

**Red Sea – Dead Sea Water Conveyance
Study Program**

Study of Alternatives at the Regional Level

**Annotated Outline of the Study of
Alternatives Report and Consultation Plan**

Prepared by

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December 2010

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I. Introduction and Context of the Study

1. The Study Program for the proposed Red Sea - Dead Sea Water Conveyance (RSDS - WC) is anticipated to address two main issues and to examine the alternatives that could be deployed to mitigate and/or solve them. The first is environmental - the restoration of the Dead Sea. The second is the provision of additional freshwater and energy to the region.

The Political Context – Political Feasibility

2. The proposed RSDS – WC is an international study program involving three beneficiary parties – Israel, Jordan and the Palestinian Authority. The diplomatic and political preliminaries to the launch of the Feasibility Study and Environmental and Social Impact Studies took place over a period of six years. In addition, earlier versions of the proposed RSDS –WC have been examined and reviewed over a period of more than thirty years. The antecedents have been numerous and they have been reviewed over protracted periods.

3. These antecedents, and the current levels of political engagement, are integral to any new evaluation of the proposed project and alternatives. At a very early point in the discussion of how to approach the alternatives study, an important feature of the process was identified by the alternatives study team. Namely that, in establishing the cooperative political foundations that enabled the launch and undertaking of the feasibility and impacts studies, special commitments were put in place by the beneficiary parties.

Historical Background of Water in the Region

4. Supply Management of New Water – 1950 to c1980. The water resource endowments of the Israel, Jordan and the Palestinian Authority are not generous and their demographic development is very challenging. There are too many people to co-exist easily in an environment blessed with rich, and as yet unexploited, renewable solar energy and extremely limited freshwater and soil water resources. The political entities of the Jordan Basin have prospered and achieved a version of water and energy security only because their human resources have been progressively enhanced.

5. It is the case that by the first decade of the twenty-first century the way water is used in the Jordan Basin reflects the ambitious interventions of the hydraulic mission era in Israel, Jordan and Syria. These interventions, driven by demography and economic growth, have brought about the decline in the level of the Dead Sea and decline of the flow of the Jordan River. Rapid demographic growth is also responsible for the overall freshwater supply predicament of the region.

6. Until the late 1950s the assumptions of engineers, policy-makers and the public – both in the basin and globally - were that every drop of water should be mobilised to secure water for households, industry and agriculture. The water for the maintenance of environment was not a priority. Until the early 1950s, this was a realistic strategy. Since then natural increases in the population and net immigration have made water self-sufficiency in the Jordan River Basin an almost impossible goal. The economies have survived through their

diversification and by gaining high returns to water in industry and mainly in services. Irrigated agriculture has remained an enduring priority which can only be reformed at the pace determined by politics. The underlying fundamentals of water resources economics and evaluation of the value of the environmental services provided by water have more recently become a component of water policy making in the region.

7. During the 1950 to 1985 period major investments were made in water development, water storage and water distribution infrastructures in Israel and Jordan. Syria also utilised significant amounts of the Yarmouk River flow in small works which diverted run-off to Syrian farms in the upper part of the basin. As a consequence, the three beneficiary parties of the Study Program have less Jordan basin waters at their disposal now than they did in 1950.

8. The political, financial and technical investments in these works put facts on the ground that have established very significant agricultural livelihoods in both Israel and Jordan. The historical priority of agriculture in obtaining fresh water is now changing, as fresh water is being reallocated away from agriculture to other uses (mainly households) and farmers rely more and more on recycled water (in Israel and Jordan today more than 50 percent of irrigated water comes from recycling plants). This process entails far reaching long-run environmental consequences that are now starting to show up and gain greater government and public attention.

9. Demand Management of Water – c1980 to 2010 – Re-Allocation at First then Development of New Water. Assumptions on how best to manage water shifted in the 1970s as awareness of both the demands of rapidly expanding populations were more widely appreciated and the value of the environmental services of water increased. It was by then evident that these environmental services were being impaired by their over-use and by the pollution of surface and groundwater sources. Israeli and Jordanian research scientists and nongovernmental organizations noted in the 1970s that the supply management vision needed to be reconsidered.

10. Periodic Droughts – 1984-85, 1989-1991, 1997-2000. The droughts have highlighted the high risks associated with keeping water levels too low in the natural reservoirs (groundwater aquifers and lakes). In Israel and Jordan, fresh (natural) water has steadily been reallocated away from agriculture, and only partly compensated by recycled water. Simultaneously, technological progress in desalination has reduced the cost of desalinated water to about US\$0.5 per cubic meter, encouraging more development and use of this source.

11. New Water After All – 2000 to the Present. This new era of supply management with additional water being provided by desalination has transformed expectations in the Israel, Jordan and the Palestinian Authority. New water via desalination was not a major reason initially for re-visiting the RSDS - WC proposal. However, as the proposal gained vigour in its current form under the ongoing Study Program, the potential production of new desalinated water for the region has become the major perceived benefit.

