TENDER DOCUMENT

FOR THE CONSTRUCTION OF PHASE – 1

OF THE SECURED ENGINEERED HAZARDOUS SOLID WASTE

LANDFILL SITE FOR

DISPOSAL OF HAZARDOUS SOLID WASTES

OF MEMBERS OF VARNI ENVIRO CARE PRIVATE LIMITED

LOCATED AT: SURVEY NO. 283, AT VILLAGE – SURAI, TALUKA – CHOTILA, DISTRICT – SURENDRANAGAR, GUJARAT, INDIA.

WORK NO.: VECPL/SWM/01/2022

VOLUME – 1: TECHNICAL BID DOCUMENT FOR CIVIL AND LINER WORKS

OWNED AND MANAGED BY:

VARNI ENVIRO CARE PRIVATE LIMITED,
101, FIRST FLOOR, AROHI – III,
OPP. KARNAVATI CLUB, S G HIGHWAY,
AHMEDABAD – 380 015, GUJARAT, INDIA

TECHNICAL CONSULTANTS OF THE PROJECT:

ENVIRONMENT ENGINEERING LABORATORY,
THE GUJARAT INSTITUTE OF CIVIL ENGINEERS AND ARCHITECTS,
NIRMAN BHAVAN, LAW COLLEGE ROAD, ELLIS BRIDGE,
AHMEDABAD – 380 006, GUJARAT, INDIA.

JUNE 2022

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CONSTRUCTION OF SECURED LANDFILL PHASE 1 OF TSDF SITE AT SURVEY NO. 283, VILLAGE-SURAI, TALUKA – CHOTILA, DISTRICT – SURENDRANAGAR, GUJARAT, INDIA

NOTICE INVITING TENDER:

Tender Notice No.	VECPL/SWM/01/2022	
Organization Name	VARNI ENVIRO CARE PRIVATE LIMITED (VECPL)	
Department Name	Hazardous Solid Waste Management Department	
Scope of Work	CONSTRUCTION OF PHASE 1 OF SECURED LANDFILL SITE AT CHOTILA	
Tender Type	Open	
Bidder Nationality	INDIAN	
Type of Contract	Work	
Bidding Currency	Single	
Joint Venture	Not allowed	
Schedule of Tender	Online Query	**The bidder who intend to raise their queries can do so through email address varnienvirocare@gmail.com on or before 22/06/2022 up to 17.00 hrs.**
	Document availability last date & time	**On Website Address: www.varnienvirocare.com Last date for downloading of tender : 22/06/2022**
	Last date & time of Bid submission	**Dt. 25/06/2022 up to 18:00 Hours in Physical form only**
	Physical submission of EMD, Document Fee, Technical & Financial bid and Supporting documents	**25/06/2022 up to 18:00 Hours at the Corporate Office of VARNI: Varni Enviro Care Pvt. Ltd., 101, First Floor, Arohi III, Opp. Karnavati Club, S G Highway, Ahmedabad – 380 015, Gujarat, India through RPAD/Speed Post/Courier/Hand Delivery.**
	Opening of Price Bid	On or After 25/06/2022, 18:00 Hour
	Bid validity period	120 days from opening of bid
	Project Duration	12 months (Excluding Monsoon i.e. 16th June to 15th October)
Payment Details	Document Fee	**Rs. 25000.00** In form of Account Payee Demand Draft/Pay Order payable in the favour of VARNI ENVIRO CARE PRIVATE LIMITED – Non Refundable
	EMD	**EMD Rs. 10,00,000.00** shall have to be paid by pay **order or demand draft** of any Nationalized Bank/Scheduled Bank payable at Ahmedabad in favour of VARNI ENVIRO CARE PRIVATE LIMITED only.
	Estimated Value	**Rs. 65,71,78,770**

CONSTRUCTION OF SECURED LANDFILL PHASE OF TSDF SITE AT SURVEY NO. 283, VILLAGE- SURAI, TALUKA – CHOTILA, DISTRICT – SURENDRANAGAR, GUJARAT, INDIA

VOLUME: I

TECHNICAL BID FOR CIVIL AND LINER WORKS

SECTION - 1
VARNI ENVIRO CARE PRIVATE LIMITED

ITEM RATE TENDER AND CONTRACT FOR CIVIL AND LINER WORKS

GENERAL RULES AND DIRECTIONS FOR THE GUIDANCE OF BIDDERS

1. All work proposed to be executed under this contract shall be notified in a form of invitation to tender Posted on a board hung up in the VARNI ENVIRO CARE PRIVATE LIMITED Office and signed by the Officer authorized by the Managing Director.

   This form will state the work to be carried out, as well as the date for submitting and opening of the tender, earnest money to be deposited with the tender, and the amount of security deposit to be deposited by the successful bidder and the percentage, if any to be deducted from bills. Copies of the specifications, designs, drawings and estimated rates, schedule rates and any other documents required in connection with the work which will be signed by the Managing Director, for the purpose of identification shall also be opened for inspection by Bidders at the Office of the Managing Director during office hours.

2. In the event of the tender being submitted by a firm, it must be signed by each partner thereof, and in the event of the absence of any partner, it shall be signed on his behalf by a person holding a power-of-attorney authorizing him to do so.

3. Receipt for payments made on account of any work when executed by a firm, should also be signed by all the partners, except where the bidders are described in their tender as a firm in which case the receipts shall be signed in the name of the firm by one of the partners, or by some other person having authority to give effectual receipt for the firm.

4. Any person who submits a technical bid of tender shall fill up the usual printed form including the column total according to estimated quantities, stating at what rate he is willing to undertake the work. Tenders which propose any alteration in work specified in the said form of invitation to tender, or in the time allowed for carrying out the work, or which contain any other conditions of any sort, will be liable to rejection. Tenders shall have the name and the number of the works to which they refer written outside the envelope.

5. In the event of a tender being accepted, the bidders shall there upon, for the purpose of identification, sign copies of the specifications and other documents mentioned in Rule 1. In the event of a tender being rejected the deposit will be refundable on application.
6. The VARNI ENVIRO CARE PRIVATE LIMITED shall have the right of rejecting all or any of the tenders without assigning any reasons thereof.

7. No receipt for any payment alleged to have been made by a Bidder regard to any matter relating to this tender or the contract shall be valid and binding to the VARNI ENVIRO CARE PRIVATE LIMITED unless it is signed by the Managing Director.

8. The memorandum of work to be tendered for and the schedule of materials to be supplied by the VARNI ENVIRO CARE PRIVATE LIMITED and their rates shall be filled in and completed by the office of the Managing Director before the tender form issued. If a form issued to an intending bidder has not been so filled in and completed, he shall request the said office to have this done before he completes and delivers his tender.

9. All work shall be measured net by standard measure and according to the rules and custom of the VARNI ENVIRO CARE PRIVATE LIMITED without reference to any local custom.

10. Under no circumstances shall any Bidder be entitled to claim enhanced rates for any items in this Contract.

11. Every Bidder shall, if so desired by the Managing Director, produce along with his tender a banker's certificate of his financial stability. If he fails to produce such a certificate his tender will not be considered.

12. All corrections and additions or pasted slips should be initialed.

13. The measurements of work will be taken according to the usual method in use in the office and no proposals to adopt alternative methods will be accepted.

14. In case of any discrepancy in rates mentioned in the tender documents due to typographical error or other, the rates mentioned for the same in SCHEDULE OF RATES shall be final and binding.

    The Managing Director's decision as to what is the "usual method in use in the office will be final".

Signature and Stamp of the Bidder

Managing Director
VARNI ENVIRO CARE PRIVATE LIMITED

SECTION - 2

TENDER FOR WORKS

I/We hereby tender for the execution for the **VARNI ENVIRO CARE PRIVATE LIMITED**(herein before and herein after referred to as " **VECPL**") of the work specified in the memorandum within the time specified in such memorandum at the tendered rates specified in schedule B (memorandum showing items of work to be carried out) and in accordance in all respects with the specification, designs, drawings, and instructions in writing referred to in Rule 1 hereof and in clause 13 of the annexed conditions of contract and agree that when materials for the work are provided by VARNI ENVIRO CARE PRIVATE LIMITED such materials and the rates to be paid for them shall be as provided in schedule A hereto.

Should this tender be accepted I/We hereby agree to abide by and fulfill all the terms and provisions of the conditions of contract annexed hereto so far as applicable, and in default thereof to forfeit and pay to VARNI ENVIRO CARE PRIVATE LIMITED in office the sums of money mentioned in the said conditions.

Receipt No. _____dated _____from VARNI ENVIRO CARE PRIVATE LIMITED in respect of the sum of Rs._____ (Rupees _____ only) / A crossed order cheque of Rs._____ (Rupees_____ only) No._____ dated _____ on the _____ _____ in favour of the Managing Director, VARNI ENVIRO CARE PRIVATE LIMITED is herewith forwarded representing the earnest money the full value of which is to be absolutely forfeited to VARNI ENVIRO CARE PRIVATE LIMITED should I/We not deposit the full amount of security deposit specified in the Memorandum, in accordance with Clause 1 of the said conditions.

Bidder:
Address:

Dated the _____ day of _____2022

(Witness)

(Address)
(Occupation)
The above tender is hereby accepted by me on behalf of the **VARNI ENVIRO CARE PRIVATE LIMITED**

Managing Director
VARNI ENVIRO CARE PRIVATE LIMITED

Dated _____day of _____2022

SECTION – 3

CONTRACT AGREEMENT
For

CONSTRUCTION OF SECURED LANDFILL PHASE OF TSDF SITE AT SURVEY NO. 283, VILLAGE- SURAI, TALUKA – CHOTILA, DISTRICT – SURENDRANAGAR, GUJARAT, INDIA

Articles of agreement made this _____ day of the month of _____ 2022 Between the Managing Director of VARNI ENVIRO CARE PRIVATE LIMITED(which expression shall include his successors and assignees of one part) and_____ hereinafter called the bidder (which expression shall include their administrator and assignees of the other part).

Whereas the Bidders above named tendered for the works above mentioned and the same having been accepted by the management of the VARNI ENVIRO CARE PRIVATE LIMITED vide Resolution No. _____ dated _____; it is hereby agreed that the Bidder should carry out the works according to the terms and conditions of the contract detailed in the Item Rate Tender Books, -conditions and specifications, which have been signed by the bidders on.

In witness whereof the said Bidders and the Managing Director on behalf of the VARNI ENVIRO CARE PRIVATE LIMITED have hereinto set their respective hands this _____ day of the month of _____ of the year 2022.

Signed, sealed and delivered by the said bidder in the presence of

1. _____

2. _____

Signature and Stamp of Bidder,

Managing Director
VARNI ENVIRO CARE PRIVATE LIMITED

I am responsible if the Bidder does not abide by the Condition of this contract.
Sealed with the common seal of the VARNI ENVIRO CARE PRIVATE LIMITED in the presence of ---

1. _____

2. _____

Managing Director,
VARNI ENVIRO CARE PRIVATE LIMITED

SECTION – 4

SURETY

This bond is made this _____ day of the month of _____ 2022. The Two Thousand _____ between Shri _____ _____ (hereinafter called the surety) of the first part and the Managing Director on behalf of the VARNI ENVIRO CARE PRIVATE LIMITED of the second part.

Whereas the Bidder/Bidders Shri/Ms._____ of _____ _____ has/have entered into a contract with the VARNI ENVIRO CARE PRIVATE LIMITED for the works detailed below:-

Name of the work	Tender Amount	Managing Director Work Order No. & date Sanctioning Contract
Construction of Phase 1 Of Secured Landfill Site- Civil and Liner Works		

And Whereas one of the conditions of the contract being that the Bidder/ bidders shall give surety/sureties to the VARNI ENVIRO CARE PRIVATE LIMITED for the due fulfillment of the contract to the full value of the total expenditure of the work.

Now This Bond Witnesses and it is hereby agreed and declared as follows:-

1. I/We Surety/Sureties hereby bind myself/ ourselves responsible for the due fulfillment of the contract in all its respects by the Bidder/Bidders and I/We do hereby agree and undertake to indemnity and keep harmless.

The VARNI ENVIRO CARE PRIVATE LIMITED jointly as well as severally if the Bidder / Bidders fail / fails to carry out the whole or any part of the contract work as per the conditions and specifications of the work and as agreed to between the parties to the contract to the extent of full value of the total expenditure to be incurred in that behalf by the VARNI ENVIRO CARE PRIVATE LIMITED provided always that the expression "the Surety/Sureties" hereinbefore used shall include the heirs, executors, assigns or administrators of each and every person in this context.

In Witness Whereof the said surety/sureties and the Managing Director on behalf of the VARNI ENVIRO CARE PRIVATE LIMITED have hereinto set their respective hands this _____ day the month of _____ of the year 2022.

Surety

Signed in the presence

1. _____

2. _____

Managing Director
VARNI ENVIRO CARE PRIVATE LIMITED

Sealed with the common seal of the
VARNI ENVIRO CARE PRIVATE LIMITED in the presence of

1. _____

2. _____

SECTION – 5

MEMORANDUM

Note: The tenders will be received a**s per Tender Notice** and will be opened as per mentioned in Tender Notice [Qualification. bid covers] if possible.

SR. NO.	ITEM DESCRIPTION	VALUES/REMARKS
1	General Description of Work	**CONSTRUCTION OF SECURED LANDFILL PHASE 1 OF TSDF SITE AT SURVEY NO. 283, VILLAGE-SURAI, TALUKA – CHOTILA, DISTRICT – SURENDRANAGAR, GUJARAT, INDIA**
2	Estimated Cost	**Rs.65,71,78,770**
3	Earnest Money Deposit	**Rs. 10,00,000.00**
4	(A) Initial Security Deposit	
	i] F.D.R. or Bank Guarantee of any Nationalized Bank or Scheduled Bank	1.5% of Tendered Amount
	(B) Percentage to be deducted 1) From Running Account bills	1.5% percent of work done
	2) From Total Security Deposit	3% percent of work done
	(C) Mobilization Advance	No Mobilization Advance shall be issued by the company
5	Time allowed for the Completion of work from date fixed in written Order to commence	12 months (Excluding Monsoon, i.e. 16th June to 15th October)
6	Compensation for delay in execution of work	0.20 percent of work amount of the tendered cost of the whole work per day, Limited to maximum 10% of the Tender cost
7	The progress of the work should confirm to the following schedule: 1) 10% of the work to be done in	25% of the time
	2) 40% of the work to be done in	50% of the time
	3) 70% of the work to be done in	75% of the time
	4) 100% of the work to be done in	100% of the time
8	Defect Liability Period	12 months (After total completion of whole work and issue of Work Completion Certificate)
9	Water Charges	Bidder shall have to make his own arrangement of water supply. If Bidder wishes, and if VECPL agrees upon, to have water from VECPL, he shall have to inform VECPL in written within 30 days from starting state of work. Charges towards the same shall be as per decided by VECPL

Signature and Stamp of the Bidder **Managing Director, VECPL**

SECTION – 6

POST-QUALIFICATION CRITERIA AND EVALUATION PROCEDURE

1. POST-QUALIFICATION CRITERIA AND EVALUATION PROCEDURE

1.1. DETAILED ASSESSMENT

The bids received under these single stage two envelope procedures shall be assessed and evaluated based on the qualification criteria and evaluation procedure prescribed hereunder:

A. Substantially completed works means those works which are at least 90% completed as on the date of submission (i.e gross value of work done up to the last date of submission is 90% or more of the original contract price) and continuing satisfactorily. For these, a certificate from the employer shall be submitted along with the application incorporating clearly the name of the work, Contract value, billing amount, date of commencement of works, satisfactory performance of the Bidder and any other relevant information.

B. The applicant who is not capable of meeting requirement listed below in **Para 1.2** shall not be qualified for the works. Post qualification of applicant will be based complying minimum criteria regarding their particular experience, financial position, personnel and equipment capabilities and other relevant information as demonstrated by the applicant's responses in the forms attached to the Letter of application. The qualifications, capacity and resources of proposed sub bidders will not be taken into account in determining the Applicant's compliance with the qualifying criteria. **The applicant to note specifically that all information given including those in the form of various formats must be supported by certificates from respective authorities (not less than Executive Engineer or equivalent) duly attested.**

Bidder can furnish the details on the separate sheets but the format should not be changed in any case.

- Financial capacity

- Past Experience

1.1.1. Financial Capacity

1.1.1.1. Definitions

- **"Financial Statements"** consist of profit-and-loss statements, balance sheet, and if available, cash flow statements (also called "Sources and Applications of funds" statements).

- **"Annual Turnover":** Average turnover of last five years will be considered for evaluation. Income from "*contractual receipts*" only will be taken into consideration. The income such as interest income, trading income will not be considered.

Base year and Escalation

The base year shall be taken as **2016-17**

Following enhancement factors will be used for the cost of works executed and the financial figures to bring to a common base for the value of works completed in India

Year before	*multiplying factor*
One	1.10
Two	1.21
Three	1.33
Four	1.46
Five	1.61
Six	1.77
Seven	1.95

1.1.1.2. Documentation to be used and referred

All applicants have to submit **audited annual reports/financial reports** of last five years. (If Audited Annual Report is not available, **Un-audited Annual Reports** shall be accepted subject to duly authentication **of Company Secretary** of the Annual Reports). Firms that do not publish financial statements, such as partnerships, submit **specially prepared statements.** A qualified external auditor should **certify such statements.** Annual reports shall include the auditor's certification.

OR

C.A. Certificate

1.2 Experience

Factors used in evaluating experience of the bidder in the last five years ending March-2022 are as follows:

Qualifying Criteria

A Average Annual financial turnover during the last five years, ending 31/03/22 should be at least 100% of the amount put to tender.

B Experience of having successfully completed similar works during last five years ending on March-2022 should be either of the following

- one similar completed works, each of amounts not less than 50% the amount put to tender

OR

- Two separate similar completed works, each of amounts not less than 30% the amount put to tender

OR

- Three similar completed work not less than the project cost equal to 20% of the amount put

to tender.

C The Bidders/Companies having solvency certificate of National / Schedule Bank amounting to not less than 5 Crores.

- **1.3 Special Notes**

(A) Disqualification

Even though the Applicants meet the above criteria, they are subject to be disqualified if Applicant or any of its constituent partners have:

- Made misleading or false representation in the forms, statements, and attachments submitted; or
- Been debarred by Central govt. organization / State govt. organization /Municipal Corporation.
- In case of a proprietary firm, partnership firm the following are the disqualification in case of failure to disclose information by partners or the proprietor:

(i) If, any of the partners or the proprietor is debarred by Central govt. organization/ State govt. organization /Municipal Corporation or any other Agency of Government of India or any of the State Governments.

(ii) If, any of the partners or the proprietor has a criminal history or has been convicted by any court of law for any of the offenses under any Indian laws.

(iii) If, any criminal proceeding is pending in any court of law in India against any of the partners or a proprietor and if any such proceeding culminates into conviction in last seven years.

Note:

1. **The experience as sub bidder shall not be considered.**
2. **Joint Venture shall not be allowed.**

Managing Director
VARNI ENVIRO CARE PRIVATE LIMITED

Signature and Stamp of the bidder

SECTION – 7

SPECIAL CONDITIONS OF CONTRACT

The person/persons whose tender may be accepted [here- in after called the Bidder, which expression shall unless excluded by or repugnant to the context include his heirs, executors, administrators and assignees] shall [within 10 days of the receipt by him of the notification of the acceptance of his tender] deposit with Managing Director cash or Government securities endorsed to the Managing Director sum sufficient which will make up the full security deposit specified in the tender.

If the amount of the security deposit to be paid in lump sum within the period specified above is not paid the tender contract already accepted shall be considered as cancelled. The security deposit lodged by Bidder shall be refunded after the expiry of the Defects Liability period as shown in the attached Memorandum after deducting dues, if any, which become liable to be recovered from the Bidder under the terms and conditions of this Agreement.

The successful tender shall have to pay as initial security deposit of 1.5% of the tendered amount. Shall be in the form of Fixed deposit or bank guarantee issued in favor of "VARNI ENVIRO CARE PRIVATE LIMITED Rajkot" by nationalized bank/Scheduled Bank located at Rajkot only.

The remaining amount of the security deposits shall be recovered from the running account bills at the rate of 1.5% of the gross amount of each bill, so as to make the total security deposit of 3% of the tendered amount.

The initial security deposit at 1.5% submitted will be refunded after payment of final bill and remaining 1.5% of security deposit deducted from the running bill will be refunded only after the expiry of defect liability period and after rectifying the defects found, if any, within defect liability period as intimated by VECPL.

VECPL will pay amount 15% of tender amount as a mobilization advance against Bank Guarantee issued by Nationalized or Scheduled Bank being valid up to one year from the date of issuance. 12% interest per annum will be charged by VECPL for Mobilization Advance.

If the security deposit is not paid within 15 days from the letter of intent then penalty at the rate of 0.065% per day of the amount of security deposit will be charged. If the security deposit is not paid within one month with interest, necessary actions as per the conditions of contract will be taken.

SECTION – 8

DESCRIPTION OF THE PROJECT

CONSTRUCTION OF SECURED LANDFILL PHASE 1 OF TSDF SITE AT SURVEY NO. 283, VILLAGE-SURAI, TALUKA – CHOTILA, DISTRICT – SURENDRANAGAR, GUJARAT, INDIA

Extent of the Scope of Work

The scope of works are to construct Phase 1 of Secured Land Fill Site as per Criteria of Hazardous Solid Waste Landfills, 2001 of CPCB. Construction of the Secured Engineered solid waste Landfill site includes excavation, grading, dressing, leveling, refilling, retaining Wall on the top at the EGL in specified slope and height, making impervious Double liner system on bottom and comprising of providing and laying Compacted Clay Liner (CCL), 1.5 mm thk. HDPE geomembrane liner, Non woven Geotextile Liner, Drainage Layer, Leachate Collection System and Leachate Collection Tanks at the bottom of the phase and also providing Double liner system on Side Slopes and Retaining Wall which comprises of providing and laying of Soil Layer to cover the excavated rock uneven surface followed by Geo Synthetic Clay Liner, 1.5 mm thk. HDPE liner, followed by Non woven Geotextile Liner followed by PCC M20 on the inner side slopes, horizontal berm at the end of the first side slope, horizontal berm at the GL and Retaining Wall, making of leachate tanks, curb walls on the top of the Phase, Peripheral service road, Storm water drains, Approach ramp into the Phase and leachate collection systems etc., as specified in the drawings and schedule of rates.

SECTION - 9

GENERAL INFORMATION TO BIDDERS

SCOPE OF WORK:

1) The scope of work is defined in detail in the schedule of rates and item wise specifications.

   Brief description includes:

   Construction of Phase 1 of Secured Land Fill Site as per Criteria of Hazardous Solid Waste Landfills, 2001 of CPCB. Construction of the Secured Engineered solid waste Landfill site includes excavation, grading, dressing, leveling, refilling, retaining Wall on the top at the EGL in specified slope and height, making impervious Double liner system on bottom and comprising of providing and laying Compacted Clay Liner (CCL), 1.5 mm thk. HDPE geomembrane liner, Non woven Geotextile Liner, Drainage Layer, Leachate Collection System and Leachate Collection Tanks at the bottom of the phase and also providing Double liner system on Side Slopes and Retaining Wall which comprises of providing and laying of Soil Layer to cover the excavated rock uneven surface followed by Geo Synthetic Clay Liner, 1.5 mm thk. HDPE liner, followed by Non woven Geotextile Liner followed by PCC M20 on the inner side slope, horizontal berm at the end of the first side slope, horizontal berm at the GL and Retaining Wall, making of leachate tanks, curb walls on the top of the Phase, Peripheral service road, Storm water drains, Approach ramp into the Phase and leachate collection systems etc., as specified in the drawings and schedule of rates.

2) Several documents forming the contract are the essential parts of the contract and requirement occurring in all, they are intended to be mutually explanatory and complementary and to describe and provide for a complete work.

3) The tender for, the work shall remain open for a period of 120 days (One Hundred Twenty days) from the date of opening of tenders for the work. The offer having validity less than 120 days will be rejected outright. The bidders will not be allowed to withdraw or modify the offer of his/their own during the course of finalization of tender.

4) The bidder shall provide drinking water facilities to the workers /laborers employed by him. However, water and power facilities shall be provided by VECPL at one point on the site. Further as per requirement the bidder shall extend it on his own at other points in the site.

5) Time of completion of the project is 12 (Twelve) months excluding the monsoon period and is to be strictly followed otherwise it shall attract penalty as discussed in the tender.

6) The bidder shall provide the amenity of shade and shelter to the workers, laborers and their children on work as soon as the work starts.

7) Incomplete tender that does not fulfill any of the above conditions will be liable to be rejected. Tender will also be liable to be rejected if:

i) The bidder proposes any alteration in the work specified or in time allowed in carrying out the works or make corrections in Schedule of quantities and Rates.

ii) Any of the page or pages in the tender is/are removed or replaced.

iii) The rate is not entered in ink, in figures and words in Schedule of quantities and rates as also amount in figures is not written and signed.

iv) The bidder does not initial all corrections, additions or pasted slips.

v) Any erasure is made in the tender and is not authenticated by full signature.

vi) The bidder or in the case of a firm, each partner or the person holding the power of attorney thereof does not sign or the signature(s) is (are) not attested by the witness wherever it is required.

vii) Earnest money for full amount and in required form is not paid with the tender.

viii) The bidder returns the tender documents without signing relevant pages of the bid.

8) Late tenders (i.e. tender received after the specified time of opening), delayed tenders (i.e. tenders received before the time of opening but after the due date and time or receipt of tenders) and post tender offers shall neither be opened nor be considered at all.

9) The tenders received after the time of date specified in the tender notice shall not be received by the concerned office from the post man for which date and time may be recorded on the cover of the tender as to when tender was refused by the officer.

10) The rate quoted by the bidder shall be inclusive of all taxes, duties, charges etc. and no claim in this context shall be entertained.

SECTION – 10

GENERAL TERMS AND CONDITIONS OF THE CONTRACT

Instructions to Bidders

Intent and Purpose: It is the intent and purpose of this contract on which bids are sought to assure the smooth and timely construction of a Hazardous Solid Waste disposal Secured Engineered Landfill along with necessary Infrastructure facilities, at one site near Village - Surai, Taluka – Chotila, District - Surendranagar, where solid wastes originating within the VARNI ENVIRO CARE PRIVATE LIMITED, or for which the VARNI ENVIRO CARE PRIVATE LIMITED has accepted responsibility, will be disposed of.

A.1 Financial Position

A.1.1 The audited balance sheets for the last five years should be submitted and must demonstrate the soundness of the bidders financial position, showing long-term profitability. Where necessary, the Employer will make enquiries with the bidder's bankers.

A.2 Litigation History

A.2.1. The bidders should provide accurate information on any litigation history or arbitration resulting from contracts completed or under execution by him over the last five years. This should also include such cases, which are in process/progress. A consistent history of awards against the bidder or any partner of a joint venture may result in failure of the bid. In case the bidder has not provided such information and has come to the notice of the Authority, the tender will be rejected at whatsoever stage and in such case all the losses that will arise out of this issue will be recovered from the bidder/bidder and he will not have any defense for the same.

A.3. All bidders shall furnish as an attachment to the bid document a list of Professional and Technical Personnel with their qualifications and experience, who are to be deployed in the construction of Secured Engineered Landfill facility together with their deployment schedule on landfill site, which should include at least one engineer with specialization in Geotechnical / Soil mechanics and at least one Civil Engineer who have experience of the construction of a Secured Engineered Landfill Site.

A.4. All bidders shall supply detailed inventories of their equipment and all accessories for each piece so listed. All leased equipment shall be separately listed and show the time remaining on each leased machine and any options of renewal. All new equipment to be acquired in fulfillment of this contract must be available on the effective date when construction start.

A.5 All bidders shall be required to demonstrate to the satisfaction of the VARNI ENVIRO CARE PRIVATE LIMITED that they have adequate financial resources, experienced personnel, and expertise to perform the services required by the specifications.

A.6. **Inspection of Site:** All bidders shall visit the site of the proposed Secured Engineered Landfill and familiarize themselves with the project, including all requirements of the plan. Submission of a bid shall be deemed conclusive by the VARNI ENVIRO CARE PRIVATE LIMITED that a site visit has been made, and it shall constitute a waiver of all claims of error in bid, withdrawal of bid, or payment of extras, or any combination thereof under the executed contract or any revision thereof..

B. INSTRUCTIONS TO BIDDERS

1. Conditional tender will not be accepted.

2. The Bidder shall strictly observe all the requirements laid down in the contract Labour (Regulation and Abolition) Act, 1970 and the contract Labour (Regulation and Abolition) Gujarat Rules, 1972 and other Acts as amended from time to time so far as applicable.

3. Bidder shall have to execute items included in price bid. Quantities of any items as per the site requirement may vary in any proportion for which the bidder shall be allowed to carry on his work, however he shall have to work without claiming any extra rate.

4. The Bidder shall be responsible for any damage occurring to the VECPL's property, general public or property of public or underground cables or overhead electrical lines laid by any agencies or incase the cause is attributed to the staff of the agency. The bidder shall have to get the same rectified at his own cost and risk, or otherwise, the same shall be attended to, by the VECPL at the risk and cost of the bidder.

5. No price Escalation or price variation shall be considered. However, if a new item which is not specified in the tender document arise during the construction of the site, the rate of the same shall be proposed by the bidder and finalized by the authorized persons of the VECPL and the item shall be executed by the bidder with mutual agreement of the terms and conditions therein.

6. The Bidder shall have to attach the following documents with the tender without which tender will be liable to be rejected

a. A true copy of registration as an approved bidder of state govt./municipal corporation etc.

b. List of works already completed in the last five years in the prescribed proforma specially listing the details of the construction of landfill works.

c. List of plants and machinery in good working order available with the Bidder for the proposed work, in prescribed Performa.

d. Declaration regarding works in hand with the Bidder in prescribed Performa.

e. An overall schedule of the "Work Plan" of the project based on 'Network Technique Method', PERT / CPM for appreciating his method of planning, scheduling and control of project execution.

