Subject: Minutes of Pre-Bid Meeting held at PMU Office on 05 October 2020

ICB-Works/PICIIP-08A

Construction of Wastewater Treatment Plant (WWTP) in North Zone, Sahiwal

As per the Bidding Documents issued on **September 18, 2020** the date of pre-bid meeting was scheduled on **September 05, 2020**. The pre-bid meeting was convened and chaired by the Project Director (PD), Program Management Unit (PMU), Punjab Intermediate Cities Improvement Investment Program (PICIIP), Local Government & Community Development Department, Punjab, Pakistan. Following officials from PMU and EPCM Consultant attended the meeting:

i. Mr. Socrat Aman Rana, Project Director, PMU, PICIIP.

ii. Mr. Javed Iqbal (Chief Engineer), PMU, PICIIP.

iii. Mr. Shuja Dar (Director Procurement & Contracts), PMU, PICIIP.

iv. Mr. Ahmed Naveed Shahbaz (Project Manager/Deputy Team Lead) EPCM.

v. Mr. Muhammad Ayyub (Senior Resident Engineer) EPCM.

vi. Mr. Muhammad Nashad Khan (Procurement & Contract Specialist) EPCM.

vii. Mr. Mohsen Islam Khan (Independent Consultant, Procurement & Contract Specialist) PMU, PICIIP.

The meeting started with the recitation of Holy Quran. The chair welcomed the participants (list attached as **Annex-A**) and asked the Independent Consultant, Procurement & Contract Specialist to start the meeting. The participants were briefed on the bidding documents, particularly the contents of Section-2 (Bid Data Sheet), Section-3 (Evaluation and Qualification Criteria), Section-4 (Bidding Forms) and Section-8 (Particular Conditions of the Contract).

The meeting was held in two parts. During the first part, it was explained in detail by reading the important Instructions to Bidders clauses on preparation of bids and application of evaluation criteria (financial and experience). It was also stressed on significance of a responsive bid submission.

During second part of the meeting, the participants were invited to raise queries. Director Procurement & Contracts advised them to submit their written queries to PMU for written replies / advice accordingly. The Bidders submitted their written queries from time to time before 19th October 2020 and the replies thereof, in writing, are attached as Annex-B.

The meeting was concluded with a vote of thanks to and from all the participants.

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RESPONSES TO BIDDERS' QUERIES ICB-Works/PICIIP-08A: Construction of Wastewater Treatment Plant (WWTP) in North Zone, Sahiwal

Sr#	Bidder Queries	PMU Clarification
1.	No Water proofing item is available in BOQ as it is mention in DWG (3976/033/C/15G01).	Addendum-01 is attached herewith to cover water proofing item.
2.	Hardcopy of drawings is not clear for reading. Please provide clear copy of drawings.	Fair copy of drawings in PDF format are attached with the email.
3.	Will the Employer provide any place for contractor camp, storage and Plant facilities?	No. The Contractor has to make those arrangements on its own. The Employer may assist the Contractor in this regard.
4.	Will the Employer designate any disposal area for excess excavated material and debris?	Area for disposal of excess excavated material and debris is not designated. The Contractor will locate and inform Employer/RE for disposal area. He will get required permissions from MC/relevant authorities before disposal of excess material/debris. Payment will be made as per actual lead chart to be approved by the Engineer.
5.	Please provide the soil investigation report or borehole logs to understand the strata.	The requisite data is attached in the email.
6.	We need to visit the site to understand the scope of work and jurisdiction of site for availability of materials etc. so it is requested that please arrange the site visit and also aligned your representative who will guide us during the site visit.	As per ITB 7.2 of the Bidding Document (BD), the Bidder is responsible to visit and examine the Site of Works and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the Bid and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the Bidder's own expense.
7.	Is it allowed or enough space available to establish our camp near site?	The Bidder is responsible to make this determination on its own as per ITB 7.2
8.	Please advise our prices are exclusive of PST or not?	As per ITB 14.7, all duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, as of the date 28 days prior to the deadline for submission of bids, shall be included in the rates and prices and the total Bid Price submitted by the Bidder. This includes all applicable taxes including federal, provincial, direct, and indirect taxes.
9.	Please provide List of Approved Manufacturer / Vendors.	All the materials, equipment and works will be according to specifications and drawings. The material will be approved by The Engineer according to the specification.

Sr#	Bidder Queries	PMU Clarification
10.	Amcorp is registered with PEC in CA 'No Limit' category and Orient in C-1 category but we do not have following: Specialization Codes ME07 and EE 11 Which is for General works. Please advise can we eligible to participate in bidding process or not?	As per subclause 2.1.6 of Section – 3 of the BD, the Bidder will be considered eligible to participate in the bidding process if they do not have any specialization code at the time of submission of bid, however, the bidder shall be bound to obtain these specialization codes before the award of the Contract, if determined as lowest evaluated bidder. Refer to Addendum No. 1.
11.	As mention in ITB 20.1 Clause Please provide BOQ in Excel or PDF format so we can submit at the time of bid submission.	ITB 20.1 requires the bidder to submit the soft copy of the priced bids in MS Excel format, that has to be developed by the bidder on their own and the Employer shall not provide the soft copies of BOQs.
12.	Please elaborate the type of WWTP, is it lagoon type or activated sludge Please confirm?	WWTP is based on waste stabilization ponds technology which consists of Anaerobic, Facultative and Maturation Ponds.
13.	Please confirm the capacity? Type of plant? And type of waste?	WWTP will treat wastewater flow of 24.6 MGD (45.7 cusec). It is based on waste stabilization ponds technology. Wastewater is mostly domestic sewage with small quantity of industrial waste.
14.	Please advise what is the completion time of the project?	Time for Completion of the Project is 730 Days as per sub-clause 1.1.3.3 of the PCC in Section – 8 of the BD.
15.	How to define the Exchange rate for conversion of USD to PKR to determine the project cost which is done in last 10 years?	The bidder shall apply the appropriate selling rate notified by the State Bank of Pakistan or National Bank of Pakistan applicable on the date of completion of the project indicated by the bidder in EXP-1 and/or EXP-2.
16.	There is no water proofing item present in BOQ?	Please refer to response at Sr. No.1
17.	Please advise if the project is in hand so it is considered for evaluation?	Only the completed project will be considered against sub-clause 2.4.1 and 2.4.2 of the Section – 3 of the BD during the evaluation of the technical bids.
18.	Please advise if one partner have the construction experience of WWTP and other has not so is it fine to participate in the bidding process with the experience available with one partner?	For a bidder who is participating in the bidding process as a Joint Venture of two or more firms, any one partner of the joint venture must meet the requirements of experience in contracts of similar size and nature as per sub-clause 2.4.1 of the Section – 3 of the BD
19.	15 Million CFT earthwork is required from general earthwork or is it required to be meet from WWTP earthwork please advise?	The bidder must demonstrate the experience in execution of at least 15 Million CFT of "Mechanically Compacted Earthwork" and 0.1 Million CFT of "Reinforced Concrete Works" as per sub-clause 2.4.2 of the Section – 3 of the BD. This is a general requirement and not related to a specific type of project.

Sr#	Bidder Queries	PMU Clarification
20.	Please advise the final discharge point / location.	The treated effluent from the WWTP will be discharged into Sukhrawa Seepage Drain. Please refer Drawing No.3976//11/C/2J106 (sheet 1 of 3).
21.	Please advise, whether the contract type is re-measured or lump sum?	It is an admeasurement contract. Payments will be made for the quantity of work actually executed, on the basis of approved rates.
22.	Please elaborate the BOD, COD, & TSS standard?	Treated effluent from WWTP shall meet PEQS standard. The values of the standard for BOD, COD and TSS are 80 mg/l, 150 mg/l and 200mg/l respectively.
23.	Please advise on personnel requirements. For example, Civil engineer is responsible for execution of civil work, so the bidder has to provide the engineer having execution experience of 12 years for civil construction projects please confirm?	Any individual proposed by the bidder must possess the appropriate qualification and minimum general and specific experience requirements as indicated in Section 6 of the BD. The indicated experience should be aligned with the specified position.
24.	Please advise on evaluating the escalation as you know the monthly bulletin is not available regularly and the rates are different from the rates available in market please advise?	As per sub-clause 13.8 of GCC Section – 7 of the BD the Engineer is empowered to determine the provisional indices until such time as each current cost index is available, for the issue of Interim Payment Certificates. When a current cost index is available, the adjustment shall be recalculated accordingly.
25.	What is the minimum amount of Interim Payment Certificate allowed?	As per sub-clause 14.6 of the PCC in Section – 8 of the BD the minimum amount of IPC is 3% (three percent) of the Accepted Contract Amount.
26.	Anaerobic Ponds, BOQ Item No.1, Jungle Clearance. Please specify the types of trees and plants to be cleared on site.	The bidder should visit the WWTP site to better ascertain the existing trees and plants at site. However, WWTP area is mostly crop area with some trees.
27.	Anaerobic Ponds, BOQ Item No.5, Brick Pavement. Please provide section drawing.	It is MRS item and should be considered according to description of item and relevant specifications.
28.	Anaerobic Ponds, BOQ Item No.6, Barbed wire fencing. Please provide section drawing.	It is MRS item and should be considered according to description of item and relevant specifications.
29.	Anaerobic Ponds, BOQ Item No.7, Steel grated doors. Please provide drawing and specify size of door.	It is MRS item and should be considered according to description of item and relevant specifications. Two doors are considered in the BOQ and quantity is given in Sft. The contractor shall submit shop drawings of gates for approval by the Engineer.
30.	Anaerobic Ponds, BOQ Item No.9, Interconnection Structures. Please provide section drawing.	Refer to drawing Nos. 3976/11/C/2J114, 3976/11/C/2J115, 3976/11/C/2J116 3976/033/C/15G03, 3976/033/C/15G03A, 3976/033/C/15G04, 3976/033/C/15G05 & 3976/033/C/15G05A.

Sr#	Bidder Queries	PMU Clarification
31.	Inlet outlet channel, BOQ Item No.1, Pen Stock gates. Please provide drawing.	The contractor will submit the shop drawings of pen stock gates. However, functional details/drawings, specifications and BOQ description are already included in the bidding documents.
32.	Office laboratory building. BOQ item No.30.Iron Grills. Please provide drawing.	It is MRS item and should be considered according to description of item and relevant specifications. For the size of windows, please refer to Drawings No. 3976/11/C/2J120.'.
33.	Office laboratory building. BOQ item No.17.Glazed tiles. Please specify the base rates for tiles.	Base rate to be decided by the bidder.

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PROGRAM MANAGEMNT UNIT PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM

LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT DEPARTMENT GOVERNMENT OF THE PUNJAB

CONSULTANCY SERVICES FOR ENGINEERING, PROCUREMENT AND CONSTRUCTION MANAGEMENT (EPCM) FOR PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM

(Wastewater Treatment Plant, Zone-1, Sahiwal City)

GEOTECHNICAL INVESTIGATION DATA

December 2019



Geotechnical & Geoenvironmental Engineering Division
NESPAK House, 1-C, Block N, Model Town Extension, Lahore

Email: geotech@nespak.com.pk; Tel: 042-99090000, Ext. 409/442/3017; Fax: 042-99231950

CONSULTANCY SERVICES FOR ENGINEERING, PROCUREMENT AND CONSTRUCTION MANAGEMENT (EPCM) FOR PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM

(Wastewater Treatment Plant, Zone-1, Sahiwal City)

GEOTECHNICAL INVESTIGATION DATA

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As per geotechnical investigations data, composite liner should be used for the construction of wastewater treatment plant to control leakage/migration of contaminants from the impoundment into the underlying soil/groundwater. The components of composite liner are:

- a) Compacted soil liner
- b) Geomembrane (HDPE)
- c) Protective soil cover

Compacted Soil Liner:

The compacted soil liner shall be placed at the bottom and on side slopes of the ponds. The material suitable to be used for compacted soil liner shall meet the following specifications:

Vertical in-situ hydraulic conductivity in compacted state $\leq 1 \times 10^{-7}$ cm/sec Fines (particles passing 0.075 mm sieve) $\geq 30 \%$ Plasticity index = 8-30 % Gravels (particles passing 75 mm sieve and retaining 4.75 mm sieve) $\leq 20 \%$ Maximum particle size $\leq 10 \text{ mm}$

During current geotechnical investigations, thirteen (i.e. two onsite and eleven borrow area) soil samples were collected to check their suitability for compacted soil liner. Location of onsite and borrow area investigation points are attached herewith as *Appendix - A*. Laboratory test results indicated that tested soil samples (collected from TP-1, TP-6, BA-1, BA-2, BA-6, BA-8 & BA-10) have characteristics as per requirement as stated above. Therefore, material from these sources can be used as lining material.

Soft soil / fill material, if encountered during construction of treatment plants, it should be excavated and removed completely. The exposed surface should be compacted to at least 90 % of the maximum modified Proctor dry density at \pm 2 % of optimum moisture content.

The compacted soil liner shall be placed at the bottom and on side slopes of the ponds and shall have a minimum thickness of 600 mm and shall meet the material specifications mentioned above. The soil liner shall be placed in layers with maximum compacted layer thickness of 150 mm and compacted to at least 90 percent of the maximum modified Proctor dry density or 95 percent of the maximum standard Proctor dry density at 2 to 3 % wet of optimum moisture content.

After the placement of each layer, it shall be inspected and tested to ascertain compliance with specifications, including dry density, moisture content, hydraulic conductivity, etc. by an independent laboratory and Engineer's approval must be taken before laying the next layer.

Geomembrane (HDPE Liner):

High density polyethylene, HDPE Liner having minimum thickness of 60 mils (60/1000 inches) shall be placed over the compacted soil liner. HDPE liner must cover the entire area of earth material that would be in contact with the treated or stored effluent.

HDPE liners shall be installed according to the manufacturer's recommendations, with particular emphasis on seaming, and QA/QC.

Protective Soil Cover:

HDPE Liner is required to be covered immediately after placement. The HDPE Liner shall be covered by at least 300 mm thick cover of soil to prevent puncture by equipment and to protect it from degradation by ultraviolet light. The on-site / borrow area fine grained soils classified as ASTM class CL (Lean Clay), free of any objectionable material, can be used in the construction of protective soil cover.

The protective soil cover shall be placed in layers with maximum compacted layer thickness of 150 mm and compacted to at least 90 percent of the maximum modified Proctor dry density at 2% of optimum moisture content. Place protective soil cover within 24 hours after placement of the HDPE Liner to minimize the potential for damage from various sources, including precipitation, wind, and ultraviolet light exposure.

The Environmental Protection Agency (EPA) requires the highest level of supervision, i.e. Level 1 supervision for clay-lined waste stabilization ponds. It means that all the earth work operations must be continuously supervised and tested by people specializing in these kinds of works.

Treatment Plant / Pond Embankment:

A side slope of 3H: 1V may be considered during the construction of pond embankment

Interior slopes must be kept free of vegetation that could cause liner damage. Trees must not be allowed to grow either in the base or on the banks of the pond. However, interior slopes should be protected by low growing grass above the water line to withstand erosion.

APPENDICES

• APPENDIX-A:

GEOTECHNICAL INVESTIGATION PLAN & LOCATION PLAN OF BORROW AREAS

• APPENDIX-B:

BOREHOLE, TESTPIT LOGS & FIELD PERMEABILITY TEST RESULTS

• APPENDIX-C:

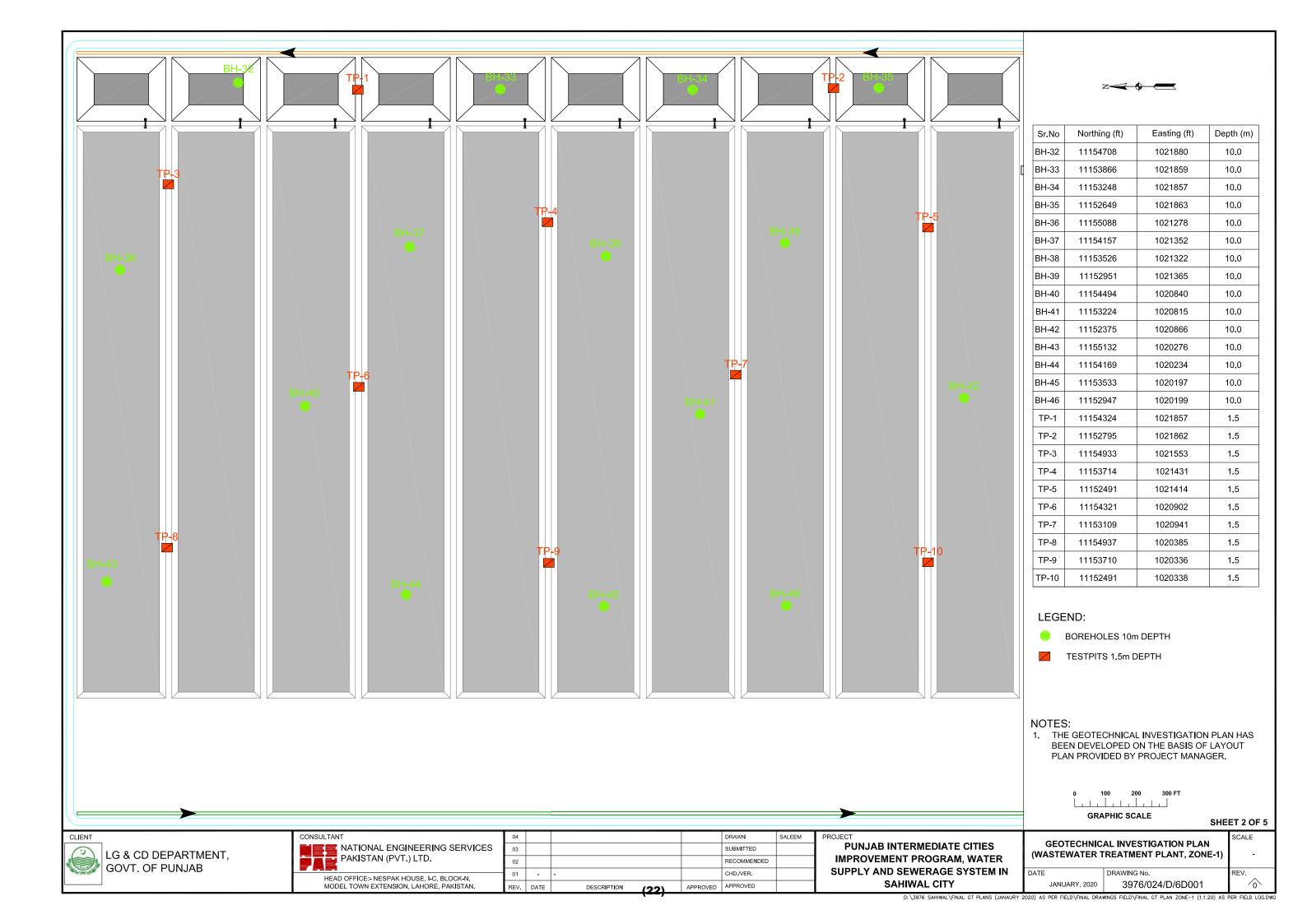
SUMMARY OF LABORATORY TEST RESULTS & DETAILED RESULT SHEETS

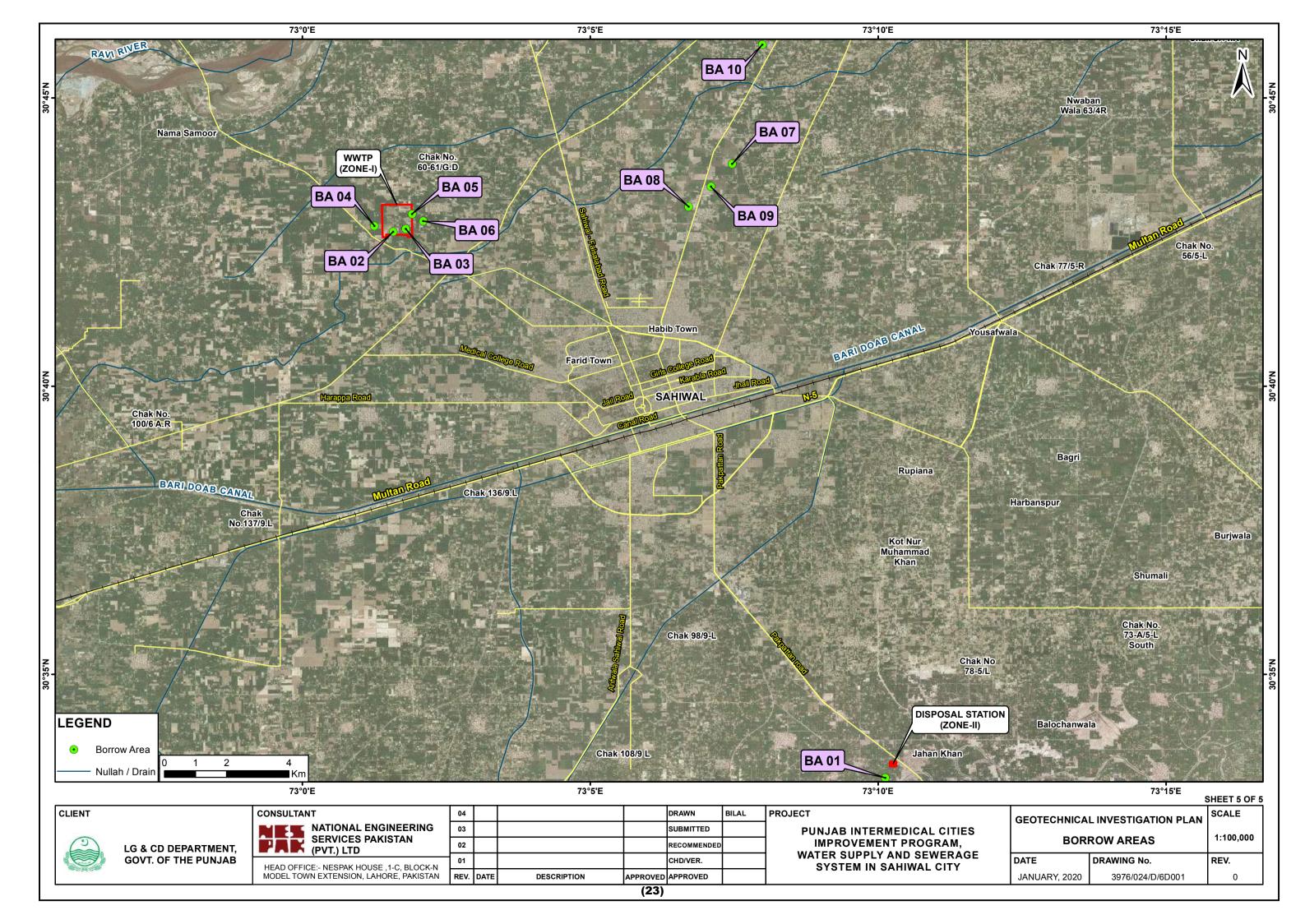
• APPENDIX-D:

REFERENCE FOR LINING MATERIAL

APPENDIX-A

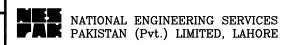
GEOTECHNICAL INVESTIGATION PLAN LOCATION PLAN OF BORROW AREAS





APPENDIX-B

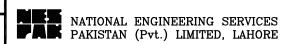
BOREHOLE, TESTPIT LOGS & PERMEABILITY TEST RESULTS



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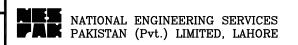
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_		//	ML			
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	SPT-7					φ 13
	SPT-8					• 8
	SPT-9					
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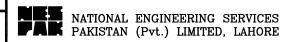
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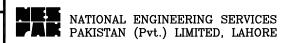
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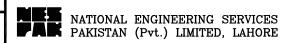
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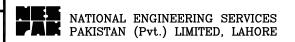
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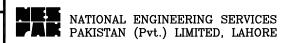
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Site Ir	ncharge _		M.ARIF	SYSTEM IN SAHIWAL CITY Client LG & CD DEPARTMENT, GOVT. OF PUN.	JAB Con	tractor	M/S	SAFE SERVI	CES
Туре	of boring							NOT ENCOU	NTERED
Coord	linates _		99787 m 1308 m	Ground Elevation164.01 m	Date	e <u>29-1</u>	0-2019	To <u>29-</u>	10-2019
o Depth o (m)	Sample No.	Legend	USCS Symbol	Description of Material	Dia of Casing/ Hole	10 \rangle	N.M.C. 70.8% Solution (1.00	0 0	Remarks
				Brown, SILT, low plastic, low to medium dry strength, trace roots, moist.	1				<u> </u>
	ODT 4	//	ML	trace roots, moist.					·
	SPT-1			Brownish grey, very loose to loose, SANDY SILT, non plastic, trace mica, moist.		φ 3			- - - -
2.0 ·	SPT-2					• 6			- - - - -
3.0	SPT-3					• 5			: : : : : : :
- - - - - - - - - -	SPT-4	/ / / / / /				• 4			:
 5.0 	SPT-5	77 77 77	ML		— Ø 100 mm —	• 6			——————————————————————————————————————
	SPT-6					• 6			— : : : : - : :
	SPT-7					6 8			
	SPT-8					• 6			
	SPT-9					6 8			——————————————————————————————————————
 _ _ _ _ 10.0	SPT-10	//		BOTTOM OF BO RSO) OLE		13			- - - -



 BOREHOLE NO.
 BH-38

 SHEET
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 OF
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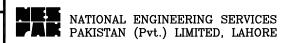
Job N	o. :	3976	Pro	PUNJAB INTERMEDIATE CITIES I pject PROGRAM, WATER SUPPLY AN	MPROVEMENT		ion			WV	VTP (Z	ONE-	1)
I				SYSTEM IN SAHIWAL Client LG & CD DEPARTMENT, GC	CITY								
I	_				-								
Coord	linates _		99595 m 1299 m	Ground Elevation	165.35 m	_ Date	_	27-1	0-20	19	_To _	27-	-10-2019
							P.L		1	V.M.C		L.L.	
£ _	No.	pu	85 <u>o</u>			Dia of Casing/ Hole	∇	10	20	x Se	3 5		
Depth (m)	Sample No.	Legend	USCS Symbol	Description of Material		Dia sing/				Blows/3			Remarks
0.0	ιχ					ပိ	10	20	30 4	02 22	8 2 8	100	
		+		Brown, SILT, low plastic, trace roots, moi	st.	4							
		+ + +											_
_		+ +											_
1.0	SPT-1			Grey, very loose to loose, fine grained, S	ILTY SAND		φ4						-
E			SM	with CLAY, trace concretion, moist.									
			OW										
2.0	SPT-2	/		Grey, loose, fine grained, poorly graded s	CAND with		9 5						
E				SILT, trace concretions, trace mica, mois									
							$\ \ $						
3.0	SPT-3							3					
													_ _ _
	SPT-4												
4.0 	0114												
E						 Eu							_
5.0 	SPT-5					100 mm		9					- -
E			SP-SM			0							
													_
6.0	SPT-6							10					<u>-</u> -
_													
	SPT-7							11					
													_ _ _
								\setminus					<u>-</u> -
E 8.0	SPT-8	1											_
E 0.0								φ 17					
Ē.													<u> </u>
E	ODT 0												_ _ _
9.0 	SPT-9							12					
								$\setminus \mid$					_
				BULLUM UE BUBERU	_								_ _ _
10.0	SPT-10	1		BOTTOM OF BO RSH) OL	L	1		1	9				_



 BOREHOLE NO.
 BH-39

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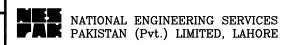
Job N	o	3976	Pro	PUNJAB INTERMEDIATE CIT PROGRAM, WATER SUPPLY	IES IMPROVEMEN Y AND SEWERAGE	IT Locat		wwt	P (ZONE-1)
				SYSTEM IN SAHIV Client LG & CD DEPARTMENT	VAL CITY					
Туре	of boring		HANI	D AUGER Drilling Fluid	-	_ Grou	nd Water De	pth <u>NC</u>	T ENCOU	NTERED
Coord	linates _		99510 m 1462 m	Ground Elevation	164.81 m	_ Date	26-10-2	<u>2019</u> T	o <u>26</u> -	10-2019
						-	P.L.	N.M.C.	L.L.	
£ (o No.	pu	8. <u>l</u>			of 'Hole	0 €	x 03 08	40	
Depth (m)	Sample No.	Legend	USCS Symbol	Description of Materi	ial	Dia of Casing/ Hole		Blows/30c		Remarks
0.0	Ø					ඊ 	30 5	9 6 6 6	90 100	
		+ _ +		Brown, SILTY CLAY, low plastic, tra	ce roots, trace	4				
_		+ + +		concretions, moist.						- - —
		+ +								- - -
1.0	SPT-1			Grey, very loose to medium dense, f	ine grained,		φ 3			<u> </u>
E				SILTY SAND, trace mica, moist.						- - -
		1								- - -
2.0	SPT-2						4 3			- -
										- - -
E										
3.0	SPT-3						9 6			<u>-</u>
										_ _ _
_										 _ _
4.0	SPT-4						Φ6			- -
										_ _ _
										<u>-</u> -
5.0	SPT-5					100 mm	Φ 7			_ _
						Ø 100				
			SM							<u>-</u> -
	SPT-6	/								_ _ _
	01 1-0						8			
										- - -
	ODT 7									- - -
7.0 	SPT-7						11			
										- -
E		/								- - -
8.0	SPT-8						9			- -
E										- - -
E										 - -
9.0	SPT-9						9 8			<u>-</u>
										_ _ _
- 10.0	SPT-10	1		BOTTOM OF BO	OLE	,	8			<u> </u>



 BOREHOLE NO.
 BH-40

 SHEET
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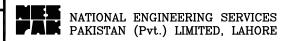
Job N	o	3976	Pro	PUNJAB INTERMEDIATE CI pject PROGRAM, WATER SUPPL	Y AND SEWERAGE			WWTP (ZONE	-1)
I				SYSTEM IN SAHI Client LG & CD DEPARTMEN	WAL CITY				
Туре	of boring		HANE	D AUGER Drilling Fluid _	-	Grou	nd Water Depth	NOT ENCO	UNTERED
Coord	inates _	N: 339	99890 m 1152 m	Ground Elevation	164.04 m	_ Date	29-10-2019	To2	9-10-2019
o.o (m)	Sample No.	Puegend	USCS Symbol	Description of Mate	rial	Dia of Casing/ Hole	∇ 0, C 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ws/30cm X O	- Remarks
- - - - -	SPT-1		SM	Greyish brown, fine grained, SILTY moist.	SAND, trace roots,				
1.0	SPT-2		SM	Greyish brown, very loose, SILT wirmica, moist.	th SAND, trace		φ 3 φ 3		
3.0	SPT-3						Ф 3		- - - - - - - - -
4.0	SPT-4			Ones leave to made have decree and	de como do d CAND		φ7		
5.0	SPT-5			Grey, loose to medium dense, poor with SILT, trace mica, moist.	ly graded SAND	——————————————————————————————————————	• 6 • 13		
- - - - - - - - - - - -	SPT-7		SP-SM				o 12		- - - - - - -
8.0 ·	SPT-8						• 10		- - - - - - -
9.0	SPT-9						o 11		- - - - - - -
E 10.0	SPT-10			BOTTOM OF BORE	HOLE	ļ	10		



 BOREHOLE NO.
 BH-41

 SHEET
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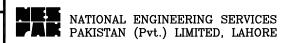
				PUNJAB INTERMEDIATE CITIES IMPROVI			ACTO (ZONE 4)
Job N				oject PROGRAM, WATER SUPPLY AND SEWE SYSTEM IN SAHIWAL CITY			
	_			Client LG & CD DEPARTMENT, GOVT. OF F D AUGER Drilling Fluid			
	linates _	N: 33	399503 m				
		E: 31	1144 m			P.L. N.M.C	. L.L.
o Depth O (m)	Sample No.	Legend	USCS Symbol	Description of Material	Dia of	<u>8</u> △ x	O O O O O O O O O O O O O O O O O O O
- - - -				Brownish grey, fine grained, SILTY SAND, trace remoist.	oots,		
_ _ _ 1.0 ·	SPT-1					φ 4	
				Grey, very loose to loose, fine grained, SILTY SAN trace mica, moist.	ND,		
2.0 - 2.0 - 	SPT-2					\$ 6	
3.0 ·	SPT-3					9	
 _ _ 4.0 · _	SPT-4					φ7	- - - - - - - - -
 5.0 · 	SPT-5		SM		— Ø 100 mm		
 _ _ 6.0 ·	SPT-6		SIVI			φ 12	
	SPT-7					9	
- - - - - - - 8.0	SPT-8	1				• 11	
9.0	SPT-9		SP-SM	Brownish grey, medium dense, poorly graded SAN with SILT, trace mica, moist.	ND	0 11	
	ODT 10			BOTTOM OF BOREANOLE			



 BOREHOLE NO.
 BH-42

 SHEET
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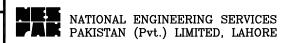
Joh N	o. :	3976	Pro	PUNJAB INTERMEDIATE CITIES IMPROVEMEN PROGRAM, WATER SUPPLY AND SEWERAGE			WWTP (ZONE-1)	
				SYSTEM IN SAHIWAL CITY Client LG & CD DEPARTMENT, GOVT. OF PUNJA	_			3
I	_			DAUGER Drilling Fluid				
Coord	linates _		99244 m 1160 m	Ground Elevation 163.65 m	_ Date	25-10-201	9 To25-10-2	.019
							.M.C. L.L.	
) th	e No.	pue	SS lod	5	Dia of Casing/ Hole	20	x 06 4 0 E	
Depth (m)	Sample No.	Legend	USCS Symbol	Description of Material	Dia		ows/30cm	emarks
0.0	S				ن ا	10 20 30 40	50 60 70 100	
		+ +		Top: Field (Cultivated Land) Brownish grey, SANDY SILT/SILTY SAND, trace	1			
		+ +		roots, moist.				
_	SPT-1	+ +						
1.0 	0111	//		Brownish grey, very loose, fine grained, SILT with	1	9 3		
				SAND, trace roots, moist.				
	CDT 0	11						
2.0 	SPT-2	//				o 2		
Ē.		//						
3.0 	SPT-3		ML			o 2		
		//						
		11						
4.0	SPT-4	//				6 3		
						$ \cdot $		
					 E			
5.0	SPT-5			Brownish grey, loose to medium dense, poorly graded	100 mm	8		
E				SAND with SILT, trace mica, moist.				
E								
6.0	SPT-6	/ ·				0 11		
E								
	SPT-7					6 8		
_								
F			SP-SM					
_ 8.0	SPT-8	, ,				0 10		
E								
_ 9.0	SPT-9							
3.0 								
10.0	SPT-10			BOTTOM OF BO RES OLE		15		



 BOREHOLE NO.
 BH-43

 SHEET
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Job N	o. :	3976	Pro	PUNJAB INTERMEDIATE CITIES IMPROVEMEN pject PROGRAM, WATER SUPPLY AND SEWERAG	NT E Loca		WWTP (ZONE-1)			
I				SYSTEM IN SAHIWAL CITY Client LG & CD DEPARTMENT, GOVT. OF PUNJ/	_					
I	_			D AUGER Drilling Fluid						
Coord	linates _		00084 m 0980 m	Ground Elevation165.32 m	Date	30-10-201	19 To <u>31-10-2019</u>			
		E: 31	0980 111			P.L. N	I.M.C. L.L.			
ے	No.	р	s lo		Dia of Casing/ Hole	7 0 2	x o			
Depth (m)	Sample No.	Legend	USCS Symbol	Description of Material	Dia c	1 1	Remarks			
	Sa		0,		Öä	SPT BI	lows/30cm 00 0 2 8 8 0 00 0 0 8 8 0 0			
0.0 -				Greyish brown, fine grained, SILTY SAND, trace roots,	1					
			SM	moist.						
1.0	SPT-1	/		Greyish brown, very loose to medium dense, fine		φ7				
				grained, poorly graded SAND with SILT, trace mica,						
				moist.						
_ 2.0	SPT-2									
	SPT-3									
3.0	0110					9				
			SP-SM							
_										
4.0 	SPT-4					þ 1 1				
E										
5.0	SPT-5							100 mm	9	
E					\ \Q_1					
6.0	SPT-6	/								
0.0				Grey, loose to medium dense, fine grained, SILTY SAND, trace mica, moist.		$ \parallel \parallel \parallel \parallel $				
_				OAND, trace mica, most.						
E	CDT 7									
7.0 	SPT-7					10				
		7								
8.0	SPT-8		SM			4 15				
E										
F										
_ 9.0	SPT-9					φ 14				
E 10.0	SPT-10			BOTTOM OF BO RS OOLE		21				



