19-615/14

Engineering-geological investigation report for new school building area in 2nd micro, Khan-Uul district, Ulaanbaatar city

/Detail design stage/

Approved by:

Director *TS.Bileg*

Prepared by:

Engineer geologist *G.Erdenetsetseg*

Ulaanbaatar city

2017

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APPENDIXES

1. LOCATION OF BOREHOLES, SC 1:1000, APPENDIX №1
2. ENGINEERING-GEOLOGICAL SECTION, APPENDIX №2

   SC Horizontal 1:100
   Vertical 1:1000
3. STANDARD PENETRATION TEST RESULT APPENDIX №4

I. GENERAL INFORMATION

1.1 Survey basis

Engineer Geodesy LLC /Drawing and geological survey company/ completed engineer geological survey work of construction area of 75th school extension in Ulaanbaatar city, han-Uul district, 2nd khoroo by "MECSS" tender in April 19th-28th 2017 and survey planned and completed as their requested.

1.2 Survey technique

Team with drill master Galzagd.Y , assistant worker Byambasuren.G is executed the drill work by UGB-50M equipment, 5 boreholes 10.0 meters depth, 50.0 t/m column drilling, to locate and define underground water depth, characteristics, construction fundament pressure effective soil depth and distribution, according to the plan and SNIP 11-03-01 in survey area engineer geological survey work.

Soil physic and mechanic characteristics been defined by taking 29 pieces of samples from drilled boreholes in soil study laboratory. According to ASTM standard, Tsagaandarkhi.L /laboratory chief/, Ganchimeg.G /laboratory engineer/ are summarized the result and tabled soil analyze in soil study laboratory of Engineer Geodesy LLC /with guaranteed number of TL-78 from Standardization and Metrology department, satisfied the standard of ISO/IEC 17025:2005, MNS ISO/IEC 17025:2005/. Engineer Geologist Erdenetsetseg.G processed the engineer geological report to create procedural plan which is made by comparison of field survey material and laboratory analyze result.

Source materials related to survey work stored in archive of Engineer Geodesy LLC.

II. ENGINEERING GEOLOGICAL INVESTIGATED CONDITION

2.1 Location

Area of re-building where 19th bus station of 2nd khoroo, Han-Uul district and 75th school's new school and planning now.

Drawing №1. Survey area of location

2.2 Climatic conditions

"Buyant-Ukhaa" climate stations indices CCM 23-01-09 standard "Climate and geotechnical indices for the construction work" have been used for the climate indices of this site, and showed in tables

Annual and monthly average air temperature, ^{0}C

Table II-1

Station	Month												Year
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Buyant-Ukhaa	-25.7	-21.1	-10.2	-0.8	8.7	15.0	17.2	15.0	7.6	-1.5	-14.1	-23.4	-2.6

Absolute maximum air temperature, ^{0}C

Table II-2

Station	Absolute maximum	Date	July average
Buyant-Ukhaa	39.4	2005.VII.15	-31.4

Absolute minimum air temperature, ^{0}C

Table II-3

Station	Absolute minimum	Date	Jan average
Buyant-Ukhaa	-49.0	1954.VII.30	-39.9

Structure and technical calculation temperature, ^{0}

Table II-4

Station	Calculation temperature, °C				
	Coldest temperature				One day during hottest temperature
	1 day	3 day	5 day	Airring	
Buyant-Ukhaa	-36.7	-35.3	-34.2	-29.9	25.8

Temperature supply indices for the construction and technical calculation during winter time (^{0}C)

Table II-5

Station	The coldest 5 days temperature supply, %				The coldest 1 day temperature supply, %			
	99.2	99.5	94	92	99.9	99.5	94	92
Buyant-Ukhaa	-41.8	-41.7	-39.4	-39.0	-43.3	-43.2	-41.5	-40.7

Air humidity and precipitation

Table II-6

Station	Precipitation							
	Warm season	Cold season	Annual	In warm season	Maximum of day	Year	Month	Day
Buyant-Ukhaa	50	72	248.8	236.5	74.9	1967	VI	27

Annual and monthly average wind speed

Table II-7

Station	Month, winter, average speed of year, m/sec													
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	winter	year
Buyant-Ukhaa	0.7	1.3	2.5	3.7	3.8	3.4	2.9	2.6	2.5	2.1	1.3	0.7	0.9	2.3

2.3 Geological formation

In survey area, from below filled soil upper and modern Quaternary alluvium-proluvium. Equal well graded gravel with sand soil spread equally thickness in survey area until 10 meter deep continued. In survey area, spread soil classified engineering-geological elements that EGE-1, defined characteristics of physics-mechanical and cross section of depth and distribution shown in drawing.

2.4 Geomorphological features ба physic-geological scene and process

Survey area different from geomorphological one element and located in higher river terraces in right hand side of Tuul river. In survey area, soil was generally equal structure and elevation is between 1284.90-1285.50 meter then elevation difference is 0.60 meter.

2.5 Hydro-geological condition

In survey area, soil groundwater has been occurred in 3.60-3.80meter deep by 5 drill holes with 10 meter depth /dated April 19-20th ,2017/. Soil ground water is minimum low level in April and it can be increased by rainfall. Ground water is with free surface and hydraulic related to Tuul river. In summer and autumn, soil ground water level increase about 1.0-1.5meter from current level and it depends on source of water.

III. ENGINEERING-GEOLOGICAL CONDITIONS AND PHYSICAL AND MECHANICAL PROPERTIES

3.1 Soil engineer geological classification and formation

In survey area, soil color was brown yellowish and type was well-graded gravel with sand - GW soil /EGE-1/. Physics and mechanical properties of soil determined and draw cut to spread and thick.

3.2 Soil physics mechanic characteristic

Depending on soil particle structure and physic mechanic characteristic classified to engineer geological 1 element.

EGE-1. Well-graded gravel with sand /GW/

Brown yellowish color, up and modern Quaternary alluvium-proluvium (apQ_{III-IV}), saturation by water and sandy equal gravel soil.

Granulometric composition from the laboratory analysis of these soil samples includes: (%):

- Gravel 63.3
- Sand 32.9
- Silt 3.8
- Clay 3.8

Physical properties indices of the soil:

- Natural moisture content 8.0
- Specific gravity, g/sm^3 2.65
- Wet density g/sm^3 2.28
- Dry density g/sm^3 2.11
- Porocity , % 20.34
- Porocity ratio 0.256
- Moisture content degree 0.83

Normative and calculation indices of the mechanical properties:

According to the norm and regulations to create the construction groundwork - CCM 50-01-16 and Table I:

Normative values:

- Cohesion C_n= 2.0 kPa
- Angle of internal friction φ_n= 40^0
- Deformation modulus E= 45 MPa

Calculation value:

- Cohesion C_{n2}= 1.33 kPa
- Angle of internal friction φ_{n2}= 36.36 ^{0}
- Calculated resistance R_0= 500 kPa

According to CCM 50-01-16 and 5.3.2, well-graded gravel with clay and sand soil is normalize by none swellings.

Silty sand with gravel soil seasonal freezing depth 3.8 m

Earthwork of measuring, dig-up III

A-119

IV. CONCLUSION

1. In survey area, low and average blub engineer geological 1 types of element occurred, and there is no swellings, soil ground water detected in 3.60-3.80meter, filled up ground spread vary thickness related to human and engineering process and this area depend on hard condition for engineering geology. For example; underground cable, network (thermal and pure water pipelines), electrical cable (lot of shear), earthquake magnitude is 8 that value is intense range.
2. Parameters of calculation and main soil spread to area physic and mechanic characteristic normative are shown in section of **Engineer Geological classification and soil Physic mechanic characteristic**.
3. Table IV-1 is shown soil blub level and earth work degree for distributed soil in survey area. Earth work degree counted as manually executed.

Table IV-1

Soil type	Earthworks degree	Bulging degree	Specific reactance om, m
Well graded gravel	III	None bulging	Dry condition: 2000-10000 Watery condition: 200-600

4. Survey area is in 8 magnitude earthquake region. (143-190см/с^2 acceleration of top soil)
5. Soil groundwater has not been occurred in 3.60-3.80meter deep by 5 drill holes with 10 meter depth /dated April 19-20th ,2017/. Soil ground water is minimum low level in April and it can be increased by rainfall. Ground water is with free surface and hydraulic related to Tuul river. In summer and autumn, soil ground water level increase about 1.0-1.5meter from current level and it depends on source of water.
6. Soil test is necessary after opening of building fundament galvanized.

Summary is written Erdenetsetseg.G /Engineer-geologist/

V. REFERENCE LIST

1. CCM 2.02.01-94. Construction codes on designing of construction foundation Ulaanbaatar, 1994 y.
2. CCM 23-01-09. Climate and geotechnical indices for the construction work Ulaanbaatar, 2009 y.
3. CCM 22.01.01/2006. Construction codes on constraction planning at seismic zones of Mongolia Ulaanbaatar, 2006 y
4. "CG 11-107-11. Guideline of engineering geologic report and summary
5. "CCM 11-03-01 Contruction norm and regulation
6. Инженерные изыскания встройтельсве (Спаровочныk) страниц таблиц -131, 1975года., зав.редакций Е.А.Ларина "Земляные работы" / СНИП-IV-5/
7. ASTM D 2487

V. BOREHOLE LOGS

BOREHOLE-1

Depth ,m	10.00	Elevation, m	1284.93
Diameter,mm	168	Drilling date:	2017.04.19

1. Filled up soil color is dark gray and contained building waste.	0.00-1.30	1.30
2. Well-graded gravel with sand soil color is brown yellowish.	1.30-10.0	8.70

Soil groundwater detected at 3.60m.
/Current date April 19th,2017 /

BOREHOLE -2

Depth ,m	10.00	Elevation, m	1285.0
Diameter,mm	168	Drilling date:	2017.04.19

1. Filled up soil color is dark gray and contained building waste.	0.00-1.40	1.40
2. Well-graded gravel with sand soil color is brown yellowish.	1.40-10.0	8.60

Soil groundwater detected at 3.70m.
/Current date April 19th,2017 /

BOREHOLE -3

Depth ,m	10.00	Elevation, m	1285.08
Diameter,mm	168	Drilling date:	2017.04.20

1. Filled up soil color is dark gray and contained building waste.	0.00-1.70	1.70
2. Well-graded gravel with sand soil color is brown yellowish.	1.70-10.0	8.30

Soil groundwater detected at 3.80m.
/Current date April 19th,2017 /

BOREHOLE -4

Depth ,m	10.00	Elevation, m	1285.50
Diameter,mm	168	Drilling date:	2017.04.20

1. Filled up soil color is dark gray and contained building waste.	0.00-1.20	1.20
2. Well-graded gravel with sand soil color is brown yellowish.	1.20-10.0	8.80

Soil groundwater detected at 3.80m.
/Current date April 19th,2017 /

BOREHOLE -5

Depth ,m	10.00	Elevation, m	1285.30
Diameter,mm	168	Drilling date:	2017.04.20

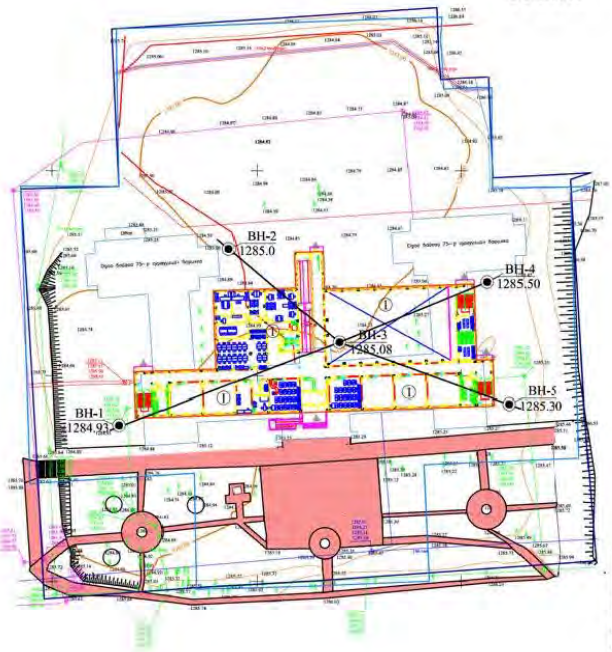
1. Filled up soil color is dark gray and contained building waste.	0.00-1.50	1.50
2. Well-graded gravel with sand soil color is brown yellowish.	1.50-10.0	8.50

Soil groundwater detected at 3.80m.
/Current date April 19th,2017 /

Borehole logs written by: D.Dashzeveg

Appendix-1

LOCATION OF BOREHOLE
SC 1:1000



LEGEND

① Construction area of Rebuild school and current school number 75.

