

## Khewra Salt Mine Project

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## **PREFACE**

As per the requirement criteria of Masters in the Project Management (MS-PM) degree program at Bahria University Lahore Campus, we have learned various Project Management tools & techniques and implement them practically. So, to record our struggle we did to learn these tools & techniques. We are submitting a comprehensive report, comprising different sections.

Our Project is to Study "Khewra Salt Mine" its different processes that are involved during the construction of its floors and its operation. Compare different types of Mining methods, methods used for mining in Pakistan and method of mining at Khewra Salt Mine.

We deeply studied the Mining Process and summarize a report on the feasibility study, procurement of services & machinery, digging of mine, extraction of salt, crushing and inventory management and testing & commissioning. We used the Primavera P6 software tool which is the most advanced software tool to implement project management practices utter by Project Management Institution (PMI). Primavera P6 is a portfolio project management tool. It has project management, product management, and Control abilities integrated with enterprise software tools i.e. Oracle and SAP's ERP system. The report also includes Project History and introduction in which way the project was taken out. Project processes are graphically displayed in this report using Primavera P6 software. Primavera P6 also generates various other reports i.e Gantt chart, Resource Histogram and "S" Curve that is graphically displayed in Primavera also part of this report.

## **ACKNOWLEDGEMENT**

We are very grateful to Bahria University Lahore Campus (BULC), especially Management Studies Department that gave us an opportunity to visit “Khewra Salt Mine” Project Site which helps us a lot in understanding this Project Processes and to implement them, for planning & scheduling purpose on Primavera P6 Software. We are thankful to our Course teacher Mr. Shehzad Ahmed who taught us this tool and provides us an opportunity to implement this tool practically for “Khewra Salt Mine” Project for better understanding with Primavera P6 Software tool.

A special thanks to the Lab staff that helped us in our project and during semester course work labs. Department provides a friendly environment, always there for us to provide support and Guidance in degree duration. At the end, we would like to express appreciation to our parents, who encouraged us for higher studies and provide morally support in hard times.

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## **Chapter#1**

### **1. History of Khewra Salt Mine**

#### **1.1. Background:**

The Khewra salt mines were discovered during the reign of Alexander the Great. After the combat with Raja Poro, Alexander and his army were resting at a place currently known as Khewra mines. During that stay, Alexander's army observed that their diseased horses were licking the nearby stones and getting better after licking. So Alexander's army was the first one to take out salt from Khewra salt mines.

at that time they did not know that they had discovered 2nd largest mine in the world.

Mid-13th century, Raja of the Janjua tribe commenced mining for commercial purposes. During the era between 1500 to 1809, the Mughal Empire took control over the salt mine. Then after the downfall of the Mughal Empire, Sikh seized the Khewra mines. In 1849 the British Empire occupied Punjab and the British government took over all the controls and administration of Khewra salt mine.

After partition, Pakistan Mineral Development Corporation (PMDC), was established and Khewra salt mine control was handed over to PMDC. In 2002, PMDC launched a project of resort development to promote tourism and successfully promoted the oldest parts of mine into a tourist spot. Now, PMDC welcomes more than 200,000 tourists annually.

Besides tourism development, PMDC also constructed a center for Asthma Resort for Speleotherapy & Heliotherapy.

Nowadays salt mine

is particularly used for commercial purposes. 350,000 tons of salt mine each year is mostly sold to ICI Soda Ash Khewra Etihad Chemical Limited at Kala Shah Kaku and sold to various tanneries. The rock salt that is the finest form is used as table salt in the country exported.

### 1.2 Development:

During the British era, the mine was provided electricity rail link, dynamite and tracked tunnels. A spring of drinkable water was discovered in 1853 and mine was linked with Royal Indian Railways at the end of 1886. Imperial Chemical Industries (ICI) Soda Ash plant was constructed in 1938. To provide fresh water to the adjacent village of Khewra a wooden waterworks were constructed. Dr. H Worth who was the chief mining engineer mapped the main tunnel at ground level and develop a 50 50 rule for salt mining in 1872 which is still followed to this date.

### 1.3 Main Features of Khewra Mines:

<b>Site</b>	161 km from Rawalpindi
<b>Zone</b>	148039966.8 Sq. Ft
<b>Length</b>	40 km
<b>Geo Horizon</b>	Before- Cambrian
<b>Purity</b>	98 Percent
<b>Extraction method</b>	Room & Pillar
<b>Resources</b>	1,000,000,000/-
<b>Shades</b>	Red- white- Pink
<b>Production 2018-19</b>	3.89 of tons
<b>Sales 2018-19</b>	3.95 of tons
<b>Contact Information</b>	PM, Mr. Tanweer Amir "Khewra salt Mines"



#### **1.4 Khewra Resort:**

PMDC had established Khewra Resort with its own means of resources in February, 2002; under the "khewra salt mine development project" with the initial cost of 7.3 million.

There were different models of famous monuments of Pakistan that were constructed inside a tourist resort with hollow salt bricks which gives different shades of color when illuminated. The following models are included: Shish Mehal, Minar e Pakistan, Shahi Mosque, and Chaghi Hills. A gigantic hall called "Assembly Hall" with 75 meters height which lure the tourist attention. There are other many chambers having ponds with saturated brine solution which creates a glorious sight for tourists. In the first phase of construction of the development program following recreational things are included:

#### **1.5 Creation of Reception/Briefing Hall**

- i) Illumination
- ii) Electric Train
- iii) Refreshment
- iv) Mine Guide

#### **1.6 Ticket Fee Rates:**

##### **Entrance Fee:**

- i) Foreign national Rs.3,000/-
- ii) Foreign national Student Rs.15,00/
- iii) Local Rs. 220.00
- iv) Local Student Rs. 110.00
- v) Senior Citizens & Children Rs 110

##### **Grip car Fee:**

- i) Local Pakistani Rs. 100
- ii) University/College/School Student Rs. 100
- iii) Senior Citizen Rs.100
- iv) No Tickets up to the age of 2 years
- v) Group of 12 people Rs. 1300 Single trip

vi) Exceeding 12 people Rs. 100 / Person

**Parking Station Fee :**

- i) Bike Rs 20/-
- ii) Motor Car Rs.50/-
- iii) Van Rs. 80/-
- iv) Coaster Rs. 100/-
- v) Heavy Truck Rs. 120/-

**Rest House Charges:**

- i) Rs.3500- Rs.4000 For single night

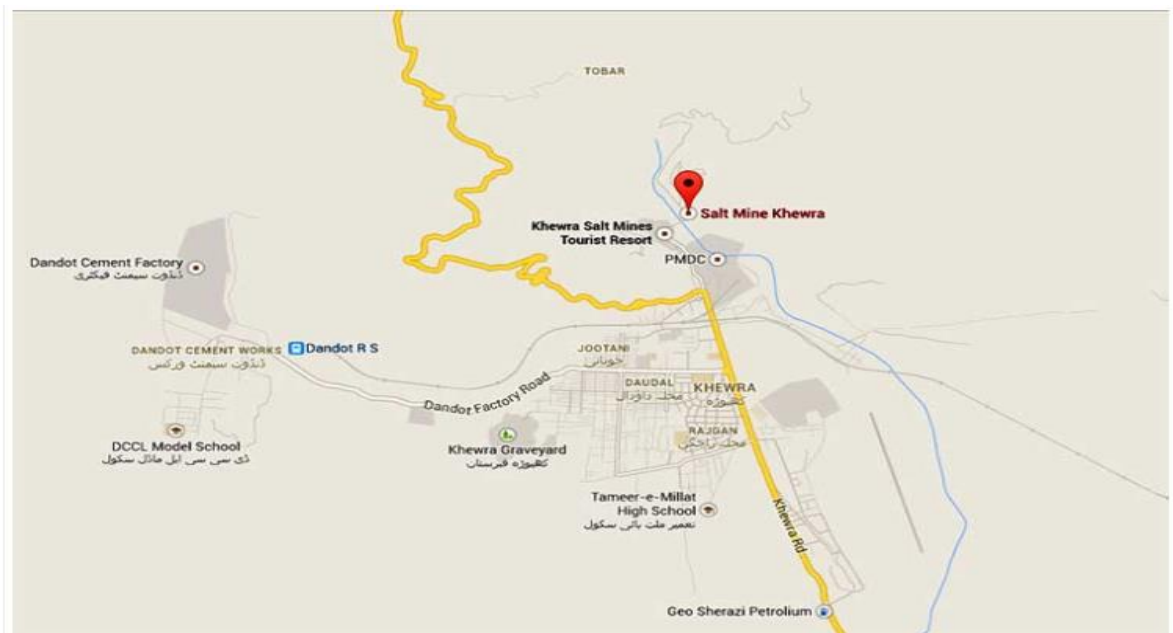
**Resort for Patients (Asthma):**

- ii) For 10 days Rs.12,500 including all services
- iii) 9 am -6 pm.

**1.6 Visiting Duration Timings:**

For tourist (all type) 9 am- to 6 pm 7 days of weeks (Including Public day off)

**Khewra Site Mine Project Sit Map:**



### **1.7 Overview of PMDC:**

PMDC is an independent body working under the authority of the Ministry of Petroleum and Natural Resources, Government of Pakistan. To flourish Mineral development in Pakistan PMDC was came into existence in 1974 with an approved capital of rupees 1000 million.

PMDC facilitates in the making of techno-economic feasibility reports, mining and marketing. It also helps in minerals research testing and evaluation of new mineral deposits.

Under PMDC umbrella 4 coal mines, 4 salt quarries, and the silica salt quarry is in functioning.

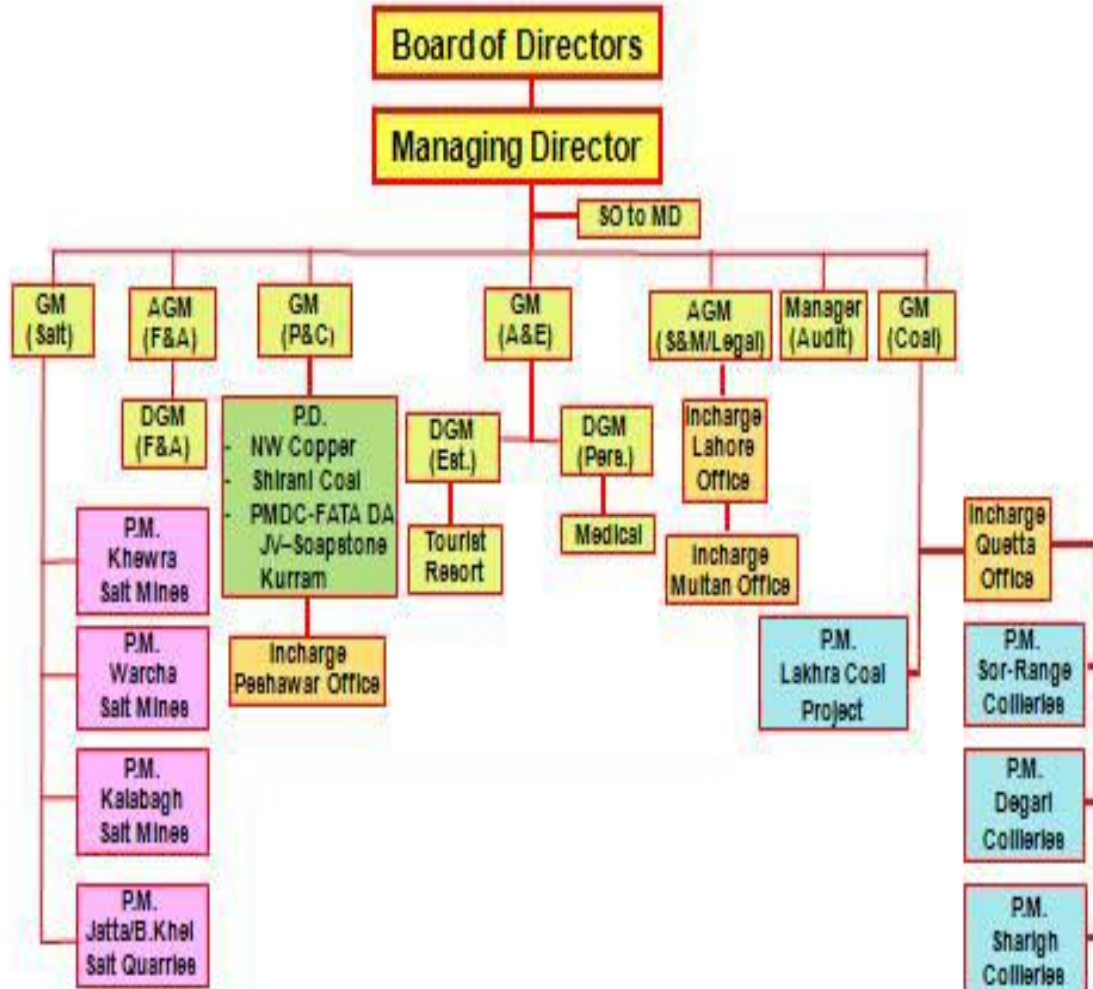
PMDC provides 58% revenue from salt production and 17% from coal.

