

An Examination of China's Three Gorges Dam Project Based on the Framework  
Presented in the Report of The World Commission on Dams

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ABSTRACT

This paper views China's Three Gorges Dam (TGD) Project in light of The World Commission on Dams (WCD) Report, *Dams and Development: A New Framework for Decision Making* (2000). A brief overview is given on the current state of dambuilding, the process used by the WCD in writing *Dams and Development*, and general technical aspects of China's TGD. I then examine the major social, environmental and economic factors associated with the TGD Project as they relate to relevant sections of the WCD report, government documents and other sources. Analysis of the TGD based on the World Commission on Dams' Seven Strategic Priorities and Five Key Decision Points shows that an insufficient and improper process was used for planning China's Three Gorges Dam. The primary finding of this paper is that the TGD was planned with a non-participatory approach. The proposal for a dam at the Three Gorges site took shape 80 years ago and has since been in the plans of the Chinese government. When construction of the dam finally became technologically and economically feasible, the political momentum behind the project made participatory needs assessment and thorough consideration of social and environmental issues secondary. This paper serves as an example of using the WCD Report as a basis for evaluating a large-scale water resource project. This analysis may also serve as a comparison for similar evaluations of large-scale water resource projects in other areas of the world and in the future to assess possible changes in China's water resource policies over time.

## Table of Contents

1. Introduction	1
2. Conceptual Framework	
The Seven Strategic Priorities	3
The Five Key Decision Points	5
3. Context and Background of the Three Gorges Dam	
Significance of Large-Scale Dambuilding	7
The World Commission on Dams: Participation and Funding	9
The Report of the World Commission on Dams	11
4. Description of the Three Gorges Dam	
History	14
Reasons for a Dam at the Three Gorges	16
5. Planning Considerations for the Three Gorges Dam	
Environmental Impacts	18
Economic Impacts	23
Financial Impacts`	25
Social Impacts	28
6. Analysis of the TGD Planning Process	
The WCD's Seven Strategic Priorities	32
The Five Key Decision Points	36
7. Conclusions	38

## **List of Tables and Figures**

Table 1: The WCD's Seven Strategic Priorities	3
Figure 1: Five Key Decision Points	6
Figure 2: Regional Distribution of Large Dams	8
Table 2: Participants in the WCD Partnership	11
Figure 3: Map of the Three Gorges Dam	14
Table 3: TGD Physical Summary	16
Table 4: Incorporation of The Seven Strategic Priorities	35
Figure 4: Decision Points Comparison	37

## **List of Abbreviations**

WCD, World Commission on Dams

TGD, Three Gorges Dam

IUCN, World Conservation Union

EIA, Environmental Impact Assessment

MWR, Ministry of Water Resources

PRC, Peoples Republic of China

ADB, Asian Development Bank

## 1. Introduction

The World Commission on Dams (WCD) Report, *Dams and Development: A New Framework for Decision Making* (2000) addresses specific standards for dam-building conventions and provides a framework for planning large-scale water resource projects. The World Commission on Dams was a body brought together in 1998 by the World Bank and The World Conservation Union for the purpose of assessing the development impact of large dams. The WCD was set up as a forum for the purpose of gathering information necessary for analyzing dambuilding efforts and establishing an accepted set of standards for planning large dam projects, which were published in the *Dams and Development* Report. In the Report, positive and negative impacts of large dams were divided into three categories: *environmental performance, social performance, and economic performance*. After a thorough assessment of each of these categories, the WCD drew up a framework for planning large dams. This framework includes Seven Strategic Priorities and Five Key Decision Points.

China's Three Gorges Dam (TGD) is the world's largest dam, making it an interesting subject for investigation of a dambuilding process. In addition to physical size, the TGD will be the world's largest power plant and will displace more people than any other water resource project. Future impacts of such an undertaking are important. The economic, environmental and social performance of the dam is critical to millions of people living in the Three Gorges Region and to China's national economy. As the nation with largest number of large dams, China plays a significant part in determining the effectiveness of dambuilding policy. Multilateral dambuilding conventions must influence China's dams to be effective; as China's premier dambuilding project, the TGD is central in China's dambuilding activities. The process used for planning the TGD project does not correspond with the framework set out in the WCD report, despite China's Ministry of Water Resources' participation in the WCD. Analysis of the TGD based on the World Commission on Dams' Seven Strategic Priorities and Five Key Decision Points shows that an insufficient and improper process was used for planning China's Three Gorges Dam.

The WCD report concludes that the primary challenge for future water resource development will involve improving assessments of options in water resource projects

(The Report of the WCD, 2000). Such changes will require increased levels of accountability and open, comprehensive decision-making phases. Applying the ideas presented in the WCD report to the TGD project requires a comparison of two different ways of viewing development projects. The WCD report says that better results come from collaborative, transparent efforts that directly involve affected peoples in all parts of the decision-making process. The TGD project relies on the expertise of the Chinese government to effectively represent its citizens such that the experts decide what is best for those citizens. Comments from the Chinese government suggest that criticism of the planning process for projects such as the TGD constitutes a rejection of their Chinese system of governance, and that such criticism should be rejected. ([www.dams.org](http://www.dams.org), *Country Review: China*, 2000)

It is noteworthy that the TGD project was underway before the WCD report was published, being six into the fifteen years expected for completion. The WCD report says that dams in the pipeline are a special case. Implementation of the WCD's framework to a project already under construction can cause undesirable delays in delivering intended benefits. However, "it is never too late to improve outcomes"(Report of the WCD, 2000, p.276) and the long term benefits of a properly-planned project can be beneficial, even in light of present setbacks. The specific recommendations of the WCD for projects under construction include reviewing/developing a compliance plan; turning resettlement and benefit-sharing commitments into formal contracts; developing a sufficient technical, social, and environmental monitoring plan; reviewing operating rules and project plans within a stakeholder forum; and arranging post-project reviews at specified intervals after a project's completion (Report of the WCD, 2000). Based on the information collected for this study, there have been no such initiatives or changes in TGD activities since the WCD report was published.

## 2. Conceptual Framework

### *The Seven Strategic Priorities*

The WCD's framework for the planning and operation of large dams consists of two major items: (1) The Seven Strategic Priorities and (2) Five Key Decision Points. The Seven Strategic Priorities, as shown in Table 1, include gaining public acceptance, comprehensive options assessment, addressing existing dams, sustaining rivers and livelihoods, recognizing entitlements, ensuring compliance, and sharing rivers for peace. The most important aspects of each of these priorities are shown under each priority heading in Table 1. These specific steps involved in reaching each of the strategic priorities, are used as a basis for evaluating the TGD project upon consideration of appropriate economic, social, and environmental impacts.

Table 1: The WCD's Seven Strategic Priorities (Source: [www.dams.org](http://www.dams.org), 2000)

<p><b>1. Gaining Public Acceptance</b> Stakeholder Analysis Negotiated Decision-Making Processes Free, Prior, and Informed Consent</p>	<p><b>4. Sustaining Rivers and Livelihoods</b> Baseline Ecosystem Surveys Environmental Flow Assessment Maintaining Productive Fisheries</p>
<p><b>2. Comprehensive Options Assessment</b> Strategic Impact Assessment for Environmental, Social, Health, and Cultural Heritage Issues Project-Level Impact Assessment for Environmental, Social, Health and Cultural Heritage Issues Multi-Criteria Analysis Life Cycle Assessment Greenhouse Gas Emissions Distributional Analysis of Projects Valuation of Social and Environmental Impacts</p>	<p><b>5. Recognizing Entitlements and Sharing Benefits</b> Baseline Social Conditions Impoverishment Risk Analysis Implementation of the Mitigation, Resettlement and Development Action Plan Project Benefit-Sharing Mechanisms</p>
<p><b>3. Addressing Existing Dams</b> Ensuring Operating Rules Reflect Social and Environmental Concerns Improving Reservoir Operations</p>	<p><b>6. Ensuring Compliance</b> Compliance Plans Independent Review Panels for Social and Environmental Matters Performance Bonds Trust Funds Integrity Pacts</p>
	<p><b>7. Sharing Rivers for Peace, Development, and Security</b> Procedures for Shared Rivers (Across Borders)</p>

Gaining public acceptance is important in order to recognize the range of interest groups that should play a part in the decision-making and planning process. Failure to include all affected groups, especially minorities, women, and others that may not normally have a say in the political process undermines the overall effectiveness of a development project. Legitimacy comes from the incorporation of stakeholder groups and an acknowledgement of their rights. Informed consent through a negotiated planning process leads to equitable and sustainable resource development.

Comprehensive options assessment involves assessing many of options (one of which is a large dam) for a particular project. Assessment techniques recommended by the WCD report include impact assessment for a range of issues, life cycle assessment, distributional analyses, and risk assessment. These criteria are important for determining which options are the most equitable, profitable, and able to meet the established needs.

In order to improve the performance of existing dams, the WCD suggests that guidelines be established that govern their operation. Modifications to operations procedures based on the principles of the other six strategic priorities will result in maximizing the long-term sustainability of a large-dam.

Sustaining rivers and livelihoods focuses on the environmental performance of a large-dam. Large dams often have negative environmental impacts and it is important to know the extent of potential impacts through ecosystem surveys and environmental flow assessment. Productive fisheries are an indicator of the overall health of a river and livelihoods and health are often contingent on maintaining productive fisheries.

Evaluating the social impacts of a large dam is important to the benefits derived from a project. Knowledge of baseline social conditions is important for monitoring the actual impacts of a development over time. Social impacts can be measured by analyzing risk of impoverishment. Positive social impacts can be equitably distributed through benefit-sharing mechanisms.

Ensuring compliance with regulations, procedures and agreements is critical to the long-term success of a project. Having items such as compliance plans, performance bonds, and trust funds help ensure continued stakeholder involvement in a project. Integrity pacts and independent review panels help ensure that project implementation creates accountability among stakeholders.

Establishing agreements governing rivers that cross borders establishes peaceful and secure use of the rivers. Such agreements also ensure that equitable benefits are gained from projects impacting a river's environment.

