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ADDENDUM OF ENVIRONMENTAL IMPACT ASSESSMENT REPORT ON BOROO-GATSUURT HAUL ROAD CONSTRUCTION PROJECT

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БАТЛАВ.
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"СЕНТЕРРАГОУЛД" ХХК-ИЙН "ХҮНД ДААЦЫН АВТО ЗАМ" ТӨСЛИЙН БАЙГАЛЬ ОРЧИНД НӨЛӨӨЛӨХ БАЙДЛЫН НАРИЙВЧИЛСАН ҮНЭЛГЭЭНИЙ НЭМЭЛТ ТОДОТГОЛ

УЛААНБААТАР ХОТ
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БАЙГУУЛЛАГА: "ГАВАР ЭКО" ХХК-ИЙН ЗАХИРАЛ Б. БАЯСГАЛАН

ТӨСӨЛ ХЭРЭГЖҮҮЛЭГЧ: Боро гоулд
"БОРОО ГОУЛД" ХХК-ИЙН ЕРӨНХИЙЛӨГЧ БАЙӨӨД
ГҮЙЦЭТГЭХ ЗАХИРАЛ ПОЛ КОРПИ

ТӨСӨЛ ХЭРЭГЖИХ НУТАГ ДЭВСГЭР:
"СЭЛЭНГЭ" АЙМАГ "МАНДАЛ" СУМЫН ЗАСАГ ДАРГА Б. ЦЭЭПЭЛДОРЖ

ONE.

PROJECT DESCRIPTION

1.1. Project name

Addendum on the change in route of the maintained haul road to be built between Boroo and Gatsuurt

1.2. Project objective

Project objectives are to build the maintained haul road in order to transport ore from Gatsuurt Hardrock Gold Deposit, a property of Centerra Gold Inc., to the Boroo Gold Processing Plant for processing there, and therefore to allocate certain amount of income to the local and state budgets, conduct environmentally friendly operation, reduce auto traffic load in the local transportation network and travel without difficulties and obstacles.

1.3. Name of the company and organization implementing the project

Centerra Gold Co., Ltd.

1.4. Address of the company implementing the project

Boroo Gold Co., Ltd.
Bodi tower, 11th floor
Chingeltei district,
Ulaanbaatar, Mongolia
Tel: 317798

1.5. Location of the project

From Boroo Gold Processing Plant to the Gatsuurt Deposit through the territories of Bayangol and Mandal soums of Selenge aimag. /sketch-map is attached/

1.6. Brief description of the project

In 2004, Centerra Gold has detailed EIA report of the project of the haul road from Boroo Gold Processing Plant to Gatsuurt Gold Deposit prepared. However the report was approved by the Ministry of Environment and Nature as compliance document, Centerra Gold company had decided to change the route direction for ore transportation.

The ore transporting haul road designed in the detailed EIA report which was approved in 2004 had a route that passes through the southern side of the tailings facility of the Boroo Gold Project, going down the valley up to the Boroo River through Burkhant Mountain Pass towards up the Zuun Mod Ravine and the Gatsuurt Hardrock Gold Deposit (Map 1).

In the amendment made to the detailed EIA report this time, route for the ore transporting haul road was changed by drawing it to the south from the Boroo Gold Processing Plant travelling down through Tsagaanchuluut pass, crossing Boroo River through the bridge to be built, circling the Burkhant Mountain on its southern side going up the Zuun Mod valley and reach the Gatsuurt Hardrock Gold Deposit from its northern side (Map-2).

In the scope of the haul road project, soil and vegetation cover state, measures necessary to be taken to eliminate and reduce negative impacts to be occurred due to the project and the Environment Protection Plan and the Environment Monitoring Plan were developed and included.

Grounds for implementing the project

Reason for implementing this project is to build a maintained haul road for transportation of ore mined from the Gatsuurt Hardrock Gold Deposit to the Boroo Gold Processing Plant by heavy duty haul trucks in order to process it there. By building the road, Boroo Gold Processing Plant will be connected with the Gatsuurt Deposit and after completion of the project, it will be left as a road of significance to improve all traffic movements including auto and passenger transportation, load turnover and penetration capacity of the Ulaanbaatar-Darkhan auto road to Tunkhel soum, Selenge aimag.

Main specifications of the project

Table 1: Main specifications for the Boroo- Gatsuurt road

Dimensions/Characteristics	Unit	**Haul Road Sections by Relative Elevation**		
Surface Feature	-	Low	Mid	High
Maximum Speed	km/hour	50	30	10-20
Road Width (Running Surface)	m	8		
Width of Road Shoulder	m	1.5 - 2.0		
Vertical Fall of Road-Way	%	2.0		
Vertical Fall of Edge	%	4.0		
Surface Type	-	Gravel		
Maximum Visibility	m	205	100	45
Maximum Horizontal slope	%	6.0		
Side Slanting of Horizontal Slope	-	1:175	1:150	1:50
Slanting Angle	%	4.0	6.0	7.0
Horizontal Distance	km	64		

TWO.
SOIL & VEGETATION COVER AND ARCHEOLOGICAL SITES IN THE ROAD AREA

It was mentioned in the previous chapter that the detailed EIA report on the maintained haul road to be built between the Boroo Gold Processing Plant and Gatsuurt Hardrock Gold Deposit in order to transport ore on was conducted in 2004.

Due to the decision of Centerra Gold Co., Ltd to change the route of the road, the soil cover, vegetation and archeological surveys were conducted again and included herein. With the change of the route of the road from the Boroo Gold Processing Plant to Gatsuurt Gold Deposit, some area under this road route is existing outside of the impact area described in the previous report.

Therefore surveys on soil cover and vegetation conditions and archeological surveys that are required for the project were conducted. As a result of the surveys, necessary measures to reduce and eliminate negative impacts on soil and vegetation cover are developed.

2.1 Soil cover along the haul road

Gatsuurt hard-rock gold deposit is located in south 26km from Zuunkharaa town, Selenge aimag, about 56 km from Boroo Gold mine site if travel through previous road route and over 200km distance from Ulaanbaatar on paved road.

It belongs to the geophysical zone of Khangai Mountains and the branch mountains of the Baga Khentii Mountain ranges, and the soil-geographical zone of steppe brown soil in the basin of Orkhon and Selenge. The highest point of the area is the Noyon Mountain that is 1722.0m above the see level. The lowest point is around Burkhant Tolgoi of Boroo River that is 880m above the sea level and the elevation even slowly decreases as goes down.

Geo-morphologically, it is a mountainous area where mountains and small mountains of the Khangai and Khentii—the continuation of the Siberian geo-morphology—are dominant. Land slope is $35\text{-}40^0$ in the mountains and $6\text{-}14^0$ in the steppe. It is in the seismic zone of 7-8 scores at Mercalli intensity scale. As for vegetation, mixed forest dominated by Siberian larch (*Larix sibirica*), pines and birches with height of 7-12m in average occurs in the forested mountain area.

Forbs- small grasses on the mountainsides, forbs- sage brushes through the steppes, and sedges-iris-feather grasses usually occur along the river valley.

70-80 percent vegetation cover is per an area of $1m^2$, its average height is 40-60cm and in some parts it reaches the height of 100-110cm.

250-300mm precipitation falls in average a year. Most of the precipitation, 70-85%, falls in July and August in form of heavy rains and the remaining falls in small amounts in other months.

The original rock forming soil is prevailed by the powder carbonated sediment of eluvia and eluvia-diluvia while pebbles and sand of alluvia are dominant in the river valleys. On the sediment of eluvia, poor developed black earth of mountain and poor developed dark brown soil are formed. In the river valley, meadow swamp of alluvia and seasonal meadow permafrost soil of alluvia are formed on the pebbles of alluvia. Previously a field study of soil with a scale of 1:25,000 was conducted for the soil cover in the area using topography map of scale of 1:100,000 in July, 2005,

The selected route is a third version of BGC's alternative routes of Boroo-Gatsuurt road. It elongates in following route direction: the Boroo Gold Procesing Plant- the Tsagaan Chuluut pass, Boroo river bridge- the Burkhan Mountain, Zuun Mod valley, Takhilt Mountain, Noyon Mountain backside- Khokh Biluut pass –and north side of the Gatsuurt Hard Rock Gold deposit..

Survey on the soil along the haul road was conducted by using the topographical map of scale of 1:25000.

When determining agro-chemical characteristics of the soil such as nitrogen, phosphorus, Kalium and pH, findings of the soil survey conducted at Gatsuurt last year were applied.

During field study, 11 types of soil were identifued as follows:

- Powder-carbonated, mountain primitive chernozem soil	Ind-1
- Mountain primitive kashtan soil	Ind-2
- Powder-carbonated, mountain dark kashtan soil	Ind-3
- Powder-carbonated, mountain primitive kashtan soil	Ind-4
- Powder-carbonated mountain kashtan soil	Ind-5
- Mountain meadow dark kashtan soil	Ind-6
- Mountain forest dark soil	Ind-7
- Steppe dark kashtan soil	Ind-8
- Criogenic soil of alluvial meadow and swamp	Ind-9
- Carbonated saline soil of alluvial meadow	Ind-10

- Swampy and criogenic dark kashtan soil of meadow Ind-11

As a result of the data processing, a soil map with scale of 1:50,000 along the paved road, the map legends and recommendations were developed. Please see the characteristics, main morphological and agrochemical parameters of the above-mentioned types of soil.

Powder-carbonated, mountain primitive chernozem soil Ind-1

This soil is formed on the hard rock of eluvia in the areas of glade in mountain forest that is 1300-1500m above the sea level. The morphological records and results of laboratory analysis of the 8^{th} profile that was conducted in a pasture land with inclination of 36^0 facing towards south on the western side of the Gatsuurt River at 3 km south of the Gatsuurt camp are shown below.

A_0-3cm	Reinforced roots of with vegetation
A_1-3-13cm	Dark brownish and black colored; wet and scarce; plant roots reinforced; light clayey and weak lump composition; it is clearly transferring to the color of the next stratum.
B_1-13-41cm	Light brown colored; wet and scarce; roots of plant is significantly more comparing to the upper layer; weak lump composition; slow to transfer to the next stratum by being poorly boiled by being affected by 10% hydrochloric acid
B_2C-41-60cm	Light yellowish colored, wet and stony

Taking soil profile recording and laboratory analysis results into account, even though thickness of the humus stratum of the soil is 13cm, in some places the thickness is more and less than the amount. This is a feature of the mountain soil with poor development.
The humus content in its upper layer is 5.89%, total nitrogen is 0,28 and the soil pH is 7.2 or it is almost neutral. A total saturated base is 33.6 MEQ and 2.97mg of movable phosphorus and 31.2mg of exchangeable Kalium in soil of 100g (Profile 8).

However, there is 22.6-24.8% of physical clay in mechanical or fiber composition of the soil. With its agro-physical characteristics, it has good water holding capacity, water and wind resistant and it is a good quality pasture land as well.

Powder-carbonated, mountain primitive kashtan soil Ind-2

This soil is formed on the carbonated sharp-edged stones of eluvia-diluvia that are occurring in the skirt of mountain forest and in the most cases behind the mountain especially in the particular place in Burkhan Tolgoi, Taxilt mountain pass and Dood Biluut.

The top soil is about A-0-3cm that has reinforced roots of plants and stony on its surface. Thickness of the humus layer is 7-11cm. However, it is less than this thickness in some cases. The soil survey conducted in 2004 shows that the contents of humus is 4.58 %, total nitrogen is 0.23% and pH is 6.6 or almost neutral on its upper layer. Sum of the saturated bases is 22.6MEQ, but the movable phosphorus is 3.14mg and exchangeable Kalium is 35.6mg. It shows that the soil is of good quality with its agrochemical parameters. (Profile 8).

Powder-carbonated mountain dark kashtan soil Ind-3

This type of soil was formed on sharp-edged gravelly sediment of eluvia-diluvia at elevation of 1100-1450m above the sea level around lower part of the dark soil of mountain forest.

The soil surface is covered by various small and large stoneswhile vegetation coverage is 50-60% per $1m^2$ area with 15-25cm plants. Let's see field records and lab analysis result of the Profile 11 that was conducted at 300m south from the iron board installed on the Tahilt mountain pass as representation the dark brown mountain soil.

A_o -3cm	Reinforced roots of plants and stones of various diameters
A-0-12cm	Dark brown colored, wet, roots of plants, light clayey, brittle, dusty lump, transfers slowly the next layer.
AB-12-38cm	Light brown, wet, high density of plant roots, brittle, dusty, lump, light clayey, weak boiling with 10% hydrochloric acid,slowly transfer into next layer in same color.

B_k-38-86 Reddish yellow, wet plant roots, not much stone, sandy, brittle, lump, boils in 10% hydrochloric acid, with its color transfers clearly into the next layer

Thickness of the layer of humus of the dark brown mountain soil is 10-19cm, the content of humus is 5.89%, total nitrogen is 0.25%, pH is 7.2-7.4 or neutral. Sum of the saturated base in 100g soil is 26.4 MEQ and most of this accounts for calcium cation. Movable phosphorus is 2.33mg, exchangeable Kalium 28.9mg, content of physical clay of mechanical component or fiber component of the soil is powdered earth /24.5-26.7%/. It proves that the soil is clayey. As for the soil fertility, analysis results revealed that its more than medium. In agricultural significance, the soil is good for pasture and farming.

