Environmental Impact Assessment

April 2019

AFG: Arghandab Integrated Water Resources Development Project

Project No. 48096-002

Part 2 of 2: Appendices

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APPENDIXES

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APPENDIX 1. RAPID ENVIRONMENTAL ASSESSMENT – DAM AND HYDROPOWER

1. Rapid Environmental Assessment (REA) Checklist

Instructions:

(i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Environment and Safeguards Division (SDES) for endorsement by Director, SDES and for approval by the Chief Compliance Officer.

(ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.

(iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title:	TA-9273 AFG: Arghandab Integrated Water Resources Development Project
Sector Division:	CWRD/CWER

A. Basic Project Design Data

1.	Dam height, m	= Dam height increased by 13.6m
2.	Surface area of reservoir, (ha)	= 4,581 ha (at full supply level)
3.	Estimated number of people to be displaced	= 5,800 persons
4.	Rated power output, (MW)	= 29.4 MW

Other Considerations:

1. Water storage type: _x_ reservoir ___ run of river
   ___ pumped storage
2. River diversion scheme: ___ trans-basin diversion ___ in-stream flow regulation
   _x_ in-stream diversion
3. Type of power demand to address: _x_ peak load _x_ base load

Screening Questions	Yes	No	Remarks
B. Project Location Is the dam and/or Project facilities adjacent to or within any of the following areas?			
▪ Unregulated river		**X**	The river is regulated by Dahla Dam.
▪ Undammed river tributaries below the proposed dam	**X**		However, new constructions underway on the Helmand river, downstream of the junction with the Arghandab.
▪ Unique or aesthetically valuable land or water form		**X**	
▪ Special area for protecting biodiversity	**X**		Dahla Dam has bird and fish species
▪ Protected Area		**X**	
▪ Buffer zone of protected area		**X**	
▪ Primary forest		**X**	
▪ Range of endangered or threatened animals		**X**	Water fowl live on the reservoir. The range of endangered or threatened animals will be confirmed during the Environmental Assessment (EA) study.
▪ Area used by indigenous peoples		**X**	No indigenous people as per SPS (2009) definition as all ethnic groups are mainstreamed into the society and have all political rights.
▪ Cultural heritage site	**X**		It is estimated that the area to be inundated as a result of rising water levels includes 11 mosques/masjibs, 7 madrasas, and 3 cemeteries. The Archaeology Institute indicated in July 2018 that they will confirm this information before the construction phase.
▪ Wetland	**X**		Waterfowl live on the reservoir. The reservoir wetland is manmade and will change due to changing water levels of the reservoir.
▪ Mangrove		**X**	
▪ Estuary		**X**	
C. Potential Environmental Impacts Will the Project cause…			
▪ short-term construction impacts such as soil erosion, deterioration of water and air quality, noise and vibration from construction equipment?	**X**		Mitigation measures will be included in the Environmental Assessment (EA) study to minimize these impacts during the construction phase.
▪ disturbance of large areas due to material quarrying?	**X**		Earthworks will be carried out during dam raising and other works. The quarry sites will be evaluated in detail in the Environmental Assessment study.
▪ disposal of large quantities of construction spoils?	**X**		Impacts due to this will be evaluated in detail in the Environmental Assessment study.
▪ clearing of large forested area for ancillary facilities and access road?		**X**	