7. Tender will also be liable to be rejected if:

a. Any of the page or pages in the tender is/are replaced.

b. The item rate's not entered in ink, in figures & words in schedule of Quantities and rates and also amount in figures is not written and signed.

c. All corrections, additions, or pasted slips are not initialed by the bidder.

d. Any erasure is made in the tender.

e. The bidder or in the case of a firm, each partner or the person holding the power of attorney thereof does not sign or the signature(s) is are not attested by the witness it is required.

f. Tender fee and Earnest money for full amount is not paid with the tender in the form of Cash/D.D./Pay Order.

g. The bidder returns the tender document without signing all the pages of the bid.

C. LIQUIDATED DAMAGES

1 If the bidder fails to complete work or a designated part thereof by stipulated completion date for the work unless extended by the Managing Director, VECPL, he shall pay liquidated damages at 0.2% of contract value per day delay.

2. The amount of liquidated damages shall, however, be subject to a maximum limit of 10% of contract value.

3. Delay in excess of one hundred days beyond the extended period if granted will be a cause for termination of the contract and forfeiture of all security for performance.

Bidder's Sign & Stamp/Address

Managing Director
VARNI ENVIRO CARE PRIVATE LIMITED

SECTION - 11

IMPORTANT CONDITIONS OF CONTRACT

1) The tender document shall be submitted in two separate sealed covers, one being the technical bid and the second being the financial bid. The financial bid will be opened only after the qualification of the technical bid. The bidder shall clearly state in the forwarding letter (in duplicate) to be enclosed with the tender document, the deviation from General Terms and Conditions, if any, with cross references. If no such letter is received, it will be presumed that the bidder agrees entirely with the General and Technical Terms and Conditions. EMD in the form of Cash/DD/Pay Order, receipt should be sealed in separate envelope and packed in envelope marked "A". Everything else i.e. (in duplicate) Drawings, Addendum if any and the forwarding letter etc. should be sealed in separate envelope and marked "B". Both envelopes "A" and "B" should be enclosed in a main envelope duly sealed. Main envelope shall contain envelope "A", envelope "B", separate sealed cover of "Technical Bid" and "Price Bid". The tender of envelope "B" will be opened, if it is accompanied by a proper valid EMD in envelope "A". Tenders received without EMD in envelope "A" shall be rejected outright.

2) Time is the essence of the project and it is to be completed within the stipulated time limit, i.e. 12 months otherwise penalty clause shall be applicable as mentioned in the tender document strictly.

3) All pages of the tender document should be signed by the bidder.

4) The work shall be earned out strictly as per drawings and details and instructions of the VECPL &/or its authorized persons including Engineer - in - charge/authorized representative of the consultant.

5) Cement used in all RCC, masonry, plaster or in any civil work should be of 53 grade ISI make as approved by the VECPL.

6) The bidder cannot sublet any part of work to any sub bidder.

7) The bidder has to make his own arrangements for the storage of materials and he will be solely responsible for its safety and damage.

8) It shall be the sole responsibility of the bidder to meet with any statutory or any other liability arising out of any accident or casualties that may occur during the course of the execution of the project.

9) Bidder has to furnish his full postal address, phone numbers etc.

10) If any extra item arises during the progress of work, the rate of the same shall be priory finalized in consultation with the VECPL /consultant and only after the finalization of the same the item may be executed.

11) The VECPL has the right to reject any of the bids out rightly without assigning any reason.

12) The bidder has to hand over the clean and clear possession of the site on completion of the work or in the event of rescindation of the work by the VECPL irrespective of the fact that settlement of the bill is pending.

13) In case of dispute or differences arising relating to interpretation, construction of any clause relating to this tender document, same shall be referred to the arbitrator to be appointed by the VECPL and whose decision shall remain final and conclusive for both the parties.

14) The bidder has to arrange for dewatering and cleaning of the site during the execution of project work at his cost.

15) The clause relating to the security deposit/earnest money/performance bond including its forfeiture shall be governed as mentioned in the tender document.

16) LAND FOR BIDDER'S FIELD OFFICE, GODOWN AND WORKSHOP: The VECPL will at his own discretion and convenience and for the duration of the execution of the work make available near the site, land for construction of bidder's field office, go downs, workshops and assembly yard required for the execution buildings and provide suitable water supply and sanitary arrangements approved by the VECPL &/or its authorized persons including Engineer - in - charge. On completion/termination of the contract of the works undertaken by the bidder, he shall remove all temporary works erected by him and have the site cleaned as directed by the VECPL &/or its authorized persons including the Engineer - in - charge not withstanding any dues outstanding or any bills pending for the settlement. If the bidder shall fail to comply with these requirements, the VECPL &/or its authorized persons including Engineer – in - charge may at the expense of the bidder remove such surplus and rubbish materials and dispose of the same as he deems fit and get the site cleared as aforesaid and bidder shall forth with pay the amount of all expenses so incurred and shall have no claim in respect of any such surplus material disposed off as aforesaid.

17) LAND FOR RESIDENTIAL ACCOMODATION: Land for residential accommodation for staff and labor will be made available at the discretion of the VECPL &/or its authorized persons including Engineer - in – charge and rent for the same will be as decided by the VECPL &/or its authorized persons including Engineer - in - charge according to location and area taken by the bidder. The same shall be vacated as soon as the said works are over and before handling of the site to the VECPL.

18) STORES TO BE SUPPLIED BY VECPL: No materials shall be supplied as such by the VECPL, however, if any such material is supplied then the basic rates of the materials supplied shall be as decided by the VECPL &/or its authorized persons including Engineer - in - charge and the bidder shall have to adjust amounts based on these rates in his billings.

19) TESTING OF DIFFERENT MATERIALS: The bidder shall bear all the charges which may occur due to testing of the different materials, as may be decided by the VECPL &/or its authorized persons including Engineer - in - charge used in the project. The details are given in the table showing frequency of tests to be performed in the Quality Assurance Plan as given in the tender.

21) Definition of terms

In the contract documents as herein defined where the context so admit, the following words, and expressions will have the following meanings:

a) The "VECPL" means VARNI ENVIRO CARE PRIVATE LIMITED (VECPL) in India having its corporate office at: 101, First Floor, Arohi III, Opp. Karnavati Club, S G Highway, Ahmedabad – 380 015, Gujarat, India.
b) The "bidder" means the person or the persons, firm or Company whose tender has been accepted by the VECPL and includes the bidder's legal representative, his successor and permitted assignees.
c) The "Engineer - in - charge" means the person designated as such by the VECPL and shall include those who are expressly authorized by him to act for and on his behalf for operation of this contract.
d) The "consultant" shall mean technical consultant for the project, or the representative/successors/assignee as designated by the office.
e) The "Work" shall mean the works to be executed in accordance with the contract or part thereof the case may be and shall include all extra, additional, altered or substituted works as required for the purpose of the contract.
f) The "Permanent Work" means and includes works which will be incorporated in and form a part of the work to be handed over to the VECPL by the bidder on completion of the contract.
h) "Construction Equipment" means all the appliances and equipment of whatsoever nature for the use in or for the execution, completion, operation or maintenance of the work unless intended to form part of the Permanent Work.
i) "Site" means the areas on which the permanent works are to be executed or carried out and any other places provided by the VECPL for purpose of the contract.
j) "Contract documents" means collectively the Tender documents, designs, drawings, specifications, and agreed variations, if any. Contract and such other documents constituting the tender and acceptance thereof.

k) "Contract" shall mean the agreement between the VECPL and the bidder for the execution of the works including there in all contract documents.

l) "Specifications" shall mean the various technical specifications attached and referred to the tender documents. It shall also include the latest edition of relevant Indian standard specifications published before entering in to contract.

m) "Drawings" shall include maps, plans and tracings or prints thereof with any modifications approved in writing by the VECPL &/or its authorized persons including Engineer - in - charge and such other drawings as may from time to time be furnished or approved in writing by the VECPL &/or its authorized persons including Engineer - in - charge.

n) "Tender" means the tender submitted by the bidder for acceptance by the VECPL.

o) "Alteration Order" means an order given in writing by the VECPL &/or its authorized persons including Engineer - in - charge to effect additions to or deletions from and alteration in the works.

p) "Period of liability" in relation to a work means the specified period from the date of completion certificate up to the date of issue of final certificate during which the bidder stands responsible for rectifying all defects that may appear in the words.

q) "Appointing authority" for the purpose of arbitration shall be the Managing Director, VECPL or any other person so designated by the VECPL.

(SIGNATURE OF THE BIDDER ALONG
WITH THE STAMP AND DATE)

SECTION – 12

GENERAL INSTRUCTION TO BIDDERS

1) Document: **a) Tenders as submitted will consist of the following:**

TECHNICAL BID: VOLUME – 1

FINANCIAL BID: VOLUME - 2

i) Complete set of tender documents as supplied, duly filled in and signed by the bidder and submitted in separate covers for "Technical Bid" and "Financial Bid submission" as prescribed in different clauses of the tender documents.

ii) Earnest money in the manner specified in the clause thereof.

iii) Information regarding the bidders in the Performa enclosed.

iv) Detail of work of similar type and magnitude carried out by the bidder in the Performa given in the document.

v) Details of construction plant and equipment available with the bidder for using in this work in the Performa under the head "Information regarding Equipment" which the bidder propose to use for this work.

b) All pages are to be initialed:

All signatures in tender documents shall be dated as well as all the pages of all sections of tender documents shall be initialed at the lower right hand corner and signed whenever required in the tender papers by the bidder or by a person holding power of attorney authorizing him to sign on behalf of the bidder before submission of tender.

c) Signature of bidder:

i) The tender shall contain the name, address of residence with contact numbers and place of business with complete address and contact numbers of the person or persons making the tender and shall be signed by the bidder with his usual signature. Partnership firms shall furnish the full names of all partners and their addresses and contact numbers in the tender. It should be signed in the partner's name by all the partners or duly authorized representative followed by the name and designation of the person signing. Tender by a company shall be signed by an authorized representative and a power of Attorney on that behalf shall accompany the tender. A copy of the constitution of the firm with name of all partners shall be furnished.

ii) When a bidder signs a tender in a language other than English, the total amount tendered should in addition, be written in the same language. The signature should be attested by at least one witness.

d) **Witness:**

Witness and sureties shall be persons or status and property and their names, occupation and address shall be stated below their signatures.

5) Right of the VECPL to Accept or Reject Tender:

The right of accepting of the tender will reset with the VECPL. The VECPL however, does not always accept the lowest tender and reserves to itself the authority to reject any or all the tenders received without assigning any reason whatsoever. The whole work may be split in between two or more bidders or accepted in part and not entirely if considered expedient. Tenders in which any of the particulars and prescribed information are missing or are incomplete in any respect and/or the prescribed conditions are not fulfilled are liable to be rejected.

6) Signing of the Contract:

The successful bidder shall be requested to execute an agreement in the Performa attached with the tender document within 10 days of the receipt as a token of acceptance of the tender. In the event of failure on the part of the successful bidder to sign the agreement within the above stipulated period, the earnest money or his initial deposit will be forfeited and the acceptance of the tender shall be considered as cancelled.

7) Field Management:

The field management will be the responsibility of the VECPL &/or its authorized persons including Engineer - in - charge who will be nominated by the VECPL. The VECPL &/or its authorized persons including Engineer - in - charge may also authorize his representatives to perform his duties and functions.

8) Co-ordination of Work:

The VECPL &/or its authorized persons including Engineer - in - charge shall co-ordinate the works of various agencies engaged at site to ensure minimum disruption of work carried out by different agencies. It shall be the responsibility of the bidder to plan and execute the work strictly in accordance with site instructions to avoid hindrance to the work being executed by other agencies.

SECTION - 13

GENERAL OBLIGATIONS

CLAUSE 1: Interpretation of Contract Documents:

Except if and to the extent otherwise provided by the contract, the provisions of the General Conditions of contract and Important conditions shall prevail over those of any other documents forming part of the contract. Several documents forming the contract are to be taken as mutually explanatory. Should there be any discrepancy inconsistency, error or omission in the contracts or any of them the matter may be referred to the VECPL &/or its authorized persons including Engineer - in - charge who shall give his decisions and issue to the bidder instructions directing in what manner the work is to be carried out. The decision of the VECPL &/or its authorized persons including Engineer - in - charge shall be final and conclusive and the bidder shall carry out work in accordance with this decision.

Works shown upon the drawing but not mentioned in the specifications or described in the specifications without being shown on the drawings shall nevertheless be held to be included in the same manner as if they had been specifically shown upon the drawings and described in the specifications.

CLAUSE – 2: Headings and Marginal Notes

All headings and marginal notes to the clauses of these General and Important Conditions of Contract or to the specifications or to any other tendered document are solely for the purpose of giving a concise indication and not a summary of the contents thereof, and they shall never be deemed to be part thereof or be used in the interpretation or construction thereof of the contract.

CLAUSE – 3: Singular and Plural

In these contract documents unless otherwise stated specifically, the singular shall include the plural and vice versa wherever the context so requires. Words importing persons shall include relevant corporate companies/registered associations/body of individuals/firm of partnership.

CLAUSE – 4: Important Conditions of Contract:

Important Conditions of Contract Shall be read in conjunction with the General Conditions of Contracts specifications of work, drawings and any other documents forming part of this contract

wherever the context so requires. Notwithstanding the subdivision of the documents into these separate sections and volumes every part of each shall be deemed to be supplementary to and complementary of every other part and shall be read with and into the contract so far as it may be practicable to do so.

Where any portion of the General Conditions of Contract is repugnant to or at variance with any provisions of the Important Conditions of Contract then, unless a different intention appears the provisions of the important Conditions of Contract shall be deemed to over-ride the provisions of the General Conditions of Contract and shall to the extent of such repugnancy, or variations, prevail.

Where it is mentioned in the specifications that the Bidder shall perform certain work or provide certain facilities, it is understood that the bidder shall do so at his cost.

The materials, design and workmanship shall satisfy the relevant Indian Standard, the job specifications contained herein and codes referred to. Where the job specification stipulate requirements in addition to those contained in the standard codes and specifications, these additional requirements shall also be satisfied.

CLAUSE – 5: Bidder to Obtain his Own Information

The bidder in fixing his rate shall for all purposes whatsoever is deemed to have himself independently obtained, all necessary information for the purpose of preparing his tender. The correctness of the details, given in the tender Document to VECPL the Bidder to make up the tender is not guarantee.

The bidder shall be deemed to have examined the Contract Documents, to have generally obtained his own information in all matters whatsoever, that might affect the carrying out the works at the scheduled rates and to have satisfied himself to the sufficiency of his tender. Any error in description of quantity or omission there from shall not vitiate the contract or release the Bidder from executing the work comprised in the contract according to drawings and specifications at the scheduled rates. He is deemed to have known the scope, nature and magnitude of the works and the requirements of materials and labor involved etc., and as to what all works he has to complete in accordance with the contract documents whatever be the defects,-omissions or errors that may be found in the Contract documents. The bidder shall be deemed to have visited surroundings to have satisfied himself to the nature of all existing structures, if any and also as to the nature and the conditions of the Railways, roads, bridges and culverts, means of transport and communications, whether by land, water or air, and as to possible

interruptions thereto and the access and excess from the site, to have made inquiries, examined and satisfied himself as to the sites for obtaining sand; stones, brick and other materials, the sites for disposal of surplus materials, the available accommodation as to whatever required depots and such other buildings as may be necessary for executing and completing the works, to have made local independent inquiries as to the sub-soil, subsoil water and variations thereof, storms, prevailing winds climatic conditions and all other similar matters effecting these works. He is deemed to have acquainted himself as to his liability for payment of Government taxes, customs duly and other charges.

Any neglect or failure on the part of the Bidder in obtaining necessary and reliable information upon the foregoing or any other matters affecting the contract shall not relieve him from any risks or liabilities or the entire responsibility from completion of the works at the scheduled rates and time in strict accordance with the contract documents,

No verbal agreement or inference from conversation with any officer or employee of the VECPL either before or after the execution of the contract agreement shall in any way affect or modify any of the terms or obligations herein contained.

CLAUSE – 6: Time of performance

The work covered by this contract shall be commenced within 15 days after the receipt of the letter of the acceptance of tender or state in work order and may be completed in stages on or before the dates as mentioned in the time schedule of the completion of the work. The bidder should bear in mind that time is the essence of this agreement unless such time be extended pursuant to the provision of the relevant clause. Request for revision of construction time after tenders are opened will not receive consideration.

CLAUSE – 7: Time Schedule of Construction/Job entrusted

The general time schedule of construction is given in the tender document. Bidder should prepare a detailed monthly or weekly construction program jointly with the VECPL &/or its authorized persons including Engineer - in - charge within ten days of receipt of Letter of Intent or acceptance of tender or issue of work order. The work shall be executed strictly as per the time schedule given in this document. The period of construction given includes the time required for testing, recertification, if any, retesting and completion in all respect to the entire satisfaction of VECPL &/or its authorized persons including Engineer - in - charge.

CLAUSE – 8: Force Majeure

Any delays in or failure of the performance of either party hereto shall not constitute default hereunder or give rise to any claims for damages, if any, to the extent such delays or failure of performance is caused by occurrences such as Acts of God or the public enemy expropriation or confiscation of facilities by Government authorities compliance with any order of any Government authorities, acts of war, rebellion or sabotage or fires, floods, earthquakes, riots or illegal strikes.

CLAUSE – 9: Extension of time

If the bidder shall desire an extension of the time for completion of the work on the grounds of his having being unavoidably hindered in its execution or on any other grounds, he shall apply in writing to the VECPL &/or its authorized persons including Engineer - in - charge within ten days of the date of the hindrance on account of which he desire such extension as aforesaid and the VECPL &/or its authorized persons including Engineer - in - charge shall if in his opinion (which shall be final) reasonable grounds have been shown therefore authorize such extension of time as may in his opinion be necessary or proper.

CLAUSE – 10: Damages for Delay

The time allowed for carrying out the work as entered in the tender shall be strictly observed by the Bidder. The work shall throughout the stipulated period of the contract be proceeded with all the diligence (time being deemed to be the essence of the contract) and the bidder shall pay to the VECPL as damages, penalty at the rate of 0.2% per day of the contract amount subject to maximum of 10% of the contract amount or actual damage/loss whichever is higher and necessary action will be taken by the VECPL .

To ensure good progress during the execution of the work, the bidder shall be bound, in all cases in which the time allowed for any work exceeds one month to complete one-fifth of the work before one-fourth of the time allowed under the contract has elapsed, three-eighth of the work before one half of such time has elapsed and three-fourth of the work before three- fourth of such time has elapsed. In the event of the bidder failing to comply with this condition, he shall be liable to pay as compensation an amount as stipulated above. The compensation so paid shall not relieve the bidder from his obligations to complete the work or from any other obligations and liabilities under the contract.

CLAUSE – 11: Bidder Remains Liable to Pay Compensation if Action Not Taken

In any case in which any of the powers conferred upon the VECPL thereof shall have become exercisable and the same had not been exercised, the non exercisable thereof shall not constitute a waiver of any of the conditions hereof and such powers shall notwithstanding be exercisable in the event of any further case of default by the bidder for which by any cause or causes hereof he is declared liable to pay compensation amounting to the whole of his security deposit and the liability of the bidder for past and further compensation shall remain unaffected. In the event of the VECPL putting in force the powers under sub clauses vested in him under preceding clauses he may, if he so desires, take possession of all or any tools, & plants, materials and stores in or upon the works or the site thereof belonging to the bidder or procured by him and intended to be used for the execution of the work or any part thereof carrying or allowing for the same in account at the contract rates-or in case of these not being applicable at current market rates to be certified by the VECPL &/or its authorized persons including Engineer-in-Charge whose certificate thereof shall be final, otherwise in VECPL &/or its authorized persons including Engineer-in-Charge may give notice in writing to the bidder or his clerk of the works, foreman or other authorized agent, requiring him to remove such tools, plant, materials or stores from the premises (within a time to be specified in such notice), and in the event of the bidder failing to comply with any such requisition, the VECPL &/or its authorized persons including Engineer-in-Charge may remove them at the bidder's expense or sell them by auction or private sale on account of the bidder and same shall be at his risk in all respects without any further notice as to the date, time or place of sale and the certificate of the VECPL &/or its authorized persons including Engineer-in-Charge as to the expense of any such removal and the amount of the proceeds and expense of any such sale shall be final and conclusive against the bidder.

CLAUSE – 12: No Compensation for Alternation in or Restriction of Work

If at any time from the commencement of the work the VECPL shall for any reason whatsoever not require the whole or part thereof as specified in the tender to be carried out, the VECPL &/or its authorized persons including Engineer-in-Charge shall give notice in writing of the fact to the bidder, who shall have no claim whatsoever on account, of any profit or advantage which he might have derived from the execution of the work in full but which he did not derive in consequence of the full amount of the work not having been carried out; neither shall he have any claim for damages by reason of any alterations having been made in the original specifications, drawings, designs and instructions which shall involve any curtailment of the work as originally contemplated nor for any additional cost incurred by him/it for the execution of the said work.

CLAUSE – 13: Change in Constitution

Where the bidder is a partnership firm the prior approval, in writing, of the VECPL shall be obtained before any change is made in the constitution of the firm. Where the bidder is an individual or a Hindu undivided family business concern, such approval as aforesaid shall likewise be obtained before such bidder enters into any agreement with other parties where under, the reconstituted firm would have the right to carry out the work hereby undertaken by the bidder. In either case if prior approval as aforesaid is not obtained, the contract shall be deemed to have been allotted in contravention of condition of the contract hereof and the same action may be taken and the same consequence shall ensue as provided in the said clause.

CLAUSE – 14: If the Bidder dies or becomes insolvent or offer bribe to a public officer or sublet the work without written approval of the VECPL:

Without prejudice to any of the rights or remedies under this contract if the bidder dies in case of an individual, the contract shall be terminated and account to be settled within a reasonable period of time and his successor or nominees shall have no right for the remaining work. The contract shall not be assigned or sublet without the written approval of the Engineer – In – Charge. And if the bidder shall assign or sublet his contract or attempt to do so or become insolvent or commence any proceeding to get himself be adjudicated an insolvent or make any compromise with his creditors, or attempt to do so, the Engineer – In – Charge may, by notice in writing rescind the contract. Also, if any bribe, gratuity, gift, loan, perquisite, reward or advantage, pecuniary or otherwise, shall either directly or indirectly be given, promised or offered by the bidder, or any of his servants or agents to any public officer or person in the employment of government in any way relating to his office or employment, or if any such officer or person shall become in any way directly or indirectly interested in contract, the Engineer – In – Charge may thereupon by notice in writing rescind the contract. In the event of contract being rescinded, the security deposit of the bidder shall thereupon stand forfeited and be absolutely at the disposal of government and the same consequence shall ensure as if the contract has been rescinded under the clause hereof and in addition the bidder shall not be entitled to recover or be paid for any work thereof actually performed under the contract.

CLAUSE – 15: Members of the VECPL /technical consultant not individually liable

Managing Director, VECPL or Official or employee of the VECPL/technical consultant shall in any way be personally bound or liable for the acts or obligations of the VECPL under contract or answerable for any default or omission in the observance of performance of any of the acts, matters or things which are herein contained.

CLAUSE – 16: VECPL not Bound by Personal Representations

The bidder shall not be entitled to any increase on the schedule rates or any other right or claim whatsoever by reason of any representation, explanation or statement or alleged representation, promise or guarantees given or alleged to have been given to him by any person.

CLAUSE – 17: Sub Contract for temporary works etc.

The VECPL may give written consent for sub contract for the execution of any part of the works at the site being enter in to by bidder provided each individual sub contract is submitted to the VECPL &/or its authorized persons including Engineer-in-charge before being entered in to and is approved by it.

CLAUSE – 18: Bidders liability not limited by Sub Bidders

Notwithstanding any subletting with such approval as aforesaid and not withstanding that the VECPL &/or its authorized persons including Engineer - in - charge shall have received copies of any sub contracts, the bidder shall remain solely responsible for the quality and proper and expeditious executions of the works and the performance of all the conditions of the contract in all respects as if such subletting or subcontracting had not taken place and, as if such work had been done directly by the bidder.

CLAUSE – 19: No remedy for action taken under this clause

No action taken by the VECPL under the clause shall relieve the bidder of any of his liabilities under the contract or give rise to any right to compensation.

CLAUSE – 20: Power of Entry

If the bidder not commence the work in the manner previously described in the contract documents or if he shall at any time in the opinion of the VECPL &/or its authorized persons including Engineer - in - charge fail to carry out the works in conformity with the contract documents or fail to carry out the works in accordance with the time schedule or substantially suspended works for a period of 14 days without authority from the VECPL &/or its authorized persons including Engineer - in - charge or fail to carry out and execute the works to the satisfaction of the VECPL &/or its authorized persons including Engineer - in - charge or fail to supply sufficient or suitable constructional plant, temporary works, labor, materials or things or commit or

suffer or permit any other breach of any of the provisions of the contract on his part to be performed or observed or persists in any of the above mentioned breaches of the contract or the fourteen days after notice in writing shall have been given to the bidder by the VECPL &/or its authorized persons including Engineer - in - charge requiring such breach to be remedied or if the bidder shall abandon the works or If the bidder during the continuance of the contract shall become bankrupt, make any arrangement or composition with his debtors or permit any execution to be levied or go into liquidation whether compulsory or voluntary etc., then in any such case the VECPL shall have the power to enter upon the works and take possession thereof and of the materials, temporary works, constructional plants and stop thereon and to revoke the bidders license to use the same and to complete the works by his agent, other bidders or workmen or to relate the same upon any terms and to such other person, firm or VECPL at the VECPL in its absolute discretion making proper to employ and for the purpose aforesaid to use or authorize the use of any materials, temporary works, constructional plants and stock as aforesaid and in such case the bidder shall have no right or any type of claim on the VECPL . The bidder for the said materials other than such as may be certified in writing by the VECPL &/or its authorized persons including Engineer - in - charge to be responsible. Bidder for the use for the temporary period of the said works, constructional plants and stock or being liable for any lose or damage thereto and if the VECPL shall by reason of his taking possession of the works or of the works being completed by other bidder the due account being taken of any such extra work or works which may be omitted) then the amount of such excess as certified by the VECPL &/or its authorized persons including Engineer - in - charge shall be deducted from any money which may be due for work done by the bidder and in addition thereto the bidder shall indemnify the VECPL for the loss actually incurred for the damages caused to the VECPL under the contract and not paid for. Any deficiency shall forthwith be made good and paid to the VECPL by the bidder and the VECPL shall have power to sell in such manner and for such price as he may think fit or all any of the constructional plant, materials etc. constructed by the belonging to and to recoup and retain and said deficiency or any part thereof out of the proceed of the sale.

CLAUSE – 21: Other Agencies at Site

The bidder shall have to execute the work in such place and condition where other agencies will also be engaged for other works such as site grading, filling, and leveling, electrical and mechanical engineering works, etc. No claim shall be entertained due to work being executed in the above circumstances.

CLAUSE – 22: Notice

Any notice hereunder may be served on the bidder or his duly authorized representative at the Job site or served by registered mail direct to the address furnished by the bidder. Proof of issue of any such notice could be conclusive of the bidder having been duly informed of all contents therein.

CLAUSE – 23: Patents and Royalties

The bidder, if licensed under any patent covering equipment, machinery, materials or compositions of matter to be used or supplied or methods and process to be practiced or employed in the performance of this contract, agrees to pay all royalties and license fees which may be due with respect thereto. If any equipment, machinery, materials composition of matters, to be used or supplied or methods and processes to be practiced or employed in the performance of this contract, is covered by a patent under which the bidder is not licensed then the bidder before supplying or using the equipment, machinery, materials, composition method or processes shall obtain such licenses and pay such royalties and license fees as may be necessary for performance of this contract. In the event the bidder fails to pay any such royalty or obtain any such license, any suit for infringement of such patents which is brought against the bidder or the VECPL as a result of such failure will be defended by the bidder at his own expense and the bidder will pay any damages and costs awarded in such suit if any solely by the bidder.

The bidder shall promptly notify the VECPL if the bidder has acquired knowledge of any plant tender which a suit for infringement could be reasonably brought because of the use by the VECPL of any equipment, machinery, materials, process, methods to be supplied here under. The bidder agrees to and does hereby grant to VECPL , together with the right to extend the same to any of the subsidiaries of the VECPL as irrevocable, royalty-free license to use in any country, any invention made by the bidder or his employee in or as a result of the performance of the work under the contract.

With respect to any sub-contract entered into by bidder pursuant to the provisions of the relevant clause hereof, the bidder shall obtain from the sub-bidder an undertaking to provide the VECPL with the same patent protection that bidder is required to provide under the provisions of this clause.

CLAUSE – 24: Liens

If, at any time, there should be evidence or any lien or claim for which the VECPL might have become liable and which is chargeable to the bidder, the VECPL shall have the right to retain out of any payment then due or thereafter to become due an amount sufficient to completely indemnify the VECPL against such lien or claim and if such lien or claim be valid the VECPL may pay and discharge the same and deduct the amount so paid from any money which may be or may become due and payable to the bidder. If any lien or claim remains unsettled after all payments are made, the bidder shall refund and make it good to the VECPL or pay to the VECPL all money that the latter may be compelled to pay in discharging such lien or claim including all costs and reasonable expenses.

CLAUSE – 25: PERFORMANCE OF WORK

CLAUSE - 25.1: Execution of Work

All the works shall be executed in strict conformity with the provisions of the contract document and with such explanatory detailed drawings, specifications and instructions as may be furnished from time to time to the bidder by the VECPL &/or its authorized persons including Engineer-in-Charge whether mentioned in the contract or not. The bidder shall be responsible for ensuring that works throughout are executed in the most substantial, proper and workman like manner with the quality of material and workmanship in strict accordance with the specifications and to the entire satisfaction of the VECPL &/or its authorized persons including Engineer-in-Charge.

CLAUSE – 25.2 : Work in Monsoon and Dewatering

The completion of the work may entail working in the monsoon also. The bidder must maintain a minimum labor force as may be required for the job and plan and execute the construction and erection according to the prescribed schedule. No extra rate will be considered for such work in monsoon.

During monsoon and other period, it, shall be the responsibility of the bidder to keep the construction work site free from water at his own cost.

