

Tidal Observation / Information of Olero Creek North Water Station and Flowstation Area

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Key words: Tidal information, Reference datum, Hydrographic services

SUMMARY

The need to carry out the tidal observation of Olero Creek area for a specific period was to ascertain the current water level behaviour of the area and to aid in the tide monitoring of the North Water Station (NWS) barge movement to fabrication yard in preparation for the Olero creek rebuild project.

The study has demonstrated and shown the water level behaviour with the characteristics of Olero Creek in general, and in comparison with the Benin River tidal prediction. The study has been able to provide information on the Mean Water Level for both Low and High Tide, the reference Datum used in Olero Creek area, and the relationship between LAT and North Water Station barge hull deck elevation as requested.

This paper will highlight the experience, the tasks, and moreover the challenges faced in data observation, compilation and processing of the Olero Creek North water station and flow station area.

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1. INTRODUCTION

Chevron was motivated to carry out tide observation of Olero creek flowstation area for a specific period in order:

- ❖ To ascertain the water level behaviour of the area.
- ❖ To aid in the North Water Station (NWS) barge movement to fabrication yard.
- ❖ For operational and facilities management.



The need for the tidal monitoring of North Water Station and Flowstation area became necessary because of:

- ❖ The increase demand for hydrographical services within the company.
- ❖ The Olero Creek rebuild project initiated as a result of the vandalized facilities by the militants within Olero Creek area during the 2003 crisis in the Niger Delta region of Nigeria.



2. OBJECTIVES AND PURPOSE

Objectives:

- To determine the :
 - ~ Mean Low Water (MLW),
 - ~ Mean High Water (MHW),
 - ~ Lowest Astronomical Tide (LAT)
 - ~ Relationship between LAT and the North Water Station (NWS) barge hull deck elevation,
- To provide information on the Datum used.

Purpose:

- For the tidal monitoring of North Water Station (NWS) barge movement to fabrication yard in preparation for the Olero creek rebuild.