Energy, Commodity Prices and Technology

12. The 2000 to 2010 period has been important for *economic* as well as *technological* reasons. There have been commodity prices spikes – especially in oil and gas. The crude oil price briefly spiked at US\$149 per barrel in 2008 and frightened consumers because the price trend seemed to be pointing at US\$200 per barrel.

13. A major criterion in the evaluation of alternatives should be the cost of fossil fuel based energy sources in the short and medium term, and the benefits of using clean renewable energy in the longer term. It has been the shocks in the global financial system that have had most impact on commodity and fossil fuel energy prices; thereby energy will be important to review in the analysis of the proposed RSDS – WC.

14. New technologies, the economics of energy and the global political economy can all be determining factors in a project of the scale of the proposed RSDS-WC project. They put at risk investments in major infrastructures. It is the case that this type of risks has existed since the dawn of industrialisation. As an example, it is worthwhile to recall that many 19th century railway projects never brought a full return to their investors.

15. In the case of the proposed RSDS-WC these issues of rapid technological advance, such as in desalination, the shadow price of energy, and accounting for environmental impacts, are all not fully unpredictable and bring potentially high risks. Elemental assumptions will have to be made in all these areas. Decisions to proceed with any alternative will depend on the extent to which confidence can be constructed in the underlying assumptions on which any evaluation is based. The assumptions will relate, among others, to technology, to the price of energy and to the capacity of global investors.

The Dead Sea from 1960 to Present

16. After reaching a height of about 380 meters below sea level at the end of the 1800s, the Dead Sea level remained relatively constant for the next 30 years (see Figure 1). However, in the 1930s a declining trend commenced and this rate accelerated sharply starting in the 1960s. As a result, the water level has fallen from 394 meters below sea level in 1960 to 423 meters below sea level as of mid-2010.

17. Today the water level continues to drop by about 1 meter per year, and the Sea's surface area is shrinking accordingly. From 1930 to 2007 the Sea's water surface area has been reduced by one third: from roughly 960 kilometres to 609 kilometres (see Figure 2).

18. The significant decline of the water level over the past 30 years is principally due to diversion of water from the Jordan and Yarmouk Rivers and from the creation and expansion of the chemical industries located at the Sea's southern end.

Figure 1. Level of the Dead Sea 1810-Present

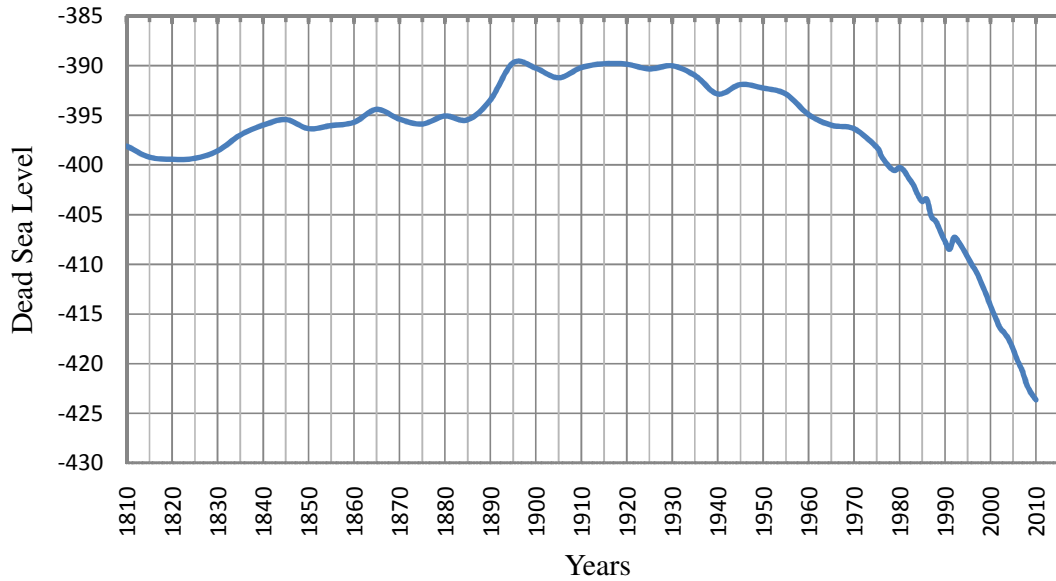
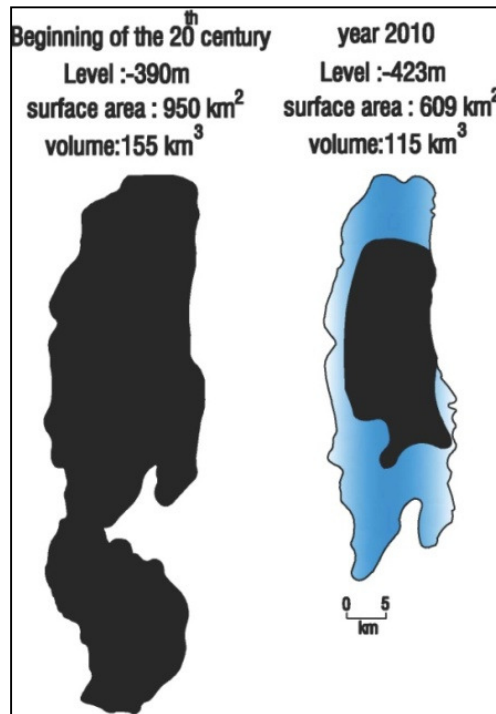


