Technical Analysis of the Deepening of the Atlantic Entrance to Drafts of 41.5', 46', and 50'

Análisis técnico para profundizar la entrada del Atlántico para calados de 41.5', 46' y 50'

ACP

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Descripción y Resumen
(No existe Resumen Ejecutivo)

Technical Analysis of the Deepening of the Atlantic Entrance to Drafts of 41.5', 46', and 50'

Autoridad del Canal de Panamá

Dredging Division
Canal Capacity Projects Division
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TECHNICAL ANALYSIS
DEEPENING OF THE ATLANTIC ENTRANCE
TO DRAFTS OF 41.5', 46', AND 50'

GENERAL DESCRIPTION OF THE STUDY

Among major components of the Panama Canal Expansion Study are the deepening and widening of the Canal navigational channels, which include the Atlantic and Pacific entrances, Gatun Lake and Gaillard Cut. The deepening of Canal navigational channels will allow the navigation of ships larger than the current Panamax size through the waterway.

This study covers the technical analysis for deepening the Atlantic Entrance navigation channel under three options as shown in the following table:

THREE SCENARIOS PROPOSED FOR ATLANTIC ENTRANCE DEEPENING

Draft	New Design Channel Bottom (PLD)	Water Depth (MLWS)
41.5'	-46.88'	-46.5'
46'	-51.38'	-51'
50'	-55.38'	-55'

Actual navigation channel bottom elevation: -44.9' PLD

Table 1. Atlantic Entrance Deepening Scenarios

The deepening to a draft of 41.5' consists of dredging the Atlantic Entrance navigational channels from station -2K+700, that is 1.7 km north of the Atlantic Entrance breakwater, to the north end of Gatun Locks. Refer to Appendix No. 1 for a sketch of the Panama Canal Atlantic Entrance. On the other hand, the dredging for the deepening to drafts of 46' and 50' begins also at station –2K+700 but ends at station 9K+000, near the old third set of locks excavation of 1939.

The deepening for a draft of 41.5' is intended for the existing Canal, provided that either the sills in some of the Canal lock chambers are lowered or the minimum operation water level in Miraflores Lake is raised to obtain at least 2 feet of under-keel clearance (UKC), required to accommodate ships with a draft of 41.5 ft. If the Miraflores Lake minimum operation water level is not increased, the sills at the south end of Pedro Miguel locks and the north end of Gatun locks should

be lowered to ensure the 2 feet under-keel clearance (UKC) for ships with 41.5 ft of draft. At present the sills in Canal locks chambers provide a minimum of 2 feet UKC for Panamax ships with a 39.5' draft; therefore, to allow ships with an increased draft of 41.5', the locks chamber sills must be cut lower to restore the minimum UKC. The ACP is studying this possibility of increasing the Miraflores Lake minimum operation water level or modifying the above-mentioned lock chamber sills to allow the navigation of 41.5' draft Panamax ships. So far, no decision has been made on this matter. Refer to Appendix No. 2, which shows the sill elevations for Panama Canal locks.

Separate from the deepening for a draft of 41.5', deepening for drafts of 46' and 50' falls under the Panama Canal Expansion Study. If the new locks are built, the Canal navigational channels will require dredging to allow the safe navigation of deeper-draft Post-Panamax vessels.

SUMMARY

Scenario No. 1: Cutter suction dredge productivity same as the MINDI's

a. In summary, deepening the Atlantic entrance navigation channels for the three options **without any contingency factor** and assuming that the Atlantic entrance channel bottom is at –44.9' PLD under scenario No. 1 are as follows:

Table 16. Summary for Scenario No. 1

SUMMARY OF VOLUME, AREAS, DURATION, EQUIPMENT, AND COST TO DEEPENING THE ATLANTIC ENTRANCE NAVIGATION CHANNELS

Assuming that additional dredge production is same as MINDI's

DRAFT	Dredging volume (m^3)	No. of dredges	Total duration (years-months)	Dredging cost ($)	Drilling & Blasting cost ($)	Total Cost ($)
41.5 ft	1,742,682	1 2	1 y 8 m	16,270,604	2,000,000	**18,270,604**
46 ft	4,657,864	1 2	2y - 2m 1y -2m	35,462,210	2,000,000	**37,462,210**
50 ft	7,599,825	1 2	3y - 5m 1y - 11m	56,827,569	2,000,000	**58,827,569**