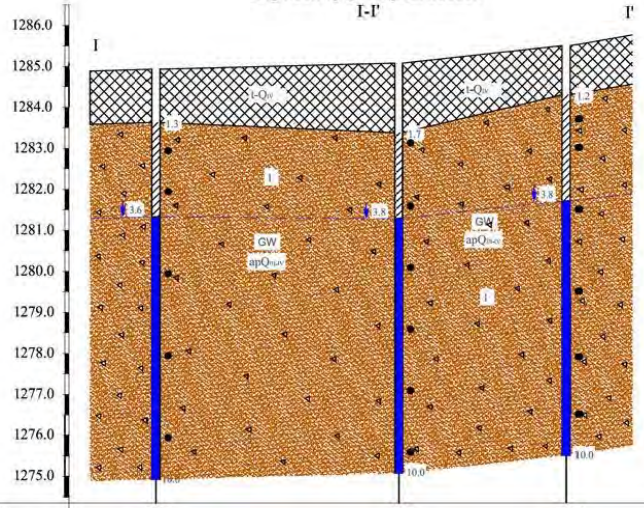
BH-1 1284.93 Drilled borehole number
Elevation, м

Engineering - geological section

	ENGINEERING GEODESY LLC			Stage WD
	CLIENT	MECSS		Page number 1
	OBJECT	Engineering-geological investigation report for new school building area in 2nd micro, Khan-Uul district, Mongolia		
Checked by		G.Erdenetsetseg	Title	Scale
Drawned by		E.Uchral	LOCATION OF BOREHOLE	1:1000

Appendix-2

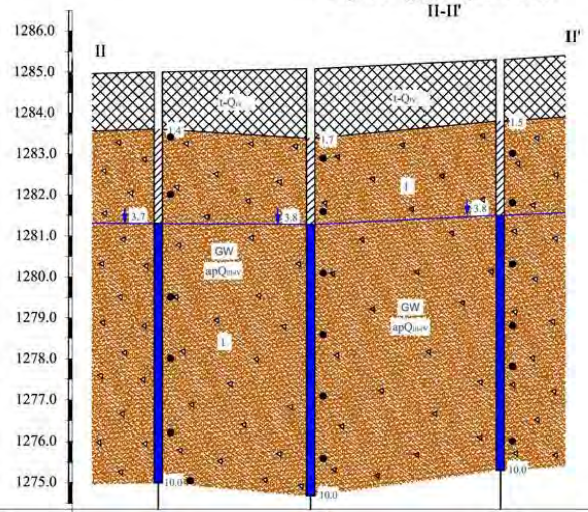
Engineering-geological section
I-I'



Borehole number	BH-1	BH-3	BH-4
Elevation (m)	1284.93m	1258.08m	1285.50m
Borehole distance (m)	57.3m	39.05m	

	ENGINEERING GEODESY LLC			Stage WD
	CLIENT	MECSS		Page number 2
	OBJECT	Engineering-geological investigation report for new school building area in 2nd micro, Khan-Uul district, Mongolia		
Checked by		G.Erdenetsetseg	Title	Scale
Drawned by		E.Uchral	Engineering geological section I-I'	Ver 1:100 Hor 1:1000

Engineering-geological section
II-II'



Borehole number	BH-2	BH-3	BH-5
Elevation (m)	1285.0m	1258.08m	1285.30m
Borehole distance (m)		35.3m	44.3m

LEGEND

- Filled up color is dark gray and contained building waste.
- EGE-1 — Brown yellowish color, upper and modern quaternary age, origin is alluvium-proluvium, humidity and sandy equal gravel soil.
- ① — Number of Engineering geological element
- Soil index of origin and age

Soil conditions

- Sandy soil
- Moistly
- Saturation by water
- Surface
- 1.30 — Boundary of soil layer
- Soil samples from depths (m)
- 3.6 — Ground water detected depth (m)
- 10.0 Depth (m)

	ENGINEERING GEODESY LLC			Stage: W/D
	CLIENT	MECSS		Page number: 3
	OBJECT	Engineering-geological investigation report for new school building area in 2nd micro, Khan-Uul district, Mongolia		
Checked by		G.Erdenetsetseg	Title	Scale
Drawned by		E.Uchral	Engineering geological section II-II'	Ver 1:100 Hor 1:1000

ENGINEERING GEODESY LLC

Object: Engineering-geological investigation report for new school building area in 2nd khoroo, Khan-Uul district, Ulaanbaatar city

ACCREDITED LABORATORY OF SOIL RESEARCH
TABLE OF LABORATORY TEST RESULT

TL-78
MNS ISO/IEC 17025:2007

Start date: 2017.04.20
Finish date: 2017.04.24

№	Borehole number	depth of sample [m]	Grain size analysis, [mm]										Hydrometr, [mm]%						%	Gravel	Sand	Silt/Clay	Soil type / ASTM D 2487/	Plastic index /MNS ASTM D 4318-2005/			Cu	CC	Natural moisture content(W), %	Specific gravity G_s, t/m³	Wet density, ρ, t/m³	Dry density, ρ_d, t/m³	Porosity, n, %	Porosity ratio, e	Saturation degree, Sr
			37.5	25.0	19	12.5	9.5	4.75	2.36	0.600	0.425	0.300	0.075	0.055	0.022	0.012	0.008	0.006	0.003	0.001						LL	PL	PI								
EGE-2 Well-graded gravel with sand /GW/																																			
1	1	9.0	6.9	7.9	9.7	6.2	15.7	16.9	14.4	6.9	3.6	3.8	3.9	0.4	0.8	0.7	1.2	0.8	0.1	0.1	100.0	63.3	32.6	4.1	GW	well-graded gravel with sand	inelastic	32	24.22	10.2	2.67	2.29	2.08	22.17	0.285	0.96
2	3	9.5	6.3	7.5	9.2	7.0	16.1	16.4	15.9	6.3	3.2	3.3	4.1	0.9	1.1	0.5	0.4	0.5	0.2	0.3	100.0	63.3	32.8	3.9	GW	well-graded gravel with sand	inelastic	32	25.92	8.9	2.67	2.28	2.09	20.39	0.256	0.91
3	2	3.0	7.1	6.9	8.6	7.9	15.4	17.2	14.2	6.5	4.5	4.6	3.3	0.5	0.6	0.9	0.8	0.4	0.5	0.1	100.0	63.1	33.1	3.8	GW	well-graded gravel with sand	inelastic	45	36.4	7.8	2.65	2.28	2.12	20.19	0.253	0.82
4	5	4.0	6.2	7.2	9.4	8.8	15.0	16.2	14.5	7.2	5.4	4.0	3.8	0.8	1.0	0.4	0.3	0.7	0.2	0.3	100.0	63.4	32.9	3.7	GW	well-graded gravel with sand	inelastic	45	40.6	6.8	2.66	2.29	2.14	19.39	0.241	0.75
5	1	2.0	5.9	8.1	8.8	9.3	16.0	16.1	14.1	6.8	3.5	3.7	4.0	0.8	0.7	0.6	0.5	0.3	0.4	0.2	100.0	64.4	32.1	3.5	GW	well-graded gravel with sand	inelastic	50	45.1	5.4	2.67	2.29	2.17	18.63	0.229	0.63
6	5	2.3	6.6	7.7	8.6	8.0	15.2	16.7	15.9	7.0	4.1	3.6	3.0	0.4	0.9	0.6	0.7	0.4	0.5	0.1	100.0	62.8	33.6	3.6	GW	well-graded gravel with sand	inelastic	22.5	21.1	7.9	2.64	2.23	2.10	20.31	0.255	0.82
7	1	3.0	7.0	7.4	9.0	5.9	15.8	17.2	15.8	6.1	3.7	4.1	3.7	0.7	1.2	0.5	0.3	0.7	0.8	0.1	100.0	62.3	33.4	4.3	GW	well-graded gravel with sand	inelastic	20	14.46	6.1	2.63	2.25	2.12	19.37	0.240	0.67
8	2	1.6	6.4	6.8	8.4	9.1	16.3	16.8	13.9	7.3	4.0	4.3	3.1	0.8	0.7	0.6	0.8	0.5	0.4	0.2	100.0	63.8	32.6	3.6	GW	well-graded gravel with sand	inelastic	30	28.8	7.4	2.64	2.26	2.10	20.29	0.255	0.77
9	1	5.0	5.5	7.0	8.9	8.5	15.7	17.5	16.0	6.8	3.8	3.2	3.9	0.3	1.1	0.4	0.6	0.4	0.1	0.3	100.0	63.1	33.7	3.2	GW	well-graded gravel with sand	inelastic	37.5	30.3	7.2	2.63	2.28	2.13	19.13	0.237	0.80
10	5	5.5	5.7	7.3	9.2	9.7	15.0	16.5	14.8	7.1	3.4	4.4	3.8	0.7	0.8	0.5	0.4	0.6	0.5	0.2	100.0	63.4	33.1	3.5	GW	well-graded gravel with sand	inelastic	38.3	33.05	8.0	2.65	2.27	2.10	20.68	0.261	0.83
11	2	5.5	6.3	9.4	11.2	5.8	13.4	17.3	13.0	8.1	4.2	4.0	3.2	0.9	1.2	0.5	0.6	0.3	0.2	0.4	100.0	63.4	32.5	4.1	GW	well-graded gravel with sand	inelastic	50	36.9	7.7	2.66	2.29	2.13	20.06	0.251	0.82
12	3	3.5	7.0	7.0	8.2	8.6	15.8	17.0	14.9	7.5	4.2	2.3	3.0	1.0	0.9	0.7	0.3	0.5	0.8	0.3	100.0	63.6	31.9	4.5	GW	well-graded gravel with sand	inelastic	25	22.5	7.3	2.65	2.28	2.12	19.82	0.247	0.78
13	4	6.0	5.0	9.0	6.5	9.7	14.3	18.7	13.5	6.9	4.7	5.1	2.8	0.8	0.6	0.5	0.6	0.7	0.4	0.2	100.0	63.2	33.0	3.8	GW	well-graded gravel with sand	inelastic	45	32.5	8.0	2.64	2.26	2.09	20.74	0.262	0.81
14	3	6.5	8.4	7.0	7.4	10.8	13.9	19.1	13.7	8.2	3.0	3.7	3.7	0.4	1.0	0.4	0.7	0.3	0.2	0.1	100.0	64.6	32.3	3.1	GW	well-graded gravel with sand	inelastic	24.6	24	8.1	2.63	2.27	2.10	20.16	0.252	0.84
15	4	4.0	6.3	7.9	7.5	9.8	17.1	15.9	13.7	8.5	3.7	3.1	3.9	0.5	0.7	0.5	0.3	0.4	0.1	0.1	100.0	64.3	32.9	2.8	GW	well-graded gravel with sand	inelastic	25	24	7.4	2.64	2.28	2.12	19.59	0.244	0.80
16	2	7.0	5.6	8.7	9.1	7.8	16.6	14.5	12.1	10.8	3.2	4.1	3.5	0.7	1.2	0.7	0.5	0.8	0.2	0.3	100.0	61.9	33.7	4.4	GW	well-graded gravel with sand	inelastic	40	25.6	8.1	2.65	2.27	2.10	20.76	0.262	0.82
17	4	2.5	7.5	6.8	8.4	7.8	16.0	15.8	16.3	7.4	2.7	3.4	3.2	1.0	1.4	0.3	0.9	0.8	0.1	0.2	100.0	62.3	33.0	4.7	GW	well-graded gravel with sand	inelastic	42	26.80	7.1	2.66	2.29	2.14	19.62	0.244	0.77
18	3	5.0	6.1	7.2	9.0	8.8	14.8	17.2	16.8	9.3	3.7	3.8	3.8	0.7	1.0	0.6	0.7	0.2	0.3	0.1	100.0	63.1	32.4	4.5	GW	well-graded gravel with sand	inelastic	40	25.6	8.1	2.64	2.28	2.11	20.11	0.252	0.85
19	1	7.0	4.5	6.1	9.2	7.8	16.5	16.8	15.4	7.7	4.1	3.6	3.6	1.1	1.5	0.7	0.3	0.5	0.4	0.2	100.0	60.9	34.4	4.7	GW	well-graded gravel with sand	inelastic	40	24.3	7.7	2.63	2.27	2.11	19.86	0.248	0.82
20	5	7.0	6.0	8.1	8.2	10.2	14.8	17.3	15.6	5.7	2.6	3.4	3.9	0.9	1.1	0.5	0.7	0.4	0.3	0.3	100.0	64.6	31.2	4.2	GW	well-graded gravel with sand	inelastic	45	36.5	8.1	2.64	2.27	2.10	20.46	0.257	0.83
21	2	10.0	7.8	7.4	9.2	8.7	12.4	19.5	14.7	6.4	3.5	3.2	3.2	0.5	0.9	0.3	0.8	0.7	0.6	0.3	100.0	65.0	31.0	4.0	GW	well-graded gravel with sand	inelastic	45.4	36.8	9.4	2.65	2.28	2.08	21.35	0.272	0.92

STANDARD PENETRATION TEST RESULT /SPT/

Borehole number	Depth of SPT (m)	0-15cm	15-30cm		30-45cm		N
		Blow counts	Real penetration thickness(cm)	Blow counts	Real penetration thickness(cm)	Blow counts	Blow counts
BH-1	2.0	25	15	42	6	50	92/21cм
	3.0	22	15	47	7	50	97/22cм
	4.0	14	15	18	15	22	40
	5.0	17	15	19	15	23	42
	6.0	15	15	17	15	27	44
	7.0	28	15	30	15	32	62
	8.0	29	15	32	15	37	69
	9.0	28	15	31	15	35	66
	10.0	33	15	42	15	48	90
BH-2	2.0	30	15	37	11	50	87/26cм
	3.0	28	15	35	13	50	85/28cм
	4.0	21	15	24	15	26	50
	5.0	24	15	26	15	30	56
	6.0	26	15	27	15	30	57
	7.0	28	15	31	15	33	64
	8.0	32	15	33	15	37	70
	9.0	34	15	38	15	40	78
	10.0	37	15	40	14	50	90/29cм
BH-3	2.0	29	15	42	10	50	92/25cм
	3.0	35	15	49	8	50	99/23cм
	4.0	24	15	26	15	25	51
	5.0	26	15	26	15	27	53
	6.0	25	15	27	15	28	55
	7.0	24	15	25	15	28	53
	8.0	25	15	28	15	30	58
	9.0	27	15	30	15	31	61
	10.0	29	15	30	15	32	62
BH-4	2.0	28	15	39	11	50	89/26cм
	3.0	33	15	46	8	50	96/23cм
	4.0	19	15	20	15	22	42
	5.0	21	15	21	15	25	46
	6.0	20	15	21	15	23	44
	7.0	19	15	22	15	22	44
	8.0	20	15	22	15	24	46
	9.0	22	15	25	15	28	53
	10.0	23	15	26	15	32	58
BH-5	2.0	24	15	42	12	50	92/27cм
	3.0	30	15	45	13	50	95/28cм
	4.0	18	15	21	15	22	43
	5.0	19	15	22	15	24	46
	6.0	20	15	22	15	25	47
	7.0	24	15	24	15	28	52
	8.0	25	15	27	15	28	55
	9.0	34	15	36	15	36	72
	10.0	35	15	38	15	40	78

Prepared by: E.Uchral

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Archive 17/035

3T19-615/14

ENGINEER GEOLOGICAL SURVEY REPORT OF NEW SCHOOL CONSTRUCTION AREA IN 7th KHOROO, CHINGELTEI DISTRICT, ULAANBAATAR CITY

/ Detail design stage /

Approved by:

DIRECTOR *TS.BILEG*

Prepared:

Engineer geologist *E.Uchral*

Ulaanbaatar city

2017

TABLE OF CONTENTS

APPENDIXES

I. GENERAL INFORMATION

1.1 Survey basis

Engineer Geodesy LLC /Drawing and geological survey company/ completed engineer geological survey work of construction area of school extension in Ulaanbaatar city, Chingeltei district, 7th khoroo by MECSS tender in April 17th-27th 2017 and survey planned and completed as their requested.

1.2 Survey technique

Team with drill master Ganbold. B, Byambaa. G, Lhagvatseren. N is executed the drill work by UGB-1BC equipment, POWER4000 drilling machine 5 boreholes 10.0 meters depth, 50.0 t/m column drilling, to locate and define underground water depth, characteristics, construction fundament pressure effective soil depth and distribution, according to the plan and SNIP 11-03-01 in survey area engineer geological survey work.

Soil physic and mechanic characteristics been defined by taking 5 pieces of samples from drilled boreholes in soil study laboratory. According to ASTM standard, Tsagaandarkhi.L /laboratory chief/, Ganchimeg.G /laboratory engineer/ and Bayarmagnai.A /laboratory assistant/ are summarized the result and tabled soil analyze in soil study laboratory of Engineer Geodesy LLC /with guaranteed number of TL-78 from Standardization and Metrology department, satisfied the standard of ISO/IEC 17025:2005, MNS ISO/IEC 17025:2005/. Engineer Geologist Uchral.E processed the engineer geological report to create procedural plan which is made by comparison of field survey material and laboratory analyze result.

