An aerial photograph of a dry, cracked riverbed in a desert landscape, showing deep, dark fissures in the parched earth. The background is a dark blue gradient.

# **GROUNDWATER REMEDICATION**

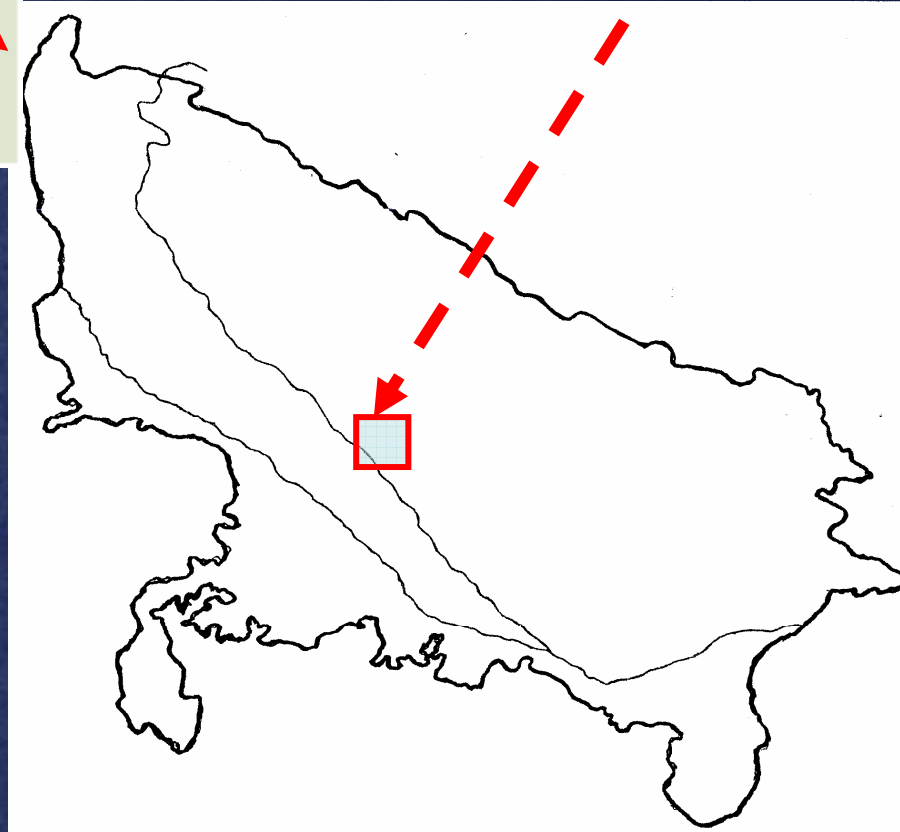
## **Kanpur, India**

*A Case study*