Powder-carbonated mountain primitive kashtan soil Ind-4

This type of soil is distributed at hard rock of eluvia-diluvia at Tahilt mountain pass, northern side of Burkhant Tolgoi and on small mountains on the southern side of the Boroo Gold mine site, the areas 1000-1250m above the sea level.

The origin of this soil is quite similar with the dark brown mountain soil previously described, but it usually spreads under the dark brown soil. Thickness of the humus layer is 07cm, brown colored, condensed, with small amount of damp, light clayey. It transfers clearly with its color into the next layer.

On the surface of the soil, vegetation cover is scarce. Its coverage per an area of $1m^2$ is 45-60% in general. Height of the plants is 15-25cm, covered with small and large stones; Content of fertility is less than in the dark brown soil. But pH is neutral. It is available for agricultural use as a pasture land for all season round.

Powder-carbonated mountain kashtan soil Ind-5

Generally, its characteristics are similar to the above-mentioned dark brown and brown soil with poor development. Let's see the results of a laboratory analysis and morphological records of the Profile 13 which was conducted on the southern side of the Nam mountain :

Thickness of the humus layer is 15-17cm and the accumulation of humus contained is 3.88-4.21%, total nitrogen is 0.19-0.21%, pH is 6.76-6.8 or neutral; saturated base in

100g of soil is 26.1-28.3MEQ, moveable phosphorus is 2.34mg and exchangeable Kalium is 28.0mg.

The analysis result on the soil fertility content shows that the soil is not of bad quality and so it is available for agricultural use as a good quality pasture land for all season round for all types of livestock.

Mountain meadow dark kashtan soil Ind-6

Its origin is a little different from the abovementioned soils. Becayse it is distributied through narrow mountain passesand meadows with rich and thick vegetation. Vegetation cover is 70-80% per $1m^2$ area and the plant's height is 2-35cm in average. It is formed on hard rocks of diluvia on the areas such as Urt pass, Khokh Biluut pass, Ajnai mountain.

Field records and the results of laboratory analysis for Profile 2 cut on northern side of the high voltage powerline pole along the Gatsuurt River below the Gatsuurt town:
The surface of the soil is covered with small particles of stones. Thickness of the humus layer of the soil is 28-32cm in average and the accumulation of humus contained in it is 6.71%, total nitrogen is 0.33%, sum of the saturated base is 24,0MEQ, moveable phosphorus is 1.98mg, exchangeable Kalium is 36.0mg and pH is 6.4-7.3 or neutral. This type of soil is very suitable for agricultural use as a pasture land. This pasture is appropriate for all kinds of livestock for all seasons round. (Soil data collected in July, 2004.)

Mountain forest dark soil Ind-7

This type of soil occurs in mixed forests, mostly, in northern side of mountain 1200-1600m above the sea level, under forest vegetation as formed on the powder carbonate sediment of eluvia-diluvia. The results of laboratory analysis and records of soil Profile 6 cut on the slope of a mountain up to the bank of the Gatsuurt River upper the Gatsuurt camp are shown below:

Thickness of humus layer is 12cm and black colored. After drying, the color becomed gryesih black. There are a lot of roots of grassy and woody plants. It is light clayey and has rounded structure. It clearly transfers into the bedrock C that forms the soil.

Content of humus is 8.6% in its upper layer, total nitrogen is 51%, pH is 5.6 and a little acidic. Sum of the saturated base in 100g of soil is 21.0-27.0MEQ, most of this amount accounts for calcium cation. Its mechanical composition, in other words, powder clay content is 27.0% or light clayey. This type of soil is quite resistant in soil erosion. Hydro-physically or agro-physically, it has a goodwater holding capacity.

This type of soil has good fertility. However, it has a limited availability for grazing as much snow falls In winter and high density of flies and mosquitoes occurs in summer time.

Steppe dark kashtan soil Ind-8

This type of soil is found a little along the road. It is distributed in farming lands in the Tsagaan Chuluut valley, behind the Takhilt mountain pass on the carbonate sediment of diluvia.

Surface of the soil in the Tsagaan Chuluut Valley is covered with particles and large stones and became abandoned farmlands. This land is located on both sides of the road running down the Tsagaan Chuluut valley. But on the both sides of Boroo River, local community is growing potatoes and vegetations.

This type of soil is set in narrow valley between mountains, powder carbonate sediment of diluvia. Thickness of humus layer is 18-24cm, content of the humus is 1.78-2.41%, total nitrogen is 0.5-0.12% and pH is neutral. Sum of the saturated base is 26.3-32.1MEQ, movable phosphorus is 1.79mg, exchangeable Kalium is 35.0mg. This land is appropriate to be used as pasture land in the future.

Alluvial criogenic soil of wetland Ind-9

This soil is common on the alluvial sediments on narrow ravines between the mountains along the Gatsuurt River, at the lowest depressions at height of 1,300-1,360m. Here are the field records of the Profile 9 conducted on the eastern bank of the Gatsuurt River 2km south from the Gatsuurt town, representing the alluvial meadow soil in the river valley, and the results of the analysis.

The surface of the ground is generally flat, has slope of 5 degrees towards east and with plants such as *Carex duriuscula, C. enervis, Potentilla* and small grasses.

A- 0-43cm Dark black and dark graywhen dried, wet, top layer is rich in plant roots, large lump structure and transfers gradually into the next stratum with same color.

AB 43-60cm Blackish colored, wet, no plant roots, large lump structure, fiber composition is medium clay, and transfers gradually into the next stratum.

BC 60-81cm Light brown colored, wet, compact, medium clay and transfer is unclear.

Thickness of humus horizons in this soil is various depending on the relief. The content of the humus decreases as goes below. The pH is 7.1-7.6 or almost neutral, not saline, sum of the saturated base is 44.0MEQ and most of them are calcium cation. Quality of the soil is very good and the soil belongs to the first class of the soils used for the agro-industrial purposes. Currently, individuals and companies are growing vegetation in the land.

Alluvial meadow carbonated saline soil Ind-10

This kind of soil is formed in the wet condition along the Boroo River. In other words, it is formed on lump gravel of alluvia where plants of hydrophilic origin are dominant. The origin of this type of soil is similar to the alluvial meadow soil. The Profile 24 was conducted in the Boroo River Valley, 2km south from the Burkhant.

A-0- 4cm Reinforced and boggy

A 4-36 Black colored but black gray after drying, large lump structure, medium clayish, and clearly transfers into the next stratum with same color.

B_k 36-63 Light brown colored, wet, no plant roots, large dusty lump structured and water was found at the depth of 41cm.

According to the laboratory analysis, the content of humus decreases gradually from the top to down. This is related to the agro-physical characteristics of the soil. Due to capillary water of the soil, microorganism effect is limited.

Sum of the saturated base contained in 100g soil is 30.5-38.0MEQ. and pH is 6.6-6.8 almost neutral in all layers. During summer and autumn, this soil is used as pasture land of good quality. But it is not available to be used for farming as the soil is saline.

Cryogenic swampy and dark kashtan soil of meadow Ind-11

This type of soil is formed on hard rocks of diluvia in the Zuun Mod valley, Bayan River valley and Urt pass, at 800-950m above the sea level. Thickness of the humus layer is 25-35cm. However, in some parts, it is thicker.
Humus layer is dark brown and dark grey after drying. It is rich in plants roots and wet. It has large granular structure. Mechanical composition is medium clayey. Physical clay content is 35.0-41.2%, transfers gradually into the next layer with same color.
Layer of eluvia or B is light brown and its thickness is 45cm, has scarce roots of plants. It has a wet and large granular particales, medium clayey in its mechanical composition, transfers gradually into the next layer.

Bedrock forming the soil is reddish coloured gravels and sand. Humus content is 6.81% in its upper layer, total nitrogen is 0.34%and pH is 6.3-6.6. Sum of the saturated base is 36.8MEQ., movable phosphorus is 2.41mg, exchangeable Kalium 35.6mg. Currently it is used as a pasture land. Fertility of the soil is quiet good. It is available to be used as an irrigated land for growing vegetation there.

Map: Soil cover around the area where the project is going to be implemented

The soil map legends:

- Powder-carbonated, mountain primitive chernozem soil	Ind-1
- Mountain primitive kashtan soil	Ind-2
- Powder-carbonated, mountain dark kashtan soil	Ind-3
- Powder-carbonated, mountain primitive kashtan soil	Ind-4
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2.4. Baseline survey on the vegetation cover

A. Objectives of the survey

The survey was reconducted due to change in the route of the project to build haul road from the Boroo Gold Mine to Gatsuurt Gold Deposit. The following objectives were set to be achieved in conducting the research work.

1. Conduct survey on the flora of the project area
2. Completely identify composition of species of flora in the area along the road to be built.
3. Identify composition of rare and endangered species of flora and as well as vascular plant species used for animal forage.
4. Conduct plant descriptions for local vegetation along the road and produce vegetation map using plant descriptions.
5. Develop recommendations based on the research results

B. Vegetation

The mountains of the study area are elevated at 960-1,530m above the sea level. The area where Gatsuurt Gold Deposit located is in the territory of Mandal soum of Selenge aimag, belonging to mountain branches of Baga Khentii, western end of the Khentii Mountain Ranges. The Khentii Mountain Range is included in the Khentii mountain taiga district, one of the 16 floristic and geographical districts of Mongolia. However, the mountain branches of Baga KKhentii are situated on the western part of forest steppe district of Mongol Daguur Mountain, and in fact, it is situated almost on the border between the districts of mountain taiga of Khentii and forest- taiga of Mongol Daguur Mountain. Therefore, it has abundant vegetation and flora with certain particular characteristics.

The district of forest taiga of Mongol Daguur Mountain includes mountain branches of Khentii Mountain Ranges and is situated by arc-like surrounding the Khentii district. Topographically, there are small mountains, hillocks and knolls existing together. Floristically, mainly, there are meadows with feather grasses and sedges along the valley, steppe with feather grasses and wild rye, steppe with stipas and wild ryes on the inner foots of the hillocks, steppe with forbs and fescues, floodplain meadow with forbs and sedges, mountain steppe with forbs, and forest of pine trees and birches on the elevated

places. But in the western and eastern parts of the area, larch forest with herbs occurs in parts along the northern side of the mountain. In addition, forests of birches and pine trees, birches and larches, mixed forest of birches, pine trees and larches, and birch forest alone and shrub thicket occur in parts. Mainly deciduous or mixed forests are found but bright larch forests can occur in some areas. Mountain steppe vegetation of various plant communities is dominant in the district. Dominant plant communities of the steppe are *Stipa krylovii- Cleistogenes squarrosa*, *Stipa Krylovii- Cleistogenes squarrosa-forbs*, *Stipa- Potentilla* while *Leymus, Stipa krylovii- Filifolium* communities play major role in the eastern part of the area. Also meadow steppe and floodplains rich in herbaceous plants occur commonly. Stony steppe plant community type occurs in the areas with granodiorites and gravels. In the sandy soiled area, various grass steppe with leaved *Caragana* prevails.

In the mountains of the Gatsuurt Gold Deposit region, where the mining is expected, birches-pine trees and birch-pine tree-larch forests and shrub thicket occur in parts. In the forest region, mainly there are young trees. In the skirt of forest, there are significantly abundant shrubs such as wild rose and *S.salicifolia*. In the mountain steppe zone, shrubs such as *Spiria* and *Cotoneaster* mainly grow and in the places with soil with rocks, granodiorites and gravels, associations and types of steppe stone with tussock grasses including salt marsh grass are dominant. Along the mountain depressions, plants of type of mountain forest steppe are widely spread. Steppe with meadows and water meadow rich in grasses are common in the area.

C. Species composition of the vegetation cover

Plant species composition of the area nearby Gatsuurt gold deposit located in the territory of the Mandal soum, Selenge aimag is described as below according to the plant classification units such as phylum, class, family, genera and species.