Source materials related to survey work stored in archive of Engineering Geodesy LLC.

II. Survey condition of engineer geology

2.1 Location

Ulaanbaatar city, Chingeltei district, 7th khoroo, existent 224th kindergarden school building to front new school construction.

Drawing №1. Survey area of location

2.2 Climatic conditions

MUIS climate stations indices and CCM 23-01-09 standard "Climate and geotechnical indices for the construction work" have been used for the climate indices of this site, and showed in tables

Annual and monthly average air temperature, ^{0}C

Table II-1

Station	Month												Annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
MUIS	-21.2	-14.9	-7.9	1.7	10.0	15.2	17.5	15.4	8.6	0.3	-11.3	-18.8	-0.5

Absolute maximum air temperature, ^{0}C

Table II-2

Station	Absolute max	Date	VII avarege
MUIS	33.8	1997.VII.10	26.5

Absolute minimum air temperature, ^{0}C

Table II-3

Station	Absolute	Date	I avarege
MUIS	-36.0	1988.I.23	-31.9

Structure and technical calculation temperature, ^{0}C

Table II-4

Station	Calculation temperature, ^{0}C				
	Coldest temprature				One day during hottest temperature
	1 day	3 day	5 day	Airring	
MUIS	-31.4	-30.3	-28.9	-25.0	26.4

Temperature supply indices for the construction and technical calculation during winter time (^{0}C)

Table II-5

Station	The coldest 5 days temperature supply, %				The coldest 1 day temperature supply, %			
	99.2	99.5	94	92	99.9	99.5	94	92
Buyant-Ukhaa	-41.8	-41.7	-39.4	-39.0	-43.3	-43.2	-41.5	-40.7

Air humidity and precipitation

Table II-6

Station	Precipitation							
	Warm season	Cold season	Annual	In warm season	Maximum in a day	Year	Month	Day
Buyant-Ukhaa	50	72	248.8	236.5	74.9	1967	VI	27

Annual and monthly average wind speed

Table II-7

Station	Month,winter,annual average speed, m/s													
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Winter	Annual
MUIS	0.6	0.9	1.5	2.2	2.1	1.8	1.5	1.2	1.4	1.2	0.9	0.5	0.7	1.3

2.3 Geological formation

In survey area distributed equally well graded gravel with clay and sand soil, weathered sandstone of poured soil from below, up and modern Quaternary eluvial-deluviam. In survey area spread silt soil is classified as a engineer geological element, physic mechanic characteristics defined and depth and distribution cross section shown.

2.4 Geomorphology characteristics and physic geological appearance, process

Survey area's relief is rugged character and general surface elevation between 1487.15-1496.75 m then slope decreased from north west to east south and generally move slowly slope formation. Survey area little bit exposed by engineering process and between current planning object and current kindergarden ravine road made by engineering process. In survey area, linear and field washed process shall be may occur.

2.5 Hydro-geological condition

Soil groundwater has not been occurred by 5 drill holes with 10.0 meter depth in survey area /dated April 17th -19th 2017/. Permeability test was conducted on BH-3 in this site. Permeability K=0.116 cm/sec.

III. ENGINEERING-GEOLOGICAL CONDITIONS AND PHYSICAL ,MECHANICAL PROPERTIES

3.1 Soil engineer geological classification and formation

In survey area well-graded gravel with clay and sand /EGE-1/ distributed equally.

3.2 Soil physic mechanic characteristic

Depending on soil particle structure and physic mechanic characteristic classified to engineer geological 1 elements.

EGE-1. Well-graded gravel with clay and sand

Yellowish, up and modern Quaternary eluvial- deluviam origin /dpQIII-IY/, solid consistency well-graded with clay and sand.

Granulometric composition from the laboratory analysis of these soil samples includes: (%):

- Gravel 67.8%
- Sand 23.3%
- Silt 7.0%
- Clay 1.9%

Physical properties indices of the soil:

- Natural moisture content 5.5
- Liquid limit 25.37
- Plastic limit 18.94
- Plastic indices 6.43
- Specific gravity, g/cм^3 2.69
- Wet density g/cм^3 2.23
- Dry density g/cм^3 2.12
- Porocity, % 21.34
- Porocity ratio 0.272
- Moisture content degree 0.55
- Consistency < 0

Normative and calculation indices of the mechanical properties:

According to the norm and regulations to create the construction groundwork - CCM 50-01-16 and Table I:

Normative value

- Cohesion C_n =14kPa
- Angle of internal friction φ_n =45^0
- Deformation modulus E=49MPa

Calculation value:

- Cohesion C_{n2}=9.33Pa
- Angle of internal friction φ_{n2}=39.13^0
- Calculated resistance R_0=450

According to CCM 50-01-16 and 5.3.6, well graded gravel clay and sand is D=3.50 and saturation of degree is S_r=0.55 which means it can create a weak bulging region.

Well graded gravel clay and sand seasonal freezing depth.

Earthwork of measuring, dig-up III

The rock soil.-Rock/Sandstone /soil weathering zone - / K_1/

In area of Sandstone weathering zone -/ K_1/ distribute widely and stone distribution depth until 7.20-9.20m thickness and it shown in engineer-geological cross section. In survey area most part of color is light green grey and bigger than average unit, distributed mica sandstone weathering zone. Sandstone physics indices:

Weathered rock soil volume weight	2.50-2.62 g/sm^3
None weathered rock soil халтан ул volume weight	2.65 g/sm^3
Rock soil percentage of erosion /%/	33.7-35.6
Quality of interaction with water softened	
Dispersely condition	disperse by hammer
Rock soil earthwork degree dig by manual:	
Soil of weathered rock	Y

IV. Conclusion

1. In survey area low blub engineer geological 1 types of element occurred, situated in one element by geomorphology, soil groundwater is not occurred and human engineering process is effected low grade area counted as a average engineer geological condition area.
2. Parameters of calculation and main soil spread to area physic and mechanic characteristic normative are shown in section of **Engineer Geological classification and soil Physic mechanic characteristic**.
3. Table IV-1 is shown soil blub level and earth work degree for distributed soil in survey area. Earth work degree counted as manually executed.

Table IV-1

Soil type	Earthworks degree	Bulging degree	Specific reactance om, m
Well-graded gravel with clay and sand	III	Weak bulging	4-40

4. Survey area is in 7 magnitude earthquake region.
5. Soil groundwater has not been occurred by 5 drill holes with 10.0 meter depth in survey area /dated April 17th -19th 2017/. Soil ground water is minimum low level in April and it can be increased by rainfall.
6. Soil test is necessary after opening of building fundament galvanized.

Summary is written: E. Uchral /Engineer/

V. Reference list

1. CCM 50-01-16. Construction codes on designing of construction foundation Ulaanbaatar, 2016 y.
2. CCM 23-01-09. Climate and geotechnical indices for the construction work Ulaanbaatar, 2009 y.
3. Seismic zone of Ulaanbaatar city. SC 1:10 000, 2015y.
4. "CG 11-107-11. Guideline of engineering geologic report and summary
5. "CCM 11-03-01 Contruction norm and regulation
6. Инженерные изыскания встройтельсве (Спаровочныk) страниц таблиц -131, 1975года., зав.редакций Е.А.Ларина,
7. "Земляные работы" / СНИП-IV-5/
8. ASTM D 2487

VI. Borehole logs

BOREHOLE-1

Depth , m	10.0	Elevation , m	1496.75
Diameter , mm	168	Drilling date	2017.04.17

1.	Top soil contained root of plant.	0.00-0.20 / 0.20
2.	Yellowish well-graded gravel with clay and sand.	0.20-0.80 / 0.60
3.	Grey green sandstone weathering area.	0.80-3.10 / 2.30
4	Grey green sandstone.	3.10-10.0 / 6.90

Soil groundwater not detected.
/current date April 17th 2017/

BOREHOLE-2

Depth , m	10.0	Elevation , m	1496.25
Diameter , mm	168	Drilling date	2017.04.17

1.	Top soil contained root of plant.	0.00-0.20 / 0.20
2.	Yellowish well-graded gravel with clay and sand.	0.20-1.00 / 0.80
3.	Grey green sandstone weathering area.	1.00-3.50 / 2.50
4	Grey green sandstone.	3.50-10.0 / 6.50

Soil groundwater not detected.
/current date April 17th 2017/

BOREHOLE-3

Depth , m	10.0	Elevation , m	1487.15
Diameter , mm	168	Drilling date	2017.04.18

1.	Filled up soil.	0.00-0.40 / 0.40
2.	Yellowish well-graded gravel with clay and sand.	0.40-2.80 / 2.40

3. Grey green sandstone weathering area.	2.80-5.00	
	2.20	
4 Grey green sandstone.	5.00-10.0	
	5.00	

Soil groundwater not detected.
/current date April 18th 2017/

BOREHOLE-4

Depth , m	10.0	Elevation , m	1493.25
Diameter , mm	168	Drilling date	2017.04.18

1. Top soil contained root of plant.	0.00-0.20	
	0.20	
2. Yellowish well-graded gravel with clay and sand.	0.20-1.20	
	1.00	
3. Grey green sandstone weathering area.	1.20-3.80	
	2.26	
4 Grey green sandstone.	3.80-10.0	
	6.20	

Soil groundwater not detected.
/current date April 18th 2017/

BOREHOLE-5

Depth , m	10.0	Elevation , m	1490.25
Diameter , mm	168	Drilling date	2017.04.19

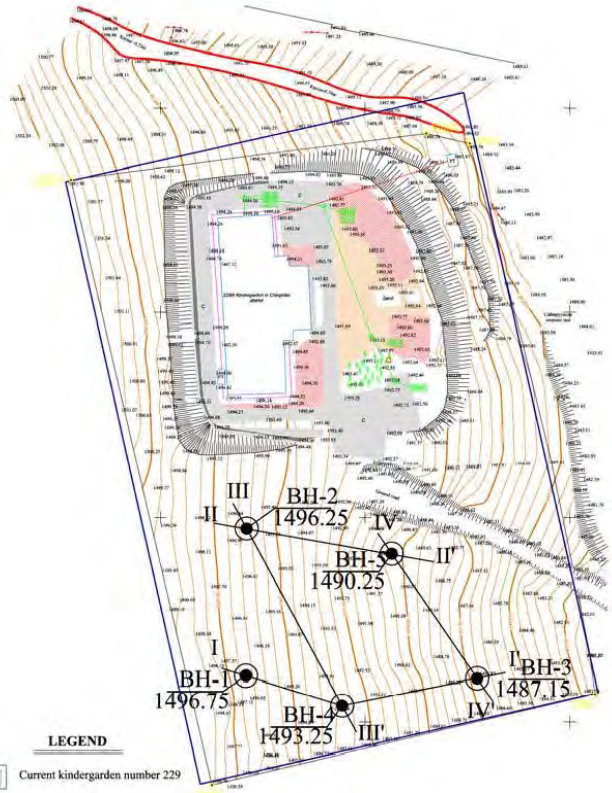
1. Filled up soil.	0.00-0.40	
	0.40	
2. Yellowish well-graded gravel with clay and sand.	0.40-2.00	
	1.60	
3. Grey green sandstone weathering area.	2.00-4.60	
	2.60	
04 Grey green sandstone.	4.60-10.0	
	5.40	

Soil groundwater not detected.
/current date April 19th 2017/

Borehole logs written by: D. Dashzeveg

LOCATION OF BOREHOLE SC 1:1000

Appendix-1



LEGEND

- Current kindergarden number 229
- Drilled boregole number / Elevation (m)
- Engineering-geological section
- Ground road
- Ravines

	ENGINEERING GEODESY LLC			Stage: WD
	Client	MECSS		Page number: 1
	Object	Engineer geological survey of new school construction area in 7th khoroo, Chingeltei district, Ulaanbaatar city		
Checked by		G.Erdenetsetseg	Title	Scale
Drawned by		E.Uchral	Location of borehole	Ver 1:100 Hor 1:1000

ACCREDITED LABORATORY OF SOIL RESEARCH

TABLE OF LABORATORY TEST RESULT

ENGINEERING GEODESY LLC

TL-78

MNS ISO/IEC 17025:2007

Object: Engineer geological survey report of construction area of school extension construction in 7th khoroo, Chingeltei district, Ulaanbaatar

Start date: 2017.04.17

Finish date: 2017.04.23

№	Borehole number	depth of sample [m]	Grain size analysis, [mm]										Hydromet., [mm]%						Gravel	Sand	Silt	Clay	Plastic index			Cu	CC	Natural moisture content W_0, %	Specific gravy G_s, t/cu.m	Wet density, ρ, t/cu.m	Dry density, ρ_d, t/cu.m	Porosity, n, %	Porosity ratio, e	Saturation degree, Sr	Consistency, I_c
			75.0	37.5	19	9.5	4.75	2.36	1.18	0.60	0.300	0.150	0.075	0.035	0.022	0.012	0.009	0.006	0.003	0.001				LL	PL	PI									
1	4	1.0	0.0	0.0	24.1	21.0	18.5	13.8	3.4	4.7	3.1	1.4	1.1	1.7	1.5	1.2	1.1	1.0	0.6	0.8	100.0	64.6	27.5	6.5	1.4	26.65	19.81	6.84	37.33	550.50	7.4	2.68	2.25	2.09	21.83	0.279	0.71	-∞
2	3	1.0	0.0	0.0	56.9	9.2	7.1	7.7	2.2	3.3	3.0	1.4	1.2	2.0	1.4	1.3	1.1	1.0	0.7	0.5	100.0	73.2	18.8	6.8	1.2	28.00	21.27	6.73	78.06	3410.80	3.0	2.70	2.11	2.05	24.11	0.318	0.25	-∞
3	2	0.8	0.0	0.0	34.5	26.3	16.1	9.8	2.2	2.5	1.8	0.8	0.7	1.1	1.0	0.9	0.7	0.6	0.5	0.5	100.0	76.9	17.8	4.3	1.0	23.00	17.70	5.38	16.70	716.43	4.6	2.69	2.27	2.17	19.33	0.240	0.52	-∞
4	5	1.2	0.0	0.0	30.4	18.7	12.2	10.4	4.5	5.9	3.6	1.7	2.1	2.5	1.5	1.2	1.5	1.1	1.9	0.8	100.0	61.3	28.2	7.8	2.7	22.70	16.00	6.70	158.42	1189.40	6.9	2.70	2.26	2.11	21.70	0.277	0.67	-∞
5	3	2.0	0.0	5.9	26.6	17.1	13.4	10.9	4.0	5.2	2.6	1.4	2.3	2.9	1.8	2.0	1.8	1.6	1.7	1.5	100.0	63.0	24.4	9.4	3.2	26.40	19.92	6.48	285.71	2817.03	5.5	2.68	2.27	2.15	19.71	0.246	0.60	-∞
Average			0.0	1.2	34.5	18.5	13.7	10.5	3.3	3.9	2.8	1.3	1.5	2.0	1.4	1.3	1.2	0.9	1.1	0.8	100.0	67.8	23.3	7.0	1.9	25.37	18.94	6.43	115.25	1736.83	5.5	2.69	2.23	2.12	21.34	0.272	0.55	-∞
Absolute max			0.0	5.9	56.9	26.3	16.1	13.8	4.5	5.9	3.6	1.7	2.3	2.9	1.8	2.0	1.8	1.1	1.9	1.5	100.0	76.9	28.2	9.4	3.2	28.00	21.27	6.84	285.71	3410.80	7.4	2.70	2.27	2.17	24.11	0.318	0.71	-∞
Absolute min			0.0	0.0	24.1	9.2	7.1	7.7	2.2	2.5	1.8	0.8	0.7	1.1	1.0	0.9	0.7	0.6	0.5	0.5	100.0	61.3	17.8	4.3	1.0	22.70	16.00	5.38	16.70	550.50	3.0	2.68	2.11	2.05	19.33	0.240	0.25	-∞