Figure 2. Dead Sea Surface Area 1900 and 2010



II. Analytical Approach and Comparison of Alternatives

19. The Terms of Reference for Study of Alternatives (SoA) at the Regional Level (see Appendix C) require that the alternatives to be examined are described in a standard format. Included in that format, for each alternative, the analysis should cover at least the following:

- Environmental and social impacts and the feasibility of mitigating these impacts;
- The costs of the alternative under consideration (capital and operating),
- Suitability for the local conditions; and
- Institutional, training and monitoring requirements.

20. To these indicators would be added:

- The cost and quantities of seawater and/or brine that would be available for the Dead Sea, and
- The cost and quantities of potable water expected from the alternatives.

21. The study will rely primarily on existing documents and studies. However, it is also anticipated that a significant amount of data may have to be developed and/or updated by the team. Study process will be supplemented by interviews with key professionals and officials in the region as required.

22. In order to capture these indicators in a standardized format, the draft layout is proposed in Table 1. The table would be presented for each alternative and expanded or contracted as needed to better represent the characteristics of that particular alternative.

23. The section for each alternative would also include a summary narrative box of the pros and cons of each alternative, as shown in Box 1 below.

24. The analysis will finally summarize for each alternative its overall feasibility (perhaps with a rating of High, Medium or Low). This rating shall be justified by a narrative overview of the critical indicators in the above tables and boxes.

Table 1. Alternative X Analysis Summary

	Capital	Operating
Cost (US\$/m3)		

	Impact	Mitigation
Environment		
Social		
Local Conditions		

Institutional	Description of Requirement/challenge
Training	Description of Requirement/challenge
Monitoring	Description of Requirement/challenge

	Capacity	Cost (US\$)
Potable Water	Mm3/year	x /m3
Hydropower	Mgw	x/kwh

	Sea Water	Brine
Available for Dead Sea (Mm3/year)		

Box 1. Pro and Con Summary for Alternative X

Summary

The Pros and Cons of the X option can be summarized as follows:

Pros:

-
-
- Etc.

Cons:

-
-
- Etc.

III. Consultation Plan

25. It is of critical importance that the representatives of the beneficiary parties and stakeholders in the region are aware of the Study of Alternatives, that the study process benefits from their inputs, their draft reports are made available for review and comments and the final report disseminated. In addition, consultation with stakeholders is required in order to gain a firm technical and political understanding of the possible alternatives. Therefore, the team proposes to consult stakeholders on three levels:

- Public consultations in Jordan, Israel and the Palestinian Authority;
- Specialized meetings with representatives of national and sub-national government, academic and applied research institutions, civil society organizations (CSOs), and nongovernmental organizations (NGOs); and
- The principal parties to the Study Program.

26. The methods for engaging at each level are described below.

27. Public Meetings. At the stage of the draft Study of Alternatives Report, the team will participate in meetings in Israel, Jordan and the Palestinian Authority. These meetings will be advertised nationally and organized by the World Bank and the Environmental and Social Assessment Study Consultant (Environmental Resources Management, Limited). Presentations will be in English and either Arabic or Hebrew. Simultaneous translation will be available. A further round of meetings may be carried out to discuss the Final Study of Alternatives Report. The agenda for these meetings will emphasize the SoA team updating its progress according to its Terms of Reference, describing draft results and receiving stakeholder input.

28. National and Sub-National Governments, Academic and Applied Research Institutions, CSOs and NGOS. These stakeholders will be consulted through meetings and phone interviews arranged by the SoA team, with the assistance of the World Bank where required. The agendas for these meetings will be developed by the SoA team and will highlight building its technical and political knowledge on various alternatives.

29. Study Program Principals. It is expected that the SoA team will consult frequently with the World Bank and the Study Program Study Management Unit. These consultations will be primarily thought phone calls and e-mails. A limited number of meetings with World Bank officials can also be expected.

