

Tabla C.1.18 Mutis Port

MUTIS PORT is located at the outlet of Martin Grande River. In 1969 the former Direction of Roads, Quays and Airports of the Department of Public Works began the construction of the wooden quay and the ramp for little boats, users of this port. On June 28, 1994 the Mutis Port Precinct was established under Executive Decree No. 31 of the same date y the National Port Authority.

Today the Panama Maritime Authority manages it and it is used principally for the coastwise trade. The agricultural consumption and materials for the region are introduced through this port, unloading the products from the Gulf of Montijo and also the alimentary needs of the people living in nearby islands. Also native fishermen of the region to trade their products use it.

| Item | Description |
|--------------------------|---|
| Administrator | <input checked="" type="checkbox"/> AMP <input type="checkbox"/> Private |
| Category | General Cargo handling Port |
| Terrestrial Area | 2,420.6 sq m |
| Berth Length | Marginal Type Pier: 16.5 m T-shaped Pier: 15m Ramp: 20m |
| Berth Depth | 0 m (LWL) |
| Access Channel | N/A (outlet of Martin Grande River) |
| Cargo Handling Equipment | N/A |
| Services Rendered | Fresh water supply, navigational aid (beacons and buoys) and bunker service |
| Port Capacity | N/A |
| Others | Located at the end of the main road |

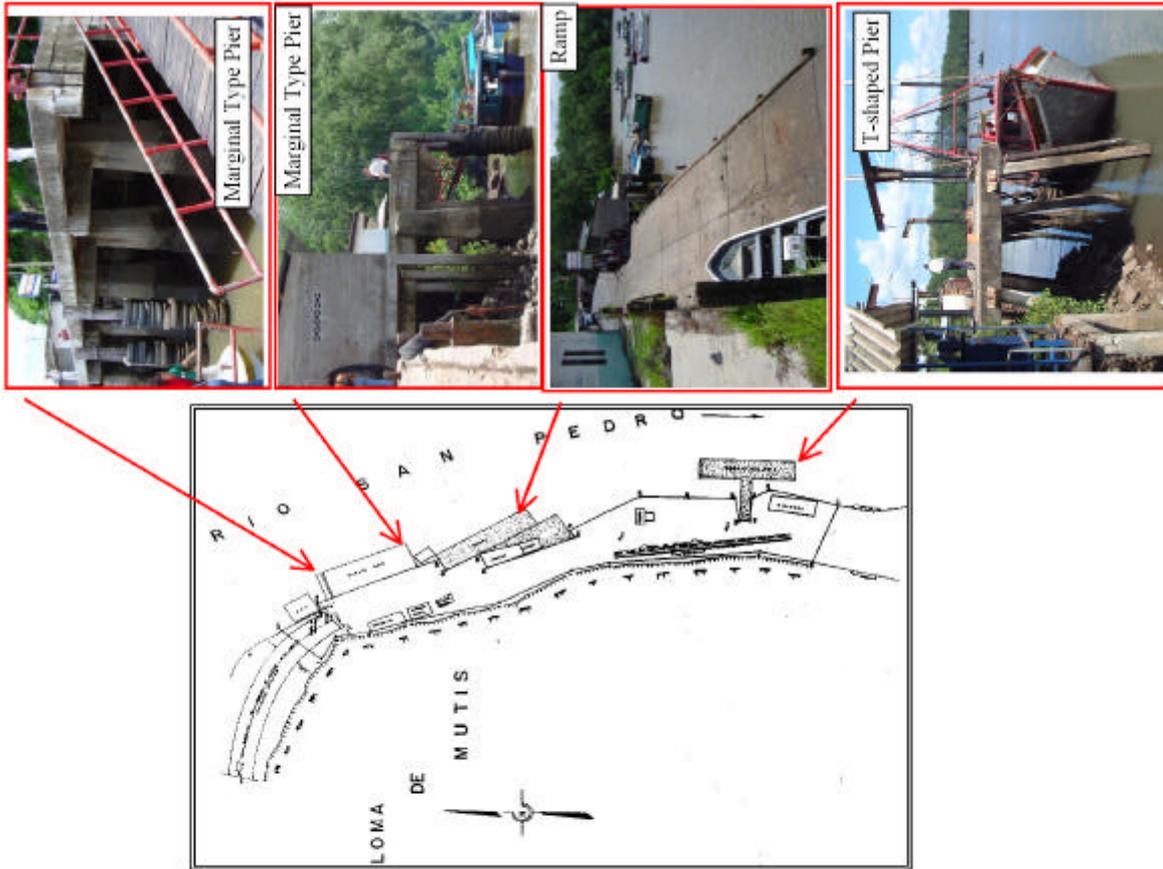


Tabla C.1.19 Pedregal Port

PEDREGAL PORT was built in 1916 and administrated since that date by Chiriquí's Railroad Division of the Department of Public Works, the Pedregal Port was transferred to the National Port Authority (its functions subrogated to the Panama Maritime Authority today) on July 1, 1978, according to Statute No. 42 of May 2, 1974.

Several maritime companies used this port for the passengers and cargo transportation (agricultural products, cattle, wood, mailing service, etc.) Today, Pedregal Port is operated by the Chiriquí Ports Company (CPC) under the Contract signed by the Panama Maritime Authority and the company on April 9, 1999. This company began operations on September 1, 1999.

| Item | Description |
|--------------------------|--|
| Administrator | <input checked="" type="checkbox"/> AMP <input type="checkbox"/> Private; Partly CPC |
| Category | Specialized Port |
| Terrestrial Area | Lot #1: 4,333.36 sq m Lot #2: 23,357.05 sq m |
| Berth Length | Lot #1: 52m Lot #2: 32m |
| Berth Depth | 2.5 m ~ 3.5 m |
| Access Road | 30 minutes from David by road |
| Cargo Handling Equipment | Ship Gear |
| Services Rendered | Electricity, fresh water supply, bunker, navigation aid (beacons and buoys) and pilotage service |
| Port Capacity | Sugar Storage: 2,000 metric tons |

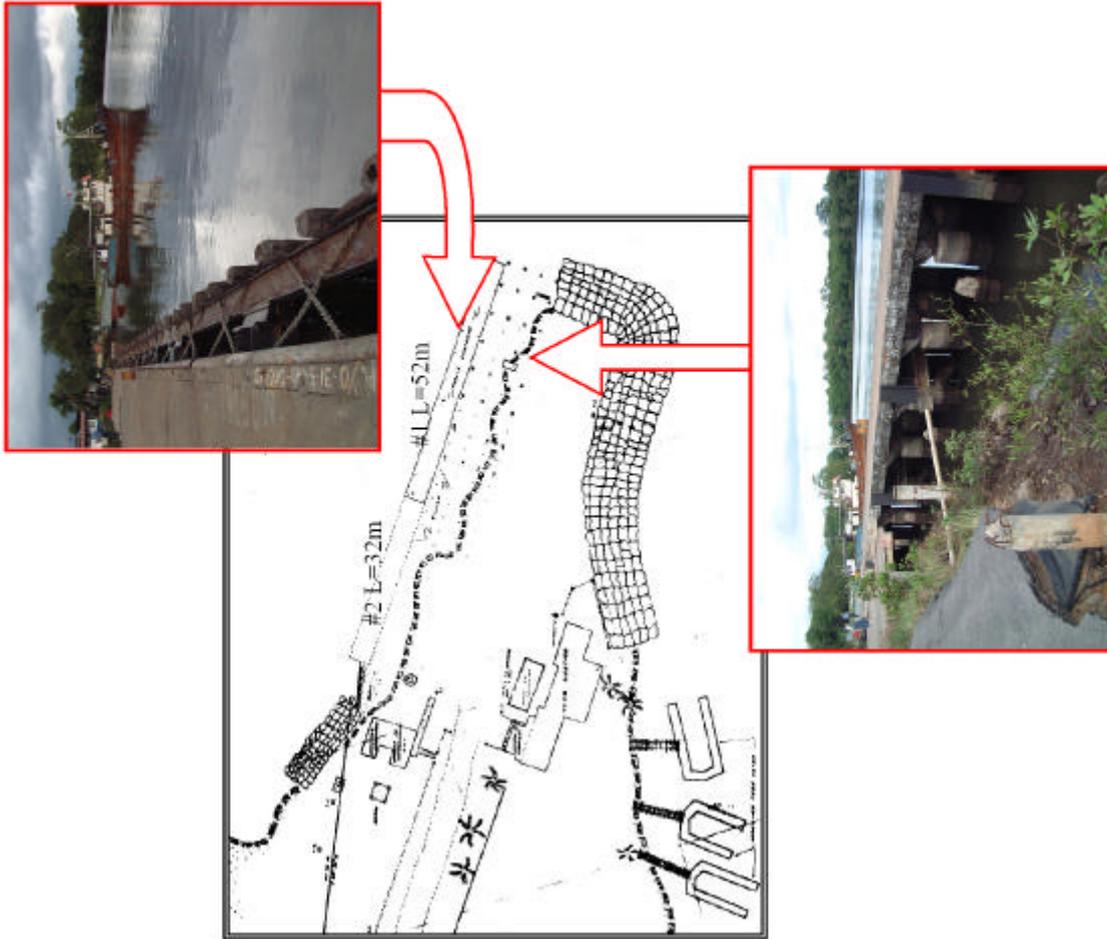


Tabla C.1.20 Armuelles Port

ARMUELLES PORT was built and operated since 1955 by the Chiriquí Land Company for banana exportation. Armuelles Port represents an important part of the Panama Maritime Authority patrimony, with great port developing and multimodal transportation perspectives.

On July 31, 1989, the banana company closed its operations in the quay renouncing to the right of use of the facility, in accordance to clause third of Contract No. 134 of Statute No. 15 of February 17, 1988.

In September, 2002, this facilities were damaged seriously due to the earthquake Today, Armuelles Port registers a minimum activity concentrating its operations in basic port services to the vessels of coastwise trade. Its conditions are expected to improve through investment plans for the rehabilitation and maintenance of this facility in a short and mid term. This work contemplates the construction of improvements in the port as the habilitation of roads leading to the port also, optimizing the transportation logistic of that region in that way.

| Item | Description |
|--------------------------|---|
| Administrator | <input checked="" type="checkbox"/> AMP <input type="checkbox"/> Private |
| Category | Specialized Port (Former Banana Port) |
| Terrestrial Area | 2,125 sq m |
| Trestle Length | 277 m (T-shaped Berth with 5.5m wide) |
| Berth Length | 137 m (T-shaped Berth with 16.5m wide) |
| Berth Depth | 10 m |
| Access Channel | N/A |
| Cargo Handling Equipment | Shap Gear |
| Services Rendered | Navigational signaling (beacons and buoys), radio communications through VHF Channel 16, fresh water supply and bunkering |
| Others | Rehabilitation program is on going |

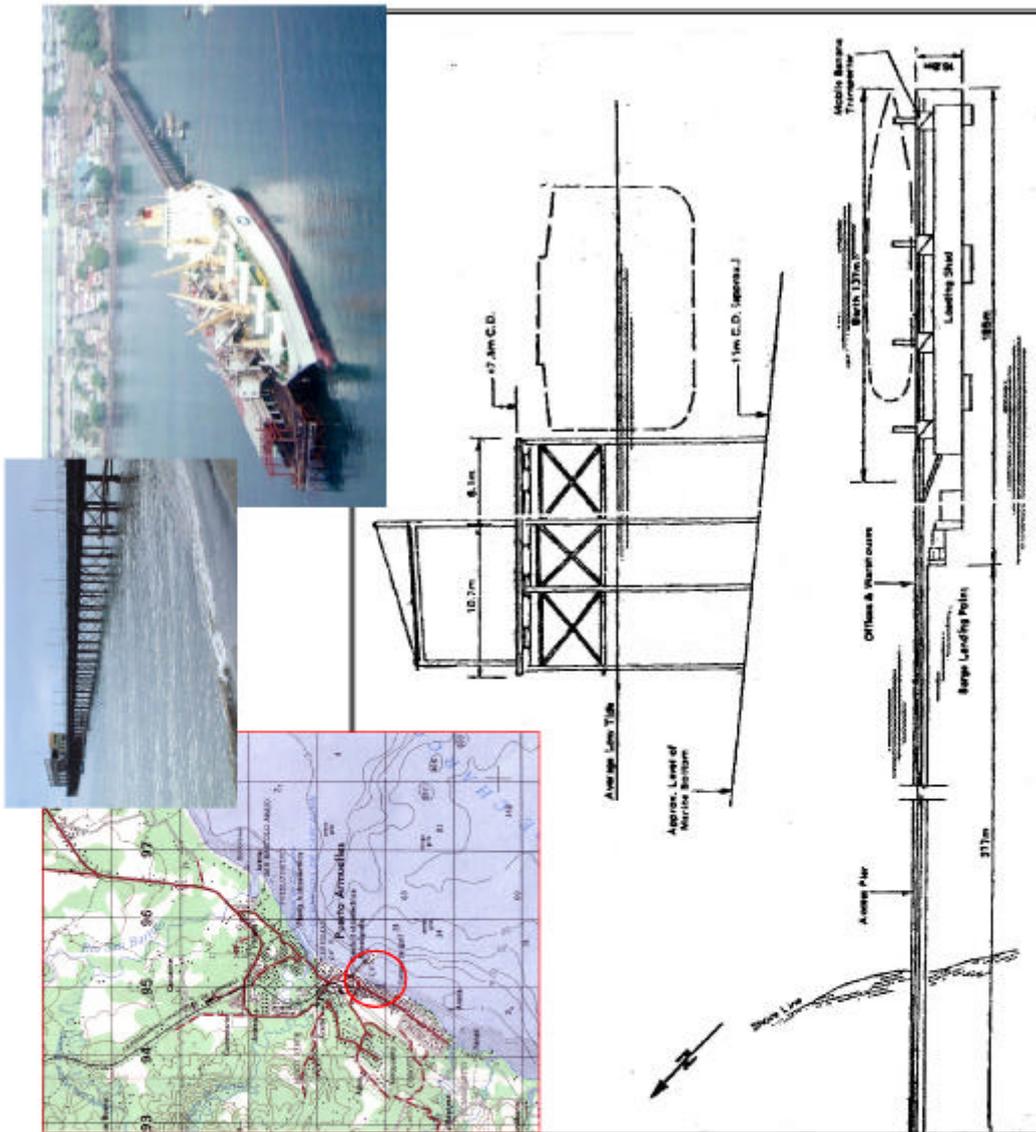


Tabla C.1.21 Charco Azul Port

CHARCO AZUL PORT is located on the Pacific coast of the Republic of Panama, on the west side of the Charco Azul Bay and on the east side of the Barro Colorado Peninsula, approximately 3.5 miles south of Puerto Armuelles, Chiriquí.

On September 26, 1977, under Statute No. 30 of the same year, the partnership contract between the state of Panama and Northville Terminal Corporation was signed, with the plan of creating a company in the Charco Azul Bay, province of Chiriquí, in charge of the developing, building and operation of a port facility specialized in the handling of oil and its derivatives, particularly originated from the Alaskan region.

As a result of this association, Petroterminal de Panamá, S.A. is born as a joint company where the state of Panama has a participation of 42% of the stocks. The Petrotero de Charco Azul terminal initiates operations on April 10, 1979, a year after the beginning of its construction.

Due to an accident occurred in 1996 by an Exxon company ship in the Alaskan coasts, a federal court decided to suspend the oil shipping activity from this region, lowering the ports operation. Nevertheless that restriction, the Petrotero Charco Azul terminal through OLEFINCOR, S.A. Company provides all types of oil derivatives products such as diesel, gasoline, bunker, etc. to the vessels using this port.

The terminal with its two-loading/unloading berths is designed to handle crude and other similar products derived from petroleum. Other operations that can be carried out are blending, transshipment and/or transportation of products through the isthmus from the Pacific to the Atlantic coast via a pipeline.



| Item | Description |
|--------------------------|--|
| Administrator | <input type="checkbox"/> AMP <input checked="" type="checkbox"/> Private: PTP, S.A. |
| Category | Petroleum Terminal (loading/unloading berths) |
| Terrestrial Area | 83 hectares + 5,597 sq m |
| Target Vessels | Berth No. 1: 265,000 DWT Berth No. 2: 25,000 ~ 200,000 DWT 2,500 ~ 4,000 DWT Barge |
| Berth Depth | Berth No. 1: 24.2 m Berth No. 2: 21.0 m |
| Access Channel | |
| Cargo Handling Equipment | Loading/Unloading Arm: 3 Nos each Loading: 40,000 b p/h (barrel per hour) Unloading: 100,000 b p/h |
| Services Rendered | Radio communications via VHF Channel 16, docking, tie units, storage, navigational aid (beacons and buoys), tug and launch rentals, inspecting agencies and ship chandlers |
| Port Capacity | Storage Tanks 833,000 barrel = 3 tanks 25,000 barrel = 1 tanks 5,000 barrel = 2 tanks |
| Others | |

Tabla C.1.22 Chiriquí Grande Port

CHIRIQUI GRANDE (RAMBALA) PORT is known as Rambala, Petroterminal de Panamá, S.A. administers it since 1982. As the Claro Azul Petroterminal, the Chiriquí (Grain) Terminal and the Iron isthman pipeline were built by contract signed by the state of Panama and the Northville Terminal Corporation Company on July 2, 1982.

In May, 1997, the company decides to modernize the container and general cargo handling, with an initial investment of 27 million dollars which included a land road connecting the rest of the country.

Today, the oil shipping and handling operations are managed by ENYORON, a subcontractor company for Petroterminal de Panamá (PTP), S.A.

Among the principal clients of the Rambala Port is the Chiquita Brands International Company who ships the banana product for exportation, especially to Europe.

AMP operates and administers the RO-RO berth directly.

| Item | Description |
|---------------------------------|--|
| Administration | <input checked="" type="checkbox"/> AMP <input checked="" type="checkbox"/> Private: PTP, S.A. |
| Category | PTP: Petroleum Terminal, Container and General Cargo Terminal AMP: RO-RO Berth |
| Berth Length | PTP: T-Shaped Pier: 182 m, Width: 24-24 m AMP: L=25.5m, 14.2m wide |
| Berth Depth | PTP: -11.0 m AMP: -2.2m |
| Cargo Handling Equipments (PTP) | Ship gear, Fork lifts (3 tons), Tractors |
| Services Rendered (PTP) | Radio communications via UHF Channel 16, dishing, fire out, storage, navigational aid (beacons and buoys), tug and launch rentals, shipping agencies, inspection agencies and ship chandlery |
| Port Capacity (PTP) | Storage capacity (on deck): 185,000 cu m Container yard: 8 hectares Reefer Container Storage: 330 TEU's Loose cargo yard: 3 hectares 3 tanks: 13,000 barrels |
| Others (PTP) | Two Single Front Mooring Buoys capable of handling tankers of up to 150,000 DWT with drafts of up to 72 ft. |

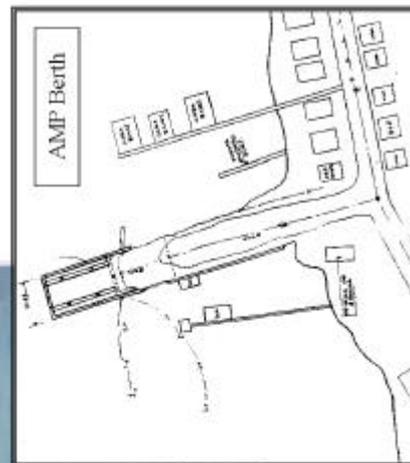
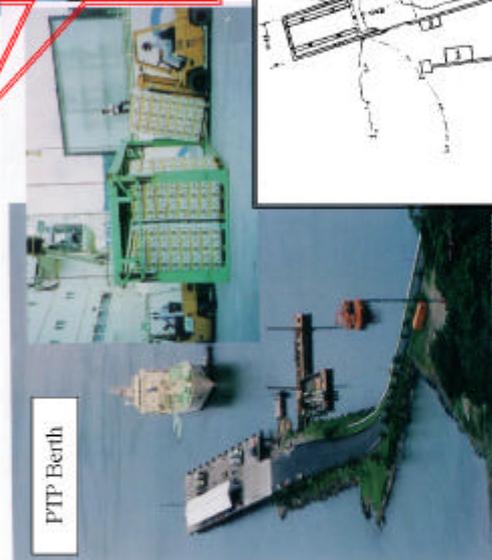
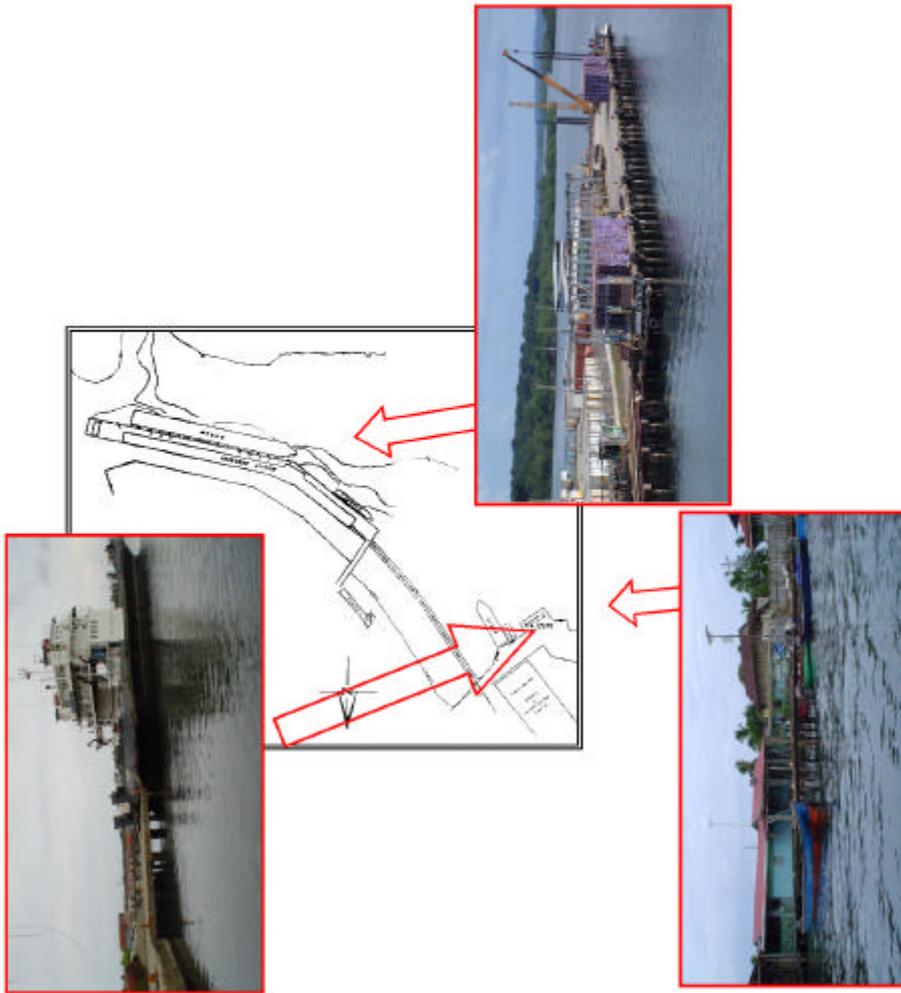


Tabla C.1.23 *Almirante Port*

ALMIRANTE PORT was built in 1908 by the United Brands Company (today, Chiquita Brands International), for general cargo handling, especially for Banana exportation.

In 1952 this facility became property of the state of Panama. But the government formalized its role of land lord through a 20 year extendable concession contract for the exclusive use of the Almirante Port by the United Brands Company under Contract No. 3, Statute No. 4 of January 7, 1976.

Today, this port is operated by the Bocas Fruit Company, a subsidiary of the Chiquita Brands International Company (CBI) under regulation of the Panama Maritime Authority.

