ASSESSMENT OF WATER QUALITY FOR IRRIGATION PURPOSE OF NAJAFGARH DRAIN USING IRRIGATION WATER QUALITY INDEX (IWQI)

PRESENTED BY:

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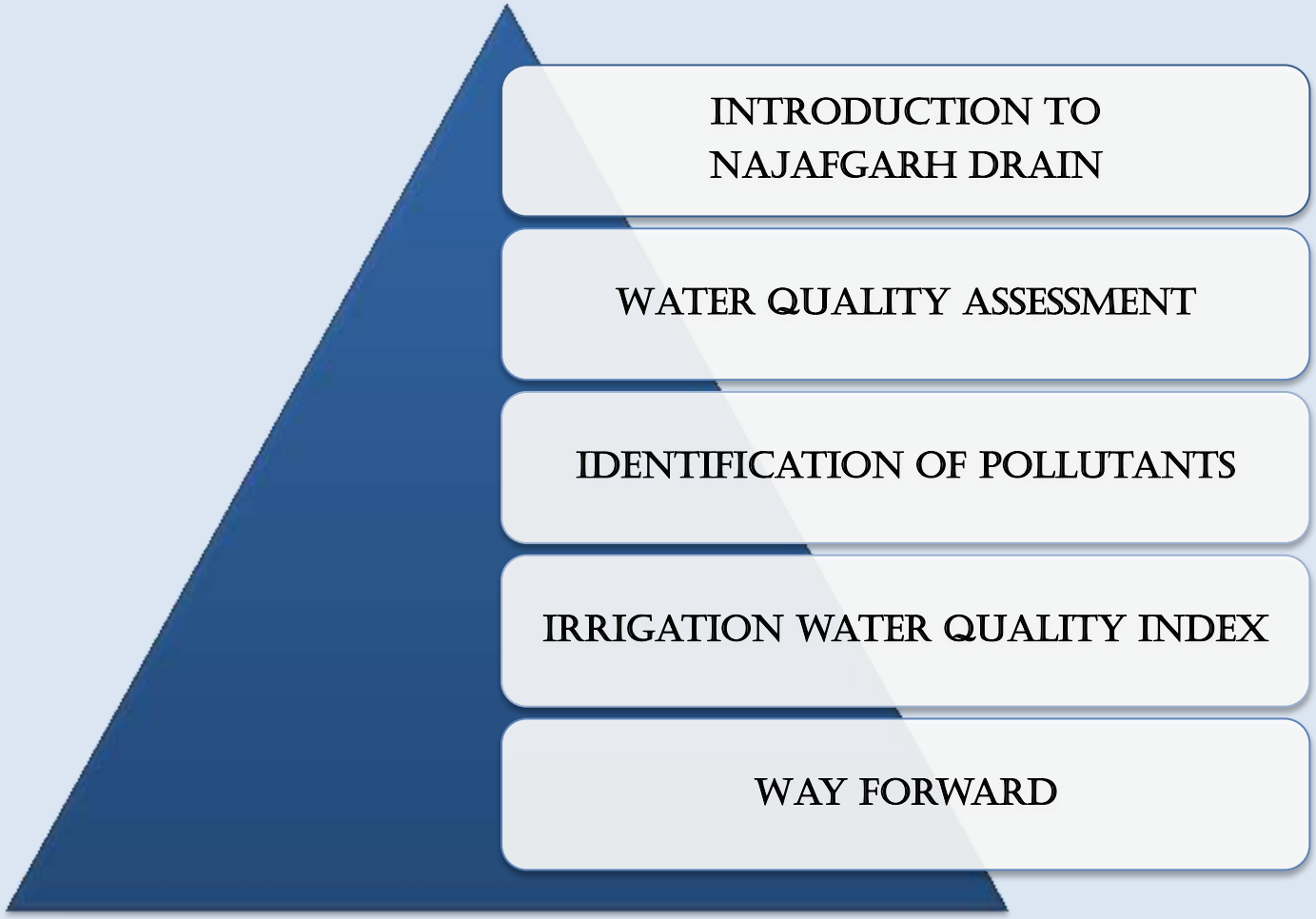
AGENDA OF PRESENTATION