#### *The Five Key Decision Points*

The other element of the WCD framework is a set of Five Key Decision Points shown in Figure 1. These criteria characterize five major decision-making elements of the large-dam planning process. The decisions should be based on: (1) needs assessment; (2) selecting alternatives and investigative studies; (3) project preparation; (4) project implementation; and (5) project operation.

In this paper, the most important decision is one determining whether or not to adopt a dam or non-dam option to meeting development needs. This decision is based on identifying a full range of alternatives that meet the needs identified in the needs assessment part of the process.

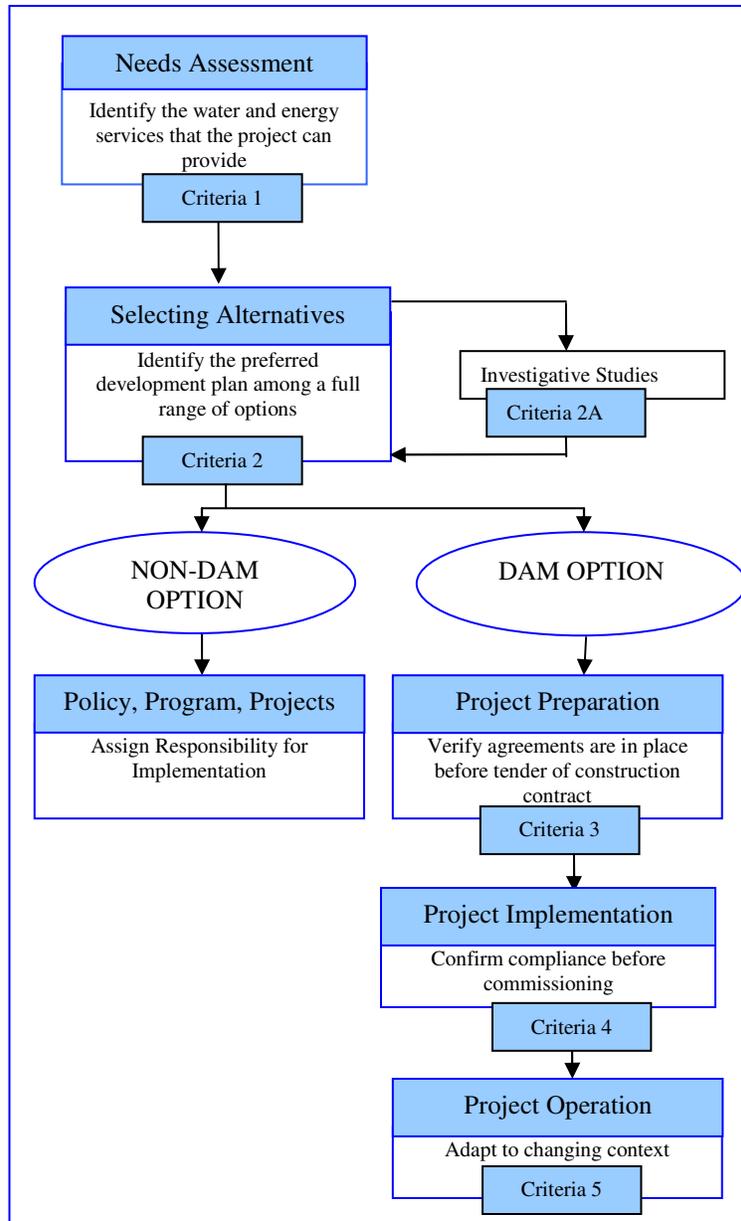


Figure 1: Five Key Decision Points (Source: The Report of the WCD, 2000)

### 3. Context and Background of the Three Gorges Dam

#### *The Significance of Large Scale Dam Building*

Water management projects affect a large portion of rivers throughout the world. Dams are an important international issue because nearly half of the world's rivers have at least one dam; large dams generate 20% of the world's electricity; 30-40% of the world's irrigated land relies on dams; and 40-80 million people have been displaced by dam reservoirs (Report of the World Commission on Dams (WCD), Chapter 1, 2000). There are five indisputable facts about the impacts of large dams: (1) Dams have had considerable benefits and made important contributions to human development; (2) The social and environmental price paid in order to secure those benefits is often unacceptable and unnecessary; (3) The distribution of benefits from large dams is often inequitable, especially when compared with alternatives; (4) Collaborative approaches create the conditions for a positive resolution of conflicts and competing interests; (5) Negotiation improves the effectiveness of water resource projects by offering stakeholders a choice of how to best meet their needs. (Report of the WCD, 2000, *Summary*, p.7)

According to the International Commission on Large Dams (ICOLD), there are 45,000 large dams (defined as those at least 15m high or 5-15m high with 300m<sup>3</sup> or greater volume); these were built to meet water and energy needs (ICOLD, 2004 and Report of the WCD, 2000). Figure 2 shows a regional distribution of large dams throughout the world. According to the Chart in Figure 2, China has almost as many large dams as the rest of the world combined; this illustrates the important role that China plays in the international dambuilding community.

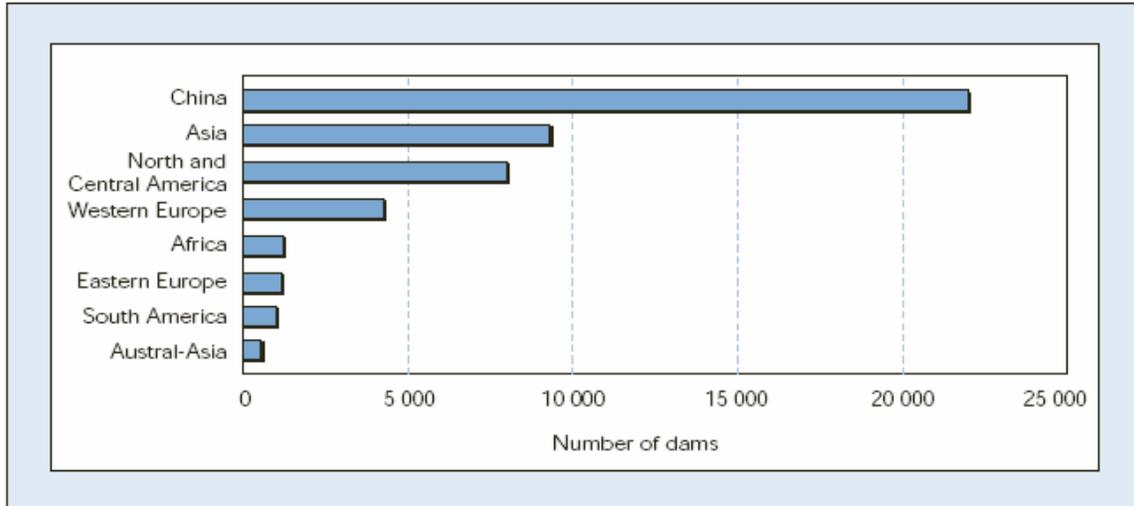


Figure 2: Regional Distribution of Large Dams in 2000 (Source: Report of the WCD, 2000, p.8)

Large dams are facing increased scrutiny. This is due to high environmental and social costs that dams cause, as well as emerging challenges to their economic viability. During construction, large dams consistently overrun projected costs by an average of 30%. Due to overrun costs and controversial benefits, international lending organizations have decreased their funding of large dams, which has resulted in changes in the approach to their funding.

The most significant development involving large dams is awareness of their negative consequences. In recognition of this, The World Bank, once the largest contributor for dambuilding projects, has cut large-dam lending from an early 1990s high of \$1 billion a year to \$100 million in 2002. In total, only 10% of the Bank's portfolio goes towards large dams, but they cause a disproportionate share of problems. (*The Economist*, 2003)

Controversy has surrounded some of the largest dams including: India's Sardar Sarovar project, Chile's Bio Bio River dam, Malaysia's Bakun dam, and Namibia's Cunene River dam. These disputed projects have been the focus of civil protest and international criticism. (www.irn.org, 2004)

In contrast, the Nam Theun 2 dam in Laos is a model for large dam planning. Financing, which was provided by the World Bank, hinged on three demanding studies aimed at (1) ensuring benefits to all concerned, (2) comparing the large dam to feasible

alternatives, and (3) determining whether the dam's watershed area could instead be made a national park (*The Economist*, 1997). These requirements, though established before the recommendations of the WCD were published, are important points made in the Report of the WCD.

Recognition of the social, environmental and economic problems associated with large dams by influential international organizations such as The World Bank and The World Conservation Union, shows increasing awareness that positive and negative benefits of large dams are directly related. For example, irrigation and power production are lost when a dam's gates are opened to control flooding; sustaining fish populations through periodic water release reduces the electricity for sale; storing water for irrigation purposes causes valuable farmland to be inundated (*Asian Review of Business and Technology*, 1998). These social, environmental, and economic contradictions often complicate the justification for large dams. Governments, private industry, and civil society organizations are aware of these contradictions and there have been numerous studies and forums set up to assess them. One of the most recent and influential meetings on the topic of large dams was The World Commission on Dams (WCD) in 2000.

#### *The World Commission on Dams: Participation and Funding*

The conveners of the WCD were the World Bank and World Conservation Union (IUCN). Impetus for the WCD came from a 1994 report by the World Bank's Operations Evaluations Department (OED). This report showed that a disproportionate number of Bank-funded dam projects had failed to provide expected benefits. The issues cited by the OED report include construction-related problems that bring about unexpected costs. (Outline of the WCD, [www.dams.org](http://www.dams.org), 2000)

The WCD encouraged dialogue between governments, international lending organizations, the private sector, and NGOs. The defined goals of the commission, as identified in their initial meeting, were to (1) evaluate the development impacts of large dams and (2) set out planning, operation, and monitoring guidelines for projects involving large dams. (Outline of the WCD, [www.dams.org](http://www.dams.org), 2000)

Between May 1998 and July 2000 the World Commission worked to produce a document called "Dams and Development: A New Framework for Decision-Making".