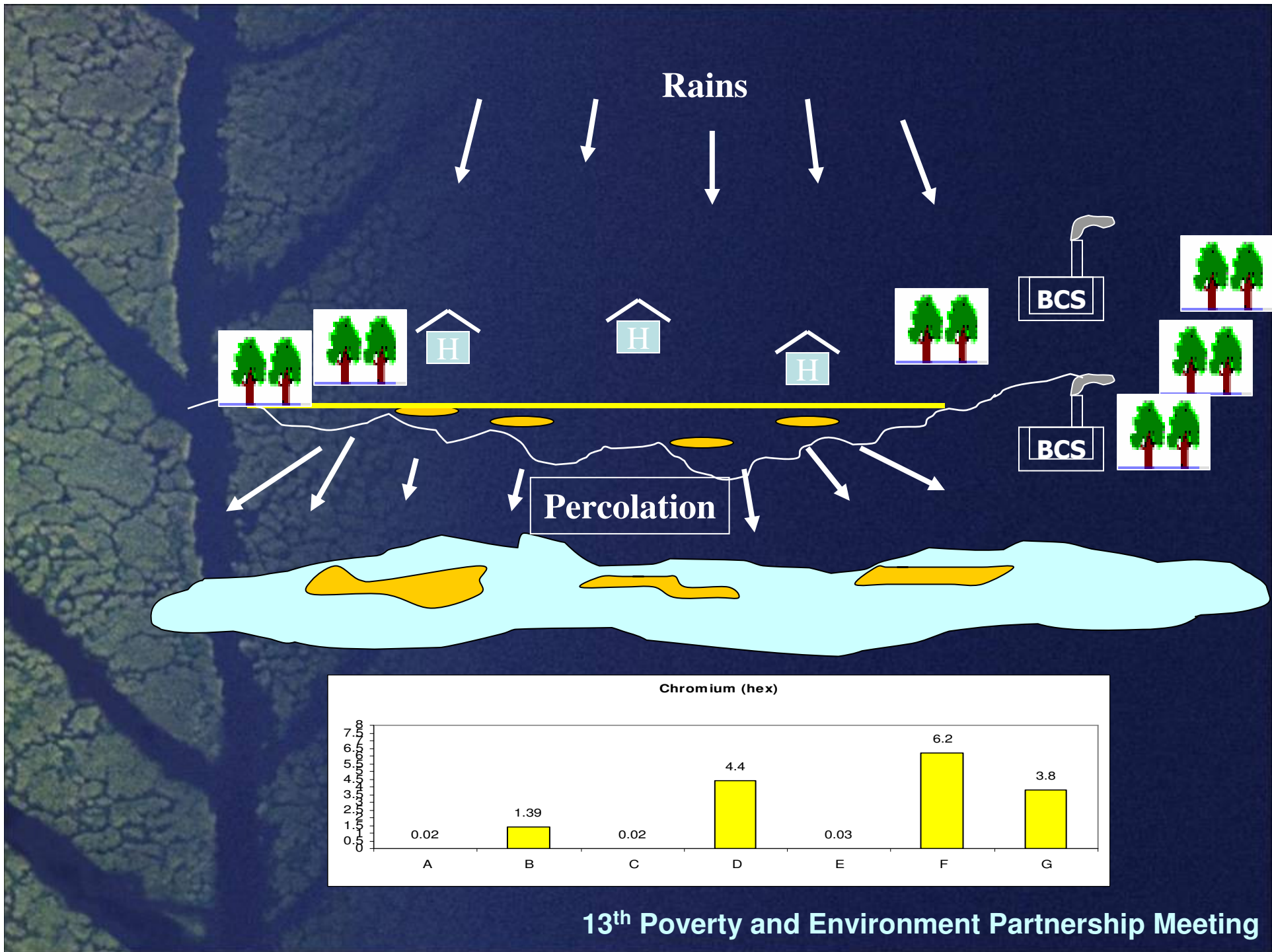


**India**

**Kanpur City**

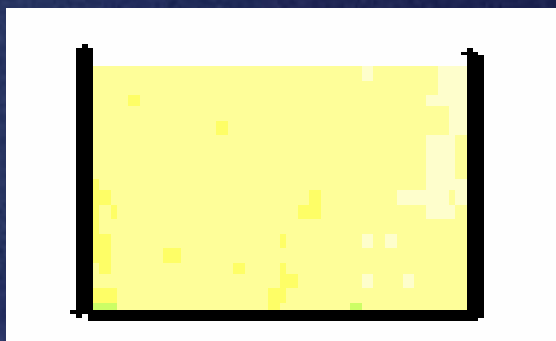


**U.P. State**





**13<sup>th</sup> Poverty and Environment Partnership Meeting**



*The (Cr) anomaly resulted from  
sludge (5-10%  $\text{Cr}_2\text{O}_3$  by wt)*

