DISTRICT SURVEY REPORT

The main objective of the preparation of District Survey Report, as per "The Sustainable Sand Mining Guideline" is to identify the areas of aggradations or deposition where mining can be allowed; and identification of areas of erosion and proximity to infrastructural structures and installations where mining should be prohibited and calculation of annual rate of replenishment and allowing time for replenishment after mining in that area.

1. Introduction

Minor Mineral Deposits:

1.1 Faridabad district of Haryana is located in South-eastern part of Haryana State and lies between 28^{O}31'17.69" to 28^{O}8'19.3"North latitudes and 77^{O} 07'34.29" to 77^{O}32'16.36" East longitudes. **The total** area is **2151 square kilometers**, in which there are 62 villages, 2 towns, 2 tehsils and 1 sub-tehsils. . Large part of the district of Faridabad is situated between Aravalies in west and river Yamuna in east. Faridabad district is bounded by the state of Delhi in the north, by the state of Uttar Pradesh in the east, in west by Gurugram district and south by Palwal and Mewat Districts.

1.2 The district has a sub-tropical continental monsoon climate where we find seasonal rhythm, hot summer, cool winter, unreliable rainfall and great variation in temperature. In winters, frost sometimes occurs during December and January. The district also gets occasional winter rains from cyclones. The rain fall is mostly restricted to rainy season. The district has Aravali hills in the West and flood - plain along the Yamuna river in the east.

1.3 River Sand (Minor Minerals) finding use as construction material are found in the river bed areas and flood plain areas. The size and the concentration of material

gradually reduce towards down stream as the heavy material of larger size settles with reduction in flow of water stream. The material deposits are found in villages of the districts located along the river or their flood plains and abandoned water courses/drains.

Quartzite (Minor Minerals) is also found in hilly areas of Aravali within jurisdiction of district Faridabad extending from North-West of the district to South-West of the district sharing with District Gurgaon.

1.4 The water of river Yamuna is diverted partly towards Uttar Pradesh and Haryana for different Canal Systems for Irrigation purposes. In the main river bed area, the maximum water is only due to release of water from Kalindikunj Barrage during rainy seasons. The water released in the river during rainy season brings huge quantity of Sand which gets deposits in the river bed area.

1.5 Part area of river Yamuna in the State of Uttar Pradesh and part area falls in the State of Haryana. Though in general river Yamuna acts as natural boundary between the two state i.e eastern part in Haryana and western part in Uttar Pradesh. However at certain places, the entire area of river (both sides of river bank) falls in either of the State. In other words there are areas of river where entire riverbed area falls within the jurisdiction of Haryana or Uttar Pradesh.

Location Map of Mineral Bearing Areas:

1.6 The minor mineral deposits in the district Faridabad can be divided mainly in two locations / blocks marked on a map prepared by joining **Survey of India Top Sheets** of the area (**Annexure "D").** The areas broadly can be divided in following Two categories for the purpose of location and type of areas :

(i) Area in river Yamuna for excavation of **Sand [Location A]**

(ii) Area in Aravali hill range[**Location B**]

This report primarily relates to Location A as a litigation regarding location B is pending for adjudication in Hon'ble Apex court.

Apart from above, Ordinary Clay/Ordinary Earth/Brick earth is also extencively available thrught the district.

2 Overview of Mining Activity in the District

Grant of Mineral Concessions for Mining of Minor Minerals.

2.1 Mode of grant of mineral concession

Before giving details of actual sites / number of sites or mineral concessions it would be appropriate to explain that the Mineral Concession in respect of minor minerals are granted as per provisions of the State Rules, framed by the respective State Governments in exercise of power under section 15 of the Mines and Minerals (D&R) Act, 1957.

2.1.1 The State of Haryana at the time of bifurcation in 1966, opted prevailing Rules namely "Punjab Minor Mineral Concession Rules 1964". These Rules were amended from time to time as per policy of the State Government for Minor Minerals. The Hon'ble Supreme Court vide its order dated 27.02.2012 directed all State Governments to revise their State Rules making provisions in accordance with various recommendations contained in the report of the 'Group' of MoE&F, GoI, on mining of minor minerals and the Model draft guidelines issued by the Ministry of Mines, GoI.

2.1.2 Accordingly, the State of Haryana comprehensively revised its State Rules namely, the "Haryana Minor Mineral Concession, Stocking, Transportation of Minerals, and Prevention of Illegal Mining Rules, 2012", repealing the prevailing Rules namely

"Punjab Minor Mineral Concession Rules 1964".

2.1.3 The mineral concessions in the Haryana are being granted in the form of **"Mining Contract"** or **"Mining Lease"** through competitive bidding process. The Mining Contracts are granted for a minimum period of 07 years and maximum period of 10 years. Whereas the Mining Leases are granted for a minimum period of 10 years and maximum period of 20 years

2.1.4 In district Faridabad mineral concessions for Yamuna River bed are/were granted in the form of Mining contacts. The areas selected for mining in river bed are allowed to excavate mineral in the central 3/4th of river bed that too up to a maximum depth of 03 meters from existing level of river bed. Further following conditions are also being imposed for excavation of minor mineral(s) from river beds in order to ensure safety of river-beds, structures and the adjoining areas:

(i) No mining would be permissible in a river-bed up to a distance of five times of the span of a bridge on up-stream side and ten times the span of such bridge on down-stream side, subject to a minimum of 250 meters on the up-stream side and 500 meters on the down-stream side;

(ii) There shall be maintained an un-mined block of 50 meters width after every block of 1000 meters over which mining is undertaken or at such distance as may be directed by the Director or any officer authorized by him;