INTRODUCTION

- The study examines the water quality of a stretch of approx. **32km of Najafgarh Drain** for agricultural usage.
- Drain Water is from three sectors i.e. **domestic, industrial and agriculture** contribute into wastewater loads in the Najafgarh Drain.
- It is a **natural habitat** for various small mammals and migratory birds.
- **Rain water** is being impounded here.
- The Background Flow is about **150 MLD** before the drain enters into NCT Delhi.
- The largest of all drains in the National Capital Territory and carries a total flow of over **2000 MLD**. [6]
- Due to limited sewerage systems, large quantities of **untreated sewage** from the secondary drains enter the Najafgarh Drain[2]

KEY ISSUES

- Under conditions of **severe water stress** at present and in the near future highlights the need for alternatives, such as wastewater, to fulfill irrigational requirements[3]
- The **quality of irrigation water** directly influences the quality of the soil and the crops grown on this soil.
- The water through ***bundh*** **present near Chhawla** just flows into agricultural land in this area.
- In April 2019, farmers from the same villages surrounding the drain **urged for compensated for losses** suffered by them due to the polluted drain.
- CGWB reported "**high fluoride content at Najafgarh**" under the "major groundwater problems and issues".
- problem of **heavy siltation**, the accumulation of solid waste from all the neighboring areas and excessive growth of water hyacinth
- **large quantity of sewage** is divert to storm water drains while the STPs are under utilized.

STUDY AREA
(Najafgarh Drain, South-West region)

Location
South West Region of Delhi at 28.5929° N, 77.0346° E

Population
22,92,363

Area
420 sq km.

Constituting three sub-divisions:
Dwarka,
Kapashera,
Najafgarh

Climatic Conditions
Summer : March- May with highest temperature : 45°C
Winter : November – February with lowest temperature of 6-7°C

Existing Trees:

Acacia leucophloea–Reonja

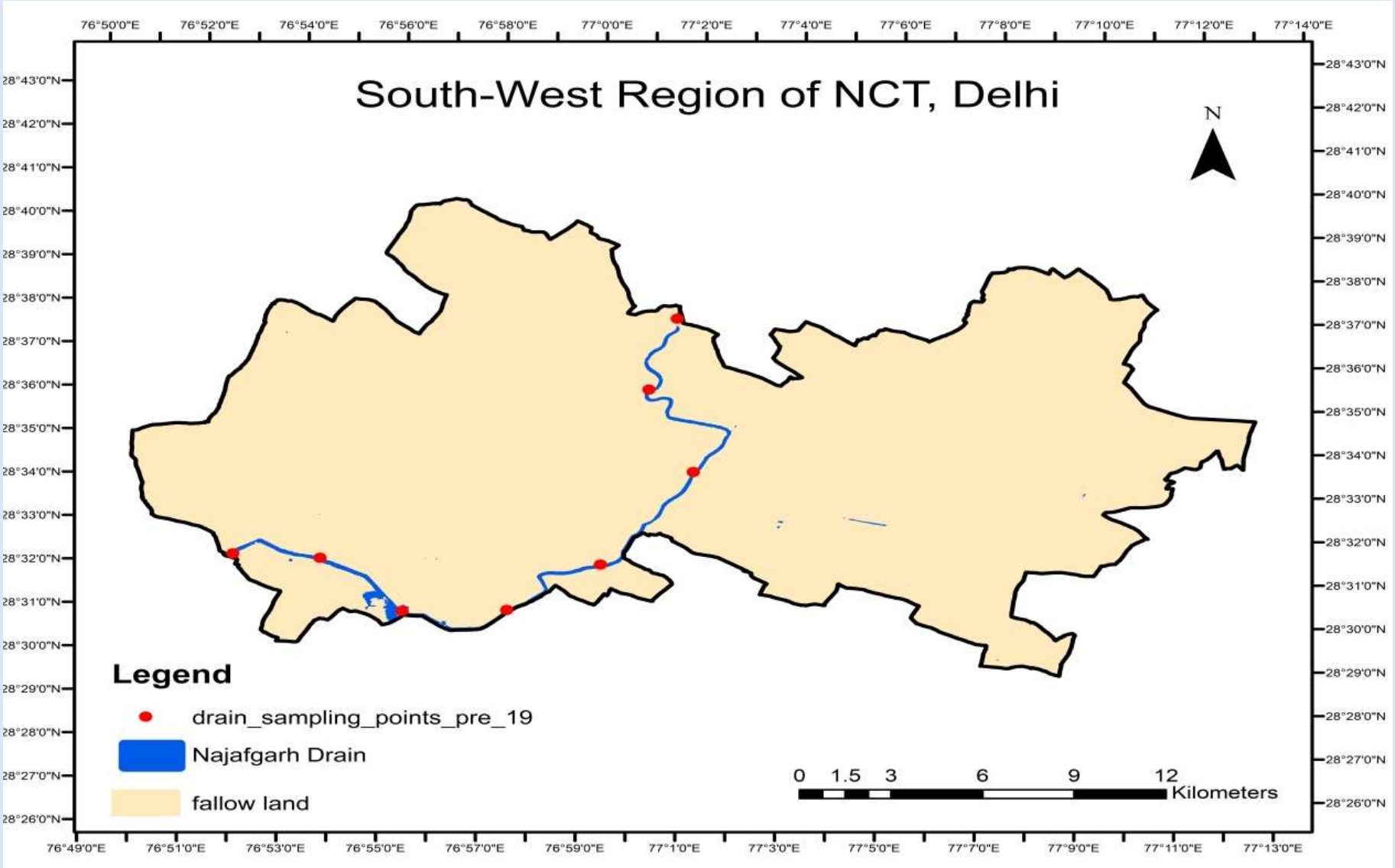
Acacia nilotica/arabica–Babul/Kikar

Eucalptus globulus–Eucalptus

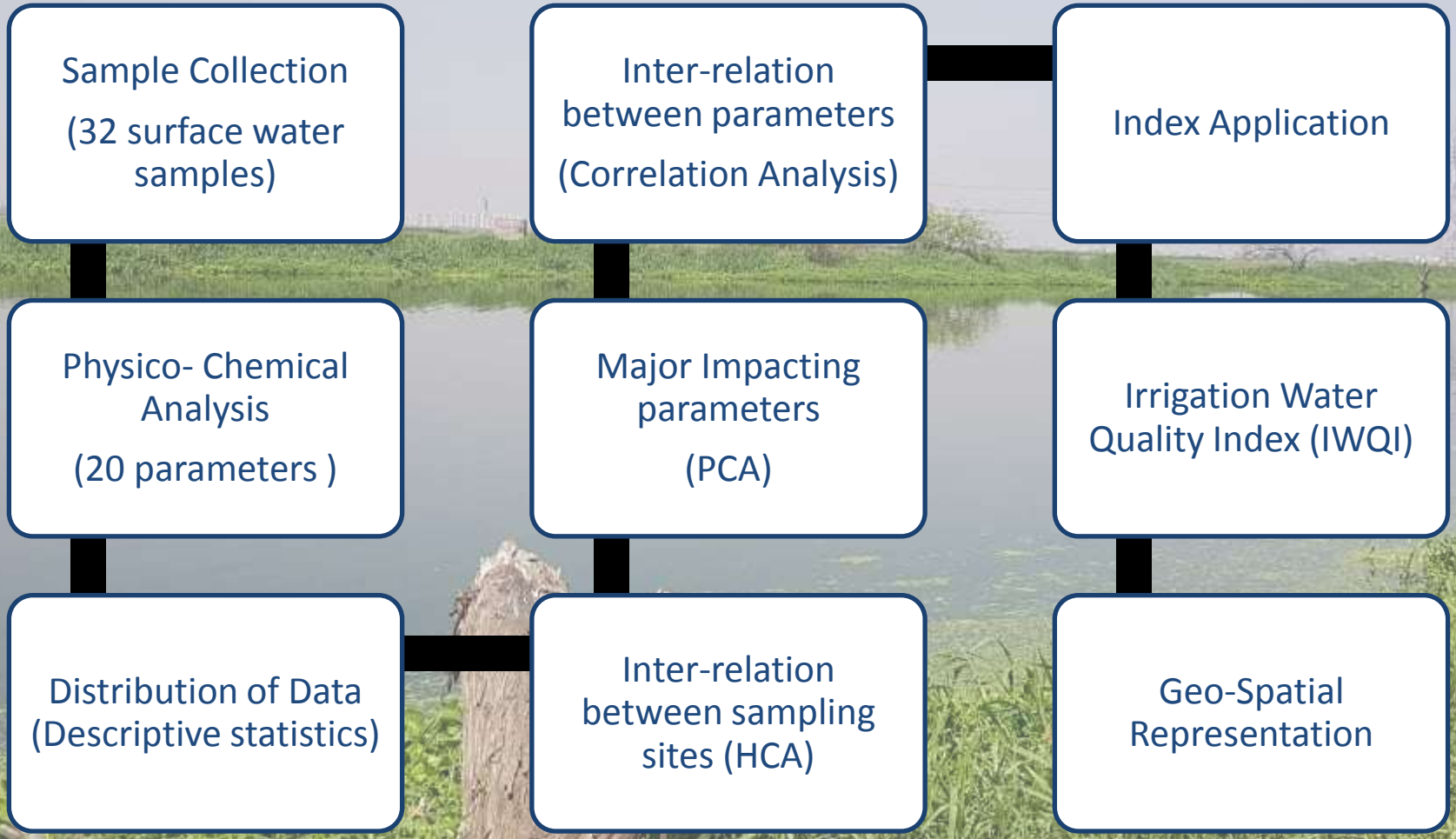
Prosopis juliflora–Vilaithi Kikar

Azadirachta indica–Neem

Ficus elastica–Indian Rubber


South-West Region of NCT, Delhi
N
Legend
drain_sampling_points_pre_19
Najafgarh Drain
fallow land
0 1.5 3 6 9 12
Kilometers
76°50'0"E
76°52'0"E
76°54'0"E
76°56'0"E
76°58'0"E
77°0'0"E
77°2'0"E
77°4'0"E
77°6'0"E
77°8'0"E
77°10'0"E
77°12'0"E
77°14'0"E
28°43'0"N
28°42'0"N
28°41'0"N
28°40'0"N
28°39'0"N
28°38'0"N
28°37'0"N
28°36'0"N
28°35'0"N
28°34'0"N
28°33'0"N
28°32'0"N
28°31'0"N
28°30'0"N
28°29'0"N
28°28'0"N
28°27'0"N
28°26'0"N
76°49'0"E
76°51'0"E
76°53'0"E
76°55'0"E
76°57'0"E
76°59'0"E
77°1'0"E
77°3'0"E
77°5'0"E
77°7'0"E
77°9'0"E
77°11'0"E
77°13'0"E

METHODOLOGY



RESULTS

- High BOD(120mg/L) and COD(203mg/l) values observed
- High Total Dissolved Solids (666mg/l) and Salinity (615mg/l)
- High Electric Conductivity values(1058 µS/cm)
- High Alkalinity (272mg/l) and Hardness (300mg/l)
- High concentration of Sodium(170mg/l) and Chloride (310mg/l)

DISCUSSION

Pre Monsoon

- Salinity and conductivity (0.99);
- BOD and COD (0.96);
- Hardness with conductivity(0.75) and salinity(0.75);
- Chloride with alkalinity (0.78) and Hardness(0.85);
- Sulphate with TDS(0.81);
- Alkalinity with sodium(0.86) and potassium(0.81)