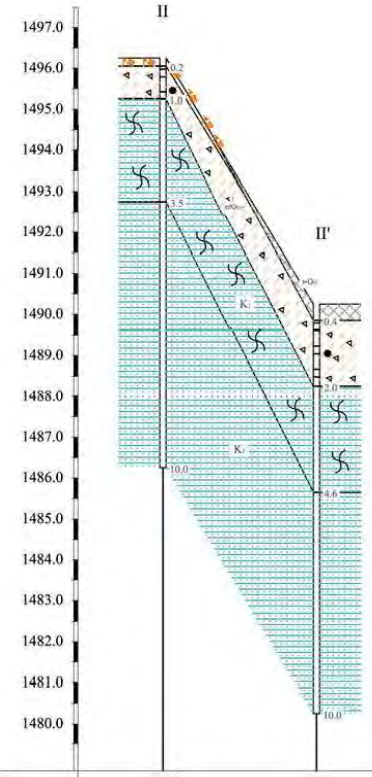
EGE-1: Well-graded gravel with clay and sand

Chief engineer of laboratory L. Tsagaanderkhi

Laboratory engineer: G. Ganzhmeg

Laborant: A. Bayarmagnai

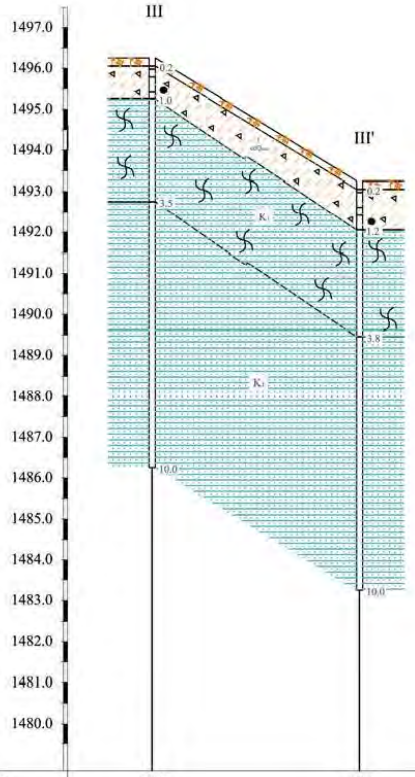
Engineering-geological section II-II'



Borehole number	BH-2	BH-5
Elevation (m)	1496.25	1490.25
Borehole distance (m)	35.96	

ENGINEERING GEODESY LLC				Stage: WD
Client	MECSS			Page number: 3
Object	Engineer geological survey of new school construction area in 7th khoroo, Chingeltei district, Ulaanbaatar city			
Checked by		G.Erdenetsetseg	Title	Scale
Drawned by		E.Uchral	Engineering-geological section II-II'	Ver 1:100 Hor 1:1000

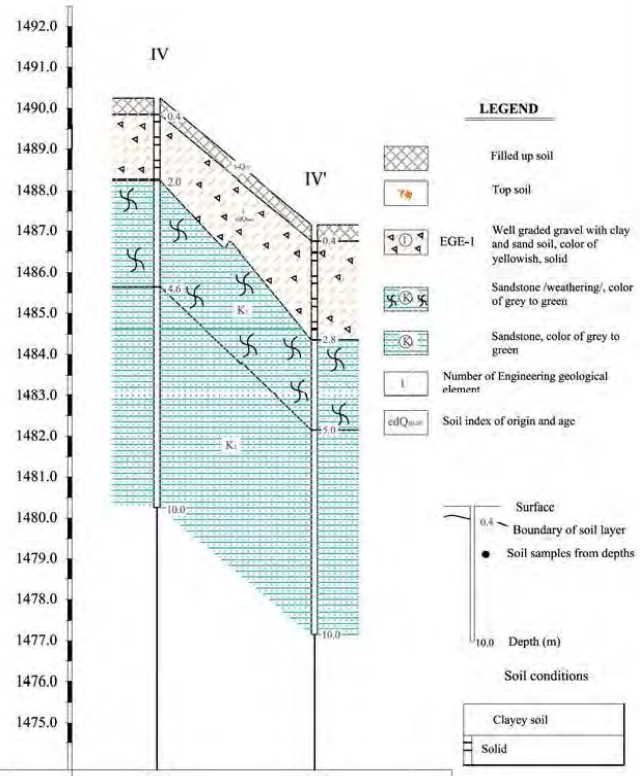
Engineering-geological section III-III'



Borehole number	BH-2	BH-4
Elevation (m)	1496.25	1493.25
Borehole distance (m)	49.16	

ENGINEERING GEODESY LLC				Stage: WD
Client	MECSS			Page number: 4
Object	Engineer geological survey of new school construction area in 7th khoroo, Chingeltei district, Ulaanbaatar city			
Checked by		G.Erdenetsetseg	Title	Scale
Drawned by		E.Uchral	Engineering-geological section III-III'	Ver 1:100 Hor 1:1000

Engineering-geological section IV-IV'



Borehole number	BH-5	BH-3
Elevation (m)	1490.25	1487.15
Borehole distance (m)	36.91	

	ENGINEERING GEODESY LLC			Stage: WD
	Client	MECSS		Page number: 5
	Object	Engineer geological survey of new school construction area in 7th khoroo, Chingeltei district, Ulaanbaatar city		
Checked by		G.Erdenetsetseg	Title	Scale
Drawned by		E.Uchral	Engineering-geological IV-IV'	Ver 1:100 Hor 1:1000

STANDARD PENETRATION TEST RESULT /SPT/

Borehole number	Depth of SPT (m)	0-15cm	15-30cm		30-45cm		N
		Blow counts	Real penetration thickness(cm)	Blow counts	Real penetration thickness(cm)	Blow counts	Blow counts
BH-3	1.0	27	14	50	5	50	100/19cm
	2.0	30	11	50	4	50	100/15cm
BH-5	1.0	33	10	50	4	50	100/14cm

Prepared by: E. Uchral

ENGINEERING GEODESY" LLC

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Bayangol district , 6-r khoroo
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3T19-615/14

ENGINEER GEOLOGICAL SURVEY REPORT OF 53th SCHOOL EXTENSION CONSTRUCTION AREA IN 16th KHOROO, BAYANZURKH DISTRICT, ULAANBAATAR CITY

/ Detail design stage /

Approved by:

Director *TS.Bileg*

Prepared by:

Engineer geologist *E.Uchral*

Ulaanbaatar city
2017

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APPENDIXES

1. LOCATION OF BOREHOLES, SC 1:1000, APPENDIX №1
2. ENGINEERING-GEOLOGICAL SECTION, APPENDIX №2

SC	Horizontal	1:100
	Vertical	1:1000

3. STANDARD PENETRATION TEST RESULT APPENDIX №4

1. GENERAL INFORMATION

1.1 Survey basis

Engineer Geodesy LLC /Drawing and geological survey company/ completed engineer geological survey work of construction area of 53th school extension in Ulaanbaatar city, Bayanzurkh district, 16th khoroo by MECSS tender in April 13th-26th 2017 and survey planned and completed as their requested.

1.2 Survey technique

Team with drill master Enkh-Amagalan, assistant worker Lkhagvatseren.N is executed the drill work by UGB-1BC equipment, 2 boreholes 10.0 meters depth, 20.0 t/m column drilling, to locate and define underground water depth, characteristics, construction fundament pressure effective soil depth and distribution, according to the plan and SNIP 11-03-01 in survey area engineer geological survey work.

Soil physic and mechanic characteristics been defined by taking 12 pieces of samples from drilled boreholes in soil study laboratory. According to ASTM standard, Tsagaandarkhi.L /laboratory chief/, Ganchimeg.G /laboratory engineer/ and bayarmagnai.A /laboratory assistant/ are summarized the result and tabled soil analyze in soil study laboratory of Engineer Geodesy LLC /with guaranteed number of TL-78 from Standardization and Metrology department, satisfied the standard of ISO/IEC 17025:2005, MNS ISO/IEC 17025:2005/. Engineer Geologist Uchral.E processed the engineer geological report to create procedural plan which is made by comparison of field survey material and laboratory analyze result.

Source materials related to survey work stored in archive of Engineering Geodesy LLC.

II. Survey condition of engineer geology

2.1 Location

Ulaanbaatar city, Bayanzurkh district, 16th khoroo, existing 53rd school building extension construction plan

Drawing №1. Survey area of location

2.2 Climatic conditions

Ulaankhuaran, MUIS climate stations indices and CCM 23-01-09 standard "Climate and geotechnical indices for the construction work" have been used for the climate indices of this site, and showed in tables.

Annual and monthly average air temperature, ^{0}C

Table II-1

Station	Month												Annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Ulaan-khuaran	-21.7	-18.7	-8.0	0.5	8.7	14.7	16.5	14.7	8.2	-0.5	-11.3	-20.1	-1.7

Absolute maximum air temperature, ^{0}C

Table II-2

Station	Absolute max	Date	July avarege
Ulaankhuaran	33.5	1969.VI.20	30.2

Absolute minimum air temperature, ^{0}C

Table II-3

Station	Absolute min	Date	Jan avarege
Ulaankhuaran	-36.0	1988.I.23	-31.9

Structure and technical calculation temperature, ^{0}C

Table II-4

Station	Calculation temperature, ^{0}C				
	Coldest temprature				One day during hottest temperature
	1 day	3 day	5 day	Airring	
Ulaankhuaran	-33.7	-32.7	-31.6	-23.0	24.7

Temperature supply indices for the construction and technical calculation during winter time (^{0}C)

Table II-5

Station	The coldest 5 days temperature supply, %				The coldest 1 day temperature supply, %			
	99.2	99.5	94	92	99.9	99.5	94	92
Buyant-Ukhaa	-41.8	-41.7	-39.4	-39.0	-43.3	-43.2	-41.5	-40.7

Air humidity and precipitation

Table II-6

Station	Precipitation							
	Warm season	Cold season	Annual	In warm season	Maximum in a day	Year	Month	Day
Ulaankhuaran	67	72	245.2	232.5	68.6	1966	VII	11

Annual and monthly average wind speed

Table II-7

Station	Month,winter,annual average speed, m/s													
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	winter	Annual
MUIS	0.6	0.9	1.5	2.2	2.1	1.8	1.5	1.2	1.4	1.2	0.9	0.5	0.7	1.3

2.3 Geological formation

In survey area distributed equally silty sand with gravel soil, clayey with sand soil and sandy lean clay origin of filled up soil from below, up and modern Quaternary diluviam-proluvial. In survey area spread silt soil is classified as a engineer geological element, physic mechanic characteristics defined and depth and distribution cross section shown.

2.4 Geomorphology characteristics and physic geological appearance, process

Survey area is located in low height slope of mountain. Survey area is gradually slope from western north to eastern south, average height is 1318.50-1320.00 meters and height difference is 1.50 meter. In survey area much engineering work has been done. Physic Geology appearance, processes are not occurred.

2.5 Hydro-geological condition

Soil groundwater has not been occurred by 2 drill holes with 10.0 metr depth in survey area /dated April 13th 2017/. Soil groundwater is minimum low level in April and it can be increased by rainfall.

III. ENGINEERING-GEOLOGICAL CONDITIONS AND PHYSICAL AND MECHANICAL PROPERTIES

3.1 Soil engineer geological classification and formation

In survey area silty sand with gravel soil /EGE-1/, clayey with sand soil /EGE-2/ and sandy lean clay soil /EGE -3/ distributed equally.

3.2 Soil physic mechanic characteristic

Depending on soil particle structure and physic mechanic characteristic classified to engineer geological 3 elements.

EGE-1. Silty sand with gravel (dpQ_{III-IV}) /SC/

Brownish yellow, up and modern Quaternary diluviam-proluvial origin /dpQ_{III-IV}/, low moist silty sand with gravel soil.

Granulometric composition from the laboratory analysis of these soil samples includes: (%):

- Gravel 17.9
- Sand 66.7
- Silt 13.0
- Clay 2.5

Physical properties indices of the soil:

- Natural moisture content 2.86
- Specific gravity, g/sm^3 2.67
- Wet density g/sm^3 2.25
- Dry density g/sm^3 2.18
- Porocity, % 18.26
- Porocity ratio 0.223
- Moisture content degree 0.342

Normative and calculation indices of the mechanical properties:

According to the norm and regulations to create the construction groundwork - CCM 50-01-16 and Table I:

Normative value

- Cohesion C_n =26kPa
- Angle of internal friction φ_n =40^0
- Deformation modulus E =39MPa

Calculation value:

- Cohesion C_{n2}=5.33Pa
- Angle of internal friction φ_{n2}=30.91^0
- Calculated resistance R_0=250

According to CCM 50-01-16 and 5.3.6, Gravel with clayey is D=14.76 and saturation of degree is S_r=0.342 which means it can create a weak bulging region.

Silty sand with gravel soil seasonal freezing depth 3.1 m

Earthwork of measuring, dig-up I

EGE-2. Clayey with sand soil (dpQ_{III-IV}) /SC/

Clayey with sand soil is red-brown, modern quaternary age, diluviam-proluvial origin (dpQ_{III-IV}) solid consistency.