# Collaborating Agencies

**CPCB**

**IIT- Kanpur**

**NGRI-Hyderabad**

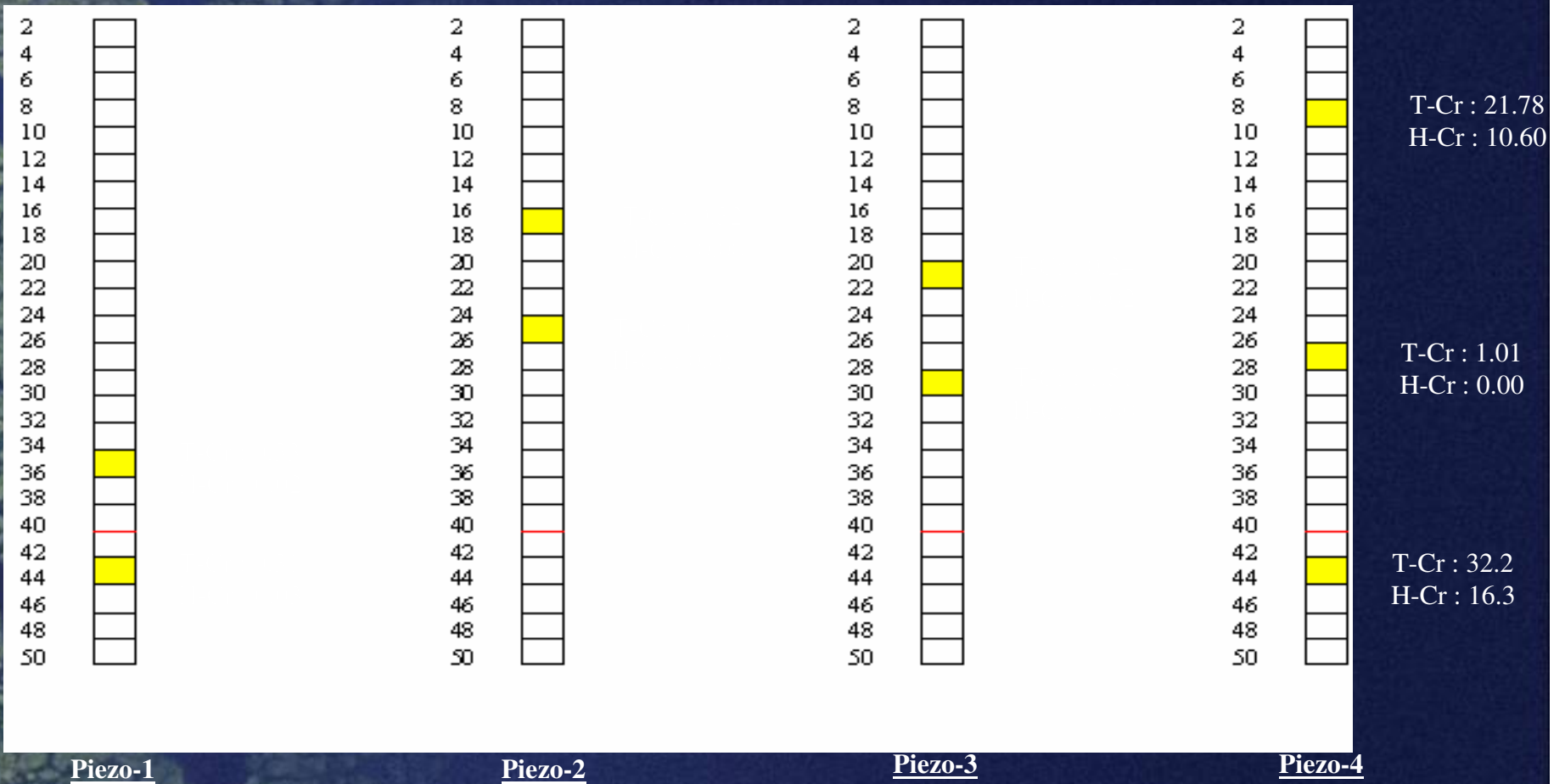
**ITRC-Lucknow**

**Blacksmith Institute -NY - USA**

# Investigation Scope

- ❖ **Ground survey and contouring**
- ❖ **Preparation of digitized map**
- ❖ **Groundwater quality and SWL**
- ❖ **Ground Resistivity measurements**
- ❖ **Watershed boundries**
- ❖ **River Monitoring**
- ❖ **Data support to GZA- Ecocycle**
- ❖ **Preparation of Fence Diagram**
- ❖ **Pilot Study ( Bio-Remediation)**