CLAUSE – 25.3: General Conditions for Construction and Erection work

The Working time at the time of work is 48 hours per week. Overtime work is permitted in cases of need and the VECPL will not compensate the same. Shift working at 2 or 3 shifts per day will become necessary and the bidder should take this aspect into consideration for formulating his rates for quotation. No extra claims will be entertained by the VECPL on this account.

The bidder must arrange for the placement of workers in such a way that the delayed completion of the work or any part thereof for any reason whatsoever will not affect their proper employment. The VECPL will not entertain any claim for idle time payment whatsoever.

CLAUSE – 26: Setting out Works

The VECPL &/or its authorized persons including Engineer-in-Charge shall furnish the bidder with only the four corners of the work site and a level bench mark and the bidder shall set out the works and shall provide an efficient staff for the purpose and shall be solely responsible for the accuracy of such setting out.

The bidder shall provide, fix and be responsible for the maintenance of all stakes, templates, level marks, profiles and other similar things and shall take all necessary precautions to prevent their removal or disturbance and shall be responsible for the consequence of such removal or disturbance should the same take place and for their efficient and timely reinstatement. The bidder shall also be responsible for the maintenance of all existing survey marks, boundary marks, distance marks and central line marks, either existing or supplied and fixed by the bidder. The work shall be set out to the satisfaction of the VECPL &/or its authorized persons including Engineer-in-Charge. The approval thereof or joining with the bidder by the VECPL&/or its authorized persons including Engineer-in-Charge in setting out the work, shall not relieve the bidder of any of his responsibilities.

Before beginning the works, the bidder shall at his own cost, provide all necessary reference and level posts, pegs, bamboos, flags, ranging rods, strings, and other materials for proper layout of the work in accordance with the scheme for bearing marks acceptable to the VECPL &/or its authorized persons including Engineer-m-Charge. The center, longitudinal or face lines and cross lines shall be marked by means of small masonry pillars. Each pillar shall have distinct mark at the center to enable theologize to be set over it. No work shall be started until all these points arc checked and approved by the VECPL &/or its authorized persons including Engineer-in-Charge in writing but such approval shall not relieve the bidder of any of his responsibilities. The bidder shall also provide all labor, material and other facilities, as necessary for the proper checking of layout and inspection of the points during construction.

Pillars bearing geodetic marks located at the sites of units of works under construction should be protected and fenced by the bidder. On completion of works, the bidder must submit the geodetic documents according to which the work was carried out.

CLAUSE – 27: Responsibility for Level and Alignment

The bidder shall be entirely and exclusively responsible for the horizontal and vertical alignment, the levels and correctness of every part of the work and shall rectify effectively any errors or imperfections therein. Such rectification shall be carried out by the bidder at his own cost, when instructions are issued to that effect by the VECPL &/or its authorized persons including Engineer-in-Charge.

CLAUSE – 28: Materials to be Supplied by Bidder

The bidder shall procure and provide the whole of the materials of such quality and specifications as suggested by the VECPL and required for the construction including M. S. Rods, cement and other building material, tools, tackles, construction plant and equipment for the completion and maintenance of the works and shall make his own arrangement for procuring such materials and for the transport thereof. The VECPL may give necessary recommendation to the respective authority if so desired by the bidder but assumes no further responsibility of any nature. The VECPL may insist on the procurement of materials which bear ISI stamp.

CLAUSE – 29: Material Procured with Assistance of VECPL

Notwithstanding anything contained in any or all the clauses of this contract if in the event of any emergency or controlled materials any materials for the execution of the contract are procured with the assistance of the VECPL either by issue from VECPL 's stock or purchases made under orders or permits or licenses issued by Government the bidder shall hold the said materials as trustee for the VECPL and use such materials economically and solely for the purpose of the contract and not dispose them of without the permission of the VECPL for any other purpose and return, if required by the VECPL &/or its authorized persons including Engineer-in-Charge, all surplus or unserviceable materials that may be left with him after the completion of the contract or at its termination for any reason whatsoever on his being paid or credited such price as the VECPL &/or its authorized persons including Engineer-in-Charge shall determine having due regard to hot Condition of the materials. The price allowed to the bidder, however, shall not exceed the amount charged to him excluding the storage charges if any. The decision of the VECPL &/or its authorized persons including Engineer-in-Charge shall be final and conclusive in such matters. In the event of breach of the aforesaid condition, the bidder shall, in terms of the licenses or permits and/or criminal breach of that, be liable to compensate the VECPL at double rate or any higher rate, in the event of those materials at that time having higher rate or not being available in the market, then any other

rate to be determined by the VECPL &/or its authorized persons including Engineer-in-charge and his decision be final and conclusive.

If any material is required to be supplied by the VECPL, the bidder should give notice for the procurement of such material 15 days in advance.

CLAUSE – 30: Materials obtained from Dismantling

If the bidder in the course or execution or the work is called upon to dismantle any part for reasons other than those stipulated in clauses hereunder the materials obtained in the work of dismantling etc, will be considered as the VECPL's property and will be disposed of to the best advantage of the VECPL.

CLAUSE – 31: Articles of Value Found

All gold, silver and other minerals of any description and all precious stones, coins, treasure, relics, antiquities and other similar things which shall be found in under or upon the site shall be the property of the VECPL and the bidder shall duly preserve the same of the satisfaction of the VECPL &/or its authorized persons including Engineer-in-Charge and shall from time to time deliver the same to such person or persons indicated by the VECPL.

CLAUSE – 32: Discrepancies between Instructions

Should any discrepancy occur between the various instructions furnished to the bidder, his agents or staff or any doubt arise as to the meaning of any such instructions or should there be any misunderstanding between the bidder's staff and the VECPL &/or its authorized persons including Engineer-in-Charge's staff, the bidder shall refer the matter immediately in writing to the VECPL &/or its authorized persons including Engineer-in Charge whose decision thereon shall be final and conclusive and no claim for losses alleged to have been caused by such discrepancies between instructions, doubts, or misunderstanding shall in any event be admissible.

CLAUSE – 33: Alterations in work

CLAUSE – 33.1:

The Engineer – In – Charge shall have the power to make any alterations in addition to the original specifications, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work and the bidder shall be bound to carry out the work in

accordance with any instructions in this connection which may be given to him in writing signed by the Engineer – In – Charge and such alternation shall not invalidate the contract and any additional work which the bidder may be directed to do in the manner above specified as part of the work shall be carried out by the bidder on the same conditions in all respects on which he agreed to do the main work and at the same rate as are specified in the tender for the main work.

CLAUSE – 33.2:

When the quantity of any item is increased or decreased than the quantity as specified in the tender, the bidder shall be paid for the same at the rates specified in the Schedule of Rates in the financial bid document of the tender.

CLAUSE – 34: Action where no specification is issued

In case of any class or work for which there is no such specification supplied by the VECPL as is mentioned in the tender documents such work shall be carried out in accordance with Indian Standard Specifications and if the Indian Standard Specifications do not cover the same, the work should be carried out as per standard engineering practice subject to the approval of the VECPL &/or its authorized persons including Engineer-in-Charge.

CLAUSE – 35: Assistance to the Engineer

The bidder shall make available to the VECPL &/or its authorized persons including Engineer - in - charge free of cost all necessary instruments and assistance in checking of setting out of works and in the checking of any works made by the bidder for the purpose of setting out and taking measurements of work.

CLAUSE – 36: Tests for Quality of Works

All workmanship shall be of the respective kinds described in the contract documents and in accordance with the instructions of the VECPL &/or its authorized persons including Engineer - in - charge and shall be subjected from time to time to such test at bidder's cost as the VECPL &/or its authorized persons including Engineer - in - charge may direct at the place of manufacturer or fabrication or on the site or at all or any such places. The bidder shall provide assistance, instruments, labor and material as are normally required for examining, measuring and testing any workmanship as may be selected and required by the VECPL &/or its authorized persons including Engineer - in - charge. All the tests that will be necessary in connection with the execution

of the work as decided by the VECPL &/or its authorized persons including Engineer – in - charge shall be carried out at such laboratory as may be prescribed by the VECPL and actual expenses incurred thereto shall be borne by the bidder.

If any tests are required to be carried out in connection with the work or materials or workmanship not supplied by the bidder, such test shall be carried out by the bidder as per the instruction of VECPL &/or its authorized persons including Engineer - in - charge and cost of such test shall be reimbursed by the VECPL .

CLAUSE – 37: Possession Prior to Completion

The VECPL &/or its authorized persons including Engineer - in - charge shall have the right to take position of or use any completed or partially completed work or part of the work. Such possession or use shall not be deemed to be an acceptance of any work completed in accordance with the contract agreement. If such prior possession or use by the VECPL &/or its authorized persons including Engineer - in - charge delays the progress of work equitable adjustment in the time of completion will be made and the contract agreement shall be deemed to be modified accordingly.

One monsoon shall be the period of liability from the date of Issue of Completion Certificate.

The bidder shall guarantee the installation/work for a period of One monsoon from the date of issue of completion certificate. Any damage or defect that may arise or lie undiscovered at the time of issue of completion certificate, or within the said period, or connected in any way with the equipment or materials supplied by him or in the workmanship, shall be rectified or replaced by the bidder at his own expense as deem necessary by the VECPL &/or its authorized persons including Engineer - in - charge or in default. The VECPL &/or its authorized persons including Engineer - in - charge may cause the same to be made good by other workman and deduct expenses for which the certificate of VECPL &/or its authorized persons including Engineer - in - charge shall be final from any sums that may be then or at any time thereafter, become due to the bidder or from his security deposit, or the proceeds of sale thereof or of sufficient portion thereof.

If the bidder feels that any variation in work or in quantity of materials or proportions would be beneficial or necessary to fulfill the guarantee called for he shall bring this to the notice of the VECPL &/or its authorized persons including Engineer - in - charge in writing.

CLAUSE – 38: Care of Works:

From the commencement to completion of the works, the bidder shall take full responsibility for the care for all works including all temporary works and in case any damages, loss or injury shall happen to the works or to any part thereof or to any temporary works from any cause whatsoever shall at his own cost repair and make good the same-so that at completion the work shall be in good order and in conformity in every respects with the requirements of the contract and the VECPL &./or its authorized persons including Engineer - in - charge instructions.

CLAUSE – 39: Defects Prior to taking over

If at any time, before the work is taken over, the VECPL &/or its authorized persons including Engineer - in - charge shall:

a) Decide that any work done or materials used by the bidder or any sub-bidder is defective or not in accordance with the contract, or that the works or any portion thereof are defective or do not fulfill the requirements of contract the all such matters being hereinafter, called 'Defects' in this clause, and
b) as soon as reasonably practicable gives to the bidder notice in writing of the said decision, specifying particulars of the defects alleged to exist or to have occurred, then the bidder shall at his own expense and with all speed make good the defects so specified.

In the case bidder shall fail to do so the VECPL may take at the cost of the bidder, such steps as may in all circumstances, be reasonable to make good such defects. The expenditure so inclined by the VECPL will be recovered from the amount due the bidder. The decision of the VECPL &/or its authorized persons including Engineer - in - charge with regard to the amount to be recovered from the bidder will be final and binding on the bidder. As soon as the works have been completed in accordance with the contract except in minor respects that do not affect their use for the purpose for which they are intended and except for maintenance thereof provided in the above clause of the contract and have passed the tests on completion, the VECPL &/or its authorized persons including Engineer - in - charge shall issue a certificate therein after called completion certificate in which he shall certify the date on which the works have been so completed and have passed the said tests and the VECPL shall be deemed to have taken over the works on the date so certified. If the works have been divided into various groups in the contract VECPL shall be entitled to take over any group or groups before the other or

others and thereupon the VECPL &/or its authorized persons including Engineer - in - charge shall issue a completion certificate which, however, be for such group or groups so taken over only.

CLAUSE – 40: Defects after taking over

In order that the bidder could obtain a completion certificate he shall make good with all possible speed any defect arising from the defective materials supplied by the bidder or workmanship or any act of omission of the contract or that may have been noticed or developed after the work or group of works has been taken over. The period allowed for carrying out such work will be normally one month. If any defect be not remedied within a reasonable time the VECPL may proceed to do the work at bidder's risk and expense and deduct from the final bill such amount as may be decided by the VECPL.

If by reason of any default the part of the bidder a completion certificate has been issued in respect to every portion of the works within one month after the date fixed by the contract for the completion of the works, the VECPL shall be at liberty to use the works or any portion thereof in respect of which a completion certificate has not been issued provided that the works or the portion of thereof so used as aforesaid shall be afforded reasonable opportunity for completing this work for the issue of completion certificate.

CLAUSE – 41: CERTIFICATES AND PAYMENTS

41.1 - Schedule of Rates and Payments

i) Schedule of Rates to be Inclusive

The prices/rates quoted by the bidder shall remain firm till the issue of final certificate and shall not be subject to escalation. Schedule of rates shall be deemed to include and complete, the works. The opinion of the VECPL &/or its authorized persons cover all costs/expenses and liabilities of every description and all type of risks of every kind to be taken in executing, completing and handing over the work to the VECPL by the bidder. The bidder shall be deemed to have known the nature, scope, magnitude and the extent of the works and materials required though the contract document may not fully and precisely furnish them. He shall make such provision in the schedule of rates, as he may consider necessary to cover the cost of such items of work and materials as may be reasonable and necessary to including Engineer-in-Charge as to the items of work which are necessary and reasonable for completion of work shall be final and binding on the bidder, although the same may not be shown on or described specifically in contract documents.

Generality of this present provision shall not be deemed to cut down or limited in any way because in certain cases it may and in other cases it may not be expressly stated that the bidder shall do or perform a work or supply articles or perform services at his own cost or without addition of payment or without extra charge or words to the same effect or that it may be stated or not stated that the same are included in and covered by the schedule of rates.

ii) **Schedule of Rates to Cover Constructional Plant, Materials, Labor etc.**

Without in any way limiting the provisions of the preceding sub-clause the schedule of rates shall be deemed to include and cover the cost of all constructional plant, temporary work except as provided for therein) pumps, materials, labor insurance, fuel, stores, and appliances to be supplied by the bidder and all other matters in connection with each item in the schedule of rates and the execution of the works or any portion thereof finished, complete in every respect and maintained as shown or described in the contract documents or as may be ordered in writing during the continuance of the contract.

iii) **Schedule of Rates to Cover Royalties, Rents and Claims:**
The schedule of rates shall be deemed to include and cover the cost of all royalties and fees for the materials, articles and processes, protected by letters, patent or otherwise incorporated in or used in connection with the works, also all royalties, rents and other payments in connection with obtaining materials of whatsoever kind for the works and shall include an indemnity to the VECPL which the bidder hereby gives against all actions, proceedings, claims damages, costs and expenses arising from the VECPL in or use on the works of any such articles, processes or materials. Other local board charges if levied on materials, equipment or machinery to be brought to site for use on work shall be borne by the bidder.

iv) **Schedule of Rates to Cover Taxes and Duties**

No exemption or reduction of custom duties, excise duties, sales tax, service tax, VAT, GST, royalties, quarry or any port dues, transport charges, stamp duties or Central or State Government or local body or municipal taxes or duties, taxes or charges (from or of any other body), whatsoever, will be granted or obtained, all of which expenses shall be deemed to be included in and covered by the schedule of rates. The bidder shall also obtain and pay for all permits or other privileges necessary to complete the work.

v) Schedule of Rates to Cover Risks of Delay

The schedule of rates shall be deemed to include and cover the risk of all possibilities of delay and interference with the bidder's conduct of work which occur from any cause including orders of the VECPL in the exercise of his powers and on account of extension of time granted due to various reasons and for all other possible or probable causes of delay.

vi) **Schedule of Rates Cannot be Altered**

For work under unit rate basis, no alteration will be allowed in the schedule of rates except as provided in any other clause of this contract by reason of works or any part of them being modified altered, extended, diminished or omitted. The schedule of rates are fully inclusive rates which have been fixed by the bidder and agreed to by the VECPL and cannot be altered.

41.2 - Procedure For Measurement/Billing of Work in Progress

i) Measurements

All measurements shall be in metric system. All the works in progress will be jointly measured by the representative of the VECPL &/or its authorized persons including Engineer-in-Charge and the bidder's authorized agent progressively. Such measurement will be got recorded in the measurement book by the VECPL &/or its authorized persons including Engineer-in-Charge and signed in token of acceptance by the bidder or his authorized representative.

For the purpose of taking joint measurement the bidder's representative shall be bound to be present whenever required by the VECPL &/or its authorized persons including Engineer-in-Charge. If however he absents for any reason whatsoever the measurements will be taken by the VECPL &/or its authorized persons including. Engineer-in-Charge and this will be deemed to be correct and binding on the bidder.

ii) Billing

The bidder will submit a bill in approved Performa in two copies to the VECPL &/or its authorized persons including Engineer-in-Charge of the work giving abstract and detailed measurements for the various items executed during the work. VECPL &/or its authorized persons including Engineer-in-Charge shall verify the same to ensure that the quantities billed for are strictly for the quantities of all the items as jointly measured and recorded by consultants and or authorized representatives of the VECPL and arrange for payment. Payment shall be made in 15 days after the bill is duly checked, certified and verified by the authorised personnel of the company &/or its representatives.

iii) **Secured Advance on Materials**

In case of tenders for completed item of work, bidder shall not be allowed any type of "Secured Advance" on the security of materials brought to site for

execution of the contracted item of work. However, Secured Advance only for Geosynthetic Clay Liner, Geomembrane liner (HDPE), Geo textile liner and HDPE pipes for leachate collection shall be made @ 50% on receipt of material and balance in the RA bill submitted for the completed work.

iv) Dispute in Mode of Measurement

In case of any dispute as to the mode of measurement not covered by the contract to be adopted for any item of work, mode of measurement as per latest Indian Standard Specifications shall be followed.

41.3 - Lump Sums in Tender

For the item in tender where it includes lump-sum in respect of parts of work, the bidder shall be entitled to payment in respect of the items at the same rates as are payable under this contract for such items, or if the part of the work in question is not in the opinion of the VECPL &/or its authorized persons including Engineer-in-Charge capable of measurement or determination, the VECPL may at his discretion pay the lump-sum amount entered in the tender or a percentage thereof and the certificate in writing of the VECPL &/or its authorized persons including Engineer-in-charge shall be final and conclusive against the bidder with regards to any sum payable to him under the provisions of this clause.

41.4 - Payments Running Account to be Regarded as Advance

All running account payments shall be regarded as payments by way of advance against the final payment only and not as payments for work actually done and completed and shall not preclude the requiring of bad, unsound and imperfect or unskilled work to be removed and taken away and reconstructed or re-erected or be considered as an admission of the due performance of the contract, or any part thereof, in tills respect, or of the accruing of any claim by the bidder, nor shall it conclude, determine or affect in any way the powers of the VECPL under these conditions or any then as to the final settlement and adjustment of the accounts or otherwise, or in any other way vary or affect the contract. The final bill shall be submitted by the bidder within one month of the date of physical completion of the work, otherwise, the VECPL &/or its authorized persons including Engineer-in-Charge's certificate of the measurement and of total amount payable for the work accordingly shall be final and binding on all parties.

41.5 - Notice of Claims for Additional Payments

Should the bidder consider that he is entitled to any extra payment or compensation or to make any claims whatsoever in respect of the works shall forthwith give notice in writing to the VECPL &/or its authorized persons including Engineer-in-Charge that he claims extra payment and/or compensation. Such notice shall be given to the VECPL &/or its authorized persons including Engineer-in-Charge within ten days from the ordering of any work or happening of any event upon, which the bidder bases such claims and such notice shall contain full particulars of the nature of such claim with full details and amount claimed. Failure on the part of the bidder to put forward any claim with the necessary particulars as above within the time above specified shall be an absolute waiver thereof. No omission by the VECPL to reject any such claim and no delay in dealing therewith shall be waiver by the VECPL of any rights in respect thereof.

41.6 - Receipt for Payment

Receipt for payment made on account of work executed by a firm must be signed by a person holding due power of attorney in this respect on behalf of the bidder, except when the bidders are described in their tender as a limited VECPL in which case the receipts must be signed in the name of the VECPL by one of its principal officers or by some other person having authority or give effectual receipt for the VECPL.

41.7 - Completion Certificate

41.7.1 - Application for Completion Certificate

When the bidder fulfils his obligation under the relevant clause, he shall be eligible to apply for completion certificate. The bidder may apply for separate completion certificate in respect of such portion of the work by submitting the completion documents along with such application for completion certificate.

The VECPL &/or its authorized persons including Engineer-in Charge shall normally issue to the bidder the completion certificate within one month after receiving an application therefore from the bidder after verifying from the completion documents and satisfying himself that the work has been completed in accordance with and as set out in the construction and erection drawings, and the contract documents. The bidder, after obtaining the

completion certificate, is eligible to present the final bill for the work executed by him under, the terms of contract.

41.7.2 - Completion Certificate

Within one month of the completion of the work in all respects, the bidder shall be furnished with a certificate by the VECPL &/or its authorized persons including Engineer-in-Charge of such completion but neither certificate shall be given nor shall the work be deemed to have been completed until all scaffolding, surplus materials and rubbish is cleaned off the site completely and until the work shall have been measured by the VECPL &/or its authorized persons including Engineer-in-Charge whose measurement shall be binding and conclusive. The work will not be considered as complete and taken over by the VECPL , until all the temporary work, labor and staff colonies etc., constructed, are removed and the work site cleaned to the satisfaction of the VECPL &/or its authorized persons including Engineer-in-Charge.

If the bidder shall fail to comply with the requirements of this clause on or before the date fixed for the completion of the work, the VECPL &/or its authorized persons including Engineer-in-Charge may at the expenses of the bidder remove such scaffolding, surplus materials and rubbish and dispose of the same as he thinks fit and clear off such dirt as aforesaid, and the bidder shall forthwith pay the amount of all expenses so incurred and shall have no claim in respect of any such scaffolding or materials as aforesaid.

41.7.3 - Completion Certificate Documents

Following documents will be deemed to form the completion documents:

i) The technical documents according to which the work was carried out.

ii) Three sets of construction drawings showing therein the modification and corrections made during the course of execution signed by the VECPL &/or its authorized persons including Engineer-in-Charge.

iii) Completion certificate for 'embedded' and 'covered' up works.

iv) Certificates of final levels as set out for various works.

v) Certificates of tests performed for various works.

41.7.4 - Certificate and Payments no Evidence of Completion

Except the final certificate, no other certificates or payments against a certificate or on general account shall be taken to be an admission by the VECPL of the due performance of the contract or any part there of or of occupancy or validity of any claim by the bidder.

CLAUSE – 42: TAXES AND INSURANCE

42.1 - Taxes, Duties etc.

The bidder agrees to and does hereby accept full and exclusive liability for the payment of any and all taxes, duties, royalties, octroi etc. now or hereafter imposed, increased, or modified, and all the GST, duties, Octroi etc. now in force and hereafter increased, imposed, or modified from time to time in respect of works and materials and all contributions and taxes for unemployment compensation, insurance and old age pensions or annuities now or hereafter imposed by any Central or State Governmental authorities which arc imposed with respect to or covered By the wages, salaries, or other compensations paid to the persons employed by the bidder and the bidder shall be responsible for the compliance with all obligations and restrictions imposed by the labor law as may be applicable to the bidder and the VECPL or any other law affecting employer-employee relationship and the bidder further agrees to comply, and to secure the compliance of all sub-bidders, with all applicable Central, State, municipal and local laws and regulations and requirements of any Central, State or Local Government agency or authority.

Bidder further agrees to defend, indemnify and hold harmless from any liability or penalty which may be imposed by the Central, State or Local authorities by reason of any violation by bidder or sub-bidder of such laws, regulations or requirements and also from all claims, suits or proceedings that may be brought against the VECPL arising under, growing out of, or by reason of the work provided for by this contract, by third parties, or by Central or State Government authority or any administrative sub-division thereof.

42.2 - Insurance

Bidder shall at his own expense cover and maintain insurance with reputable insurance companies to the satisfaction of the VECPL as follows:

42.3 - Employees State Insurance Act

The bidder agrees to and does hereby accept frill and exclusive liability for the compliance with all obligations imposed by the Employees State Insurance Act, 1548, and the bidder further agrees to defend, indemnify and hold VECPL harmless from any liability or penalty which may be imposed by the

Central, State or Local authority by reason of any asserted violation by bidder or sub bidder of the Employees' State Insurance Act, 1948 and also from all claims, suits or proceeding that may be brought against the VECPL arising under, growing out of or by reasons of the work provided for by this contract whether brought by employees of the bidder, by third parties or by Central or State Government authority or any political sub-division thereof.

The bidder further agrees and undertake to comply with due procedure of law including drilling and filing of various forms, returns, documents etc. with the concerned department of the government with in prescribed time and deposit the contribution there under with in a prescribed time.

The bidder agrees to fill in with the Employee's State Insurance VECPL, the declaration forms, and all forms which may be required in respect of the bidder's or sub bidder's employees who are employed in the work provided for or those covered by ESI from time to time under the Agreement. The bidder shall deduct and secure the agreement of the sub bidder to deduct the employee's contribution as per the first schedule of the Employee's State Insurance Act from wages and affix the Employee's Contribution Cards at wages payment intervals. The bidder shall remit and secure the agreement of the sub-bidder to remit to the State Bank of India Employee's State Insurance VECPL Account, the Employees' contribution as required by the Act. The bidder agree to maintain all Card and records as required under the Act in respect of employees and payments, and the bidder shall secure the agreement of the sub-bidder to maintain such records. Any expenses inclined for the contribution, making contributions or maintaining records shall be to the bidder's or sub-bidder's account.

The VECPL shall retain such sum as may be necessary form the total contract value unit the bidder shall furnish satisfactory proof that all contribution as required by the Employees State Insurance Act, 1948, has been paid.

42.4 - Workman's Compensation and Employer's Liability Insurance

Before undertaking the work relating to this project the bidder agrees and undertake to submit a copy of the insurance policy taken under the Workman's Compensation Act 1923 and bidder should ensure that it has been properly covered both in number of employees and type of employment i.e. skill, semiskilled and unskilled workers. Insurance shall be affected for all the bidder's employees engaged in the performance of his contract: If any of the work is sublet, the bidder shall require the sub-bidder to provide Workman's Compensation and employer's liability insurance for the tatter's employees of such employees are not covered under the bidders Insurance. The bidder should also insure his personnel under the personal accident cover policy if required.

42.5 - Any other Insurance required under any Law or Regulation

Bidder shall also ensure to carry and maintain all other insurance policies which he may be required under any law or regulation from time to time. He shall also carry and maintain any other insurance as may be required by the VECPL.

42.6 - Damage to Property

i) Bidder shall be responsible for making good to the satisfaction of the VECPL any loss and any damage to all structures and properties belonging to the VECPL or being executed or procured or being procured by the VECPL or of other agencies within the premises of all the work of the VECPL, if such loss or damage is due to fault and/or the negligence or willful acts or omission of the bidder, his employees, agents, representatives or sub-bidders.

ii) The bidder shall indemnify and keep the VECPL harmless of all claims for damage to property other than VECPL's property arising under or by reason of this agreement if such claims result from the fault and/or negligence or willful acts or omissions of the bidder, his employees, agents, representative or sub-bidders.

iii) The VECPL shall have no liability towards the accident occurred if any, to any person involved in carrying out the work relating to project or while handling, loading, unloading, carrying, dumping, excavating etc. of any material and for the loss, damage etc. occurred to the vehicle indulged in such handling or carrying the material and it shall be the total responsibility of the bidder to compensate the same and meet with all statutory liabilities arising there from.

CLAUSE – 43: LABOUR LAWS AND SAFETY REGULATIONS

43.1 - Labour Laws

No labor below the age of fifteen years shall be employed on the work. The bidder shall not pay less than what is provided under law to laborers engaged by him on the work. The bidder shall at his expense comply with all labor laws as applicable and keep the VECPL indemnified in respect thereof. The bidder shall ensure to VECPL with various provisions of labor laws as may be applicable to them.

43.2 - Bidder to Indemnify the VECPL

i) The bidder shall indemnify the VECPL and every member, officer and employee of the VECPL , also the VECPL &/or its authorized persons including Engineer-in-Charge and his staff against all actions, proceedings, claims, demands, costs and expenses whatsoever arising out of or in connection with the matters referred to and elsewhere and all actions, proceedings, claims, demands, costs and expenses which may be made against the VECPL for or in respect of or arising

out of any failure by the bidder in the performance of his obligations under the contract documents. The VECPL shall not be liable, for or in respect of any demand or compensation payable under any law in respect or in consequence of any accident or injury to any workmen or other person in the employment of the bidder or his sub-bidder and bidder shall indemnity and keep indemnified the VECPL against all such damages, and compensations and against all claims, damages, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto.

ii) **Payment of Claims and Damages**

Should the VECPL have to pay any money in respect of such -claims or demands as aforesaid the amount so paid and the costs incurred by, the VECPL shall be charged to and paid by the bidder and the bidder shall not be at liberty to dispute or question the right of the VECPL to make such payments notwithstanding the same may have been made without his consent, or authority or in law or otherwise to the contrary.

iii) In every case in which by virtue of the provisions of section 12, sub-section (i) of workmen's compensation act, 1923 or other applicable provision of Workmen's Compensation Act or any other Act, the VECPL is obliged to pay compensation to a workman, employed by the bidder in execution of the works, the VECPL will recover from the bidder the amount of the compensation so paid, and without prejudice to the rights of VECPL under section 12, sub-section (2) of the said Act, VECPL shall be at liberty to recover such amount or any part thereof by deducting it from the security deposit or from any sum due to the bidder whether under this contract or otherwise. The VECPL shall not be bound to contest any claim made under section 12 sub-section (1) of the said Act, except on the written receipt of the bidder and upon his giving to the VECPL full security for all costs for which the VECPL might become liable in consequence of contesting such claim.

43.3 - Health and Sanitary Arrangements for Workers

In respect of all labor directly or indirectly employed in the works for the performance of the bidders part of this agreement, the bidder shall comply with or cause to be complied with all the rules and regulations of the local sanitary and other authorities or as framed by the VECPL from time to time for the protection of health and sanitary arrangements for all the workers.

43.4 - Safety Regulations

(i) In respect of all labor, directly or indirectly employed in the work for the performance of bidder's part of this agreement, the bidder shall at his own expense arrange for all the safety provisions as per safety codes of C.P.W.D., Indian Standards Institution, The electricity Act, The Mines Act and such other acts as applicable.