Table 2.7

Plant species composition in the study area

	Plant name (Phylum, family, genus, species)	**Rare plants**	**Useful plants**
I.	**Pteridophyta**		
1.	Polypodiaceae (3/3)		
L.	Woodsia ilvensis (L.) R. Br.		
2.	Cystopteris fragilis (L.) Bernh.		
3.	Athyrium crenatum (Sommerf.) Rupr.		
II	**Equisetophyta**		
2.	Equisetaceae (1/4)		
1.	Equisetum fluviatile L.		+
2.	E. pratense L.		+
3.	E. palustre L.		+
4.	E. arvense L.		+
3.	Selaginellaceae Mett. (1/1)		
1.	Selaginella sanguinolenta (L.) P.B.		
III.	**Gymnospermae**		
4.	Pinaceae (1/2)		
1.	Larix sibirica Mill.		+
2.	Pinus sylvestris L.		+
5.	Cupressaceae (1/2)		
1.	Juniperus pseudosabina Fisch. et Mey.	+	+
2.	J. sabina L.	++	+
6.	Ephedraceae (1/2)		
1.	Ephdra sinica Starf.		+
2.	E. monosperma J.G.Gmel. Ex C.A.Mey.		+
IY.	**Angiospermae**		
A.	**Monocotyledoneae**		
7.	Typhaceae Juss. (1/1)		
1.	Typha Laxmannii Lep.		
8.	Potamogetonaceae (1/4)		
1.	Potamogeton gramineus L.		+
2.	P. vaginatus Turcz.		+
3.	P. perfoliatus L.		+
4.	P. pusillus L.		+
9.	Juncaginaceae (1/2)		
1.	Triglochin maritimum L.		+
2.	T. palustre L.		+
10.	Butomaceae (1/1)		
1.	Butomus umbellatus L.		+
11.	Gramineae (25/59)		
1.	Spodiopogon sibiricus Trin.		+
2.	Panicum miliaceum L.		+

3.	Setaria virides (L.) P.B.		+
4.	Phalaris arundinenacea L.		
5.	Hierochloe glabra Trin.		+
6.	Achnatherum splendens (Trin.) Nevskii		+
7.	Stipa sibirica (L.) Lam.V		+
8.	S. baicalensis Roshev.		+
9.	S. Krylovii Roshev.		
10.	Phleum phleoides (L.) Karst.		+
11.	Alopecurus aequalis Sobol.		+
12.	A. brachystachyus M.B.		+
13.	A. arundinaseus Poir.		+
14.	Agrostis clavata Trin.		+
15.	A. Trinii Turcz.		+
16.	A. mongholica Roshev.		+
17.	Calamagrostis macrolepis Litv.		
18.	C. purpurea (Trin.) Trin.		
19.	C. macilentha (Griseb.) Litv.		+
20.	C. neglecta (Ehrh.) Gaerth., Mey et Scherb.		+
21.	Avena fatua L.		+
22.	A. sativa L.		+
23.	Cleistogenes Kitagawae Honda		+
24.	C. squarrosa (Trin.) Keng.		+
25.	Eragrostis pilosa (L.) P.B.		+
26.	Eragrostis minor Host.		+
27.	Koeleria macrantha (Ldb.) Schult. Et Schult. fil.		
28.	K. altaica (Domin.) Kryl.		
29.	K. mukdenensis Domin		+
30.	Catabrosa aquatica (L.) P.B.		
31.	Melica virgata Turcz. ex Trin.		+
21.	Poa subfastigiata Trin.		+
32.	P. pratensis L.		+
33.	P. supina Schrad.		
34.	P. attenuata Trin.		+
35.	P. argutensis Roshev.		+
36.	P. botroides Trin.		+
37.	P. ochotensis Trin.		+
38.	Glyceria triflora (Korsh.) Kom.		+
39.	Puccinella tenuiflora (Griseb.) Scribn. Et Merr.		+
40.	Festuca sibirica Hack. Ex Boiss.		+
41.	F. rubra L.		+
42.	F. dahurica (St.-Ives) Krecz. Et Bobr.		
43.	F. lenensis Drob.		
44.	F. valesiaca Gaud.		+
45.	Bromus inermis Leyss.		
46.	B. Pumpellianus Scribn.		
47.	B. Korotkyi Drob.		
48.	Agropyron repens (L.) P.B.		
49.	A. cristatum (L.) P.B.		

50.	A. aegilopoides Drob.		
51.	Hordeum Roshevitzii Bowden		+
52.	H. brevisubulatum (Trin.) Link.		
53.	Elymus mutabilis (Drob.) Tzvel.		
54.	E. chinensis (Trin.) Keng.		+
55.	E. secalinus (Georgii) Bobr.		+
56.	E. Gmelinii (ldb.) Tzvel.		+
57.	E. sibiricus L.		+
58.	E. dahuricus Turcz. ex Griseb.		+
59.	E. Komarovii (Nevskii) Tzvel.		
12.	Cyperaceae (6/18)		
1.	Eriophorum brachyanthemum Trautv. Et Mey.		
2.	E. latifolium Hoppe.		
3.	E. polystachyon L.		
4.	Scirpus orientalis Ohwi		+
5.	Blysmus rufus (Huds.) Link.		+
6.	Eleocharis intersida Zinserl.		
7.	Kobresia filifolia (Turcz.) Clarke		+
8.	Carex argutensis turcz. ex trev.		
9.	C. duriuscula C.A.Mey.		+
10.	C. enervis C.A.Mey.		+
11.	C. appendiculata (Trautv. Et C.A.Mey) Kuk.		+
12.	C. Schmidtii Meinsh.		+
13.	C. norvegica Retz.		+
14.	C. sabulosa Turcz. ex Kunth.		+
15.	C. pediformis C.A.Mey.		+
16.	C. Korshinskyi Kom.		+
17.	C. Gotoi Ohwi		+
18.	C. orthostachys C.A.Mey.		+
13.	Juncaginaceae (2/4)		
1.	Juncus alpinus Vill.		+
2.	J. bufonius L.		+
3.	J. salsuginosus Turcz.		+
4.	Luzula pallescens (Wahlbg.) Bess.		
14.	Liliaceae (8/20)		
1.	Hemerocallis minor Mill.		+
2.	Gagea pauciflora (Turcz. ex Trautv.) Ldb.		
4	Allium odorum L.		+
5	A. nerinifolium (Herb.) Baker.		+
6	A. leucocephalum Turcz. ex Ldb.		+
7	A. lineare L.		+
8	A. schoenoprasum L.		+
9	A. senescens L.		+
10	A. prostratum Trev.		+
11	A. anisopodium Ldb.		+
12	A. bidentatum Fisch. ex Prokh.		+
13.	Lilium dahuricum Ker.-Gawl.	++	+
14.	L. martagon L.	++	+

15.	L. pumilum DC.		+
16.	Asparagus dahuricus Fisch.		
17.	Majanthemum bifolium (L.) F.Schmidt.		
18.	Polygonatum sibiricum Delaroche		+
19.	P. odoratum (Mill.) Druce		+
20	Paris quadrifolia L.		+
15.	Iridaceae (1/6)		
1.	Iris sibirica L.		+
2.	I. ruthenica Ker.-Gawl.		+
3.	I. lactea Pall.		+
4.	I. flavissima Pall.		+
5.	I. Potaninii Maxim.		+
6.	I. tigridia Bge		+
16.	Orchidaceae (10/13)		
1.	Cypripedium guttatum Sw.		
2.	C. macranthum Sw.	++	
3.	C. calceolus L.	++	
4.	Micristylis monophyllos (L.) Lindl.		
5.	*Calypso bulbosa (L.) Reichb.f.	++/Recorded only in the Noyon Mountain/	
6	Spiranthes amoena (M.B.) Spreng.	+	
7	Goodyera repens (L.) R.Br.		
8	Herminium monorchis (L.) R.Br.		
9	Coeloglossum viride (L.) C.Hartm.	+	
10	Platanthera bifolia (L.)Rich.	++	
11	Gymnadenia conopsea (L.) B.Br.		
12	Orchis salina Turcz. ex Lindl.		
13	O. militaris L.	++Recorded only in the Noyon Mountain	
14	O. Fuschii Druce	++	
B.	**Dicotyledoneae**		
17.	Salicaceae (2/11)		
1.	Salix rorida Laksch.		+
2.	S. Miyabiana Seemen		+
3.	S. Ledebouriana Trautv.		
4.	S. pyrolifolia Ldb.		
5.	S. taraikensis Kimura		
6.	S. Kochiana Trautv.		
7.	S. pseudopendandra Flod.		
8.	S. Bebbiana Sarg.		
9.	S. rosmarinifolia L.		+
10	Populus tremula L.		+
11	P. suaveolens Fisch.		
18.	Betulaceae (1/4)		

1.	Betula Hippolytii Sukacz.		
2.	B. plathyphylla Sukacz.		+
3.	B. fusca Pall. ex Georgi		
4.	B. fruticosa Pall.		+
19	Ulmaceae Mirb.(1/2)		
1	Ulmus pumila L.		
2	U. macrocarpa Hance		
20	Cannabaceae (1/1)		
1	Cannabis ruderalis Janisch.		
21.	Urticaceae (1/2)		
1.	Urtica cannabina L.		+
2	U. angustifolia Fisch.		
22	Santalaceae R.Br.(1/1)		
1	Thesium refractum C.A.Mey		
23.	Polygonaceae (4/19)		
1.	Rheum undulatum L.		+
2.	Rh. compactum L.		+
3.	Rumex Gmelinii turcz.		+
4.	R. thyrsiflorus Fingerh.		+
5.	R. acetosella L.		
6.	R. aquaticus L.		
7.	Polygonum convolvulus L.		+
8.	P. cognatum Meissn.		+
9.	P. aviculare L.		+
10.	P. amphibium L.		+
11.	P. lapathifolium L.		+
12.	P. viviparum L.		+
13.	P. alopecuroides Turcz. ex Meiss.		
14.	P. Valerii A. Skvorts.		+
15.	P. alpinum All.		+
16.	P. sibiricum Laxm.		+
17.	P. angustifolium Pall.		+
18.	P. divaricatum L.		+
19.	Fagopyrum sagittatum Gilib.		+
24.	Chenopodianaceae (6/20)		
1.	Chenopodium aristatum L.		
2.	Ch. foliosum		
3.	Ch. glaucum L.		
4.	Ch. acuminatum Wiild.		
5.	Ch. hybridum L.		
6.	Ch. urbicum L.	+	
7.	Ch. prostratum Bge.		
8.	Ch. album L.		
9.	Kochia densiflora Turcz.		+
10.	Artiplex sibirica L.		
11.	A. fera (L.) Bge.		
12.	A. laevis C.A.Mey.		
13.	Axyris prostrata L.		

14.	A. hybrida L.		
15.	A. amaranthoides L.		
16.	Bassia dasyphylla (Fisch. et Mey.) Ktze		
17.	Kochia prostrata (L.) Schrad.		
18.	K. scoparia (L.) Schrad.		
19.	Salsola collina Pall.		
20.	S. pestifera Nels.		
25.	Caryophyllaceae (8/17)		
1.	Stellaria dichotoma L.	+	+
2.	S. diffusa Willd.		
3.	S. graminea L.		+
4.	S. dahurica Willd.		+
6.	Cerastium arvense L.		+
7.	C. dahuricum Fisch.		+
8.	Arenaria capillaris Poir.		+
9.	Silene jenisseensis Willd.		+
10.	S. repens Patr.		+
11	Lychnis sibirica L.		+
12	Melandrium apricum (Turcz.) Rohrb.		+
13	M. brachypetalum (Hornem.) fenzl.		+
14	Gypsophylla Patrinii Ser.		+
15	G. dahurica Turcz.		+
16.	Dianthus versicolor Fisch.		+
17	D. superbus L.	+	+
26.	Ranunculaceae (15/42)		
1.	Paeonia anomala L.	+	+
2.	Caltha natans Pall. ex Georgii		
3.	C. palustris L.		+
4.	C. membranacea (Turcz.) Schipz.		+
5.	Trollius asiaticus L.	+	+
5.	Leptopyrum fumaroides (L.) Riech.		+
6.	Cimicifuga foetida L.		+
7.	Aquilegia viridiflora Pall.		+
8.	A. glandulosa Fisch.	+	
9.	A. sibirica Lam.		+
10.	Delphinium triste Fisch.		
11.	D. dissectum Huth.		
12.	D. grandiflorum L.		
13.	D. cheilanthum Fisch.		+
14.	Aconitum barbatum Pers.		
15.	A. septentrionale Koelle		
16	A. Turczaninovii Worosch.		+
17	A. Chekanovskyi Steinb.		
18	Anemone sylvestris L.		+
19	A. dichotoma L.		
20	A. reflexa Steph.	+	
21	A. crinita Juz.		
22.	Pulsatilla flavescens (Zicc.) Juz.		+

23	P. Bungeana C.A.Mey. var.Bungeana		+
24.	P. Bungeana C.A.Mey. var.tenuiloba (Turcz.) Grub.		+
25.	P. Turczaninovii Kryl. et Serg.		+
26.	P.ambigua (Turcz.) Juz.		+
27.	Atragene sibirica L.		+
28	Halerpester sarmentosa (Adans.) Kom.		
29.	Ranunculus pulchellus C.A.Mey.		+
30	R. Gmelinii DC.		
31.	R. natans C.A.Mey.		
32.	R. radicans C.A.Mey.		
33	R. repens L.		
34.	R. sceleratus L.		+
35.	R. monophyllus Ovcz.		
36.	R. japonicus Thunb.		
37.	Thalictrum petaloideum L.		+
38	Th. foetidum L.		+
39	Th. squarrosum Steph. ex Willd.		+
40.	Th. simplex L.		+
41.	Th. minus L.		+
42	Adonis mongolica Simonovicz.	++	
27.	Berberidaceae Juss. (1/1)		
1	Berberis sibirica Pall.		
28.	Menispermaceae (1/1)		
1.	Menispermum dahuricum DC.		
29.	Papaveraceae (4/6)		
1.	Papaver nudicaule L.		+
2.	P. rubro-aurantiacum (DC.) Fisch. ex Steud.		+
3.	Chelidonium majus L.	+	+
4	Corydalis sibirica (L.) Pers.		+
5	Chiazospermum erectum L.		+
6	Ch. lactiflorum Kar. Et Kir.		+
30.	Cruciferae (14/23)		
1.	Brassica juncea (L.) Chern.		+
2.	B. campestre		+
3.	Lepidium latifolium L.		+
4.	L. densiflorum Schrad.		
5.	Isatis oblongata DC.		+
6	Thlaspi cochleariforme DC.		+
7.	Th. arvense L.		+
8.	Capsella bursa-pastoris (L.) Medic.		
9	Neslia panicula (L.) Desv.		
10	Alyssum lenense Adams.		+
11	A. obovatum (C.A.Mey.) Turcz.		
12	Ptilotrichum tenuifolium (Steph.) C.A.Mey.		+
13	P. canescens C.A.Mey.		
14	Draba nemorosa L.		+
15	Arabis pendula L.		+
16	Dontostemon integrifolius (L.) C.A.Mey.		

