Ivanhoe Mines Mongolia Inc

OYU TOLGOI PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

VOLUME 1
REPORT OF OYU TOLGOI TO GASHUUN SUKHAIT ROAD AND INFRASTRUCTURE CORRIDOR

Environmental protection plan and
Environmental monitoring plan

Prepared by:
ECO-TRADE LLC., Environmental Consultants, Mongolia

Ulaanbaatar, 2004

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Preface

The recently discovered Oyu Tolgoi copper-gold deposit in Mongolia is located near the Southern border, in a remote area with relatively weak infrastructure development. This Gobi region is about 570km away from state paved auto roads and 450km from the nearest railway station. It is an economically underdeveloped area with no connection to the power grid and has a small population.

Ivanhoe Mines has completed its exploration activities at this deposit and has completed the preliminary reserve estimates with the exploitation and mining plans currently underway. During the Project's initially stage, there is a plan to build a concentrate plant with a capacity to process 20 millions tons of ore per annum with a gradual increase to 40 million tons per year.

In order to implement such a large-scale project, infrastructure network will be of vital importance to this region. After studying several different infrastructure options for the mine, the company has selected and developed a project to build a road through the Gashuun Sukhait temporary border crossing, located in Khanbogd Soum of the South Gobi aimag and "B" section of the Small Gobi Strictly Protected Area, to reach the People's Republic of China and then use Wuyan Chinese railway station, which is the closest one to Oyu Tolgoi, to connect to the international transportation network. This is the shortest route that calls for the shortest transportation distance within our country's territory, which relatively minimize the negative environmental impact and does not violate any rules and legislations pertaining to the limited zone of the SPA.

During the fall of 2003, ECO-TRADE has completed environmental studies on this corridor planned for road construction, transportation, and power line construction. This report is based on results of these studies and the project documents. This report is an inseparable part of the Comprehensive Environmental Impact Assessment report and contains all documents regarding the Environmental Protection Plan and Environmental Monitoring Program that are to be followed when upgrading, sealing and transporting through the road and constructing power and other all activities that would take place between Oyu Tolgoi and Gashuun Sukhait.

1. Project Transport and Power Description

1.1 Existing Infrastructure

Oyu Tolgoi is located 80 km from the Chinese border and, by the most direct route, within 300 km of the Chinese railway system. The Trans-Mongolian Railway is located approximately 450 km to the east. The region is serviced by a network of informal tracks that link Soum and Aimag centres. Cross border transport near Oyu Tolgoi is limited to periodic border openings at Gashuun Sukhait, the nearest crossing point 80 km south of Oyu Tolgoi, and at Hangi, approximately 295 km east-south east of Oyu Tolgoi.

The south Gobi region is not connected to the Mongolian power grid. Power is generated locally in the Aimag capital of Dalanzadgad, and seasonally in smaller Soum centres, from small coal fired power stations.

1.2 Project Alternatives

Project planning has investigated several transport and power supply options, and preferred routes have been identified within the Oyu Tolgoi to Gashuun Sukhait infrastructure corridor. The infrastructure corridor, as indicated in Map 1, contains two road transport options and a power line transmission option for the connection of Oyu Tolgoi to the Inner Mongolian power grid. It is most unlikely that the initial project will bear the capital cost of a railway however; most of the final road route selected should be suitable for relatively low cost, future railway construction.

The option of using the Hangi border crossing, further east of Gashuun Sukhait, has been dismissed due to the distance of road requiring construction within Mongolia, and the ability to access good quality roads from Gashuun Sukhait to the Wuyuan rail head, only 330km from Oyu Tolgoi. The preferred option to Gashuun Sukhait requires the upgrading and eventual reconstruction of approximately 100 km of road as opposed to over 300 km of new road construction required to use the Hangi border crossing. The

construction of a road from Oyu Tolgoi to Hangi will also result in three times the land disturbance, from road and borrow pits, than the Gashuun Sukhait crossing options. Map 2 indicates the discounted Hangi crossing option and demonstrates the extra distance of road required when compared to Road Options 1 and 2.

Based on the practicality of logistics and costs for supplying materials to the Oyu Tolgoi site (both for the construction and operation phases of the project) and for shipment of produced concentrate from site once the project is operational, it is unlikely that any access options other than via China will be economically viable.

If the Oyu Tolgoi concentrate is to be shipped by rail within China then the road haul distance to the nearest Chinese rail link (in the vicinity of Wuyuan) is 100 km from Oyu Tolgoi, see Map 2, to the border plus 230 km from the border to Chinese rail network. This will result in an all up road haulage distance of approximately 330 km.

A round trip cycle time from the time a truck loads with concentrate to when it is back at the process plant to reload concentrate for the next trip (assuming a driver changeover at the unloading point) is likely to be in the order of 12-15 hours.

The transport routes required for the Oyu Tolgoi Project will involve the upgrading of unsealed tracks that currently service the site and surrounding towns, and the construction of a dedicated unsealed road for the transport of product to China and the importation of equipment into Mongolia. The road transport options investigated for access to China include the existing access route to the Gashuun Sukhait border crossing and a more direct route to the west of the existing road. These two road options are presented in Map 1.

Road Option 1 generally follows the existing access road from Oyu Tolgoi south to Gashuun Sukhait, via the Javkhalant Bag centre and the Border Protection Authority (BPA) check point. The road is 102.57 km in length from Oyu Tolgoi to Gashuun Sukhait. This road option avoids a major drainage basin to the west and has potentially

better access to water and road building materials than options to the west of the drainage basin. Numerous water supplies have been identified along the route from Oyu Tolgoi to Javkhalant Bag.

Road Option 1 also passes through Javkhalant Bag centre providing improved local road access for local residents. The road passes in close proximity to the Galbyn Gobi water resource exploration area and is likely to provide project access to this borefield, subject to final water exploration outcomes.

Approximately 13 km of this road route passes through the Small Gobi B Strictly Protected Area (SGSPA) from the BPA checkpoint to the border crossing. The road route proposed through the SGSPA follows the existing access road. Approximately 12 km of road also traverses the SGSPA Buffer Zone (see map 1).

Road Option 1 follows generally flat terrain with only 6km of road passing through the hilly section near the Tsagaan Had temporary border settlement.

Road Option 2 is 97.4 km long and is a more direct route from Oyu Tolgoi to Gashuun Sukhait and traverses relatively flat land. The entry point to the SPA is south of the existing BPA checkpoint and would therefore require relocation of this checkpoint. Preliminary discussions with the BPA indicate some concerns with regard to the proposed route in relation to the border and border protection zone.

The main disadvantage of this route is that it traverses approximately 20km over an alluvial filled valley which has sandy surface soils that are not suitable for road construction. It is unlikely that road construction material will be found within this alluvial plain so road base materials will need to be transported substantial distances. Approximately 20 km of the road also runs along a large north/south tending drainage basin that could be a problem during any potential short duration flood event.

Both road options share a common route for the 36 km between the Project Area and Javkhalant Bag centre. The first 12 km of this section south of Oyu Tolgoi, traverses relatively flat desert and semi desert steppe prior to entering the Umdai River valley where rocky outcrops and river crossings are common for a 14 km section south to Javkhalant. This section of road will require flood ways and culvert crossings to be established for permanent road requirements.

1.3 Road Requirements

The short term requirements of the Oyu Tolgoi Project include the importation of certain equipment and supplies for the project from China. The proposed incoming and outgoing freight schedules required for the project are included in Appendix A. Approximately 3000 tonnes of incoming freight would be required in 2004 for commencement of underground mining. This would increase to 3344 tonnes in 2005 with the commencement of importation of construction equipment. The freight requirements are such that the upgrading of local roads would be sufficient for incoming freight until 2005.

Construction equipment will be imported using 35 tonne trucks. Therefore it is expected that 200 truck movements will occur for the 2004 period, increasing to 223 truck movements during construction in 2005. Some larger tonnage loads will also be imported for construction as described in Section 1.4**.**

The short term road upgrading will involve the maintenance grading of existing local roads. This work will be limited to the use of graders to maintain and better define existing road surfaces. Water trucks may be used in conjunction with the grading to provide dust control and surface binding of material.

River crossings may be improved for local road upgrades, providing for improved surfaces across the sandy river beds. However, this will be limited to floodway constructions that are likely to be washed away during river flood events.

The approval for upgrading and maintaining existing local roads between Oyu Tolgoi and the BPA checkpoint has been provided by the Governor of Khanbogd Soum and is separately attached in this report in Appendix A.

The construction of a permanent road from Gashuun Sukhait to Oyu Tolgoi will be required for the importation of large construction materials. This road will also be used for the export of copper concentrate and, potentially, copper plate from solvent extraction and electrowinning process and the import of supplies required for on going operations.

Total freight during production will peak in year 12 of operation with an estimated 2.3 million tonnes of concentrate produced. This represents road use of:

- For road trains (180 tonne capacity) – approximately 12 800 trucks per year. Based on operations 365 days per year/24 hours per day, approximately 35 road trains in each direction every day or approximately three truck movements per hour.
- For conventional trucks with a trailer (35 tonne capacity) – approximately 65 700 trucks per year. Based on operations 365 days per year/24 hours per day, approximately 180 loaded trucks per day or 15 truck movements per hour.

In addition to the concentrate export form the project, general road freight will be imported using the same route. Table 1 summarises the expected general road freight requirements for the initial and expanded project. The importation of hazardous materials will be in accordance with Mongolian and Chinese transport regulations.

Table 1. General Road Freight

Freight Type	Tonnes per annum of freight	
	20 Mt/a process	40 Mt/a process
Coal	3,950	3,950
Diesel Fuel	22,.800	45,700
Explosives	14,800	26,300
Process Reagents	32,000	59,400
Grinding Media	24,000	49,200
Liners and Spares	2,300	4,500
Miscellaneous	6,800	9,100
Total	**102,700**	**198,150**
Total Excluding Coal	*102,700*	*194,200*

1.4 Road Design Parameters

The road access to Gashuun Sukhait will initially be an unsealed gravel road that would be suitable for bitumen sealing later in the life of the project. The initial gravel road will have some benefit over a sealed road due to the potential for damage to a sealed road surface from very large imported construction equipment.

Based on the expected traffic volumes and the type of trucks using the road, a minimum pavement width of 8 meters is proposed. An additional 1 meter of road shoulder will be provided on each side of the road. The maximum speed for design purposes is assumed to be 80 km/hour.

The maximum road grade for the desert and semi desert steppe along the majority of the road route will be 5%, but may increase to 8% in the hilly areas to the south where a maximum 5% grade can not be achieved.

The road pavement design will be based on:

- Minimum of 100mm natural insitu material sub-base, compacted and rolled
- Minimum of 200mm of suitable gravel road material compacted and rolled in 2 lifts
- For possible road sealing, a minimum of 80 -100 mm of bitumen asphalt final surfacing will be targeted.

The road embankment and shoulders will be raised slightly above the surrounding terrain to cater for flood events and assist in drainage of water away from the road surface. Preliminary design profiles are provided in Appendix B.

Approximately 14 borrow sites will be used for road upgrading, construction and maintenance as shown in Map 9. Each borrow site will have a maximum disturbance of 4 ha, resulting in a total disturbance of 56 ha.

1.5 Power supply

Power for the construction phase and the initial operation of the Project will be drawn from the Inner Mongolian grid and supplemented by local diesel generators. When the concentrator is expanded, a number of power supply options will be considered, including a coal-fired power station in the Gobi, supply from the Mongolian grid or additional supply from Inner Mongolia.

