2.7 Cost Estimate; Foreign Currency Component

The CYJV cost estimate was prepared according to the guidelines provided by MWREP regarding the sources of labour, materials and equipment; therefore, the Panel concludes that the cost estimate has complied with the TOR.

While the foreign currency component in the cost estimate does not affect the technical or economic feasibility of the Project, the Panel believes that the estimated foreign cost component is rather low considering the magnitude and complexity of the project and the relatively tight construction schedule. To meet the demands of the schedule, it will be crucial that essential materials and equipment be acquired on time from available sources. Therefore, the Panel recommends that the availability of materials and equipment in China be reviewed prior to preparation of the tender documents to ensure that undue currency constraints are not placed on bidders and suppliers.

2.8 Effects of Higher Operating Levels

The possibility of using operating levels higher than the 140/160 m FCL/NPL was mentioned and some effects of these higher levels are contained in the above discussions. Changes and/or studies in design and construction which must be addressed if higher levels are decided upon are summarized below.

a) Navigation Locks. See following section 4

b) Generating Units. The number and size of units needed to accommodate increased capacity will require review. New ranges of heads will necessitate restudy of operation at the various required levels to ensure that excessive cavitation will not occur.

c) Spillway. The overflow spillway and the outlets will have to be modified to pass the PMF without overtopping the dam.

3. SEDIMENT

3.1 Compliance with the Terms of Reference

The Terms of Reference related specifically to sediment, articles 3.3 (iv), (v), and (vi), have been met by CYJV. Item 3.2 (b) of the Terms of Reference is not responded to explicitly in the Feasibility Report, although most parts of it are treated in segmented fashion in various parts of the Report. This question is treated further in paragraph 3.2.

It is the judgement of the Panel that the sediment management strategy proposed for TGP and analyzed by CYJV in its feasibility study is very sound. The Panel submits that there are no sediment or sediment–related problems that render the project infeasible. The sediment–related maintenance problems that will arise are not unique for a project of this magnitude, and can be handled with available techniques.

The Panel believes that the draft Feasibility Report does not adequately reflect the high quality and large quantity of work done by CYJV in its TGP sediment investigation and recommends that certain modifications and additions be incorporated into the Final Report. These are set forth in the paragraph 3.2.

3.2 Recommendations for final report

The following should be incorporated into the Final Report:

3.2.1 General

Add a section which lists the reservoir operation schemes investigated by the CYJV sediment team. Include a compilation of the sediment related limitations on reservoir operation (e.g. the upstream end of the fluctuating backwater reach should not be at or near Chongqing; maintenance of required flood control storage volume; flood stage limits at Chongqing; etc).

Add a concise summary, perhaps in tabular form, of the positive and negative sediment–related aspects of each reservoir operation scheme investigated.

Develop a summary, perhaps in tabular form, of the consequences of, and corresponding remedies for, reasonably conceivable failures of TGP sediment to behave as predicted.

The CYJV recommendation concerning further sensitivity analyses (pg. 7–18, Vol. 5) of the sediment – related results to model input parameters is strongly endorsed.

Appendix A of Volume 5 should be rewritten to present a more detailed description of the CYJV evaluation of the Chinese mathematical model. The extensive CYJV translations and summary report prepared on those should be placed in an appendix to Volume 5, or cited as being available from one or more permanent reference sources (e.g. YVPO, CIPM, MWREP, IWHR, etc).

3.2.2 Fluctuating Backwater Reach

Point out that neither the Chinese nor the CYJV mathematical models include the coarser–size sediment fractions ("bed load"). (This refinement is just now being incorporated into the IWHR Chinese mathematical model.) Emphasize that, because of the very small relative volume of bed load, this is a minor shortcoming.

Emphasize that the coarser, bed–load material will be deposited during the initial years of operation principally in the upstream portion of the fluctuating backwater reach, and that any attendant navigation problems can be readily handled by dredging and/or river–training works.