Granulometric composition from the laboratory analysis of these soil samples includes: (%):

- Gravel 65.1
- Sand 20.3
- Silt 8.4
- Clay 6.2

Physical properties indices of the soil:

- Natural moisture content 7.5
- Liquid limit 27.1
- Plastic limit 15.6
- Plastic indices 11.5
- Specific gravity, g/см^3 2.72
- Wet density g/см^3 2.07
- Dry density g/см^3 1.93
- Porocity, % 29.08
- Porocity ratio 0.411
- Moisture content degree 0.490
- Consistency < 0.0

Normative and calculation indices of the mechanical properties:

According to the norm and regulations to create the construction groundwork - CCM 50-01-16 and Table 1:

Normative value:

- Cohesion C_n =47.0kPa
- Angle of internal friction φ_n =25^0
- Deformation modulus E=47MPa

Calculation value:

- Cohesion C_{n2}=31.33kPa
- Angle of internal friction φ_{n2}=21.74^0
- Calculated resistance R_0=300

According to CCM 50-01-16 and 5.3.5: Clayey with sandy /EGE-2/ is R_f=0.49 which means it can't measurable a bulging freezing region.

Clayley with sand soil seasonal freezing depth 2.6 m

Earthwork of measuring, dig-up I

EGE-3. Sandy lean clay /CL/

Sandy lean clay is red-brown, modern quaternary age, delivuim-proluvial origin (dpQ_{III-IV}) solid consistency.

Granulometric composition from the laboratory analysis of these soil samples includes: (%):

- Gravel 14.0
- Sand 23.8
- Silt 49.9

- Clay 12.4

Physical properties indices of the soil:

- Natural moisture content 21.0
- Liquid limit 37.2
- Plastic limit 19.9
- Plastic indices 17.3
- Specific gravity, g/см^3 2.73
- Wet density g/см^3 1.97
- Dry density g/см^3 1.63
- Porocity, % 40.35
- Porocity ratio 0.680
- Moisture content degree 0.831
- Consistency < 0.0

Normative and calculation indices of the mechanical properties:

According to the norm and regulations to create the construction groundwork - CCM 50-01-16 and Table 1:

Normative value:

- Cohesion C_n =63.0kPa
- Angle of internal friction φ_n =20^0
- Deformation modulus E=23MPa

Calculation value:

- Cohesion C_{n2}=42.0kPa
- Angle of internal friction φ_{n2}=17.39^0
- Calculated resistance R_0=400

According to CCM 50-01-16 and 5.3.5: Clayey with sandy /EGE-3/ is R_f=0.15 which means it can't weak a bulging freezing region.

Sandy lean clay soil seasonal freezing depth 2.6 m

Earthwork of measuring, dig-up I

IV. CONCLUSION

1. In survey area low and average blub engineer geological 3 types of element occurred, situated in one element by geomorphology, groundwater is not occurred and human engineering process is effected pretty much etc area counted as a average engineer geological condition area.
2. Parameters of calculation and main soil spread to area physic and mechanic characteristic normative are shown in section of **Engineer Geological classification and soil Physic mechanic characteristic**.
3. Table IV-1 is shown soil blub level and earth work degree for distributed soil in survey area. Earth work degree counted as manually executed.

Хүснэгт IV-1

Soil type	Earthwork degree	Bulging degree	Spectic reactance om, m
Silty sand with gravel	I	Weak bulging	Dry condition: 2000-10000 Watery condition: 200-600
Clayey with sand	I	Measurable bulging	40-80
Sandy lean clay	I	Weak bulging	4-40

4. Survey area is in 8 magnitude earthquake region.
5. Soil groundwater has not been occurred by 2 drill holes with 10.0 meter depth in survey area /dated April 13th 2017/. Tilt soil ground water is minimum low level in April and it can be increased by rainfall.
6. Soil test is necessary after opening of building fundament galvanized.

Summary is written E. Uchral /Engineer-geologist/

4. REFERENCE LIST

1. CCM 50-01-16. Construction codes on designing of construction foundation Ulaanbaatar, 2016 y.
2. CCM 23-01-09. Climate and geotechnical indices for the construction work Ulaanbaatar, 2009 y.
3. CCM 22.01.01/2006. Construction codes on construction planning at seismic zones of Mongolia Ulaanbaatar, 2006 y
4. "CG 11-107-11. Guideline of engineering geologic report and summary
5. "CCM 11-03-01 Contruction norm and regulation
6. Инженерные изыскания встройтельсве (Спаровочныk) страниц таблиц -131, 1975года., зав.редакций Е.А.Ларина,
7. "Земляные работы" / СНИП-IV-5/
8. ASTM D 2487

5. BOREHOLE LOGS

Borehole-1

Depth , m	10.00	Elevation , m	1318.60
Diametr , mm	168	Drilling date	2017.04.13

1.	Filled up soil.	0.00-0.60	0.60
1.	Brownish color, silty sand with gravel.	0.60-2.30	1.70
2.	Red-brown color, clayey with sand soil.	2.30-3.80	1.50
3.	Red-brown color, sandy lean clay soil.	3.80-10.00	6.20

Soil groundwater not detected.
/current date April 13th 2017/

Borehole-2

Depth , m	10.00	Elevation , m	1319.59
Diametr , mm	168	Drilling date	2017.04.13

1.	Filled up soil.	0.00-0.90	0.90
2.	Red-brown color, clayey with sand soil.	0.90-7.00	6.10
3.	Red-brown color, sandy lean clay soil.	7.00-10.00	3.00

Soil groundwater not detected.
/current date April 13th 2017/

Borehole logs written by: D. Batbayar

Appendix-1

LOCATION OF BOREHOLE
SC 1:1000

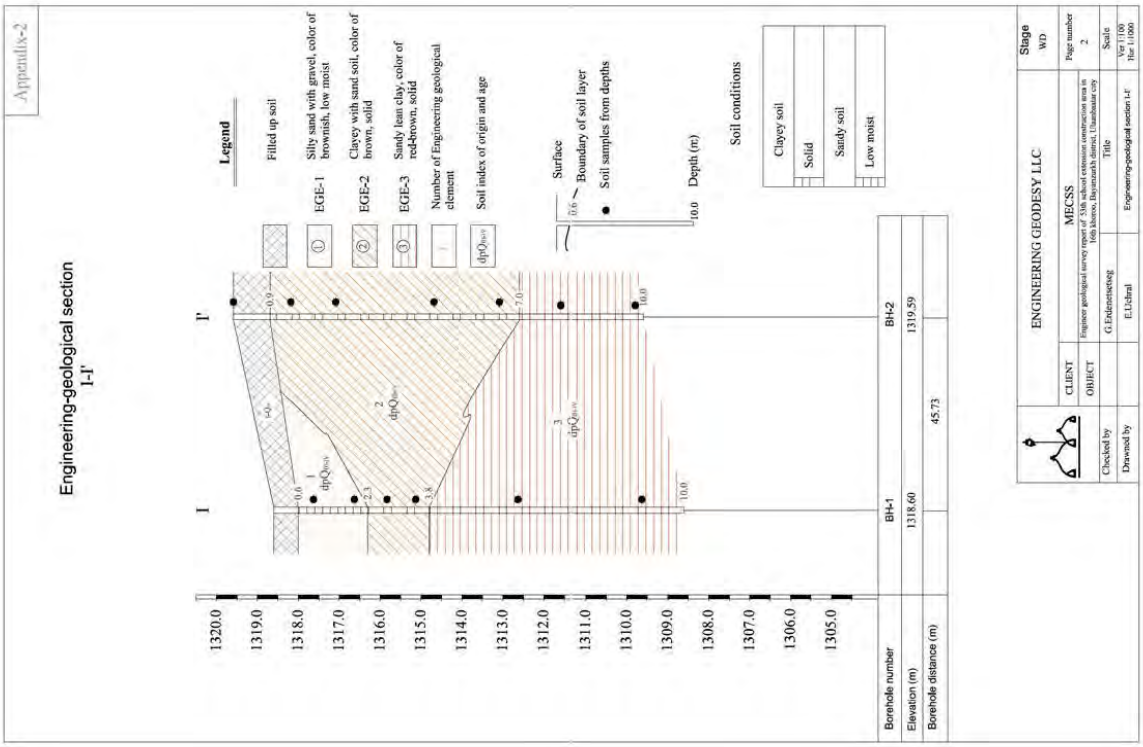
IEGEND

Current school number 53

Drilled borehole number
Elevation (m)

Engineering-geological section

ENGINEERING GEODESY LLC			Stage WD
CLIENT	MECSS		Page number 1
OBJECT	Engineer geological survey report of 53th school extension construction area in 16th khoroo, Bayanzurkh district, Ulaanbaatar city		
Checked by	G.Erdenetsetseg	Title	Scale
Drawwed by	E.Uchral	LOCATION OF BOREHOLE	1:1000



ACCREDITED LABORATORY OF SOIL RESEARCH

TABLE OF LABORATORY TEST RESULT

TL-78
MNS ISO/IEC 17025:2007

ENGINEERING GEODESY LLC

Object: **Engineer geological survey report of 53th school extension construction area in 16th khoroo, Bayanzurkh district, Ulaanbaatar city**

Start date: 2017.04.14
Finish date: 2017.04.20

№	Borehole number	depth of sample [m]	Grain size analysis, [mm]											Hydrometr, [mm]%								Gravel	Sand	Silt	Clay	Plastic index			Cu	CC	Natural moisture content(W), %	Specific gravy G_s, t/cm³	Wet density, ρ, t/cm³	Dry density, ρ_d, t/cm³	Porosity, n, %	Porosity ratio, e	Saturation degree, Sr	Consistency, J
			75.0	37.5	19	9.5	4.75	2.36	1.18	0.60	0.300	0.150	0.075	0.035	0.022	0.012	0.009	0.006	0.003	0.001						I.I.	PI.	PI										
EGE-2. Clayey sand /SC/																																					
1	BH-1	2.8	0.0	0.0	0.0	0.0	8.5	13.8	4.5	8.7	10.0	8.1	6.7	7.7	6.9	6.2	5.9	5.2	4.5	3.3	100.0	8.5	51.8	31.9	7.8	27.20	16.41	10.79	59.210	0.037	9.1	2.73	2.05	1.89	30.84	0.446	0.558	<0
2	BH-2	1.4	0.0	0.0	0.0	0.0	14.6	16.6	5.1	9.0	9.5	7.1	6.3	8.5	5.7	5.0	4.5	4.2	3.4	2.5	100.0	14.6	53.6	25.0	5.9	25.04	15.46	9.58	98.913	0.299	5.1	2.70	2.14	2.04	24.55	0.325	0.419	<0
3	BH-2	4.9	0.0	0.0	0.0	0.0	5.2	11.6	3.5	9.0	10.1	9.0	8.7	8.0	7.8	6.8	6.2	5.7	4.8	3.6	100.0	5.2	51.9	34.5	8.4	27.81	15.69	12.12	40.540	0.021	7.1	2.71	2.04	1.90	29.71	0.423	0.455	<0
4	BH-1	3.5	0.0	0.0	0.0	0.0	8.9	14.6	4.8	9.2	9.8	8.6	7.0	7.4	7.0	5.2	4.9	5.3	4.2	3.1	100.0	8.9	54.0	29.8	7.3	28.15	15.79	12.36	70.423	0.0677	9.5	2.73	2.07	1.89	30.75	0.444	0.584	<0
5	BH-2	2.5	0.0	0.0	0.0	0.0	11.9	15.1	4.9	9.4	9.1	7.9	6.4	7.0	6.0	5.8	4.9	4.5	3.5	3.6	100.0	11.9	52.8	28.2	7.1	26.62	14.52	12.10	69.620	0.0953	6.2	2.71	2.05	1.93	28.77	0.404	0.416	<0
6	BH-2	6.5	0.0	0.0	0.0	0.0	10.9	14.2	5.3	8.9	10.6	8.6	7.1	6.9	5.7	5.3	5.1	4.6	3.4	3.4	100.0	10.9	54.7	27.6	6.8	27.65	15.72	11.93	72.500	0.118	8.0	2.72	2.06	1.91	29.87	0.426	0.511	<0
Avarege			0.0	0.0	0.0	0.0	10.0	14.3	4.7	9.0	9.9	8.2	7.0	7.3	6.5	5.7	5.3	4.9	4.0	3.3	100.0	10.0	53.1	29.7	7.2	27.08	15.60	11.48	68.534	0.106	7.5	2.72	2.07	1.93	29.08	0.411	0.490	<0
Absolute max			0.0	0.0	0.0	0.0	14.6	16.6	5.3	9.4	10.6	9.0	8.7	8.0	7.8	6.8	6.2	5.7	4.8	3.6	100.0	14.6	54.7	34.5	8.4	28.15	16.41	12.36	98.913	0.299	9.5	2.73	2.14	2.04	30.84	0.446	0.584	<0
Absolute min			0.0	0.0	0.0	0.0	5.2	11.6	3.5	8.7	9.1	7.1	6.3	6.5	5.7	5.0	4.5	4.2	3.4	2.5	100.0	5.2	51.8	25.0	5.9	25.04	14.52	9.58	40.540	0.021	5.1	2.70	2.04	1.89	24.55	0.325	0.416	<0

Chief engineer of laboratory: L. Tsegsandakhi

Laboratory engineer: G. Ganchimeg

Laborant: A. Bayarmagnai

ENGINEERING GEODESY LLC

ACCREDITED LABORATORY OF SOIL RESEARCH

TABLE OF LABORATORY TEST RESULT

TL-78
MNS ISO/IEC 17025:2007

Object: **Engineer geological survey report of 53th school extension construction area in 16th khoroo, Bayanzurkh district, Ulaanbaatar city**

Start date: 2017.04.14
Finish date: 2017.04.20

№	Borehole number	depth of sample [m]	Grain size analysis, [mm]											Hydrometr, [mm]%							Gravel	Sand	Silt	Clay	Plastic index			Cu	CC	Natural moisture content W, %	Specific gravy G_s t/m^3	Wet density, ρ, t/m^3	Dry density, ρd, t/m^3	Porosity, n, %	Porosity ratio, e	Saturation degree, Sr
			75.0	37.5	19	9.5	4.75	2.36	1.18	0.60	0.300	0.150	0.075	0.035	0.022	0.012	0.009	0.006	0.003	0.001					LL	PL	PI									
EGE-1. Silty sand with gravel																																			
1	BH-1	1.0	0.0	0.0	0.0	0.0	18.3	28.8	7.5	11.1	9.9	5.8	3.7	3.4	2.8	2.3	2.1	1.8	1.4	1.1	100.0	18.5	66.8	12.4	2.5	inelastic			107.69	3.887	2.87	2.67	2.24	2.18	18.45	0.226	0.339
2	BH-1	2.0	0.0	0.0	0.0	0.0	17.5	27.8	7.3	12.1	9.2	6.0	4.1	4.0	3.0	2.6	2.0	1.9	1.5	1.0	100.0	17.5	66.5	13.5	2.5	inelastic			121.74	14.91	2.85	2.67	2.25	2.19	18.07	0.220	0.345
Avarege			0.0	0.0	0.0	0.0	17.9	28.3	7.4	11.6	9.6	5.9	3.9	3.7	2.9	2.5	2.1	1.9	1.5	1.1	100.0	17.9	66.7	13.0	2.5	inelastic			114.72	9.40	2.86	2.67	2.25	2.18	18.26	0.223	0.342
Absolute max			0.0	0.0	0.0	0.0	18.3	28.8	7.5	12.1	9.6	6.0	4.1	4.0	3.0	2.6	2.1	1.9	1.5	1.1	100.0	18.3	66.8	13.5	2.5	inelastic			121.74	14.91	2.87	2.67	2.25	2.19	18.45	0.226	0.345
Absolute min			0.0	0.0	0.0	0.0	17.5	27.8	7.5	11.1	9.2	5.8	3.7	3.4	2.8	2.3	2.0	1.8	1.4	1.0	100.0	17.5	66.5	12.4	2.5	inelastic			107.69	3.89	2.85	2.67	2.24	2.18	18.07	0.220	0.339