(iii) The maximum depth of mining in the river-bed shall not exceed three meters measured from the un-mined bed level at any point in time with proper bench formation;

(iv) Mining shall be restricted within the central 3/4th width of the river/ rivulet;

2.1.5 The method of excavation for mineral as stated above takes place only up to a maximum depth of 03 meters in the Central 3/4th part of the river bed. The area left on both side of the river bank not only ensures the safety of banks(bank cutting due

to water stream) but also ensures that in the central part of river, water stream flows smoothly during rains and process of river meandering does not occur. The light weight excavator/JCBs are being deployed to remove mineral from river bed up to maximum depth of 03 meter layer from general level of the bed. The mineral excavated is directly loaded in the vehicles/dumpers and the vehicles owners and drivers take away the mineral directly to the stone crushers or screening plans or consumers. In certain cases mineral concession holders stacks mineral on the river bank in case are not able to sell the material on actual mining itself

2.1.6 Further **in case** of excavation of Ordinary Clay/Ordinary Earth/Brick Short Term Permits are being issued to either the owner of the land or to a person/owner of Brick Kiln, having consent from the owner of the land. The Short Term Permits are being issued under rule 6, 30 and 31 of the **"**Haryana Minor Mineral Concession, Stocking, Transportation of Minerals, and Prevention of Illegal Mining Rules, 2012".

2.A. Method of Mining in river bed areas (semi-mechanized/mechanized or manual)

2.A.1 The Hon'ble NGT with regards to river bed mining has specifically desired to examine the mode of mining – shall the same be **semi mechanized /mechanized or manual**.

2.A.2 There is no specific definition of **Semi – Mechanized Mining.** The term Semi – mechanized mining in general is used were method of working in general are undertaken mechanically, however, some operations are also undertaken manually. Therefore the semi mechanized mining or mechanized mining, is the same method of working. Sometime mechanized mining with light machines are also referred as semi- mechanized mining. The term semi mechanized mining is being used in general parlance where in the very same mining area in part area as per requirement manual mining is also under taken along with mechanized mining of manual sand/river bed mining.

2.A.3 Whereas **Manual** mining operations are undertaken using conventional hand tools only like chisel, hammer and crowbar etc. and operations are only labour intensive. As per requirement manual lifting of sand and directly loading the sand in tractor trolleys etc. through labours itself.

2.A.4 The **Mechanized** mining operations in respect of sand mining are undertaken with the help of excavator-cum-loaders. In this process sand is lifted/excavated from the river bed through excavator-cum-loaders and directly loaded in dumpers or other mode of transport. The vehicles carrying the mineral from mines to site of use/ site of construction or sale stocks outside lease hold areas (*an independent business than that of mining*).

2.A.5 **I**n the current scenario it is impractical to undertake manual mining beacuase :

(i) The labours are not easily available;

(ii) Manual mining cannot be undertaken in systematic and scientific manner as compared to mechanical mining which can be undertaken systematic/ scientific and controlled mining.

(iii) In case of manual mining to achieve desired level of production more number of manpower would be required meaning thereby human interface within river bed area would increase and more ecological damage would be caused.

2.A.6 The method of mining even otherwise can not be uniform even for same area and all the methods have their own pros and cons, however, considering the current scenario wherever feasible mechanized (semi-mechanized or mechanized is same thing) mining should be preferred over manual method.

2.B Regulation relating to Mining

2.B.1 As per prevailing State Rules the Mineral Concession holders are required to get a Mining Plan for the area prepared from a **"**Registered Qualified Persons". The mining plan includes the area specific details along with the Mine Closure Plan (Progressive & Final) taking into consideration the details of the geology and lithology of the area including the estimated mineral reserves of the area. Proposed method of mining/ development of mines, use of explosives and blasting operations, if any, stacking and disposal of minerals,

mine-drainage pattern, handling of the overburden, location of weigh bridges, and mineral processing, if any. The extent of manual mining or mining with the use of machinery and mechanical devices along Level of Production (production from year-to-year for a period of five years), Mechanization, Type of Machinery to be used, nature and extent of the mineral body/ spot or spots where the mining operations are proposed to be undertaken; natural water courses, limits of mineral reserves and other forest areas and density of trees, if any, assessment of impact of mining activity on land surface and environment including air and water pollution i.e. the environment management plan. In addition to this Mining plan also suggests the details of scheme of restoration/ rehabilitation of the area through aforestation, land reclamation, use of pollution control devices and such other measures as may be directed by the State Government from time to time.

2.B.2 The Mining Plan are to be got approved from the authorized officer of the State Government. Based on mining plan prior environmental clearance from the competent authority as per provisions of EIA Notification dated 14.09.2006 of MoEF, CC, GoI.

2.B.3 After obtaining the Environmental Clearances as Further, to comply with requirement of Air Act, 1981 the consent to establish and **"consent to operate"** from State Pollution Control Board are also obtained before actual mining

2.B.4 The above said provisions mainly relates to mineral conservation and environmental protection. With regards to provisions related to safety in mines and welfare of labors provisions under the Mines Act, 1952 are ensured by the Directorate General Mines Safety a department under the Ministry of Labour, Government of India.

3 The List of Mining Leases in the District with location, area and period of validity

Areas selected for Mining in District Faridabad

3.1 As per rough estimate total area of rivers beds passing through district Faridabad is about **9 sq. km**. Further recommendation of CEC for approximately 600 Hectares out of entire Aravali range within Faridabad is pending approval before Hon,ble Supreme Court Of India which is also having mineral deposits. As regards selection of area for mining it may be pointed out that:

(i) Earlier, (about 16-18 years back) mineral concession/mining contracts were being granted for extraction of sand from river Yamuna of district Faridabad on revenue estate basis, subject to various restrictions. The mineral concession holders used to undertake mining in areas after leaving restricted area.

