

6.8 Economic and Financial Evaluation

6.8.1 General

It is generally the case for projects to be evaluated from two viewpoints. The first, known as the economic evaluation, involves analysis based on the balance of resources from the viewpoint of the national economy in the country concerned. And the second, known as the financial evaluation, involves analysis based on the balance of currency from the viewpoint of project implementing bodies (public and private agencies such as governments or corporations).

The generally adopted technique of project evaluation is "with case" and "without case" analysis, whereby comparison is carried out between conditions in the case where the project is implemented ("with case") and the case where the project is not implemented ("without case"). Analysis is carried out from both viewpoints.

Specifically speaking, in the economic evaluation, analysis and evaluation are carried out by measuring the additional national economic resources (benefit) resulting from the "with case" and comparing this with the corresponding cost. In the financial evaluation, the revenue to the implementing body in the "with case" is estimated and analysis and evaluation are carried out to determine whether the implementing body can afford the costs. Projects are normally evaluated by determining the appropriateness of project implementation from a comprehensive viewpoint via these analysis and evaluation approaches.

However, in the case of the Project, no change arises in national economic resources between the "with case" and "without case" before and after implementation of the Orinoco River Improvement Plan, which is put forward as an engineering proposal in order to comply with the desirable waterway transportation system that was examined in Chapter 5. That is to say that no changes arise in the annual combined freight transportation volume and annual combined transportation time on Orinoco River as a result of the improvement plan.

Accordingly, since the economic evaluation in the Project cannot be performed by conventional cost-benefit analysis, the following approach shall be adopted.

In comparison of the current Rio Grande waterway maintenance cost (without case) and the improvement plan construction cost and maintenance cost (with case), evaluation shall be carried out by analyzing which is more advantageous in terms of national economic cost over a set period.

If economy of the improvement plan is shown to be appropriate as a result of the above economic evaluation, the financial evaluation shall be carried out by examining whether or not the improvement plan construction cost and maintenance cost can be covered through existing river transport charges.

6.8.2 Economic Evaluation

(1) Economic Cost Comparison Between the Improvement Plan and No Improvement

In Section 6.3 one improvement alternative is proposed for Aramaya Section, four improvement alternatives are proposed for Barrancas Section, and two improvement alternatives are proposed for Guasina Section.

Accordingly, as the first stage, economic cost in the case of improvement plan implementation and no improvement was viewed as cash flow for each section-separate improvement plan, the current value was sought by deducting a 10 % discount rate, and comparison of current values was carried out in order to examine the economic appropriateness of the improvement plans.

Moreover, the shadow rate from market price to economic price was set at 0.8 for the construction cost (in consideration of materials cost, equipment cost, and personnel cost), and 0.9 for the dredging cost.

The results of the comparison are as indicated in the following table (see Supporting Report for the calculation process Tables).

Table 6.8.1 Economic Cost by Alternative (Cumulative Present Value for 30 years)

Unit; U.S. \$

Aramaya Section		Barrancas Section		Guasina Section	
No Improvement	23,163,000	No Improvement	87,305,000	No Improvement	33,630,000
Improvement (A-1)	58,137,000	Improvement (B-1)	104,735,000	Improvement (G-1)	44,410,000
		Improvement (B-2)	83,370,000		
		Improvement (B-3)	104,241,000		

According to the examination, none of proposed improvement plans are economically appropriate in Aramaya Section and Guasina Section, but plan B-2 alone is appropriate in the case of Barrancas Section.

(2) Evaluation

Concerning alternatives B-2 and B-3, which are judged to be the most economic and second most economic alternatives for Barrancas Section in quantitative terms, the economic internal rate of return (EIRR) is calculated to be 11 % and 5 % respectively as indicated in Tables 6.8.2 and 6.8.3.