(ii) The bidder shall observe and abide by all fire and safety regulations of the VECPL. Before starting construction work bidder shall consult with VECPL's safety engineer or VECPL &/or its authorized persons including Engineer-in-Charge and must make good to the satisfaction of the VECPL any loss or damage due to fire to any portion of the work done or to be done under this agreement or for any of the VECPL 's existing property.

43.5 - Jurisdiction

The contract shall be governed by and constructed according to the laws in force in India. In case of dispute or differences arising relating to interpretation, construction and or implementation of any clause relating to this tender document, same shall be referred to the arbitrator to be appointed by the VECPL and whose decision shall remain final, conclusive and binding for both the parties.

43.6 - SAFETYCODE

43.6.1 - General

Bidder shall adhere to safe construction practice and guard against Hazardous and unsafe-working conditions and shall comply with VECPL's safety rules as set forth herein. Prior to-start of construction, bidder will be furnished copies, of VECPL's "Safety Code" for information and guidance, if it has been prepared.

43.6.2 - First Aid and Industrial Injuries

1) Bidder shall maintain, first aid facilities for its employees and those of its sub bidders.
2) Bidder shall make outside arrangements for ambulance service and for the treatment of industrial injuries. Names of those providing these service shall be furnished to VECPL prior to start of construction and their telephone numbers shall be prominently posted in Bidder's field office.
3) All critical industrial injuries shall be reported promptly to VECPL and a copy of bidder's report covering each personal injury requiring the attention of a physician shall be furnished to the VECPL.

43.6.3 - General Rules

Smoking within the battery area, tank farm or dock limits is strictly prohibited. Violators or the no smoking rules shall be discharged immediately.

43.6.4 - Bidder's Barricades

(1) Bidder shall erect and maintain barricades required in connection, with his operation to guard or protect.

(a) Excavations.
(b) Hoisting areas
(c) Area adjudged Hazardous by Bidder's, or VECPL 's inspectors
(d)VECPL 's existing property subject to damage by Bidder's Operations
(d) Rail road unloading spots.

(2) Bidder's employees and those of his sub-bidders shall become acquainted with VECPL's barricading practice and shall respect the provisions thereof.

(3) Barricades and Hazardous areas adjacent to but not located in normal routes of travel shall be marked by red flasher lanterns at nights

43.6.5 - Scaffolding

(i) **Suitable** scaffoldings should be provided for workmen for all woks that cannot safely be done from the ground or from solid construction except such short period work as can be done safely from ladders. When a ladder is used an extra worker shall be engaged for holding the ladder and if the a ladder is used for carrying materials, as well, suitable footholds and handholds shall be provided on the ladder and the ladder shall be given an inclination not steeper than 1 in 4 (1 horizontal and 4 vertical).

(ii) Scaffolding or staging more than 4 meters above the ground or floor, swing suspended from an overhead support or erected with stationary support shall have a guard rail properly attached, bolted, braced and otherwise rewarded at least 3 ft. high above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying the building or structure.

(iii) Working platform, gangways and stairways should be so constructed that they should not sag unduly or unequally and if the height of the platform of the gangway or the stairway is more than 4 meters above ground level or floor level, they should be closely boarded, should have adequate width and should be suitably fastened as described in (ii) above.

(iv)Every opening in the floor of a building or in a working platform shall be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be 1 meter.

(v) Safe means of access shall be provided to all working platforms and other working places, every ladder shall be securely fixed. No portable single ladder shall be over 9 meters in length while the width between side rails in rung ladder shall in no case be less than 30 cm for ladder up to and including 3 meters in length. For longer ladder this width should be increased at least 5 mm for each additional foot of length. Uniform steps spacing shall not exceed 30 cm. Adequate precautions shall be taken to prevent danger from electric equipment. No materials on any of the sites of work shall be so stacked or placed to cause danger or inconvenience to any person or public. The bidder shall also provide all necessary fencing and lights to protect the workers and staff from accidents, and shall be bound to bear the expenses of defense of every suit, action or other proceedings of law that may be brought by any person for injury sustained owing to neglect of the above precautions and pay any damages and costs which may be awarded in any such suit or action or proceedings to any such person or which may with the consent of the bidder be paid to compromise any claim by any such person.

43.6.6 - Excavation and Trenching

All trenches 1.2 meters or more in depth shall at all times be supplied with at least one ladder for each 50 meters length or fraction thereof.

Ladder shall be extended from bottom of the trench to at least 1 meter above the surface of the ground. The sides of the trenches which are 1.5 meters in depth shall be stepped back to give suitable slope or securely held by timber bracing so as to avoid the danger of sides to collapse. The excavated materials shall not be placed within 1.5 meters of the edge of the trench or half of the trench width whichever is more. Cutting shall be done from top to bottom. Under no circumstances undermining or under cutting shall be done.

SECTION – 14

ITEM WISE TECHNICAL SPECIFICATIONS OF CIVIL WORKS

The specifications described here given are covered in the Schedule of Rates. Relevant IS codes for all the works mentioned below, covering all building materials, proportions in which they are required to be mixed/prepared, procedure for making/laying/fixing of the materials, if any, shall be applicable and the works have to be done as per the specifications and guidelines mentioned therein with relevant tests carried out as specified of the prepared structure and all the materials used in the said work which should be noted and strictly followed as a part of quality assurance program in the construction work. Specifications for general items covered in construction of different components of landfill are described here:

GENERAL

1. Scope of Work

The work contemplated under this contract includes General Construction for the aforesaid project, all as detailed in the Bill of Quantities, Specifications and Drawings.

Such other works which are not included in the aforesaid Bill of Quantities are generally intended to be executed through a separate agency. Not with-standing the above, the VECPL reserve the right to order additional works under the same Contract. The VECPL also reserve the right to omit any item of work included in the aforesaid Bill of Quantities or not perform it at all at their discretion and the Bidder shall not have any claim because of the same.

The Bidder for this work shall be required to work in co-operation and co-ordination with other agencies on site and give them all reasonable assistance and help for the execution of the work in an efficient manner as directed. The words "approved" or "as directed" shall be deemed to convey approval or the discretion of The Engineer.

2. Indian Standard Specifications

The particular Specifications for the work is as detailed hereinafter. The Specification shall be read in conjunction with the relevant Indian Standard Specifications and the obtainable local practice as detailed in various regional handbooks of practice and the work shall be executed accordingly. Where the Specifications in any of the standards are at variance with the Specifications detailed herein, the Specifications herein shall govern.

3. Quality of materials & General Standards of work

The Bidder under this contract commits himself to use first class material and assumes full responsibility for the quality of all material incorporated or brought for in VECPL in the work. The work shall be executed in accordance with best engineering practice and as per directions of the Engineer.

4. Water and Power for construction

Please refer relevant clauses under "Special Conditions of the Contract".

5. Scaffolding

All scaffolding and ladders required for the proper execution of the work shall be provided by the Bidder.

Measurements

The mode of measurements, wherever possible is specifically mentioned in these documents, where it has not been mentioned, it shall be as per provisions of the relevant Indian Standards. All the measuring tapes and other accessories necessary, shall be provided by the Bidder.

6. Tools and Plant

The bidder along with his tender furnish a list of tools, plant and machinery which he intends to use on the works. The list should indicate the exact type of machine, its capacity, year of manufacture, kind and capacity of propelling force, spare parts readily available and all other pertinent information. The bidder is obliged to use all the machinery mentioned in his list if the Engineer considers in necessary.

7. Surveying and staking

It is the express responsibility of the Bidder to bring to site all surveying instruments necessary for the marking out, fixation of levels, etc. and conduct these survey operations himself with utmost accuracy. The Bidder shall put up stable stakes, benchmarks etc. as necessary for the work. The Engineer will be present when this work is being carried out and will inspect all these operations with the Bidder's assistance.

8. Dewatering

Dewatering of all accumulated water in all locations on job site from whatever source or cause until the completion of the entire work, shall be done by the bidder at his own expense and shall not be separately paid for. The rates quoted by the bidder shall be deemed to be inclusive of this.

9. Access to site, approach roads and roads within the premises.

The bidder shall at his own cost provide all approach roads required in connection with the access to site for transport of materials and labor and such other uses. He shall acquaint himself thoroughly regarding condition and suitability of public roads leading up to the limits of the premises and will provide vehicles for transportation of materials which meet the requirements of these road conditions. It shall also be the responsibility of the bidder to maintain at his own cost these roads till the construction is completed.

Item No. 01: Mass Excavation in all sorts of soil including hard soil, soft and hard rock with side slope in 1:1 (V:H) from existing ground level to the specified depth with a 3 m wide horizontal berm constructed at 7 m depth from the EGL followed by second slope of the specified depth as indicated, as well as vertical excavation at the bottom most part of the phase for 1.50 m depth for incorporating bottom liners:

Excavation of the earthen tank shall be carried out in all sorts of soil from existing ground levels to an average depth of 14.75 m from existing GL (EGL) in the specified slope of 1:1 (V:H) in accordance with the drawing supplied by the company. The depth at the ramp side shall be maintained at 13.50 m from the EGL, whereas that at the leachate collection tank side shall be maintained at 16.0 m from the corresponding EGL on that side. Moreover, a horizontal berm of 3 m width is to be constructed at a depth of 7 m from the EGL for easy working. The remaining slope height shall be governed by the overall depth at the specific location as indicated in the drawing. Since the site is having a slope with higher level towards the ramp side and lower level towards the leachate tank side, the depth specified shall be maintained from the corresponding average level of the side mentioned. The bottom of the phase shall be uniformly leveled. The work includes excavation, filling and transportation as well as dumping of the soil/rock obtained from excavation within the total site area for further future use or disposal outside the site as instructed by the Engineer – in - charge. The excavated soil/rock should be dumped in such a way in the site area that it shall be easily usable for other works or be disposed off outside the site.

Vertical excavation of 1.50 m depth shall be done once the bottom level as specified is reached to incorporate the bottom liner system. There is a slope along the lengths side and the width side of the phase to be maintained at the bottom level of the phase as mentioned in the drawing to allow the leachate to flow from the ramp side to the leachate collection tank side. Moreover, the central line of the bottom shall be at the highest level and levels at the sides of the bottom shall be at lowest level width wise for the leachate to flow easily into the leachate collection pipes. After maintaining in the specified bottom slope, the vertical excavation as indicated for incorporation of the bottom liners and drainage layer shall be done in the same slope.

The excavation shall be measured as per the exact length, width and depth according to the instruction of the VECPL &/or its authorized persons including Engineer - in - charge. The depth of the tank shall be measured from the existing ground level. The rate of excavation includes de watering whenever required at the site. Any extra precaution required for excavation shall be taken in accordance with the instruction given by the VECPL &/or its authorized persons including Engineer - in - charge. It may include use of normal excavator machines for soil/soft rock and controlled blasting in case of hard rock.

1: GENERAL PROCEDURE AND SPECIFICATIONS FOR MASS EXCAVATION AND EARTH WORK:

1.1. Applicable Codes

The following Indian Standard Codes, unless otherwise specified herein, shall be applicable. In all cases, the latest editions including all applicable official amendments and revisions shall be referred to.

a)	IS 3764	-	Excavation work - Code of Safety .
b)	IS 2720	-	Methods of test for soils:
	(Part-1)	-	Preparation of dry soil samples for various tests.
	(Part-2)	-	Determination of Water Content.
	(Part-4)	-	Grain size analysis.
	(Part-5)	-	Determination of liquid and plastic limit.
	(Part-7)	-	Determination of water content - dry density relation using light compaction.
	(Part-8)	-	Determination of water content - dry density relation using heavy compaction.
	(Part-9)	-	Determination of dry density – moisture content by constant weight of soil method.
	(Part-14)	-	Determination of density index (relative density) of cohesionless soils.
	(Part-22)	-	Determination of organic matter.
	(Part-26)	-	Determination of pH Value.
	(Part-27)	-	Determination of total soluble sulphates.
	(Part-28)	-	Determination of dry density of soils in place, by the sand replacement method.
	(Part-33)	-	Determination of the density in place by the ring and water replacement method.
	(Part-34)	-	Determination of density of soil in place by rubber balloon method.
	(Part-38)	-	Compaction control test (Hilf Method).

1.2. Excavation

1.2.1 General

Excavation for trenches over areas and for pits, etc. shall be done to widths, lines and levels as shown in drawings or to such lesser or greater widths, lines and levels as directed. The bottom and sides of excavation shall be trimmed to required levels, profile, etc. watered and thoroughly rammed. Should any excavation be taken below the specified levels, the bidder shall at his own cost fill up such excavation with cement concrete (M-10) to required levels. Filling in such excavation with excavated material is prohibited.

All excavation work shall be carried out by mechanical equipment unless, in the opinion of Engineer, the work involved requires it to be carried out by manual methods.

1.2.2 Grubbing and Clearing

Before excavation is started, the area coming under cutting / excavation shall be thoroughly grubbed and cleared off shrubs, rank vegetation, grass, bush wood, debris, trees / sapling of girth up to 300 mm. The roots shall be removed up to depth of 600 mm below ground. The rubbish shall be removed outside the site as directed by the Engineer.

1.2.3 Dewatering

The Bidder shall ensure that the excavation and the structures are free from water during construction and shall take all necessary precautions and measures to exclude ground/rain water so as to enable the works to be carried out in reasonably dry conditions in accordance with the construction program. Sumps made for dewatering must be kept clear of the excavations/trenches required for further work. The method of pumping shall be approved by Engineer, but in any case, the pumping arrangement shall be such that there shall be no movement of subsoil or blowing in due to differential head of water during pumping. Pumping arrangements shall be adequate to ensure no delays in construction. The dewatering shall be continued for at least (7) seven days after the last pour of the concrete. The Bidder shall, however, ensure that no damage to the structure results on stopping of dewatering.

The Bidder shall study the sub-soil conditions carefully and shall conduct any tests necessary at the site with the approval of the Engineer to test the permeability and drainage conditions of the sub-soil for excavation, concreting etc., below ground level.

The scheme for dewatering and disposal of water shall be approved by the Engineer. The Bidder shall suitably divert the water obtained from dewatering from such areas of site where a buildup of water in the opinion of the Engineer obstructs the progress of the work, leads to insanitary conditions by stagnation, retards the speed of construction and is detrimental to the safety of men, materials, structures and equipment.

When there is a continuous inflow of water and the quantum of water to be handled is considered in the opinion of Engineer, to be large, a well point system- single stage or multistage, shall be adopted. The Bidder shall submit to the Engineer, details of his well point system including the stages, the spacing, number and diameter of well points, headers etc., and the number, capacity and location of pumps for approval.

Unless separately provided for in the Schedule of quantities, cost of dewatering is deemed to have been included in the unit rates quoted for excavation. If separately provided for, the unit of measurement shall be as indicated in the Schedule of Quantities.

1.2.4 Timbering to excavation (shoring)

Where the soil is soft and sides of excavation needs supporting, suitably designed planking and strutting shall be provided.

Close timbering shall be done by completely covering the sides of the trenches and pits generally with short, upright members called 'polling boards'. These shall be of minimum 25 cm x 4 cm sections or as approved by the Engineer. The boards shall generally be placed in position vertically side by side without any gap on each side of the excavation and shall be secured by horizontal wailings of strong wood at maximum 1.2 meter spacing, strutted with bellies or as approved by the Engineer. The length of the bellies struts shall depend on the width of the trench or pit. If the soil is very soft and loose, the boards shall be placed horizontally against each side of the excavation and supported by vertical wailings, which in turn shall be suitably strutted. The lowest boards supporting the sides shall be taken into the ground and no portion of the vertical side of the trench or pit shall remain exposed, so as to render the earth liable to slip out.

Timber shoring shall be 'close' or 'open' type, depending on the nature of soil and the depth of pit or trench. The type of timbering shall be as approved by the Engineer. It shall be the responsibility of the Bidder to take all necessary steps to prevent the sides of excavations, trenches, pits, etc. from collapsing.

Timber shoring may also be required to keep the sides of excavations vertical to ensure safety of adjoining structures or to limit the slope of excavations, or due to space restrictions or for other reasons. Such shoring shall be carried out, except in an emergency, only under instructions from the Engineer.

The withdrawal of the timber shall be done carefully to prevent the collapse of the pit or trench. It shall be started at one end and proceeded with, systematically to the other end. Concrete or masonry shall not be damaged during the removal of the timber.

In the case of open timbering, the entire surface of the side of trench or pit is not required to be covered. The vertical boards of minimum 25 cm x 4 cm sections shall be spaced sufficiently apart to leave unsupported strips of maximum 50 cm average width. The detailed arrangement, sizes of the timber and the spacing shall be subject to the approval of the Engineer. In all other respects, the Specifications for close timbering shall apply to open timbering.

In case of large pits and open excavations, where shoring is required for securing safety of adjoining structures or for any other reasons and where the planking across sides of excavations/pits cannot be strutted against, suitable inclined struts supported on the excavated bed shall be provided. The load from such struts shall be suitably distributed on the bed to ensure no yielding of the strut. If however, Engineer directs any timbering to be left-in, keeping in mind the type of construction or any other factor, Bidder shall be paid for at the scheduled item rate for such left-in timbering.

Unless otherwise separately provided for in Schedule of Quantities, the timber shoring is deemed to have been included in the unit rates quoted for excavation. If separately provided for, then the actual effective area of shored faces as approved by Engineer shall be measured in Sq. m. The area of planking embedded in the bed/sides of excavation will not

be considered, nor the area supporting inclined struts in case of large pits/open excavation. All planks, boards, wailings, verticals, struts, props and all other materials required for shoring and subsequent safe dismantling and removal shall be included in the quoted unit rates.

1.2.5 Soil / Rock Classification

1.2.5.1 General

All materials to be excavated shall be classified by Engineer, into one of the following classes and shall be paid for at the rate contracted for that particular class of material. No distinction shall be made whether the material is dry, moist or wet. The decision of Engineer regarding classification of the material shall be final and binding on bidder and not be a subject matter of any appeal or arbitration. Excavation shall be classified under one of the following categories by the Engineer.

a) Ordinary and Hard Soils

These shall include all kinds of soils containing kankar, sand, silt, murrum and/or shingle, gravel, clay, loam, peat, ash, shale etc. which can generally be excavated by spade, pick-axes and shovel and which is not classified under “soft and decomposed rock” and “hard rock” defined below. This shall also include embedded rock boulders not longer than 1 meter in any direction and not more than 200 mm in any one of the other two directions.

b) Hard Rock

This shall include all rock occurring in large continuous masses which cannot be removed except by blasting for loosening it. Hard varieties of rock with or without veins and secondary minerals which, in the opinion of Engineer require blasting shall be considered as hard rock. Boulders of rock occurring in such sizes and quality shall also be classified as hard rock. Concrete work both reinforced and unreinforced to be dismantled will be measured under this item unless a separate provision is made in the Schedule of Quantities.

c) Soft and Decomposed Rock

This shall include rock, boulders, slag, chalk, slate, hard mica schist, laterite, sand stone and all other materials which in the opinion of Engineer is rock but does not need blasting and could be removed with picks, hammer, crow bars, wedges and pneumatic breaking equipment. The mere fact that bidder resorts to blasting for reasons of his own, shall not qualify for classification under “hard rock”.

1.2.5.2 Stripping Loose Rock

All loose boulders, detached rocks partially and other loose material which might move therewith not directly in the excavation but so close to the area to be excavated as to be

liable, in the opinion of Engineer, to fall or otherwise endanger the workmen, equipment, or the work shall be stripped off and removed from the area of the excavation. The method used shall be such as not to render unstable or unsafe the portion which was originally sound and safe.

Any material not requiring removal in order to complete the permanent works, but which, in the opinion of Engineer, is likely to become loose or unstable later, shall also be promptly and satisfactorily removed. The cost of such stripping will be paid for at the unit rates accepted for the class of materials in question.

1.2.6 Blasting

Where blasting has to be resorted to for rock cutting it shall be the responsibility of the bidder to arrange for the following at his entire risk, cost and responsibility.

a) Permission from all the connected Public Authorities such as Municipal Corporation, Nagarpalika, Gram Panchayat, Inspector of Explosives, Police, Highway Authorities, etc. shall be obtained.
b) Fees, royalties and any other levies, attendant on such blasting work shall be entirely borne by the bidder.
c) All precautionary measures such as notices to adjoining property and other agencies working in and around the plot, signaling and watch etc. shall strictly adhere to according to the various regulations in force.
d) All risk Insurance in respect of the blasting hazards to men and materials within and in the vicinity of the plot. This insurance shall be apart from the Bidders all Risk Insurance Policy stipulated under General Conditions unless the Bidder incorporates blasting hazards and its coverage in the said general policy.
e) Storing of blasting materials shall be strictly as per Explosive Regulations.

The bidder must acquaint himself with the site conditions in regard to blasting, nature of rock likely to be met with, timing and other restrictions to blasting etc. No. claims whatsoever in this regards shall be entertained.

1.2.7 Disposal of Surplus excavated materials

All materials considered surplus shall be removed to destinations and disposed off as directed. The disposal of the material can be in any of the following ways as directed by the Engineer.

Filling in low lying areas
Filling in at places of filling such as under floors, in roads, etc.
Stacking of material in pre-designated stacking yard.
Removal of material outside the plot for disposal.

1.2.8 Measurements

Measurements for all excavation, filling, carting away and earthwork shall be in solid measure. The rates quoted by the bidders are thus for solid measure units. The following factors shall be applied to obtain quantities of solid measure.

- Excavation	:	Volume shall be determined by levels taken before commencement of excavation and after completion upto the required level.
- Filling watered and consolidated in layers	:	Volume shall be determined by levels taken before and after compacted filling and by measuring the length and breadth as required.
- Stack measure as in rubble, etc.	:	Volume of stack less 40%

The mode of measurement for various types of excavations shall be as under:-

a) In case of trenches, pits and areas, measurements shall be on the basis of the width of foundation and the depth to bottom of foundation (bottom of bed concrete if provided) formation.

b) Excavation in rock shall be measured up to levels indicated or required. No undulations as physically appearing after excavation shall be taken into consideration while arriving at the quantities.

c) Where such measurement is not possible as in the case of strata intermixed with soil, excavated rock shall be properly stacked as directed by the Engineer and the volume of rock calculated on the basis of stack measurements after making appropriate allowance for voids.

d) Excavation beyond the widths or depths required will not be paid for, any additional concrete or bedding material required as a result of over-excavation at the Bidder's expense.

1.2.9 Rates

The rates shall be inclusive of all the operations described above including clearing and grubbing, dewatering, shoring and disposal at site as directed by the Engineer.

1.3. Earth Filling, Backfilling and Site Grading in the voids of excavated rock to prepare a smooth surface for placement of liners and prevent damage of liners

1.3.1 General

All fill material shall be subject to the Engineer's approval. If any material is rejected by Engineer, the Contractor shall remove the same forthwith from the site. Surplus fill material shall be deposited/disposed of as directed by Engineer after the fill work is completed.

No earth fill shall commence until surface water discharges and streams have been properly intercepted or otherwise dealt with to the approval of the Engineer.

The Contractor shall not commence the placement of any fill or back fill at any location without the approval of the Engineer.

1.3.2 Material

To the extent available, selected surplus soils from excavations shall be used as backfill. Backfill material shall be free from lumps, organic or other foreign material. All lumps of earth shall be broken or removed. Where excavated material is mostly rock, the boulders shall be broken into pieces not larger than 150 mm size, mixed with properly graded fine material consisting of murrum or earth to fill the voids and the mixture used for filling.

If fill material is required to be imported, the Contractor shall make arrangements to bring such material from outside borrow pits. The material and source shall be subject to the prior approval of the Engineer. The approved borrow pit areas shall be cleared of all bushes, roots of trees, plants, rubbish, etc. Top soil containing foreign material shall be removed. The materials so removed shall be disposed of as directed by Engineer. The Contractor shall provide the necessary access roads to borrow areas and maintain the same if such roads do not exist, at his cost.

1.3.3 Filling in pits and trenches around foundations of structures, walls, etc.

As soon as the work in foundations has been accepted and measured, the spaces around the foundations, structures, pits, trenches, etc., shall be cleared of all debris, and filled with earth in layers not exceeding 15 cm, each layer being watered, rammed and properly consolidated, before the succeeding one is laid. Each layer shall be consolidated to the satisfaction of Engineer. Earth shall be rammed with approved mechanical compaction machines. Usually no manual compaction shall be allowed unless the Engineer is satisfied that in some cases manual compaction by tampers cannot be avoided. The final backfill surface shall be trimmed and leveled to a proper profile to the approval of the Engineer.

1.3.4 Sand Filling in Plinth and Other Places

At places where backfilling is required to be carried out with local sand it shall be clean, medium grained and free from impurities. The filled-in-sand shall be kept flooded with water for 24 hours and drained to ensure maximum hydraulic compaction. Any temporary work required to contain sand under flooded condition shall be on Contractor's account. The surface of the consolidated sand shall be dressed to required level or slope. Construction of floors or other structures on sand fill shall not be started until the Engineer has inspected and approved the fill.

1.3.5 Filling in Trenches

Filling in trenches for pipes and drains shall be commenced as soon as the joints of pipes and drains have been tested and passed. The backfilling material shall be properly consolidated by watering and ramming, taking due care that no damage is caused to the pipes.

Where the trenches are excavated in soil, the filling from the bottom of the trench to the level of the center line of the pipe shall be done by hand compaction with selected approved earth in layers not exceeding 8 cm; backfilling above the level of the center line of the pipes shall be done with selected earth by hand compaction, or other approved means in layers not exceeding 15 cm.

In case of excavation of trenches in rock, the filling up to a level 30 cm above the top of the pipe shall be done with approved excavated soil. The filling up to the level of the center line of the pipe shall be done by hand compaction in layers not exceeding 8 cm whereas the filling above the center line of the pipe shall be done by hand compaction or approved means in layers not exceeding 15 cm. The filling from a level 30 cm above the top of the pipe to the top of the trench shall be done by hand or other approved mechanical methods with broken rock filling of size not exceeding 15 cm mixed with fine material as available to fill up the voids.

Filling of the trenches shall be carried out simultaneously on both sides of the pipe to avoid unequal pressure on the pipe.

1.3.6 General Site Grading

Site grading shall be carried out as indicated in the drawings and as approved by the Engineer. Excavation shall be carried out as specified in the Specifications. Filling and compaction shall be carried out as specified and elsewhere unless otherwise indicated below.

The fill shall be placed in layers not exceeding 200 mm and levelled uniformly and compacted before the next layer is deposited.

To ensure that the fill has been compacted as specified, field and laboratory tests shall be carried out by the Contractor at his cost.

Field compaction tests shall be carried out in each layer of filling until the fill to the entire height has been completed. This shall hold good for embankments as well. The fill will be considered as incomplete if the desired compaction has not been obtained.

The Contractor shall protect the earth fill from being washed away by rain or damaged in any other way. Should any slip occur, the Contractor shall remove the affected material and make good the slip at his cost.

If so specified, the rock as obtained from excavation may be used for filling and levelling to the indicated grades without further breaking. In such an event, filling shall be done in layers not exceeding 50 cms approximately. After rock filling to the approximate level, indicated above has been carried out, the voids in the rock filling shall be filled with finer materials such as earth, broken stone, etc. and the area flooded so that the finer materials fill up the voids. Care shall be taken to ensure that the finer fill material does not get washed out. Over the layer so filled, a 100 mm thick mixed layer of broken material and earth shall be laid and consolidation carried out by a 12 ton roller. No less than twelve passes of the roller shall be accepted before subsequent similar operations are taken up.

1.3.7 Fill Density

The compaction, where so called for, shall comply with minimum 95% of maximum dry density as per IS 2720 (Part 8) at moisture content differing not more than 4% from the optimum moisture content. The Contractor shall demonstrate adequately by field and laboratory tests that the specified density has been obtained.

1.3.8 Lead

Lead for deposition/disposal of excavated material, shall be as specified in the respective item of work. No extra compensation is admissible on the grounds that the lead including that for borrowed material had to be transported over marshy or 'katcha' land/route.

1.3.9 Measurements

Backfilling as per specification the sides of foundations of columns, footings, structures, walls, tanks, rafts, trenches etc. with excavated material will be paid for separately. It shall be clearly understood that the rate quoted for excavation shall include stacking of excavated material as directed, excavation/packing of selected stacked material, conveying it to the place specified etc. as specified. As a rule, material to be backfilled shall be stacked temporarily as directed by the Engineer.

Backfilling, plinth filling etc. with borrowed earth will be paid for at rates quoted. The quoted rate shall include all operations such as clearing, excavation, lead and transport, fill,

compaction etc, as specified. Actual quantity of consolidated filling or actual quantity or excavation in the borrow pits (less such top soil which has been excavated and not used for filling) whichever is less shall be measured and paid for in cubic meters. The lead, lift etc. shall be as indicated in the schedule of quantities.

Actual quantity of consolidated sand filling shall be measured and paid in cubic meters.

1.3.10 Rates

The rates shall be inclusive of clearing and grubbing, spreading, watering and compaction as per specification above.

Item No. 2: Providing and Laying of Amended Clay liner on the bottom liner system - 450 mm thickness – 2 layers:

The item includes P/L of amended clay liner using the soil obtained from the outside borrow pits and mixing with good quality sodium bentonite in appropriate proportion with soil to achieve the desired permeability as specified in criteria of CPCB, on the bottom surface of the phase in two layers of 450 mm thickness each and compacted thoroughly. 5% bentonite is tentatively taken for evaluation of the cost of clay liner. However, it shall depend on the soil and quality of bentonite that shall be used at the time of execution of the work. The exact % of bentonite shall be determined based on the laboratory test as specified in the tests to be carried out in the technical bid of the tender. Based on the actual result the cost of the clay liner shall be evaluated and fixed. It can increase or decrease and shall also depend on the distance of the source of soil brought. However max. Distance allowed is 25 km. and not more. The exact proportion of the bentonite as determined in the laboratory by mixing procured bentonite sample with the selected soil sample and compacted to achieve a proctor density of 95% on the bottom and 90% on the side slopes, along with determination of Permeability of the liner to < 1x 10^{-7} cm/sec shall be laid on the areas where the clay liner has to be applied. The contractor shall mix the excavated soil and bentonite in specified thickness and with rolling, watering and compaction thoroughly. The item shall be executed as per the no. of quality assurance tests specified and methodology for liner preparation and application shall be as per the quality assurance plan provided separately at the end of the specifications.