 BOREHOLE NO.
 BH-44

 SHEET
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Job N	0.	3976	Pro	PUNJAB INTERMEDIATE CITIES IMPROVEME Diect PROGRAM, WATER SUPPLY AND SEWERAGE			WWTP (ZONE-1)
Site Ir	ncharge _	1	NAUMAN	SYSTEM IN SAHIWAL CITY Client LG & CD DEPARTMENT, GOVT. OF PUN.	_ <u>JAB</u> Cor	ntractor	M/S SAFE SERVICES
Туре	of boring		HANE	DAUGER Drilling Fluid	Gro	ound Water Dep	th NOT ENCOUNTERED
Coord	linates _		99791 m 0967 m	Ground Elevation165.54 m	Dat	e <u>30-10-20</u>	19 To <u>30-10-2019</u>
o Depth o (m)	Sample No.	Legend	USCS Symbol	Description of Material	Dia of Casing/ Hole	SPT E	N.M.C. L.L. 0 00 00 00 00 00 00 00 00 00
	SPT-1		CL-ML	Light brown, SILTY CLAY, low plastic, trace roots, moist.			
1.0 · 			CL-ML	Brown, soft, SILTY CLAY, low plastic, medium dry strength, trace fine sand, moist.		φ 3	
2.0 ·	SPT-2			Brownish grey, loose to medium dense, poorly graded SAND with SILT, fine grained, trace concretions, trace mica, moist.		6	
3.0	SPT-3					• 11	
- 	SPT-4					• 10	
5.0 5.0 	SPT-5				Ø 100 mm	o 11	
- 	SPT-6		SP-SM			• 11	
- - - - - - - - - -	SPT-7					o 12	
- - - - - - - - - -	SPT-8					o 11	
- - - - - - - - -	SPT-9					• 9	
_ 10.0	SPT-10			BOTTOM OF BO RSH OLE		10	

	NATIONAL	ENGINEERING	SERVICES
Pak	PAKISTAN	(Pvt.) LIMITED	, LAHORE

 BOREHOLE NO.
 BH-45

 SHEET
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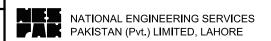
Job N	o	3976	Pro	PUNJAB INTERMEDIATE C	LY AND SEWERAGE			CHAK 66	6/G.D (W	WTP 2	ZONE-1)
Site Ir	ncharge _		M.ARIF	SYSTEM IN SAF Client LG & CD DEPARTME	IIWAL C I TY NT, GOVT. OF PUNJA	B Contr	ractor	M/	S SAFE	SERV	ICES
Туре	of boring		HANE	DAUGER Drilling Fluid	_	_ Grou	nd Water	Depth _	NOT E	NCOU	INTERED
Coord	linates _		99597 m	Ground Elevation	165.63 m	_ Date	29-1	0-2019	To	29-	10-2019
		E: 31	0956 m				P.L.	N.M.		L.L.	
			_			ole	∇	Х		0	
Depth (m)	Sample No.	Legend	USCS Symbol	Description of Mat	erial	Dia of sing/ H	10	50		!	Remarks
	Sam	Le	⊃ &			Dia of Casing/ Hole		PT Blows			
0.0							10	30 40 50	0 0 0 8	90	_
_				Brown, SILTY CLAY, low to mediu dry strength, trace roots, moist.	ım plastic, medium	Ť					_ _ _
			CL-ML								<u>-</u>
_	0.D.T. 4									-	_ _
1.0	SPT-1			Brown, very soft to firm, LEAN CL	AY, low to medium		9 2				_ -
				plastic, medium dry strength, trace	e concretion, moist.						_ _ _
											
_ 2.0	SPT-2		CL				06				_ _
											_ _ _
	UDS-1										_ (She ll by)
	0.07.0										UDS-1 2.50-
3.0	SPT-3			Brown, loose, SANDY SILT, non բ	plastic, low dry		6				3.00m – depth
		7.1		strength, trace concretion, moist.	·						_ _ _
		11									
_ 4.0	SPT-4		ML								_
		//									 _ _
		11									<u>-</u> -
E	0DT 5	//				ШШ					_ _
5.0 	SPT-5			Brownish grey, loose to medium o	lense, fine grained,	100 mm	9				 =
E				poorly graded SAND with SILT, tra	ace mica, moist.	0					_ _ _
_ 6.0	SPT-6										_ _
											_ _ _
_											- -
	ODT 7										_ _ _
7.0 	SPT-7						þ 12				
E			SP-SM								_ _ _
			SF-SIVI								
E8.0	SPT-8						Q 12				_
E											_ _ _
											_
E	SPT-9										_ _ _
9.0 	<u> </u>							3			 _ _
_											_
E			,								_ _
E 10.0	SPT-10	1		BOTTOM OF BOR	8) OLE	ų.	17				_

	NATIONAL	ENGINEERING	SERVICES
Pak	PAKISTAN	(Pvt.) LIMITED	, LAHORE

 BOREHOLE NO.
 BH-46

 SHEET
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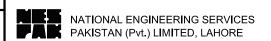
Job N	0	3976	Pro	PUNJAB INTERMEDIATE C pject PROGRAM, WATER SUPP			ion CHAK 66	i/G.D (WWTP ZONE-1)			
				SYSTEM IN SAH	IWAL CITY		Contractor M/S SAFE SERVICES				
	_			D AUGER Drilling Fluid							
	linates		99418 m								
00010			0957 m	Ground Elevation	100100 111	Date	00 10 2010	1000 10 2010			
Oepth O (m)	Sample No.	Legend	USCS Symbol	Description of Mate	erial	Dia of Casing/ Hole	Sh 4 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	© 0 Remarks			
	SPT-1		CL-ML	Brown, SILTY CLAY, low to mediu dry strength, trace roots, moist.	m plastic, medium		9 2				
	SPT-2		CL-ML	Brown, very soft, SILTY CLAY, low high dry strength, moist.	to medium plastic,						
2.0 · 	<u> </u>			Brown, very soft, LEAN CLAY, me dry strength, moist.	dium plastic, high		Q 2				
3.0 ·	SPT-3		CL				7				
_ 4.0	SPT-4						18				
5.0	SPT-5			Grey, medium dense, fine grained mica, moist.	, SILTY SAND, trace	– Ø 100 mm ————	o 12				
6.0	SPT-6						o 12				
	SPT-7		SM				9 19				
8.0	SPT-8 SPT-9						ф 1 3				
9.0	OT 1-0			BOTTOM OF BO RS	igh OLE		• 11				



 Test Pit No.
 TP-01

 Sheet
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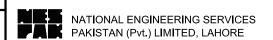
Job N	o	3976	Proje	PUNJAB INTERMEDIATE CITIES IMPR PROGRAM, WATER SUPPLY AND SE SYSTEM IN SAHIWAL CITY	WERAG		Location	ı	WWT	P (ZONE	≣-1)
Site Ir	ncharge ₋		NOUMAN	Client LG & CD DEPARTMENT, GOV		JNJAB (Contract	tor	M/S S	AFE SEI	RVICES
Coord	inates		99838 m 1462 m	Ground Elevation 164.4	64.41 m Date02-11-2019 TO 02-11-2019					11-2019	
						Field De	ensity est	Lab. De	ensity est		
Depth in meter	Elevation in meter	Legend	USCS Symbol	DESCRIPTION OF MATERIAL	Sample Type/No.	Dry Density kN/m ³	Moisture Content %	Max. Dry Density kN/m ³	Optimum m.c. %	Inplace % Compaction	REMARKS
0.0 		///	ML	Brown, SILT, low plastic, trace fine sand, trace clay, trace roots, moist.	•						
 0.5 				Brown, SILT, low plastic, low dry strength, trace to few fine sand, moist.							
			ML		FDT-1	15.7	6.7	_	-	-	
			CL	Brown, LEAN CLAY, medium plastic, medium dry strength, moist.	- CS-1						
				BOTTOM OF TESTPIT							
				(40)	1						



Test Pit No. <u>TP-02</u>
Sheet <u>1</u> OF <u>1</u>

TESTPIT I OG

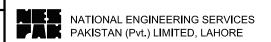
PUNJAB INTERMEDIATE CITIES IMPROVEMENT 3976 Project PROGRAM, WATER SUPPLY AND SEWERAGE Location WWTP (ZONE-1) SYSTEM IN SAHIWAL CITY NOUMAN Client LG & CD DEPARTMENT, GOVT. OF PUNJAB Contractor M/S SAFE SERVICES Site Incharge _ N: 3399372 m 164.68 m Date 02-11-2019 TO 02-11-2019 ____ Ground Elevation _____ Coordinates E: 311464 m Lab. Density Field Density Test **DESCRIPTION OF MATERIAL REMARKS** Max. Dry Density kN/m ³ Brown, SILT, low plastic, trace clay, trace ML Brown, SILT, low plastic, low dry strength, trace roots, moist. 0.5 FDT-1 16.3 2.5 ML 1.0 Brownish grey, fine grained, SILTY SAND, trace mica, moist. CS-1 SM 1.5 **BOTTOM OF TESTPIT** (41)



Test Pit No. <u>TP-03</u>
Sheet <u>1</u> OF <u>1</u>

TESTPIT I OG

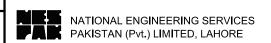
PUNJAB INTERMEDIATE CITIES IMPROVEMENT 3976 Project PROGRAM, WATER SUPPLY AND SEWERAGE Location WWTP (ZONE-1) SYSTEM IN SAHIWAL CITY NOUMAN Client LG & CD DEPARTMENT, GOVT. OF PUNJAB Contractor M/S SAFE SERVICES Site Incharge _ N: 3400023 m 164.81 m Date 02-11-2019 TO 02-11-2019 ____ Ground Elevation _____ Coordinates E: 311369 m Lab. Density Field Density Test **DESCRIPTION OF MATERIAL REMARKS** Depth in meter Max. Dry Density kN/m ³ JSCS Symbol Brown, SILT, low plastic, low to dry strength, trace clay, trace fine sand, moist. FDT-1 15.2 13.1 ML 0.5 1.0 Greyish brown, fine grained, SILTY SAND, moist. SM 1.5 **BOTTOM OF TESTPIT** (42)



 Test Pit No.
 TP-04

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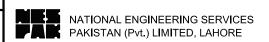
	0	070		PUNJAB INTERMEDIATE CITIES IMPR					\ A /\ A /\	'D /70NI	= 4)
Job N	o. <u>3</u>		Proje	SYSTEM IN SAHIWAL CITY	,						
Site In	charge _		NOUMAN	Client LG & CD DEPARTMENT, GOV	T. OF PL	JNJAB (Contract	or	M/S S	AFE SEI	RVICES
Coord	inates		99652 m 1332 m	Ground Elevation 165.0	Ground Elevation165.05 m Date03-11-20			1-2019	TO 03-	11-2019	
						Field De	ensity est	Lab. De	ensity est		
Depth in meter	Elevation In meter	Legend	USCS Symbol	DESCRIPTION OF MATERIAL	Sample Type/No.	Dry Density kN/m ³	Moisture Content %	Max. Dry Density kN/m 3	Optimum m.c. %	Inplace % Compaction	REMARKS
 0.0 		//,	ML	Brown, SILT, low plastic, trace clay, trace roots, moist.							
0.5			ML	Light brown, SILT with SAND, non plastic to low plastic, trace roots, moist.	CS-1						
_ 1.5		//	CL-ML	Brown, SILTY CLAY, low to medium plastic, low to medium dry strength, moist.	FDT-1	14.0	21.9	-	-	-	
				BOTTOM OF TESTPIT							



 Test Pit No.
 TP-05

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l doL	No	3976	Proje	PUNJAB INTERMEDIATE CITIES IMPR PROGRAM, WATER SUPPLY AND SE SYSTEM IN SAHIWAL CITY	WERAG	NT BE I	_ocation		WWT	P (ZONE	E-1)
Site	ncharge _.		NOUMAN	Client LG & CD DEPARTMENT, GOV		JNJAB (Contract	or	M/S S	AFE SEI	RVICES
Coor	dinates		99279 m 1327 m	Ground Elevation 164.8	4 m	[Date	02-1	1-2019	TO 02-	11-2019
						Field De	ensity est	Lab. De	ensity est		
Depth in meter	Elevation in meter	Legend	USCS Symbol	DESCRIPTION OF MATERIAL	Sample Type/No.	Dry Density kN/m ³	Moisture Content %	Max. Dry Density kN/m ³	Optimum m.c. %	Inplace % Compaction	REMARKS
0.0 			SM	Grey, fine grained, SILTY SAND, trace roots, moist.							
0.5 0.5 		// / / / / / / / / / / / / / / / / / /	ML	Brownish grey, fine grained, SANDY SILT with GRAVEL, trace mica, moist.	- CS-1						
 1.0 		1 1			FDT-1	16.9	5.2	16.5	16	102	<u> </u>
 _ _			CL-ML SM	Brown, SILTY CLAY, low to medium plastic, medium dry strength, moist. Greyish brown, fine grained, SILTY SAND,	-						
1.5				Trace mica, moist. BOTTOM OF TESTPIT							
- - - - -				(44)							



 Test Pit No.
 TP-06

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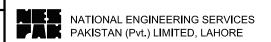
PUNJAB INTERMEDIATE CITIES IMPROVEMENT Job No. 3976 Project PROGRAM, WATER SUPPLY AND SEWERAGE Location WWTP (ZONE-1) SYSTEM IN SAHIWAL CITY												
Site Incharge		NOUMAN		Client LG & CD DEPARTMENT, GOVT. OF PUNJAB		NJAB (B Contractor M/S SAFE SERVICES				RVICES	
Coordinates		N: 3399837 m E: 311171 m		Ground Elevation 164.41 m		[Date	03-1	1-2019	TO 03-1	11-2019	
							Field Density Test		Lab. Density Test			
Depth in meter	Elevation in meter	Legend	USCS Symbol	DESCRIPTION OF MATERIAL		Sample Type/No.	Dry Density kN/m ³	Moisture Content %	Max. Dry Density kN/m ³	Optimum m.c. %	Inplace % Compaction	REMARKS
0.0 		//	ML	Light brown, SILT, low plastic, trace clay, trace roots, moist.								
			ML	Light brown, SANDY SILT, non plastic, tr roots, moist.	ace							
0.5 				Brown, LEAN CLAY, medium plastic, lo medium dry strength, trace roots, moist.		- CS-1						
1.0 1.0 			CL		<u>F</u>	DT-1	14.0	24.8	-	-	-	
			SM	Greyish brown, SILTY SAND, fine grain trace mica, moist.	ed,	•						
- - - - -				BOTTOM OF TESTPIT								
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 Test Pit No.
 TP-07

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Job No	O	3976	Proje	PUNJAB INTERMEDIATE CITIES IMP ect PROGRAM, WATER SUPPLY AND S	SEWERAG		Location		WWT	P (ZONE	≣-1)
Site In	charge		NOUMAN	SYSTEM IN SAHIWAL CIT Client LG & CD DEPARTMENT, GC		JNJAB	Contract	or	M/S S	AFE SEF	RVICES
Coordinates		N: 3399468 m E: 311183 m		Ground Elevation 164.	Ground Elevation 164.07 m		Date	03-1	1-2019	TO 03-1	11-2019
						Field D	ensity est		Lab. Density Test		
Depth in meter	Elevation In meter	Legend	USCS Symbol	DESCRIPTION OF MATERIAL	Sample Type/No.	Dry Density kN/m ³	Moisture Content %	Max. Dry Density kN/m 3	Optimum m.c. %	Inplace % Compaction	REMARKS
0.0 			CL-ML	Brown, SILTY CLAY, low to medium plastic, medium dry strength, trace roots, moist.							
0.5			SP-SM	Grey, fine grained, poorly graded SAND with SILT, trace mica, trace concretions, moist.	- CS-1						
- 1		0			FDT-1	16.5	5.3	16.6	16	100	
				BOTTOM OF TESTPIT							
_				(46)							

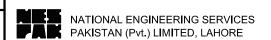


 Test Pit No.
 TP-08

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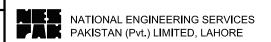
TESTPIT LOG

		070		PUNJAB INTERMEDIATE CITIES IMPR					\ A (\ A (\ \	D /70NE	- 4)
Job N	03			ct PROGRAM, WATER SUPPLY AND SE SYSTEM IN SAHIWAL CITY						P (ZONE	
Site In	ncharge _		NOUMAN	Client LG & CD DEPARTMENT, GOV	T. OF PU	NJAB (Contract	or	M/S S	AFE SEF	RVICES
Coord	inates		00025 m 1013 m	Ground Elevation 165.1	1 m	[Date	03-1	1-2019	TO 03-	11-2019
						Field De	ensity est	Lab. De			
Depth in meter	Elevation In meter	Legend	USCS Symbol	DESCRIPTION OF MATERIAL	Sample Type/No.	Dry Density kN/m ³	Moisture Content %	Max. Dry Density kN/m 3	Optimum m.c. %	Inplace % Compaction	REMARKS
0.0 		///	ML	Brown, SILT, trace clay, low plastic, trace roots, moist.							
0.5 			SP-SM	Grey, fine grained, poorly graded SAND with SILT, trace mica, moist.	FDT-1	4.6	16.9	15.7	18	108	
 1.5											
				BOTTOM OF TESTPIT							



TESTPIT I OG

PUNJAB INTERMEDIATE CITIES IMPROVEMENT PROGRAM, WATER SUPPLY AND SEWERAGE __ Project __ __ Location ____ WWTP (ZONE-1) SYSTEM IN SAHIWAL CITY Client LG & CD DEPARTMENT, GOVT. OF PUNJAB Contractor ______M/S SAFE SERVICES Site Incharge _ NOUMAN N: 3399651 m 165.48 m Date <u>03-11-2019 TO 03-11-2019</u> ____ Ground Elevation _____ Coordinates E: 310998 m Lab. Density Field Density Test **DESCRIPTION OF MATERIAL REMARKS** Max. Dry Density kN/m ³ JSCS Symbol Brown, SILTY CLAY, low to medium plastic, medium dry strength, trace roots, moist. CL-ML 0.5 Light brown, LEAN CLAY, medium plastic, few fine sand, moist. 1.0 S-1 CL FDT-1 15.0 11.6 19.2 12.3 1.5 **BOTTOM OF TESTPIT** (48)

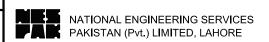


 Test Pit No.
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TESTPIT LOG

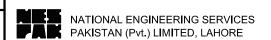
Job N		976	Proje	PUNJAB INTERMEDIATE CITIES IMPR ect PROGRAM, WATER SUPPLY AND SE			Location		\ \ /\ \ /T	D (70NI	= 1\
300 14	J	1310	FIOJE	SYSTEM IN SAHIWAL CITY	•						
Site In	charge _		NOUMAI	Client LG & CD DEPARTMENT, GOV	T. OF PL	JNJAB	Contract	or	M/S S	AFE SE	RVICES
Coord	inates		99279 m 0999 m	Ground Elevation 165.2	9 m		Date	02-1	1-2019	TO 02-	11-2019
							Density Test	Lab. De	ensity est		
Depth in meter	Elevation in meter	Legend	USCS Symbol	DESCRIPTION OF MATERIAL	Sample Type/No.	Dry Density	Moisture Content %	Max. Dry Density kN/m ³	Optimum m.c. %	Inplace % Compaction	REMARKS
Ost Depth i	Elevation meter me	Duages	SOSI ORING	Brown, SILTY CLAY, low to medium plastic, medium dry strength, trace roots, moist. Light brown, SANDY SILT, trace mica, moist. Brown, SILT, low plastic, low dry strength, trace clay, moist. BOTTOM OF TESTPIT	ndmeS FDT-1		Working State of the Courter of the	Max. D Pensity I	Optimu " " " " " " " " " " " " " " " " " " "	Inplace % Com	
				(40)							



Test Pit No. <u>BA-01</u>
Sheet <u>1</u> OF <u>1</u>

TESTPIT LOG

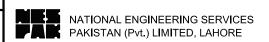
lak Ni	_ 2	076	Due!e	PUNJAB INTERMEDIATE CITIES IMPRI	OVEME		1 4:		^ ^ D ^ DI	IALIANI	KUANI
				PROGRAM, WATER SUPPLY AND SE SYSTEM IN SAHIWAL CITY							
Site In	charge _		NOUMAN	Client LG & CD DEPARTMENT, GOVT	OF PU	INJAB_	Contract	or	M/S S	AFE SEI	RVICES
Coord	inates		31531 m 1351 m	Ground Elevation			Date	08-1	1-2019	TO 08-	11-2019
		T T				Field D) anaih	Lab. De	ancity.		
							est		est		
	드			DESCRIPTION OF MATERIAL	_				_	action	REMARKS
Depth in meter	Elevation In meter	Legend	USCS Symbol		Sample Type/No.	Dry Density KN/m ³	Moisture Content %	Max. Dry Density kN/m ³	Optimum m.c. %	Inplace % Compaction	
0.0	ш с			Brown, LEAN CLAY, medium plastic, medium	07 F		20	202	0 =	= 8	
_				dry strength, moist.		-					<u> </u>
			CL								_
0.5 			CL		BS-1⊤						
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_ _ 0.90		1/4			,						<u> </u>
				BOTTOM OF TESTPIT							
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Test Pit No. <u>BA-02</u>
Sheet <u>1</u> OF <u>1</u>

TESTPIT I OG

PUNJAB INTERMEDIATE CITIES IMPROVEMENT 3976 Project PROGRAM, WATER SUPPLY AND SEWERAGE Location CHAK 66/4 D-WWTP SYSTEM IN SAHIWAL CITY NOUMAN Client LG & CD DEPARTMENT, GOVT. OF PUNJAB Contractor M/S SAFE SERVICES Site Incharge __ N: 3399276 m _____ Date _____ 08-11-2019 TO 08-11-2019 ____ Ground Elevation ___ Coordinates E: 310996 m Lab. Density Field Density Test DESCRIPTION OF MATERIAL **REMARKS** Depth in meter Max. Dry Density kN/m 3 Moisture Content % JSCS Symbol Brown, LEAN CLAY, low to medium plastic, low to medium dry strength, moist. CL 0.5 BS-1 - 1.0 **BOTTOM OF TESTPIT** (51)

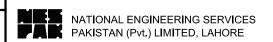


 Test Pit No.
 BA-03

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TESTPIT I OG

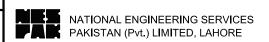
				PUNJAB INTERMEDIATE CITIES IMPR		NT					
Job No	o	3976	Proje	ct PROGRAM, WATER SUPPLY AND SE SYSTEM IN SAHIWAL CITY	WERAG		Location		CHAK (66/4 D-W	WTP
Site In	charge		NOUMAN	Client LG & CD DEPARTMENT, GOV		NJAB (Contract	or	M/S S	AFE SEI	RVICES
Coordi	inates	N: 339	99359 m	Ground Elevation			Date	08-1	1-2019	TO 08-	11-2019
000101	inatos		1352 m	Ground Elevation				00 1	1 2010	10 00	11 2010
						Field D	ensity est	Lab. De	ensity est		
				DESCRIPTION OF MATERIAL		''	251		331	<u></u>	REMARKS
r n	Elevation in meter	pu	9 <u>l</u> od	DESCRIPTION OF MATERIAL	Sample Type/No.	sity 3	ture ent %	Dry 13 S	unu %	Inplace % Compaction	KLWAKKS
Depth in O meter	Eleva	Pegend	USCS		Sam	Dry Density kN/m ³	Moisture Content %	Max. Dry Density kN/m ³	Optimum m.c. %	Inpla Co	
0.0 				Brown, LEAN CLAY, medium plastic, medium dry strength, moist.							
_			CL		A						<u> </u>
0.5			02		BS-1						_
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Test Pit No. <u>BA-04</u>
Sheet <u>1</u> OF <u>1</u>

TESTPIT LOG PUNJAB INTERMEDIATE CITIES IMPROVEMENT

Job No	o	3976	Proje	PROGRAM, WATER SUPPLY AND SE	WERAG		_ocation	CHA	AK 66/4	NEAR S	TE AREA
Site In	charge		NOUMAI	SYSTEM IN SAHIWAL CITY Client LG & CD DEPARTMENT, GOV		INJAB (Contract	or	M/S S	AFE SEI	RVICES
Coord		N: 339	99470 m 0479 m								
						Field De	ensity est	Lab. De	ensity est		
Depth in meter	Elevation in meter	Legend	USCS Symbol	DESCRIPTION OF MATERIAL	Sample Type/No.	Dry Density kN/m ³	Moisture Content %	Max. Dry Density kN/m 3	Optimum m.c. %	Inplace % Compaction	REMARKS
_ 0.0	<u></u>	3	⊃ ω ML	Brown, SILT, low plastic, trace roots, moist.	S E		ΣΟ	2 0 2	ŌΈ	<u>""</u>	
			CL	Brown, SANDY LEAN CLAY, medium plastic, medium dry strength, moist.	BS-1						
0.5				BOTTOM OF TESTPIT	<u> </u>						
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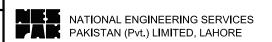


 Test Pit No.
 BA-05

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TESTPIT LOG

Job N	o3	3976	Proje	PUNJAB INTERMEDIATE CITIES IMPR PROGRAM, WATER SUPPLY AND SE SYSTEM IN SAHIWAL CITY	WERAG		_ocation	CHA	AK 66/4 I	NEAR S	TE AREA
Site Ir	ncharge _		NOUMAN	Client LG & CD DEPARTMENT, GOV	T. OF PL	JNJAB (Contract	or	M/S S	AFE SEF	RVICES
Coord	linates		99835 m 1530 m	Ground Elevation		I	Date	08-1	1-2019	TO 08-′	11-2019
						Field De	ensity est	Lab. De	ensity est		
Depth in meter	Elevation in meter	Legend	USCS Symbol	DESCRIPTION OF MATERIAL	Sample Type/No.	Dry Density kN/m ³	Moisture Content %	Max. Dry Density kN/m ³	Optimum m.c. %	Inplace % Compaction	REMARKS
0.0 		++		Brown, SILT, low plastic, trace roots, moist.							
			CL-ML	Brown, SILTY CLAY with SAND, low to medium plastic, medium dry strength, moist.	BS-1						
1.0 - - - - - - - - - 1.5			CL	Brown, LEAN CLAY, medium plastic, medium dry strength, moist.	BS-2						
1.70				BOTTOM OF TESTPIT							

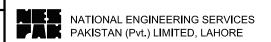


 Test Pit No.
 BA-06

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TESTPIT LOG

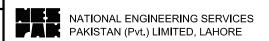
	. ^	1076	D'	PUNJAB INTERMEDIATE CITIES IMPR			00-4'-	DEF	DI ITV 14	'AL A (C'	IAK 66/4)
				PROGRAM, WATER SUPPLY AND SE SYSTEM IN SAHIWAL CITY							IAK 66/4)
Site In	charge _	ļ	NOUMAN	Client LG & CD DEPARTMENT, GOV	. OF PL	JNJAB (Contract	or	M/S S	AFE SEF	RVICES
Coordi	nates		99600 m 833 m	Ground Elevation		[Date	08-1	1-2019	TO 08-1	1-2019
						5.115		Lab. De			
						Field De	ensity est		ensity est		
	트			DESCRIPTION OF MATERIAL	نه ا		_	_	_	action	REMARKS
Depth in meter	Elevation In meter	Legend	USCS Symbol		Sample Type/No.	Dry Density kN/m ³	Moisture Content %	Max. Dry Density kN/m ³	Optimum m.c. %	Inplace % Compaction	
0.0	ш с			Brown, LEAN CLAY, medium plastic, medium	, F		20	5 C 3	0 =	= 0	
			01	dry strength, moist.	A	_					<u> </u>
			CL		BS-1⊤						
0.5					Ţ						
_ 0.6 _				BOTTOM OF TESTPIT							
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Test Pit No. <u>BA-07</u>
Sheet <u>1</u> OF <u>1</u>

TESTPIT LOG

PUNJAB INTERMEDIATE CITIES IMPROVEMENT 3976 Project PROGRAM, WATER SUPPLY AND SEWERAGE Location CHAK 88/6 R SYSTEM IN SAHIWAL CITY NOUMAN Client LG & CD DEPARTMENT, GOVT. OF PUNJAB Contractor M/S SAFE SERVICES Site Incharge __ Lat: 30.7308 Ground Elevation ______ Date ______ Date ______09-11-2019 TO 09-11-2019 Coordinates Long: 73.1244 Lab. Density Field Density Test **DESCRIPTION OF MATERIAL REMARKS** Depth in meter Sample Type/No. Max. Dry Density kN/m 3 Moisture Content % -egend USCS 0.0 Brown, SILTY CLAY, low to medium plastic, CL-ML medium dry strength, trace roots, moist. Brown, LEAN CLAY, medium plastic, medium dry strength, moist. CL BS-1 0.5 8.0 **BOTTOM OF TESTPIT** (56)

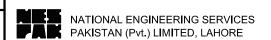


 Test Pit No.
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TESTPIT I OG

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Job No	o	3976	Proje	PUNJAB INTERMEDIATE CITIES IMPROPRIED PROGRAM, WATER SUPPLY AND SE	WERAG	N I <u>BE</u>	_ocation		RA ⁻	TT I TABI	31
Site In	charge		NOUMAN	SYSTEM IN SAHIWAL CITY N Client LG & CD DEPARTMENT, GOVT	. OF PU	JNJAB (Contract	or	M/S S	AFE SEI	RVICES
Coord	inates		0.718553 73.1118			I	Date	09-1	1-2019	TO 09-	11-2019
						Field De	ensity	Lab. De			
						Te	est	Te	est		
_	u u		_	DESCRIPTION OF MATERIAL	, 0		o +	>	E	Inplace % Compaction	REMARKS
Depth in meter	Elevation In meter	Legend	USCS Symbol	Tama Cultivated land	Sample Type/No.	Dry Density kN/m ³	Moisture Content %	Max. Dry Density kN/m ³	Optimum m.c. %	place Com	
_ 0.0	ш =	17/	CL-ML	Top: Cultivated land. Brown, SILTY CLAY, medium plastic, trace	0) -	00 2	20	2 O X	0 =	= 8	_
_		//	OL-IVIL	roots, moist. Brown, LEAN CLAY, medium plastic, medium	A	-					
				dry strength, moist.							
_ 0.5											_
_			CL		BS-1						_
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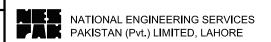


Test Pit No. <u>BA-09</u>

Sheet <u>1</u> OF <u>1</u>

TESTPIT LOG

PUNJAB INTERMEDIATE CITIES IMPROVEMENT 3976 Project PROGRAM, WATER SUPPLY AND SEWERAGE Location PATTI TABBI SYSTEM IN SAHIWAL CITY NOUMAN Client LG & CD DEPARTMENT, GOVT. OF PUNJAB Contractor M/S SAFE SERVICES Site Incharge _ Lat: 30.724351 - Date _____09-11-2019 TO 09-11-2019 ___ Ground Elevation __ Coordinates Long: 73.118289 Lab. Density Field Density Test **DESCRIPTION OF MATERIAL REMARKS** Depth in meter Sample Type/No. Max. Dry Density kN/m 3 Moisture Content % -egend USCS 0.0 Brown, SILTY CLAY, low to medium plastic, CL-ML trace roots, moist. Brown, LEAN CLAY, medium plastic, medium dry strength, moist. 0.5 CL BS-, 1.0 - 1.5 **BOTTOM OF TESTPIT** (58)



Test Pit No. <u>BA-10</u>
Sheet <u>1</u> OF <u>1</u>

TESTPIT I OG

II. NI		076	D	PUNJAB INTERMEDIATE CITIES IMPR	OVEME				CLI	AL EEG	D
				PROGRAM, WATER SUPPLY AND SE SYSTEM IN SAHIWAL CITY			Location				
Site In	charge _		NOUMAN	Client LG & CD DEPARTMENT, GOV	I. OF PU	INJAB	Contract	or	M/S S	AFE SEI	RVICES
Coord	inates		0.765520 73.1331				Date	09-1	1-2019	TO 09-	11-2019
								l -t D			
							ensity est	Lab. De	ensity est		
	드			DESCRIPTION OF MATERIAL						action	REMARKS
Depth in meter	Elevation in meter	Legend	USCS Symbol		Sample Type/No.	Dry Density KN/m ³	Moisture Content %	Max. Dry Density kN/m ³	Optimum m.c. %	Inplace % Compaction	
_ 0.0	ĒĒ		⊃ới	Brown, LEAN CLAY, medium plastic, medium	o ⊢	00 \$	ΣŎ	Z Q Z	δÉ	<u> </u>	
_				dry strength, few roots, moist.							<u> </u>
_			CL								_
0.5											
_ 											<u> </u>
_				Brown, LEAN CLAY, medium plastic, medium dry strength, moist.	†						
_ 1.0			CL		BS-1						<u> </u>
_ 1.0 _			02		ŭ						<u> </u>
_ 											
				BOTTOM OF TESTPIT							
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_ _ _				(50)							

ME	Natio	nal Engineerin	_								
<u> Pai</u>	K .		CONSTAN		PER			TEST	$\overline{}$	 	-
Name of I SAHIWA	-	ER SUPPLY AND	SANITATIO	N SECTORS		Site	Zone-1		w	ocation: astewater Tr ant	reatmen
Depth bel	ow top of cas	ing/standpipe to:				Job	No. 3976		Bo	orehole No. 3	32
	m of borehole		<u>.</u>			Date	e: 01-11-20	19	Sh	neet lofi	
·			<u>.</u>				und level: Inance datu	m)	Cr	rew/Operator	r: .
	n of casing:5.			<u>.</u>			ther: Cloud		Τε	emperature:	23 °C
<u> </u>	filter materia			•			e of test:	inflow	1		
`:	ofpiezomete			•					ing /	standpipe: 8.	2 cm
•	groundwater	.				-		<u>-</u>		Dia. of filter	
Height of	casing/standp	ipe above surface:	0. 8 0 m			Len	gth of filter	· •	TI)M	Dia. of filter	r
Elevation	of casing/star	ndpipe:	(Ordnar	nce datum)		Тур	e of piezon	eter			
Test recor	ď			<u> </u>							
Time	Time				ureme			Tlass		Head, H	q/H
	elapsed 't'	1/√t	Fall in standpipe	Internal dia. of	Volu of f		Time for flow	Flow	(4)	neau, 17	цулт
	-	Loss		standpipe	,	3、			/_>		m²/s
	hr min	in ml	(m)	(m)	(n	r)	min se	(m³.	's) 	(m)	111 /3
1036	- 1	1630									
	- 2	3050									
	- 2	3020									
	- 3	3970					İ				
	- 3	3760	^								
	- 5	5870									
	- 5	5690									
	- 5	5610									
	- 5	5600									
	- 5	5600					[
	- 5	5600_									
	41 min	49400 ml									
	71 111111	4) TOO III									

 $K = q / (F \times H_C)$, q = 20.08 cc/sec. D = 8.2 cm, $F = 2.75 \times D = 22.55$ cm $K = 1.5 \times 10^{-3}$ cm/sec.

