



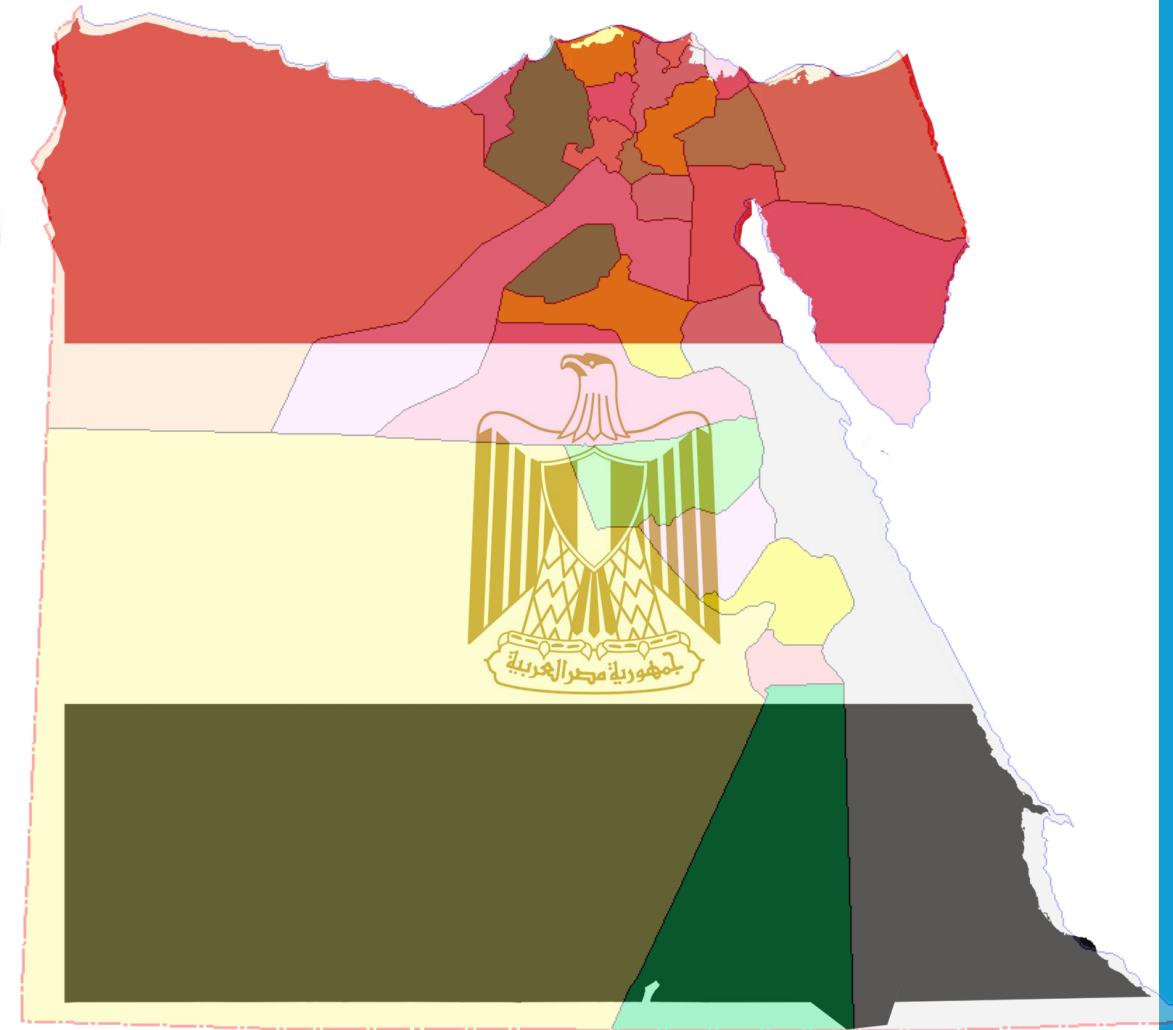
Integrated Water Quality Assessment and Forecasting

Date: 25 April 2025



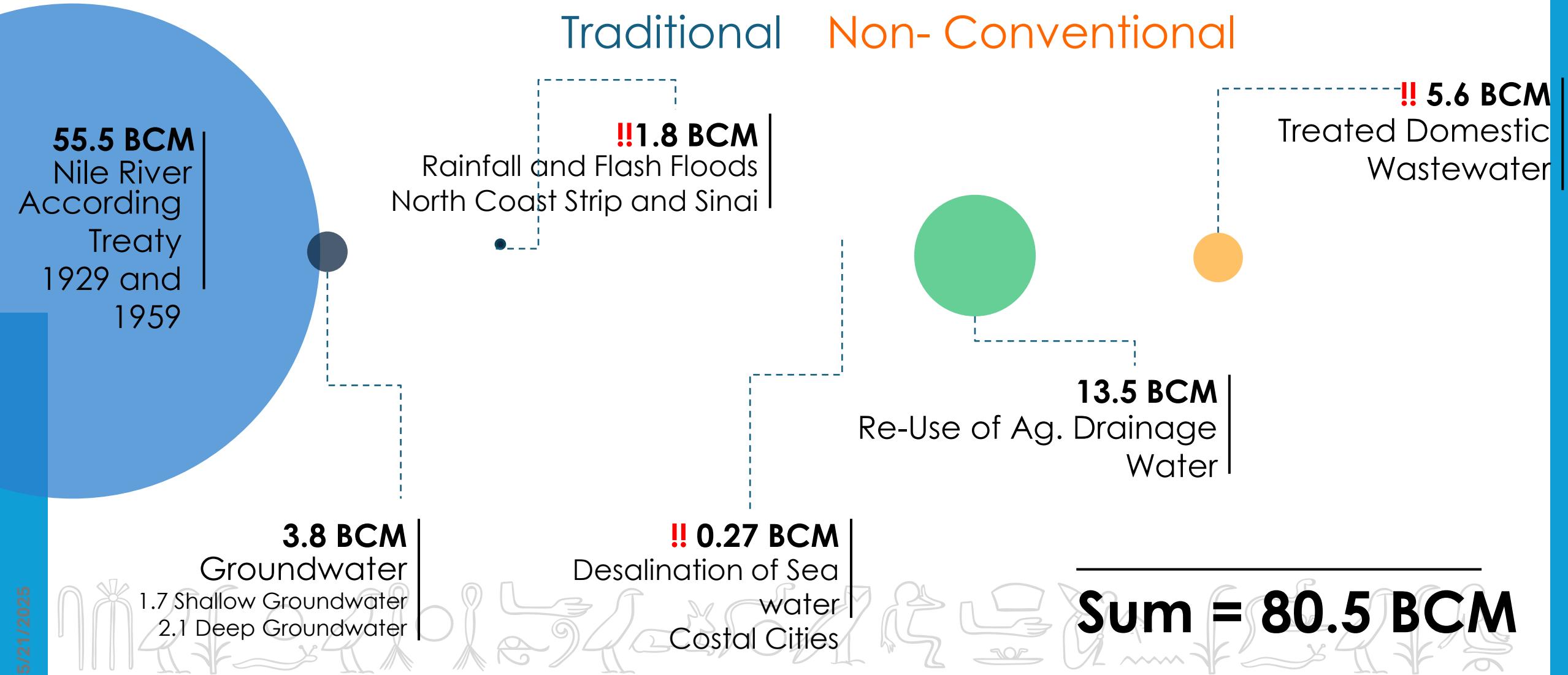


-  27 Governorates
-  250 Cities
-  4700 Villages
-  35,000 Settlements (Azba)
-  More than 117 Million