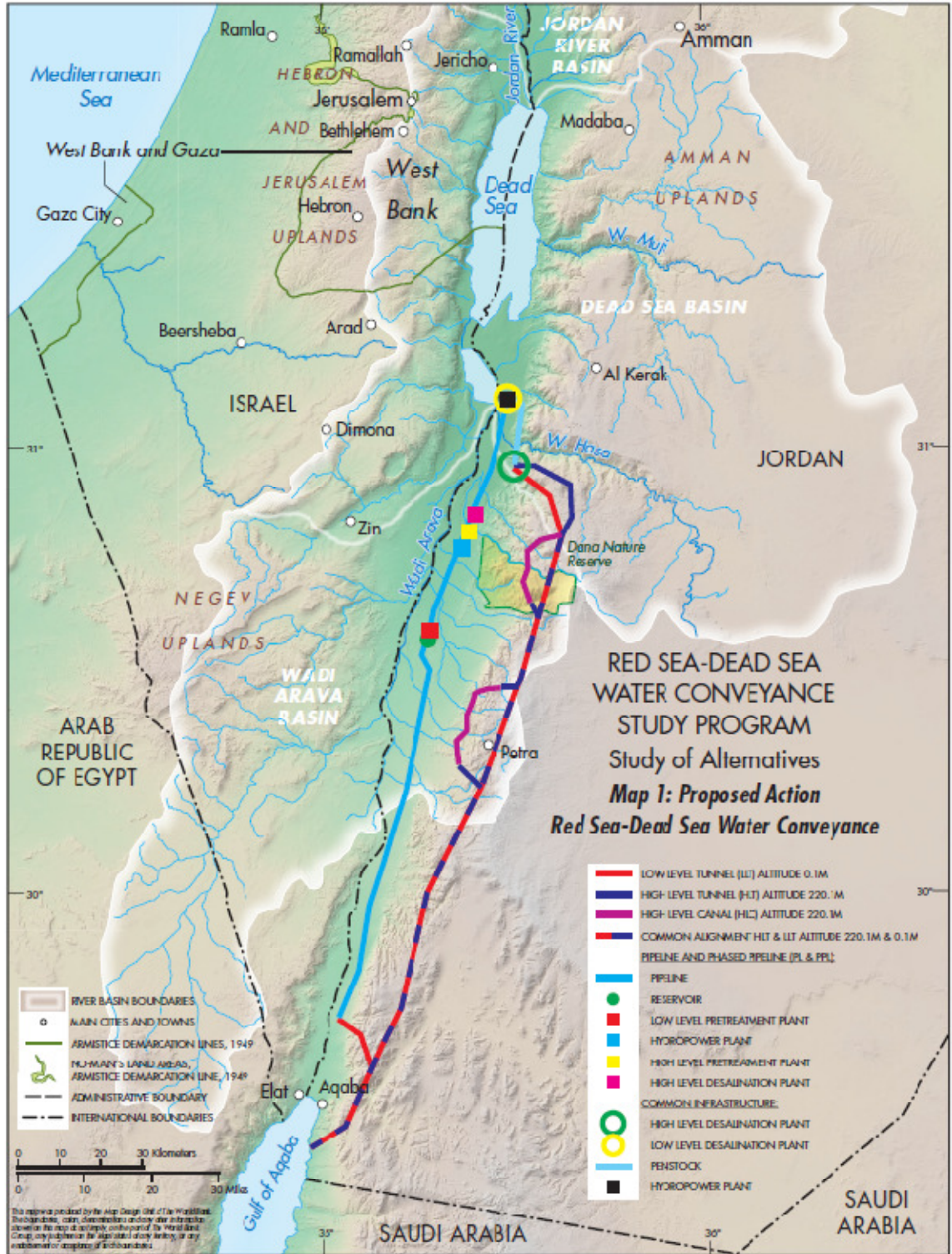
30. Technical Steering Committee. The SoA team will also meet with the Beneficiary Parties as required, and will likely be asked to attend one of more Study Program Technical Steering Committee meetings.

31. As is the case with all consultant reports under the Study Program, reports of the SoA team will be reviewed by the Study Management team, the Panel of Experts, and in their draft and final forms posted to the Study Program website for public access.