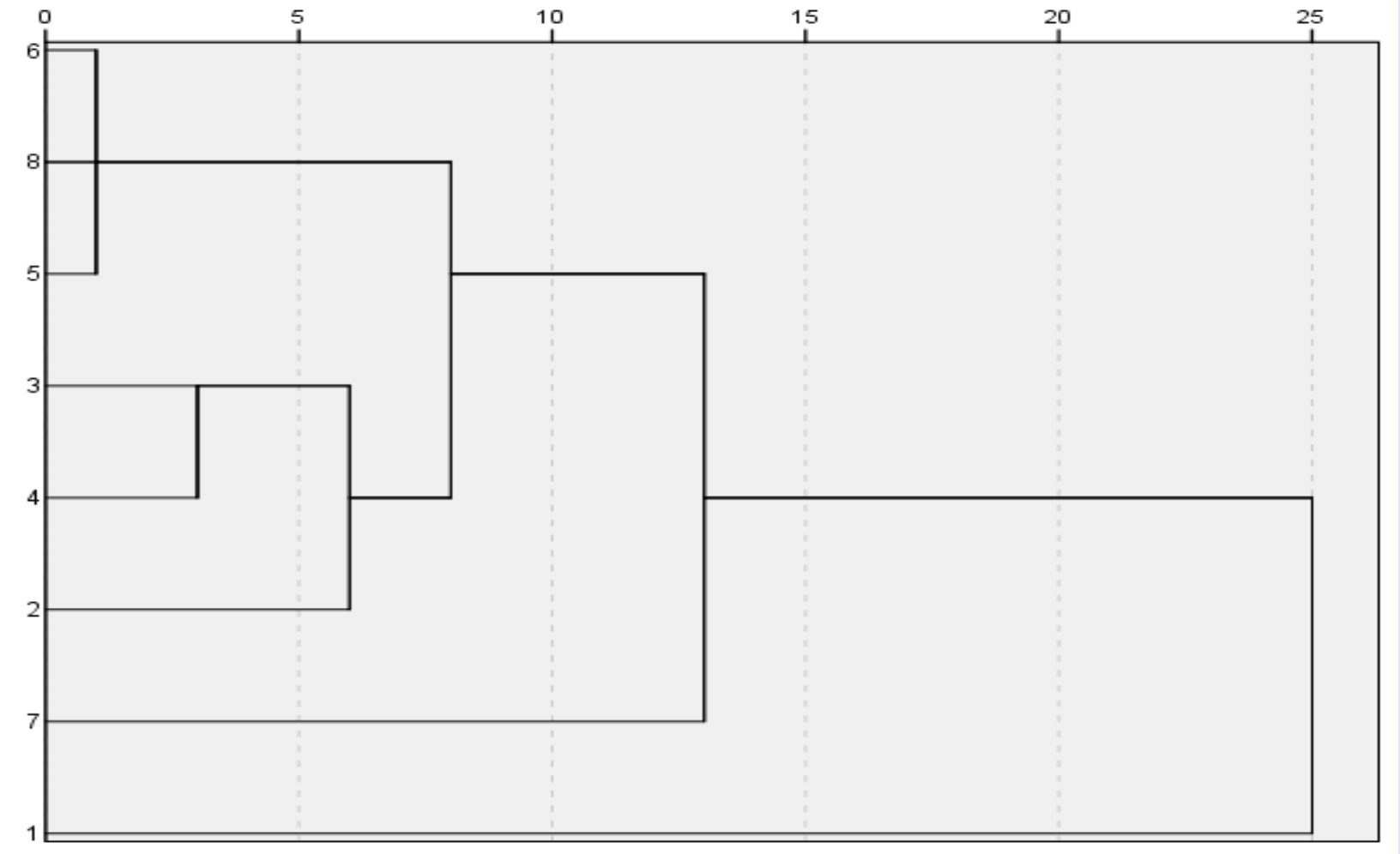
Post Monsoon

- Conductivity with salinity(0.95), TDS(0.90), alkalinity (0.89), chloride(0.89) and sodium (0.90);
- Salinity with TDS(0.97), alkalinity (0.84), hardness (0.84), chloride(0.96);
- TDS with alkalinity(0.82), hardness (0.81) and chloride(0.98);
- Alkalinity with hardness(0.80), chloride(0.78);