Dam Reach

Add a discussion of the likely extent and severity of sediment induced wear of mechanical equipment (turbines, gates, wicket gates, etc) and conduits. The favorable experience to date of Gezhouba dam in this respect should be cited.

Downstream Channel and Estuary

Concisely summarize the reasons that the TGP impact on the Yangtze River estuary and nearby coastline will be extremely small, likely undetectable. Cite the extensive sediment deposition and inflow between TGP and the estuary, and the large amount of sediment available for entrainment from the channel bed and banks.

Downgrade the importance of aggregate (sand, gravel) mining on river bed degradation around Yichang. This impact is judged to be overstated in the draft report.

3.2.5 Other

Add a section or chapter recounting successful experience with dam/reservoir projects, in China and elsewhere, that have utilized sediment management strategies similar to that proposed for TGP. The objective is to demonstrate that there is adequate precedent for the proposed TGP strategy, and that it is not just a computational prediction. Experience at Sanmenxia should be stressed. CYJV should request YVPO to provide relevant references on these projects in China.

Add a statement that the CYJV analysis of TGP reservoir sedimentation and its consequences is conservative, because of: not taking account of the diminished future sediment inflows resulting from new upstream reservoirs and improved land–management practices; the growing body of experience with management of reservoir sedimentation; and the designed sediment–control features incorporated into TGP dam, (eg. low level sluices).

It is to be noted that, because of the special topography of the TGP reservoir and the way in which it will be operated, loss of live storage due to sedimentation will not affect power generation. To allay misconceptions about the impacts of loss of live storage CYJV should add a section describing the special features of TGP and its operation and summarizing relevant sensitivity studies which support the conclusion that these issues are irrelevant for TGP.

3.3 Effects of Higher Operating Levels

For FCL greater than about 140 m, the volume of sediment deposition upstream from Changshou increases rapidly with increasing reservoir elevations, as do the costs attendant to sediment control (dredging,

training structures). An FCL greater than 145 m could raise the 100–year flood stage at Chongqing, after about 100 years of TGP operation, to around 200 m.

The principal sediment related consequence of higher operating levels, which include higher FCL, is the shifting of the fluctuating backwater reach further upstream, and the attendant increase in sediment deposition that will increase the flood stage at Chongqing. Sediment deposition in the port at Chongqing also will be increased, and the amount of dredging and the required training works correspondingly increased.

4. NAVIGATION

4.1 Compliance with Terms of Reference:

In general, the Feasibility Report has substantially addressed the requirements outlined in the Terms of Reference. Although in the area of traffic demand, the Report depicts estimates of wide variance, it must be recognized that an historical data base is lacking and that the projections used for the economic analysis and for sizing the lock system are as appropriate as possible at this time. The average navigation benefits calculated represent 4 percent of total project benefits.

It is recognized that two lines of locks will have to be provided at some time in the future. If a system using twin flight locks is selected, then providing both lines in the original construction is appropriate for technical reasons of construction, and is appropriate for the Feasibility Report. However, clarifications are deemed necessary. For example, the concerns of MOC referred to on page 1 – 15, Vol. 6, relate to operating levels and controlled flows. The report should be more specific in stating how these concerns have been addressed.

4.2 Alternative Facility Configuration

The Feasibility Report indicates that a system using staged, separate lines of locks would be economical if the demand for the second line did not manifest itself until six years after the first line was completed. Although it is questioned whether the rate of growth in demand would be that high, there may be technical reasons, such as the pondage requirements and the entrance conditions, which would favour retention of the flight lock system. In any case, the economic profitability of the project is not materially affected by the type of lock system used nor by whether the construction is staged or completed originally. The Report should include a

justification of the recommended facility based on an analysis of the technical advantages and disadvantages of each system.

4.3 Sedimentation

While the recommended NPL of 160 m will improve navigation conditions on the Yangtze river, sedimentation concerns will remain in the backwater reach and at the entrances to the navigation structures. These do not affect the feasibility of the project. The Panel concurs that the backwater reach can be managed with appropriate structural control works and dredging as the situation demands. Also, the Panel would recommend that a system for sluicing the sediments at the upstream entrance to the navigation facilities be considered in the design stage.