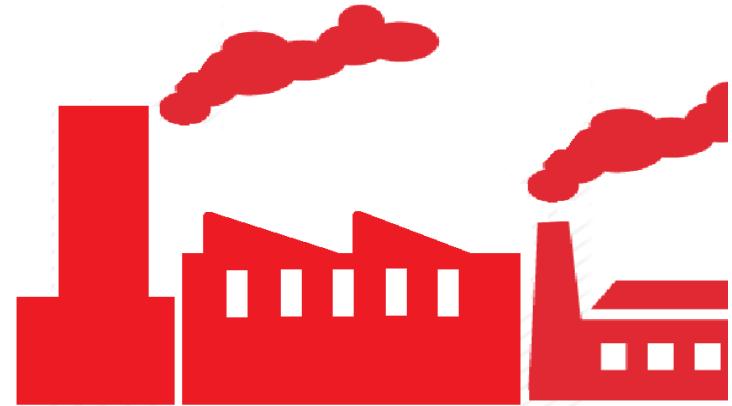


Water Resources





Water Uses



Industry
8 BCM/Y

Sum = 87.5 BCM/Y





Acknowledgment

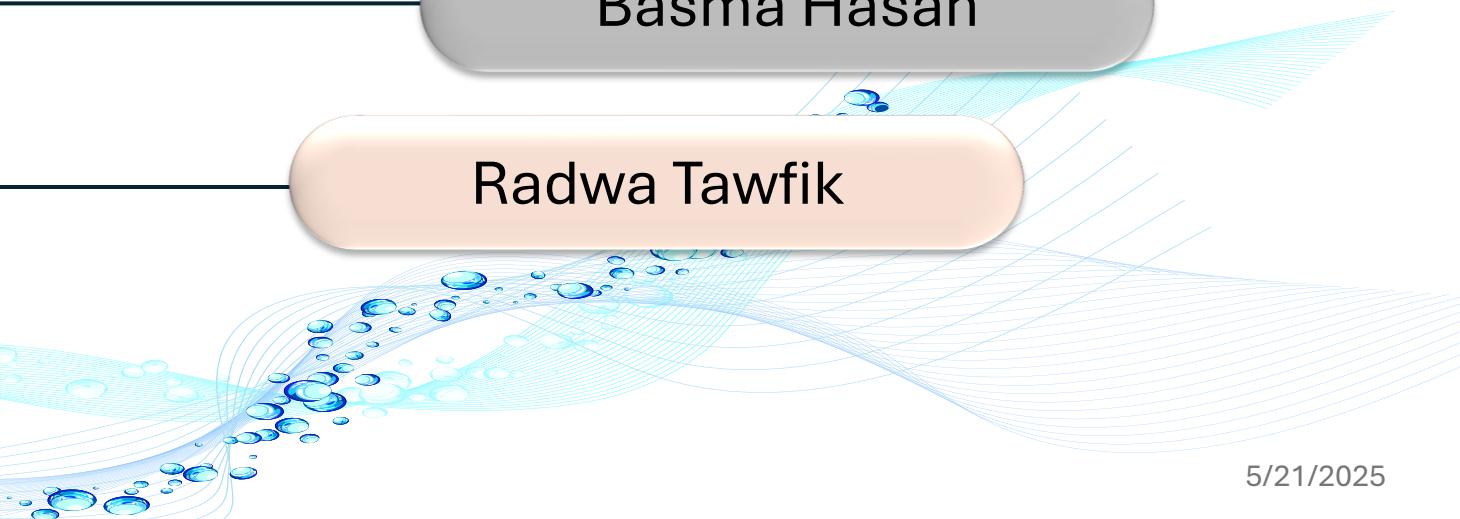
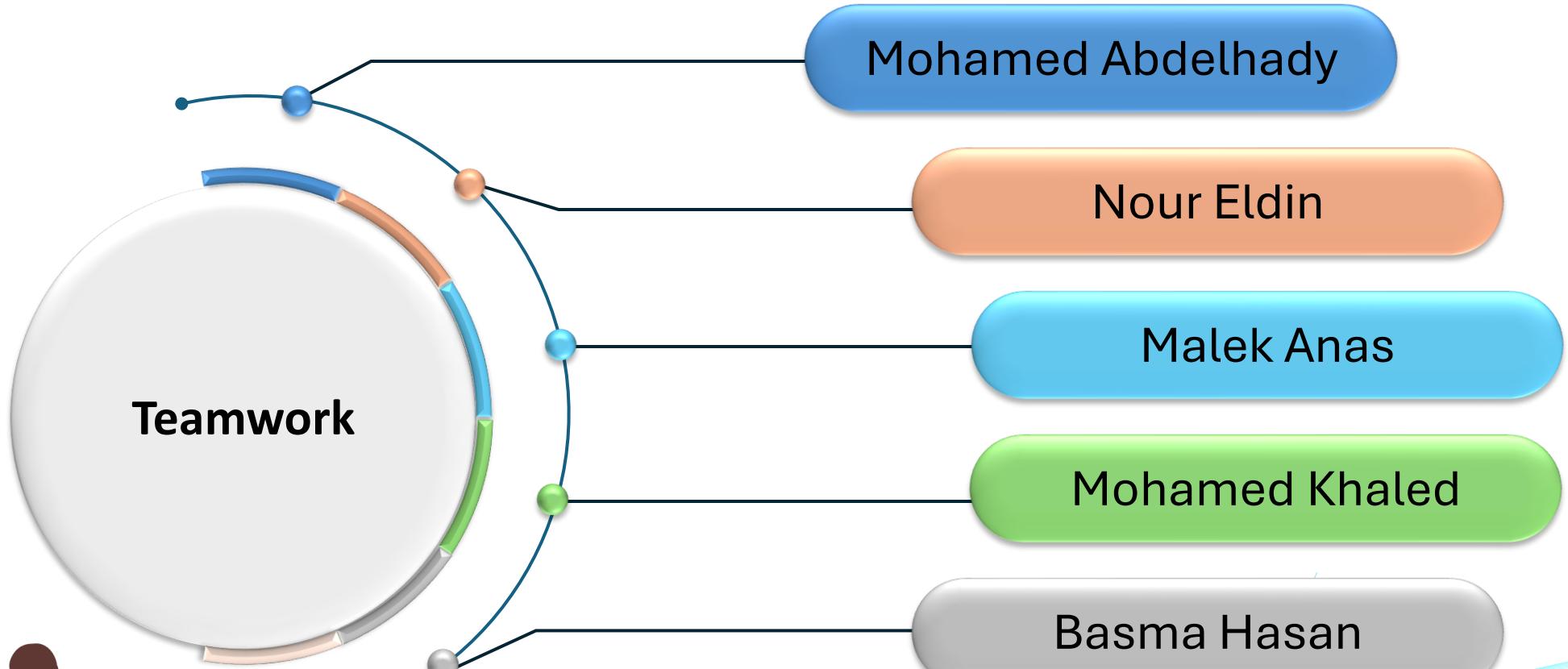
We express our appreciation to the **Ministry of Communications and Information Technology** for their support and guidance throughout the project. Their commitment to fostering digital innovation and addressing real-world issues is commendable.

And extend our sincere gratitude to the **Egyptian Digital Pioneers Initiative** for providing us with this invaluable opportunity to develop and apply our data analysis and modeling skills to a critical environmental challenge

We would like to express our deepest appreciation and immense gratefulness to **CLS CO.** and **Eng. Wael Gomaa** for his support and guidance during the initiative period course. His contributions were essential to our learning and development.

Finally, we would like to acknowledge the invaluable contributions of our **dedicated mentors**. Their expertise, feedback, and encouragement were instrumental in our progress and success. They helped us navigate challenges, refine our methodologies, and ultimately deliver meaningful results.





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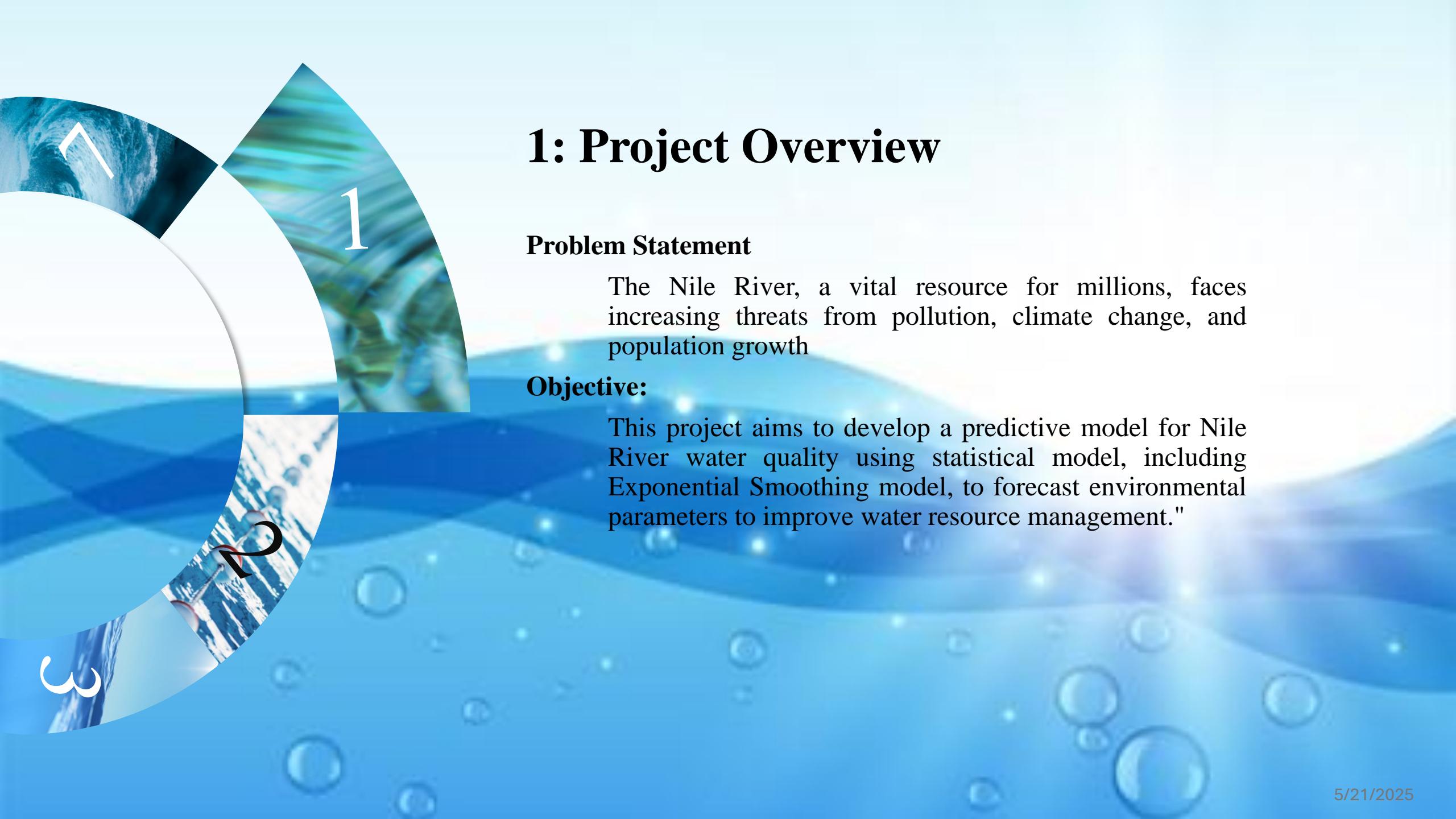
11: Reports & Dashboard

12: Challenges & Solutions

13: Conclusion & Future Work

14: Project Impact





1: Project Overview

Problem Statement

The Nile River, a vital resource for millions, faces increasing threats from pollution, climate change, and population growth

Objective:

This project aims to develop a predictive model for Nile River water quality using statistical model, including Exponential Smoothing model, to forecast environmental parameters to improve water resource management."



1: Project Overview

Scope:

Four governorates (Aswan, Minya, Cairo, Alexandria), Nile river is direct source for WTPs' Intakes.

Data Range:

Monthly readings from January 2018 to December 2024.

Key Parameters:

Turbidity, pH, TDS, BOD, DO, PO₄, NO₃, Temperature, Fecal Coliform.