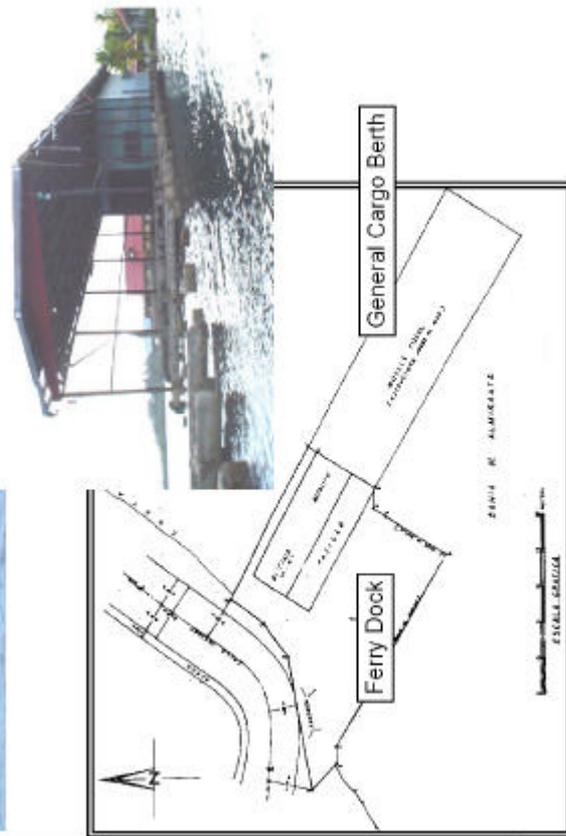


| Item | Description |
|--------------------------|---|
| Administrator | <input checked="" type="checkbox"/> AMP <input checked="" type="checkbox"/> Private: CBI, S.A. |
| Category | CBI: Specialized Port (Banana handling) AMP: Ferry Berth |
| Berth Length | CBI Banana handling Berths: 304.8 m AMP Ferry Berths: 10m |
| Berth Depth | CBI Berth: -11.0m AMP Berth: -5m |
| Access Channel | The entrance of channel is narrow and shallow (-8m)... |
| Cargo Handling Equipment | Ship Gear |
| Services Rendered | Radio communications via UHF Channel 16, docking, tie-untie, storeroom, navigational aid (beacons and buoys), tug and launch rentals, shipping agencies, inspection agencies and ship chandlery |

Tabla C.1.24 Bocas del Toro Port

BOCAS DEL TORO PORT is located at "Isla Colon" (Colon Island) on the Atlantic Coast, in the Province of Bocas del Toro.
 General cargo berth was damaged due to the earthquake and not utilized. Ferry dock is used by the Ferry to/from Port of Almirante.

| Item | Description |
|--------------------------|--|
| Administrator | <input checked="" type="checkbox"/> AMP <input type="checkbox"/> Private |
| Category | Multipurpose Port |
| Berth Length | General Cargo Berths: 18m (unutilized) Ferry Dock: 30m, 12m wide |
| Berth Depth | 3.9 m |
| Access Route | to and from Port of Almirante |
| Cargo Handling Equipment | N/A |
| Services Rendered | Fresh water supply, navigation aid (beacons and buoys) and electric power supply |
| Port Capacity | N/A |
| Others | No program for the rehabilitation of berth |



Apéndice D Puerto de Aguadulce y Canal del Río

Contenidos

Alineamiento del Canal Ribereño de Aguadulce

Canal Ribereño de Aguadulce: Cambios en el Lecho de 1993 a 2003

Canal Ribereño de Aguadulce: Balance de Acrecencia - Erosión 1993 - 2003

Diseño del Canal de Aguadulce: Dragado Inicial para Mejoramiento a -4.0 m

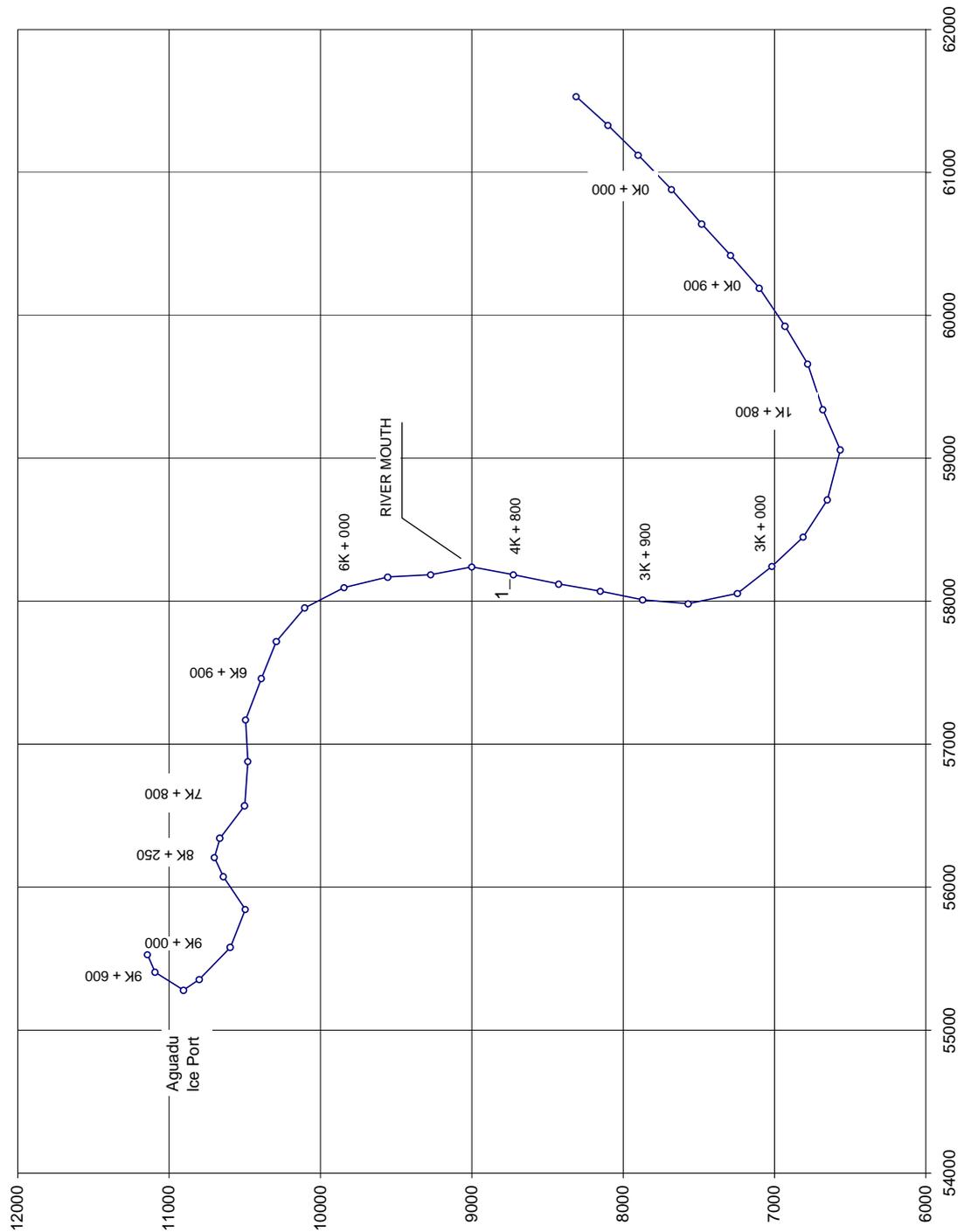
Canal Ribereño de Aguadulce: Cambio en el Canal del Río (Sección Cruzada)

Plan del Puerto de Aguadulce + Canal de Navegación (Escala 1:3,000)

Plan del Puerto de Aguadulce: Alineamiento del Canal de Navegación (Escala 1:20,000)

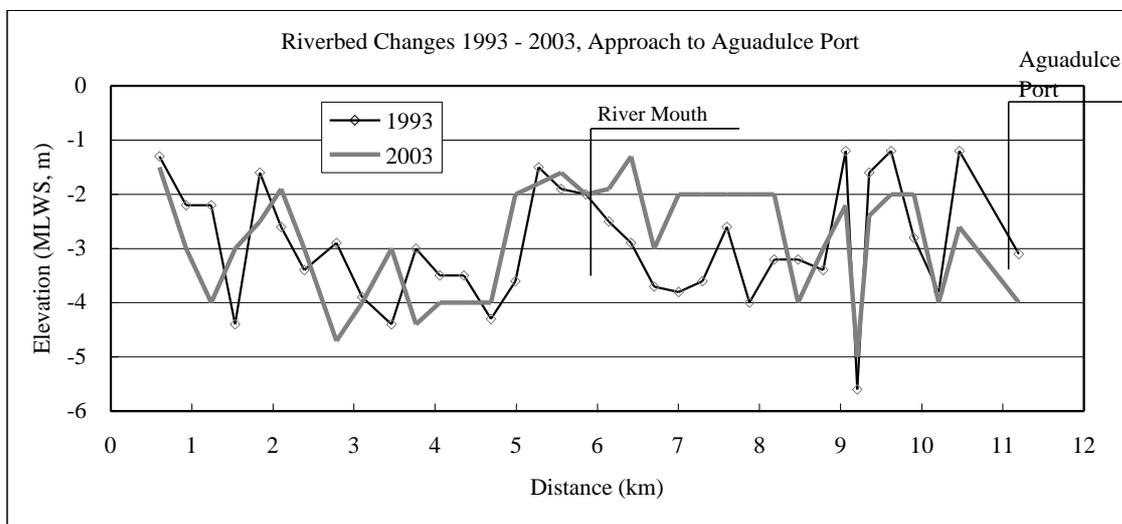
Plan del Puerto de Aguadulce: Plan del Diseño del Canal (Escala 1:5,000) No.1 - No.7

Canal Ribereño de Aguadulce: Alineamiento



Canal Ribereño de Aguadulce: Cambios en Lecho del Río desde 1993 a 2003

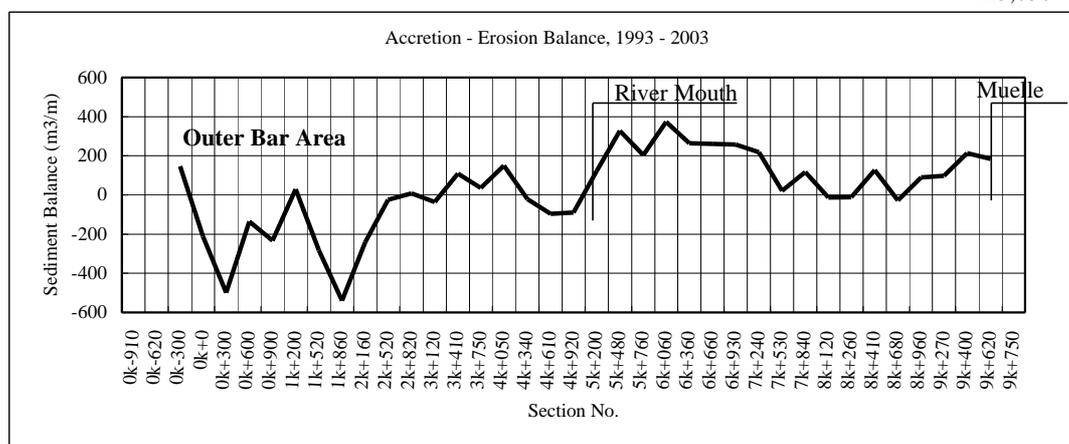
| Section No. | Interval (m) | Distance (m) | (km) | Riverbed at Center Line | |
|-------------|--------------|--------------|-------|-------------------------|------|
| | | | | 1993 | 2003 |
| 0k-300 | 302.69 | 600.01 | 0.60 | -1.3 | -1.5 |
| 0k+0 | 331.72 | 931.73 | 0.93 | -2.2 | -3.0 |
| 0k+300 | 308.60 | 1,240.33 | 1.24 | -2.2 | -4.0 |
| 0k+600 | 293.32 | 1,533.65 | 1.53 | -4.4 | -3.0 |
| 0k+900 | 304.87 | 1,838.52 | 1.84 | -1.6 | -2.5 |
| 1k+200 | 262.49 | 2,101.01 | 2.10 | -2.6 | -1.9 |
| 1k+520 | 287.92 | 2,388.93 | 2.39 | -3.4 | -3.0 |
| 1k+860 | 396.79 | 2,785.72 | 2.79 | -2.9 | -4.7 |
| 2k+160 | 315.00 | 3,100.72 | 3.10 | -3.9 | -4.0 |
| 2k+520 | 360.41 | 3,461.13 | 3.46 | -4.4 | -3.0 |
| 2k+820 | 305.29 | 3,766.42 | 3.77 | -3.0 | -4.4 |
| 3k+120 | 291.33 | 4,057.75 | 4.06 | -3.5 | -4.0 |
| 3k+410 | 296.15 | 4,353.90 | 4.35 | -3.5 | -4.0 |
| 3k+750 | 334.07 | 4,687.97 | 4.69 | -4.3 | -4.0 |
| 4k+050 | 301.30 | 4,989.27 | 4.99 | -3.6 | -2.0 |
| 4k+340 | 286.36 | 5,275.63 | 5.28 | -1.5 | -1.8 |
| 4k+610 | 279.51 | 5,555.14 | 5.56 | -1.9 | -1.6 |
| 4k+920 | 307.17 | 5,862.31 | 5.86 | -2.0 | -2.0 |
| 5k+200 | 280.25 | 6,142.56 | 6.14 | -2.5 | -1.9 |
| 5k+480 | 275.35 | 6,417.91 | 6.42 | -2.9 | -1.3 |
| 5k+760 | 284.45 | 6,702.36 | 6.70 | -3.7 | -3.0 |
| 6k+060 | 299.29 | 7,001.65 | 7.00 | -3.8 | -2.0 |
| 6k+360 | 296.25 | 7,297.90 | 7.30 | -3.6 | -2.0 |
| 6k+660 | 298.92 | 7,596.82 | 7.60 | -2.6 | -2.0 |
| 6k+930 | 278.57 | 7,875.39 | 7.88 | -4.0 | -2.0 |
| 7k+240 | 308.08 | 8,183.47 | 8.18 | -3.2 | -2.0 |
| 7k+530 | 290.34 | 8,473.81 | 8.47 | -3.2 | -4.0 |
| 7k+840 | 310.64 | 8,784.45 | 8.78 | -3.4 | -3.0 |
| 8k+120 | 279.23 | 9,063.68 | 9.06 | -1.2 | -2.2 |
| 8k+260 | 140.68 | 9,204.36 | 9.20 | -5.6 | -5.0 |
| 8k+410 | 146.82 | 9,351.18 | 9.35 | -1.6 | -2.4 |
| 8k+680 | 271.36 | 9,622.54 | 9.62 | -1.2 | -2.0 |
| 8k+960 | 281.95 | 9,904.49 | 9.90 | -2.8 | -2.0 |
| 9k+270 | 305.12 | 10,209.61 | 10.21 | -3.8 | -4.0 |
| 9k+400 | 255.32 | 10,464.93 | 10.46 | -1.2 | -2.6 |
| 9k+750 | 729.76 | 11,194.69 | 11.19 | -3.1 | -4.0 |



Canal Ribereño de Aguadulce: Balance de Acrecencia - Erosión 1993 -2003

| Section No. | Interval (a) (m) | Distance (b) (m) | 2003 - 1993 | | Balance (e) (m ³ /m) | Sediment (f) Volume (m ³) |
|-------------|------------------------|------------------------|---|---------------------------------------|---------------------------------------|---|
| | | | Accretion (c) (m ³ /m) | Erosion (d) (m ³ /m) | | |
| | | | Refer to Cross Sections in Appendix D | | (c) + (d) | 0.5 *(a: I)* [(e: I-1)+(e: I)] |
| 0k-910 | 0.00 | 0.00 | | | | |
| 0k-620 | 290.00 | 290.00 | | | | |
| 0k-300 | 302.69 | 592.69 | 198.0 | -52.0 | 146.0 | 22,096 |
| 0k+0 | 331.72 | 924.41 | 6.0 | -218.0 | -212.0 | -10,947 |
| 0k+300 | 308.60 | 1233.01 | 4.0 | -502.6 | -498.6 | -109,646 |
| 0k+600 | 293.32 | 1526.33 | 177.2 | -312.6 | -135.4 | -92,982 |
| 0k+900 | 304.87 | 1831.20 | 4.8 | -238.2 | -233.4 | -56,218 |
| 1k+200 | 262.49 | 2093.69 | 121.6 | -91.8 | 29.8 | -26,721 |
| 1k+520 | 287.92 | 2381.61 | 67.2 | -349.0 | -281.8 | -36,278 |
| 1k+860 | 396.79 | 2778.40 | 0.0 | -540.4 | -540.4 | -163,120 |
| 2k+160 | 315.00 | 3093.40 | 102.0 | -343.6 | -241.6 | -123,165 |
| 2k+520 | 360.41 | 3453.81 | 92.6 | -117.6 | -25.0 | -48,043 |
| 2k+820 | 305.29 | 3759.10 | 86.0 | -76.8 | 9.2 | -2,412 |
| 3k+120 | 291.33 | 4050.43 | 75.2 | -112.0 | -36.8 | -4,020 |
| 3k+410 | 296.15 | 4346.58 | 189.8 | -79.8 | 110.0 | 10,839 |
| 3k+750 | 334.07 | 4680.65 | 167.0 | -131.4 | 35.6 | 24,320 |
| 4k+050 | 301.30 | 4981.95 | 328.2 | -179.6 | 148.6 | 27,750 |
| 4k+340 | 286.36 | 5268.31 | 85.6 | -106.2 | -20.6 | 18,327 |
| 4k+610 | 279.51 | 5547.82 | 58.0 | -154.0 | -96.0 | -16,295 |
| 4k+920 | 307.17 | 5854.99 | 18.4 | -107.8 | -89.4 | -28,475 |
| 5k+200 | 280.25 | 6135.24 | 162.0 | -39.8 | 122.2 | 4,596 |
| 5k+480 | 275.35 | 6410.59 | 328.0 | | 328.0 | 61,981 |
| 5k+760 | 284.45 | 6695.04 | 204.0 | | 204.0 | 75,664 |
| 6k+060 | 299.29 | 6994.33 | 373.6 | | 373.6 | 86,435 |
| 6k+360 | 296.25 | 7290.58 | 262.8 | | 262.8 | 94,267 |
| 6k+660 | 298.92 | 7589.50 | 260.8 | | 260.8 | 78,257 |
| 6k+930 | 278.57 | 7868.07 | 286.0 | -28.0 | 258.0 | 72,261 |
| 7k+240 | 308.08 | 8176.15 | 251.4 | -34.0 | 217.4 | 73,231 |
| 7k+530 | 290.34 | 8466.49 | 72.8 | -52.0 | 20.8 | 34,579 |
| 7k+840 | 310.64 | 8777.13 | 121.6 | -4.0 | 117.6 | 21,496 |
| 8k+120 | 279.23 | 9056.36 | 45.2 | -58.4 | -13.2 | 14,576 |
| 8k+260 | 140.68 | 9197.04 | 94.0 | -106.0 | -12.0 | -1,773 |
| 8k+410 | 146.82 | 9343.86 | 184.0 | -56.0 | 128.0 | 8,516 |
| 8k+680 | 271.36 | 9615.22 | 60.0 | -88.0 | -28.0 | 13,568 |
| 8k+960 | 281.95 | 9897.17 | 90.0 | | 90.0 | 8,740 |
| 9k+270 | 305.12 | 10202.29 | 164.0 | -66.0 | 98.0 | 28,681 |
| 9k+400 | 127.64 | 10329.93 | 294.0 | -80.0 | 214.0 | 19,912 |
| 9k+620 | 226.32 | 10556.25 | 234.0 | -50.0 | 184.0 | 45,038 |
| 9k+750 | 131.85 | 10688.10 | | | | |

125,036

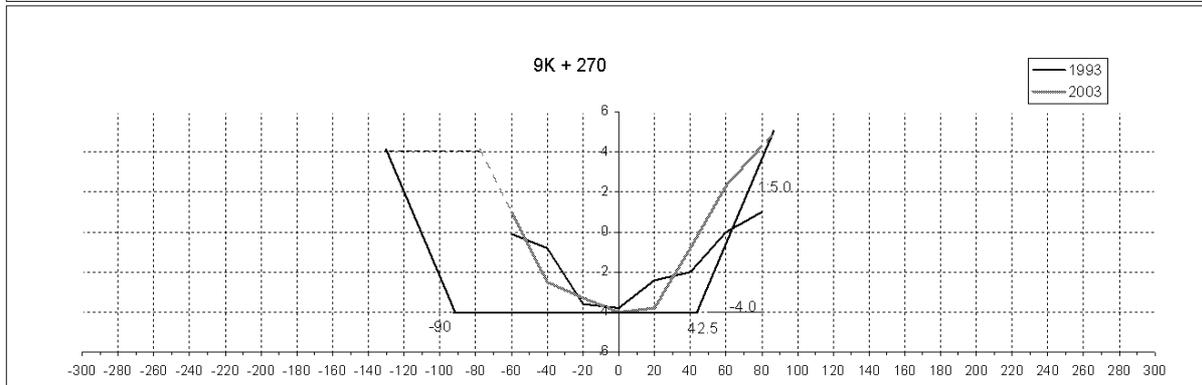
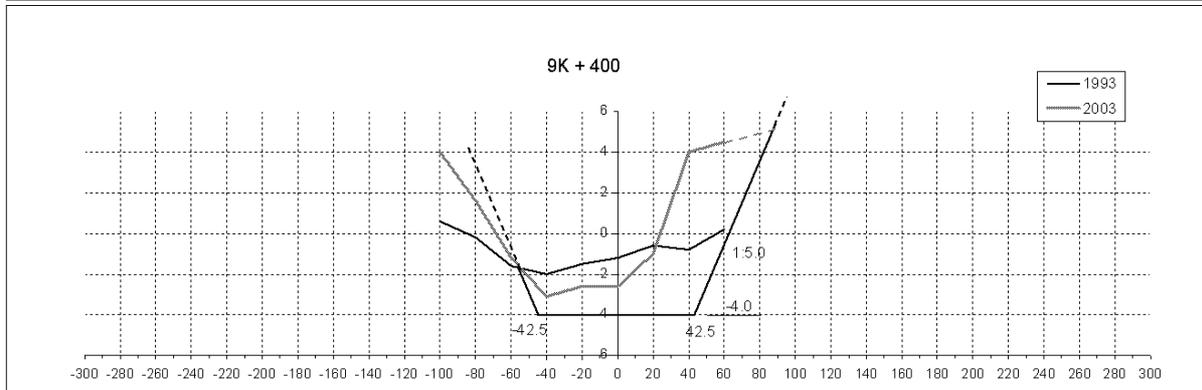
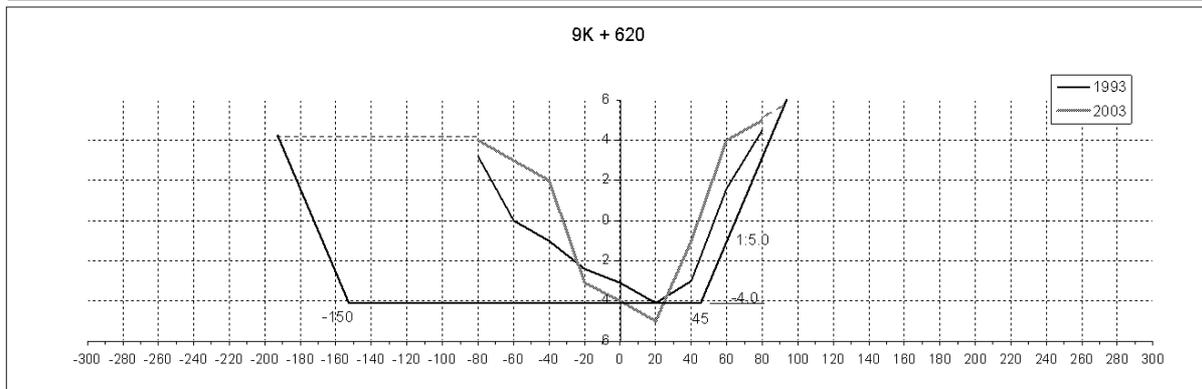
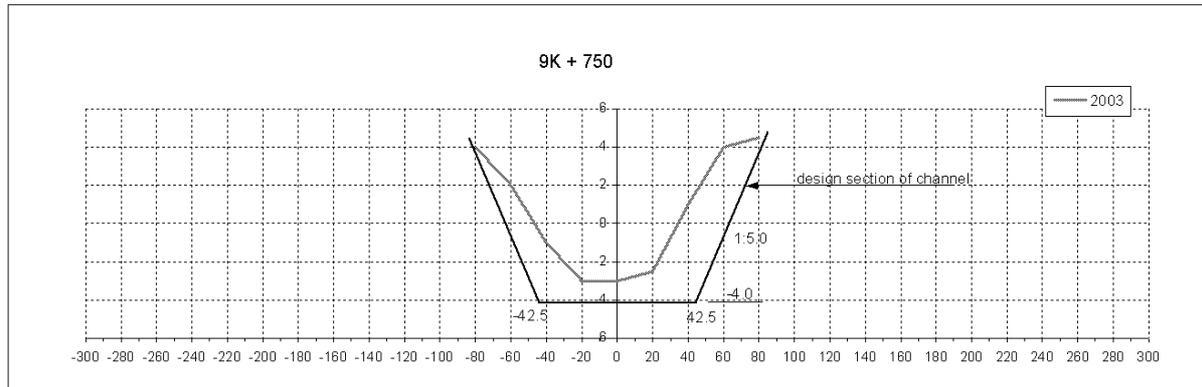