Notes:

1. The 41.5' draft deepening ends at the north end of Gatun locks.

2. The 46' and 50' draft deepening ends near the 1939 third set of Atlantic side locks excavation.

b. Assuming deepening be executed in phases, the summary is as follows:

Table 17. Summary for Scenario No. 1

**SUMMARY OF VOLUME, AREAS, DURATION, EQUIPMENT, AND COST
TO DEEPENING THE ATLANTIC ENTRANCE NAVIGATION CHANNELS**

Assuming that additional dredge production is same as MINDI's

DRAFT	Dredging volume (m^3)	No. of dredges	Dredging cost ($)	Drilling & Blasting cost ($)	Total Cost ($)
39.5 to 41.5 ft	1,742,682	1 2	16,270,604	2,000,000	**18,270,604**
41.5 to 46 ft	3,411,463	1 2	26,174,280	2,000,000	**28,174,280**
46 to 50 ft	2,941,961	1 2	21,365,359	2,000,000	**23,365,359**

Notes:

1. The 41.5' draft deepening ends at the north end of Gatun locks.

2. The 46' and 50' draft deepening ends near the 1939 third set of Atlantic side locks excavation.

Scenario No.2: Cutter suction productivity is 50% more than the MINDI's

a. In summary, deepening the Atlantic entrance navigation channels for the three options **without any contingency factor** and assuming that the Atlantic entrance channel bottom is at –44.9' PLD under scenario No. 2 are as follows:

Table 18. Summary for Scenario No. 2

SUMMARY OF VOLUME, AREAS, DURATION, EQUIPMENT, AND COST TO DEEPENING THE ATLANTIC ENTRANCE NAVIGATION CHANNELS

Assuming that one dredge production is same as MINDI's, and additional dredge production is 1.5 times of MINDI's

DRAFT	Dredging volume (m^3)	No. of dredges	Total duration (years-months)	Dredging cost ($)	Drilling & Blasting cost ($)	Total Cost ($)
41.5 ft	1,742,682	1	9m	10,850,418.00	2,000,000	**12,850,418**
		2	6m	12,791,222.00		**14,791,222**
46 ft	4,657,864	1	1y - 6m	23,653,684.00	2,000,000	**25,653,684**
		2	11m	28,699,534.00		**30,699,534**
50 ft	7,599,825	1	2y - 5m	37,905,388.00	2,000,000	**39,905,388**
		2	1y - 6m	46,006,609.00		**48,006,609**

Notes: 1. The 41.5' draft deepening ends at the north end of Gatun locks.

2. The 46' and 50' draft deepening ends near the 1939 third set of Atlantic side locks excavation.

3. The cost does not contemplate any equipment investment.

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b. Assuming deepening be executed in phases, the summary is as follows:

SUMMARY OF VOLUME, AREAS, DURATION, EQUIPMENT, AND COST TO DEEPENING THE ATLANTIC ENTRANCE NAVIGATION CHANNELS

Assuming that additional dredge production is same as MINDI's

DRAFT	Dredging volume (m^3)	No. of dredges	Dredging cost ($)	Drilling & Blasting cost ($)	Total Cost ($)
39.5 to 41.5 ft	1,742,682	1	10,850,418	2,000,000	**12,850,418**
		2	12,791,222		**14,791,222**
41.5 to 46 ft	3,411,463	1	17,458,381	2,000,000	**19,458,381**
		2	21,085,784		**23,085,784**
46 to 50 ft	2,941,961	1	14,251,704	2,000,000	**16,251,704**
		2	17,307,074		**19,307,074**

Notes:

1. The 41.5' draft deepening ends at the north end of Gatun locks.

2. The 46' and 50' draft deepening ends near the 1939 third set of Atlantic side locks excavation.

Table 19. Summary for Scenario No. 2