### **1.8. Organization structure of PMDC:**

Following departments works under Pakistan Mineral Development Corporation:

- i) Accidental & Emergency
- ii) Finance & Accounts
- iii) Surveillance & Monitoring
- iv) Salt
- v) Audit
- vi) Coal
- vii) Planning & Convergence

## 1.9 PMDC Organogram:



## 1.10 PMDC Projects:

### 1.10.1 Coal Mines:

- i) Lakkhra Coal Mines
- ii) Degarri Coal Mines
- iii) Sor range Coal Mines
- iv) Shahring Coal Mines

**1.10.2 Salt Mines:**

- i) Khewra Salt Mines
- ii) Warcha Salt Mines
- iii) Kalabagh Salt Mines
- iv) Jatta Salt Mines
- v) Bahadur Kheal Salt Mines
- vi) Makrach Salt Mines

**1.10.2.1 Warrcha Salt Mines:**

The structure of salt is irregular and broken salt mound shape. Usually, it is used by the maker of House salt. It is transparent, crystalline and pure white. It is located 276 kilometers from Islamabad.

<b>Site</b>	277 km from south Rawalpindi
<b>Zone</b>	14573417.9427 Sq.meter
<b>Geo Horizon</b>	Before-Cambrian
<b>Purity</b>	98 Percent
<b>Shades</b>	Pink & Pure White
<b>Extraction method</b>	Room and Pillar
<b>Resources</b>	More than 1,000,000,000 tons
<b>Production (2018-19)</b>	7.1 Tons
<b>Sales (2018-19)</b>	7.3 Tons
<b>Whom to Contact</b>	PM , Mr. Muhammad Naeem, +92-300 6079639

### 1.10.2.3 Kalabaagh Salt Mine:

From here salt is extracted by room and pillar method. Salt is still extracted manually as some room is about 80 meters deep. Salts Extracted here is of different shades of color almost thirteen different kinds of salt. It is located near the bank of the Indus River.

<b>Site</b>	50km from Miann Wali
<b>Zone</b>	15531066.0465 Sq.meters
<b>Geo Horizon</b>	Before -Cambrian
<b>Purity</b>	96 Percent
<b>Shades</b>	Pure White & Light Pink
<b>Extraction method</b>	Room and Pillar
<b>Resources</b>	Above 28881 tons
<b>Production (2018-19)</b>	16.5 tons
<b>Sales (18-19)</b>	165,337 tons
<b>Whom to Contact</b>	PM Mr. Irfan Ahmed Miawali +92-300 8866467

### 1.10.2.4 Jattah Salt Mine:

<b>Site</b>	217 km from Kohaat City
<b>Zone</b>	15531066Sq meter
<b>Geo Horizon</b>	Tertiary Level
<b>Purity</b>	98 percent
<b>Shades</b>	Pure White & Light grey

<b>Extraction</b>	Data not found
<b>Resources</b>	Above 1,000,000,000 tons
<b>Production</b>	88.8 ton
<b>Sale</b>	88.8 ton
<b>Whom to Contact</b>	PM Ali Raza Ahmen PMDC +92 92-7222009

#### 1.10.2.5 Bahaadur Kheal Salt Mine:

<b>Site</b>	265km from Islamabad or 112km from Kohat
<b>Zone</b>	0.70 Acres
<b>Geo Horizon</b>	Tertiary level
<b>Purity</b>	98 percent
<b>Shades</b>	Dark & Light Grey
<b>Extraction method</b>	Data not found
<b>Resources</b>	1,000,000,000 tons
<b>Production</b>	Data not found
<b>Sales</b>	Data not found
<b>Whom to Contact</b>	PM Ali Raza Ahmen PMDC +92 92-7222009

### 1.10.2.6 Makkrach Salt Mine:

<b>Site</b>	161 Km from south of Rawalpindi
<b>Zone</b>	Data not found
<b>Geo-Horizon</b>	Data not found
<b>Shades</b>	Data not found
<b>Production</b>	113,618 of tons
<b>Sale</b>	113,618 of tons
<b>Whom to Contact</b>	PM Farrukh Ahmed PMDC +92 544-231119



## **Chapter #2**

### **2. Review of BULC Trip To Khewera Salt Mine:**

#### **2.1 Introduction:**

A trip was arranged by Bahria University Lahore Campus on 7th December 2019 to Khewra Salt Mines near Jehlum. The basic aim of this tour is to notice salt mines processes and extraction activities and present a complete report with the scheduling of activities & processes on Primavera P6 software. There were 200 students for this industrial trip. At Khewra Salt Mine tourist guide was available to help the students in the understanding of the processes of the salt mine. The following processes were observed during the whole journey at Khewra Salt Mine.

#### **2.2 Mineral and Mining:**

The minerals are believed to be very important for a country's economic and industrial growth. Minerals like sulphur, aluminum, salt, lithium, etc. are basic minerals that are used in the industry. The minerals like coal, gas, and oil are the fundamentals resources for the production of energy that is used for transportation, industries, plants, and in everyday life. Besides this salt is a basic nutrient of our human body it is also used in the food. With the help of uranium, electricity is produced; uranium is also very helpful in the treatment of cancer and other diseases. Silicon is used in the making of computer chips.

#### **2.3 Definition of Minerals:**

A mineral is formed by the geological processes which have well defined physical structure and chemical properties. They can be differentiated from one another due to their unique chemical properties and structure.

#### **2.4 Definition of Mining:**

Mining is the process of surveying, mine construction and extraction of precious minerals from the Earth. Anything which cannot be produced from the process of cultivation or produced artificially in a lab is mined from the Earth through extraction.

## **2.5 What is Mine?**

According to the act of 1923, mine means unearthing where processes are carried for the excavation of minerals which include all the machinery, tracks, works, digging up below or above the ground or adjacent or sideways given that property shall not be used for the process where construction is going on unless those processes were making of coke or dressing of mineral.

## **2.6 Ownership of Minerals:**

The minerals like oil, gas, and atomic related minerals are under the proprietorship of the Islamic Republic of Pakistan. Except for these three, all other minerals like aluminum, sulphur, coal, salt, gypsum, etc. are the property of the provincial government of Pakistan.

The Provincial authority to get a permit for the extraction of minerals is "Director General, Mines and Minerals Development of Directorate of Minerals Development" whereas for those minerals which fall under the Federal Government the licensing authority is the concerned federal ministry. Any business entity had to take license for the start of the processes of mining whereas the technical control will be under the Inspector of mining of the concerned province.

## **Chapter# 3**

### **3. Mineral Prospecting, Exploration and Feasibility Study:**

#### **3.1 Prospecting and Mineral Exploration:**

Before starting the mining activity it is mandatory to survey the concerned area, for each survey license is required from the relevant authority. Then, in-depth prospecting analysis is conducted by the geological department of the organization. This prospecting is carried out by keeping in mind the Geological Survey of Pakistan. Following things have to consider in this survey:

- i) Underground stratification
- ii) The thickness of the seam and its grade
- iii) Availability of minerals reserve
- iv) department at which minerals are available

#### **3.2 Feasibility Study Report:**

A feasibility report is established based on the data collected from the survey conducted by the geological department of the business entity. This report covers the following things:

- i) Underground stratification
- ii) Amount of minerals and its quality
- iii) The underground point at which minerals exists
- iv) Width and condition of the mineral seam
- v) Method of mining
- vi) Machinery required at the site
- vii) Lengths of shaft and its levels
- viii) Basic physical organizational structures and facilities for the staff
- ix) Cost benefit ratio
- x) Payback period
- xi) Marketability
- xii) Return on capital employed
- xiii) Impact of the project on the livelihood of the general public
- xiv) Economic impact of the project on the country

### **3.3 Grant of Mining Lease:**

The next procedure is the approval of the license for mining from the Licensing Authority by the business entity. To obtain lease permit of the area is necessary step to start the processes of the mining.

### **3.4 Approval of Mine Development Plan:**

Based on the prospecting/exploration and feasibility study, a long term plan is created which is approved by the board of directors of the organization. If that organization is government funded then detailed PC I and PC II will be prepared. These PC's must be approved by the concerned government.

These PC's must be including total cost of mining, infrastructure structure cost, overhead cost and plant machinery cost. Total cost should be broken down in annually. For example; the cost for plant machinery should be include source of procurement, the drivage, procurement services & equipment.

After that tenders are issued for the plant machinery in a manner that it contains every minute details of the machinery. For those equipment's and machinery which are to be imported tenders are issued with the buffer of six months period before the time when it is required at the site.

## **Chapter# 4**

### **4. Mining Operation:**

#### **4.1 Commencement of Mining Operation:**

The project management of the mining operation needs to inform the Chief Inspector of Mine with handwritten notice at least 15 days before the commencement. District Magistrate of the concerned District shall also be informed.

If the commencement of the mining operation is not started within 60 days the notice shall be expired. The project manager shall have to submit a new notice to the concerned authorities.

Following things will have to prepare with the beginning of mining operation:

#### **4.2 Offices for Staff and Residential Areas:**

The land shall be purchased for construction and the civil department of the project will issue tenders for bidding. The contract shall be awarded to the successful bidder which had to complete within the specified period.

#### **4.3 Power Supply:**

Incessant power supply will be required for the operation of the mining. For a continuous power supply, WAPDA is proceeding for arrangements of the supply or to build grid station for the project. Besides, supply from the WAPDA, the Project Manager should be constructed his own power supply as a contingency so that the work cannot be stopped due to poor electricity supply.

#### **4.4 Machinery for the Plant Mining:**

The following machinery will be required for the mining operations:

##### **4.4.1 Railway Line:**

A railway line will be placed along with the mining operations from the central depot point to all its exits for the smooth extraction of rocks and minerals. The line should be narrow for the mining processes in the underground tunnel.

##### **4.4.2 Locomotive:**

Vendors should be approached for the locomotives.

**4.4.2 Dumpers:**

Dumpers are very essential for mining operations in the extraction process. Dumpers are very handy where the rail line is not laid down. Dumpers are useful for the transportation of minerals from narrow passages to the central depot point, etc.

**4.4.3 Water Pumps:**

Water pumps are installed inside the area to extract water underground to the sub storage tank. These water pumps should be fireproof.

**4.4.5 Haulages:**

Haulages are constructed for the transportation of goods and minerals from one underground level to another. These haulages should be fire-resistant.

**4.4.6 Safety Helmets:**

Safety helmet and other precautionary equipment should be available in a mine in an abundant quantity for the mineworkers, inspectors, etc.

**4.4.7 Safety Lamps:**

According to a mining act, mine lamps are required for every worker and the Supervisor. These are issued to all workers at their starting of shift and at their ending of the shift should be given back to the mine lamp room where lamps are recharged again.

**4.4.8 Mining Tubs:**

Mining tubs are installed inside the mine for the transportation of goods and minerals from underground to the mouth of the mine. These tubes are attached to the locomotives or moved manually by the workers. On each tub, their weight capacity to transport minerals should be mentioned. Their weight capacity is measured in tonnage/minerals.

