



**Technical Analysis of Disposal Sites
for Work on Panama Canal Post-
Panamax Channels and Locks with
Gatun Lake at 9.14 m PLD**

**Análisis Técnico de Sitios de
Disposición para Trabajos en
Esclusas y Cauces Pospanamax del
Canal de Panamá con el Lago Gatún
a 9.14 m PLD**

ACP

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**Descripción y Resultados
(No existe Resumen Ejecutivo)**

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Panama Canal Authority
Department of Engineering and Projects
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TECHNICAL ANALYSIS
OF DISPOSAL SITES FOR WORK ON PANAMA CANAL
POST-PANAMAX CHANNELS AND LOCKS
WITH GATUN LAKE AT 9.14 m PLD

1 GENERAL DESCRIPTION OF THE STUDY

The construction of new Post-Panamax locks at the Panama Canal would require improvements to the existing Canal navigation channels and construction of new Post-Panamax locks navigation approach channels, which involve deepening and widening work to guarantee the safe and expedite transit of Post-Panamax vessels through the Canal.

This report covers the technical analysis of disposal site options to accommodate dry and wet excavation material resulting from navigation channel improvement work. The ACP contracted the services of external consultants Moffatt & Nichol (M&N) and Louis Berger Group (LBG), to evaluate the different alternatives for the disposal of excavated and dredged material in Gaillard Cut and the Canal's Pacific entrance. Such studies were completed in March 2004, and may be reviewed by accessing the consultants' final reports delivered to the ACP.¹

The management of dry and wet excavation material in the Canal represents the most critical issue of any excavation and dredging operation because of the environmental implications regarding disposal sites, the limited number of available sites, their limited capacity, the hauling distance, and the large volume of excavated and dredged material.

2 POST-PANAMAX NAVIGATION CHANNEL EXCAVATION AND DREDGING VOLUME ESTIMATES

- As part of the Canal Expansion Program, dredging and excavation work would be performed along existing Canal channels from the northern end of the Atlantic entrance to the southern end of the Pacific entrance. Similar work would also be required on the new Atlantic and Pacific lock alignments or approach channels. Refer to Appendix No. 1 for a sketch of areas of expansion and construction of Canal navigation channels, and Appendix No. 2 for Post-Panamax design ship dimensions.
- The design ship's main characteristics used to determine the proposed new Canal locks and improved navigation channels dimensions are as follows:
 - Length: 360 m

¹ Moffatt&Nichol Engineers, Louis Berger Group, Golder Associates, "Pacific Side Excavation & Dredging Material Disposal Alternatives Evaluation", Final Report, 3 Volumes, March 2004.

Moffatt&Nichol Engineers, Louis Berger Group, Golder Associated, "Feasibility Study of Island Development at the Pacific Entrance of the Panama Canal", Final Report, 4 Volumes, May 2004.

Louis Berger Group, "Environmental Evaluation of Options for the Construction of New Locks and Deepening of the Atlantic and Pacific Entrance to the Panama Canal", August 2004.

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- Beam: 46 m
- Draft: 13.1m to 13.7 m
- The deepening and widening of Canal existing channels, and the construction of approach channels for new locks would produce navigation channels with the following minimum dimensions:
 - Atlantic entrance = 225 m wide and a 13.7 m draft
 - Atlantic new locks northern approach channel = 218 m wide and a 13.7 m draft
 - Atlantic new locks southern approach channel = 218 m wide and 9.14 m PLD²
 - Gatun Lake = 280 m in straight reaches, 366 m in bends, and 9.14 m PLD
 - Gaillard Cut = 218 m and 9.14 m PLD
 - Pacific new locks northern approach channel = 218 m and 9.14 m PLD
 - Pacific new locks southern approach channel = 218 m and 13.7 m draft
 - Pacific entrance navigation channel = 225 m and 13.7 m draft
- Table No. 1 summarizes the excavation and dredging volumes that the deepening and widening would produce for each of the expansion areas described above.
- As shown in Table No. 1, the amounts of material dredged and excavated for navigation channel improvements and construction total 50.12 million bank cubic meters, and 83.64 million bank cubic meters, respectively. It was assumed that a preliminary bulking value for the hard and soft material could be around 25 to 30 percent; however, this bulking factor could then be reduced to approximately 15 to 20 percent as material is placed on a disposal site, is compacted and consolidated. However, at this early assessment stage, using a conservative 30 percent value is recommended to ensure that available capacity of on-land and marine disposal sites meets or exceeds the dredging and excavation material volume estimates.
- Assuming a bulking factor of 30 percent, the total amounts of dredging and excavation material would be 65.16 million loose cubic meters, and 108.73 million loose cubic meters, respectively

² All Canal elevations are referred to Precise Level Datum, which is close to Atlantic and Pacific entrance mean sea level.