Volume 6 "Navigation" should be correlated with Volume 5, "Sedimentation", particularly with respect to the upstream shifting of sediment deposition.

4.4 Downstream Degradation

From a technical viewpoint, it appears that the remedial methods to overcome the effects of downstream degradation on the depth of water over the lock sill at Gezhouba relies on a minimum average daily flow of 5 000 cms and a minimum flow of 3 200 cms on which the economic analysis is based. Since it is conceded that the degradation could be overcome by structural provisions, these should be explained, the recommended minimum discharge should be clarified, and the impact of selecting a higher minimum discharge on project economics should be highlighted.

4.5 Effect of Higher Operating Levels

While a higher operating level is feasible from a technical standpoint and would improve navigation conditions over certain reaches, it also produces certain negative effects. These involve the creation of flooding conditions and additional sedimentation problems near Chongqing. It would also require the alterations of the lock system, especially at the downstream gate of the uppermost lock.

5. ENVIRONMENT

5.1 Compliance with Terms of Reference

Environmental aspects of the report can be considered adequate for a feasibility investigation and are in compliance with the TOR, after comments made in the tabled documents and during meetings with representatives have been considered. The allowance of 2 percent of the project cost estimate for overall environmental costs is prudent but requires further breakdown in the final presentation.

The Panel accepts the conclusion that there are no issues that jeopardize the environmental feasibility of the project, with the provision that the comprehensive list of future studies, protective measures, special equipment, mitigatory measures and further monitoring that are specified in the Feasibility Report as well as in the report of the 4th SC meeting be carried out as recommended. If these measures are not carried out successfully, the Panel believes there is some risk of environmental damage involving endangered species and wildlife habitat and, therefore, compensation may become necessary.

A very positive aspect of the project that has important implications for decreasing the risk of a number of environmental impacts is the small operating volume of the reservoir in relation to the large volume of discharge of the river at all operating levels.

5.2 Future Considerations

The Panel emphasizes the importance of the linkage between resettlement and environmental impacts to the overall organization, arrangements, responsibilities and justification for environmental management.

The Panel emphasizes the importance of the long construction period as an opportunity for getting an early start in preparing measures for mitigating adverse environmental impacts. It also points out the necessity to sustain monitoring and protection measures for many decades through the entire construction and operational stages.

The Panel believes that there are a number of unusually good opportunities for exemplary environmental enhancement measures to be carried out as part of the environmental program. These involve such things as cultural heritage, protection of natural zones and rare and endangered species, not

necessarily associated with TGP, which might benefit the project by attracting international assistance and recognition.

The Panel suggests that concerned authorities should give proper attention to future cumulative effects of other projects (upstream hydro developments and interbasin water transfers), since the Report suggests that some of these (i.e. decreases in October discharges) may be much greater than the modifications in streamflow by TGP.

6. RESETTLEMENT

6.1 Compliance with Terms of Reference

The Report is inadequate in demonstrating the feasibility of resettlement and full compliance with the TOR for any NPL for three reasons:

1. The receipt of requisite material was delayed.

2. The Report does not resolve the issues of land availability, non–agricultural job creation and the impact on the host population, as identified at the 4th SC meeting.

3. The Report contains numerous statements that require significant clarification. These statements have been identified in documents that have been tabled and in comments made during meetings with various representatives. The documents and comments are further identified in the summary of the meetings of the environmental and resettlement subgroups provided to the Secretariat for circulation.

The treatment of other resettlement issues is adequate for a feasibility level investigation, but the Panel wishes to emphasize the need, during the implementation phase, of following up on the activities recommended in the CYJV report.

The technique for arriving at the cost of resettlement appears to be adequate for a feasibility investigation, but until resettlement feasibility is clearly demonstrated, this estimate should be interpreted with caution.