Chief engineer of laboratory L. Tsogsandarkhi

Laboratory engineer: G. Ganchimeg

Laborant: A. Bayarmagnai

ENGINEERING GEODESY LLC

ACCREDITED LABORATORY OF SOIL RESEARCH

TABLE OF LABORATORY TEST RESULT

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Start date: 2017.04.14
Finish date: 2017.04.20

№	Borehole number	depth of sample [m]	Grain size analysis, [mm]											Hydrometr, [mm]%							Gravel	Sand	Silt	Clay	Plastic index			Cu	CC	Natural moisture content W, %	Specific gravy G_s t/m^3	Wet density, ρ, t/m^3	Dry density, ρd, t/m^3	Porosity, n, %	Porosity ratio, e	Saturation degree, Sr	Consistency, I$_c$
			75.0	37.5	19	9.5	4.75	2.36	1.18	0.60	0.300	0.150	0.075	0.035	0.022	0.012	0.009	0.006	0.003	0.001					LL	PL	PI										
EGE-3. Sandy lean clay																																				
1	BH-1	6.0	0.0	0.0	0.0	0.0	14.0	5.3	1.7	2.5	2.9	3.3	3.9	12.1	11.3	10.4	9.9	8.9	7.7	6.1	100.0	14.0	19.6	52.6	13.8	32.40	18.25	14.15	9.57	0.001	29.8	2.74	1.96	1.51	44.89	0.815	1.002	<0
2	BH-1	9.0	0.0	0.0	0.0	0.0	11.5	5.5	1.4	3.7	5.1	5.6	6.5	11.7	10.5	9.3	8.7	7.9	6.9	5.7	100.0	11.5	27.8	48.1	12.6	42.00	19.30	22.70	14.04	0.002	17.5	2.72	1.97	1.68	38.34	0.622	0.764	<0
3	BH-2	8.0	0.0	0.0	0.0	0.0	15.1	6.0	1.3	3.0	4.3	4.5	5.3	10.6	10.9	9.9	9.5	8.1	6.0	5.5	100.0	15.1	24.4	49.0	11.5	35.6	21.5	14.10	14.80	0.0025	16.9	2.72	1.97	1.69	38.04	0.614	0.749	<0
4	BH-2	10.0	0.0	0.0	0.0	0.0	15.3	5.2	1.6	3.6	3.3	5.1	4.6	10.9	11.5	10.2	8.6	8.5	6.3	5.3	100.0	15.3	23.4	49.7	11.6	38.9	20.6	18.30	15.00	0.0029	19.9	2.73	1.96	1.63	40.12	0.670	0.811	<0
Avarege			0.0	0.0	0.0	0.0	14.0	5.5	1.5	3.2	3.9	4.6	5.1	11.3	11.1	10.0	9.2	8.4	6.7	5.7	100.0	14.0	23.8	49.9	12.4	37.2	19.9	17.3	13.35	0.002	21.0	2.73	1.97	1.63	40.35	0.680	0.831	<0
Absolute max			0.0	0.0	0.0	0.0	15.3	6.0	1.7	3.7	5.1	5.6	6.5	12.1	11.5	10.4	9.9	8.9	7.7	6.1	100.0	15.3	27.8	52.6	13.8	42.0	21.5	22.7	15.00	0.003	29.8	2.74	1.97	1.69	44.89	0.815	1.002	<0
Absolute min			0.0	0.0	0.0	0.0	11.5	5.2	1.3	2.5	2.9	3.3	3.9	10.6	10.5	9.3	8.6	7.9	6.0	5.3	100.0	11.5	19.6	48.1	11.5	32.4	18.3	14.1	9.57	0.001	16.9	2.72	1.96	1.51	38.04	0.614	0.749	<0

Chief engineer of laboratory L. Tsogsandarkhi

Laboratory engineer: G. Ganchimeg

Laborant: A. Bayarmagnai

STANDARD PENETRATION TEST RESULT /SPT/

Borehole number	Depth of SPT (m)	0-15cm	15-30cm		30-45cm		N
		Blow counts	Real penetration thickness(cm)	Blow counts	Real penetration thickness(cm)	Blow counts	Blow counts
BH-1	1.0	25	15	31	15	42	73
	2.0	28	15	36	15	46	82
	3.0	15	15	18	15	22	40
	4.0	17	15	18	15	23	41
	5.0	14	15	16	15	20	36
	6.0	18	15	21	15	23	44
	7.0	12	15	14	15	15	29
	8.0	10	15	13	15	15	28
	9.0	14	15	17	15	21	38
	10.0	15	15	16	15	15	31
BH-2	2.0	14	15	17	15	18	35
	3.0	16	15	19	15	23	42
	4.0	11	15	14	15	13	27
	5.0	12	15	16	15	19	35
	6.0	15	15	18	15	20	38
	7.0	9	15	13	15	14	27
	8.0	7	15	10	15	12	22
	9.0	8	15	11	15	11	22
	10.0	10	15	12	15	14	26

Prepared by: E.Uchral

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Archive 17/034

ZT19-615/14

ENGINEER GEOLOGICAL SURVEY REPORT OF CONSTRUCTION AREA OF 109th SCHOOL EXTENSION CONSTRUCTION IN 3rd KHOROO, NALAIKH DISTRICT, ULAANBAATAR CITY

/ Detail design stage /

Approved by:

Director *TS.Bileg*

Prepared by:

Engineer geologist *E.Uchral*

Ulaanbaatar city
2017

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2. ENGINEERING-GEOLOGICAL SECTION, (APPENDIX №2)
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3. SOIL PHYSIC MECHANIC CHARACTERISTIC GENERAL TABLE (APPENDIX №3)
4. STANDARD PENETRATION TEST RESULT (APPENDIX №4)

I. GENERAL INFORMATION

1.1 Survey basis

Engineer Geodesy LLC /Drawing and geological survey company/ completed engineer geological survey work of construction area of 109th school extension in Ulaanbaatar city,Bayanzurkh district, 3rd khoroo by MECSS tender in April 17th-28th 2017 and survey planned and completed as their requested.

1.2 Survey technique

Team with drill master Enkh-Amagalan, assistant worker Lkhagvatseren.N is executed the drill work by UGB-1BC equipment, 2 boreholes 10.0 meters depth, 40.0 t/m column drilling,to locate and define underground water depth, characteristics, construction fundament pressure effective soil depth and distribution, according to the plan and SNIP 11-03-01 in survey area engineer geological survey work.

Soil physic and mechanic characteristics been defined by taking 24 pieces of samples from drilled boreholes in soil study laboratory. According to ASTM standard, Tsagaandarkhi.L/laboratory chief/, Ganchimeg.G /laboratory engineer/ and bayarmagnai.A /laboratory assistant/ are summarized the result and tabled soil analyze in soil study laboratory of Engineer Geodesy LLC /with guaranteed number of TL-78 from Standardization and Metrology department, satisfied the standard of ISO/IEC 17025:2005, MNS ISO/IEC
17025:2005/. Engineer Geologist Uchral.E processed the engineer geological report to create procedural plan which is made by comparison of field survey material and laboratory analyze result.

Source materials related to survey work stored in archive of Engineer Geodesy LLC.

II. ENGINEERING GEOLOGICAL INVESTIGATED CONDITION

2.1 Location

The extension construction of school 109 was planned by connect to the construction of 109th school's left side which located in 3rd khoroo, Nalaikh district, Ulaanbaatar .

Drawing *1. Survey area of location*

2.1 Climatic conditions

Khurel-togoot, Terelj climate stations indices and CCM 23-01-09 standard "Climate and geotechnical indices for the construction work" have been used for the climate indices of this site, and showed in tables.

Annual and monthly average air temperature, °C

Table II-1

Station	Month												Annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Terelj	-24.1	-18.2	-11.6	-1.3	6.8	11.8	13.9	11.9	5.3	-3.0	-14.4	-21.6	-3.7

Absolute maximum air temperature, °C

Table II-2

Station	Absolute maximum	Date	July average
Khurel-togoot	31.3	1975.VIII.19	26.1

Absolute minimum air temperature, °C

Table II-3

Station	Absolute minimum	Date	Jan average

Khurel-togoot	-36.7	1966.L16	-30.3

Structure and technical calculation temperature, ^{0}

Table II-4

Station	Calculation temperature °C				
	Coldest temprature				One day during hottest temperature
	1 day	3 day	5 day	Airring	
Terelj	-34.8	-33.1	-31.5	-26.7	23.9

Air humidity and precipitation

Table II-5

Station	Precipitation							
	Warm season	Cold season	Annual	In warm season	Maximum in a day	Year	Month	Day
Terelj	56	75	372.9	354.9	55.5	1994	VIII	04

Annual and monthly average wind speed

Table II-6

Station	Month, winter, average speed of year, m/s													
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	winter	annual
Terelj	0.8	1.2	1.8	2.6	2.3	1.5	1.2	1.2	1.6	1.5	1.1	0.8	0.9	1.5

2.3 Geological formation

In survey area distributed equally silty sand with gravel soil, clayey with sand soil and sandy lean clay origin of filled up soil from below, up and modern Quaternary diluviam-proluvial. In survey area spread silt soil is classified as a engineer geological element, physic mechanic characteristics defined and depth and distribution cross section shown.

2.4 Geomorphology characteristics and physic geological appearance, process

Survey area is located on the geomorphology's one element and surface's elevation is 1481.04-1481.85 meters, height difference is 0.81 meter. The survey area is went down from eastern north to western south and it's surface is being generally flat. In survey area permafrost soil was spreaded , because seasonal melting process is being dominated.

2.5 Hydro-geological condition

Survey area is located on the geomorphology's one element and surface's elevation is 1481.04-1481.85 meters, elevation's difference is 0.81 meters. /April, 17th, 2017/. Soil ground water is minimum low level in April and it can be increased by rainfall. And soil ground water increase depends on seasonal melting process. Permeability test was conducted on BH-4 in this site. Permeability K=7.1*10^{-3}cm/sec.

2.6 Permafrost /PFT/

Nalaikh district belong in zone which discontinuities distribution permafrost soil. In planning building area, permafrost soil depth started from 4 meter and Silty sand with gravel soil is permafrost then with solid texture, low ice form hard to dry permafrost. Permafrost soil 10 meter's depth temperature is (-0,5^{0}c). Top boundary of permafrost soil connect to directly depth of freezing and melting. Freezing temperature of soil is -0.1^{0}C.

III. ENGINEERING-GEOLOGICAL CONDITIONS AND PHYSICAL, MECHANICAL PROPERTIES

3.1 Soil engineer geological classification and formation

In survey area, from light yellowish to brown yellow color silty sand with gravel soil /EGE-1/distributed. Soil physical mechanical properties determined and shown by drawing section of distribution and thickness. Then soil type is 2 class which first class is seasonal freezing and melting silty sand with gravel soil, second class is permafrost soil and determined physical mechanical properties indices one by one.

3.2 Soil physic mechanic characteristic

Depending on soil particle structure and physic mechanic characteristic classified to engineer geological 1 elements.

EGE-1. Silty sand with gravel soil /seasonal freezing and melting/

From light yellowish to brown color, top and modern quaternary age, delivuim-proluvial origin (dpQIII-IV) solid consistency, with moisture and this soil that silty sand with gravel soil. Brown color clay sand with gravel soil lens layer 4.80-5.00 meter.

Granulometric composition from the laboratory analysis of these soil samples includes: (%):

- Gravel 39.4
- Sand 44.6
- Silt 13.5
- Clay 2.6

Physical properties indices of the soil:

- Natural moisture content 7.8
- Specific gravity, g/sm3 2.67
- Wet density g/sm3 2.26
- Dry density g/sm3 2.10
- Porocity, % 21.47
- Porocity ratio 0.275
- Moisture content degree 0.719

According to the norm and regulations to create the soil mechanical properties - BNaR 50-01-16 and Table I

Normative value

- Cohesion C_n = 2.0 кПа
- Angle of internal friction $\varphi_n = 40^0$
- Deformation modulus E= 45MIIa

Calculation value:

- Cohesion C_{n2}= 1.33 kPa
- Angle of internal friction φ_{n2}= 36.0 ^{0}
- Calculated resistance R_0= 500 kPa

According to CCM 50-01-16 and 5.3.2, Silty sand with gravel soil is normalize by none swellings. Silty sand with gravel soil merge directly upper boundary of PFT soil's seasonal melting depth .

Earthwork grade dig by manually III

IGE-1a. Silty sand with gravel soil **/with PFT /**

From light yellowish to brown color, top and modern quaternary age, delivuim-proluvial origin(dpQIII-IV) solid consistency, saturated with water this soil that silty sand with gravel soil.

Granulometric composition from the laboratory analysis of these soil samples includes: (%):

- Gravel 38.6
- Sand 45.1
- Silt 13.5
- Clay 2.8

Physical properties of PFT soil:

1. Total moisture $W_c=W_f$ 0.121
2. Permafrost soil's pore filled grade by water and ice 0.93
3. Sum of ice – same of sum moisture $W_c=JI_c$
4. Melting factor A=0.0099

IV. CONCLUSION

1. In survey area low and average blub engineer geological 1 types of element occurred, groundwater not detected, filled up ground spread vary thickness, permafrost /PFT/ soil is same and it is related to hard condition area for engineer-geology
2. Base soil in area which physics and mechanical properties indices of calculation and norm is shown in **"ENGINEERING GEOLOGICAL CLASSIFICATION AND PHYSICAL-MECHANICAL PROPERTIES OF SOIL"** chapter.
3. Table IV-1 is shown soil blub level and earth work degree for distributed soil in survey area. Earth work degree counted as manually executed.