2: Project Planning & Management

Timeline

Phase	Phase 1	Phase 2	Phase 3
Time interval	January – February-March 2025	February -March 2025	March – April 2025
Phase Target	Data & Analysis	Data Refinement	Final Reports & Dashboard
Tasks	<ul style="list-style-type: none">-Data Collection-Dax for WQI-Data Cleaning-Statistical Analysis-Reports	<ul style="list-style-type: none">-Report preparation-Data & Cleaning Discussion-Statistical Analysis	<ul style="list-style-type: none">-Individual reports-Dashboard-Final Presentation



2: Project Planning & Management

Risks & Mitigation

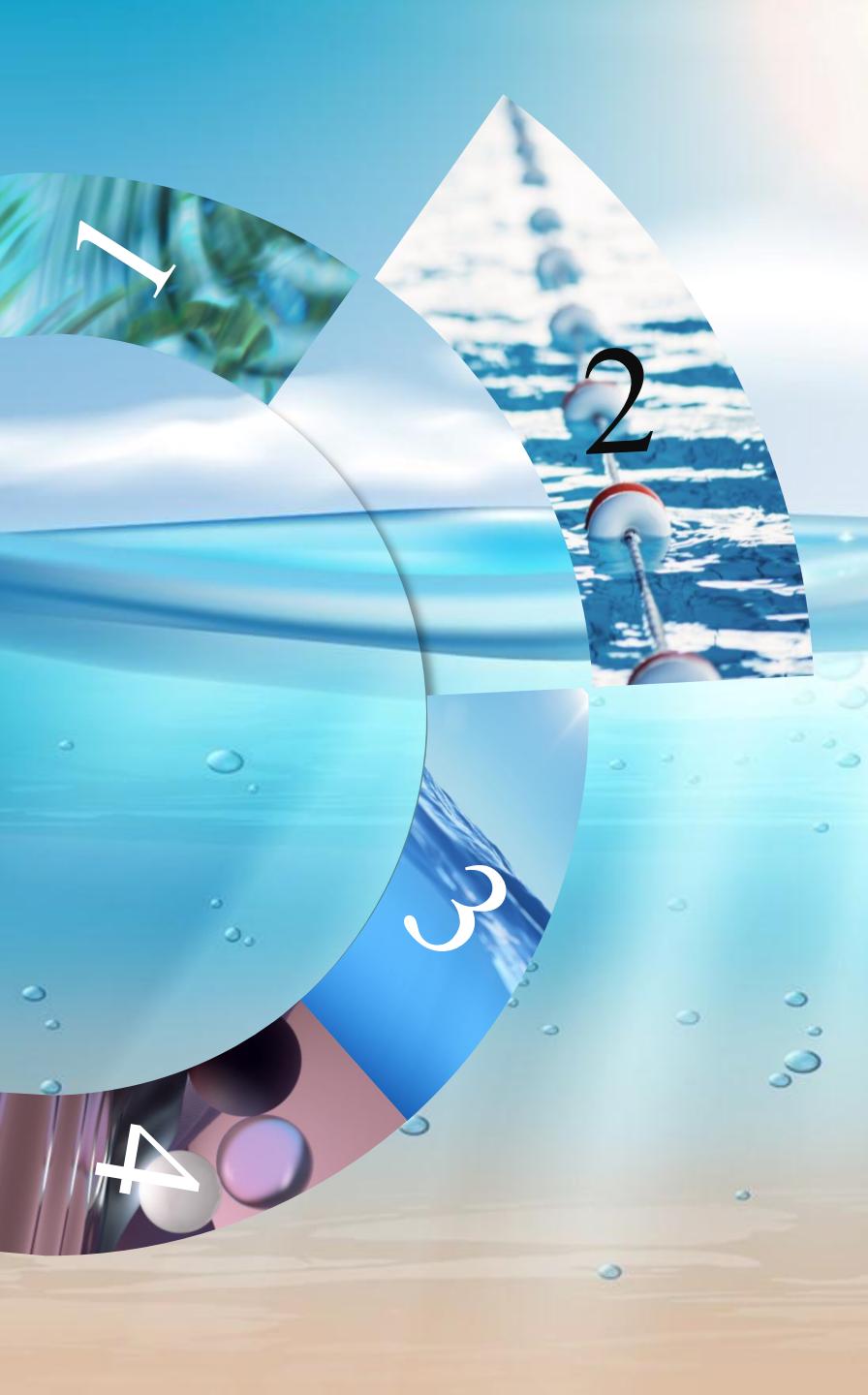
Source	Risk	Mitigation
Data	Limited, poor quality.	Collaborate, use diverse sources, standardize.
Model	Inaccuracy.	Test, refine, use expert input.
Politics:	Access issues.	Build relationships, be flexible.



2: Project Planning & Management

KPI for achieving project objectives

KPI	Interpretation
Accuracy	Model prediction precision.
Data	Coverage, completeness.
Time	Prediction speed.
Impact	Stakeholder use.
Quality	Water improvement.
Usability	Ease of use.
Efficiency	Project within scope.



2: Project Planning & Management

Methodology:

- 1- Data Collection:** Monthly readings (2018–2024).
- 2- Power BI:** Dashboards for Different analytical parameters, WQI visualization. And different correlations
- 3- Python:** Statistics Model: Exponential Smoothing (Holt-Winters).



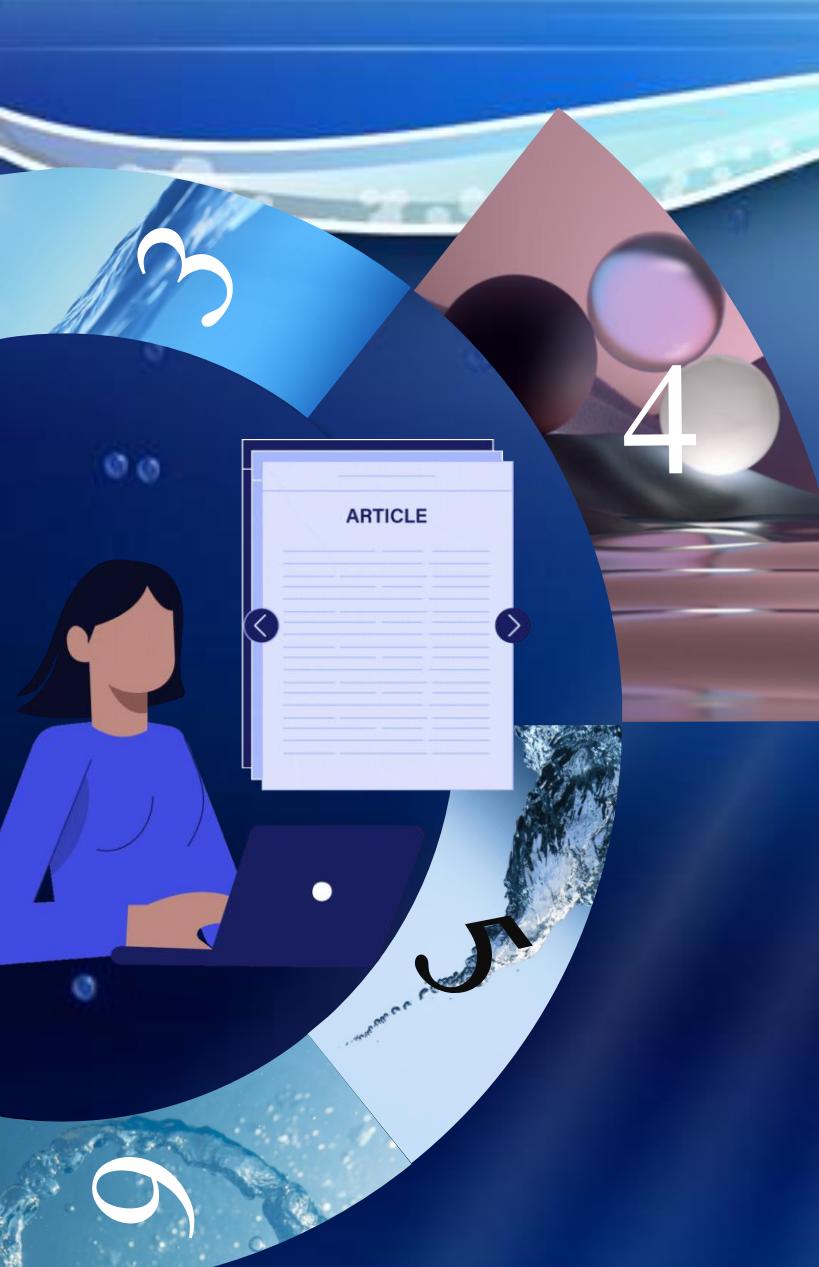
3: Tools & Equations

Tools:

- Excel (database)
- Power Query (Data Cleaning).
- Power BI (DAX Formulas, Dashboards).
- Python (Pandas, Statsmodels, SciPy, matplotlib.pyplot).

Equations:

- WQI Calculation.
- Statistical analysis
- Forecasting Models.



4: Literature Review

Research References:

Egyptian standards for water quality, global WQI references, Egyptian Guidelines for surface water competence.

Findings:

In reference to available data base and historical records , NSF WQI reference is used for calculation of WQI.

Gaps & Rationale:

This project will focus on the development of a predictive water quality model for the Nile River.



5: Requirements Gathering

Stakeholders:

- The Ministry of Communications.
- Local water authorities.

User Stories & Use Cases:

- Project teammates.
- Water authorities.
- Decision-makers.

Functional Requirements

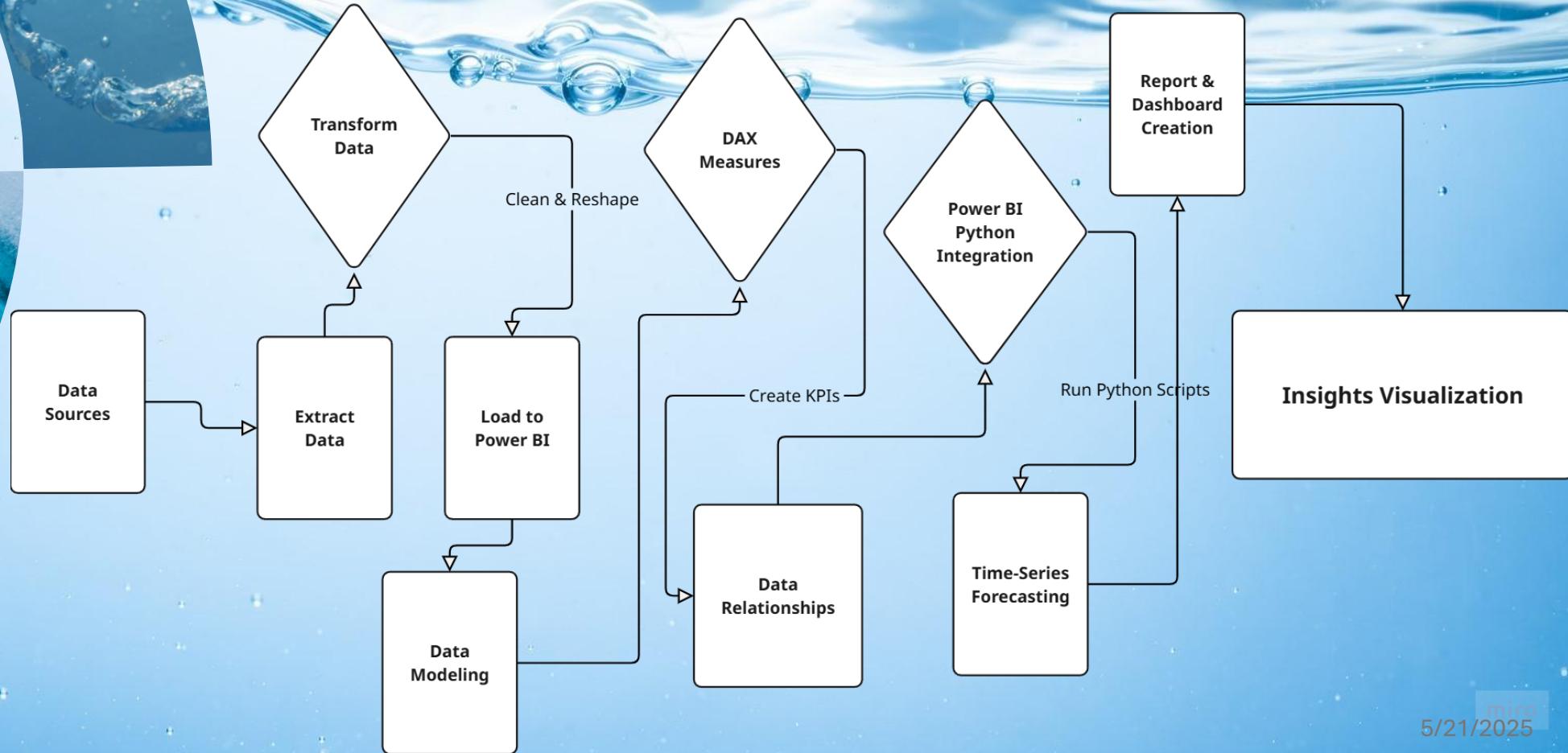
- water parameters over time.