Many sources agree that the result was an innovative, dynamic framework for evaluating, planning, and operating large dams. (Outline of the WCD, *Mandate and Structure*, www.dams.org, 2000)

As a multidimensional group of stakeholders, the WCD reviewed a wide range of topics, ranging from the economic benefits of hydropower and ecological impacts to resettlement compensation and disparities in gender-related benefits. Information was drawn from case studies at the national, basin-wide, and community levels; consultations; hearings; and topic-specific task force investigations. A list of organizations that contributed to this knowledge base is identified in Table 2. Contributors came from national governments, lending organizations, private industry and local civil society groups. The intent of this wide-ranging process was to inspire confidence in the WCD forum as well as the eventual report. Such collaborative processes derive their credibility through direct involvement and participatory consensus-building. (*The WCD Forum*, www.dams.org, 2000)

WCD financing was drawn from a wide range of different sources to ensure that no single organization was too influential. The initial proposal and funding for the WCD forum came from The World Bank and The World Conservation Union, however, in order to guarantee independence, these two organizations did not exercise any power over the commission's agenda or efforts. There were 54 separate financial contributors to the WCD project. Of those, 38% were private sector companies, 24% were nongovernmental organizations, and 38% were public sector institutions. "Governments and development co-operation agencies" were responsible for 63% of the funds, "foundations and NGOs" accounted for 16%, multi-lateral organizations contributed 12%, and private sector companies put in the remaining 9%. Additionally, no single organization donated more than 12% of the US \$10,116,716 total. (*Fundraising and Finances*, www.dams.org, 2000)

Table 2: Participants in the WCD Partnership (Source: www.dams.org, *Financial Contributors and Partnerships*, 2000)

<b>Participant</b>	<b>Contributing Role</b>
Environmental Monitoring Group	NGO Assistance
International Association on Impact Assessments	Impact assessment information
International Commission on Large Dams	Large dam technical information
International Energy Agency	Hydropower technologies and program agreements
International Rivers Network	Communication with NGO networks
IUCN – The World Conservation Union	Environmental policy, WCD fiduciary responsibility, management support
Transparency International	Corruption and integrity of business transactions
The United Nations Environment Programme	Environmental aspects associated with large dams and mechanisms for financing sustainable development projects
The UN Food and Agriculture Organization	Dams and inland fisheries information
The World Archaeological Congress	Dams and cultural heritage information
The World Bank	Technical aspects, fundraising and networks of expertise
The World Health Organization	Health impacts associated with large dams
The World Resources Institute	Relevance of the WCD process as a model for global public policy

*The Report of the World Commission on Dams*

The World Commission on Dams report, *Dams and Development: A New Framework for Decision Making*, was published in 2000 and has two major sections. The first part is entitled *The Global Review of Large Dams* (Chapters 2-6). The opening three chapters focus on economic, environmental, and social performance issues, respectively. These chapters are followed by two more on *Options for Water and Energy*

*Resources Development and Decision-Making, Planning and Institutions* associated with large-scale water resource projects.

Part two of the WCD report, entitled *The Way Forward*, develops a framework for governing how water resource projects can be planned and carried out. Chapter 7, *Enhancing Human Development*, assesses water resource development options through a ‘rights and risks’ approach to negotiating outcomes. In Chapter 8, a decision-making framework of seven priorities is laid out. Chapter 9 specifies these priorities within the dambuilding process by establishing frameworks for their implementation. One framework is a flow chart outlining five key decision points in the dambuilding processes. The other consists of twenty-six “Guidelines for Good Practice” that fall under the ‘strategic priorities’ of Chapter 8. These guidelines involve specific steps that should be taken in order to follow each strategic priority.

Chapters 2-6 of the WCD report offer a critique of ‘the way things have been done’. This section criticizes past dambuilding projects by pointing out shortcomings in environmental and social areas. The underlying themes of this section are that: (1) The economic performance of large dams is often overestimated and unsustainable; and (2) Cost overruns are the norm in large-scale dam building projects and, as a result, benefits seldom reach expectations. Environmental performance critiques focus on terrestrial ecosystem and biodiversity considerations, greenhouse gas emissions, fisheries, floodplain ecosystems and cumulative impacts. Social performance issues involve physical resettlement and disruption of societal norms. The social systems that are moved, created, or destroyed require far more attention than the traditional approach of providing resettlement money and new homes.

The foci of the frameworks presented in the final chapters of the WCD report are the requirements for and alternatives to construction of large dams. Such efforts involve complete consideration of the positive and negative impacts of any proposed dam project. According to the WCD report, such assessment will involve benefits analyses for all those affected by a project, and evaluation of environmental and social considerations to a degree rarely seen in the dambuilding world. There should also be mechanisms in place to ensure long-term compliance with performance standards, transparency in decision-making and shared benefits among affected peoples.

A myriad of reactions to the WCD report, from full, enthusiastic support to outright rejection, are available at [www.dams.org/report/reaction](http://www.dams.org/report/reaction). In general, governments in developing countries are critical of the WCD report, as are a number of dambuilding organizations. Their main criticism is that the recommendations of the WCD report are unrealistic and unfeasible for implementing in a dam-building process. International lending organizations, NGOs, and civil society groups are supportive of the Report's findings, though implementation of the WCD's Framework for Decision Making has been limited. For example, the African Development Bank, in a 2001 letter to the WCD chair, gave a supportive review, stating that the WCD Report is a useful guide for financing future water management projects. The World Bank chose to endorse the findings of the WCD, however they are not strictly adopting the recommended guidelines. The Institute of Civil Engineers (UK) issued a press report on November 20, 2000, stating that "the WCD has ignored key issues and the full scale of the problem that the world faces has not been correctly assessed"(Institute of Civil Engineers, UK, Press Release November 20, 2000). Comments by the International Hydropower Association say the WCD report has a "negative tone concerning the role of dams", unresearched claims, and unrealistic views (International Hydropower Association, Press Release, November 16, 2000). The World Health Organization gave the WCD report "a strong endorsement", as did UNEP and The World Bank (*Reactions to the Final Report*, [www.dams.org](http://www.dams.org), 2000).

Judging from these reactions, journal articles, and national government information, the WCD report has influenced dambuilding projects at many levels. Like similar United Nations studies, the WCD report has become a touchstone for the pressing set of challenges facing large-scale water resource projects. Based on the criticisms towards the Report from developing countries, the WCD is not (yet) a universally accepted standard, however it has the potential to be a useful and influential tool for planning large dams.

#### 4. Description of the Three Gorges Dam

##### *History*

China has an impressive history of water resource and development projects. The oldest of these is the Dujiang Dam, a 2,200 year-old project that still irrigates 800,000 hectares of farmland (Lei, 2003). While this is an impressive accomplishment in terms of longevity, the Three Gorges Dam (TGD) project takes water resource management to an unprecedented level in terms of size. Upon its expected completion in 2009, the TGD will be 1.6 miles long, 610 feet high, and form a 400 mile-long reservoir in the midsection of the Yangtze, the world's third largest river (Major, 1999). By all accounts, the Three Gorges is the largest dam project ever attempted. A map showing the location of the TGD is shown in Figure 2 and a summary of the Dam's technical specifications is shown in Table 3.

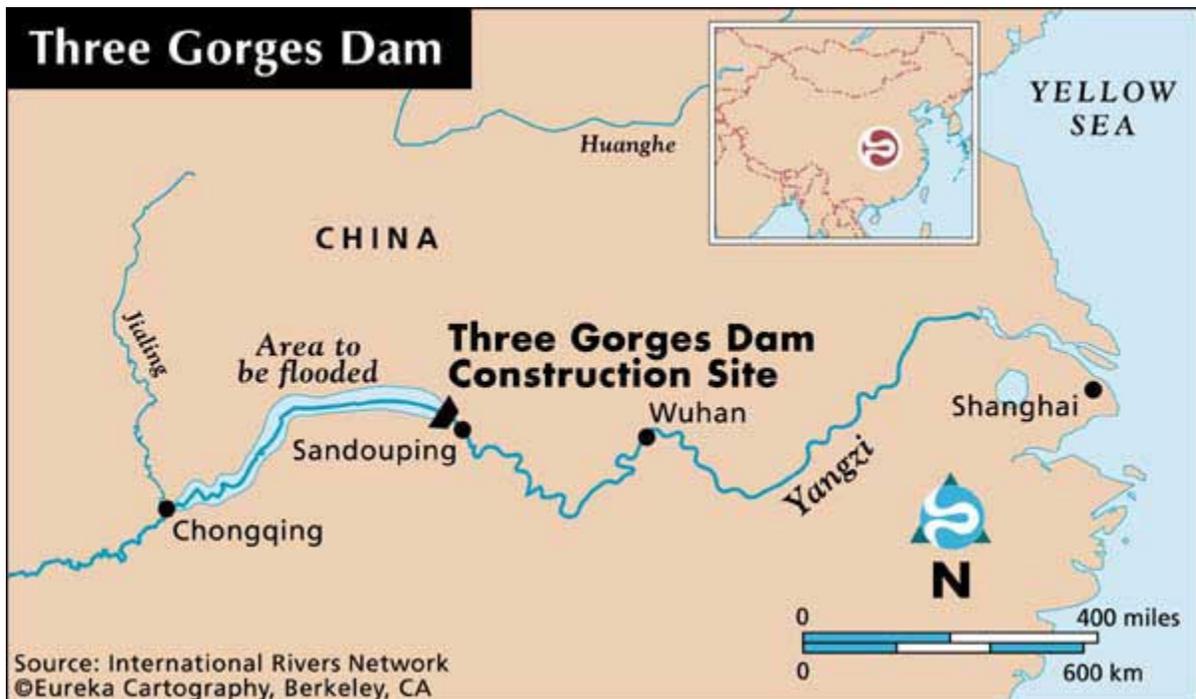


Figure 3: Map of the Three Gorges Dam

(Source: [www.irn.org/programs/threeg/map.shtml](http://www.irn.org/programs/threeg/map.shtml), 2004)

The impetus behind the TGD dates back to the early 20<sup>th</sup> Century, with provisional President of the Republic of China, Sun Yat-sen, and corresponds with the long-held Chinese practice of undertaking magnificent economic development schemes.

The TGD is asserted to be China's largest project since the Great Wall (Jackson and Sleigh, 2000).