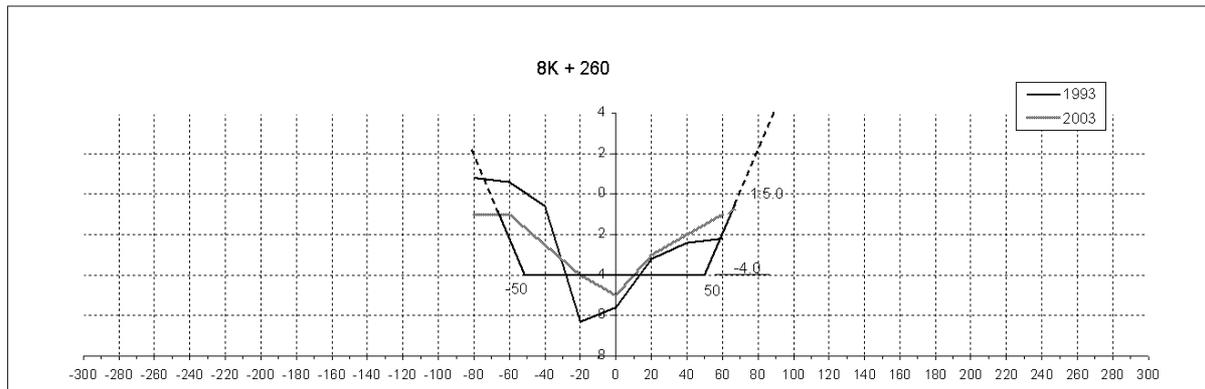
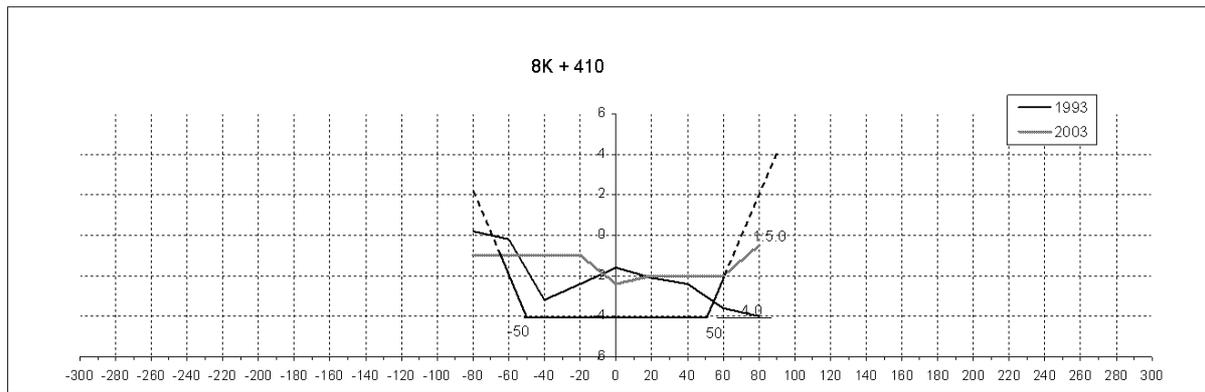
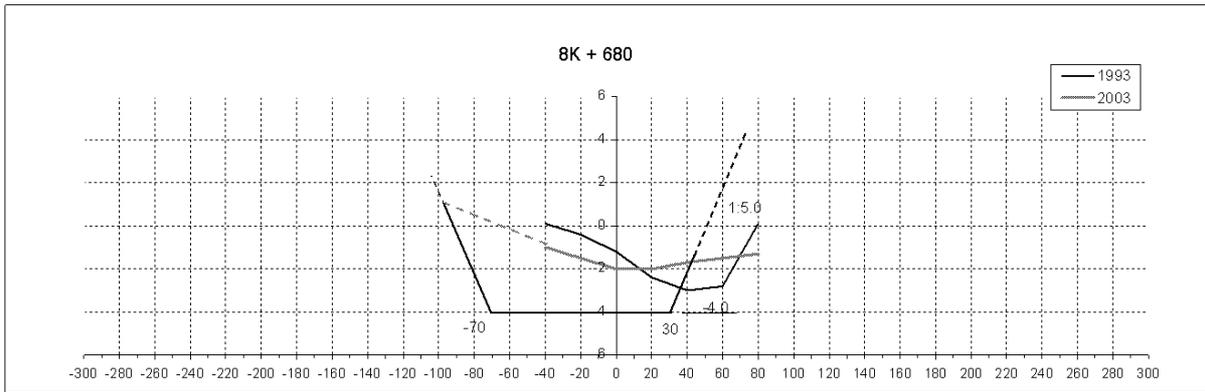
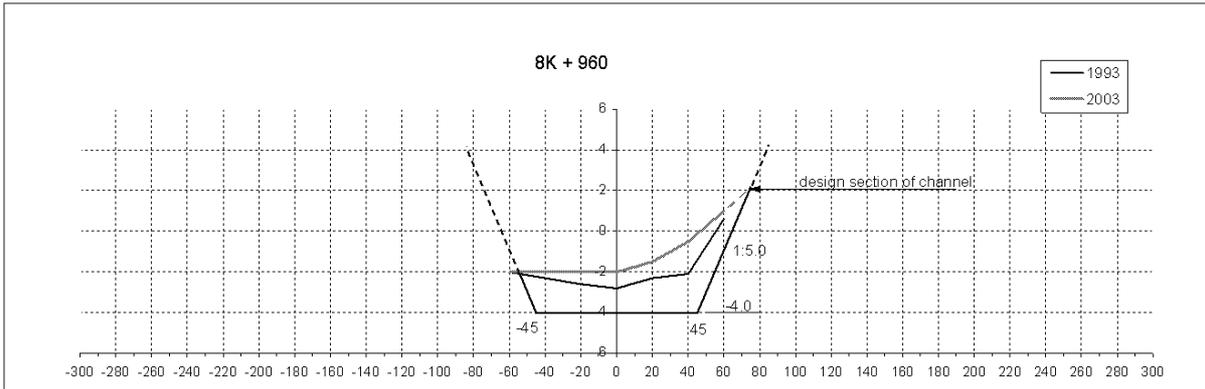
Diseño de Canal de Aguadulce: Dragado Inicial para Mejoramiento a -4.0m

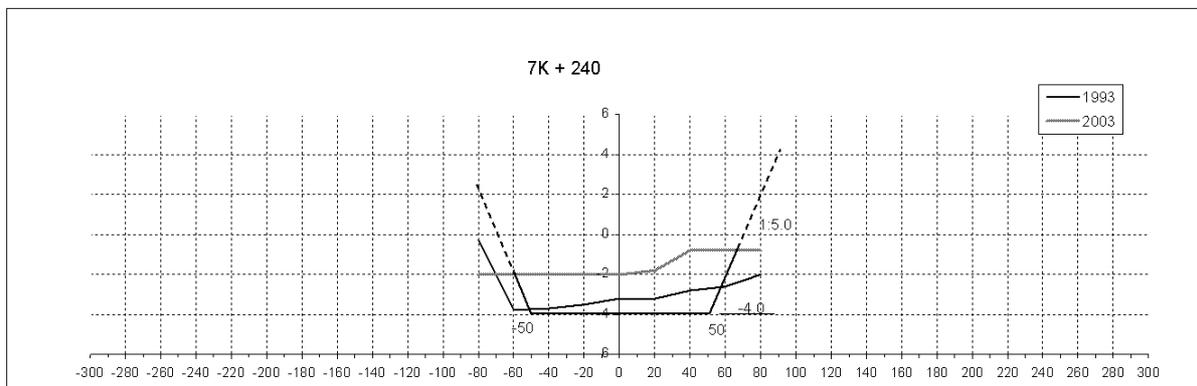
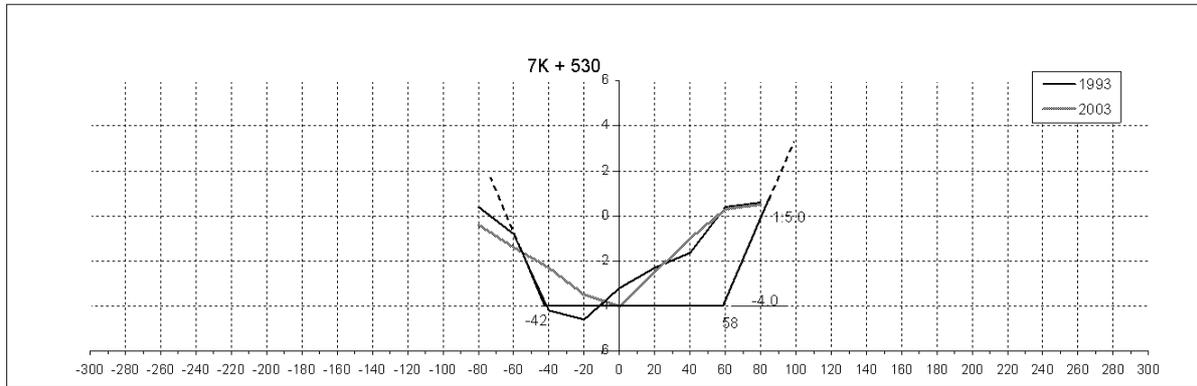
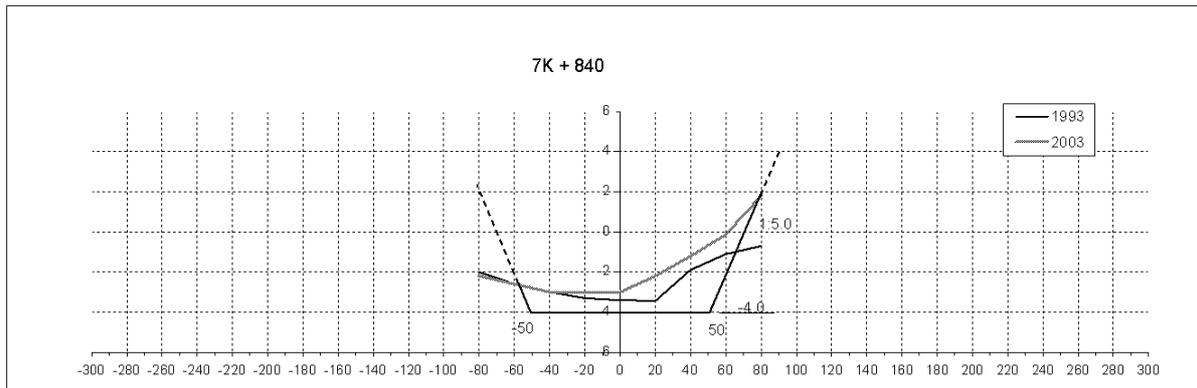
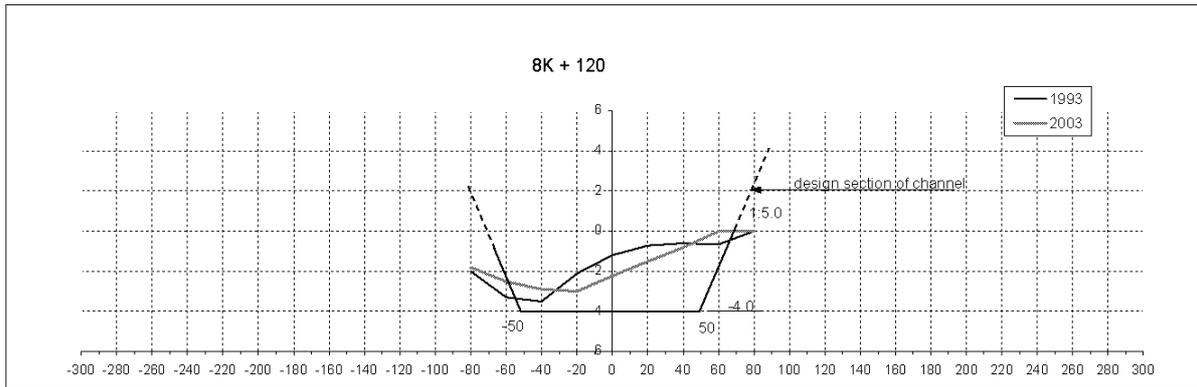
| Section No. | Interval (m) | Distance (m) | Section (m ³ /m) | Dredging Volume (m ³) | |
|-------------|--------------|--------------|------------------------------|-----------------------------------|------------------|
| 0k-910 | 0.00 | 0.00 | | | |
| 0k-620 | 297.32 | 297.32 | | | |
| 0k-300 | 302.69 | 600.01 | 235.0 | 35,566 | |
| 0k+0 | 331.72 | 931.73 | 110.0 | 57,222 | |
| 0k+300 | 308.60 | 1,240.33 | 23.0 | 20,522 | |
| 0k+600 | 293.32 | 1,533.65 | 45.0 | 9,973 | |
| 0k+900 | 304.87 | 1,838.52 | 155.0 | 30,487 | |
| 1k+200 | 262.49 | 2,101.01 | 217.0 | 48,823 | |
| 1k+520 | 287.92 | 2,388.93 | 143.0 | 51,826 | |
| 1k+860 | 396.79 | 2,785.72 | 25.0 | 33,330 | |
| 2k+160 | 315.00 | 3,100.72 | 111.0 | 21,420 | |
| 2k+520 | 360.41 | 3,461.13 | 89.0 | 36,041 | |
| 2k+820 | 305.29 | 3,766.42 | 100.0 | 28,850 | |
| 3k+120 | 291.33 | 4,057.75 | 82.0 | 26,511 | |
| 3k+410 | 296.15 | 4,353.90 | 30.0 | 16,584 | |
| 3k+750 | 334.07 | 4,687.97 | 6.0 | 6,013 | |
| 4k+050 | 301.30 | 4,989.27 | 232.0 | 35,855 | |
| 4k+340 | 286.36 | 5,275.63 | 205.0 | 62,570 | |
| 4k+610 | 279.51 | 5,555.14 | 232.0 | 61,073 | |
| 4k+920 | 307.17 | 5,862.31 | 180.0 | 63,277 | |
| 5k+200 | 280.25 | 6,142.56 | 261.0 | 61,795 | |
| 5k+480 | 275.35 | 6,417.91 | 360.0 | 85,496 | |
| 5k+760 | 284.45 | 6,702.36 | 271.0 | 89,744 | |
| 6k+060 | 299.29 | 7,001.65 | 330.0 | 89,937 | |
| 6k+360 | 296.25 | 7,297.90 | 296.0 | 92,726 | |
| 6k+660 | 298.92 | 7,596.82 | 292.0 | 87,882 | |
| 6k+930 | 278.57 | 7,875.39 | 323.0 | 85,660 | |
| 7k+240 | 308.08 | 8,183.47 | 259.0 | 89,651 | |
| 7k+530 | 290.34 | 8,473.81 | 198.0 | 66,343 | |
| 7k+840 | 310.64 | 8,784.45 | 192.0 | 60,575 | |
| 8k+120 | 279.23 | 9,063.68 | 235.0 | 59,616 | |
| 8k+260 | 140.68 | 9,204.36 | 77.0 | 21,946 | |
| 8k+410 | 146.82 | 9,351.18 | 264.0 | 25,033 | |
| 8k+680 | 271.36 | 9,622.54 | 551.0 | 110,579 | |
| 8k+960 | 281.95 | 9,904.49 | 566.0 | 157,469 | |
| 9k+270 | 305.12 | 10,209.61 | 738.0 | 198,938 | |
| 9k+330 | 99.57 | 10,309.18 | 785.0 | 75,823 | |
| 9k+400 | 155.75 | 10,464.93 | 879.0 | 129,584 | |
| 9k+470 | 176.31 | 10,641.24 | 485.0 | 120,243 | |
| 9k+580 | 195.80 | 10,837.04 | 800.0 | 125,802 | |
| 9k+620 | 227.65 | 11,064.69 | 489.0 | 146,720 | |
| 9k+750 | 130.00 | 11,194.69 | 397.8 | 57,643 | |
| | | | Total (m³) | 2,685,148 | 1,169,780 |

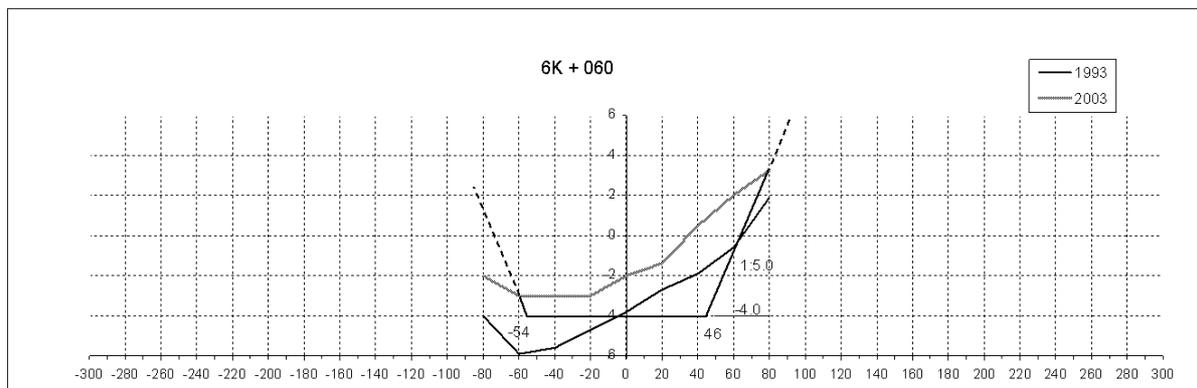
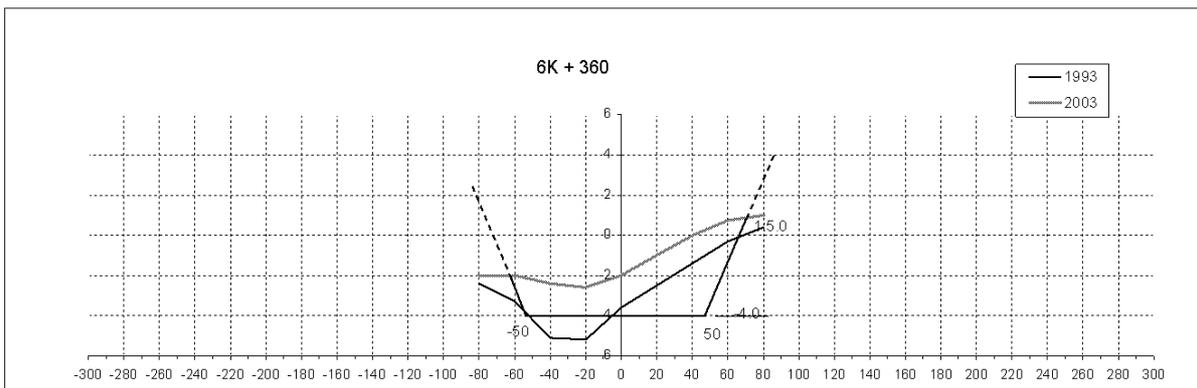
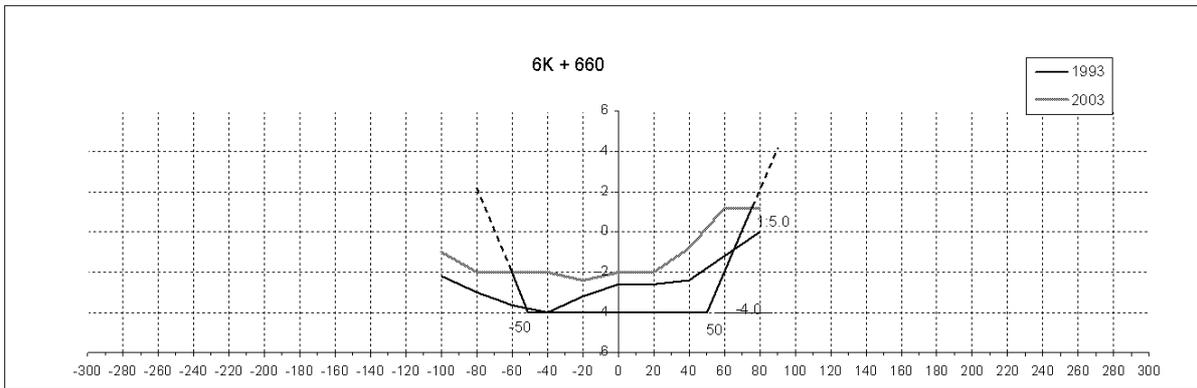
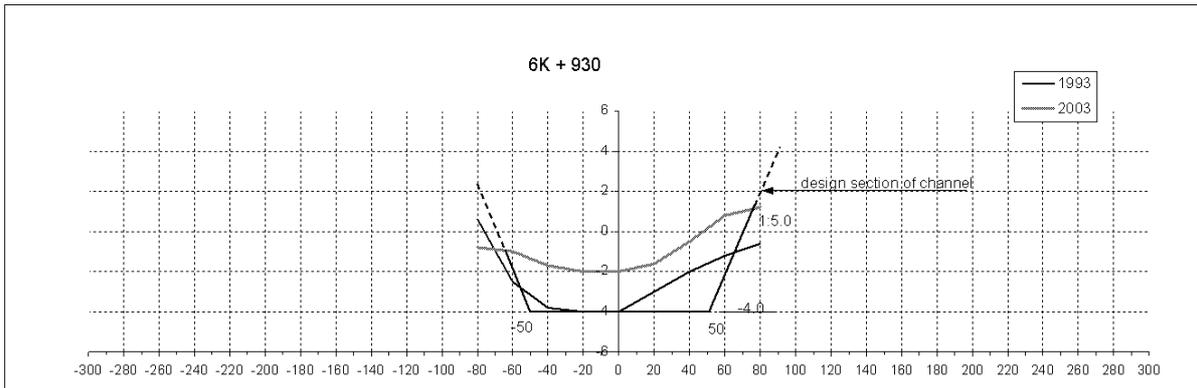
Dredging (m³)
 8k+120 -
 9k+750