**4.4.9 Weigh Bridge:**

These are placed at the center point of the depot to measure the weight of the incoming minerals as well as minerals weight measurement for sale purposes.

#### **4.4.10 Pneumatic Drill/Picks:**

Pneumatic drill or pneumatic pick is used underground for the cutting or drilling of mine and other purposes.

#### **4.5 Rescue Stations:**

The government or the concerned authority can make rules for the establishment of rescue operation for future unwanted incidents as under:

- i) Construction of rescue point at mine.
- ii) Establishing rules for the management of the rescue station and rules for the manager, supervisors, and other functioning authority.
- iii) Training rules and responsibilities for rescue station employees.
- iv) To prevent accidents and for the safety of workers, the project manager can make by-laws with the collaboration of mine chief inspector.
- v) Rules and regulations for the rescue operations and conducts during unwanted happening should be placed in each mine.

## **Chapter# 5**

### **5 Special Precautions against Underground Fire:**

#### **5.1 Detection of Carbon Monoxide gas:**

Carbon monoxide is a highly flammable gas so inside the mine where there are any chances of incendiary incidents small birds are kept all the time. Any other precautions taken against underground fire should be approved by the Chief Inspector of the mine.

#### **5.2 Fire Proof Safety Lamps:**

Besides, normal lamps, some fireproof lamps are placed in the mine for those areas where there is any danger of fire.

#### **5.3 Non-Flame-proof Surface Structure:**

The surface structure covering the shafts and all ventilation systems should be fire-resistant.

#### **5.4 Non-Combustion material at Air Crossings:**

The air crossings in the main airways and all the ventilation doors around fans and shafts should be made of non-combustion material.

#### **5.5 Fire Extinguishers Equipment:**

Plenty of fire extinguishers are placed at the mine where timber and other flammable material are stored.

#### **5.6 Water Taps and Hose Pipes:**

There should plenty of water taps for the water pipes or other pipes containing water under high pressure. In the mine, the length of the hose pipe should not be less than 200 feet and the distance between the taps should not be greater than the hose pipe length.

#### **5.7 Portable Fire Extinguishers and Water Tanks:**

The following measures are taken with the approval of the Chief Inspector of mine for those areas where fire extinguishers cannot be installed. These are:



- i) Portable water tank with a pipe which should have enough pressure. Moreover, the length of the hose pipe should be adequate.
- ii) Portable fire extinguishers
- iii) Sand and other incombustible dust should be available in sufficient quantity

#### **5.8 Evacuation drill in case of fire detection:**

In the case of carbon monoxide, smoke and fire are detected all the workers from the mine should be evacuated immediately. After the fire is quenched, then a thorough inspection of the area is made by the Manager or concerned authority. The findings of the inspection are documented in the inspection book. Fire-resistant safety lamp, electric torches are used during the inspection. Aviaries are also used during examination for the detection of carbon monoxide gas.

#### **5.9 Ventilation Safety Measures:**

In a mine the areas where underground fire exists, the ventilation system is not usually wet. The following measure will be taken for the ventilation system:

- i) Railroads and air haulages should be clear from any agglomeration of combustible dust and materials.
- ii) To avoid explosives in contact with the combustible material all roads in mine should be handled with water and this precaution should be taken in the vicinity of around 400 ft. area.

#### **5.10 Measures to prevent Air Passage through broken Strata:**

Necessary precautions should be taken where there is a danger of fire to prevent air passage through strata.

#### **5.11 Other Precautions:**

- i) In case of fire water cannot be used over electricity wires or to quench oil fire.
- ii) No person can light a fire at least 40 ft. from the shaft.

## **Chapter#6**

### **6 Explosives and their Management:**

According to the Explosives Act 1884, a place is constructed which is only fixed to store permitted explosives magazine, cartridges, gun powder, detonators, and other necessary ammunition. Explosives Magazines cannot be used without the approval of the Chief Inspector of Mine.

#### **6.1 Management of Explosives:**

Following measures should be taken to manage and control of explosives:

- i) A special duty is assigned by the manager in the office of mine, whose sole responsibility is to manage explosives magazine, gunpowder, detonator, etc. He should maintain a record of the issued explosives of all kinds; keep track of the remaining and receiving explosives from the mine.
- ii) If the explosives magazine needs to be stored underground, then a sufficient distance is maintained from other explosives magazines. Besides, these are not stored in those areas where is progressing or in the way of traveling. A record should be maintained of underground explosive magazines and their quantity should not surpass the need required for two days.
- iii) Precautions should be taken for transportation of explosives to the underground mine. Explosives should be boxed in a locked container. The weight of the container should not be more than five pounds.
- iv) Explosives and gun powder should only be used underground in the form of cartridges except for fuses and detonators.
- v) According to the Explosives Act 1984, a person should be appointed for the preparation and drying of damp cartridges. No person shall be allowed to process the cartridges. A place is also authorized from the concerned authority for the reconstruction of cartridges.
- vi) An experienced person should handle all the explosives operations like, blasting and detonating, who is appointed by the manager. The age of the person should not be less than 18 years.
- vii) When there are more than 50 workers in an underground mine then only short firer perform his duty of inspection of the whole mine shift wise.

- viii) A book record should be maintained of all the used and unused underground explosives. The unused explosives should put back to their magazine immediately. Next time these unused explosives should be issued first before the usage of new stock.
- ix) When the hole for the blasting operation needs to change no person shall use any kind of iron or steel rod. Unnecessary force should be avoided during the adjustment of explosives in a hole.
- x) No extra hole should be charged, only those holes charged with fuses that need to explode and these holes should be detonated at the same time.
- xi) Before detonated any explosives one alarming notice should be given and a person should inspect every entrance and leaving points of the mine.
- xii) Explosives should not be used between those areas having a distance of only 10 feet apart. For blasting in those areas all workers should be evacuated first.
- xiii) In open-air blasting, all the workers should be informed before detonating the explosives.
- xiv) Two persons shall be appointed by the manager who will count the fired shots, and then only those fired shot considered correct which are lowest. No person shall be allowed to work after blasting. There should be 30 minutes of a gap to start work after blasting.
- xv) When the shorts are fired through some electrical means, the time interval between the shots should not be less than 2 minutes.
- xvi) If the explosive is misfired and the charged is burned down then no person shall be allowed to work in the area to at least 1 hour.
- xvii) When the short is fired then the authorized person should inspect the area first then workers are allowed to enter into working place.
- xviii) The misfired hole shall not be drilled again a minimum of 12 inches of the hole. In the presence of the short firer, a new hole should be drilled and debris should be removed from the misfired hole within 6 feet of the hole.

## **Chapter#7**

### **7 Methods of Mining:**

There different methods of mining used in the World. The selection of the mining method depends on the geological properties of the deposits of the minerals and their quantity. The majority of the minerals are extracted from underground.

There are three main methods of mining used Worldwide which are Surface Mining, Underground Mining, and In-Situ Leach Mining.

#### **7.1 Surface Mining:**

Minerals reserve in which surface mining used to have the following characteristics;

- i) A horizontally stratified type which has thick or thin layers of overburden
- ii) Stratified vein-type reserves which are at an inclined angle than the natural angle. In these reserves, waste cannot be disposed into the pit.
- iii) Very large in-depth reserves where waste dumping cannot be possible.

There are three types of Surface mining methods:

##### **7.1.1 Strip Mining:**

This method is used for those surfaces in which mineral deposits are not very deep and a large wide-area surface is available for mining.

The appropriate conditions for this method are:

- i) As compared to other surfaces these have a thin layer of overburden maximum of 50 meters.
- ii) More than 20 different kinds of the mineral layer in its smooth and constant topography.
- iii) Vast areas for the mine enable the mine to recover all its capital costs within a specific time.

Walking drag-lines machine is the most appropriate machine used in this method to its flexibility and easy handling. The drag-line machine does not use conveyors and trucks it is the combine cyclic machine of excavator and material. The machine lies above the overburden layers of minerals, excavate the materials dump it on the lower side to remove the layers.

The longer strip is used in the machine for efficient productivity which saves time. Due to low bits, the large surface area is consumed which causes transportation problems. There are other problems as well for using the longer strip, for example, active mining present at the front. Moreover, it is necessary to increase the stability of waste dumps when the direction of floor dips is towards the high wall.

### **7.1.2 Terrace Mining:**

Shovels and trucks are used in this method to unearth the seam. The outermost layer is exposed by using a hydraulic excavator, bucket wheel excavator, and conveyer belt. Continuous transport becomes essential where the overburden is too thick or pit is steep which allows the waste to dump directly over the pit. This is called a multi-benched sideways method. It is not necessary to move the mining ore reserves in a single bench. Multi-sideways is the feature of excavation depth and the machinery type.

### **7.1.3 Open-Pit Mining**

The usability of this method depends on the geological structure of the seam whether the ore body is pipe-shaped, vein-type or irregular. In this method, hydraulic shovels are used with the help of trucks. For cyclic process drilling and blasting are used. Due to non-availability of any space in the pit waste is accumulated at the mouth of the mine. To reduce the transport cost as low as possible waste is accumulated on the edge of the pit.

The transporting cost is highest in the open-pit method; in order to reduce cost following measures are taken:

- i) The continuous transport system should be avoided instead of crusher along with a conveyor is used in the pit.
- ii) Fast speed trucks are used along with digitalized dispatch system.
- iii) Where stability permits a steeper bench slope angle should be used.

### **7.2 Underground Mining:**

Most of the mining in the World is done through this method. In Pakistan, underground mining is the primary method used with different techniques. The

basic idea in this method is that tunnels are created from the surface to the mineral reserves and for extraction of minerals, different kinds of machinery are used. To approach the mineral reserves, the following three methods are used:

- i) Drift Mine: In this method, drift mine started from one side of the hill horizontally and dig up the hill in this manner.
- ii) Slope Mine: Slope mine begins at the bottom and tunnels are made to access the mineral reserves.
- iii) Shaft Mine: In these mines, reserves are extracted from the deepest point with the help of shafts and excavators.

The actual mining includes Room and Pillar Mining and Long Wall Mining.

#### **7.2.1 Room and Pillar Mining Method:**

In this method, mining is done through the cutting of networks of rooms. Through these rooms, minerals are extracted to the surface with of help of mining tubs and conveyors. The reserves made Pillars are carved inside the mine. These pillars made at small distances to support the networks of mine. The surface of the room made strong by using bolts to prevent the roof from falling down.

#### **7.2.3 Room and Pillar Retreat Mining Method:**

This method is like a room and pillar mining with a small deviation. In this method, pillars are removed from the drainage in the direction opposite to the direction from where mine is excavated.

#### **7.2.4 Long Wall Mining Method:**

In this method, reserves are approached deep by making levels and underground tunnels. In this method pillars are not used, the whole lengths of reserves are extracted by the use of hydraulic pioneered support which supports the roof during excavation. With increase advancement of excavation, the roof of the excavation which left behind is falling down. This method is most efficient to extract minerals in terms of quantity, safety, and costing.

#### **7.2.5 High Wall Mining Method:**

This method is used when the physical and geological conditions of the mine are difficult to extract minerals. In this method, heavy machinery is used for

excavation to extract the minerals. It is often used for those mines where minerals are left behind due to previous mine operations. The extraction process started horizontally at the bottom of the seam where pillars are also constructed for the support of the roof. This method is a relatively new method; it is generally not used in Pakistan.

There are further two types of high wall mining method that are used:

#### **7.2.5.1 Continuous High-wall Mining:**

In this method machinery is used incessantly to mine the seam in a rectangular way with a high wall. Then minerals are extracted to the surface by using conveyors and other resources.

#### **7.2.5.2 Auger Mining Method:**

Angular mining machine is used in this method. These machines have cutters at their mouth and they cut through the surface like a pneumatic drill, drilling large circular holes to approach the mineral reserves. Then the minerals are extracted with the help of conveyors and auger machine.

### **7.3 In-Situ Leach Mining:**

This method is used for those mines where the underground geological conditions are weak that are impossible to use room and pillar method. Its strata conditions do not allow us to hold up the underground surfaces. It is used when the minerals reserves are too deep inside the surface.