# Stratification of Cr VI



Piezo-1

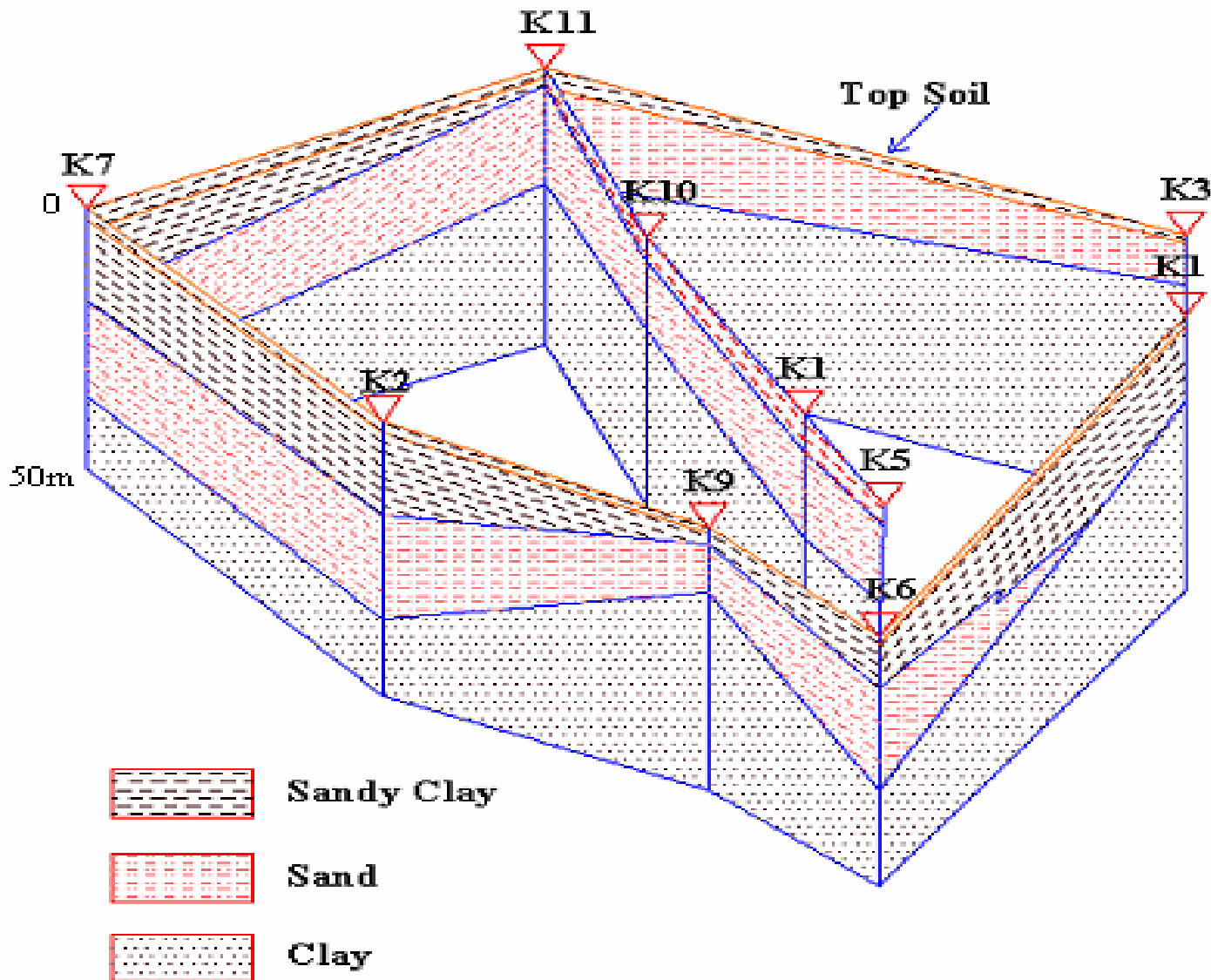
Piezo-2

Piezo-3

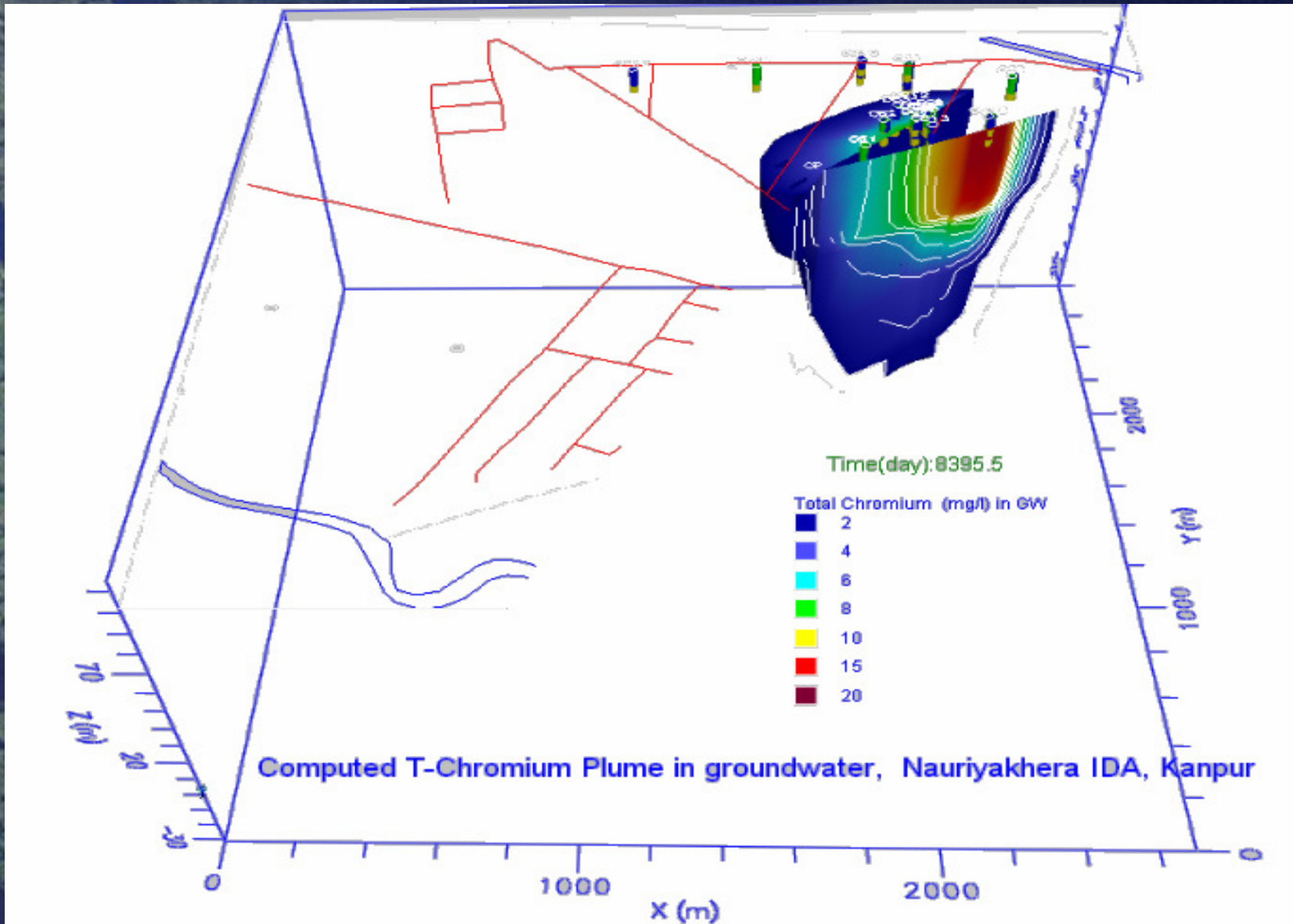
Piezo-4

*Concentration in mg/l*  
 \* meter below ground level

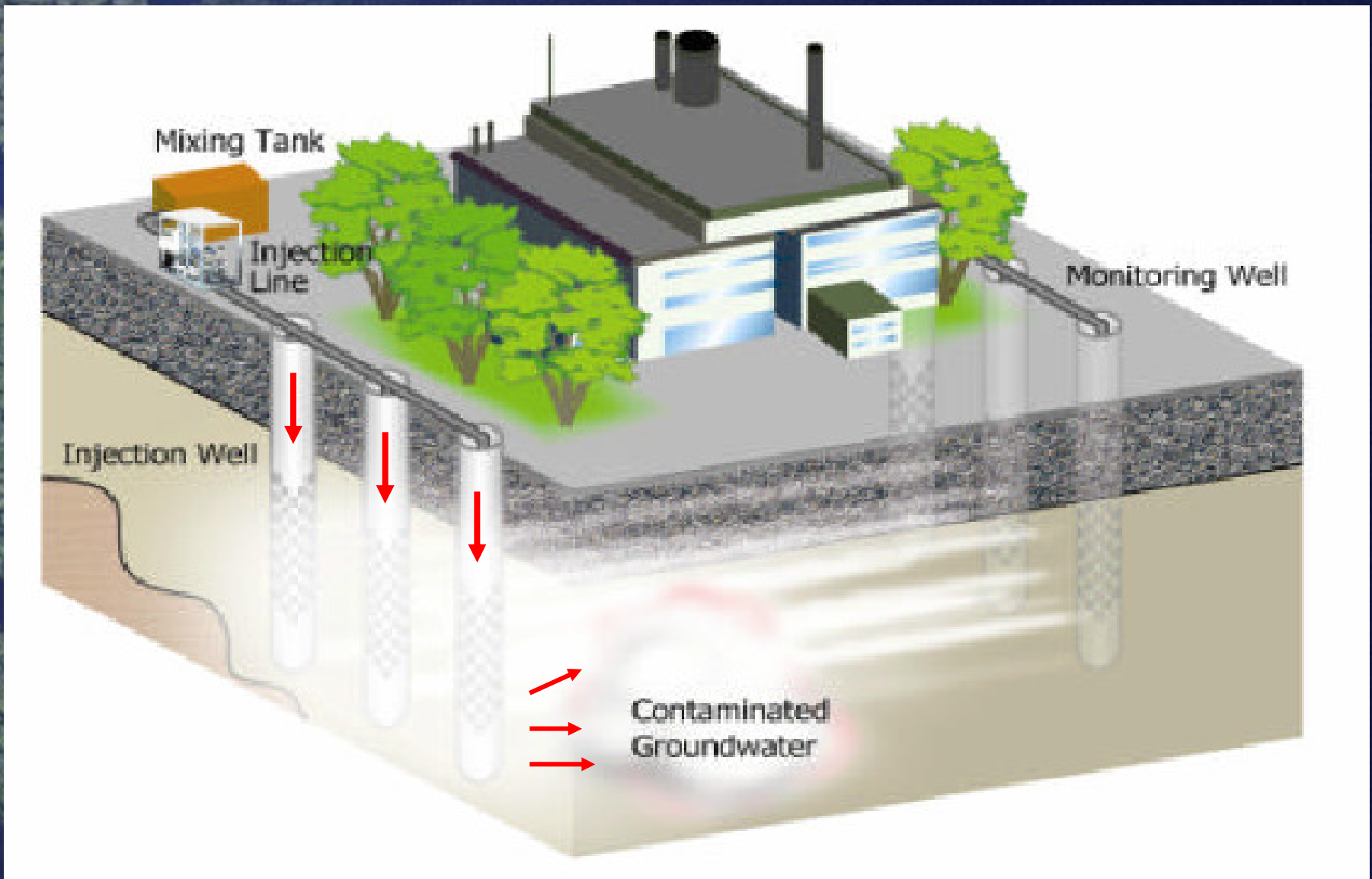
# Geo-Electric Log : Study Area



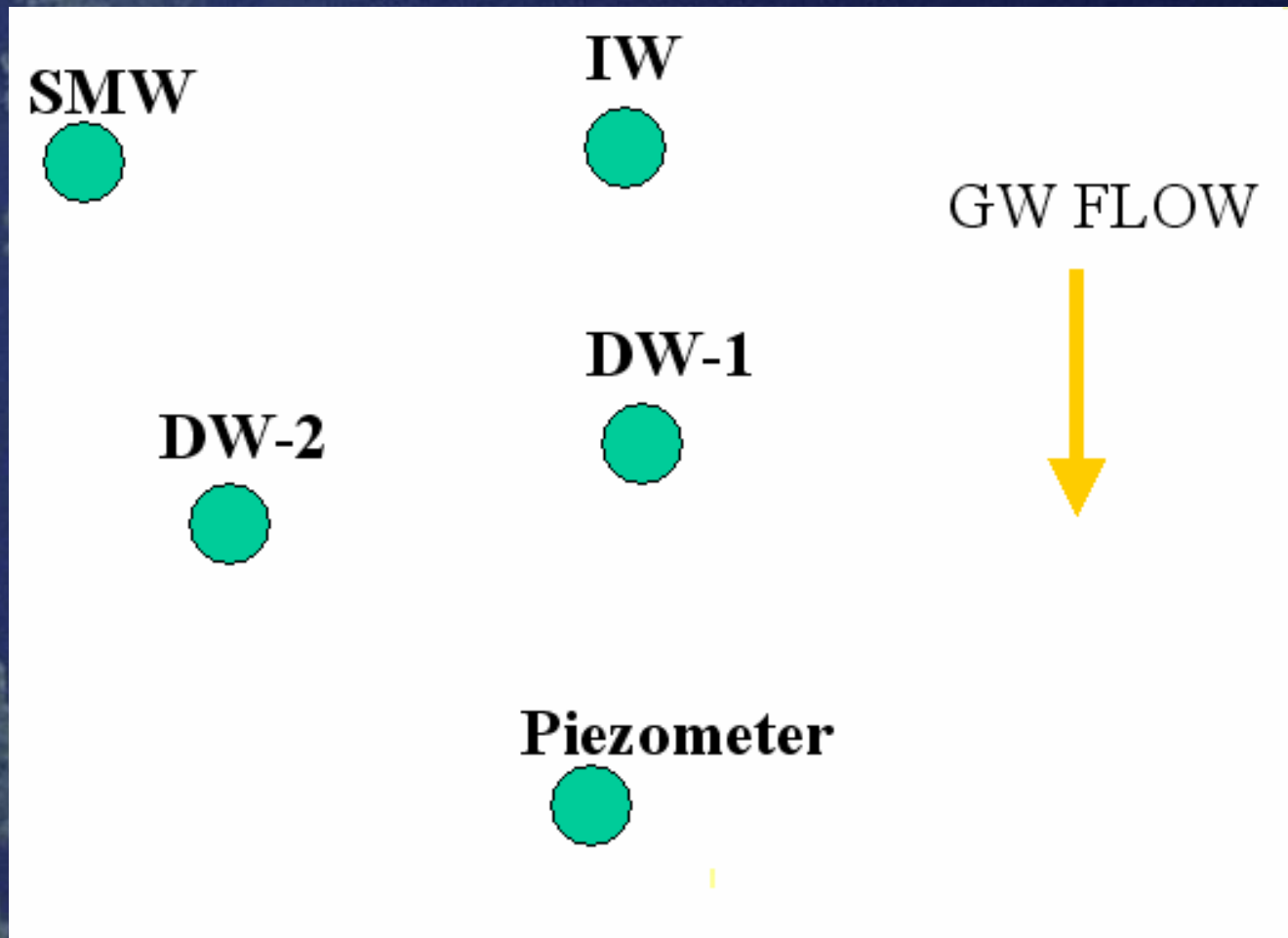
# Cr(VI)-Plume



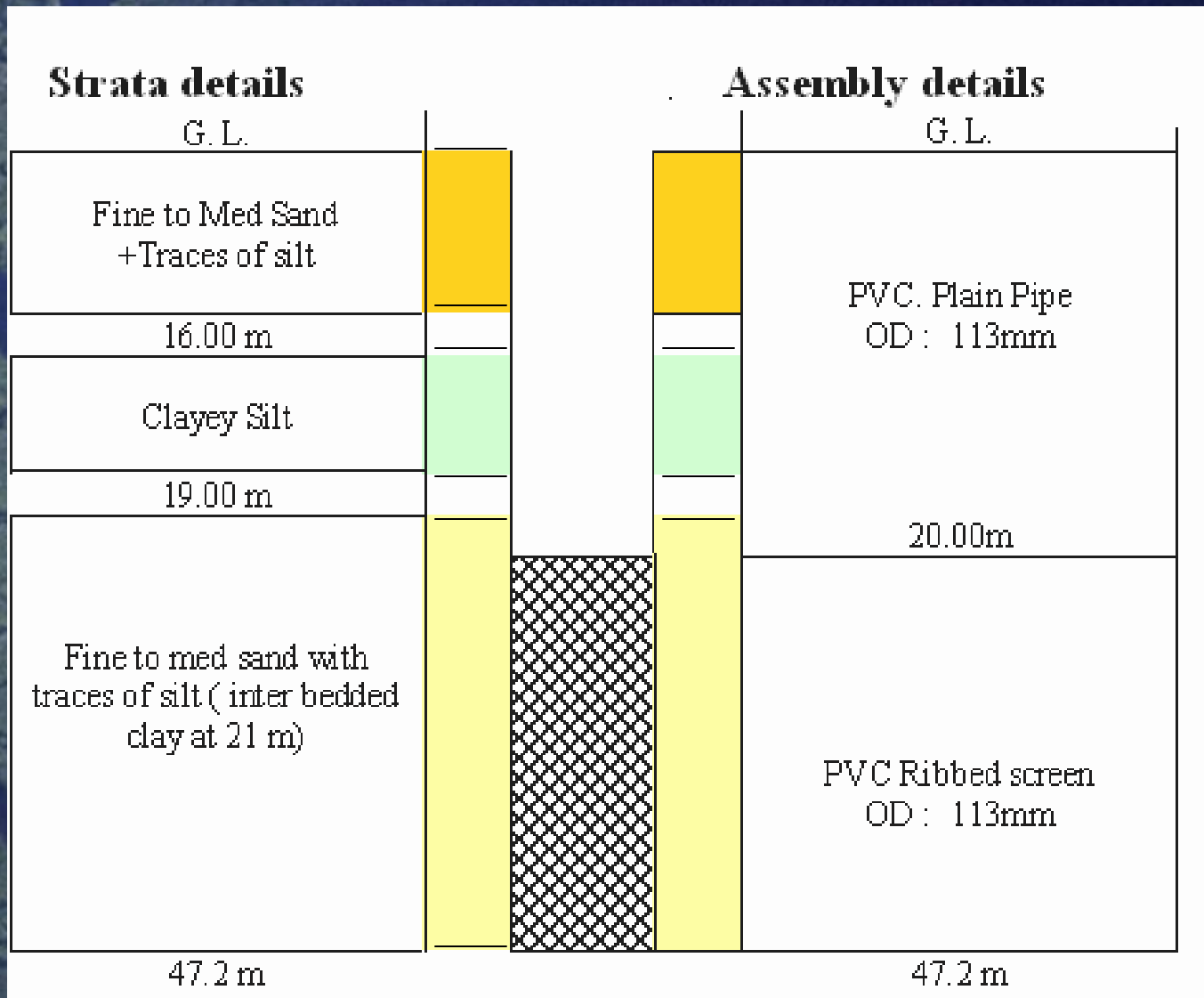
# Bio-Remediation Model



# The Well Field



# Well Construction



# Parameters Monitored

- **Static Water Level**
- **pH; Dissolved Oxygen**