Table 6.8.2 Economic Evaluation (B-2 Case)

Year	Without Improvement Cost	With Improvement Cost (B-2)	Balance	E.I.R.R
2001	9,173	20,811	-11,638	
2002	9,173	32,449	-23,276	
2003	9,173	32,449	-23,276	
2004	9,173	6,445	2,728	
2005	9,173	6,445	2,728	
2006	9,173	525	8,648	
2007	9,173	525	8,648	
2008	9,173	525	8,648	
2009	9,173	525	8,648	
2010	9,173	525	8,648	
2011	9,173	525	8,648	
2012	9,173	525	8,648	
2013	9,173	525	8,648	
2014	9,173	525	8,648	
2015	9,173	525	8,648	
2016	9,173	525	8,648	
2017	9,173	525	8,648	
2018	9,173	525	8,648	
2019	9,173	525	8,648	
2020	9,173	525	8,648	
2021	9,173	525	8,648	
2022	9,173	525	8,648	
2023	9,173	525	8,648	
2024	9,173	525	8,648	
2025	9,173	525	8,648	
2026	9,173	525	8,648	
2027	9,173	525	8,648	
2028	9,173	525	8,648	
2029	9,173	525	8,648	
2030	9,173	525	8,648	
2031	9,173	525	8,648	
2032	9,173	525	8,648	
				11%

Table 6.8.3 Economic Evaluation (B-3 Case)

Year	Without Improvement Cost	With Improvement Cost (B-3)	Balance	E.I.R.R
2001	9,173	17,992	-8,819	
2002	9,173	26,812	-17,639	
2003	9,173	26,812	-17,639	
2004	9,173	9,159	14	
2005	9,173	6,024	3,149	
2006	9,173	6,024	3,149	
2007	9,173	6,024	3,149	
2008	9,173	6,024	3,149	
2009	9,173	6,024	3,149	
2010	9,173	6,024	3,149	
2011	9,173	6,024	3,149	
2012	9,173	6,024	3,149	
2013	9,173	6,024	3,149	
2014	9,173	6,024	3,149	
2015	9,173	6,024	3,149	
2016	9,173	6,024	3,149	
2017	9,173	6,024	3,149	
2018	9,173	6,024	3,149	
2019	9,173	6,024	3,149	
2020	9,173	6,024	3,149	
2021	9,173	6,024	3,149	
2022	9,173	6,024	3,149	
2023	9,173	6,024	3,149	
2024	9,173	6,024	3,149	
2025	9,173	6,024	3,149	
2026	9,173	6,024	3,149	
2027	9,173	6,024	3,149	
2028	9,173	6,024	3,149	
2029	9,173	6,024	3,149	
2030	9,173	6,024	3,149	
2031	9,173	6,024	3,149	
2032	9,173	6,024	3,149	
				5%

To sum up the findings of the above evaluation, it is deemed most desirable from the viewpoint of national economy to carry out improvement on Barrancas Section according to Alternative B-2 and to leave existing waterway management as it is on the other sections. Needless to say, it is essential for separate reexamination of dredging to be carried out.

6.8.3 Financial Evaluation

(1) Revenue (River Transport Charge)

Individual transport charges and service charges are placed on the freight and shipping that use Orinoco River, respectively, and income from these charges is used to pay for river maintenance and operation.

Freight transport charges, river tolls, are set separately for each freight item, and current charges are as indicated in Table 6.8.4.

Table 6.8.4 Orinoco River Tolls

Commodity	Orinoco River Tolls per M.Ton
Iron Ore	US\$1.3511
Direct Reduced Iron	US\$1.3511
Steel Product	US\$2.0615
Steel Bar	US\$2.0615
Steel Materials	US\$2.0615
Bauxite	US\$0.4407
Alumina	US\$4.0000
Aluminum Ingot	US\$4.0000
Aluminum Products	US\$2.0615
Coke, Tar, Carbon	US\$2.0615
Caustic Soda	US\$2.0615
Crude Oil	US\$1.7233
Wood Chip	US\$2.0615
Silicon	US\$2.0615
Anode	US\$2.0615
Clinker	US\$2.0615
Others	US\$0.3233

Service charges placed on shipping consist of a pilotage service charge of US\$ 885.00 and other service charge of US\$ 740.00 (on average) per vessel.

Based on the Summary of Cargo Throughput Forecast given in Section 4.7.3 and the Future Ship Traffic Volume given in Section 4.8.3, future revenue from charges related to freight distribution in the lower reaches of Orinoco River is estimated as follows. Moreover, concerning the freight volume and the number of ships, estimates were made for the low growth case and the medium growth case.

1) Revenue on River Tolls

Tables 6.8.5 and 6.8.6 show the year-separate, item-separate freight transportation volumes in the low growth case and the medium growth case respectively. By

multiplying these volumes by the transport charges shown in the preceding Table 6.8.4, annual revenue for both cases can be obtained as shown in Tables 6.8.7 and 6.8.8.