Remarks:

National Engineering Services Pakistan (Pvt.) Limited

Name of I SAHIWA	-	ER SUPPLY AN	D SANITA	ATION SECT	ORS	Site	: Zone-1		Location: Wastewater Tr Plant	eatment
Depth bei	ow top of cas	ing/standpipe to:				Job	No. 3976		Borehole No. 3	15
	m of borehok					Date	e: 01-11 -2 019		Sheet 1 of 1	
(,							und level:		Crew/Operator	:
	m of casing:						inance datum)			
(c) top of	filter materia	il: -		·			ther: Sunny		Temperature:	28 °C
(d) centre	of piezomet	ertip: -				Тур	e of test:	inflow		
(e) initial	groundwater	level: Not end	countered			Inter	mal diameter o	of casing/	standpipe: 8.2	cm
Height of	casing/standp	pipe above surface	e: 0.10 m			Len	gth of filter:	- mm	Dia. of filter	mm
Elevation	of casing/star	ndpipe:	. (0	rdnance datu	m)	Тур	e of piezomete	er		
Test recor	rd			•				-		Ξ,
Time	Time						of flow	<u> </u>		
	elapsed 't'	1/√t	Fall in standpi	Internal dia. of	Volu of fl		Time for flow	Flow q _t	Head, H	q/H
	'	Loss	pe	standpipe			104			_
	hr min	in 1	(m)	(m)	(m	')	min sec	(m³/s)	(m)	m²/s
1701	<u>- 1</u>	ml 2660	(111)				·			
	- 2	4970								
	- 2	4800								
	- 3	6700		•						
	- 3	6410								
	- 5	9270								
	- 5	8550								
	- 5	7920]							
	- 5	7790]							
	- 5	7450								
	- 5	7200								
	- 5 - 5	7010 6840								
	- 5	6705								
	- 5	6705					,			
	- 5	6705								
	66 min	107685 ml	1							
	AO TILIE	10/003 1111								
	· .									
						. [V = - f T	I N	H = 27.10 -	oleas
									q = 27.19 c $5* D=22.59$	
	l						D - 6.2 (i	III, 1 4.7	75* D=22.55 n/sec.	Cit

Remarks:

National Engineering Services Pakistan (Pvt.) Limited CONSTANT HEAD PERMEABILITY TEST Name of Project: WATER SUPPLY AND SANITATION SECTORS Site: Zone-1 Location: Wastewater Treatment SAHIWAL CITY Borehole No. 43 Job No. 3976 Depth below top of casing/standpipe to: Date: 31-10-2019 Sheet 1 of 1 (a) bottom of borehole: 7.37 m Ground level: Crew/Operator: (Ordnance datum) (b) bottom of casing: 7.47 m Temperature: 30 °C (c) top of filter material: Weather: Sunny Type of test: inflow (d) centre of piezometer tip: Internal diameter of casing / standpipe: 8.2 cm (e) initial groundwater level:-Not encountered Length of filter: mm Dia, of filter Height of casing/standpipe above surface: 0.87 m Elevation of easing/standpipe: Type of piezometer (Ordnance datum) Test record Measurement of flow Time Time Head, H Fall in Internal Volume Time for Flow q_i elapsed 1/ √ t standpipe dia. of of flow flow standpipe Loss (m³) (m^3/s) (m) min (m) (m) min sec in ml 1036 1 1290 2 2010 2 1760 3 2240 3 2020 5 2900 5 2780 5 2660 2570 5 2520 5 2410 5 2350 5 2310 5 2300 5 2300 2300

 $K = q / (F \times H_C)$, q = 9.27 cc/sec. D = 8.2 cm, F = 2.75* D = 22.55 cm $K = 0.62*10^{-3}$ cm/sec.

g/H

 m^2/s

Remarks:

66 min

36720 ml

SAHIWA	AL CITY	TER SUPPLY AN	ID SANITA			RMEABIL ite: Zone-1		Location: Wastewater Tr Plant	eatment
Depth be	low top of car	sing/standpipe to:			Jo	ob No. 3976	•	Borehole No. 4	16
(a) botto	om of borehol	e: 4.50 m .				ate: 30-10-201	19	Sheet 1 of 1	
(b) botto	m of casing:	4.60 m				iround level: Ordnance datun	,	Crew/Operator	:
	f filter materi					/eather: Sunny	. "	Temperature:	29 °C
	e of piezomet					ype of test:	inflow	•	
	l groundwater		countered	-			of casing/	standpipe: 8.2	cm:
		pipe above surfac	e: 0.50 m			ength of filter:		Dia. of filter	
•	of casing/sta			rdnance datur		ype of piezome			
Test reco			. (-		,) F P			-
Time	Time			Me	easuremen				
	elapsed 't'	1/√ι	Fall in	Internal dia. of	Volume of flow	Time for	Flow q,	Head, H	q,/H
		Loss	standpi pe	standpipe		How			
	hr min	in m]	(m)	(m)	(m ₃)	min sec	(m³/s)	(m)	m²/s
1221	- 1	640	(111)						
	- 2	950							
	- 2	1140							
	- 3 - 3	1470					İ		
	- 5	1490 2480							
	- 5	2550							
	- 5	2325							
	- 5	2300							
	- 5	2270							
	- 5 - 5	2240 2185							
	- 5	2185							
	- 5	2120							
	- 5	2120							
	- 5	2120							
	66 min	30525 ml	1						
				.					
						75 (6	<u> </u>	<u> </u>	,
								q = 7.71 cc.	
						$\int_{K}^{D-\delta .2.0} K = 0.7$	m, F=2.7 4*10 ⁻³ cm	5* D=22.55 /sec	cin
			i			IX V.1	. IO OII	# 500.	

National Engineering Services Pakistan (Pvt.) Limited

CONSTANT HEAD PERMEABILITY TEST

Name of Project: WATER SUPPLY AND SANITATION SECTORS SAHIWAL CITY	Site: Zone-1	Location: Disposal Station
Depth below top of casing/standpipe to:	Job No. 3976	Borehole No. 47
(a) bottom of borehole: 5.75 m	Date: 03-11-2019	Sheet 1 of 1
(b) bottom of casing:5.75 m	Ground level: (Ordnance datum)	Crew/Operator:
(c) top of filter material: -	Weather: Cloudy	Temperature: 28 °C
(d) centre of piezometer tip: -	Type of test: inflow	,
(e) initial groundwater level:-	Internal diameter of cas	ing / standpipe: 8.2 cm
Height of casing/standpipe above surface: 0.25 m	Length of filter: -	mm Dia. of filter
Elevation of casing/standpipe: (Ordnance datum)	Type of piezometer	
T. of word		

Test record

Test reco	rd .								
Time	Time				surement of				
	elapsed		Fall in	Internal	Volume	Time for	Flow q _t	Head, H	q/H
	't'	1/√t	standpipe	dia. of	of flow	flow			
	hr min	Loss	(m)	standpipe (m)	(m³)	min sec	(m³/s)	(m)	m²/s
	nr min	in Lit	(111)	''''	(1117)	min sec	(111 /5)	(111)	111 /5
1450	- 1	2.200				1			
1430	- 2	3.500							
	2	2.800			l				
	- 2 - 3 - 3	4.070							
	- 3	1		İ					
		4.030							
	- 5 - 5	6.500							
	- 5	6.150				İ			
	- 5	5.300							
	- 5	5.900							
	- 5	5.950		•	[
	- 5	5.970							
	- 5	6.625							
	- 5	7.530		ļ					
	- 5	7.530							
	- 5	7.530				1	ĺ		İ
	61 min	81.585 Litre							
]							!	
		1					•		
	1					<u> </u>	1		i
	1				K	= q/(Fx)	$H_{\rm C}$), $q =$	0.223 lit	sec.
						= 8.2 cm, 1			
					K	= 1.8*10	cm/se	c.	
			1						
						,			

Remarks:



National Engineering Services Pakistan (Pvt.) Limited

CONSTANT HEAD PERMEABILITY TEST

CONSTANT HEAD.	PERMEABILITY II	<u> </u>
Name of Project: WATER SUPPLY AND SANITATION SECTORS SAHIWAL CITY	Site: Zone-1	Location: Disposal Station
Depth below top of casing/standpipe to:	Job No. 3976	Borehole No. 50
(a) bottom of borehole: 4.67 m	Date: 03-11-2019	Sheet 1 of 1
(b) bottom of casing:4.67 m	Ground level: (Ordnance datum)	Crew/Operator;
(c) top of filter material: -	Weather: Cloudy	Temperature: 29 °C
(d) centre of piezometer tip: -	Type of test: inflow	
(e) initial groundwater level:-	Internal diameter of casi	ing / standpipe: 8.2 cm
Height of casing/standpipe above surface: 0.17 m	Length of filter: -	mm Dia. of filter mm
Elevation of casing/standpipe: (Ordnance datum)	Type of piezometer	
mo		

Γime	Tim	e			Mea	surement of	flow			Ï	
	elaps 't'	ed	1 / √ t	Fall in standpipe	Internal dia, of	Volume of flow	Time flov		Flow q _i	Head, H	q∤H
	hr m	in	Loss in ml	(m)	standpipe (m)	(m³)	min	sec	(m³/s)	(m)	m²/s
612	- 1		1000								
	- 1		700								
	- 2		1100								
	- 2 - 2 - 3	,	1200								
	- 3		1425								
	- 3		1775								
	- 5	;	2275								
	- 5	i	2500		;						
	- 5 - 5 - 5	i	2475								
			2750								
	- 5	i	2650								
	- 5		2400								
	- 5		2375								
	- 5		2300								
	- 5		2300								
	- 5		2300								
	62 m	in	31525								
			ml								
	1						İ	ŀ			
							<u> </u>	ŧ			
							K = q $D = 8$	/ (F 3.2 cr	x H _C), q n, F=2.75	= 8.47 cc * D=22.55 ec.	/sec. 5 cm
							K =	U.8*	IU cm/se	ec.	

Remarks:

lame of I AHIWA	-	ER SUPPLY AND	ONSTAN SANITATION			e: Zone-2		Location: Disposal Sta	tion
		ng/standpipe to:			Job	No. 3976		Borehole No	
-	m of borehole					te: 07-11-2019		Sheet 1 of	
4) 0000	III OT OUTCHOLD	. 4.13 11			Gre	ound level:		Crew/Operat	
	n of casing: 4					dnance datum)			
c) top of	filter materia	l: -				ather: Cloudy		Temperature	: 24 °C
d) centre	of piezomete	r tip: -			Ту	pe of test:	inflow		
e) initial	groundwater	level:-			Int	ernal diameter (of casing/	standpipe: 8	.2 cm
leight of	casing/standp	ipe above surface:	0.13 m		Lei	ngth of filter:	- mn	Dia. of filte	r
levation	of casing/star	ndpipe:	(Ordnar	ce datum)	Ту	pe of piezomete	er		
est recor	rd								
Time	Time	· <u>.</u>			urement of		P1	Ting 127	_ /177
	elapsed 't'	1/√:	Fall in standpipe	Internal dia. of	Volume of flow	Time for flow	Flow q _t	Head, H	q_i/H
	}	Loss	}	standpipe			. 3.	2	m²/s
	hr min	in Lit	(m)	(m)	(m³)	min sec	(m³/s)	(m)	m-78
1602	- 1	0.460	·- <u>-</u>						
	- 2	0.480							İ
	- 2	0.450							
	- 3	0.900					\		
	- 3	0.560						1	
	- 5	1.050							
	- 5	0.820		<u> </u>					
	- 5	0.790					}	1	
	- 5	0.540						1	
	- 5 - 5	0.420 0.390							
	5	0.390							ŀ
	- 5	0.350	1						
	- 5	0.350							
	56 min	7.910 Litre							
									ļ
							1		
					K =	q/(FxH _C). $a = 2$.	35 cc/sec	
					D=	8.2 cm, F=	2.75* D	=22.55 cm	ı
					 	2.5*10 ⁻⁴	cm/sec.		

National Engineering Services Pakistan (Pvt.) Limited CONSTANT HEAD PERMEABILITY TEST Name of Project: WATER SUPPLY AND SANITATION SECTORS Site: Zone-2 Location: SAHIWAL CITY Disposal Station Job No. 3976 Depth below top of casing/standpipe to: Borehole No. 55 (a) bottom of borehole: 5.95 m Date: 07-11-2019 Sheet 1 of 1 Ground level: Crew/Operator: (b) bottom of casing: 6.05 m (Ordnance datum) (c) top of filter material: Weather: Cloudy Temperature: 19 °C (d) centre of piezometer tip: Type of test: (e) initial groundwater level:-Not encountered Internal diameter of casing / standpipe: 8.2 cm Height of casing/standpipe above surface: 0.45 m Length of filter: mm Dia. of filter Elevation of casing/standpipe: (Ordnance datum) Type of piezometer Test record Measurement of flow Time Time elapsed 't' q/HFall in Internal Volume Time for Flow q, Head, H 1/√t standpipe dia. of of flow flow Loss standpipe (m^3) (m^3/s) m^2/s mîn in (m) (m) min sec (m) mŀ 1659 670 1 2 980 2 1005 3 1095 3 1010 5 1560 5 1550 5 1550 1550 31 min 10970 ml $K = q / (F \times H_C), q = 5.90 \text{ cc/sec.}$ D = 8.2 cm, F=2.75* D=22.55 cm K = $0.43*10^{-3}$ cm/sec. Remarks:

APPENDIX-C

TABLE C-1 SUMMARY OF LABORATORY TEST RESULTS

TABLE C-2 SUMMARY OF FIELD DENSITY TESTS

DETAILED RESULT SHEETS

								CON	SULTANC	Y SERVICES FO	R ENGINEERIN	G, PROCUREMENT AND CONST (Wastewate SUMMARY OF TH	r Treatment Plan	nt, Zone-1)		ERMEDIATE	CITIES INVEST	TMENT PROG	RAM											
No. Section									Atterberg Limits		Material	l Classification	Modified AASHT	O Compaction Test				Consolidat				ompression T	est Direct	Shear Test	Chemica	al Analysis of S	Soil	Chem	nical Analysis	s of water
Note	Locatio	n BH/TP No	o. Sample No.	Depth	Natural Moisture Content NMC	In-situ Bulk Density	In-situ Dry Density	Grain Size Analysis(% Passing)	LL PL P	PI Classification System Symbol	Classification	Material Description	ОМС	Max. Dry Density (MDD)	CBR at 95% of	ОМС	Max. Dry Density (MDD)	Hydraulic Conductivity	e _o	Cc				c	Sulphate Content	Chloride Content	Organic Matter	Sulphate Content	Chloride Content	TDS pH
Part				(m)	(%)	(kN/m³)	(kN/m³)	3/8 #4 #10 #40 #100 #200	(%) (%) (%	%)			(%)	kN/m ³	(%)	(%)	kN/m ³	(cm/sec)	-	-	(kPa)	kPa) (%	Deg	kPa	(%)	(%)	(%)	(ppm)	(ppm)	(ppm) -
Note		DV. 22	SPT-3	3.00-3.45				100 100 100 100 61 29		SM	A-2-4	Silty sand	-																	
March		ВН-32	SPT-9	9.00-9.45				100 100 99 95 22 11		SP-SM	A-2-4	Poorly graded sand with silt																		
No. March		ВН-33			25.61	16.96	13.5		22 16 0			Silty clay with sand							0.70	0.142		12.7 1	0							
March Marc												-																		\vdash
Part		ВН-34										-													0.08	0.04	0.16			\vdash
March															+		+ +													$\overline{}$
Mathematical Content of the conten	-	ВН-35																					+							
1			SPT-3	3.00-3.45				100 100 100 100 38 13		SM	A-2-4	Silty sand													0.09	0.06	0.14			
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		BH-36	SPT-7	7.00-7.45				100 100 100 99 32 9		SP-SM	A-3	Poorly graded sand with silt																		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $			SPT-5	5.00-5.45				100 100 100 99 89 58		ML	A-4	Sandy silt																		
		ВН-37	SPT-10	10.00-10.45				100 100 100 100 34 12		SP-SM	A-2-4	Poorly graded sand with silt																		
Property of the property of		BH-38	SPT-5	5.00-5.45				100 100 100 98 38 12		SP-SM	A-2-4	Poorly graded sand with silt																		
No. No.			SPT-10	10.00-10.45				100 99 98 93 22 15		SM	A-2-4	Silty sand																		
Property Section Property Se		BH-39	SPT-3	3.00-3.45				100 100 100 100 88 44		SM	A-4	Silty sand																		
No. No.	÷																													
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		BH-40																												
Richard SFT-9 Sp0-9-55 10 10 10 10 10 10 10	nent pla									-															0.11	0.17	0.20			
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	er Treat	BH-41																							0.11	0.17	0.20			
No. 102 Fig. 103 104 105 106 106 107 123 106 106 107 123 106 106 107 123 106 106 107 123 106 106 107 123 106 106 107 123 106 107 123 106 107 107 108			CDT 2	200 245				100 100 100 100 07 79																					$\overline{}$	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		BH-42																											-	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$																							+			+		+	\rightarrow	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		ВН-43																	-				+					+		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	-	BH-44										1																+	$\overline{}$	
BH-45 SPT-10 10.00-10.45 100 100 99 97 45 13 10 100 99 98 36 21 15 CL A-6 Lean clay 17.4 17.6 8.00x10 ⁴ 0.62 0.164 Nil 136 TP-02 CS-1 1.05-1.50 100			UDS-01		23.50	18.40	14.9		30 20 1										0.69	0.198		17.6 5	-		0.09	0.16	0.26		\rightarrow	
BH-46 BH-46		ВН-45																											$\overline{}$	
109 SPT-7 7.00-7.45 100 100 100 96 29 14 SM A-2-4 Silty sand 17.4 17.6 8.00x10 ⁴ 0.62 0.164 Nil 18.00x10 ⁴ 18.00x10		n	SPT-2	2.00-2.45					36 21 1	15 CL	A-6																			
136 TP-02 CS-1 1.05-1.50		ВН-46	SPT-7	7.00-7.45				100 100 100 96 29 14		SM	A-2-4	Silty sand																		
137 TP-04 CS-1 0.7-1.40 100 100 100 100 100 92 79 Non plastic ML A-4 Silt with sand 14.3 17.7 11 138 TP-05 CS-1 0.40-1.22 100 100 100 100 84 67 ML A-4 Sandy silt 15.8 16.5 13		TP-01	CS-1	1.15-1.50					35 21 1	14 CL	A-6	lean clay				17.4	17.6	8.00x10 ⁻⁶	0.62	0.164	Nil									
138 TP-05 CS-1 0.40-1.22 100 100 100 100 84 67 ML A-4 Sandysit 15.8 16.5 13																							_							
									Non plasti															+						
1/4/3A19 one of the									33 20 1				15.8	10.5	13	17.4	16.9	7,43v1n ⁻⁶	0.65	0.170	Nil									$\overline{}$
140 TP-07 CS-1 0.45-1.50 100 100 100 97 29 9 SP-SM A-3 Poorly graded sand with silt 16.12 16.6 16	1							 					16.12	16.6	16		2017	7.45310	-100											
141 TP-08 CS-1 0.35-1.50 100 100 100 100 41 5 SP-SM A-3 Poorly graded sand with silt 18.35 15.7 15		TP-08	CS-1	0.35-1.50				100 100 100 100 41 5		SP-SM	A-3	Poorly graded sand with silt	18.35	15.7	15															
142 TP-09 CS-1 0.70-1.50 100 100 100 99 96 94 29 20 9 CL A-4 Leanday 12.3 19.2 7		TP-09	CS-1	0.70-1.50				100 100 100 99 96 94	29 20 9	9 CL	A-4	Lean clay	12.3	19.2	7															

															(Wastewa SUMMARY OF T	ter Treatment Pla THE LABORATOR																		
												tterberg Limits		Material Clas			TO Compaction Test			Proctor AASHTO paction Test	Consolidat	ion Test w Measure		tential	Unconfi Compressio (on soil sa	n Test D	Direct Shear	r Test	Chemical	Analysis of	f Soil	Che	emical Analy	sis of water
Sr. No. Location	BH/TP No.	Sample No.	Depth	Moisture	In-situ Bulk Density	In-situ Dry Density	Grain	n Size Anal	ysis(% Pa	ssing)	LL	PL PI	Unified Soil Classification System Symbol (USCS)	AASHTO Classification Symbol	Material Description	ОМС	Max. Dry Density (MDD)	3 Point Soaked CBR at 95% of MDD	ОМС	Max. Dry Density (MDD)	Hydraulic Conductivity	e _o	C _c	Swell Pressure		Failure Strain	φ		Sulphate Content	Chloride Content	Organic Matter	Sulphate Content	Chloride Content	TDS
			(m)	(%)	kN/m³)	(kN/m ³)	3/8 #4	4 #10	#40 #1	00 #2	200 (%)	(%)				(%)	kN/m³	(%)	(%)	kN/m³	(cm/sec)	-	-	(kPa)	(kPa)	(%)	Deg	kPa	(%)	(%)	(%)	(ppm)	(ppm)	(ppm)
143	BA-01	CS-1#	0.20-0.90				100 10	00 100	100 9	5 9	2 31	20 11	CL	A-6	Lean clay				15.7	17.9	7.79x10 ⁻⁶	0.55	0.113	Nil										
144	BA-02	CS-1#	0.50-1.00				100 10	0 99	98 9	6 9	5 33	20 13	CL	A-6	Lean clay				17.2	17.2	5.03x10 ⁻⁶	0.62	0.142	Nil										
145	BA-03	CS-1#	0.20-0.70				100 10	00 100	100 9	8 9	6 31	20 11	CL	A-6	Lean clay																			
146	BA-04	CS-1#	0.15-0.50				100 10	00 100	100 9	6 6	9 29	20 9	CL	A-4	Sandy lean clay																			
147 g	BA-05	CS-1#	0.25-1.00				100 10	00 100	100 9	3 8	5 24	17 7	CL-ML	A-4	Silty clay with sand																			
148	BA-05	CS-2#	1.00-1.70				100 10	00 100	100 9	9 9	6 34	21 13	CL	A-6	lean clay																			
149 g	BA-06	CS-1#	0.20-0.60				100 10	00 100	100 9	8 9	7 32	20 12	CL	A-6	lean clay				15.9	17.0	8.73x10 ⁻⁶	0.65	0.113	Nil										
150	BA-07	CS-1#	0.20-0.80				100 10	0 97	96 9	4 9	2 34	21 13	CL	A-6	lean clay																			
151	BA-08	CS-1#	0.15-1.00				100 10	00 100	100 9	8 9	5 37	21 16	CL	A-6	lean clay				17.2	16.7	8.21x10 ⁻⁶	0.71	0.179	Nil										
152	BA-09	CS-1#	0.20-1.50				100 10	0 99	99 9	7 9	5 32	20 12	CL	A-6	lean clay																			
153	BA-10	CS-1#	0.70-1.30				100 10	0 99	97 9	5 9	4 35	21 14	CL	A-6	lean clay				17.1	16.7	7.75x10 ⁻⁶	0.72	0.179	Nil										
LEGEND:		BH SPT UDS	BOREHOLE STANDARD PENET UNDISTURBED SAM		т				•	•			TPIT MPOSITE SAMPLE BORROW AREA												•			•	,					

CONSULTANCY SERVICES FOR ENGINEERING, PROCUREMENT AND CONSTRUCTION MANAGEMENT FOR PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM

(Wastewater Treatment Plant, Zone-1)

Summary of Field Density Tests

					I	Density	Modified A	ASHTO	
Sr. No.	Testpit No.	FDTs	Depth (m)	Moisture Content (%)	Bulk (kN/m³)	Dry (kN/m³)	Max. Dry Density (kN/m³)	OMC(%)	Relative Compaction (%)
1	TP-1	FDT-1	0.80	6.7	16.8	15.7			
2	TP-2	FDT-1	0.60	2.5	16.7	16.3			
3	TP-3	FDT-1	0.50	13.1	17.2	15.2			
4	TP-4	FDT-1	1.50	21.9	17.1	14.0			
5	TP-5	FDT-1	1.00	5.2	17.8	16.9	16.5	16	102
6	TP-6	FDT-1	1.10	24.8	17.5	14.0			
7	TP-7	FDT-1	1.25	5.3	17.4	16.5	16.6	16	100
8	TP-8	FDT-1	0.90	4.6	17.7	16.9	15.7	18	108
9	TP-9	FDT-1	1.35	11.6	16.7	15.0	19.2	12.3	78
10	TP-10	FDT-2	0.70	24.4	17.4	14.0			



GEOTECHNICAL TESTING LABORATORIES 18-Km, Multan Road, Labore. Ph: 042-37510942-43 Fax:042-37515267

SUMMARY OF NMC BULK DENSITY TEST RESULTS

PUNJAB INTERM CITIES INVESTMENT PROGRAM SAHIWAL CITY Location: **Project:**

Client: Lab. Ref:

SAFE SERVICES 54/2019

	KEMAKKS														
Specific	Gravity														
(g/cu.cm)	Dry														
DENSITY (g/cu.cm)	Bulk	1.808	1.781	1.910	1.516	1.857	1.635	1.879	1.729						
ľ	WC%	20.50	24.39	14.88	16.42	17.89	22.67	21.41	25.61						
	Location														
Depth	(m)	4.00-4.80	8.00-8.80	12.00-12.70	5.00-5.80	10.00-10.80	7.00-7.50	16.00-16.70	2,45-2,95						
Sample		UDS-1	UDS-2	e-san	I-San	UDS-2	1-SQO	UDS-4	UDS-1						
BH/TP	Ŋ.	BH-28	BH-28	BH-28	BH-29	BH-29	BH-30	BH-30	BH-33					,	

Ikram Ullah

Tested By:

22/11/2019

Dated:

Mahmood

Checked By:



18-Km, Multan Road, Lahore. Ph: 042-37510942-43 Fax:042-37515267

SUMMARY OF NMC BULK DENSITY TEST RESULTS

SAFE SERVICES 56/2019 Client: Lab. Ref: Project: PUNJAB INTERM CITIES INVESTMENT PROGRAM Location: SAHIWAL CITY

DUMARKS	CANDELL							114									
Specific	Gravity							-									
(g/cu.cm)	Dry		C. Serv		·e	- 4 / 50	er e		2-		÷		\$	 -	 	A.Ta.A	
DENSITY (g/eu.cm)	Bulk	1.649	1.881	1.845	1.748	1.866	1.584	1.888	1.860	1.728	2.015	1.940	1.730				
	MC%	31.69	14.05	23.58	25.88	35.38	15.25	12.93	24.07	15.35	23.98	24.51	17.71				
400000 A	Location																
Depth	(m)	4.50-5.00	13.00-13.90	2.45-3.00	08'9-00'9	4.00-4.50	10.00-10.80	4.00-4.80	12,00-12,60	08:9-00:9	4.00-4.60	7.00-7.80	10.00-10.80				
Sample	No.	UDS-1	CDS-2	UDS-1	1-SQO	1-SQN	UDS-2	1-SQO	UDS-2	UDS-1	UDS-1	UDS-1	UDS-2				
BH/TP	No.	BH-31	BH-31	BH-45	BH-51	BH-52	BH-52	BH-53	BH-53	BH-56	BH-57	BH-58	BH-58				-

Ikram Ullah Mahmood 3/12/2019 Checked By: Tested By:

Dated:

Z SOITCON

18-Km, Multan Road, Lahore. Ph: 042-7510942-43 Fax:042-7515267

SUMMARY OF FIELD DENSITY TEST

SAFE SERVICES 56/2019	Remarks																	-	
Client: Lab. Ref:	Specific Gravity												i						
	Field Dry Density (g/cu.cm)								,										
PUNJAB INTERMEDIATE CITY INVESTMENT PROGRAM TREATMENT PLANT IN SAHIWAL CITY	M.C.%	6.70	2.51	13.14	21.99	27.5	24.84	68.3.	4.61	11.62	24.47					-			
E CITY INV I PLANT IN	Location																		
PUNJAB INTERMEDIATE CITY INVESTMENT PROGRAM TREATMENT PLANT IN SAHIWAL	Depth (m)	080	90.9	0.50	,	1.00	1.10	1.25	•	1.35	0.7						-		
PUNJAB IN PROGRAM	Sample No.	FDT	FDT	FDT	FDT	FDT	FDT	FDT	FDT	FDT	FDT								
Project: Location:	BH / TP No.	TP-1	TP-2	TP-3	TP-4	TP-5	TP-6	TP-7	TP-8	TP-9	TP-10								

Checked By: MAHMOOD

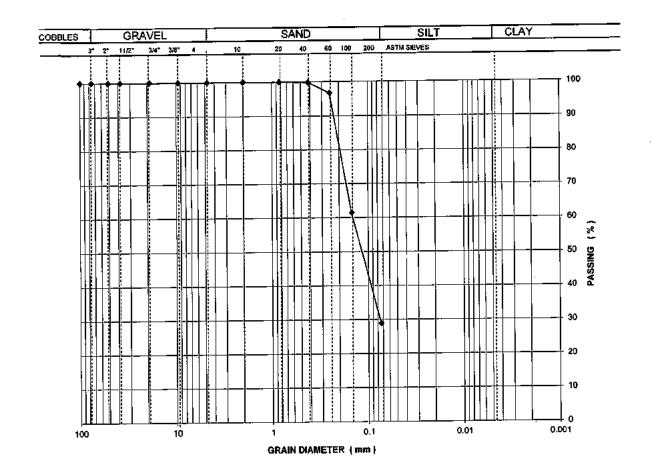
Tested By: / M. ASLAM

30.12-2019

Dated:

TESTED BY	CHECKED BY
KRAM ULLAH	МАНМООВ
1/1	(idl)

CLIENT	SAFE SERV	/ICES						
PROJECT	PUNJAB INTI	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM						
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY						
BORE HOLE	BH-32	SAMPLE	SPT-3					
TYPE	DISTURBED	DEPTH(m)	3.00-3.45					
SPECIMEN	1	DATE	21/11/2019					



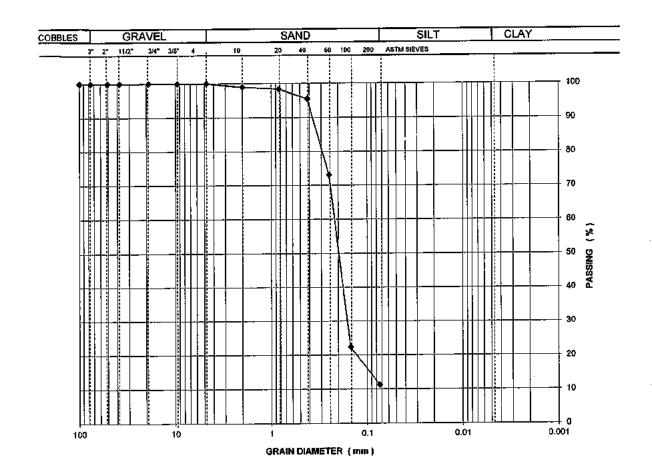
ŞIEVE NÖ.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100_	100	100	1 <u>00</u>	100	61	29

LAB, REF. 56/	2019

REMARKS:			
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TESTED BY	CHECKED BY
KRAM ULLAH	маниюор
1/2	(2)D

CLIENT	SAFE SERV	SAFE SERVICES						
PROJECT	PUNJAB INT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM						
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY						
BORE HOLE	BH-32	SAMPLE	SPT-9					
TYPE	DISTURBED	DEPTH(m)	9.00-9.45					
SPECIMEN	1	DATE	21/11/2019					



SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	99	95	22	11

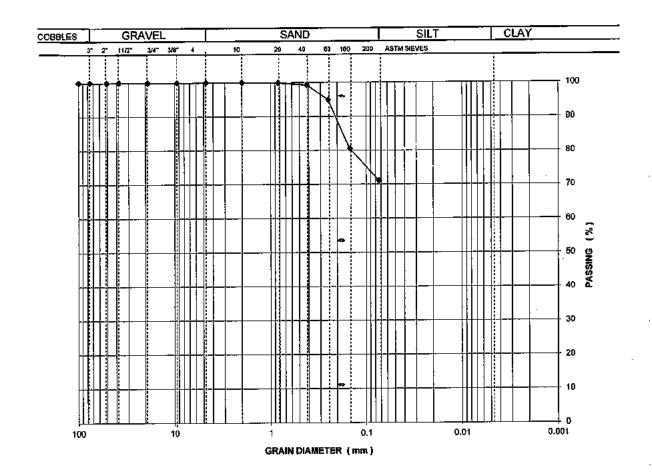
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LAB, REF.	56/2019

REMARKS:				
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GRAIN SIZE ANALYSIS

TESTED BY	CHECKED BY
IKRAM ULLAH	MAHMOOD
1/2	Pel

CLIENT	SAFE SERV	/ICES					
PROJECT	PUNJAB INTI	ERMEDIATE C	TIES INVESTMENT PROGRAM				
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY					
BORE HOLE	BH-33	SAMPLE_	UDS-1				
TYPE	DIŜTURBED	DEPTH(m)	2.45-2.95				
SPECIMEN	1	DATE	17/11/2019				



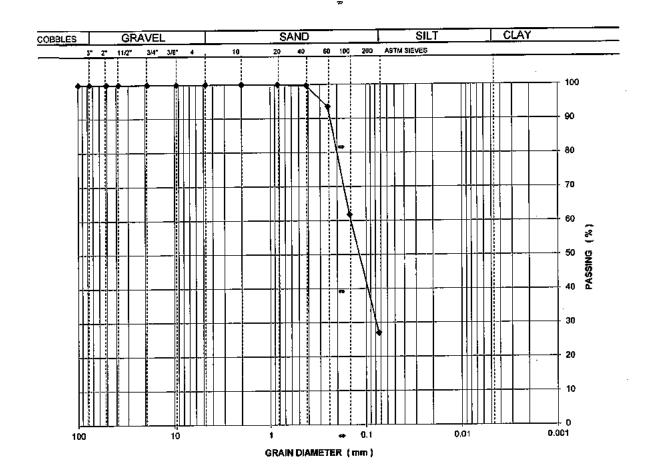
SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100_	100	100	_100	99	81	<u>71</u>

REMARKS:				
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LAB. REF. 54/2019

TESTED BY	CHECKED BY			
IKRAM ULLAH	Минисор			
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	<u> </u>	IVAIIA OIEE V	1747.1.1.1.1.1.1					
CLIENT	SAFE SERV	/ICES						
PROJECT	PUNJAB INT	ERMEDIATE CITI	ES INVESTMENT PROGRAM					
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY						
BORE HOLE	BH-33	SAMPLE	SPT-8					
TYPE	DISTURBED	DEPTH(m)	8.00-8.45					
SPECIMEN	1	DATE	17/11/2019					



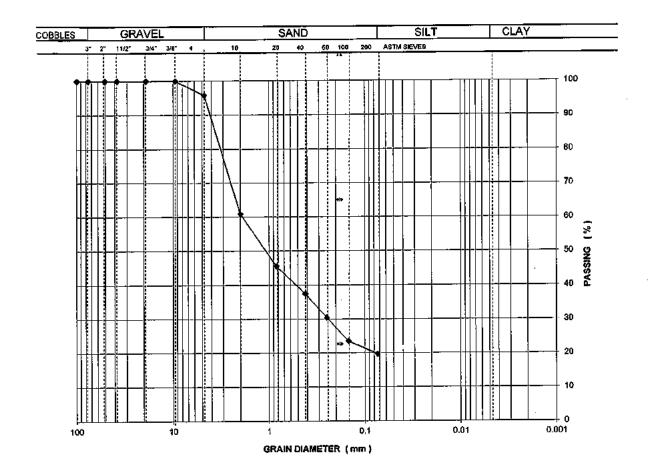
SIEVE NO.	3"	2°	1*1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	,100	100	62	27

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REMARKS:		

GRAIN SIZE ANALYSIS

TESTED BY	CHECKED BY
IKRAM ULLAH	MATHMOOD
1/1	(well

CLIENT	SAFE SERV	SAFE SERVICES							
PROJECT	PUNJAB INT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM							
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY							
BORE HOLE	BH-34	SAMPLE	SPT-4						
TYPE	DISTURBED	DEPTH(m)	4.00-4.45						
SPECIMEN	1	DATE	13/11/2019						



					.					
SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	. 4	10	40	100	200
PASSING (%)	100	100	100	100	100	96	6 1	37	24	20

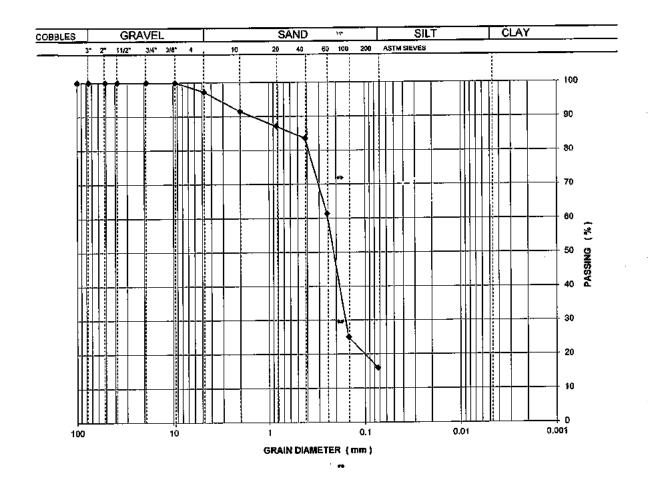
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REMARKS:					
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LAB. REF.