3. PROJECT STUDY AREA

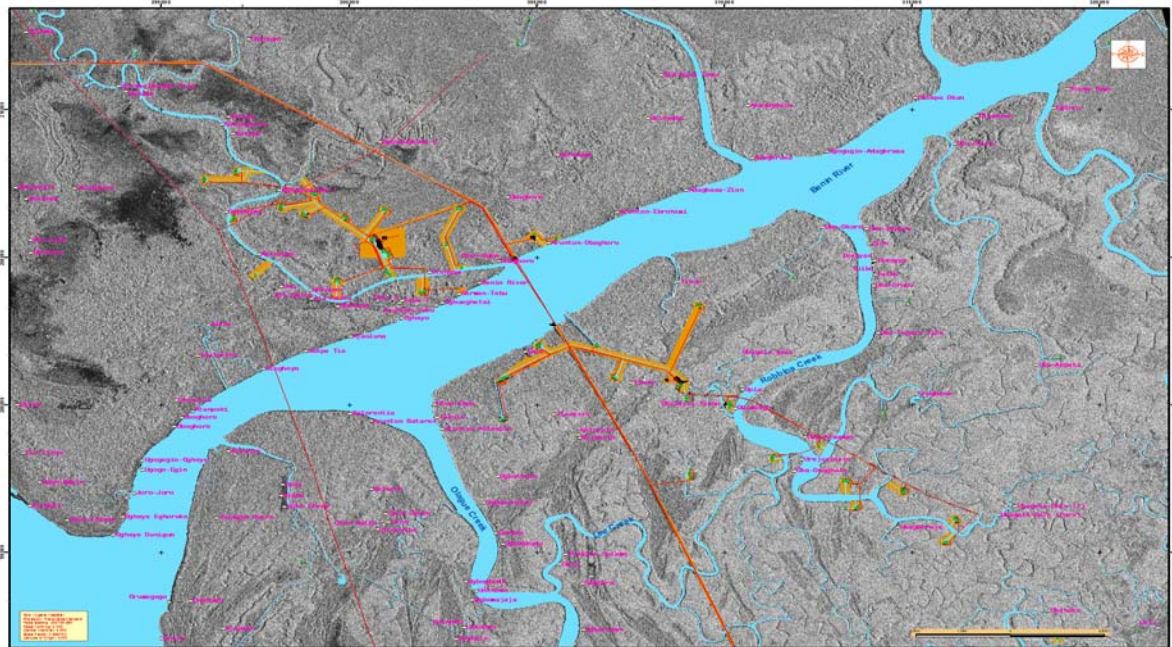


Fig. 1a: Map showing the Study Area

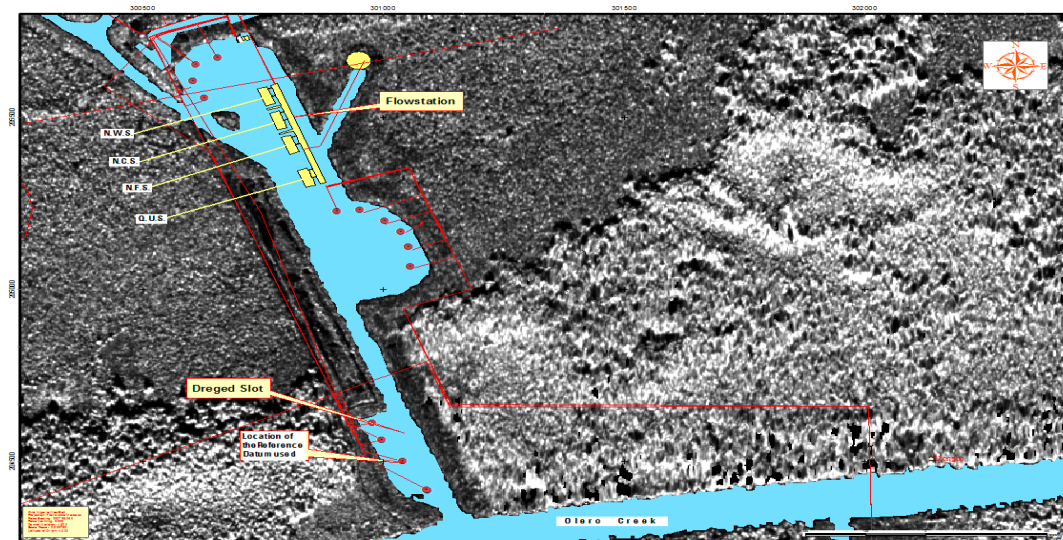


Fig. 1b: Map showing the Study Area



Fig. 2: Photo Showing the North Water Station of Study Area

4. FIELD OBSERVATION

Tide pre-Planning



Olero GB-3 location with the 1m mark.



Check on the 1m mark at GB-3 location.



Tide Gauge Installation at the project area.

Sketch below shows the 1m mark LLWS reference datum at Olero GB-3 location used for the project.