New information that was received from YVPO concerning its ongoing land availability and job creation studies (noted in the 4th SC meeting) is favourable and encouraging.

6.2 Factors to be Considered

Resettlement at TGP is an extremely difficult problem at all NPL because of topographical (land) constraints, population density and intensity of land use.

The increases in the scope and difficulty of resettlement for a higher operating level than 160 m are major; therefore, plans involving higher NPL's should be treated with extreme caution.

It is especially important for the success of TGP resettlement program that not only the population to be resettled but also the host population are convinced that they will benefit from the Project. Socio–economic impacts of resettlement on the host area's population and natural resources are especially important to consider in resettlement and development planning.

6.3 Terms of Reference

The supplemental Terms of Reference, that requires CYJV to review the new information received from YVPO and incorporate it into the final report, are adequate. The objectives of these Terms of Reference will be satisfied if the following questions are answered:

1. What amount of cultivatable land exists for new agricultural development within the resettlement area as defined by the limits of air photo interpretation?

2. What proportion of inundated land could be replaced in each county in the presently defined resettlement area?

3. Is the mechanism in place, or will the mechanism be in place, required for resettlement planning at the macro and micro levels on an integrated regional basis?

4. Are the anticipated effects of resettlement on the host population acceptable?

5. Are the expectations for the transfer of farmers to non–agricultural employment realistic in socio–economic terms and from the point of view of business viability?

6.4 Further Action

The Panel wishes to withhold judgement on whether the final results of land availability and job creation study will be adequate to demonstrate feasibility of resettlement for various NPL's until it can examine 3 items:

a) the final results

b) CYJV report of its analysis, verification and interpretation of the final results

c) CYJV overall response to numerous resettlement clarifications suggested in the tabled documents and comments.

The Panel recommends that arrangements be made for selected members of the Panel to examine these items in June 1988.

7. FLOOD CONTROL

7.1 Compliance with the Terms of Reference

The Panel considers that the treatment of flood control in this report is in compliance with the TOR. The methodology for flood routing and evaluation of physical damages with and without the project is of high quality and the unit prices and the magnitude of estimated flood control benefits are acceptable. The Panel notes, however, that the accuracy of these benefits is limited by uncertainties about the probability of damaging floods and the degree of aversion to the risk of exceptional floods; on both counts the assumptions made by CYJV appear conservative.

7.2 Clarifications

Flood control benefits for the 185/160/140 m scheme amount to 26 percent of project benefits; a large part of them attributed to flood diversion and beach areas. However, if one were to focus on a particular rare event, the benefits would be larger and a greater part of the benefits would be attributable to protected areas. The Panel recommends that this point be highlighted and illustrated in tabular form in the CYJV report.

Raising the NPL/FCL combinations to 170/145 m or 180/150 m does not substantially impact the flood control benefits; and that too should be highlighted.

Other clarifications are needed for the following:

a) flooding models for the reservoir rim area and backwater reach;

b) economic evaluation of the one–in–twenty year flooding criterion for the permanent resettlement of populations as opposed to the compensation of damages;

c) distribution of risk and cost of flood damages between the dam area and the backwater reach; and

d) sensitivity of resettlement costs if flood protection is increased to one–in–fifty years for the reservoir rim and backwater reach.

8. POWER SYSTEM

8.1 Compliance with the Terms of Reference

The Panel deems this section in compliance with the TOR. The methodology for developing alternative expansion schemes with and without the project, the unit prices and the magnitude of estimated benefits are acceptable. The Panel notes that the evaluation of benefits on the basis of the cost of the next best alternative supply of power underestimates the value of this power to the consumer but that, nevertheless, the measure of benefits adopted by CYJV provides a sound basis to judge the feasibility of the project and to optimize its features.

8.2 Clarifications

Power benefits represent 70 percent of total project benefits. In the case where all the project costs are attributed to power and other benefits are ignored, the project is still competitive with respect to thermal and hydro alternatives, although by a small margin which could vanish if peak discharges were constrained further by navigation requirements.