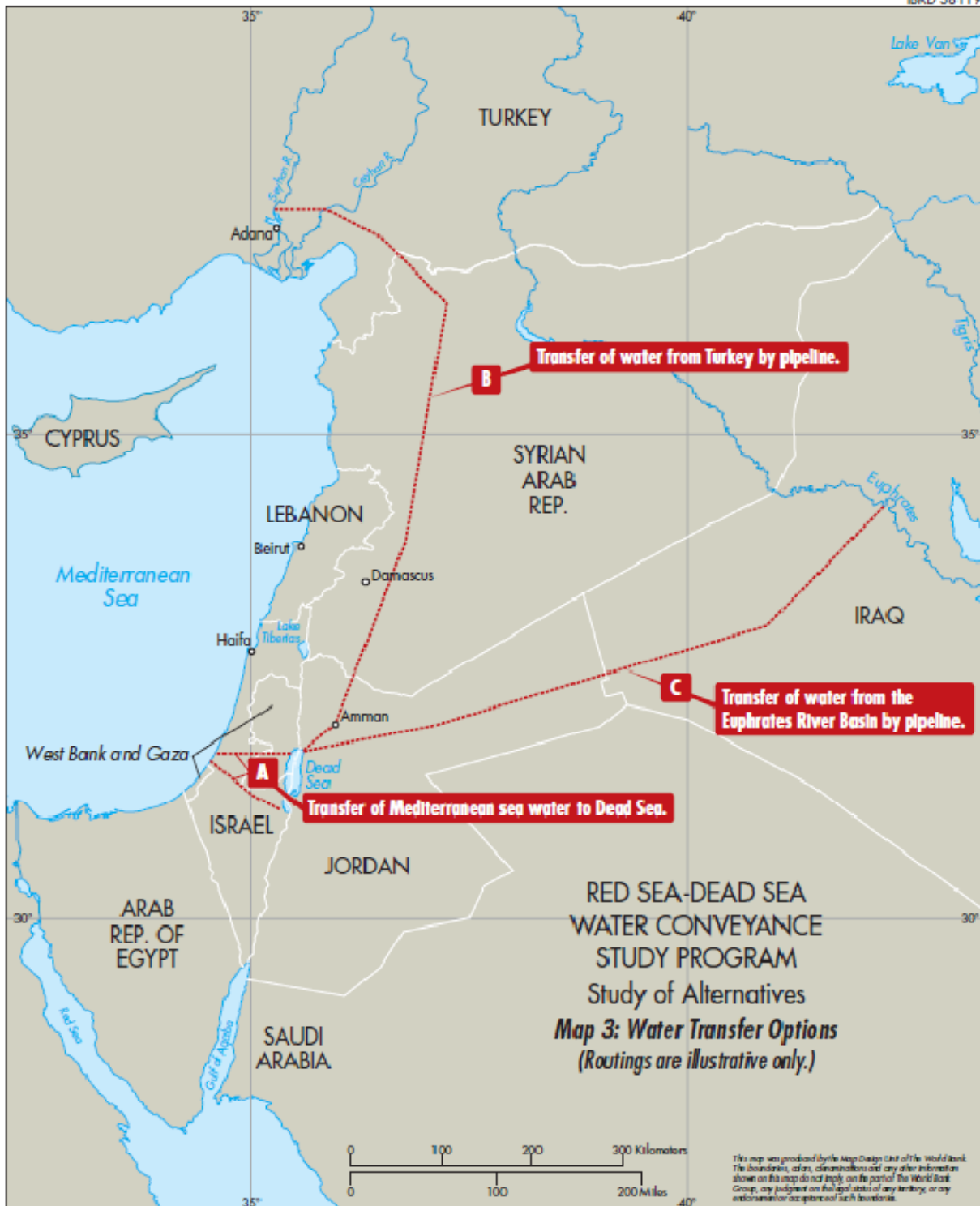
Appendix A

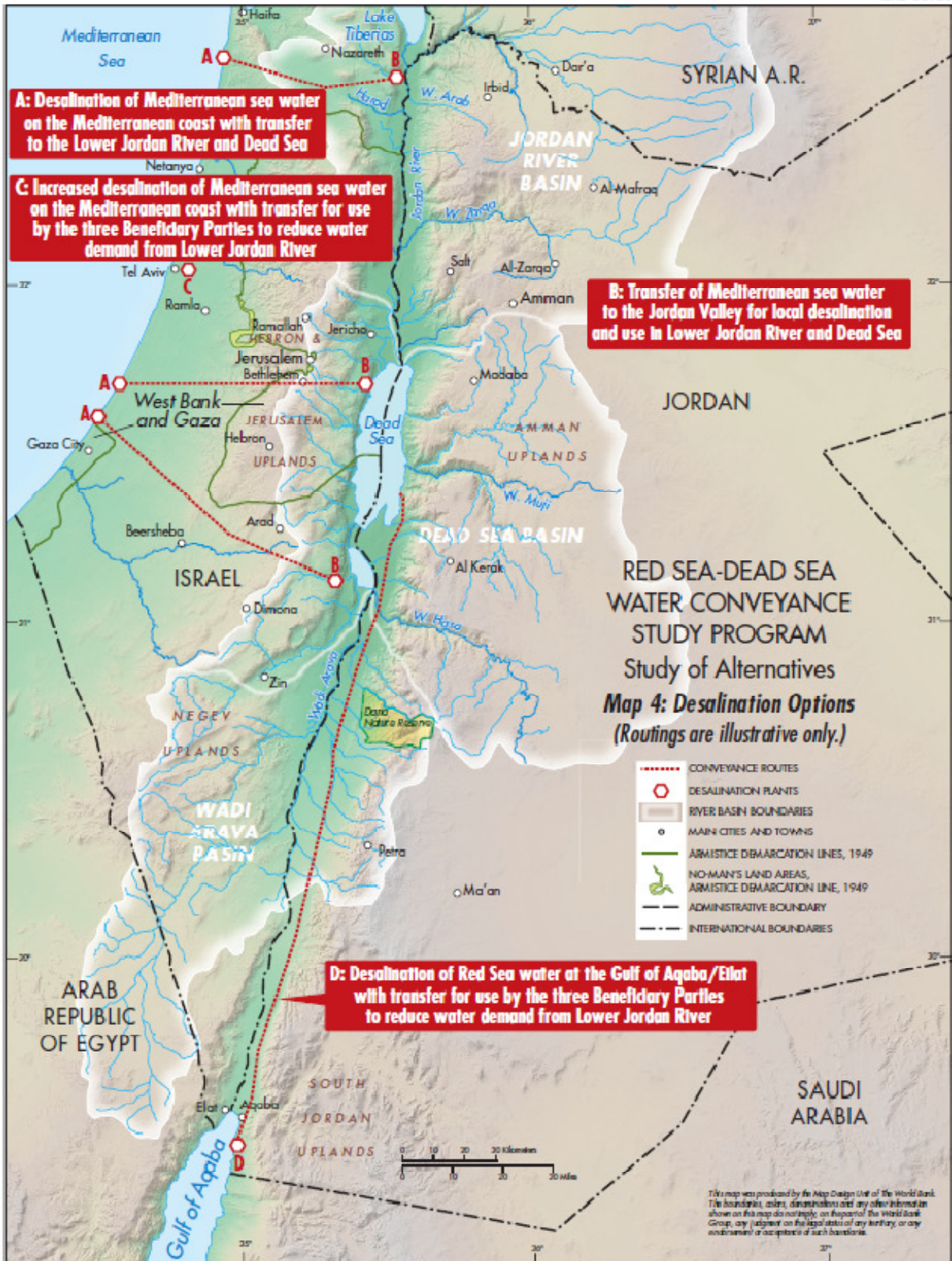
Preliminary Maps of Alternatives

IBRD 38117









Appendix B

Proposed Table of Contents for Draft Study of Alternatives Report

1. Executive Summary
 - Text on principal findings and conclusions
 - Comparative Summary Table
 - Summary of Public and Stakeholder Consultations
2. Methodology
 - Description of the methodology used to examine each option (e.g., desk study, new analysis, etc.)
 - Description of the standard comparative analysis criteria to be applied to each option
 - Structure of the report for each alternative
3. No Action Alternative
4. Proposed Action Red Sea-Dead Sea Water Conveyance
These are to be based on material provided by consultants working on the feasibility study and the environmental and social assessment.
5. Lower Jordan River Options
 - Full Restoration of Historic lower Jordan River flows
 - Partial Restoration of lower Jordan River flows
6. Water Transfer Options
 - Mediterranean – Dead Sea
 - Turkey transfer via pipeline
 - Euphrates River basin transfer via pipeline
7. Desalination Options
 - Desalination on Mediterranean coast with transfer to the lower Jordan River and Dead Sea
 - Transfer of Mediterranean seawater to the Jordan Valley for desalination
 - Increased desalination of Mediterranean seawater on the Mediterranean coast for use by the three Beneficiary Parties to reduce water abstractions from the lower Jordan River
 - Desalination seawater at the Gulf of Aqaba/Eilat for use by the three Beneficiary Parties to reduce water abstractions from the lower Jordan River
8. Technical and Water Conservation Options
 - Changes in Technology by the Dead Sea Chemical Industries
 - Increased water conservation in the lower Jordan River basin
 - Increased use of treated wastewater and greywater
 - Changes in crop types and cultivation methods
9. Additional Alternatives

10. Combination of Alternatives
11. Stakeholder Consultation Summary
12. Summary of Analysis and Follow-on Work
 - Comparison of all alternatives discussion
 - Alternatives recommended for further examination

Appendixes (preliminary)

Maps

References

- Officials and experts interviewed

List of Tables (preliminary)

- Summary Comparison of all Alternatives
- Other tables as required for each alternative
- List of alternatives to be examined further
- Estimated budget for alternatives to be examined further

Appendix C

Terms of Reference (October 2009)

Study of Alternatives at the Regional Level

Red Sea – Dead Sea Water Conveyance Study Program