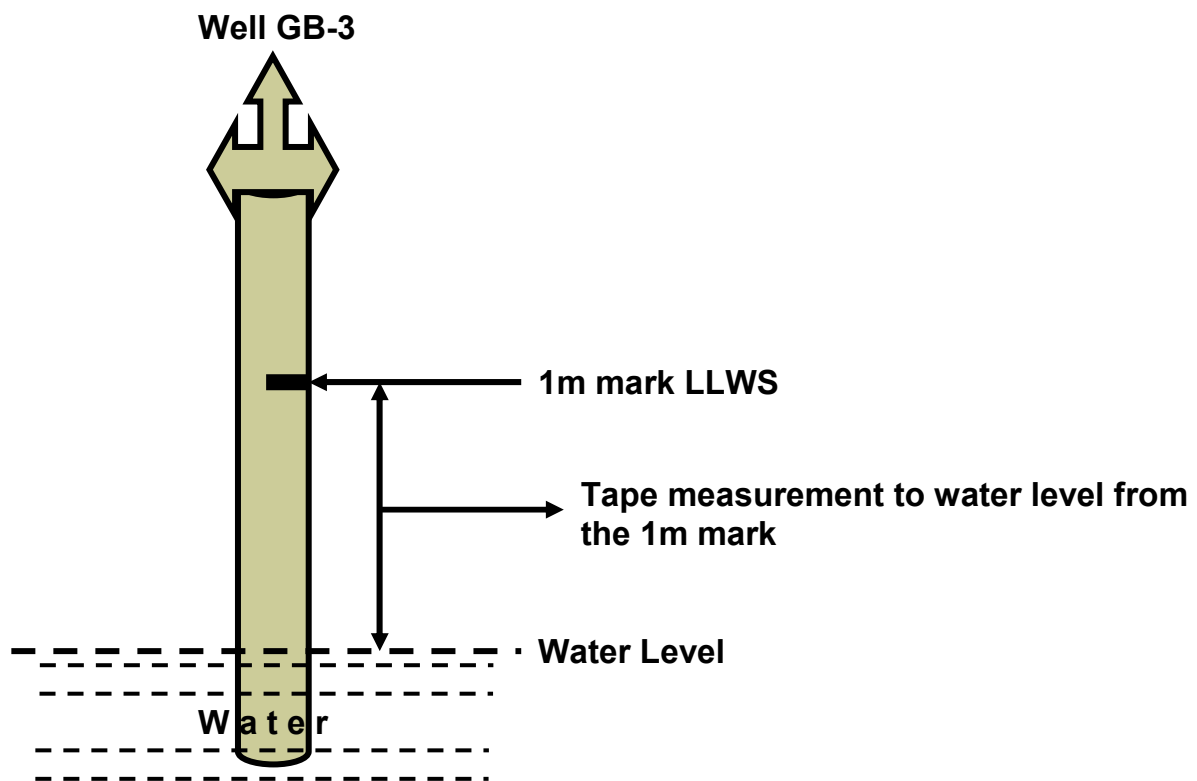


Fig 3: 1m mark Reference Datum at GB-3 Location

Methodology:

- Personnel – a team of our tidal crew (1 surveyor and 3 assistants)
- Operations:
 - ~ *Setting up and installation of tide gauge in water.*
 - ~ *Check on the 1m mark reference datum used at GB-3 location.*
 - ~ *Simultaneous observation at both the 1m mark datum and tide gauge station for tide correction.*
 - ~ *Computation for tide correction using the 1m mark reference datum at GB-3 location.*
 - ~ *Tidal observation / monitoring at every 15 minutes for 24 hours.*
 - ~ *Tide data input, processing and integrity check (for quality assurance).*
 - ~ *Weekly analysis of observation carried out to determine the weekly mean of water level.*
 - ~ *Comparison of input data with Benin River tidal prediction for the period of observation.*
 - ~ *Relationship between LAT and NWS barge hull deck elevation determined.*

5. DATA PROCESSING

Computation for Tide correction using 1m mark Reference Datum at GB-3 Location

Date	Time h : m	Ref Datum (1m mark)	Measurement to Water Level (m)	Tide (m)	Reading from Tide Gauge (m)	Tide Correction (m)
Day 1	15 : 00	1	0.775	0.225	0.548	0.323
	15 : 30	1	0.79	0.21	0.52	0.31
	15 : 45	1	0.785	0.215	0.525	0.31
	16 : 00	1	0.77	0.23	0.528	0.298
Day 2	08 : 30	1	0.515	0.485	0.783	0.298
	08 : 45	1	0.5	0.5	0.79	0.29
	09 : 00	1	0.49	0.51	0.808	0.298
	09 : 15	1	0.485	0.515	0.812	0.297
					Mean Corr.	0.303
					Approx.	0.30

Table1: Showing observed readings for 2 days at different periods for Tide Correction

6. RESULTS AND DISCUSSION

Reference Datum: 1m mark LLWS at GB-3 location at Olero Creek.

Location	LAT	MLLWS	MLW	MTL	MHW	MHHWS	HAT
Olero Creek	-0.244	0.059	0.138	0.373	0.608	0.683	2.299

Table 2: Showing the final result for the specific period of observation.

The Lowest and Highest Water Levels for the specific period of observation and their period of occurrence:

Lowest Water Level = -0.266 at 14:30 hours

Highest Water Level = 0.839 at 05:45 hours

Comparison between Olero Creek and Benin River

A weekly comparison was carried out for the period of observation. See table and chart below for the comparison.

Period	Olero Creek		Benin River	
	MLW Olero Cr.	MHW Olero Cr.	MLW Benin R.	MHW Benin R.
Week 1	0.180	0.544	0.536	1.164
Week 2	0.221	0.730	0.229	1.521
Week 3	0.279	0.624	0.55	1.193
Week 4	0.289	0.725	0.364	1.414
Week 5	0.242	0.585	0.586	1.179
Week 6	0.216	0.741	0.243	1.593
Week 7	0.199	0.578	0.614	1.193
Week 8	0.063	0.599	0.393	1.436
Week 9	0.101	0.558	0.6	1.221
Week 10	0.047	0.662	0.293	1.579
Week 11	0.066	0.535	0.614	1.229
Week 12	-0.069	0.512	0.514	1.4
Week 13	-0.04	0.519	0.486	1.4
Sum	1.794	7.912	6.022	17.522
Frequency	13	13	13	13
Mean	0.138	0.608615	0.4632307	1.3478461
Approx.	0.138	0.609	0.463	1.348
Tide Range	0.471		0.885	
	Difference	0.414 m		

Table 3: Showing weekly comparison between Olero Creek tide information and Benin River tide prediction.