This study is based on power being transmitted to the site by 220 kV overhead lines. The capacity of the line will be approximately 150 MW, sufficient for initial operation and underground development. The construction and operational power requirements of the project are summarised in Appendix C.

The power transmission line will enter Mongolia near the existing border crossing of Gashuun Sukhait and will follow a direct path to the Project. Preliminary data relating to power supply and power line information is included in Table 2.

Table 2 Preliminary Power Line Information

Maximum Nominal Voltage of Power circuit	220kV
Number of Power circuits	2
Maximum Power per circuit	150MW
Minimum height of energized conductor at the tower	25m
Average Distance between towers	300m
Construction Method	Erection of towers after acquiring the right of way
Suggested Right-of-way width for double circuit 220kV lines	60m
Audible noise at the edge of right-of-way Under wet weather conditions	46dB(A)
Radio Interference under fair weather conditions at the edge of right-of-way	38dB
Electric Field at the edge of right-of-way	0.3kV/m

Location of Conductors	**Minimum Clearance, m**
Over land likely to be travelled by road vehicles	6.1
Over the right-of-way of underground pipelines	6.1
Over or alongside farmland likely to be travelled by vehicles	6.1
Above top of rail at railway crossings	9.0
Over walkways normally accessible to pedestrians	4.6

1.2. Existing environment within Oyu Tolgoi – Gashuun Sukhait infrastructure corridor

2.1 Geography and Topography

Geographically, the infrastructure corridor area belongs to the Galbyn Gobi desert area. The Galbyn Gobi is semi flat terrain with the lowest altitude in the country. The general altitude of the corridor area fluctuates between 937.3 m (Bulan Sukhai) to 1202.3 m above sea level (ASL) (Zagaliin Khuren Ovoo) and lowers towards the south west of the area to 878.5 m ASL in Daichingiin Zag (Daichin's saxauls). The area of the corridor is of low relief with small hills occurring along the 30 km section south of Oyu Tolgoi to the Umdai River crossing at Javkhalant Bag centre and within 20km of the border with China where the hills reach 1150-1196 m ASL. Map 3 provides 10m topographic contours of the corridor area and major geographic features.

Geological structure of this area is very compound. Basically, main rock deposit consisted from Cretaceous conglomerate, sandy rock, alevrite and Neogene red clay. And they are fractured tectonically. But, quaternary and present age gravels; sand and sandy loam thickness can reached 20-180 m. Some of them specially, clay and clay loam soils can swell after rain and high moisture.

2.2 Climate

The climate of the area is very similar to the Oyu Tolgoi Project Area which is described in the Oyu Tolgoi Baseline Study (IMMI, 2003). Temperature variation is extreme with winter minimum temperatures as low as -43º C and summers producing maximum temperatures regularly above 40º C.

The Galbyn Gobi has an arid climate where the average precipitation is only 80 mm/year, 90% of which falls in the form of rain in the warm seasons and the remaining 10% in the form of snow in the wintertime. Rainfall is spasmodic and unreliable, occurring with summer storms in July and August. However, long periods of little rainfall can be experienced in any specific area due to the nature of summer storm activity.

The strongest wind storms occur late March through to April, with regular dust storms from the north. Dust storms can significantly affect the regional air quality and extend across Southern Mongolia and Northern China. The average wind speed in April is 5.5 m/sec. However wind storms with gusts of up to 40 m/sec occur for short periods. Only 19% of spring days can be expected to be calm or low winds. This figure is only 24% for the rest of the year with average wind speeds varying between 4-6 m/sec.

Winter snow storms and blizzards also occur in the Gobi region with between 5 and 8 days a year experiencing winter winds up to 40 m/sec (144km/hr). However the spring dust storms are far more frequent and can continue through June and July when rain fronts bring strong winds ahead of rain storms.

The latitude of the Project Area results in long summer days and short winter days (Table 3).

Table 3. Variation in Daylight Hours - Khanbogd Soum

Date	December		March		June		September	
	sunrise	sunset	sunrise	sunset	sunrise	sunset	sunrise	sunset
10	0727	1633	0608	1752	0423	1939	0533	1827
20	0730	1630	0608	1752	0415	1941	0547	1813
30	0730	1630	0553	1807	0420	1940	0602	1758

Source: Climatologic data of Khanbogd weather station, Institute of Climate and Hydrology, 2002

The annual average temperature of the soil surface layer of the ground is + 8.8°C, and only in winter months does it fall below freezing. From November to February the average soil temperature falls from - 3.6°C to – 13.2°C, and from March until October it increases +0.3°C to + 29°C (G.Namkhaijantsan, 2002).

During the hot summer months the maximum surface soil temperature may reach 65ºC. In cold winter days with snow cover, the absolute minimum soil temperature reaches minus 37^0C.

Soil freezing usually occurs between November and March. The depth and period of soil freezing varies with the severity of winters. The average depth of the seasonal freezing process is 1.5 m in clay soils, 1.9 m in sandy soil, and up to 2.2 m in the gravel soils. The depth of freezing is variable with soil type and moisture content and does not generally exceed 2m in depth.

2.3 Air Quality

The regional air quality of southern Mongolia is affected by regional dust storms that result in high particulate levels during strong north and north-westerly winds in spring. Monitoring at Oyu Tolgoi during June 2003 recorded a maximum 24 hour average Total Suspended Particulate concentration of 530ug/m3. The Mongolian National Standard for dust concentrations is 150ug/m3 over a 24 hour averaging period. The maximum 24 hour PM10 (<10 micron diameter) fraction concentration was 129 ug/m3 and the maximum 24 hour PM2.5 concentration was 51 ug/m3 during recorded dust storms.

The monitoring indicates that seasonal dust storms will reduce visibility and cause dust concentrations in excess of environmental and health standards. Mongolian observational data indicates that between 20 and 30 dust storms can be expected in an annual period, with the average storm lasting between 3 and 6 hours (Natsagdorj, 2002).

The infrastructure corridor is located in an area of low population and no major waste emissions to air occur within or surrounding the corridor. Apart from the periodic dust storm events, the air quality of the corridor is essentially pristine.

2.4 Surface Water

Both road options considered within the infrastructure corridor share a common route south from Oyu Tolgoi to Javkhalant Bag centre. This common route follows an existing local road that crosses many ephemeral creek and river beds. Map 4 shows the dry river beds and ravines along that occur through the infrastructure corridor. River crossings along the existing local road and the proposed road route options are provided in Table 4. The river crossings along the existing road are unformed tracks and are likely to vary following flow events. River flows are temporary following rain events which are usually dry after few days. Flows after heavy summer rain storms often result in very turbulent high velocity mud flows, locally termed "Gobian wild floods". These floods have been known to destroy road crossings and carry away vehicles caught in the river beds.

No surface flow data is available for these isolated and episodic flood events. Discussions with local herders indicate that, on average, four to six flow events occur in summer to autumn and high velocity flow events usually last between 30 to 90 minutes. During field surveys in June 2003, the Umdai River was flowing at a depth of 1.5 to 2.0 m deep at the crossing near Javkhalant Bag centre (crossing 2 on Table 4)

Suspended sediments during turbid creek flows contain fine grained clay and clay loam with gravels. Such deposits result in very soft and swelling soils which become difficult to traverse in vehicles.

Several shallow springs occur along the Umdai River between Oyu Tolgoi and Javkhalant Bag centre. These springs occur where subsurface river bed flows are forced to the surface and result in shallow surface flows between 5 and 50 metres in length. For example, Khukh Khad (46T0653810 UTM475661), Maanit, Burkhant (46T0663490 UTM4737060) and Tavan Ovoot (46T0663490 UTM4737060) springs as shown on Map 4.

All surface water systems flow generally south through the infrastructure corridor and terminate in broad flat playa systems where evaporation results in increased salinity. The

playa systems contain salt tolerant woody vegetation species including *Tamarix ramossima, Carex diruscula, Reamurria soongarica and Salsola passerina.* Shallow surface water often remains in the playas for weeks following heavy rain events and are therefore unsuitable for road construction.

Table 4. Hydrological Sections of River Crossing from Oyu Tolgoi to Gashuun Sukhait Road Routes

No	Cross sections	Location	Size of dry riverbeds		
			Depth,m	Width,m	Lenght,km
1.	Budaa	E 659728.13 N 4752813.49	1.1	5.1	20.32
2.	Umdai	E 660798.49 N 4750337.91	1.7	8.5	70.2
3.	Umdai	E 664009.55 N 4742108.27	2.2	11.3	76.5
Road Option 1					
4.	URB	E 668826.16 N 4736688.76	0.6	1.2	1.6
5.	URB	E 671368.25 N 4734681.53	0.8	6.6	9.5
6.	URB	E 677857.29 N 4731603.78	0.56	3.5	25.5
7.	Shine us	E 680666.97 N 4728592.94	0.9	6.8	2.0
8.	URB	E 686821.51 N 4725715.90	0.3	1.8	41.4
9.	Bulan sukhain sair	E 690233.27 N 4724110.13	0.7	5.1	3.2
10.	URB	E 703345.13 N 4723240.33	0.9	3.9	5.5
11.	URB	E 710235.54 N 4714943.79	0.3	2.2	5.7
12.	Ikh Gunii sair	E 708563.11 N 4708119.21	1.3	7.1	3.7
13.	URB	E 709499.68 N 4705710.54	0.8	2.9	11.3
14.	URB	E 710302.44 N 4704037.85	1.0	3.4	2.7
15.	URB	E 711239.00 N 4701361.54	0.7	2.1	4.1
16.	URB	E 711841.08 N 4700424.83	0.8	2.5	2.4
Road Option 2					
17.	URB	E 668357.88 N 4735283.70	0.8	2.1	2.3
18.	URB	E 672839.99 N 4729128.20	0.5	1.9	6.0
19.	URB	E 681135.25 N 4718021.53	0.7	2.3	3.1
20.	URB	E 682473.20 N 4716683.38	0.7	1.9	6.1
21.	Khuhk ergiin sair	E 692240.19 N 4706981.78	1.3	7.1	13.3
22.	Khukh ergiin sair	E 695852.64 N 4705375.99	1.2	6.5	12.1
23.	URB	E 697190.58 N 4705041.46	0.7	2.2	7.9
24.	URB	E 699799.58 N 4707104.75	0.3	2.0	11.7
25.	URB	E 701472.01 N 4703970.94	0.4	2.0	3.8
26.	Ikh gun	E 707492.76 N 4705844.35	1.1	7.6	11.3

Source: Field survey results completed in September and November, 2003 through the road routes.

Note: URB- Unnamed river bed crossing the road routes.

2.5 Surface Soils

The field survey of soils in the infrastructure corridor of the Oyu Tolgoi to Gashuun Sukhait transport corridor was completed in November 2003. A soil map, Map 5, was produced from transects and sample profiles.

The field survey recorded three main soil subtypes which belong to the typical Gobian soil type, including; desert light brown soil, semidesert-steppe light brown soil and semidesert-steppe grey brown soil. The main characteristics of soils are represented as below. The chemical characteristics of the main soil types are presented in Table 5.