- 1. Introduction.** The Government of Jordan (GOJ), Government of Israel (GOI) and Palestinian National Authority (PNA) (the Beneficiary Parties) are undertaking a Study Program to examine the environmental, technical and economic feasibility of the proposed Red Sea – Dead Sea Water Conveyance. The Study Program is being overseen by the Technical Steering Committee (TSC) composed of representatives of the three Beneficiary Parties and the World Bank. The Study Program includes a Feasibility Study (FS), an Environmental and Social Assessment (ESA) and Red Sea and Dead Sea Technical Studies (TS), which will examine issues at both the regional and project-specific levels. An element of the ESA is a Study of Alternatives at the Regional Level that will be undertaken by a specialized study team working under a contract with the World Bank. The Study of Alternatives will be subject of consultation meetings. The Consultant for the ESA will integrate the Study of Alternatives into the more comprehensive study. Information on the Study Program, including the Terms of Reference for the Feasibility Study, Environmental and Social Assessment and Technical Studies is available at: <http://go.worldbank.org/85HXOVM1A0>.
- 2. Consultant Team for the Study of Alternatives.** There will be three principal members of the team, one from each of the Beneficiary Parties selected by the World Bank from the proposed candidates, who will serve as the senior experts responsible for preparation of the Study of Alternatives. These three principal members should be senior level experts with a minimum of 20 years' relevant professional experience and may not be current government officials. They will be supported by additional independent specialists working on a short-term basis, as appropriate, to assist in the collection of information, compilation of data, development of maps and graphic materials and report preparation and translation. The additional independent specialists would be reviewed and approved by the World Bank. The team will have a work plan and a budget to cover the expenses for preparation of the Study of Alternatives. The team will also have access to qualified personnel from the Consultant for the ESA to assist in both the planning of the public consultation process on the Study of Alternatives and disclosure reporting.
- 3. Preparation of a Study of Alternatives at the Regional Level.** The objective of the study is to provide an analysis of the regional alternatives to the proposed project. The study of alternatives should examine the “no action” or “without project alternative,” the proposed action (Red Sea – Dead Sea Water Conveyance), as well as regional development alternatives. This will allow decision makers and the public to understand the various options that may exist to restore the Dead Sea and the implication of taking no action. The Consultants for the Study of Alternatives will examine a range of alternatives that have been proposed to address the decline of the Dead Sea, to include, but not be limited to, those identified in Attachment A.
- 4.** In examining alternatives, the Consultants for the Study of Alternatives should prepare a catalogue of proposed alternatives that describe in a standardized format,