(ii) Initially about **28 villages (includes 12 villages of present district Palwal)** during joint Faridabad were being offered for mining, as area of some of the villages came under other restrictions either because of construction of some bridges on river bed or due to other development projects including habitation.

(iii) The mode of grant of mining contracts of individual quarries/revenue estates in Faridabad district was changed in late nineties and instead granting individual quarries on contract, number of adjoining quarries were clubbed for the purpose of granting mineral concession. On 18.04.2000, three zones namely Agwanpur-Basantpur Zone, Chandpur Zone and Murtzabad Zone were auctioned for three years. This mode was further changed and all minor mineral quarries of the district were given "as one unit". In this way their used to be a single contractor for all minor mineral quarries of a **"district as one unit"** from 03.06.2003 for a period up to 28.02.2010.

*(iv) Needless to state that such **mineral concession areas** use to have even the areas having no mineral deposits the areas otherwise not permissible for mining. The mineral concession holders were under obligation to undertake mining only in the areas free from all restriction and as per prevailing all Rules and Regulations. Mineral Concessions for minor Mineral prior to 14.09.2006 were not required to obtain environmental clearance.*

(v) The EIA notification dated 14.09.2006 became applicable for fresh contacts/ leases and in the year 2008 for grant of mineral concessions in respect of other areas in the State fresh auction was notified subject to condition that mining will be allowed

to be undertaken only after prior environmental clearance is obtained as per requirement of EIA notification dated 14.09.2006 of MoEF,CC, GoI**.** However, said condition was challenged by some prospective bidders on the plea that the notification dated 14.09.2006 was not applicable for mining of minor minerals.

(vi) The operation of notification dated 14.09.2006 for mining of minor mineral was stayed by the Hon'ble Punjab and Haryana High Court vide its interim order dated 07.04.2008 in CWP No. 4578 of 2008- Chandi Mandir Stone Crusher Consumer Company Vs. Union of India and Others.

(vii) The State could not have granted long term contracts during the pendency of said case because operation of the notification was under stay and in case long term contracts were granted the mineral concession holders would have claimed that at the time of grant the notification was not applicable for them or may have sought to cancel the contract.

(viii) Subsequently, the Hon'ble High Court on 15.05.2009 while disposing of the above said writ petition (along with CWP no 20134 of 2004 Vijay Bansal V/s State) upheld that notification dated 14.09.2006 was applicable for mining of minor mineral also.

(ix) However, as regards the process of obtaining the prior environmental clearance, the Hon'ble High Court directed the process to be followed in two parts. In the first stage, it was directed that the state of Haryana would submit the ToRs to the EAC and the EIA report will be prepared by Expert Appraisal Committee (EAC) in the MoEF, GoI before conducting the auctions. Subsequent to the holding of the auctions, the successful bidder shall obtain the prior environmental clearance from the competent authority.

(x) The Hon'ble High Court, considering that some time would be required for completing the process as per above, and general public would face problems due to sudden closure of mining, permitted mining without environmental clearance for the period up to 28.02.2010.

(xi) Accordingly, no long term contact in Faridabad area could be granted due to above litigation and after expiry of the last contact the mining operations was allowed in district Faridabad (as well as in other part of the state) for the period of up to 28.02.2010 without environmental clearance as per orders of Hon'ble High Court.

(xii) However, the order dated 15.05.2009 of Hon'ble High Court relating to preparation of EIA report by the State Government was not acceptable to the MoEF, CC, GoI. The

MoEF was of the view that state being regulating agency can not prepare the said report at its own. Therefore, the applications submitted by State of Haryana for approval of ToR were not considered.

(xiii) The MoEF initially filed a Review Application before the Hon'ble High Court and thereafter SLP before the Hon'ble Supreme Court. During the pendency of said matter the state of Haryana neither could take further action relating to preparation of EIA report nor could auctioned its minor mineral areas for grant of mineral concessions subject to condition that Environmental Clearance shall be obtained by the project proponent.

(xiv) The mining in district Faridabad/other parts of the State came to grinding halt on 01.03.2010.

(xv) It may be pointed out here itself that since than mining is lying closed in the district. The mining operations prior to01.03.2010 was either undertaken by the contactors to whom contact was granted prior to 14.09.2006 or under special dispensation granted by the Hon'ble High Court.

(xvi) Subsequently, Hon'ble Supreme Court on 28.10.2013 while disposing of the SLP No. 729 of 2011 of the MOEF CC, GoI held that prior environmental clearance was to be obtaining by the concerned mining lease holders and not by the State Government. In other words the process for obtaining prior environmental clearance was to be followed as prescribed by MoEF, CC, GoI under its notification dated 14.09.2006 as amended to time to time (uniformly applicable for country).

(xvii) In view of above the State of Haryana in November, 2013 could issued notifications for grant of mineral concession in the various part of the State including for district Faridabad through open auctions which held in December, 2013.