The issue of building a dam at the Three Gorges site has seemingly been on the minds of China's leaders since Sun Yat-sen's idea in 1919 (*Ministry of Water Resources (MWR) of the Peoples Republic of China (PRC)*, 1994). However, economic conditions, political and social instability, and technical limitations made the project infeasible until the early 1990s (*The Economist*, 2003). In 1992, the National People's Congress of China confirmed a resolution to proceed with the Three Gorges Project; in 1994 the project officially got underway; and in 1995 the resettlement of 1.1-1.5 million people began. A timeline outlining further details of the political history behind the TGD is included in Appendix 1 (*MWR fo the PRC*, 1994). According to the Asian Review of Business and Technology, projects like the TGD...

*should be viewed in the light of the historical struggle of Chinese rulers to control the mighty Yellow River and the Yangtze River. Since ancient times there has been the Chinese thought that whoever wants to rule the state must first control the waters. By the construction of water projects, which began on a large scale after 1949, the Government began to tame the rivers; and these... hydro projects now represent a major step towards finally "conquering" these dangerous 'old enemies'. (Asian Review of Business and Technology, 1998, p2)*

The Chinese are by far the world leaders in dambuilding and, as such, are the most experienced country at dealing with engineering and social aspects of large dam construction. Experience, however, does not equal success, because China is also responsible for disasters, such as the string of dam failures in 1975 that caused 230,000 deaths (*The Economist*, 2003).

Table 3: TGD Physical Summary (www.irm.org, 2004)

<b>Location</b>	
Dam Site	Sandouping, Hubei Province, China
Dam Crest	185 meters
Dam Length	2,000 meters
<b>Reservoir Specifications</b>	
Normal Pool Level	175 meters
Flood Control Level	145 meters
Total Storage Capacity	39.3 billion cubic meters
Flood Control Storage	22.1 billion cubic meters
Navigation	Reservoir level raised by 10-100m to allow 10,000 ton ships to Chongqing
<b>Power Generation</b>	
Installed Capacity	17,680 MW
Unit Capacity	26 units, 680 MW/unit
<b>Inundation</b>	
Land	632 km-long, 19 cities, 326 towns
Arable Land	430,000 mu (30,000 hectares)
Population	1,980,000 people

*Reasons for a Dam at the Three Gorges*

Flood control is the number one reason for the TGD project. Chinese records show that 200+ major floods, about one per decade, occurred between 185 BC and 1911 AD; the three most disastrous of these floods, those in 1931, 1935 and 1954, killed over 320,000 people (Jackson and Sleigh, 2000). Another flood in 1998 affected 300 million people (Albert, 1998). Floods of the magnitude seen on the Yangtze can also have significant economic impacts. For instance, costs from the 1998 flood amounted to nearly 50 billion dollars (MWR of the PRC, 1994). The variability in river flows and runoff throughout the year are a primary cause of droughts and floods, which in turn affect the stability of agricultural production and water supply (MWR of the PRC, 1994).

Of the 39.3 billion m<sup>3</sup> storage capacity of the TGD, just over half (22.15 billion m<sup>3</sup>) will be available for flood control, allowing China to mitigate the effects of disastrous floods from levels expected once every decade to those expected once a century (www.irn.org, 2004).

The second major driving force for a dam at the Three Gorges site is energy production. China's electricity supply has fallen short of demand in recent years, and industries are expanding at an annual rate of 22% (State Statistical Bureau of China, 1996, p. 204 and 403). The TGD will help this problem with an 18.2 million KW output, making it the world's largest power plant of any type (MWR of the PRC, 1994). The TGD will make up a significant part of this increase, producing up to 10% of China's total available energy. Increased power generation is considered vital to the continued growth China has experienced over the last decade. In the coming years, China's overall power generation is planned to increase by 8-9%. (*Asian Review of Business and Technology*, 1998)

A third benefit of the TGD is increased navigability of the Yangtze River, providing an extended shipping and travel route into mainland China. Shipping access will increase trade and provide a much-needed economic boost for the Three Gorges area. The TGD will create a direct route from the Pacific Ocean into mainland China, allowing large ocean-going vessels to travel to the city of Chongqing (pop. 30 million). The intended result of the increased navigability is increased trade in mainland China, which will cause the emergence of new markets, job creation, and economic vitality. (Albert, 1998)

The fourth reason for the TGD is access to fresh water. Fluctuations in the Yangtze's water levels have a significant affect on the water available for agricultural, as well as human use and consumption. The TGD will consistently supply water for agriculture, people and industries in the vicinity of the TGD, and to Northern China as part of a major interbasin water transfer project. (*MWR of the PRC*, 1994)

The benefits that will be derived from the TGD are significant and will have lasting, positive impacts on China's economy. From an economic standpoint, the TGD is an attractive, effective development option that also has the potential to benefit society in terms of safety, health, and overall quality of life.

## 5. Planning Considerations for the Three Gorges Dam

### *Environmental Impacts*

Review of literature discussing environmental impacts of the Three Gorges Dam (TGD) shows inconsistent conclusions that can be accurately predicted based on the information source. Documents released by the Chinese government or individuals associated with companies contracted on the TGD are consistently more positive than those from environmental activist organizations. The majority of the literature from international bodies such as the World Commission on Dams (WCD) concludes that environmental impacts of large-scale dambuilding projects, including the TGD, are undervalued. Documents from China's Ministry of Water Resources (MWR) and similar sources cite the ability to deal with almost any environmental problem through careful planning and management of a dam's facilities. Inconsistencies between these sources are an important part of this analysis and will be identified through the course of this discussion.

The overwhelming conclusion of the WCD report is that dams have a negative net-impact on the environment. The most common impacts cited by the WCD include loss of forests and wildlife, greenhouse gas emissions, loss of aquatic biodiversity, creation of wetlands, and cumulative impacts on water quality (from multiple dams) (Report of the WCD, 2004).

The main Yangtze River is one of the most polluted waterways in the world due to coal shipping, acid rain, and its location in the heart of industrial China (Albert, 1998). There are an extremely large number of physical and chemical alterations that will occur in the Yangtze River when the TGD is completed. Commonly cited examples include the 15 tons of dust per day released from explosions during construction of the dam's foundations, and lower temperatures and oxygen levels that will be present in the water below the dam after completion (*Environmental Impact Assessment Review*, 1999; Albert, 1998). While a complete list of specific chemical alterations is outside the scope of this discussion, other informative sources include the Chinese MWR's *Environmental Impact Assessment of the Three Gorges Project*, environmental organizations such as the International Rivers Network ([www.irn.org](http://www.irn.org), 2004) or Three Gorges Probe ([www.threegorgesprobe.org](http://www.threegorgesprobe.org), 2004), and independent investigations (*Science*, 2004).

When the TGD is fully operational, there will be significant changes in water temperature, silt levels, and seasonal flow fluctuations. Additionally, breakdown of vegetation, silt, and other organics at the bottom of the reservoir will release significant amounts of greenhouse gasses (GHG) (Palmieri, 2001). No specific numbers are available on the amount of greenhouse gasses that will be emitted from the reservoir itself, however, the probability of significant GHG emissions poses an interesting conflict with the assumed environmental benefits of the TGD project. The focus on “clean” hydroelectric power is assumed to eliminate the greenhouse gases that would otherwise be released by coal-burning power plants. While this number is significant, concerns that the reservoir will also release considerable amounts of GHGs detracts from the “clean energy” argument. According to the WCD, reservoirs account for a significant portion (between 1 and 28%) of the global warming potential of GHG emissions. This statistic challenges conventional wisdom that hydropower has no negative atmospheric impacts. (Report of the WCD, 2000, p.75)

Neither the TGD’s environmental impact assessment (EIA) nor the numerous statements from the Chinese government spoke of GHG emissions from the reservoir itself. While the Chinese government is certainly aware of these emissions, the only mention of greenhouse gasses had to do with GHG reductions. These reductions will come from replacing coal fired power plants with hydroelectric power from the TGD (MWR of the PRC, 1994; Environmental Impact Assessment of the TGD, 1992)

Hydroelectricity generated from the TGD will annually replace 50 million tons of raw coal used in coal fired power plants, preventing the release of large amounts of Carbon Dioxide, Sulfur Dioxide, Carbon Monoxide, and Nitrous Oxide emissions, as well as wastewater and solid pollutants ([www.power-technology.com/projects/gorges/](http://www.power-technology.com/projects/gorges/), 2004). Social benefits exist in the form of lowered health risks from reduced (coal-fired powerplant) emissions. It is expected that hydroelectric substitution will prevent acid rain damage and raise air quality in middle and eastern China. According to some sources, greater power generation availability may also have positive health impacts (as discussed later). (Rushu, 2004)

Another undermining of perceived benefits arises from the widely circulated argument that extensive silting in the TGD reservoir will reduce the anticipated positive

impacts of navigability and power generation. The Yangtze is well known for the large amount of silt contained in its waters. Silt will settle to the bottom of the reservoir when the water is moving slowly. Silt that backs up near the dam itself might reduce the effectiveness of power generation schemes, while upstream siltation may impact navigability. According to some sources, silt buildup at the upper end of the reservoir over time will actually *increase* the possibility of flooding upstream from the dam. (Maize, 1996)

A related set of downstream environmental effects has to do with reduced summer flows, increased winter flows and lower silt levels (Jackson and Sleigh, 2000). According to the WCD loss of the silts and nutrients resulting from upstream dams results in reduced fertility in downstream floodplain agricultural soils. Additional impacts are felt in flood-plain ecosystems because the floods on which these ecosystems rely disappear. Disruption of the natural distribution and timing of streamflow disrupt aquatic ecosystems. The water-level fluctuations on which these ecosystems are based are an important part of a river's physical foundation (Holden and Stalnaker, 1975, p217)

The Chinese government has a water release plan called environmental flow release (EFR) (MWR of the PRC, 1994). EFRs use timed water releases to preserve ecosystems that depend on water-level variations. Regular releases mimic the river's natural water-level fluctuations and meet the needs of downstream ecosystems. According to the WCD Knowledge Base, environmental mitigation efforts such as EFRs meet with limited success, however, short-term financial expenditures on EFRs can improve sustainability and lead to a healthier environment (Report of the WCD, 2000, p.81).