17	Clausia aprica (Steph.) Korn.-Tr.		
18	C. trichosepala (Turcz.) Dvorak		
19	Erysimum flavum (Georgi) Bobr.		
20	E. diffusum Ehrh.		
21	E. cheiranthoides L.		
22	E. hieracifolium L.		
23.	Descurainia Sophia (L.) Webb. Ex Prantl.		+
31.	Crassulaceae (3/7)		
1.	Rhodiola rosea L.	++	+
2.	Sedum aizoon L.		+
3.	S. purpureum (L.) Schult.		+
4.	Orostachys malacophylla (Pall.) Fisch.		+
5.	O. spinosa (L.) C.A.Mey.		+
6	O. fimbriata (Turcz.) Berger.		
7	O. thyrsiflora Fisch.		
32.	Saxifragaceae (3/6)		
1	Saxifraga spinulosa Adams.		+
2.	Parnassia palustris L.		+
3.	Ribes pulchellum Turcz.		+
4	R. diacantha Pall.		+
5	R. rubrum L.		+
6	R. altissumum Turcz.		+
33.	Rosaceae (17/46)		
1.	Spiraea salicifolia L.		+
2.	S. aquilegifolia Pall.		+
3.	S. pubescens Turcz.		
4.	S. flexuosa Fisch.		+
5	S. sericea Turcz.		+
6.	S. media F. Schmidt.		+
7.	Cotoneaster melanocarpa Lodd.		+
8.	C. mongolica Pojark.		+
9.	Malus baccata (L.) Borkh.		+
10.	Sorbus sibirica Hedl.	+	
11.	Crataegus dahurica Koehne		+
12.	C. sanguinea Pall.		+
13.	Rubus saxatilis L.		+
14.	R. sachalinensis Lev.		+
15.	Fragaria orientalis losinsk.		+
16.	Dasiphora fruticosa (L.) Rydb.		+
17.	D. parvifolia (Fisch.) Juz.		+
18.	Potentilla anserina L.		+
19.	P. fragellaris Willd.		+
20.	P. bifurca L.		+
21.	P. fragerioides L.		+
22.	P. verticillaris Steph. ex Willd.		+
23.	P. multifida L.		+
24.	P. sericea L.		+
25.	P. conferta Bge.		+

26.	P. strigosa Pall. ex Pursh.		+
27.	P. supina L.		+
28.	P. sanguisorba Willd.		+
29.	P. viscosa G.Don.		+
30	P. nudicaulis Willd. Ex Schlecht.		+
31	P. tanacetifolia Willd. Ex Schlecht.		+
32	P. evestida Th. Wolf.		+
33	P. nivea L.		+
34	P. norvegica L.	+	+
35	P. acaulis L.		+
36	Sibbaldianthe adpressa (Bge) Juz.		+
37	Chamaerhodes erecta (L.) Bge		+
38	Ch. altaica (Laxm.) Bge		+
39	Geum aleppicum Jacq.		+
40	Filipendula ulmaria (L.) Maxim.		+
41	F. palmata (Pall.) Maxim.		+
42	Agrimonia pilosa Ldb.		+
43	Sanguisorba officinalis L.		+
44	Rosa acicularis Lindl.		+
45	R. davurica Pall.		+
46	Padus asiatica Kom.		+
34.	Fabaceae (14/56)		
1.	Thermopsis dahurica Czefr.		+
2	Trigonella coerulea (Desr.) Ser.		+
3	Medicago lupulina L.		+
4	M. falcata L.		+
5	Melilotus albus Medic.	+	+
6	M. dentatus (W. et Kir.) Pers.		+
7	M. suaveolens Ldb.		+
8.	Trifolium lupinaster L.		+
9	T. pratense L.		+
10	Lotus corniculatus L.		+
11	Caragana microphylla (Pall.) Lam.		+
12	Astragalus versicolor Pall.		+
13	A. dahuricus (Pall.) DC.		+
14	A. mongolicus Bge.		+
15	A. membranaceus (Fisch.) Bge.		
16	A. melilotoides Pall.		+
17	A. tenuis Turcz.		
18	A. puberulus Ldb.		
19	A. inopinatus Boriss.		+
20	A. austrosibiricus Schischk.		
21	A. adsurgens Pall.		
22	A. fruticosus Pall.		+
23	A. laguroides Pall.		
24	A. scaberrimus Bge.		+
25	A. brevifolius Ldb.		
26.	Oxytropis filiformis DC.		+

27.	O. coerulea (Pall.) DC.		+
28	O. glabra (Lam.) DC.		+
29	O. lasiopoda Bge.		
30	O. viridiflava Kom.		
31	O. myriophylla (Pall.) DC.		+
32.	O. Turczaninovii Jurtz.		
33	O. oxyphylla (Pall.) DC.		
34	O. selengensis Bge.		
35	O. grandiflora (Pall.) DC.		
36	O. nitens Turcz.		
37	O. leptophylla (Pall.) DC.		
38.	O. strobilacea Bge		+
39	O. ambigua (Pall.) DC.		+
40.	Hedysarum alpinum L.		+
41	H. Gmelinii Ldb.		
42.	H. pumilum (Ldb.) B.Fedtsch.		+
43.	Onobrychis sibirica (Sir.) Turcz. ex Grossh.		+
44	Lespedeza hedysaroides (Pall.) Kitag.		
45	L. dahurica (Ldb.) Schindl.		
46	Vicia sativa L.		+
47.	V. unijuga A.Br.		+
48	V. baicalensis (Turcz.) B. Fedsch.		
49	V. venosa (Willd. Ex Link.) Maxim.		
50.	V. multicaulis Ldb.		+
51.	V. cracca L.		+
52.	V. amoena Fisch.		+
53	Lathyrus sativus L.		+
54.	L. pratensis L.		+
55.	L. humilis (Ser.) Spreng.		+
56.	L. palustris L.		+
35.	Geraniaceae (2/5)		
1.	Geranium sibiricum L.		+
2.	G. pseudosibiricum J.Mayer.		+
3	G. pratense L.		+
4.	G. Vlassovianum Fisch.		+
5	Erodium stephanianum Willd.		
36.	Linaceae (1/1)		
1.	Linum sibiricum DC.		+
37	Rutaceae Juss. (1/1)		
1.	Haplophyllum dahuricum (L.) G.Don.fil.		+
38.	Polygalaceae (1/3)		
1.	Polygala hybrida DC.		+
2.	P. sibirica L.		+
3.	P. tenuifolia Willd.		+
39.	Euphorbiaceae (1/2)		
1.	Euphorbia hunifusa Willd.		
2.	E. discolor Ldb.		
40	Empetraceae S.F.Gray. (1/1)		

1.	Empetrum sibiricum	+	
41	Malvaceae Juss. (1/2)		
1.	Malva mohileviensis Down.		+
2.	M. neglecta Wallr.		+
42	Tamaricaceae Link. (1/1)		
1.	Myricaria longifolia (Willd.) Ehrenb.		+
43.	Violaceae (1/5)		
1.	Viola Gmeliniana Schult.		+
2.	V. arenaria DC.		
3.	V. dactyloides Schult.		
4.	V. dissecta Ldb.		
5.	V. sacchalinensis Boissieu		
44.	Thymelaceae (1/1)		
1.	Stellera chamajasme L.		+
45.	Onograceae (1/2)		
1.	Epilobium palustre L.		+
2.	Chamaenerion angustifolium (L.) Scop.		+
46	Hippuridaceae Link.		
1.	Hippuris vulgaris L.		
47.	Umbelliferae 11/17)		
1.	Sphallerocarpus gracilis (Bess. Ex Trev.) K.-Pol.		+
2.	Pleurospermum uralense Hoffm.		
3.	Bupleurum scorzonerifolium Willd.		+
4.	B. bicaule Helm.		+
5.	Cicuta virosa L.		+
6.	Carum buriaticum Turcz.		+
7.	C. carvi L.		+
8.	Aegopodium alpestre Ldb.		
9.	Sium suave Walt.		+
10.	Cnidium dahuricum (Jacq.) Turcz. ex Fisch. et Mey.		
11	Phlojodicarpus sibiricus (Steph.) K.-Pol.		
12	Saposhnikovia divaricata (Turcz.) Schischk.		+
13	Peucedanum salinum Pall. ex Spreng.		+
14	P. hystrix Bge.		+
15	P. baicalense (Redow) C.Koch.		+
16	P. vaginatum Ldb.		+
17	Heracleum dissectum Ldb.		+
48.	Pyroaceae (1/4)		
1.	Pyrola rotundifolia L.		
2.	P. incarnata (DC.) Freyn.		
3.	P. secunda L.		
4.	P. obtusata (Turcz.) Kom.		
49.	Ericaceae (3/3)		
1.	Rhododendron dahuricum L.	++	+
2.	Vaccinium vitis-idaea L.		+
3.	Ledum palustre L.		
50.	Primulaceae (4/9)		
1.	Primula nutans Georgi		+

2.	P. farinosa L.		+
3.	Androsace maxima L.		+
4.	A. filiformis Retz.		+
5.	A. septentrionalis L.		+
6.	A. lactiflora Pall.		+
7	A. incana Lam.		+
8	Trientalis europea L.		+
9	Glaux maritima L.		+
51.	Plumbaginaceae (2/2)		
1.	Limonium flexuosum (L.) Ktze.		
2.	Goniolimon speciosum (C.A.Mey.) Boiss.		
52.	Gentianaceae (3/7)		
1.	Gentiana macrophylla Pall.	++	+
2.	G. dahuirica Fisch.		
3.	G. decumbens L.f.		+
4.	G. barbata Froel.		+
5.	G. acuta Michx.		+
6.	G. squarrosa Ldb.		+
7.	G. nutans Bge.		+
8	G. pseudoaquatica Kusn.		
9	G. leucomelaena Maxim.		
10	Lomatogonium carinthiacum (Wulf.) A.Br.		+
11	L. rotatum (L.) Pers.		+
12	Anagellidium dichotomum (L.) Griseb.		
53.	Convolvulaceae (1/2)		
1.	Convolvulus Ammanii Desr.		+
2.	C. arvensis L.		
54	Cuscutaceae (1/1)		
1.	Cuscuta monogyna Vahl.		
2.	C. europaea L.		
55	Polemoniaceae Juss.(1/1)		
1.	Polemonium racemosum (Rgl.) Kitam.		
56.	Boraginaceae (5/8)		
1.	Myosotis caespitosa C.F.Schultz.		+
2.	M. sylvatica (Ehrh.) Hoffm.		+
3.	M. suaveolens Wlaldst. Et Kit.		
4.	Lappula intermedia (Ldsb.) M.Pop.		+
5.	L.myosotis Moench.		+
6.	Amblynotus rupestris (Pall.) M.Pop. Ex Serg.		
7.	Pulmonaria mollissima Kerner	+	
8.	Anoplocaryum compressum (Turcz.) Ldb.		
57	*Verbenaceae Jaume (1/1)*		
1.	Caryopteris mongolica Bge.	+	+
58.	Labiatae (11/16)		
1.	Amethystea coerulea L.		
2.	Scutellaria scordifolia Fisch. ex Schrank.		+
3.	Lagopsis supina (Steph.) Ik.-Gal.		

4.	Lophanthus chinensis (Raf.) Benth.		+
5.	Schizonepeta multifida (L.) Briq.		+
6.	Dracocephalum foetidum Bge.		+
7.	D. fruticulosum Steph.		
8.	D. Ruyschiana L.		+
9.	D. nutans L.		
10.	Phlomis tuberosa L.		+
11.	Galeopsis bifida Boenn.		
12.	Lamium album L.		+
13.	Leonurus sibiricus L.		
14	L. mongolicus Krecz. Et Kupr.		
15	Thymus dahuricus Serg.		+
16	Th. gobicus Tschern.		+
59	*Solanaceae Juss. (1/1)*		
1.	Hyoscyamus niger L.		
60.	Scrophulariaceae (9/22)		
1.	Linaria buriatica Turcz.		+
2.	L.acutiloba Fisch. ex Reichb.		+
3.	Scrophularia incisa Weinm.		+
4.	Veronica anagallis-aquatica L.		+
5.	V. sibirica L.		+
6.	V. linarifolia Pall. Ex Link.		+
7.	V. incana L.		+
8.	V. dahurica Stev.		+
9.	V. longifolia L.		+
10.	Castilleja pallida (L.) Spreng.		
11.	Euphrasia hirtella Jord.		+
12.	E. tatarica Fisch. ex Spreng.		
13.	Odontites rubra (Baumg.) Pers.		+
14.	Rhinanthus songaricus (Sterneck.) B.Fedtsch.		
15.	Pedicularis labrodorica Wirs.		
16.	P. resupinata L.		+
17.	P. Karoi Freyn.		
18.	P. striata pall.		
19.	P. rubens Turcz.		
20	P. uliginosa Bge.		+
21	P. flava Pall.		
22	Cymbaria dahurica L		+
61.	Plantaginaceae (1/2)		
1.	Plantago depressa Willd.		+
2.	P. major L.		+
62.	Rubiaceae (2/5)		
1.	Rubia cordifolia L.		+
2.	Galium uliginosum L.		+
3.	G. verum L.		+
4.	G. Vaillantii		+
5.	G. boreale L.		+