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EXCAVATION AND DREDGING VOLUME FOR CANAL EXPANSION PROGRAM

Scenario: Gatun Lake and Gaillard Cut at 9.14 m (30') PLD

| | Areas | Stations | Width (m) | Dredging | | Excavation | |
|---|--|--------------------|-----------|--------------------------|---------------------------|--------------------------|---------------------------|
| | | | | (M bank m ³) | (M loose m ³) | (M bank m ³) | (M loose m ³) |
| 1 | Atlantic entrance navigation channel | -2K+700 to 7K+100 | 225 | 6.95 | 9.04 | | |
| 2 | Northern Approach Channel - Atlantic new locks | 7K+100 to 9K+700 | 218 | 6.55 | 8.52 | 0.90 | 1.17 |
| 3 | Northern plug of Atlantic new locks | 9K+700 to 9K+900 | 250 | 0.61 | 0.79 | 0.16 | 0.21 |
| 4 | Atlantic Post Panamax Locks Site | 11K+000 to 12K+820 | 94 | | | 18.00 | 23.4 |
| 5 | Atlantic new locks southern plug 9.14 m PLD | 12K+820 to 13K+020 | 300 | 0.79 | 1.03 | 0.40 | 0.52 |
| 6 | Gatun Lake widening to 280m & 366 m to 9.14 m PLD | 16K+200 to 44K+000 | 280 | 16.03 | 20.84 | | |
| 7 | Gaillard Cut deepening to 9.14 m PLD (existing prism line) | 44K+940 to 61K+920 | 218 | 3.89 | 5.06 | | |
| 8 | Gaillard Cut deepening for 218 m at 9.14 m PLD | 44K+940 to 61K+920 | 218 | 2.14 | 2.78 | 2.50 | 3.25 |
| 9 | Pacific new locks northern approach channel north of Gaillard Cut plug, 9.14 m PLD | 1k+700 @ 2k+740 | 218 | 2.82 | 3.67 | 7.18 | 9.33 |
| 10 | Gaillard Cut or northern plug | 2K+587 to 2K+671 | 256 | 0.39 | 0.51 | 0.17 | 0.22 |
| 11 | Pacific new locks northern approach channel north of intermediate plug, 9.14 m PLD | 2K+740 to 7K+220 | 218 | | | 40.00 | 52.00 |
| 12 | Pacific new locks intermediate plug | 6K+680 to 6K+840 | 275 | 0.30 | 0.39 | 0.13 | 0.17 |
| 13 | Pacific Post Panamax Locks Site | 6K+840 to 9K+200 | 94 | | | 14.20 | 18.46 |
| 14 | Pacific new locks southern plug | 9K+200 to 9K+400 | 400 | 0.63 | 0.82 | | |
| 15 | Pacific new locks southern approach channel | 9K+460 to 10K+800 | 218 | 2.51 | 3.26 | | |
| 16 | Pacific entrance navigation channel | 71K+900 to 86+500 | 225 | 6.51 | 8.46 | | |
| TOTAL EXCAVATION & DREDGING VOLUME | | | | 50.12 | 65.16 | 83.64 | 108.73 |

Notes: A bulking factor of 30 percent was assumed to determine loose cubic meter.
Stations numbering in red are just for reference.

Table No.1. Excavation and Dredging Volumes for Canal Expansion Program

3 RECOMMENDED DISPOSAL SITES FOR NAVIGATION CHANNEL DREDGING MAINTENANCE

- The following table shows those disposal sites available to accommodate dredging material from future periodical navigation channel maintenance after Canal expansion:

| RECOMMENDED DISPOSAL SITES FOR CANAL NAVIGATION CHANNEL DREDGING MAINTENANCE | | | | |
|--|----|--|--------------|---|
| Areas | | Capacity after Canal Expansion (M m ³) | Observations | |
| Atlantic area | 1 | Limon Bay Fan dumping | 4.32 | |
| | 2 | South Limon Bay site | 0.40 | |
| | 3 | Sherman | 1.50 | Site could be upgraded to increase volume capacity |
| Gatun Lake & Gaillard Cut | 4 | Along Gatun Lake navigation channel | | Cutter suction dredge discharge material over islands or underwater |
| | 5 | Frijoles | 6.00 | |
| Pacific area | 6 | Victoria | 0.66 | |
| | 7 | Rosseau | 0.55 | |
| | 8 | Velasquez | 1.30 to 2.29 | |
| | 9 | Farfan | 2.66 to 3.66 | Assuming site's existing capacity |
| | 10 | Palo Seco | 1.02 | |
| | 11 | Tortolita | 0.60 | Extension of site boundaries would increase site volume capacity |
| | 12 | Tortolita South | 1.00 | Extension of site boundaries would increase site volume capacity |
| TOTAL REMAINING CAPACITY | | 16.05 | | |

Table No. 4. Recommended disposal sites available for future periodical navigation channel dredging maintenance program after Canal Expansion work