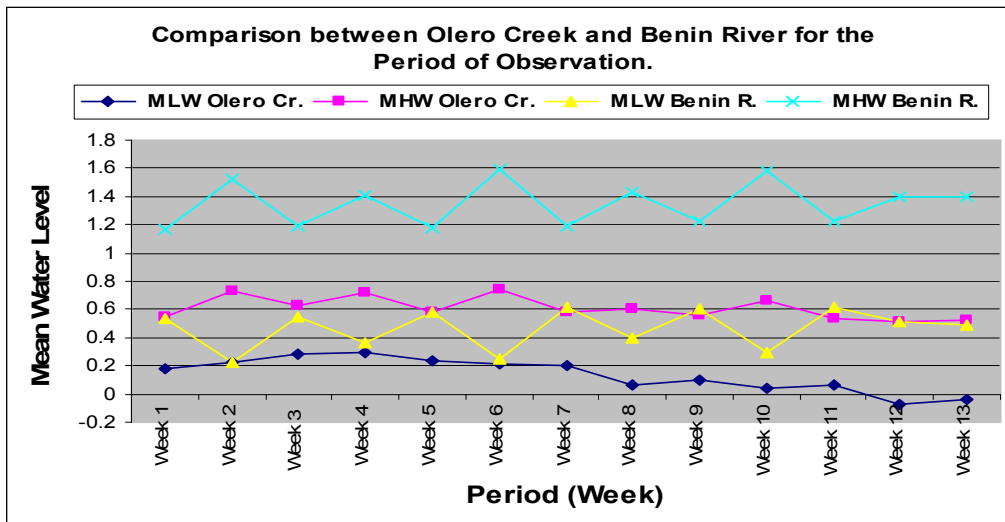


Fig 4: Chart showing comparison between Olero Creek tide information and Benin River tide prediction.

Findings:

- Benin River is higher in tide than Olero Creek.
- Difference in tide elevation between the two is about 0.414 m.
- The difference is as a result of Benin River being closer to the sea than Olero Creek.
- Benin River is about 1hr 45mins earlier than Olero at Low Water and 1hr 30mins at High Water.

Relationship between LAT and NWS barge hull deck elevation.

LAT: -0.244m (computed from the tide observation)

HAT: 2.299m (computed from the tide observation)

NWS barge Hull Deck Elevation:

Bottom of Hull: -1.118m (given)

Top of Hull: 2.134m (given)

LAT	-0.244m	HAT	2.299m
Bottom of Hull	-1.118m	Top of Hull	2.134m
Difference	0.874m	Difference	0.165m

Table 4: Showing the relationship between LAT and NWS barge hull deck elevation.

Tide Characteristics.

- Olero Creek has a mixture of Semidiurnal and Mixed Tide, whereby there are two high waters and two low waters each tidal day.
- At the semidiurnal tide period, the two high waters for each tidal day are almost equal in height and the two low waters are also approximately equal in height.

- At the mixed tide period, the two high waters and the two low waters of each tidal day have marked differences in their heights.
 - (See some of the weekly tide charts for details on the tide characteristics below).

Weekly Tide Charts showing Tide Characteristics

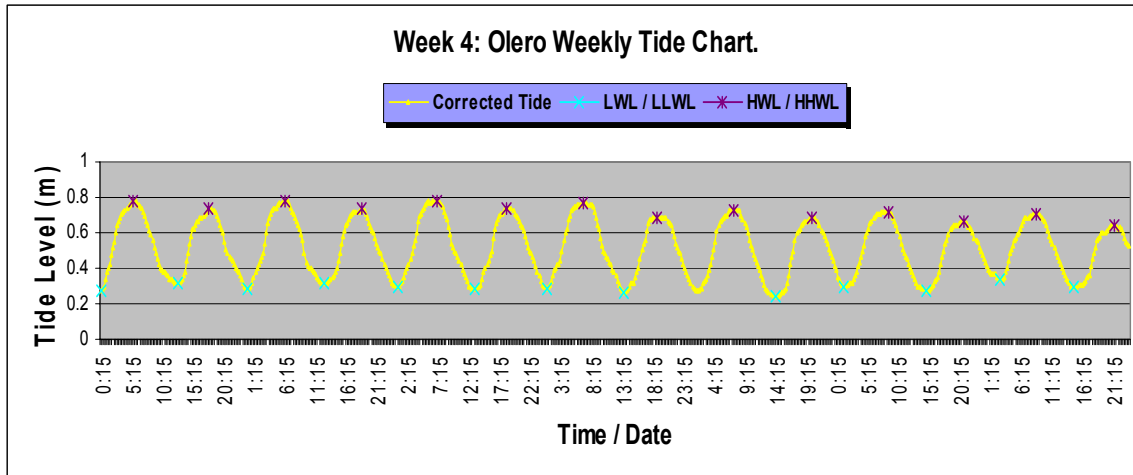


Fig 5: Chart showing sample of semidiurnal tide.