3.2 Areas Selected for mining in November/ December, 2013 and thereafter, the areas at present on contracts or to be granted on mining contracts

It is stated that two contracts /concessions in district Faridabad had been granted to M/s D.Krish Builders Pvt. Ltd. 624,6th Floor, DLF Tower A, District Centre, Jasola, New Delhi-110025, was the highest bidder (62.50 Crores) for the Sand quarries of Faridabad Unit-1 which include Yamuna riverbed area of villages Basantpur, Agwanpur, Dadasiya, Kiravali, Lalpur, Mahawatpur, Mozmabad, Rajpur Kalan, Baskola, Shikargarh and M/s NCR Real Tech Pvt. Ltd., Plot No. A-101 Sharma Market PWL, Pahaladpur, New Delhi

being the highest bidder (50.00 Crores) for the Sand quarries of Faridabad Unit-2 which include Yamuna riverbed area of villages Shekkhpur, Manjihauli, Gharaura, Ghurasan, Nangla Majra, Chandpur, Shahjahanpur, Imammudinpur, Sahupur Khadar, Arwa, Latifpur, Jaffarpur, Chhainsan and Mohna for which auction was held on 27-12-13. Apart from above villages one more village has taken into consideration namely Amipur through which river Yamuna is passing.

"Letter of Intent" had been issued by the Director Mines & Geology Haryana vide letter dated 03-01-2014 for Mining of Sand (Minor Mineral) in10 villages of Faridabad Unit-1, over an area of 273.50 hectares for a period of 08 years and in 14 villages of Faridabad Unit-2, over an area of 655.63 hectares for a period of 10 years in district Faridabad, Haryana.

4 Details of Royalty or Revenue received in last three years

Due to NGT orders dated 02.11.2015, both the mining units were restrained to undertake mining operations

5 Detail of Production of Sand or Bajari or minor mineral in last three years

Due to pending litigations in Hon'ble Punjab and Haryana High Court and Hon'ble Supreme Court of India sand mining in the district Faridabad remained vacant since 01.03.2010 hence production in last 3 years is/was nil.

6 Process of Deposition of Sediments in the rivers of the District

Description of formations

Description of formations found in the area is as under:

Soil/ alluvium: The finer sediments have been deposited in the flood plains of the River Yamuna.

6.1 Sand

Sediments of less than 1-3 mm size are predominantly deposited in the riverbed by flood waters during rainy season. There is no perfect classification between Sand and Silt. They have been deposited in a mixed state. As usual the larger size sediments are deposited at the bottom and the smaller sizes are deposited at the top, on the edges/flanks of the riverbed.

However, during the course of shifting of the river course towards East about five hundred years back, silt was deposited on top in thicker layers up to 3 meters in some cases underlain by about 6-15 meters of sand.

Sediments of various sizes and in mixed form are predominantly deposited in the river bed and there is no perfect classification between sediments. These may be called as coarse sand, medium sand and fine sand. The term sand is used to denote an aggregate of mineral or rock grains greater than 1/16mm and less than 2 mm in diameter.

Most sand is made of quartz or its microcrystalline cousin chalcedony, because that common mineral is resistant to weathering. The farther from its source rock sand is, the closer it is to impure quartz. But Yamuna sands contain quartz grains, tiny bits of rock (lithics), or dark minerals like limestone and ferruginous concretions.

The size of the sediments is variable. The grains whether small or large are rounded in shape. Sand is grey, brown in color, coarse to fine grained. The present deposits are of good quality and can be used for building industries. There is no other use of this material.

6.2 Origin and control of mineralization (annual replenishment of mineral in river bed area vis-a-vis sedimentation)

Yamuna basin is bordered by river Yamuna from Yamunanagar to Delhi and National Highway No. 1 from Nilokheri to Delhi. Between Nilokheri and Delhi the National Highway No.1 is aligned on the levee of River Yamuna and acts as water divide between the ancient River Saraswati and Yamuna. The Riverine action deposited several meter thick sand layers in the riverbed. Slow shifting of river Yamuna towards east left behind several meter deep sand deposits, which was subsequently covered by alluvium consisting sand, silt and clay to form topsoil. The Yamuna basin measuring around 1700 sq km is estimated to have 300 billion cu m of sand deposits in the basin.

River sediment is transported based on the strength of the flow that carries it and its own size, volume, density, and shape. Stronger flows will increase the lift and drag on the particle, causing it to rise, while larger or denser particles will be more likely to fall through the flow. Rivers and streams carry sediment in their flows. This sediment can be in a variety of locations within the flow, depending

on the balance between the upwards velocity on the particle (drag and lift forces), and the settling velocity of the particle

If the upwards velocity is approximately equal to the settling velocity, sediment will be transported downstream entirely as suspended load. If the upwards velocity is much less than the settling velocity, but still high enough for the sediment to move (see Initiation of motion), it will move along the bed as bed load by rolling, sliding, and saltating (jumping up into the flow, being transported a short distance then settling again). If the upwards velocity is higher than the settling velocity, the sediment will be transported high in the flow as wash load.

Sedimentation, *in the geological sciences, is a process of deposition of a solid material from a state of suspension or solution in a fluid (usually air or water). Broadly defined it also includes deposits from glacial ice and those materials collected under the impetus of gravity alone, as in talus deposits, or accumulations of rock debris at the base of cliffs. The term is commonly used as a synonym for sedimentary petrology and sedimentology. Sedimentation is generally considered by geologists in terms of the textures; structures, and fossil content of the deposits lay down in different geographic and geomorphic environments. The factors which affects the "Computation of Sediment":*

a) Geomorphology & Drainage Pattern: The following geomorphic units plays important role:

- *Structural Plain*
- *Structural Hill*
- *Structural Ridge*
- *Denudation Ridge & Valley*
- *Plain & Plateau of Gangetic plain*
- *Highly Dissected pediment*
- *Un dissected pediment*

b) Distribution of Basin Area River wise (Area in Sq. Km or Sq. Miles)

c) Drainage System/Pattern of the area (Drainage Density = Km/Sq. Km of Yamuna River

d) Rainfall & Climate: Year wise Rainfall data for previous 10 years of Yamuna Basin/River

e) As per ***Dandy & Bolton study*** *"Sediment Yield" can be related to*

i) Catchment Area and

ii) Mean Annual Run-off

Sand is an essential minor mineral used extensively across the country as a useful construction constituent and variety of other uses in sports, agriculture, glass making (a form of sand with high silica content) etc. It is common knowledge that minerals are non-renewable but this form of mineral naturally gets replenished from time to time in a given river system and is very much interrelated to the hydrological cycle in a river basin.