Principal Component Analysis (PCA)

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
PRE MONSOON						
1	7.22	38.01	38.01	5.52	29.06	29.06
2	5.43	28.59	66.60	5.09	26.80	55.87
3	4.26	22.42	89.02	4.99	26.30	82.17
4	1.06	5.59	**94.62**	2.36	12.44	94.62
POST MONSOON						
1	10.20	60.02	60.02	8.86	52.17	52.17
2	2.50	14.74	74.77	2.46	14.47	66.64
3	1.80	10.59	85.36	2.37	13.99	80.63
4	1.03	6.08	**91.45**	1.83	10.81	91.45

Hierarchical Cluster Analysis(HCA)



Irrigation Water Quality Index (IWQI)

Identification of parameters

↓

Calculation of SAR $SAR = \frac{Na^{+1}}{\sqrt{\frac{Ca^{+2}+Mg^{+2}}{2}}}$

↓

Definition of quality measurement value (qi)

qi = qimax – [(xij – xinf)*qiamp) / xamp]

↓

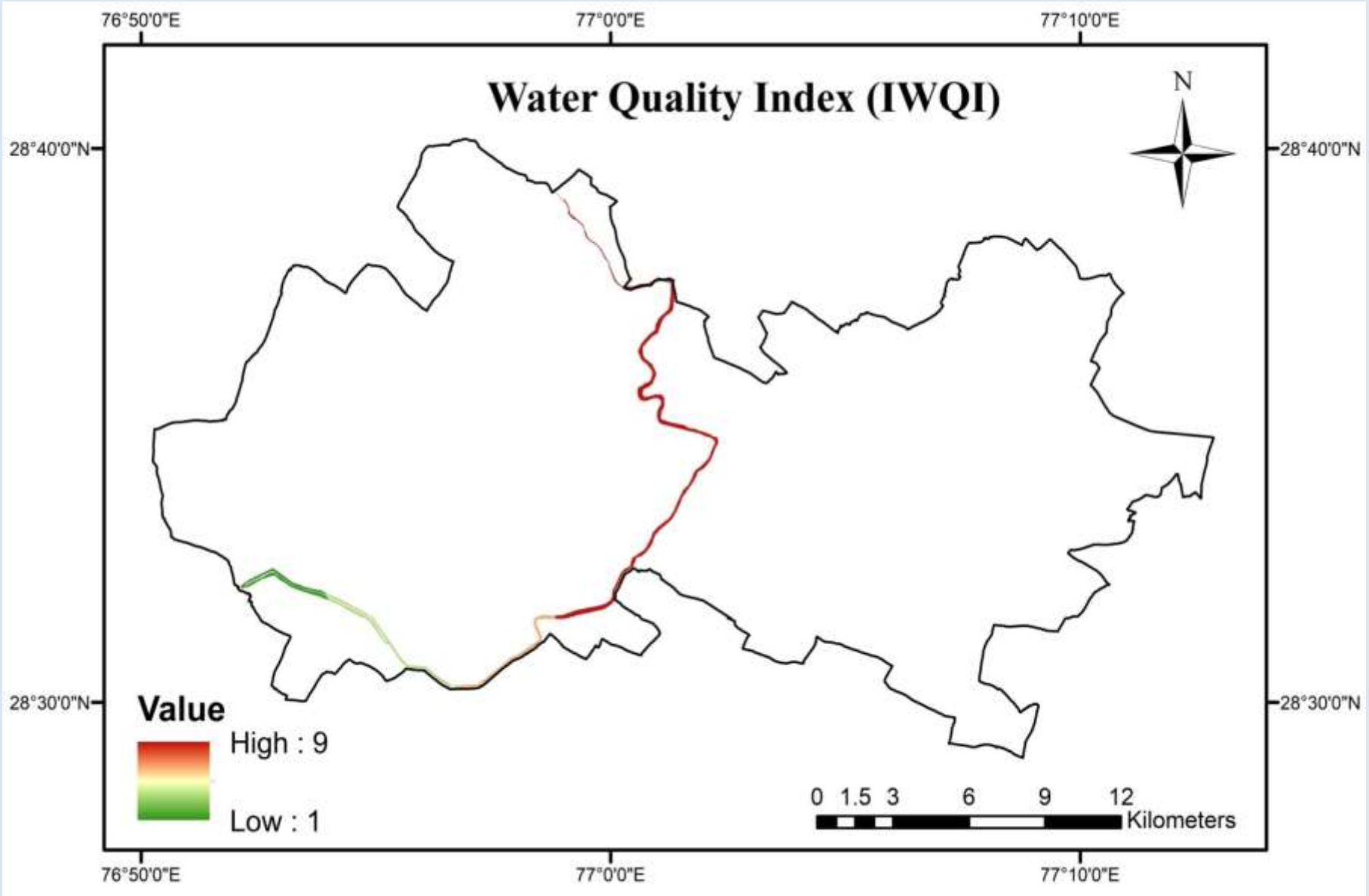
Aggregation of weights (wi) $IWQI = \sum_{i=1}^{n} q_i w_i$