Gobian small hill, light brown, poor developed soil (Number-1)

This subtype of soil distributed to the south from Oyu Tolgoi to the Tavan Ovoo in the small Gobian hills and hillocks within 900-1150 m of altitude and also near the Gashuun Sukhait border point where hills are within 920-1160m of altitude. Field survey results (Appendix E, profiles 2 and 9) show no typical A horizon of topsoil, but rather a cover of aeolian sands up to 3cm deep with between 40 and 60% of the layer containing small granules of weathered rocks.

Small hill, semidesert-steppe, grey brown soil (Number-2)

This subtype of soil is very similar to the above mentioned soil but with a poorly developed humus layer with covered sands to 2 cm of depth. The results of profile No-15 made near the west side of Gashuun Sukhait show a light brown coloured A horizon of 2 cm depth. Plant roots typically extend to 10 cm below the surface. The horizons show clear distinction of granular composition. This soil type is alkaline with a pH of 9.

Semidesert-steppe light brown soil (Number-3)

This subtype of soil is distributed in the wide valleys within 920 and 1180 m altitude. The soils contain light brown fine clay with a high weathered stone content. These soils have very low humus content and support sparse vegetation. The soils are highly alkaline and low in nutrients.

Alluvial soils of dry river beds and broad valley floors

These soils are distributed along the dry river beds and broad alluvial fans. These contain course deep depositional sands and sandy loams with no A horizon.

Playa soil

Playa soils occur in two places through the route from Khongor Ovoo to Tsagaan Khad temporarily border settlement. The soil type is characteristic of the areas flooded from seasonal rainfall where fine sediments are deposited and dried to form typical playa or "clay pans". The playa is often saline due to the residual salts deposited following evaporation of flood waters.

Semidesert-steppe grey brown soil (number-4)

This soil type is distributed in the wide and narrow valleys within 900-1000m of altitude. The surface is covered by aeolian sands, without humus layer and is grey brown coloured and dry. These soils have very low humus content, are highly alkaline and high in salts (Na and Mg).

Table 5. Agrochemical characteristics of soils

No of Profile	Layer of soil	Sampled depth ,m	Percentage			pH	Alcalines per 100g soil, mg-equivalent			Exchangable elements	
			Humus	Total nitrogen	carbonate		Ca	Mg	Ca+Mg	P_2O_5	K_2O
Semidesert-steppe, poor developed, small hills, light brown soil (Number-1)											
2	B_1К	0-10	0.38	-	2.44	9.3	11.0	6.2	17.8	1.26	18.1
	B_1Cк	20-30	-	-	3.74	10.1	12.0	7.1	19.1	-	-
Semidesert-steppe, carbonated and light clay loam soil (number-2)											
15	B_1К	0-8	0.64	0.03	3.64	9.6	9.20	7.4	16.60	1.34	17.8
Semidesert-steppe light brown soil – (number- 3)											
1	B_1К	2-10	0.57	0.03	1.74	10.1	12.8	10.2	23.0	1.44	18.9
	B_2Cк	20-30	-	-	2.79	10.0	10.8	9.0	19.8	-	-
Semidesert-steppe, grey brown soil – (number-4)											
	B_1К	0-15	0.33	-	7.64	10.2	11.5	10.1	21.6	1.38	13.4
13	B_2C	20-30	-	-	-	9.8	-	-	-	-	-
17	B_1К	0-15	0.27	-	5.49	9.6	11.3	8.1	19.4	1.56	20.1

Source: Analysis results completed in Soil Research Laboratory of Institute of Geography,September,2003

2.6 Vegetation

The vegetation of the Oyu Tolgoi to Gashuun Sukhait infrastructure corridor is typical of Central Asian semi desert and desert steppe flora types. The open flat desert plains and low hills are sparsely covered with small (<0.5m) drought tolerant shrub species. The ephemeral river beds, creek beds and playas support some larger species of trees and tall shrubs associated with shallow underground water.

The Bulan Sukhait area is unique in the Galbyn Gobi as it contains plant communities not usually occurring in this environment. For example, about 350 species Tamarix, 3-4 species of oleaster and several fields of bamboo. Location of this specific community marked on the map of vegetation cover of Road and transport corridor area. It is very near just west side of existing water exploration camp in the Galbyn Gobi. Such community rarely in the Gobi area.

To the east of the Tsagaan Khad temporary border settlement a community (approximately 100 trees) of Tooroi (*Populus diversifolia*) occurs. This species is associated with shallow fresh water and is rarely found in the Galbyn Gobi. A small area of saxaul (*Haloxylon ammondendron*) forest in the south western section of the infrastructure corridor contains the species *Sophora alopecuroides* and *Glycihiza uralensis*. Both of these species are rarely found in either the Galbyn Gobi or the Aslahan Gobi to the west.

A field survey of vegetation in the infrastructure corridor was completed in November 2003. The survey found five dominant plant communities within the corridor. These were mapped, see Map 6 and are discussed below.

Javkhalant semi desert plain

The section of road corridor from Oyu Tolgoi to Javkhalant Bag centre contains valley floors with a typical semi desert steppe vegetation type. This vegetation type is dominated by *Anabasis brevifolia, Reammuria soongarica, Salsola passerina* and

Nitruria sibirica. These are drought tolerant and salt tolerant species, less than 10 cm in height and sparsely distributed (9% surface coverage). Plant densities range from 20 to 30 plants per $10m^2$.

Galbyn Gobi desert plain

The vast Galbyn Gobi plains occur south of Javkhalant Bag centre. These arid plains have sparse low (< 20 cm) shrubs with typical plant densities between 20 to 25 plants per $10m^2$. The vegetation is dominated by *Sympegma regellii, Anabasis brevifolia, Salsola passerina, Reamurria soongarica, Potaninia Mongolica, Convolvulus fruticosa, Zygophylluim xantexylon and Nitraria Sibirica.*

Galbyn Gobi low hills

The low hills south east of Oyu Tolgoi and near the Chinese border have a sparse coverage of Zygophyluim *xantexylon, Anabasis brevifolia, Salsola passerina, Reamurria soongarica* and *Sympegma regelii*. This vegetation type is also dominated by low arid shrubs less than 20 cm in height and with a maximum density of 20 plants per $10m^2$.

Ephemeral river beds

Vegetation density increases near the ephemeral streams that flow south and contain available moisture within the course river sands. Surface vegetation cover is an average of 50% and the shrub species are generally between 50 and 80 cm in height. Shrub species are represented by *Achnatherum splendens, Kalidimn faliatinim, Reammuria soongarica and Nitraria sibirica*. Elm trees *(Ulmus pumila)* to 4 m in height occur along the stream beds in the northern sector of the infrastructure corridor between Oyu Tolgoi and Javkhalant Bag centre.

Galbyn Gobi playa

A large playa (dry lake bed) locally named Bulan Sukhait, occurs between road options 1 and 2, west of present water exploration camp. This area is one of the lowest areas of the Galbyn Gobi and all surface flows terminate within this low lying saline basin. The

availability of shallow groundwater within the playa results in the establishment of sufficient vegetation to stabilize soils and allow the accumulation of soil humus. These playa systems are therefore able to support larger plant species and high plant densities. The communities are dominated by *Tamarix ramossima, Carex diruscula, Reamurria soongarica and Salsola passerina.*

2.7 Fauna

The proposed infrastructure corridor (Road Option 1) passes through 13 km of Part B of the Small Gobi Protected Area (SGPA). The SGSPA is split in two sections: Part A is the western section; and Part B is the eastern section which is partly traversed by the corridor. Fauna information for the area focuses on the SGPA and these records have been used in this report.

Fauna survey of the SGSPA (D.Enkhbileg and G.Mainjargal, 2001) have recorded 33 species of mammals, 110 species birds in Part A and 31 species of mammals and 45 species birds in Part B. These surveys are discussed more in the following Section 9.2.8. Recorded mammal species within the infrastructure corridor are provided in Appendix D.

Bird species were recorded during the field survey of the Oyu Tolgoi to Gashuun Sukhait infrastructure corridor and have been used to update previous records for the SGSPA. The results of these surveys are provided in Appendix D. Many of the bird species recorded from the area are migratory species.

The Galbyn Gobi is wide lowland with several surface springs and areas of shallow ground water which are significant water resources for fauna species, particularly the migratory mammal species. These areas include the Umdai River's temporarily springs, Bulan Sukhait area, Saglagar Sair and Daichin Zag springs. The expansive saxaul forests in the south west Galbyn Gobi and the Tamarix dominated playa are important habitat areas for these species.

The wild Asiatic ass (*Equus hemionus*) and blacktailed gazelle (*Gazella subgutturosa)* are threatened species listed in the Red Book of Mongolia. These migratory species have been impacted by reduced habitat from grazing and hunting pressure. One objective of reservation of the SGSPA is to conserve these species. The area is very remote with a low human population and generally poor grazing. Recent population studies of the wild

ass in the SGSPA area have resulted in estimates of between 3500 head (S.Dulamtseren,2004) and 5000 head (D.Enkhbileg,2003).

The wild ass and gazelle are migratory species that travel vast distances for pasture and water. Little is known about the migratory patterns of these species in the Galbyn Gobi area. But it is expected that significant migration occurs from between the eastern and western sections of the SGSPA. The proposed infrastructure corridor is likely to transect these migration paths.

2.8 Small Gobi Strictly Protected Area (SGPA)

The Small Gobi SPA consists of A and B parts and occupies 1,839,176 hectares of land in Nomgon, Bayn-Ovoo and Khanbogd Soums of Umnugobi Aimag and Borzon Zeemgene and Kharmagtain Gobi areas, which are the southern part of Khatanbulag Soum of Dornogobi Aimag(Appendix D, map 7). In 1993, it was established as a strictly protected area by Parliament Resolution No 83.

This area represents the main characteristics of the south eastern Gobi region of Mongolia and has relatively preserved its original natural features and conditions. It is the main habitat for recognised threatened species including the Asiatic wild ass, black tailed Gazelle, Wild Sheep and Ibex. Approximately 50% of the wild ass population of Mongolia inhabits this area.

During field surveys of the SGSPA carried out in 1997, the wild ass population density was estimated at 1 head per 1000 ha. The population of wild ass in SGSPA and surrounding buffer zone was estimated to be 5000 head (S.Dulamtseren *et al,* 2001).

Later surveys completed in the 1999 significantly increased this estimate and have assessed the population of wild ass as between 12 400 and 20 280 in the SGSPA and buffer zone (D.Enkhbileg *et al*,2001).
The last survey of wild ass carried out by a team from the Mongolian National University was completed in September 2003 and results indicate a population of approximately 4500 head of wild ass in the eastern territory of Umnogovi Aimag, including Khurmen, Bayan Ovoo, Khanbogd and Manlai Soums and the SGSPA. It is expected that this number more accurately reflects the remaining population of wild ass in the area.

Black tailed gazelle (*Gasella subgutturosa;* Guldenstedt, 1780) were surveyed in 1997 when 3397 black tailed gazelle were recorded in the SGSPA from 253 herds. The estimated population black tailed gazelle in the SPSGA and buffer zone from that survey was 33 800 head (S.Dulamtseren *et al,* 2001). The same study estimated a Mongolian

gazelle (*Procarpa gutturoza;* Pallas, 1777) population in the SGSPA as approximately 7000.

Apart from the surveys of large migratory mammal species described above, few biological studies have been completed within the SGSPA. Part B of the SGSPA is considered more remote from the western section and is subject to limited management and no ongoing ecological monitoring. Complete fauna and flora surveys have not been undertaken within the SGSPA and the impacts of grazing and hunting are not quantified.