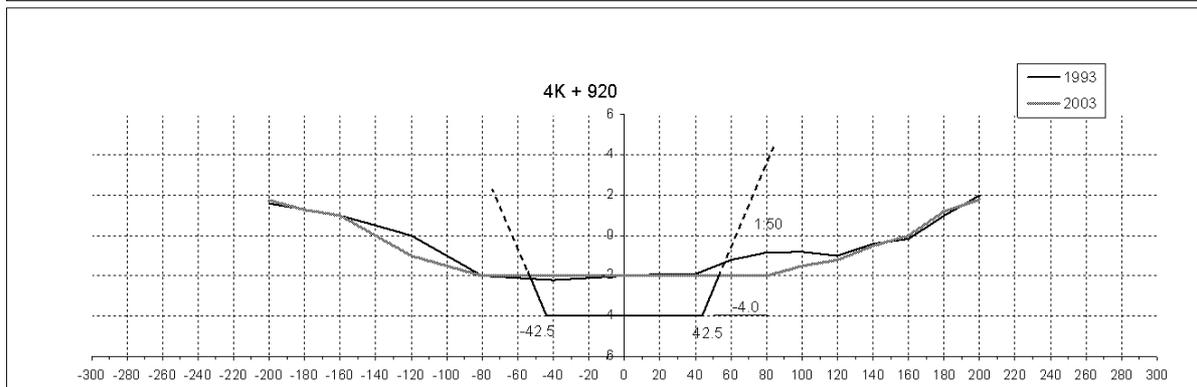
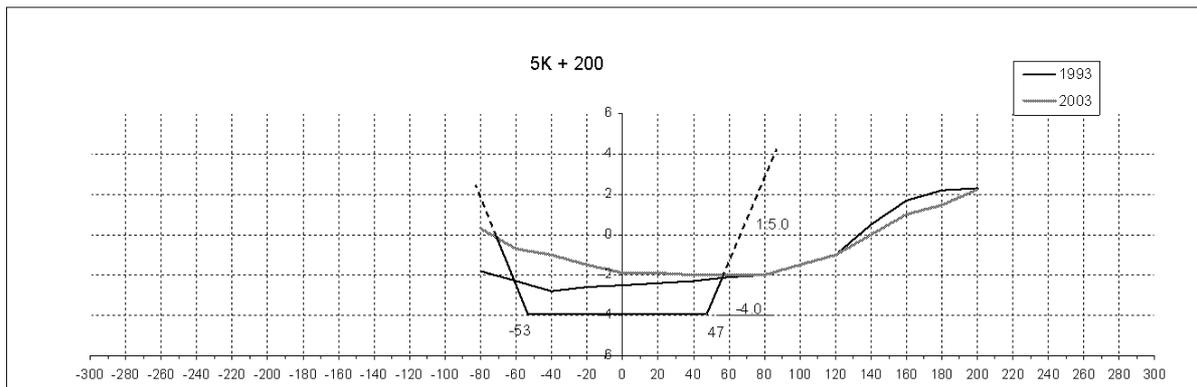
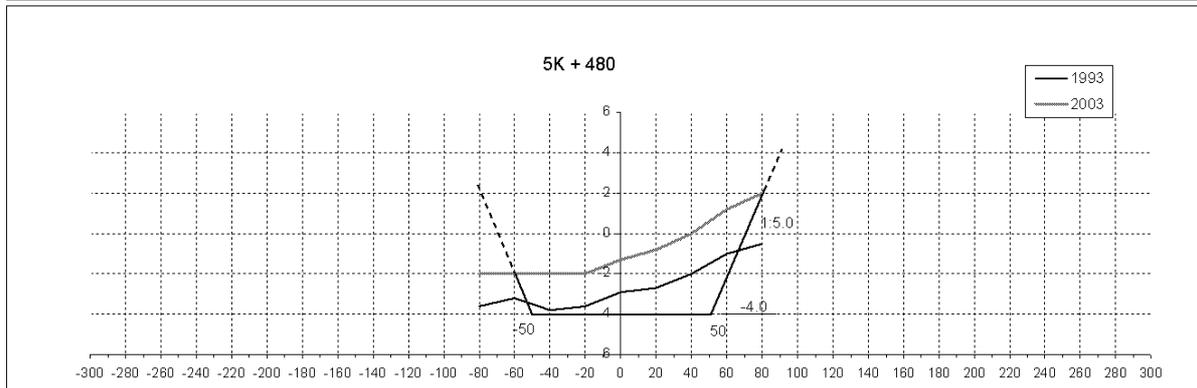
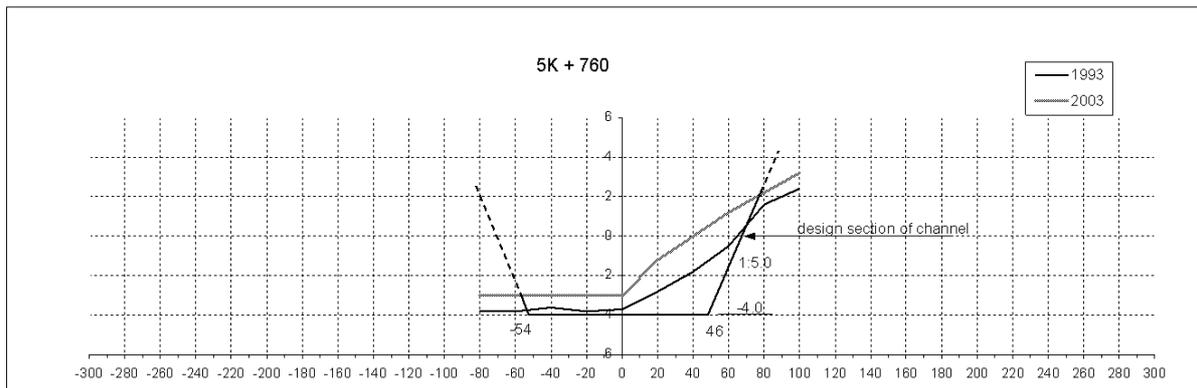
Canal Ribereño de Aguadulce: Cambios en el Canal del Rio (perfil transversal)

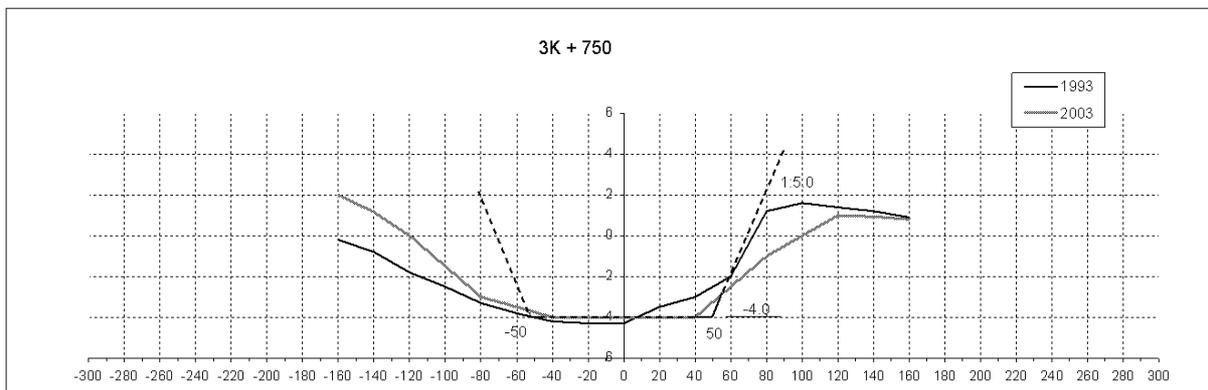
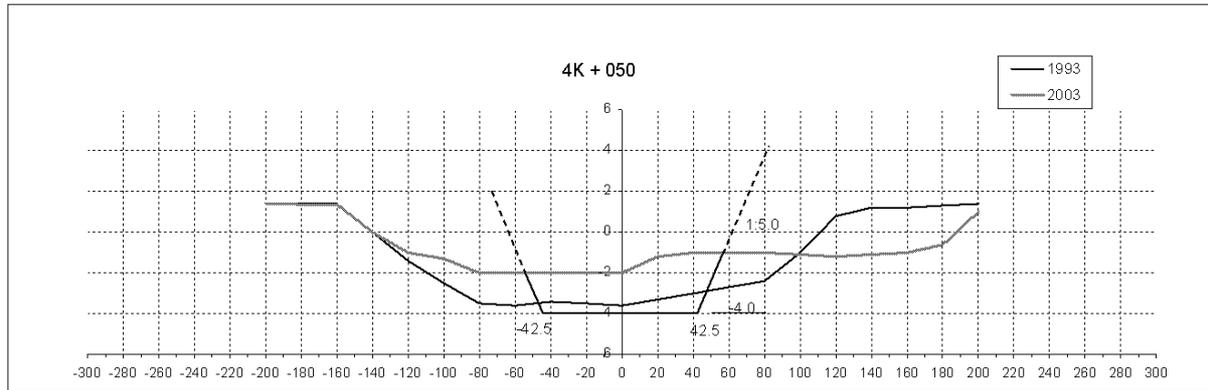
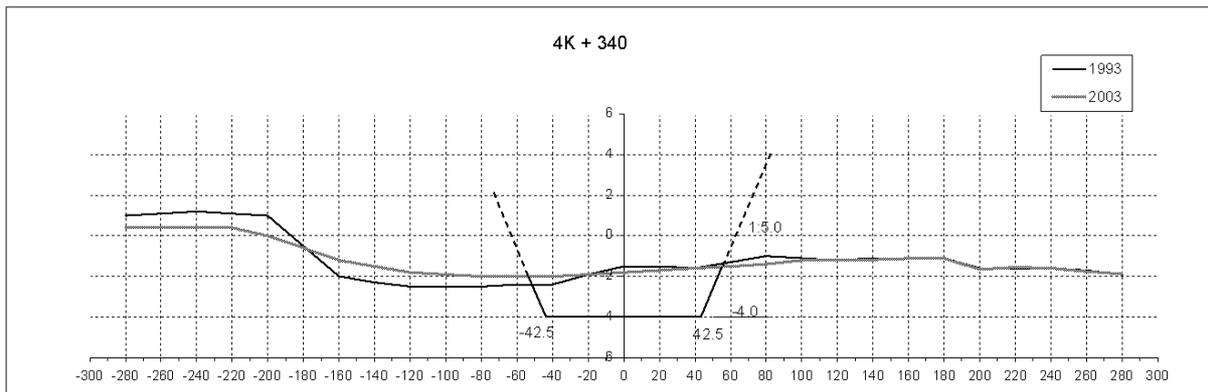
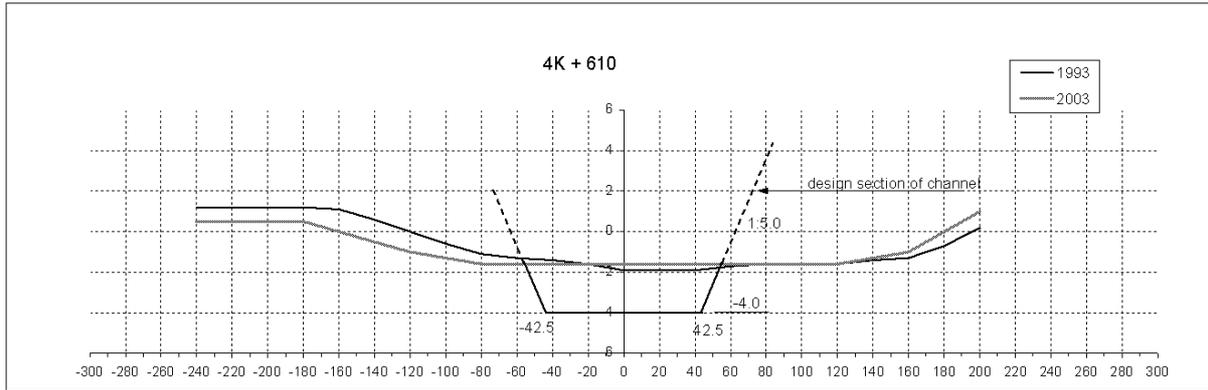


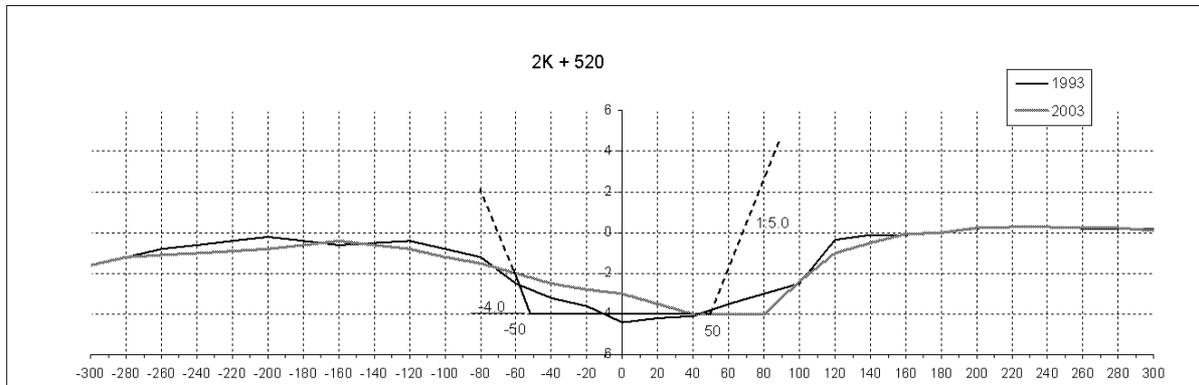
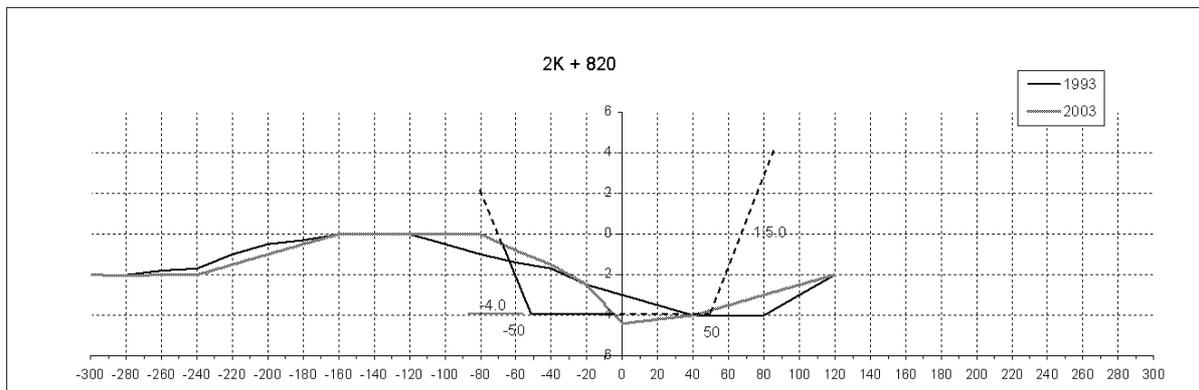
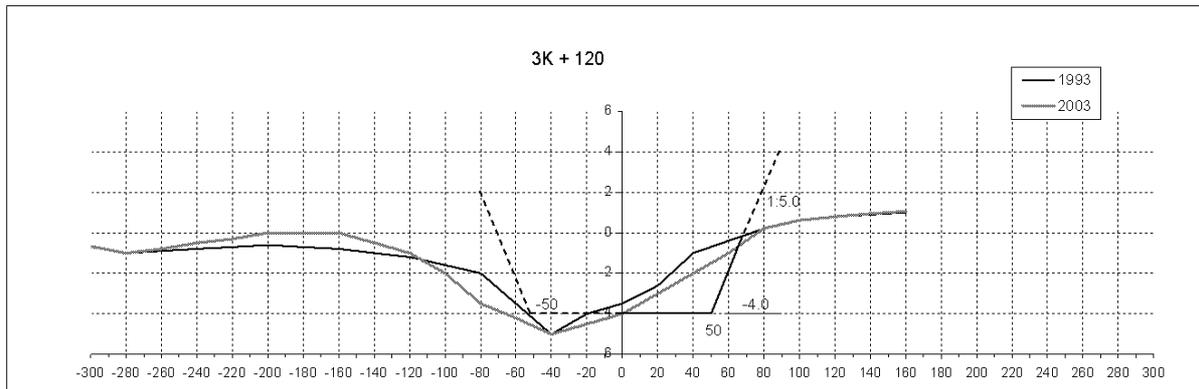
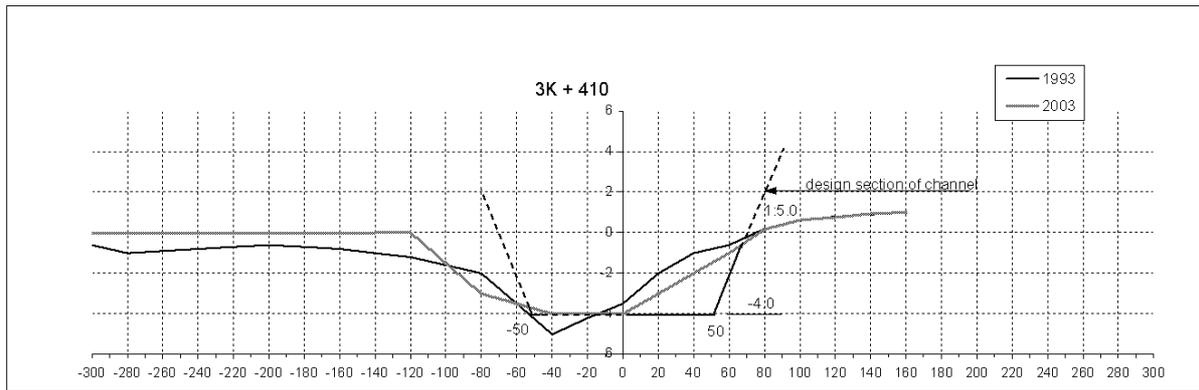


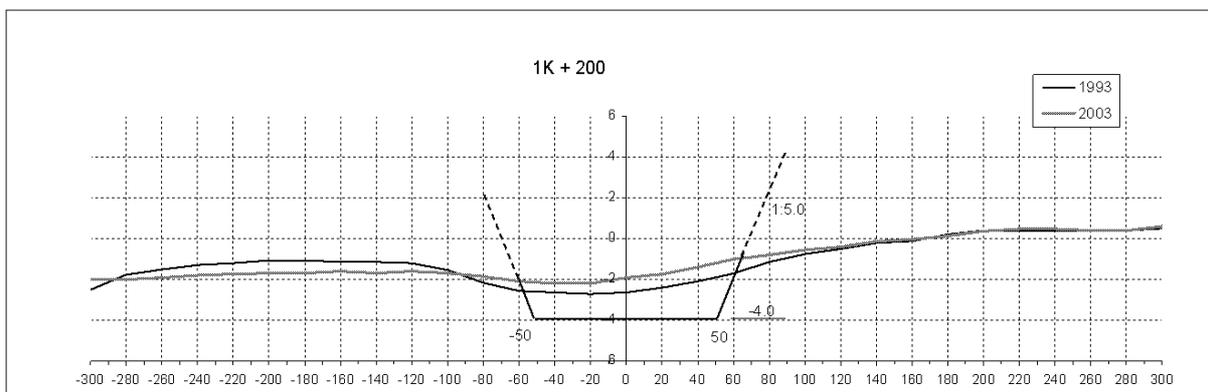
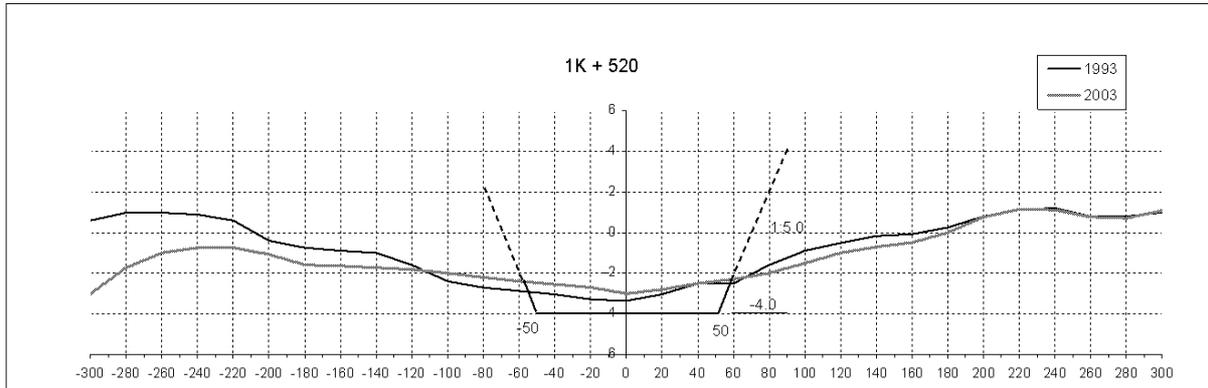
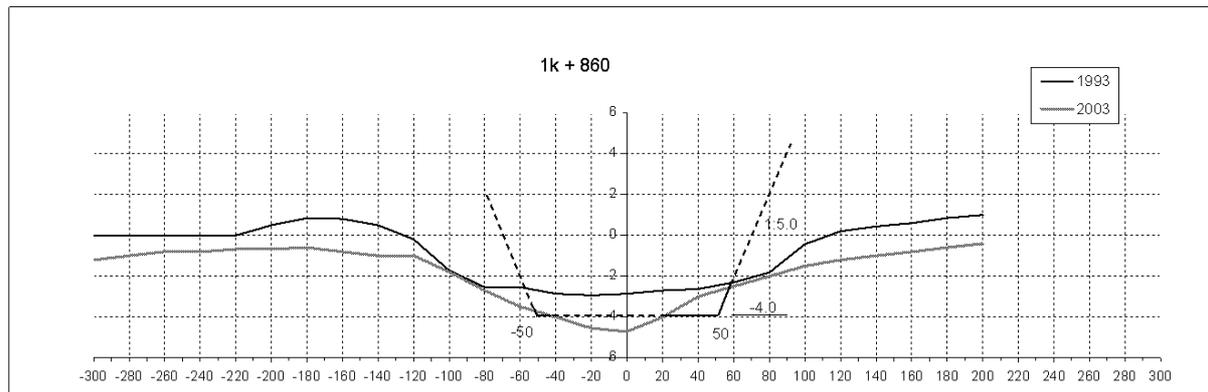
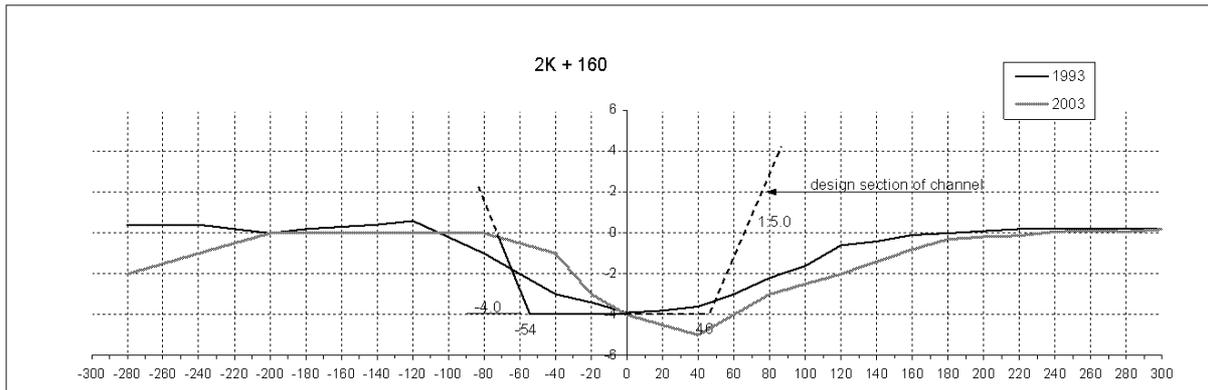


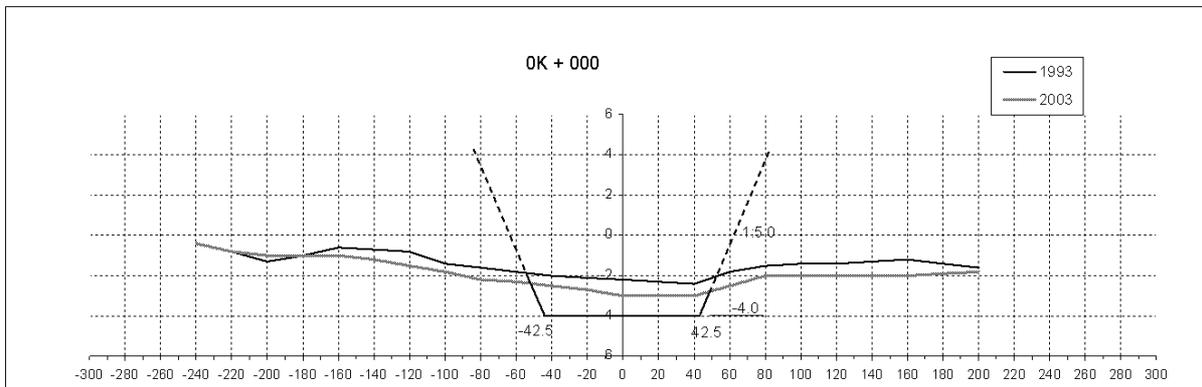
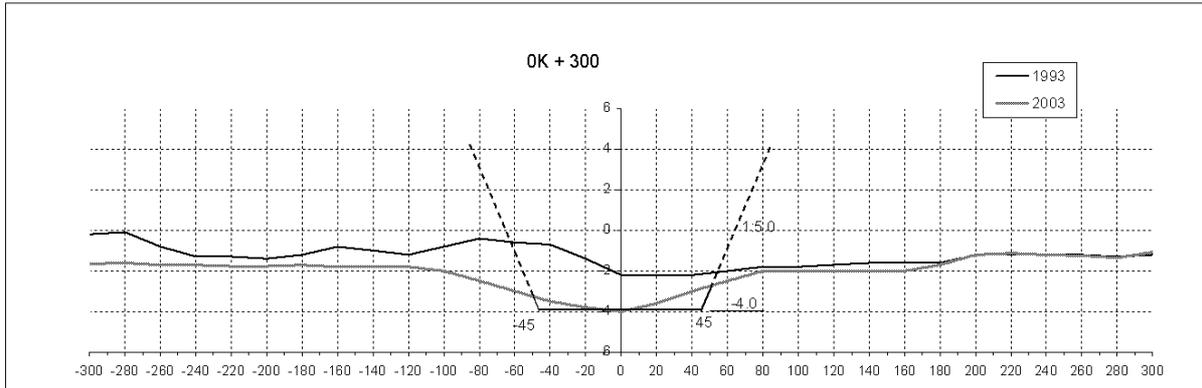
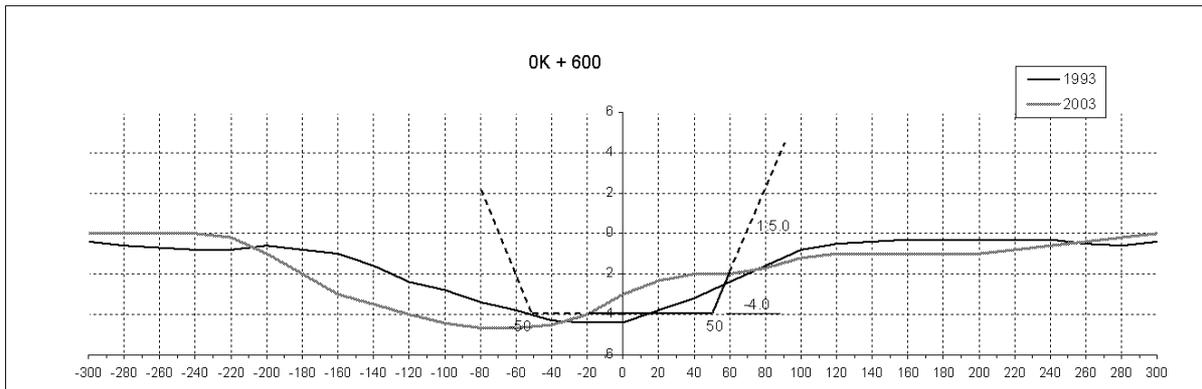
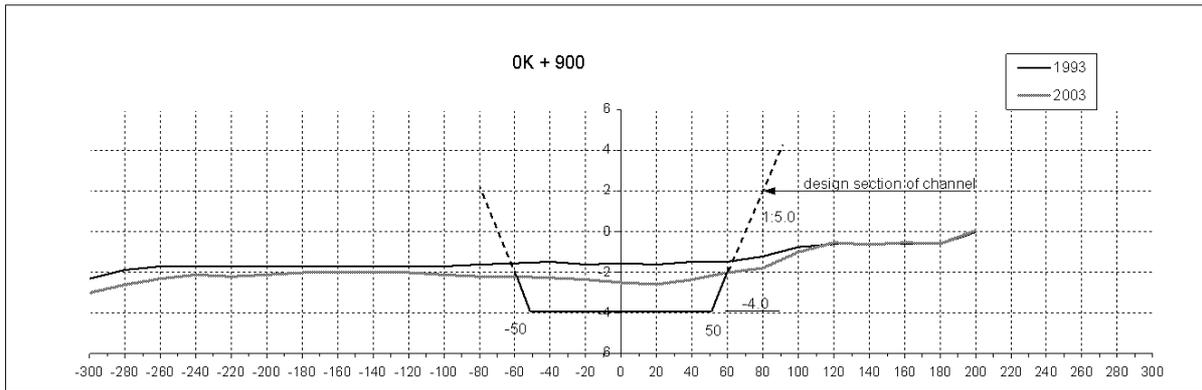