- **Conductivity**
- **Sulphide ; Sulphate; Nitrate**
- **TOC**
- **Metals (Cr-VI& Cr-T, Mn,Fe,  
Cu,Ni,Co,Pb,Zn,Hg,As)**
- **ORP**

# Remedial Additive Injection

EDC-M1	:	165 Kg ( dilution 100-200times)
EDC-M2	:	375 Kg ( dilution 200-300times)
M1:M2	:	7:2
pH buffer	:	120 Kg
Water	:	50,000 It (Formation water)
Injection Flow:		0.6-1.0 LPM(constant head)

# Contaminated Target Zone

Saturated zone : 26 m

Contaminated volume : 736 Cub m

Requirement of EDC : 700g/ Cub m




# ACHIEVEMENTS

# Chromium-VI \*

Well	PRE	7 d	14d	60d	78 d	106 d
IW	10.01	*	*	ND	ND	ND
SMV	8.16	*	0.56	ND	ND	ND
DWI	11.2	0.34	0.06	ND	ND	ND
DWII	12.55	0.23	ND	ND	ND	0.67
PM	11.8	4.17	0.32	ND	ND	ND

*\* in mg/l*



# **VALIDATION OF RESULTS**

# T- Chromium \*

Well	Pre Injection	Days 'after' Injection of EDC				
		7D	14 D	60D	78D	106 D
IW	12.88	-	6.42	0.19	0.08	0.12
SMW	16.39	-	0.86	0.47	0.87	0.57
DW-1	15.28	10.16	1.68	7.78	0.4	0.2
DW-2	19.49	9.09	7.79	3.3	2.71	2.87
PM	14.94	10.66	0.46	1.44	0.9	0.28

*\* in mg/l*

# Dissolved Oxygen\*

Well	PRE	7d	14d	60d	78d	106d
IW	414		0.9	1.7	1.6	1
SMW	48		1.8	1	1.8	1.4
DWH	46	37	29	0.8	1.3	1.2
DWHI	49	34	27	0.8	1.2	0.8
FM	32	38	3	0.8	1.3	1.5

*\* in mg/l*

# Sulphide\*

Well	PRE	7 d	14 d	60 d	78 d	106 d
IW	ND	*	*	5.96	34.2	3.3
SMW	ND	*	1	3.73	1.2	6.2
DW-I	ND	2.24	0.6	10.2	6.8	92
DW-II	ND	12.16	0.5	4.26	8.24	ND
PM	ND	0.85	ND	3.98	7.7	2.7

*\* in mg/l*

# Sulphate\*

Well	PRE	7 d	14 d	60 d	78 d	106 d
IW	139	*	270	35.18	28.94	61
SMW	263	*	140	60.41	77.38	161
DWH	214	337	142	58.57	31.32	76
DWHI	289	352	236	92.98	96.09	93
PM	394	183	235	95.33	148.88	55