Table 6.8.5 Trend of Cargo Throughput (Low Growth Case)

(Unit; Thousand Tons)

Commodity	1999	2000	2001	2002	2003	2005	2020
Iron Ore	7,420	6,783	5,436	4,718	4,000	4,000	4,000
Direct Reduced Iron	2,710	4,210	6,410	6,410	6,320	6,320	6,320
Steel Product	1,778	1,778	1,778	1778	1,778	2,401	5,346
Steel Bar	448	448	448	448	550	550	550
Steel Materials	495	495	495	495	495	611	1,309
Bauxite	291	329	366	403	440	440	440
Alumina	567	610	653	697	740	740	250
Aluminum Ingot	427	436	444	452	460	460	640
Aluminum Products	50	50	50	50	50	50	65
Coke, Tar, Carbon	508	511	514	517	520	520	645
Caustic Soda	258	263	268	274	279	279	279
Crude Oil	3,940	3,940	3,940	3,940	3,940	3,940	3,940
Wood Chip	450	700	950	1,200	1,200	1,200	1,200
Silicon	35	35	35	35	35	35	35
Anode	29	29	29	29	29	29	29
Clinker	360	360	360	360	360	490	490
Others	109	109	109	109	109	109	109
Total	19,875	21,086	22,285	21,915	21,305	22,174	25,647

Table 6.8.6 Trend of Cargo Throughput (Medium Growth Case)

(Unit; Thousand Tons)

Commodity	1999	2000	2001	2002	2003	2005	2015	2020
Iron Ore	7,420	6,783	5,436	4,718	4,000	4,000	4,000	4,000
Direct Reduced Iron	2,710	4,210	6,410	6,410	6,320	6,320	6,320	6,320
Steel Product	1,778	1,778	1,778	1778	1,778	2,401	3,546	5,346
Steel Bar	448	448	448	448	550	550	550	550
Steel Materials	495	495	495	495	495	611	903	1,309
Bauxite	291	329	366	403	440	440	440	440
Alumina	567	610	653	697	740	740	250	250
Aluminum Ingot	427	436	444	452	460	460	640	640
Aluminum Products	50	50	50	50	50	50	65	65
Coke, Tar, Carbon	508	511	514	517	520	520	645	645
Caustic Soda	258	263	268	274	279	279	279	279
Crude Oil	3,940	3,940	3,940	3,940	3,940	3,940	3,940	3,940
Wood Chip	450	700	950	1,200	1,200	1,200	1,200	1,200
Silicon	35	35	35	35	35	35	35	35
Anode	29	29	29	29	29	29	29	29
Clinker	360	360	360	360	360	490	490	490
Others	109	109	109	109	109	109	109	109
Total	19,875	21,086	22,285	21,915	21,305	22,174	23,441	25,647

Table 6.8.7 Trend of Revenue on River Tolls (Low growth Case)

(Unit; Thousand Tons)

Commodity	1999	2000	2001	2002	2003	2005	2020
Iron Ore	10,025	9,165	7,345	6,374	5,404	5,404	5,404
Direct Reduced Iron	3,661	5,688	8,661	8,661	8,539	8,539	8,539
Steel Product	3,665	3,665	3,665	3,665	3,665	4,950	11,021
Steel Bar	924	924	924	924	1,134	1,134	1,134
Steel Materials	1,020	1,020	1,020	1,020	1,020	1,260	2,699
Bauxite	128	145	161	178	194	194	194
Alumina	2,268	2,440	2,612	2,788	2,960	2,960	1,000
Aluminum Ingot	1,708	1,744	1,776	1,808	1,840	1,840	2,560
Aluminum Products	103	103	103	103	103	103	134
Coke, Tar, Carbon	1,047	1,053	1,060	1,066	1,072	1,072	1,330
Caustic Soda	532	542	552	565	575	575	575
Crude Oil	6,790	6,790	6,790	6,790	6,790	6,790	6,790
Wood Chip	928	1,443	1,958	2,474	2,474	2,474	2,474
Silicon	72	72	72	72	72	72	72
Anode	60	60	60	60	60	60	60
Clinker	742	742	742	742	742	1,010	1,010
Others	35	35	35	35	35	35	35
Total	33,709	35,632	37,536	37,325	36,680	38,471	45,030

Table 6.8.8 Trend of Revenue on River Tolls (Medium Growth Case)