63.	Caprifoliaceae (1/1)		
1.	Sambucus manshurica Kitag.	++	+
64.	Valerianaceae (2/3)		
1.	Valeriana officinalis L.	+	+
2.	Patrinia sibirca (L.) Juss.		+
3.	P. rupestris (Pall.) Dufr.		+
65	Dipsacaceae (1/1)		
1.	Scaboisa comosa Fisch.		+
66.	Campanulaceae (2/4)		
1.	Campanula glomerata L.		+
2.	Adenophora stenanthina (Ldb.) Kitag.		+
3.	A. tricuspidata (Fisch.) DC.		+
4.	A. verticillata Fisch.		+
67.	Compositae (32/73)		
1.	Solidago dahurica Kitag.	++	+
2.	Heteropappus altaicus (Willd.) Novopokr.		+
3.	H. biennis (Ldb.) Tamamsch.		+
4.	H. hispidus (Thunbg.) Less.		+
5.	Aster alpinus l.		+
6.	Arctogeron gramineum (L.) DC.		+
7.	Galatella dahurica DC.		+
8.	Erigeron lonchophyllus Hook.		+
9.	E. elongatus Ldb.		+
10.	Antennaria dioica (L.) Gaertn.		+
11.	Leontopodium lentopodioides (Willd.) Beauvd.		+
12.	L. ochroleucum Beauvd.		
13.	Inula britannica L.		+
14.	Achillea alpina L.		
15.	A. asiatica Serg.		+
16.	A. millefolium L.		
17.	Chrysanthemum Zawadskii Herb.		+
18.	Tanacetum vulgare L.		+
19.	Filifolium sibiricum (L.) Kitam.		+
20.	Artemisia dracunculus L.		+
21.	A. glauca Pall.		+
22.	A. pectinata Pall.		+
23.	A. anethifolia Web. Ex Stechm.		
24.	A. macrocephala Jack.		+
25.	A. sieversiana Willd.		
26.	A. palustris L.		+
27	A. scoparia Waldst. et Kit.		+
28.	A. Gmelinii Web. Ex Stechm.		+
29.	A. phaeolepis Krasch.		
30.	A. laciniata Willd.		+
31.	A. tanacetifolia L.		+
32.	A. integrifolia L.		+
33.	A. mongolica Fisch. ex Nakai.		+
34.	A. sericea Web. Ex Stechm.		+

35.	A. rutifolia Steph. ex Spreng.		+
36.	A. frigida Willd.		+
37.	A. Adamsii Bess.		+
38.	A. commutata Bess.		+
39.	A. pycnorhiza Ldb.		+
40.	A. monostachya Bge. Ex Maxim.		
41.	A. dolosa Krasch.		+
42.	Cacalia hastata L.		+
43.	Senecio campester (Retz.) DC.		+
44.	Ligularia sibirica (L.) Cass.		+
45.	Echinops latifolius Tausch.		+
46.	Saussurea salicifolia (L.) DC.		+
47.	S. amara (L.) DC.		
48.	Cirsium esculenthum L.		+
49.	C. arvense (L.) Scop.		+
50.	Serratula centauroides (L.) Hill.		+
51	S. marginata Tausch.		+
52	Leuzea uniflora (L.) Holub.		+
53	Leibnitzia anandria		
54	Scorzonera radiata Fisch.		
55	S. austriaca Willd.		
56	Tragopogon trachycarpus S.Nikit.		+
57	Sonchus arvensis L.		+
58	Lactuca sibirica (L.) Benth. Ex Maxim.		+
59	Youngia tenuifolia (Willd.) Babc. Et Stebbins.		+
60	Ixeridium gramineum (Fisch.) Tzvel.		+
61	Taraxacum dealbatum Hand.-Mazz.		+
62	T. collinum DC.		+
63	T. leucanthum (Ldb.) Ldb.		+
64	T. officinale Wigg.		+
65	T. ceratophorum (Ldb.) DC.		+
66	T. mongolicum Hand.-Mazz.		+
67	Hieracium umbellatum L.		+
68	H. echioides Lumn.	++Recorded only in the Noyon Mountian	
69	H. Korshinskyi Zahn.	++/Recorded in two points, one is in the Noyon Mountain/	
70	H. virosum Pall.		
71	Crepis crocea (Lam.) Babc.		+
72	C. Bungei Ldb.		+
73	C. sibirica L.		

Sign for rare plants:

++ Endandered plants listed in the Natural Plant Law of Mongolia

+ Rare plants

Pastoral, forage, medical and other economic plants are included in the list of useful plants.

Study on vegetation and flora nearby Gatsuurt gold deposit area was conducted using plot method that chooses certain points and make field description. As a result of the study, a total 625 vascular plant species of 269 genera, 67 families and 4 phylum which is the biggest taxonomical unit (Shown in Table 2.2).

Table 2.2

Plant species composition identified at the study area by flora taxonomy

	Total	Pteridophyta	Equisetophyta	Gymnospermae	Angiospermae	
					Monocoty-ledoneae	Dicoty-ledoneae
Family	67	1	1	3	10	52
Genus	269	3	2	3	56	205
Species	625	3	5	6	128	483

A total 1039 plant species (1996) were recorded in the forest and steppe zone of Mongol Daguur Mountain. If comparing it to the plant species composition of the Gatsuurt area, it makes up 60% of the total species composition of the Mongol Daguur zone. It is directly related to the fact that study area covers considerable territory of forest and steppe zone of Mongol Daguur mountain, in other words, it covers west and northwest parts of the Dahurian circle in semi-circle shaped narrow stripe.

Table 2.3

	Plant name /phylum, family, genus, species/
I.	**Pteridophyta**

1.	Polypodiaceae (3/3)
II	**Equisetophyta**
2.	Equisetaceae (1/4)
3.	Selaginellaceae Mett. (1/1)
III.	**Gymnospermae**
4.	Pinaceae (1/2)
5.	Cupressaceae (1/2)
6.	Ephedraceae (1/2)
IY.	**Angiospermae**
A.	Monocotyledoneae
7.	Typhaceae Juss. (1/1)
8.	Potamogetonaceae (1/4)
9.	Juncaginaceae (1/2)
10.	Butomaceae (1/1)
11.	Gramineae (25/59)
12.	Cyperaceae (6/18)
13.	Juncaginaceae (2/4)
14.	Liliaceae (8/20)
15.	Iridaceae (1/6)
16.	Orchidaceae (10/13)
B.	Dicotyledoneae
17.	Salicaceae (2/11)
18.	Betulaceae (1/4)
19.	Ulmaceae Mirb.(1/2)
20.	Cannabaceae (1/1)
21.	Urticaceae (1/2)
22.	Santalaceae R.Br.(1/1)
23.	Polygonaceae (4/19)
24.	Chenopodianaceae (6/20)
25.	Caryophyllaceae (8/17)
26.	Ranunculaceae (15/42)
27.	Berberidaceae Juss. (1/1)
28.	Menispermaceae (1/1)
29.	Papaveraceae (4/6)
30.	Cruciferae (14/23)
31.	Crassulaceae (3/7)
32.	Saxifragaceae (3/6)
33.	Rosaceae (17/46)
34.	Fabaceae (14/56)
35.	Geraniaceae (2/5)
36.	Linaceae (1/1)
37.	Rutaceae Juss. (1/1)
38.	Polygalaceae (1/3)
39.	Euphorbiaceae (1/2)
40.	Empetraceae S.F.Gray. (1/1)
41.	Malvaceae Juss. (1/2)
42.	Tamaricaceae Link. (1/1)
43.	Violaceae (1/5)

44.	Thymelaceae (1/1)
45.	Onograceae (1/2)
46.	Hippuridaceae Link.(1/1)
47.	Umbelliferae (11/17)
48.	Pyroaceae (1/4)
49.	Ericaceae (3/3)
50.	Primulaceae (4/9)
51.	Plumbaginaceae (2/2)
52.	Gentianaceae (3/7)
53.	Convolvulaceae (1/2)
54.	Cuscutaceae (1/1)
55.	Polemoniaceae Juss.(1/1)
56.	Boraginaceae (5/8)
57.	***Verbenaceae Jaume (1/1)***
58.	Labiatae (11/16)
59.	***Solanaceae Juss. (1/1)***
60.	Scrophulariaceae (9/22)
61.	Plantaginaceae (1/2)
62.	Rubiaceae (2/5)
63.	Caprifoliaceae (1/1)
64.	Valerianaceae (2/3)
65.	Dipsacaceae (1/1)
66.	Campanulaceae (2/4)
67.	Compositae (32/73)
	Total 269/625

When making estimation on the 18 to 20 species which belongs to families with more 73 species occurring along the road heading from Boroo goldmine on the territory of Selenge aimag to Gatsuurt deposit, a total species composition can be accounted to 140-150 species or comprises 63.7-57.8%. .

The steppe and mountain elements representing specific nature of the Mongol Daguur belt are widely spread, also weeds are spread a lot where the land is cultivated.

Table 2.4

	Large families /In Latin /	Number of genus	Percentage	Number of species	percentage
1.	Compositae	32	11.9	73	11.7
2.	Gramineae	25	9.3	59	9.4
3.	Fabaceae	14	5.2	56	8.96
4.	Rosaceae	17	6.3	46	7,4
5.	Ranunculaceae	15	5.6	42	6.7

6.	Cruciferae	14	5.2	23	3.7
7.	Scrophulariaceae	9	3.3	22	3.5
8.	Liliaceae	8	3	20	3.2
8.	Chenopodiaceae	6	3	20	3.2
		140	52%	361	57.8
9.	*Polygonaceae*	4	1.5	19	3
10	Cyperaceae	6	3	18	2.9
		10	4.5	37	5.9
		150	56.5	398	63.7

As of life forms:

- Mature trees
- Shrubs
- Shrubby plants
- Herbaceous plants: -perennial
    - -annual (one or two years)

Mature trees forming forest: pine, larch, birch.

There are mentionable amount of shrubs dominantly growing and playing important roles in the in the mountainous forest-steppe zone including *Dasiphora fruticose, Salix, Spriraea, Rosa acicularis, Cotoneaster, Vaccinium vitis*. The percentage of the shrubs and shrubby plants is significantly less compared to Khangai and Khentii regions. The number of the planted species and annual vegetation, compared to Khentii belt, is comparatively high due to existence of arable lands of this area. The weed grass also grows along areas where soil along roadside is degressed and destroyed. Substantial part of annual plants include weed vegetation.

According to the plant functional type, vegetation cover studied by this survey, which belongs to the Mongol Daguur region are divided into hydrophytes (23%), mesophytes (15%) , xerophytes (12%) and halophytes (6%) respectively. Hydrophytes and mesophytes are spread in forest areas, along river basins, in the meadow lands, while the xerophytes and lytophytes occur more in stony and gravelly hills and in mountainous steppe zones. Major role is played, on one hand, by forested and wet meadow vegetation and, on the other hand, by plants that grow in stone and dry steppe zones.

In the area where vegetation survey are undertaken, a total 412 species of forage and valuable plants are growing, i.e, it comprises 66% of the total species composition.

It has been identified that 17 extremely rare and 18 rare plant species, those designated by Mongolian Law on Natural Vegetation and listed in the Red Book of Mongolia, exist

within the scope of the study area . It is an exceptional importance for such a small-sized territory.

In other words, the fact that number of endangered plant species occupying 5.6% of the total species composition draws great attention.

But it should be mentioned that distribution of the above-said rare plants are becoming almost absent in the linear area along the haul road to be built between Boroo- Gatsuurt as the local soil and vegetation cover are greatly disturbed and undergone great changes due to previously employment of the multi routed dirt roads.

Therefore, the construction and the operation of this road cannot be seen as negative impact on the rare plants.

2.3 Archeolgical survey

Objetcives of the field survey

This survey was conducted for the following purposes:

- Inquire if any archeological findings such as typesites from palaeolithic and neolithic ages, tombs, tombsburials, burial mounds, ruins and monuments remained by ancient nomadic people in the area along the haul road to be built between Boroo Gold mine, Mandal soum, Selenge aimag and Gatsuurt pass of Noyon Mountain,
- Identify the locations and geographical coordinates of the findings,
- Determine shapes and charecteristics of the findings,
- Make photos evidences of the some interesting archeological findings,
- Make evaluations on the findings,
- Give instructions and recommendations on further academic research and protections of the findings in case of using those areas in which archeological finds are occurred for the purpose of road-building.

Review on the previous studies

Initially, the archeological study in the territory of Selenge aimag was carried out in 1887 by Russian scientist Razintsov and he collected some findings such as stone arms in shape of sickle, scraper, knife-like chip from sandy hill in the vicinity of sand dunes of Altanbulag soum, Selenge aimag.

The Russian-Tibetan expedition headed by P.K.Kozlov was initially explored the big graves of aristocrats from the Xiunnu age between 1924-1925 at Mt. Noyon. As a result of excavations on 10 graves, he discovered uncommon archeological findings.

In 1927, A.D. Simukov done archeological excavation at Mt. Noyon and exposed fascinating findings such as slice of felt flooring, cut of forged gold with plant-like ornaments, iron with ornaments in shape of golden horse, slice of silk, lacquerly painted cup with Chinese script. Also, Ts. Dorjsuren discovered and excavated over 20 graves of relevance with the Xiunnu age from the Mt. Noyon between 1954-1955 /D. Tumen and D. Navaan, 2005/. In 1998, the archeologist headed by D. Tseveendorj conducted survey

in the mining area of the Boroo gold processing plant at Mt. Noyon under order of Boroo Gold Company. In addition, in 2005, at the request of Centerra Gold Mongolia LLC, D. Tumen and D. Navaan were carried out survey in the area from Gatsuurt valley to Boroo gold processing plant and also in the vicinity of Mt. Noyon in accordance with the site plan worked out by the company at the request of Gazar Eco LLC.
Judging from the results of the below-mentioned surveys, Mt. Noyon area is rich archelogical finds.