Disruption of ecosystems from the intrusion of salt water into the river delta is another commonly cited problem and one where different information sources provide opposing conclusions. Government documents such as the *Environmental Impact Assessment of the Three Gorges Dam* say that there will be a decrease of salt-water intrusion into downstream areas (MWR of the PRC, 1994), while independent environmental assessments disagree (Yeng, 2003; Xing, et.al. 2001; Chen, 2001). Nongovernmental sources say that the river delta may also decrease in size because of lower silt levels in the water. Lower silt levels mean that less sediment is deposited at the

mouth of the river, hindering the natural replenishing function of the river's delta (*Asian Review of Business and Technology*, 1998). These claims are confirmed by the WCD, which says that elimination of beaches and backwater areas is a common effect of large dams (Report of the WCD, 2000, p.84).

There are additional impacts that relate less specifically to the four major benefits of the TGD (flood control, energy, navigability, and water availability – see p.14), but should be mentioned in a discussion of environmental issues. Specifically, large dams decrease the temperature and oxygen level in the water below the dam, which affects fish and other animals that live downstream. Overall, dams can have both positive and negative affects on fisheries. Independent sources say that disruption of silt flows from the TGD will deprive downstream fish of critical nutrients ([www.power-technology.com/projects/gorges](http://www.power-technology.com/projects/gorges), 2004), while the Chinese MWR says that the reservoir will improve fishing because the reservoir itself will support increased fish populations (*MWR of the PRC*, 1994).

Having many dams along a river's main tributary may exacerbate negative environmental impacts along its length. The TGD is one of many dams along the main Yangtze River and several more dams are planned for the Upper Yangtze River in the future. The WCD Report points out that placing more than one dam along a river has a multiplier effect on habitat fragmentation for both river and terrestrial species. This point is made despite the lack of conclusive evidence indicating a point at which marginal environmental impacts of additional dams decline. According to the WCD, mitigation is contingent upon proper site selection (i.e. not building dams on a river's main stem) and impact-minimizing dam design (Report of the WCD, 2000). The TGD is on the main stem of the Yangtze, however China's MWR indicates that effective dam design and planning will prevent nearly all of the TGD's negative environmental impacts.

Environmental changes associated with the TGD will have an important impact on the region's plants and animals. Losses of aquatic biodiversity as well as plant and wildlife species are important environmental considerations. The Environmental Impact Assessment (EIA) indicates that there are 47 rare or endangered plant species in the TGD area that are protected by national law. According to China's MWR, because there is little vegetation in the inundated areas, there will be no serious losses of these endangered

plants. The 26 rare animals that are in the mountainous region of the Three Gorges will also not be significantly affected (MWR of the PRC, the Environmental Impact Assessment of the TGD, 1992). River animals such as the Chinese River Dolphin (less than 100 are left) and Chinese Sturgeon will be sustained by natural reserves, artificial spawning programs, and increased measures to ensure their survival (Lei, 1998). The framework of the EIA used for the TGD project is shown in Appendix 4.

Other sources say that the TGD is one of the world's most dangerous large-dam projects (Wu et al, 2003; Xie, 2003; The International Rivers Network, 2004; Probe International, 2004). A study conducted by the Chinese Academy of Sciences Mountainous Disaster and Environment Institute in Chengdu, China divided the natural and social ecology and environment into subsystems varying from climatology to terrestrial fauna. Out of 78 subsystems, the report says that the TGD would affect 9 subsystems positively, 6 neutrally and 63 negatively (Edmonds, 1991).

One of the most endangered species affected by the TGD Project is the Chinese River Dolphin. Thus far, relocation efforts for the Dolphin have not been effective. The reservoir created by the TGD will cover a significant section of the dolphin's Yangtze River habitat. Other impacts affecting not only the Chinese River Dolphin, but other endangered fish species such as the Chinese sturgeon (*Acipenser sinensis*), River sturgeon (*A. dabryanus*), and Chinese paddlefish (*Psephurus gladius*) include reduction in dissolved oxygen levels, higher concentrations of toxins, and increased levels of eutrophication (Xie, et al. 2003; Rosenberg, 2000). Relocation efforts for other river species look more promising and there will be a huge amount of monitoring along the Yangtze River to assess damages and keep track of changes in species population (Lei, 1998; Wu et al., 2003).

Chinese government documents, especially those released by the Ministry of Water Resources, commonly note that overall ecosystem enhancement will occur because of the TGD. This will include the establishment of new ecosystems supported by the TGD reservoir and better, more controlled conditions in the areas downstream of the dam. Based on the literature and findings of the WCD, this statement should be questioned. There are a few recognized ecosystem benefits that occur from the construction of large dams, however the net environmental effect is almost always

negative (Report of the WCD, 2000). According to the WCD, examples of ecosystem enhancement include the creation of productive wetlands (though this is not generally applicable to reservoirs like the Three Gorges that have high depth and steep slopes) and the support of threatened bird or reptile species. Comparison of MWR and WCD reports shows that environmental benefits associated with large dam projects (as identified in the WCD report) differ considerably from those mentioned by the Chinese government sources such as climate improvement (*MWR of the PRC*, 1994).

The TGD lies near a fault line, and large dams have been known to increase the possibility of earthquakes. Mudslides are also a common occurrence due to the rising water tables and the steep slopes found along many dams. The TGD is a candidate for landslides because of the steepness of slides and relatively unstable soils due to extensive farming and clearing that has taken place on those hillsides. (*Catena*, 1997; *Engineering Geology*, 2001)

### *Economic Impacts*

Economic benefits are the most favorable of the claims given by the Chinese government for building the TGD. Control of Yangtze floodwaters up to 100-year frequency will save millions of dollars in flood damage. The hydroelectric power produced by the TGD is viewed as a self-sustaining, renewable energy source that will help pay for the dam by 2012 and turn a significant profit thereafter. Water availability from the TGD's reservoir will provide drinking water, boost agricultural output in the surrounding area and act as one component in a major south to north water transfer project. Increased navigability along the Yangtze will benefit the economy of central China through trade and tourism, specifically in the city of Chongqing (*MWR of the PRC*, 1994). These purely economic benefits will be realized quickly after completion of the TGD but, according to the WCD report, large dam projects require a broader economic analysis.

According to China's MWR documents, the economic viability of the TGD project was calculated through cost-benefit analysis which, at the time, corresponded with the prevailing assessment techniques for costing large dams. Cost-benefit analyses were used for assessing the economic aspects of the TGD project. The WCD report says

that insufficient weight is placed on social and environmental costs in such analyses. This is especially important in cases where economic analysis is made in terms of tangible, first-order economic benefits. Criticisms of this type of approach, as seen in the WCD report, clearly indicate the interconnectivity between economic, social and environmental issues and advocate equitable weight distribution between them.

There is little doubt that the TGD will increase the ability for flood control along the Yangtze River, saving millions of dollars worth of damage and increase energy production levels. There are questions about the long-term sustainability of energy production due to silting (see the previous section, *Environmental Impacts*). The negative elements of these benefits involve harmful environmental and social effects of the TGD's construction and operation. The crux of the WCD's economic criticism of most dam projects is that these issues seldom carry significant weight in an economic analysis. Literature from the Chinese Ministry of Water Resources briefly mentions studies that look at these types of issues in the case of the TGD, though they are not available to the public.

In the case of water availability, the TGD will provide a significant, steady supply of water for cities and farmland resulting in economic benefits for city dwellers and farmers. Related negative economic benefits come from the significant amount of productive farmland land, in the 'breadbasket' of China, that will be flooded. Loss of this farmland will eliminate just under 1/10 of China's current grain supply, of which over 50% is rice (Zhu, *et al.*, 1996).

The government's plan for resettled farmers is to have them cultivate citrus fruits and other value-added products (Jackson and Sliegh, 2000). This type of scheme shifts landowners from their accustomed, largely self-sufficient lifestyle to one that is not. Such lifestyle transitions are challenging. According to the WCD, the lifestyle changes brought on by dam resettlement often result in significant job-placement issues. The portion of resettled farmers that do not receive replacement land from the government will receive training for and be expected to take new jobs in cities and towns (Hemming *et al*, 2001). A related economic criticism of the shift from subsistence farming is that there is no mention (in the consulted literature) of a plan to domestically make up for the

significant grain supply that will be lost. The lost grain supply will probably be replaced through increases in imported grain.

Trade in the vicinity of the TGD will have an estimated five-fold increase. Improved navigation will ease travel complications between Yichang and Chongqing, allowing transportation costs to drop by an estimated 35-37% (Rushu, 2004). The decrease in travel costs will make trade along the Yangtze river more profitable.

The Chinese government also expects tourism to increase, as the TGD itself will be a 'marvel of the modern world' (MWR of the PRC, 1992). The Chinese government says that the reservoir will allow access to previously hard-to-reach tourism spots, and transportation will be improved between a number of tourism destinations along the Yangtze River. Official sources claim that the TGD will not damage the scenery of the Three Gorges ([www.china.org.cn](http://www.china.org.cn), 2004), however, this fact is hard to accept. The Three Gorges landscape has been the subject of famous works of Chinese art and poetry for thousands of years (Qing, 1992). When the dam is in place, a significant portion of the Gorges will be inundated along with some of the oldest and most cherished cultural and religious sites in China. The WCD report makes special note that important historic and religious sites should be protected as much as possible, as they play an important part in a nation's culture and past.

Large numbers of Chinese and a significant number of foreigners visit the Three Gorges each year. While it is impossible to tell exactly how tourism will be affected before the dam is in place, it seems as though there are more things to consider than the Chinese government has acknowledged in its published literatures. In an attempt to deemphasize these issues on the national level, in 1992 the Chinese government banned a number of anti-dam publications, the most famous of which is "Yangtze! Yangtze!" by Dai Qing, a collection of letters, interviews and essays arguing that the natural beauty of the Three Gorges is too valuable to flood. (Qing, 1989)

### *Financial Impacts*

Official plans have the Three Gorges Dam completely repaid by 2012. The World Bank did not agree to help finance the TGD project, due to criticism regarding the environmental and social issues of the project. The US Export-Import Bank also denied

funding. Financing for the TGD has come via a national power sales tax and revenue from the Gezhouba hydropower project, located downstream on the Yangtze. Additional funding has come from State Development Bank loans and sales of the power produced at the TGD site after 2003, when the first stage water level is reached and power generation begins. Additional international support has come from the export credit agencies of Germany, Switzerland, Sweden, France, UK, Canada, the US, and Japan, all of whom have given support to companies and suppliers from their countries. (www.power-technology.com, 2004; *The Economist*, 2003)

Estimates show 45% of the predicted costs for the TGD project will be used for compensation and projects for relocated peoples (*Asian Review of Business and Technology*, 1998). It is hard to determine ahead of time how effective these resettlement schemes will be. According to China's Ministry of Water Resources, relocation and resettlement programs are proceeding according to plan (www.china.org.cn, *Last Migrants Leave the Three Gorges*, 2004).