systematically compare feasible alternatives to the proposed project, in terms of their potential environmental and social impacts, the feasibility of mitigating these impacts, their investment, operation and maintenance costs, their suitability under local conditions, and their institutional, training and monitoring requirements. For each alternative the Consultants will quantify the environmental and social impacts to the extent possible and attach economic values where feasible.

5. The Study of Alternatives should make use of maps and figures that show the relative locations and features of the proposed action and the alternatives. Use of tables, maps, and graphics to present the alternatives and support their analysis is strongly encouraged. Detailed or uninterpreted data are not appropriate in the main text and should be presented in annexes or a separate volume. Citations should be provided for references used in the study.

6. **Coordination with Other Studies.** The Consultants for the Study of Alternatives will be expected to closely coordinate with the consultants appointed to prepare the FS, ESA and TS. This will include working with the Consultant for the ESA concerning the planning, timing and location of public consultations to be undertaken as part of the preparation process for the Study of Alternatives. It should be noted that the Consultant for the ESA is preparing a description of the proposed project and an analysis of the “no action” alternative at the regional level, which should be integrated into the Study of Alternatives. The Consultant for the ESA is also examining technical alternatives associated with the proposed Red Sea – Dead Sea Water Conveyance, such as the alternative alignments of the conveyance structure and alternative locations for key infrastructure such as the sea water intake.

7. **Reports.** The Consultants for the Study of Alternatives will be responsible for the preparation of a series of reports and for participation in public consultations on the draft reports as outlined in Attachment B.

8. **Time Schedule.** The study will be conducted over a 12 month time frame as outlined in Attachment C. The Consultants for the Study of Alternatives should begin work upon contract signature. The Consultants for the Study of Alternatives should propose a clear schedule with critical milestones and make all possible efforts to meet the proposed time schedule.

9. **Consultant Supervision.** The work of the Consultants for the Study of Alternatives will be supervised by the TSC, which will be the focal point for coordination with all other ministries, agencies and any other international institutions. The TSC will facilitate access by the Consultants for the Study of Alternatives to the data available from the Beneficiary Parties and support field visits. It will also provide liaison and contacts with government, academic and applied research institutions, Civil Society Organizations and Nongovernmental Organizations, and will work cooperatively with the Consultant for the ESA on all public participation and public consultation activities.

10. **Ownership and Control of Information, Data and Documents.** Provision of information and data to the Consultants for the Study of Alternatives shall not constitute transfer of any intellectual property rights, ownership, licensing or other rights to use these for any other purpose than the Study. Documents and information/data provided to and/or generated by the Consultants for the Study of Alternatives shall not be disclosed without the expressed written consent of the TSC. The Consultants for the Study of Alternatives are advised that with respect to commercially generated information/data, there might be a need to conclude specific agreement with the owners of such information/data.

Attachment A

LIST OF ALTERNATIVES

1. The Consultants for the Study of Alternatives will examine a range of measures that have been proposed to address the decline of the Dead Sea, to include, but not be limited to, the following:
 - **No Action** – Analysis to be provided by the Consultant for the ESA
 - **Proposed Action – Red Sea – Dead Sea Water Conveyance** – Description and Analysis to be provided by the Consultant for the ESA
 - **Lower Jordan River Options**
 - Full Restoration of Historic Lower Jordan River Flow Levels
 - Partial Restoration of Historic Lower Jordan River at a Variety of Flow Levels
 - **Water Transfer Options**
 - Transfer of Mediterranean Sea Water to Dead Sea
 - Transfer of Water from Turkey by pipeline
 - Transfer of Water from the Euphrates River Basin by pipeline
 - **Desalination Options**
 - Desalination of Mediterranean Sea Water on the Mediterranean Coast with Transfer to the Lower Jordan River and Dead Sea
 - Transfer of Mediterranean Sea Water to the Jordan Valley for Local Desalination and Use in Lower Jordan River and Dead Sea
 - Increased Desalination of Mediterranean Sea Water on the Mediterranean Coast with Transfer for Use by the Three Beneficiary Parties to Reduce Water Demand from Lower Jordan River
 - Desalination of Red Sea Water at the Gulf of Aqaba/Eilat with Transfer for Use by the Three Beneficiary Parties to Reduce Water Demand from Lower Jordan River
 - **Technical and Water Conservation Options**
 - Changes of Technology Used by the Dead Sea Chemical Industry
 - Increased Water Conservation in the Lower Jordan Basin
 - Increased Use of Treated Wastewater and Greywater
 - Changes in Crop Types and Cultivation Methods
 - **Additional Alternatives Identified by the Consultants**
 - **Combination of Alternatives** – Examine a Range of Combinations of Alternatives to Assess the Benefits of Such an Approach.