In November 2003, eight herder families with 4000 head of livestock were occupying Part B of the SGSPA. These traditional herder families occupied the area prior to the gazettal of the protected area and have not been required to relocate. One of the herders is working as ranger for the SPA Authority and is living near Tugrik Well near Nomgon Bag of Khanbogd Soum. Another ranger is employed in the eastern section of the SGSPA in Dorngovi Aimag. These rangers are poorly resourced with no access to suitable vehicles and communications and little formal training for the role. The rangers are primarily herders who graze stock within the protected area and undertake some patrolling for illegal hunting.

The Gashuun Sukhait border crossing point and border military unit are located within the western section of Part B of the SGSPA. The border crossing is open on a temporary basis for local trade with China and primarily handles exports of cashmere and animal products and imports grain and small goods. The temporary border point facilitates trade from much of Umnogovi Aimag and surrounding regions. It is estimated that up to 250 trucks, 250 cars and 60 motorcycles utilize the border crossing during the temporary opening. The existing road through the SGSPA to Gashuun Sukhait is made up of a number of poorly defined tracks. Uncontrolled access through the SPA during border openings results in significant land disturbance.

Between 800 and 1500 people come from neighbouring areas of Umnugobi, Dundgobi and Dornogobi Aimags during the border opening periods and stay in the temporary

settlement of Tasaan Khad, located on the border of the SGSPA. This settlement has no ablution or waste facilities and is unmanaged by local governments or the border authority. The area is severely overgrazed and degraded (Appendix F).

Illegal hunting of wild ass was recorded within the SGSPA during the German-Mongolian expedition in 2003. Approximately 30 carcases of wild ass were found within Part B of the protected area, all as a result of hunting for meat. Local authorities advised that the congregation of large numbers of people at the Tsagaan Khad settlement is contributing to local hunting of wild ass. Rangers also advised that local herders will hunt wild ass as it is commonly believed that they compete with domestic stock for grazing pasture.

2.9 Land use and Socio-Economic Condition

The transport corridor area is located in the territory of Javkhalant Bag of Khanbogd Soum, Umnogovi Aimag and is the least populated administrative unit of Mongolia. The corridor passes through the Galbyn Gobi which is generally unsuitable for pasture and supports few traditional herders. The herders that do use the area are nomadic and occupy a number of pasture areas and shallow wells to support small grazing herds for cashmere, camel hair, meat and milk products. Javkhalant bag centre is located 30 km south of Oyu Tolgoi and is adjacent to the proposed road option, on the existing local road from Khanbogd Soum to Gashuun Sukhait. The Bag centre consists of a small community centre used for occasional meetings and mobile health clinics that operate from Khanbogd Soum.

Most herder families within the corridor occupy nomadic camps along the Umdai River where shallow wells are dug into the river bed (Map 4). Table 6 lists all 13 families living within the corridor in November 2003 and provides details of family members and the number of animals for most families.

Nomadic herder families within the area produce cashmere, leather and camel wool for trade. Spring and Autumn are the main trading periods for the sale of these products to China. Between 3 to 4 ton of raw cashmere, 4 to 5 tonne of camel wool and 8 to 15 ton of leather is traded annually to China through the Gashuun Sukhait border crossing (Umnugobi aimag, Statistical data, 2003). Seasonally, up to 200 herders from the immediate region enter China for trade (Umnugobi aimag, Statistical data, 2003). The Gashuun Sukhait border point has a significant influence on the local economics within the infrastructure corridor, not only from trade, but also the provision of services and supplies to the many thousands of traders who are attracted to this area during the seasonal openings.

Table 6 Herder Families Occupying the Infrastructure Corridor (Map 8)

No	Name of family	No. of People in family	Dug well name (or living place)	Coordinates of wells	Number of livestock
1	Dolgorsuren and Namsrai	6	Khukh Khad	46T0653810 UTM4756614	C-50 H+C-15 S+G-120
2	Chuluu	5	Burkhant (Ekhen Burkhant)	46T0663490 UTM4737060	C-100 H+C-70 S+G-200
3	Tsend Ayush And Bagakhuu		Tavan Ovoot	46T0663490 UTM4737060	C-100 H+C-70 S+G-200
Through the road option No-1					
4	Amar		Modot khoshuu	N 42° 58' 21,9'' E 107^0 35' 14.6''	C-50 H+C-25 S+G-170
	Bandia		Nomt	N 43° 04' 17.2'' E 107^0 38' 18.5''	C-120 H+C-60 S+G-300
	Bunten		Daravgai	N 42° 40' 00,1'' E 107^0 30' 59.0''	C-75 H+C-70 S+G-120
	Sumiya		Den	N 43°03'39,1'' E 107^0 34' 00.3''	C-60 H+C-45 S+G-140
Through the road option No-2					
	Doljinsuren	7	Burgasnii khudag	46T0663490 UTM4737060	C-10 H+C-00 S+G-50
	Nadmid	8	Khulsan us	46T0662575 UTM4735414	C-50 H+C-20 S+G-400
	Jargalsaikhan	4	Builsan us	46T0661561 UTM4732089	C-80-90 H+C-0 S+G-120
	(Buluu) Sodnomdorj	9	Ulaan khoshuu	46T0660466 UTM4726939	C-80 H+C-40 S+G-220
	Buluu	6	Zurkhaich	46T0659981 UTM4721590	C-30-40 H+C-10 S+G-100
	Adiya	5	Punzet	46T0658904 UTM4719006	C-50 H+C-0 S+G-200
	Surenkhuu	4	Shine us	46T0657400 UTM4710822	C-70-80 S+G-100

Source: Field survey results completed during September,2003 ECO-TRADE experts.

Abbreviations note: C= Camel (100-120 liter/week) , H= Horse (20-30 liter/day), C=Cows(30-40 liter/day), S=sheep(4-5 liter/day)-, G=goats (3.5-4 liter/day).

1.3. Road Construction and Transport - Discussion of Impacts

3.1 Climate Impacts

The existing climatic conditions will not be affected by the infrastructure corridor. However, the harsh climatic conditions will influence the construction of roads and operation of transport equipment. For example, the influence of the prevailing north and north-westerly winds in the Galbyn Gobi is estimated to increase wind resistance of north bound traffic by between 50 and 70 kg/m^2 , resulting in potential increased fuel consumption by as much as 25 % above fuel consumption during non windy periods.

Snow falls through the Oyu Tolgoi to Gashuun Sukhait transport corridor area are generally light with average falls between 8 and 12 mm per year. Occasional high snow fall over a short period will impact transport operations. Records from November 2002 indicate a snow fall event of 45 cm in 5 hours (Bayan-Ovoo and Khanbogd meteorological station records,2002*)*. These are rare events that will limit transport for relatively short periods. It is more likely that rainfall events in summer and autumn will have a greater impact on transport operations when storm events result in high stream flows that would be impassable. It is expected that the short term upgrading of local roads will use floodways (formed basements over river beds) rather than bridges and culverts to traverse the usually dry stream beds. The formed floodways are unlikely to survive a storm flow event. Hence, it is expected that transport delays may extend for several days following a storm event during the initial upgrade of local roads. The construction of formed permanent roads for the importation of large equipment and export of concentrate will require permanent river crossings that will withstand the expected flood events.

Regional dust storms during strong wind events in spring are also likely to impact operational transport requirements. It can be expected that dust storms will potentially impact transport activities between Oyu Tolgoi and Gashuun Sukhait for up to 4 days a year between March and June.

3.2 Air Quality

Dust emissions

The potential dust sources from the construction and operation of the proposed infrastructure corridor include:

- Land clearing during road and power line construction
- Traffic on unsealed roads
- Spillage from haulage trucks
- Borrow pit excavation and stockpiling of road building materials

The objective of dust management and control strategies it to protect human health. The Mongolian National Dust Standards (MNS 4585:98) is based on health standards for the respirable component of dust emissions (PM10 and PM 2.5). Dust can also have adverse impacts on road side vegetation that is subject to long term covering of dust.

The most significant increase in emissions will be from increased traffic on the unsealed road from Oyu Tolgoi to Gashuun Sukhait. Currently the local unsealed tracks are used by trucks and cars accessing the border crossing which is open for two weeks, four times a year. It is expected that the upgraded road to Gashuun Sukhait will be sealed at some time during the operation of the Oyu Tolgoi Project. However, prior to sealing of the road, the dust from vehicle movements will increase local dust levels.

The road transport associated with the project will increase from 223 trucks per year during initial construction, based on 35 tonne capacity trucks, to 15 truck movements per hour, if 35 tonne capacity trucks are used, or 3 truck movements per hour, if 180 tonne capacity road trains are used. Trucks will have an average road speed of 80km per hour.

The section of road from Oyu Tolgoi to Gashuun Sukhait is some of the most remote and sparsely populated parts of the country. It is also subject to existing high dust levels during wind storm events. No settlements or permanent residences are located adjacent to either road option route. The Javkhalant Bag centre is located adjacent to the existing

local road from Oyu Tolgoi to Gashuun Sukhait. This area will be bypassed by the upgraded road and a suitable access road constructed to the facility. Temporary nomadic camp sites located along the road section form Oyu Tolgoi to the Javkhalant Bag centre will also be avoided and bypassed. It is therefore expected that the dust from increased vehicle movements will be an insignificant factor. However, measures will be implemented to minimise dust emissions from transport operations.

Dust mitigation measures

The following measures will be implemented to minimise the emission of dust from the transport and power corridor:

- The use of water trucks during road and power line construction to suppress dust from earthmoving equipment and vehicles.
- Limit vehicle speed on unsealed roads.
- Progressively seal the access road during operation of the Oyu Tolgoi Project.
- Implement, where practicable, surface treatments for the unsealed road to minimise dust emissions from vehicle use.
- Rehabilitate borrow pits and old unused tracks along the access route.
- Limit land disturbance from road and power line construction.
- Limit spillage of concentrates during road haulage.
- Ensure a minimum separation distance of 500 m from Javkhalant Bag centre and temporary nomadic camp sites.

Vehicle emissions

Vehicle emissions from the transport of concentrate out and supplies in to Oyu Tolgoi will increase above existing vehicle emission levels for the region. The calculation of actual emission levels is not considered in this report as the fuel used and the type of trucks to be used for the project have not been confirmed. However, vehicle emission estimates from standard value sets have been provided as an indication of total emissions. The data presented in Table 7 provides indicative figures for the various transport types and standard fuels used in Mongolia.

Table 7. Estimated vehicle emissions for return trip between Oyu Tolgoi and Gashuun Sukhait

No.	Classification of vehicle	Gas emissions (grams)		
		CO_2	NO	CO
1	Lorry	2020	320	220
2	Car	270	16	10

Source: Gas emission pollutants and results of analysis, Environment of Mongolia, 1995

Note: *standard diesel fuel, one trip loaded and return trip empty. Average speed 80 km/hr*)

Mitigation of vehicle emissions

IMMI will implement the following measures to minimise vehicle emissions from the transport activities associated with the project:

- Comply with Mongolian emission standards or appropriate international standards for all vehicles used on the project including: emissions from petrol engines (MNS 5031:2003) and emissions from diesel engines (MNS 5014:2003).
- Comply with Mongolian standards or appropriate international standards for fuel used for transport activities.
- Maintain vehicles and road condition to maximise fuel efficiency of transport activities.