The optimization of the installed capacity is based on flow models to determine the maximum peak discharge that can be re–regulated by the Gezhouba reservoir and on the savings that increments in the project

capacity will generate system wide. This approach is in compliance with the TOR. The Panel recommends that these savings be broken down into their capacity and energy components.

8.3 Effect of Higher Operating Levels

Increases in the NPL/FCL beyond the 160/140 m scheme recommended by CYJV generates additional power benefits: about 800 MW of firm energy for increases of 10 m in the NPL (and 5 m in the FCL); however, the value of this power is more than offset by the incremental cost of resettlement (260 000 people from NPL 160 m to 170 m). This incremental analysis should be extended to integrate other costs and benefits and its findings should be highlighted by CYJV in the selection of the recommended scheme.

9. ECONOMIC ANALYSIS

9.1 Compliance with the Terms of Reference

The methodology is deemed by the Panel to be in compliance with the TOR. However, the most important findings are still judged to be tentative and need to be ascertained further on the basis of the following:

a) confirmation of feasibility and cost of human resettlement,

b) clarifications about the derivation of economic prices, the labour content and the foreign exchange component for all the major items of the economic analysis: TGP construction and resettlement, thermal and hydro alternatives, flood damages,

c) risk analysis with revised assumptions on the evolution of coal prices,

9.2 Effect of Higher Operating Levels

As mentioned in paragraph 8.2, and analysis of incremental benefits and costs around a reference scheme should be included in the study to help to visualize the relative merits of the various schemes. This analysis, carried out for increments above and below the 160 m/140 m scheme shows that higher operating levels have a rate of return of less than 10 percent, as evidenced by the following incremental benefit/cost ratio calculated from Table 6.2, Vol. 3.

NPL/FCL	INCREMENTAL B/C RATIO
150/130 m	1.26
170/145 m	0.88
180/150 m	0.89

Although a formal risk analysis of all alternative schemes for operating levels is not required, the findings of the analysis for the recommended scheme should be used in considering the impact of major risk factors on some other representative schemes. For instance, increments in NPL do entail additional downside risks, in resettlement and construction costs and schedule, but little or no upside risks since power benefits are expected to stay close to the base case estimate.

Once the other representative schemes have been completely evaluated, the findings need to be summarized in a matrix as requested in the TOR. The Panel recommends that this matrix contain only quantified indicators, inter alia, energy output, installed capacity, population affected by resettlement, project benefits and costs broken into their major components and NPV in the base case.

10. FINANCIAL ANALYSIS

10.1 Compliance with the Terms of Reference

The methodology is deemed by the Panel to be in compliance with the TOR. In light of the important share of power benefits in the total project benefits, the financial rate of return (FRR) is primarily dependent on the power tariffs. This FRR is about 11 percent when the project revenues are calculated on the basis of the long–run marginal cost of power. This is in agreement with the results of the economic analysis mentioned in para. 8.2. However, the findings of this section are still subject to the confirmation of the feasibility and cost of resettlement and environmental mitigation. In addition, the open question on the navigation net benefits and possible allocation of common costs needs to be addressed.

10.2 Clarifications

Further clarifications are recommended by the Panel, namely:

a) the need to establish the project financial rate of return (FRR) over a range of power tariffs with the tariff based on long–run marginal cost as a maximum limit of competitiveness for the output of the TGP.

b) the need to annex financial projections (income statement, funds flow and balance sheet), to illustrate how project costs are distributed over the years and can be recovered under the financing plans sketched by CYJV; for these simulations, the inflation rate will be assumed to be 3 percent per annum for the life of the project.

11. REGIONAL IMPACT ANALYSIS

The analysis is deemed by the Panel to be in compliance with the TOR, subject to the adequate treatment of the following:

a) impact of temporary evacuation in case of floods along the reservoir rim area and backwater reach;

b) impact of incremental coal use and transportation in the case where TGP is not constructed.