Table IV-1

Soil type	Earthrocks degree	Bulging degree	Specific reactance om, m
Silty sand with gravel soil	III	None swellings	Dry condition: 2000-10000 Wet condition: 200-600

4. Survey area is in 7 magnitude earthquake region.
5. In survey area, soil groundwater has been occurred in 4 drill holes with 10 meter depth /dated April 17th ,2017/. Soil ground water is minimum low level in April and it can be increased by rainfall. And soil ground water increase depends on seasonal melting process.
6. Soil test is necessary after opening of building fundament galvanized.

Summary is written: Uchral.E / Engineer-geologist/

V. REFERENCE LIST

1. CCM 50-01-16. Construction codes on designing of construction foundation Ulaanbaatar, 2016 y.
2. CCM 23-01-09. Climate and geotechnical indices for the construction work Ulaanbaatar, 2009 y.
3. Seismic zones of Nalaikh. SC 1:34000, 2015y.
4. "CG 11-107-11. Guideline of engineering geologic report and summary
5. "CCM 11-03-01 Contruction norm and regulation
6. Инженерные изыскания встройтельсве (Спаровочныk) страниц таблиц - 131,1975года., зав.редакций Е.А.Ларина,
7. "Земляные работы" / СНИП-IV-5/
8. ASTM D 2487

VI. BOREHOLE LOGS

Borehole-1

Depth , m	10.00	Elevation , m	1481.85
Diameter , mm	168	Drilling date	2017.04.17

1.	Filled up soil color is dark gray and contained building waste.	0.00-0.50 0.50
2.	From light yellowish to brown color with moisture and this soil that silty sand with gravel soil	0.50-10.0 9.50

Soil groundwater not detected.
PFT soil detected at 4.00 meter.
/current date April 17th 2017/

Borehole-2

Depth , m	10.00	Elevation , m	1481.15
Diameter , mm	168	Drilling date	2017.04.17

1.	Filled up soil color is dark gray and contained building waste.	0.00-0.60 0.60
2.	From light yellowish to brown color with moisture and this soil that silty sand with gravel soil.	0.60-10.0 9.40

Soil groundwater not detected.
PFT soil detected at 4.00 meter.
/current date April 17th 2017/

Borehole-3

Depth , m	10.00	Absolute elevation , m	1481.04
Diameter , mm	168	Drilling date	2017.04.17

1.	Filled up soil color is dark gray and contained building waste	0.00-0.60 0.60
2.	From light yellowish to brown color with moisture and this soil that silty sand with gravel soil	0.60-10.0 9.40

Soil groundwater not detected.
PFT soil detected at 4.00 meter.
/current date April 17th 2017/

Borehole-4

Depth , m	10.00	Elevation , m	1481.32
Diameter , mm	168	Drilling date:	2017.04.17

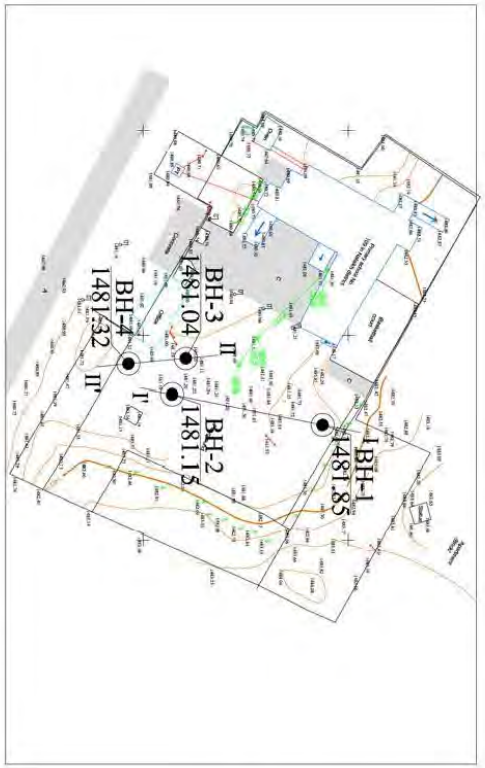
1.	Filled up soil color is dark gray and contained building waste.	0.00-0.70 / 0.70
2.	From light yellowish to brown color with moisture and this soil that silty sand with gravel soil.	0.70-4.80 / 4.10
3.	Brown color clay sand with gravel soil lens layer.	4.80-5.10 / 0.30
4.	From light yellowish to brown color with moisture and this soil that silty sand with gravel soil.	5.10-10.0 / 4.90

Soil groundwater not detected.
PFT soil detected at 4.00 meter.
/current date April 17th 2017/

Borehole logs written by: E.Uchral

Appendix-1

LOCATION OF BOREHOLE
SC1:1000



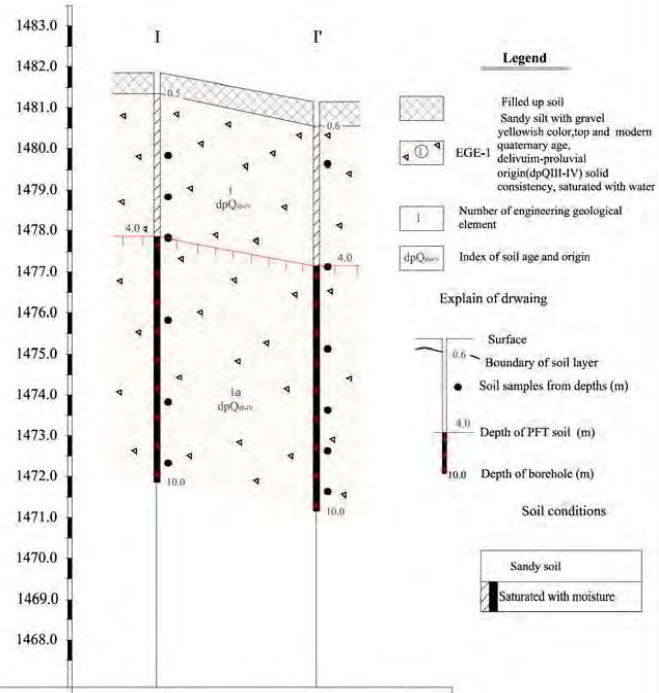
Legend

- Current school number 109
- Drilled borehole number / Elevation (m)
- Engineering- geological section

ENGINEERING GEODESY LLC

Client	JICA	Stage	WD
Object	Engineer geological survey report of construction areaof 109th school extension construction in 3rd khoroo,Nalaikh district, Ulaanbaatar city	Page number	1
Checked by	Endorsetseteg.G	Title	
Drawned by	Uchral.E	LOCATION OF BOREHOLE	
		Scale	1:1000

Engineering-geological section
I-I' linear

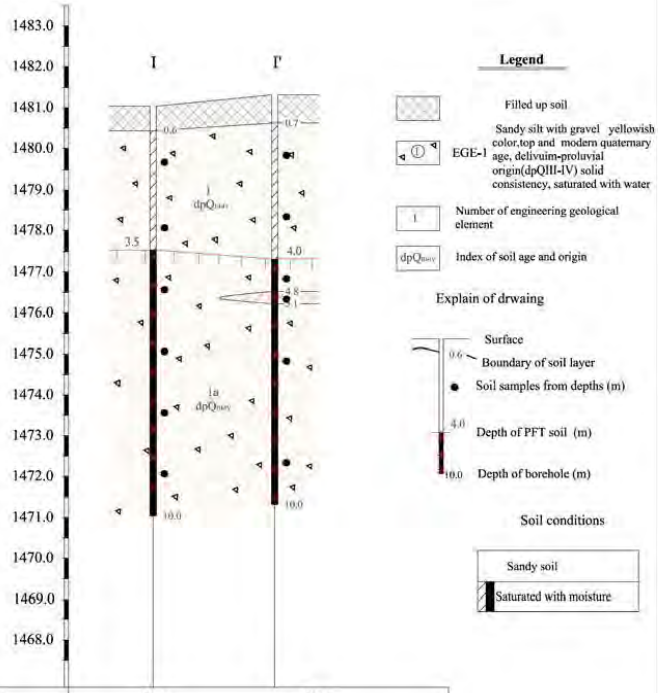


Borehole number	BH-1	BH-2
Elevation (m)	1481.85	1481.15
Borehole distance (m)	37.43	

	ENGINEERING GEODESY LLC			Stage WD
	Client	JICA		Page number 2
	Object	Engineer geological survey report of construction aeaof 109th school extension construction in 3rd khoroo,Nalaikh district, Ulaanbaatar city		
	Checked by	Erdenetsetseg.G	Title	Scale
	Drawned by	Uchral.E	Engineering-geological section, I-I' linear	Vertical 1:100 Horizontal 1:1000

Appendix-2

Engineering-geological section
I-I' linear



Borehole number	BH-1	BH-2
Elevation (m)	1481.04	1481.32
Borehole distance (m)	14.06	

	ENGINEERING GEODESY LLC			Stage WD
	Client	JICA		Page number 2
	Object	Engineer geological survey report of construction aeaof 109th school extension construction in 3rd khoroo,Nalaikh district, Ulaanbaatar city		
	Checked by	Erdenetsetseg.G	Title	Scale
	Drawned by	Uchral.E	Engineering-geological section, II-II' linear	Vertical 1:100 Horizontal 1:500

ACCREDITED LABORATORY OF SOIL RESEARCH

TABLE OF LABORATORY TEST RESULT

TL-78
MNS ISO/IEC 17025:2007

ENGINEERING GEODESY LLC

Object: Engineer geological survey report of construction areaof 109 th school extension construction in 109th khoroo, Nalaikh district, Ulaanbaatar

Start date: 2017.04.17
Finish date: 2017.04.23

№	Borehole number	Depth of sample, m	Grain size analysis											Hydrometr, [mm]%								Gravel	Sand	Silt	Clay	Plastic index		Cu	CC	Natural moisture content(W), %	Specific gravity Gs, g/cm³	Wet density, ρ, g/cm³	Dry density, ρd, g/cm³	Porosity, n, %	Porosity ratio, e	Saturation degree, Sr
			75.0	37.5	19	9.5	4.75	2.36	1.18	0.60	0.300	0.150	0.075	0.035	0.022	0.012	0.009	0.006	0.003	0.001							LL	PL									
EGE-1. Silty sand with gravel / permafrost condition/																																				
1	1	6.0	0.0	0.0	9.8	13.2	15.3	14.9	4.1	6.5	9.7	7.6	5.8	3.2	2.4	2.8	1.7	1.5	1.2	1.0	100.0	38.3	48.6	10.9	2.2	inelastic		110.83	16.943	6.0	2.68	2.27	2.14	20.09	0.251	0.639
2	1	4.0	0.0	0.0	1.1	9.5	14.7	18.7	2.7	6.1	10.5	11	9.2	4.1	3.1	2.6	2.1	1.9	1.6	1.1	100.0	23.3	58.2	13.8	2.7	inelastic		101.79	4.618	21.9	2.67	2.25	1.85	30.87	0.447	1.309
3	4	6.5	0.0	0.0	6.1	10.7	13.1	15.6	4.3	6.5	9.3	9.4	8.1	3.7	3.2	3.0	2.3	1.9	1.6	1.2	100.0	29.9	53.2	14.1	2.8	inelastic		128.20	6.782	7.6	2.68	2.26	2.10	21.63	0.276	0.738
4	2	4.0	0.0	0.0	20.4	10.4	6.3	17.2	2.9	3.2	6.7	7.8	3.2	4.8	4.3	3.6	2.9	2.5	2.1	1.7	100.0	37.1	41.0	18.1	3.8	inelastic		686.16	42.542	36.4	2.66	2.27	1.66	37.44	0.598	1.618
5	1	9.5	0.0	0.0	15.5	11.2	12.8	15.2	3.2	7.0	5.2	7.2	5.6	4.2	3.1	2.8	2.2	2.0	1.7	1.1	100.0	39.5	43.4	14.3	2.8	inelastic		198.31	20.434	12.4	2.67	2.25	2.00	25.03	0.334	0.992
6	1	2.0	0.0	0.0	11.2	15.0	15.4	12.8	5.0	6.7	8.2	6	8.5	3.2	3.0	2.3	1.9	2.1	1.4	1.3	100.0	41.6	43.2	12.5	2.7	inelastic		205.64	36.270	7.1	2.66	2.26	2.11	20.67	0.261	0.725
7	2	8.5	0.0	0.0	17.4	9.2	13.9	10.1	6.2	7.8	9.0	5.5	5.3	2.9	3.2	2.5	2.2	1.9	2.0	0.9	100.0	40.5	43.9	12.7	2.9	inelastic		172.31	27.370	6.9	2.68	2.26	2.11	21.11	0.268	0.691
8	3	7.5	0.0	0.0	11.0	14.1	16.8	12.9	3.8	7.0	8.5	6.2	5.2	3.1	3.1	2.2	2.3	1.7	1.9	1.1	100.0	41.9	42.7	12.4	3.0	inelastic		221.21	34.340	7.2	2.67	2.25	2.10	21.39	0.272	0.706
9	2	6.0	0.0	0.0	5.9	16.9	17.1	14.5	3.8	6.9	7.8	6.9	6.2	3.6	2.8	2.3	2.8	1.6	1.2	0.8	100.0	39.9	45.2	12.9	2.0	inelastic		176.46	26.419	8.5	2.67	2.26	2.08	21.99	0.282	0.805
10	1	8.0	0.0	0.0	14.2	12.2	14.9	13.9	4.6	5.2	6.6	6.5	6.6	4.2	3.2	2.5	1.9	1.5	1.3	0.7	100.0	41.3	43.4	13.3	2.0	inelastic		183.45	22.730	15.0	2.66	2.28	1.98	25.47	0.342	1.168
11	3	9.0	0.0	0.0	12.5	11.2	16.8	15.2	4.3	4.9	5.8	8.7	4.8	3.6	2.9	2.2	2.2	2.1	1.7	1.1	100.0	40.5	43.7	13.0	2.8	inelastic		213.95	23.158	9.5	2.66	2.27	2.07	22.07	0.283	0.893
12	4	4.5	0.0	0.0	9.5	15.1	16.7	12.6	5.2	3.9	9.5	6.3	5.2	3.9	2.5	2.4	2.3	1.9	1.8	1.2	100.0	41.3	42.7	13.0	3.0	inelastic		210.97	29.038	21.6	2.67	2.26	1.86	30.39	0.437	1.321
13	2	7.5	0.0	0.0	11.1	15.2	14.9	13.6	4	5.2	8.6	6.4	4.8	4.0	3.1	2.3	1.9	2.2	2.0	0.9	100.0	41.2	42.6	13.3	2.9	inelastic		204.00	29.924	8.1	2.66	2.28	2.11	20.71	0.261	0.825
14	3	6.0	0.0	0.0	12.5	9.8	18.2	10.8	5.9	6.6	6.9	7.4	5.3	3.5	2.8	3.2	2.3	1.7	1.8	1.2	100.0	40.6	42.9	13.5	3.0	inelastic		235.88	23.257	10.8	2.66	2.25	2.03	23.66	0.310	0.927
15	4	9.0	0.0	0.0	9.1	11.8	16.9	16.1	4.1	5.9	8	6.2	4.8	3.3	3.2	2.9	2.5	2.0	1.6	1.3	100.0	37.8	45.1	13.9	3.2	inelastic		232.63	31.332	9.9	2.67	2.26	2.06	22.98	0.298	0.886
16	3	4.5	0.0	0.0	5.0	16.2	17.2	14.3	4.5	6.4	7.4	7.6	4.3	4.2	3.9	2.2	1.9	1.8	2.0	1.1	100.0	38.4	44.5	14.0	3.1	inelastic		183.33	19.245	7.1	2.66	2.27	2.12	20.32	0.255	0.741
17	2	9.5	0.0	0.0	11.5	14.5	14.8	13	4.5	5.6	6.6	7.4	4.9	3.9	3.3	2.7	2.4	1.9	1.9	1.1	100.0	40.8	42.0	14.2	3.0	inelastic		217.39	23.388	8.9	2.67	2.29	2.10	21.24	0.270	0.881
Aswege			0.0	0.0	10.8	12.7	15.0	14.1	4.3	6.0	7.9	7.2	5.5	3.7	3.1	2.6	2.2	1.9	1.7	1.1	100.0	38.6	45.1	13.5	2.8	inelastic		216.615	24.588	12.1	2.67	2.26	2.03	23.94	0.320	0.933
Absolute max			0.0	0.0	20.4	16.9	18.2	18.7	6.2	7.8	10.5	11.0	9.2	4.8	4.3	3.6	2.9	2.5	2.1	1.7	100.0	41.9	58.2	18.1	3.8	inelastic		686.160	42.542	36.4	2.68	2.29	2.14	37.44	0.598	1.618
Absolute min			0.0	0.0	1.1	9.2	6.3	10.1	2.7	3.2	5.2	5.5	3.2	2.9	2.4	2.1	1.7	1.5	1.2	0.7	100.0	25.3	41.0	10.9	2.0	inelastic		101.790	4.618	6.0	2.66	2.25	1.66	20.09	0.251	0.639

