



Darbandikhan Basin Project
Status report of
Nature Iraq/Twin Rivers Institute Work

DRAFT

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This report is prepared to summarize and inform partner agencies on the status and progress of the study of Darbandikhan Basin/Reservoir. For more information please refer to Nature Iraq's web site: www.natureiraq.org or write to:

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Introduction

On Wednesday, 30th of July 2008 it was reported that some individuals threw poison into Darbandikhan Lake near the Tanjero input and that this resulted in a massive fish kill. Nature Iraq/Twin Rivers Institute of the American University of Iraq-Sulaimani (NI/TRI-AUIS), the KRG Ministry of Environment (KMoE) and the University of Sulaimani (UoS) were contacted and visited the area to collect site information and samples on three separate occasions (August, September & October). Physical parameters were measured and some chemical samples were taken of water and sediment. Also fish samples were taken for analysis of hydrocarbons and heavy metals¹. Most physical parameters were within normal ranges (except for turbidity and total dissolved solids, which were high in some locations) but some sediment samples and water samples were found to contain high levels of heavy metals.

Initial consultative meetings were held to discuss the problem of the fish kill, but the results of the meetings were inconclusive as opinions in regards to the causality of the fish kill varied and agreement could not be even reached in regards to the number, size, species, etc., of animals killed in the incident. Some of those present opined that the fish kill was due to depleted oxygen and not due to the use of poison to catch fish; still others indicated that it was due to low flow of water (lack of rain).

A larger meeting was then held in Erbil and called for by the minister of environment of the Kurdish Region, Dr. Dara M. Amin Saeed, and a second meeting was also held and attended not only by the KRG minister of environment, but also the KRG minister of health. The KRG government was especially concerned about the health implications of the heavy metal traces found in the samples and asked the assembled representatives of various governmental and non-governmental agencies to advise the government on steps that can be taken in the short and long term to address the problems. The KRG government instructed those present to cooperate fully with the investigation so that the results can be an example of how private and public entities can work together to protect the public and advance the case of environmental protection in Kurdistan-Iraq and the rest of Iraq.

In total, four large meetings were held and several consultative/smaller meetings were held in Erbil and Sulaimani between various entities participating in the investigation. The Italian advisors of Nature Iraq attended a couple of the meetings to present a summary of the Italian experience in similar problems. Those attending the meetings reviewed maps of the areas and past incidents and, after long discussions, it was concluded that while there is a recent problem

¹ Results on hydrocarbon tests in fish, performed at the University of Basrah, are pending and heavy metal tests in fish, performed at the NI/TRI-AUIS lab are complete but under review.

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with the fish poisoning/fish kill, there is a deeper underlying problem in the basin of not only the Tanjero River, but also all the rivers leading to Darbandikhan reservoir.

As such, it was necessary to change the focus of the study from just trying to identify the reasons for the fish poisoning/fish kill to formulating a better and deeper understanding of the underlying systematic problems associated with the tributaries of the reservoir both inside Iraq and outside. Further, it is the opinion of those studying the issue that there is no magical solution to the problems underlying the water quality of Darbandikhan reservoir, other than long-term solutions that focus on cleaning up the environment and stopping practices that are causing the degradation of the water. The participants have resolved to give long-term and short-term solutions and projects that can be implemented by both governmental and non-governmental entities to work on improving the environmental conditions in Iraq.

Presented herein is a status report on the study being undertaken by Nature Iraq and the Twin Rivers Institute of the American University of Iraq – Sulaimani in conjunction with co-researchers from the University of Sulaimani, KRG Ministry of Environment, KRG Ministry of Health, KRG Ministry of Municipalities, KRG Ministry of Industry, and others in Kurdistan-Iraq.



Plate 1: Map of Darbandikhan by Google Earth, showing area where contamination may have occurred

Chronology of the Fish Kill Incident and developments henceforth,

30 July: Alleged poisoning/fish kill event occurs

1 August: A Nature Iraq staff person, who was out of the country at the time, heard about a fish kill that took place at Darbandikhan in an email on August 1st from a student at the University of Sulaimani. This student had found out from people living in the area about the incident and that some people were arrested for putting poison in Darbandikhan Reservoir.

2 August: When the NI staff person arrived in Sulaimani on 2nd August, a family member told him that several people were arrested and that one had escaped from the forestry policeman. At this point we learned that the incident had happened on 30 July.

4 August: All NI staff in Sulaimani notified of the incident and it was suggested that NI send out a team but there the NI/TRI lab was not ready to accept any samples.