12. CONCLUSIONS

In its study, CYJV has covered all of the important aspects which influence technical and economic feasibility of the project. The study is comprehensive and balanced, and has addressed the various issues in accordance to their importance. The Panel wishes to compliment CYJV and the Chinese participants for their professional accomplishment.

The salient conclusions of the Panel of Experts are:

1. The Three Gorges Project as proposed by the Government of China and studies by CYJV, with NPL/FCL ranging between 180/150 m and 150/135 m, is feasible from an engineering standpoint. All engineering problems can be solved to satisfy international standards of quality by means of available technology.

2. The Project can be constructed in 18 years, with first generation of power in the 12th year.

3. The nature and the magnitude of the sediment – related problems have been competently assessed, and adequate feasible technical provisions for sediment management are incorporated in the TGP design. Flood control and power benefits of the Project are not affected by sedimentation.

4. All major environmental impact issues related to the Project have been identified and it appears there are no issues that jeopardize the environmental feasibility, provided that the CYJV recommendations are implemented and progressively refined in response to future findings and experience.

5. Resettlement feasibility is not yet clearly demonstrated. Unresolved issues pertaining to land availability, job creation and host population, and other issues need further clarification in the Report. Efforts are underway to resolve these issues a by June 1988.

6. The CYJV economic analyses have shown that the representative alternative schemes are all economically feasible; however, the Panel notes that increments in NPL above 160 m exhibit rates of return of less than 10 percent, due to the additional requirements for human resettlement.

7. The selection of the 185/160/140 DCL/NPL/FCL made by CYJV is endorsed on the basis of the economic and risk analyses.

8. In light of the important share of power benefits in the total project benefits, the financial rate of return of the project is primarily dependent on electric power tariffs. The Panel notes that the project appears viable for power prices that are higher than current ones but still are competitive with alternative sources in East and Central China.

The final Feasibility Report, particularly Volume 1, is a critically important document. It will be widely circulated in China and in the rest of the world. It will be used not only by policy decision makers but also by others who may not be as familiar with the details of the study; therefore,

this document must stand alone and must clearly present the results, the conclusions and the recommendations regarding the various aspects of the Project. Where justification of an important conclusion or recommendation is necessary, it should be succinctly stated.

The Panel, therefore, strongly recommends that the Feasibility Report, particularly Volume 1, be further refined and edited before it is officially accepted.

RESETTLEMENT ADDENDUM TO THE FINAL REPORT
PANEL OF INTERNATIONAL EXPERTS
THREE GORGES PROJECT

Montreal, Canada
June 28, 1988

At the 6th Steering Committee meeting held June 26 through 28, 1988 in Montreal, Canada, one member of the Panel of International Experts for the TGP Feasibility Study reviewed the June 1988 drafts of the parts of the CYJV Feasibility Report that address resettlement. These parts are Volume 9 and its appendices, Chapter 7 of Volume 8 and Chapters 1, 2, and 17 of Volume 1. (Volume 3 was reviewed by another member the panel and is addressed separately in his report). The principal purpose of this review was to evaluate the report's compliance with the Terms of Reference of June 16, 1986 and the Supplementary Terms of Reference.

Compliance with terms of Reference

The Panel has concluded that:

1) January 1988 Supplementary Terms of Reference for this study have been satisfied by the work reported in Volume 9.

2) The CYJV analytical work satisfied the original Terms of Reference as amended by the Steering Committee. In fact, the study significantly advances the quality and methodology of resettlement studies carried out at the feasibility stage of large internationally financed projects.

3) Expression of the findings is adequate in most parts of the text of the appendices of Volume 9, the text of Volume 9, the text of chapter 7 of Volume 8 and the text of chapter 17 of Volume 1.

4) Expression of the findings is not yet adequate in the summary of Volume 1.

5) Expression of conclusions and recommendations throughout the subject volumes is not yet uniform and consistent.

6) CYJV should proceed to finalize the subject volumes, taking into account the points that were raised by the resettlement subcommittee in documents tabled and in deliberations conducted during its January 26 and 27, 1988 meeting.