Chief engineer of laboratory: L. Tsagaandarkhi Laboratory engineer: G. Ganchimeg

STANDARD PENETRATION TEST RESULT /SPT/

Borehole number	Depth of SPT (m)	0-15cm	15-30cm		30-45cm		N
		Blow counts	Real penetration thickness(cm)	Blow counts	Real penetration thickness(cm)	Blow counts	Blow counts
BH-1	1.0	29	15	48	8	50	98/23cm
	2.0	32	15	45	10	50	95/25cm
	3.0	35	15	44	8	50	94/23cm
	4.0	28	15	46	11	50	96/26cm
	5.0	33	15	49	9	50	99/24cm
	6.0	28	15	42	13	50	92/28cm
	7.0	24	15	36	14	50	86/29cm
	8.0	28	15	40	12	50	90/27cm
	9.0	30	15	46	9	50	96/24cm
	10.0	34	15	47	7	50	97/22cm
BH-2	1.0	33	15	46	9	50	96/24cm
	2.0	30	15	41	11	50	91/26cm
	3.0	28	15	42	13	50	92/28cm
	4.0	35	15	48	8	50	98/23cm
	5.0	31	15	47	7	50	97/22cm
	6.0	28	15	44	10	50	94/25cm
	7.0	30	15	45	9	50	95/24cm
	8.0	32	15	43	11	50	93/26cm
	9.0	29	15	46	8.8	50	96/23.8cm
	10.0	36	15	50	6	50	100/21cm
BH-3	2.0	31	15	44	8	50	94/23cm
	3.0	35	15	48	6.5	50	98/21.5cm
	4.0	37	15	50	6	50	100/21cm
	5.0	32	15	49	7	50	99/22cm
	6.0	29	15	45	10	50	95/25cm
	7.0	27	15	40	8	50	90/23cm
	8.0	31	15	47	9	50	97/24cm
	9.0	33	15	45	8	50	95/23cm
	10.0	30	15	42	10.5	50	92/25.5cm
BH-4	1.0	33	15	47	7	50	97/22cm
	2.0	31	15	44	10	50	94/25cm
	3.0	36	15	47	9.3	50	97/24.3cm
	4.0	35	15	49	8	50	99/23cm
	6.0	30	15	45	12	50	95/27cm
	7.0	29	15	41	11	50	91/26cm
	8.0	30	15	46	9	50	96/24cm
	9.0	34	15	48	7	50	98/22cm
	10.0	33	15	47	9	50	97/24cm

Prepared by: E.Uchral

ENGINEERING GEODESY LLC

ACCREDITED LABORATORY OF SOIL RESEARCH

TABLE OF LABORATORY TEST RESULT

TL-78
MNS ISO/IEC 17025:2007

Object: Engineer geological survey report of construction areaof 109th school extension construction in 109th khoroo, Nalaikh district, Ulaanbaatar

Start date: 2017.04.17
Finish date: 2017.04.23

№	Borehole number:	Depth of sample /m/	Grain size analysis											Hydrometr, [mm]%								Gravel	Sand	Silt	Clay	Plasticity limit (%)		Cu	CC	Natural moisture content(W), %	Specific gravity Gs, g/cm3	Wet density, ρ, g/cm3	Dry density, ρd, g/cm3	Porosity, n, %	Porosity ratio, e	Saturation degree, Sr	Konsistens, k
			75.0	37.5	19	9.5	4.75	2.36	1.18	0.60	0.300	0.150	0.075	0.035	0.022	0.012	0.009	0.006	0.003	0.001						LL	PL										
Clay sand with gravel /lens ayer/																																					
1	4	5.0	0.0	0.0	2.2	3.3	11.0	9.0	3.9	6.2	7.8	8.3	8.4	9.7	7.5	6.3	5.1	4.8	3.8	2.7	100.0	16.5	43.6	33.4	6.5	28.80	19.16	51.34	0.050	4.6	2.74	2.07	1.98	27.77	0.384	0.327	<0

ENGINEERING GEODESY LLC

ACCREDITED LABORATORY OF SOIL RESEARCH

TABLE OF LABORATORY TEST RESULT

TL-78
MNS ISO/IEC 17025:2007

Object: Engineer geological survey report of construction areaof 109th school extension construction in 109th khoroo, Nalaikh district, Ulaanbaatar

Start date: 2017.04.17
Finish date: 2017.04.23

№	Borehole number:	Depth of sample /m/	Grain size analysis											Hydrometr, [mm]%								Gravel	Sand	Silt	Clay	Plasticity limit (%)		Cu	CC	Natural moisture content(W), %	Specific gravity Gs, g/cm3	Wet density, ρ, g/cm3	Dry density, ρd, g/cm3	Porosity, n, %	Porosity ratio, e	Saturation degree, Sr
			75.0	37.5	19	9.5	4.75	2.36	1.18	0.60	0.300	0.150	0.075	0.035	0.022	0.012	0.009	0.006	0.003	0.001						LL	PL										
EGE-1a. Silty sand with gravel / seasonal freezing and melting/																																					
1	1	3.0	0.0	0.0	10.7	15.4	14.5	12.0	4.7	7.1	7.9	5.6	4.8	3.7	3.3	2.9	2.4	2.1	1.8	1.1	100.0	40.6	42.1	14.4	2.9	inelastic		265.070	37.078	5.2	2.67	2.24	2.13	20.24	0.254	0.545
2	3	1.4	0.0	0.0	16.0	10.2	15.2	16.6	5.2	7.4	7.1	5.5	4.9	2.6	2.6	1.3	1.9	1.6	1.2	1.0	100.0	41.4	46.4	10.0	2.2	inelastic		78.443	678.030	6.6	2.68	2.26	2.12	20.86	0.264	0.667
3	2	1.5	0.0	0.0	8.6	16.5	15.0	17.2	4.9	6.2	5.3	3.1	4.7	4.4	3.5	2.6	2.1	1.7	1.4	0.8	100.0	40.1	43.4	14.3	2.2	inelastic		180.278	47.628	4.4	2.67	2.25	2.16	19.27	0.239	0.491
4	4	1.5	0.0	0.0	7.9	14.8	15.8	12.9	4.1	6.4	13.2	5.2	4.2	3.3	2.9	2.4	2.4	1.9	1.4	1.2	100.0	38.5	46.0	12.9	2.6	inelastic		204.09	32.818	16.9	2.68	2.27	1.94	27.54	0.380	1.198
5	4	3.0	0.0	0.0	6.0	15.9	17.1	13.5	6	6.5	7.2	5.2	5.2	3.7	3.5	3.2	2.0	2.2	1.9	0.9	100.0	39.0	43.6	14.6	2.8	inelastic		211.00	32.259	6.5	2.67	2.25	2.11	20.87	0.264	0.658
6	3	3.0	0.0	0.0	8.5	12.4	15.8	12.5	4.2	6.8	7.3	9.1	5.9	4.2	3.2	2.9	2.6	1.9	1.3	1	100.0	36.7	45.8	14.8	2.7	inelastic		177.28	31.168	7.2	2.66	2.28	2.13	20.04	0.251	0.764
Average			0.0	0.0	9.6	14.2	15.0	14.1	4.9	6.7	8.0	6.0	5.0	3.7	3.2	2.6	2.2	1.9	1.6	1.0	100.0	39.4	44.6	13.5	2.6	inelastic		186.03	139.830	7.8	2.67	2.26	2.10	21.47	0.275	0.719
Absolute max			0.0	0.0	16.0	16.5	17.1	17.2	6.0	7.1	13.2	9.1	5.9	4.4	3.5	3.2	2.6	2.2	1.9	1.2	100.0	41.4	46.4	14.8	2.9	inelastic		265.08	678.030	16.9	2.68	2.28	2.16	27.54	0.380	1.198
Absolute min			0.0	0.0	6.0	10.2	14.5	12.0	4.1	6.2	5.3	3.1	4.2	2.6	2.6	1.3	1.9	1.6	1.2	0.8	100.0	36.7	42.1	10.0	2.2	inelastic		78.44	31.168	4.4	2.66	2.24	1.94	19.27	0.239	0.491

7. References

No.	Document title	Medium	Issued yr	Issuing agency
1	Mongolia Sustainable Development Vision 2030	Electric data	2016	Parliament of Mongolia
2	Action Program of the Government of Mongolia for 2016-2020	Electric data	2016	Parliament of Mongolia
3	State Education Policy 2014-2024 (in Mongolian)	Electric data	2014	Parliament of Mongolia
4	Educational Quality Reform Policy 2012-2016 (in Mongolian)	Electric data	2013	MECS
5	Statistical Yearbook- Eduction and Science 2015-16	Booklet	2016	MECS
6	Statistics of General Education Schools 2016-17 (in Mongolian)	Electric data	2017	MECSS
7	UBC Education Statistics 2016-17 (in Mongolian)	Electric data	2017	UBC Education Dept.
8	UBC Education Statistics 2015-16 (in Mongolian)	Electric data	2016	UBC Education Dept.
9	Mongolian Statistical Yearbook 2015	Electric data	2016	NSO
10	Pupulation by district/khoroo and type of dwelling 2016 (in Mongolian)	Electric data	2017	UBC Statistical Division
11	Population by single age 2016 (in Mongolian)	Electric data	2017	UBC Statistical Division
12	Future development challenges in Mongolia: Multi-state population projections by age, sex and education	Electric data	2013	IUSSP-International Population Conference
13	Mongolia State Budget 2017 (in Mongolian)	Electric data	2016	Miinstry of Finance
14	Mongolia State Budget 2016 (in Mongolian)	Electric data	2015	Miinstry of Finance
15	Ulaanbaatar City Budget 2017 (in Mongolian)	Electric data	2016	Miinstry of Finance
16	Needs for new kindergartens, schools, dormitories and gyms and options to meet those needs-Policy Project	Booklet	2012	MECS
17	School location map of General Education Schools and Kindergartens (in Mongolia)	Electric data	—	UBC Education Department
18	Model Blueprints of General Education Schools (in Mongolian)	Electric data	—	Swaziland National Trust Commission
19	Initial Environmental Examination - Mongolia: Sustaining Access to and Quality of Education during Economic Dificulties	Electric data	2017	MECSS/ADB
20	Construction Code of Mongolia (CCM) 31-03-03/11, Public and Civil Buildings (in Mongolian)	Booklet	2011	MCUD
21	Construction Regulations (CR) 31-113-11 Designing of General Education Institutions (in Mongolian)	Booklet	2011	MCUD

No.	Document title	Medium	Issued yr	Issuing agency
22	CCM 52-01-10 Concrete and Reinforced Concrete Structures, Principal Rules (in Mongolian)	Booklet	2010	MCUD
23	CR 31-101-04 Handbook for Barrier-Free Construction-Planning for Handicapped (in Mongolian)	Booklet	2004	MCUD
24	CCM 22-101-01/2013 Construction Planning at Seismic Zones of Mongolia	Booklet	2013	
25	Ulaanbaatar City General Development Plan 2030 (in Mongolian)	Electric data	2014	MCUD, UBC
26	Law of Mongolia on the Rights of Persons with Disabilities (Un-authorized translation)	Electric data	2016	Parliament of Mongolia
27	Report: Data Collection and Verification Survey on Special Needs Education in Mongolia (in Japanese)	Electric data	2014	JICA (Human Development Dept.)
28	PPTA- Ensuring inclusiveness and service delivery to persons with disabilities- Poverty and Social Analysis	Electric data	2016	ADB
29	Mongolia Country data book on Disability (in Japanese)	Electric data	2016	Project for promoting social participation of PWD in UBC
30	Law of Mongolia on Disaster Protection (Revised, in Mongolian)	Electric data	2017	Parliament of Mongolia
31	Final Report: Data Collection and Verification Survey on Disaster Prevention Sector of Mongolia (in Japanese)	Electric data	2016	JICA
32	Desaster Management in Schools (in Mongolian)	Booklet	2016	MECSS
33	Advancing School Safety in Asia	Electric data	-	World Vision
34	Environmental Protection Law of Mongolia	Electric data	1995	Parliament of Mongolia
35	Law of Mongolia on Environmental Impact Assessment	Electric data	2011	Parliament of Mongolia
36	Strategies for Development of Green Energy Systems in Mongolia (2013-2035)-Extended Executive Summary	Booklet	2015	Global Green Growth Institute
37	Green Public-Private-Partnerships for Public Infrastructure in Mongolia	Booklet	2016	Global Green Growth Institute
38	Financing Mechanisms for Green Public Education Buildings in Mongolia	Booklet	2016	Global Green Growth Institute
39	Green School- PPT Presentation	Electric data	-	“N.A.P Group” LLC