Screening Questions	Yes	No	Remarks
▪ impounding of a long river stretch?		X	No, the dam already exists.
▪ dryness (less than 50% of dry season mean flow) over a long downstream river stretch?		X	The 13.6m dam raise will not cause the stated dryness condition as this already exists; What the project will do is to reduce environmental flows in wet years as the dam can store more. Further detailed environmental flow requirement studies will be undertaken.
▪ construction of permanent access road near or through forests?		X	There are no forests.
▪ creation of barriers for migratory land animals		X	This is not foreseen as the dam already exists.
▪ loss of precious ecological values due to flooding of agricultural/forest areas, and wild lands and wildlife habitat; destruction of fish spawning/breeding and nursery grounds?	X		Loss agricultural land is expected due to increased flooding of the area. However, loss of land with precious ecological value is not anticipated. However, this and other aspects will be further evaluated during the Environmental Assessment stage.
▪ deterioration of downstream water quality due to anoxic water from the reservoir and sediments due to soil erosion?		X	This is not foreseen as the dam already exists.
▪ significant diversion of water from one basin to another?		X	No additional diversion.
▪ alternating dry and wet downstream conditions due to peaking operation of powerhouse?		X	The power houses will only be used as additional benefit following water release for irrigation and urban water.
▪ significant modification of annual flood cycle affecting downstream ecosystem, people's sustenance and livelihoods?	X		This will be evaluated in detail as part of Environmental Assessment.
▪ loss or destruction of unique or aesthetically valuable land or water forms?		X	
▪ proliferation of aquatic weeds in reservoir and downstream impairing dam discharge, irrigation systems, navigation and fisheries, and increasing water loss through transpiration?		X	No aquatic weeds expected due to good water quality in the reservoir.
▪ scouring of riverbed below dam?		X	Existing slope stability (bedrock).
▪ downstream erosion of recipient river in trans-basin diversion?		X	
▪ increased flooding risk of recipient river in trans-basin diversion?		X	
▪ decreased groundwater recharge of downstream areas?		X	
▪ draining of downstream wetlands and riparian areas?		X	
▪ decline or change in fisheries below the dam due to reduced peak flows and floods, submersion of river stretches and resultant destruction of fish breeding and nursery grounds, and water quality changes?	X		Environmental flow will sustain aquatic habitats.
▪ loss of migratory fish species due to barrier imposed by the dam?		X	Dam is already existing, raise of the dam will not affect migratory fish. However, this will be further evaluated as part of the Environmental Assessment study.
▪ formation of sediment deposits at reservoir entrance, creating backwater effect and flooding and waterlogging upstream?		X	
▪ significant disruption of river sediment transport downstream due to trapping in reservoir?		X	

Screening Questions	Yes	No	Remarks
▪ environmental risk due to potential toxicity of sediments trapped behind the dams?		X	This is highly unlikely as no such activities (like industrial etc.) are carried out upstream of the dam site. This will be further investigated as part of the EA study.
▪ increased saltwater intrusion in estuary and low lands due to reduced river flows?		X	
▪ significant induced seismicity due to large reservoir size and potential environmental hazard from catastrophic failure of the dam?	X		The dam design considerations will ensure no major damage is caused during a seismic event. The provision of an emergency response plan will ensure the impact during any such disaster can be minimized.
▪ cumulative effects due to its role as part of a cascade of dams/ reservoirs?		X	This is not foreseen. However, will be further assessed as part of the Environmental Assessment (EA) study.
▪ depletion of dissolved oxygen by large quantities of decaying plant material, fish mortality due to reduced dissolved oxygen content in water, algal blooms causing successive and temporary eutrophication, growth and proliferation of aquatic weeds?		X	Not expected due to good water quality in the reservoir (only turbidity and fecal coliform bacteria were found during field survey in December 2018; very small settlements upstream dam; and no or minor sewage drainage into the dam).
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?	X		Construction activities may result in impacts on community safety if not properly managed. The EMP will include, and will not be limited, to the following mitigation measures: (i) Only authorized trained personnel shall be permitted inside the work area. (ii) All workers shall be given PPEs. All occupational health and safety precautions should be in place as per Occupational Health & Safety Plan. Moreover, the project design will incorporate considerations to ensure minimal damage in case of natural hazard (e.g. earthquake). Moreover, provision of emergency response plans will ensure minimal impact during any such event.
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?	X		Engaging labor force outside the local communities would increase burden on social infrastructure and services specifically water resources. It could be avoided through involving local labor forces for the project implementation. Proper mitigation measures (like getting water from other sources, provision of septic tanks in construction camps etc.) will be provided in the Environmental Assessment study to ensure burden on existing infrastructure remains minimal.
▪ creation of community slums following construction of the hydropower plant and its facilities?		X	