Technical and Social Feasibility of Resettlement at Various NPLs

The Panel believes that the CYJV conclusion about feasibility is consistent with evidence that has reached the Panel and therefore accepts this conclusion. This conclusions reads as follows: "Underlying the assessment of all elements of resettlement is the need for adequate financial and organizational resources. CYJV has identified these requirements and assumes they will be made available. CYJV concludes that the NPL 150/160 schemes are feasible. Applying the same assessment methodology to the higher NPLs, CYJV is not able to fully confirm feasibility at this time. CYJV believes this situation could change if, in the course of further planning, additional land and/or job opportunities can be adequately demonstrated."

Future Considerations

The Panel wishes to re–emphasize the need for following up on the recommendations and suggestions put forth in the aforementioned CYJV resettlement reports and appendices. The Panel strongly believes that sustained and careful attention to these recommendations and suggestions is vital for the successful implementation of the resettlement program.

Donald L. Graybill

D. Graybill

ADDENDUM TO THE FINAL REPORT
PANEL OF INTERNATIONAL EXPERTS
THREE GORGES PROJECT

ECONOMIC AND FINANCIAL ANALYSIS

1. As a member of the Panel of Experts, Mr. Albouy reiterated the view endorsed in January 1988 by the SC that raising the NPL from 160 m to 170 m and higher is not economically viable (incremental benefit–cost ratio lower than one). With the uncertainties now identified by CYJV for the resettlement with higher NPLs, the risks of higher resettlement cost and longer resettlement schedules must be recognized: the schedule risks would certainly lead to a resettlement in stages as envisaged by the CPE. What must also be recognized is that this staging will further deteriorate the economic return of raising the NPL because full power benefits would be postponed while some incremental costs would still be incurred up–front. The POE would like to see this incremental analysis reflected not only in Volume 3 and Volume 1, chapter 19, but also in this summary of recommendations (chapter 2 of Volume 1). The uncertainty about resettlement for higher NPLs should be reflected throughout Volume 1 and Volume 3 (Table 6.5).

2. The risk analysis must be redone – in the view of the POE – not only to incorporate more symmetrical risks on the coal prices as recommended by the POE in January 1988 but also to incorporate the following:

   a) the likelihood of a success rate of less than 100% on project management and material supply policies leading to lower labour productivity and construction delays – which CYJV acknowledge to be now unaccounted for in the risk analysis (p.7,15, Vol. 3)

   b) the revision of resettlement estimates; and

   c) the revision of the breakdown of all the major cost items in the economic analysis into local labour, materials and foreign component (table 7.6, Vol.3)

The results of the risk analysis should be more prominently and explicitly presented in the summary (Ch.2 of Vol 3).

In view of the above, the POE does not support the opinion expressed in Para 4, Section 2.12 of that summary that higher NPL would be attractive in the long run. This opinion should be supported by the analysis or deleted.

3. Financial Analysis:

The POE has found that the debt coverage under the concessional and commercial financing scenarios are missing. They should be calculated and the date until which this coverage is inferior to one should be highlighted in Chapter 8 of Vol. 3 and Vol. 1.

4. Other improvements were discussed and agreed with CYJV for the incorporation into the relevant chapters of Vol. 1 and Vol. 3, inter alia:

- Impact of NPL on flood control benefits (Vol.3, 5.9)
- Impact of project on coal transportation (Vol 3, 5.11)
- Geographical allocation of power benefits
- Calculation of economic costs and of the share of basic commodities on the project cost (Table A.3.1 of Vol. 3)

THREE GORGES PROJECT FEASIBILITY STUDY
STATEMENT BY THE WORLD BANK
Washington, D.C., September 1988

The World Bank has reviewed the Three Gorges Project feasibility report prepared by CYJV. It is satisfied that the consultant has fulfilled the terms of reference under which this work was to be carried out.

In view of the analysis presented in the CYJV report, it appears to the Bank that the feasibility of the Three Gorges Project has been demonstrated for a Normal Pool Level 150 m or 160 m above sea level. The Bank endorses the consultant's selection of the NPL 160 m scheme.