Survey method and methodology

In order to gain succes in conducting the survey, we had identified geographical names and the area to be explored by directions.
This survey was conducted in the area of 40 km distance from the bridge on Boroo River to Gatsuurt pass, and finds occurred in the vicinity of the area where the haul road of changed route will be built had been identified.

Pedestrian survey was conducted by two persons in the mountainous, snowy and rocky areas. In the area that is steppe-like places that are less snowy and visible whether there is a remarkable sight, survey was conducted by using vehicle. The sites where the surevy was started and/or completed to conduct were recorded on the GPS, and meaurements were conducted and coordinates were determined on the sites descovered. The burial sites were named as GRAVE and numbered and some interesting ones were photographed.

Result of the survey

The survey was conducted along the haul road to be built between the bridge on Boroo River and Gatsuurt ravine of Mt. Noyon within the distance of 40 km in total. Throughout the road, 5 graves were revealed and other types of archeological finds were not discovered. The area along the road from the bridge on Boroo River to the Khar Chuluutai hill was an area that is not suitable for burial place and keeping other memorial sites. However, we have discovered 3 graves in total from the sunny side of a bridge that is located in continuance of the hill Khar Chuluutai and that is a place where available graves and other memorial sites to be found at its foot. Those graves were

existed at the foot of the Zuunmod ravine or the sunny side of the Burkhant mountain pass.

Grave 1

It had a small ancillary structure. It was marked in the description as Grave 1A. There is a believe that the G**raves 1, 1A and 2** may be relevant to each other or complex grave for a family.

(Picture: Graves 1, 1a and 2)

Grave 3

It was in the southern slope of a mountain abounding in stones and situated not far away from the **Graves 1 and 2**.

Along the road farther away from there to the Khokh Biluutei ravine were exposed no any archeological sites. The **Graves 4 and 5** had been revealed from the foot of the Khoekh Bilutei ravine.

(Picture: Grave 3)

Grave 4

It was in the form of a pair of stone structures and quiet particular with regards to their design and arrangement.

(Picture: Grave 4)

Grave 5

It was situated in the vicinity of the **Grave 4** and approximately 10m far from the road.

(Picture: Grave 5)

The farther area from there that is along the road to a Children's summer camp was a suitable place for graves of ancient nomads and no memorial sites was occurred during the survey conducted along this section of the road. The forest began from the Children's camp and there was no possibility to find any archeological site.

These historical sites were very interesting with regards to shape, arrangement and geographical location, and located in the area that could be disturbed during the construction of the road from the Boroo River bridge to Gatsuurt ravine route of which has been changed from its first version. Therefore, it needs to conduct archeological excavations and surveys before the start of the road-building.

Description of the graves:

Grave 1

Coordinate: 48^0 42' 03,5" 106^0 18' 32,6"

Location: in front of the road and in the distance of 6.7m from the road

Direction: from the southwest to the northeast

Size: 6x7

Height: 20cm

Arrangement: rectangular and buried under compacted stones on its center

Grave 1A

Coordinate: 48^0 42' 03,4" 106^0 18' 32,5"

Location: in between of the graves 1 and 2

Direction: from the southwest to the northeast

Size: 2x1.5

Arrangement: circular and buried under a few stones

Grave 2

Coordinate: 48^0 42' 03,5" 106^0 18' 32,6"

Location: on the left side of the graves 1 and 1A

Direction: from the southwest to the northeast

Size: 4x5

Height: 908

Arrangement: Buried under compacted rectangular stones and the stone on its center were in enlarged circumstances.

Grave 3

Coordinate: 48^0 42' 03,4" 106^0 18' 33,2"

Location: on the backside of the road in the distance of 4.5m

Direction: from the south to the north

Size: 5x3

Height: 1025

Arrangement: Circular and made by medium-size stones

Grave 4

Coordinate: 48^0 44’ 33,3" 106^0 33’ 40,9"

Location: On the right side of the road in the distance of about 50m

Direction: from the southwest to the northeast

Size: 1.5x2 1.5x2

Height: 1004

Arrangement: Elliptical, at intervals of 1m, with a pair of heaps of stones and buried under quite big stones

Grave 5

Coordinate: 48^0 44 31,1" 106^0 33’ 43,3"

Location: on the left side of the road in the distance of about 10m

Direction: northwest

Size: 6x3

Height: 999

Arrangement: Basic setting of the grave was not disturbed and buried in a lot of stones.

Map: Archeological survey conducted on the project area

THREE.

ENVIRONMENTAL IMPACT ASSESSMENT OF THE PROJECT

Positive and negative environmental impacts are covered in detail in the EIA of the ore transporting maintained haul road project that was conducted in 2004.

Certain and potential impacts on the additional area existing outside of the previously studied area due to the change in the route of the ore transporting, maintained haul road are described in the addendum,.

3.1. Project impact on the local soil cover

A. Negative impacts

It is expected that intensity and scope of the negative impacts due to the change in the route of the maintained road on the soil cover of the area will be the same as they were in the EIA conducted in 2004.

By changing the road route, previously concluded works in the report such as amount of earth work required for road construction, forest transplanting issue, ditches and protection embarkment are matters to be added or excluded.

If estimate road width 8.0m and width of the road shoulder 1.5-2.0m then total width of the road is 9.5-10.0m for the maintained road that is planned to be built in the direction from the Boroo Gold Processing Plant to the Gatsuurt Gold Deposit. . The total length of the road will be approximately 64 km and the area that is expected to be under the road will be out of the agricultural use.

During construction of road, concernable amount of fertile soil will be destroyed.

Besides, great amount of civil work is going to be required when making road route from Takhilt to Kukh Biluut pass.

From construction of the maintained road, negative impacts such as an increase of the number of vehicles involving in the traffic, environmental pollution, deterioration of fertility of the area, decrease in natural resources in the region might be caused.

1. Let's see impacts that will be caused from a vehicle involving in the traffic on the environment along the changed parts because of the change in the route of the maintained road: researchers discovered that the dust produced by a vehicle traveling with a speed of 20-30 km/hour on a dirt road during a slight windy day covers an area of

50-150 m in length, 10-20 m in height and stays in the air for 5-8 hours. But, during a not windy day, the dust will stay in the air for 10-15 hours.

2. Exhaust pipe of a vehicle produces gases with various chemical compounds. It was revealed that compound with lead will decrease the growth of agricultural and natural plants by 3-4 times, poison the surface of the area and the plants, and furthermore increase in lead content may cause metabolism damage by reaching brain cells. Increase of selenium content in soil may cause hair loss; while increase of zinc, cadmium and aluminum contents increases the chances for cancer. Also vehicles pollute the environment with lead, bromine, selenium and as well as with ferrous metals such as zinc, copper, lead, cadmium, fluorine. Lead and other heavy metals produced by vehicle engine spread out and accumulate in 10-15m distance along the two sides of the road and in 200 m distance in the open steppe to pollute the soil.

3. For these various chemical compounds, which polluted the environment by being accumulated, it is very rare to de-compound themselves and be washed away. Currently, there is no other method to clean them.

It is potential to have negative impacts of having improper relationship with the nature and polluting the environment due to centralization of humans and settlements, and increased traffic causing social and economic development following the road construction. Though the number of transportation means will increase because of the maintained road in this region, the negative impact to the environment by diesel engines will comparatively be lower than the gasoline engines as all the transportation means travel on this road will be generated by diesel engines.

3.2. Project impact on flora

Central Mongolia is the southern zone of coniferous forest in the Asia. The maintained road to be built between Boroo Gold Mine and Gatsuurt Gold deposit will go through significant amount of mixed forest of pine and birches as reaches to the lower slope of the Mt. Noyon. There is a necessity to cut certain amount of pine trees to build the road of changed route. In other word, the road of changed route to be built will have width of 9.5-10 meters. Therefore, in the case of expanding the road of changed route towards the

Khokh Biluut pass through forest, it will be approximately 4 km. Thus road in this section will be newly built.

For construction of haul road in distance of 4km from Biluut pass to Gatsuurt hard-rock gold deposit, forest cover of about 40,000m^2 or 4.0 ha area is required to be cut and resettled. The estimation above shows that the size of the area forest of which to be cut and resettled to another place during the construction of the road towards the Khokh Biluut pass is 29,284m^2 smaller than the size of the road to be built towards the Zuun Mod gateway.

Due to forest cut along the road to be built, forest gap will be formed and get dry therefore the probability for species composition of the flora to undergo change will reduce.

After the construction of the road in the Khokh Biluut pass, heavy trucks will travel permanently on the road. It is very important to take dust suppression measures such as road watering and wetting in order to prevent formation of constant dust clouds along the road between inter mountains. Otherwise, the dust cloud will damage parts of plants by blocking respiratory gap (stomas) of the coniferous mixed forest and other plants .As a result, forest size and vegetation cover will decrease, plants lose reproductive ability and there will be no restoration.

The flora in the mountains of Khokh Biluut pass has enough humidity and many favorable ecological conditions to have abundant and dense vegetation.

It was discovered that there are 35 species of rare and extremely rare vascular plants distributed very scarcely and rarely around the Noyon Mountain. The rare and endangered plants go extinct even from minor ecological changes. They are very weak in reproduction, grow scarcely alone in a spot, and almost impossible to transplant or introduce them to new environment.

The EIA conducted in 2004 includes detailed description of the impacts of the project on the air, fauna, society and economy.

FOUR.

RISK ASSESSMENT

In general, there is almost no harm from this road project to the whole local landscape. However, during the utilization of the road, it is possible for harms caused by human operations. As traffic movement rapidly increases following the road completion, there will be increase in potential impacts caused by human activity. It includes:

- Steppe fire caused by functional errors of motor vehicles
- Steppe fire caused by careless human actions
- Cause of damages to road structure and cause of traffic accidents/incidents during the period of taking measures on prevention from the accidents/incidents caused by the natural factors.
- Occurrence of landslide, being affected by snowdrift and flood because of bad preventative measures taken on the parts where mining operation is expected.

In some areas, depending on the environment conditions and landscape formation, dangerous situation that can cause traffic accidents or oppose traffic safety is formed. It includes:

-Risk of occurrence of a rockslide while vehicles involve in traffic on the road nearer to steep slope that would cause an accident.
- Risk of occurrence of slip out from the road for a vehicle or a crash of vehicles involving in the traffic while they make a sharp turn on a hilly and curved road at normal or high speed.
- Risk of occurrence of an accident because of a slide of a vehicle on a road built across a steep slope in the season of cold.

FIVE.
NECESSARY MEASURES TO TAKE IN ORDERTO REDUCE AND ELIMINATE NEGATIVE IMPACTS

5.1. Mandatory actions to be taken for changing the route of the road from Boroo Gold Processing Plant to the Gatsuurt deposit.

There is a necessity to strip off the fertile soil surface on the significant part of the road site during the road construction and the building its infrastructure. This topsoil earth keeps the organic compound of the basic fertility and the source of nutritious elements that are the main indicators of the fertile soil and serve as a kind of reserves of natural resources. Under the appropriate technological processing by taking care of the soil by tilling, this soil could easily be reclaimed. Therefore it is considered that the stripped surface of the earth is available to be used for the reclamation and reducing negative impacts on environment during the process of road construction. The stripped soil could be used in the following ways:

- To cover the sand and gravel pits with soil stripped for reclamation.
- To use the soil stripped for reclamation of the disturbed area and gravel mine sites.

It is essential to protect road from snow cover during winter time and build durable fences to protect the road rock fall in certain locations next to the high and rocky sides of the mountain according to the international best practices.
The important part of reducing and eliminating negative impacts on the environment is to clean the left over construction wastes from road site territory, cover it by soil, replenish with fresh soil and make forestation. It would be useful to plant seeds of perennial plants those best adapted in the areas disturbed for soil recovery in.

It is ecologically and economically proper to choose the borrow pits for gravel and earth from the previously used and abandoned places. This prevents:

- the virgin land to be disturbed newly as much as
- many species of plants, especially the rare and endangered plants, to be affected and to be extinct.

It is proper to obtain assistance from professional organizations in building the maintained road, excavating pits for obtaining gravels for the road and conducting reclamation. It is necessary to have design drawing developed that is appropriate for the environmental and climatic conditions of the area where the road is planned to be built prior to its construction, have it authorized by the relevant governmental and administrative agencies. Also road construction should be executed by licensed company with experienced staffs available to conduct in accordance with the road map and design and then to commission in accordance with the act to be issued. It is needed to choose the ways and methods of building new bridges in the possible shortest period of time and using explosives as less as possible. All necessary measures should be taken against spillage of petroleum products by polluting air, water and soil during the construction of bridge, dam and road facilities.

It is important to select the ways and methods that will cause difficulties as less as possible to the local community members by following the laws, standards and relevant rules effective in Mongolia during the road construction.

It was clear from the survey that the issue of forest will be raised at higher level during the road construction. In other words, Centerra Gold Company has a goal to build the road towards the Khokh Biluutei Ravine to connect it to the Gatsuurt Deposit that is the shortest route from Boroo Gold Procesing Plant to the Gatsuur Deposit. However, this route requires build 4 km long section of the road to pass across a forested area. It means that the forest will cut in distance of 4 km which covers a total 40000m^2 or 4.0ha area. Thus, it is necessary to proceed by having assessment on ecological and economical losses of the cut forest done by a professional organization and spending expenses equal to the amount of the loss effectively for reclamation of the forest area disturbed. In order to restore above mentioned amount of forest resource, afforestation and tree transplanting is required for 8.0 ha area. A reason for requiring afforestation and tree transplanting area to be 2 times bigger than the cut area is that the success rate of the afforestation is 50% on average due to environmental condition of Mongolia. Afforestation and tree transplanting operation will be conducted by professional organizations, i.e, the companies licensed by Ministry of Environment, Green Development and Tourism.