54/2019

TESTED BY	CHECKED BY
IKRAM ULLAH	MAHMOOO
/h	(کاریس)

CLIENT	SAFE SERV	SAFE SERVICES						
PROJECT	PUNJAB INTI	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM						
SITE	TREATMEN	FREATMENT PLANT IN SAHIWAL CITY						
BORE HOLE	BH-34							
TYPE	DISTURBED	DEPTH(m)	9.00-9.45					
SPECIMEN	1	DATE	13/11/2019					

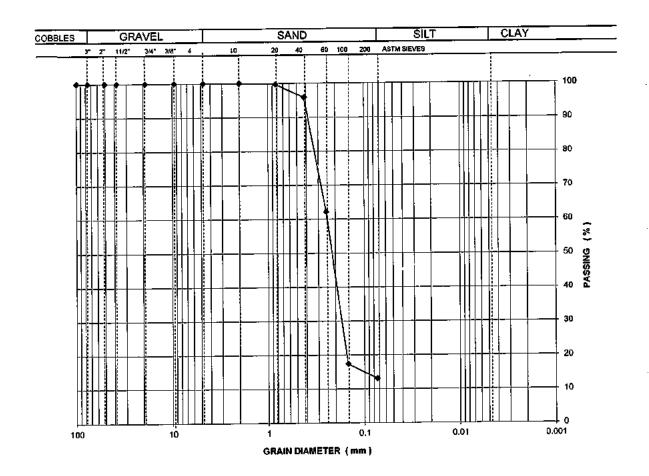


SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	97	91	84	25	16_

LAB. REF.	54/2019	19
REMARKS:		
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TESTED BY	CHECKED BY
IKRAM ULLAH	MAHMOOD
1/1	(usl)

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CLIENT	SAFE SERV	/ICES				
PROJECT	PUNJAB INTI	ERMEDIATE C	ITIES INVESTMENT PROGRAM			
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY				
BORE HOLE	BH-35	SAMPLE	SPT-3			
TYPE	DISTURBED	DEPTH(m)	3.00-3.45			
SPECIMEN	1	DATE	21/1 <u>1/2019</u>			



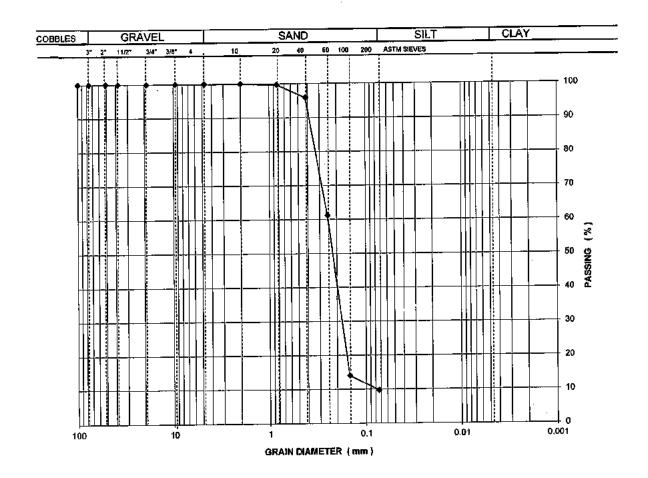
SIEVE NO.	3 [#]	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	100	96	17	13

LAB. REF.	56/2019

REMARKS:			
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IKRAM ULLAH	ОООМНАМ
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		107111 0126 7	<u> </u>		
CLIENT	SAFE SERV	/ICES			
PROJECT	PUNJAB INT	ERMEDIATE CITI	ES INVESTMENT PROGRAM		
SITE	TREATMENT PLANT IN SAHIWAL CITY				
BORE HOLE	BH-35	SAMPLE	SPT-8		
TYPE	DISTURBED	DEPTH(m)	8.00-8.45		
SPECIMEN	1	DATE	21/11/2019		



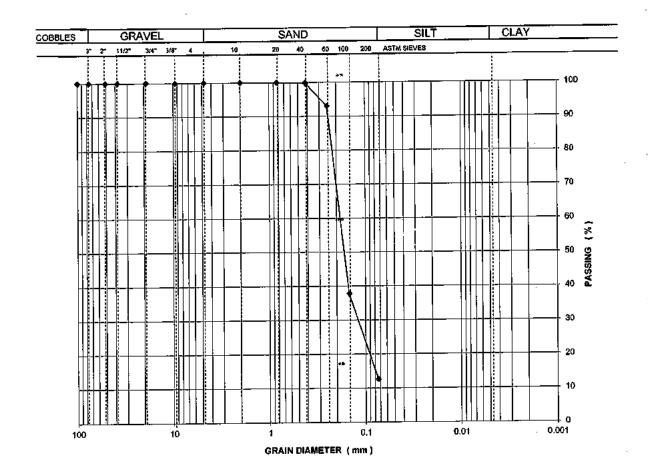
SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	100	96	14	10

LAB, REF.	56/2019

REMARKS:	j				
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TESTED BY	CHECKED BY
IKRAM ULLAH	MAHISOOD
1/1	(sel

CLIENT	SAFE SERV	/ICES						
PROJECT	PUNJAB INT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM						
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY						
BORE HOLE	BH-36	SAMPLE	SPT-3					
TYPE	DISTURBED	DEPTH(m)	3.00-3.45					
SPECIMEN	1	DATE	17/11/2019					



									· · · · · · · · · · · · · · · · · · ·	
SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	100	100	38	13

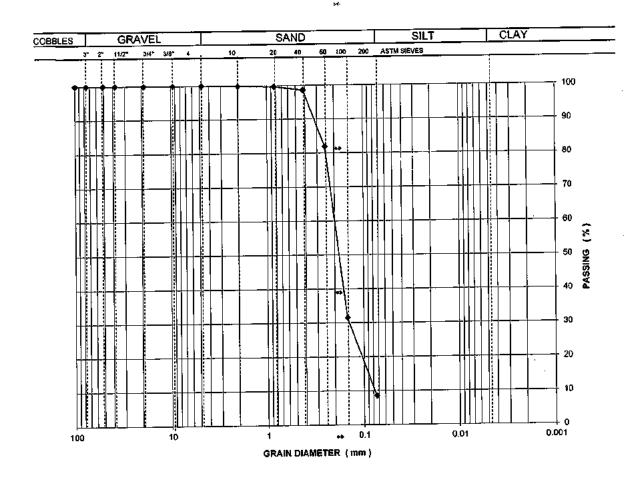
LAB. REF.	54/2019

REMARKS:				•	**
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GRAIN SIZE ANALYSIS

TESTED BY	CHECKED BY
IKRAM ULLAH	МАНМООО
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CLIENT	SAFE SER	/ICES							
PROJECT	PUNJAB INT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM							
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY							
BORE HOLE	BH-36	SAMPLE	SPT-7						
TYPE	DISTURBED	DEPTH(m)	7.00-7.45						
SPECIMEN	1	DATE	17/11/2019						



										
SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10 _	40	100	200
PASSING (%)	100	100	100	100	100	100	100	99	32	9

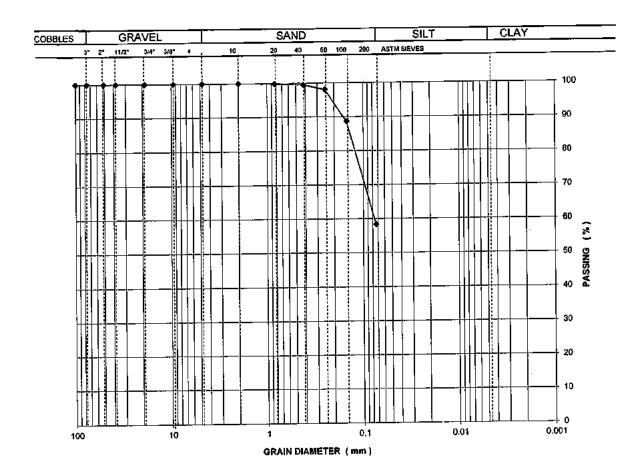
REMARKS:			
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54/2019

LAB. REF.

TESTED BY	CHECKED BY
IKRAM ULEAN	MAHMOOD
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		100114						
CLIENT	SAFE SERV	/ICES						
PROJECT	PUNJAB INT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM						
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY						
BORE HOLE	BH-37	SAMPLE_	SPT-5					
TYPE	DISTURBED	DEPTH(m)	5.00-5.45					
SPECIMEN	1	DATE	21/11/2019					



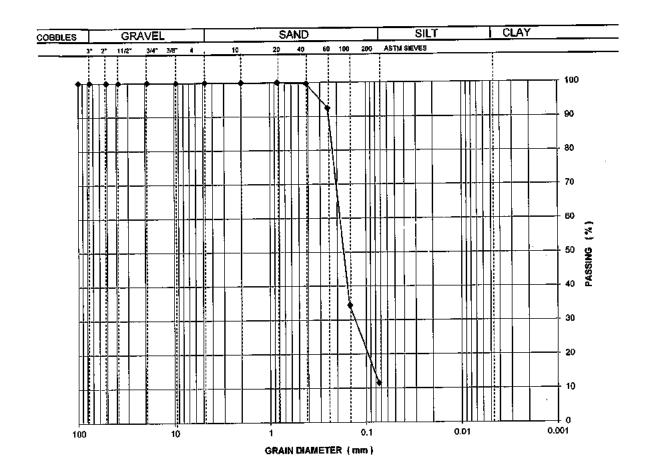
			_							
SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	100	99	89	58

LAB. REF.	56/2019

REMARKS:				
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TESTED BY	CHECKED BY		
IKRAM ULLAH	MAHMOOD		
1	(ide)_		

		II CALLA CILLE				
CLIENT	SAFE SERV	/ICES				
PROJECT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM					
SITE	TREATMENT PLANT IN SAHIWAL CITY					
BORE HOLE	BH-37 SAMPLE SPT-10					
TYPE	DISTURBED	DEPTH(m)	10.00-10.45			
SPECIMEN	1	DATE	21/11/2019			



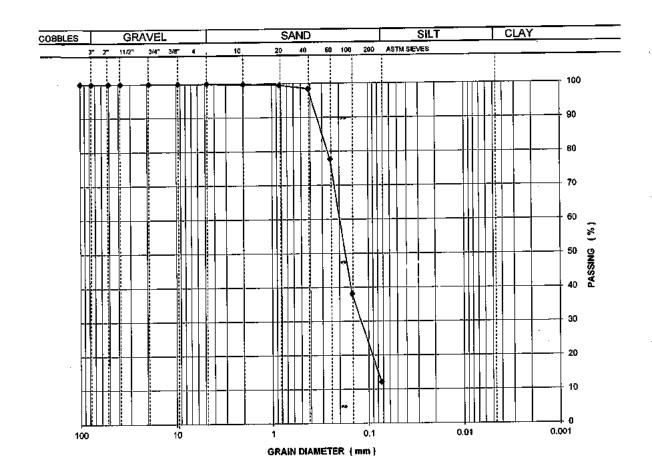
SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40_	100	200
PASSING (%)	100	100	100	100	100	100	100	100	34	12

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LAB. REF.	56/2019

REMARKS:	J			
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TESTED BY	CHECKED BY
IKRAM ULLAH	МАНМООО
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		1 2 2111 0 1				
CLIENT	SAFE SERV	/ICES				
PROJECT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM					
SITE	TREATMENT PLANT IN SAHIWAL CITY					
BORE HOLE	BH-38	BH-38 SAMPLE SPT-5				
TYPE	DISTURBED	DEPTH(m)	5.00-5.45			
SPECIMEN	7 1	DATE	13/11/2019			



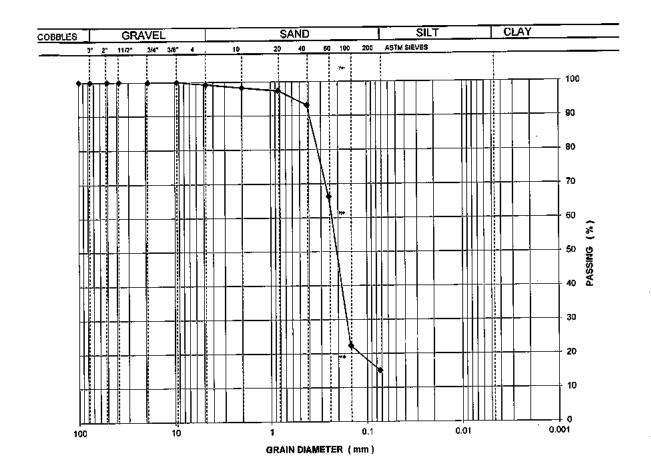
SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	" 1 <u>0</u>	40	100	200
PASSING (%)	100	100	100	100	100	100	100	98	38	12

LAB. REF.	54/2019

REMARKS:			
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TESTED BY	CHECKED BY
IKRAM ULLAH	MATRICOD
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		104111 01			
CLIENT	SAFE SERVICES				
PROJECT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM				
SITE	TREATMEN	IT PLANT IN	SAHIWAL CITY		
BORE HOLE	BH-38	SAMPLE	SPT-10		
TYPE	DISTURBED	DEPTH(m)	10.00-10.45		
SPECIMEN	1	DATE	13/11/2019		



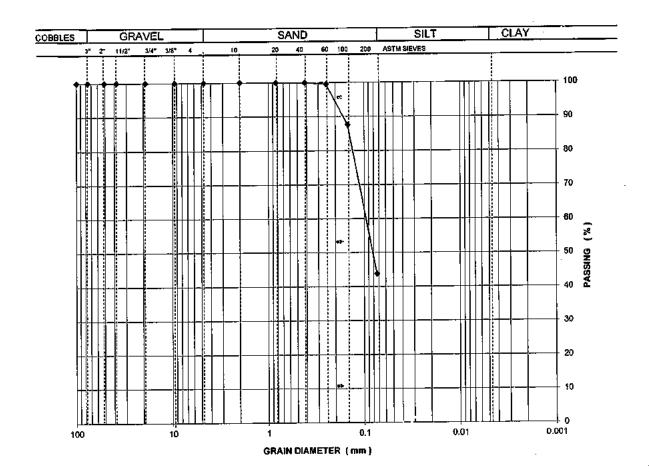
SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	. 4	10	40	100	200
PASSING (%)	100	100	100	100	100	99	98	93	22	15

LAB. REF.	54/2019

REMARKS:			40	
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TESTED BY	CHECKED BY
(KRAM ULLAH	MAHMOOD
W	(wl
W	(wl

		11 O-III T T-L	71111 1-1-1-1			
CLIENT	SAFE SERV	SAFE SERVICES				
PROJECT	PUNJAB_INT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM				
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY				
BORE HOLE	BH-39	SAMPLE	SPT-3			
TYPE	DIŜTURBED	DEPTH(m)	3.00-3.45			
SPECIMEN	1	DATE	17/11/2019			



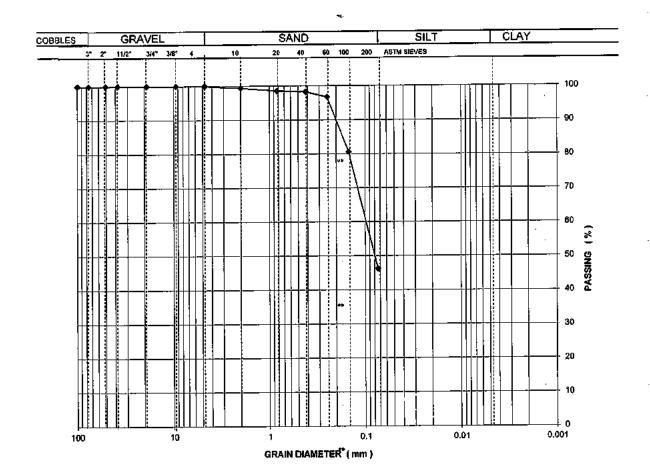
							65			T
SIEVE NO.	3"	2"	1"1/2	3/4"_	3/8"	4	10	40	100	200_
PASSING (%)	100	100	100	100	100	100	100	100	88	44

LAB. REF.	54/2019
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REMARKS:				
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TESTED BY	CHECKED BY
IKRAM ULLAH	MAHNOOD
	(w/N)

OIGHIO CIED MANDIO CO						
CLIENT	SAFE SERVICES					
PROJECT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM					
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY				
BORE HOLE	BH-3 <u>9</u>	SAMPLE	SPT-9			
TYPE	DISTURBED	DEPTH(m)	9.00-9.45			
SPECIMEN	1	DATE	17/11/2019			

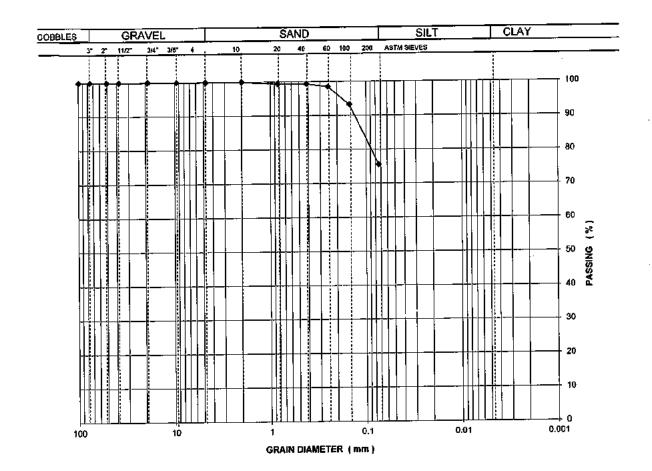


SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	_100	200
PASSING (%)	100	100	100	100	100	100	99	98	81	46

REMARKS:		
	 	
	 	

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TESTED BY	CHECKED BY
(KRAM ULLAH	MAHMOOD
//	(20)

		VAIIT OILL	AITAE I GIO				
CLIENT	SAFE SERV	/ICES					
PROJECT	PUNJAB INTI	ERMEDIATE C	ITIES INVESTMENT PROGRAM				
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY					
BORE HOLE	BH-40	SAMPLE	SPT-2				
TYPE	DISTURBED	DEPTH(m)	2.00-2.45				
SPECIMEN	1	DATE	21/11/2019				



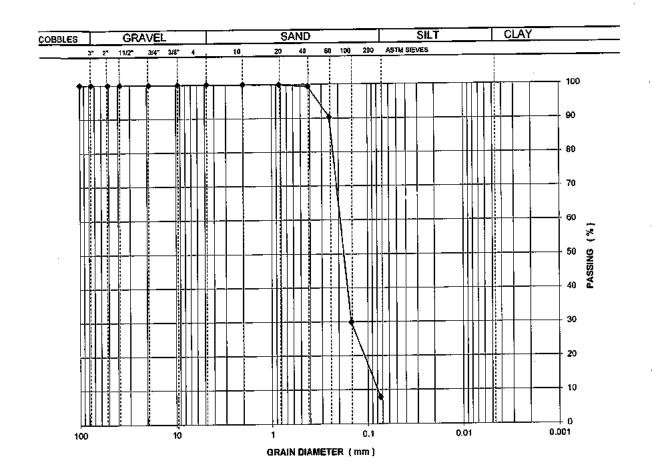
SIEVE NO.	3"	2"	1*1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	100	99	93	76

LAB, REF.	56/2019

REMARKS:				
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TESTED BY	CHECKED BY
IKRAM ULLAH	ОООМНАМ
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CLIENT	SAFE SERVICES								
PROJECT	PUNJAB INT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM							
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY							
BORE HOLE	BH-40	SAMPLE	SPT-7						
TYPE	DISTURBED	DEPTH(m)	7.00-7.45						
SPECIMEN	1	DATE	21/11/2019						

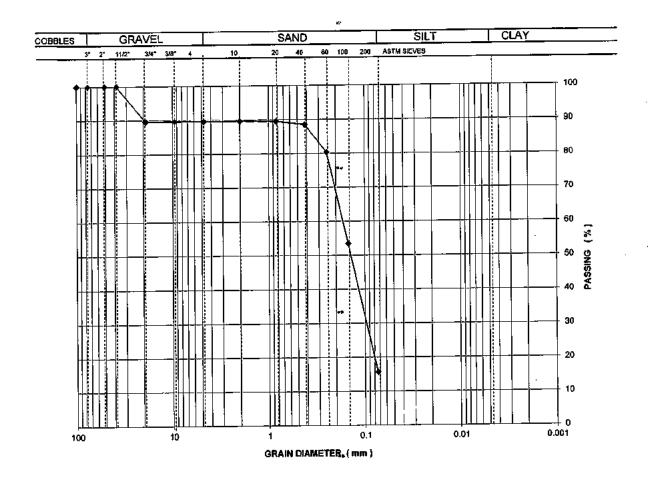


SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	100	99	30	8

REMARKS:				
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TESTED BY	CHECKED BY		
IKRAM ULLAH	ОООМНАМ		
(hr	(40)		

		7						
CLIENT	SAFE SERV	/ICES						
PROJECT	PUNJAB INT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM						
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY						
BORE HOLE	BH-41							
TYPE	DISTURBED	DEPTH(m)	4.00-4.45					
SPECIMEN	1	DATE	17/11/2019					

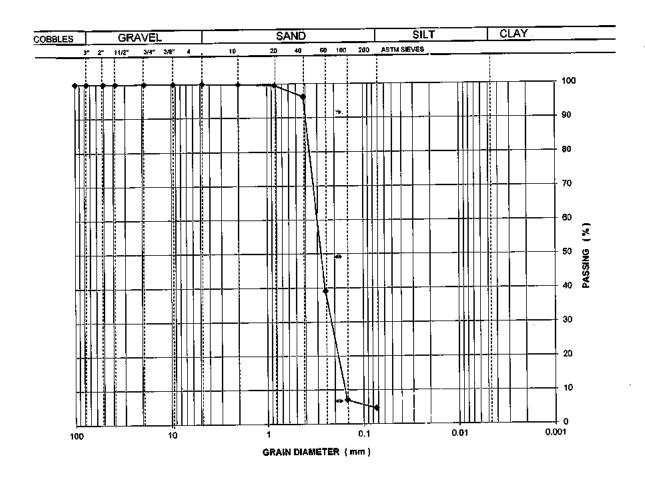


SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	90	90	90	90	89	53	16

LAB. REF.	54/2019			
REMARKS:				

TESTED BY	CHECKED BY
IKRAH ULLAH	манмоор
M	(20)

		TOTAL OFFI	- Allactoro					
CLIENT	SAFE SERV	SAFE SERVICES						
PROJECT	PUNJAB INT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM						
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY						
BORE HOLE	BH-41	SAMPLE	SPT-9					
TYPE	DISTURBED	DEPTH(m)_	9.00-9.45					
SPECIMEN	1	DATE	13/11/2019					



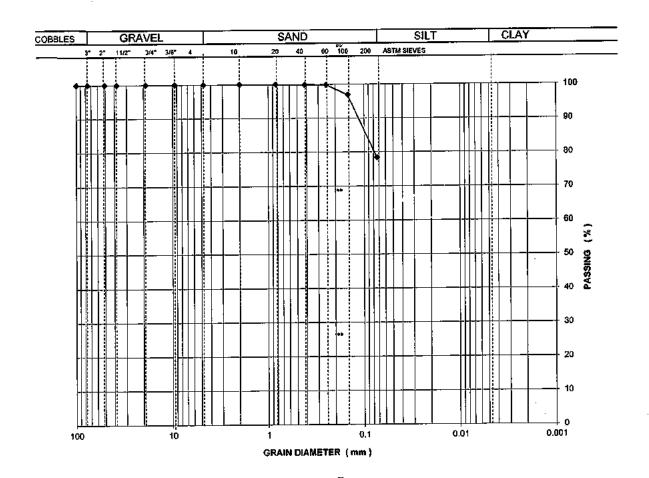
										-
SIEVE NO.	3"	2*	1"1/2	3/4"	3/8"	4	** 10 <u> </u>	40	100	200
PASSING (%)	100	100	100	100	100	100	100	96	7	5

LAB. REF.	54/2019

REMARKS:					
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TESTED BY	CHECKED BY		
IKRAM ULLAH	манмооо		
1/2	(20		

		II WAIN OILL						
CLIENT	SAFE SERV	/ICES	<u></u>					
PROJECT	PUNJAB INTI	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM						
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY						
BORE HOLE	BH-42	BH-42 SAMPLE SPT-3						
TYPE	DISTURBED	DEPTH(m)	3.00-3.45					
SPECIMEN	1	DATE	13/11/2019					



SIEVE NO.	3"	ייפ	1*1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	100	100	97	78

LAB. REF.	54/2019

REMARKS:				
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GRAIN SIZE ANALYSIS

TESTED BY	CHECKED BY
KRAM ULLAH	Маниоор
1/1	(20

	7%					
CLIENT	SAFE SERV	SAFE SERVICES				
PROJECT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM					
SITE	TREATMENT PLANT IN SAHIWAL CITY					
BORE HOLE	BH-42_	BH-42 SAMPLE SPT-8				
TYPE	DISTURBED	DEPTH(m)	8,00-8,45			
SPECIMEN	1	DATE	17/ <u>1</u> 1/2019			

SAND SILT CLAY

3º 2º 11/2º 3/4º 3/6º 4 10 20 40 60 100 200 ASTM SEVES

100 100 100 100 200 ASTM SEVES

100 20 40 60 100 200 ASTM SEVES

100 20 40 60 100 200 ASTM SEVES

100 20 40 60 100 200 ASTM SEVES

SIEVE NO.	3*	2°	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	100	97	23	8 _

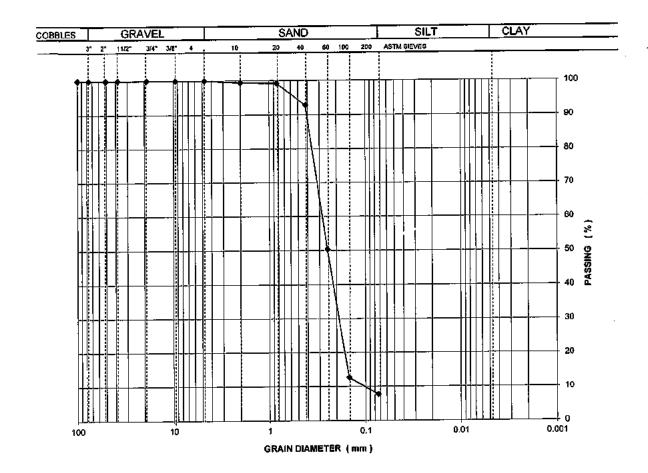
REMARKS:			
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LAB. REF.

54/2019

TESTED BY	CHECKED BY
IKRAM ULLAH	МАНМООВ
W.	(wC)

CLIENT	SAFE SERV	SAFE SERVICES					
PROJECT	PUNJAB INT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM					
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY					
BORE HOLE	BH-43	BH-43 SAMPLE SPT-4					
TYPE	DISTURBED	DEPTH(m)	4.00-4.45				
SPECIMEN	1	DATE	21/11/2019				



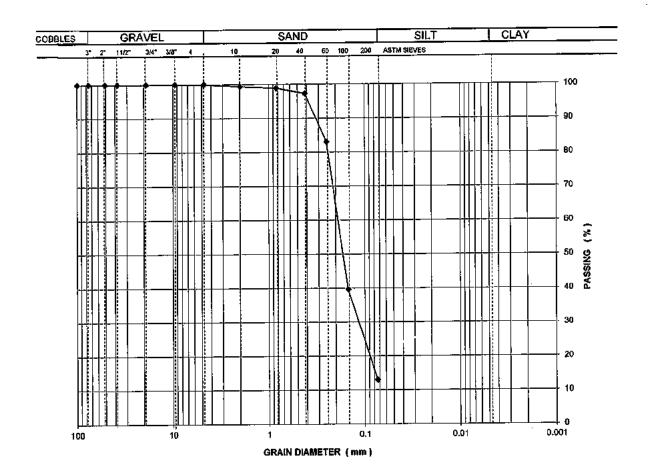
SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	99	93	13	. 8

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REMARKS:				
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		<u>, =,==</u>				
CLIENT	SAFE SERV	/ICES				
PROJECT	PUNJAB INT	ERMEDIATE CIT	FIES INVESTMENT PROGRAM			
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY				
BORE HOLE	BH-43	SAMPLE	SPT-9			
TYPE	DISTURBED	DEPTH(m)	9.00-9.45			
SPECIMEN	1	DATE	21/11/2019			



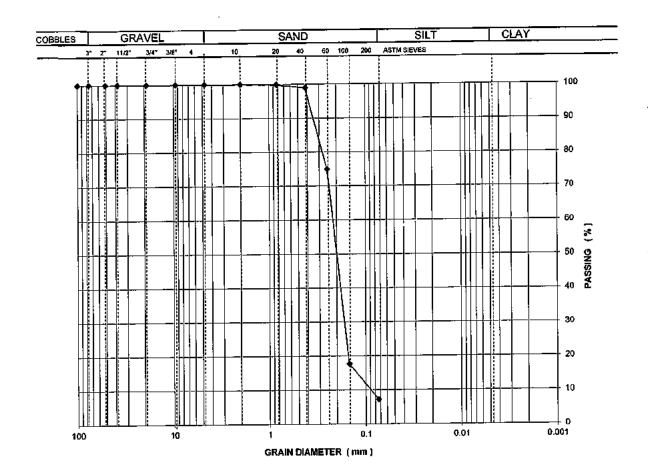
SIEVE NO.	3"	2"	1"1/2	3/4"_	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100_	99	97	40	13

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REMARKS:				
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TESTED BY	CHECKED BY
IKRAM ULLAH	MAHMOOD
1/4	(WE)

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CLIENT	SAFE SERY	/ICES _					
PROJECT	PUNJAB INT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM					
SITE	TREATMEN	REATMENT PLANT IN SAHIWAL CITY					
BORE HOLE	BH-44	SAMPLE	SPT-5				
TYPE	DISTURBED	DEPTH(m)	5.00-5.45				
SPECIMEN	1	DATE	21/11/2019				



SIEVE NO.	3°	2"	1"1/2	3/4"	3/8"_	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	100	99	18	7

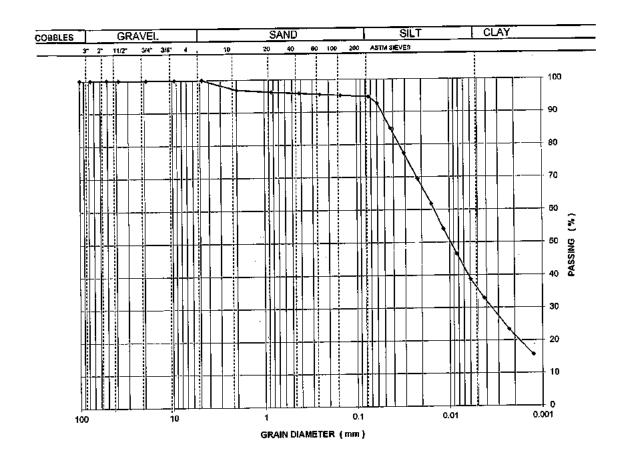
LAB. REF.	56/2019

REMARKS:						
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GRAIN SIZE ANALYSIS

TESTED BY	CHECKED BY
IKRAM ULLAH	манмооо
/w	(2)

		177111 0120					
CLIENT	GEOSCIEN	CE ASSOCIA	ATES				
PROJECT	PUNJAB IN	PUNJAB INTERMEDIATE CITIES INVESTMENT					
SITE	PROGRAM	PROGRAM SAHIWAL CITY					
BORE HOLE	BH-45	SAMPLE	UDS-1				
TYPE	UNDISTURBET	DEPTH m	2.45-3.00				
SPECIMEN	1	DATE	2/12/2019				



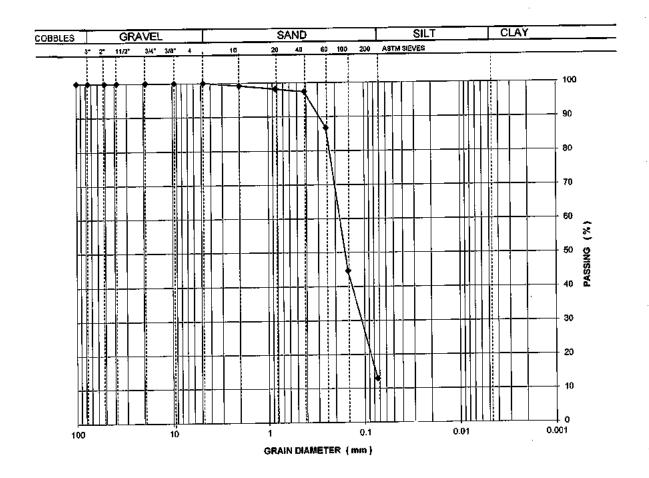
SIEVÉ NO.	3.	2*	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	97	96	95	95

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TESTED BY	CHECKED BY
IKRAM ULLAH	MAHNOOD
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GIANI GIZE ANAZI GIG							
CLIENT	SAFE SERV	SAFE SERVICES					
PROJECT	PUNJAB INTERMEDIATE CITIES INVESTMENT FROGRAM						
SITE	TREATMENT PLANT IN SAHIWAL CITY						
BORE HOLE	BH-45	SAMPLE	SPT-10				
TYPE	DISTURBED	DEPTH(m)	10.00-10.45				
SPECIMEN	1	DATE	21/11/2019				