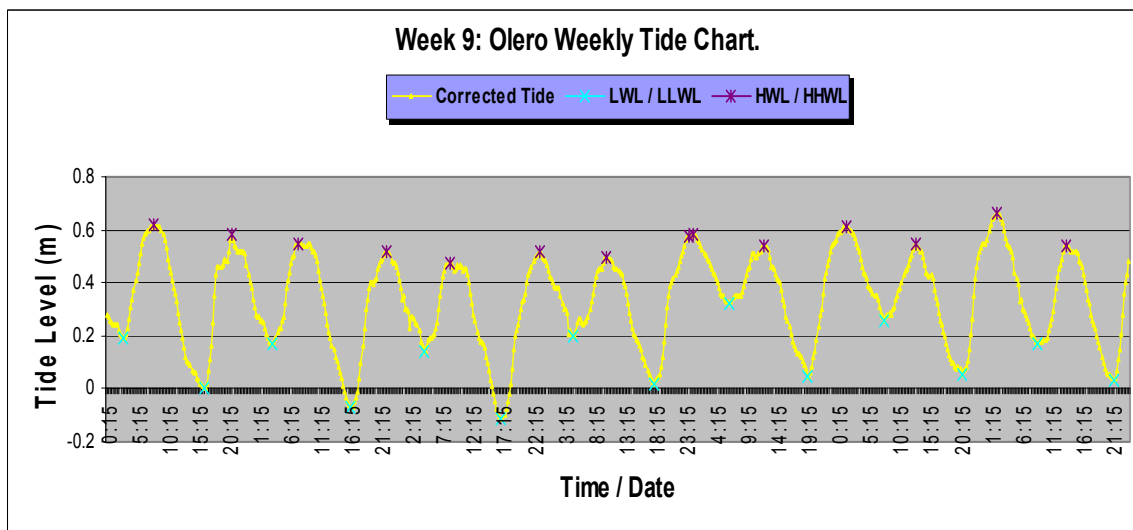


Fig 6: Chart showing sample of mixed tide.

7. CONCLUSION

The study has:

- Demonstrated and shown the water level behaviour of Olero Creek and its characteristics.
- Provided information on:
 - ~ Mean Water Level for Low and High Tide,
 - ~ Lowest Astronomical Tide (LAT),
 - ~ Highest Astronomical Tide (HAT),
 - ~ Reference Datum used in Olero Creek, and
 - ~ Relationship between LAT and North Water Station (NWS) barge hull deck elevation.
- Achieved the purpose for tidal monitoring and forecast for North Water Station (NWS) barge movement to fabrication yard.
- Provided opportunity for tidal studies and management of company facilities.

8. RECOMMENDATIONS

- Tidal data should be saved and stored so that it may be retrieved later for further use and study.
- Continuous monitoring and upgrade through GPS positional data and digital tide gauge.
- The use of digital tide gauge and GPS combined with the field application of the conceptual work will generate more and better tidal information for onshore and offshore facilities planning, engineering, and research.

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BIOGRAPHICAL NOTES

Surv. Emmanuel Olayinka Ajayi, born in 1957 is a fellow of the Nigeria Institution of Surveyors. Graduated in 1982 with a B.Sc in Surveying from University of Civil Engineering, Bucharest, Romania. Obtained M.Sc degree in Surveying (with bias to Geodesy) from University of Lagos, Nigeria in 1988 and MBA degree in Project Management from Obafemi Awolowo University, Ile-Ife, Nigeria in 2001. He was registered to practice as a Surveyor in Nigeria in 1989. He joined Chevron Nigeria Limited in 1994 as a Survey Engineer in the Facility Engineering Department and rose to the position of Chief Surveyor, GIS-Survey Unit, Chevron Nigeria Limited since May 1998.

Surv. Sylvester Efe Owjojeta, born in 1967 is a member of the Nigerian Institution of Surveyors. Graduated in 1991 with a B.Sc in Surveying, Geodesy and Photogrammetry from University of Nigeria, Nsukka, Nigeria. Obtained a Masters degree in Petroleum Economics from Ambrose Alli University, Ekpoma, Nigeria in 2005. He was registered to practice as a Surveyor in Nigeria in 2001. Up to date he has been practicing as a Registered Surveyor. Since July 2005 on contract engagement with the GIS-Survey Unit of Chevron Nigeria Limited, Escravos – Nigeria

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