It is proper to plant transplantable trees and bushes from the road construction into undisturbed lands and use them for creating tree belt along the road.

It is also required to transplant the rare and endagered species, if they are found in the project area, protect and provide with conditions in which they will grow.

The road will pass through windy passes and valleys in terms of climate, reliable method to protect areas along the road from noise pollution is to create forested zone on both sides of road, especially upper side against wind. For Centerra Gold it needs much attention. In doing so, it is necessary to conduct detailed survey and determine the distance of the stripe of forest from the road, and the thickness and scarsity of the trees and bushes to be transplanted there depending on the conditions of micro climate, wind directions and speed of the area. In other words, it is necessary to regulate that the snow and sand drift accumulated at the foot of the trees will not cause an obstacle for the traffic on the road depending on the height of the trees and bushes transplanted. It is proper to have the stripe of forest in the areas with thick soil and the soil with medium thickness in the hollow between mountains, on river valleys and at the foot of mountains. To have stripe of forest in the stony and rocky parts of a mountain peak is ecologically and technically difficult.

It would be essential to build special protective enclosure along high mountain passes and rocky slopes in order to protect the road from snowdrifts in winters and strong winds in spring and autumn.

It is estimated that the number of transportation means is limited and the daily amount of chemical compound that will be accumulated in the local soil will be equal to the amount of toxic compounds to be emited by the heavy haul trucks. Therefore, it is essentailly necessary to implement the system of reducing air and soil pollution level and the prior measures for this would be to keep the road in quality. In other words, to take care of the road: to keep the road watered always during the dry season, maintain its damaged parts, take additional action in time in order to protect the road from being damaged and keep it in quality. They are the best methods to reduce environmental technogenic pollution.

The road is designed for heavy haul trucks. The drivers need to be careful of potential traffic accidents, keep the speed limit suitable to the driving conditions and aware of other obstacles when they drive the truck.

It was aforementioned. The increase of density of vehicles involving in traffic is a major factor for occurance of accidents and obstacles for the traffic involving pedestrians

(human and animals) and vehicles in addition to the road accidents. The following regulatory actions should be taken:

- Proper placement of the road signs and trffic marks;
- Build parking lots and subsidiary roads;
- Build a specific crossing at the part of the road where it crosses a road and place a sign there.

Regulation of the traffic is due to the following several requirements. Particularly,

1. It is not rare case in the particular place to organize movement of herders and livestock while they face difficult climatic conditions and natural disaster (snow blizzard, *zud* and drought);
2. The road should not serve as the major or separating obstacle for the regular/permanent movement of the local people/livestock;
3. It should not be an obstacle separating the movement of wild animals from a place to a place.
4. Ensure that cross sectional movement of the traveling human and livestock should not be obstacle for transportation vehicles traveling on the road.

It is necessary to calculate water flow and maximum flow amount to be formed at the dry beds, floodplains, rivers and streams those crossing sections of the planned road, to select water collection, diversion, passing versions, protection embarkments as well as their shape, size and transport capacity. These structures will be required to protect not only the road also ensure water to flow normally and freely along its course.

Conditions for forming the maximum water flow

The process of formation of the maximum flow in any Mongolian rivers, small or big, is characterized by two basic factors – climatic conditions (nature of creation of conditions for precipitation, the amount of precepitation, evapotranspiration, soil and air temperatures) and land surface (relief, geoformation, soil and vegetation). Precipitation amount and its intensity are extremely important within above two factors in forming flow regime of the riverine ecosystem. Judging from the results of studies conducted by researchers, it has been already determined that flood is occured in rivers and ravines of the country after heavy rainfall of 40-120mm or more a day. In case of Mongolia, maximum amount of daily precipitation in the various ecological zones and regions, as well as degree of meeting demands for water, also probability of precipitation to fall in

this amount one time within how many years is interesting. Because this kind of information on the severe flood of local rivers and streams and probability to occur is important for technical estimation.

It is observed that in Mongolia, intense tunderstorms occur mostly between the mid of July and the mid of August. From the data taken from observations and measurements conducted in a meteorological station, the maximum amount of the rainfall per day in the area of interest, Mt. Noyon reached 93 mm in 1952.

There will be a necessity to assess the maximum water flows in the streams, bridges and water drainage facilities that will cross the road and to take additional measures to stabilize water level, plan and build facilities on it. If the tentative estimation on water drainage facilities is coducted with deficiency, no water will flow there by changing its course affecting the road damage on its some part after some period. Therefore, the assessment of water level stability and determination whether there is a necessity for addional facilities are an important step for not disturbing the environment by having additional facilities built and spending extra expenses for these. Therefore, we provide below the assessment conducted on stability of water level of rivers, streams and drybeds that will cross the road by using three different methods. In designing bridges, water drainage pipes and water collecting facilities, it needs to be planned considering the following indicators.

Change in riverbeds and condition of change along the road

All riverbeds are divided into two types:

- Riverbeds that are not changed. They are the riverbeds with concrete, stone and wooden lining and enclosures, dams and elevations that are regulating water drainage and its flows; and
- Riverbeds that are permanently changed. They are the riverbeds in their natural conditions: those that are not disturbed by roads and hydrotechnical operations and those where it is available to occur temporary flood and those that are vulnerable to flood-water.

Ye. M. Lorsen, N.P. Gaya, B.V. Saimongs, Ye.V. Richardson, V.A. Vanoni, Lisan Fan, S. P. Garg, A.K. Agravala and P.R.Sing et al., and many studies conducted on this topic in the real nature by T.A. Velikanov, N.A. Rjanitsyn, S. Altunin, Levi de Vris, I. L. Rozovskii. There are many studies either have been tested in nature or modeled in laboratory. However, none of these seem to be suitable for the conditions of Mongolia

which has extreme climatic conditions and which is located in the elevations of the Central Asia.

One of the many indicators of riverbed stability of river, streams and drybeds is particle size of the bottom sediments to resist the speed of the flow or the indicator of resistance, an ability of remaining without movement. This ability of resistance depends directly on weight of alluvial sediment, in other words, amount of the alluvial sediments equals to d^3 (diameter of the sediment particles`), flow ability to move sediments or hydrodynamic pressure on the each particle of the sediment or v^2*d^2.

Then ability of flow to move the alluvia (v^2) depends on slope of a water bed and the amount of hydrodynamic pressure on each particle size of the alluvia has a relevance of v^2 J.

Based on the non-dimensional indicator of V. M. Lokhtin, a Russian-Kazakh researcher, it is available to conduct assessment on stability of water beds of rivers, gullies and drybed that will across the road to the Gatsuurt Gold Deposit.

According to the estimations by V. M. Lokhtin, it is seen that there is a natural law if the particular indicator is as high, the water bed will be comparatively stable and if it is low, the water bed will have much changes.

The V. M. Lokhtin indicator is expressed in the following formula:

L number = d^3 / d^2 J = d / J

Also the dimension of the width of the river bed is considered with the surface of the hydrosphere and the ratio that depends on the average depth of the flow is also an indicator of water bed change. This is expressed in the following indicator V. G. Glushkov:

$B^m /H = KI$

Therefore, it is necessary to take appropriate measures on hydro-engineering, road and bridge building at rivers, gullies and drybeds based on a detailed study conducted with assistance of a professional organization, and build bridges, dams and various water passing facilities pipes.

For the purposes to let water flow along the road with less impact on the water facilities along the road, ensure normal water flow and control erosion process, methods such as changing the flow and flowing it through the borrow ditch, letting it to flow through the natural water bed by draining it through conveyer pipeline, building monitoring dam, erect embankment and passing it through a pipeline are widely used in the practice of road construction. The following facilities with shapes, sizes and indicators that were chosen as a result of assessment and estimation on hydrogeological conditions, flow indicators and the flooding conditions may be constructed in order to insure the stability of the road.. They include:

- The borrow ditch
- Conveyer pipeline
- Monitoring dam
- Pipeline

The borrow ditch. The borrow ditch performs two basic roles. It accumulates and redirects the water that might damage the road site construction and its pavement surface, and drains water out through holes in the wall when the level of ground water rises.

The size of the ditch could be different depending on the hydraulic capacity, on the amount of water flow in the local area and on the growing amount of water flows emerged in sloping area condition. The ditch under this condition could be made from concrete and stones erected.

Conveyer pipeline. This pipeline is built for the purpose to pass the water streams flowing across the road without damaging the road structures. The number of such pipelines depends on the density of the ground cross sections, and waterbeds with permanent and temporary streams that will cross the road structure.

It is necessary to consider the following conditions in installing the conveyer pipelines:

- To pass less amount of water than of its own size, and don't let sediment to stay in by blocking the stream.
- Ground cross sections of the particular area are in difficult conditions;
- Small stones are permanently come in by the stream in the waterbed.

The conveyer pipeline is produced with stones erected, concrete and metal pipes and rectangular concretes.

The monitoring dam. For the purpose of decreasing the intensity of the stream in the vicinity of the road, letting the road structures to be not affected by the stones brought by the stream and the stream to flow free, the monitoring dams may be installed in the places where the most extensive stream is formed and is available to occur flood and flooding processes. The monitoring dam is usually built in the form with steppes and gabions. As of the design, depending on the amount of the coming water stream, it could be made of iron concrete structure, concrete and stone bricks and even of wood and logs in places where the stream is low.

Pipeline. This pipeline plays the same role as the conveyer pipeline. In addition, it may be also used for the purpose of reducing the intensity of the stream and precipitate the sedimentary rocks by being equipped its inner wall with specifically designed liner. This structure is economically effective in removing and coordinating small-sized streams.

It is necessary to build the abovementioned structures in the appropriate places depending on availability of formation of the most extensive stream, estimation of flooding, ground cross section and the stream intensity that were included in the report.

It is necessary to take the following measures not to have water polluted during the road construction and to reduce pollution already occurred:

- To take management and organizational measures against water pollution;
- To treat polluted water produced from construction operations;
- To monitor concrete making process;
- To use large containers for cement mixture and other technological process;
- Prepare Emergency response plan;

In taking management and organizational measures, it is necessary to focus on taking all necessary measures to plan the construction works, choose a method of effectiveness for water used in the technological process, not to pollute the surface water, not to excavate gravel and other materials in the vicinity of the water sources, not to wash the equipment and materials in the surface water, not to occur spillage of petroleum products in the underground and surface water by considering the factors such as the most extensive stream and flooding process.

It is also necessary to take measures on conducting treatment for water that has been already polluted and conducting monitoring to use it again, not to pollute the underground water by draining the water that is polluted with petroleum products, that is containing chemical substances and that is of bad quality directly into ground. The following table shows how the polluted water will penetrate into the soil.

Table 5.1

Soil indications	Sand	Sandy loam	Clay loam	Mud loam	Clay loam
Penetration	50	25	13	3	5
Penetration speed mm/h	25-250	13-75	8-20	0.3-5	1-10
l\ min\ha	8,000	4,000	2,000	500	800

It is noted that there will be a danger of having permanent underground water source pollution if the above mentioned in the table penetration is occurred in it and there is no way to conduct water treatment.

Reimbursement in case of evacuating local residents

Residency of citizens is not so intensive along the road and so there is a comparatively small changes in land use share. Therefore, an issue of citizens movement will not be raised in high level.

It was observed during the survey that there is almost no need to move citizens from the area in connection with the road construction works.

In other words, no any families, except herding families, settle in the area and this will be the ground for activities of moving citizens to another places from the road area.

In some places, the herders tend to live nearby water sources across the road. In necessary cases, it needs to reach mutual agreement with herder families upon no loss basis.

Herders will not settle in one place as they live according to the traditional farming.

Whereas only object that affected by evacuation or negative impact is local Children's summer camp located within project site. Based upon mutual agreement with local authority /Mandal soum/, necessary actions should be taken for the summer camp prior to construction of the road.

Waste disposal management

All waste materials including solid waste, sewage and any other wastes will be fully contained on site and transported to a permitted disposal facility for permanent disposal. There will be no sewage treatment on site nor will there be a solid waste management facility.

With road construction, it is necessary to implement measures that will protect the nature and the environment. There are some of the measures to be taken on this regard:

a) Conduct advocacy works among passengers and drivers that they should not litter along the road.
b) Create workplaces by employing herders as contractor to have them watch over, protect and clean areas along the roads those overlapping with their wintering and spring quarters,
c) Set up frequent stations for temporary stop of the heavy duty haul trucks
d) Create an insentive for herders and the citizens residing in the vicinity of the road and making contributions to keeping the road clean and free of waste
e) Inspection agency of the relevant soum shall be responsible for freeing the construction area from disposed waste and taking measures on reclamation the area.

Surplus soil or earth remained from the construction work is needed to be evenly spread on the ground where it is necessary, some should be transported to eroded ditches to be filled up and seeds of plants should be vegetated and after all this, the area should be commissioned to the soum's environmental inspection agency. While the survey was conducted it was established that the advocacy works on not littering along the road sides and mobilising all tools for such activities.