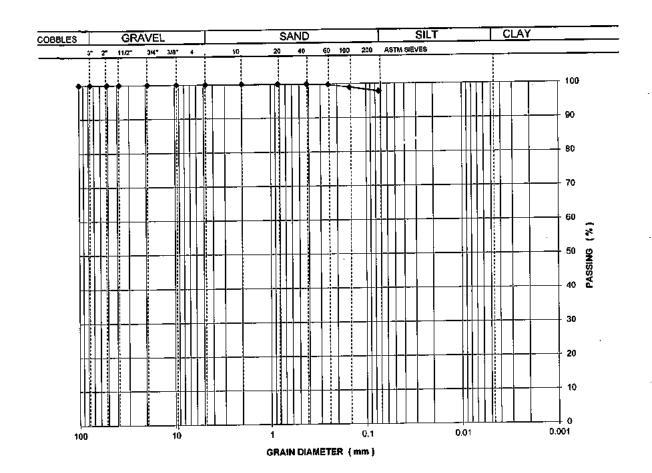
SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	99	97	45	13

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REMARKS:	J		

TESTED BY	CHECKED BY
IKRAM ULLAH	MAHMOOD
1/1	(w)

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CLIENT	SAFE SER\	SAFE SERVICES					
PROJECT	PUNJAB INT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM					
SITE	TREATMENT PLANT IN SAHIWAL CITY						
BORE HOLE	BH-46	BH-46 SAMPLE SPT-2					
TYPE	DISTURBED	DEP <u>TH(</u> m)	2.00-2.45				
SPECIMEN	1	DATE	21/11/2019				



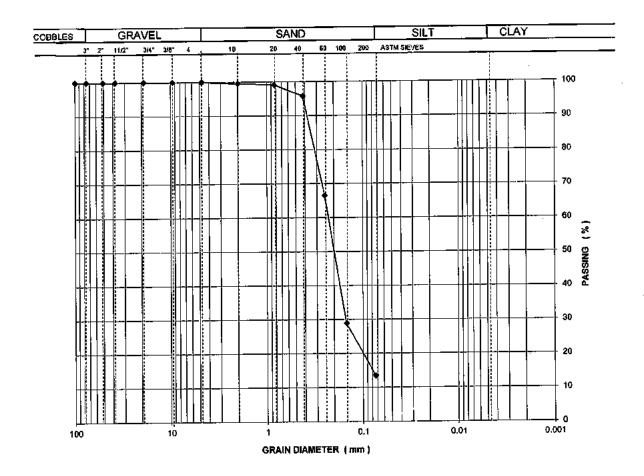
SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	100	100	99	98

LAB. REF.	56/2019

REMARKS:				
				
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TESTED BY	CHECKED BY		
IKRAN ULLAH	манмоор		
1/1	(ull)		

		7 9 1111 010						
CLIENT	SAFE SERV	/ICES						
PROJECT	PUNJAB INT	ERMEDIATE C	ITIES INVESTMENT PROGRAM					
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY						
BORE HOLE	BH-46	BH-46 SAMPLE SPT-7						
TYPE	DISTURBED	DEPTH(m)	7.00-7.45					
SPECIMEN	1	DATE	21/11/2019					



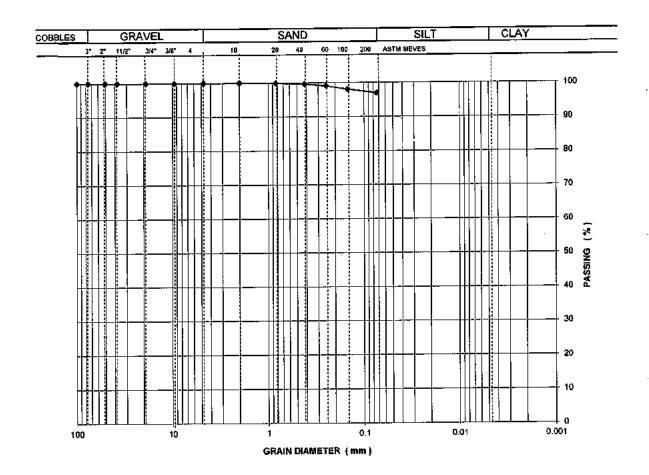
SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	100	96	29	14

LAB. REF.	56/2019

REMARKS:					
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TESTED BY	CHECKED BY
IKRAM ULLAH	МАНМООО
W	(20)

CLIENT	SAFE SERV	SAFE SERVICES							
PROJECT	PUNJAB INT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM							
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY							
BORE HOLE	TP- <u>1</u>	CS-1							
TYPE	DISTURBED	DEPTH(m)	1.15-1.50						
SPECIMEN	1	DATE	21/11/2019						



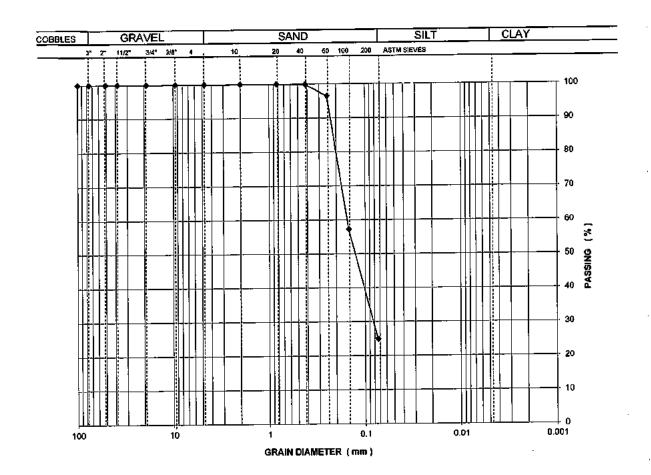
SIEVE NO.	3"	2"	1"1 <i>t</i> 2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	100	100	98	97

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REMARKS:				
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TESTED BY	CHECKED BY
IKRANI ULLAH	МАНМООВ
	(web)

CLIENT	SAFE SERV	/ICES						
PROJECT	PUNJAB INTI	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM						
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY						
BORE HOLE	TP-2							
TYPE	DISTURBED	DEPTH(m)_	1,05-1.50					
SPECIMEN	1	DATE	21/11/2019					

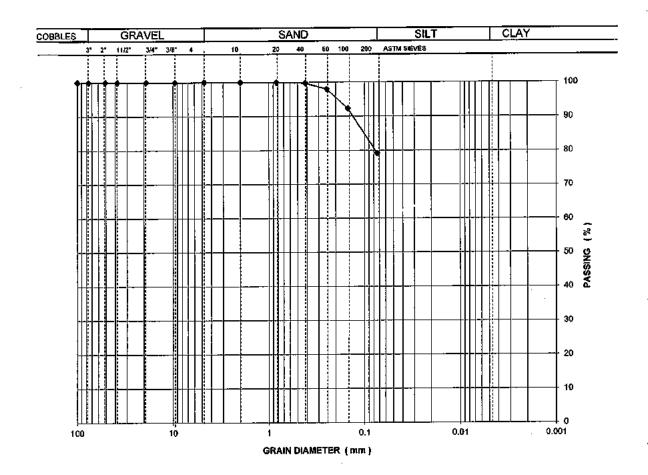


SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	100	100 _		25

REMARKS:					
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TESTED BY	CHECKED BY
IKRAM ULLAH	MAHMOOD
M	(20)

CLIENT	SAFE SER\	SAFE SERVICES					
PROJECT	PUNJAB INT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM					
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY					
BORE HOLE	TP-4	TP-4 SAMPLE CS-1					
TYPE	DISTURBED	DEPTH(m)	0.70-1.40				
SPECIMEN	1	DATE	21/11/2019				



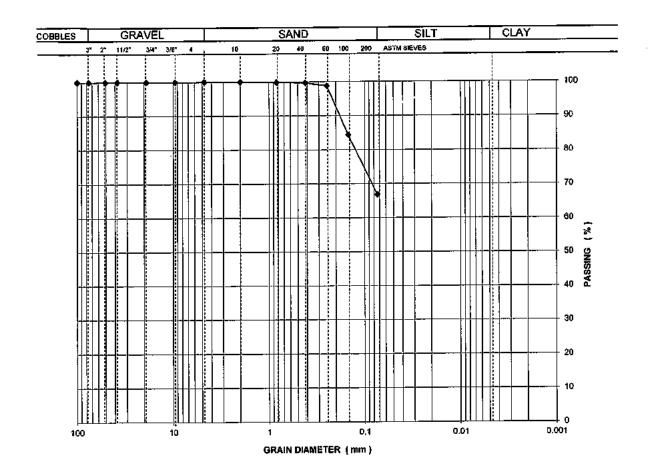
SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	100	100	92	79

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REMARKS:			
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GRAIN SIZE ANALYSIS

TESTED BY	CHECKED BY
IKRAM ULLAH	ДООМНАК
W.	(WO

CLIENT	SAFE SERV	SAFE SERVICES					
PROJECT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM						
SITE	TREATMENT PLANT IN SAHIWAL CITY						
BORE HOLE	TP-5	TP-5 SAMPLE CS-1					
TYPE	DISTURBED	DEPTH(m)	0,40-1.22				
SPECIMEN	1	DATE	21/11/2019				



										
SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	100	100	84	67

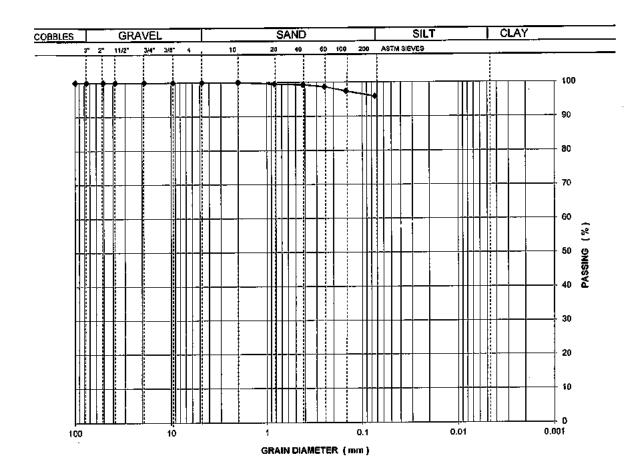
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56/2019

TESTED BY	CHECKED BY
KRAM ULLAN	MAHMOOD
1/1	(well

CLIENT	SAFE SERV	SAFE SERVICES					
PROJECT	PUNJAB INT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM					
SITE	TREATMENT PLANT IN SAHIWAL CITY						
BORE HOLE	TP-6	SAMPLE	CS-1				
TYPE	DISTURBED	DEPTH(m)	0,50-1.35				
SPECIMEN	1	DATE	21/11/2019				



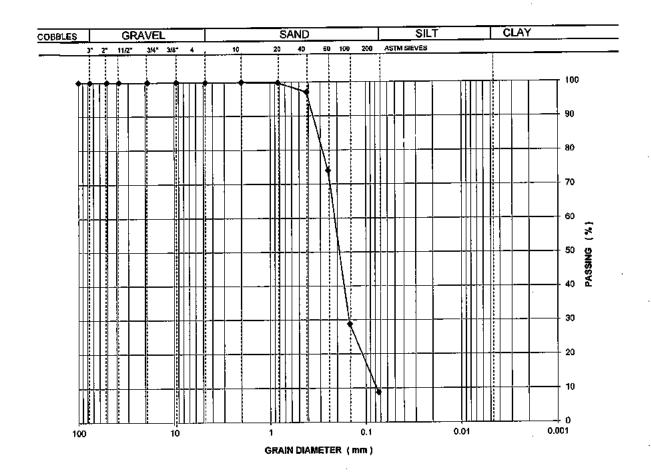
	_					_				
SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	100	99	97	96

LAB, REF.	56/2019			
REMARKS :				
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GRAIN SIZE ANALYSIS

TESTED BY	CHECKED BY
KRAM ULLAH	MAHMOOD
1/1	(wl)

CLIENT	SAFE SERV	SAFE SERVICES							
PROJECT	PUNJAB INTI	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM							
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY							
BORE HOLE	TP-7	SAMPLE	CS-1						
TYPE	DISTURBED	DEPTH(m)	0.45-1.60						
SPECIMEN	1	DATE	21/11/2019						



SIEVE NO.	3"	2"	1*1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	100	97	29	9

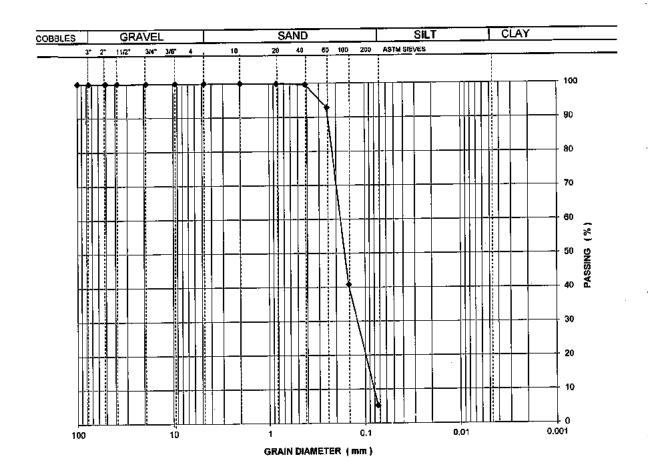
REMARKS:				
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56/2019

TESTED BY	CHECKED BY
IKRAM ULLAH	MAHMOOD
M	Call

CLIENT	SAFE SERVICES							
PROJECT	PUNJAB INT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM						
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY						
BORE HOLE	TP-8	SAMPLE	<u>CS-1</u>					
TYPE	DISTURBED	DEPTH(m)	0.35-1.50					
SPECIMEN	1	1 DATE 21/11/2019						



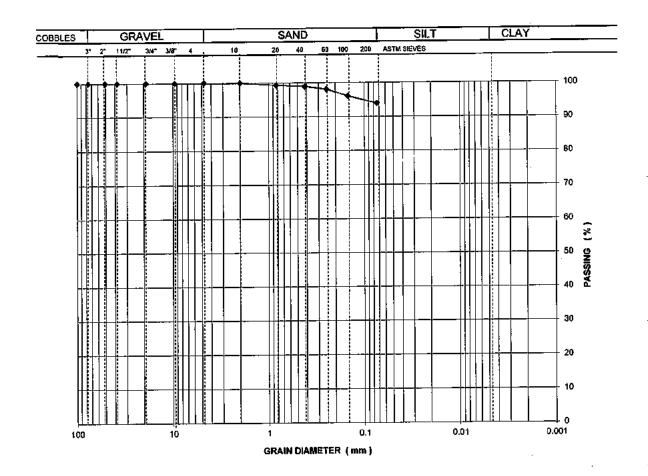
SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	100	100	41 _:	5

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REMARKS:					
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TESTED BY	CHECKED BY
IKRAM ULLAH	MAHMOOD
1/4	(40)

		10 111 1 0120									
CLIENT	SAFE SERV	SAFE SERVICES									
PROJECT	PUNJAB INTI	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM									
SITE	TREATMEN	FREATMENT PLANT IN SAHIWAL CITY									
BORE HOLE	TP-9	SAMPLE	_CS-1								
TYPE	DISTURBED	DEPTH(m)	0.20-1.50								
SPECIMEN	1	DATE	21/11/2019								



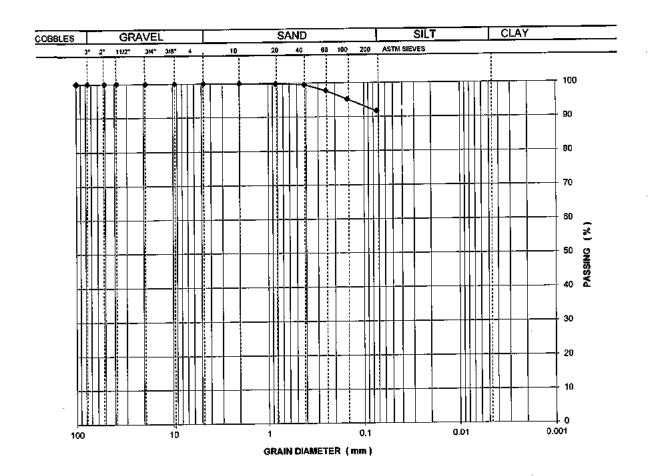
SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	100	99	96	94

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REMARKS:					
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TESTED BY	CHECKED BY
IKRAM ULLAH	MAHMOOD
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		NO WIT OILL									
CLIENT	SAFE SERV	SAFE SERVICES									
PROJECT _	PUNJAB INT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM									
SITE	TREATMEN	REATMENT PLANT IN SAHIWAL CITY									
BORE HOLE	BA-1	SAMPLE	CS-1								
TYPE	DISTURBED	DEPTH(m)	0.20-0.90								
SPECIMEN	1	DATE	21/11/2019								



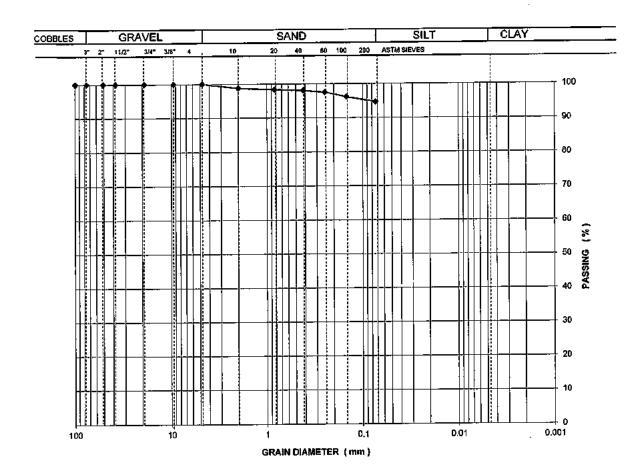
			_					·		
SIEVE NO.	3"	2"	1"1/2	3/4"	3/8*	4_	10	40	100	200
PASSING (%)	100	100	100	100	100	100	100	100	95	92

LAB. REF.	56/2019

REMARKS:						
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TESTED BY	CHECKED BY
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GRAIN GIZE ANALTOIG											
CLIENT	SAFE SERY	SAFE SERVICES									
PROJECT	PUNJAB INT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM									
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY									
BORE HOLE	BA-2	SAMPLE	CS-1								
TYPE	DISTURBED	DEPTH(m)	0.50-1.00								
SPECIMEN	1	DATE	21/11/2019								



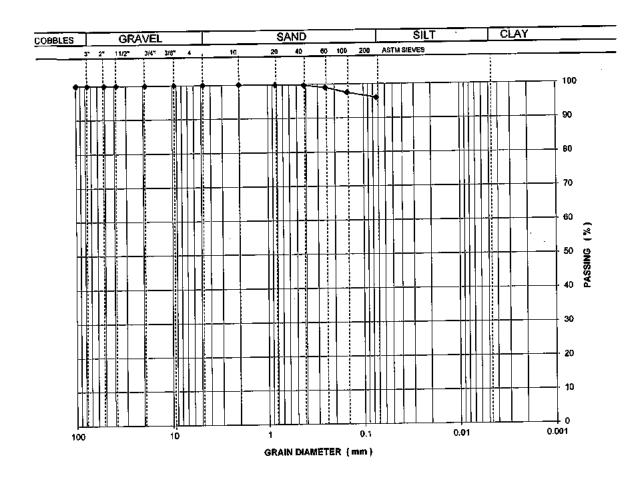
										_ <u> </u>
SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	99	98	96	95

	56/2019
LAB. REF.	ו פוטבעטט

REMARKS:		
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TESTED BY	CHECKED BY
IKRAM ULLAH	MAHNOOD
M	(ve)

		1031,10122					
CLIENT	SAFE SERV	/ICES					
PROJECT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM						
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY					
BORE HOLE	BA-3						
ITYPE	DISTURBED	DEPTH(m)	0.20-0.70				
SPECIMEN	1	DATE	21/11/2019				



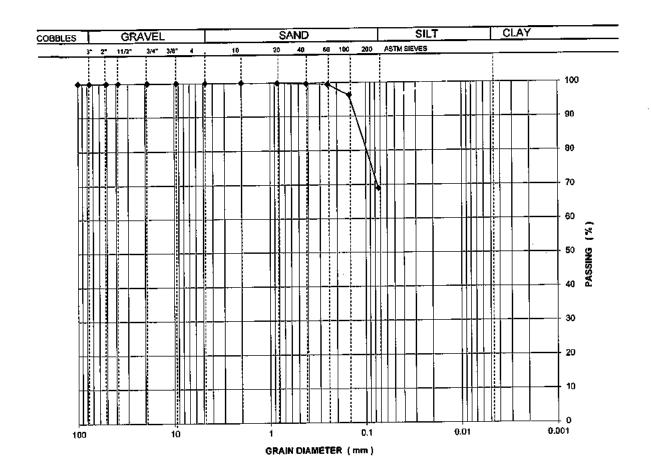
SIEVE NO. 3" 2" 1"1/2 3/4" 3/8" 4 10 40 100 200											
100 98 96	SIEVE NO.	3"		1"1/2	3/4"	3/8"	4	10	40	_100	200
	PASSING (%)	100	100	100	100	100	100	100	100	98	96

LAB. REF.	56/2019

REMARKS:					
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TESTED BY	CHECKED BY
KRAM ULLAH	МАНМООО
- Mr	(well

GIGGIT GILLD FILL ILL INC.							
CLIENT	SAFE SERV	/ICES					
PROJECT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM						
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY					
BORE HOLE	BA-4 SAMPLE CS-1						
TYPE	DISTURBED	DEPTH(m)	0.15-0.50				
SPECIMEN	1	DATE	21/11/2019				



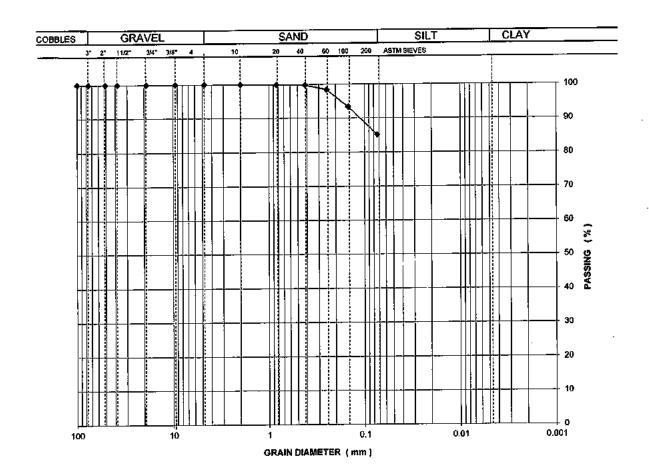
					·				400	200
SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	100	100	96	69

LAB, REF.	56/2019

REMARKS:					
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TESTED BY	CHECKED BY
KRAM ULLAH	манмооо
1/1	(vel

CLIENT	SAFE SER\	SAFE SERVICES						
PROJECT	PUNJAB INT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM						
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY						
BORE HOLE	BA-5	BA-5 SAMPLE CS-1						
TYPE	DISTURBED	DEPTH(m)	0.25-1.00					
SPECIMEN	1	DATE	21/11/2019					



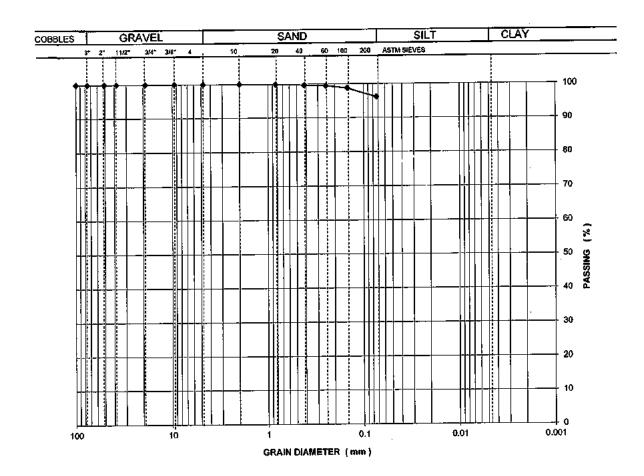
SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	100	100	93	85

LAB. REF.	56/2019

REMARKS:					
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TESTED BY	CHECKED BY
IKRAM ULLAH	манмоор
- M	(20)

CLIENT	SAFE SERV	SAFE SERVICES					
PROJECT	PUNJAB INT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM					
SITE	TREATMENT PLANT IN SAHIWAL CITY						
BORE HOLE	BA-5	SAMPLE					
TYPE	DISTURBED	DEPTH(m)	1.00-1.70				
SPECIMEN	1	DATE	21/11/2019				



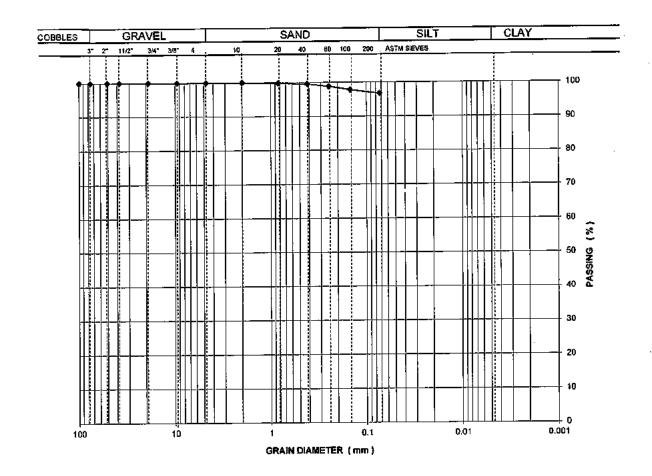
SIEVE NO.	3"	2"	1*1/2	3/4"	3/8"	4	10	. 40	100	200
PASSING (%)	100	100	100	100	100	100	100	100	99	96

LAB. REF.	56/2019
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REMARKS:					
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TESTED BY	CHECKED BY
BKRAM ULLAH	MAHMODD
/h-	(well

CLIENT	SAFE SERV	SAFE SERVICES					
PROJECT	PUNJAB INT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM					
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY					
BORE HOLE	BA-6	SAMPLE	CS-1				
TYPE	DISTURBED	DEPTH(m)	0.20-0.80				
SPECIMEN	1	DATE	21/11/2019				



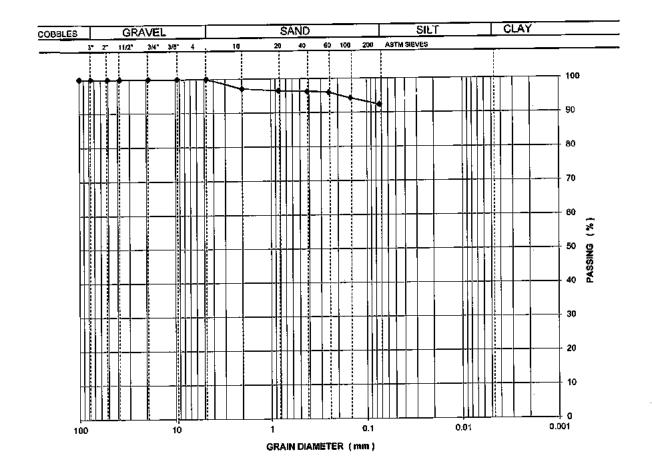
SIEVE NO.	3"	2"	1"1/2	3/4"	3/8*	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	100	100	98	97

LAB. REF.	56/2019

REMARKS:						
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TESTED BY	CHECKED BY
KRAM ULLAH	DOOMHAM
W	(we)

								
CLIENT	SAFE SERV	/ICES						
PROJECT	PUNJAB INTI	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM						
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY						
BORE HOLE	BA-7							
TYPE	DISTURBED	DEPTH(m)	0.20-0.80					
SPECIMEN	1	DATE	21/11/2019					



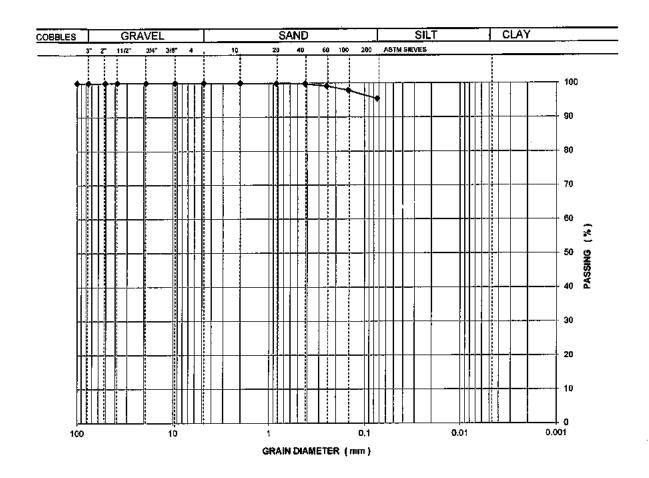
SIEVE NO.	3"	2°	1"1/2	3/4"	3/8"_	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	97	96	94	92

LAB, REF. 56/2019	··	
	LAB, REF.	56 <u>/2019</u>

REMARKS:					
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TESTED BY	CHECKED BY		
IKRAM ULLAH	MAHMOOD		
1/m	(w)O		

CLIENT	SAFE SERV	/ICES						
PROJECT	PUNJAB INTI	UNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM						
SITE	TREATMEN	REATMENT PLANT IN SAHIWAL CITY						
BORE HOLE	BA-8	BA-8 SAMPLE CS-1						
TYPE	DISTURBED	DEPTH(m)	0.15-1.00					
SPECIMEN	1	DATE	21/11/2019					

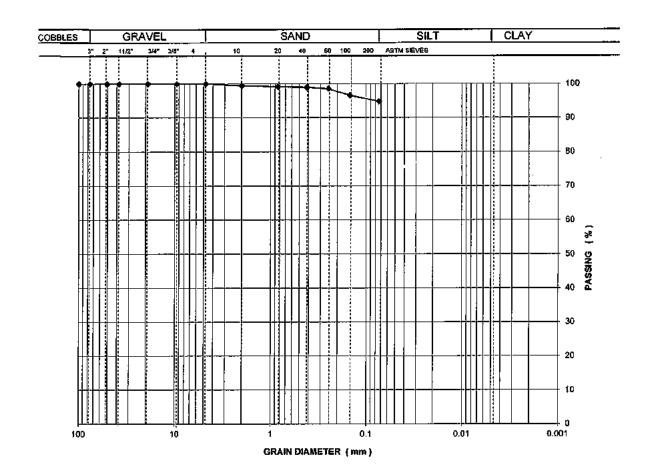


·····					-				· 	
SIEVE NO.	3"_	2"	1"1/2	3/4"	3/8"	4	10 _	40	100	200
PASSING (%)	100	100	100	100	100	100	100	100	98	95

LAB. REF.	56/2019			
REMARKS:]			
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TESTED BY	CHECKED BY
KRAM ULLAH	MAHMOOD
W.	(w)

CLIENT	SAFE SER\	SAFE SERVICES						
PROJECT	PUNJAB INT	UNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM						
SITE	TREATMEN	REATMENT PLANT IN SAHIWAL CITY						
BORE HOLE	BA-9	BA-9 SAMPLE CS-1						
TYPE	DISTURBED	DEPTH(m)	0.20-1.50					
SPECIMEN	1	DATE	21/11/2019					

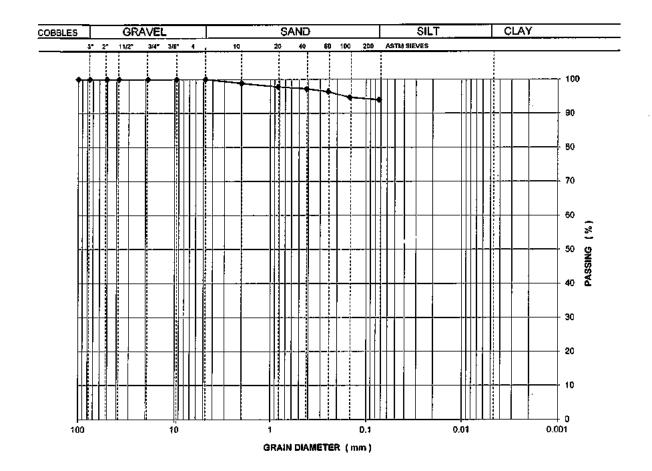


SIEVE NO.	3"	2"	1"1/2	3/4"	3/8*	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	99	99	97	95

LAB. REF.	56/2019		
REMARKS:			

TESTED BY	CHECKED BY
IKRAM ULLAH	МАНМООО
	(nl)

CLIENT	SAFE SERV	SAFE SERVICES					
PROJECT	PUNJAB INT	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM					
SITE	TREATMEN	TREATMENT PLANT IN SAHIWAL CITY					
BORE HOLE	BA-10 SAMPLE CS-1						
TYPE	DISTURBED	DEPTH(m)	0.70-1.30				
SPECIMEN	1	DATE	21/11/2019				



SIEVE NO.	3"	2"	1"1/2	3/4"	3/8"	4	10	40	100	200
PASSING (%)	100	100	100	100	100	100	99	97	95	94

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REMARKS:	

LIQUID & PLASTIC LIMIT

(ASTM D-4318)

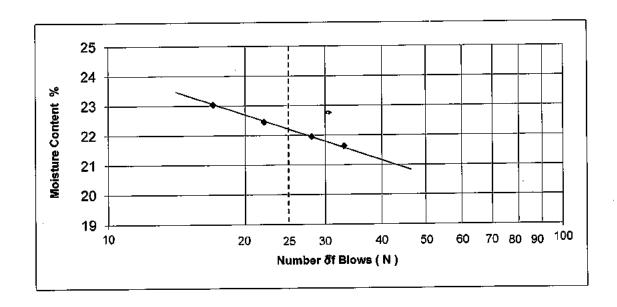
PROJECT	PUNJAB INTERMEDIATE INVESTMENT PROGRAM								
LOCATION	TREATMENT	TREATMENT PLANT IN SAHIWAL							
CLIENT	SAFE SERVIC	ES							
BOREHOLE	BH-33								
LAB. REF.	54/2019	40 44 2040							

LIQUID LIMIT

	<u> </u>				
Number of Blows N	17	22	28	33	
	_				
Moisture Content %	23.04	22.45	21.95	21.64	

<u>.</u>	 		
Moisture Content %	15.62	15. <u>6</u> 7	15.72

LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
22	167	6



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MAHMOOD	ASLAM
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LIQUID & PLASTIC LIMIT

(ASTM D-4318)

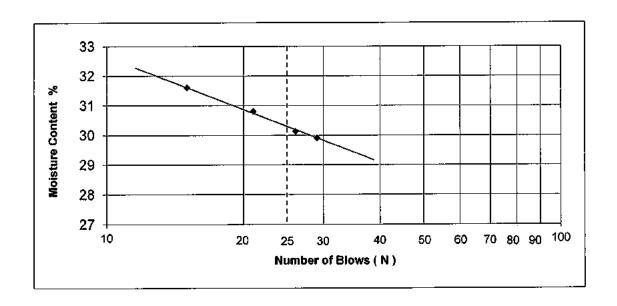
PROJECT	PUNJAB INTE	PUNJAB INTERMEDIATE INVESTMENT PROGRAM									
LOCATION	TREATMENT	TREATMENT PLANT IN SAHIWAL									
CLIENT	SAFE SERVIC	ES		-							
BOREHOLE	BH-45	BH-45 SAMPLE UDS-1 TYPE DISTURBED									
LAB. REF.	56/2019	DEPTH m	2.45-3.00	DATE							

LIQUID LIMIT

Number of Blows N	15	21	26	29	
Moisture Content %	31.61	30.81	30.14	29.91	·

Moisture Content %	19.63	19.69	19.72	

LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
30	20	10



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LIQUID & PLASTIC LIMIT

(ASTM D-4318)

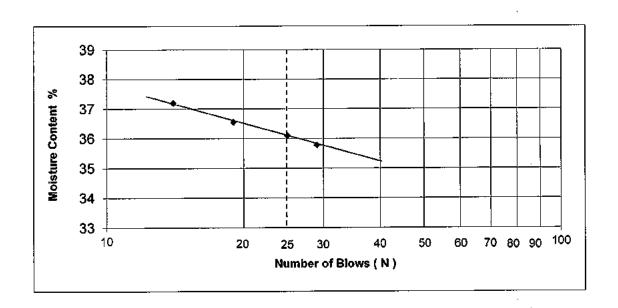
PROJECT	PUNJAB INTE	RMEDIATE INV	ESTMENT P	ROGRAM	
LOCATION	TREATMENT	PLANT IN SAH	IWAL		<u></u>
CLIENT	SAFE SERVIC	ES			
BOREHOLE	BH-46	SAMPLE	SPT-2	TYPË	DISTURBED
LAB. REF.	56/2019	DEPTH m	2.00-2.45	DATE	27.11.2019