Item No. 3: Providing and Laying of Concrete work PCC M20 – 200 mm thickness on the inner side slopes of the phase:

The item includes providing and laying Plain Cement Concrete M-20 200 mm thickness for very severe conditions with minimum cement content of 260 Kg/Cu.m. and minimum free water - cement ratio of 0.45 as per IS 456, 2000 at the inner side slope of the phase for providing a solid support and covering of GeoSynthetic Clay liner, HDPE liner and Geotextile liner on the side slope from bottom of the phase to the earthen bund top with curing complete, excluding form work as shown in the drawing. The PCC item includes providing and laying of PCC of specified grade and thickness on the areas as above in the specified proportion so as to cover the surface completely and give a finished surface. Mixing of concrete shall be done with the help of mechanical mixer and the mixer drum shall be turned at least for 1½ minutes after all the ingredients are added and the

drum shall be placed on the water tight platform. The cement concrete shall be kept well watered for efficient setting. The item shall be executed as per the no. of quality assurance tests specified and methodology for material selection and layer application shall be as per the quality assurance plan provided separately at the end of the specifications.

Item No. 4: Providing and laying of Drainage layer – 300 mm thk. In two layers at the bottom of the phase:

The item includes providing and laying of drainage layer at the base of the phase so as to allow leachate to flow to the leachate collection well. It includes first providing 100 mm thick layer of coarse aggregates consisting of hard quality crushed stones of 10 - 20 mm in size at the base, followed by another 100 mm thick layer of 6 – 10 mm size on it and finally a 100 mm thick layer of coarse sand on the top. Each layer need to be applied and compacted with a light weight dozer or roller to make a compact layer. The item shall be executed as per the no. of quality assurance tests specified and methodology for material selection and layer application shall be as per the quality assurance plan provided separately at the end of the specifications.

Item No. 5: Construction of Storm Water Drain around landfill and infrastructure facilities (total site) - 1 m wide - 1082 m in length, 0.50 m depth

The item includes construction of Storm Water Drain in RCC on the bottom outer edge of the retaining wall of the phase on the G/L and around the infrastructure facilities as shown in the layout Plan of the landfill site. The item includes excavation, providing and laying 230 mm thk rubble soling layer in the excavated area, 100 mm thick PCC (1:4:8) and specified thickness RCC M20 layer.

a) The excavation item includes excavation in all types of soil including soft rock, manually or by machine as the case may be for construction of SWD and disposing the excavated earth in different works inside the Secured Engineered Landfill site area only.

b) The rubble soling item includes providing and laying 230mm thk.rubble stone filling with 33% murrum in specified thickness with watering, compaction etc. complete. The rubbles shall be laid with hand packed stones and interstices filled with stone metal and 33% murrum soil in specified thickness with watering, leveling, compaction etc. complete as per drawing, specifications and as directed by Engineer-In-Charge.

   The rubble soling item includes providing and laying of rubbles laid on the prepared base using 60 – 170 mm size rubbles. The stone shall be quarried and shall be sound, angular, durable and free form flows and decay and shall be approved by the Engineer in charge. The stone shall be stacked on neat and uniform ground at road sides, stack shall be of height not less than 1.0 mt. The rubble spouls shall be screened for any rubbish dust or grass. Rubbles or spouls then shall be laid on hearing bone bond to required grade and camber as directed by Engineer in charge. The rubble shall be sorted out from stacks. Extra earth debris, shall be removed and the rubbles/spouls shall be placed in position over the earth level formed

to give a suitable soling formation by packing voids no hollow space is left. The soling shall be filled by selected soil/murrum/earth to fill, interlock the small cavities between the soling and the whole soiling shall be made a compact, solid and continues level, which shall not be disturbed, while rolling. The entire surface shall be well watered and rolled with a heavy roller weight not less than 8 ton capacity. The gaps if any are formed shall be packed again by the same process. Spouls shall be laid on hearing bond to required grade and camber.

c) Providing & laying Plain Cement Concrete 1:4:8 (1 cement : 4 coarse sand : 8 hand broken stone aggregates 40 mm nominal size) for very severe conditions with minimum cement content and minimum free water - cement ratio as specified in IS 456, 2000 and curing complete in Foundation and plinth. The PCC item includes providing and laying of 100 mm PCC (1:4:8) on the areas excavated as above in the specified proportion so as to cover the surface completely and give a finished surface. The PCC item includes providing and laying of 100 mm PCC (1:4:8) on the areas excavated as above in the specified proportion so as to cover the surface completely and give a finished surface. Mixing of concrete shall be done with the help of mechanical mixer and the mixer drum shall be turned at least for 1½ minutes after all the ingredients are added and the drum shall be placed on the water tight platform. The cement concrete shall be kept well watered for efficient setting.

d) Providing and Laying of specified thickness of RCC work M20 for very severe conditions with minimum cement content and minimum free water - cement ratio as specified in IS 456, 2000 for footing using aggregate of size 10-20 mm, centring, curing, finishing etc. complete on PCC above. RCC item includes providing and laying of RCC M20 including form work for RCC, curing and steel reinforcement. It includes Providing and Laying controlled cement concrete M-20 and curing complete so as to give a rough finish including centering, shuttering, strutting and propping etc. It also includes providing, Cutting, Bending, Binding and Hooking and binding with wire for RCC work Fe500 Grade ISI Brand TMT bar reinforcement round bar and placing in position complete up to any floor level. All bars shall be placed as per the design given and utmost care shall be taken to keep them in the same position. Before laying the concrete, the reinforcement shall be got approved from either by the consultant or by the VECPL &/or its authorized persons including Engineer - in - charge. The mixing of the concrete shall be done in mechanical mixer or by hand operations including vibrating the same with a pneumatic vibrator as decided by the VECPL &/or its authorized persons including Engineer - in - charge. The mixing shall be carried out on water tank platforms, if carried out by hand mixing. In case of mixing by the concrete with the help of mechanical mixer, the mixer drum shall be turned at least for 1½ minutes after all the ingredients are added and the drum shall be emptied every time and the concrete from the drum shall be placed on the water tight platform. Before starting laying of the concrete in position, the centering shall be well watered. The concrete shall be laid in forms and poured in such a way that no honey comb surface appears on removal of the forms. All edges and corners of the concrete surface shall remain unbroken. The cement concrete shall be kept well watered at least for 20 days.

e) Providing Fe500 Grade ISI Brand TMT bar reinforcement for RCC works including cutting, bending, binding and placing in position complete up to two floor level. Before laying the

concrete, the reinforcement shall be got approved from either by the consultant or by the VECPL &/or its authorized persons including Engineer - in - charge.

f) Providing and Laying of Form work with sheeting of steel sheets so as to give a fair finish for concrete structure at the base as mentioned above as shown in the drawing and including centering, shuttering and propping etc. Height of propping and centering below supporting floor to ceiling not exceeding 4 m and removal of the same for in situ reinforced concrete and plain concrete work in Foundations, footings, bases of columns and mass concrete.

Item No. 6: Construction of Leachate Wells in RCC M25 - 2 Nos.:

The leachate wells have to be constructed in RCC M25 grade concrete of size 2.0 m x 2.0 m x 38.50 m (H) with 175 mm thickness wall as shown in the drawing. The well shall be kept open from the top. The item includes excavation of soil, P/L of 300 mm thick Rubble Soling, 200 mm thick PCC (1:4:8) and specified thickness of RCC M25 grade, P/L of reinforcement bars for RCC, Form work for PCC and RCC works, 20 mm thk. Single coat finish cement plaster in CM (1:4), P/L 25 -50 mm Thk. IPS on inside of the Bottom of the tanks, Providing and Fixing of 110 mm dia UPVC water spouts-200 mm long.

a) The excavation item includes excavation in all types of soil including soft rocks, manually or by machine as the case may be for construction of toe wall and disposing the excavated earth in different works inside the landfill site area only.

b) The rubble soling item includes providing and laying of rubble soling layer of specified thickness with hand packed stones and interstices filled with stone metal, including compacting it properly, leveling etc. complete as per drawing, specifications and as directed by Engineer-In-Charge.

The rubble soling item includes providing and laying of rubbles laid on the prepared base using 60 – 170 mm size rubbles. The stone shall be quarried and shall be sound, angular, durable and free form flows and decay and shall be approved by the Engineer in charge. The stone shall be stacked on neat and uniform ground at road sides, stack shall be of height not less than 1.0 mt. The rubble spouls shall be screened for any rubbish dust or grass. Rubbles or spouls then shall be laid on hearing bone bond to required grade and camber as directed by Engineer in charge. The rubble shall be sorted out from stacks. Extra earth debris, shall be removed and the rubbles/spouls shall be placed in position over the earth level formed to give a suitable soling formation by packing voids no hollow space is left. The soling shall be filled by selected earth to fill, interlock the small cavities between the soling and the whole soiling shall be made a compact, solid and continues level, which shall not be disturbed, while rolling. The entire surface shall be well watered and rolled with a heavy roller weight not less than 8 ton capacity. The gaps if any are formed shall be packed again by the same process. Spouls shall be laid on hearing bond to required grade and camber.

c) Providing & laying Plain Cement Concrete 1:4:8 (1 cement : 4 coarse sand : 8 hand broken stone aggregates 40 mm nominal size) for very severe conditions with minimum cement

content and minimum free water - cement ratio as specified in IS 456, 2000 and curing complete in Foundation and plinth. The PCC item includes providing and laying of 100 mm PCC (1:4:8) on the areas excavated as above in the specified proportion so as to cover the surface completely and give a finished surface. The PCC item includes providing and laying of 100 mm PCC (1:4:8) on the areas excavated as above in the specified proportion so as to cover the surface completely and give a finished surface. Mixing of concrete shall be done with the help of mechanical mixer and the mixer drum shall be turned at least for 1½ minutes after all the ingredients are added and the drum shall be placed on the water tight platform. The cement concrete shall be kept well watered for efficient setting.

d) Providing and Laying of specified thickness of RCC work M25 for very severe conditions with minimum cement content and minimum free water - cement ratio as specified in IS 456, 2000 for footing using aggregate of size 10-20 mm, centring, curing, finishing etc. complete on PCC above. RCC item includes providing and laying of RCC M25 including form work for RCC, curing and steel reinforcement. It includes Providing and Laying controlled cement concrete M-20 and curing complete so as to give a rough finish including centering, shuttering, strutting and propping etc. It also includes providing, Cutting, Bending, Binding and Hooking and binding with wire for RCC work Fe500 Grade ISI Brand TMT bar reinforcement round bar and placing in position complete up to any floor level. All bars shall be placed as per the design given and utmost care shall be taken to keep them in the same position. Before laying the concrete, the reinforcement shall be got approved from either by the consultant or by the VECPL &/or its authorized persons including Engineer - in - charge. The mixing of the concrete shall be done in mechanical mixer or by hand operations including vibrating the same with a pneumatic vibrator as decided by the VECPL &/or its authorized persons including Engineer - in - charge. The mixing shall be carried out on water tank platforms, if carried out by hand mixing. In case of mixing by the concrete with the help of mechanical mixer, the mixer drum shall be turned at least for 1½ minutes after all the ingredients are added and the drum shall be emptied every time and the concrete from the drum shall be placed on the water tight platform. Before starting laying of the concrete in position, the centering shall be well watered. The concrete shall be laid in forms and poured in such a way that no honey comb surface appears on removal of the forms. All edges and corners of the concrete surface shall remain unbroken. The cement concrete shall be kept well watered at least for 20 days.

e) Providing Fe500 Grade ISI Brand TMT bar reinforcement for RCC works including cutting, bending, binding and placing in position complete up to two floor level. Before laying the concrete, the reinforcement shall be got approved from either by the consultant or by the VECPL &/or its authorized persons including Engineer - in - charge.

f) Providing and Laying of Form work with sheeting of steel sheets so as to give a fair finish for concrete structure at the base as mentioned above as shown in the drawing and including centering, shuttering and propping etc. Height of propping and centering below supporting floor to ceiling not exceeding 4 m and removal of the same for in situ reinforced concrete and plain concrete work in Foundations, footings, bases of columns and mass concrete.

g) The Single coat water proof finish plaster is of 20 mm thickness and is to be uniformly applied to give finish surface of the concrete. It should be applied in the specified proportion so as to cover the surface completely and give a finished surface. Mixing of concrete shall be done with the VECPL of mechanical mixer and the mixer drum shall be turned at least for 1½ minutes after all the ingredients are added and the drum shall be placed on the water tight platform. The cement concrete shall be kept well watered for efficient setting.

h) P/L 25 -50 mm Thk. IPS on inside of the Bottom of the tanks.

i) Providing and Fixing of 110 mm dia UPVC water spouts- 200 mm long.

Item No. 7: Providing and Laying of Leachate Collection system comprising of Leachate pipe network - 160 mm dia lateral pipes of length – 997 m and 225 mm dia main header pipe of length – 53 m laid in RCC leachate Collection trench of dimensions shown in the drawing:

a) The item includes providing and laying of 160 mm OD size HDPE perforated pipes as lateral pipes and 225 mm OD size main header whole pipe, each of 10 Kg/cm2 pressure grade and ISI make as per IS – 4984 with material grade PE – 80 and material density of 946.40 Kg/cm2. The lateral pipes shall have holes of 10 mm @ center to center 140 mm distance and pitch of 70 mm arc length between two holes in the upper half section of the pipes, throughout the length of the pipes including the necessary pipe fittings as required for making connections of the pipes and as shown in the diagram attached.

b) The pipes are to be laid horizontally at the bottom of the phase as shown in the layout plan of the landfill and are connected with the RCC leachate wells. The pipes connecting the leachate well are to be laid in such a way so as to make a slope of 1% in the lateral side (length side) and 2% on the (width side) with the center line at the highest level and end of pipes at the lowest level to allow leachate to flow easily in to the Leachate well. This is done in order to prevent stagnation of leachate in the pipes. The base slope of the phase has to be made in such a way that above slope is available on both sides of the pipes laid so as to allow the leachate to flow easily into the pipes. The pipes shall be laid in a RCC M20 leachate collection trench constructed in the top layer of the primary clay liner so that the pipes shall be laid in the drainage layer for effective leachate management. The detail of the pipe network is shown in the Lay out diagram of the Leachate collection system. The Leachate wells are to be connected to a 225 mm external diameter main header.

c) The leachate wells shall have a leachate lifting system with submersible sludge pumps provided inside the leachate well. The pumps for leachate situated at G/L includes providing and laying of Sludge pumps capable of delivering 100 Cu.m./Hr of leachate and operating at discharge head of 50 m. It should be capable of handling 25 mm size of particles in the leachate and of non clog type. The pump shall be supplied with F class or higher grade electrical motor operating in delta mode and at 2850 rpm speed with 20 hp power. It should operate at 415 V/3 Phase/50Hz/AC supply and should be connected with a cable of 10.0 Core x 4.0 Sq. mm size with minimum 50 mtr. Length. It should also have a control panel -

Dol starter with overload, SPP, water level guard for auto run pump, thermal & moisture protection , over voltage, dry run ampere base protection with indoor type control panel.

d) The RCC trench to be constructed for holding the leachate pipes shall be constructed in the top level of the Amended Clay liner with excavation in PCC as specified in other items above and as shown in the drawing.

e) Providing and Laying of Sludge pumps with complete electrical system including high efficiency motor, operating at a discharge head of 50 m minimum and delivering the leachate at the rate of 100 Cum/Hr.

Item No. 8: Construction of Approach Ramp 7 m wide 108 m slope length in 1:8 slope in RCC + Entrance Area Development + Kerb walls 0.60 m high on both the edges of the ramp:

The item includes construction of approach ramp in RCC 7 m clear width with kerb walls 0.60 m high on both the edges of the ramp for safety of trucks moving into and out of the phase. Total area of ramp with slope and entrance area shall be 2895 Sq.m. Slope length is 108 m and constructed in a slope of 1:8 (V:H). The item includes providing and laying 100 mm thick PCC (1:4:8) and 150 mm thk. RCC M20 layer.

a) Providing & laying Plain Cement Concrete 1:4:8 (1 cement : 4 coarse sand : 8 hand broken stone aggregates 40 mm nominal size) for very severe conditions with minimum cement content and minimum free water - cement ratio as specified in IS 456, 2000 and curing complete in Foundation and plinth. The PCC item includes providing and laying of 100 mm PCC (1:4:8) on the areas excavated as above in the specified proportion so as to cover the surface completely and give a finished surface. The PCC item includes providing and laying of 100 mm PCC (1:4:8) on the areas excavated as above in the specified proportion so as to cover the surface completely and give a finished surface. Mixing of concrete shall be done with the help of mechanical mixer and the mixer drum shall be turned at least for 1½ minutes after all the ingredients are added and the drum shall be placed on the water tight platform. The cement concrete shall be kept well watered for efficient setting.

b) Providing and Laying of specified thickness of RCC work M20 for very severe conditions with minimum cement content and minimum free water - cement ratio as specified in IS 456, 2000 for footing using aggregate of size 10-20 mm, centring, curing, finishing etc. complete on PCC above. RCC item includes providing and laying of RCC M20 including form work for RCC, curing and steel reinforcement. It includes Providing and Laying controlled cement concrete M-20 and curing complete so as to give a rough finish including centering, shuttering, strutting and propping etc. It also includes providing, Cutting, Bending, Binding and Hooking and binding with wire for RCC work Fe500 Grade ISI Brand TMT bar reinforcement round bar and placing in position complete up to any floor level. All bars shall be placed as per the design given and utmost care shall be taken to keep them in the same position. Before laying the concrete, the reinforcement shall be got approved from either by the consultant or by the VECPL &/or its authorized persons including Engineer - in - charge. The mixing of the concrete shall be done in mechanical mixer or by hand operations including vibrating the same with a pneumatic vibrator as decided by the VECPL &/or its authorized persons including Engineer - in - charge. The mixing shall be

carried out on water tank platforms, if carried out by hand mixing. In case of mixing by the concrete with the help of mechanical mixer, the mixer drum shall be turned at least for 1½ minutes after all the ingredients are added and the drum shall be emptied every time and the concrete from the drum shall be placed on the water tight platform. Before starting laying of the concrete in position, the centering shall be well watered. The concrete shall be laid in forms and poured in such a way that no honey comb surface appears on removal of the forms. All edges and corners of the concrete surface shall remain unbroken. The cement concrete shall be kept well watered at least for 20 days.

c) Providing Fe500 Grade ISI Brand TMT bar reinforcement for RCC works including cutting, bending, binding and placing in position complete up to two floor level. Before laying the concrete, the reinforcement shall be got approved from either by the consultant or by the VECPL &/or its authorized persons including Engineer - in - charge.

d) Providing and Laying of Form work with sheeting of steel sheets so as to give a fair finish for concrete structure at the base as mentioned above as shown in the drawing and including centering, shuttering and propping etc. Height of propping and centering below supporting floor to ceiling not exceeding 4 m and removal of the same for in situ reinforced concrete and plain concrete work in Foundations, footings, bases of columns and mass concrete.

Item No. 9: Construction Of RCC M30 Retaining Wall on Inside edge of the inner side slope and on outside edge with 4 m wide top service road in between the walls in RCC and filling the in between space of the walls with the excavated rock on EGL:

The item includes construction of RCC M30 retaining wall of 300 mm thickness on waste filling side of top service road - 725 m length and 230 mm thickness wall on outer side of top service road - 752 m length and 12.0 m clear height at the existing ground level to increase the capacity of the phase. The walls shall be supported with each other by construction of columns at specified intervals and beams joint together. The design and details are shown in the drawings.

The work includes excavation for foundation of the wall, at the base of the wall, providing and laying of 200 mm PCC M15, 300 mm thick RCC M30 wall on the waste filling side and 230 mm thick RCC M30 wall on the outer edge of the 4 m wide service road, and the walls supported construction of columns and beams joint together and at specified intervals in RCC M30. The walls shall have 25 mm thk. Gap in the wall for expansion/contraction of concrete and which is to be filled with HD100 polymer expansion joint filler board at intervals shown in the construction drawings. The wall shall also have a 300 mm x 8 mm thk. PVC Water stopper as per IS 15058 inserted at the expansion joints to prevent water leakage from the wall. Details of the same are shown in the retaining wall drawing.

a) The excavation item includes excavation in all types of soil, manually or by machine as the case may be for construction of retaining wall up to a depth of 1.5 mt. from existing GL in accordance with the drawings supplied by the company and disposing the excavated earth in different works / inside the landfill site area up to 200 mt. lead only.

b) Providing & laying Plain cement concrete M15 grade with curing complete in Foundation and plinth. The PCC item includes providing and laying of 200 mm PCC M15 on the areas excavated as above in the specified proportion so as to cover the surface completely and give a finished surface. Mixing of concrete shall be done with the help of mechanical mixer and the mixer drum shall be turned at least for 1½ minutes after all the ingredients are added and the drum shall be placed on the water tight platform. The cement concrete shall be kept well-watered for efficient setting (without form work and reinforcement).

c) Providing and laying controlled cement concrete M-30 and curing complete, excluding form work and reinforcement for reinforced concrete work over PCC as above in:
(a) Foundations, footings, base of columns, beams and mass concrete.
(b) Wall from top of foundation level up to 12.55 m height. And

Providing and laying of 750 mm thk. RCC M30 footing, 300 mm thk. RCC wall on inner side (filling side) and 230 mm thk. RCC wall on outer side of top service road up to 12.55 m height and supported by columns and beams joint together using aggregate of size 10-20 mm, centering, curing, finishing etc. complete on PCC above, with 25 mm thk. Gap in the wall for expansion/contraction of concrete and which is to be filled with HD100 polymer expansion joint filler board at intervals shown in the construction drawings. The wall shall also have a 300 mm x 8 mm thk. PVC Water stopper as per IS 15058 inserted at the expansion joints to prevent water leakage from the wall. Details of the same are shown in the retaining wall drawing. All Concrete mix shall be M – 30 or otherwise specified, Machine Mixed & Vibrated. Execution of work shall be carried out as per NBC and relevant Indian standards. All the construction material to be used should confirm to relevant Indian Standards. Cube test for each casting should be carried out and submitted to the Engineer-In-Charge. Testing of cement (other than factory test result) should be carried out and submitted to the Engineer-In-Charge. Cement brand like J.K., J.K. Laxmi, Binani, J.K.Vijay Stambh or Its Equivalent. Minimum Cement content shall be 325 Kg/M3 In M30 Concrete grade. Please refer drawing for RCC retaining wall for more details. The inner side of the wall shall be lined with HDPE and geotextile liners as mentioned before. RCC item includes providing and laying of RCC M 30 excluding form work for RCC, curing and steel reinforcement. It includes providing and laying controlled cement concrete M-30 and curing complete so as to give a rough finish including centering, shuttering, strutting and propping etc. It also includes providing, Cutting, Bending, Binding and Hooking and binding with wire for RCC work Fe500 Grade ISI Brand TMT bars and placing in position complete up to any floor level. All bars shall be placed as per the design given and utmost care shall be taken to keep them in the same position. Before laying the concrete, the reinforcement shall be got approved from either by the consultant or by any of the authorized persons including Engineer - in - charge.

The mixing of the concrete shall be done in mechanical mixer or by hand operations including vibrating the same with a pneumatic vibrator as decided by the VECPL &/or its authorized persons including Engineer - in - charge. The mixing shall be carried out on water tank platforms, if carried out by hand mixing. In case of mixing by the concrete with the help of mechanical mixer, the mixer drum shall be turned at least for 1½ minutes after

all the ingredients are added and the drum shall be emptied every time and the concrete from the drum shall be placed on the water tight platform. Before starting laying of the concrete in position, the centering shall be well watered. The concrete shall be laid in forms and poured in such a way that no honey comb surface appears on removal of the forms. All edges and corners of the concrete surface shall remain unbroken. The cement concrete shall be kept well watered at least for 20 days.

d) Providing Fe500 Grade ISI Brand TMT bars reinforcement for RCC works including cutting, bending, binding and placing in position complete up to any floor level.

e) Providing and Laying of Form work with sheeting of steel sheets so as to give a rough finish for concrete structure at the base as mentioned above as shown in the drawing and including centering, shuttering and propping etc.

f) Providing and Laying of flat ribbed PVC Water stopper in the 25 mm wide expansion joint provided in the retaining RCC wall of size 300 mm x 8 mm over the total height of the wall. PVC water stopper has excellent elasticity and corrosion resistance. PVC water stopper, also called PVC water stop seal or PVC water stop belt, is manufactured from superior grade polyvinyl chloride resin and various chemical additives by the process of mixing, granulating and extrusion. It is used to prevent leakage and permeation in construction joint by taking full advantage of polyvinyl chloride resin property of good elastic deformation. It is highly resistant to corrosion and it has excellent durability. The item includes procuring the product, preparation of application system and applying the product all inclusive.

Applications:- Strategic concrete structure such as Dams, Canals, Over Head/Under Ground Water Tanks, Swimming Pools, Basement, Bridges, Road Embankments, Retaining Walls, High Rising Multi Storied Buildings, Waste water and water treatment facilities, Tunnels and Culverts, Foundations, Primary and Secondary Containment Structures.

PVC Water Stopper is used in concrete masonry construction of hydraulic structures to safeguard from hydrostatic pressure and water seepage. Water Stopper also withstands expansion and contraction of joints as well takes care of any deflection and displacement arising due to change in temperature or settlement of foundation eliminating dangers of cracks since these is engineered as water tight seals in poured concrete structures. After being embedded in concrete, PVC water stops fill up the joints to form a continuous watertight diaphragm that prevents the passage of fluid.

How to Apply:

Most popular way of the placement of the water stop seal is tied to the steel frame works or small eyelet by means of small wires, certain metal clamps made to grip the water stop seal to keep it in proper position. The water stop must be designed and installed properly to accommodate joint expansions, contraction and lateral & transverse movements. In addition

to these considerations, the water stop must be compatible with the concrete system and the liquids and chemicals to be contained or controlled. The basic kind of water stops, suggested normally for use in construction joints where movement is not expected, is the basic type of flat ribbed water stopper, however, the ribbed type with canter bulb is used in expansion joints where movement is likely to occur.

Test to be carried out:

- Checking of various parameters as per IS: 15058 to be carried out.

g) Providing and fixing 25 mm thk. HD100 Polymer Expansion joint filler board in the expansion joint of the retaining wall and its counter fortes structure:

25 mm thk. HD100 Polymer based expansion joint filler board is a cross linked, pre molded high performance joint filler board. It is readily compressible and ensures low load transfer. It is a closed cell with excellent chemical resistance, thermally stable up to 70°C, and very compressible as well as elastic with almost more than 90% recoverable to its original state and rot proof and bacteria resistant. The item includes procuring the product, preparation of application system and applying the product all inclusive.

Following shall be the technical specifications of the product and shall be tested for the same for its performance on site confirming to IS: 1838 – 3 (2011).

Property	Units	Typical Value	Test Method
Density	Kg/Cu.m.	100 ± 10%	ASTM D – 3575
Water absorption	Kg/Sq.m. of cut surface area	0.080 max.	ASTM D – 3575
Compression, deflection and recovery % without weathering	%	94% min	Highway Clause 1015
Compression, deflection and recovery % with weathering	%	92% min	Highway Clause 1015
Extrusion	Mm	3 mm max.	Highway Clause 1015
Alkali resistance		No effect observed	AS – 1350 – 460.2-1982
Weathering test		No disintegration	Highway Clause 1015

h) Providing 15 mm. thick cement plaster in single coat on fair side of brick concrete walls for plastering as per drawing upto floor two level and finished even and smooth in Cement mortar 1:3 (1 cement : 3 sand).

i) Finishing wall with water proofing cement paint on an undecorated wall surfaces (two coats) to give an approved brand and manufacture (Snowcem, Deorocem or other similar brands approved) and of required shape even shade after thoroughly brushing the surface to remove all dirt and remains of loose powered materials.

j) Supplying and applying HOT BITUMEN VG10 grade conforming to IS:73 @2.0 Kg/sq.m. on Concrete work surface: The item includes Supplying and applying one coat of HOT BITUMEN VG10 grade conforming to IS:73 @1.2 Kg/sq.m. & Supplying and applying Second coat of HOT BITUMEN VG10 grade conforming to IS:73 @0.8 Kg/sq.m. to be applied on the RCC retaining wall 300 mm thk surface inside (waste filling side) to prevent corrosion of RCC and Steel. This shall prevent any chemical attack on the concrete surface from the chemicals present in the hazardous wastes. The hot bitumen shall be applying over the retaining wall and on outer slope in hot conditions as shown in the drawing.

Specifications and details of the same is as under as per IS: 73, 2006:

VISCOSITY GRADE BITUMEN - Bitumen Viscosity Grade VG-10:

1. Introduction:

Viscosity Grade Bitumen (Asphalt) is a Bitumen grade mostly used as a Paving Grade and it's suitable for road construction and for the asphalt pavements producing with premier attributes. VG Bitumen is usually used in the production of hot mix asphalt.

Viscosity Grade Bitumen is petroleum grade bitumen, which produced from fractional vacuum bottom which comes from distillation of crude oil, which feasible appliance and behavior changes according to its temperature.

Viscosity Grade bitumen is specified by ASTM Standard D3381-09 and AASHTO M226-80 (2008). VG Bitumen specifications cover by Viscosity at 60° C (140 °F).

There are two methods of grading:

- Standard Viscosity Grade Bitumen (AC-Grades), in which the Viscosity of the standard bitumen (asphalt) is measured at 60 ºC (140 ºF).
- RTFOT Viscosity Grade Bitumen (AR-Grades), in which the Viscosity of bitumen (asphalt) is measured at 60 °C (140 °F) after the roll on thin film oven test.

Viscosity grade bitumen has a thermoplastic feature which causes the material to soften at high temperatures and to harden at lower temperatures. This temperature viscosity relevance is significant when specifying the performance parameters such as the adhesion, rheology, durability and application temperatures of bitumen. In the Viscosity Grade Bitumen specifications, the most important emphasizes is based on the Bitumen ductility.