Attachment B

LIST OF REPORTS

1. The Consultants will be responsible for the preparation of a series of reports and for participation in public consultations on draft reports as follows:
 - ***Annotated Outline of the Study of Alternatives Report and Consultation Plan.*** The Annotated Outline of the Study of Alternatives Report and Consultation Plan should be submitted to the TSC according to the time schedule in Attachment C. The Annotated Outline should consist of the proposed full table of contents to be used for the Study of Alternatives, complete with chapter titles, annex titles, main author responsible for each section, and main technical issues to be addressed in each section. Preparation of the Annotated Outline and Consultation Plan should benefit from discussions with the consultants for the Feasibility Study and Environmental and Social Assessment. The consultation schedule, as appropriate, should be coordinated with that for the Environmental and Social Assessment.
 - ***Preliminary Draft Study of Alternatives Report*** The Preliminary Draft Study of Alternatives Report should be submitted within the time schedule set out in Attachment C, in Arabic, English and Hebrew. This report should provide the Consultants' preliminary analysis concerning the proposed project and other alternatives under study. It should include a preliminary table that allows for a comparison of the various alternatives. It should also contain draft maps and figures that show the relative locations and features of these alternatives. The preliminary draft information should be compiled in formats that can easily become part of the draft reports or draft technical annexes.
 - ***Draft Study of Alternatives Report – Executive Summary and Main Report.*** The Draft Study of Alternatives Report should be submitted within the time schedule set out in Attachment C, in Arabic, English and Hebrew. The objective of the Draft Study of Alternatives Report is to present in a draft format the comparative analysis of the proposed project and its alternatives in a manner that allows for effective discussion by decision makers and stakeholders of these options. It will include a draft Executive Summary and draft Main Report.
 - *The Executive Summary* should include a narrative text and comparative tables, and contain other tables, figures and/or maps as needed. It should also provide information on consultations that have been undertaken.
 - *The Main Report* should focus on provision of a clear comparative analysis of the proposed project and alternatives to the proposed project as outlined above in the terms of reference. This report should provide the Consultants' analysis concerning the proposed project and other alternatives under study and should include a series of tables that allow for a comparison of the various alternatives. It should also contain draft maps and figures that show the relative locations and features of these alternatives. Use of tables, maps, and graphics to present the alternatives and support their analysis is strongly encouraged. Detailed or uninterpreted data are not appropriate in the main text and should be presented in annexes or a separate volume. Citations should be provided for references used in the study.

The Draft Study of Alternatives Report should be delivered to the TSC and will be disclosed to the public by posting it on the Study Program website and making it available at appropriate locations in printed form. It will also be subject to public consultation and comment. Once the TSC has reviewed the Draft Report and provided its comments and the Consultants have also received the comments from the public consultation process, the Consultants will proceed with preparation and submission of the Final Study of Alternatives Report.

- ***Final Study of Alternatives Report – Executive Summary and Main Report.*** The Study of Alternatives Report will be prepared in Arabic, English and Hebrew and should be submitted within the time schedule set out in Attachment C. The Final Study of Alternatives Report will provide complete details of all work performed and analyses made by the Consultants. This report will build upon the reports completed previously and integrate comments received from the TSC and from public consultations, including issues raised and discussed at review meetings, as well as written comments. The Final Study of Alternatives Report will be delivered to the TSC and disclosed to the public by posting it on the Study Program website and making it available at appropriate locations in printed form. In addition, a master hard copy and master soft electronic copy suitable for reproduction purposes should be provided to the TSC to meet any future needs for reprinting.

Attachment C

INDICATIVE SCHEDULE FOR THE STUDY OF ALTERNATIVES

Milestone	Month
1. Appointment of Consultants	0
2. Submit Annotated Outline Report and Consultation Plan	1
3. Comments issued by Technical Steering Committee	2
4. Submit Preliminary Draft Study of Alternatives Report	6
5. Comments issued by Technical Steering Committee	7
6. Submit Draft Study of Alternatives Report – Executive Summary and Main Report	9
7. Comments by Technical Steering Committee	10
8. Issue Final Study of Alternatives Report – Executive Summary and Main Report	12