LIQUID LIMIT

Number of Blows N	14	19	25	29	
Moisture Content %	37.20	36.56	36.10	35.78	

	· · · · · · · · · · · · · · · · · · ·			ı
Moisture Content %	20.82	20.86	20.91	╛

LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
36	21	15



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LIQUID & PLASTIC LIMIT

(ASTM D-4318)

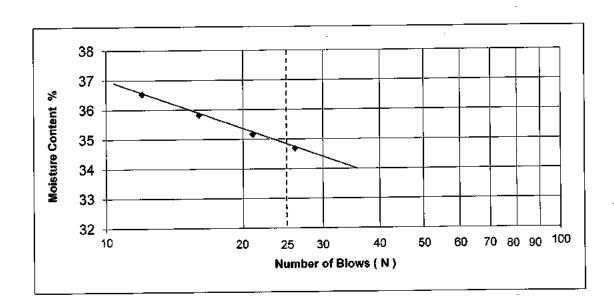
PROJECT		PUNJAB INTERMEDIATE INVESTMENT PROGRAM				
LOCATION	TREATMENT	PLANT IN SAH	IWAL	<u> </u>		
CLIENT	SAFE SERVIC	ES				
BOREHOLE	TP-1	SAMPLE	<u>CS-1</u>	TYPE	DISTURBED	
LAB. REF.	56/2019	DEPTH m	1.15-1.50	DATE	21.11.2019	

LIQUID LIMIT

Number of Blows N	12	16	21	26	
Moisture Content %	36.53	35.82	35.17	34. <u>69</u>	

· · · · · · · · · · · · · · · · · · ·				
Moisture Content %	21.14	2 <u>1.18</u>	21.22	

LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
35	21	14



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MAHMOOD	ASLAM ASLAM
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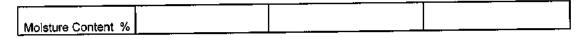
LIQUID & PLASTIC LIMIT

(ASTM D-4318)

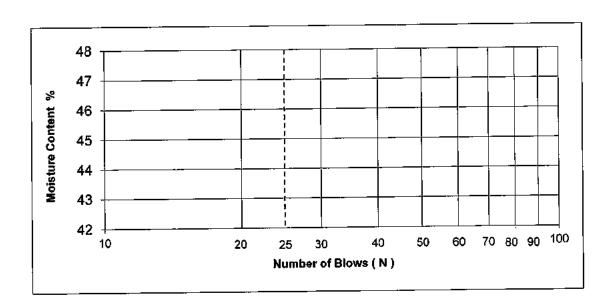
THE REPORT OF THE PROPERTY OF						
		PUNJAB INTERMEDIATE INVESTMENT PROGRAM				
LOCATION	TREATMENT P	FREATMENT PLANT IN SAHIWAL				
CLIENT	TREATMENT P	TREATMENT PLANT IN SAHIWAL				
BOREHOLE	TP-4					
LAB. REF.	56/2019	DEPTH m	0.70-1.40	DATE	21.11.2019	

LIQUID LIMIT

Number of Blows N	11	FOURTHER READING NOT POSSIBLE
Moisture Content %	25.00	



LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
	NON-PLASTIC	



TESTED BY	CHECKED BY
MAHMOOD	ASLAM
al	

LIQUID & PLASTIC LIMIT

(ASTM D-4318)

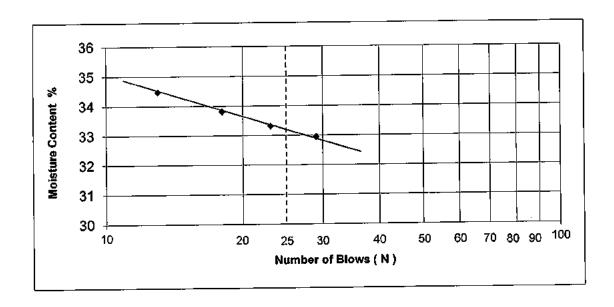
PROJECT	PUNJAB INTE	PUNJAB INTERMEDIATE INVESTMENT PROGRAM				
LOCATION	TREATMENT	TREATMENT PLANT IN SAHIWAL				
CLIENT	SAFE SERVIC	SAFE SERVICES				
BOREHOLE	TP-6					
LAB. REF.	56/2019	DEPTH m	0.50-1.35	DATE	21,11,2019	

LIQUID LIMIT

Number of Blows N	13	_18	23	29	
Moisture Content %	34.48	33.81	33. <u>32</u>	32.95	

			
Moisture Content %	20 <u>.21</u>	20.27	20.32

LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
33	20	13	



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MAHMOOD	ASLAM A
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LIQUID & PLASTIC LIMIT

(ASTM D-4318)

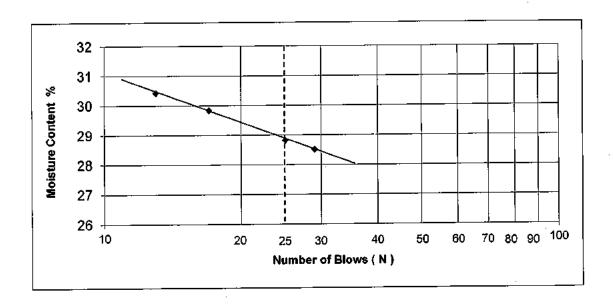
PROJECT	PUNJAB INTE	PUNJAB INTERMEDIATE INVESTMENT PROGRAM				
LOCATION	TREATMENT	TREATMENT PLANT IN SAHIWAL				
CLIENT	SAFE SERVIC	SAFE SERVICES				
BOREHOLE	TP-9	1, 0				
LAB. REF.	56/2019	DEPTH m	0.25-1.00	DATE	21.11.2019	

LIQUID LIMIT

Number of Blows N	13	17	25	29	
Moisture Content %	30.43	29.84	28.82	28.51	

Moisture Content %	20.31	20.36	20.41

LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
29	20	9



TESTED BY	CHECKED BY
MAHMOOD	ASLAM
(Dg)	

LIQUID & PLASTIC LIMIT

(ASTM D-4318)

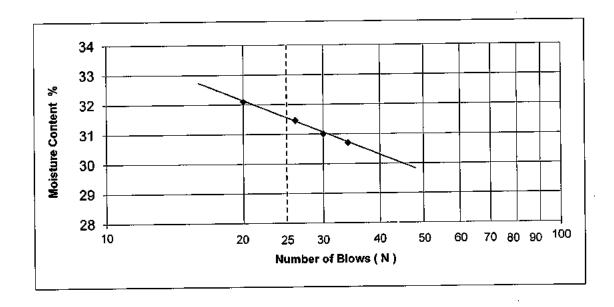
PROJECT					
LOCATION	TREATMENT PLANT IN SAHIWAL				
CLIENT	SAFE SERVICES				
BOREHOLE	BA-1	SAMPLE	CS-1	TYPE	DISTURBED
LAB. REF.	56/2019	DEPTH _m	0.20-0.90	DATE	21,11.2019

LIQUID LIMIT

Number of Blows N	20	26	30	34	
Moisture Content %	32.10	31.47	31.01	30.70	. <u> </u>

				1
Moisture Content %	20.18	20.22	20.26	

LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
31	20	11



TESTED BY	CHECKED BY
MAHMOOD	ASLAM
(w) e)	

LIQUID & PLASTIC LIMIT

(ASTM D - 4318)

PROJECT	PUNJAB INTE	PUNJAB INTERMEDIATE INVESTMENT PROGRAM				
LOCATION	TREATMENT	TREATMENT PLANT IN SAHIWAL				
CLIENT	SAFE SERVIC	SAFE SERVICES				
BOREHOLE	BA-2	SAMPLE	CS-1	TYPE	DISTURBED	
LAB, REF.	56/2019	DEPTH m	0.50-1.00	DATE	21.11.2019	

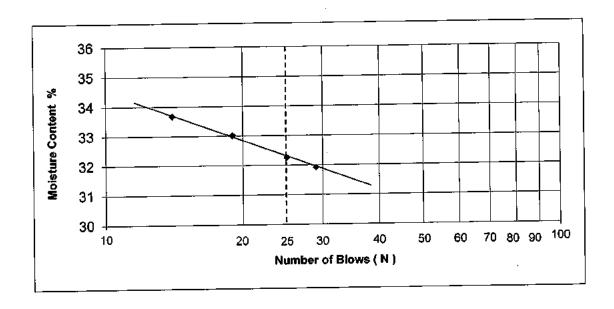
LIQUID LIMIT

Number of Blows_N	14	19	25	29	

Moisture Content %	33.68	33.02	32.26	31.92	

Moisture Content %	19.62	19.67	19.72

LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
33	20	13



TESTED BY	CHECKED BY
MAHMOOD	ASLAM
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LIQUID & PLASTIC LIMIT

(ASTM D-4318)

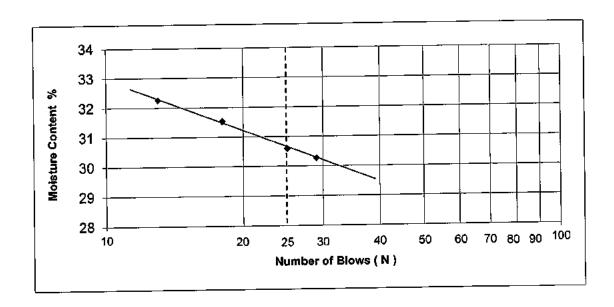
PROJECT		PUNJAB INTERMEDIATE INVESTMENT PROGRAM				
LOCATION	TREATMENT	TREATMENT PLANT IN SAHIWAL				
CLIENT	SAFE SERVIC	SAFE SERVICES				
BOREHOLE	BA-3	SAMPLE	CS-1	TYPE	D <u>ISTURB</u> ED	
LAB. REF.	56/2019	DEPTH m	0.20-0.70	DATE	21,11,2019	

LIQUID LIMIT

Number of Blows N	13	18	25	29	
Moisture Content %	32.26	31.53	30.59	30.27	

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Moisture Content %	19.92	19.97	20.01
MOISTUIN COUNCIL 70			

LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
31	20	11



TESTED BY	CHECKED BY
MAHMOOD	ASLAM
(21)	

LIQUID & PLASTIC LIMIT

(ASTM D-4318)

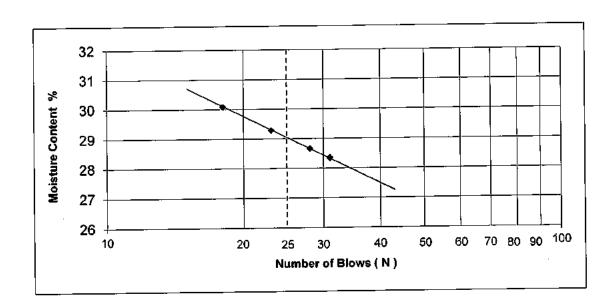
					
PROJECT		PUNJAB INTERMEDIATE INVESTMENT PROGRAM			
LOCATION	TREATMENT	TREATMENT PLANT IN SAHIWAL			
CLIENT	SAFE SERVIC	SAFE SERVICES			
BOREHOLE	BA-4	SAMPLE	CS-1	TYPE	DISTURBED
LAB. REF.	56/2019	DEPTH m	0.15-0.50	DATE	21.11.2019

LIQUID LIMIT

Number of Blows N	18	23	28	31	
Moisture Content %	30.09	29.29	28.67	28.35	

		<u> </u>	
Moisture Content %	20.11	20.17	20.22

LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
29	20	9



TESTED BY	CHECKED BY
МАНМООД	ASLAM
(wd)	

LIQUID & PLASTIC LIMIT

(ASTM D-4318)

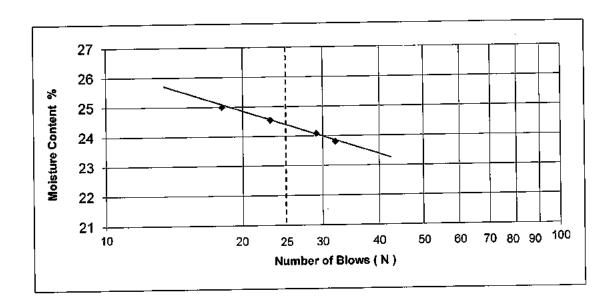
PROJECT	PUNJAB INTE	PUNJAB INTERMEDIATE INVESTMENT PROGRAM					
LOCATION	TREATMENT	TREATMENT PLANT IN SAHIWAL					
CLIENT	SAFE SERVIC	ES					
BOREHOLE	BA-5	SAMPLE	CS-1	TYPE	DISTURBED		
LAB. REF.	56/2019	DEPTH m	0.25-1.00	DATE	21.11.2019		

LIQUID LIMIT

Number of Blows N	18	23	29	32	
Moisture Content %	25.00	24.55	24.09	23.81	_

			
Moisture Content %	16.52	16.57	16.61

LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
24	17	7



TESTED BY	CHECKED BY
MAHMOOD	ASLAM
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LIQUID & PLASTIC LIMIT

(ASTM D-4318)

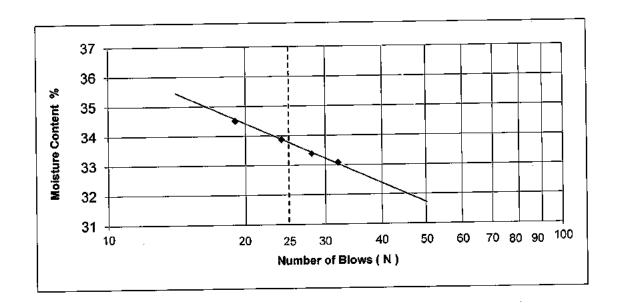
								
PROJECT		PUNJAB INTERMEDIATE INVESTMENT PROGRAM						
LOCATION	TREATMENT	TREATMENT PLANT IN SAHIWAL						
CLIENT	SAFE SERVIC	E\$						
BOREHOLE	BA-5	SAMPLE	CS-2	TYPE	DISTURBED			
LAB, REF.	56/2019	DEPTH m	1.00-1.70	DATE	.21.11.20 <u>1</u> 9			

LIQUID LIMIT

Number of Blows N	19	24	28	32	
Moisture Content %	34.51	33.87	33.39	33.08	

Moisture Content %	21.32	21.36	21.41	

LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
34	21	13



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MAHMOOD	ASLAM
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LIQUID & PLASTIC LIMIT

(ASTM D-4318)

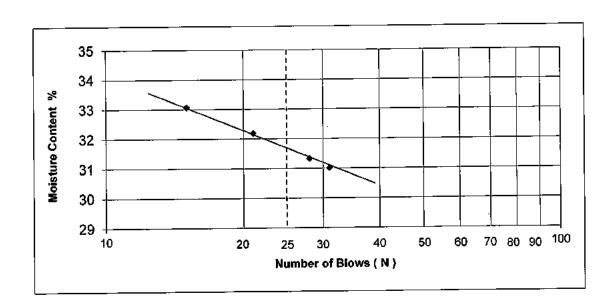
PROJECT		PUNJAB INTERMEDIATE INVESTMENT PROGRAM						
LOCATION	TREATMENT	TREATMENT PLANT IN SAHIWAL						
CLIENT	SAFE SERVIC	ES						
BOREHOLE	BA-6	SAMPLE	CS-1	TYPE	DISTURBED			
LAB. REF.	56/2019	DEPTH m	0.20-0.60	DATE	21.11,2019			

LIQUID LIMIT

Number of Blows N	15	21	28	31	
Moisture Content %	33.07	32.19	31.33	31.02	

<u> </u>	·	<u></u>	1
Moisture Content %	20.21	20.26	20.31

LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
32	20	12



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манмоор	ASLAM
(w)O	

LIQUID & PLASTIC LIMIT

(ASTM D-4318)

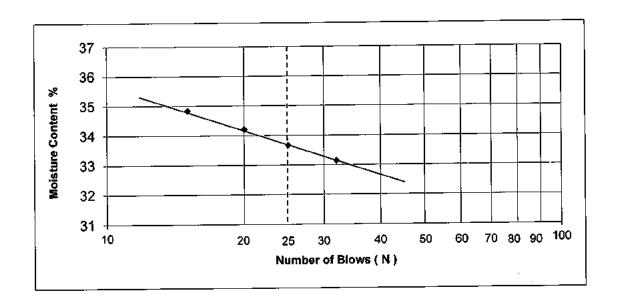
PROJECT		PUNJAB INTERMEDIATE INVESTMENT PROGRAM				
LOCATION	TREATMENT	TREATMENT PLANT IN SAHIWAL				
CLIENT	SAFE SERVIC	SAFE SERVICES				
BOREHOLE	BA-7	SAMPLE	CS-1	TYPE	DISTURBED	
LAB. REF.	56/2019	DEPTH m	0.20-0.80	DATE	21.11.2019	

LIQUID LIMIT

			i .	
Number of Blows N 15	_20	25	32	
Moisture Content % 34.84	34.21	33.67	33.14	

		<u>-</u>	
Moisture Content %	20.81	20.86	20.92
1110101010 001110111 111			

LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
34	21	13



TESTED BY	CHECKED BY
MAHMOOD	ASLAM
(a)	

LIQUID & PLASTIC LIMIT

(ASTM D-4318)

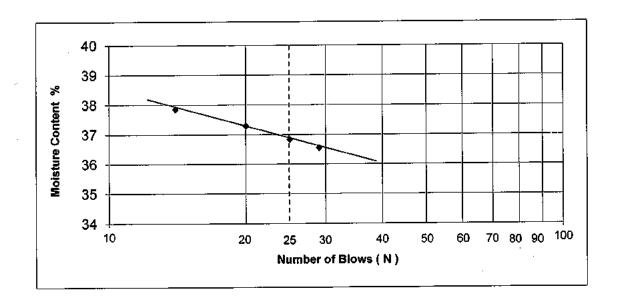
PROJECT	PUNJAB INTE	PUNJAB INTERMEDIATE INVESTMENT PROGRAM				
LOCATION	TREATMENT	TREATMENT PLANT IN SAHIWAL				
CLIENT	SAFE SERVIC	SAFE SERVICES				
BOREHOLE	BA-8	SAMPLE	CS-1	TYPE	DISTURBED	
LAB. REF.	56/2019	DEPTH m	0.15-1.00	DATE	21.11.2019	

LIQUID LIMIT

Number of Blows N	14	20	25	29	
Moisture Content %	37.86	37.29	36.83	36.55	

·		· ·	
Moisture Content %	21.18	21.23	21,27

LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
37	21	16



TESTED BY	CHECKED BY
MAHMOOD	ASLAM
(De	

LIQUID & PLASTIC LIMIT

(ASTM D-4318)

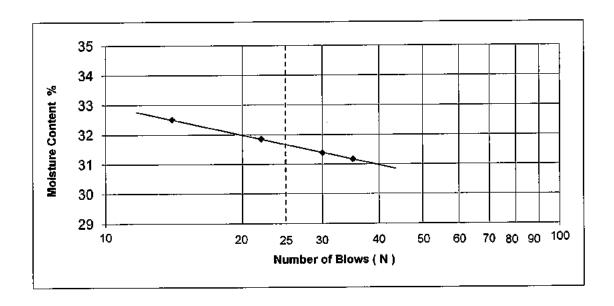
PROJECT	PUNJAB INTE	PUNJAB INTERMEDIATE INVESTMENT PROGRAM						
LOCATION	TREATMENT	TREATMENT PLANT IN SAHIWAL						
CLIENT	SAFE SERVIC	SAFE SERVICES						
BOREHOLE	BA-9	SAMPLE	CS-1	TYPE	DISTURBED			
LAB. REF.	56/2019	DEPTH m	0.20-1.50	DATE	21.11.2019			

LIQUID LIMIT

Number of Blows N	14	22	30	35	
Moisture Content %	32.51	31.86	31.39	31.18	

Moisture Content %	19.61	19.64	19.69

LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
32	20	12



TESTED BY	CHECKED BY
МАНМООД	ASLAM 😓
(w)	

LIQUID & PLASTIC LIMIT

(ASTM D-4318)

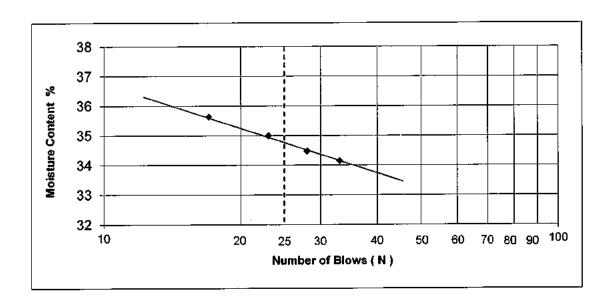
PROJECT	PUNJAB INTE	PUNJAB INTERMEDIATE INVESTMENT PROGRAM						
LOCATION	TREATMENT	TREATMENT PLANT IN SAHIWAL						
CLIENT	SAFE SERVIC	SAFE SERVICES						
BOREHOLE	BA-10	BA-10 SAMPLE CS-1 TYPE DISTURBED						
LAB. REF.	56/2019	DEPTH m	0.70-1.00	DATE	21.11	1.2019		

LIQUID LIMIT

Number of Blows N	17	23	28	33	
Moisture Content %	35.64	35.00	34.48	34.15	

				ı
Moisture Content %	20.82	20.86	20.91	

LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
35	21	14



TESTED BY	CHECKED BY
MAHMOOD	ASLAM
(Del	

COMPACTION TEST

SOILCON GEOTECHNICAL TESTING LABORATORIES

18-Km Multan Road Lahore, Ph.No: 042-7510942-3 Fax No: 7510944

Test Method: Modified AASHTO T-180 (Method A)

Dia of Mould: 4.0 inch

No of Blows : Test Pit No:

o: TP-2 Sa

25 No of Layers 5 ΓΡ-2 Sample No. CS-1 Volume of Mould:

938 cm³

Drop:

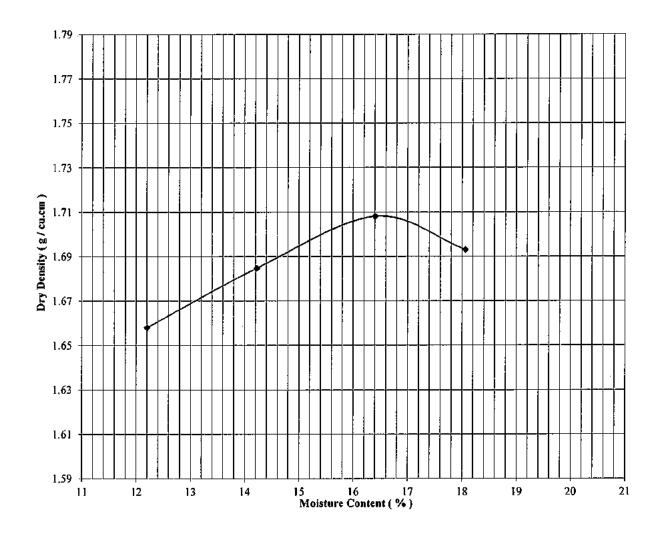
18 inch

Wt of Hammer :

10 lbs

Depth (m):

1.05-1.50



Optimum Moisture Content (%) 16.4			16.40	Maximur	n Dry Density	1.708 g/cm ³	
Project:	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM						
Location:	TREATMENT PLANTS IN SAHIWAL CITY				Client: SAFE SERVICES		
Tested By	$\triangle 12$	Checked	Ву	11 -	Dated	LAB, REF	
Mahmood	مدرين	Ikram Ul	illah \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\		06.12.2019	56/2019	

REMARKS:		 _
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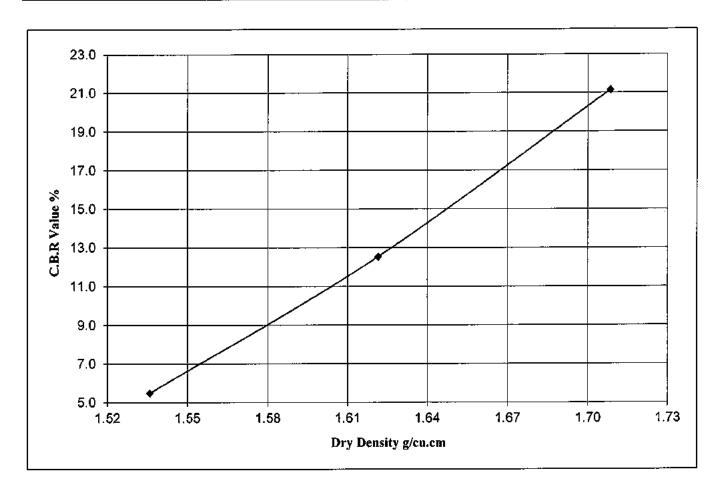


GEOTECHNICAL TESTING LABORATORIES, 18-Km, MULTAN ROAD, LAHORE

C.B.R. TEST

(AASHTO T-193)

No.of Blows per Layer	65	30	10		
CBR Value at 0.1 in %				COMPACTION	MODIFIED
CBR Value at 0.2 in %	21.2	12.5	5.5	M.D.D. g/cu.cm	1.708
Dry Density g/ cm ³	1.708	1.621	1.536	O.M.C %	16.40
Moisture Content %	16.11	16.11	16.11		
Absorption %	4.13	6.21	8.48		
Swelling %		-			



PROJECT:	PUNJAB INTERN	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM							
LOCATION:	TREATMENT PL	REATMENT PLANTS IN SAHIWAL CITY CLIENT SAFE SERVICES							
TP/ BH NO:	TP-2	SAMPL	E NO:	CS-1	DEPTH (m)	1.05-1.50			
LAB REF. NO :	56/2019	56/2019 DATE : 31.12.2019							
TESTED BY : MAHMOOD		1 7 12 1		CKED BY:	1/~-				

COMPACTION TEST

SOILCON GEOTECHNICAL TESTING LABORATORIES

18-Km Multan Road Lahore, Ph.No: 042-7510942-3 Fax No: 7510944

Test Method: Modified AASHTO T-180 (Method A)

Dia of Mould: 4.0 inch

No of Blows: Test Pit No:

25 No of Layers CS-1 TP-4 Sample No.

Volume of Mould:

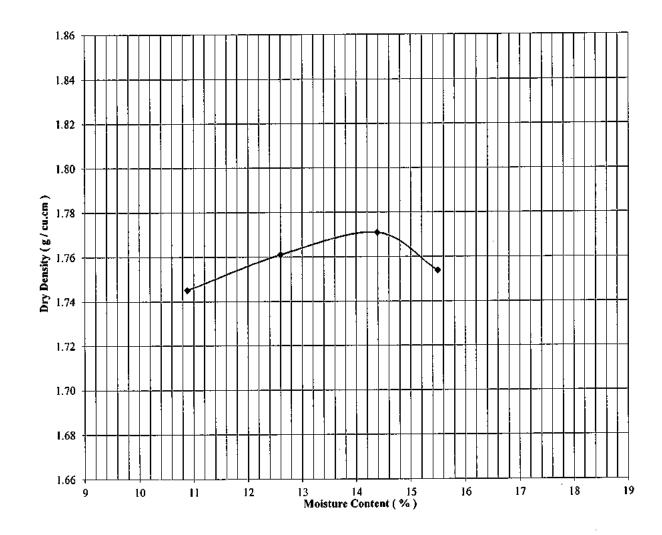
938 cm³

Drop:

inch 18 10 lbs

Wt of Hammer: Depth (m):

0.70-1.40



Optimum Moisture Content (%)			14.38	Maximun	n Dry Density	1.771 g/cm ³	
Project:	roject: PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM						
Location:	TREATME	NT PLANTS IN	SAHIWAL	Client: SAFE SERVIC	ES		
Tested By	$\bigcap D_{2}$	Checked	Checked By			LAB. REF	
Mahmood		Ikram U	llah	1/2	06.12.2019	56/2019	

REMARKS:	 		·	<u> </u>
	 	·		
	 '	<u></u>		

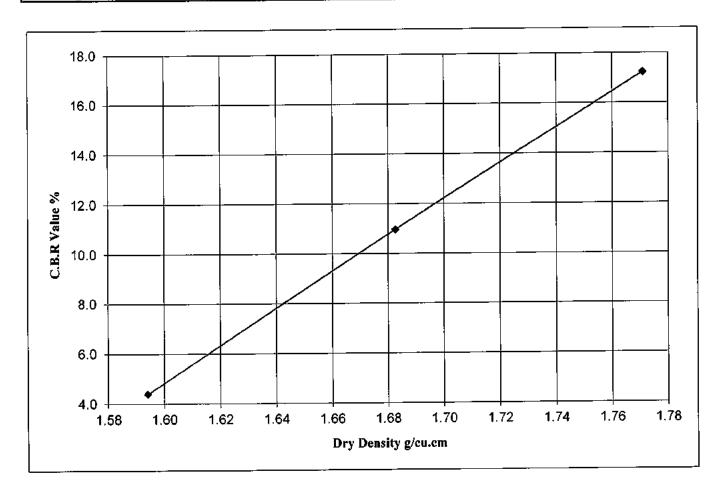


GEOTECHNICAL TESTING LABORATORIES, 18-Km, MULTAN ROAD, LAHORE

C.B.R. TEST

(AASHTO T-193)

No.of Blows per Layer	65	30	10		
CBR Value at 0.1 in %				COMPACTION	MODIFIED
CBR Value at 0.2 in %	17.2	11.0	4.4	M.D.D. g/cu.cm	1.771
Dry Density g/ cm ³	1.771	1.683	1.594	O.M.C %	14.38
Moisture Content %	14.09	14.09	14.09		
Absorption %	3.14	4,77	5.80		
Swelling %					



PROJECT:	PUNJAB INTER	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM							
LOCATION:	TREATMENT P	TREATMENT PLANTS IN SAHIWAL CITY CLIENT SAFE SERVICES							
TP/ BH NO:	TP-4	SAMPLE	NO:	CS-1	DEPTH (m)	0.70-1.40			
LAB REF. NO :	56/2019	DATE:	30.1	2.2019					
TESTED BY : MAHMOOD		00		CHECKED BY : IKRAM ULLAH					

COMPACTION TEST

SOILCON GEOTECHNICAL TESTING LABORATORIES

18-Km Multan Road Lahore, Ph.No: 042-7510942-3 Fax No: 7510944

Test Method: Modified AASHTO T-180 (Method A)

Dia of Mould: 4.0 inch

No of Blows: 25 No of Layers Test Pit No:

CS-1 TP-5 Sample No.

Volume of Mould:

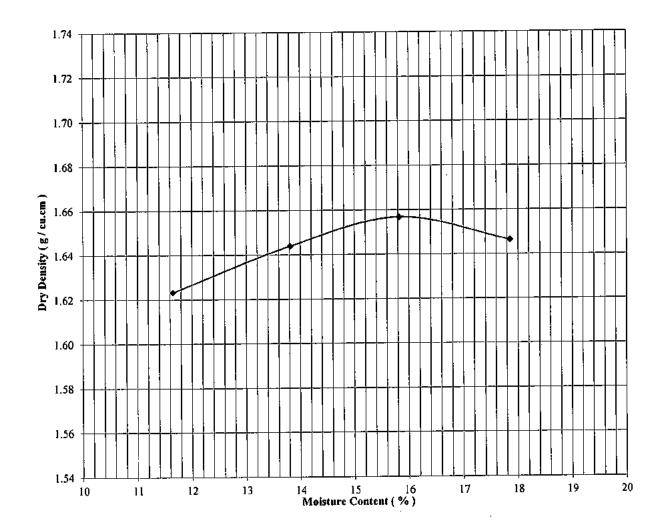
938 cm³

Drop: Wt of Hammer:

18 inch 10 lbs

Depth (m):

0.40-1.22



Optimum Mois	sture Conte	nt (%)	15.82	Maximur	n Dry Density	1.657 g/cm ³			
Project:	PUNJAB II	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM							
Location:	TREATME	ENT PLANTS I	N SAHIWAL C	ITY	Client: SAFE SERVI	CES			
Tested By	DV.	Check	ed By		Dated	LAB. REF			
Mahmood	سرسه [Ikram	Ullah		06.12.2019	56/2019			

REMARKS:	 	 	 	
	 _	 		

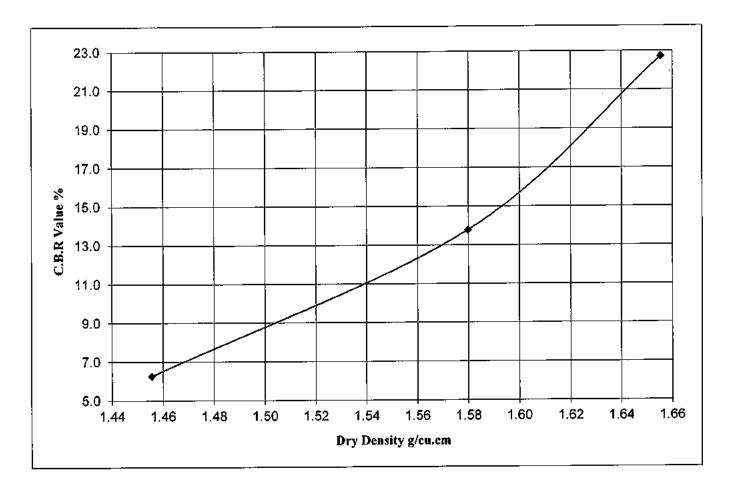


GEOTECHNICAL TESTING LABORATORIES, 18-Km, MULTAN ROAD, LAHORE

C.B.R. TEST

(AASHTO T-193)

No.of Blows per Layer	65	30	10		
CBR Value at 0.1 in %				COMPACTION	MODIFIED
CBR Value at 0.2 in %	22.7	13.8	6.3	M.D.D. g/cu.cm	1.657
Dry Density g/ cm ³	1.655	1.580	1.456	O.M.C %	15.82
Moisture Content %	15.43	15.43	15.43		
Absorption %	6.45	7.10	8.18		
Swelling %					



PROJECT:	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM							
LOCATION:	TREATMENT PL	REATMENT PLANTS IN SAHIWAL CITY CLIENT SAFE SERVICES						
TP/ BH NO:	TP-5	TP-5 SAMPLE NO: CS-1				0.40-1.22		
LAB REF. NO:	56/2019	DATE:	30.12	2.2019	<u> </u>			
TESTED BY:		() o	7 1 6		CKED BY:			
MAHMO	טטט ַ	IKRAM ULLAH						

COMPACTION TEST

SOILCON GEOTECHNICAL TESTING LABORATORIES

18-Km Multan Road Lahore, Ph.No: 042-7510942-3 Fax No: 7510944

Test Method: Modified AASHTO T-180 (Method A)

Dia of Mould: 4.0 inch No of Blows:

Test Pit No:

No of Layers 25

TP-7 Sample No. CS-1

Volume of Mould:

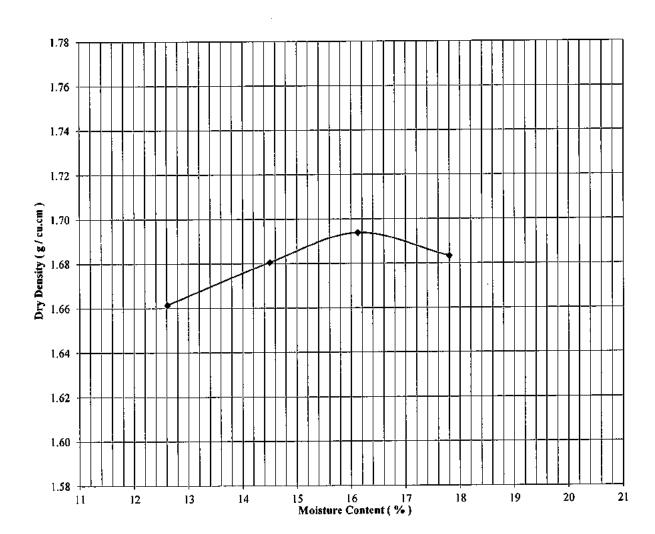
938 cm³

Drop:

18 inch

Wt of Hammer: Depth (m):

10 lbs 0.45-1.60



Optimum Moisture Content (%)			16.12	Maximur	n Dry Density	1.694 g/cm ³
Project: PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM						
Location:	TREATME	NT PLANTS IN	SAHIWAL	CITY	Client: SAFE SERVIO	CES
Tested By	Checked By				Dated	LAB. REF
Mahmood	7/4	Ikram U	llah	06.12.2019	56/2019	

REMARKS:				
	<u> </u>			
	 	<u></u>	<u>.</u> .	