*\* in mg/l*

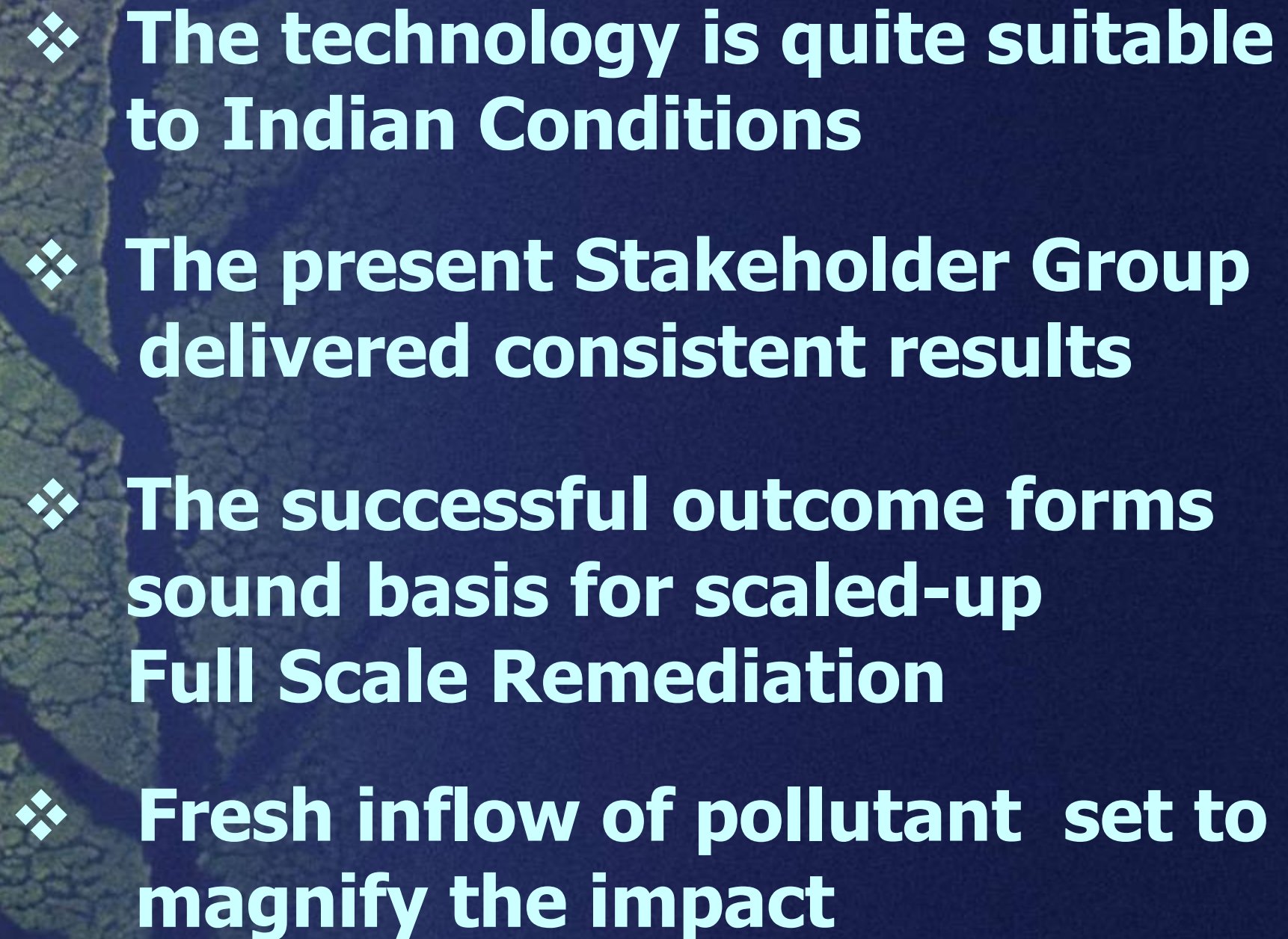
# Oxidation-Reduction Potential( ORP)\*

Well	PRE	7 d	14 d	60 d	78 d	106 d
IW	118	*	-25	-140	-163	-110
SMM	115	*	-93	-70	-196	-234
DWH	105	-18	-49	-70	-394	-128
DWHI	112	-15	-24	-43	-110	-1
PM	105	-12	-13	-36	-88	-156

\* milivolts

An aerial photograph of a dry, cracked riverbed in a desert landscape. The cracked earth is a mix of light brown and tan, with deep, dark shadows in the crevices. The riverbed is irregular and winds across the frame. The background is a solid, dark blue color.

# Lessons Learnt

- 
- An aerial photograph of a river system. The river is dark and appears polluted in the upper portion, while the lower portion is lighter and more natural. The surrounding land is green and textured, possibly agricultural or forested. The image is used as a background for a list of bullet points.
- ❖ **The technology is quite suitable to Indian Conditions**
  - ❖ **The present Stakeholder Group delivered consistent results**
  - ❖ **The successful outcome forms sound basis for scaled-up Full Scale Remediation**
  - ❖ **Fresh inflow of pollutant set to magnify the impact**

An aerial photograph of a dry, cracked riverbed in a desert landscape. The riverbed is a dark, winding line through a light-colored, cracked earth. The cracks are irregular and form a network of small polygons. The overall scene is arid and desolate.

**Thus.....**

**Effective , Eco-friendly and  
Economical Remediation  
of Groundwater in India  
is a ...reality**

**Thanks**

An aerial photograph of a river delta, showing a network of water channels and land. The image is overlaid with a dark blue, semi-transparent background. The text is positioned in the upper right and lower center areas of the image.

**For any specific issue  
please interact**

**rsingh 1962@rediffmail.com**