3.3 Hydrology

As discussed in Section 2.4, the streams flowing through the Oyu Tolgoi to Gashuun Sukhait infrastructure corridor are ephemeral with temporary flow following summer and autumn rain events. The potential impacts on surface water systems within the corridor include:

- Changes to natural flow paths and increased erosion of banks along surface streams from the impacts of road drainage, floodway, and culvert or bridge construction.
- Changes to natural stream flow may have impacts on riparian vegetation, natural springs and shallow herder wells downstream.
- Increased risk of pollution of surface and groundwater from spillages and accidents associated with the transport of hazardous materials.

Positive impacts are also associated with the upgrading of road facilities along the corridor. These include:

- The formation of dedicated stream crossings will reduce the number of undefined and informal crossings that now exist along the section of local roads. This will significantly reduce the area where stream banks and river beds are disturbed by uncontrolled vehicle access.
- The improvement of the road and crossings will reduce the risk associated with existing transport of hazardous materials.

Mitigation

It is proposed that the following mitigation measures shall be implemented to manage impacts associated with the construction of road and power infrastructure:

- The number of stream crossings used for the final selected road option will be minimised as much as possible, and will be less than the current number used for existing local roads.

- Stream crossings will avoid areas with significant features including surface springs, elm trees and herder wells, and will be constructed to ensure that impacts to these systems are avoided.
- Stream crossings will be designed to maintain natural flow regimes.
- The transport of hazardous chemicals will comply with all permits and approvals issued under the Mongolian Law on Toxic Chemicals.
- Hazardous chemical transport procedures and emergency response procedures will be developed to meet appropriate international standards (recognised by Mongolia and China).

3.4 Soils

The proposed road and power line infrastructure will result in short term disturbance of soils through the corridor. These soils are significantly impacted by regional dust storm events and are further degraded within the corridor where informal local tracks have been established. The area of soil disturbance associated with the infrastructure corridor will total approximately 341 ha and can be summarised as:

- The road construction and upgrade of local roads will result in a final surface width of 8 m and embankments of 3m on each side, having a total road width of 14 m. The road construction will therefore result in approximately 150 ha of soil disturbance from road construction using road option 1 or 2.
- Approximately 14 borrow sites will be used for road upgrading, construction and maintenance as shown in Map 9. Each borrow site will have a maximum disturbance of 4 ha, resulting in a total disturbance of 56 ha.
- The construction of 90 km of power line will result in temporary disturbance during construction of approximately 135 ha based on a 15m wide disturbance corridor for construction.

The construction of a dedicated and well maintained local road will allow for multiple informal tracks running parallel within the corridor to be rehabilitated during the construction and upgrade program. The road will provide a much improved road surface for local transport and will greatly reduce the level of “off road” travelling which currently occurs. The upgrade and construction of a single well maintained road will therefore result in less soil disturbance from uncontrolled off road access. For example, where road option 1 crosses the Umdai River near Maanit Spring, there are up to 3 informal tracks adjacent to the main used track. These tracks run parallel to each other and result in soil disturbance of up to 75 m in width.

Mitigation

The proposal to upgrade the existing road, construct an access road and to construct a power line through the infrastructure corridor will include the following measures to protect and enhance soils within the area:

- All road construction, maintenance and power line construction work will be undertaken to minimise soil disturbance within the corridor. The movement of machinery and vehicles will be restricted using operation procedures to ensure that disturbance occurs within identified clearing lines.

- Areas temporarily disturbed through road and power line construction, including borrow pits, will be managed such that top soil is removed and stockpiled adjacent to the area of disturbance and replaced on final restoration of the area. IMMI will implement appropriate restoration techniques to conserve top soil and establish vegetation once the soil is replaced. Restoration activities will be timed to avoid, wherever possible, the loss of exposed top soils during the spring dust storm period.

- IMMI will restore and rehabilitate informal tracks adjacent to the upgraded and constructed new road within the corridor. Old tracks will be shallow ripped (scarified) to prevent further vehicle use and encourage revegetation.

- Effective hazardous material transport procedures will be implemented in line with Mongolian and international standards. These procedures will include measures to be taken to prevent contamination of soil from accidents and spills during transport activities.

3.5 Flora

The upgrading of the existing road alignment from OyuTolgoi to Gashuun Sukhait will generally follow areas with existing disturbance from unformed tracks. As discussed above, the unformed tracks have disturbed areas up to 75m in width. The new road will limit flora disturbance to the 14 m wide corridor of road surface and shoulder. A total area of 150 ha will be used for road contraction, of which a considerable component will be existing disturbed areas from unformed tracks. The restoration of these tracks during road construction will result in revegetation of a considerable area.

The power line construction will result in only temporary disturbance of vegetation during construction. A maintenance track of approximately 3.5 m width will remain along the power line route.

The disturbance of vegetation will be similar to that outlined in the soils discussion above. The potential for dust impacts on road side vegetation has been considered. From experience with other unsealed roads in the area and considering the volume of traffic proposed for the route, impacts on vegetation condition to a maximum distance of 15m on each side of the road is possible.

The road and power line corridor will generally follow the flat terrain of the semi-desert and desert steppe. North of Javkhalant Bag Centre to Oyu Tolgoi the road will generally follow areas where the Javkhalant semi-desert steppe vegetation type (Section 2.6) is dominant. River crossings in this sector will be dominated by the typical riparian vegetation dominated by *Achnatherum splendens, Kalidimn faliatinim, Reammuria soongarica and Nitraria sibirica.* Elm trees are sparsely distributed along the river banks and will be avoided during road and power line construction.

South of Javkhalant Bag, road option 1, the preferred option, traverses 54 km of the sparse Galbyn Gobi desert plain vegetation type. Approximately 20 km north of Gashuun Sukhait, the vegetation is dominated by *Zygophyluim xantexylon, Anabasis*

brevifolia, Salsola passerina, Reamurria soongarica and *Sympegma regelii*, where the road corridor enters the low hills near the border checkpoint. This vegetation type continues into the SGSPA area.

Neither road option will disturb locally or regionally significant vegetation types. The playa vegetation community, tamarix dominated, and the saxaul and poplar communities located in the corridor will be avoided by the final road alignment.

A section of approximately 8 km of the power line route will traverse the playa vegetation type located west of the water exploration camp south of Javkhalant Bag centre. However, the power line construction will result in only temporary disturbance and selection of the maintenance track route will avoid individual large shrubs wherever possible.

Mitigation

The road and power line corridor will be constructed and operated to minimise impacts on flora using the following measures:

- All road construction, maintenance and power line construction work will be undertaken to minimise vegetation disturbance within the corridor. The movement of machinery and vehicles will be restricted using operation procedures to ensure that disturbance occurs within identified clearing lines.

- Areas temporarily disturbed through road and power line construction, including borrow pits, will be managed such that top soil and existing vegetation is removed and stockpiled adjacent to the area of disturbance and replaced on final restoration of the area. IMMI will implement appropriate restoration techniques to revegetate temporarily disturbed areas including borrow pits, road verges and areas disturbed during power line construction.

- Revegetation activities will be timed to avoid the period of strong winds during the spring period.

- IMMI will restore and rehabilitate informal tracks adjacent to the upgraded and constructed new road within the corridor. Old tracks will be shallow ripped (scarified) to prevent further vehicle use and encourage revegetation.

- Dust control and progressive sealing of the access road will minimise dust impacts on road side vegetation.

- The road and power line route will avoid disturbance to individual elm trees located along streams in the corridor and disturbance of tamarix shrubs within the dry playa lake will be minimised during power line construction.

3.6 Fauna

The road and power line construction of the Oyu Tolgoi to Gashuun Sukhait transport corridor has the potential to result in the following impacts on fauna within the corridor:

- Disturbance of significant habitat, including habitat of rare and threatened species listed in the Mongolian Red Book, during the construction of roads, river crossings and power lines.
- Increased traffic and average road speed on the road route has the potential to increase fauna deaths from vehicles.
- Improved road access along the route may increase hunting pressure on mammal species and birds.
- The migration of wild ass and gazelle may be impacted by the increase of traffic on the improved road.

The risks to significant fauna species from the road improvement is difficult to quantify due to the absence of research into habitat value, migratory routes and populations within the south Gobi Region generally. The SGSPA has been reserved due to its habitat value to threatened species and its relative isolation from hunting pressure and population impacts. However, the level of management within the SGAPA and resources available to manage and research internationally significant species is significantly lacking.

In terms of mitigation of risk to fauna, IMMI propose to support the improved management of wildlife protection and research in the SGSPA, buffer zones and the infrastructure corridor generally. Improved knowledge of populations, habitat use and migration will allow informed management decisions to be made both inside and out of the protected areas. The research will also assist IMMI in managing transport operations and infrastructure to minimise fauna impacts, and will, in time, result in the ability for local authorities to provide greater security for species of conservation significance.

In response to concerns raised by various Government authorities, IMMI propose to construct a fence on each side of the improved access road through the 13 km of the

SGSPA. The primary objective of the fence is to control unauthorised vehicle access outside of the corridor and to demarcate a clear management zone between the infrastructure corridor and the protected areas on each side. However, without appropriate design, the fence may also prevent wildlife migration between parts A and B of the SGSPA. It is therefore proposed to ensure adequate crossing zones are incorporated into the fence and corridor design.

Mitigation

The impacts on fauna from the proposed infrastructure corridor will be minimised and managed through implementation of the following measures:

- The road and power line construction will avoid areas of significant wildlife habitat. The construction of the powerline through the tamarix shrubland will be undertaken to minimise disturbance to this potentially significant area.

- The construction of the road will avoid river crossings near surface springs and other water resources used by local fauna.

- The construction of the fence along the corridor boundary through the SGSPA will ensure adequate facility to allow the migration of wildlife through the corridor and consider the potential vehicle traffic issues within migratory zones.

- A program of support for improved SGSPA management will include support for ranger training, ranger facilities and management capability to ensure improved protection of wildlife within the SGSPA.

- IMMI will support fauna research programs within the SGSPA, buffer zone and infrastructure corridor to improve the understanding of habitat, population and migration of significant conservation species and to assist IMMI in managing the provision of transport and power in a manner that minimises fauna impacts.

3.7 Small Gobi Strictly Protected Areas (SGSPA)

The objective of the impact assessment of the infrastructure corridor through the SGSPA is to maintain and enhance the environmental values of the protected area in accordance with the requirements of the Mongolian Law on Protected Areas. The law limits developments within protected areas but allows access roads where such roads are in accordance with management objectives.

The transport and power line traverse 13 km of Part B of the SGSPA to access Gashuun Sukhait. The identified preferred route, option 1, follows the existing route to the border crossing from the checkpoint (see Map 1). Over the last 5 years, the existing route has been used by traders during short term seasonal opening of the border. A temporary settlement at Tsasaan Khad, located at the entry to the SGSPA, is used by traders during the two week seasonal border openings. This area is severely degraded due to concentrated grazing, uncontrolled vehicle access and lack of appropriate waste disposal facilities. (Appendix F)

The construction of a formal access corridor through the SGSPA will significantly improve access to this remote border crossing. It is expected that the permanent opening of this border point will increase traffic through the SGSPA. This will potentially increase pressure on the protected area environment unless improved management and control of the area is implemented. The potential impacts from increased use of the access associated with project transport requirements include:

- Increased illegal hunting of game species.
- Unmanaged settlements close to the border will result in further degradation of the environment.
- Increased uncontrolled access to the SGSPA areas.
- Increased grazing pressure resulting from herders attracted by economic activity at the border point.