6 August (approximately): The head of police at the Darbandikhan Forestry Police Station called NI and told us that >3 million fish were killed due to poison. A message was sent to all NI staff about this at that time.

13 August: Three NI staff went to do a site inspection (Korsh Ararat, Shorsh M., Mudhafar Salim) and they took pictures and brought back fish and turtle samples (three dead turtles had been seen on the site visit). One site was visited on this trip just below the destroyed bridge over the Tanjero River nearest the main body of the lake, near the village called Jardasna. There were many dead fish and a bad smell at this location.

14 August: NI sent another team (Korsh Ararat, Ali Mohammed Mahir, Haider Falih, Laith, Ra'id Abdulmehdi & Bassam) and visited four sites (the one visited the previous day, two above this location and one below). Physical parameters were measure and samples were taken of water, sediment and fish. High turbidity and total dissolved solids were found as some sites associated with the Tanjero River input and high levels of lead and nickel were found in both water² and sediments at all sites. Fish test results are still pending at the time of this report.

17 August (approximately): NI Staff, Ali M. Mahir contacted the head of the Darbandikhan Police Station (Officer Jwamer) and asked him about the people who were arrested and what

² Often a mistake is made in comparing heavy metals in the waters of lakes and rivers to drinking water standards. It is more appropriate to compare to standards for surface (untreated, natural waters). There is no single standard for heavy metals. NI/TRI-AUIS compared water samples to the following different reference standards: Langmuir (1997); WHO (2006); European Standards (2004); Manharawi & Hafiz (1997); McKenzie (2001); Hem (1985); Hamil & Bill (1986); Crompton (1997); Swedish EPA (2000), and the Environmental and Health Protection office Of Sulaimani (2006).

poison was used. There is confusion over who exactly arrested these people but NI was told that the people were transferred to either the main office of the police in Sulaimani³.

7 September: A subsequent sampling trip was done at four separate locations along the Tanjero River input and in the lake/reservoir (as well as below the dam) in conjunction with the KRG Ministry of Environment to take measurements of physical parameters and water samples for chemical testing. As with the August trip, these tests showed high concentrations of lead and, in two case, nickel⁴ in water samples. High total dissolved solids and turbidity were also reported at sites in the Tanjero River input particularly.

September: NI/TRI-AUIS drafted its first two reports on the fish kill and sampling results.

15, 16 October: Several meetings were conducted on the issue with various stakeholders and the Kurdish Ministry of Environment providing oversight in both Erbil and Sulaimani. The data was reviewed at these meetings and various causes for the fish kill were discussed. At that time it was decided that the problems of the basin are broader than one specific to a single fish kill event and a larger project proposed for the entire Darbandikhan Basin.

26-30 October: An additional third round of sampling was done at the original (August) samples sites, of which, the upper three were dry at this time (including the area where the fish kill is believed to have occurred). In addition, a sample was taken from the Tanjero River near Sulaimani and the bridge to Qara Dagh, where water is still present in the river. Samples from the lake site itself showed elevated lead and nickel levels in sediment but only elevated lead in water. The Tanjero River site near Sulaimani had high level (higher than all previous samples) of lead and nickel in both water and sediment. In addition, a survey of industries in the basin was conducted, building upon a recent effort by the Social & Crime Research Center of Sulaimani. More than 60 industries were surveyed in the upper basin⁵.

November: NI staff began collecting previous data available on the Basin from the Suliamani Municipality and the Health Department. In addition, NI contacted the court in Sulaimani and found that the two men that had been arrested had been released. Tests had been conducted by the University of Sulaimani on basic physical and chemical parameters and had not provided proof that a poisoning event had taken place. The status of the case is not clear but it remains open⁶.

³More recently it was learned that these individuals were handled by the Forestry police from Warmawa (Zarayan) and that three people were involved in the original poisoning event (but only two were arrested). They were transferred to the court in Halabja but then they were transferred to the court in Sulaimani.

⁴ Nickel levels were not detected in the second and third sample site.

⁵The following information was collected on industries in the basin: GPS locations, site description and production type, type and characterization of waste outputs, existing treatment and monitoring activities, and identification of specific receiving waters.

⁶It should be noted that if pesticides had been used by the individuals in questions, conventional lab testing for nutrients and standard physical parameters would not have shown any problems. A GC-MS instrument with specific sample pre-treatments is required to conduct tests for pesticides and such equipment may not be readily available in Iraq. A future NI procurement will obtain this device for the Twin Rivers Institute (TRI-AUIS) lab in Sulaimani in the coming year.