2. Viscosity Grade Bitumen Uses:

VG-10 is mostly used in spraying applications such as surface dressing and Paving in very cold climate instead of 80/100 penetration bitumen grade. It is also used to produce Bitumen Emulsion and Modified Bitumen products.

3. REQUIREMENTS

3.1 The paving bitumen binder shall be homogeneous and shall not foam when heated to 175°C.

3.2 The various grades of bitumen shall conform to the requirements prescribed in Table 1.

Table 1: REQUIREMENTS OF VISCOSITY GRADE (VG) BITUMEN SPECIFICATION AS PER IS 73:2006

Characteristics	**VG – 10**	Methods of Test, Ref to IS No.
Absolute Viscosity at 60°C, Poise, Min	800	IS 1206 (Part 2)
Kinematic Viscosity, 135˚C, cST, min	250	IS 1206(Part 3)
Flashpoint (Cleveland Open Cup), °C, min.	220	IS 1209
Solubility in trichloroethylene, %, min	99.0	IS 1216
Penetration at 25˚C, 100 gm, 5 s, 0.1 mm	80-100	IS 1203
Softening point (R&B), °C, min	40	IS 1205
Tests on residue from thin film over test / RTFOT		
I. Viscosity ratio at 60˚C, max	4.0	IS 1206 (Part 2)
II. Ductility at 25˚C, cm, min after thin film oven test	75	IS 1208

4 SAMPLING AND CRITERIA FOR CONFORMITY

4.1 Lot

In any consignment, all the containers of paving grade bitumen binders of same category and grade from the same batch of manufacture shall be grouped to constitute a lot.

4.2 Selection of containers

The number of containers to be selected at random from the lot shall depend upon the size of the lot given in Table 2

4.3 From each of the containers selected as in 4.2 an average sample representative of the material in the container shall be drawn in accordance with the methods prescribed in IS 1201, taking all the precautions mentioned therein. All these samples from individual containers shall be stored separately.

Table 2: Scale of Sampling Of Viscosity Grade (Vg) Bitumen As Per Is 73:2006

Sr.No.	Lot Size	No. of Containers to be Selected
1	Up to 50	3
2	50 – 150	5
3	151 – 500	7
4	501 and above	10

4.4 Number of Tests

4.4.1 All the individual samples shall be tested for absolute viscosity at 60°C, penetration and softening point tests.

4.4.2 For the remaining characteristics, a composite sample prepared by mixing together equal quantities of paving grade bitumen, sampled, as the case may be, from all individual samples taken from each sample container, shall be tested.

4.5 Criteria for Conformity

4.5.1 The lot shall be considered as conforming to the requirements of this standard, if the conditions mentioned under 4.5.2 and 4.5.3 are satisfied.

4.5.2 From the test results of absolute viscosity at 60°C, penetration and softening point, the mean (X) and the range (R) shall be calculated. The following conditions shall be satisfied:

a) [X – 0.6R] shall be greater than or equal to the minimum specification limit specified in Table 1, and

b) [X + 0.6R] shall be less than or equal to the maximum specification limit specified in Table 1.

4.5.3 The composite sample when tested for the characteristics mentioned in 4.4.2 shall satisfy the corresponding requirements of the characteristics given in Table 1.

5 PACKING AND MARKING

5.1 Packing

Penetration grade bitumen of all types shall be suitably packed in a container as agreed to between the purchaser and the supplier.

5.2 Marking

Each container of penetration grade bitumen shall be legibly and indelibly marked with the following:

a) Manufacturer's name or trade-mark, if any;
b) Month and year of-manufacture;
c) Type of the material and Grade; and
d) Batch Number

5.3 BIS Certification Marking

The container may also be marked with the Standard Mark.

5.3.1 The use of Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made there under. The details of conditions under which the license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

k) **Rubble Filling work in between Retaining walls**

Providing and laying rubble stone filling with 33% murrum in specified thickness with watering, compaction etc. complete. Here the excavated rubble available at the site shall be used to fill in the space up to a height of 12.55 m from the foundation raft of the walls to the top of the walls. However, the rubbles shall be filled in such a way so as not to damage the columns and beams constructed in support of the walls. It shall be done along with the construction of the walls at every lift.

Item No. 10: Construction of Kerb walls on both sides of the top service road in RCC M20. - 1) On top edge of outer side retaining wall - 600 mm high and 100 mm thk. - 752 m long, 2) On top edge of Inner side retaining wall - 600 mm high and 100 mm thk. - 725 m long.

The item includes making of Kerb Wall on both side edges of the phase top service road. The work includes providing and laying of RCC M 20 including form work for RCC, curing and steel reinforcement.

a) Providing and Laying of specified thickness of RCC work M20 for very severe conditions with minimum cement content and minimum free water - cement ratio as specified in IS 456, 2000 for footing using aggregate of size 10-20 mm, centering, curing, finishing etc. complete. RCC item includes providing and laying of RCC M20 including form work for RCC, curing and steel reinforcement. It includes providing and laying controlled cement concrete M-20 and curing complete so as to give a rough finish including centering, shuttering, strutting and propping etc. It also includes providing, Cutting, Bending, Binding and Hooking and binding with wire for RCC work Fe500 Grade ISI Brand TMT bar reinforcement round bar and placing in position complete up to any floor level. All bars shall be placed as per the design given and utmost care shall be taken to keep them in the same position. Before laying the concrete, the reinforcement shall be got approved from either by the consultant or by the VECPL &/or its authorized persons including Engineer - in - charge. The mixing of the concrete shall be done in mechanical mixer or by hand operations including vibrating the same with a pneumatic vibrator as decided by the VECPL &/or its authorized persons including Engineer - in - charge. The mixing shall be carried out on water tank platforms, if carried out by hand mixing. In case of mixing by the concrete with the help of mechanical mixer, the mixer drum shall be turned at least for 1½ minutes after all the ingredients are added and the drum shall be emptied every time and the concrete from the drum shall be placed on the water tight platform. Before starting laying of the

concrete in position, the centering shall be well watered. The concrete shall be laid in forms and poured in such a way that no honey comb surface appears on removal of the forms. All edges and corners of the concrete surface shall remain unbroken. The cement concrete shall be kept well watered at least for 20 days.

b) Providing Fe500 Grade ISI Brand TMT bar reinforcement for RCC works including cutting, bending, binding and placing in position complete up to two floor level. Before laying the concrete, the reinforcement shall be got approved from either by the consultant or by the VECPL &/or its authorized persons including Engineer - in - charge.

c) Providing and Laying of Form work with sheeting of steel sheets so as to give a fair finish for concrete structure at the base as mentioned above as shown in the drawing and including centering, shuttering and propping etc. Height of propping and centering below supporting floor to ceiling not exceeding 4 m and removal of the same for in situ reinforced concrete and plain concrete work in Foundations, footings, bases of columns and mass concrete.

SECTION – 15

ITEM WISE TECHNICAL SPECIFICATIONS FOR LINER WORKS

The specifications described here given are covered in the Schedule of Rates. Relevant IS codes for all the works mentioned below, including specifications for Geosynthetic Clay Liner, HDPE liner, and Nonwoven Geo Textile liner in which they are required to be joined/prepared, procedure for making/laying/fixing of the materials, if any, shall be applicable and the works have to be done as per the specifications and guidelines mentioned therein with relevant tests carried out as specified of the prepared structure and all the materials used in the said work which should be noted and strictly followed as a part of quality assurance program in the construction work. Quality assurance tests and methodology for liner preparation and application shall be as per the quality assurance plan provided separately. Specifications for general items covered in construction of different components of landfill liner systems are described here:

Item No. 01: Providing and laying of 1500 microns virgin quality HDPE geo membrane liner on different areas as described below with heat welding technique:

The item includes providing and laying of 1500 microns virgin quality single layer HDPE liner. The thickness of HDPE geomembrane should not vary across the roll by more than 10 percent. It shall be applied on the clay liner and anchored below the top service road of the landfill. The HDPE liner shall be sealed and packed from both ends with the existing layers by employing comb wedge fusion process. The over lapping between two HDPE sheets shall be minimum 100 mm and the machine welding shall produce two sealing lines between one overlap for perfect sealing of the liner. The lining material shall be of highest quality high density polyethylene (HDPE) sheeting, manufactured in using virgin high density polyethylene resin entirely free of Plasticizers or other filler materials.

The machine should be capable of applying 1000 N pressure and sufficient temperature to produce leak proof seals at the seam on HDPE sheets. Maximum width of the film laid down singly shall not be less than 6 m. The liner so provided shall be tested at CIPET or other NABL approved laboratories for parameters specified by the VECPL &/or its authorized persons. The material shall be supplied and laid with the following criteria:

- The HDPE sheet shall have minimum length of 100 to 140 m and minimum width of 6 to 9 m to reduce the no of welding/seaming points.
- The liner material shall be compatible with chemicals to be contained on site.
- The liner material shall be supplied with non collapsible plastic caps on end of rolls.
- The overlapping and welding area shall be marked with a white line to assure an optimum welding.
- The welding area on the outside edge of the liner shall be smooth.
- The thickness of the HDPE geomembrane shall not vary across the roll by more than 10%.

- The material must accompany with Manufacturer's Test Certificate complying to the acceptable value mentioned below.
- After receipt of the material at site Third Party Test shall be carried out as indicated above.

It should comply all the physio chemical properties as specified below i.e. Tear resistance, Puncture resistance, Tensile strength at yield and break, Carbon black content, density, etc. All the individual sheets shall be tested accordingly. Average Minimum specifications of the HDPE liner is as follow:

Table 1: Specification of 1.50 mm HDPE Smooth Geomembrane:

No.	Property	Test Method	Specified Values
1	Thickness, mm	ASTM D5199	≥ 1.5 mm
2	Density, g/cm3	ASTM D 1505/D792	≥ 0.94 g/cc
3	Melt Flow Index, g/10 min	ASTM D 1238/D190/5	< 1 g/10 min
4	Tensile Strength at Yield, N/mm	ASTM D 638	≥ 23 kN/m
5	Tensile Strength at Break, N/mm	ASTM D 638	> 43 kN/m
6	Elongation at Yield, %	ASTM D 638	>13
7	Elongation at Break, %	ASTM D 638	> 700
8	Tear Resistance,	ASTM D 1004	≥ 150 N
9	Puncture Resistance, N	ASTM D 5494	≥ 250 N
10	Oxidative Induction time (OIT)	ASTM D 3895	100 min.
11	UV Resistance	-	Yes
12	ESCR, 100 hours	ASTM D 1693	Pass
13	Dimensional Stability after warm storage 1 hr/100 °C, %	ASTM D 1024	± 2%
14	Carbon Black Content %	ASTM D 1603 - 94	≥ 2%
15	Carbon Black Dispersion, Category	ASTM D 5596 – 94	Cat. 1 -2
16	Seam Strength (Shear)	ASTM D 4437	≥ 90% of parent material
17	Seam Strength (Peel)	ASTM D 4437, D413	≥ 60% of parent material
18	Roll Width, m	-	Min. 6 to 9 m
19	Chemical Resistance		Resistant to most strong acids and alkalis

The measurements shall be taken of the covered area only and no overlaps will be considered. The HDPE liner at the outer most edge shall be jammed below the rubble layer on the service road and compacted to provide for proper holding of the liner. The details are shown in the drawing.

Testing of HDPE liner:

Agency shall get the following tests done in a NABL certified laboratory as per the Test Protocol given below.

Sampling:

- Sampling is to be done from rolls. The sample shall be 1 m in width. For HDPE smooth sample size shall be as per Testing Laboratory requirement.
- The average of the test result should be calculated per the particular standard cited and compared to the average values listed out in table 1.
- In case differences beyond the normal tolerances and fluctuations experienced usually are found in the tests, the Supplier shall be given the right to explain his test methods and how discrepancies can occur, for consideration of the Purchaser. The purchaser shall consider it accordingly for evaluation and then decide on acceptance/rejection.
- Tests may be conducted at the Purchaser's discretion at an external independent laboratory. Frequency of such tests shall be @ every 5,000 Sq.m.

Retest and Rejection

If the test results of any test do not conform to the requirements of this specification, retesting to determine conformance or rejection should be done.

Transportation and On-site Storage

The geomembrane rolls shall be shipped by flatbed trailer to the job site. The geomembrane shall be stored so as to be protected from puncture, dirt, grease, moisture, and excessive heat. Damaged material shall be stored separately for repair or replacement. The rolls shall be stored on a prepared smooth surface (not wooden pallets) and should not be stacked more than two rolls high.

Earthwork

General

The owner or his representative (soil quality assurance engineer) shall inspect the subgrade preparation. Prior to liner installation the subgrade shall be compacted in accordance with the project specifications. Weak or compressible areas which cannot be satisfactorily compacted should be removed and replaced with properly compacted fill. All surfaces to be lined shall be smooth, free of all foreign and organic material, sharp objects, or debris of any kind. The subgrade shall provide

a firm, unyielding foundation with no sharp changes or abrupt breaks in grade. Standing water or excessive moisture shall not be allowed.

Anchor Trench

The anchor trench shall be excavated to the line, grade, and width shown on the project construction drawings, prior to liner system placement. Slightly rounded corners shall be provided in the trench to avoid sharp bends in the geomembrane. If anchor trench is not used, it may be sandwiched between the base of the top service road and the RCC layer.

Method of Placement

The rolls shall be deployed using a spreader bar assembly attached to a loader bucket or by other methods approved by the project-in-charge.

The installer shall be responsible for the following:

1. Equipment or tools shall not damage the geomembrane during handling, transportation and deployment.
2. Personnel working on the geomembrane shall not smoke or wear damaging shoes.
3. The method used to unroll the panels shall not cause scratches or crimps in the geomembrane and shall not damage the supporting soil.
4. Adequate loading (e.g., sand bags or similar items that will not damage the geomembrane) shall be placed to prevent uplift by wind (in case of high winds, continuous loading is recommended along edges of panels to minimize risk of wind flow under the panels).

Field Seaming

Approved seaming processes are fusion and extrusion welding. On side slopes, seams shall be oriented in the general direction of maximum slope, i.e., oriented down, not across the slope. In corners and odd-shaped geometric locations, the number of field seams shall be minimized.

No base T-seam shall be closer than 5 feet from the toe of the slope. Seams shall be aligned with the least possible number of wrinkles and “fish mouths”. If a fish mouth or wrinkle is found, it shall be relieved and cap-stripped.

Seaming shall be completed by wedge welding with single air channel for all welds and extrusion weld only for repairs and where wedge welding cannot be performed.

Test Seams

Field test seams shall be conducted on the liner to verify that seaming conditions are satisfactory. Test seams shall be conducted at the beginning of each seaming for each seaming apparatus.

Performing filed Quality Assurance Checks at site only by Air Pressure Tests, Vacuum pressure tests, Shear Tests and Peel Tests

Acceptance / Rejection:

- Geomembrane not meeting the requirements of these Technical Specifications shall be rejected and not be delivered to the site or upon knowledge of defects, shall be removed from the site within 15 working days.

- The Purchaser will issue Receiving Certificates at the Site after reception of the Geomembrane, verifying the quantities and the completeness of all related test certificates and the compliance of the test certificates with these Technical Specifications within 7 days from receipt of materials at the Stores. The Receiving Certificate qualifies the Supplier for payment in accordance with the payment schedule.

Method of Measurement:

The Geomembrane supplied shall be measured in square meter. The measurements shall be taken of the covered area only and no overlaps will be considered.

Item No. 02: Providing and Laying of 500 GSM Non-Woven Geotextile above HDPE liner as Protection Layer

The item includes providing and laying of 500 GSM virgin quality Polypropylene Fiber Needle Punched Nonwoven Geotextile liner manufactured through machine made process of heat bonding or needle punching techniques to be laid over HDPE Liner to protect the HDPE liner. It shall be applied on the inner side slope and anchored below the top service road and approach Ramp in to the phase over HDPE Liner. It shall be sealed and packed from both ends with the existing layers and fused with weaving the liner. The over lapping between two geotextile sheets shall be minimum 100 mm.

Maximum width of the film laid down singly shall not be less than 4 m. The liner so provided shall be tested at CIPET or other NABL approved laboratory for parameters specified by the VECPL &/or its authorized persons.

It should comply all the physio chemical properties as specified i.e. Tear resistance, Puncture resistance, Tensile strength, Mass per unit area, UV resistance, etc. The measurements shall be taken of the covered area only and no overlaps will be considered. The details are shown in the drawing. Additional criteria and specifications of the material shall be as follow:

1 Material

The needle punched nonwoven geotextile shall be used as protection layer above geomembrane. The geotextile shall be made of Polypropylene fibers manufactured through machine made process of heat bonding or needle punching techniques. The Average Roll Values of Geotextile shall be as shown in table 2.

Table 2 Properties of 500 GSM Geotextile Liner:

Property	Test Method	Average Value
Mass per Unit Area, g/m²	ASTM D 5261	500
Thickness, mm	ASTM D 5199	3.20
Tensile Strength, kN/m	ASTM D 4595	36.0
Grab Tensile Strength, N	ASTM D 4632	1700
Elongation Break, %	ASTM D 4595	50-75
CBR Puncture Resistance, N	ASTM D 6241	5100
AOS, Microns	ASTM D 4751	<75
Permeability, Lit/m^2/sec	ASTM D 4491	30
Tear Strength, N	ASTM D 4533	700
UV Resistance, %	ASTM D 4355	70
Roll Length, m		50
Roll Width, m		4/6

Note:

The values are average roll values in which all the properties are likely to have ±10% tolerances. Water Permeability, Elongations are likely to have -30% tolerance and Apparent Opening Size (AOS) have + 30%.

2 Method of measurement

Quantity of filter geotextile shall be determined from cross sections and the linear distance, and paid for under the appropriate contract items. The measurements shall be taken of the covered area only and no overlaps will be considered.

3 Eligibility of Manufacturer / Supplier

The geotextile shall meet the minimum requirements as mentioned above. Geotextile shall be procured only from an Indian suppliers / Indian authorized Distributor. The Geotextile manufacture / Supplier shall be ISO 9001: 2008 certified. General manufacturing procedures shall be performed in accordance with the manufacturer's internal quality control guide and or/ documents.

4 Storage and Handling of Geotextile

Each roll delivered to site shall be clearly labeled with grade, batch number and wrapped in material that will protect the geotextile including the ends of rolls from damage due to shipment, water, sunlight and contaminants. The protective wrapping shall be maintained during shipment and storage. During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, temperatures in excess of 50°C, and any other environmental condition that may damage the physical property values of the Geotextile.

5 Basis of Payment

Accepted geotextile shall be paid for at the unit price (per square meter area) for each pay item included in the contract. The measurements shall be taken of the covered area only and no overlaps will be considered.

6 Method of Testing

The supplier has to submit a Quality conformity certificate and Manufactures test certificate for the parameters indicated in table 1 for every lot/shipment.

Item No. 03: Providing and Laying of 1200 GSM Non-Woven Geotextile above HDPE liner as Protection Layer

The item includes providing and laying of 1200 GSM virgin quality Polypropylene Fiber Needle Punched Nonwoven Geotextile liner manufactured through machine made process of heat bonding or needle punching techniques to be laid over HDPE Liner to protect the HDPE liner. It shall be applied on the bottom over HDPE Liner. It shall be sealed and packed from both ends with the existing layers and fused with weaving the liner. The over lapping between two geotextile sheets shall be minimum 100 mm.

Maximum width of the film laid down singly shall not be less than 4 m. The liner so provided shall be tested at CIPET or other NABL approved laboratory for parameters specified by the VECPL &/or its authorized persons.

It should comply all the physio chemical properties as specified i.e. Tear resistance, Puncture resistance, Tensile strength, Mass per unit area, UV resistance, etc. The measurements shall be taken of the covered area only and no overlaps will be considered. The details are shown in the drawing. Additional criteria and specifications of the material shall be as follow:

1 Material

The needle punched nonwoven geotextile shall be used as protection layer above geomembrane. The geotextile shall be made of Polypropylene fibers manufactured through machine made process of heat bonding or needle punching techniques. The Average Roll Values of Geotextile shall be as shown in table 2.

Table 3 Properties of 1200 GSM Geotextile Liner:

Property	Test Method	Average Value
Mass per Unit Area, g/m²	ASTM D 5261	1200
Thickness, mm	ASTM D 5199	6
Tensile Strength, kN/m	ASTM D 4595	55
Grab Tensile Strength, N	ASTM D 4632	3600
Elongation Break, %	ASTM D 4595	70
CBR Puncture Resistance, N	ASTM D 6241	13000
AOS, Microns	ASTM D 4751	<70

Permeability, Lit/m^2/sec	ASTM D 4491	3
Tear Strength, N	ASTM D 4533	2550
UV Resistance, %	ASTM D 4355	>50% strength retention
Roll Length, m		25
Roll Width, m		4/5

Note:

The values are average roll values in which all the properties are likely to have ±10% tolerances. Water Permeability, Elongations are likely to have -30% tolerance and Apparent Opening Size (AOS) have + 30%.

2 Method of measurement

Quantity of filter geotextile shall be determined from cross sections and the linear distance, and paid for under the appropriate contract items. The measurements shall be taken of the covered area only and no overlaps will be considered.

3 Eligibility of Manufacturer / Supplier

The geotextile shall meet the minimum requirements as mentioned above. Geotextile shall be procured only from an Indian suppliers / Indian authorized Distributor. The Geotextile manufacture / Supplier shall be ISO 9001: 2008 certified. General manufacturing procedures shall be performed in accordance with the manufacturer's internal quality control guide and or/ documents.

4 Storage and Handling of Geotextile

Each roll delivered to site shall be clearly labeled with grade, batch number and wrapped in material that will protect the geotextile including the ends of rolls from damage due to shipment, water, sunlight and contaminants. The protective wrapping shall be maintained during shipment and storage. During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, temperatures in excess of 50°C, and any other environmental condition that may damage the physical property values of the Geotextile.

5 Basis of Payment

Accepted geotextile shall be paid for at the unit price (per square meter area) for each pay item included in the contract. The measurements shall be taken of the covered area only and no overlaps will be considered.

6 Method of Testing

The supplier has to submit a Quality conformity certificate and Manufactures test certificate for the parameters indicated in table 1 for every lot/shipment

Item No. 04: Providing and Laying of 5 Kg/Sq.m. Sodium Bentonite based GeoSynthetic Clay Liner on Inner Side Slope and on Inner Side of Vertical Retaining Wall

The item includes providing and laying of Sodium bentonite Based Geosynthetic Clay liner comprising of lower layer made from virgin quality Polypropylene Fiber Needle Punched Nonwoven Geotextile liner manufactured through machine made process of heat bonding or needle punching techniques and upper layer made from virgin quality Polypropylene Fiber Needle Punched Woven Geotextile liner with filling of Sodium Bentonite with a mass of 5 Kg/Sq.m. to allow the permeability of the liner to be reduced to the desired permeability required for landfill projects. It is to be laid before laying of HDPE Liner and shall serve as a first barrier to prevent leachate flowing through the liner system. It shall be applied on the inner side slope and inner side of the vertical retaining wall on waste filling side as shown in the drawing. It shall be sealed and packed from both ends with the existing layers and fused with weaving the liner. The over lapping between two GCL sheets shall be minimum 100 mm.

Maximum width of the film laid down singly shall not be less than 5 m. The liner so provided shall be tested at CIPET or other NABL approved laboratory for parameters specified by the VECPL &/or its authorized persons.

It should comply all the physio chemical properties as specified i.e. Tear resistance, Puncture resistance, Tensile strength, Mass per unit area, UV resistance, Hydraulic conductivity etc. The measurements shall be taken of the covered area only and no overlaps will be considered. The details are shown in the drawing. Additional criteria and specifications of the material shall be as follow:

1 Material

The Average Roll Values of Geosynthetic Clay liner shall be as shown in table 4.

Table 4 Properties of 5 Kg/Sq.m. Sodium Bentonite based Geosynthetic Clay Liner:

Property	Test Method	Average Value
Geotextile Property		
Cap Non-Woven PP – Mass per Unit Area, g/m²	EN ISO 9864	200
Carrier Woven PP – Mass per Unit Area, g/m²	EN ISO 9864	125
Sodium Bentonite Properties		
Montmorillonite content, %	XRD Analysis	85
Swell Index, ml/2g	ASTM D 5890	25
Fluid Loss, ml	ASTM D 5891	17
Finished GCL Properties		
Bentonite mass per unit area @ 12% moisture content, Kg/Sq.m.	EN 14196	5
Bentonite mass per unit area @ 0% moisture content, Kg/Sq.m.	EN 14196	4.4
Hydraulic Conductivity, m/s	ASTM D 5887	2×10^{-11}
Index Flux, $m^3/m^2/s$	ASTM D 5887	5×10^{-9}
Tensile Strength - MD, kN/m	ASTM D 6768	12
Tensile Strength - CMD, kN/m	ASTM D 6768	12
Strain at Max. Load–MD, CMD, %	ASTM D 6768	≤30
Static Puncture Strength, KN	EN ISO 12236	2.2
Peel strength – MD, N/10cm	ASTM D 6496	65
Roll Length/Width, m		40/5
Thickness, mm	EN ISO – 9863 -1	6

2 Method of measurement

The measurements shall be taken of the covered area only and no overlaps will be considered.

3 Basis of Payment

Accepted GCL shall be paid for at the unit price (per square meter area) for each pay item included in the contract. The measurements shall be taken of the covered area only and no overlaps will be considered.

6 Method of Testing

The supplier has to submit a Quality conformity certificate and Manufactures test certificate for the parameters indicated in table 4 for every lot/shipment

Item No. 05: Providing and laying of 150 gsm thick unprocessed non woven Geotextile liner on the perforated HDPE leachate collection pipe to allow leachate to flow to the leachate collection well:

The item includes providing and laying of 150 GSM virgin quality Polypropylene Fibre Needle Punched unprocessed Nonwoven Geotextile liner manufactured through machine made process of heat bonding or needle punching techniques to be laid over HDPE pipe for leachate collection and wrapped on the pipe. This shall permit high flow of leachate into the leachate collection pipes and shall carry leachate to the leachate well. The liner shall be placed over the leachate collection pipe system. The liner shall be covered with 300 mm thick layer of gravels as used in drainage layer. Each layer need to be applied and compacted with a light weight dozer or roller to make a compact layer. The specifications for 150 gsm Geotextile liner are as follow:

Property	Test Method	Average Value
Mass per Unit Area, g/m²	ASTM D 5261	150
Thickness, mm	ASTM D 5199	1.20
Tensile Strength, kN/m	ASTM D 4595	9
Grab Tensile Strength, N	ASTM D 4632	525
Elongation@Break, %	ASTM D 4595	50-95
CBR Puncture Resistance, N	ASTM D 6241	1100
AOS, Microns	ASTM D 4751	160

Permeability, Lit/m^2/sec	ASTM D 4491	230
Tear Strength, N	ASTM D 4533	190
UV Resistance, %	ASTM D 4355	70
Roll Legnth, m		50
Roll Width, m		2/4/6

Note:

The values are average roll values in which all the properties are likely to have ±10% tolerances. Water Permeability, Elongations are likely to have -30% tolerance and Apparent Opening Size (AOS) have + 30%.

Method of measurement

Quantity of Nonwoven geotextile liner shall be in terms of Square meters. The measurements shall be taken of the covered area only and no overlaps will be considered.

SECTION – 16

QUALITY ASSURANCE PLAN FOR CONSTRUCTION OF SECURED LANDFILL

Quality Assurance Principles

Quality in construction of the Secured landfill facility has to be ensured to match highest standards. The basic purpose is to minimize the possibility of deviation from design specifications. To ensure the quality of the overall structure of the Secured Landfill facility, the individual components must meet the quality standards. Quality assurance must relate to both the quality of the materials used and the workmanship in accordance with the existing state of technology. Quality assurance is particularly important during the use of minerallic clay in landfill sealing system. The clay must conform to the quality specifications described in the Tender documents. Therefore, at each and every stage of construction, the construction procedure, specifications of materials used and the tests results have to be documented.

The Quality assurance planning mainly involves

- Quality Assurance before the start of Construction – quality control of soil used for earthen bunds, quality control of different civil materials used for construction etc.
- Quality assurance during preparation and placement of clay liner
- Quality Assurance during the placement of Geosynthetic Clay Liner, HDPE Geo membrane and Geotextile liners in the landfill
- Quality assurance during leachate collection system
- Quality assurance during placement of top cover liner system including top cover soil.
- Documentation of all quality control records to be submitted to concerned authorities
- Checking of the list of the tests to be carried out during landfill construction to regulatory authority and get approved before start of construction. It also involves inviting of regulatory authorities periodically during construction of landfill and submission of the complete documentation to the regulatory authorities in time.
- Photographs and videography at every stage of construction and testing have to be taken and documented.

1.1 Quality assurance planning before start of construction.

Before the start of construction activity, the sources of raw materials to be procured from shall be finalized. Later on there should be no change, which can affect the quality of construction. The following are the test to be conducted before start of construction;

(a) On existing soil

- Classification test.
- Atterbergs limit
- Permeability test
- Density
- Moisture content

(b) Minerallic clay to be used for bottom and side liner system

- Permeability test "as compacted-then-saturated" samples: using flexible-wall permeability as per ASTM: D: 5084 or by using consolidation cell permeameter (Olson and Daniel (1979)).
- Density test as per IS: 2720 (part28, 29,34)
- Moisture content as per IS : 2720 (part-2)
- Grain size distribution as per IS 1498 and IS 2720 (Part 4 and 5)
- Strength parameters "as-compacted-then saturated" as per IS : 2720 (part 10,11,12)
- Atterberg's limit

(c) 1.5 mm thick HDPE Geomembrane:

Specifications

The geomembrane is normally expected to meet the following requirements:

- It should be impervious
- It should have adequate strength to withstand sub grade deformations and construction loads
- It should have adequate durability and longevity to withstand environmental loads
- The joints/seams must perform as well as the original material.

Typical specifications for geomembrane liners are given below.