Sand mining has become a widely spread activity and does not require a huge set up or technology, the number of ventures has increased extensively and it has become a footloose industry in itself but the backward-forward linkages are becoming stronger as many are getting employed as well as the construction activity / industry requires this mineral at consistent rates. In the state of Punjab, sand has been declared as an essential commodity so as to control its extraction and sale price. Andhra Pradesh on the hand is heading towards a lottery system1. Riverine environmental systems are unique in themselves and provide environmental services, natural resources to meet variety of needs of urban and rural communities. The Rivers originating from the Himalayas bring with them lots of aggregate materials whereas as they move downstream, only finer elements / minerals like sand are found in abundance. River Yamuna near Dak pathar barrage leaves Uttarakhand and enters Himachal Pradesh.

The YAMUNA RIVER is the biggest tributary of the river Ganga in North India. Its source in the Yamunotry glacier at an elevation of 6387 mtrs on South western sides of Banderpooch crests in the lower Himalayan ranges. The overall span of the Yamuna river is 1376 Kms (855 miles) with catchment area of 366223 square km (141,399 square mile). This encompasses 40.2 % of the whole Ganga valley, prior to joining Ganga at Triveni Sangam in Allahabad (UP)

Itinerary of Yamuna River:

The river passes through many states such as Uttrakhand, UP, Haryana, going across to HP and then Delhi. With yearly discharge of around 10,000 cubic billion meters (cbm) and consumption of 4400 cbm (of which irrigation comprises 96), the river represents above 70 of water provision of Delhi. Yamuna water are fairly good quality for its entire span from Yamunotri in Himalayan ranges to Wazirabad in Delhi, the length of which is around 375 Kms.

Itinerarv of Drainage area of Yamuna:

The origin of Yamuna is situated in the Yamunotri glacier at an elevation of 6387 mtrs on SE sides of Banderpooch crests, which are located in the Mussoorie range of lower Himalayan range in Uttrakashi district of Uttrakhand, to the North of Haridwar. From this place Yamuna runs to South around 200 Kms across the Shivalik mountain ranges and lower Himalayan ranges. A significant portion of its beginning of Drainage basin (with total area of 2320 square km) is situated in HP and a major tributary sapping the upper drainage basin in the Tons, which is also biggest and most extensive tributary of the Yamuna. Other tributaries in the area are the Rishi Ganga, Giri, Hanuman Ganga, Kunta & Bata, which sap the upper drainage basin of the huge Yamuna river. Subsequently, the river moves down the terrains of Doon basin at Oak Pathar close to Dehradun, in this place water is redirected into a channel for the purpose of electricity generation. Once it goes across the sikh religious place of Ponta Sahib, the river arrives at Mamdubas village near Hathnikund in the YAMUNANAGAR district of Haryana where a Barrage is being constructed. This Barrage/dam is the origin of the two major channels or water courses - Eastern Yamuna Canal and Western Yamuna Canal and both drain in UP & Haryana. The Western Yamuna Canal (WYC) traverses Karnal, Yamunanagar and Panipat prior to arriving at the Haiderpur water treatment plant, which provides a portion of municipal water provisions of Delhi. The Yamuna also forms natural boundary between the states of Uttrakhand & HP and also amid the states of UP and Haryana. Together with the Ganga to which it flows almost parallel once it meets the Indo-Gan getic plateau, the biggest Alluvial productive area in the World, it forms the Ganges-Yamuna Doad are stretched across 69,000 square Km which is 33% of the whole area.Table of Drainage Basin area of River Yamuna (square KM/square mile) with of Drainage Basin

1	*HP*	*5799/2240 (1.6)*
2.	*UP & Uttrakhand*	*74208/28662 (21.50)*
3.	*Rajasthan*	*102883/39739 (29.80)*
4.	*Haryana*	*21265/8214(6.5)*
5.	*Delhi*	*1485/574(0.4)*
6	*MP*	*14023/5416 (40.6)*

The closest mountain system in all these places is the Shivaliks i.e. Outer Himalayan region where the sub-mountainous regions begin and eventually expand into plains. As the river flows further down, the reach or its active floodplains increase.

Dandy & Boltan formula for calculation of Sediment Yield:

Dandy bolton formula is often used to check whether the sedimentation yield exceeds the replenishment rate but the whole question is whether there is adequate monitoring of the river basin, the answer is no as hydrological stations are sparsely spread. The formula uses catchment area and mean annual runoff as key determinants to give a yield value. It does not differentiate in basin wide smaller streams and their characteristics. ewe distinguishes river basins as classified and non-classified, as per the latest hydrological data for unclassified River basins; there are 122 GDSW (Gauge, Discharge, Sediment & Water Quality) sites in 12 such basins, the number was 147 in 2005. This brings in context the whole issue of scientific mining, thereby indicating that the monitoring of sediment yield in rivers / streams within the river basin is essential to arrive at extraction rates and express and conduct environmental studies based on these basin wide characteristics which should become part of the Terms of Reference' Sediment Yield versus Drainage Area

Dandy and Bolton studied sedimentation data from about 1500 reservoirs, ponds, and sediment detention basins. In developing their formulas, they used data from about 800 of these reservoirs with drainage areas greater than or equal to 1 mi2. The smaller watersheds-those of drainage area less than 1 mi2-were excluded because of their large variability of sediments yield, reflecting the diverse effects of soils, local terrain, vegetation, land use, and agricultural practices.