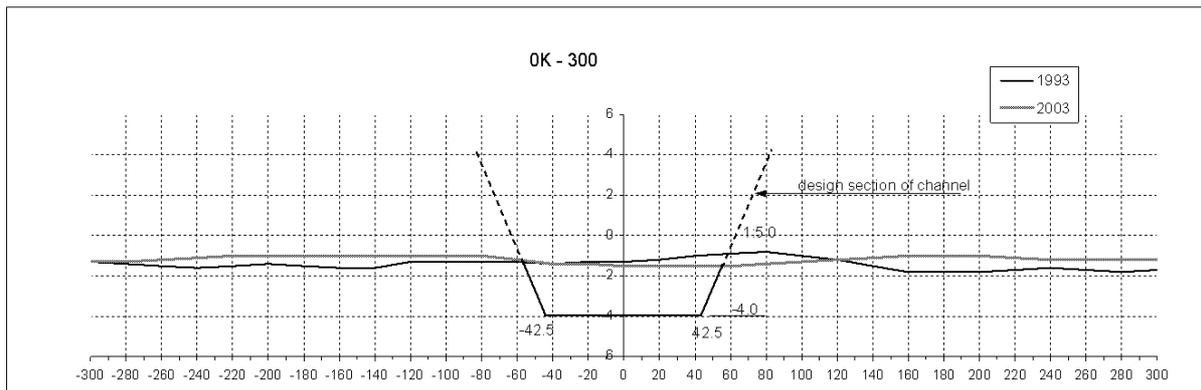


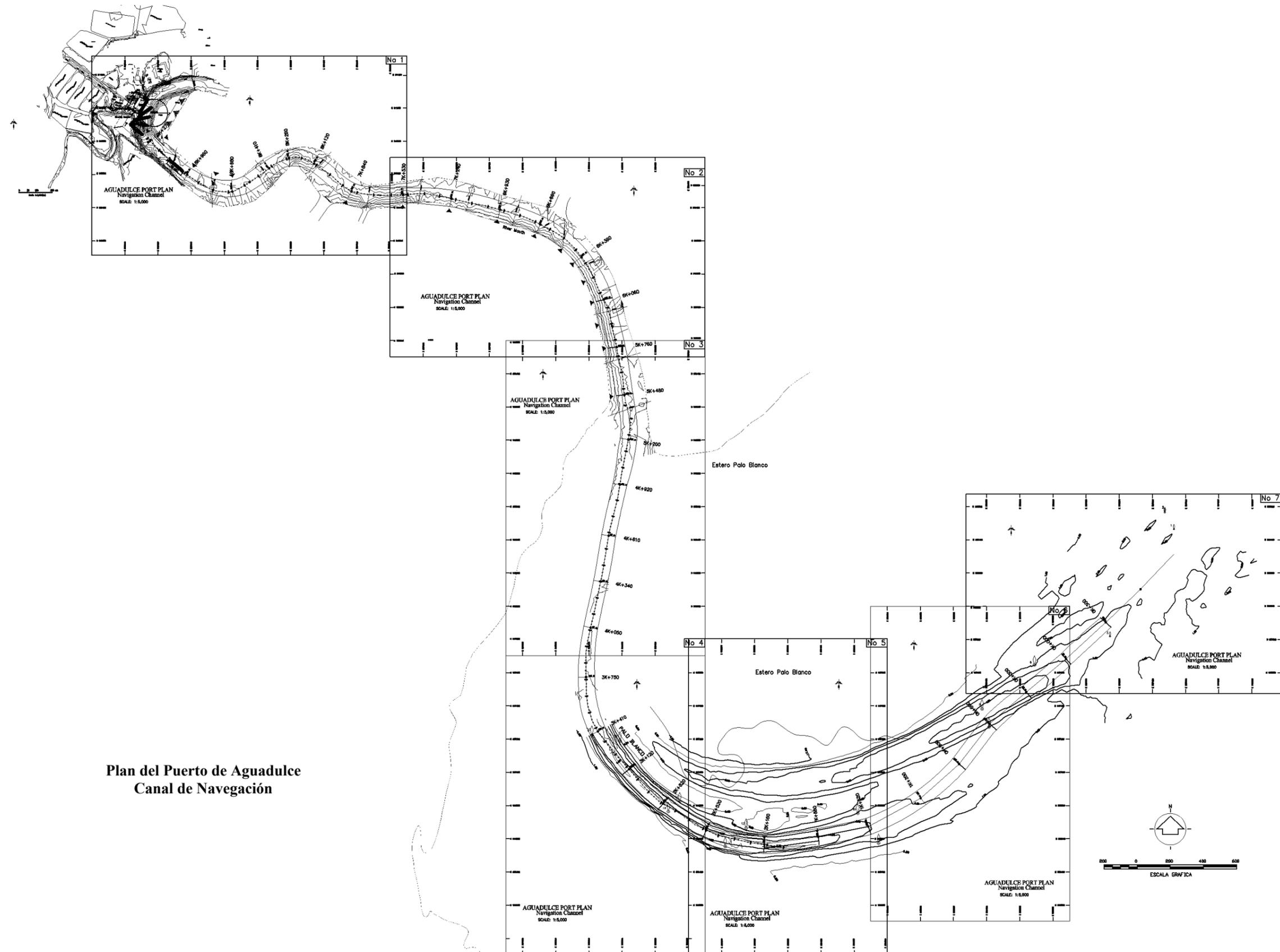




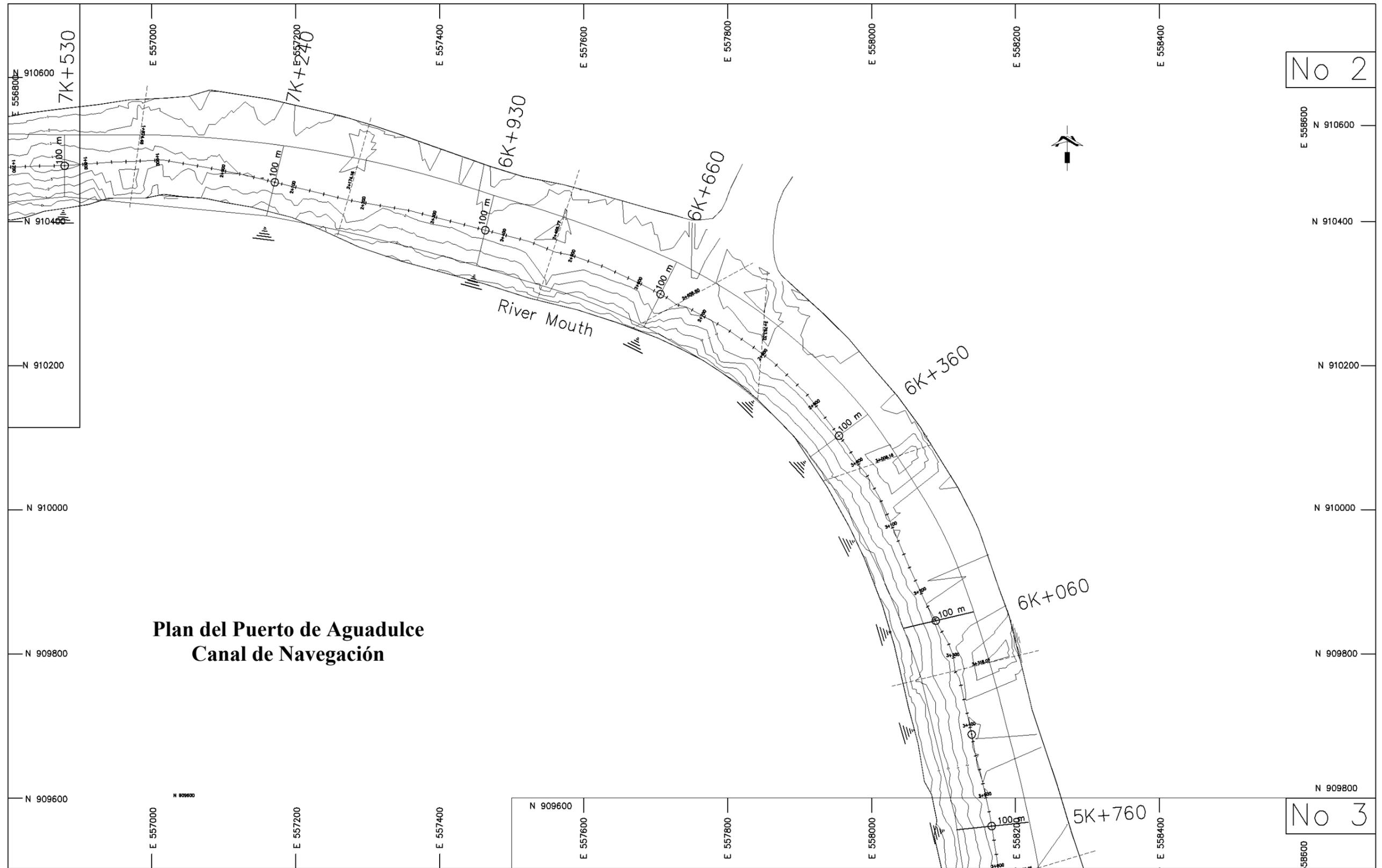


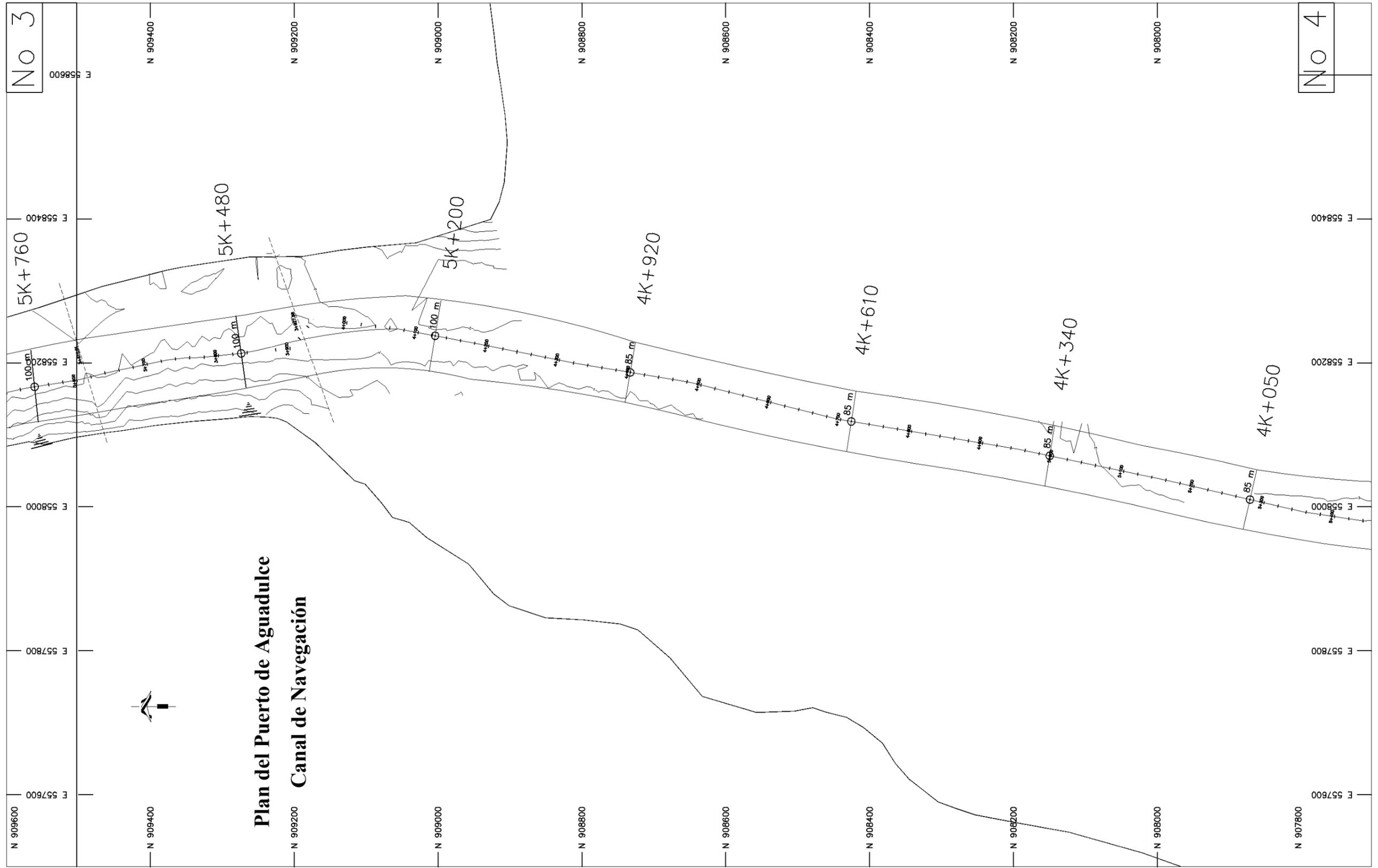


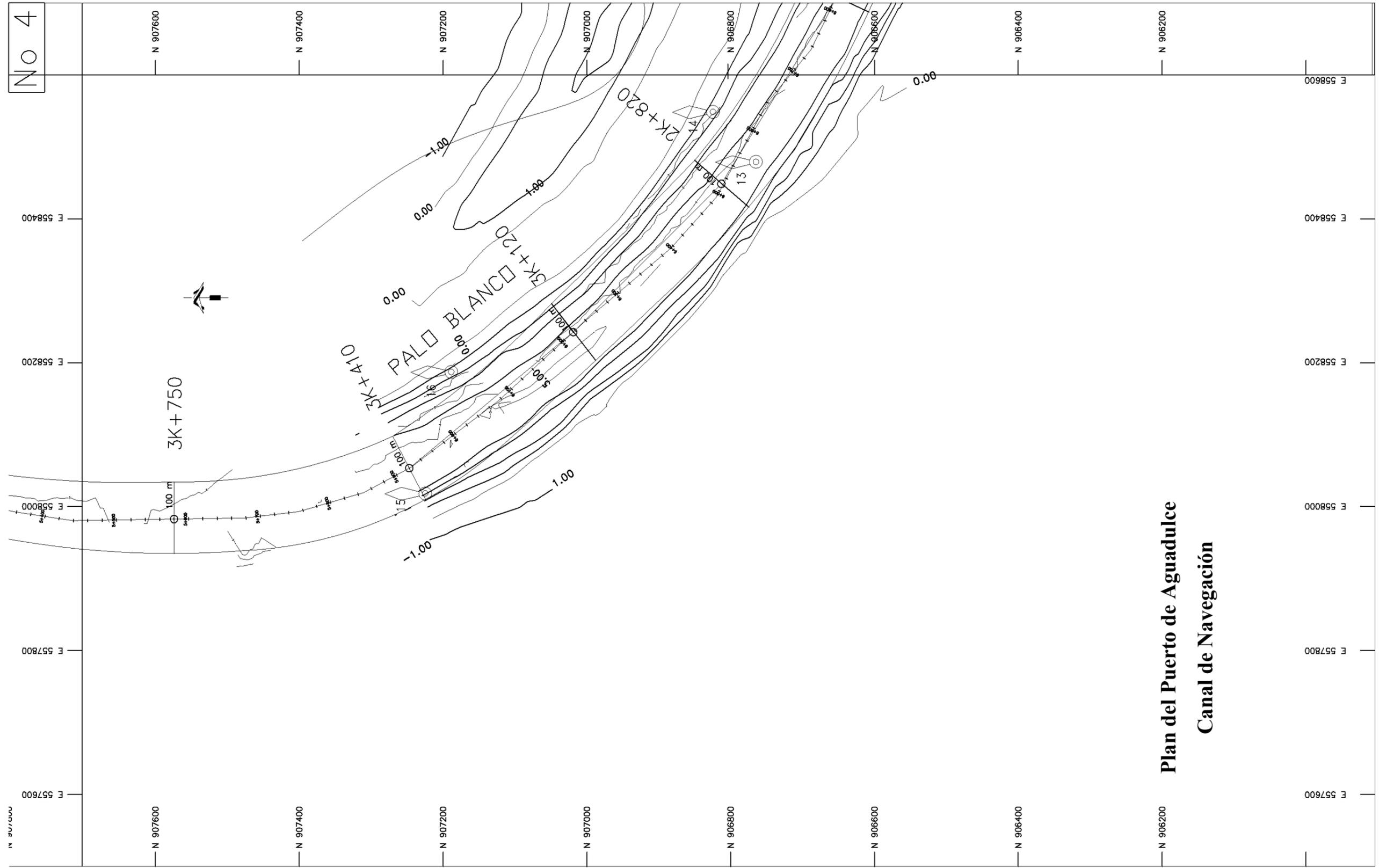


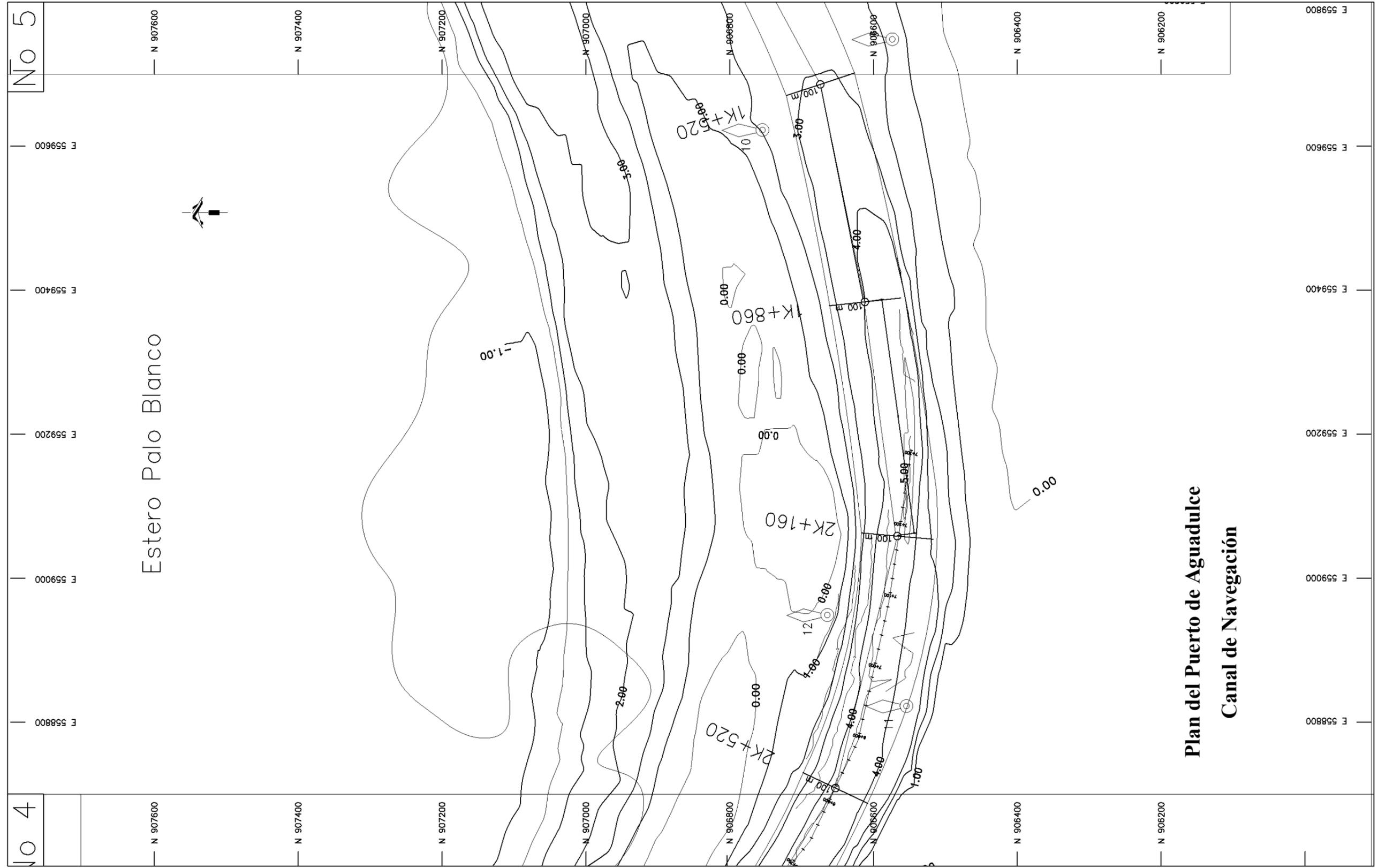


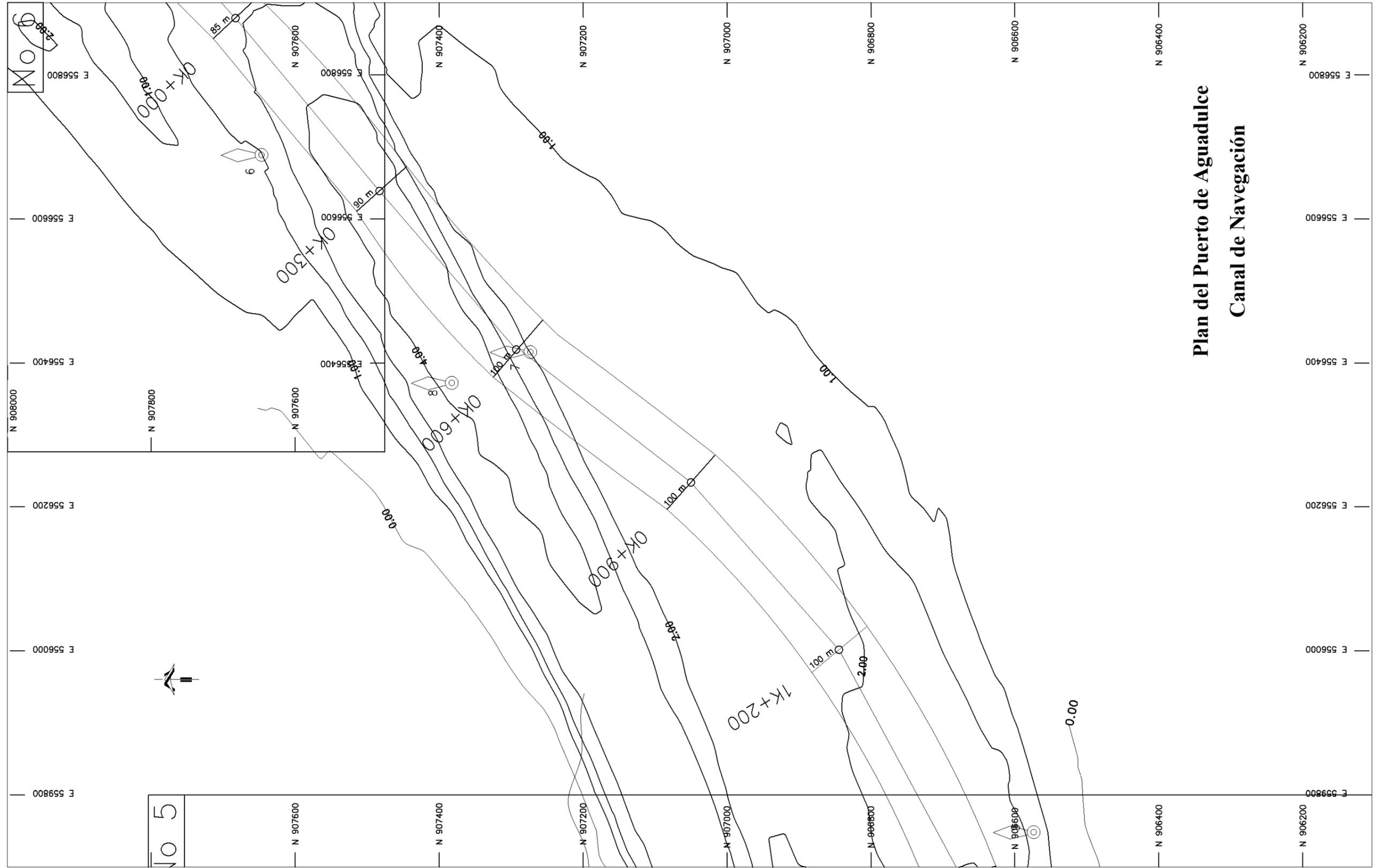
Plan del Puerto de Agudulce
Canal de Navegación