↓

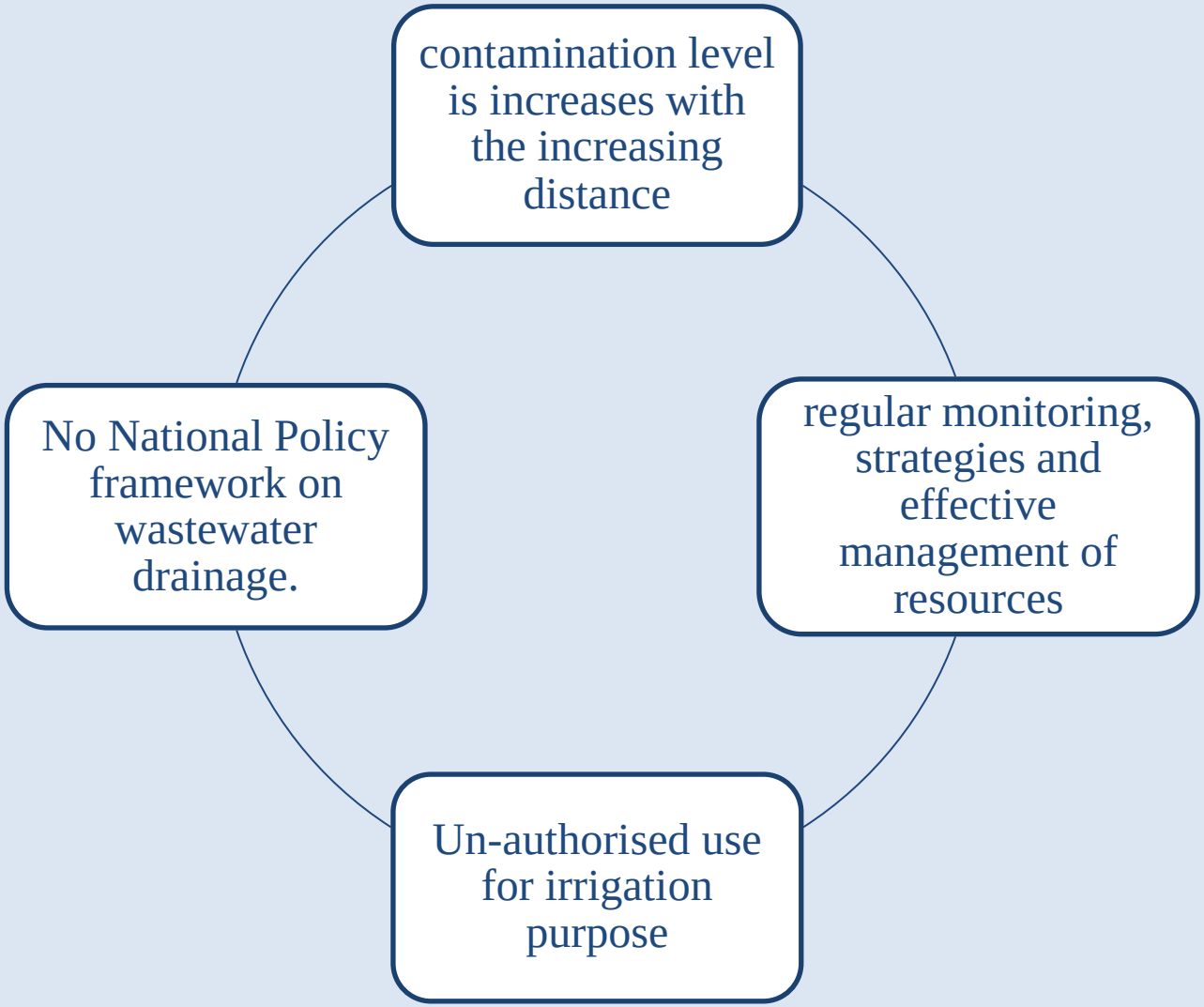
Calculation of IWQI

IWQI	Category	Impact on Soil	Impact on Plant
85-100	no restriction	low probability of causing salinity; extremely low permeability	no toxicity risk to plants
70-85	low restriction	moderate permeability	avoid salt sensitive plants
55-70	moderate restriction	moderate to high permeability	plants with moderate tolerance to salts
40-55	high restriction	use in soils with high permability without compact layers	plants with high tolerance to salts with special salinity control
0-40	severe restriction	avoided for irrigation purpose	only plants with high salt tolerance

Sampling location	Pre monsoon	Post monsoon
A1	85.25	62.57
A2	63.12	78.63
A3	66.12	67.74
A4	39.5	53.7
A5	38.31	35.99
A6	35.58	39.22
A7	27.32	44.11
A8	27.83	38.83


Water Quality Index (IWQI)
N
76°50'0"E
77°0'0"E
77°10'0"E
28°40'0"N
28°30'0"N
Value
High : 9
Low : 1
0 1.5 3 6 9 12
Kilometers

CONCLUSION


contamination level is increases with the increasing distance
regular monitoring, strategies and effective management of resources
Un-authorised use for irrigation purpose
No National Policy framework on wastewater drainage.

WAY FORWARD

- rejuvenation of the water bodies is of the utmost importance.
- support multiple recreational activities to bring in water activities.