(Unit; Thousand Tons)

Commodity	1999	2000	2001	2002	2003	2005	2015	2020
Iron Ore	10,025	9,165	7,345	6,374	5,404	5,404	5,404	5,404
Direct Reduced Iron	3,661	5,688	8,661	8,661	8,539	8,539	8,539	8,539
Steel Product	3,665	3,665	3,665	3,665	3,665	4,950	7,310	11,021
Steel Bar	924	924	924	924	1,134	1,134	1,134	1,134
Steel Materials	1,020	1,020	1,020	1,020	1,020	1,260	1,862	2,699
Bauxite	128	145	161	178	194	194	194	194
Alumina	2,268	2,440	2,612	2,788	2,960	2,960	1,000	1,000
Aluminum Ingot	1,708	1,744	1,776	1,808	1,840	1,840	2,560	2,560
Aluminum Products	103	103	103	103	103	103	134	134
Coke, Tar, Carbon	1,047	1,053	1,060	1,066	1,072	1,072	1,330	1,330
Caustic Soda	532	542	552	565	575	575	575	575
Crude Oil	6,790	6,790	6,790	6,790	6,790	6,790	6,790	6,790
Wood Chip	928	1,443	1,958	2,474	2,474	2,474	2,474	2,474
Silicon	72	72	72	72	72	72	72	72
Anode	60	60	60	60	60	60	60	60
Clinker	742	742	742	742	742	1,010	1,010	1,010
Others	35	35	35	35	35	35	35	35
Total	33,709	35,632	37,536	37,325	36,680	38,471	40,482	45,030

2) Revenue on Ship Traffic

Tables 6.8.9 and 6.8.10 show the year-separate ship traffic revenue obtained by multiplying the estimated number of ships by the aforementioned charges in the low growth case and the medium growth case respectively.

Table 6.8.9 Revenue on Ship Traffic (Low Growth Case)

Year	Ship Traffic Volume	Pilotage Service Charge	Other Charges	Revenue on Ship Traffic
1999	908	US\$885.00	US\$740.00	US\$1,475,500.00
2000	956	US\$885.00	US\$740.00	US\$1,553,500.00
2001	1,012	US\$885.00	US\$740.00	US\$1,644,500.00
2002	1,008	US\$885.00	US\$740.00	US\$1,638,000.00
2003	1,007	US\$885.00	US\$740.00	US\$1,636,375.00
2005	1,019	US\$885.00	US\$740.00	US\$1,655,875.00
2020	1,148	US\$885.00	US\$740.00	US\$1,865,500.00

Table 6.8.10 Revenue on Ship Traffic (Medium Growth Case)

Year	Ship Traffic Volume	Lunch Service Charge	Other Charge	Revenue on Ship Traffic
1999	908	US\$885.00	US\$740.00	US\$1,475,500.00
2000	956	US\$885.00	US\$740.00	US\$1,553,500.00
2001	1,012	US\$885.00	US\$740.00	US\$1,644,500.00
2002	1,008	US\$885.00	US\$740.00	US\$1,638,000.00
2003	1,007	US\$885.00	US\$740.00	US\$1,636,375.00
2005	1,019	US\$885.00	US\$740.00	US\$1,655,875.00
2015	1,148	US\$885.00	US\$740.00	US\$1,865,500.00
2020	1,172	US\$885.00	US\$740.00	US\$1,904,500.00

3) Total Revenue

The total of the above river tolls and service charges is the revenue from river transportation on Orinoco River. Tables 6.8.11 and 6.8.12 show the year-separate revenues for the low growth case and the medium growth case respectively.

Table 6.8.11 Revenue (Low Growth Case)