Non-Functional Requirements

- Performance (fast data load), reliability, security of data.

6: System Analysis & Design

Architecture





7: Data Collection & Cleaning

Data Sources:

1. Holding Company for Water and Wastewater
2. Monthly water samples (2018–2024).
3. 4 Governorates, 9 parameters.

Four governorates (Aswan, Minya, Cairo, Alexandria), Nile river is direct source for WTPs' Intakes.

Cleaning:

1. Power Query

Removed duplicates, handled missing values, normalized data.



7: Data Collection & Cleaning																																												
Data Before Cleaning																																												
City	Code	Date	Parameter	Color	Turbidity	Tempreature	pH	Electric Conductivity	Total Dissolved Solids	Total Alkalinity as (CaCO3)	Carbonate Alkalinity	Bicarbonate Alkalinity	Chlorides (Cl)	Sulfates (SO4)	Phosphate (PO4)	Total Hardness	Permanganat	Calcium Hardness	Magnesium m	Calcium (Ca)	Magnesium (Mg)	Ammonia (NH3)	Nitrites as	Nitrates as	Silica (SiO2)	Floride (F)	Dissolved Oxygen	Biological Oxygen	COD	TSS	TS	Cyanide (CN)	Sodium (Na)	Potassium (K)	Iron (Fe)	Manganese (Mn)	Aluminum (Al)	Copper (Cu)	Lead (Pb)	Cadmium (Cd)				
					NTU	°C	6.5-8.5						mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l									
		Day	Month	Unit	Haze	-C	<500	µS/cm																																				
Alex	Ax1812	December	2018	61.66667	35.46667	20.08333	7.69	765	468	190.8	0	190.8		80.19167	85.23567	0.3293933	201.233	10.43333	126.53	77.4184	50.61	18.8	4.7	0.543	8.11733	3.1583	NA	6.5333333	15	36.8	58	526	NA	87.1	8.70999	0.449	0.0285	0.67	ND	ND	ND			
Alex	Ax1901	January	2019	52.5	25.4	16.9	7.9	798.25	488.95	207.75	0	207.75		90	93.885	0.193375	211.9	4.15	125.33	95.66114	50.13	23.23	5.25	0.472	9.5075	2.5661	NA	8.925	5.25	34.4	38.5	527.45	NA	96.69	9.66936	0.185	0.0205	0.365	ND	ND	ND			
Alex	Ax1902	February	2019	47.5	20.15	18.25	7.76	702.75	421.65	191.95	0	191.95		79.4	69.2825	0.20375	182.7	9.25	116.33	70.4178	46.53	17.1	4.725	0.638	7.366	1.3715	NA	7.75	5	32.18	41.75	463.4	NA	85.98	8.59759	0.31	0.0695	0.4875	ND	ND	ND			
Alex	Ax1903	March	2019	41.66667	34.88333	18.28333	7.545	547.6866667	331.46667	165.57	0	165.57		54.66667	50.555	0.1495	160.7	5	91.1	63.78782	36.44	15.49	1.94	0.342	8.81962	3.0983	NA	7.8833333	5.4	40.07	49.333	380.8	NA	60.49	6.04874	0.132	0.009	0.21	ND	ND	ND			
Alex	Ax1904	April	2019	55	75.4625	20.5	7.8275	610.75	366.45	171.8	0	171.8		1.05	48.15	0.18775	176.35	4.55	99.275	77.78902	39.71	18.89	2.4	1.129	16.465	2.4349	NA	7.05	5.8	27.2	73.5	439.95	NA	62.72	6.21786	0.326	0.01235	0.237	ND	ND	ND			
Alex	Ax1905	May	2019	37.5	158.9	23.075	7.67	562	337.2	166.05	0	166.05		5.475	85.86525	0.22365	150.7	-15.35	92.293	57.40924	36.917	13.94	3.485	0.619	15.2372	1.914	NA	6.2	13.5	23.09	137	474.2	NA	81.79	8.17922	0.425	0.057	0.354	0.005	ND	ND			
Alex	Ax1906	June	2019	37.5	87.9	23.075	7.7125	74.65	457.75	0	457.75		0.457	29.1625	34.9925	0.11255	152.7	7	95.5	73.79456	38.2	17.92	0.45	0.397	7.77	3.1745	0.465	7.05	3.65	15.04	9.42	24.9916	0.185	0.009	0.186667	ND	ND	ND						
Alex	Ax1907	July	2019	36.25	89.55	22.065	7.7325	514.5	308.7	143.05	0	143.05		4.45	46.82275	0.23185	162.9	19.85	94.25	62.7995	37.7	15.25	0.78	0.763	8.71175	2.5656	0.509	6.8	6.6	12.74	34.1	342.8	NA	37.98	3.79757	0.113	0.0203333	0.131	ND	ND	ND			
Alex	Ax1908	August	2019	56.66667	107.0433	24.83333	7.926667	534	320.4	154.0667	0	154.0667		147.8	46.82067	47.88967	0.1225	154.667	0.6	88.067	66.6	35.227	16.17333	1.76	2.276	4.11533	2.41	6.2723	17.656667	0.275	5.45	79.333	399.73	NA	52.29	5.22936	0.629	0.0755	0.874333	0.001	ND	0.02		
Alex	Ax1909	September	2019	40	222	23.76667	7.966667	640.6666667	385.2667	181.3333	0	181.3333		63.65	59.21967	0.27	139.733	41.6	104.57	35.2725	41.827	8.566667	3.41	1.56	7.3342	1.9291	0.18668	7.3	8	13.14	191.67	315.1	NA	86.28	8.67279	0.38	0.037	0.93	ND	ND	ND			
Alex	Ax1910	October	2019	76.25	217.5	20.6	7.515	43.75	262.5	145.5	0	145.5		31.25	43.32725	0.10205	142.8	-2.7	93	43.6508	37.2	10.6	0.0305	0.289	9.97385	3.1295	NA	6.6	2.45	26.95	29.0	553.3	NA	45.48	4.54835	0.1621	0.138	ND	ND	ND				
Alex	Ax1911	November	2019	21.66667	13.30333	21.43333	7.85	581	348.6	167.4	0	167.4		173.4	6	83	90.47426	33.2	0.92	63.9	7.48623	1.5181	NA	7.6666667	6.8333333	15.8	17.59	21.333	366.93	NA	49.02	4.90247	0.129	0.0036667	0.113	ND	0.01	ND						
Alex	Ax1912	December	2019	50	151.04333	21.55333	7.893333	662	397.6	180.4667	0	180.4667		184.13333	72.06733	49.06933	0.1623	185.133	4.666667	115.0	70.05833	46.03	16.91333	3.933333	61.3	13.181	2.5797	NA	8.27	16.5	18.94	12.733	524.93	NA	73.01	7.30085	NA	NA	NA	NA	NA			
Alex	Ax2001	January	2020	62.5	130.75	15.425	7.68	556.75	330.5	180.15	0	180.15		59.875	47.58125	0.1412	181.05	0.9	90.056	90.99375	36.023	22.1225	1.9125	0.365	11.27	1.9855	NA	8.225	3	10.89	66.25	396.75	NA	54	5.39992	0.034	0.007	0.7515	0.582	0.001	0.001			
Alex	Ax2002	February	2020	35	81.225	18.75	7.9225	663.25	397.9	171.25	0	171.25		57.245	22.205	191.55	20.3	106.1	85.45	42.44	2.355	0.536	8.9	2.6764	NA	8.425	5.6	28.75	58.25	456.15	NA	64.13	6.41256	0.054	0.01	0.586333	1.487	ND	0.001					
Alex	Ax2003	March	2020	30	14.15	20	7.85	675	405	168.3	0	168.3		73.4	27.163	0.213	170.305	2.005	101.04	69.6275	40.415	16.83	3.25	0.908	4.175	1.3745	NA	7.9	5.5	26	24	429	NA	55.74	5.57364	0.023	ND	0.139	0.232	ND	ND			
Alex	Ax2004	April	2020	42.5	16.01	30.093	7.84333	718.6666667	357	160	NA	NA	NA	55.4	42.645	0.0736	163.6	3.6	NA	NA	NA	NA	NA	1.67	0.645	7.9173	1.1298	NA	7.65	6	21.75	26	NA	NA	NA	NA	NA	NA	NA	NA	0.008			
Alex	Ax2005	May	2020	NA	20.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA						
Alex	Ax2006	June	2020	25	15.45	23.5	7.795	434.5	307.7	138.4	0	138.4		34.2	19.95	0.0445	184.5	46.1	113.94	70.5625	45.575	17.133	1.056	0.406	5.505	1.1634	7.35	19.885	0.099	5.6	20	327.7	NA	11.54	1.15396	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
Alex	Ax2007	July	2020	20	11.6	25.85	7.93	453.5	270	141.1	0	141.1		43	33.23	0.1334	140.1	-1	85.675	54.425	34.27	13.235	0.84	0.396	6.3467	2.45	7.45	19.1	0.109	3.25	22.5	29.2	NA	42.41	4.24123	ND	ND	0.65815	ND	ND	ND			
Alex	Ax2008	August	2020	25	9.425	24.25	7.905	557	330.5	161.5	0	161.5		50.7	25.9585	0.10605	148.4	-13.1	90.4	58	36.16	14.113	1.68	0.506	3.63075	1.825	NA	7.775	5.8	20	13	343.5	NA	48.83	4.88327	ND	ND	ND	ND					
Alex	Ax2009	September	2020	27.5	25.9	23.15	7.87	464.5	278.1	142.1	0	142.1		32.6	23.6	0.70385	135.6	-6.5	85.488	50.1125	34.195	12.195	0.972	0.39	5.69325	1.7633	8.1	13.3	0.073	15.3	40	318.1	NA	34.19	3.41857	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
Alex	Ax2010	October	2020	25	44.6	22.65	7.905	431	256.5	139.5	0	139.5		29.3	23.475	0.51066	100.7	21.0	80.775	64.725	32.31	15.733	0.173	0.364	6.28628	7.35	13.7	0.1197	7.5	52.5	309	NA	40.55	4.05542	0.009	ND	0.009	ND	ND	ND				
Alex	Ax2011	November	2020	27.5	22.20	1.9	7.74	610.00	174.90	0.00	174.90		60.30	44.26	0.30	202.30	27.40	115.70	85.60	46.28	21.01	1.68	0.89	10.90	2.16	NA	7.04	2.95	13.35	8.50	374.10	NA	47.18	4.72	0.10	0.01	0.19	0.01	0.01	0.01	0.01	0.01		
Alex	Ax2012	December	2020	30	10.95	20.55	7.43	552.50	331.30	157.50	0	157.50		1.31	105.50	0.060	157.50	0.60	42.62	12.26	0.63	0.76	8.91	2.05	NA	7.42	3.10	11.15	8.80	340.10	NA	45.60	4.56	0.11	0.									