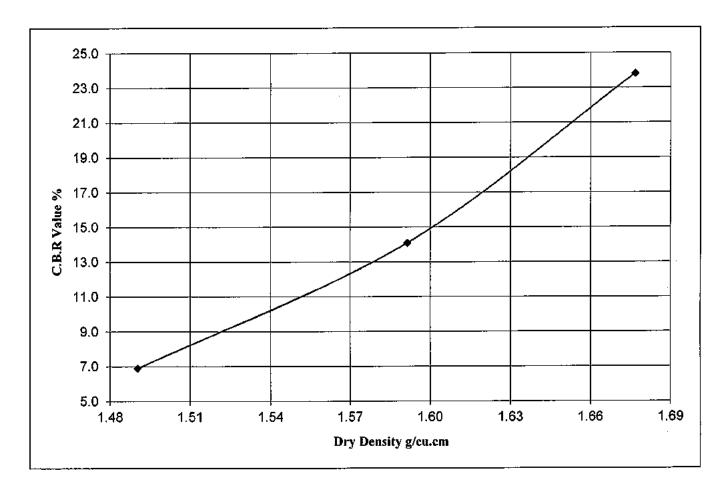


GEOTECHNICAL TESTING LABORATORIES, 18-Km, MULTAN ROAD, LAHORE

C.B.R. TEST

(AASHTO T-193)

No.of Blows per Layer	65	30	10		
CBR Value at 0.1 in %				COMPACTION	MODIFIED
CBR Value at 0.2 in %	23.8	14.1	6.9	M.D.D. g/cu.cm	1.694
Dry Density g/ cm ³	1.677	1.591	1.490	O.M.C %	16.12
Moisture Content %	15.88	15.88	15.88	· · · · · ·	
Absorption %	3.64	5.28	7.77		
Swelling %		-			



PROJECT:	PUNJAB INTER	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM							
LOCATION:	TREATMENT P	REATMENT PLANTS IN SAHIWAL CITY CLIENT SAFE SERVICES							
TP/ BH NO:	TP-7	SAMPLE	SAMPLE NO: CS-1			0.45-1.60			
LAB REF. NO:	56/2019	DATE:	31.12.	2019					
TESTE Mahn		00			CKED BY: AM ULLAH	1/			

COMPACTION TEST

SOILCON GEOTECHNICAL TESTING LABORATORIES

18-Km Multan Road Lahore, Ph.No: 042-7510942-3 Fax No: 7510944

Test Method: Modified AASHTO T-180 (Method A)

Dia of Mould: 4.0 inch

No of Blows: Test Pit No:

25 No of Layers TP-8

_Sample No.

Volume of Mould:

938 cm³

Drop:

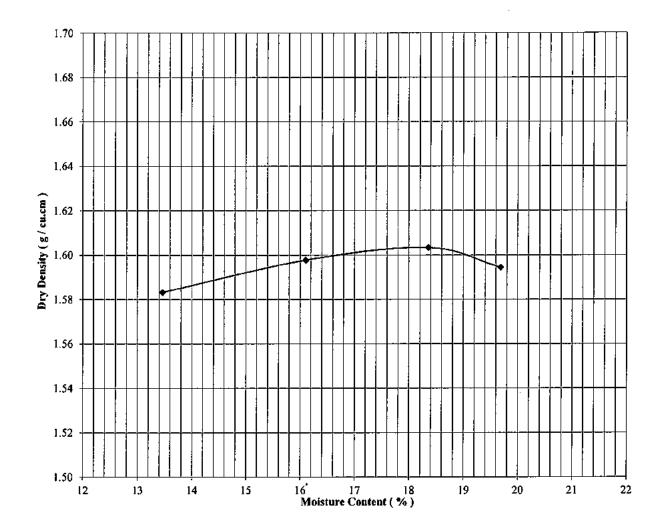
18 inch

Wt of Hammer:

10 Ibs

Depth (m):

0.35-1.50



Optimum Moisture Content (%)			18.35	N	Taximun	n Dry Density	1,603 g/cm ³
Project;	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM						
Location:	TREATMENT PLANTS IN SAHIWAL CITY					Client: SAFE SERVIC	CES
Tested By	10 M	Checked By				Dated	LAB. REF
Mahmood (אנע [Ikram U					56/2019

REMARKS:		
		-

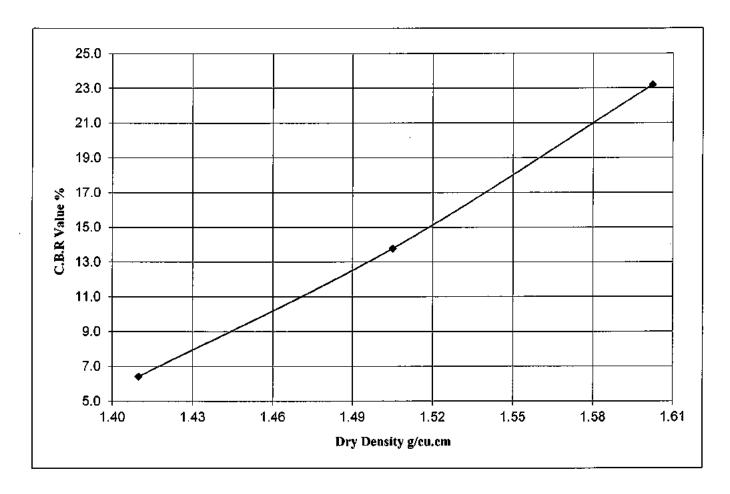


GEOTECHNICAL TESTING LABORATORIES, 18-Km, MULTAN ROAD, LAHORE

C.B.R. TEST

(AASHTO T-193)

No.of Blows per Layer	65	30	10		
CBR Value at 0.1 in %				COMPACTION	MODIFIED
CBR Value at 0.2 in %	23.2	13.8	6.4	M.D.D. g/cu.cm	1.603
Dry Density g/ cm ³	1,602	1.505	1.410	O.M.C %	18.35
Moisture Content %	17.88	17.88	17.88		
Absorption %	6.20	7.56	8.83		
Swelling %		_			



PROJECT:	PUNJAB INTERN	PUNJAB INTERMEDIATÉ CITIES INVESTMENT PROGRAM							
LOCATION:	TREATMENT PL	REATMENT PLANTS IN SAHIWAL CITY CLIENT SAFE SERVICES							
TP/ BH NO:	TP-8	TP-8 SAMPLE NO: CS-1				0.35-1.50			
LAB REF. NO:	56/2019	DATE:	31.1:	2.2019					
TESTED BY : MAHMOOD		1 / \1//		CKED BY : M ULLAH	1/~				

COMPACTION TEST

SOILCON GEOTECHNICAL TESTING LABORATORIES

18-Km Multan Road Lahore, Ph.No: 042-7510942-3 Fax No: 7510944

Test Method: Modified AASHTO T-180 (Method A)

Dia of Mould: 4.0 inch

No of Blows: Test Pit No:

25 No of Layers

TP-9 CS-1 Sample No.

Volume of Mould:

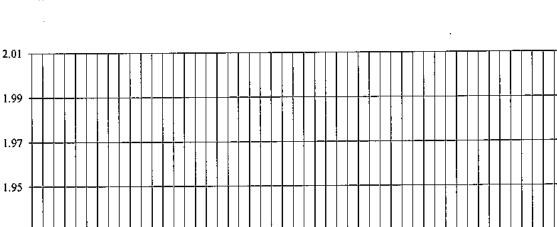
938 cm³

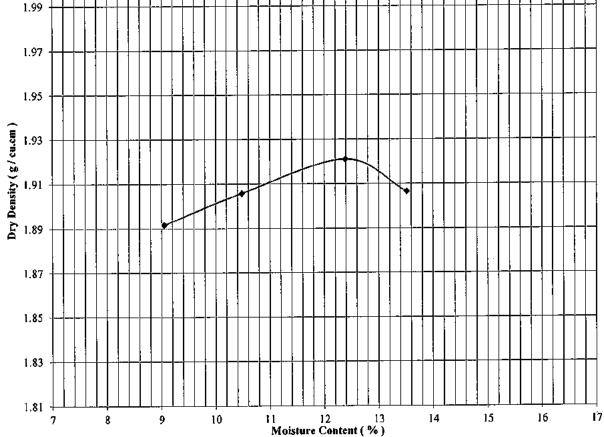
Drop:

18 inch 10 lbs

Wt of Hammer: Depth (m):

0.70-1.50





Optimum Mois	ture Contei	nt (%)	12.38	Maximur	n Dry Density	1.921 g/cm ³
Project:	pject: PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM					
Location:	TREATMENT PLANTS IN SAHIWAL CITY				Client: SAFE SERVIO	CES
Tested By	De	Checked	1 By		Dated	LAB. REF
Mahmood		Ikram U	llab	- Ehr	06.12,2019	56/2019

REMARKS:		 	·	<u> </u>
	<u></u>	 		

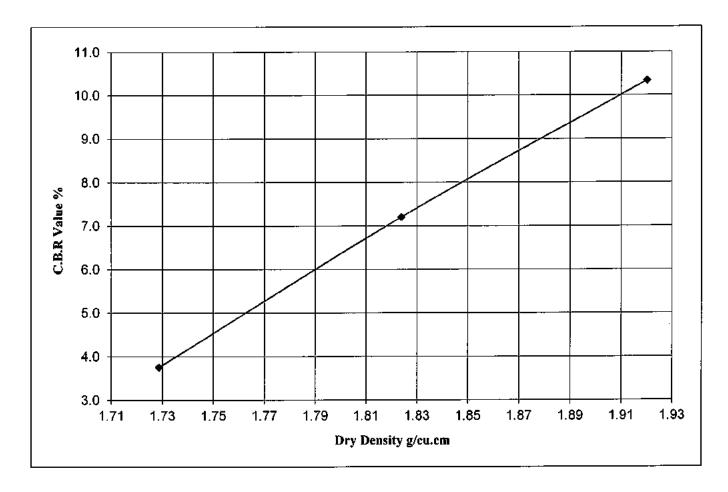


GEOTECHNICAL TESTING LABORATORIES, 18-Km, MULTAN ROAD, LAHORE

C.B.R. TEST

(AASHTO T-193)

No.of Blows per Layer	65	30	10		
CBR Value at 0.1 in %				COMPACTION	MODIFIED
CBR Value at 0.2 in %	10.3	7.2	3.8	M.D.D. g/cu.cm	1.921
Dry Density g/ cm ³	1,920	1.824	1.729	O.M.C %	12.38
Moisture Content %	11.61	11.61	11.61		
Absorption %	1.89	2.57	3.68		
Swelling %		1.63			



PROJECT:	PUNJAB INTER	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM						
LOCATION:	TREATMENT P	REATMENT PLANTS IN SAHIWAL CITY CLIENT SAFE SERVICES						
TP/ BH NO:	TP-9	ŞAMPL	E NO:	DEPTH (m)	0.70-1.50			
LAB REF. NO:	56/2019	DATE:	30.1	2.2019				
TESTE	BY:		2	CHE	CKED BY:			
MAHM	OOD	OD IKRAM ULLAH						

COMPACTION TEST

SOILCON GEOTECHNICAL TESTING LABORATORIES

18-Km Multan Road Lahore, Ph.No: 042-7510942-3 Fax No: 7510944

Test Method: Standard Proctor AASHTO T-99 (Method A)

Dia of Mould: 4.0 inch

No of Blows: Test Pit No:

25

No of Layers TP-1 Sample No.

CS-1

Volume of Mould: 938 cm³

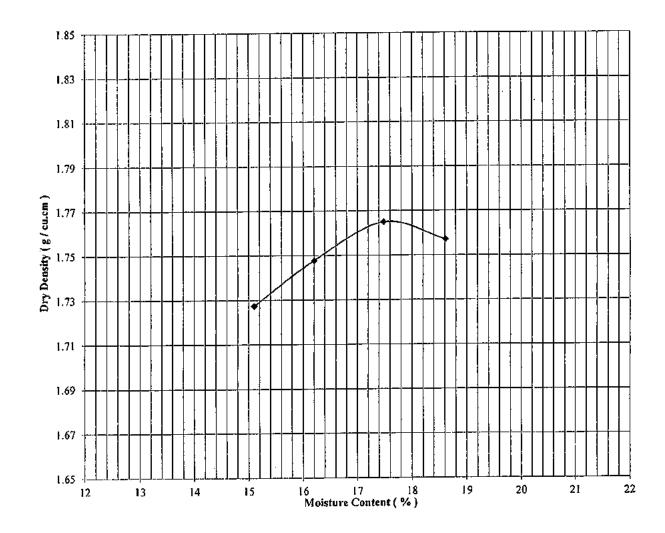
12 inch

Wt of Hammer:

5.5 lbs

Depth (m):

1.15-1.50



Optimum Moisture Content (%)		17.48	Maximur	n Dry Density	1.765 g/cm ³	
Project:	PUNJAB II	NTERMEDIATE	TE CITIES INVESTMENT PROGRAM			
Location:	TREATME	TREATMENTS PLANT IN SAHIWAL CITY			Client: SAFE SERVICE	CE
Tested By		Checked	l By	1/2	Dated	LAB. REF
Mahmood		Ikram U	llah	\ \ \ \	17.12.2019	56/2019

REMARKS:	 	 	 	 	
				_	

COMPACTION TEST

SOILCON GEOTECHNICAL TESTING LABORATORIES

18-Km Multan Road Lahore, Ph.No: 042-7510942-3 Fax No: 7510944

Test Method: Standard Proctor AASHTO T-99 (Method A)

Dia of Mould: 4.0 inch

No of Blows:

Test Pit No:

No of Layers TP-6 Sample No.

CS-1

Volume of Mould: 938 cm³

Drop:

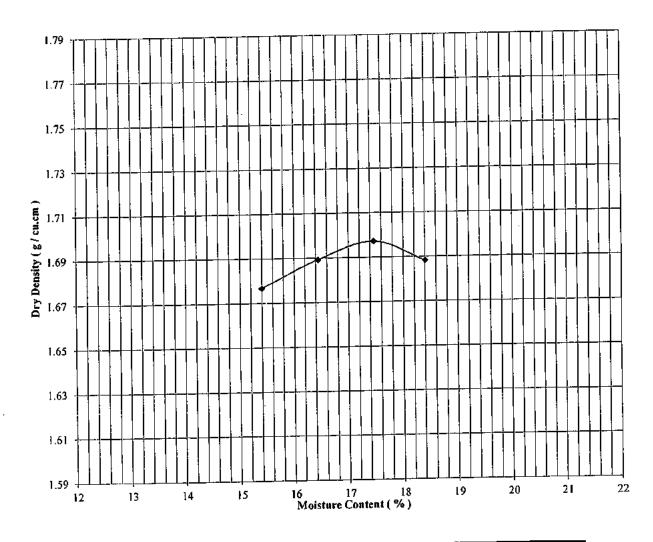
inch 12

Wt of Hammer:

ibs 5.5

Depth (m):

0.50-1.35



Optimum Moisture Content (%)				1.697 g/cm ³	
PUNJAB II	TERMEDIATE			GRAM Client: SAFE SERVI	ICE
	Checked	By_	-	Dated	LAB. REF 56/2019
	PUNJAB II TREATME	PUNJAB INTERMEDIATE TREATMENTS PLANT IN Checked	PUNJAB INTERMEDIATE CITIES IN TREATMENTS PLANT IN SAHIWAL Checked By	PUNJAB INTERMEDIATE CITIES INVESTMENT PRO TREATMENTS PLANT IN SAHIWAL CITY Checked By	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM TREATMENTS PLANT IN SAHIWAL CITY Checked By Dated

REMARKS:	

COMPACTION TEST

SOILCON GEOTECHNICAL TESTING LABORATORIES

18-Km Multan Road Lahore, Ph.No: 042-7510942-3 Fax No: 7510944

Test Method: Standard Proctor AASHTO T-99 (Method A)

Dia of Mould: 4.0 inch

No of Blows: Test Pit No:

25 No of Layers BA-1 Sample No.

CS-1

Volume of Mould:

938 cm³

Drop:

12

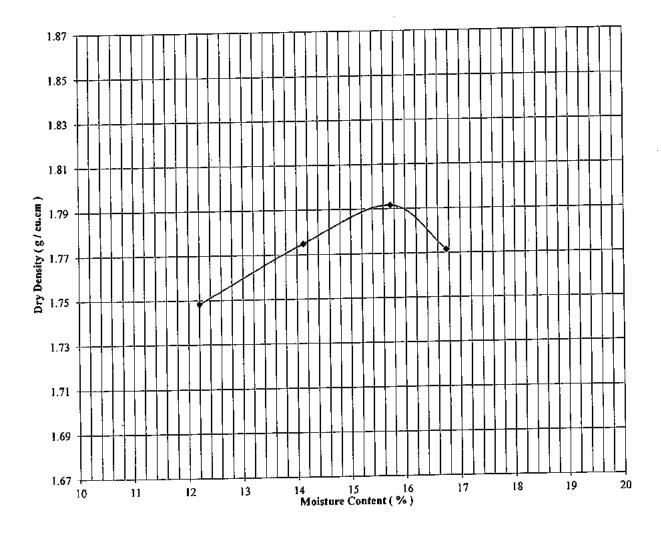
Wt of Hammer:

5.5 lbs

inch

Depth (m):

0.20-0.90



Optimum Mois	sture Conte	nt (%)	15.73		m Dry Density	1.792 g/cm ³
Project: Location:		NTERMEDIAT		VESTMENT PRO CITY	GRAM Client: SAFE SERVI	CE
Tested By Mahmood	well .	Check Ikram	ed By	Umi	Dated 20.12.2019	LAB. REF 56/2019

REMARKS:	

COMPACTION TEST

SOILCON GEOTECHNICAL TESTING LABORATORIES

18-Km Multan Road Lahore, Ph.No: 042-7510942-3 Fax No: 7510944

Test Method: Standard Proctor AASHTO T-99 (Method A)

Dia of Mould: 4.0 inch

Test Pit No:

No of Blows:

25 🛬 No of Layers

BA-2 Sample No.

Volume of Mould: 938 cm3

Drop:

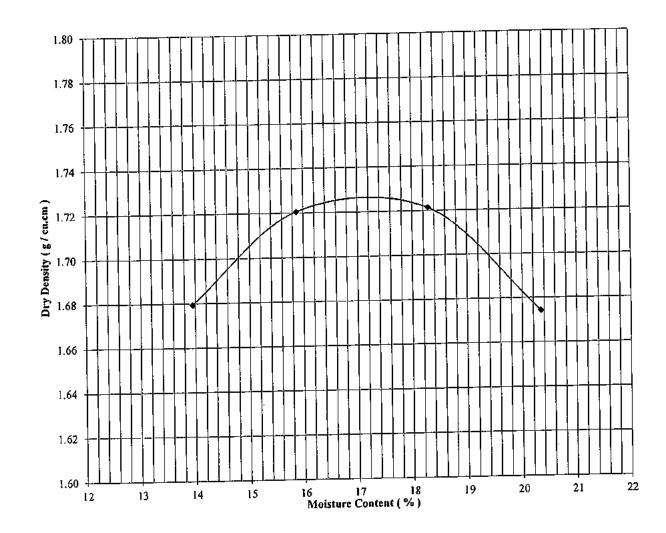
12 inch

Wt of Hammer:

lbs 5.5

Depth (m):

0.50-1.50



Optimum Mois	sture Content	(%)	17.20		n Dry Density	1.728 g/cm ³
Project:	PUNJAB IN	TERMEDIATI TS PLANT IN		VESTMENT PRO	GRAM Client: SAFE SERVIC	CE
Location : Tested By Mahmood	- WEST	Checke Ikram	d By	Umi	Dated 17.12.2019	LAB. REF 56/2019

REMARKS:	

COMPACTION TEST

SOILCON GEOTECHNICAL TESTING LABORATORIES

18-Km Multan Road Lahore, Ph.No: 042-7510942-3 Fax No: 7510944

Test Method: Standard Proctor AASHTO T-99 (Method A)

Dia of Mould: 4.0 inch

No of Blows: Test Pit No:

25

No of Layers BA-6 Sample No.

CS-1

Volume of Mould:

938 cm³ 12

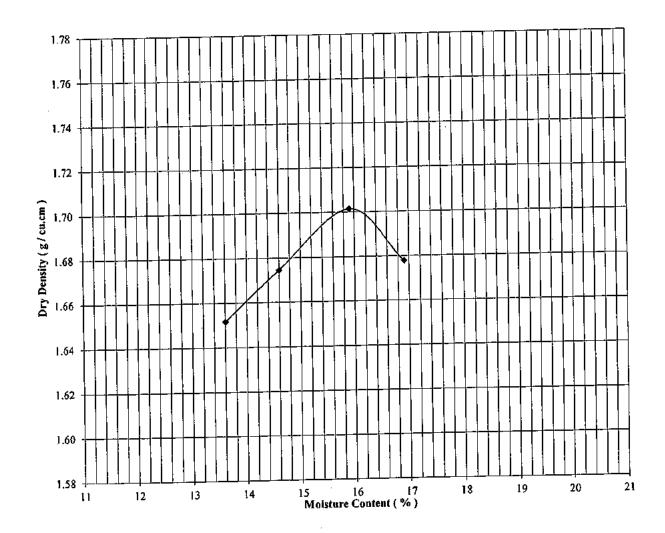
Drop:

Wt of Hammer:

Depth (m):

lbs 5.5 0.20-0.60

inch



Optimum Mois	ture Content	(%)	15.91		n Dry Density	1.702 g/cm ³
Project:	PUNJAB IN	TERMEDIATE NTS PLANT IN		VESTMENT PRO CITY	GRAM Client: SAFE SERVI	CÉ
Location : Tested By Mahmood	W U	Checked Ikram U	l By	1/-	Dated 17.12.2019	LAB. REF 56/2019

REMARKS:	 		

COMPACTION TEST

SOILCON GEOTECHNICAL TESTING LABORATORIES

18-Km Multan Road Lahore, Ph.No: 042-7510942-3 Fax No: 7510944

Test Method: Standard Proctor AASHTO T-99 (Method A)

Dia of Mould: 4.0 inch

No of Blows: Test Pit No:

No of Layers

CS-1 BA-8 Sample No.

Volume of Mould:

938 cm³

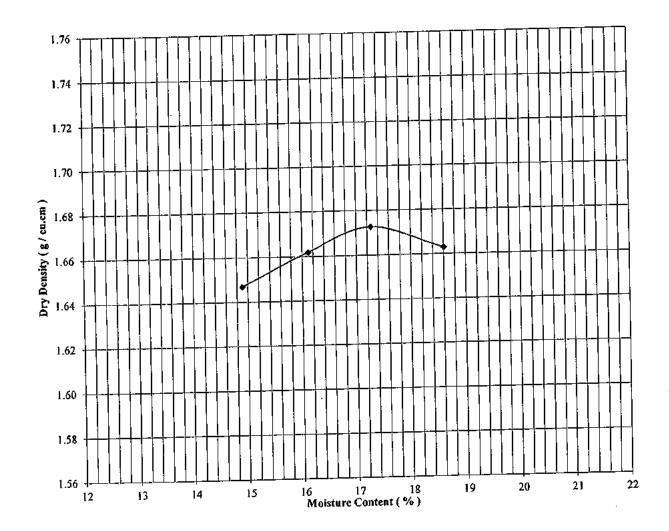
Drop:

inch 12

We of Hammer:



ibs 5.5 0.15-1.00



ture Conte	ıt (%)	17.27			1.673 g/cm ³
PUNJAB II	TERMEDIATE			GRAM Client: SAFE SERVI	CE
012	Checked	By	-	Dated 17.12.2019	LAB. REF 56/2019
	PUNJAB INTREATME	TREATMENTS PLANT IN Checker	PUNJAB INTERMEDIATE CITIES IN TREATMENTS PLANT IN SAHIWAL Checked By	PUNJAB INTERMEDIATE CITIES INVESTMENT PRO TREATMENTS PLANT IN SAHIWAL CITY Checked By	PUNJAB INTERMEDIATE CITIES INVESTMENT PROGRAM TREATMENTS PLANT IN SAHIWAL CITY Client: SAFE SERVI Dated

REMARKS:	

COMPACTION TEST

SOILCON GEOTECHNICAL TESTING LABORATORIES

18-Km Multan Road Lahore, Ph.No: 042-7510942-3 Fax No: 7510944

Test Method: Standard Proctor AASHTO T-99 (Method A)

Dia of Mould: 4.0 inch

No of Blows: Test Pit No:

No of Layers BA-10 Sample No.

CS-I

Volume of Mould:

938 cm³

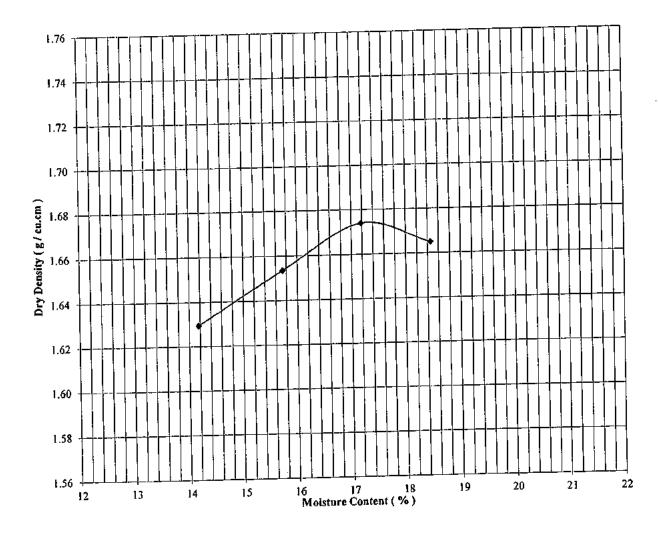
Drop:

Wt of Hammer:

12 inch ibs

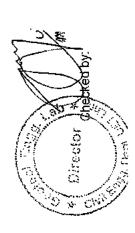
Depth (m):

5.5 0.70-1.30



Optimum Moi	sture Conte	nt (%)	17.18	Maximum	n Dry Density	1.674 g/cm ³
Project:	PUNJAB I	NTERMEDIATE		ESTMENT PRO	GRAM SARR SERVICE	
Location:	TREATME	NTS PLANT IN		CITY	Client: SAFE SERVIC	LAB. REF
Tested By Mahmood	(N)	Checke Ikram U		1/2	20.12.2019	56/2019

REMARKS:	



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Geotechnical Engineering Laboratory Department of Civil Engineering

Falling Head Permeability Test

Consultancy Services For Engineering, Procurement And Construction Management For Punjab Intermediate Cities Improvement Investment Program (Treatment Plants in Sahiwal City) Project:

SAFE Client: TP-1 BH No.

Sample No. CS-1

Depth (m) 1.15 -1.50

Remoulded dry density of sample =

1.8 gm/cm³

Internal Dia of mould = D (cm) =

Internal Height of mould = L (cm):

12.7 cm

10.53 cm

87.09 cm²

Int. Vol of mould = V

Int Area of Mould = A

1105.99 cm³

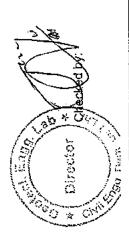
0.6 cm

Dia of stand pipe, d

Area of stand pipe, a

	11	h2	Log(h1/h2)	tsec	J. L	T °C K ₇₌ [2.3a.L/A.t)}log(h1/h2) K 20=K _T (ητ/η20)	K ₂₀ =K _T (ηπη ₂₀₎
est No	(cm)	E S					
-	03	40.7	0.01	09	26	1.11E-05	8.46E-06
	6	10.1					
2	į.	0 14	0.01	99	56	8.79E-06	6.72E-06
1	66	5.40					
,	. 69	Ω.	0.01	90	56	1.15E-05	8.82E-06
7	9	9					





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Geotechnical Engineering Laboratory Department of Civil Engineering

Falling Head Permeability Test

Consultancy Services For Engineering, Procurement And Construction Management For Punjab Project:

Intermediate Cities Improvement Investment Program (Treatment Plants in Sahiwal City)

SAFE Client:

TP-6

BH No.

Sample No. CS-1

Depth (m) 0.50 -1.35

Internal Dia of mould = D (cm) =

internal Height of mould = L (cm):

Int Area of Mould = A

Remoulded dry density of sample =

10.53 cm

1.8 gm/cm³

87.09 cm²

12.7 cm

Int. Vol of mould = V

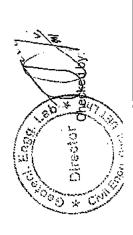
1105.99 cm³

Dia of stand pipe, d

0.6 cm

Area of stand pipe, a

	Ξ	h2	Log(h1/h2)	t sec	ာ့ ၂	$T \circ C \mid K_{T} = [2.3a.L/A.t] \setminus \log(h1/h2) \mid K_{20} = K_T(\eta_T \eta_{L0})$	K 20=Kr(111/11/20)
Test No	(cm)	(cm)					
1	33	6 0 0	0.01	09	26	8.06E-06	6.16E-06
	20	03.0					
2	i.	0	0.01	99	56	1,11E-05	8.46E-06
1	င္ပ	43.7					
	u u	573	0.01	09	26	1.01E-05	7.69E-06
٠	o n	١.					



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Falling Head Permeability Test

Consultancy Services For Engineering, Procurement And Construction Management For Punjab Intermediate Cities Improvement Investment Program (Treatment Plants in Sahiwal City) Project:

SAFE Cllent:

BA-1

BH No.

Sample No. CS-1

Depth (m) 0.20 -0.90

1.8 gm/cm³

Internal Dia of mould = D (cm) =

Remoulded dry density of sample = 10.53 cm

87.09 cm²

12.7 cm

Internal Height of mould = L (cm) :

Int. Vol of mould = V

Int Area of Mould = A

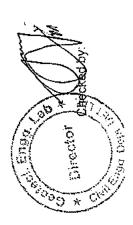
1105.99 cm³

0.6 cm

Dia of stand pipe, d

Area of stand pipe, a

- 11	Ħ	h2 ()	Log(h1/h2)	tsec	၁ _° 1	T °C K _{T*} [2.3a.L/A.t)}log(h1/h2, K ₂₀ =K _T (n _T /η ₂₀)	K 20=Kτ(ητ/η20)
est No	(cm)	(cm)					
-	ų.		0.00	90	26	1.53E-06	1.17E-06
	43	2					
2	į	Ċ	0.01	09	26	1.51E-05	1.16E-05
ı	၁၁	020.0					
 	, L	ç	0.01	90	56	1.39E-05	1.06E-05
**	20	7					



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Department of Civil Engineering Geotechnical Engineering Laboratory

Falling Head Permeability Test

Consultancy Services For Engineering, Procurement And Construction Management For Punjab Intermediate Cities Improvement Investment Program (Treatment Plants in Sahiwal City) Project:

Client: SAFE

BH No. BA-2

Sample No. CS-1

Remoulded dry density of sample =

Depth (m) 0.50 -1.50

1.8 gm/cm³

Internal Dia of mould = D $\langle cm \rangle =$

12.7 cm

10.53 cm

87.09 cm²

Internal Height of mould = L (cm) : int Area of Mould = A

1105.99 cm³

Dia of stand pipe, d

int. Vol of mould = V

0.6 cm

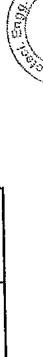
Area of stand pipe, a

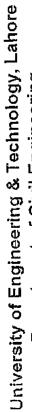
0.28 cm²

7.14	FI (15 12 12	Log(h1/h2)	tsec	၁့ 1	T °C K _{T-} [2.3a.L/A.t)}log(h1/h2)	K 20=K1(111,1120)
est No	(CIII)	CIMI)					
-	Ç	ου υ	0.00	09	26	4.59E-06	3.51E-06
	200	2					1
2	· ·	Š	0.00	09	26	6.37E-06	4.86E-06
	င္ရ	04.4					
¢	14	24.2	0.01	90	26:	8.79E-06	6.72E-06
·	3	2.5					

77.7

(163)





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Geotechnical Engineering Laboratory Department of Civil Engineering

Falling Head Permeability Test

Consultancy Services For Engineering, Procurement And Construction Management For Punjab Intermediate Cities Improvement Investment Program (Treatment Plants in Sahiwal City) Project:

SAFE Client: BA-6 BH No.

Sample No. CS-1

Depth (m) 0.20 -0.60

1.8 gm/cm³

Internal Dia of mould = D (cm) =

Internal Height of mould = L (cm):

Int Area of Mould = A

10.53 cm

Remoulded dry density of sample =

87.09 cm²

12.7 cm

int. Vol of mould = V

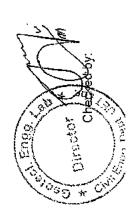
1105.99 cm³

Dia of stand pipe, d

0.6 cm

Area of stand pipe, a

		4.2				(1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	# W // // //
Toef No	= { £	(m2)	Log(h1/h2)	t sec	ပ မ	T°C K _{T=} [2.3a.L/A.t)}log(n1/112) N 20-157/117/120)	C 20-171/1[20]
1	50	49.2	0.01	99	26	1.11E-05	8.46E-05
	3	1					
2	7.5	77	0.01	90	56	1.08E-05	8.22E-06
	2,	2					
"	50	7.65	0.01	09	26	1.25E-05	9.53E-06
>)						



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Falling Head Permeability Test

Consultancy Services For Engineering, Procurement And Construction Management For Punjab Intermediate Cities Improvement Investment Program (Treatment Plants in Sahiwal City) Project:

SAFE Client: BA-8 BH No.

Sample No. CS-1

Depth (m) 0.15 -1.00

Internal Height of mould = L (cm) :

Remoulded dry density of sample =

1.8 gm/cm³

Internal Dia of mould = D (cm) =

12.7 cm

10.53 cm

87.09 cm²

Int. Vol of mould = V

Int Area of Mould = A

1105.99 cm³

Dia of stand pipe, d

Area of stand pipe, a

0.28 cm²

0.6 cm

K 20=KT(11111120) 7.04E-06 8.95E-06 8.65E-06 K_{T=}[2.3a.L/A.t)}log(h1/h2, 1.13E-05 9.21E-06 1.17E-05 ပ္ 8 26 26 t sec 90 8 69 Log(h1/h2) 0.01 0.0 0.01 63.9 59.2 54.1 h2 (cm) ի1 (cm) 22 9 65 Test No ന N



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Geotechnical Engineering Laboratory Department of Civil Engineering

Falling Head Permeability Test

Consultancy Services For Engineering, Procurement And Construction Management For Punjab Intermediate Cities Improvement Investment Program (Treatment Plants in Sahiwal City) Project:

SAFE Client: Sample No. CS-1

BA-10

BH No.