In this method, the blasting process is generally used to piercing into the seam with the help of explosives and hydraulic fracturing. After that, a leach solution injects to the mineral deposits. The ores are mixed with the solution and pushed back to the surface where it is processed. This method overruled the traditional approach to underground mining. The type of leach solution depends on the properties of the deposited minerals:

- i) **Soluble salt:** For the deposits of salt rock salt, sodium chloride and sodium sulphate with pure water are used for the solution.
- ii) **Uranium:** For the solution of uranium acids like sulphuric and nitric acid are used. Carbonates can also be used in solution which are sodium

bicarbonates, ammonium carbonate or dissolved carbon dioxide. Australia, USA, and other countries used this method; about 41% of uranium are extracted through this method worldwide.

iii) **Gold:** For gold chloride and iodide are used in the leach solution.

### **Advantages and Disadvantages:**

It is used for those conditions where the strata conditions are weak to allow us to construct rooms or tunnels, where passages for conveyors and other materials cannot be built. It is also suitable for those conditions where the mine has no fire problem or has no ventilation system.

There are the following disadvantages of using this technique:
























- i) Contamination of groundwater with acids.
- ii) Instable mobilization of uncertain metals like radioactive materials and uranium.
- iii) The devastation of the natural environment affecting living organisms like bacteria.
- iv) The probable splashing of hazardous leach solution on the surface.


























## Chapter#8

### 8. “Khewra Salt Mine” Project On Primavera P6

#### 8.1 Resources

Resources				
Projects	Activities	Resources		
▽ Display: Current Project's Resources				
Resource ID	Resource Name	Resource Type	Unit of Measure	Primary Role
 PM	Project Manager	Labor		
 MT	Managment Team	Labor		
 ProT	Procurement Team	Labor		
 CE	Chief Engineer	Labor		
 MW	Mine Worker Team	Labor		
 ME	Mine Engineer	Labor		
 DD	Design Team	Labor		
 S	Surveyor	Labor		
 PD	Project Director	Labor		
 SE	Safety Engineer	Labor		
 G	Geologist	Labor		
 MO	Machine Operator	Labor		
 PT	Packing Team	Labor		
 SF	Short Firer	Labor		
 MT-1	Marketing Team	Labor		
 WM	Warehouse Manager	Labor		
 EnV	Environmental Engineer	Labor		
 CFO	Chief Finance Officer	Labor		
 Elect	Electrician	Labor		
 LT	Lab Technician	Labor		
 D	Drill	Nonlabor		
 Cut	Cutter	Nonlabor		
 V	Vehicles	Nonlabor		

## Resources

Projects	Activities	Resources		
▾ Display: Current Project's Resources				
Resource ID	Resource Name	Resource Type	Unit of Measure	Primary Role
 Elect	Electrician	Labor		
 LT	Lab Technician	Labor		
 D	Drill	Nonlabor		
 Cut	Cutter	Nonlabor		
 V	Vehicles	Nonlabor		
 M	Meggar	Nonlabor		
 GPS	GPS	Material	Unit	
 SH	Safety Helmets	Material	Unit	
 LL	Light Lamps	Material	Unit	
 WP	Water Pumps	Material	Unit	
 HP	Hand Picks	Material	Unit	
 TS	Total Station	Material	Unit	
 WB	Wheel Barrow	Material	Unit	
 WP-1	Wooden Planks	Material	Unit	
 Ex	Explosives	Material	Unit	
 Cond	Conductors	Material	Unit	
 EF	Exhaust Fans	Material	Unit	
 Lv	Locomotive	Material	Unit	
 Cr	Crushers	Material	Unit	
 Si	Sieve	Material	Unit	
 Pak	Packing Machine	Material	Unit	
 Sack	Sack	Material	Unit	
 St	Search Torches	Material	Unit	

## Activities

### Projects Activities

Layout: Classic Schedule Layout		Filter: All Activities				
Activity ID	Activity Name	Original Duration	Resources	Budgeted Total Cost	Start	Finish
<b>KSMPPR Khewra Salt Mine Project</b>		355d		Rs.13,911,150.00	01-Nov-18 08:00 AM	25-Aug-19 07:00 PM
<b>KSMPPR.F Feasibility</b>		20d 4h		Rs.329,200.00	01-Nov-18 08:00 AM	17-Nov-18 12:00 PM
PS	Project Start	0d		Rs.0.00	01-Nov-18 08:00 AM	
PL	Prospecting of Land	4d	GPS, Surveyor, Vehicles, Total Station	Rs.216,000.00	01-Nov-18 08:00 AM	04-Nov-18 10:00 AM
LS	Land Selection	1d	Geologist, Vehicles, GPS, Chief Engineer	Rs.10,000.00	04-Nov-18 10:00 AM	04-Nov-18 07:00 PM
SI	Subsoil Investigation	2d	Geologist, Drill, Megger, Lab Technician	Rs.6,000.00	05-Nov-18 08:00 AM	06-Nov-18 03:00 PM
MQQ	Minerals Quality and Quantity study	2d	Geologist, Drill, Megger, Lab Technician	Rs.6,000.00	06-Nov-18 03:00 PM	08-Nov-18 10:00 AM
US	Underground Stratification	2d	Geologist, Drill, Megger	Rs.4,400.00	08-Nov-18 10:00 AM	09-Nov-18 05:00 PM
EMT	Plan of Extraction Method	1d	Geologist, Project Manager, Mine Engineer	Rs.5,000.00	09-Nov-18 05:00 PM	10-Nov-18 03:00 PM
NLS	Plan of Number and Level of Shafts	1d	Geologist, Project Manager, Mine Engineer	Rs.5,000.00	10-Nov-18 03:00 PM	11-Nov-18 12:00 PM
TNP	Tools and Plant requirements	1d	Design Team, Project Manager, Procurement Team, Chief Engineer, Chief Finance Officer	Rs.12,500.00	11-Nov-18 12:00 PM	12-Nov-18 10:00 AM
ID	Design of Infrastructure Development	5d	Design Team, Project Manager, Procurement Team, Chief Finance Officer, Chief Engineer	Rs.62,500.00	12-Nov-18 10:00 AM	16-Nov-18 10:00 AM
EA	Environmental Analysis	1d	Environmental Engineer	Rs.1,800.00	16-Nov-18 03:00 PM	17-Nov-18 12:00 PM

## 8.2 Activity Details.

## Activities

### Projects Activities

Layout: Classic Schedule Layout		Filter: All Activities				
Activity ID	Activity Name	Original Duration	Resources	Budgeted Total Cost	Start	Finish
EA	Environmental Analysis	1d	Environmental Engineer	Rs. 1,800.00	16-Nov-18 03:00 PM	17-Nov-18 12:00 PM
<b>KSMPR.SP Services Procurement</b>		<b>30d</b>		<b>Rs. 582,000.00</b>	<b>17-Nov-18 08:00 AM</b>	<b>10-Dec-18 07:00 PM</b>
RIP	Request for Proposal (Consultancy)	15d	Project Manager, Procurement Team, Project Director	Rs. 120,000.00	17-Nov-18 08:00 AM	28-Nov-18 07:00 PM
B0	Bidding Opening	1d	Project Manager, Procurement Team, Project Director	Rs. 8,000.00	29-Nov-18 08:00 AM	29-Nov-18 05:00 PM
VS	Vendor Selection	1d	Project Manager, Procurement Team, Project Director	Rs. 8,000.00	29-Nov-18 05:00 PM	30-Nov-18 03:00 PM
RelP	Request for Proposal (civil works, site camps, grid station)	15d	Project Manager, Procurement Team, Project Director	Rs. 120,000.00	17-Nov-18 08:00 AM	28-Nov-18 07:00 PM
B0	Bidding Opening	1d	Project Manager, Procurement Team, Project Director	Rs. 8,000.00	29-Nov-18 08:00 AM	29-Nov-18 05:00 PM
VS	Vendor Selection	1d	Project Manager, Procurement Team, Project Director	Rs. 8,000.00	29-Nov-18 05:00 PM	30-Nov-18 03:00 PM
RelP1	Request for Proposal (Health and Safety Services)	15d	Project Manager, Procurement Team, Project Director	Rs. 120,000.00	17-Nov-18 08:00 AM	28-Nov-18 07:00 PM
B01	Bidding Opening	1d	Project Manager, Procurement Team, Project Director	Rs. 8,000.00	29-Nov-18 08:00 AM	29-Nov-18 05:00 PM
VS1	Vendor Selection	1d	Project Manager, Procurement Team, Project Director	Rs. 8,000.00	29-Nov-18 05:00 PM	30-Nov-18 03:00 PM
IS	Hiring Human Resource	12d	Project Manager	Rs. 24,000.00	30-Nov-18 03:00 PM	10-Dec-18 10:00 AM
Ins	Inspection of Services	30d	Project Manager, Procurement Team	Rs. 150,000.00	17-Nov-18 08:00 AM	10-Dec-18 07:00 PM

## Activities

### Projects Activities

Layout: Classic Schedule Layout		Filter: All Activities				
Activity ID	Activity Name	Original Duration	Resources	Budgeted Total Cost	Start	Finish
Ins	Inspection of Services	30d	Project Manager, Procurement Team	Rs.150,000.00	17-Nov-18 08:00 AM	10-Dec-18 07:00 PM
<b>KSMPPR.PoE Procurement of Equipmen</b>		<b>20d</b>		<b>Rs.740,000.00</b>	<b>17-Nov-18 08:00 AM</b>	<b>02-Dec-18 07:00 PM</b>
RIP1	Request for Proposal (Rail tracks, rail engine, dumper trucks)	15d	Project Manager, Procurement Team, Project Director	Rs.120,000.00	17-Nov-18 08:00 AM	28-Nov-18 07:00 PM
B01	Bid Opening	1d	Project Manager, Procurement Team, Project Director	Rs.8,000.00	29-Nov-18 08:00 AM	29-Nov-18 05:00 PM
VS1	Vendor Selection	4d	Project Manager, Procurement Team, Project Director	Rs.32,000.00	29-Nov-18 05:00 PM	02-Dec-18 07:00 PM
RIP2	Request for Proposal (water supply, power supply)	15d	Project Manager, Procurement Team, Project Director	Rs.120,000.00	17-Nov-18 08:00 AM	28-Nov-18 07:00 PM
B02	Bid Opening	1d	Project Manager, Procurement Team, Project Director	Rs.8,000.00	29-Nov-18 08:00 AM	29-Nov-18 05:00 PM
VS2	Vendor Selection	4d	Project Manager, Procurement Team, Project Director	Rs.32,000.00	29-Nov-18 05:00 PM	02-Dec-18 07:00 PM
RIP3	Request for Proposal (Safety Equipments, mining safety lamps, mining tubs, weigh	15d	Project Manager, Procurement Team, Project Director	Rs.120,000.00	17-Nov-18 08:00 AM	28-Nov-18 07:00 PM
B03	Bid Opening	1d	Project Manager, Procurement Team, Project Director	Rs.8,000.00	29-Nov-18 08:00 AM	29-Nov-18 05:00 PM
VS3	Vendor Selection	4d	Project Manager, Procurement Team, Project Director	Rs.32,000.00	29-Nov-18 05:00 PM	02-Dec-18 07:00 PM
RIP4	Request for Proposal (Explosives, Rescue Station)	15d	Project Manager, Procurement Team, Project Director	Rs.120,000.00	17-Nov-18 08:00 AM	28-Nov-18 07:00 PM
B04	Bid Opening	1d	Project Manager, Procurement Team, Project Director	Rs.8,000.00	29-Nov-18 08:00 AM	29-Nov-18 05:00 PM