AutoSave Off Radwa- Data Form Alex WQI updated 17-03-2025.xlsx

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Insert Delete Format Fill Sort & Filter Find & Select Add-ins Analyze Data Create and Share Adobe PDF Adobe Acrobat AI Assistant for Excel AI Classification

7: Data Collection & Cleaning

Data Before Cleaning

			Date	Parameter	Turbidity NTU	Delta Temp. °C	pH	Total Dissolved Solids mg/l	Phosphate s (PO4) mg/l	Nitrates as (NO3) mg/l	Dissolved Oxygen mg/l	Biological Oxygen Demand mg/l	Fecal Coliform (Cell/100m l)	
#	City	Code	Day	Month	Unit	wi*qi	wi*qi	wi*qi	wi*qi	wi*qi	wi*qi	wi*qi	wi*qi	wi*qi
1	Alex	Ax1801	Jan	2018	0	0	2.0833333	0.25	70.5	2.11	18.33333	2.2	0	31.01
2	Alex	Ax1802	Feb	2018	0	0	59.583333	7.15	91	2.73	4.64	0.1392	68.9475	5.5158
3	Alex	Ax1803	March	2018	0	0	0	85.25	2.5875	5.36	0.1608	81.025	6.482	31.075
4	Alex	Ax1803	Apr	2018	0	0	72.083333	8.65	60.5	1.815	14	0.42	85.835	6.8668
5	Alex	Ax1805	May	2018	0	0	65.833333	7.9	78	2.34	25.88	0.7764	85.2725	6.8218
6	Alex	Ax1806	June	2018	0	0	37.916667	4.55	70.5	2.115	39.46	1.1838	91.81	7.3448
7	Alex	Ax1807	July	2018	0	0	92.638889	11.116667	61.25	1.8375	40.26	1.2078	93.3925	7.4714
8	Alex	Ax1808	August	2018	0	0	0	74.5	2.265	44.68	1.3404	61.22375	4.8979	0
9	Alex	Ax1809	September	2018	0	0	0	0	0.716667	2.93	30.02	0.9006	90.61667	7.249333
10	Alex	Ax1810	October	2018	0	0	0	97.6667	2.93	30.02	0.9006	90.61667	7.249333	0
11	Alex	Ax1811	November	2018	0	0	88.333333	10.6	86	2.58	18.12	0.5436	85.825	6.866
12	Alex	Ax1812	December	2018	0	0	27.083333	3.25	81	2.43	6.4	0.192	83.80333	6.704267
13	Alex	Ax1901	Jan	2019	0	0	54.444444	6.5333333	60	1.8	2.21	0.0663	90.33125	7.2265
14	Alex	Ax1902	Feb	2019	0	0	78.055556	9.3666667	74	2.22	15.67	0.4701	89.8125	7.185
15	Alex	Ax1903	March	2019	0	0	76.388889	9.1666667	95.5	2.865	33.7067	1.0112	92.525	7.402
16	Alex	Ax1903	Apr	2019	0	0	4.16666667	0.5	67.25	2.0175	26.71	0.8013	90.6125	7.249
17	Alex	Ax1905	May	2019	0	0	52.083333	6.25	83	2.49	32.56	0.9768	88.8175	7.1054
18	Alex	Ax1906	June	2019	0	0	52.083333	6.25	78.75	2.3625	45.07	1.3521	94.3725	7.5498
19	Alex	Ax1907	July	2019	0	0	25	3	76.75	2.3025	38.26	1.1478	88.4075	7.0726
20	Alex	Ax1908	August	2019	0	0	25	3	76.75	2.3025	38.26	1.1478	88.4075	7.0726
21	Alex	Ax1909	September	2019	0	0	89.166667	10.7	63.3333	1.6	22.9467	0.6884	86.5	6.92
22	Alex	Ax1910	October	2019	0	0	70.555556	8.4666667	98.5	2.955	47.5	1.425	94.9875	7.599
23	Alex	Ax1911	November	2019	0	0	87.777778	10.533333	65	1.95	30.28	0.9084	94.355	7.5484
24	Alex	Ax1912	December	2019	0	0	82.777778	9.9333337	60.66667	1.82	20.48	0.6144	91.885	7.3508
25	Alex	Ax2001	Jan	2020	0	0	78.333333	9.4	80	2.4	33.9	0.1017	92.94	7.4352
26	Alex	Ax2002	Feb	2020	0	0	86.666667	10.4	83	2.49	20.42	0.6126	88.975	7.118
27	Alex	Ax2003	March	2020	0	0	91.666667	11	69.5	2.085	19	0.57	89.35	7.148
28	Alex	Ax2003	Apr	2020	0	0	4.16666667	0.5	74.5	2.235	28.6	0.858	96.32	7.7056
29	Alex	Ax2005	May	2020	0	0	50.833333	6.1	69	2.07	0	0	0	0
30	Alex	Ax2006	June	2020	0	0	50.833333	6.1	69	2.07	0	0	0	0
31	Alex	Ax2007	July	2020	0	0	51.666667	6.2	88.5	2.655	46	1.38	93.33	7.4664
32	Alex	Ax2008	August	2020	0	0	10.833333	1.3	91.5	2.745	33.9	1.017	94.6975	7.5758
33	Alex	Ax2009	September	2020	0	0	59.166667	7.1	83.5	2.505	44.38	1.3314	96.3075	7.7046
34	Alex	Ax2010	October	2020	0	0	35.833333	4.3	92	2.76	48.7	1.461	74.47	5.9576
35	Alex	Ax2011	November	2020	0	0	90.833333	10.9	91	2.73	28.3	0.849	94.525	7.562
36	Alex	Ax2012	December	2020	0	0	86.666667	10.4	83	2.49	20.42	0.6126	88.975	7.118
37	Alex	Ax2101	Jan	2021	0	0	91.666667	11	69.5	2.085	19	0.57	89.35	7.148
38	Alex	Ax2102	Feb	2021	0	0	4.16666667	0.5	74.5	2.235	28.6	0.858	96.32	7.7056
39	Alex	Ax2103	March	2021	0	0	50.833333	6.1	69	2.07	0	0	0	0
40	Alex	Ax2104	April	2021	0	0	50.833333	6.1	69	2.07	0	0	0	0
41	Alex	Ax2105	May	2021	0	0	51.666667	6.2	98.5	2.655	46	1.38	93.33	7.4664

Integrated Water Quality Assessment and Forecasting

Home Transform Add Column View Tools Help

New Source Recent Enter Data Data source settings Manage Parameters Refresh Preview Advanced Editor Properties

Choose Columns Remove Columns Keep Rows Remove Rows Sort Split Column Group By Use First Row as Headers Replace Values Merge Queries Text Analytics Vision Combine Files Azure Machine Learning

7: Data Collection & Cleaning

Data Before Cleaning

MNS, 287 ROWS Column profiling based on top 1000 rows

Query Settings

PROPERTIES

- Name: Alex
- All Properties

APPLIED STEPS

- Source
- Navigation
- Changed Type
- Removed Top Rows
- Promoted Headers
- Changed Type1
- Renamed Columns
- Removed Top Rows1
- Kept First Rows
- Changed Type2
- Rounded Off
- Rounded Off1
- Rounded Off2
- Rounded Off3
- Filtered Rows
- Replaced Errors
- Replaced Errors1
- Replaced Errors2
- Replaced Errors3
- Replaced Errors4
- Replaced Errors5
- Replaced Errors6
- Replaced Value
- Replaced Value1
- Replaced Value2
- Replaced Value3
- Replaced Value4
- Replaced Value5
- Replaced Value6
- Replaced Value7
- Replaced Errors7
- Rounded Off4
- Rounded Off5
- Removed Columns
- Filtered Rows1
- Changed Type3
- Replaced Value8
- Renamed Columns1
- Changed Type4
- Removed Columns1
- Renamed Columns2
- Replaced Value9

5/21/2025

= Table.ReplaceValue(#"Renamed Columns2", "Alex ", "Alexander", Replacer.ReplaceText, {"City"})