A number of positive outcomes have also been identified from the formalising of the access route and the investment of resources in infrastructure and management. These benefits and opportunities include:

- A dedicated upgraded road access through the SGSPA will remove the need for the multiple informal tracks currently traversing the area between Gashuun Sukhiat and Tsagaan Khad.
- The increased use of the access road and permanent border opening provides an opportunity to focus protected area management at the entrance to the SGSPA. The increased revenue from border trade and associated economic activity would provide sufficient resources for dedicated ranger facilities.
- The focus of economic activity at Gashuun Sukhait could result in improved settlement facilities for traders and various border authority, customs and protected area authority rangers. Improved facilities, including power, or fuel, and waste facilities would significantly reduce the impacts associated with the existing temporary settlements.

Mitigation

In addition to the opportunities mentioned above, IMMI propose to implement the following initiatives to minimise impacts and enhance the environmental values of the SGSPA during road upgrade and road and powerline construction:

- The infrastructure corridor will be limited to a width of 150 m for road and powerline easements through the SGSPA.
- The corridor will be fenced using a wire and picket stock fence, with appropriate gaps in the fence to allow the egress of migrating wildlife across the corridor.
- IMMI will rehabilitate informal tracks within the corridor that are no longer required once the road is constructed.
- Measures to support SGSPA management of the area will be initiated with agreement of the Protected Area Management Authority. Preliminary discussions with the Authority include Ivanhoe support for ranger training, a ranger facility at

the entry to the SGSPA and a commitment of support for on going management of the protected area for the period of mining operations at Oyu Tolgoi.

- IMMI will cooperate with appropriate Mongolian research organisations to institute long term funded research programs aimed at the conservation of the Asiatic wild ass and black tailed gazelle within the SGSPA. These research programs will be commenced at the construction phase of the project.
- IMMI will support measures to rehabilitate the area surrounding Tsagaan Khad.
- Activities within the SGSPA infrastructure corridor will be limited to road building, maintenance and powerline construction. Borrow pits and other materials will be sourced outside the SGSPA.
- The progressive sealing of the access road will be undertaken during the life of the Oyu Tolgoi Project. The section through the SGSPA will be a priority area for the commencement of this work.
- Dust control within the SGSPA corridor will include alternative surface treatments prior to sealing being completed.
- The transport of hazardous materials through the SGSPA corridor will be in accordance with relevant laws and standards, and transport procedures will be developed in consultation with the protected area authority.

3.8 Community

Thirteen nomadic herder families have been identified as using the infrastructure corridor from Oyu Tolgoi to Gashuun Sukhait for seasonal camp sites and grazing pasture. These activities are generally focussed around well sites as identified in Table 6 and Map 8. The low population density of the area will limit the potential for impacts associated with increased traffic and power line construction. However, there is potential for some disruption to the livelihood of these families should the project proceed without appropriate management measures. These potential impacts include:

- Increased dust and noise from vehicle traffic for camps located adjacent to the road.
- Increased dust and noise at the Javkhalant Bag centre.
- Impacts on shallow herder wells from water resources used for road construction.
- Loss of stock from road kill associated with increased traffic.

Mitigation

The implementation of the following mitigation measures is proposed to address the above issues:

- Maintain a minimum separation distance of 500m between the road alignment and herder camps or community facilities.
- Freight vehicles to comply with relevant Mongolian standards for noise emissions.
- Initially the unsealed road will have appropriate dust suppression applied during operations. The progressive sealing of the road will eventually resolve the dust issue.
- Water resources used for road construction, maintenance and dust control will be resourced from dedicated bores or wells in a manner that maintains local water supplies.
- Employment and training initiatives for construction and maintenance within the infrastructure corridor will target and give preference to local residents.

- IMMI will liaise and consult with local families using pastures within the infrastructure corridor to minimise the risk of stock loss from vehicle accidents through an assessment of well locations and grazing patterns.
- IMMI will assist the local community in accessing the imported power supply for the Javkhalant Bag centre.

3.9 Public Safety

The construction of road and powerline infrastructure from Oyu Tolgoi to Gashuun Sukhait will result in minimal public safety issues due to the very low population of the area. However, an assessment of the potential risks has identified the following potential public safety concerns:

- Increased traffic volume and road speed have the potential to increase road accidents. The preferred transport route is a public road currently used by freight trucks and local traffic. Average road speed will increase from approximately 40 km per hour on existing tracks, to 80 km per hour for an upgraded road. The volume of trucks using the road during peak production at Oyu Tolgoi will result in a significant safety risk without appropriate measures implemented.
- Power lines across the sparsely populated region may result in increased safety risk due to accidents and fallen power lines during storm events.
- Risks associated with the transport of hazardous materials will be increased with public use of the road.
- The section of road between Oyu Tolgoi and Javkhalant Bag centre is likely to require blasting of surface rock to allow construction of a suitable road alignment.

Mitigation

These issues are proposed to be managed through the implementation of the following measures:

- IMMI will apply appropriate safety standards, with legal compliance being a minimum requirement, for all vehicles and transport operations. Driver safety training will be required for freight drivers who will be competency tested on a regular basis.
- The design of the fully constructed road will be suitable for the safe operation of predicted traffic volumes and the size of trucks. IMMI, with local authorities and other road users, will continuously review the adequacy of the road and road surface to ensure public safety is maintained. The management of dust prior to road sealing will be a major component of maintaining safety.

- All power lines will meet appropriate minimum clearance levels as described in Table 2. The power line will be engineered to cater for local wind conditions and will be inspected at least weekly for faults or maintenance requirements.
- IMMI will implement appropriate procedures for the transport of hazardous materials and incident response. These procedures will, as a minimum, meet legal compliance and include the involvement of local authorities and community awareness programs.
- All blasting activities will comply with Mongolian laws and regulations. Nearby residents will be notified of blasting operations and appropriate safety exclusions will be maintained in accordance with accepted standards.

3.10 Cultural Heritage

The Institute of Archaeology at the Mongolian Academy of Science has completed a survey of potentially significant archaeological sites through the infrastructure corridor. A copy of the report is attached as Appendix G. The report identified numerous grave sites within the corridor shown on Map 11. The area of Javkhalant Bag centre and the low hills immediately north of Tsagaan Khad are the areas of highest concentration of grave sites. Several grave sites are located within 20m of the existing access track to Javkhalant Bag centre. However, the majority of the road and powerline routes traverse the broad flat Galbyn Gobi plain where no graves have been identified.

The construction of the road and power line have the potential to disturb sites of archaeological and cultural significance if identified sites are not adequately protected or if unidentified sites are uncovered during construction activities.

Mitigation

IMMI propose to manage the protection of cultural heritage sites in accordance with the following measures:

- The road and power line alignments will be designed to avoid disturbance of identified sites wherever possible. Where identified sites can not be avoided, an application for disturbance of the sites will be made to the Institute for Archaeology who will undertake excavations and issue clearances for disturbance in accordance with Mongolian Law.

- Where a site of potential cultural significance is identified during construction of roads and powerlines, the site will be reported to the authorities in accordance with the Mongolian Law on Cultural Protection. Further disturbance will not continue until official clearance is provided.

1.4 Road Construction and Transport - Assessment of Impacts

Table 8. Impact Assessment Table

No	Negative Impacts of Project	Expert evaluation of risk		
		High	Moderate	Low
1	Air quality and noise level of area: Increase dust emission during the use of upgraded roads and construction of new roads and power lines.	**H**	M	L
2	Increase the noise level of area from increased vehicle use.	H	**M**	L
3	Increase risk of road accidents from increased vehicle use and environmental conditions.	H	**M**	L
4	Increase vehicle exhaust emissions	H	M	**L**
5	Surface water drainage system: Changes to natural flow paths and increased erosion of banks along surface streams from the impacts of road drainage, floodway, and culvert or bridge construction	H	**M**	L
6	Changes to natural stream flow may have impacts on riparian vegetation, natural springs and shallow herder wells downstream	H	**M**	L
7	Increased risk of pollution of surface and groundwater from spillages and accidents associated with the transport of hazardous materials	H	**M**	L
8	Soil cover: Soil surface impacted from road construction with the upgrade of local roads resulting in a final surface width of 8 m and embankments of 3m on each side, having a total road width of 14 m.	H	**M**	L
9	The road construction will therefore result in approximately 150 ha of soil disturbance from road construction using road option 1 or 2	H	M	**L**
10	Approximately 14 borrow sites will be used for road upgrading, construction and maintenance. Each borrow site will have a maximum disturbance of 4 ha, resulting in a total disturbance of 56 ha of top soil	H	**M**	L
11	During transportation through this road should be pollute soil by hazardous chemicals while spilling them	H	M	**L**
12	The construction of 90 km of power line will result in temporary disturbance during construction of approximately 135 ha based on a 15m wide disturbance corridor for construction	H	**M**	L
13	Potential long term accumulation of metals from vehicle emission exhaust in soils adjacent to road route including: Pb, Br, Ce, Zn, Cd and F.	H	M	**L**
14	Vegetation cover: Approximately 150 ha of sparsely vegetated land will be temporarily disturbed by the road upgrade.	H	**M**	L
15	Temporary disturbance of 14 borrow sites will have a maximum disturbance of 56 ha of vegetation cover	H	**M**	L
16	Should be increase pollution of plants neighboring road with width 15 m on each side by vehicle emission elements mentioned above	H	M	**L**
17	Fauna: Disturbance of significant habitat, including habitat of rare and threatened species listed in the Mongolian Red Book, during the construction of roads, river crossings and power lines.	**H**	M	L
20	Increased traffic and average road speed on the road route has the	H	**M**	L

No	Negative Impacts of Project	Expert evaluation of risk		
		High	Moderate	Low
	potential to increase fauna deaths from vehicles			
22	Improved road access along the route may increase hunting pressure on mammal species and birds	H	**M**	L
23	The migration of wild ass and gazelle may be impacted by the increase of traffic on the improved road	H	**M**	L
24	SGSPA: Unmanaged settlements close to the border will result in further degradation of the environment	**H**	M	L
25	Increased uncontrolled access to the SGSPA areas and increased grazing pressure resulting from herders attracted by economic activity at the border point	H	**M**	L
26	Increased illegal hunting of game species	H	M	**L**
27	Community: Increased dust and noise from vehicle traffic for camps located adjacent to the road	H	**M**	L
28	Increased dust and noise at the Javkhalant Bag centre	H	M	**L**
29	Impacts on shallow herder wells from water resources used for road construction	H	**M**	L
30	Loss of stock from road kill associated with increased traffic	H	**M**	L
31	Public safety: The volume of trucks using the road during peak production at Oyu Tolgoi will result in a significant safety risk without appropriate measures implemented	H	**M**	L
32	Power lines across the sparsely populated region may result in increased safety risk due to accidents and fallen power lines during storm events	H	M	**L**
33	Risks associated with the transport of hazardous materials will be increased with public use of the road	H	**M**	L
34	The section of road between Oyu Tolgoi and Javkhalant Bag centre is likely to require blasting of surface rock to allow construction of a suitable road alignment – potential blasting impacts on local residents.	H	**M**	L
35	Cultural heritage: The construction of the road and power line have the potential to disturb sites of archaeological and cultural significance if identified sites are not adequately protected or if unidentified sites are uncovered during construction activities	H	**M**	L
	Total	3	23	9
	Percentage,%	8	66	26