Definition of the Darbandikhan Basin Project

Some stakeholders speculated that only fish and only fish of a certain size were killed. As stated previously, some believed that low D.O. levels caused the fish kill. Field samples at the site indicated that fish of varying size classes were killed and other organisms (birds and reptiles) were also found dead in the same area. Despite the arrest of two individuals whose case is still under investigation, the ultimate cause of the fish kill is still uncertain at this time. But due to the discussions with the various stakeholders, it was clear that the problems of the basin are extensive.

It is known that there are some obvious problems that exist in the Darbandikhan reservoir and the Tanjero basin in particular due to sewage inputs from the city of Sulaimani and other towns and villages. Also heavy metals have been found in the water and sediments in different areas of the basin. Other issues that may be affecting water quality and/or quantity include industrial wastes, landfill and trash burning operations, in-stream and pit gravel mining operations, agricultural run-off, wastes from river and lake users (for example motor oil and solvents from car washing and fishing boats, dumping of garbage and fill within the flood plain), etc. There is little to no control, oversight or examination of many of these activities.

Thus a project was conceived to evaluate and seek strategies to solve the diverse environmental problems affecting water quality, environmental and public health within the Darbandikhan Basin including the Tanjero River and its tributaries, the Zalm River and its tributaries, the Sirwan River and its tributaries, Darbandikhan Lake, and the Diyala River downstream.

The ultimate goals of this project are:

- to determine the cause of the fish kill and
- to ensure projects be undertaken and improvements in practices are implemented such that the waters of Darbandikhan Lake are suitable, once more, for human consumption and use.

To accomplish these goals the following basic tasks are identified:

1. Identify all existing data on the basin and assemble into an integrated database for analysis by stakeholders and setting up a system by which new information on the basin can be added and shared.
2. Identify gaps in information and all potential sources of contamination within the basin and develop a list of sub-projects for addressing and obtaining missing information (for example: if information on industrial inputs to the basin is lacking, a sub-project might be started under the oversight of the committee to begin a survey of area industries and small, medium, to large-scale businesses to determine what waste products that they are generating)

3. Produce a “State of the Basin” Report documenting current knowledge of the basin, identifying gaps and suggesting next steps, including further research projects, preliminary lists of projects that can be undertaken to immediately improve the water quality or at least stop further deterioration.

It should be understood that this will be a long-term process, and this report should be a living document that is revised periodically to update the state of the knowledge and follow up on the implementation of recommended actions.