Table 1: Specification of HDPE Smooth Geomembrane

No.	Property	Test Method	Specified Values
1	Thickness, mm	ASTM D5199	≥ 1.5 mm
2	Density, g/cm3	ASTM D 1505/D792	≥ 0.94 g/cc
3	Melt Flow Index, g/10 min	ASTM D 1238/D190/5	< 1 g/10 min
4	Tensile Strength at Yield, N/mm	ASTM D 638	≥ 23 kN/m
5	Tensile Strength at Break, N/mm	ASTM D 638	> 43 kN/m
6	Elongation at Yield, %	ASTM D 638	>13
7	Elongation at Break, %	ASTM D 638	> 700
8	Tear Resistance,	ASTM D 1004	≥ 150 N
9	Puncture Resistance, N	ASTM D 5494	≥ 250 N
10	Oxidative Induction time (OIT)	ASTM D 3895	100 min.
11	UV Resistance	-	Yes
12	ESCR, 100 hours	ASTM D 1693	Pass
13	Dimensional Stability after warm storage 1 hr/100 °C, %	ASTM D 1024	± 2%
14	Carbon Black Content %	ASTM D 1603 - 94	≥ 2%
15	Carbon Black Dispersion, Category	ASTM D 5596 – 94	Cat. 1 -2
16	Seam Strength (Shear)	ASTM D 4437	≥ 90% of parent material
17	Seam Strength (Peel)	ASTM D 4437, D413	≥ 60% of parent material
18	Roll Width, m	-	Min. 6 - 9 m
19	Chemical Resistance		Resistant to most strong acids and alkalis

The following components have to be designed / checked for in the case of geomembrane:

- Anchor Trench
- Sliding Along Slopes
- Allowable Weight Of Vehicle
- Uneven Settlement
- Panel Layout Plan

Tests of several physical properties of the membrane must be performed before installation. Usually most of these tests are performed at the time of manufacturing in the manufacturer's laboratory.

The owner may arrange for an independent observer to oversee the tests, conduct the tests in an independent laboratory, or use a 'split sampling' technique. This issue of responsibility for pre-installation quality control tests must be clearly mentioned or resolved during the binding process.

(d) 150/500/1200 GSM Non-woven Geotextile liner:

Specifications:

The needle punched nonwoven geotextile shall be used as protection layer above geomembrane. The geotextile shall be made of Polypropylene fiber manufactured through machine made process of heat bonding or needle punching techniques. The Average Roll Values of Geotextile shall be as shown in table 2.

Table 2 Properties of 500/1200 GSM Geotextile Liner:

Property	Test Method	Average Value For 150 GSM liner	Average Value For 500 GSM liner	Average Value For 1200 GSM liner
Mass per Unit Area, g/m²	ASTM D 5261	150	500	1200
Thickness, mm	ASTM D 5199	1.20	3.20	6
Tensile Strength, kN/m	ASTM D 4595	9	36.0	55
Grab Tensile Strength, N	ASTM D 4632	525	1700	3600
Elongation Break, %	ASTM D 4595	50-95	50-75	70
CBR Puncture Resistance, N	ASTM D 6241	1100	5100	13000
AOS, Microns	ASTM D 4751	160	<75	<70
Permeability, Lit/m²/sec	ASTM D 4491	230	30	3
Tear Strength, N	ASTM D 4533	190	700	2550
UV Resistance, %	ASTM D 4355	70	70	>50% strength retention
Roll Length, m		50	50	25
Roll Width, m		2/4/6	4/6	4/5

Note:

The values are average roll values in which all the properties are likely to have ±10% tolerances. Water Permeability, Elongations are likely to have -30% tolerance and Apparent Opening Size (AOS) have + 30%.

(e) **Sodium Bentonite based GeoSynthetic Clay Liner:**

Sodium bentonite Based Geosynthetic Clay liner comprises of lower layer made from virgin quality Polypropylene Fiber Needle Punched Nonwoven Geotextile liner manufactured through machine made process of heat bonding or needle punching techniques and upper layer made from virgin quality Polypropylene Fiber Needle Punched Woven Geotextile liner with filling of Sodium Bentonite with a mass of 5 Kg/Sq.m. to allow the permeability of the liner to be reduced to the desired permeability required for landfill projects. It shall be sealed and packed from both ends with the existing layers and fused with weaving the liner. The over lapping between two GCL sheets shall be minimum 100 mm.

Maximum width of the film laid down singly shall not be less than 5 m. The liner so provided shall be tested at CIPET or other NABL approved laboratory for parameters specified as given in Table 3 below.

Table 3 Properties of 5 Kg/Sq.m. Sodium Bentonite based Geosynthetic Clay Liner:

Property	Test Method	Average Value
Geotextile Property		
Cap Non-Woven PP – Mass per Unit Area, g/m²	EN ISO 9864	200
Carrier Woven PP – Mass per Unit Area, g/m²	EN ISO 9864	125
Sodium Bentonite Properties		
Montmorillonite content, %	XRD Analysis	85
Swell Index, ml/2g	ASTM D 5890	25
Fluid Loss, ml	ASTM D 5891	17
Finished GCL Properties		

Bentonite mass per unit area @ 12% moisture content, Kg/Sq.m.	EN 14196	5
Bentonite mass per unit area @ 0% moisture content, Kg/Sq.m.	EN 14196	4.4
Hydraulic Conductivity, m/s	ASTM D 5887	2×10^{-11}
Index Flux, $m^3/m^2/s$	ASTM D 5887	5×10^{-9}
Tensile Strength - MD, kN/m	ASTM D 6768	12
Tensile Strength - CMD, kN/m	ASTM D 6768	12
Strain at Max. Load–MD, CMD, %	ASTM D 6768	≤30
Static Puncture Strength, KN	EN ISO 12236	2.2
Peel strength – MD, N/10cm	ASTM D 6496	65
Roll Length/Width, m		40/5
Thickness, mm	EN ISO – 9863 -1	6

(f) Hard soil for sub base/soil bund/Rock Filling

- Density
- Grain size distribution
- Atterbergs limit as per IS: 2720 (part-5)
- Strength parameters" as compacted -then- saturated" as per IS:2720 (PART 10,11,12)
- Compressibility parameters as per :IS2720 (part 15)
- Moisture content

(g) Surface Layer (Top Soil)

- Grain size distribution
- Plasticity
- Compaction test
- Shear strength

(h) Gravel/Coarse aggregates (for drainage layer)

The leachate collection layer or the drainage layer above the geomembrane in the liner system must have a permeability of 10^{-2} cm/sec or more. Other specifications include the following:

- Shape of particles

- Grain size distribution
- Constant head Permeability > $1x10^{-2}$ cm /sec, as per IS 2720 (part 30,37)
- Insitu density test as per IS 2720 (part 14)
- Shear strength test as per IS 2720 (part 13)

(i) HDPE pipe (Leachate)

- M.F.I
- Density
- Wall Thickness
- C.B.C

(j) Other Civil Materials and relevant tests as per IS codes for civil construction:

Relevant tests like compressive strength, tensile strength and other such tests needed for civil work for different materials like bricks, RCC, PCC, steel etc. need to be carried out as per norms specified in IS codes during civil works.

(k) Flat ribbed PVC Water stopper in the 25 mm wide expansion joint in RCC Wall confirming to IS: 15058, 2002:

Table 4: Various parameters listed in IS: 15058, 2002:

Property, Unit and Average Values	**Test Method**
Physical Properties - Before Ageing	
Hardness Test, Ave. Value - 65 Shore (A), min.	IS: 3400, (Part II)
Tensile Strength, Ave. Value – 13.8 MPa, min.	IS: 3400, (Part I)
Elongation at Break, Ave. Value – 285% min.	IS: 3400, (Part I)
Water absorption, Ave. Value – 0.60% max.	IS: 3400, (Part VI)
Cold Bend Test at – 25°C, Ave. Value – Should not crack	IS: 9766
Accelerated Extraction Test – Tensile Strength, Ave. Value – 10.30 MPa, min.	IS: 3400, (Part IV)
Accelerated Extraction Test – Elongation at Break, Ave. Value – 280% min.	IS: 3400, (Part IV)
Stability in effect of alkalis test:	

a. Weight increase in 7 days, Ave. Value – 0.25 % max.	IS: 3400, (Part IV)
b. Weight decrease in 7 days, Ave. Value – 0.10 % max.	IS: 3400, (Part IV)
c. Change in Hardness in 7 days, Ave. Value – ± 5 Shore (Max.)	IS: 3400, (Part IV)
d. Weight increase in 28 days, Ave. Value – 0.40 % max.	IS: 3400, (Part IV)
e. Weight decrease in 7 days, Ave. Value – 0.30 % max.	IS: 3400, (Part IV)
f. Change in Elongation at Break in %, Ave. Value – ± 1% (Max.)	IS: 3400, (Part IV)

(l) 25mm Thk. HD100 Polymer Expansion Joint Filler Board in RCC Wall and Counter fortes – confirming to IS: 1838 – 3 (2011). Table – 5:

Property, Unit and Average Values	**Test Method**
Density, Kg/Cu.m, Ave. Value - 100 ± 10%	ASTM D – 3575
Water absorption, Kg/Sq.cm of cut surface area, Ave. Value - 0.080 max.	ASTM D – 3575
Compression, deflection and recovery % without weathering, %, Ave. Value – 94% min.	Highway Clause 1015
Compression, deflection and recovery % with weathering, %, Ave. Value – 92% min.	Highway Clause 1015
Extrusion, mm, Ave. Value - 3 mm max.	Highway Clause 1015
Alkali resistance, Ave. Value – No effect observed	AS – 1350 – 460.2-1982
Weathering test, Ave. Value – No Disintegration	Highway Clause 1015

(m) Viscosity Grade Bitumen VG – 10 to be applied on RCC wall, counter fortes and on outside slope– all exposed RCC surfaces confirming to IS: 73 – 2006, Table - 6:

Property, Unit and Average Values	**Test Method**
Absolute Viscosity at 60°C, Poise, Ave. Value – 800 Poise min.	IS 1206 (Part 2)
Kinematic Viscosity, 135˚C, cST, Ave. Value – 250 cST min.	IS 1206(Part 3)
Flashpoint (Cleveland Open Cup), °C, Ave. Value – 220 °C min.	IS 1209
Solubility in trichloroethylene, %, Ave. Value – 99.0% min.	IS 1216

Penetration at 25˚C, 100 gm, 5 s, 0.1 mm, Ave. Value – 80 -100	IS 1203
Softening point (R&B), ºC, Ave. Value – 40 ºC min.	IS 1205
Tests on residue from thin film over test (RTFOT)	
I. Viscosity ratio at 60˚C, Ave. Value – 4.0 max.	IS 1206 (Part 2)
II. Ductility at 25˚C, cm, Ave. Value – 75 cm, min. after thin film oven test	IS 1208

1.2 Quality Assurance during the Preparation of the Clay Liner

1.2.1 Clay Liner Specification

The criteria for choosing clay is primarily based on the compacted permeability achievable under field conditions. The clay that can be compacted to obtain permeability ($1x10^{-7}$ cm/sec or less) sample when compacted to 90-95% of the maximum Procter's dry density at optimum moisture content is chosen for landfill liner construction.

The selection of material to be used a soil barrier layer will usually be governed by the availability of materials as given in the specifications. The local soil does not have the adequate permeability as per the specifications. Hence the foreign soil has to be imported or other available soil to be mixed other materials and amended. Properties of the same is listed below.

Usually a soil with the following specification would prove suitable for liner construction. In case of the absence of the clay of such properties, the **workable range** is also given.

- Liquid Limit> 30% (25-30)
- Plasticity Index>15% (10-15)
- Plastic Limit>10% (10-15)
- 50% fraction<0.074 mm (40-50)
- Clay fraction> 25%. (18-25)

From the above, it is recommended that the permeability of the available soil could be achieved with addition of bentonite or other materials such as lime. The procedure for the same is described below.

1.2.2 Amended Soils (Compacted Clay)

In-situ available soil if of good quality or the one obtained from outside borrow pits may be mixed with medium to high plasticity imported clay, or commercial clays such as bentonite, to achieve the required low hydraulic conductivity. Soil bentonite admixtures are commonly used as low

permeability amended soil liners. Requirement of bentonite to be mixed with local soil is to be ascertained in the soil testing laboratory for the specified tests and based on the results, appropriate % of bentonite shall be mixed with local soil to achieve the required standards.

The most commonly used bentonite admixture is sodium bentonite. It is not necessary that the bentonite should be the only additive to be considered for selection. Medium to high plasticity clays from not too distant areas, can also be imported and mixed with the local soils. Usually high quantities of clays (10 to 25 percent) are required to achieve the required permeability. Nevertheless, these may sometimes prove to be more economical than bentonite amended soils and their permeability may not be significantly influenced by leachate quality.

1.2.3 Specifications

A competent barrier made of compacted soils – clays or amended soils is normally expected to fulfill the following requirements:

- Hydraulic conductivity of 10^{-7} cm/sec or less;
- Thickness of 45 cm – 2 layers.
- Absence of shrinkage cracks due to desiccation
- Absence of clods in the compacted clay layer
- Adequate strength for stability of liner under compressive loads as well as alongside slopes; and
- Minimal influence of leachate on hydraulic conductivity.

Clays of high plasticity with very low values of permeability (usually well below the prescribed limit), exhibit extensive shrinkage on drying, as well as tend to form large clods during compaction in the relatively dry state. Their permeability can also increase on ingress of certain organic leachates. Well compacted inorganic clays of medium plasticity, either natural or amended, appear to be most suitable for liner construction.

1.2.4 Quality for the Raw materials

Before the preparation of clay liner the materials for mix shall be prepared as per the specification mentioned. The soil may be sieved and segregated separately based on their sizes, later on from the segregated material the aggregate shall be mixed in percentage as per the specification. The mixing

should be in a mixing plant until it attains uniformity. The quantity of the prepared aggregate shall be 10 % more than what is required.

A sample of aggregate shall be taken for testing before it is used for preparation of desired clay. The testing shall be done by the contractor in presence of the Engineer-In-Charge. After the test results obtain from the above tests and finds suitable as per the specifications, then only the material has to be used for preparation of clay liner. The test results have to be documented. The test should be conducted for the soil is as under:

It is necessary to perform detailed laboratory tests and some field trial tests prior to liner construction to establish that the requirements pertaining to permeability, strength, leachate compatibility and shrinkage are met. All testing charges shall be borne by contractor.

1.2.5 Design Process

The design process for a compacted soil liner consists of the following steps:

1. Identification of borrow area or source of material – in-situ or nearby.

2. For in-situ soils, conducting field permeability tests to assess suitability of the natural soil in its in-situ condition.

3. Laboratory studies on liner material (from in-situ or nearby locations) comprising of the following tests:

- Soil classification tests
- Compaction tests
- Permeability tests
- Strength tests
- Shrinkages tests
- Leachate compatibility tests.

4. Identification of source of additive-natural clay from not too distant areas or commercially available clay such as bentonite.

5. Laboratory studies (as detailed in (2) above) on soil-additive mixes using different proportions of additive to find minimum additive content necessary to achieve the specified requirements.

6. Field trial on test pads; to finalize compaction parameters (layer thickness, number of passes, speed of compactor), as well as verify that field permeability of the compacted soil lies within pre-specified limits.

1.2.6 Test Reports

The evaluated results of the tests which are carried out during and after placement of clay are documented on paper by contracting firm. A note is made of the deviations, if any, from the desired values. The delivered batches of the mix are matched with the retained samples at the construction site, and the remarks are noted on the construction plan. The copy of test report should be submitted by the client for checking of the finished work. The report has to be preserved.

1.3 Quality Assurance during the Placement of Clay Liner into the Landfill

The special requirements of quality assurance in landfill sealing make it necessary that the personnel employed for operating the machines and for placement process should have adequate experience. A special type of equipment is required for the placement of clay on slopes. The placement of clay is carried out by using finishing machines or pavers which can ensure a uniform distribution and a good pre-compaction.

The following points has to be considered while placement of clay

- The sub grade with adequate load-bearing capacity is a prerequisite for the placement of clay. The foundation must be strong enough to permit the movements of the paving machine for the placement of clay without affecting the formation.
- The sub grade is true to slope profile, even and load-bearing. The subgrade should not deviate from the designed height by more than + 20 mm.
- The longitudinal and transverse gradients specified for the placement must not be affected while placement.
- The placement of clay layers must be carried out only in dry weather conditions.
- The total thickness of the clay after the compaction must be at equal to that of designed thickness.
- Any shortfall in the thickness should be compensated during the placement of the subsequent layer.
- It is necessary to ensure an adequate bounding of the lower layer of sealing layer with the base layer. If required, the surface of the base liner is evenly sprayed with binders.

1.3.1 Tests during and after placement of clay.

The following are the tests to be carried out during and after the placement of clay.

- Stability of subgrade before placing

- Layer thickness of clay after placement, before compaction.
- Layer thickness of clay after placement, after compaction.
- Permeability after compaction.
- Evenness
- Slope profile after compaction.

The above test results have to be recorded and documented for future reference.

1.4 Quality assurance planning during construction activity

During construction activity, arrangement for conducting the entire required tests at each stage of construction in time should be made. The tests to be conducted in the field as well as laboratory for different components of bottom, side and top liner is as follows:

a) During placement of clay liner

Total thickness = 90 cm **(**Placing in Four layers of not more than 23 cm each**.)** No. of tests and the type of tests to be carried out is indicated in Section – 17 below.

b) During placement of hard soil for Soil filling in Excavated Rock (With murrum)

Layer wise construction, thickness of each layer = 23 cm. No. of tests and the type of tests to be carried out is indicated in Section – 17 below.

d) During placement of HDPE Geomembrane and Geotextile.

- Check for thickness
- Check the joints

The quality control tests that are performed during installation include the following:

- Inspection of surface of compacted clay/amended soil layer.
- Verification of the proposed layout plan
- Check roll overlap
- Checking anchoring trench and sump
- Testing of all factory and field seams using proper techniques over full length.
- Destructive seam strength test
- Patch up repair

Geomembrane must be covered with protective layer of Geotextile or soil as soon as possible. Bare membrane should be guarded against such damage by fencing the area or by other appropriate methods.

The following procedure may be adopted:

- At least 500/1200 GSM Geo Textile should be spread on the membrane as a protective layer.
- The traffic routing plan must be carefully made so that the vehicle (s) does not travel on the membrane directly.

2.1 Documentation

All the quality assurance measures and tests carried out during construction must be documented by the contracting firm. A note is to be made in case of any deviations from the desired values. The copy of test report should be submitted to regulatory authorities. These reports have to be preserved for at least 20 years.

3.1 Checking

Regular checking shall be carried out after final closing of landfill facility. The Engineer-in-charge shall assess, whether the finished liner system conforms to the specification stipulated in report. If any problem arises, it has to be rectified immediately.

SECTION – 17

FREQUENCY AND TYPE OF TESTS TO BE CARRIED OUT UNDER QUALITY ASSURANCE PROGRAM FOR THE CONSTRUCTION OF SECURED LANDFILL PHASE AS PER MANUAL FOR DESIGN, CONSTRUCTION AND QUALITY CONTROL OF LINERS AND COVERS FOR HAZARDOUS WASTE LANDFILLS, CPCB, 2001 - 2002:

PLEASE NOTE: One set of tests is 3 samples per set which are taken from the same sample and all the samples are to be tested.

Sr. No.	Material	Type of test	Method	Frequency of tests to be done
1 A	On Soil surface from borrow pits and piling of the soil to be used for amended clay liner	Grain size distribution/Classification test – 1 set of samples per 1000 cu.m. of excavated soil 1) Total soil requirement of Clay liner = 12117 cu.m. 2) So no. of samples to be tested – 3 x 12117/1000 = 36.35 ~ 36 samples.	IS 1498 (part 4)	36
B		Atterberg limits – 1 set of sample per 1000 cu.m. of excavated soil as (1a) above	IS 2720 (part 5)	36
C		Water/Moisture Content – 1 set of sample per 1000 cu.m. of excavated soil as (1a) above	IS 2720 (part 2)	36
D		Standard Proctor and Modified Proctor Density (Light and Heavy Compaction) – One set of test of each type per 5000 cu.m. of excavated soil 1) Total soil requirement of Clay liner = 12117 2) So no. of samples to be tested – 3 x 12117/5000 = 7.27 ~ 7 samples. Therefore, total no. of samples to be collected = 7 + 7 = 14 samples in which 7 samples for Standard Proctor Density and 7 samples for Modified Proctor Density.	IS 2720 (part 7 & 8) & IS 2720 (part 28/29/34)	14 (7 of each type)
E		Laboratory Permeability test – "As Compacted then Saturated Samples"- One Set of tests (3 samples per Set) per 5000 Cu.m. of excavated soil 1) Total soil requirement of Clay liner = 12117	ASTM: D – 5084 or Consolidation Cell Permeameter	7

		2) So no. of samples to be tested – 3 x 12117/5000 = 7.31 ~ 7 samples.	(Olson and Daniel, 1979)	
2 A	On Clay Material – Sodium Bentonite or Clayey Soils for each bentonite of clay sample procured	Grain Size Distribution/Classification test and Clay Content, Size – 50% fraction passing through <0.074 mm size sieve	IS 1498 (part 4 & 5)	3
B		Atterberg limits – Plastic/Liquid Limits/Plasticity Index	IS 2720 (part 5)	3
C		Permeability test – Permeability value to be achieved - less than 1 x 10^{-7} cm/sec	ASTM: D – 5084 or Consolidation Cell Permeameter (Olson and Daniel, 1979)	3
D		Standard and Modified Proctor Density	IS 2720 (part28/29/34)	3
E		Moisture Content	IS2720(part2)	3
F		Strength Parameters	IS 2720(part 10,11,12)	3
G		Compressibility Parameters	IS 2720 (part 15)	3
3 A	For mixture of sodium bentonite and soil in Lab to fix upthe % of bentonite to be mixed with soil	% of bentonite mixed with soil . Please repeat these tests for each different type of bentonite used for selecting bentonite. So the no. of samples shall vary with the no. of bentonite samples supplied to lab		1
B		Permeability of the mixture - Permeability value to be achieved - less than 1 x 10^{-7} cm/sec	ASTM: D – 5084 or Consolidation Cell Permeameter (Olson and Daniel, 1979)	1

C		Proctor Density	IS2720(part 28/29/34)	1
D		Classification tests	IS 1498(part 4&5)	1
E		Atterberg limits	IS 2720 (part 5)	1
F		Moisture Content	IS 2720 (part 2)	1
G		Strength Parameters	IS 2720 (part 10,11,12)	1
H		Compressibility Parameters	IS 2720 (part 15)	1
4	Compacted Clay/Amended Clay Liner – Field Trial Test Pads of size 10m x 30m. No. of test pads to be constructed – 2 (One each for Primary and Secondary Clay Liner).	Compacted Clay/Amended Clay Liner – Field Trial Test Pads of size 10m x 30m. No. of test pads to be constructed – 2 (One each for Primary and Secondary Clay Liner). The thickness of the pad should ideally be the same as the full-sized liner but can be lower (not lower than 45 cm), to be constructed prior to the construction of the liner. Field permeability tests and quality control tests can be performed to obtain information regarding the range of values obtained in the field trials. Total Volume of compacted Clay/Amended Clay Liner of field trial test pad = 10 m x 30 m x0.90 m thk. (0.45 m each layer) = 270 Cu.m.		
A		In Situ Density - 5 tests per 500 Sq.m. of each lift of 23 cm thickness compacted layer. Acceptable range of In Situ Density by Standard Proctor is > 95% of Maximum Dry Density and > 90% in Modified Proctor Density 1) Total Area of each lift of 23 cm thickness of the trial pad = 10 x 30 m = 300 Sq.m. 2) No. of test in each lift of 23 cm thickness of the trial pad = 300 x 5/500 = 3 samples. 3) Total no. of lifts in One layer of 45 cm compacted Clay liner = 2 4) So, no. of samples for total thickness of 45 cm of compacted Clay liner = 3 x 2 = 6 Samples. 5) So, for total compacted Clay liner thickness of 90 cm, no. of samples = 6 x 2 = 12 samples	IS:2720 (Parts 28/29/34)	12
B		In Situ Water/Moisture Content - 5 tests per 500 Sq.m. of each lift of 23 cm thickness compacted layer. Therefore, No. of samples for total thickness as above shall be 12 samples.	IS:2720 (Part 2)	12

		Acceptable water contents may be typically in the range of optimum moisture content to 5 percent above optimum moisture content.		
C		Laboratory Permeability on "As-Compacted-Then-Saturated" Samples – One Set of tests (3 samples per set) for 2000 cu.m. of earth work. 1) Total Volume of Clay/Amended Clay Liner of field trial test pad = 10 m x 30 m x0.90 m thk. (0.45 m each layer) = 270 Cu.m. 2) No. of samples to be taken = 270 x 3/2000 = 0.40 ~ 1 sample. 3) To be on safer side, One sample on each 45 cm of compacted clay liner.	ASTM: D – 5084 or Consolidation Cell Permeameter (Olson and Daniel, 1979)	1
5	Actual Compacted Amended Clay Liner – 90 cm total thickness consisting of One Primary Clay liner of 45 cm thickness and One Secondary Clay Liner of 45 cm thickness	Amended Compacted Clay Liner –Total Volume of Compacted Amended Clay Liner of 90 cm thickness = 12755 Cu.m. So, Volume of each 45 cm thk. Layer = 6378 Cu.m. Each 45 cm thk. Layer will be constructed in 2 layers of 23 cm thk. Lifts. Area of each 45 cm thk. clay liner = 14172 Sq.m.		
A		In Situ Density - 5 tests per 500 Sq.m. of each lift of 23 cm thickness compacted layer. Acceptable range of In Situ Density by Standard Proctor is > 95% of Maximum Dry Density and > 90% in Modified Proctor Density 1) Total Area of each lift of 23 cm thickness of the actual clay liner = 14172 Sq.m. 2) No. of test samples in each lift of 23 cm thickness = 14172 x 5/500 = 142 samples. 3) Total no. of lifts in One layer of 45 cm compacted Clay liner = 2 4) So, no. of samples for total thickness of 45 cm of compacted Clay liner = 142 x 2 = 284 Samples. 5) So, for total compacted Clay liner thickness of 90 cm, no. of samples = 284 x 2 = 568 samples	IS:2720 (Parts 28/29/34)	568
B		In Situ Water/Moisture Content - 5 tests per 500 Sq.m. of each lift of 23 cm thickness compacted layer. Therefore, No. of samples for total thickness as above shall be 568 samples.	IS:2720 (Part 2)	568

		Acceptable water contents may be typically in the range of optimum moisture content to 5 percent above optimum moisture content.		
C		Laboratory Permeability on "As-Compacted-Then-Saturated" Samples – One Set of tests (3 samples per set) for 2000 cu.m. of earth work. 1) Total Volume of Amended Compacted Clay Liner = 12755 Cu.m. 2) No. of samples to be taken = 12755 x 3/2000 = 19.13 ~ 19 samples.	ASTM: D – 5084 or Consolidation Cell Permeameter (Olson and Daniel, 1979)	19
D		Grain Size distribution and Atterberg's limits of additive (bentonite) – One Set of tests for every 200 Cu.m. of additive. 1) Considering 5% bentonite (if bentonite is added more, this shall change) requirement, volume of bentonite required = 12755 x 0.05 = 637.75 cu.m. ~ 638 cu.m. 2) So, no. of Grain size distribution tests = 638 x 3/200 = 9.57 ~ 10 samples. 3) Similarly No. of Atterberg's limit of additive = 10 samples.	IS 1498 (part 4 & 5)	10 samples for each test
E		Grain Size distribution and Atterberg's limits of soil + additive mixture – One set of test for every 1000 Cu.m. of mixed soil produced. Total Volume of Amended Compacted Clay Liner = 12755 Cu.m. 1) No. of samples to be taken = 12755 x 3/1000 = 38.26 ~ 38 samples.	IS 1498 (part 4 & 5)	38 samples for each test
F		Standard Proctor and Modified Proctor test – One Set of test of each type for every 2500 Cu.m. of mixed soil produced. Total Volume of Amended Compacted Clay Liner = 12755 Cu.m. 1) No. of samples to be taken = 12755 x 3/2500 = 15.30 ~15 samples. 2) So, 15 samples for Standard Proctor and 15 samples for Modified Proctor Density	IS 2720 (part28/29/34)	15 samples for each type of Proctor test
G		Laboratory Permeability Test on As Compacted – Then – Saturated samples – One set of tests for every 2500 Cu.m. of mixed soil produced. Permeability value to be achieved - less than 1 x 10^{-7} cm/sec 1) So as above, no. of samples to be taken = 15 samples.	ASTM: D – 5084 or Consolidation Cell Permeameter (Olson and Daniel, 1979)	15

6	1.5 mm thk. HDPE membrane liner	1.5 mm thk. HDPE membrane - frequency of testing is one set per 5000 Sq.m or per lot (lot meaning consecutively numbered rolls from the same manufacturing line. In any case, the number of sets of samples should not be less than five for the landfill or not less than two for each yearly phase of the landfill. 1) Total quantity of HDPE liner required = 85993 Sq.m. 2) No. of samples to be taken = 85993 x 3/5000 = 51.59 ~ 52 samples. 3) However, If per lot is calculated, then lot details shall be submitted by the contractor and accordingly no. of samples to be taken. 4) In any case, sample quantity shall not be less than 5 for each primary as well as secondary liner work. Hence for both of the liners, it shall not be less than 10.		
		Thickness, mm – Ave. Value - ≥ 1.5 mm	ASTM D5199	52 Or per lot
		Density, g/cm3 – Ave. Value - ≥ 0.94 g/cc	ASTM D1505/D792	52 Or per lot
		Melt Flow Index, g/10 min – Ave. Value – < 1 g/10 min	ASTM D1238/D190/5	52 Or per lot
		Tensile Strength at Yield, N/mm – Ave. Value - ≥ 23 kN/m	ASTM D 638	52 Or per lot
		Tensile Strength at Break, N/mm – Ave. Value - > 43 kN/m	ASTM D 638	52 Or per lot
		Elongation at Yield, % - Ave. Value - >13	ASTM D 638	52 Or per lot
		Elongation at Break, % - Ave. Value - > 700	ASTM D 638	52 Or per lot
		Tear Resistance, Ave. Value - ≥ 150 N	ASTM D 1004	52 Or per lot
		Puncture Resistance, Ave. Value - ≥ 250 N	ASTM D 4833	52 Or per lot