For drainage areas between 1 and 30,000 mi2, Dandy and Bolton found that the annual sediment yield per unit area was inversely related to the 0.16 power of the drainage area: In which 5= sediment yield in tons per square mile per year; SR = Reference sediment yield corresponding to a 1-mi2 drainage area, equal to 1645 tons per year; A = drainage area in square miles; and AR = reference drainage area (1 mi2)

Sediments Yield versus Mean Annual Runoff

Dandy and Bolton studied sedimentation data from 505 reservoirs having mean annual runoff data. Annual sediment yield per unit area was shown to increase sharply as mean annual runoff O increased from 0 to 2 inches. Thereafter, for mean annual runoff from 2 to 50 inches, annual sediment yield per unit area decreased exponentially.
This led to the following equations.

For O <2 in.:

For O >2 in.:

In which OR = reference mean annual runoff OR = 2 in.

Dandy and Bolton combined above equations into a set of equations to express sediment yield in terms of drainage area and mean annual runoff(Q).

For Q <2 in.:

For Q >2 in.:

***Sediment Productions/yield**.*

For S = 1645 tons/mi2/y, Q = 2 in., and A= 1 mi2, reduces to the followings:
For Q <2 in.: S = 1280 Q0.46(1.43 - 0.26 log A)
For Q >2 in.: S = 1965e-0.055Q{1.43 - 0.26 log A)

*Above equations are based on average values of grouped data; therefore, they should be used with caution. **In** Certain cases, local factors such as soils, geology, topography, land use, and vegetation may have greater influence on sediment yield than either mean annual runoff or drainage area. Nevertheless, these equations provide a first approximation to be regional assessment of sediment yield for watershed planning purposes.*

Calculation of Sediment Yield for Sand Mines of Faridabad-

- *Area under riverbed: 9 square KM.*
- *Drainage basin area of river Yamuna in Haryana : 21265 square kilometers*
- *Average Annual Runoff from Yamuna Nagar to Palwal district: 140.50 mm*

(the data used for runoff calculation is of the year 2004-2008 of district Yamunanagar, Karnal, Panipat, Sonipat, Faridabad and 25% is being taken as runoff)

With above inputs, the calculation of the sediment yield by the Dandy and Bolton formula is illustrated below:

Formulas

For $Q < 2$:

$$S = 1280\ Q^{0.46}[1.43 - 0.26 \log(A)]$$

For $Q \geq 2$:

$$S = 1965\ e^{-0.055Q}[1.43 - 0.26 \log(A)]$$

[Q (mm), A (km^2), Y ($tons/km^2/yr$)]

Reference

With above formula the value of S = 209.39 T/ square KM /annum

Therefore the Total Sediment Yield per annum for drainage basin of 21265 square kilometers will be = 21265 x 209.39= 44,52,678 T per annum.

Dandy & Boltan formula also says that actual sediments yield from individual drainage basins may vary 10-fold or even 100 fold from computed yields. Since itinerary of river Yamuna indicates that its basin comprises of sediment rocks with good average rainfall and high drainage density therefore there are fair chances of yield of sediments to be 50 fold of computed results hence Annual Sediment Yield will be : 44,52,678 T x 50 fold = 22,26,33,900 T / Annum. Even if calculated on lower site of 10 foals then also the Annual Sediment Yield will be 44,52,678x10= 4,45,26,780 T / Annum.

The equations express the general relationships between sediment yield runoff and drainage area. They may provide a quick rough approximation of mean sediment yields on a regional basis for preliminary watershed planning. Because Dandy & Bolton have derived the equation form average values computed sediment yields normally would be low for highly erosive area and high for well stabilized drainage basins with high plant density. Factors which have direct bearing on sediments yield & limitations of Dandy & Bolton equation.

Sediment yield of a sediment basin has direct impact of local terrain, climate, vegetation, soils, agricultural practices & land use pattern of catchment area of the sediment basin aforesaid factors varies from basin to basin therefore, Dandy & Bolton has category stated that use of the equation to predict sediment yield for a specific location would be unwise because of the wide variability caused by local factors not considered in the equation development. Actual sediment yield form individual drainage basins may vary 10-fold or even 100-fold from computed yields.

The sediments are river borne and are the product of sedimentary process. The entire river bed is having ample quantity of sediments. The size of the sediments depends upon the velocity of flow of water in the river.

River sediment are transported based on the strength of the flow that carries it and its own size, volume, density, and shape. Stronger flows will increase the lift and drag on the particle, causing it to rise, while larger or denser particles will be more likely to fall through the flow. Rivers and streams carry sediment in their flows. This sediment can be in a variety of locations within the

flow, depending on the balance between the upwards velocity on the particle (drag and lift forces), and the settling velocity of the particle

If the upwards velocity is approximately equal to the settling velocity, sediment will be transported downstream entirely as suspended load. If the upwards velocity is much less than the settling velocity, but still high enough for the sediment to move (see Initiation of motion), it will move along the bed as bed load by rolling, sliding, and saltating (jumping up into the flow, being transported.a short distance then settling again). If the upwards velocity is higher than the settling velocity, the sediment will be transported high in the flow as wash load.

7 General Profile of the District

As regards to the profile of the district is concerned on the western edge of the district there are varieties of formations of Delhi Super Group ranging from 200 at bottom and 315 at top. On the eastern edge of the district is river Yamuna

8 Land Utilization Pattern in the district:

Forest, Agriculture, Horticulture, Mining etc.In district Faridabad, part area is under Agriculture and Horticulture, part area is for mining and few part of land is also forest.