Historic evidence shows that the actual costs of the large projects should be significantly higher than expected. Since it is so large, the consequences of a cost overrun on the TGD project could have considerable negative impacts on China's economy. With the successful first stage of inundation and power-generation in 2003, the project is proceeding on time and, according to China's MWR, under budget.

Construction of the dam itself provides jobs to Chinese people, though only 31% of the TGD contracts have been given to Chinese companies. The relatively high amount of investment by foreign companies such as Alstom, the ABB Group, Kvaerner, Voith, Siemens and GE shows the influence that international dambuilding corporations had in the planning and decision-making processes. The primary contractor of the project is China's Gezhouba Co. and bidding for the project was conducted under international bidding law. (*Asian Review of Business and Technology*, 1998; MWR of the PRC, 1994)

Considerable benefits will also come from technology transfer into China. A wide range of international contractors are participating in this project, including many rival contractors that do not normally work together. This point of having many companies work on the TGD project is to bring together the most capable companies to work collaboratively on the project and ultimately get the most innovative product. This

approach makes sense since the TGD is one of the largest and most challenging construction projects ever attempted. As time goes on, the plan has domestic workers taking aspects of the project that were initially hired out to international bidders. Such involvement will increase the technological ability of Chinese workers and create valuable human capital and technological experience. (www.power-technology.com, 2004)

Long-term economic success is a critical component of a large dam, because of the large costs involved in the initial stages. Generally, the benefits of large dam projects do not meet expectations (Report of the WCD, 2000). One important cause of this can be operation at less than ideal conditions for a many years. Environmental conditions such as silting can increase flood potential, decrease fresh water availability, and reduce power generation levels. Constantly increasing need/costs for power and water in China will contribute to the profitability of the TGD. Significant financial and population growth in China is expected to continue to fuel the energy and water needs provided by the dam.

Maintenance will be needed to keep the dam profitable over time. A new city has been built to house TGD maintenance workers. There will also be an unprecedented amount of monitoring of the dam's operation. A significant amount of monitoring will also be conducted by both the government and other institutions to look at the environmental and social implications (Heming, 2001).

Maintenance in the form of structural upkeep and safety is needed to ensure long-term benefits. If problems arise with the structural integrity of the TGD, repercussions could be disastrous. There have been safety concerns during the construction phase of the TGD project. These concerns involve government corruption and the way in which construction contracts were awarded (*Maclean's*, 1999). A number of officials were accused of embezzlement, contracting bids were allegedly won through bribery and construction funds were embezzled by selecting cheap, inferior equipment and materials; such corruption has resulted in infrastructure and construction accidents (www.power-technology.org , 2004).

### *Social Impacts*

The social arena is the area where effective planning of water resource projects can have the most resounding impact. The WCD report concludes that “past decision-making and planning efforts have often neither adequately assessed nor accounted for the adverse social impacts of large dams,”(Report of the WCD, 2000, p.129). Specific criticisms of the decision-making and planning processes from the WCD are generalized as follows:

- Accounting mechanisms do not fully realize the wide ranging social and indirect costs associated with large dams;
- People living downstream are not sufficiently considered; displaced persons are not recognized; compensation, if existing at all, is inadequate; and
- Livelihoods are often destroyed and seldom restored; and there is a lack of recognition that vulnerable groups such as the poor, indigenous peoples, and women tend to shoulder a disproportionate amount of social costs (Report of the WCD, 2000, p.98,128-130)

These general findings demonstrate that national governments, funding organizations, and dambuilding companies often lack the commitment and/or capacity to effectively cope with the complicated, controversial, and costly issues of displacement.

The largest social implication of the TGD involves the relocation of over one million people from the reservoir area. Chinese government estimates are a bit lower at 0.75 million displaced people (*MWR of the PRC, 1994*), while some sources set the real number at 1.7-2.0 million (*The Economist, 2000*). Though the difference between these estimates seem an incredible difference, history shows that resettlement numbers of World-Bank funded dam projects average 47% higher than initial estimates (World Bank, 1996). The very fact that huge inconsistencies exist between estimated and actual population displacement estimates indicate the propensity for governments to miscalculate and therefore mismanage planning requirements for such projects. Miscalculated estimates shows a lack of accurate information at a base level that is illustrative of the predominant top-down planning structure used in large dambuilding projects.

Similar differences arise in studies looking at the Chinese peoples' reactions to the TGD. Independent sources display a wide range of conclusions: some say that people rate their displacement compensation as "miserly" while others say the majority of displaced people are optimistic and confident in the TGD project. (Heming, 2001)

The TGD will be the largest population resettlement ever attempted for a dam project. In China, the previous largest (official) population resettlement effort, 250,000 people in the 1960's, involved less than one-third the number of people affected by the TGD project (Jackson and Sleight, 2000). Estimates say that a total of 10.2 million Chinese have been relocated because of dams, though according to some independent sources numbers may reach 10 million people just in the Yangtze River Valley (Jing, 1999).

Water from the TGD will inundate 4000 villages, 140 towns, 13 cities, and 100,000 acres of farmland, displacing people from not only their homes, but their jobs, culture, and way of life. Some of the villages and towns to be flooded are thousands of years old (Topping, 1995). According to the WCD report, scale is an important factor for resettlement planning because of the correlation "between the magnitude of displacement and the ability to rehabilitate and restore livelihoods adequately – the larger the number of displaced people, the less likely it is that livelihoods can be restored"(Report of the WCD, 2000, p.129). This is especially important in rural areas where jobs and social fabrics are bound to the surrounding natural landscape and climate. In many villages, lifestyles depend on characteristics of an undamed river such as seasonal water level fluctuations, silt deposited by flood waters, and water-based transportation systems.

China's resettlement problems are characterized as 'seven difficulties' and 'four inadequacies'. The seven difficulties include electricity, drinking water, schools, food, medical services, and means of communication and transportation problems; the four inadequacies include poor quality irrigation, housing, flood control, and reservoir maintenance facilities (Jing, 1999). As of 2000, statistics showed that out of the 10 million Chinese people displaced by dam-related projects, about of 46% are in 'extreme poverty' (World Bank, 1994). In China, resettlement has also accompanied food shortages and increases in drinking water toxin levels (WHO, 1999).

In order for any resettlement program to be effective it must have a legal framework. China's Reservoir Resettlement Act provides such a framework. The Reservoir Resettlement Act stipulates affected peoples' rights, state obligations, procedures for settling conflicts, and procedures for redressing of complaints (ADB, 1999). China's Xiaolangdi Dam resettlement strategy mixes land and non-land activities to guarantee livelihoods (Jing, 1999). The Xiaolangdi project involves enhancing existing skills as well teaching new ones, with special capacity-building components geared towards women. Additional economic benefits-sharing schemes are exemplified in China's multipurpose Daganba Project (Van Wicklin, 1999).

Common WCD criticisms for resettlement programs hinge on failure to deliver homes, land, money and other necessities promised by the government. Sometimes compensation takes place but repayment does not necessarily equal effective resettlement. China's resettlement activities let localities decide how much compensation to give each individual for resettlement benefits. This system lacks mechanisms ensuring accountability of the local governments and has resulted in corruption, embezzlement, and overall mismanagement of well-meaning government funds. Such corruption results in failure to deliver promised benefits to relocated individuals. (Jackson and Sleigh, 2000)

Due to its unsuccessful historical record of population resettlement, the Chinese government has recently adopted a 'relocation with development' policy, similar to the one recommended by the World Bank in the early 1990's. According to a 2001 study published in *The Geographical Journal*, this approach shows a marked improvement over old population resettlement methods though the system still has shortcomings (Hemming et al, 2001). Particular problems include a proportionately larger allocation of relocation benefits towards urban dwellers. This corresponds with a criticism brought up repeatedly in the WCD report: that a disproportionate distribution of costs falls on the politically powerless. In TGD-related literature there are disturbingly few assessments of the gender-related impacts, though the WCD specifically states that women bear a greater proportion of any new burdens created by large dams.

Resettlement causes increased stress on already overpopulated land. Resettlement schemes for other projects in China have severely stressed areas and caused huge problems with runoff, landslides, and hastened environmental degradation of landscapes.

Some short and long-term jobs will be created because of the dam and an entire city was built to house the dam construction and maintenance people. Many of these jobs will be transient, disappearing when the dam is finished, and the permanent jobs ensured by the dam will in no way make up for those lost. Other positive benefits will come from transportation infrastructure associated with the project, specifically shiplocks that allow large vessels to travel upstream on the Yangtze River. The TGD will connect local economies to national markets.

Significant social gains will come from flood control, helping to curb the numbers of people harmed by the Yangtze's potentially deadly floods. Current flood mitigation technologies on the Yangtze River have reduced flooding potential to a 10 year frequency. The TGD will provide 100-year frequency flood protection to areas downriver of the Three Gorges, including Jinjiang, Dongting, and Wuhan (Rushu, 2004).

Another important social impact is the large number of archaeological sites and historical artifacts that will become inaccessible because of the TGD. Many of these sites are important locations for ancestor worship among the Chinese people. Further increasing these cultural and historic losses are the time-constraints, under-budgeting and shortage of personnel available for preserving the artifacts that can be saved. (Childs-Johnson, 2000)

## 6. Analysis of the TGD Planning Process

### *The WCD's Seven Strategic Priorities*

This section discusses how the planning process used for the TGD compares with the the recommendations set out in the WCD report. The recommendations of the WCD report exist in a framework that sets out seven strategic priorities for water resource projects (Table 2). These seven strategic priorities have anywhere from one to eight guiding principles associated with each of them. The following discussion analyzes the WCD framework in order to determine how closely the TGD planning process coincides with the seven strategic priorities as set out by the WCD, as shown in Table 4.