Activities

Projects Activities

Layout: Classic Schedule Layout		Filter: All Activities				
Activity ID	Activity Name	Original Duration	Resources	Budgeted Total Cost	Start	Finish
B04	Bid Opening	1d	Project Manager, Procurement Team, Project Director	Rs.8,000.00	29-Nov-18 08:00 AM	29-Nov-18 05:00 PM
VS4	Vendor Selection	4d	Project Manager, Procurement Team, Project Director	Rs.32,000.00	29-Nov-18 05:00 PM	02-Dec-18 07:00 PM
I1	Inspection	20d	Project Manager, Procurement Team	Rs.100,000.00	17-Nov-18 08:00 AM	02-Dec-18 07:00 PM
<b>KSMPR.MIP Mining Process</b>		<b>150d</b>		<b>Rs.6,322,050.00</b>	<b>11-Dec-18 08:00 AM</b>	<b>12-Apr-19 07:00 PM</b>
PMR	Profile of Mine Route	20d	Surveyor, Total Station, GPS, Design Team	Rs.284,000.00	11-Dec-18 08:00 AM	27-Dec-18 07:00 PM
RD	Rocks Drilling	50d	Drill, Mine Engineer, Mine Worker Team, Safety Helmets, Light Lamps, Water Pumps, Hand Picks	Rs.1,107,500.00	28-Dec-18 08:00 AM	06-Feb-19 07:00 PM
EP	Explosives placement	65d	Drill, Mine Engineer, Safety Helmets, Light Lamps, Hand Picks, Explosives, Shot Fier	Rs.1,213,000.00	10-Jan-19 08:00 AM	02-Mar-19 07:00 PM
DA	Detonator Activation	65d	Mine Engineer, Safety Engineer, Safety Helmets, Light Lamps, Shot Fier	Rs.330,000.00	10-Jan-19 08:00 AM	02-Mar-19 07:00 PM
RC	Rocks collection	70d	Mine Engineer, Mine Worker Team, Safety Helmets, Light Lamps, Management Team, Wheel Barrow	Rs.367,900.00	14-Jan-19 08:00 AM	10-Mar-19 07:00 PM
RP	Rocks Piling With size	80d	Mine Engineer, Mine Worker Team, Safety Helmets, Light Lamps, Management Team, Wheel Barrow	Rs.407,900.00	22-Jan-19 08:00 AM	27-Mar-19 07:00 PM
PM	Mine Safety	110d	Mine Engineer, Safety Engineer, Safety Helmets, Light Lamps	Rs.1,441,250.00	28-Dec-18 08:00 AM	27-Mar-19 07:00 PM

## Activities

### Projects Activities

Layout: Classic Schedule Layout		Filter: All Activities				
Activity ID	Activity Name	Original Duration	Resources	Budgeted Total Cost	Start	Finish
RP	Rocks Piling With size	80d	Mine Engineer, Mine Worker Team, Safety Helmets, Light Lamps, Management Team, Wheel Barrow	Rs.407,900.00	22-Jan-19 08:00 AM	27-Mar-19 07:00 PM
PM	Mine Safety	110d	Mine Engineer, Safety Engineer, Safety Helmets, Light Lamps, Wooden Planks	Rs.1,441,250.00	28-Dec-18 08:00 AM	27-Mar-19 07:00 PM
EM	Electrification	10d	Mine Engineer, Safety Helmets, Light Lamps, Electrician, Conductors	Rs.1,061,500.00	28-Mar-19 08:00 AM	04-Apr-19 07:00 PM
MV	Mine Ventilation	5d	Safety Helmets, Light Lamps, Exhaust Fans, Environmental Engineer	Rs.67,750.00	05-Apr-19 08:00 AM	08-Apr-19 07:00 PM
EE	Emergency Exit way	5d	Safety Engineer, Mine Worker Team, Safety Helmets, Light Lamps	Rs.41,250.00	09-Apr-19 08:00 AM	12-Apr-19 07:00 PM
<b>KSMPR.Prs Processing of Salt</b>		55d		Rs.4,186,650.00	13-Apr-19 08:00 AM	26-May-19 07:00 PM
TSM	Salt transportation to Plant	10d	Safety Helmets, Light Lamps, Management Team, Locomotive, Mine Worker Team	Rs.2,044,150.00	13-Apr-19 08:00 AM	20-Apr-19 07:00 PM
CLR	Cutting of Large Size Rocks	10d	Cutter, Machine Operator	Rs.11,500.00	21-Apr-19 08:00 AM	28-Apr-19 07:00 PM
LS S	Lumps Screening	10d	Mine Engineer, Mine Worker Team, Safety Helmets	Rs.49,000.00	29-Apr-19 08:00 AM	06-May-19 07:00 PM
SSM	Separation of salt for monuments	10d	Mine Engineer, Mine Worker Team, Safety Helmets	Rs.49,000.00	07-May-19 08:00 AM	14-May-19 07:00 PM

## Activities

Projects Activities

Layout: Classic Schedule Layout		Filter: All Activities				
Activity ID	Activity Name	Original Duration	Resources	Budgeted Total Cost	Start	Finish
SSM	Separation of salt for monuments	10d	Mine Engineer, Mine Worker Team, Safety Helmets	Rs.49,000.00	07-May-19 08:00 AM	14-May-19 07:00 PM
C	Crushing	10d	Crushers, Machine Operator	Rs.2,010,000.00	15-May-19 08:00 AM	22-May-19 07:00 PM
SAT	Sieve analysis	5d	Sieve, Mine Engineer, Mine Worker Team	Rs.23,000.00	23-May-19 08:00 AM	26-May-19 07:00 PM
<b>KSMPR.P Packaging</b>				<b>Rs.1,075,000.00</b>	<b>27-May-19 08:00 AM</b>	<b>03-Jun-19 07:00 PM</b>
CP	Commercial Coarse particles	10d	Packing Machine, Packing Team, Sack	Rs.537,500.00	27-May-19 08:00 AM	03-Jun-19 07:00 PM
FP	House holds Fine Particals	10d	Sack, Packing Machine, Packing Team	Rs.537,500.00	27-May-19 08:00 AM	03-Jun-19 07:00 PM
<b>KSMPR.I/M Inventory/Marketing</b>				<b>Rs.1,05,000.00</b>	<b>04-Jun-19 08:00 AM</b>	<b>19-Jun-19 07:00 PM</b>
SSW	Warehouse Management	10d	Warehouse Manager, Marketing Team, Project Manager	Rs.65,000.00	04-Jun-19 08:00 AM	11-Jun-19 07:00 PM
DU	Distribution Unit	10d	Warehouse Manager, Mine Worker Team	Rs.40,000.00	12-Jun-19 08:00 AM	19-Jun-19 07:00 PM
<b>KSMPR.TC Testing and Commissioning</b>				<b>Rs.346,250.00</b>	<b>20-Jun-19 08:00 AM</b>	<b>29-Jun-19 07:00 PM</b>
SRR	Surveillance	30d	Mine Engineer, Safety Helmets, Light Lamps, Search Torches	Rs.123,750.00	20-Jun-19 08:00 AM	13-Jul-19 07:00 PM
EET	Emergency Exit Test	5d	Project Manager, Mine Engineer, Safety Engineer, Safety Helmets, Light Lamps, Search Torches	Rs.87,500.00	14-Jul-19 08:00 AM	17-Jul-19 07:00 PM
ST	Safety Testing	15d	Project Manager, Mine Engineer, Safety Engineer, Safety Helmets, Light Lamps, Search Torches	Rs.135,000.00	18-Jul-19 08:00 AM	29-Jul-19 07:00 PM