As an hydro power project, the recommended scheme is slightly more economic than its base hydro–thermal alternative. The project also substantially helps navigation on the Yangtze river; yet, in the final analysis, its main competitive advantage in spite of the large size of the required human resettlement lies in the large flood control benefits which only this massive dam can bring about.

The feasibility report contains evidence to indicate that increasing the NPL from 160 m to 170 m and higher would not be an economically viable proposition. This would not substantially increase flood control benefits and the incremental cost most likely would exceed the additional economic benefits. Resettlement problems at higher pool levels may become unmanageable.

The report represents a significant advance in the quality of feasibility studies on resettlement and is acceptable at this stage of planning. Nevertheless, there should be no question that the resettlement of more than 700 000 people will be a difficult task under the best of circumstances and that considerable additional work will have to be done if the decision is taken to proceed with the project. Plans must be made and executed on appropriate institutional and financial arrangements for resettlement if the proposed program is to be implemented.

The report concludes that the project at NPL 160 m would have a notable impact on the natural heritage which is to create a fjord–like environment where there are now rapids and canyons. The report demonstrates that the adverse consequence on natural habitat and on rare and endangered species can be mitigated. With the help of the budget considered in the study, a program for a positive environmental protection and enhancement could also be considered. However, in order to address all the issues

raised by the project, detailed studies would have to be carried out at an early stage of its implementation. In particular, the impact on the areas downstream of the project must be fully investigated.

If the Government of China decides to proceed with the project, a commitment must be made to put into place a strong organization to supervise and coordinate the various parts of this very major undertaking.

THREE GORGES WATER CONTROL PROJECT
FEASIBILITY STUDY

CIDA CONCLUDING STATEMENT

Ottawa, September, 1988

CIDA has examined the Three Gorges Water Control Project Feasibility Study prepared by CYJV and finds the report satisfies the terms of reference as modified to reflect the guidance provided by the Steering Committee throughout the conduct of the study.

The Consultant has come forward with a recommended project providing 31 billion cubic metres of flood control storage which would afford major relief to the flood prone middle reach of the Yangtze basin. Optimization studies leading to maximum net benefits for flood control, navigation and power generation have resulted in the determination of an NPL of 160 m and FCL of 140 m for the recommended project based upon the economic criteria laid down by the Steering Committee and taking into account all information available at this time.

The report demonstrates that there is no viable alternative to providing the desired level of flood protection to some 14.5 million people who remain at risk in the middle reach of the river between Yichang and Wuhan. Neither is there any viable alternative to improving navigation conditions between Yichang and Chongqing.

The power produced by the project would provide a significant portion of the additional energy supply required by the Central and East China power regions, would be an integral component of the least cost power system expansion programs for these regions, and could produce sufficient revenues to support development and secure the multipurpose benefits.

The study has conservatively estimated all costs and benefits associated with development and has demonstrated, through comprehensive risk analysis, that the expected value of net benefits is most likely to be some 10% higher than projected in feasibility assessment.

It is noted that information and data is still becoming available which may vitally affect resettlement costs, particularly at higher NPL levels. Continuing studies of changing economic factors in China and availability of new data could lead to consideration of slightly modified operating levels.

CIDA believes further work on resettlement and environment is absolutely essential. The most urgent problem is identification of the institutions which will be responsible for coordination of the implementation for resettlement with development and for environmental protection and enhancement wherever possible.

CIDA is responsible to the Government of Canada under federal law for ensuring that resettlement and environmental issues are fully recognized and treated with care and sensitivity in any further activities CIDA might undertake. CIDA will wish to talk with China about CIDA's continued involvement in the development of strategies in these areas and opening lines of communication with all those institutions responsible for resettlement and environmental issues.

CIDA believes the CYJV Feasibility Report together with the Chinese Justification Report will provide the foundation for informed decision making regarding the future of the Three Gorges Project.