No	**Positive impacts of Project**	**Expert evaluation**		
		High	**Moderate**	**Low**
1	The long term construction of a sealed road surface will reduce dust emissions currently experienced.	H	**M**	L
2	A dedicated road will significantly reduce the area of land and river bed disturbed from existing uncontrolled vehicle access.	H	M	**L**
3	The improvement of the road and crossings will reduce the risk associated with existing transport of hazardous materials	H	**M**	L
4	Upgrading the existing road surface and eventual sealing will reduce the current erosional processes affecting existing tracks	H	**M**	L
5	An improved road surface will allow the restoration of vegetation on existing multiple side tracks.	H	**M**	L
6	Old tracks will be shallow ripped (scarified) to prevent further vehicle use and encourage revegetation. So it will be used as pasture.	H	**M**	L
7	The bridges, culverts and other engineering constructions are good habitat place for reptiles and birds for hide shadows and cool places for hot season	H	**M**	L
8	Should be some animals come back and herd in the restored places existing local roads	H	M	**L**
9	A dedicated upgraded road access through the SGSPA will remove the need for the multiple informal tracks currently traversing the area between Gashuun Sukhiat and Tsagaan Khad	**H**	M	L
10	The increased revenue from border trade and associated economic activity would provide sufficient resources for dedicated ranger facilities	**H**	M	L
11	Improved facilities, including power and waste facilities would significantly reduce the impacts associated with the existing temporary settlements	**H**	M	L
	Total	3	6	2
	Percentage	27	54	18

*Summary conclusion**: 1. By the comparison of negative and positive impacts, 76 % of all impacts are negative, 24 % are positive impacts.***

1. ***From the results of percentage, 66 % of all negative impacts in moderate rate and 26% in low rate(together,92%).***
2. ***Generally, Negative impacts moderate to the environment of OT-Gashuun Sukhait Road and transport corridor construction and transport activity.***

1.5 Monitoring parameters and limitations

1.5.1 Monitoring parameters and standards for sampling and analysis

Table 9. Monitoring parameters and standards for sampling and analysis

No	Monitoring parameters	Standards and methods
	For the air quality and impacts on air : Dust in air, SO_2, NO_2, CO_2, Pb	MNS 4585-98, MNS 3384:1982 for the sampling MNS 0017-2-5-11:1988 for nitrogen dioxide MNS 0017-5-1-20:1992 for exhaust from diesel engine, MNS 0017-5-1-22:1992 for emission toxic elements from using gas, MNS 4048:1988 for the dust analyses.
2	Soil contamination and degradation. Physical properties, humus, total nitrogen, carbonate, Ca, Mg, P_2O_5, K_2O and pH of soil, Pb, Cd, As, Zn and Ce	MNS 3297:1991 for sampling soil MNS 3307:1998 and MNS 3308:1998 for chemical contents of soil MNS 3309:1998 for the soil salts MNS 3675:1984for determine the organic contents, MNS 4006:1987 exchangeable cations
3	Vegetation condition Density Average height Dominant species.	Instruction for field survey records of plants, Institute of Botany, 1992, Questionnaire for field records
4	Surface and well water: PH, TDS (grav), Total Hardness (CaCO3) Ca, Mg, Na, K, SO_4, NO_2, NO_3, NH_4, As, Cd, Cu, Hg, Pb, Zn, Cr, Fe, Ni, Taste, smell, colour	MNS (ISO) 4867:1999 for sampling and storing samples, MNS 4586:1998 for water quality MNS (ISO) 5667-14:1998 for sampling and transportation guidelines. 13.060.50 Standards for chemical contents of water
5	Fauna Visual observations	Instruction for field survey records of wild animals, Institute of Biology, 1992, Questionnaire for field records
5	Monitoring of SGSPA impacts	The law on SPA, regime of SPA limited zone,

1.5.2 Some Important Standard Limitations

Table 10. Mongolian National Air Quality Standards (MNS 4585-98)

Index	Test's condition	Unit of measures	Permit rate	Method of analysis
Admixture of gas				
Sulphur dioxide (SO_2)	During 20 minute Average per day	Mg/m^3	0.5 0.03	Ararozalin MNS- 0017.2.5.12-88 Pulse UV fluoresce
Carbon monooxide (CO)	During 20 minute Average per day	Mg/m^3	8 3	NDIR and Gas correlation
Nitrogen dioxide (NO_2)	During 20 minute Average per day	Mg/m^3	.085 0.04	Griss-Elovsk MNS 0017.2.5.11-88 Chemi-luminescence
Ozone (O_3)	Average of hour	Mg/m^3	120.0	UV photometric method
Dust				
Dust (SPM)	During 20' Average per day	Mg/m^3	0.5 0.15	Weight method Air pump
Lead	Average per day	Mg/m^3	.001	ASS and X-ray fluroscense
Benzo/a/pyren	Average per day	Mg/m^3	0.001	Solution chromatography -Gas chromatography

Table 11. MNS 4586-98 Mongolian National Standard for water quality

No	Name of index	Unit of measures	Maximum Concentration
1	PH		6.5-8.5
2	Dissolved oxygen O_2	mgO/l	>6 and 4
3	Biochemical oxygen demand BOD	mgO/l	3
4	Chemical oxygen demand COD	mgO/l	10
5	Ammonia nitrogen NH_4	mgN/l	0.5
6	Nitrite ' s nitrogen NO_2-N	mgN/l	0.02
7	Nitrate ' s nitrogen NO_3-N	mgN/l	9.0
8	Mineral phosphorus (PO_4-P)	mgP/l	0.1
9	Chlorides Cl	mg/l	300
10	Fiuorine F	mg/l	1.5
11	Sulphates SO_4	mg/l	100
12	Marganese Mn	mg/l	0.1
13	Nickel Ni	mg/l	0.01
14	Copper Cu	mg/l	0.01
15	Molybdenum Mo	mg/l	0.25
16	Cadmium Cd	mg/l	0.005
17	Cobalt Co	mg/l	0.01
18	Lead Pl	mg/l	0.01
19	Arsenic As	mg/l	0.01
20	Total chromium Cr	mg/l	0.05
21	Chrom $Cr^{6`+}$	mg/l	0.01
22	Zinc Zn	mg/l	0.01
23	Hg	mkg/l	0.1
24	Mineral oil	mg/l	0.05
25	Phenols	mg/l	0.001
26	Detergents	mg/l	0.1
27	Benzo/a/pyren	mkg/l	0.005

ENVIRONMENTAL PROTECTION PLAN for TRANSPORT AND INFRASTRUCTURE CORRIDOR OF OYU TOLGOI-GASHUUN SUKHAIT (OT-GS)

Total expenses for implementation EMP:

In MNT 412.000.000.00

as March,1,2004

9.1 Environmental Protection Plan

The Environmental Protection Plan (EPP) provided here is a summary of proposed actions and commitments to manage the environmental impacts of the infrastructure corridor as discussed in the previous sections. The EPP is developed to meet the requirements of the Mongolian Environmental Impact Assessment Procedures and the specific guidelines for the Oyu Tolgoi Project issued by the Ministry of Nature and Environment (MNE) in March 2003 and as attached as Appendix . This plan establishes the objectives and schedule of activities to protect identified environmental values. Further detailed management protection plans will be developed prior to construction and operation.

The estimated forecast expenditure for each item is provided in accordance with the guidelines. These estimates are for works directly related to environmental protection and do not include the costs associated with design outcomes that have environmental benefits or that reduce impacts. It should also be noted that these environmental protection measures relate only to the activities associated with the operation of the Oyu Tolgoi project and that the use of the transport and infrastructure facilities by other parties is outside the direct control of IMMI.

Table 9.11 Environmental Protection Plan

no	Environmental Factor	Potential Impact	Required Mitigation	Period or frequency of	Predicted Expenditure (estimate) (1000Tugrics)	Legal or Policy Obligations
1	**Air Quality**	Dust emissions during road upgrade, road construction and power line construction	Dust control measures will be applied to all construction activities and will include: Use of water sprays during construction and upgrading Protecting top soil stockpiles from wind exposure	During the upgrading and construction (2004- 2008)	20 000	Law on air and air pollution MNS 0017-2-3-16:1998 (at residential areas)
		Dust emissions from vehicles using the unsealed road	Road surface to be sufficiently treated to minimise dust emissions. Treatment options include water or binding agents.	During project use of the unsealed road	60 000	Law on air and air pollution MNS 0017-2-3-16:1998 (at residential areas)
		Vehicle Emissions	Vehicles using the road route to be maintained so as to meet emission standards	During project use of road	No direct cost	Petrol engines MNS 5013:2003 Diesel engines 5014:2003
2	**Noise**		The road will avoid existing residential areas such that the traffic noise received at any existing residence is within National Standards. A minimum setback of 500m will be maintained between the road and residents or community facilities.	Final road design	No direct cost	MNS ISO 226:2003

Table 9.11 Environmental Protection Plan

no	Environmental Factor	Potential Impact	Required Mitigation	Period or frequency of	Predicted Expenditure (estimate) (1000Tugrics)	Legal or Policy Obligations
3	**Water Resources**	Impact of stream beds by construction of crossings, culverts and drainage may impact stream flow, springs and riparian vegetation.	Design stream crossings to maintain flow regimes; Crossings will avoid surface springs and large trees; Design road drainage to minimise impacts on surface streams	Design	No direct costs	
		Stream crossing may restrict natural flow if not maintained	Ensure removal of debris and maintenance of culverts after flow event	During Operation	10 000	
		Potential erosion of stream banks from disturbance associated with road and crossing construction	Minimise disturbance to stream banks during construction. Restore and protect disturbed stream banks to minimise risk of erosion.	Construction	Restoration costs approx' 20 000	
		Potential risk of contamination of streams from loss of oils and fuels during crossing construction.	No refueling near river beds will occur Storage of fuels/oils will be a minimum of 100m from stream beds Emergency response procedures will be developed to include fuel/oil spills and remediation requirements	Construction	Emergency response procedures and equipment – 5000	

Table 9.11 Environmental Protection Plan

no	Environmental Factor	Potential Impact	Required Mitigation	Period or frequency of	Predicted Expenditure (estimate) (1000Tugrics)	Legal or Policy Obligations
	Water Resources (cont'd)	Potential risk of contamination of streams from accidents involving hazardous material transport	Develop a hazardous material transport plan in consultation with Soum, Aimag and National Government to meet national and appropriate international standards, Prepare emergency response procedures that include response to hazardous material spills and remediation requirements.	Prior to transport of hazardous materials	Hazardous material transport procedures and training 5000 Emergency response procedures and training 5000	
		Use of groundwater during construction may impact shallow herder wells and natural springs.	Obtain water supplies for road construction and operations in a manner that maintains existing herder wells and natural springs Implement a monitoring program for herder wells and springs along the transport route. Include water quality and quantity.	Prior to construction through to end of operations	Monitoring program: 20 000	
4	**Soil Resources**	Soil disturbance from road and power line construction	Soil disturbance will be minimized by using existing road alignments where possible. Where topsoil is to be disturbed, the material will firstly be stockpiled for later restoration. For material borrow pits, top soil will be replaced and pits will be re contoured to minimise erosion and promote revegetation.	During construction	Road, power line and borrow pit soil restoration 44 000	Law on land rehabilitation and on environment and their items. MNS 3473:1983 Environment. Land. Land use. Terminology and determination.