#### STRATEGIC PRIORITY 1: GAINING PUBLIC ACCEPTANCE

The WCD report stipulates that public acceptance should be gained through stakeholder analysis, negotiated decision-making processes, and free, prior and informed consent. Based on the consulted literature, it appears that there were few efforts to gain public acceptance (as described in the WCD) in the planning of the TGD project. There was stakeholder analysis, though not the type of direct stakeholder analysis that would qualify as the “rights and risks” approach set out in the WCD report. Negotiated decision making processes did take place in the PRC Congress, but this was confined to one government bureau and therefore does not constitute the direct participatory decision making process as outlined in the WCD report. As representatives of the citizens, government officials gave their consent to the project, but this is not the free, prior and informed consent of the affected individuals as discussed in the WCD report.

#### STRATEGIC PRIORITY 2: OPTIONS ASSESSMENT

Many of the components of an options assessment were included in the planning process of the TGD. The missing component was a set of alternatives to building a dam. Assessments for environmental, social, and health were conducted using economically based analytical techniques. There was consideration of Greenhouse gasses and there was a small amount of analysis completed on improving economic risks and valuing social and environmental impacts. It is debatable whether or not the fact that greenhouse gasses will be released from the reservoir was a factor in the TGD decision making process.

The areas of ‘options assessment’ that were not addressed involve a larger range of environmental and social issues. There were no studies conducted concerning realistic, viable alternatives to the TGD project. The project is vulnerable to the critique that political and economic momentum behind the project precluded consideration of alternatives. The genesis of this lies in the political history of the TGD plans and 80 years worth of government efforts to commence the project.

#### STRATEGIC PRIORITY 3: ADDRESSING EXISTING DAMS

There was little change made to the TGD’s construction plans based on the WCD report. There were also no visible changes in China’s overall dambuilding policy based on the WCD report. There were no efforts to improve reservoir conditions in the TGD or elsewhere after the WCD report was published. The Chinese government would say that they already have sufficient operating rules that accurately reflect the social and environmental concerns identified by their own background research.

#### STRATEGIC PRIORITY 4: SUSTAINING RIVERS AND LIVELIHOODS

The Chinese government did address baseline surveys of ecosystems and environmental flows. China’s MWR stipulates that fisheries will not only be maintained, but improved by the TGD project. The Chinese government also says that, because of the TGD, overall quality of life in the region will be better after the dam is built.

Based on the consulted literature, less investigation was made into the complexities of ecosystem relationships and repercussions of ecosystem fragmentation than recommended by the WCD report. Further, there was insufficient direct cooperation with people whose livelihoods and lifestyles will be directly impacted by the TGD project.

#### STRATEGIC PRIORITY 5: RECOGNIZING ENTITLEMENTS AND SHARING BENEFITS

There were a number of resettlement and development plans and benefit-sharing mechanisms carried out by the Chinese government for displaced people. Fully 45% of the total costs of the project were allocated towards this (MWR of the PRC, 1994). With such a large number of people facing resettlement more time is required to accurately tell if these mechanisms will have the intended effect. Current studies come to different conclusions on the effectiveness of China’s TGD resettlement schemes, though most recognize significant shortcomings. There have been country-wide studies conducted by

the Chinese government to look at the degree of impoverishment among resettled peoples, and resettlement policy for the TGD project has been adjusted to reflect these findings. These policies were in place well before the WCD report was published and have not changed since. Other recommendations for project benefit-sharing mechanisms have been considered for the TGD, though not to the extent recommended in the WCD report.

#### STRATEGIC PRIORITY 6: ENSURING COMPLIANCE

Compliance requirements for population resettlement and dam operations are in place under Chinese law. Review panels for social and environmental matters are conducted by the Chinese government. There is environmental monitoring in place through university and university-government partnerships. As discussed in the sections on environmental and social issues, there will be social and environmental monitoring by the scientists, universities, the Chinese government, and NGOs. If changes are needed, there will be very few ways in which the findings and/or recommendations of these groups can effectively be addressed. There was no information found stating whether or not performance bonds and/or trust funds were utilized in the TGD project. Integrity pacts are non-existent in the TGD project, apart from those inherent in standard construction contracts.

#### STRATEGIC PRIORITY 7: SHARING RIVERS FOR PEACE, DEVELOPMENT, AND SECURITY

The Yangtze River exists entirely in China, therefore there are no cross-border issues to deal with. Sharing development for peace, development, and security however extends beyond borders and looks at water resource development in light of the entire world, including citizens of the home country and those directly affected by a project.

Table 4: Incorporation of the Seven Strategic Priorities in the TGD Planning Process

<b>WCD Strategic Priorities (As Presented in the WCD Report)</b>		<b>Consideration in the TGD Planning Process</b>
<b>1. Gaining Public Acceptance</b>		
	Stakeholder Analysis	Limited
	Negotiated Decision-Making Processes	Limited
	Free, Prior, and Informed Consent	No
<b>2. Comprehensive Options Assessment</b>		
	Strategic Impact Assessment for Environmental, Social, Health, and Cultural Heritage Issues	Limited
	Project-Level Impact Assessment for Environmental, Social, Health and Cultural Heritage Issues	Limited
	Multi-Criteria Analysis	Limited
	Life Cycle Assessment	Limited
	Greenhouse Gas Emissions	No
	Distributional Analysis of Projects	Limited
	Valuation of Social and Environmental Impacts	Limited
	Improving Economic Risk Assessment	Yes
<b>3. Addressing Existing Dams</b>		
	Ensuring Operating Rules Reflect Social and Environmental Concerns	Limited
	Improving Reservoir Operations	N/A
<b>4. Sustaining Rivers and Livelihoods</b>		
	Baseline Ecosystem Surveys	Yes
	Environmental Flow Assessment	Limited
	Maintaining Productive Fisheries	Limited
<b>5. Recognizing Entitlements and Sharing Benefits</b>		
	Baseline Social Conditions	Yes
	Impoverishment Risk Analysis	Limited
	Implementation of the Mitigation, Resettlement and Development Action Plan	Limited
	Project Benefit-Sharing Mechanisms	Limited
<b>6. Ensuring Compliance</b>		
	Compliance Plans	Yes
	Independent Review Panels for Social and Environmental Matters	Limited
	Performance Bonds	Information Not Available
	Trust Funds	Information Not Available
	Integrity Pacts	No
<b>7. Sharing Rivers for Peace, Development, and Security</b>		
	Procedures for Shared Rivers (Across Borders)	N/A

### *The Five Key Decision Points*

Intrinsically related to the Seven Strategic Priorities, the Five Key Decision (Figure 2) points outlined by the WCD report further specify planning choices for large-dam projects. The key decision points include needs assessment, selecting alternatives, project preparation, project implementation, and project operation.

According to the WCD report, the most important decision of the process outlined in Figure 2 (left) involves selection of a “preferred development plan.” In the case of large dams this includes the decision of whether to build a dam or select another water resource-management option. The TGD project effectively bypassed this important decision because political and economic momentum left the project selection predetermined. The resulting planning process did not follow the one recommended by the WCD report.

A representation of the TGD planning process is shown on the right of Figure 3. Here the parts of the planning process are limited in scope and the major decision point (whether to build a dam or select a different alternative) is left out. Selection of a dam at the Three Gorges site is the area of greatest disparity between the WCD report and the TGD project because selection of the project had its origin in 1919, making the TGD project a pre-determined option. In the case of the TGD, the process involved limited versions of the needs assessment, preparation, implementation, and operation phases.

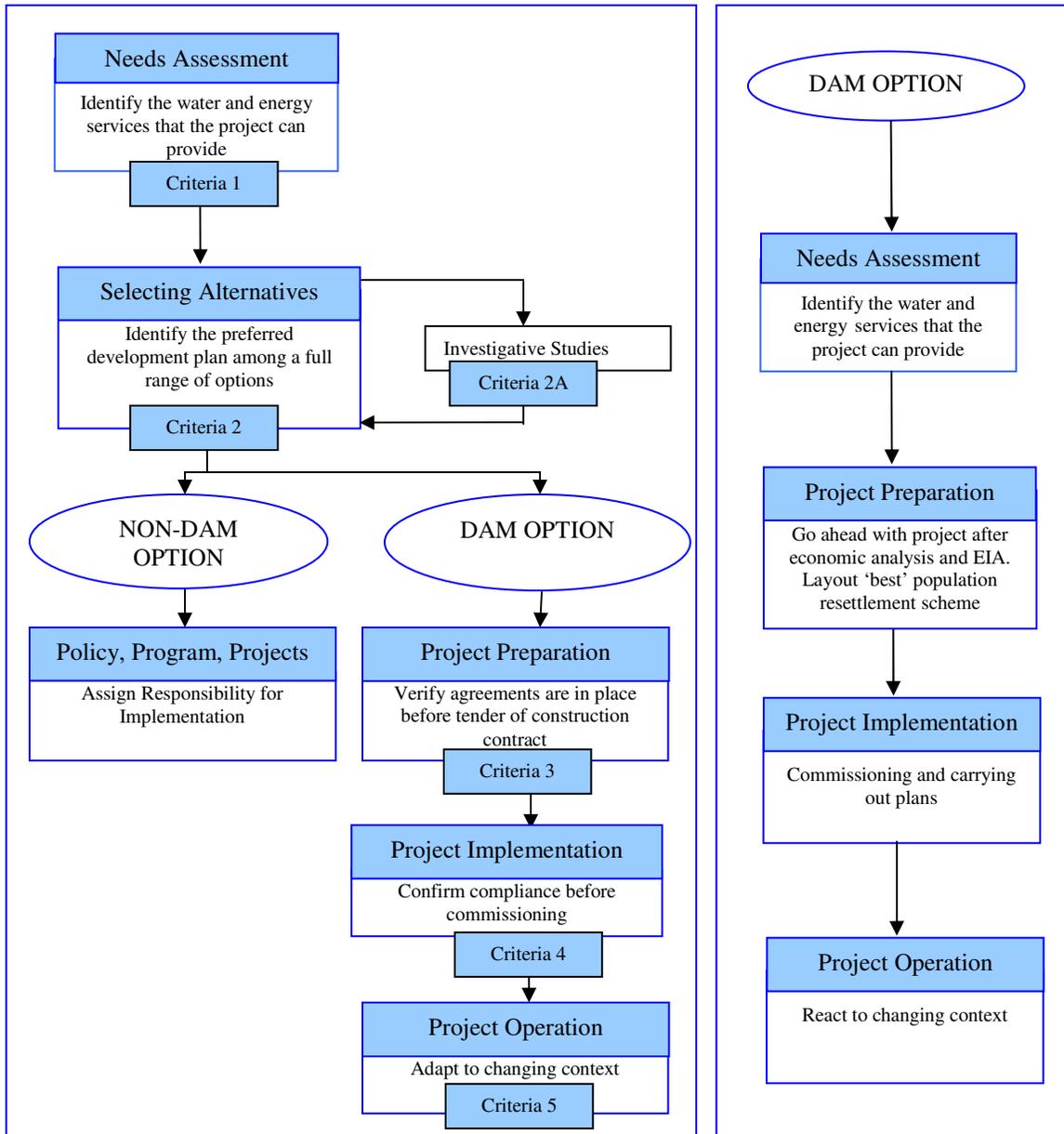


Figure 4: Five Key Decision Points (left) (Source: The Report of the WCD, 2000)