		ESCR, 100 hours, Ave. Value – Pass	ASTM D 1693	52 Or per lot
		Dimensional Stability after warm storage 1 hr/100 °C, %, Ave. Value - ± 2%	ASTM D 1024	52 Or per lot
		Oxidative Induction Time (OIT), min, Ave. Value – 100 min	ASTM D 3895	52 Or per lot
		Carbon Black Content %, Ave. Value - ≥ 2%	ASTM D 1603 - 94	52 Or per lot
		Carbon Black Dispersion, Category, Ave. Value - Cat. 1 -2	ASTM D 5596 – 94	52 Or per lot
		Roll Width, m, Ave. Value – Min. 6 -9 m	-	52 Or per lot
		Chemical Resistance - Resistant to most strong acids and alkalis	-	52 Or per lot
		Seam Strength (Shear), Ave. Value - ≥ 90% of parent material. One test every 150 m of length or for every no. of joint. 1) Average bottom longer side length = 233 m 2) Average bottom shorter side length = 82 m 3) Average width of HDPE liner = 7 m 4) Average length of HDPE liner roll = 130 m 5) So, No. of joints on longer length side = 1 6) No. of joints on shorter length side = 82/7 = 12 7) Hence no. of seam samples for primary and secondary liner on bottom = 1 + 12 + 1 + 12 = 26 8) Average length of 1st side slope from GL to berm = 9.90 9) Average Periphery of 1st Side slope = 673 m 10) So No. of joints on slope length = 1 11) No. of joints along periphery = 673/130 = 5 12) Hence no. of seam samples for primary and secondary liner on 1st side slope = 1 + 5 + 1 + 5 = 12 13) Average length of 2nd side slope from berm to bottom = 9.55 14) Average Periphery of 2nd Side slope = 590 m 15) So No. of joints on slope length = 1 16) No. of joints along periphery = 590/130 = 5	ASTM D 4437	84

		17) Hence no. of seam samples for primary and secondary liner on 2nd side slope = 1 + 5 + 1 + 5 = 12 18) Width of horizontal berm between two side slopes = 3 m 19) Average Periphery of 3 m berm = 633 m 20) So No. of joints on width = 0 21) No. of joints along periphery of berm = 633/130 = 5 22) Hence no. of seam samples for primary and secondary liner on 3 m berm = 5 + 5 = 10 23) Width of horizontal berm between starting of 1st side slope and bottom of retaining wall at GL = 3.10 m 24) Average Periphery of 3.10 m berm = 703 m 25) So No. of joints on width = 0 26) No. of joints along periphery of berm = 703/130 = 5 27) Hence no. of seam samples for primary and secondary liner on 3.1 m berm on GL = 5 + 5 = 10 28) Height of Retaining wall on which the liner is to be placed = 12 m + 2 m anchor = 14 m 29) Average Periphery of the Filling Side retaining wall = 711 m 30) Joints on wall along height of wall = 14/7 = 2 x 2 liners = 4 31) Joints on wall along periphery of the wall = 711/130 = 5 x 2 liners = 10. Hence total no. of seam and peel samples on bottom, side slopes, berms and on wall = 26 + 12 + 12 + 10 + 10 + 4 + 10 = 84		
		Seam Strength (Peel) –Ave. Value - ≥ 60% of parent material	ASTM D 4437, D413	84
7 A	Leachate Collection System – Coarse Sand and Drainage layer consisting of 10 – 20 mm and 6 – 10 mm size gravels/aggregates	Shape of particles - One set of tests per 1000 cu.m of drainage layer material recd. 1) Total Volume of drainage layer in Primary and Secondary liner system = 2834 x 3 = 8502 Cu.m. of each layer. 2) No. of samples to be taken = 8502 x 3/1000 = 25.50~ 26 samples.	By view	26
B		Grain size distribution - One set of tests per 1000 Cu.m of compacted drainage layer	IS:2720 (Part 4)	26

C		Constant head permeability - One set of tests per 2000 Cu.m. of compacted drainage layer. = 8502 x 3/2000 = 12.75 ~ 13 samples	IS 2720 (part 30,37)	13
D		Insitu density: One set of tests per 1000 cu.m.	IS 2720 (part 28 & 33)	26
8	HDPE pipes – Leachate Collection Pipes	MFI, 1 set for 160/225 mm dia HDPE pipe	IS 4984:1995	2
		Density, 1 set for 160/225 mm dia HDPE pipe	IS 4984:1995	2
		Wall Thickness, 1 set for 160/225 mm dia HDPE pipe	IS 4984:1995	2
		CBC, 1 set for 160/225 mm dia HDPE pipe	IS 4984:1995	2
9 a	Hard Soil for sub base and for soil filling in excavated rock on side slopes - For imported Soil – sample to be taken from the source place of soil	Grain Size Distribution - One Set of tests - 3 samples every 1000 Cu.m. of earthwork on horizontal berm on GL + 1st side slope + 3 m wide berm between side slopes + 2nd side slope up to bottom – compacted/watered/rolled 1) Total volume of soil used in earth filling in excavated rock at above mentioned places – 2584 cu.m. so no. of samples to be tested – 3 x 2584/1000 = 8 samples.	IS 1498 (part 4 & 5)	8
b		Atterberg limits - 3 sample per 1000 cu.m. of excavated soil as (9a) above	IS 2720 (part 5)	8
c		Compressibility parameters - 3 sample per 1000 cu.m. of excavated soil as (9a) above	IS 2720 (part 15)	8
d		Moisture Content- 3 sample per 1000 cu.m. of excavated soil as (9a) above	IS 2720 (part 2)	8
e		Strength Parameters “as compacted then saturated” - 3 sample per 1000 cu.m. of excavated soil as (9a) above	IS 2720 (part 10,11,12)	8
f		Field Dry Density and Maximum Dry Density- Standard Proctor Test - >95% Std. Proctor density on horizontal compacted surface and >90% on side slopes - 3 sample per 1000 cu.m. of excavated soil as (9a) above	IS 2720 (part 28/29/34)	8

10	Viscosity Grade Bitumen VG – 10 to be applied on RCC wall, counter fortes and on outside slope– all exposed RCC surfaces confirming to IS: 73 – 2006	Absolute Viscosity at 60°C, Poise, Ave. Value – 800 Poise min.	IS 1206 (Part 2)	1
		Kinematic Viscosity, 135˚C, cST, Ave. Value – 250 cST min.	IS 1206(Part 3)	1
		Flashpoint (Cleveland Open Cup), °C, Ave. Value – 220 °C min.	IS 1209	1
		Solubility in trichloroethylene, %, Ave. Value – 99.0% min.	IS 1216	1
		Penetration at 25˚C, 100 gm, 5 s, 0.1 mm, Ave. Value – 80 -100	IS 1203	1
		Softening point (R&B), °C, Ave. Value – 40 °C min.	IS 1205	1
		Tests on residue from thin film over test (RTFOT)		1
		a. Viscosity ratio at 60˚C, Ave. Value – 4.0 max.	IS 1206 (Part 2)	1
		b. Ductility at 25˚C, cm, Ave. Value – 75 cm, min. after thin film oven test	IS 1208	1
11	25mm Thk. HD100 Polymer Expansion Joint Filler Board in RCC Wall and Counter fortes			
		Density, Kg/Cu.m, Ave. Value - 100 ± 10%	ASTM D – 3575	1
		Water absorption, Kg/Sq.cm of cut surface area, Ave. Value - 0.080 max.	ASTM D – 3575	1
		Compression, deflection and recovery % without weathering, %, Ave. Value – 94% min.	Highway Clause 1015	1
		Compression, deflection and recovery % with weathering, %, Ave. Value – 92% min.	Highway Clause 1015	1
		Extrusion, mm, Ave. Value - 3 mm max.	Highway Clause 1015	1

		Alkali resistance, Ave. Value – No effect observed	AS – 1350 – 460.2-1982	1
		Weathering test, Ave. Value – No Disintegration	Highway Clause 1015	1
12	Flat ribbed PVC water Stopper in Expansion Joint in RCC Wall – As per Clause No. 3.2, IS:15058-2002	Physical Properties - Before Ageing		
		Hardness Test, Ave. Value - 65 Shore (A), min.	IS: 3400, (Part II)	1
		Tensile Strength, Ave. Value – 13.8 MPa, min.	IS: 3400, (Part I)	1
		Elongation at Break, Ave. Value – 285% min.	IS: 3400, (Part I)	1
		Water absorption, Ave. Value – 0.60% max.	IS: 3400, (Part VI)	1
		Cold Bend Test at – 25°C, Ave. Value – Should not crack	IS: 9766	1
		Accelerated Extraction Test – Tensile Strength, Ave. Value – 10.30 MPa, min.	IS: 3400, (Part IV)	1
		Accelerated Extraction Test – Elongation at Break, Ave. Value – 280% min.	IS: 3400, (Part IV)	1
		Stability in effect of alkalies test:		1
		a. Weight increase in 7 days, Ave. Value – 0.25 % max.	IS: 3400, (Part IV)	1
		b. Weight decrease in 7 days, Ave. Value – 0.10 % max.	IS: 3400, (Part IV)	1
		c. Change in Hardness in 7 days, Ave. Value – ± 5 Shore (Max.)	IS: 3400, (Part IV)	1
		d. Weight increase in 28 days, Ave. Value – 0.40 % max.	IS: 3400, (Part IV)	1
		e. Weight decrease in 7 days, Ave. Value – 0.30 % max.	IS: 3400, (Part IV)	1
		f. Change in Elongation at Break in %, Ave. Value – ± 1% (Max.)	IS: 3400, (Part IV)	1

Additional General Construction materials tests and their frequency:

Sr. No.	Material	Type of test	Method	Frequency of tests to be done
13	Water used for Construction	As per IS – 456: • pH Value • Limits of Acidity • Limits of Alkalinity • Percentage of Solids • Chlorides • Suspended matter • Sulphates • Inorganic Solids • Organic Solids	IS – 3025/APHA	Water from each source shall be got tested before the commencement of work and thereafter once in every three months till the completion of the work. Water from municipal source need be tested only once in six months. Number of Tests for each source shall be 3
11	Cement	a) Physical Requirement i) Fineness ii) Soundness iii) Setting Time (initial and final) iv) Compressive Strength v) Consistency of standard cement paste	IS – 4031 Part (II) Part (III) Part (V) Part (VI) Part (VI)	Every 50 tonnes or part thereof. Each brand of cement brought to site shall be tested as per this frequency. Total Cement Consumption = 6259.433 MT , so no. of cement samples to be analysed = 125 samples
12	Rubble – Basalt (Deccan trap)	i) Specific gravity ii) Compressive Strength iii) Shear strength iv) Tensile strength v) Porosity vi) Resistance to abrasion vii) Modulus of Elasticity	IS – 1123: 1975	1 set of sample every 1000 cu.m. Total rubble consumption in all works = 334 Cu.m. So no. of samples to be analysed = 0.334~ 1 sample
13	Coarse and Fine Aggregates	i) Percentage of soft or deleterious material ii) Particle size	IS 2386	1 set of sample every 50 Cu.m. 1) Total Volume of Coarse aggregates consumed in all

	used for PCC & RCC work	iii) Estimation of organic Impurities iv) Surface Moisture v) Determination of 10% fine value vi) Specific gravity vii) Bulk density viii) Aggregate crushing Strength ix) Aggregate impact value		works = 16833.02 Cu.m. So no. of samples to be analysed = 337 samples 2) Total Volume of fine aggregates consumed in all works = 9362.09 Cu.m. So no. of samples to be analysed = 187 samples.
14	PCC (1:4:8) & PCC M20 grade	i) Minimum Compressive strength of 150 mm cube after 28 days shall be 7.5 N/mm^2 ii) Total Quantity of Dry Aggregates by Mass per 50 kg of cement, to be taken as the Sum of the Individual Masses of Fine and Coarse Aggregates, Kg. Max – 625 kg iii) Proportion of Fine Aggregate to Coarse Aggregate (by Mass) - Generally 1:2 but subject to an upper limit of 1: 1 ½ and a lower limit of 1:2 ½ iv) Quantity of Water per 50 kg of Cement, max Ltr. – 45 Ltrs.	IS – 456	1 set of sample every 50 Cu.m. Total PCC (1:4:8) work = 680 Cu.m. So, no. of samples to be analysed = 680/50 = 14 samples Total PCC M20 work = 4682 Cu.m. So, no. of samples to be analysed = 4682/50 = 94 samples
15	RCC M 20, M 25 & M30	i) Minimum Compressive strength of 150 mm cube after 28 days shall be 20 N/mm^2 for M20 grade concrete and 25 N/mm^2 for M25 grade concrete	IS – 456	4 set of samples upto 50 Cu.m. Then 1 sample additional every 50 Cu.m. in addition to 4 samples above. a) Total no.of samples for RCCM20 work = 878/50 = 18 + 5 = 23 samples. b) Total no. of samples for RCC M25 work = 130/50 = 3 +5 = 8 samples c) Total no. of samples for RCC M30 work = 13528/50 = 271 +5 = 276 samples

16	Reinforcement Steel - Fe 500 grade TMT bars	i) ii) iii) iv)	0.2 Per cent Proof stress/ yield stress, Min, N/mm^2 – 500 N/mm2 Elongation, per cent, Min. on gauge length 5.65 Sq.root of A , where A is the cross-sectional area of the test piece. – 16.0 % Tensile strength, Min - 10 Per cent more than the actual 0.2 per cent proof stress/yield stress but not less than 565.0 N/mm^2 Total elongation at maximum force, percent, Min on gauge length 5.65 Sq.root of A , where A is the cross-sectional area of the test piece. – 5%	IS – 432 Part I & II & IS - 1786	1 set of sample every 45 MT. Total Reinforcement Steel consumption in all works = 3038.186 MT. So, no. of samples to be analysed = 68 samples

Notes:

1) **Total RCC M30 work – 13528 Cu.m.**
2) **Min. Cement consumption in RCCM30 grade with 20 mm aggregates – 325 Kg/cu.m. (as specified by structural consultant), so Cement consumption – 4396600 Kg = 4396.60 MT = 87932 bags**
3) **Total RCC M25 work – 130 Cu.m.**
4) **Min. Cement consumption in RCCM25 grade with 20 mm aggregates – 325 Kg/cu.m. (as specified by structural consultant), so Cement consumption – 42250 Kg = 42.250 MT = 845 bags**
5) **Total RCC M20 work – 878 Cu.m.**
6) **Min. Cement consumption in RCCM20 grade with 20 mm aggregates – 320 Kg/cu.m. (as per IS:456 -2000 – severe conditions), so Cement consumption – 280960 Kg = 280.96 MT = 5619.20 bags**

7) **Total PCC work M 20 grade – 4682 Cu.m.**
8) **Min. Cement consumption in PCC grade with 20 mm aggregates – 260 Kg/cu.m. (as per IS:456 -2000 – severe conditions), so Cement consumption – 1217320 Kg = 1217.32 MT = 24346.40 bags**
9) **Total PCC work (1:4:8) grade – 680 Cu.m.**
10) **Min. Cement consumption in PCC grade with 20 mm aggregates – 250 Kg/cu.m. (as per IS:456 -2000 – severe conditions), so Cement consumption – 170000 Kg = 170.0 MT = 3400 bags**
11) **Total Plaster works in CM (1:4) = 19881 Sq.m. = 397.62 Cu.m. (20 mm thk.). Dry volume of plaster = 1.33 x 397.62 = 528.83 Cu.m.**
12) **Cement consumption in plaster works = 0.20 x 528.83 = 105.76 cu.m. x 1440 kg/cu.m. = 152303 kg = 152.303 MT = 3046.06 bags.**
13) **Thus Total Cement Consumption = 4396.60 + 42.25 + 280.96 + 1217.32 + 170.0 + 152.303 = 6259.433 MT.**
14) **Total Steel work – 3038.186 MT including 8 mm, 10 mm, 12mm, 16 mm, 20 mm & 25 mm dia bars**
15) **Total Rubble Soling Work = 334 Cu.m.**
16) **Total Aggregate consumption:**
    a) **In PCC (1:4:8) work = 625 kg/50 kg of cement = 625/50 x 170000 = 2125000 Kg, of which Fine aggregates (sand) = 1/3 x 2125000 = 708333 Kg and 20 mm Coarse Aggregates = 2/3 x 2125000 = 1416667 Kg. So, Volume of fine aggregate (sand) = 708333/1600 = 442.70 Cu.m. considering a bulk density of 1600 Kg/cu.m. and Volume of coarse aggregate = 1416667/1550 = 913.98 Cu.m. considering a bulk density of 1550 Kg/cu.m for coarse aggregates.**
    b) **In PCC M20 work = 625 kg/50 kg of cement = 625/50 x 1217320 = 15216500 Kg, of which Fine aggregates (sand) = 1/3 x 15216500 = 5072167 Kg and 20 mm Coarse Aggregates = 2/3 x 15216500 = 10144333 Kg. So, Volume of fine aggregate (sand) = 5072167/1600 = 3170.10 Cu.m. considering a bulk density of 1600 Kg/cu.m. and Volume of coarse aggregate = 10144333/1550 = 6544.73 Cu.m. considering a bulk density of 1550 Kg/cu.m for coarse aggregates.**

c) **In RCC M20 (1:1.5:3), Volume of RCCM20 = 878 Cu.m. Now Volume of fine aggregates (sand) needed = 0.428 Cu.m per Cu.m. of RCCM20 and Volume of Coarse aggregates (20mm aggregates) needed = 0.856 Cu.m. per Cu.m. of RCC M20. Therefore Quantity of fine aggregates needed for RCCM20 work = 0.428 x 878 = 375.78 Cu.m. and quantity of coarse aggregates needed for RCC M20 work = 0.856 x 878 = 751.57 Cu.m.**

d) **In RCC M25 (1:1:2), Volume of RCC M25 = 130 Cu.m. Now Volume of fine aggregates (sand) needed = 0.385 Cu.m per Cu.m. of RCCM25 and Volume of Coarse aggregates (20mm aggregates) needed = 0.77 Cu.m. per Cu.m. of RCC M25. Therefore Quantity of fine aggregates needed for RCCM25 work = 0.385 x 130 = 50.05 Cu.m. and quantity of coarse aggregates needed for RCC M25 work = 0.77 x 130 = 100.10 Cu.m.**

e) **In RCC M30, Volume of RCC M30 = 13528 Cu.m. Now Volume of fine aggregates (sand) needed = 0.37 Cu.m per Cu.m. of RCCM30 and Volume of Coarse aggregates (20mm aggregates) needed = 0.63 Cu.m. per Cu.m. of RCC M30. Therefore Quantity of fine aggregates needed for RCCM30 work = 0.37 x 13528 = 5005.36 Cu.m. and quantity of coarse aggregates needed for RCC M30 work = 0.63 x 13528 = 8522.64 Cu.m.**

f) **In Cement Plaster CM (1:4), Volume of Plaster = 397.62 Cu.m. Volume of fine aggregates (sand) used = 0.80 x 397.62 = 318.10 Cu.m.**

g) **Thus Total Volume of fine aggregates consumed in all the works including PCC and all grades of RCC and in plaster = 442.70 + 3170.10 + 375.78 + 50.05 + 5005.36 + 318.10 = 9362.09 Cu.m. and Total Volume of Coarse aggregates consumed in all the works including PCC and all grades of RCC = 913.98 + 6544.73 + 751.57+ 100.10 + 8522.64 = 16833.02 Cu.m.**

SECTION – 18

PROFORMA OF AGREEMENT

CONTRACT AGREEMENT FOR THE WORK OF -------- DATED..... (Two Thousand) Between M/s ..... in the town of ..... here in after called the "BIDDER" (which term shall unless excluded by or repugnant to the subject or context include its successors and permitted assignees) of the one part and the "VARNI ENVIRO CARE PRIVATE LIMITED" herein after called the "VECPL" (which term shall unless excluded by or repugnant to the subject or context include its successors, and assignees) of the other part, Whereas

A) The VECPL being desirous of having provided and executed certain works mentioned, enumerated or referred to in the tender documents including Short Tender Notice, General Tender Notice, General Conditions of Contract, Important Conditions of Contract. Specifications, Drawings, Plants, Time Schedule of Completion or Jobs, Agreed Variations other documents has called for Tender.

B) The bidder has inspected the site and surroundings of the works specified in the tender documents and has satisfied himself by careful examination before submitting has tender as to the nature of the surface strata, sob-soil and ground, live form and nature of site and local conditions, the quantities, nature and magnitude of the work the availability of labor and materials necessary for the execution of work, the means of site, the supply of power and water thereto and the accommodation he may require and has made local and independent inquiries and obtained complete information as the matters and things and referred to or implied in the tender document or having any connection therewith, and has considered the nature and extent of all probable and possible situations hindrances or interference's to or with the execution and completion of the work to be carried out under the Contract and has examined and considered all other matters, condition and things and possible, and general all matters incidental thereto and ancillary thereof affecting the execution and completion of the work and which might have influenced him in making his tender.

C) The notice inviting tender, general conditions of contract, important conditions of contract, general obligations, specifications, drawings, plans, time schedule of completion of jobs, letter of acceptance of tender and any statement of agreed variation with its enclosures, copies of which are also hereto annexed, form part of this contract though separately set out herein and are included in the expression "CONTRACT" wherever herein used.

And Whereas

The VECPL accepted the tender of the bidder for the provision and the execution of the said work at the rates stated in the Schedule of quantities of works and finally approved by VECPL (here in after called the "Schedule of Rates") upon the terms and subject to the conditions of contract,

Now This Agreement Witnesseth and it is hereby agreed and declared as follows:-

In consideration of the payment to be made to the bidder for the work to be executed by him, the bidder hereby make covenant with the VECPL that the bidder shall and will duly provide, execute and complete the said works and shall do and perform all other acts and things in the contract mentioned or described or which are to be implied there from or may be reasonably necessary for the completion of the said works and at the said times and in the manner and subject to the terms and conditions or stipulations mentioned in the contract.

In consideration of the due provision execution and completion of the said works, the VECPL does hereby agree with the Bidder that the VECPL will pay to the bidder the respective amounts for the work actually done by him and approved by the VECPL at the Schedule of Rates and such other sum payable to the bidder under provision of Contract, such payment to be made at such time in such manner as provided for in the Contract.

AND

In consideration of the due provision, execution and completion of the said works the bidder does hereby agree to pay such Sums as may be due to the VECPL for the services rendered by the VECPL to the Bidder, such as power supply water supply and others as set for in the said contract and such other sum as may become payable to the VECPL towards the controlled items of consumable materials or towards loss damage to the VECPL 's equipment, materials construction plant and machinery, such payments to he made at such time and in such manner as is provided in the Contract.

It is specifically, and distinctly understood and agreed between the VECPL and the Bidder that the bidder shall have no aright, title or interest in the site made available by the VECPL for execution of the works or in the building, structures or works executed on the said site by the bidder or in the goods articles, materials etc. brought on the said site (unless the same specifically belongs to the bidder) and the bidder shall not have or deemed to have any lien whatsoever charge for unpaid bills nor will be entitled to assume or retain possession or control of the site or structures and the VECPL shall have an absolute and unfettered right to take full possession of site and to

remove the bidder, their servants, agents and materials belonging to the bidder and lying on the site.

The bidder shall be allowed to enter upon the site for execution of the works only as a license simplicitor and shall not have any claim, right, title or interest in the site or the structures erected thereon and the VECPL shall be entitled to terminate such license at any time without assigning any reason.

The materials including sand, gravel, stone, loose earth, rock etc dug up or excavated from the said site shall, unless otherwise expressly agreed under this contract exclusively belong to the VECPL and the bidder shall have no right to claim over the same and such excavations and materials should be disposed of on-account of the VECPL according to the instructions in writing issued from time to time, by the VECPL &/or its authorized persons including Engineer-in- Charge.
In Witness whereof the parties have executed these present in the day and the year first above written.

Signed and Delivered for and on behalf Of the VECPL Date Place	Signed, Stamped and Delivered for and on behalf of the Bidder Date Place

In Presence of two Witnesses

SECTION - 19

INFORMATION ABOUT BIDDER

As per General Conditions of Contract, General Instructions to Bidders

A. In case of Individual

1) Name and address of Business with contact numbers, fax nos., e-mail:

2) Whether his business is registered:

a) GST Registration No./TIN No.:

b) Provident Fund Registration No.:

c) Government Approved Bidder Registration Class:

3) Date of commencement of business:

4) Whether he pays Income Tax over Rs. 10,000/-per year. Please furnish details for the last five years, with corresponding Income Tax Certificate and CA Certificate showing the Turn Over as mentioned earlier:

B. In case of partnership firm

i) Name and address of partnership firm with contact numbers, fax no., e-mail:

ii) Name and address of each partner with contact numbers, fax nos., e-mail, recent passport size photographs of each partner with their specimen signatures:

iii) Whether the partnership is registered and copy of the partnership deed

iv) Date of establishment of firm

v) Certified Copy of the deed of partnership firm

vi) Attach complete organizational chart of the firm

vii) In case of Government royalty applicable to the Bidder, it is compulsory to submit a receipt of royalty payment with tender.

viii) In case of Octroi applicable to the goods of supplier/Bidder, the Bidder/supplier has to submit the attached copy of all octroi receipts.

ix) If each of the partners of the firm pays income tax, over Rs. 10000/- a year and if not which of them pays the same. Furnish details for the last five years.

C. In case of Limited Liability Company or Company Limited by Guarantees:-

i) Amount of paid up capital

ii) Names and address of Directors

iii) Certificate of incorporation of Bidding Company

iv) Copies of the last five years balance sheets of the Bidding Company

v) Copy of Memorandum and of Articles of Association of the Bidding Company

vi) Certified true copy of Board resolution authorizing to undertake the work related to this project

Signature and Stamp of Bidder

SECTION - 20
FINANCIAL DETAILS OF THE FIRM

(LAST FIVE YEARS)

SR.NO.	ITEM DESCRIPTION	AMOUNT IN RS.
1	Share Capital	
2	Reserves	
3	Total Working Capital	
4	Annual Turnover	
5	Value of works on hand	
6	Proposed Funds to be diverted for this work	
Remarks:		

ATTACHMENTS:

1) GST Certificate with proof of residence
2) PAN No. and TIN No.
3) Income Tax Returns of last three financial years
4) Solvency Certificate
5) Labour Insurance and Labour PF Account No.
6) Bank Guarantee
7) Work Contract Tax No.
8) “C” certificate no.

Signature and Stamp of Bidder

SECTION - 21
DETAILS OF EXPERIENCE

Bidder shall give information of similar works done during past five years strictly as per the proforma given below. This shall be submitted in quadruplicate.

Sr. No	Full particulars of similar work carried out by Bidder	Value of Contract	Completion time as stated in Tender in months	Actual Completion time in months	Year of compl-etion	Name and postal address of the client

Note: Attach details in separate sheet if needed.
Certified that the above information is correct.

Signature and Stamp of the Bidder

SECTION - 22

DETAILS OF EQUIPMENT POSSESSED BY THE BIDDER TO EXECUTE THIS WORK

Bidder shall give information of the equipment possessed by him or propose to bring on rental basis strictly as per the proforma given below.

Sr. No	Description of the equipment	No. of such equip-ment	Make of Equipment	Capacity	Owned or rented	Approx. date when it will be deployed at site	Period of retention on site

Note: Attach details in separate sheet if needed. Certified that the above information is correct.

Signature and Stamp of the Bidder

SECTION - 23

PROPOSED SCHEDULE OF THE BIDDER

BIDDERS PROPOSED COMPLETION SCHEDULE IN THE FORM OF BAR/PERT/CPM CHART OF ANY OTHER METHOD AS APPROVED BY THE VECPL

SIGNATURE AND STAMP OF THE BIDDER:

NAME AND ADDRESS:
DATE:

SECTION - 24
PROFORMA FOR BANK GUARANTEE FOR FINAL PAYMENT

To,

Dear Sirs,

WHEREAS _____ a Company

Incorporated under the Companies Act, 1956 and having its Registered Office at_____
(hereinafter referred to as the Bidder, which expression shall include its successors and permitted assigns) has, in terms of purchase Order No._____ Dated _____ issued by you to the said Bidder and accepted by the said Bidder, contracted to construct the "Construction of Secured Landfill facility" as stated in the said purchase Order.

AND WHEREAS it is provided in the said purchase order that you may retain with you a sum Rs._____ (RUPEES_____ ONLY) towards defects in the Construction of Infrastructure Facilities by the bidder or in construction thereof till the expiry of the Defects Liability period as provided in the said purchase Order, but that the Bidder shall have option to furnish a Bank Guarantee in your favor in lieu of such retention money.

AND WHEREAS the Bidder has requested us to issue in your favor the Bank guarantee as aforesaid.

NOW, we _____(name of the Bank)_____ hereby irrevocably agree and undertake as follows :

1. That the said Bidder shall duly and faithfully carry out its obligation under the said Purchase Order to you satisfaction, Failing which we hereby irrevocably guarantee to pay to you without reference to the bidder and without any demur, merely on demand from you stating that the amount claimed is due by way of loss or damage caused to or that may be caused to or suffered by the Company by

reason of the breach by the Bidder of any of the terms and conditions in the said Purchase Order. Any such demand made on us shall be conclusive as regards the amount due and payable to you under this Guarantee.

However our liability under this guarantee shall be restricted to an amount not exceeding Rs. _____(being the amount of the Bank Guarantee in lieu of Retention Money contemplated by the aforesaid Purchase order).

This guarantee shall remain in full force and effect for a period of 12 months from the date of Virtual Completion of Civil Work provided always that the guarantee shall be valid for a period of at least 6 months from the date, the Bidder rectifies any defective work or repairs the same.

We, lastly undertake not to revoke this guarantee during its currency except with your previous consent in writing. Notwithstanding anything contained herein above our liability under this guarantee is restricted to Rs. _____(RUPEES _____ ONLY).

This guarantee shall remain valid for the period provided for in Clause above. Unless a claim in writing is lodged with us within a period of 3 months from the date of expiry of the guarantee, all your rights under this guarantee shall be forfeited and we shall be released and discharged from all liabilities under this guarantee.