9 Physiography of the District;

9.1 Physiography, Hydrogeology, Drainage and Climate

The area of is marked by flat topography of sedimentary formations, which are surrounded by fine-grained blown soil overlying the sand deposits. Highest elevation is 191.70 mRL & lowest 181.10 mRL in the proposed lease area.

The Yamuna river flows from N to S direction. The alluvial ground surface area over lying sand some distance away from the riverbed is under cultivation. It is believed that in the past, the River Yamuna used to flow closer to the present GT road which has now moved about 5-15 kms towards east.

9.2 Hydrogeology

Ground water occurs in alluvium and the underlying weathered/ fractured quartzite. Alluvium comprises sands silt, kankar and gravel which form the principal ground water bearing horizon. In Quartzite formation, occupying the north- western part of the district, ground water occurs in weathered and jointed fractured horizons.

Weathering and fracturing has resulted in format ion of semi-consolidated sand beds (BADARPUR SANDS) which form potential aquifer zones. The Depth of water level lies between 3.35 to 18.00 m.bgl during pre-monsoon and 3.96 to 21.00 m.bgl during post-monsoon period in the district. In small areas in the west, in parts of Palwal and Hathin blocks, shallow water level 2 to 5m deep was observed. Deeper water level, in the depth range of 10m to 15 m occurs in the south-eastern parts of Ballabgarh and Faridabad blocks. Water level elevation range from 220 to 180 m amsl and the general groundwater flow is towards southeast and east. Isolated Groundwater mounds and troughs in different parts of the district have been created because of heavy pumping in city area. In general water table has declined all over the district over the past

10 **Rainfall:**

ENVIRONMENT STATISTICS (CLIMATE)

Monthly Normal Rainfall by Districts Average of 5 years (2004-2008)

No. 4.2

(Millimetres

District	Monthly				
	January	February	March	April	May
1	2	3	4	5	6
Ambala	28.00	51.00	46.50	12.30	47.70
Panchkula	30.06	48.40	56.40	3.80	24.80
Yamunanagar	28.36	41.56	32.98	18.56	33.70
Kurukshetra	17.40	24.90	21.10	4.80	24.90
Kaithal	7.48	19.46	23.12	5.64	29.26
Karnal	16.60	34.90	18.50	6.10	39.80
Panipat	13.60	16.00	22.00	3.20	17.20
Sonipat	10.80	17.30	19.90	4.70	38.00
Rohtak	3.40	12.30	18.70	8.40	27.20
Jhajjar	3.44	17.46	21.24	0.80	38.92
Faridabad	4.64	15.84	19.96	8.06	30.04
Gurgaon	1.72	24.56	24.32	2.04	34.52
Mewat	0.0	16.32	7.20	1.00	21.24
Rewari	2.64	23.24	22.04	3.84	31.38
Mahendragarh	4.68	21.96	14.30	8.66	26.82
Bhiwani	3.20	18.06	18.72	8.44	35.24
Jind	10.74	32.66	27.94	5.06	43.34
Hisar	6.76	15.90	15.68	6.16	22.22
Fatehabad	7.50	16.16	17.36	10.10	23.36
Sirsa	2.80	14.60	16.50	3.30	11.10

ENVIRONMENT STATISTICS (CLIMATE)

Monthly Normal Rainfall by Districts Average of 5 years (2004-2008)

No. 4.2 (Concld.)

(Millimetres)

District	Monthly							Annual
	June	July	August	September	October	November	December	Total
1	7	8	9	10	11	12	13	14
Ambala	102.80	235.86	271.60	104.60	20.50	1.20	1.80	1004.06
Panchkula	78.40	208.40	289.00	115.24	22.40	0.00	1.00	877.90
Yamunanagar	159.20	234.96	171.60	81.48	10.75	1.30	4.60	819.26
Kurukshetra	64.00	50.50	95.70	45.10	6.00	0.00	1.10	355.50
Kaithal	98.14	84.10	104.00	107.68	3.54	0.80	0.03	435.28
Karnal	55.15	69.13	108.50	60.40	12.50	1.00	0.00	442.59
Panipat	63.60	108.90	118.80	122.40	6.20	1.40	0.00	493.30
Sonipat	71.52	126.70	149.50	97.00	21.40	5.60	0.20	583.72
Rohtak	64.40	98.60	119.00	91.40	10.80	2.60	3.40	480.70
Jhajjar	79.00	117.56	115.12	86.84	7.40	0.0	0.00	493.80
Faridabad	46.52	127.10	156.72	56.00	25.80	0.44	0.08	491.20
Gurgaon	51.82	94.26	133.22	62.88	20.62	0.46	0.64	451.08
Mewat	47.96	51.80	33.60	14.32	0.0	0.00	0.00	198.44
Rewari	72.23	152.24	100.02	93.20	3.00	0.00	0.30	504.90
Mahendragarh	155.12	96.28	76.56	66.10	9.60	2.04	1.50	503.62
Bhiwani	58.23	80.96	113.36	56.04	10.60	1.16	0.76	404.84
Jind	90.74	130.86	113.66	108.54	12.46	2.80	1.06	530.06
Hisar	52.10	53.38	57.52	50.32	5.36	2.20	1.48	230.08
Fatehabad	65.06	64.40	59.20	68.80	1.00	0.94	1.40	335.78
Sirsa	57.20	40.00	30.26	27.20	3.90	1.00	1.50	209.36

Source: Director of Land Records, Haryana

11 Geology and Mineral Wealth

11.1 Regional Geology

The regional geology of Distt. Faridabd & Palwal (Haryana) is represented by varieties of formations belonging to Delhi Super Group. Stratigraphically the rock formations of Delhi super group are composed of arenaceous, argillaceous & calcareous sediments. These sediments have been placed by Heron (1923) in the Alwar & Ajabgarh series of Delhi system & intruded by basic granitic rocks.