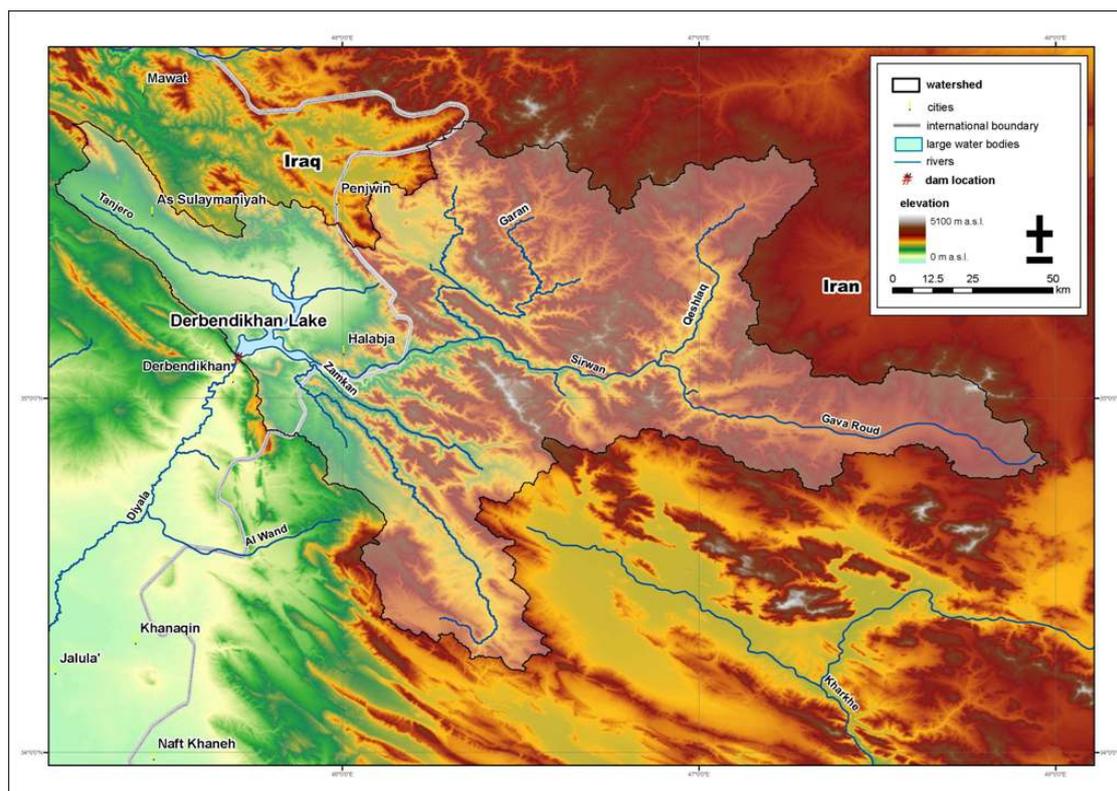


Plate 2: Darbandikhan Basin

Task 1: Existing Data and Database

Collection of Historical Data

NI/TRI-AUIS and others have been involved in previous sampling efforts in the area and have collected additional information on heavy metals and high nutrient levels in the basin. Nature Iraq’s Key Biodiversity Areas (KBA) survey looked at plankton levels in the waters entering Darbandikhan Lake in 2007 and found that certain plankton species are present that may be achieving levels of toxicity for human health. Also benthic invertebrates’ surveys from the

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KBA project have shown pollution tolerant species exist in the Tanjero Basin and have also notice deformities in these organisms within the Tanjero River.

Additional information exists within the Universities of Sulaimani and Salahaddin, the Municipality of Sulaimani, the Health department and others. NI/TRI-AUIS staff began collecting this data and assembling it in preparation for integrating all information into a comprehensive database. The following table provides a list of the historical data collected to date.

List of Collected Historical Data / Darbandikhan Basin Project

#	Name of the Document	Type of Document / date	Source of the Document
1	Environmental Study on the Polluted water in Tangero river	Theses / 1979	University of Sulay
2	Study on the Primary productivity of Serchinar spring	Theses / 1980	University of Sulay
3	Study on the Algal Ecology of Springs in Sulay Province	Theses / 1981	University of Sulay
4	Impact of sewage waste water on the environment of Tangero river and its Basin within Sulay city	Theses / 2002	University of Sulay
5	Pollution in Dukan and Darbandikhan Lakes	Report / 2004	MoWR/ Darbandikhan Dam Directorate
6	Registered Pesticides used in Agriculture and general Health in Iraq	Report / 2002	MoAG
7	Lab and Field measurements for Sirwan, Zamakan and Tangero	Data Sheets / Aug.2008	MoWR/Directory of Water in Sulay
8	Lab Measurements for Darbandikhan lake	Data Sheet / Oct-2005	University of Sulay
9	Water factory measurements/ Darbandikhan area	Data Sheet / April-2004	MoWR
10	Lab Measurements of Darbandikhan streams	Data Sheet / Jan-2006	MoWR
11	Lab measurements of Darbandikhan Dam Water	Word Data Sheet / jan-2006	MoWR
12	Different Chemical and bacteriological analyses on the	Excel Data Sheet / different years	MoH

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#	Name of the Document	Type of Document / date	Source of the Document
	well water in Sulaimani.		
13	Industries Information / Catchment area	Word Data sheet / 2008	NI
14	KBA Report (including the area)	Data & Report / 2007 (drafts) & 2008 (the latter in preparation)	NI
15	The Sulaimani Sewage Plan	Report/Nov.2003	Prepared under CPA
16	The water and wastewater and solid waste	From Sualy master Plan/October 2008	Sulaimani Municipality
17	Timeline on fish killed Incident	Report/Aug 2008 until now	NI
18	Tanjero Cross Training I	Data & Report Spring 2008	NI
19	Tanjero Cross Training II	Data & Report Fall 2008 (in preparation)	NI
20	Rapid Assessment of Fish Kill site	Data & Report, September (2 reports), & October (data only), 2008	NI

Other potential sources of historical data, which remain to be checked include: the Kurdistan Technical Research Center, RTI, University of Salahaddin and Baghdad.

Database

A meeting was conducted with Italian experts in November to discuss the design of a database structure for the Darbandikhan Basin data. A preliminary design is underway at this time with preliminary results expected before the end of 2008.