Table 9.11 Environmental Protection Plan

no	Environmental Factor	Potential Impact	Required Mitigation	Period or frequency of	Predicted Expenditure (estimate) (1000Tugrics)	Legal or Policy Obligations
	Soil Resources (cont'd)	The road upgrade and construction will reduce the area of soil disturbed from informal tracks	Old tracks alongside the new and upgraded road will be scarified to promote revegetation and soil restoration.	During construction	20 000	
		Loss of soils near river crossings and culvert discharges from changes to drainage and natural flow.	Include soil erosion protection measures in floodway and crossing designs, and protect culvert discharges.	Design and construction	15 000	
5	**Vegetation**	Loss of vegetation from road upgrade, borrow pits and power line construction	Rehabilitate temporarily disturbed areas through top soil replacement, contouring, scarifying and, where necessary, consider seeding or planting. Minimise vegetation disturbance during construction and road maintenance through the control of vehicle movement and applying clearing lines.	Following Construction During construction and maintenance	18 000	Law on land, rehabilitation and on environment and their items and MNS 4918:2000 Environment. Basic requirement for replantation of destroyed land
		The road upgrade and construction will reduce the area of vegetation disturbed from informal tracks	Old tracks alongside the new and upgraded road will be scarified to promote revegetation and soil restoration.	During construction	20 000	

Table 9.11 Environmental Protection Plan

no	Environmental Factor	Potential Impact	Required Mitigation	Period or frequency of	Predicted Expenditure (estimate) (1000Tugrics)	Legal or Policy Obligations
	Vegetation (cont'd)	Loss of riparian vegetation from changes to stream flows near river crossings	Crossing design will ensure that crossings are located away from significant stands of elm trees. Crossings will be designed and maintained to ensure that natural flow is maintained.	Design and road maintenance.	No direct costs	
6	**Fauna**	Fence through SGSPA may hinder migration of wildlife	Design of fence to include regular gaps to allow egress of animals. Fence to be designed in consultation with SPA authority.	Design	No direct costs	
		Potential impact on migratory fauna are unknown	IMMI to support and contribute to fauna research, particularly Asiatic wild ass and black tailed gazelle within the SGSPA. Research will be cooperative with existing Mongolian research facilities. Ensure road drainage and embankment design allows for uninhibited crossing of migratory wildlife.	Construction through operation Design	50 000 over the period of operation at OT	

Table 9.11 Environmental Protection Plan

no	Environmental Factor	Potential Impact	Required Mitigation	Period or frequency of	Predicted Expenditure (estimate) (1000Tugrics)	Legal or Policy Obligations
	Fauna (cont'd)	Increased access of the border area may result in increased hunting and other pressures on fauna species.	Contribute to the improvement of ranger services and facilities at the SGSPA, including: Assistance to ranger training programs in cooperation with the SPA Authority; Assistance in provision of ranger facilities at the SGSPA in cooperation with the SPA Authority	Construction through operation	100 000 over the period of operation at OT	
Estimated cost of Infrastructure Corridor Environmental Protection Plan for the design, construction and operational period					**412 million Tg**	

9.2 Environmental Monitoring Plan

The Environmental Monitoring Plan (EMP), Table 9.12, includes a description and schedule for the measurement of environmental parameters required to ensure that IMMI's activities in relation to the Oyu Tolgoi to Gashuun Sukhait infrastructure corridor are within the criteria, standards and limits established in the EPP and EIA. The EMP is relates directly to the commitments included in the EPP where such commitments are quantitative in nature.

In accordance with Mongolian Law on Environmental Protection, Law on Environmental Impact Assessment and Minerals Law, IMMI will undertake monitoring at its own expense using approved methods and accredited facilities. The monitoring information will be submitted to relevant Soum, Aimag and Central Government Organisations on an annual basis for review.

Environmental monitoring procedures will be developed by IMMI to ensure that sampling, equipment and analysis are undertaken in a manner that provides results of acceptable accuracy. Training of environmental monitoring employees will be included in the training program for the Oyu Tolgoi project.

Table 9.12 Environmental Monitoring Plan

No	Monitoring Parameters	Recommended Location of monitoring	Period and Frequency of monitoring	Preliminary Cost Estimate (Thousand Tg)	Standards and Methods
	Air Quality: **Dust Monitoring** Total Suspended Particulate, PM10 **Gaseous Emissions** SO_2, NO_2, CO_2,Pb	Oyu Tolgoi Project Area, Javkhalant Bag centre, Khongor Ovoo, Tsagaan Khad, and Gashuun Sukhait.	**Dust Monitoring**: Monthly during road upgrade, construction and sealing works. Quarterly during operation of the unsealed road. **Gaseous emissions** Annually following commencement of operation of the access road	20 000 20 000	MNS 4585-98, MNS:3384:1982 for the sampling, MNS: 0017-2-5-11:1988 for nitrogen dioxide, MNS:0017-5-1-20:1992 for exhaust of smoke from diesel engine, MNS:0017-5-1-22:1992 for emission toxic elements from using gas, MNS:4048:1988 for the dust analyses.
2	**Soil Condition and Contamination:** Physical properties, organic content, total nitrogen, carbonate, Ca, Mg, P_2O_5,K_2O and pH of soil, Pb, Cd, As, Zn and Ce	Umdai river crossing point, Khongor ovoo, Tsagaan Khad, Gashuun Sukhait border point	Annually commencing during construction and upgrading of existing road.	15 000	MNS:3297:1991 for sampling soil, MNS:3307:1998 and MNS:3308:1998 for chemical contents of soil, MNS:3309:1998 for the soil salts, MNS:3675:1984 for determine the organic contents, MNS:4006:1987 Exchangeable cations

Table 9.12 Environmental Monitoring Plan

No	Monitoring Parameters	Recommended Location of monitoring	Period and Frequency of monitoring	Preliminary Cost Estimate (Thousand Tg)	Standards and Methods
3	**Vegetation:** Plant density, distribution and condition in $25m^2$ plots	Umdai River crossing point, Khongor Ovoo, Tsagaan Khad, Gashuun Sukhait.	Quarterly during road construction and annually during operation	25 000	Instruction for field survey records of plants, Institute of Botany, 1992, Questionnaire for field records
4	**Water Quality**: PH, TDS (grav), Total Hardness (CaCO3) Ca, Mg, Na, K, SO_4, NO_2, NO_3, NH_4, As, Cd, Cu, Hg, Pb, Zn, Cr, Fe, Ni, Taste, smell, colour	Maanit Spring Takhilt well Naimaa us Ikh Gunii sair, Tsagaan Khad well	Quarterly during the upgrading and sealing of the road and 2 times per year during the transport operations	50 000	MNS(ISO):4867:1999 for sampling and storing samples, MNS 4586:1998 for water quality, MNS(ISO):5667-14:1998 for sampling and transportation guidelines. MNS 13.060.50 Standards for chemical contents of water
5	**Fauna:** Wildlife research programs to be initiated with Mongolian research facility – population, migration, species diversity	Throughout the infrastructure corridor from OT to Gashuun Sukhait	Annually commencing at construction and continuing during transport operations	100 000	Instruction for field survey records of wild animals, Institute of Biology, 1992, Questionnaire for field records

Table 9.12 Environmental Monitoring Plan					
No	**Monitoring Parameters**	**Recommended Location of monitoring**	**Period and Frequency of monitoring**	**Preliminary Cost Estimate** (Thousand Tg)	**Standards and Methods**
5	**South Gobi Strictly Protected Area:** Cooperate and support ranger monitoring near the transport corridor through the SPA. Develop monitoring station to include : climate, dust, soil, flora, fauna and water quality	Within the corridor area of the SGSPA and surrounding area	Monthly monitoring program to be coordinated with rangers and SPA Authority	75 000	The law on SPA, regime of SPA zone,
Total Estimated cost for environmental monitoring during infrastructure corridor construction and operation				**305 Million Tg**	

CONCLUSION

Based on the results of the Environmental Impact Assessment on the infrastructure strip between Oyu Tolgoi and Gashuun Sukhait, the following general conclusions have been made:

1. Through bilateral border and trade agreement between Mongolia and the People's Republic of China, Gashuun Sukhait border crossing, located in Khanbogd Soum of the South Gobi aimag and "B" section of the Small Gobi Strictly Protected Area, has been designated as a border trade area. Traders from nearby soum, aimag, and the capital come on a seasonal basis to engage in commerce and this activity could further expand in the future. In doing so, it is important that the requirements in conducting activities in the SPA are fully met, the rules of the limited zone are strictly followed, and that all measures (as stated in EPP and EMP) are taken in improving the management of the Small Gobi Strictly Protected Area, streamlining the operations, and upgrading the capabilities in connection with the local environmental protection authorities.
2. The area covering the Oyu Tolgoi - Gashuun Sukhait infrastructure corridor is currently in its natural state with its sensitive characteristics of the Gobi ecosystem. Most of the corridor goes through the desert and desert-like steppes of the Galbyn Gobi. All research information regarding this region's current condition and unique aspects are included in this report.
3. There is a plan to improve and upgrade the gravel road at the Oyu Tolgoi - Gashuun Sukhait infrastructure corridor currently used by local traders and border protection post employees. Given that other project activities such as constructing power lines have been evaluated in the category of "moderate" in terms of their environmental impact, it has been determined that this Project should be implemented.
4. It is required that measures should be taken to minimize the negative impacts outlined in this report and that the Environmental Protection Plan and Environmental Monitoring Program are fully implemented when improving, construction and transporting through the road and constructing and using power lines and other infrastructure facilities within the infrastructure corridor.

REFERENCES

1. Soil study Moscow, 1972

2. V.G.Miniev Agrochemical ecological issues Moscow, 1982

3. Agrochemistry Moscow, 1989

4. O.Bekhtur Soil study Ulaanbaatar, 1986

5. N. Ulziikhutag Plants of Mongolia Ulaanbaatar, 1998

6. The red book of Mongolia Editor in chief Ts. Shiirevdamba, Ulaanbaatar, 1998

7. J. Sanjid. Field survey report of vegetation cover through the road routes OT-Gashuun Sukhait, November, 2003

8. D. Myagmarsuren Special Protected areas of Mongolia., Ulaanbaatar, 2000.

9. S. Amgalanbaatar, S.Dulamtseren, Alois Leagle, Steppe ungulates winter distribution and herd structure in Small Gobi Area. Scientific Papers of Institute Biology, Academy of Sciences Mongolia., Volume-23, Ulaanbaatar,2001. p39-46.

10. D.Enkhbileg, S.Dulamtseren, Z.Namshir, L.Sandui, Richard Reading and Joel Berger. Distribution and population of the Asiatic Wild Ass in the Small Gobi Strictly Protected Area, adjacent territory. Scientific Papers of Institute Biology, Academy of Sciences Mongolia., Volume-23, Ulaannbaatar,2001. p105-116.

11. A. Bold. Field survey report for EIA Road and transport corridor of OT-Gashuun Sukhait, December,2003

12. Umnugobi aimag, Statistical data, 2003

APPENDIXES

Appendix A. Relating legal aproval and documents

Appendix B. Road design and scoping parameters and Informations of freight

Appendix C. Power construction design parameters and Informations of power demand

Appendix D. Additional information tables of OT- GS Infrastructure Corridor Area Environment

Appendix E. Map attachments

Appendix F. Photo attachments

Appendix G. Archeological and cultural sites information in the OT-GS Infrastructure Area