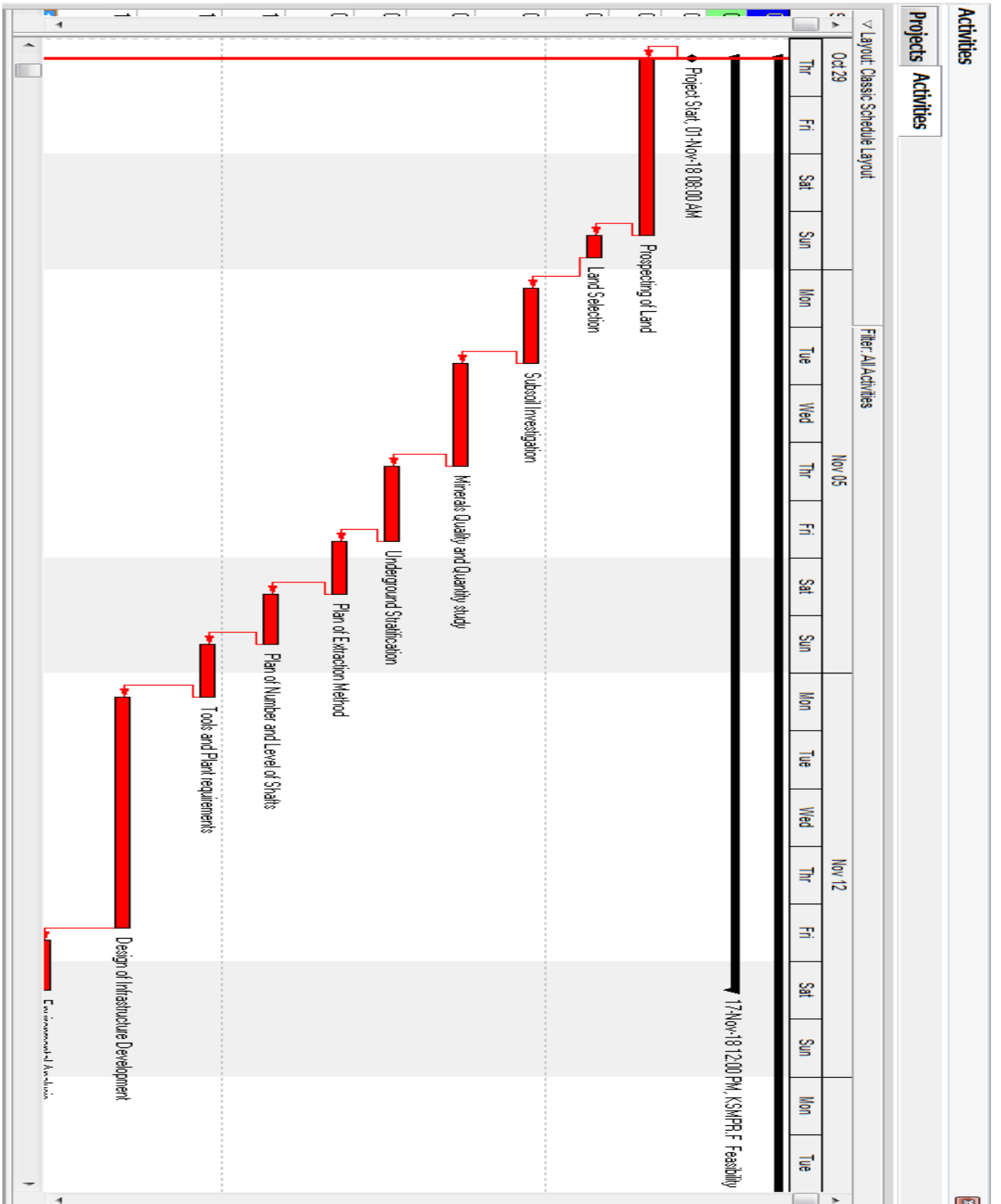


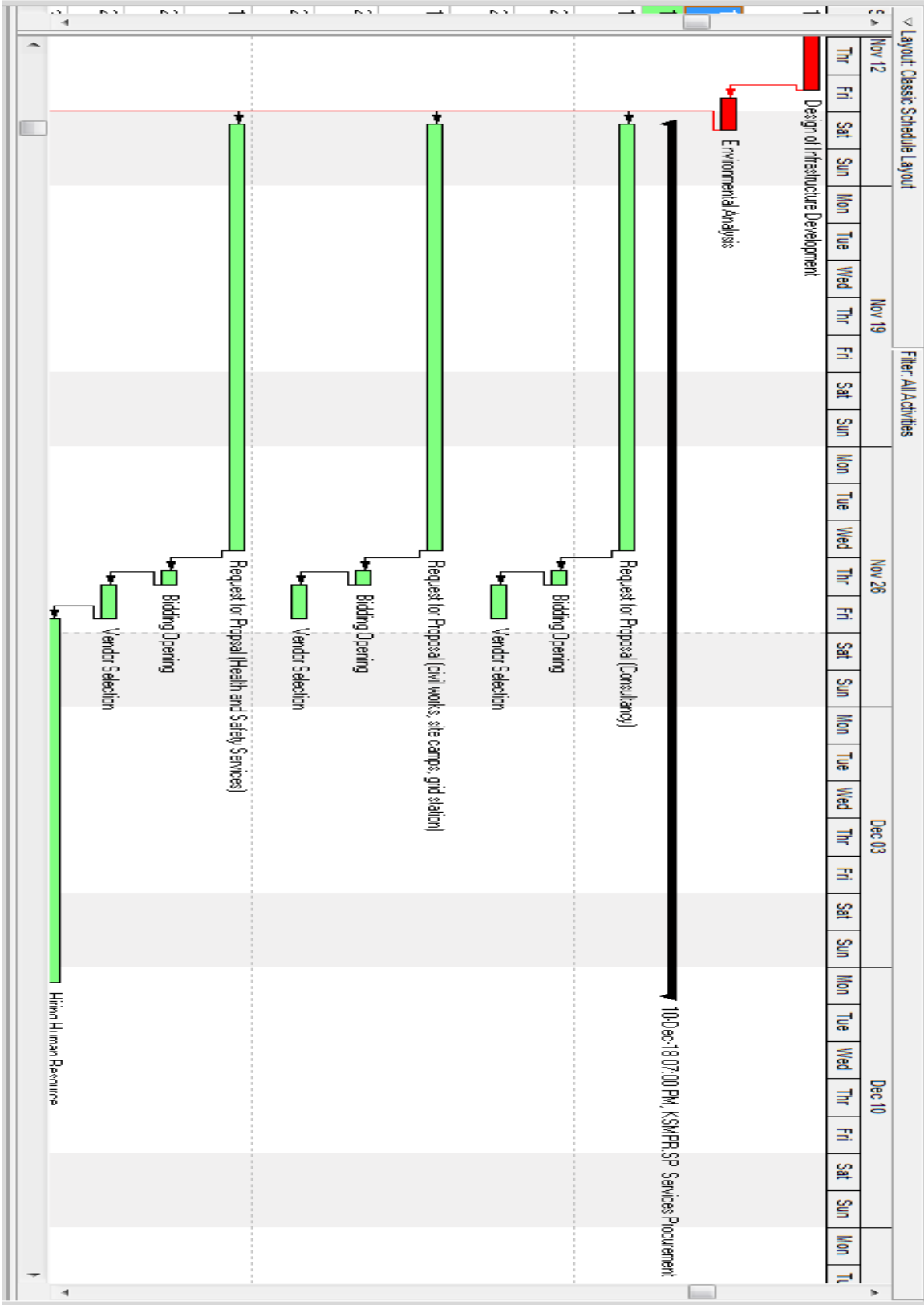
Activities

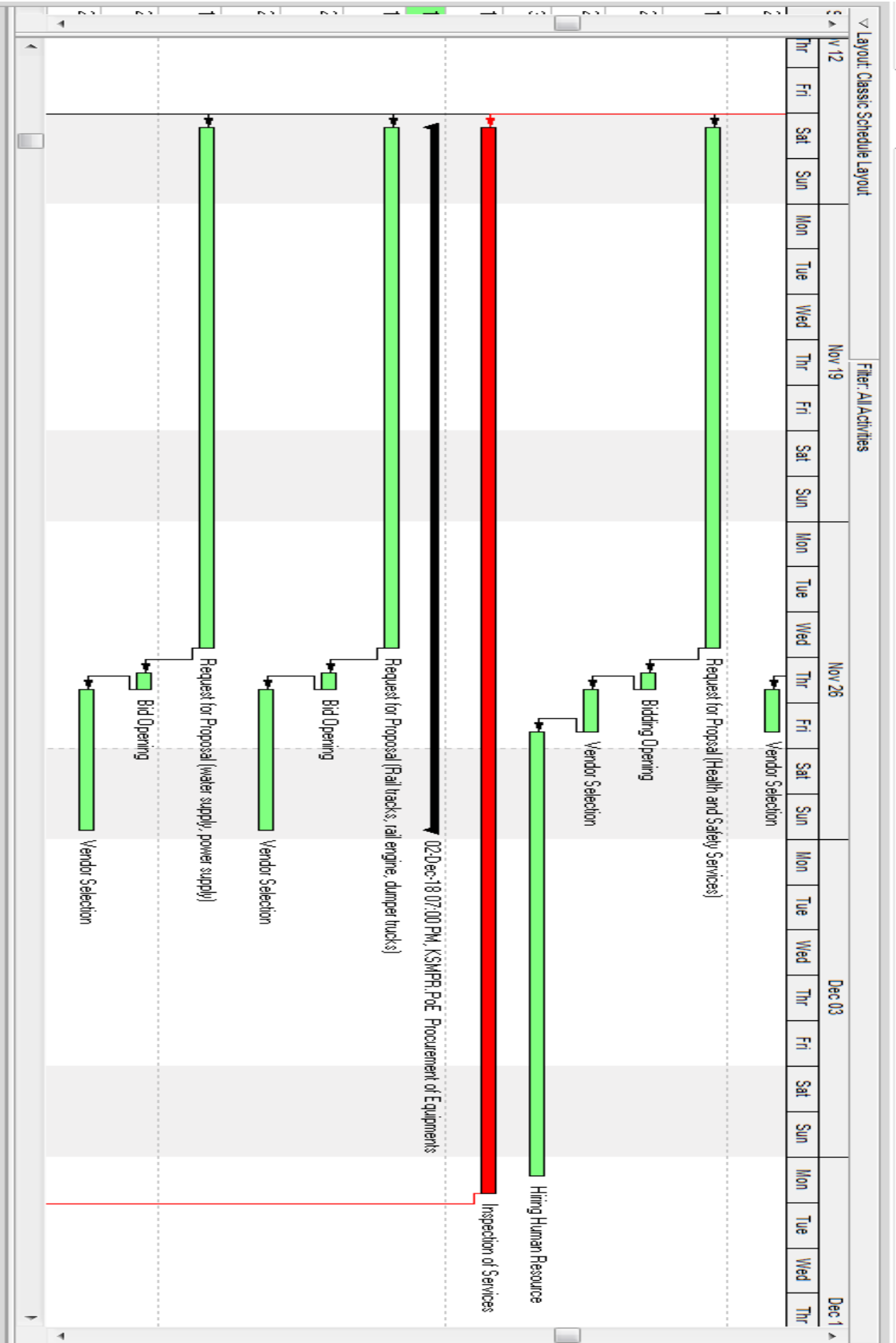
Projects Activities

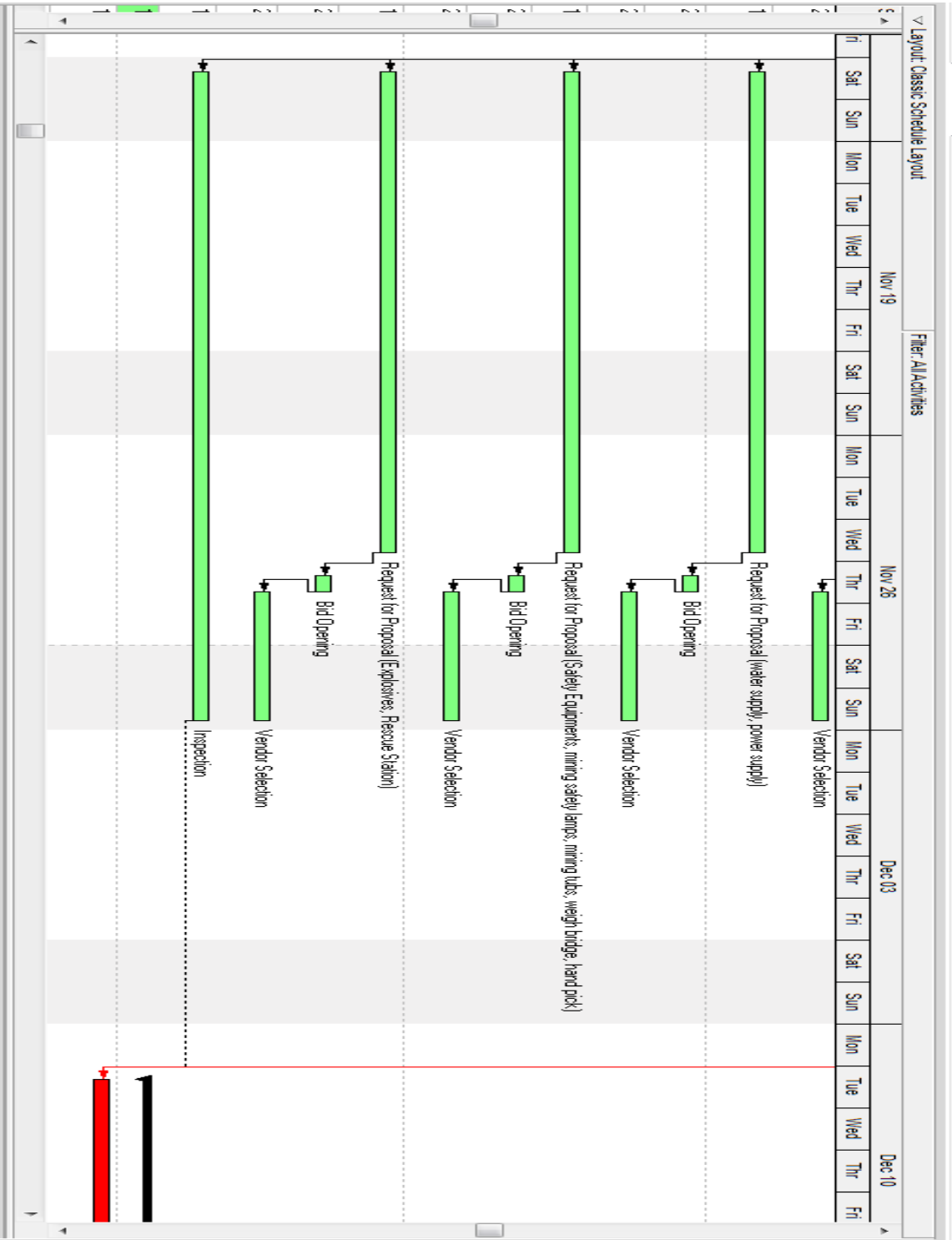
Layout: Classic Schedule Layout		Filter: All Activities				
Activity ID	Activity Name	Original Duration	Resources	Budgeted Total Cost	Start	Finish
<b>KSMPP.P Packaging</b>						
CP	Commercial Coarse particles	10d	Packing Machine, Packing Team, Sack	Rs.537,500.00	27-May-19 08:00 AM	03-Jun-19 07:00 PM
FP	House holds Fine Particals	10d	Sack, Packing Machine, Packing Team	Rs.537,500.00	27-May-19 08:00 AM	03-Jun-19 07:00 PM
<b>KSMPP.I/M Inventory/Marketing</b>						
SSW	Warehouse Management	10d	Warehouse Manager, Marketing Team, Project Manager	Rs.65,000.00	04-Jun-19 08:00 AM	11-Jun-19 07:00 PM
DU	Distribution Unit	10d	Warehouse Manager, Mine Worker Team	Rs.40,000.00	12-Jun-19 08:00 AM	19-Jun-19 07:00 PM
<b>KSMPP.TC Testing and Commissioning</b>						
SRR	Surveillance	30d	Mine Engineer, Safety Helmets, Light Lamps, Search Torches	Rs.123,750.00	20-Jun-19 08:00 AM	13-Jul-19 07:00 PM
EET	Emergency Exit Test	5d	Project Manager, Mine Engineer, Safety Engineer, Safety Helmets, Light Lamps, Search Torches	Rs.87,500.00	14-Jul-19 08:00 AM	17-Jul-19 07:00 PM
ST	Safety Testing	15d	Project Manager, Mine Engineer, Safety Engineer, Safety Helmets, Light Lamps, Search Torches	Rs.135,000.00	18-Jul-19 08:00 AM	29-Jul-19 07:00 PM
<b>KSMPP.H/T Handing/Taking</b>						
H	Project transition to PMDC	30d	Chief Engineer, Project Manager, Project Director	Rs.225,000.00	30-Jul-19 08:00 AM	25-Aug-19 07:00 PM
PF	Project Finish	0d		Rs.0.00		25-Aug-19 07:00 PM