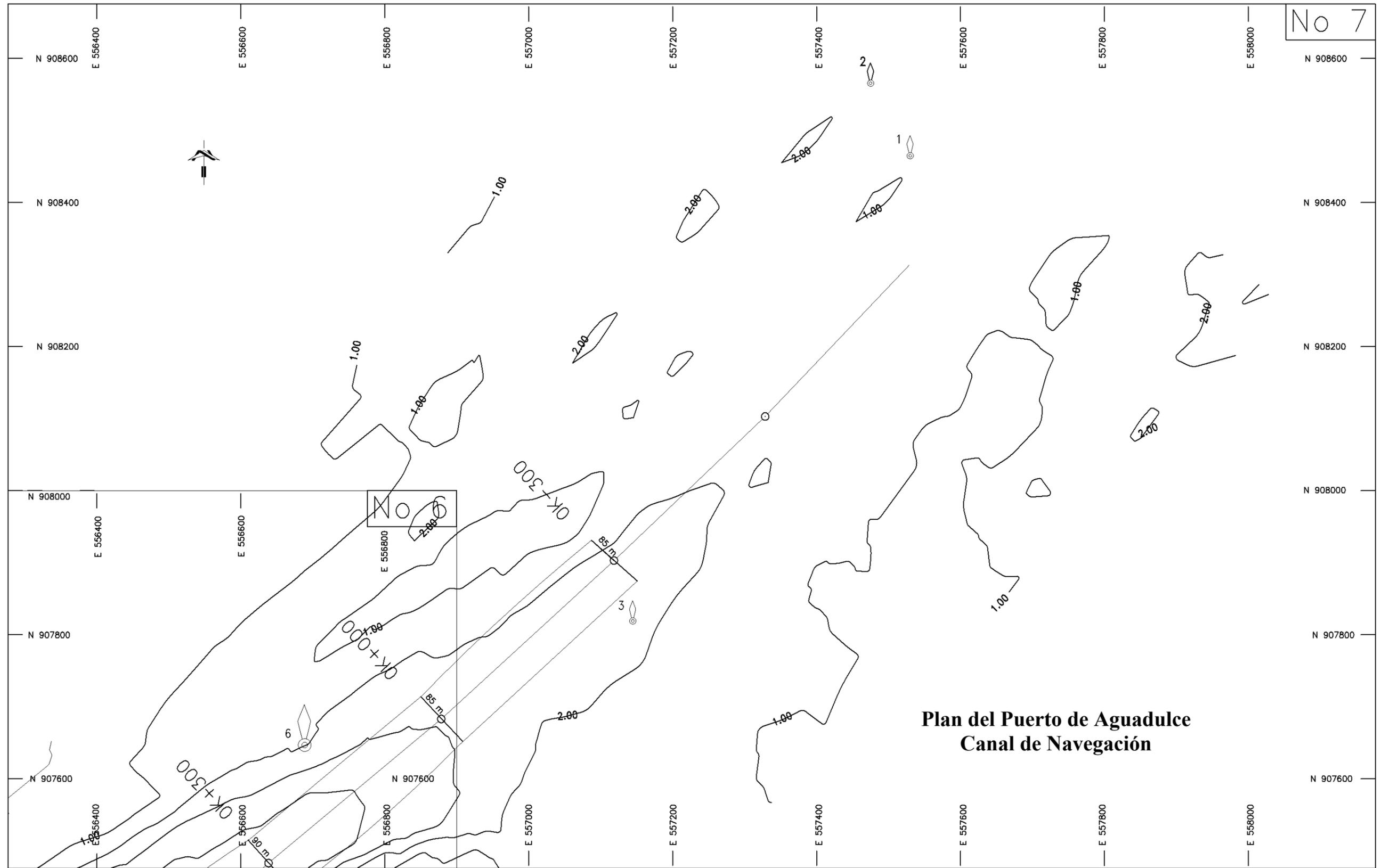












Apéndice E Análisis de Ola en la Costa del Pacífico

E.1 Generalidades

En los puertos candidatos de este Estudio, tres puertos (Puerto de Bocas del Toro, Puerto de Chiriquí (Armuelles) y Puerto de Vacamonte) son afectados por olas de cierta magnitud.

El Puerto de Bocas del Toro está ubicado en la Bahía Almirante circundada por varias islas en la costa Atlántica, así que las olas generadas por el viento son dominantes en la bahía cerrada y la altura y período de las olas son generalmente pequeños debido a la corta longitud expuesta a la acción del viento. Por tanto, la afectación de las olas en el Puerto de Bocas del Toro es escasa y de poca frecuencia.

Por otro lado, hay toda posibilidad que las olas de mar afuera estén afectando directamente al Puerto de Chiriquí (Armuelles) y el Puerto de Vacamonte, en vista que ellos están frente a la costa del Pacífico. Las olas que atacan estos puertos son olas de largo período en vista que la marejada fuera de costa, teniendo gran energía y ocurrencia frecuente. Por tanto las olas tienen que ser consideradas como una de las condiciones críticas en la planificación portuaria o estudio de diseño preliminar.

Aunque existe alguna información¹, en relación al estudio de ola, análisis de ola donde se requiera para la planificación portuaria en este estudio para estos puertos, utilizando los datos recientes disponibles.

E.2 Alcance del Análisis

El análisis de ola para el Puerto de Chiriquí (Armuelles) y el Puerto de Vacamonte se llevaron a cabo para establecer las particularidades de las olas, y especialmente para garantizar los siguientes propósitos:

- **Determinar el diseño de las olas para las instalaciones de protección del nuevo puerto**
- **Examinar la necesidad de las instalaciones de protección del nuevo puerto**
- **Confirmar la pertinencia del alineamiento del nuevo muelle.**

Figura E.2.1 muestra la secuencia de los análisis que incluye dos aspectos para la aproximación:

- El fenómeno de ola fuera de la costa y cerca de la costa (el límite señalado como línea accidentada)
- Tipo de olas para el análisis tales como **olas fuera de la costa, olas de diseño y olas típicas.**

Estas se examinan seguidamente.

¹ LM/TAMS (1981): Estudio de Factibilidad Técnico Económico para un Puerto en Puerto Armuelles, Informe Final Livesey & Henderson (1974): Estudio Puerto Pesquero Fase B, Volumen 3 Ingeniería APN & Ingenieros Consultores (1996): Servicio de Ingeniería para el Mantenimiento Correctivo de la Escollera de Protección de la Ribera del Puerto de Vacamonte, Primer Informe de Progreso

- **Olas fuera de la costa** como las olas mutuas con olas de diseño y olas típicas, se definen en la condición que la profundidad es mayor a la mitad de la longitud de la ola ($h/L > 1/2$) sin deformación por las condiciones topográficas y batimétricas.
- **Olas de diseño** para el diseño estructural se consideran como olas probables con un período de retorno de $R_p=50$ años para las instalaciones portuarias (i.e. olas de diseño fuera de la costa para el cálculo de la deformación de ola, olas de diseño significativo frente a la instalación protectora, etc.)
- **Olas típicas** se asumen como las olas típicamente representada en las particulares de ola fuera de la costa (i. e. olas típicas fuera de la costa etc.).

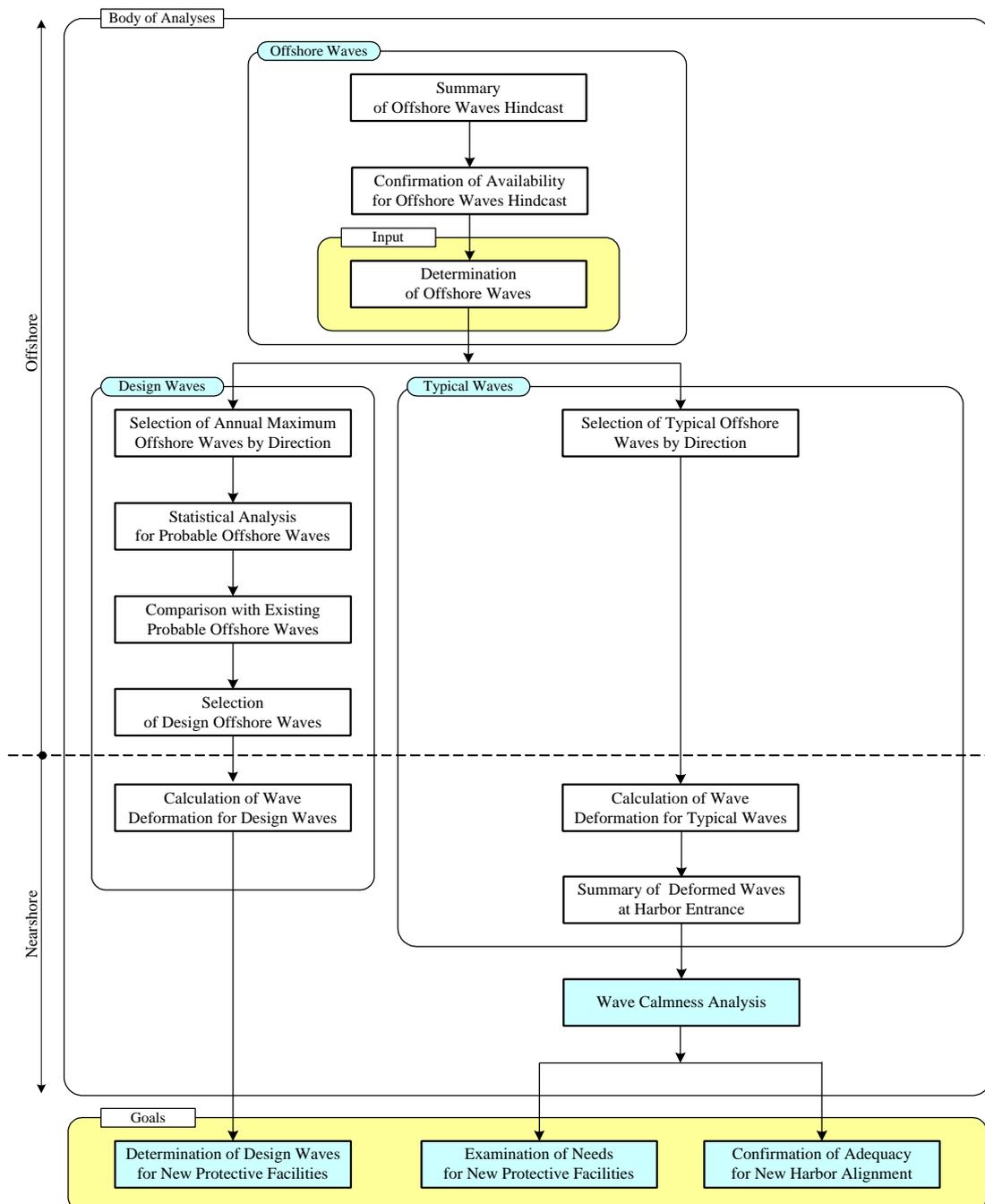


Figura E.2.1 Secuencia del Análisis de Ola

E.3 Metodologías de los Análisis

Las metodologías como elementos clave del análisis (como se indica en la secuencia) se resumen como sigue.

E.3.1 Últimos Datos de Registros Previos del Movimiento de Ola

La fuente de datos de ola para estos análisis es la Base de Datos Previos Globales de Olas del Océano (GWDB) calculada de una nueva tercera generación de modelo de ola JWA3G (JWA3G), que la Asociación Climatológica del Japón (JWA) desarrolló. La Figura E.3.1 muestra la cuadrícula seleccionada para los dos puertos dada por la GWDB. Los últimos datos obtenidos durante cinco años a partir de 1997 a 2001 se utilizan en el análisis.

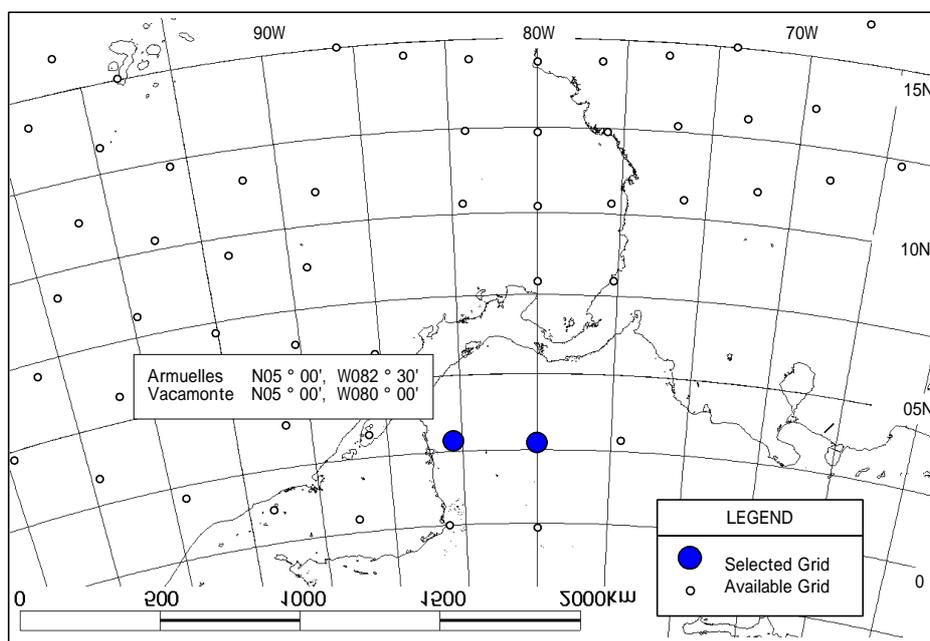


Figura E.3.1 Cuadrícula Seleccionada en la Base de Datos (GWDB)

E.3.2 Análisis Estadístico de Extremos

Con el fin de estimar la ola probable de R_p (período de retorno) = 50 años para ser adoptada para el diseño estructural, un análisis extremo aplicado a los datos de ola máxima anual se seleccionó de los datos recabados. Las olas probables se estimaron mediante cálculo de la probabilidad para no excedente adoptando la función de distribución de Gumbel y Weibull.

E.3.3 Método de Cálculo de Deformación de Ola en Aguas Poco Profundas

Este cálculo estimaría las olas en aguas poco profundas considerando su refracción y falta de profundidad en las dimensiones-2 desde el punto 150-200 m de profundidad de la entrada del muelle (-10 m profundidad). Los cálculos fueron expuestos a las olas típicas para el análisis de la tranquilidad de la ola y olas de diseño en los análisis. La Ecuación del Balance de Energía

establecido por Karlsson², generalmente bien conocido, fue adoptado como modelo numérico de propagación de ola.

La Figura E.3.2 muestra los puntos de entrada de las olas fuera de la costa en el cálculo. Hay una diferencia de puntos originales como se muestra en la Figura E.3.1. No obstante los puntos de entrada pueden ser considerados sólo como el límite entre olas de aguas profundas (fuera de la costa) y olas de aguas poco profundas (cerca de la costa) de un porcentaje de $(h/L > 1/2)$. Las áreas de cálculo de las simulaciones numéricas para ambos puertos se muestran en la Figura E.3.3.

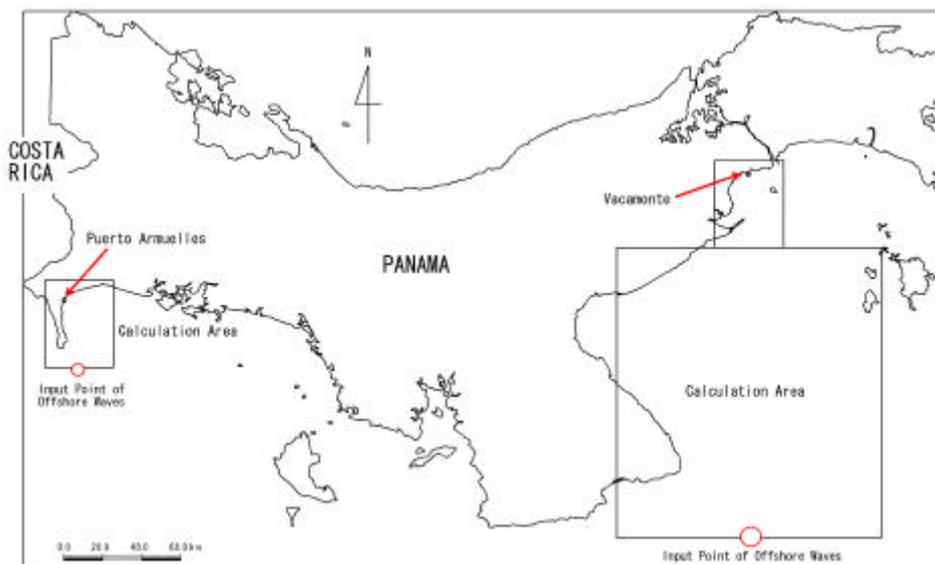


Figura E.3.2 Puntos Entrada Olas Costa Afuera en Cálculo Deformación Ola

E.3.4 Análisis de Tranquilidad de Ola en el Puerto

El análisis de la tranquilidad de la ola incluye dos aspectos: cálculo de las olas en el muelle y el examen del porcentaje de trabajo para el manejo de la carga con un valor para altura de la entrada de la ola en unos puntos meta. Para la reflexión y difracción de la ola dentro del puerto, las olas dentro del puerto se calcularon en condiciones de entrada como olas transmitidas sin rompe olas en la entrada del puerto (-10m profundidad). Un métodos establecido por Takayama³ fue adoptado como el modelo básico para la reflexión y difracción de ola dentro del puerto.

El alineamiento del nuevo puerto de Chiriqui (Armuelles) en el requerimiento como se menciona en el informe principal, se muestra en la Figura E.3.4. El alineamiento del muelle para el puerto de Vacamonte, como también se describe en la Figura E.3.4, adoptó capas existentes para confirmar la disponibilidad futura sobre la capa existente sin ninguna expansión del puerto. La Figura E.3.5 muestra la secuencia general del análisis de tranquilidad de ola.

² Karlsson (1969): Refraction of Continuous Ocean Wave Spectra, J. Waterways and Harbors Division, Proc. ASCE, Vol. 95, pp 437 - 448

³ Takayama (1981): Wave Diffraction and Wave Height Distribution in a Harbor, Technical Note of the Port & Harbor Research Institute, No. 367, pp 1 - 140

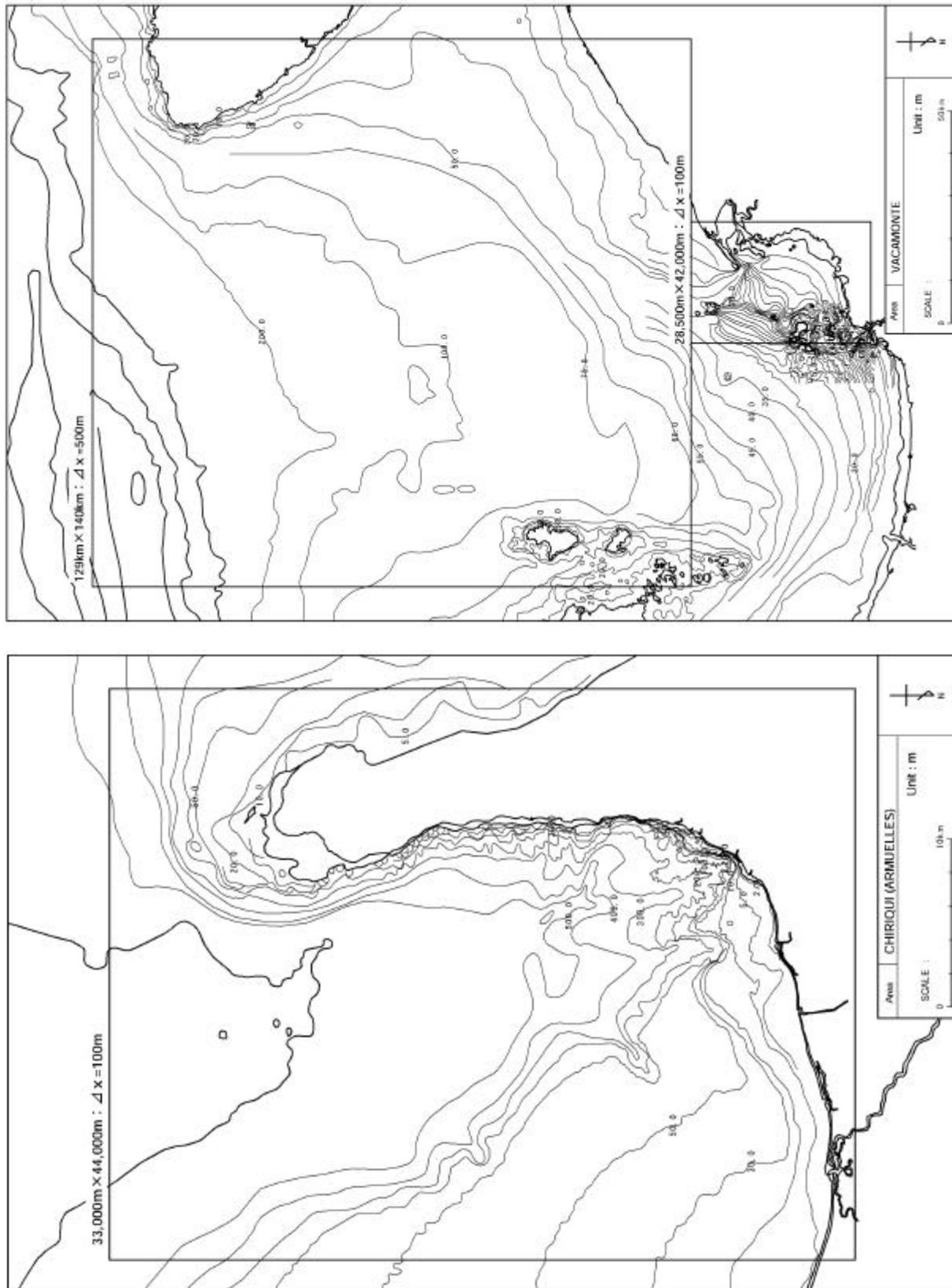
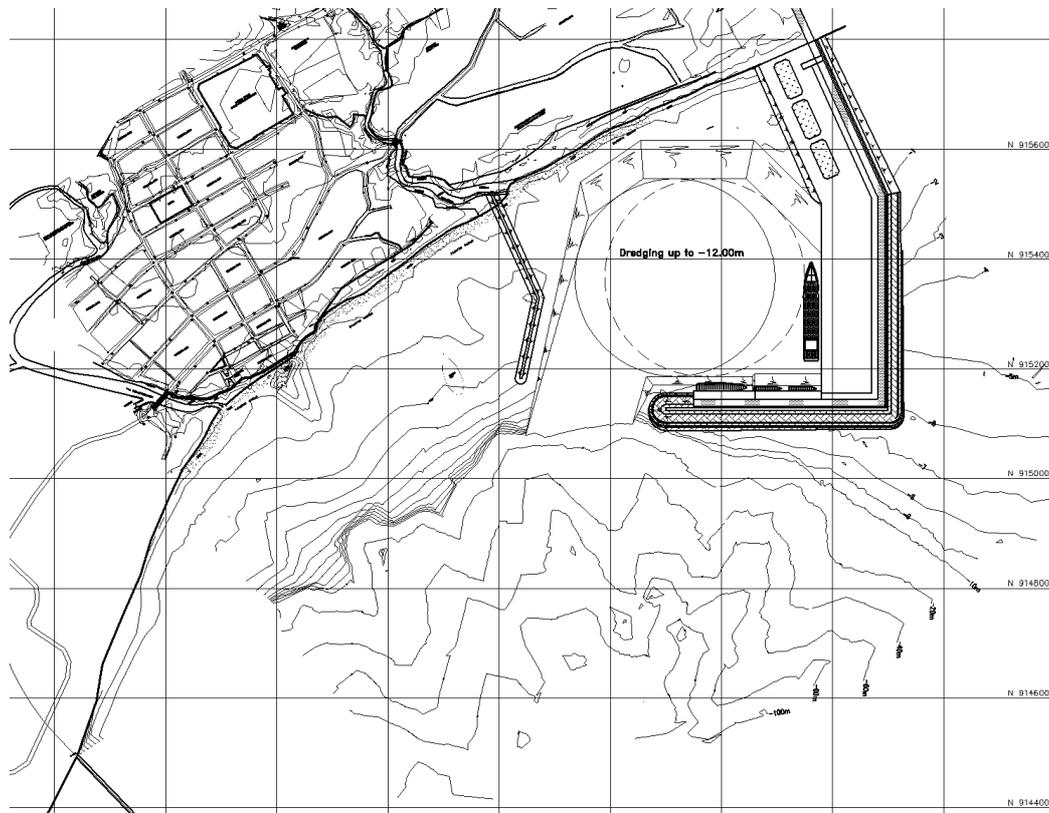