Task 2: Identification of Gaps & Subprojects

This task will be conducted once the database is constructed and the existing historical data has been migrated to the database. This will allow for a comprehensive look at the current knowledge on the basin and help in the identification of those areas where information is missing.

At that point a series of additional projects may be identified include potentially the following:

- Identify the sources of pollution, including industrial plants, municipal dumps, slaughter houses, sewage plants, etc. in a data base and implement a long term monitoring

program to evaluate the effluents from these industries and how they are impacting the groundwater and/or surface water.

- An emergency response plan for dealing with environmental spills (either accidental or intentional) in the basin that threaten environmental or human health to ensure that response to the spill is swift and effective.
- Additional sampling for either parameters not yet examined or in areas where sampling has not been done.
- Collect information about groundwater conditions in the area of the basin.
- Establish channels of communications with Iranian authorities who control approximately 2/3 of the basin of Darbandikhan reservoir
- Collect information regarding agricultural activities in the basin, including pesticide use and fertilizer consumption as well as the quality of the drainage water and its disposal.
- Implement long-term reforms and improvement in irrigation practices to reduce pollutions as well as improve the economy of the agricultural activities in the area.

Task 3: “State of the Basin” Report

The results of the above tasks would be presented to participating stakeholders and the general public in a document reviewing all current knowledge on the health of the basin; gaps in knowledge and data; preliminary conclusions on the environmental and public health of the basin; recommendations for gap-filling activities and future projects to resolve water quality, environmental and public health problems in the basin. Below is a general outline showing the Table of Contents of the proposed report.

EXECUTIVE SUMMARY

INTRODUCTION

This section explains the methodology that would be followed

HYSTORY OF THE AREA

This chapter should present the history of the site and its development during the past decades

PRESSURES

POPULATION

General statistics

How many people, how are they distributed, etc.

Waste water generation and existing sanitation infrastructures

Need a complete listing of all sewage facilities in the area, be it collection, treatment, or simply dumping.

Solid waste generation

Water usage and water consumption

Nature resources consumptions in general

AGRICULTURE

Characterization of the present conditions, drainage, animal husbandry

INDUSTRY

ENERGY GENERATION

OTHER ECONOMIC ACTIVITIES

... if any...

LAND USE

STATE OF THE BASIN

PHYSICAL SETTINGS

Geography

Topography

Climate

Hydrology

Geology and Hydrogeology

ENVIRONMENTAL SETTINGS

Flora and Vegetation

Fauna

Landscape

Habitat

Water Quality

Lake, rivers and groundwater

GAP ANALYSIS

REQUIRED DATA

This chapter should provide a list of the information that would be required to prepare a comprehensive state of the basin study. For a complete characterization of the lake, international standards could be utilized (American or European...), and considering the present state of the available information, a proper data collection strategy should be defined.

COMPARISON BETWEEN AVAILABLE AND NEEDED INFORMATION

This chapter should provide a comparison between the data we have collected and are readily available and the data that are needed in order to prepare a comprehensive study (chapter above)

DATABASE

This chapter describes the database we are going to set up for data collection and storage

RECOMMENDATION

Here we provide recommendations on which data we need and how to get them

RESPONSES

OBJECTIVES AND STRATEGIES

INSTITUTIONAL POLICIES

PROPOSED ACTIONS

Civil

Short

Medium

Long Term

Industrial

Short

Medium

Long Term

Agriculture

Short

Medium

Long Term

Territory

Short

Medium

Long Term

REFERENCES

APPENDIXES

Summary

This State of the Basin report should be considered a living document, reviewed and updated on a yearly basis, or more often (i.e. as new information becomes available), if possible. The document should clearly identify the challenges, but strive to identify short-term, medium-term and long-term solutions and/or strategies to address the problems identified. In compiling this document, we strived to bring in western technology and know how and use Iraqi knowledge and data to come up with a methodology as well as a process that can be replicated elsewhere in Iraq, whenever possible.

References

- Nature Iraq (2008A). Preliminary Field Report: Darbandikhan Lake Poisoning Event. Unpublished report by Korsh Ararat Raid Abdulmehdi, haider Ahmed Falih & Ali Mohammed Maher. August 2008.
- Nature Iraq (2008B). Nature Iraq Field & Lab Report: Darbandikhan Sampling Results. Unpublished report by Raid Abdulmehdi. September 2008.
- Nature Iraq (2008C). Darbandikhan Basin Project Work Plan. Unpublished document. November 2008.