Natural, historical and cultural heritages

The area nearby Noyon mountain is considered to be a place of many historical and cultural heritages. But as a result of the detailed survey conducted on the area the road will be built, 5 main and on auxiliary tombs were discovered: 2 main and 1 auxiliary tombs in the sunny side of the Burkhant Davaa and 2 main tombs in the pass of Khokh Biluut on the route of the haul road from the Boroo Gold Mine to the Gatsuurt Gold Deposit. Therefore, these 5 tombs should be taken under protection and should have them studied well through detailed archeological survey to be conducted by a professional organization. As well as it is necessary to have established protection zone for them and plan the changed route of the road to place outside the zone. If historical artefacts, burial sites, tombs, and tombs or archeological and palaentological findings are discovered, the road construction shall be stopped on the site for the purpose of protecting the historical and cultural heritages. It should be reported to the relevant authorities and guards should be asigned on the area.

Protection of historical and cultural sites along the roadside

We mentioned before that there are many natural and historical sites along the road. To protect them, it is necessary to overview them by classifying them natural and historical sites respectively. In the local area, there are many types of landscapes and it is a wide and vast territory. Therefore, it is particular with its natural conditions and with its resources. In taking the natural sites under protection, it is significant to include extensive area in the vicinity of the road not limited with just the area along the road.

In protecting the historical sites, it is appropriate to place a board of a particular site besides the road. Also it is necessary to establish ranks for the historical sights of high significance. Protection zone must be outlined for the natural and historical sites at suitable distance from the actual object.

Establish borrow pit for gravel extraction for road construction and its reclamation

It is ecologically and economically appropriate to choose previously exploited pits for gravel for the road construction if possible. This will prevent firstly, from destroying untouched lands and secondly, many species of plants, especially rare and endangered species of plants from being affected and destroyed.

For establishing pits for gravel extraction for road construction and conducting reclamation, it is necessary to excavate according to the design worked out and approved by relevant government agencies in conformity with the standards and rules effective in Mongolia. It is appropriate to have executed the road construction and maintenance by professional company. After filling up and reclaiming the pits, an act of completion of the works should be issued on the area by the same company. In the Chapter 9, the description of the standards and instructions for exploration and selecting the gravel pits, reclaiming and vegetating destroyed land found while the exploration was conducted.

Managing local herders' movement

Herders' movement and the route of the road can be intersected sometimes.

Local herders living nearby project area stay in the sunny slopes of mountains during winter and spring, nearby meadow and floodplain of the river valleys during summer and settle down in the lower slopes of mountains in autumn. It can be seen in most cases that this movement will cross the projected road.

In order to ensure the normal movement of herders around the four seasons of the year it is necessary to:

- establish crossroads for livestock moving there;
- develop road sign system to coordinate traffic involving livestock and local residents
- establish crossroad section for pedestrians;
- have several wells digged in order to improve pure water supply in the local area.

The minor resettlement movements and small number of livestock passing across the road can be coordinated by road signs.

However, cross sections with signs must be taken place along the road for large number of livestock (800 or more) and bigger size of pre-planned resettlement of herders.

Recommendations to protect fauna

To fill up all the holes and pits for gravel and rocks used for the road construction, level and cover them with soil in time by creating biogenic conditions for plants to grow and for animals such as inverbetrates and small mammals to be inhabited from the nearest native environment.

To take measures on preventing and stopping hunting animals and thouching the nature (cutting trees, setting a field fire and gathering useful plants) in the ways, except the ways provided in the Mongolian laws by introducing an equipment to monitor the traffic on the road.

To have patrols work on the area in close cooperation with the processing plant administration, local government, law and environment protection agencies.

To take measures on not destroying nests and lairs of the animals that is included in the Red Book of Mongolia and other animals, not killing them and not being frightened during conducting the road construction.

Because the project area contains marmot habitats, measures such as to choose the season available for small marmots to appear independently from their lairs, , and scare them away by digging out their lairs considering their lair structure.

To have the marmots not hunted by the road constructors and the people residing for a temperory and permanent periods and take measures on prevention of the road constructors and the people from being infected from marmot plague.

To place signs of warning and limit of speed on the parts where animals can cross the road and where the large birds that fly slowly can have a rest on.

To take all necessary measures on prohibition of birds and animals of all species listed in the Red Book of Mongolia and in the conventions to which Mongolia is signatory to kill, frighten and flee, to break down and destroy their nests and lairs and catch them while they are alive.

SIX.

ENVIRONMENT PROTECTION PLAN

Amount and scope of the annual works toward environmental protection and ecological degradation prevention of The Centerra Gold LLC should be compatible with expenditure on the environmentally friendly operations and reclamation of the disturbed land.

Further it is necessary to take measures such as seek possibility to reclaim lands affected by soil stockpiles and excavation during road construction and return them to nation's commercial use within short time, prevent soil from erosion and degradation due to water and wind through revegetation and other protective measures. Plant species and planting methods for reclaiming exploited land for borrow pits will be chosen based on soil property, structure, local topographical gradient and other conditions while seedlings and planting should be undertaken during appropriate season.

Besides of complying operations and reclamation works those will be arisen from road construction as instructed in this addendum report, mandatory works specified in the DEIA report issued by Ministry of Environment in 2004 must be implemented in order. In other word, this addendum report should be compiled with previously conducted DEIA report and make a complete report.

Table 6.1

Environment Protection Plan

#	Actions to be taken	Duration	Cost/expenditure thous./togrog
1	Compensation options that are available to the mine company for removal of trees are payment for loss of trees or planting a comparable tree stand in a suitable location. The area and trees that are required to be transplanted will be determined in consultation with local officials and environmental inspectors (not local).	During the process of road construction	15,000.0

2	If necessary, to erect special enclosures and fences at areas besides high mountain pass and rocky mountain slopes where rock sliding is potential for the purpose of protecting the road from the snow drifts in winter time and from strong wind in spring and autumn seasons.	During the process of road construction	15,000.0
3	To erect protective enclosures and fences, cover with soil and vegetation on the parts where the risk of rocks to fall down from the elevated mountain passes and hills exists during the road construction.	During the process of road construction	5,000.0
4	To select the closest to the site of road construction gravel deposit for materials necessary for the road construction, conduct detailed estimation on the amount of reserves to be used, environment to be destroyed and the haul road and its route, prepare the design that will destroy the environment at smallest level and implement it.	During the process of road construction	3,000.0
5	Transplant and protect rare and endangered species if they discovered in the project area and provide them with the conditions of growth.	During and after the process of road construction	14,000.0
6	To reclaim the affected/disturbed area by the road construction activity (gravel mining and etc.)	During and after the process of road construction	16,000.0
7	To re-vegetate the reclaimed area	During and after the process of road construction	8,000.0
8	To make crossroads dedicated for the local herder families to move, drift their livestock or drive agricultural equipment at the sections crossing the road.	During the process of road construction	6,000.0
9	To conduct striping on the areas where the pits are planned to be excavated for the road construction materials and where the road construction will take place, and the soil will be stockpiled in a separate place in order to use it for reclamation the area destroyed.	Through the project implementation	12,000.0

10	To built a bridge on the Boroo river.	During an appropriate period	15,000.0
Total		**109,000.0**	

SEVEN.

MONITORING PROGRAM

Environment for conducting monitoring: Ambient air

#	Indicators for conducting the monitoring	Actions to be taken	Location for monitoring	Duration and frequency	Standards to follow
1	Total content of dust µg/м^3	- sampling - laboratory analysis	Take samples at 50 and 100 m from the gravel pits in the directions of prevailing wind, and at 20 and 50 m from both sides of the road in each 10 kilometers along the road and send the samples for analysis.	Two times during the dry seasons of spring and autumn through the project implementation period.	UST 3384–92 Requirements for conducting atmospheric sampling. Methods to determine sulfur combinations in the air UST17.2.5.12-79, UST3381-82, UST 3398-83 UST 3600-83
2	Carbon dioxide CO_2 µg/м^3	- sampling - laboratory analysis	———x———	———x——x–	
3	Nitrogen dioxide NO_2 gr/м^3	——x———	———x———	———x——x	
4	Sulfuric gas content SO_2 mkg				

Notes: Summary of results of the monitoring must be submitted to the Ministry of the Environment, Green development and Tourism every year on November 15.

Environment for conducting monitoring: Surface water

#	Indicators for conducting the monitoring	Actions to be taken	Location for monitoring	Duration and frequency	Standards to follow
1	Water pH	- sampling - laboratory analysis	From downstream of temporal stream formed by precipitation, from the Boroo river.	When temporary stream is formed because of heavy rain, each month through the implementation of the project.	SSC 3534-83 method of taking samples for water analysis MNS-900-92
2	Amount of Iron, Fe мg/l	——x——	———x———x—	———x——	
3	Lead, Pb мg/кg	——x——	———x———x—	———x——	
4	Amount of oil products	——x——	———x———x—	———x——	
5	Amount of organic substances OR мg/l	——x——	———x———x—	———x——	
6	BODamount, O_2	——x——	———x———x—	———x——	
7	Total suspended solids, мg/l	——x——	———x———x—	———x——x	
8	Odor in U- score	——x——	———x———x—	———x——x	

Annotation: Summary of results of monitoring program must be submitted to the Ministry of the Environment, Green Development and Tourism every year on November 15th.

Environment for conducting monitoring: Soil

#	Indicators for conducting the monitoring	Actions to be taken	Location for monitoring	Duration and frequency	Standards to follow
1	Soil pH	- sampling - laboratory analysis	In the vicinity of the pits and road by selection.	On seasonal basis through the project implementation period	UST 32-98-90 "Requirements for sampling soil for analysis" UST 17.5.1.18 "Types of assessment indicators for soil hygiene in the cities and the residential area' UST 17.5.1.19-92 "General requirements for conducting reclamation in the destroyed area "
2	Neutralization capacity	- sampling - laboratory analysis	———x———	———x——	
3	Thickness of the top fertile soil	- conduct measurement	———x———	———x——	
4	Amount of humus mg/кg	- sampling - laboratory analysis	———x———	———x——	
5	Total amount of carbonates, C мg/кg	——x——	———x———	———x——	
6	Amount of nitrogen, N мg/кg	——x——	———x———	———x——	
7	Amount of phosphorus, P мg/кg	——x——	———x———	———x——	

Annotation: Summary of results of monitoring program must be submitted to the Ministry of the Environment, Green Development and Tourism every year on November 15th.

GENERAL CONCLUSION

With respect to the change in the route of the maintained heavy-duty haul road between Gatsuurt Gold Deposit and the Boroo Processing Plant, surveys on soil cover, flora and archeology were conducted in the scope of this addendum to the DEIA. After filtering, comparing, summarizing and compiling the survey results in accordance with appropriate methodology, the following conclusions were made. They include:

1. The project implementation is going positively impact the national and local social- economic development of Mongolia;
2. In condition to fully comply 'The Environmental Protection Plan', 'Environmental Monitoring Plan', recommendations given on the negative impact mitigation plan for ecology, requirements of relevant standards, legislations and technological specifications by taking required negative impact reduction and elimination measures on timely bases and successfully implementing the project, its negative impact on the environment will be comparatively low and even it is going to have positive impact in the local area by protecting the local land to be disturbed by unmanaged multi-branched dirt roads and reclaiming soil and vegetation cover of considerable size.

3. The project implementing company must have 'The Environmental Protection Plan' and 'The Environmental Monitoring Plan' approved by the central state body in charge of environmental matter before February 15 of each year in accordance with the Article 31 of the Law of Mongolia on Environment Protection and the Article 10.2.2 of the Law on EIA. If it is not approved, there is a right to the central body of state administration to cancel the EIA report.

4. The previously completed EIA report in the scope of the project will be effective within 5 years and it is required to make addendum to the EIA once in a three year period.
5. Centerra Gold LLC is required to have ecological and economical loss assessment done by a professional organization.

6. During the construction of the Boroo-Gatsuurt maintained haul road and its operation, special attention should be paid to the following measures among others on reducing the negative impacts included in the EIA report made in 2004 and in this addendum. They include:

   - To make crossroads designed for the sections that have difficult traffic conditions, as well as livestock and animals traveling and crossing at the every required places, place warning signs and boards that will regulate auto vehicles, establish proper traffic system
   - To consider duration of building embankment and protection dam in building the bridges on rivers and other structures and take measures on not polluting the surface and underground water with oil products and construction and other materials. The construction should be performed by professional organizations and statement on their performance should be issued by the state commission.
   - Take dust suppression and watering measures in the parts of road and pits where great amount of dust can be produced during the dry period on regular basis.
   - To place signs of warning of sliding on the parts where slippery is available, where a turn is required in a short distance and where the road is sloping on whatever direction, and to take measures on protecting from sliding.
   - Consult with local authority and conclude whether location of the children's summer camp located in the project impact zone should be changed and negative impact mitigation plan.
   - To take measures on having the soil cover less damaged during the road construction period, conducting stripping on the areas where the pits for gravel are mined and then reclaiming them, having the flora less damaged and conducting vegetation on the reclaimed areas of pits.

Finally, in order to conserve natural form of the project area, it is necessary to implement all required measures on conducting surveys and studies for the EIA and prevention from the negative impacts on the environment and reducing and eliminating negative impacts and consequences in time.

The project implementation is possible if the Environment Protection Plan and the Environment Monitoring Plan are followed and implemented in time.

Close cooperation of Centerra Gold LLC with the local administration agencies and environmental protection agencies on ecological monitoring part of the project will serve as a very important basis for reducing negative impacts on the local environment.