Date	1.2 Turbidity	1.2 Seasonal	1.2 Temperature	1.2 Delta T	1.2 pH	1.2 Total Dissolved Solids	1.2 Phosphates (PO4)	1.2 Nitrates as (NO3)	1.2 Dissolved Oxygen	1.2 Biological Oxygen Demand	1.2 Fecal Coliform
100% ● Valid	100% ● Valid	100% ● Valid	100% ● Valid	100% ● Valid	100% ● Valid						
0% ● Error	0% ● Error	0% ● Error	0% ● Error	0% ● Error	0% ● Error						
0% ● Empty	0% ● Empty	0% ● Empty	0% ● Empty	0% ● Empty	0% ● Empty						
84 distinct, 84 unique	81 distinct, 79 unique	29 distinct, 28 unique	69 distinct, 55 unique	77 distinct, 70 unique	45 distinct, 23 unique	79 distinct, 74 unique	36 distinct, 17 unique	77 distinct, 71 unique	58 distinct, 45 unique	60 distinct, 44 unique	78 distinct, 72 unique
17-Jan-18	7.21	21.31	19.35	-1.96	7.79	501.15	0.39	9.39	7.75	4.9	
17-Feb-18	6.45	null	20.1	-0.81	7.59	476	0.62	7.8	6.62	3.8	
17-Mar-18	8	null	24.08	2.77	7.9	450	0.38	6.0	6.54	4.4	
17-Apr-18	29.95	22.51	21.95	-0.56	7.72	370.6	0.29	10.91	7.3	4.78	
17-May-18	10.5	null	21.82	-0.68	7.79	302.7	0.16	6.13	6.3	5.8	
17-Jun-18	11.91	null	23.75	1.24	7.79	260.7	0.12	6.00	7.17	1.6	
17-Jul-18	17.23	25.1	24.95	-0.15	7.79	260.7	0.12	6.00	6.93	12	
17-Aug-18	25.48	null	27.32	2.23					7.07	4.7	
17-Sep-18	91.43	null	23.02	-2.08					7.37	4	
17-Oct-18	40.45	21.54	22.77	1.22					5.82	15	
17-Nov-18	7.27	null	21.77	0.23							
17-Dec-18	35.47	null	20.08	-1.46	7.69	468	0.32	8.12	6.53	15	
17-Jan-19	23.4	17.81	16.9	-0.91	7.9	488.95	0.19	9.51	8.93	5.25	
17-Feb-19	20.75	null	18.25	0.44	7.76	421.65	0.2	7.37	7.75	5	
17-Mar-19	34.88	null	18.29	0.47	7.54	331.47	0.15	8.82	7.88	5.4	
17-Apr-19	75.46	22.42	20.5	-1.92	7.83	366.45	0.19	16.46	7.05	5.8	
17-May-19	158.9	null	23.38	0.96	7.67	337.2	0.22	15.24	6.2	13.5	
17-Jun-19	87.9	null	23.38	0.96	7.71	274.65	0.11	7.77	7.05	3.65	
17-Jul-19	89.55	23.55	22.05	-1.5	7.73	308.7	0.23	8.71	6.8	6.6	
17-Aug-19	107.04	null	24.83	1.28	7.93	320.4	0.12	4.12	7.66	0.28	
17-Sep-19	222	null	23.77	0.22	7.97	385.27	0.27	7.33	7.3	8	
17-Oct-19	217.5	21.19	20.6	-0.59	7.51	262.5	0.1	9.97	6.6	2.45	
17-Nov-19	13.3	null	21.43	0.24	7.85	348.6	0.11	7.49	7.67	6.83	
17-Dec-19	151.04	null	21.53	0.34	7.89	397.6	0.16	13.18	8.27	16.5	
17-Jan-20	130.75	18.06	15.43	-2.63	7.68	330.5	0.14	11.27	8.23	3	
17-Feb-20	81.22	null	18.75	0.69	7.92	397.9	0.22	8.9	8.43	5.6	
17-Mar-20	14.75	null	20	1.94	7.85	405	0.21	4.17	7.9	5.5	
17-Apr-20	16.01	26.8	30.09	3.3	7.84	357	0.07	7.92	7.65	6	
17-May-20	20.2	null	22.76	0	7.67	327.61	0.206	9.24	7.7	4.78	
17-Jun-20	15.45	null	23.5	-3.3	7.79	307.7	0.04	5.5	19.88	0.1	
17-Jul-20	11.6	24.42	25.85	1.43	7.93	270	0.13	6.35	19.1	0.11	
17-Aug-20	9.43	null	24.25	-0.17	7.9	330.5	0.11	6.36	7.78	5.8	
17-Sep-20	25.9	null	23.15	-1.27	7.87	278.1	0.07	5.69	13.3	0.07	
17-Oct-20	44.6	21.98	22.65	0.67	7.91	256.5	0.51	8.26	13.7	0.12	
17-Nov-20	19.75	null	22.75	0.77	8.11	358.5	0.11	8.65	23.04	0.29	
17-Dec-20	73.95	null	20.55	-1.43	7.74	433.5	0.29	10.63	7.8	0.6	
17-Jan-21	47.85	19.97	20.4	0.43	7.7	455.5	0.42	9.06	46.31	4.78	
17-Feb-21	21.65	null	19.7	-0.27	7.67	347.6	0.19	6.85	4.9	11	
17-Mar-21	80.9	null	19.4	-0.17	7.8	289.5	0.14	10.22	7.7	1.6	
17-Apr-21	45.45	23.07	21.15	-1.92	7.75	381.5	0.21	10.28	7.7	5.8	
17-May-21	40.55	null	24.05	0.98	7.81	362.4	0.37	8.18	7.7	4.78	
17-Jun-21	24.85	null	24	0.93	7.68	320.1	0.24	6.63	7.7	4.7	
17-Jul-21	14.8	26.57	25.6	-0.97	7.62	291.5	0.22	7.44	7.7	7.3	
17-Aug-21	20.55	null	28.35	1.78	7.59	262.2	0.21	7.88	7.7	4.9	
17-Sep-21	17.65	null	25.75	-0.82	7.66	228.6	0.09	6.57	7.7	3.65	
17-Oct-21	15.05	22.02	23.3	1.28	7.58	318.7	0.27	10.39	6.95	3.65	
17-Nov-21	11.65	null	22.2	0.18	7.59	365.6	0.3	10.9	7.04	2.95	
17-Dec-21	10.95	null	20.55	-1.47	7.42	331.3	0.31	8.91	7.42	3.1	

Data After Cleaning

Query Settings

PROPERTIES

- Name: Alex
- All Properties

APPLIED STEPS

- Source
- Navigation
- Changed Type
- Removed Top Row
- Promoted Headers
- Changed Type1
- Renamed Columns
- Removed Top Row
- Kept First Rows
- Changed Type2
- Rounded Off
- Rounded Off1
- Rounded Off2
- Rounded Off3
- Filtered Rows
- Replaced Errors
- Replaced Errors1
- Replaced Errors2
- Replaced Errors3
- Replaced Errors4
- Replaced Errors5
- Replaced Errors6
- Replaced Value
- Replaced Value1
- Replaced Value2
- Replaced Value3
- Replaced Value4
- Replaced Value5
- Replaced Value6
- Replaced Value7
- Replaced Errors7
- Rounded Off4
- Rounded Off5
- Removed Columns
- Filtered Rows1
- Changed Type3
- Replaced Value8
- Renamed Columns
- Changed Type4
- Removed Columns
- Renamed Columns
- Replaced Value9

Home Help External tools

Cut Copy

Data

Queries

Relationships

Calculation group

Security

Q&A setup

Language schema

Sensitivity

Publish

7: Data Collection & Cleaning

Measures

Results for Cleaning

- Σ Biological Oxygen Demand (<6)
- City
- Date
- Σ Delta T
- Σ Dissolved Oxygen (>6)
- Σ Fecal Coliform
- Σ Index
- Σ Nitrates as (NO3) <8.825
- Σ pH (6.5-8.5)
- Σ Phosphates (PO4) <2
- Σ Seasonal
- Σ Temperature °C
- Σ Total Dissolved Solids (<500)
- Σ Turbidity
- Σ WQI
- WQI Category

Measures for Nile

- Average BOD
- Average D.O
- Average Delta T
- Average F.C
- Average nitrate
- Average PH
- Average phosphate
- Average Turbidity
- Average Total Solids
- Average W.Q
- Correlation D.O & BOD
- Correlation D.O & T
- Max BOD
- Max D.O
- Max Delta T
- Max F.C
- Max Nitrate
- Max PH
- Max Phosphate
- Max Total Solids
- Max Turbidity
- Max W.Q.
- Min BOD
- Min D.O
- Min Delta T
- Min F.C
- Min Nitrate
- Min PH
- Min Phosphate
- Min Turbidity
- Min Total Solids
- Min W.Q.
- Safety BOD
- Safety Dissolved Oxygen
- Safety Fecal Coliform
- Safety Nitrate

Historical Data

- Σ Biological Oxygen Demand
- City
- Date
- Σ Delta T
- Σ Dissolved Oxygen
- Σ Fecal Coliform
- Σ Nitrates as (NO3)
- Σ pH
- Σ Phosphates (PO4)
- Σ Seasonal
- Σ Temperature
- Σ Total Dissolved Solids
- Σ Turbidity
- Σ WQI
- WQI Category

Forcasting

- Σ Biological Oxygen Demand
- City
- Date
- Σ Delta T
- Σ Dissolved Oxygen
- Σ Fecal Coliform
- Σ Nitrates as (NO3)
- Σ pH
- Σ Phosphates (PO4)
- Σ Temperature
- Σ Total Dissolved Solids
- Σ Turbidity

Modelling

F_allex

- Σ Biological Oxygen Demand
- City
- Date
- Σ Delta T
- Σ Dissolved Oxygen
- Σ Fecal Coliform
- Σ Nitrates as (NO3)
- Σ PH
- Σ Phosphates (PO4)
- Σ Temperature
- Σ Total Dissolved Solids
- Σ Turbidity

F_cairo

- Σ Biological Oxygen Demand
- City
- Date
- Σ Delta T
- Σ Dissolved Oxygen
- Σ Fecal Coliform
- Σ Nitrates as (NO3)
- Σ PH
- Σ Phosphates (PO4)
- Σ Temperature
- Σ Total Dissolved Solids
- Σ Turbidity

F_manya

- Σ Biological Oxygen Demand
- City
- Date
- Σ Delta T
- Σ Dissolved Oxygen
- Σ Fecal Coliform
- Σ Nitrates as (NO3)
- Σ PH
- Σ Phosphates (PO4)
- Σ Temperature
- Σ Total Dissolved Solids
- Σ Turbidity

F_aswan

- Σ Biological Oxygen Demand
- City
- Date
- Σ Delta T
- Σ Dissolved Oxygen
- Σ Fecal Coliform
- Σ Nitrates as (NO3)
- Σ PH
- Σ Phosphates (PO4)
- Σ Temperature
- Σ Total Dissolved Solids
- Σ Turbidity

Properties

Data

Tables Model

Search

- > Measures for Nile
- > Alex
- > Aswan
- > Cairo
- > F_allex
- > F_aswan
- > F_cairo
- > F_manya
- > Forcasting
- > Historical Data
- > Menya
- > Results for Cleaning

5/21/2025



8: WQI Calculation (DAX)

WQI Concept

User-Friendliness: WQI is displayed in reference to a colour-coded range values

DAX Approach:

Created measures in Power BI.