- landscaped embankments and adorned with ornamental and aesthetically to capitalize on the beautification.
- install meshes of varied densities at various places.
- help raise groundwater level and benefit.

REFERENCES

[1] Central Pollution Control Board annual report, 2001- 2002

[2] Water and Power Consultancy Services (WAPCOS) report, 1999

[3] Al-Jiburi, H. K., and Al-Basrawi, N. H. (2007): "The Hydrogeology of Iraqi western and southern desert", Western Iraqi Desert Journal, Special Issue, pp.77-91.

[4] Tanji, K. K. (1990). "Agricultural Salinity Assessment and Manag-ement". *American Society of Civil Engineers*, Manuals and Reports on Engineering Practice, No.(71), pp.(619).

[5] Kwiatkowski, J.; Marciak, L. C., Wentz, D. & King, C. R. (1995), Salinity mapping for resource management within the County of Wheatland, Alberta, Conservation and Development Branch, Alberta Agriculture, Food and Rural Development, Edmonton, pp. (22).

[6] Nema, A., & Agrawal, L. (2003). WASTEWATER MANAGEMENT IN NAJAFGARH DRAINAGE BASIN–KEY TO WATER QUALITY IMPROVEMENT IN RIVER YAMUNA. In *Indian Association of Environment Management, Annual Conference* (pp. 1-12). New Delhi: Foundation for Greentech Environmental Systems.

[7] Story of Najafgarh: How a River Was Murdered After Flood of Flying Fishes By: Angana Chakrabarti, Aniruddha Ghosal & Rounak Kumar; March 2020


THANK YOU