Depth (m) 0.70 -1.30

1.8 gm/cm³

Internal Dia of mould = D (cm) =

Remoulded dry density of sample =

10.53 cm

Internal Height of mould = L (cm) :

12.7 cm

87.09 cm²

Int. Vol of moutd = V

Int Area of Mould = A

1105.99 cm³

Dia of stand pipe, d

Area of stand pipe, a

0.28 cm²

0.6 cm

K 20=K _T (गाग्ग20)	7.40E-06	5.27E-06	1.06 E -05
Т°С K _{T=} [2.3a.L/A.t]}log(h1/h2, K ₂₀ =К _Т (ητ/η ₂₀₎	9.585-06	6.90E-06	1.39E-05
ာ ⊥	26	26	56
t sec	90	90	90
Log(h1/h2)	0.01	0.00	0.01
h2 (cm)	49.3	59.4	44.1
h1 (cm)	50	60	45
Test No	-	2	ო

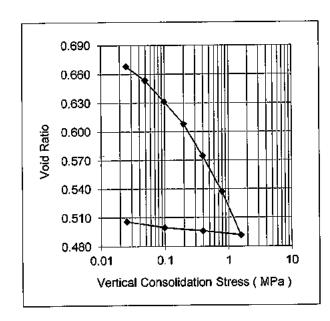
(166)

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CONSOLIDATION TEST

CLIENT	SAFE SEF				
PROJECT			ATE CITIES INVESTMEN		
SITE	PROGRAM	VIIN SA <u>HIW</u>	AL CITY		
BORE HOLE	BH-33	BH-33 SAMPLE UDS-1			
SPECIMEN	1	TYPE	ÜNDISTURBED		
DEPTH m	2,45-2,95	DATE	22.11.2019		

Operator	Checked by
Nisar Ahmad	Mahmopol
NINSTE	



SOIL AND SPECIMEN CHARACTERISTICS

Initial Bulk Density	1949	Kg/m ³
Final Bulk Density	2053	Kg/m³
Initial Water Content	22.46	%
Final Water Content	19.49	%
Initial Specimen Height	20.00	mm
Specimen Diameter	63.70	mm
Specific Gravity App.	2.708	
Initial Void Ratio	0.702	

TEST CHARACTERISTICS

	·
No. of Loading Steps	7
No. of unloading Steps	3

LAB REF. 54/2019

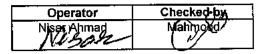
	1.00E-02		T	
6	1.00E-03			
Cv (sq.cm/sec)	1.00E-04			
3	1.00E-05			
	1.00E-06 0.01	0.1	1	10
	Vertic	al Consolidati	ion Stress	(MPa)

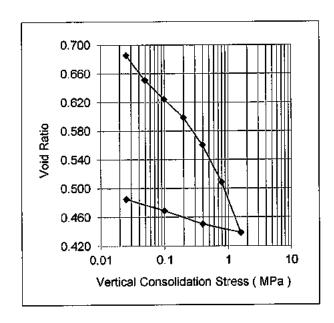
Void Ratio	Çv
	cm²/sec_
0.668	
0.654	
0.632	
0.608	5.12E-04
0.575	4.75E-04
0.537	4.37E-04
0.492	3.99E-04
0.496	
0.500	
0.506	
	0.654 0.632 0.608 <u>0.575</u> 0.537 0.492 0.496 0.500

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CONSOLIDATION TEST

CLIENT	SAFE SEF	· · ·	
PROJECT	PUNJAB II	NTERMEDI	ATE CITIES INVESTMEN
SITE	PROGRAM	NIN SAHIW	AL CITY
BORE HOLE	BH-45	SAMPLE	UDS-1
SPECIMEN	1	TYPE	UNDISTURBED
DEPTH m	2 45-2 95	DATE	27.11.2019





SOIL AND SPECIMEN CHARACTERISTICS

Initial Bulk Density	1878	Kg/m³
Final Bulk Density	2065	Kg/m³
Initial Water Content	22.50	%
Final Water Content	18.66	%
Initial Specimen Height	20.00	mm
Specimen Diameter	63.70	mm
Specific Gravity	2.585	
Initial Void Ratio	0.686	

TEST CHARACTERISTICS

	·	
No. of Loading Steps	7	
No. of unloading Steps]3	

LAB REF. 56/2019

	1.00E-02			
()6	1.00E-03 -	<u> </u>	+	
Cv (sq.cm/sec)	1.00E-04			
రే	1.00E-05			
	1.00E-06 0.01	0.1	1	10
	Verti	cal Consolidat	ion Stress	(MPa)

Pressure	Void Ratio	Cv
Мра		cm²/sec
0		
0.025	0.686	
0.049	0.651	
0.098	0.624	
0.196	0.599	5.17E-04
0.392	0.560	5.60E-04
0.785	0.509	4.33E-04
1.569	0.439	3.99E-04
0.392	0.451	
0.098	0.469	
0.025	0.485	

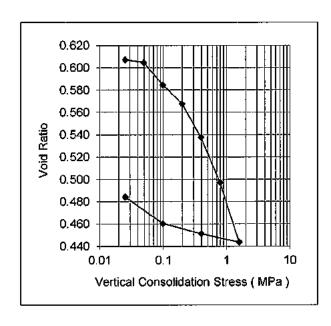
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CONSOLIDATION TEST

CLIENT	SAFE SEF	SAFE SERVICES			
PROJECT		PUNJAB INTERMEDIATE CITIES INVESTMEN			
SITE	PROGRAI	PROGRAM IN SAHIWAL CITY			
BORE HOLE	TP-1	TP-1 SAMPLE CS-1			
SPECIMEN	1	1 TYPE DISTURBED			
DEPTH m	1.15-1.50	1.15-1.50 DATE 30.12.2019			

Operator	Checked by
Nisar Ahmad	Mahmood



SOIL AND SPECIMEN CHARACTERISTICS

Initial Bulk Density	1987	Kg/m ³
Final Bulk Density	2156	Kg/m³
Initial Water Content	18.50	%
Final Water Content	17.71	%
Initial Specimen Height	20.00	mm
Specimen Diameter	63.70	mm
Specific Gravity	2.718	
Initial Void Ratio	0.621	

TEST CHARACTERISTICS

No. of Loading Steps	7
No. of unloading Steps	3

LAB REF. 56/2019

	1.00E-02			
<u></u>	1.00E-03 -			
Cv (sq.cm/sec)	1.00E-04			
5	1.00E-05 ·			
	1.00E-06 ·	0.1	1	10
		ertical Consolid	ation Stress	(MPa)

P	ressure	Void Ratio	Cv
Г	Мра		cm²/sec
Г	0		
1	0.025	0.607	
	0.049	0.605	
1	0.098	0.585	
	0.196	0.568	2.09E-04
	0.392	0.538	1.60E-04
	0.785	0.497	1.43E-04
	1.569	0.444	1.34E-04
	0.392	0.451	
	0.098	0.460	
	0.025	0.484	

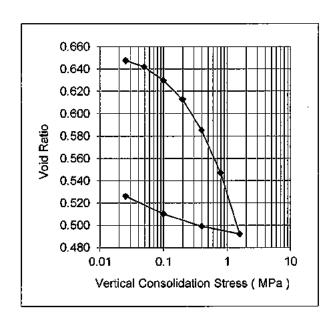
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CONSOLIDATION TEST

CLIENT		SAFE SERVICES			
PROJECT	PUNJAB II	PUNJAB INTERMEDIATE CITIES INVESTMEN			
SITE	PROGRAM	PROGRAM IN SAHIWAL CITY			
BORE HOLE	TP-6	TP-6 SAMPLE CS-1			
SPECIMEN	1	1 TYPE DISTURBED			
DEPTH m	0.50-1.35	0.50-1.35 DATE 30.12.2019			

Mahmood



SOIL AND SPECIMEN CHARACTERISTICS

		_,
Initial Bulk Density	1926	Kg/m ³
Final Bulk Density	2090	Kg/m³
Initial Water Content	19. 4 6	%
Final Water Content	19.63	%
Initial Specimen Height	20.00	mm
Specimen Diameter	63.70	mm
Specific Gravity	2.666	
Initial Void Ratio	0.654	

TEST CHARACTERISTICS

No. of Loading Steps	7
No. of unloading Steps	3

LAB REF. 56/2019

	1.00E-02 ₁				
ec)	1.00E-03				
Cv (sq.cm/sec)	1.00 E -04 ·				
ر در	1.00E-05 -			_	
	1.00E-06 - 0. Ve	01 (ertical Con	D.1 solidation	1 Stress	10 (MPa)

Pressure	Void Ratio	Cv
Мра		cm ² /sec
0		
0.025	0.648	
0.049	0.642	
0.098	0.630	
0.196	0.613	2.77E-04
0.392	0.585	2.48E-04
0.785	0.547	1.98E-04
1.569	0.492	1.87E-04
0.392	0.499	
0.098	0.510	
0.025	0.526	

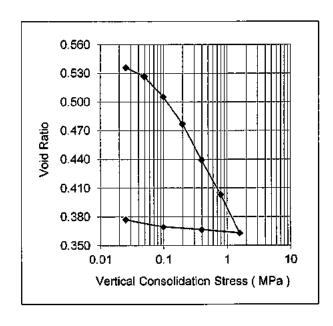
端肌 SOILCON

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CONSOLIDATION TEST

CLIENT		SAFE SERVICES		
PROJECT		PUNJAB INTERMEDIATE CITIES INVESTMEN		
SITE	PROGRA	PROGRAM IN SAHIWAL CITY		
BORE HOLE	BA-1	BA-1 SAMPLE CS-1		
SPECIMEN	1	TYPE _	DISTURBED	
DEPTH m	0.20-0.90	DATE	01.01.2020	

Operator	Checked by
Nisar Ahmad Nasak	Mahmood



SOIL AND SPECIMEN CHARACTERISTICS

Initial Bulk Density	2004	Kg/m ³
Final Bulk Density	2185	Kg/m³
Initial Water Content	17.73	%
Final Water Content	14,21	%
Initial Specimen Height	20.00	mm
Specimen Diameter	63.70	mm
Specific Gravity	2.635	
Initial Void Ratio	0.548	

TEST CHARACTERISTICS

No. of Loading Steps	7
No. of unloading Steps	3

LAB REF. 56/2019

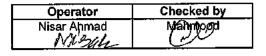
	1.00E-02			
(ç)	1.00E-03			
Cv (sq.cm/sec)	1.00E-04			
3	1.00E-05			
	1.00E-06 0.0		1	10
	Vertical Consolidation Stress (MPa)			

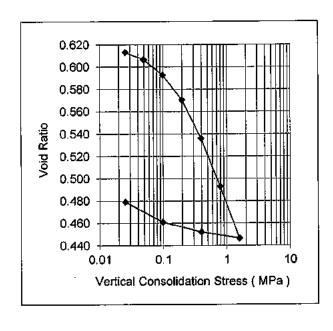
Pressure	Void Ratio	Cv
Мра		cm ² /sec
0		
0.025	0.536	1
0.049	0.527	
0.098	0.506	Ì
0.196	0.477	4.85E-04
0.392	0.439	3.49E-04
0.785	0.403	3.10E-04
1,569	0.363	2.94E-04
0.392	0.367	
0.098	0.370	
0.025	0.377	

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CONSOLIDATION TEST

CLIENT		SAFE SERVICES		
PROJECT		PUNJAB INTERMEDIATE CITIES INVESTMEN		
SITE	PROGRAM	PROGRAM IN SAHIWAL CITY		
BORE HOLE	BA-2	SAMPLE	CS-1	
SPECIMEN	1	TYPE	DISTÜRBED	
DEPTH m	0.50-1.50	DATE	30.12.2019	





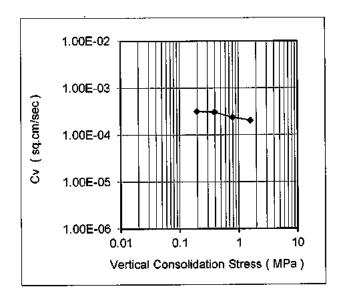
SOIL AND SPECIMEN CHARACTERISTICS

Initial Bulk Density	1961	Kg/m³
Final Bulk Density	2109	Kg/m ³
Initial Water Content	19.46	%
Final Water Content	17.09	%
Initial Specimen Height	20.00	mm
Specimen Diameter	63.70	mm
Specific Gravity	2.664	
	0.623	
Initial Void Ratio	0.023	

TEST CHARACTERISTICS

No. of Loading Steps	7
No. of unloading Steps	3

LAB REF. 56/2019



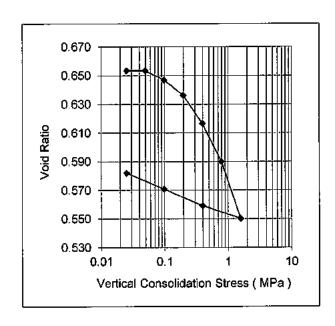
Pressure	Void Ratio	Cv
Mpa		cm²/sec
0		
0.025	0.613	
0.049	0.607	
0.098	0.593	
0.196	0.571	3.18E-04
0.392	0.536	3.06E-04
0.785	0.493	2.37E-04
1.569	0.446	2,06E-04
0.392	0.452	
0.098	0.461	
0.025	0.479	

18-Km, Multan Road Lahore. Ph: 042-7510942, Fax: 042-7510944

CONSOLIDATION TEST

CLIENT	T T. T	SAFE SERVICES	
PROJECT		PUNJAB INTERMEDIATE CITIES INVESTMEN	
SITE	PROGRA	PROGRAM IN SAHIWAL CITY	
BORE HOLE	BA-6	SAMPLE	CS-1
SPECIMEN	1	TYPE	DISTURBED
DEPTH m	0.20-0.60	DATE	30.12.2019

Operator	Checked by
Nisar Ahmad	Mahmpog P
Nisas	- (N)



SOIL AND SPECIMEN CHARACTERISTICS

Initial Bulk Density	1874	Kg/m³
Final Bulk Density	2039	Kg/m³
Initial Water Content	17.07	%
Final Water Content	21.89	%
Initial Specimen Height	20.00	mm
Specimen Diameter	63.70	mm
Specific Gravity	2.646	
Initial Void Ratio	0.653	•••

TEST CHARACTERISTICS

No. of Loading Steps	7
No. of unloading Steps	3

LAB REF. 56/2019

	1.00E-02			
Q	1.00E-03			
Cv (sq.cm/sec)	1.00E-04			
5	1.00E-05			
	1.00E-06	0.1	1	10
	Vertic	al Consolidati	ion Stress	(MPa)

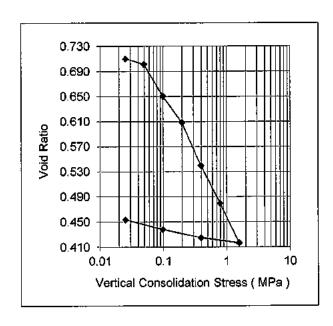
Pressure	Void Ratio	Cv
Mpa		cm²/sec
0		
0.025	0.653	
0.049	0.653	
0.098	0.647	
0.196	0.636	4.14E-04
0.392	0.617	3.80E-04
0.785	0.590	3.57E-04
1.569	0.550	3.32E-04
0.392	0.559	
0.098	0.571	
0.025	0.582	

18-Km, Multan Road Lahore. Ph: 042-7510942, Fax: 042-7510944

CONSOLIDATION TEST

CLIENT	SAFE SER		<u>-</u>	
PROJECT	PUNJAB II	PUNJAB INTERMEDIATE CITIES INVESTMEN		
SITE	PROGRAM	PROGRAM IN SAHIWAL CITY		
BORE HOLE	BA-8	SAMPLE	CS-1	
SPECIMEN	1	TYPE	DISTURBED	
DEPTH m	0.20-0.90	DATE	01.01.2020	

Operator	Checked by
Nisar Ahmad	Mahmgod



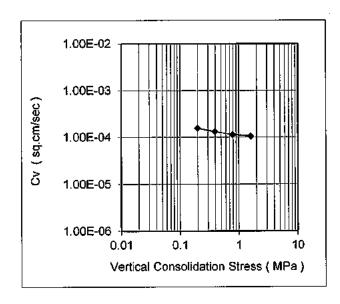
SOIL AND SPECIMEN CHARACTERISTICS

Initial Bulk Density	1896	Kg/m³
Final Bulk Density	2185	Kg/m³
Initial Water Content	19.27	%
Final Water Content	16.57	%
Initial Specimen Height	20.00	mm
Specimen Diameter	63.70	mm
Specific Gravity	2.725	
Initial Void Ratio	0.714	

- 1		
	TEST	CHARACTERISTICS

No. of Loading Steps	7
No. of unloading Steps	3

LAB REF. 56/2019



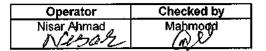
Pressure	Void Ratio	Cv
Мра		cm²/sec
0		
0.025	0.710	
0.049	0.702	
0.098	0.651	
0.196	0.609	1.58E-04
0.392	0.540	1.32E-04
0.785	0.480	1.14E-04
1.569	0.417	1.05E-04
0.392	0.425	
0.098	0.438	
0.025	0.454	

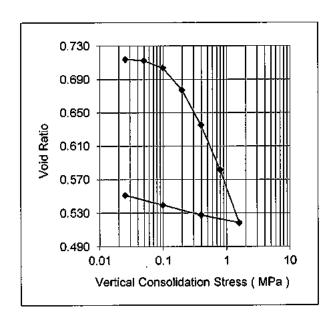
騙肌 SOILCON

18-Km, Multan Road Lahore. Ph: 042-7510942, Fax: 042-7510944

CONSOLIDATION TEST

CLIENT	1	SAFE SERVICES			
PROJECT	PUNJAB	PUNJAB INTERMEDIATE CITIES INVESTMEN			
SITE	PROGRA	PROGRAM IN SAHIWAL CITY			
BORE HOLE	BA-10	BA-10 SAMPLE CS-1			
SPECIMEN	1	TYPE	DISTURBED		
DEPTH m	0.70-1.30	DATE	01.01.2020		





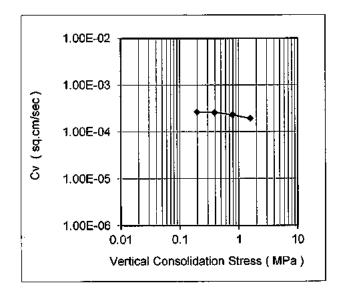
SOIL AND SPECIMEN CHARACTERISTICS

Initial Bulk Density	1895	Kg/m ³
Final Bulk Density	2111	Kg/m³
Initial Water Content	19.18	%
Final Water Content	20.11	%
Initial Specimen Height	20.00	mm
Specimen Diameter	63.70	mm
Specific Gravity	2.727	
Initial Void Ratio	0.715	

TEST CHARACTERISTICS

No. of Loading Steps	7
No. of unloading Steps	33

LAB REF. 56/2019



Pressure	Void Ratio	Cv
Мра		cm²/sec
0		
0.025	0.714	
0.049	0.713	
0.098	0.704	
0.196	0.678	2.65E-04
0.392	0.636	2.59E-04
0.785	0.582	2.30E-04
1.569	0.519	1.92E-04
0.392	0.528	
0.098	0.540	
0.025	0.551	
1		

SOILCON GEOTECHNICAL TESTING LABORATORIES

18-Km, Multan Road, Lahore. Ph: 042-7510942-43 Fax:042-7515267

SUMMARY OF SWELL PRESSURE TEST RESULTS

Remarks

SAFE SERVICES 56/2019 Swell Pressure (kg/cm²) Lab. Ref: 틸틸틸틸 NIL 텀 Client: DENSITY (g/cu.cm) Dr. PUNJAB INTERMEDIATES CITIES IMPROVEMENT PROGRAM Bulk Free swell % TREATMENT PLANT IN SAHIWAL CITY Location 0.20-0.90 0.20-0.60 0.15-1.00 0.50-1.35 0.70-1.30 1.15-1.50 Depth (m) Sample S-1 S-1 Location: BH/TP Project: BA-10 TP-6 BA-1 BA-2 BA-6 BA-8 ŝ TP-1

Dcram Ullah Tested By:

CHECKED BY Mahmood

01.01.2020

Dated:

(176)



■ SOILCON

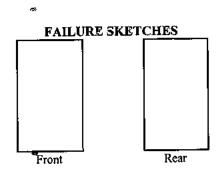
GEOTECHNICAL TESTING LABORATORIES, 18-Km,

UNCONFINED COMPRESSION TEST

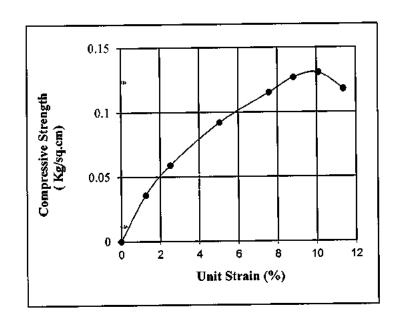
PROJECT:	PUNJAB INTERMEDIATE CITIES INVESTMENT	BH NO	BH-33
LOCATION:	PROGRAM SAHIWAL	SAMPLE NO	UDS-1
LAB REF.	54/19	DEPTH m	2.45-2.95
DATE:	22.11.2019	CLIENT	SAFE SERVICES
CAMDIE DE	SCRIPTION		

Specimen Conditions

Diameter Average	3.86	cm
Area Average	11.75	cm ²
Height	7.925	cm _
Volume	92.78	cm³
Weight Wet	156.61	g
Water Content	25.66	%
Dry Density	1,343	g/cm³
P.R Factor	0.1422	Kg/div.
Compressive Strength	0.13	Kg/cm ²
Strain	8.83	%



Deformation Dial Reading	Unit Strain %	Compressive Strength (Kg/sq.cm)
0	0.00	0.00
100	1.26	0.04
200	2.52	0.06
400	5.05	0.09
600	7.57	0.12
700	8.83	0.13
800	10.09	0.13
1000	11.36	0.12
		.,



Remarks: Tested By: M. Aslam
Checked By: Mahmood



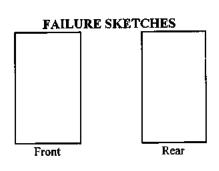
GEOTECHNICAL TESTING LABORATORIES, 18-Km,

UNCONFINED COMPRESSION TEST

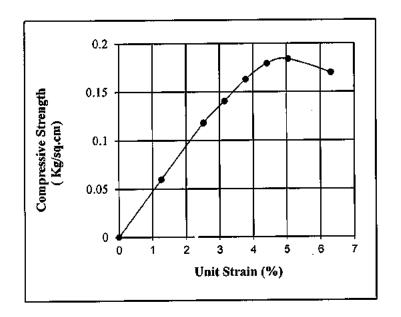
PROJECT:	PUNJAB INTERMEDIATE CITIES INVESTMENT	BH NO	BH-45	
	PROGRAM SAHIWAL CITY	SAMPLE NO	UDS-I	
LAB REF.	56/19	DEPTH m	2.45-3.00	
DATE:	3.12.2019	CLIENT	SAFE SERVICES	
САВЛОТ В ТЕ	SCRIPTION	=		

Specimen Conditions

Diameter Average	3.86	cm
Area Average	11.75	cm ²
Height	7.925	em
Volume	92.78	cm ³
Weight Wet	171.11	<u>g</u>
Water Content	23.61	%
Dry Density	1.492	g/cm³
P.R Factor	0.1422	Kg/div.
Compressive Strength	0.18	Kg/cm ²
Strain	4.42	%



Deformation Dial Reading	Unit Strain %	Compressive Strength (Kg/sq.cm)
0	0.00	0.00
100	1.26	0.06
200	2.52	0.12
250	3.15	0.14
300	3.79	0.16
350	4.42	0.18
400	5.05	0.18
500	6.31	0.17



Remarks:	Tested By:	M. Aslam	<u> </u>
	Checked By:	Mahmood	TWO
· · · · · · · · · · · · · · · · · · ·	-	<u> </u>	

University of Engineering & Technology, Lahore Department of Civil Engineering Geotechnical Engineering Laboratory

SUMMARY OF THE TEST RESULTS

PROJECT:

Consultancy Services For Engineering, Procurement And Construction Management For Punjab Intermediate Cities Improvement Investment Program (Treatment Plants

in Sahiwal City)

Client:

SAFE

Job Ref. SS/Letter/1637/19

Dated: 21/11/2019

BH/ TP No.	Sample No	Depth (m)	Sulphate Contents (%)	Chloride Contents (%)	Organic Contents (%)
BH-36	SPT-3	3.00-3.45	0.09	0.06	0.14
BH-34	SPT-4	4.00-4.45	0.08	0.04	0.16
BH-31	UDS-1	4.50-5.00	0.06	0.09	0.08
BH-30	UDS-1	7.00-7.50	0.07	0.13	0.06
BH-29	UDS-1	5.00-5.80	0.03	0.08	0.15
BH-28	UDS-1	4.00-4.80	0.05	0.09	0.12

Prepared by:

Director checked by: 19

(179)

University of Engineering & Technology, Lahore Department of Civil Engineering Geotechnical Engineering Laboratory

SUMMARY OF THE TEST RESULTS

Consultancy Services For Engineering, Procurement And Construction Management For Punjab Intermediate Cities Improvement Investment Program (Treatment Plants

PROJECT: For Punjab Inter in Sahiwal City)

SAFE

III Gainwai Gir

Client:

Job Ref. SS/Letter/1637/19

Dated: 21/11/2019

BH/ TP No.	Sample No	Depth (m)	Sulphate Contents (%)	Chloride Contents (%)	Organic Contents (%)
BH-58	SPT-3	3.00-3.45	0.06	0.14	0.22
BH-56	UDS-1	6.00-6.80	0.03	0.11	0.13
BH-53	UDS-1	4.00-4.80	0.08	0.13	0.16
BH-51	UDS-1	6.00-6.80	0.04	0.09	0.09
BH-45	UDS-1	2.45-3.00	0.09	0.16	0.26
BH-41	SPT-4	4.00-4.45	0.11	0.17	0.20

Prepared by:

Director Cheened by:

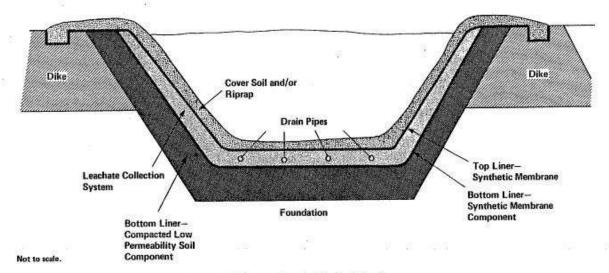
(180)

APPENDIX-D

REFERENCE FOR LINING MATERIAL

STATE OF MICHIGAN

Department of Environment, Great Lakes and Energy (EGLE) (www.michigan.gov)



Cross section of an idealized clay liner system.

WASTEWATER TREATMENT AND STORAGE LAGOONS (GUIDE SHEET IV)

GUIDESHEET IV

Wastewater Treatment and Storage Lagoons

Unless otherwise approved by the Department of Environmental Quality (DEQ) all wastewater treatment and storage lagoons associated with a discharge to the groundwaters of the State must meet the requirements specified in Rule 2237.

Dike Walls

For above-grade construction or if the lagoon liner base does not extend to the ground surface, perimeter dike walls are required to be constructed using a soil that is keyed to the natural soil base and meets the following criteria:

The relationship between hydraulic conductivity, moisture, and density is to be established with laboratory testing for the source of clay that will serve as the compacted clay portion of the composite liner. The relationship is to be determined using either the modified proctor test, ASTM D1557-91, or the standard proctor test, ASTM D698-91. And

Each lift is required to be thoroughly and uniformly compacted to achieve a hydraulic conductivity of not more than 1 x 10⁻⁷ centimeters per second based upon the density and moisture content determined as described above. The hydraulic conductivity of the soil is to be determined using ASTM method D5084-90 as modified by the department. If flexible wall permeameters are used, then confining pressures are required to be equivalent to the minimum pressure expected after the lagoon is placed in service. Soil is not be compacted at a moisture content that is less than optimum and is not to be compacted to less than either of the following densities:

Ninety percent of the maximum dry density, as determined by the modified proctor test, ASTM D1557-91, and

Ninety-five percent of the maximum dry density, as determined by the standard proctor test, ASTM D698-91.

Composite liners and Base

Each lagoon must have a composite liner with a base that meets the following requirements as specified in subrule (2) of Rule 2237:

The base of the composite liner is required to be a natural soil barrier, a compacted soil barrier or a geocomposite clay liner that meets the specific criteria for each of these technologies.

Natural Soil Barrier Requirements

A natural soil barrier used as a base in a composite liner system is required to meet all of the following requirements:

The natural soil shall be free of sand lenses and not less than 10 feet thick.

The soil shall have a saturated vertical hydraulic conductivity of not more than 1×10^{-7} centimeters per second.

<u>Note</u>: The hydraulic conductivity of the soil is required to be determined using ASTM method D5084-90, If flexible wall permeameters are used, then confining pressures are required to be equivalent to the minimum pressure expected after the lagoon is placed into service.

The natural soil liner surface is required to be properly prepared for placement of the flexible membrane liner (FML) to remove the potential for failures to the FML.

An engineer licensed under Act No. 299 of the Public Acts of 1980, as amended, otherwise known as the "Occupational Code," is required to certify to the department, that the requirements of the rule were met during installation of the natural soil base of the composite liner. The certification is to be accomplished through spatially random testing and measurements. At least 1 soil test is required to be conducted and an additional test is required for every 5,000 cubic yards placed and when the texture of the soil changes.

Compacted Soil Barrier

A compacted soil liner used as a segment of the composite liner system is required to meet all of the following:

The compacted soil liner shall have a minimum thickness of 2 feet.

The relationship between hydraulic conductivity, moisture, and density must be established with laboratory testing for the source of clay that will serve as the compacted clay portion of the composite liner. The relationship is to be determined using either the modified proctor test, ASTM D1557-91, or the standard proctor test, ASTM D698-91.

Each lift shall be thoroughly and uniformly compacted to achieve a hydraulic conductivity of not more than 1 x 10⁻⁷ centimeters per second based upon the density and moisture content determined as described above. The hydraulic conductivity of the soil is to be determined using ASTM method D5084-90, as modified by the department in R 299.4920. If flexible wall permeameters are used, then confining pressures are required to be equivalent to the minimum pressure expected after the lagoon is placed in

service. Soil shall not be compacted at a moisture content that is less than optimum and are not to be compacted to less than either of the following densities:

Ninety percent of the maximum dry density, as determined by the modified proctor test, ASTM D1557-91. And,

Ninety-five percent of the maximum dry density, as determined by the standard proctor test, ASTM D698-91.

The soil is to be placed so that each lift is not more than 6 inches after compaction.

The compacted soil liner surface is to be prepared for placement of the FML to remove the potential for failures of the FML.

The department may approve alternative test and investigative methods.

An engineer licensed under Act No. 299 of the Public Acts of 1980, as amended, otherwise known as the "Occupational Code," shall certify to the department, that the requirements of this rule were met during installation of the compacted soil base of the composite liner. The certification is to be accomplished through spatially random testing and measurements. At least 1 soil test of the compacted soil is required to be conducted and an additional test shall be conducted for every 5,000 cubic yards placed and when the texture of the soil changes.

Geocomposite Clay Liners

A geocomposite clay liner (GCL) used as a segment of a composite liner must meet all of the following requirements:

The GCL must be a factory-manufactured hydraulic barrier consisting of sodium bentonite clay supported by geotextiles that are held together by needling, stitching, or adhesives.

The GCL must be seamed according to the manufacturer's specifications to prevent leakage at the seams.

The GCL must not be laid during a precipitation event and is to be covered immediately by a flexible membrane liner or by another protective cover until the flexible membrane liner can be laid directly over the GCL.

The GCL must be installed according to the manufacturer's specifications and quality assurance and quality control plans. The installation is required to be certified by an engineer licensed under Act No. 299 of the Public Acts

of 1980, as amended, otherwise known as the "Occupational Code," overseeing the installation of the composite liner.

Flexible Membrane Liners

A flexible membrane liner (FML) required by this rule is to be placed directly over a natural soil barrier, compacted soil barrier or geocomposite clay liner to form what is referred to as the "composite liner." The FML and its installation must meet all of the following requirements:

The liner must be a minimum of 40 mils thick polyvinyl chloride (PVC) or 60 mils thick high-density polyethylene (HDPE). Other materials and thickness may be used if the department determines before installation, that the proposed material and thickness are sufficient to ensure that the integrity of the liner is not compromised due to contact with the soil base, wastewater, climatic conditions, or the stress of installation or daily operation.

An FML is required to be covered immediately after placement. The FML is to be covered by an adequate thickness of soil or other material approved by the department to prevent puncture by equipment and to protect the exposed portion of the FML from degradation by ultraviolet light.

The FML is to be placed upon a foundation or base capable of providing support to the liner and resistance to pressure gradients above and below the liner to prevent slope failure and failure of the liner due to settlement, compression, or uplift.

The FML must cover the entire area of earth material that would be in contact with the treated or stored effluent.

The slopes over which an FML is to be placed may not exceed a grade of 25 percent unless the owner and operator can demonstrate slope stability for slopes with steeper grades.

FML Seams

The field seams of an FML shall meet all of the following requirements:

Seaming is to be done in accordance with the minimum industry standards. The shear strength and peel strength of the seams must be adequate to maintain the integrity of the seam under all operating conditions.

Horizontal seams are not to occur on side slopes.

Horizontal seams are to be located not less than 5 feet from the toe of the slope.

Field seams are to be installed parallel to the line of maximum slope.

The seam area shall be free of moisture, dust, dirt, debris, and foreign material of any kind before seaming.

No field seaming is to be done in weather conditions that would adversely affect the integrity of the seam.

An engineer licensed under Act No. 299 of the Public Acts of 1980, as amended, otherwise known as the "Occupational Code," must certify to the department that all necessary quality assurance testing was conducted to ensure that the FML was installed appropriately.

Quality Assurance Reporting

As indicated previously, the owner and operator of a facility must ensure that a properly licensed engineer certifies in a report to the Water Resources Division of the DEQ that the installation of the natural soil base barriers, compacted soil base, GCL and FML were completed in accordance with approved plans and that all necessary quality assurance testing was completed. The report must include:

A narrative of the results of the quality assurance tests.

Construction records for each component of the composite liner, including all field notes and results of all quality assurance tests. Drawings should be prepared which reference the location of each test to the respective result.

A summary of the testing methods used in determining quality assurance.

For quality assurance test results that did not meet specifications contained in the approved engineering plans, the methods for bringing the components of the composite liner into compliance with approved specifications.

A set of as built plans, signed and sealed by the properly licensed engineer. As a minimum, the as built plans should include the following:

- Dimensions, location, and elevation of the base of the excavation.
- Elevations of the surface and the base of the clay liner(s).
- Elevations of the surface of the protective layer.
- Cross sections of the lagoon(s), including dike locations, keying details and FLM anchor trench details.

All elevations are to be \pm 0.5 feet, United States Geological Survey Datum.

A membrane panel layout drawing showing; panel and seam locations, repair locations, slope directions and slope toe locations.

Alternative Lagoon Standards

The department may approve a storage or treatment lagoon liner that does not meet 1 or more of the requirements specified in the rules if the applicant demonstrates that the requirements of either of the following provisions are met:

The lagoon holds only wastewater that meets the standards of Rule 2222.

The existing system or the proposed design provides equal or greater environmental protection to protection provided by a lagoon liner constructed according to the rules. For an existing system, the demonstration can be made by either of the following:

Through an exfiltration test that demonstrates, to the department's satisfaction, that the lagoon is not leaking at a rate likely to impact groundwater. or

Through monitoring of the groundwater and a demonstration approved by the department that the lagoon has not impacted, and is not likely to impact, groundwater.