Index	WQI VALUE
Excellent	100-91
Good	90-71
Medium	70-51
Bad	50-26
Very Bad	25-0

Water Quality Index (WQI) Data Analysis															
Row ID	City	Date	Turbidity	Seasonal	Temperature °C	Delta T	pH (6.5-8.5)	Total Dissolved Solids (<500)	Phosphates (PO4) <2	Nitrates as (NO3) <8.825	Dissolved Oxygen (>6)	Biological Oxygen Demand (<6)	WQI	Fecal Coliform	WQI Category
1	Alexandria	Wednesday, January 1, 2018	6.45		20.5	-0.81	7.59	476.8	0.62	7.81	6.62	3.0	41	204	Bad
2	Alexandria	Thursday, February 1, 2018	8		24.08	2.77	7.64	473.2	0.38	6.08	6.42	4.4	35	130	Bad
3	Alexandria	Thursday, March 1, 2018	10.5		21.82	-0.68	7.72	370.6	0.29	8.08	6.3	5.5	39	243	Bad
4	Alexandria	Tuesday, May 1, 2018	11.91		23.75	1.24	7.79	302.7	0.16	6.13	5.53	8.8	36	402	Bad
5	Alexandria	Friday, June 1, 2018	25.13		27.32	2.23	7.75	276.6	0.78	9.72	6.93	1.1	29	205	Bad
6	Alexandria	Wednesday, August 1, 2018	21.43		23.02	-2.08	7.48	349.9	0.19	11.56	7.07	4.4	34	282	Bad
7	Alexandria	Saturday, September 1, 2018	21.43		23.02	-2.08	7.48	349.9	0.19	11.56	7.07	4.4	34	282	Bad
8	Alexandria	Thursday, November 1, 2018	7.27		21.77	0.23	7.64	409.4	0.28	8.67	5.82	1.1	40	230	Bad
9	Alexandria	Saturday, December 1, 2018	35.47		20.08	-1.46	7.69	468	0.32	8.12	6.53	1.1	33	326	Bad
10	Alexandria	Friday, February 1, 2019	20.15		18.25	0.44	7.76	421.65	0.2	7.37	7.75	1.1	43	130	Bad
11	Alexandria	Friday, March 1, 2019	34.88		18.28	0.47	7.54	331.47	0.15	8.82	7.88	5.5	42	101	Bad
12	Alexandria	Wednesday, May 1, 2019	158.9		23.38	0.96	7.67	337.2	0.22	15.24	6.2	13.3	37	112	Bad
13	Alexandria	Saturday, June 1, 2019	87.9		23.38	0.96	7.71	74.65	0.11	7.77	7.05	3.6	43	201	Bad
14	Alexandria	Thursday, August 1, 2019	107.04		24.83	1.28	7.93	20.4	0.12	4.12	7.66	0.2	34	257	Bad
15	Alexandria	Sunday, September 1, 2019	222		23.77	0.22	7.97	381.27	0.27	7.33	7.3	4.1	607	Bad	
16	Alexandria	Friday, November 1, 2019	13.3		21.43	0.24	7.85	34.86	0.11	7.49	7.67	6.8	42	302	Bad
17	Alexandria	Sunday, December 1, 2019	151.04		21.53	0.34	7.89	39.16	0.16	13.18	8.27	16.1	40	190	Bad
18	Alexandria	Saturday, February 1, 2020	81.22		18.75	0.69	7.92	391.9	0.22	8.9	8.43	5.5	41	75	Bad
19	Alexandria	Sunday, March 1, 2020	14.15		20	1.94	7.85	46.5	0.21	4.17	7.9	5.1	46	54	Bad
20	Alexandria	Friday, May 1, 2020	20.2		22.76	0	7.67	327.6	0.206	9.24	7.7	4.7	28	20	Bad
21	Alexandria	Monday, June 1, 2020	15.45		23.5	-3.3	7.79	307.1	0.04	5.5	19.88	0	28	110	Bad
22	Alexandria	Saturday, August 1, 2020	9.43		24.25	-0.17	7.9	330.5	0.11	6.36	7.78	5.5	35	195	Bad
23	Alexandria	Tuesday, September 1, 2020	25.9		23.15	-1.27	7.87	278.1	0.07	5.69	13.3	0	53	597	Medium
24	Alexandria	Sunday, November 1, 2020	79.75		22.75	0.77	8.11	358.5	0.11	8.65	23.04	0.2	54	153	Medium
25	Alexandria	Tuesday, December 1, 2020	73.95		20.55	-1.43	7.74	433.5	0.29	10.63	7.8	0	41	150	Bad
26	Alexandria	Monday, February 1, 2021	21.65		19.7	-0.27	7.67	347.6	0.19	6.85	4.9	1	32	120	Bad
27	Alexandria	Wednesday, March 1, 2021	80.9		19.8	-0.17	7.8	289.5	0.14	10.22	7.7	1	28	170	Bad
28	Alexandria	Saturday, May 1, 2021	40.55		24.05	0.98	7.81	362.4	0.37	8.18	7.7	4.7	52	225	Medium
29	Alexandria	Tuesday, June 1, 2021	24.85		24	0.93	7.68	320.1	0.24	6.63	7.7	4.1	35	190	Bad
30	Alexandria	Sunday, August 1, 2021	20.55		28.35	1.78	7.59	262.	0.21	7.88	7.7	4.1	47	154	Bad
31	Alexandria	Wednesday, September 1, 2021	17.65		25.75	-0.82	7.66	228.1	0.09	6.57	7.7	3.6	54	202	Medium
32	Alexandria	Monday, November 1, 2021	11.65		22.2	0.18	7.59	365.5	0.3	10.9	7.04	2.9	47	205	Bad
33	Alexandria	Wednesday, December 1, 2021	10.95		20.55	-1.47	7.42	33.3	0.31	8.91	7.42	3.1	40	70	Bad
34	Alexandria	Friday, February 1, 2022	10		17	-1.35	7.51	33	0.16	9.68	7.62	5.5	39	135	Bad
35	Alexandria	Tuesday, March 1, 2022	11.5		17.85	-0.5	7.59	318.3	0.18	9.37	7.82	4.2	60	60	Bad
36	Alexandria	Sunday, May 1, 2022	13.1		22.3	-0.23	7.58	300	0.18	9.45	8.05	5.5	42	167	Bad
37	Alexandria	Wednesday, June 1, 2022	11.8		23.05	0.52	7.56	265.5	0.12	8.98	7.05	7.5	41	72	Bad
38	Alexandria	Monday, August 1, 2022	22.75		25	-0.95	7.87	273	0.18	9.78	6.85	5.5	38	252	Bad
39	Alexandria	Thursday, September 1, 2022	12.95		26.05	0.1	7.45	262.45	0.16	8.68	7.15	4.7	55	79	Medium
40	Alexandria	Tuesday, November 1, 2022	15		23.25	0.3	7.78	266.44	0.07	7.66	7.45	6.0	44	122	Bad
41	Alexandria	Thursday, December 1, 2022	13		19.85	-3.1	8.02	284.89	0.14	7.4	7.45	4.3	44	12	Bad
42	Alexandria	Wednesday, February 1, 2023	9.55		20.75	0.15	7.26	267.5	0.26	7.69	7.15	6	43	180	Bad
43	Alexandria	Saturday, March 1, 2023	6.52		20.85	0.25	7.46	331.5	0.21	12.55	7.6	0.1	53	166	Medium
44	Alexandria	Monday, May 1, 2023	10.36		23.85	-0.43	7.83	255	0.19	11.28	6.75	3.5	45	106	Bad
45	Alexandria	Thursday, June 1, 2023	22.35		25	0.72	7.94	252.6	0.17	12.97	6.97	12	38	65	Bad
46	Alexandria	Tuesday, August 1, 2023	14.45		28.6	0.32	7.89	294.5	0.13	9.37	6.9	3.1	46	10	Bad
47	Alexandria	Friday, September 1, 2023	22.25		26.05	-2.23	7.46	326.7	0.16	4.81	7.06	4.8	37	33	Bad
48	Alexandria	Wednesday, November 1, 2023	16.5		27.45	1.77	7.97	368.1	0.25	21.35	7.01	5.0	33	52	Bad
49	Alexandria	Friday, December 1, 2023	15.7		22.35	-3.33	7.75	406.3	0.39	16.1	6.7	3.6	34	17	Bad
50	Alexandria	Thursday, February 1, 2024	16.5		18.75	-0.2	8.18	282.5	0.13	7.68	6.79	3	46	687	Bad
51	Alexandria	Friday, March 1, 2024	16.5		18.75	-0.2	8.18	282.5	0.13	7.68	6.79	3	46	40	Bad
52	Alexandria	Wednesday, May 1, 2024	16.8		23.05	-2.45	7.6	342.1	0.27	11.7	6.8	3.7	35	98	Bad
53	Alexandria	Saturday, June 1, 2024	21		29.75	4.25	7.6	305	0.15	9.84	6.55	5.2	33	78	Bad
54	Alexandria	Thursday, August 1, 2024	17.4		31.35	-0.02	7.94	303.75	0.08	11.7	6.76	4.1	47	105	Bad
55	Alexandria	Sunday, September 1, 2024	17.4		31.35	-0.02	7.94	303.75	0.08	11.7	6.76	4.1	46	100	Bad
56	Alexandria	Friday, November 1, 2024	14.55		23.25	-0.45	7.78	266.44	0.07	7.66	7.45	6.0	42	122	Bad



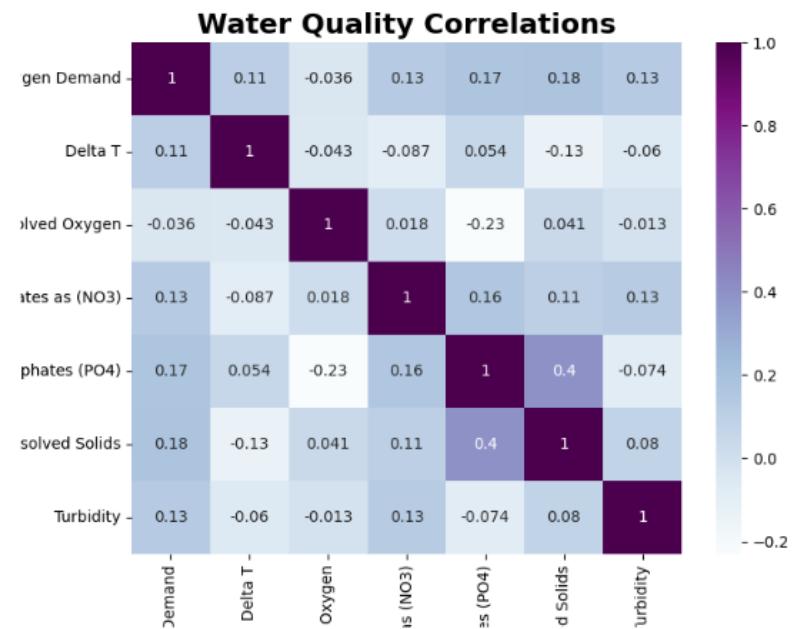
9: Statistical Analysis

Approach:

using mean, standard deviation, correlation for statistical analysis of data.