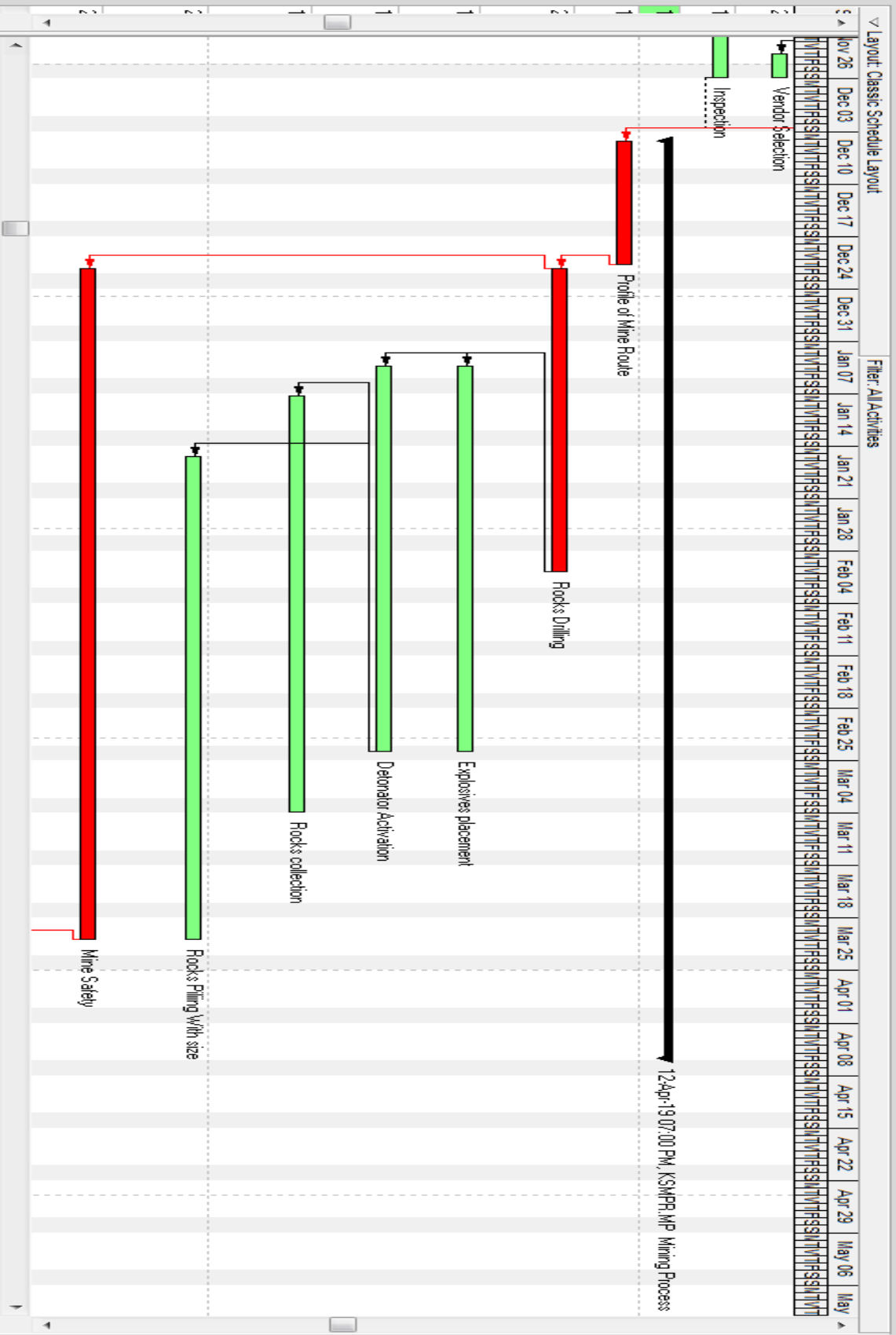
### 8.3 Gantt Chart.