Unit; Thousand U.S \$

	River Tolls	Service Charges	Total
1999	33,709	1,475.50	35,185
2000	35,632	1,553.50	37,186
2001	37,536	1,644.50	39,181
2002	37,325	1,638.00	38,963
2003	36,680	1,636.38	38,316
2004	36,680	1,636.38	38,316
2005	38,471	1,655.88	40,127
2006	38,471	1,655.88	40,127
2007	38,471	1,655.88	40,127
2008	38,471	1,655.88	40,127
2009	38,471	1,655.88	40,127
2010	38,471	1,655.88	40,127
2011	38,471	1,655.88	40,127
2012	38,471	1,655.88	40,127
2013	38,471	1,655.88	40,127
2014	38,471	1,655.88	40,127
2015	38,471	1,655.88	40,127
2016	38,471	1,655.88	40,127
2017	38,471	1,655.88	40,127
2018	38,471	1,655.88	40,127
2019	38,471	1,655.88	40,127
2020	40,482	1,865.50	42,348
2021	40,482	1,865.50	42,348
2022	40,482	1,865.50	42,348
2023	40,482	1,865.50	42,348
2024	40,482	1,865.50	42,348
2025	40,482	1,865.50	42,348
2026	40,482	1,865.50	42,348
2027	40,482	1,865.50	42,348
2028	40,482	1,865.50	42,348
2029	40,482	1,865.50	42,348
2030	40,482	1,865.50	42,348
2031	40,482	1,865.50	42,348
2032	40,482	1,865.50	42,348

Table 6.8.12 Revenue (Medium Growth Case)

Unit; Thousand U.S \$			
	River Tolls	Service Charges	Total
1999	33,709	1,475.50	35,185
2000	35,632	1,553.50	37,186
2001	37,536	1,644.50	39,181
2002	37,536	1,638.00	39,174
2003	36,680	1,636.38	38,316
2004	36,680	1,636.38	38,316
2005	38,471	1,655.88	40,127
2006	38,471	1,655.88	40,127
2007	38,471	1,655.88	40,127
2008	38,471	1,655.88	40,127
2009	38,471	1,655.88	40,127
2010	38,471	1,655.88	40,127
2011	38,471	1,655.88	40,127
2012	38,471	1,655.88	40,127
2013	38,471	1,655.88	40,127
2014	38,471	1,655.88	40,127
2015	40,482	1,865.50	42,348
2016	40,482	1,865.50	42,348
2017	40,482	1,865.50	42,348
2018	40,482	1,865.50	42,348
2019	40,482	1,865.50	42,348
2020	45,030	1,904.50	46,935
2021	45,030	1,904.50	46,935
2022	45,030	1,904.50	46,935
2023	45,030	1,904.50	46,935
2024	45,030	1,904.50	46,935
2025	45,030	1,904.50	46,935
2026	45,030	1,904.50	46,935
2027	45,030	1,904.50	46,935
2028	45,030	1,904.50	46,935
2029	45,030	1,904.50	46,935
2030	45,030	1,904.50	46,935
2031	45,030	1,904.50	46,935
2032	45,030	1,904.50	46,935

(2) Financial Evaluation

Financial evaluation shall be carried out for improvement plan B-2 on Barrancas Section, which was judged to be feasible in the economic evaluation. The improvement construction cost and OM cost in improvement plan B-2, the dredging cost in of Alternative B-2 following improvement, and the total dredging cost (market price) in other sections including Aramaya

and Guasina and Boca Grande were included in the cash flow as the necessary cost over 30 years, and the financial internal rate of return (FIRR) was calculated from the above-mentioned year-separate revenue. The findings of this are shown in Tables 6.8.13, 6.8.14, and 6.8.15.

Table 6.8.13 Financial Evaluation (Improvement B-2 Plan) Case 1

Unit; Thousand US\$								
	B-section	A-section	G-section	Others	Boca Grande	Total Cost	Revenue	Balance
								F.I.R
2001	24,740	2,704	3,926	5,226	26,000	62,596	35,185	-27,411
2002	39,287	2,704	3,926	5,226	26,000	77,143	37,186	-39,957
2003	39,287	2,704	3,926	5,226	26,000	77,143	39,181	-37,962
2004	7,161	2,704	3,926	5,226	26,000	45,017	38,963	-6,054
2005	7,161	2,704	3,926	5,226	26,000	45,017	38,316	-6,701
2006	583	2,704	3,926	5,226	26,000	38,439	38,316	-123
2007	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2008	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2009	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2010	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2011	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2012	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2013	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2014	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2015	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2016	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2017	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2018	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2019	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2020	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2021	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2022	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457
2023	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457
2024	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457
2025	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457
2026	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457
2027	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457
2028	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457
2029	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457
2030	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457
2031	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457
2032	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457

#NUM!