Key Findings:

correlation between all applied parameters & WQI





▷ ▾

```
from statsmodels.tsa.stattools import adfuller
import pandas as pd

def test_stationarity(timeseries):
    # Dickey-Fuller Test
    print('Results of Dickey-Fuller Test:')
    dfoutput = adfuller(timeseries, autolag='AIC')

    dfoutput = pd.Series(dfoutput[0:4], index=[

        'Test Statistic',
        'p-value',
        'Number of Lags Used',
        'Number of Observations Used'
    ])

    for key, value in dfoutput[4].items():
        dfoutput[f'Critical Value ({key})'] = value

    print(dfoutput)

# Check stationarity for each variable
for column in df_numeric.columns:
    print(f"\nChecking stationarity for {column}")
    test_stationarity(df_numeric[column])
```

...

```
Checking stationarity for Turbidity
Results of Dickey-Fuller Test:
Test Statistic           -8.546254e+00
p-value                  9.485622e-14
Number of Lags Used      3.000000e+00
Number of Observations Used 3.320000e+02
Critical Value (1%)      -3.450201e+00
Critical Value (5%)      -2.870285e+00
Critical Value (10%)     -2.571429e+00
dtype: float64
```

```
Checking stationarity for Temperature
```

```
Results of Dickey-Fuller Test:
Test Statistic           -3.991209
p-value                  0.001457
Number of Lags Used      4.000000
Number of Observations Used 331.000000
Critical Value (1%)      -3.450262
Critical Value (5%)      -2.870312
Critical Value (10%)     -2.571443
dtype: float64
```

```
Checking stationarity for Delta T
```

10: Python Forecasting

To keep them open, add a folder instead.



```
import numpy as np
import pandas as pd
from scipy import stats
import matplotlib.pyplot as plt
from statsmodels.tsa.holtwinters import ExponentialSmoothing
```

```
def advanced_forecast_multivariate(df, forecast_steps=12):
```

```
    if not isinstance(df.index, pd.DatetimeIndex):
```

```
        df.index = pd.to_datetime(df.index)
```

```
    forecast_results = pd.DataFrame(
```

```
        index=pd.date_range(
```

```
            start=df.index[-1] + pd.offsets.MonthBegin(1),
```

```
            periods=forecast_steps,
```

```
            freq='MS'
```

```
        )
```

```
    )
```

```
    forecast_details = {}
```

```
    for column in df.columns:
```

```
        try:
```

```
            model = ExponentialSmoothing(
```

```
                df[column],
```

```
                trend='add',
```

```
                seasonal='add',
```

```
                seasonal_periods=3
```

```
            )
```

```
            fit_model = model.fit()
```

```
            forecasts = fit_model.forecast(steps=forecast_steps)
```

```
            forecast_results[column] = forecasts
```

```
            forecast_details[column] = {
```

```
                'model_type': 'Exponential Smoothing',
```

```
                'parameters': {
```

```
                    'trend': 'additive',
```

```
                    'seasonal': 'additive',
```

```
                    'seasonal_periods': 3
```

```
                }
```

```
            }
```

```
        except Exception as e:
```

```
            print(f"خطأ في التنبؤ لـ {column}: {e}")
```

```
        try:
```

```
            ma = df[column].rolling(window=3).mean()
```

```
            last_ma = ma.iloc[-1]
```

```
            trend = (ma.iloc[-1] - ma.iloc[0]) / len(ma)
```

```
            forecasts = [last_ma]
```

10: Python Forecasting

editors. To keep them open, add a folder instead.



```
from sklearn.metrics import mean_absolute_error, mean_squared_error
import numpy as np

def evaluate_forecast(original_df, forecast_df):
    """
    ملخص دقة التنبؤ MAE, RMSE و MAPE
    """
    evaluation_report = "\n"
    evaluation_report += "=" * 30 + "\n"

    for column in forecast_df.columns:
        try:

            actual = original_df[column][-len(forecast_df):]
            predicted = forecast_df[column]

            mae = mean_absolute_error(actual, predicted)
            mse = mean_squared_error(actual, predicted)
            rmse = np.sqrt(mse)
            mape = np.mean(np.abs((actual - predicted) / actual)) * 100

            evaluation_report += f"المتغير: {column}\n"
            evaluation_report += f"MAE: {mae:.4f}\n"
            evaluation_report += f"RMSE: {rmse:.4f}\n"
            evaluation_report += f"MAPE: {mape:.2f}%\n"
            evaluation_report += "-" * 30 + "\n"

        except Exception as e:
            evaluation_report += f"خطأ في تقييم {column}: {e}\n"

    return evaluation_report
```

```
print(evaluate_forecast(df_numeric, forecast_results))

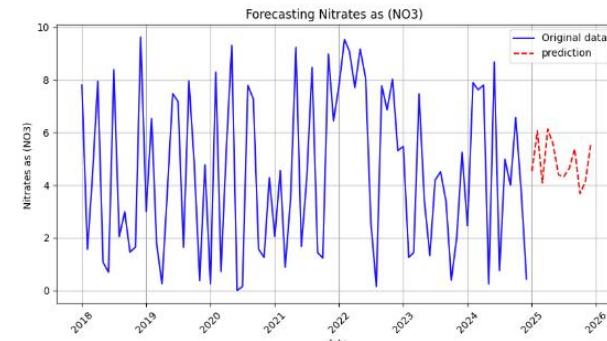
...
تقديم جودة التنبؤ
=====
التغیر: Turbidity
MAE: 1.2083
RMSE: 1.3835
MAPE: nan%
-----
التغیر: Temperature
MAE: 1.0744
RMSE: 1.1485
MAPE: nan%
-----
التغیر: Delta T
MAE: 0.2893
RMSE: 0.3286
MAPE: nan%
-----
التغیر: PH
```

10: Python Forecasting

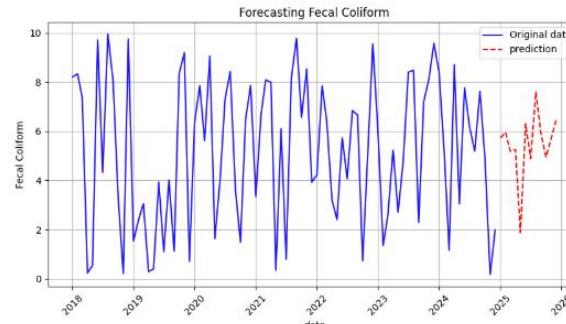
10: Python Forecasting



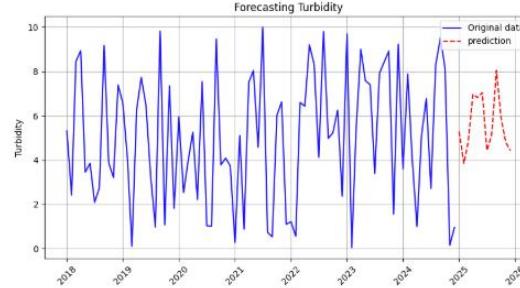
Biological Oxygen Demand



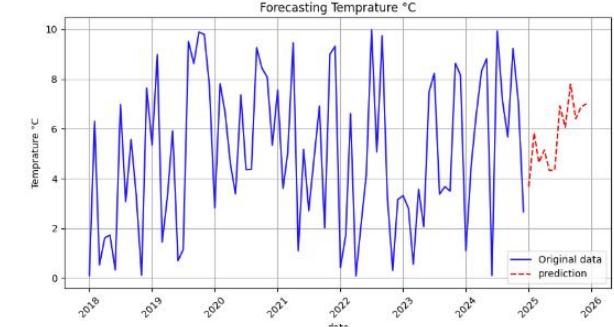
pH



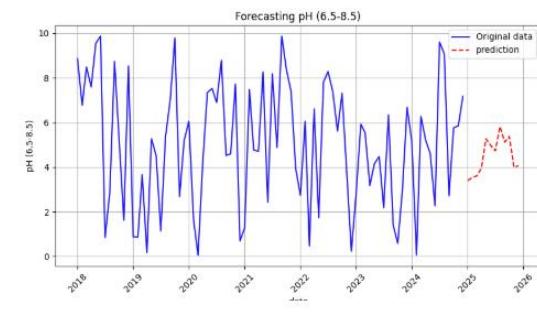
Fecal Coliform



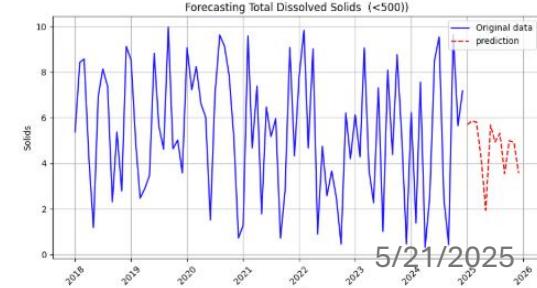
Dissolved Oxygen



Phosphates (PO₄)



Total Dissolved Solids



5/21/2025

11: Reports & Dashboard





12: Challenges & Solutions

1. Challenges

- Collected Data & its quality .
- Prediction Model.

2. Lessons Learned

- Importance of historical Data.
- Importance of using DAX/Python to link.

3. Future Challenges

- Qualified Data.
- Integrated Models
- Population Growth
- Environmental Changes
- Laws & Regulations
- Online monitoring for Real Time Data collection.



13: Conclusion & Future Work

Objective Achievement:

This project successfully achieved its objectives by providing a comprehensive and insightful analysis of water quality through Power BI.

Application Value:

The interactive dashboards and forecasting models offer significant value for:

- Monitoring water quality trends .
- Identifying pollution sources.
- Supporting informed decision-making for water resource management.

13: Conclusion & Future Work

Future Work:

- Additional parameters (heavy metals, pesticides).
- Real-time data from IoT sensors.
- Integration with more advanced ML models.





13: Conclusion & Future Work

Benefits:

- Improved decision-making, potential cost savings, environmental protection.
- Sustainability:
- Long-term data, model, and expertise.
 - Efficient resource use.
 - Financial viability.
 - Social/Environmental Impact:
 - Better water management.
 - Healthier people and ecosystems.
 - Empowered communities.
 - Sustainable economy.



14: Project Impact

Policy: Supports Egypt's *National Water Resources Plan 2037*.

Sustainability: Aligns with UN SDG 6 (Clean Water and Sanitation).

Supporting informed decision-making for water management and conservation."

Future Impact: Empowers stakeholders to proactively address water quality challenges and promote sustainable water management practices.

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