Figura E.3.3 Áreas de Cálculo de Deformación de Ola para Chiriqui (Armuelles) y Vacamonte

(a) Puerto Chiriqui (Armuelles)



(b) Puerto Vacamonte



Figura E.3.4 Alineamiento del Muelle para Análisis Tranquilidad de Ola

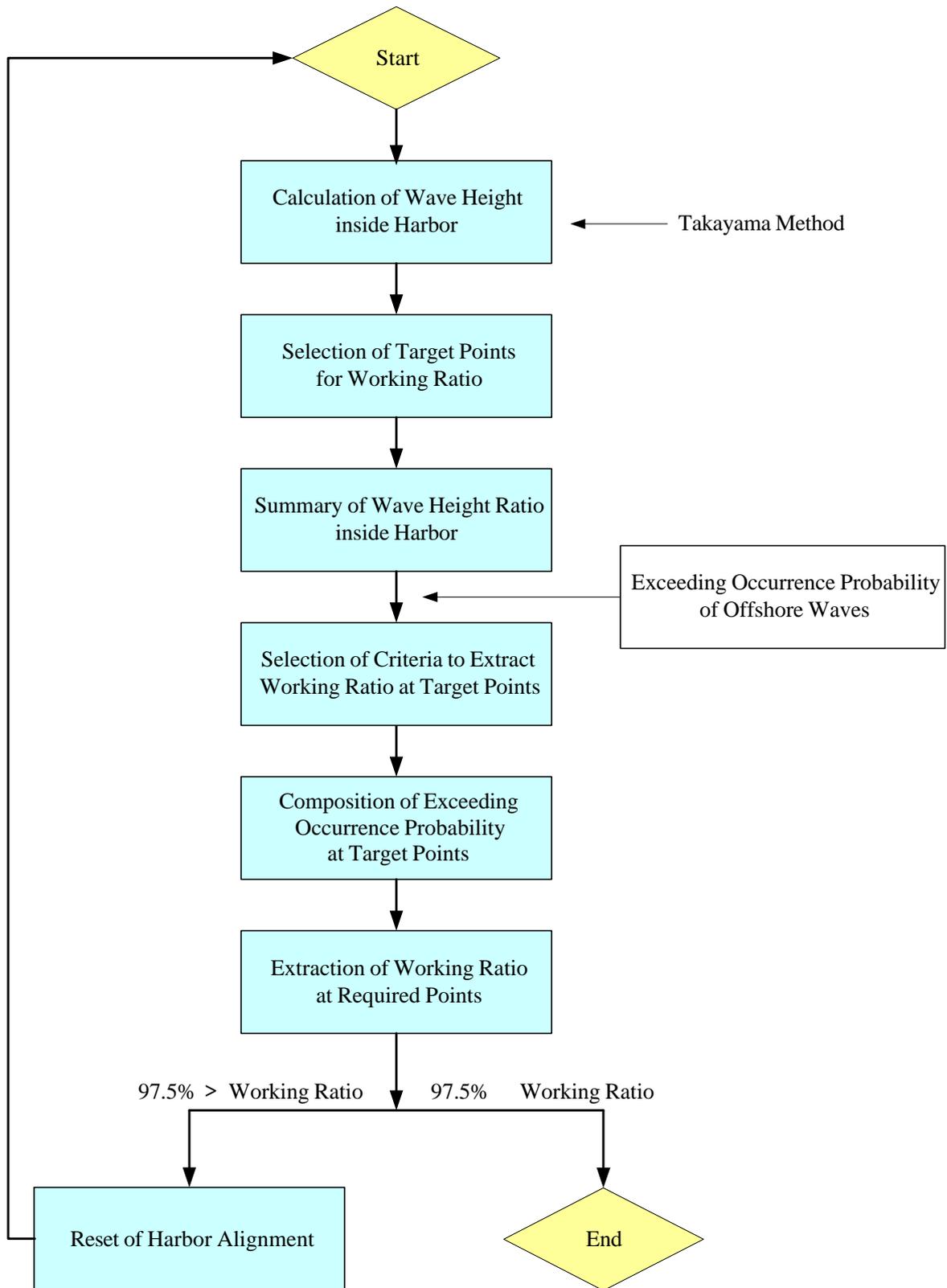


Figura E.3.5 Secuencia General de Análisis de Tranquilidad de Ola

E.4 Resultados del Análisis

E.4.1 Estudio de las Olas Costa Afuera

(1) Resumen del Registro Previo de Olas Costa Afuera con GWDB

- 1) Registro Previo de Olas Costa Afuera en Punto de Cuadrícula adoptado para Chiriqui (Armuelles)

La Figura E.4.1 describe los datos recabados en serie de tiempos, y la Tabla E.4.1 y Figura E.4.2 resume la frecuencia de ocurrencia de ola costa afuera de Chiriqui (Armuelles) (N050°0', W082°30'). De la tabla y figuras, se caracteriza que:

- Dirección de la ola es principalmente dominante en dirección SSW
- Las máximas olas son H=4.3 m , T=12.6 sec, de SSW
- Las olas promedio son H=1.3 m, T=6.5 sec, de SSW
- La energía media de las olas calculadas es H=1.6 m, T=6.5 sec, de SSW
- Las olas entrantes entre S y WSW son cerca del 70% de la frecuencia de ocurrencia.

- 2) Registro Previo de Olas Costa Afuera en Punto de Cuadrícula Adoptado para Vacamonte

La Figura E.4.3 presenta los datos recabados en series de tiempo, la Tabla E.4.2 y la Figura E.4.4 resume la frecuencia de ocurrencia de ola fuera de la costa de Vacamonte (N050°0', W082°00'). De la tabla y las figuras, se caracteriza que:

- La dirección de la ola es especialmente dominante en dirección SW-SSW, excepto por la dirección N
- Las máximas olas son H=3.7 m, T=15.0 sec, de SW
- Las olas promedio son H=1.3 m, T=5.2 sec, de W
- La energía media de las olas calculadas es H=1.6 m, T=5.2 sec, de SW
- Las olas entrantes entre S y WSW son cerca del 60% de la frecuencia de ocurrencia.

(2) Confirmación de la Disponibilidad de Registro Previo de Olas Costa Afuera

Los datos existentes anotados seguidos fueron utilizados con el fin de examinar la validez de los datos GWDB:

- Marina EEUU, Estadísticas **SSMO**
- NCC/NOAA⁴, **MARSDEN SQUARE 009 (MS-009)**
- Oficina Meteorológica Británica, **MARSDEN SQUARE 8-55 (MS 8-55)**.

Cada detalle examinado para Chiriqui (Armuelles) y Vacamonte se presenta seguido.

⁴ National Climate Center (NCC) & National Oceanic and Atmospheric Administration (NOAA), USA

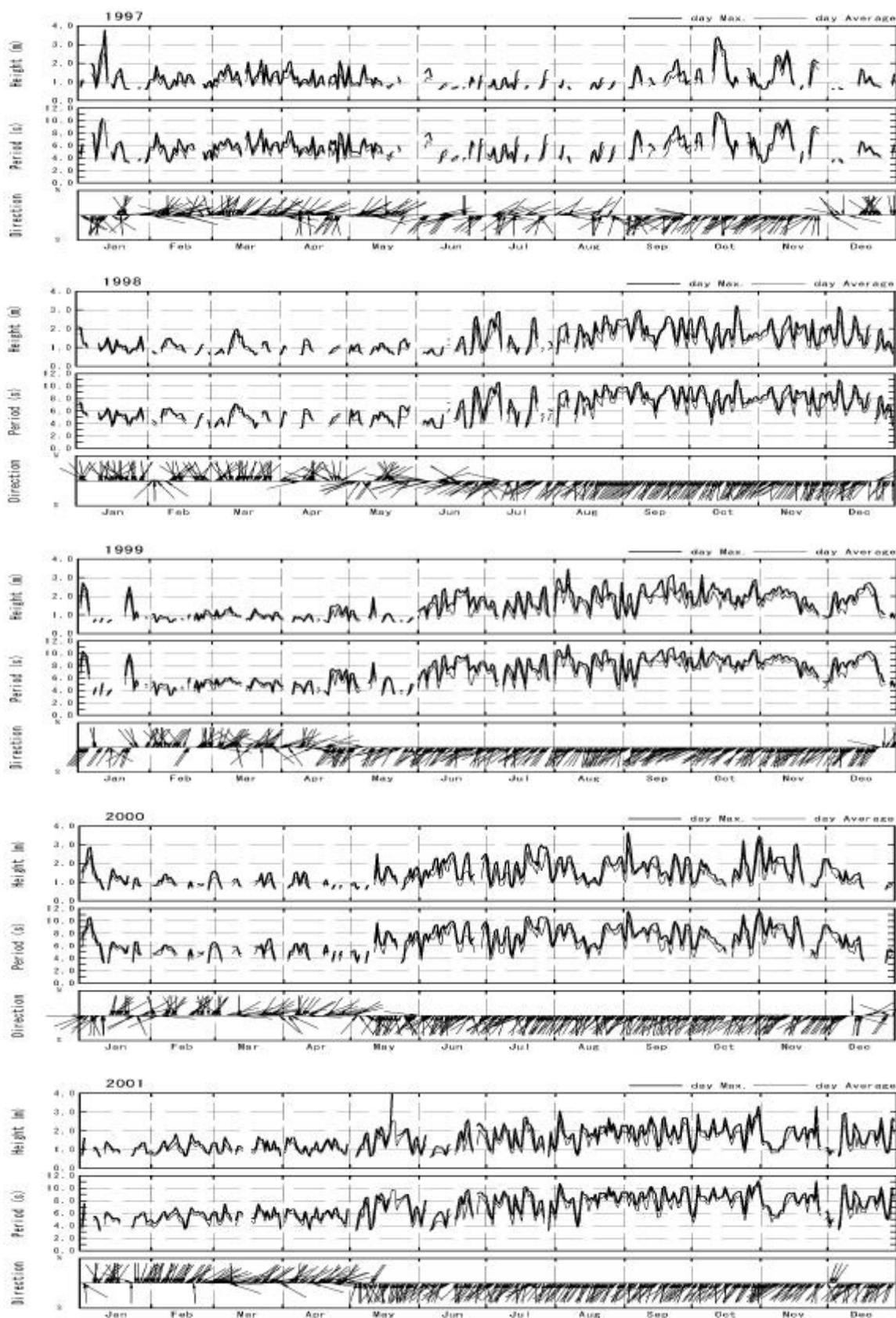
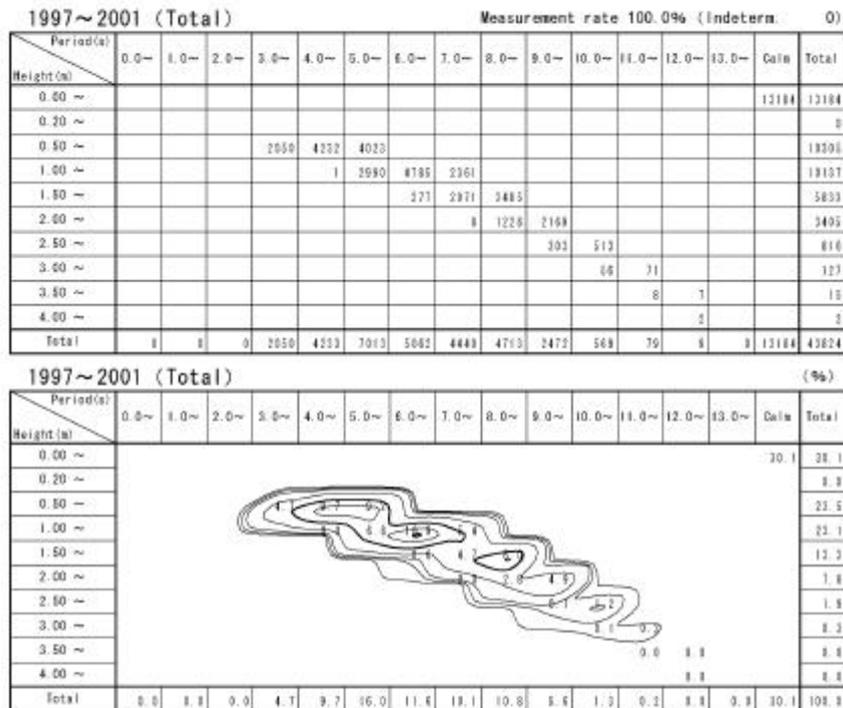


Figura E.4.1 Registro de Datos de Ola Costa Afuera en Series de Tiempo (N050°0', W082°30')

Tabla E.4.1 Frecuencias de Ocurrencia de Ola Costa Afuera (N050°0', W082°30')

(a) Altura de Ola vs. Período de Ola



(b) Altura de Ola vs. Dirección de la Ola

1997~2001 (Total) Measurement rate 100.0% (Indeterm. 0)

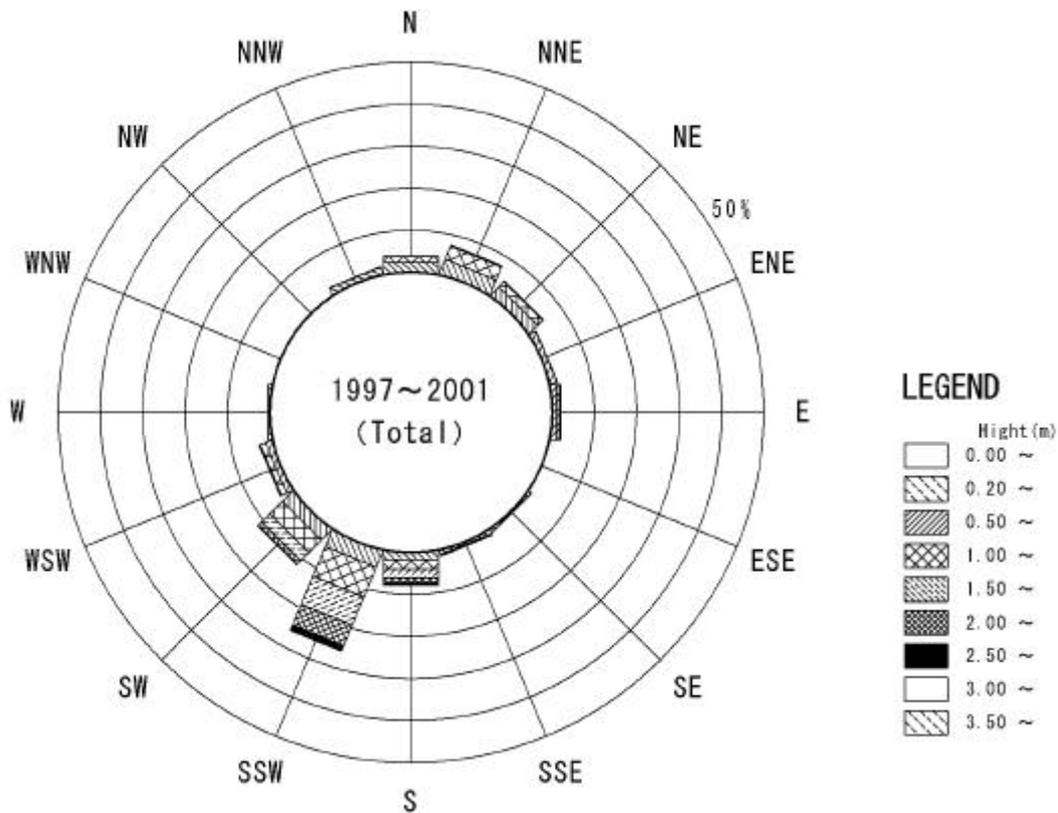
| Direction \ Height(m) | NNE | NE | ENE | E | ESE | SE | SSE | S | SSW | SW | WSW | W | WNW | NW | NNW | N | Calm | Total |
|-----------------------|------|------|-----|-----|-----|-----|-----|------|-------|------|------|-----|-----|-----|-----|------|-------|-------|
| 0.00 ~ | | | | | | | | | | | | | | | | | 13184 | 13184 |
| 0.20 ~ | | | | | | | | | | | | | | | | | | 0 |
| 0.50 ~ | 1495 | 1806 | 846 | 440 | 180 | 161 | 246 | 724 | 1702 | 1358 | 681 | 120 | 120 | 189 | 507 | 1839 | | 19305 |
| 1.00 ~ | 1464 | 743 | 56 | 311 | 12 | 17 | 62 | 966 | 3241 | 1804 | 638 | 81 | 10 | 8 | 77 | 634 | | 19137 |
| 1.50 ~ | 834 | 93 | | 80 | 11 | | 60 | 902 | 3172 | 1164 | 131 | 6 | | | 1 | 66 | | 5833 |
| 2.00 ~ | | 5 | | 8 | 3 | | 19 | 300 | 2342 | 604 | 25 | | | | | | | 3405 |
| 2.50 ~ | | | | | | | 8 | 195 | 634 | 77 | 3 | | | | | | | 816 |
| 3.00 ~ | | | | | | | | 60 | 69 | 8 | | | | | | | | 127 |
| 3.50 ~ | | | | | | | | | 17 | | | | | | | | | 17 |
| Total | 3894 | 1907 | 605 | 849 | 130 | 168 | 425 | 3377 | 11167 | 4957 | 1237 | 210 | 123 | 117 | 635 | 1639 | 13184 | 43824 |

(c) Período de Ola vs. Dirección de la Ola

1997~2001 (Total) Measurement rate 100.0% (Indeterm. 0)

| Direction \ Period(s) | NNE | NE | ENE | E | ESE | SE | SSE | S | SSW | SW | WSW | W | WNW | NW | NNW | N | Calm | Total |
|-----------------------|------|------|-----|-----|-----|-----|-----|------|-------|------|------|-----|-----|-----|-----|------|-------|-------|
| 0.0 ~ | | | | | | | | | | | | | | | | | 13184 | 13184 |
| 1.0 ~ | | | | | | | | | | | | | | | | | | 0 |
| 2.0 ~ | | | | | | | | | | | | | | | | | | 0 |
| 3.0 ~ | 235 | 183 | 150 | 93 | 25 | 63 | 184 | 117 | 284 | 238 | 143 | 67 | 38 | 67 | 86 | 189 | | 2808 |
| 4.0 ~ | 864 | 633 | 328 | 89 | 44 | 59 | 90 | 166 | 354 | 293 | 153 | 39 | 49 | 52 | 407 | 742 | | 4233 |
| 5.0 ~ | 1582 | 879 | 119 | 395 | 32 | 25 | 67 | 472 | 1285 | 850 | 328 | 25 | 45 | 18 | 141 | 850 | | 7913 |
| 6.0 ~ | 413 | 280 | 8 | 169 | 5 | 11 | 58 | 565 | 1808 | 1191 | 241 | 65 | | | 3 | 136 | | 5865 |
| 7.0 ~ | | 33 | | 85 | 18 | | 51 | 785 | 2273 | 1857 | 183 | 13 | | | | 3 | | 4440 |
| 8.0 ~ | | | | 17 | 4 | | 32 | 665 | 2969 | 946 | 78 | 2 | | | | | | 4713 |
| 9.0 ~ | | | | | | | 19 | 826 | 1703 | 311 | 13 | | | | | | | 2472 |
| 10.0 ~ | | | | | | | 4 | 141 | 363 | 56 | | | | | | | | 569 |
| 11.0 ~ | | | | | | | | 40 | 37 | 2 | | | | | | | | 79 |
| 12.0 ~ | | | | | | | | | 9 | | | | | | | | | 9 |
| 13.0 ~ | | | | | | | | | | | | | | | | | | 0 |
| Total | 3894 | 1907 | 605 | 849 | 130 | 168 | 425 | 3377 | 11167 | 4957 | 1237 | 210 | 123 | 117 | 635 | 1639 | 13184 | 43824 |

(a) Altura de Ola vs. Dirección de la Ola



(b) Período de Ola vs. Dirección de la Ola

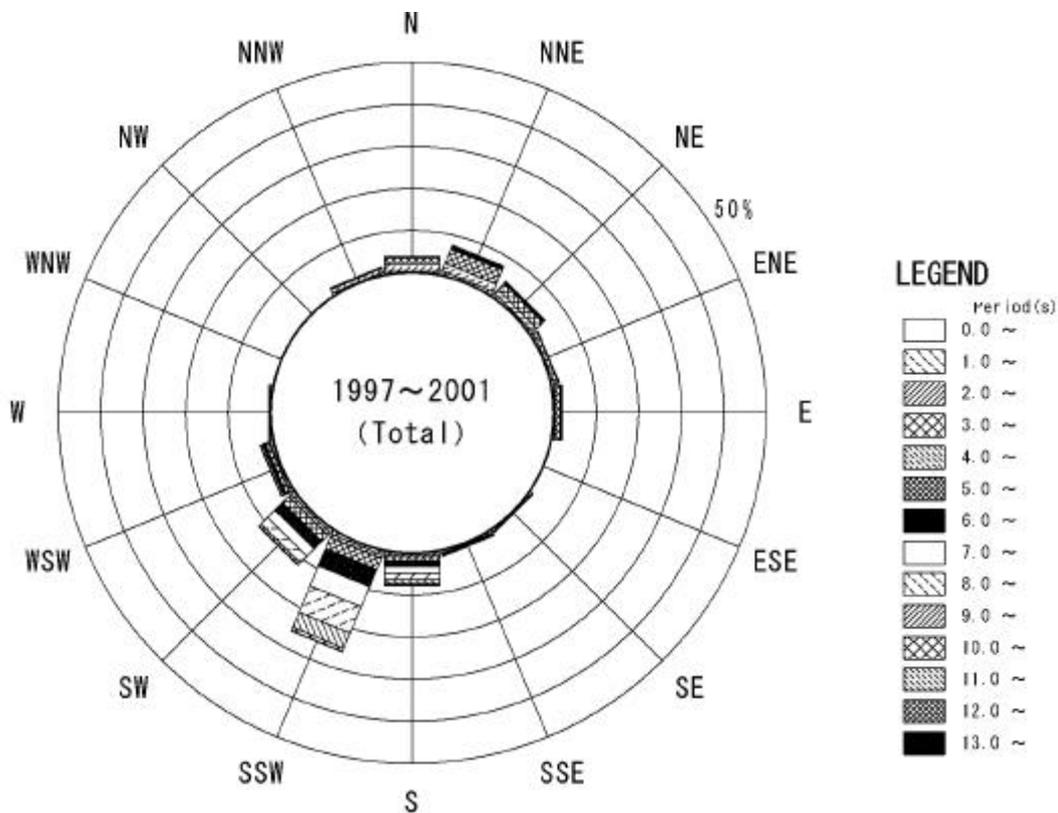


Figura E.4.2 Rosas de Ola Costa Afuera (N050°0', W082°30')