The TGD Decision-Making Process (right)

## 7. Conclusions

This discussion reviewed China's TGD Project in light of The Report of the World Commission on Dams, *Dams and Development: A New Framework for Decision Making*. This review of the major social, environmental and economic factors associated with the TGD Project showed significant differences in the way that social and environmental elements were considered when compared to the WCD report. The guidelines in the WCD report specified planning processes that were more inclusive towards affected peoples and placed more importance on social and environmental consequences.

It is important to acknowledge that considerable economic benefits will result from the TGD project, making it an extremely attractive development project. The ability to reduce flood damage, increase trade, and produce energy makes the TGD project potentially beneficial to China's society in important ways.

The primary conclusions of this critique show that the TGD was planned through a top-down, non-participatory approach. The proposal for a dam at the Three Gorges site took shape 80 years ago and has been in the plans of the Chinese government ever since. When construction of the dam finally became technologically and economically feasible, the political momentum behind the project made participatory needs assessment and thorough consideration social issues an afterthought. When viewed in light of the WCD report, the TGD project does not adequately consider the full range of relevant social, environmental, and economic issues. The process followed for the TGD project sharply contrasts with the participation-based needs and impact assessment, as laid out in the WCD report.

The WCD report needs to have influence in China and other developing countries in order to be an effective, internationally accepted document. Rejections of the WCD report (as seen in responses to the WCD at [www.dams.org](http://www.dams.org)) are primarily based on the expense and impracticality of implementing all of the WCD's recommendations. The words and actions of the Chinese government show that the WCD report has not been influential in their decision-making processes. In order for the WCD report to be important in the dam-building community it needs to be accepted by the (mostly developing) countries that are actively building dams. The report's influence can be increased through increased adoption by participants in the dam-building process,

especially international lending organizations. Adoption of the WCD Report by a larger variety of stakeholders will amplify economic and political pressure for its adoption.

Changes in the approach towards building large dams developed in the six years between the start of construction on the TGD and publishing of the WCD Report. Though the WCD report recommends that dams in the pipeline should reconsider their initial assumptions based on the WCD framework, no such efforts were indicated in the TGD project; in fact the WCD report was sharply criticized by the Chinese government. The lack of incorporation of the WCD report into China's TGD dambuilding process shows the initial weakness of the WCD report in influencing current dambuilding projects as well as unwillingness on the part of those involved in TGD construction to consider potentially beneficial alternatives for China's TGD.

Responses to the WCD report from the Chinese government have been few and negative in tone. However, the Asian Development Bank (ADB), a funder of dam projects in Asia, has shown willingness to work with the WCD report. In an official response to the WCD report, the ADB responded to each criterion on the WCD report and noted whether recommendations were or were not being incorporated into their projects (ADB, 2004). The willingness of lending organizations such as the ADB to assess the WCD report and compare their dambuilding criteria shows that there is some acceptance of the WCD report on an international level, even if acceptance by national governments is limited.

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## Appendices

Appendix 1: Timeline of the TGD Project

Appendix 2: Framework of the TGD Environmental Impact Assessment

## Appendix 1: Chronology showing the political involvement and interest in the TGD project from 1919 through 1997 ([www.china-embassy.org](http://www.china-embassy.org))

--The Yangtze, the world's third largest river after the Amazon and the Nile, will be blocked on November 8 to allow construction of the mammoth Three Gorges Dam. The following is a chronology of major events leading to construction of the world's largest water control project:

--During the more than 2,000 years between the Han Dynasty (206 BC-AD 220) and the Qing Dynasty (1644-1911), floods occurred on the Yangtze River nearly once every ten years. During the last 300 years, severe floods breached the Jingjiang Dam 60 times, and disastrous floods struck twice in the past 100 years. Floods have been a persistent problem for residents and businesses along the Yangtze and for the Chinese government.

--In 1919 Dr. Sun Yat Sen, forerunner of China's democratic reform, proposed construction of a dam at Three Gorges to make better use of the rich water resources of the Yangtze and improve navigation.

--In 1944, American dam expert John Lucian Savage was invited to do field research at the Three Gorges by the resources committee of the Republic of China. Savage drafted a preliminary report on the water control project.

In May of 1946, the resources committee of the government of the Republic of China, which was in power then, signed an agreement with its U.S. counterpart to jointly design the dam project.

--In May of 1947, the government of the Republic of China ordered the project dropped because of runaway inflation and an economic crisis.

--In 1949, severe flooding again devastated the region along the Yangtze, prompting new China at birth to attach importance to flood control on the middle and lower reaches of the river. Three years later, the Jingjiang flood diversion project was completed on the Yangtze.

-- In 1953, Chairman Mao Zedong was presented with an outline for building reservoirs on the river. He urged that a dam be built at Three Gorges to control flooding.

-- In the flood season of 1954, the Yangtze Valley suffered the most severe flooding of the century, serving as another warning that permanent measures were required to harness the Yangtze.

-- In the ensuing four decades starting in 1955, China began the arduous job of planning, prospecting, researching and designing the Three Gorges project. Serious discussions began on the project's feasibility.

-- In March 1958, late Premier Zhou Enlai delivered a report on the Yangtze Valley and the Three Gorges Project at a CPC Central Committee conference held at Chengdu, the capital of the southwestern China's Sichuan Province. In August of the same year, he presided over a meeting concerning the Three Gorges Project held at the north China resort city of Beidaihe to study the project's designing and other relevant preparatory work.

-- In 1970, the central government decided to kick off the Gezhouba Dam Project as a part of the Three Gorges Project to cope with the growing demand for electrical power in central China.

-- In 1979, the Ministry of Water Resources submitted a proposal on the project to the State Council, and recommended an immediate decision by the central government.

-- In 1980, late leader Deng Xiaoping inspected the proposed dam site at Sandouping in the Xiling Gorge. Two years later, Deng Xiaoping pledged to proceed with the Three Gorges Project.

-- In April of 1984, the State Council authorized the Yangtze Valley Planning Office to draft a feasibility report on the Three Gorges Water Control Project.

-- In June of 1986, the central government demanded a re-examination of the project and more feasibility studies. For the next three years, the Ministry of Water Resources organized 14 expert groups for a large-scale, thorough review of the project.

-- In 1989, the planning office revised the feasibility report and proposed starting the project as soon as possible. A basic building was also prepared for the project.

-- In July 1990, a supervisory committee was set up for the project, with Vice-Premier Zou Jiahua being the director. The committee approved the feasibility report in August 1991 and submitted it to the State Council for final deliberation at the Seventh National People's Congress.

-- On April 3 of 1992, the Fifth Plenary Session of the Seventh National People's Congress approved a resolution to

proceed with the Three Gorges Project, with 1767 deputies for, 177 against, and 664 abstaining. The project was included in the Ten-Year Program for National Economic and Social Development, and the State Council was authorized to carry out the project at an appropriate time.

-- In January of 1993, the Three Gorges Project Construction Committee (TGPC) was set up to represent the State Council in decision-making and regulating vital issues. Premier Li Peng was director of the committee. The committee had three executive bodies: the administrative office, the Bureau of Resettlement and Development, and the China Yangtze Three Gorges Project Development Corporation.

-- On July 26, 1993, the TGPC approved a preliminary design plan for the Three Gorges Project, representing the beginning of the period of construction preparations.

-- In August of 1993, the State Council unveiled a set of regulations for resettlement, adopting a development-oriented resettlement policy in the Three Gorges Reservoir Area, pledging accelerated economic growth and improved living standards for those residents to be resettled in the reservoir region.

-- On December 14, 1994, Premier Li Peng officially announced the official launching of construction of the Three Gorges Project.

-- In 1995, the resettlement program was kicked off.

-- In August of 1996, two major transportation projects, including a Xiling Bridge across the Yangtze and an airport in the city of Yichang, were completed and went into service.

-- In January of 1997, the State Planning Commission approved the issuance of 1 billion yuan in corporate bonds. This was the first move of the TGPC to raise funds for construction through bonds offering.

-- In March of 1997, Chongqing's upgrade to a municipality was approved by the Fifth Plenary Session of the Eight National People's Congress, a move to ease resettlement and expedite the progress of the project.

-- In mid-September of 1997, most of the first wave of residents in the reservoir region were relocated.

-- On October 1, 1997, the Qinjiatuo Bridge opened to traffic, concluding construction of transportation facilities for the dam project.

-- On October 6, 1997, navigation opened along a 3.5-km diversion canal on the southern bank of the Yangtze, another preparation for blocking the main channel.

-- On October 14, 1997, a decision was made at the 63rd Executive meeting of the State Council to block the Yangtze on November 8, which signals the completion of the first-phase construction of the Three Gorges Project and the beginning of its second-phase project.