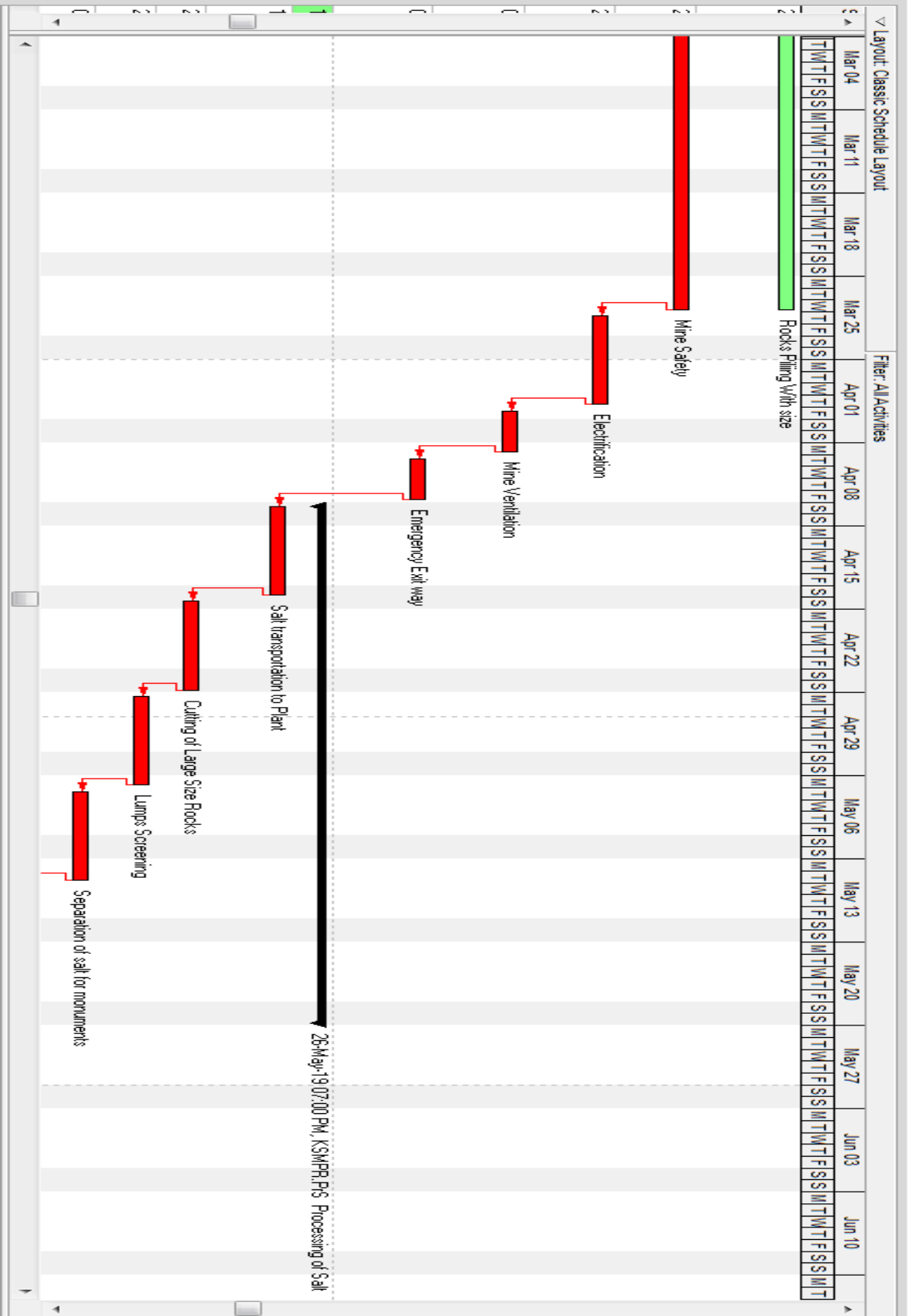


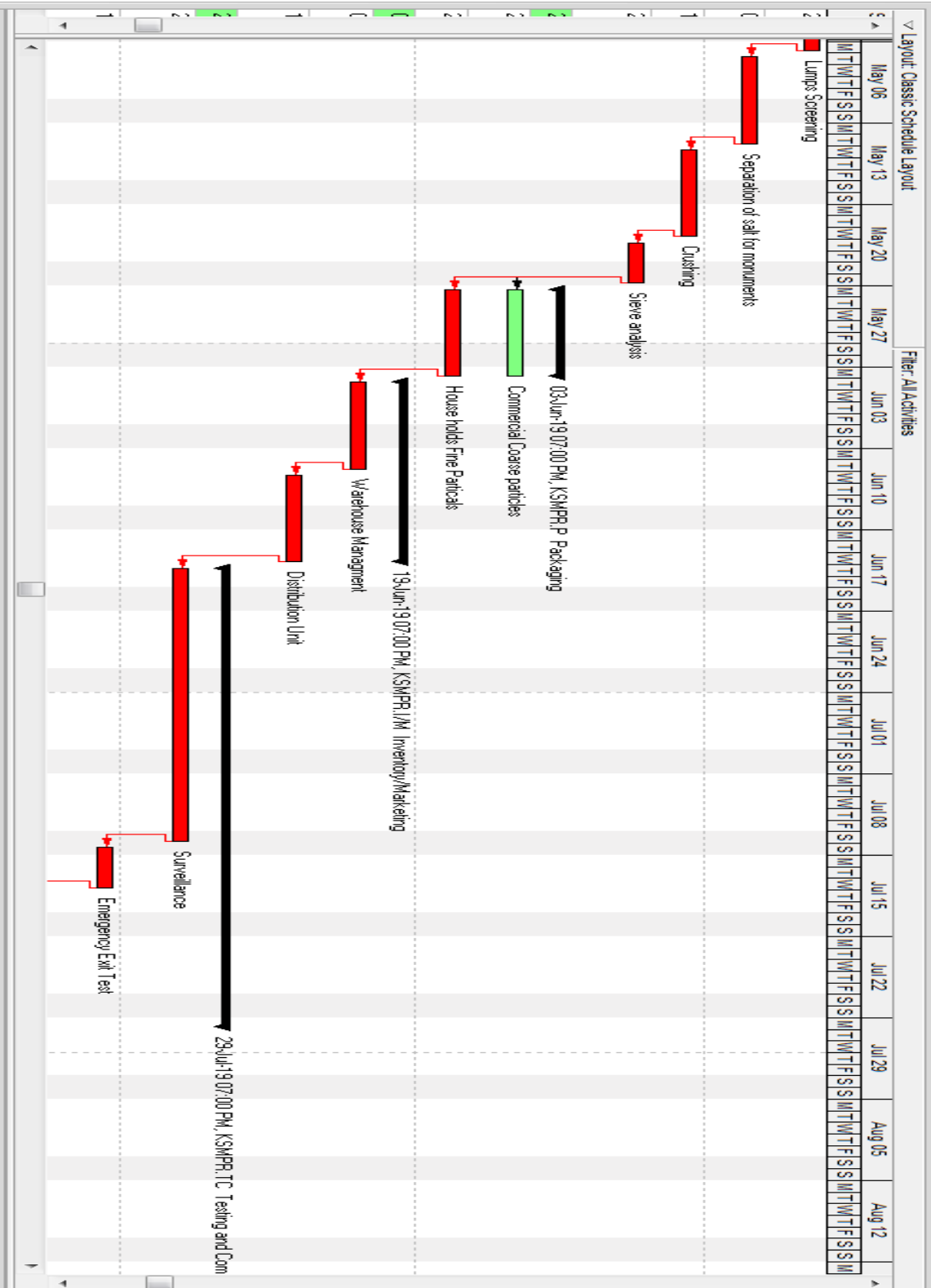




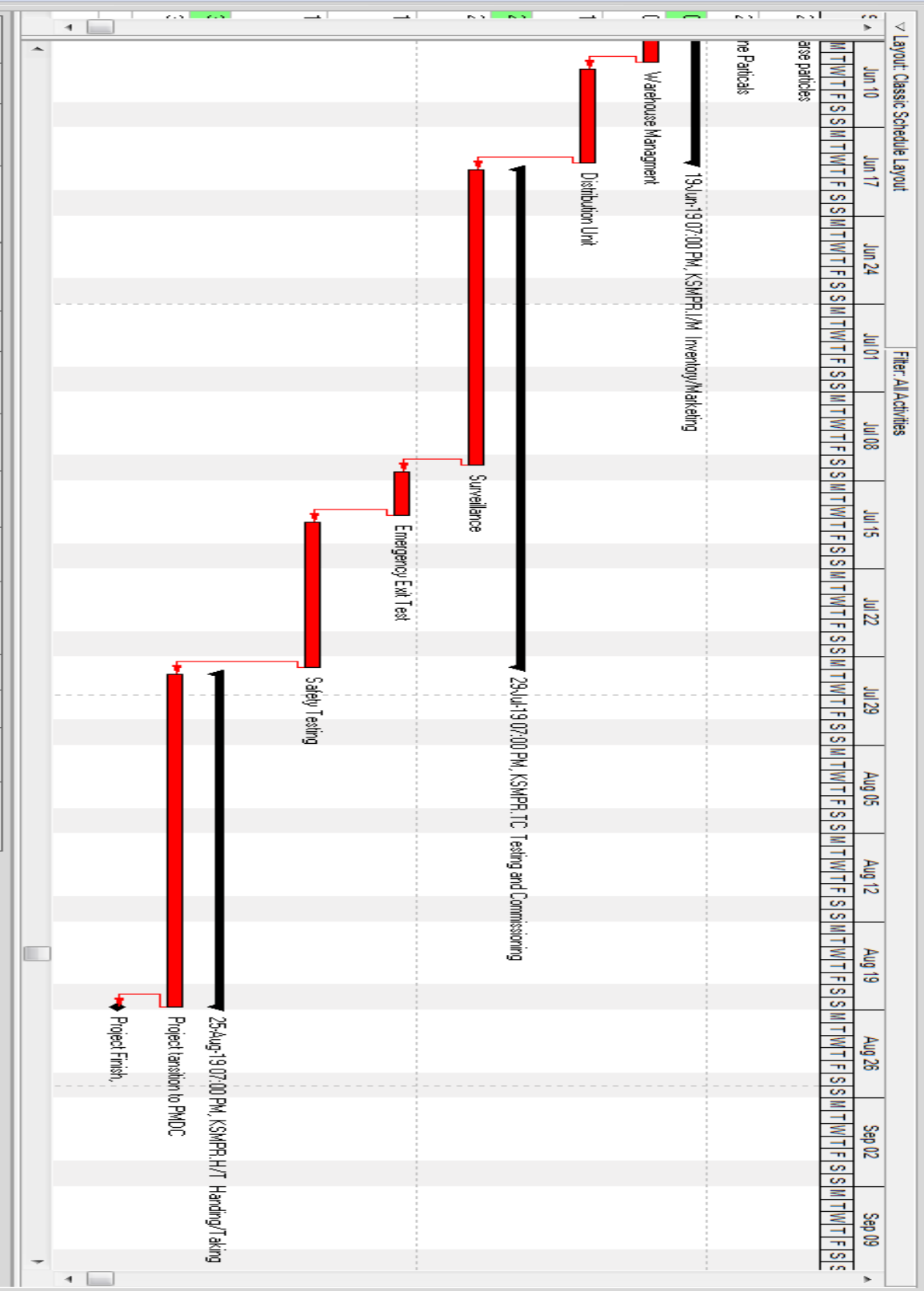




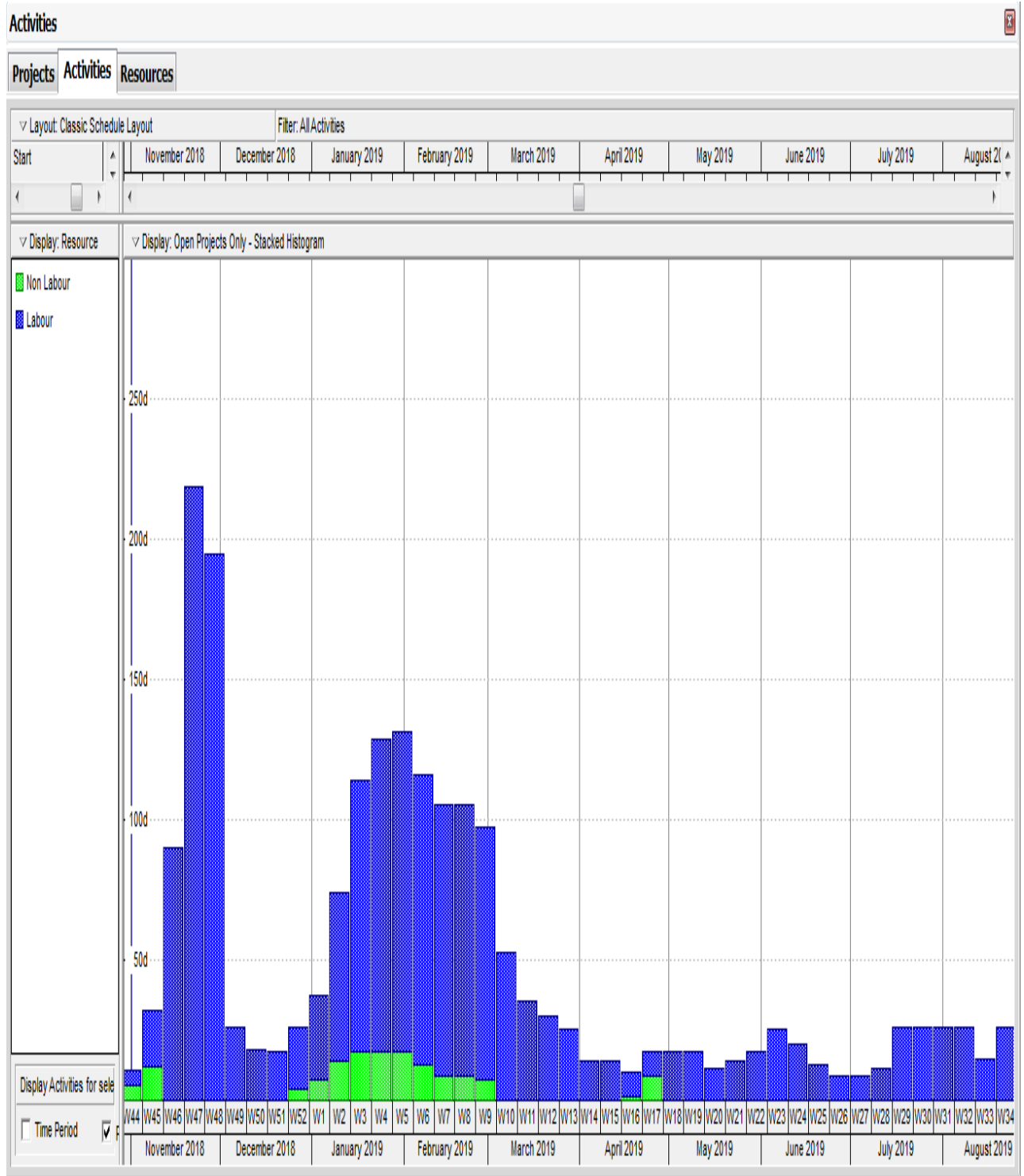




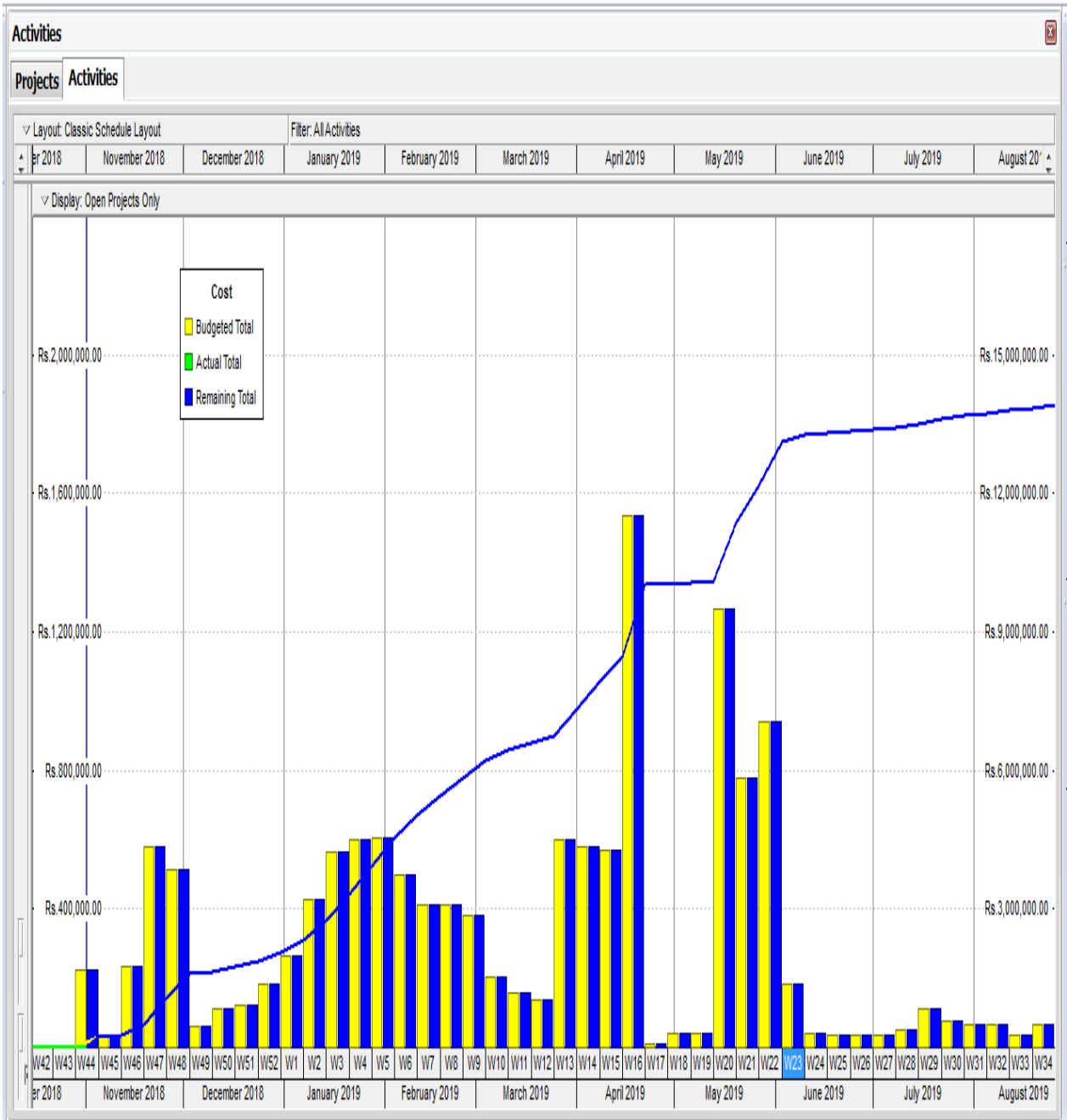




## 8.4 Resource Histogram:



## 8.5 S Curve:



## References:

[http://swisspak.com/web/pakistan/khewra\\_salt\\_mine](http://swisspak.com/web/pakistan/khewra_salt_mine)

[https://en.wikipedia.org/wiki/Khewra\\_Salt\\_Mine](https://en.wikipedia.org/wiki/Khewra_Salt_Mine)

<https://www.youlinmagazine.com/story/the-salts-of-time-inside-the-khewra-mine/NzQQ>

<http://www.pakistantoursguide.com/khewra-salt-mines.html>

<https://whc.unesco.org/en/tentativelists/6118/>

<https://www.youtube.com/watch?v=aHYuVzPZlzs>

# Khewra Salt Mines Project

*by* Shafiqur Rehman

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## PRIMARY SOURCES

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Springer Science and Business Media LLC,  
2018

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Submitted to Gwynedd Mercy College

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