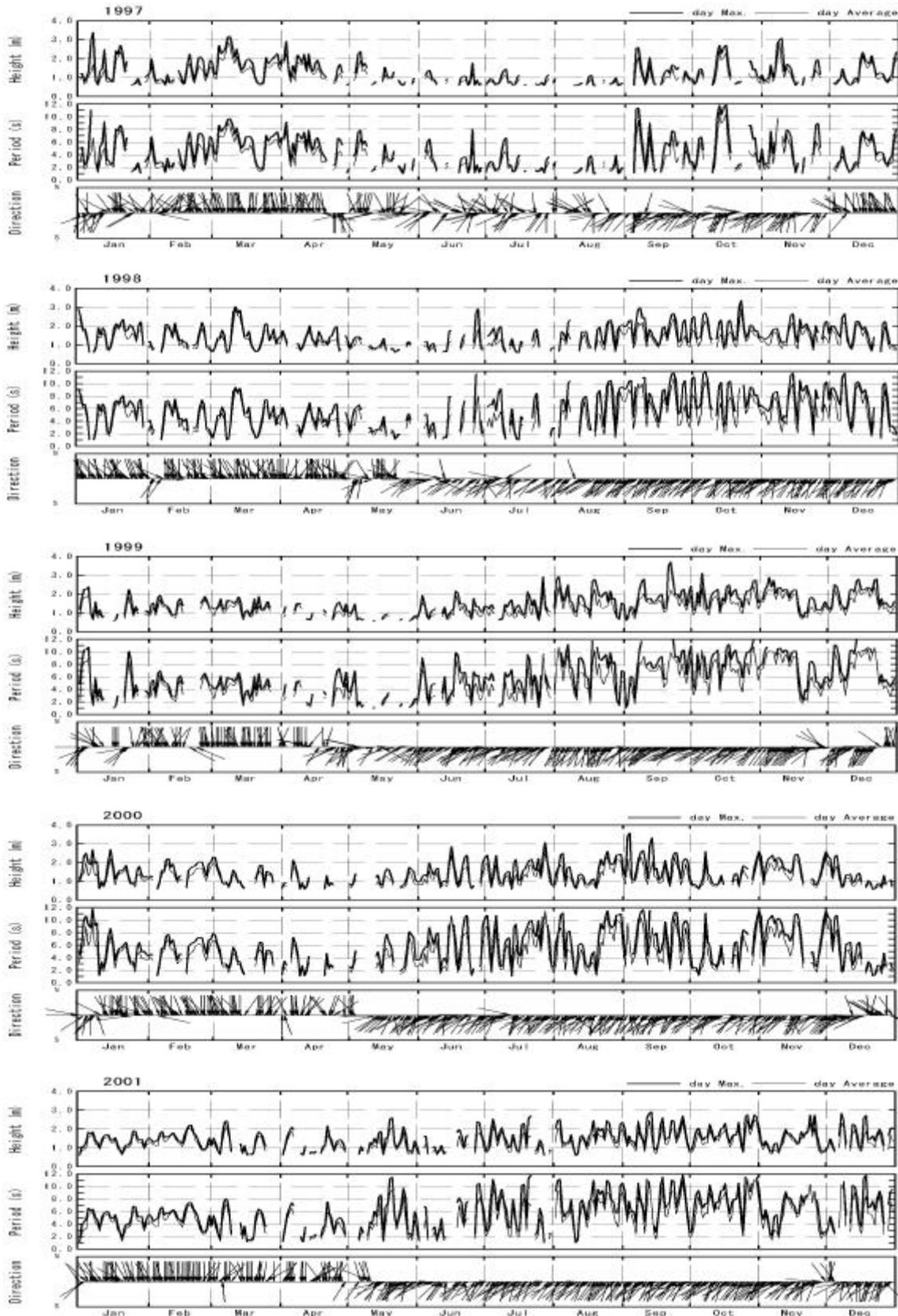
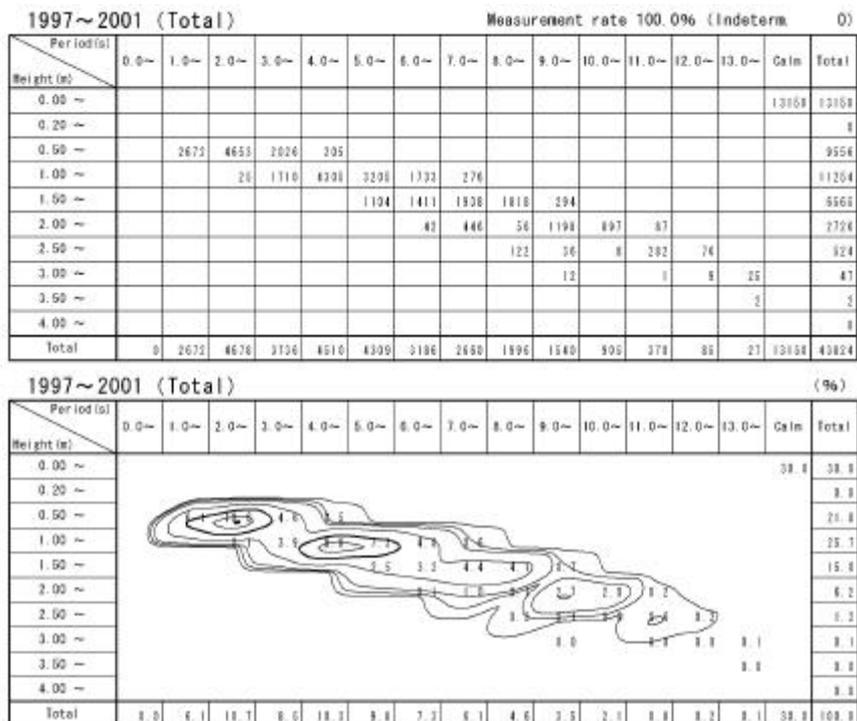


Figura E.4.3 Registro Previo de Ola Costa Afuera en Series de Tiempo (N050°0', W082°00')

Tabla E.4.2 Frecuencias de Ocurrencia de Ola Costa Afuera (N050°0', W082°00')

(a) Altura de Ola vs. Período de la Ola



(b) Altura de Ola vs. Dirección de la Ola

1997~2001 (Total) Measurement rate 100.0% (Indeterm. 0)

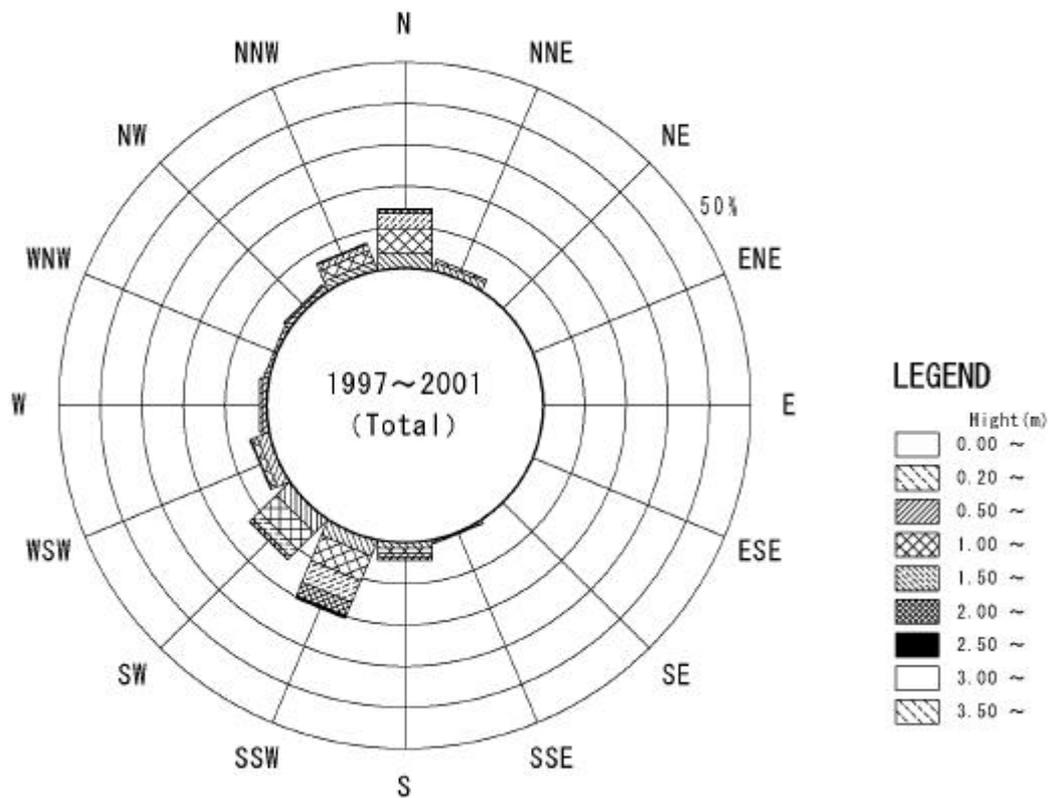
| Direction \ Height (m) | NNE | NE | ENE | E | ESE | SE | SSE | S | SSW | SW | WSW | W | WNW | NW | NNW | N | Calm | Total |
|------------------------|------|----|-----|----|-----|----|-----|------|------|------|------|-----|-----|-----|------|------|-------|-------|
| 0.00 ~ | | | | | | | | | | | | | | | | | 13158 | 13158 |
| 0.20 ~ | | | | | | | | | | | | | | | | | | 3 |
| 0.50 ~ | 784 | 86 | 19 | 16 | 21 | 40 | 106 | 546 | 1640 | 1743 | 1120 | 473 | 318 | 443 | 847 | 1514 | | 8559 |
| 1.00 ~ | 310 | 13 | 4 | | | 9 | 84 | 635 | 2871 | 3503 | 638 | 328 | 19 | 178 | 1211 | 2575 | | 11254 |
| 1.50 ~ | 14 | | | | | 3 | 1 | 406 | 2014 | 1869 | 149 | 1 | | 21 | 678 | 1710 | | 6563 |
| 2.00 ~ | | | | | | | | 246 | 1543 | 393 | 19 | 3 | | 1 | 149 | 337 | | 2726 |
| 2.50 ~ | | | | | | | | 47 | 275 | 46 | | | | | 28 | 126 | | 524 |
| 3.00 ~ | | | | | | | | 4 | 27 | 4 | | | | | | | 12 | 47 |
| 3.50 ~ | | | | | | | | | 1 | 1 | | | | | | | | 2 |
| Total | 1026 | 98 | 42 | 16 | 21 | 52 | 171 | 1814 | 8771 | 6746 | 1926 | 709 | 337 | 653 | 2897 | 6324 | 13158 | 43824 |

(c) Período de Ola vs. Dirección de la Ola

1997~2001 (Total) Measurement rate 100.0% (Indeterm. 0)

| Direction \ Period (s) | NNE | NE | ENE | E | ESE | SE | SSE | S | SSW | SW | WSW | W | WNW | NW | NNW | N | Calm | Total |
|------------------------|------|----|-----|----|-----|----|-----|------|------|------|------|-----|-----|-----|------|------|-------|-------|
| 0.0 ~ | | | | | | | | | | | | | | | | | 13158 | 13158 |
| 1.0 ~ | 184 | 39 | 22 | 16 | 12 | 21 | 21 | 138 | 380 | 509 | 361 | 181 | 119 | 147 | 222 | 394 | | 2512 |
| 2.0 ~ | 504 | 47 | 19 | | 9 | 13 | 45 | 186 | 597 | 665 | 485 | 183 | 191 | 252 | 481 | 970 | | 4678 |
| 3.0 ~ | 232 | 10 | 2 | | | 4 | 51 | 221 | 679 | 582 | 314 | 124 | 21 | 114 | 491 | 981 | | 3226 |
| 4.0 ~ | 86 | 2 | | | | 3 | 26 | 266 | 842 | 815 | 266 | 119 | 5 | 73 | 631 | 1342 | | 4513 |
| 5.0 ~ | 20 | | | | | 4 | 28 | 243 | 1113 | 842 | 212 | 84 | 1 | 46 | 416 | 1388 | | 4309 |
| 6.0 ~ | | | | | | 2 | 4 | 150 | 633 | 781 | 62 | 16 | | 13 | 436 | 886 | | 3186 |
| 7.0 ~ | | | | | | | | 231 | 1187 | 649 | 102 | 3 | | 1 | 175 | 310 | | 2660 |
| 8.0 ~ | | | | | | | | 160 | 1192 | 404 | 48 | | | | 28 | 124 | | 1996 |
| 9.0 ~ | | | | | | | | 147 | 1818 | 308 | 39 | 1 | | | 7 | 35 | | 1540 |
| 10.0 ~ | | | | | | | | 188 | 651 | 188 | 6 | | | | | | | 965 |
| 11.0 ~ | | | | | | | | 45 | 382 | 43 | | | | | | | | 379 |
| 12.0 ~ | | | | | | | | 9 | 84 | 12 | | | | | | | | 85 |
| 13.0 ~ | | | | | | | | | | 23 | 4 | | | | | | | 27 |
| Total | 1026 | 98 | 42 | 16 | 21 | 52 | 170 | 1814 | 8771 | 6746 | 1926 | 709 | 337 | 653 | 2897 | 6324 | 13158 | 43824 |

(a) Altura de Ola vs. Dirección de la Ola



(b) Período de Ola vs. Dirección de la Ola

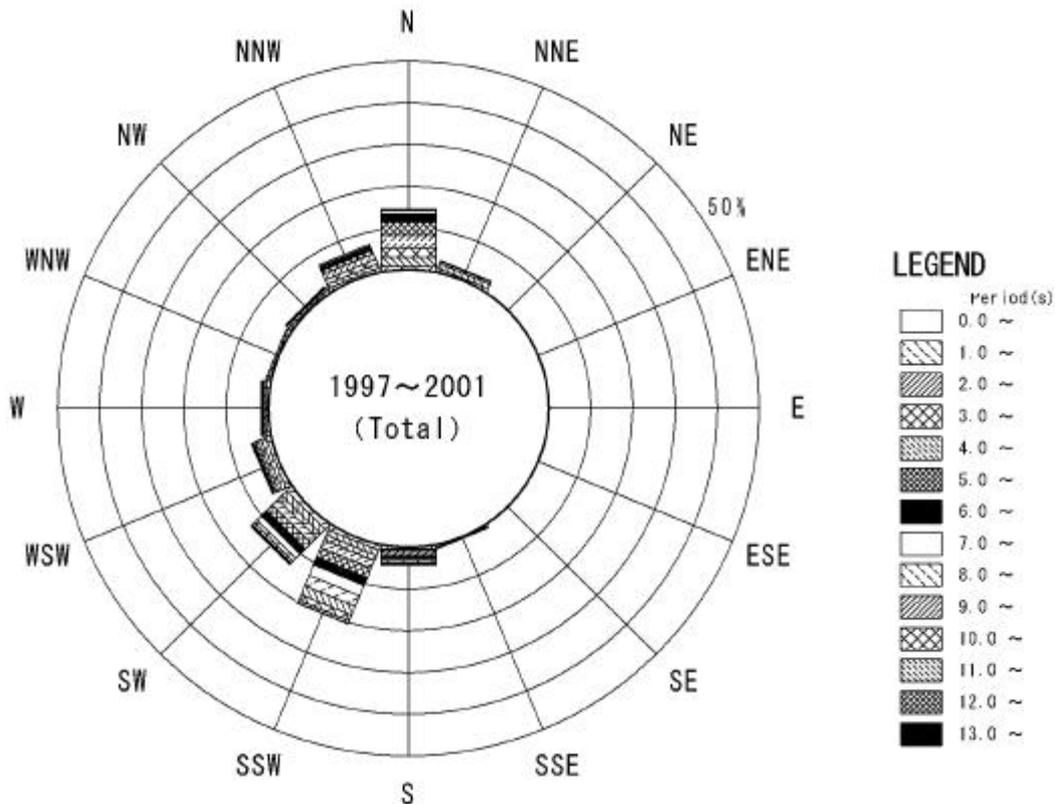


Figura E.4.4 Rosas de Ola Costa Afuera (N050°0', W082°00')

1) Chiriqui (Armuelles)

La Figura E.4.5 (1) describe una comparación de la altura de ola costa afuera entre datos GWDB, SSMO y MARSDEN SQUARE 009 (MS-009). De esta descripción, el dato de GWDB está en concordancia con los datos existentes.

La Figura E.4.5 (2) muestra una comparación del período de olas costa afuera entre datos GWDB y SSMO. No había ninguna información sobre el período de ola de datos MS-009. De esta descripción, aunque las probabilidades de ocurrencia excedente para período de ola T=5-9 sec de datos GWDB son mayores que la de los otros, los datos GWDB han dado casi la misma distribución con los datos existentes.

La Figura E.4.5 (3) muestra una comparación de la dirección de ola costa afuera entre datos GWDB y MS-009. No hay ninguna información sobre la dirección de la ola de datos SSMO. De esta descripción, el dato GWDB es especialmente dominante de SSO, y por otro lado, el rango de la dirección del dato MS-009 parece ser amplio de E – O, y la dirección principal dominante es entre S a SO.

2) Vacamonte

La Figura E.4.6 (1) describe una comparación de la altura de ola costa afuera entre datos de GWDB, MARSDEN SQUARE 8-55 (MS 8-55). De esta descripción, el dato de GWDB mayormente concuerda con el dato existente excluyendo menos de 1 m de altura de la ola.

La Figura E.4.6 (2) muestra una comparación del período de ola fuera de la costa entre datos GWDB y MS 8-55. De esta descripción, aunque las probabilidades de ocurrencia excedente para el período de ola T=4-10 sec del dato GWDB son mayores que otras, el dato de GWDB tiene la misma inclinación con el dato existente.

La Figura E.4.6 (3) muestra una comparación de la dirección de la ola costa afuera entre datos de GWDB y MS 8-55. De esta descripción, el dato GWDB es principalmente dominante para SO, por otro lado, el rango de la dirección para el dato de MS 8-55 parece estar abierto de E-O y la principal dirección de S domina.

(3) La Selección de las Olas Costa Afuera

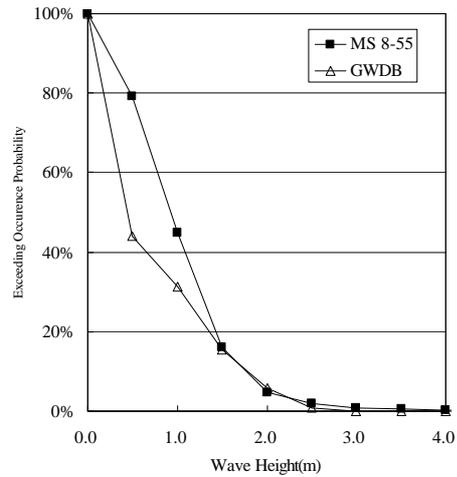
Comparado entre datos de GWDB y fuente de dato existente de SSMO, MS-009 y MS 8-55, la disponibilidad de datos de registro previo de GWDB fue confirmado para el uso en los análisis porque:

- Ambas alturas de la ola indican una buena concordancia
- Ambos períodos de ola muestran casi la misma distribución (aunque algún dato de GWDB no está de acuerdo con el dato existentes, se traza en el lado seguro).

En términos de las direcciones de la ola, hay diferencias de la ocurrencia, no obstante es buena información cuando la dirección tiene que ser decidida como una entrada de dato de elemento en el cálculo. Especialmente las direcciones de la ola de S – E en el dato de GWDB deben ser considerados en los análisis si alguno.

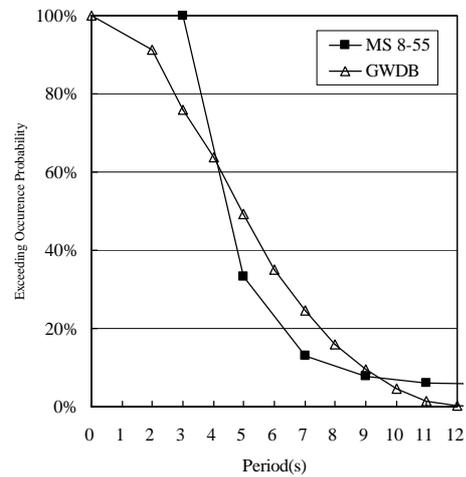
(a) Altura de la Ola

| H (m) | MS 8-55 | | | GWDB | | |
|-------|---------|------|--------|-------|-------|--------|
| 0.0 ~ | 596 | 2862 | 100.0% | 24538 | 43824 | 100.0% |
| 0.5 ~ | 983 | 2266 | 79.2% | 5605 | 19286 | 44.0% |
| 1.0 ~ | 826 | 1283 | 44.8% | 6937 | 13681 | 31.2% |
| 1.5 ~ | 319 | 457 | 16.0% | 4140 | 6744 | 15.4% |
| 2.0 ~ | 84 | 138 | 4.8% | 2199 | 2604 | 5.9% |
| 2.5 ~ | 30 | 54 | 1.9% | 368 | 405 | 0.9% |
| 3.0 ~ | 11 | 24 | 0.8% | 35 | 37 | 0.1% |
| 3.5 ~ | 7 | 13 | 0.5% | 2 | 2 | 0.0% |
| 4.0 ~ | 0 | 6 | 0.2% | | 0 | 0.0% |
| 4.5 ~ | 4 | 6 | 0.2% | | 0 | 0.0% |
| 5.0 ~ | 1 | 2 | 0.1% | | 0 | 0.0% |
| 5.5 ~ | 1 | 1 | 0.0% | | 0 | 0.0% |
| 6.0 ~ | 0 | 0 | 0.0% | | 0 | 0.0% |
| | 2862 | | | 43824 | | |



(b) Período de la Ola

| Wave Period(s) | MS 8-55 | | | Wave Period(s) | GWDB | | |
|----------------|---------|------|--------|----------------|-------|-------|--------|
| 3.0 ~ | 1648 | 2467 | 100.0% | 0.0 ~ | 2672 | 30674 | 100.0% |
| 5.0 ~ | 496 | 819 | 33.2% | 2.0 ~ | 4678 | 28002 | 91.3% |
| 7.0 ~ | 132 | 323 | 13.1% | 3.0 ~ | 3736 | 23324 | 76.0% |
| 9.0 ~ | 43 | 191 | 7.7% | 4.0 ~ | 4510 | 19588 | 63.9% |
| 11.0 ~ | 7 | 148 | 6.0% | 5.0 ~ | 4309 | 15078 | 49.2% |
| 13.0 ~ | 7 | 141 | 5.7% | 6.0 ~ | 3186 | 10769 | 35.1% |
| 15.0 ~ | 4 | 134 | 5.4% | 7.0 ~ | 2660 | 7583 | 24.7% |
| 17.0 ~ | 1 | 130 | 5.3% | 8.0 ~ | 1996 | 4923 | 16.0% |
| 19.0 ~ | 38 | 129 | 5.2% | 9.0 ~ | 1540 | 2927 | 9.5% |
| 21.0 ~ | 91 | 91 | 3.7% | 10.0 ~ | 905 | 1387 | 4.5% |
| | | | | 11.0 ~ | 370 | 482 | 1.6% |
| | | | | 12.0 ~ | 85 | 112 | 0.4% |
| | | | | 13.0 ~ | 27 | 27 | 0.1% |
| | 2467 | | | | 30674 | | |



(c) Dirección de la Ola

| | MS 8-55 | | GWDB | |
|------|---------|-------|-------|-------|
| E | 92 | 3.2% | 16 | 0.0% |
| ESE | | | 21 | 0.1% |
| SE | 77 | 2.7% | 52 | 0.2% |
| SSE | | | 171 | 0.5% |
| S | 445 | 15.5% | 1874 | 5.8% |
| SSW | | | 8771 | 27.0% |
| SW | 399 | 13.9% | 5746 | 17.7% |
| WSW | | | 1926 | 5.9% |
| W | 294 | 10.2% | 709 | 2.2% |
| Calm | 1566 | | 13150 | |
| | 2873 | | 32436 | |

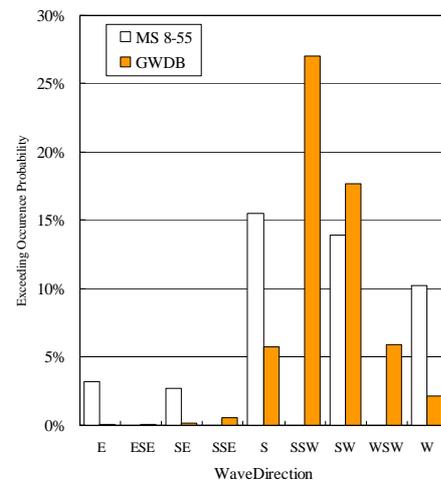


Figura E.4.6 Probabilidad de Ocurrencia Excedente (Olas Costa Afuera) para Vacamonte