Table 6.8.14 Financial Evaluation (Improvement B-2 Plan) Case 2

Unit; Thousand US\$

	B-section	A-section	G-section	Others	Boca Grande	Total Cost	Revenue	Balance	F.I.I.R
2001	12,370	2,704	3,926	5,226	26,000	50,226	35,185	-15,041	
2002	19,644	2,704	3,926	5,226	26,000	57,500	37,186	-20,314	
2003	19,644	2,704	3,926	5,226	26,000	57,500	39,181	-18,319	
2004	7,161	2,704	3,926	5,226	26,000	45,017	38,963	-6,054	
2005	7,161	2,704	3,926	5,226	26,000	45,017	38,316	-6,701	
2006	583	2,704	3,926	5,226	26,000	38,439	38,316	-123	
2007	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688	
2008	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688	
2009	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688	
2010	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688	
2011	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688	
2012	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688	
2013	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688	
2014	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688	
2015	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688	
2016	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688	
2017	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688	
2018	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688	
2019	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688	
2020	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688	
2021	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688	
2022	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457	
2023	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457	
2024	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457	
2025	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457	
2026	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457	
2027	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457	
2028	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457	
2029	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457	
2030	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457	
2031	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457	
2032	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457	

3%

Table 6.8.15 Financial Evaluation (Improvement B-2 Plan) Case 3

Unit; Thousand US\$								
	B-section	A-section	G-section	Others	Boca Grande	Total Cost	Revenue	Balance
2001	0	2,704	3,926	5,226	26,000	37,856	35,185	-2,671
2002	0	2,704	3,926	5,226	26,000	37,856	37,186	-670
2003	0	2,704	3,926	5,226	26,000	37,856	39,181	1,325
2004	7,161	2,704	3,926	5,226	26,000	45,017	38,963	-6,054
2005	7,161	2,704	3,926	5,226	26,000	45,017	38,316	-6,701
2006	583	2,704	3,926	5,226	26,000	38,439	38,316	-123
2007	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2008	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2009	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2010	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2011	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2012	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2013	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2014	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2015	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2016	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2017	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2018	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2019	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2020	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2021	583	2,704	3,926	5,226	26,000	38,439	40,127	1,688
2022	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457
2023	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457
2024	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457
2025	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457
2026	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457
2027	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457
2028	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457
2029	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457
2030	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457
2031	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457
2032	583	2,704	3,926	5,226	26,000	38,439	46,896	8,457

13%

Case 1 in Table 6.8.13 is the case where all the improvement construction cost and other related costs are borne by the implementation agency; Case 2 in Table 6.8.14 shows the case where approximately 50 % of the said costs are borne by the implementation agency and the rest by another governmental agency; and Case 3 in Table 6.8.15 shows the case where the said costs are covered entirely by another governmental agency.

Judging from the analysis results, it can be seen that the improvement construction cost and other related cost can not be financed by the total revenues coming from the transportation along the Orinoco River. Therefore, unless the improvement works are financed by another governmental agency, it will not be financially feasible. This situation corresponds to Case 3 which is suggested as the suitable for the present case.

6.8.4 Comprehensive Evaluation

Concerning the structural measures, according to the economic and financial evaluations, implementation of the B-2 improvement plan on Section B of the Rio Grande would be an appropriate measure from the viewpoint of national economy in Venezuela. However, in order to financially balance the maintenance of this channel, it is considered necessary for the initial investment to be provided from public funds.

6.9 Selection of Priority Project

In the master plan study, three sections were primarily selected for the study of structural measures among the seven dredging sections on the view of fact that measures cannot be realistic in other four sections due to the high construction cost compared with the maintenance dredging cost. The appropriate improvement measures should be point measures targeting specific places, as large scale improvement measures along the longitudinal direction of the channel would not be economically feasible.

In Aramaya and Sacupana-Guasina sections, even closing dikes, a type of point structural measures, are not economical due to large scale structures as a result of wide width of the channel. In Guaguapo-Barrancas-Ya Ya section, Alternative B2, closure of the Tortola channel would be the only effective measure to lower the bed elevation and to provide the required navigation depth. The economic and financial evaluations reveal that implementation of B-2 improvement plan would provide slightly higher benefit compared to the cost. In addition, as hydraulic analysis was carried out in a macro scale applying one-dimensional numerical study with limited available data. Therefore, it is desirable to confirm it as an appropriate measure by a detailed study with 2 dimensional numerical analysis and further site surveys. Accordingly, the alternative B2 is tentatively selected as a priority item and will be discussed in detail in the Chapter 7. (see Fig. 6-9-1)