The general succession of Delhi system can be represented as follows: (Das, Gupta S.P. 1968)

Series		Rock Types
Recent intrusives		Alluvium, dune sand, soil, ankerite, chert, guartz veins, younger basic dykes. Granites, Pegmatites,

		Quartz veins Older basic rocks.
Ajabgarh series	8.	Carbonaceous phyllites & schists etc. (Local).
	7.	Massive Quartzites.
	6.	Phyllites, Mica-shists (Local).
	5.	Marble, calc-gneiss, amphibolite etc.
	4.	Schist with or without garnet.
		Stauroite, Kyanite, Sillimenite, Andalusite, phyllites, sandy phyllites.
Alwar series	3.	Amphibole quartzite, marble, Amphibolites.
	2.	Arkosic quartzites, quartzites & Interealated phyllite & schists. Magnetite & Hametite quartzites etc.
	1.	Phyllite & schists.

11.2 LOCAL GEOLOGY

River sand found in Distt. Faridabad & Palwal are Alluvial sediments of fluvial deposits brought down from Himalayas from the upstream side by river Yamuna and its tributaries which have variable thickness depending upon the original land form on which deposition took place. The river sand is most recent deposit of clean sand deposited by river Yamuna and is being reworked every year.

The litho units encountered in the river bed are younger sedimentary formations in nature and are brought by river water from high reaches of Himalayan range of hills of Himachal Pradesh. The sediments are river borne and have been deposited in the riverbed and its flood plains.

i) Geology of the area

The sediments of the river bed are of recent nature. These sediments have been brought by river water and deposited in the bed of Yamuna river. The following sequence of formations has been observed in the area:

- Soil/Alluvium
- Sand

In district Faridabad there is only one source of river sand i.e. river Yamuna.

12. Drainage system with description of main rivers

S. No.	Name of the river	Area drained (Sq. Km)	% Area drained
1	Yamuna River (1376 km)	21265	6.5

13. Salient Feature of Important Rivers and Streams:

S. No.	Name of the River or Stream	Total Length in the District (in Km)	Place of origin	Altitude at Origin
1	River Yamuna	38.50	Yamnotri	3291 mts
				Or 10797 feets

14. Methodology adopted for calculation of Mineral Potential

Portion of the River or Stream Recommended for Mineral Concession	Length of area recommended for mineral concession (in kilometer)	Average width of area recommended for mineral concession (in meters)	Area recommended for mineral concession (in square meter)	Mineable mineral potential (in metric tonne) (60% of total mineral potential)
35 km	35	290 meters	1,01,50,000 Sqm	2,74,05,000 MT

15. Present Status of mining

16. Mineral Potential

Sand (MT) min.	Total Mineable Mineral Potential (MT)
2,74,05,000	2,74,05,000
Annual Deposition	
4,45,26,780	4,45,26,780

Recommendation:

From the above, it is clear that about 2,74,05,000 MT of mineral is available up to depth of three meters in the river bed of Yamuna River in Faridabad District. The annual deposition is 4,45,26,780 MT. Hence, 2,74,05,000/- MT of mineral can be safely removed and disposed off every year.

Further, if any new area with mineral deposit is available in future, inadvertaltly leftout or received under any scheme of the Government from neighboring state then the same will also be part of the mineral concession.

District Faridabad

Faridabad	Sr. No.	Name of village	Area earlier auction in 2013 (in hectare)	Re-verified area (in hectare)	Area for ancillary activity
Sand Unit (I)	1	Bsantpur	117.80	00.00	Nil
	2	Agawanpur	11.20	00.00	Nil
	3	Dadasia	56.40	58.50	12.65
	4	Kidawali	13.10	13	00.00
	5	Lalpur	11.20	0.93 (Part)	00.00
	6	Mahawatpur	13.80	27.60 (part)	10.82
	7	Mojmabad	4.40	1.30	00.00
	8	Baskola	12.40	12.25	00.00
	9	Dungarpur	00.00	15.41	10.00
	10	RajpurKalan	18.00	4.80	00.00
	11	Shikargah	15.20	15.00	00.00
	12	Amipur	00.00	66.23	25.2
Total			**273.50**	**215.02**	**58.42**
Sand Unit (II)	1	Shekhpura	60.50	00 (due to bridge)	00.00
	2	Manjhawali	163.00	00 (due to bridge)	00.00
	3	Gharora	15.95	00 (due to bridge)	00.00
	4	Ghorasan	23.10	15.90 (part area)	10.00
	5	Dalelgarh	00.00	05.00	00.00
	6	NanglaMajra	7.80	6.52	00.00
	7	Chandpur	14.45	12.29	10.00
	8	Imamudeenpur	5.20	00 (due to bridge)	00.00
	9	Arwa	38.90	00 (due to bridge)	00.00
	10	Sajhapur	9.50	6.55 (2.85+3.7)	05.00
	11	SahupuraKhadar	62.60	25.50 (part)	10.00
	12	Parasrampur (Dhulepur)	00.00	19.26	00.00
	13	Latifpur	20.60	64	00.00
	14	Makanpur	00.00	56	10.00
	15	Bhikuka	00.00	4.66	00.00
	16	Jaffarpur	20.85	1.26	00.00
	17	Chainsa	112.00	34.29	15.00
	18	Mohna	101.20	00 (due to bridge)	00.00
Total			**655.63**	**243.80**	60.00