Screening Questions	Yes	No	Remarks
• social conflicts if workers from other regions or countries are hired?	**X**		During construction phase mainly, local labor force will be involved. However, international staff will be engaged, hence, there is possibility of social conflict. Proper planning and management can reduce the risk of such conflicts. Furthermore, staff will be sensitized with local cultural norms to avoid any conflicts.
▪ uncontrolled human migration into the area, made possible by access roads and transmission lines?		**X**	
▪ disproportionate impacts on the poor, women, children or other vulnerable groups?		**X**	No such impacts are envisaged. However, these will be further evaluated in the Environmental Assessment (EA) study
▪ community health and safety risks due to the transport, storage, and use and/or disposal of materials likely to create physical, chemical and biological hazards?	**X**		The management of risks associated with the transport, storage, use, and disposal of materials will be in accordance with the EMP. This should include mitigation measures specific to waste management and disposal, and material storage and handling.
• risks to community safety due to both accidental and natural hazards, especially where the structural elements or components of the project (e.g., dams) are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?	**X**		Risk to community health and safety will be minimized through preparation of implementation of an Emergency Response Plan and other such provision to be provided in the EMP's for various project phases (construction, operation).

A Checklist for Preliminary Climate Risk Screening

Country/Project Title: AFG: Arghandab Integrated Water Resources Development Project

Sector: Agriculture, Natural Resources and Rural Development

Subsector: Irrigation and Water-based natural resources management

Division/Department: CWRD / CWER

Screening Questions		Score	Remarks[1]
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?		
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?		
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?		
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s)?		
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?		

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response will be categorized as high risk project.

Result of Initial Screening (Low, Medium, High):_____

Other Comments:_____
_____

Prepared by: _____

[1] If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

APPENDIX 2. RAPID ENVIRONMENTAL ASSESSMENT – ROADS AND HIGHWAYS

ROADS AND HIGHWAYS

RAPID ENVIRONMENTAL ASSESSMENT
ROADS AND HIGHWAYS (COMPONENT 1)

Instructions:

- This checklist is to be prepared to support the environmental classification of a project. It is to be attached to the environmental categorization form that is to be prepared and submitted to the Chief Compliance Officer of the Regional and Sustainable Development Department.
- This checklist is to be completed with the assistance of an Environment Specialist in a Regional Department.
- This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB checklists and handbooks on (i) involuntary resettlement, (ii) indigenous peoples planning, (iii) poverty reduction, (iv) participation, and (v) gender and development.
- Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title:	TA-9273 AFG: Arghandab Integrated Water Resources Development Program-Component 1 (Roadway realignment)
Sector Division:	CWRD/CWER

SCREENING QUESTIONS	Yes	No	REMARKS
A. Project Siting Is the Project area adjacent to or within any of the following environmentally sensitive areas?			
▪ Cultural heritage site	☐	☒	
▪ Protected Area	☐	☒	
▪ Wetland	☐	☒	
▪ Mangrove	☐	☒	
▪ Estuarine	☐	☒	
▪ Buffer zone of protected area	☐	☒	
▪ Special area for protecting biodiversity	☐	☒	
B. Potential Environmental Impacts Will the Project cause…			

▪ encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?	☐	☒	Encroachment on historical/ cultural areas will be verified on site by Kabul Institute of Archaeology. No significant disfiguration of landscape by road embankments cuts or fills is expected. Only existing and licensed borrow areas will be used. NEPA will approve the use of quarries.
▪ encroachment on precious ecology (e.g. sensitive or protected areas)?	☐	☒	The area used for the new alignment is almost without vegetation. There is no encroachment on precious ecology.
▪ alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?	☐	☒	There are no permanent water courses to be crossed. Culverts will be designed to ensure drainage basins during rainfall events and snow melt. No siltation due to increased soil erosion at the construction site is expected.
▪ deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?	☐	☒	Potential impacts are confined to construction stage. Snow melt and rain waters may drift suspensions (mixture of dust, sand, fine gravel) and sanitarian waste from camp site to natural and artificial declines and water courses. This can however be avoided by appropriate mitigation measures, intelligent camp site selection and up to date organization and management of constructor's camp. Implementation of mitigation measures and proper environmental management of the camp will be part of the contract.
▪ increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing?	☒	☐	Temporarily confined to construction stage. After finishing of constructions no additional impacts of this type remain. Suitable mitigation measures during construction stage, such as keeping asphalt plant away from settlement areas at a sufficient distance will help to reduce the described impacts.

▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation during project construction and operation?	☒	☐	Construction activities may result in impacts on community safety if not properly managed. The EMP will include, and will not be limited, to the following mitigation measures: (i) Only authorized trained personnel shall be permitted inside the work area. (ii) All workers shall be given PPEs. All occupational health and safety precautions should be in place as per Occupational Health & Safety Plan. To avoid any safety risks for the workers that are usually involved with road construction projects, a health and safety seminar will be held prior to construction start and the workers will be regularly updated on any health and safety issues relevant to their work.
▪ noise and vibration due to blasting and other civil works?	☒	☐	Noise and vibration impacts will be generated during construction as well as operation phases. These will be evaluated as part of EA study.
▪ dislocation or involuntary resettlement of people?	☒	☐	Resettlement Specialist will issue LARP covering assessment of loss and compensation procedure.
▪ dislocation and compulsory resettlement of people living in right-of-way?	☒	☐	People are not living within the RoW, but operating their business and their enterprises within the RoW. Resettlement Specialist will issue LARP covering assessment of loss and compensation procedure.
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?	☒	☐	Poor and vulnerable households might be affected. Resettlement Specialist will issue LARP covering assessment of loss and compensation procedure.
▪ other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?	☐	☒	Living conditions will not change.
▪ hazardous driving conditions where construction interferes with pre-existing roads?	☐	☒	

▪ poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases (such as STI's and HIV/AIDS) from workers to local populations?	☒	☐	Implementation of the Environmental Management Plan (EMP) during the construction phase will ensure all such impacts remains minimal. A waste management plan will also be prepared for proper handling and disposal of waste.
▪ creation of temporary breeding habitats for diseases such as those transmitted by mosquitoes and rodents?	☐	☒	This is not expected. Moreover, it will be avoided by suitable mitigation measures.
▪ accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials?	☒	☐	A traffic management plan will be prepared during construction phase to avert these and other impacts.
▪ increased noise and air pollution resulting from traffic volume?	☒	☐	There will be an increase in the noise levels during construction and operation phases. However, these will not breach the guideline values / standards as the background noise levels in the area are quite low. Similarly, exceedance of the ambient air quality standards is also not foreseen during the construction and operation phases. However, these aspects will be further evaluated in detail as part of the EA study.
▪ increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?	☒	☐	These will be avoided during construction phase through provision of a spill management plan. The likelihood of this impact is quite low during operation phase due to low volumes of traffic on the new road.
▪ social conflicts if workers from other regions or countries are hired?	☒	☐	The proposed project will engage both national and international staff; hence, there is possibility of social conflict. During construction phase mainly, local labor force will be involved, However, proper planning and management can avoid such conflicts. Furthermore, staff will be sensitized with local cultural norms to avoid any conflicts.

▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?	☒	☐	Engaging labor force outside the local communities would increase burden on social infrastructure and services specifically water resources. It could be avoided through involving local labor forces for the project implementation. Proper mitigation measures (like getting water from other sources, provision of septic tanks in construction camps etc.) will be provided in the Environmental Assessment study to ensure burden on existing infrastructure remains minimal.
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?	☐	☒	The management of risks associated with the transport, storage, use, and disposal of materials will be in accordance with the EMP. This should include mitigation measures specific to waste management and disposal, and material storage and handling.
▪ community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning.	☒	☐	Risk to community health and safety will be minimized through preparation of implementation of an Emergency Response Plan and other such provision to be provided in the EMP's for various project phases (construction, operation).

Climate Change and Disaster Risk Questions The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.	**Yes**	**No**	**REMARKS**
▪ Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes (see Appendix I)	☒	☐	The whole region is an earthquake-prone zone and exposed to climate change. Sand storms occur.
▪ Could changes in temperature, precipitation, or extreme events patterns over the Project lifespan affect technical or financial sustainability (eg., increased erosion or landslides could increase maintenance costs, permafrost melting or increased soil moisture content could affect sub0-grade)?	☒	☐	See notes to the previous item.
▪ Are there any demographic or socio-economic aspects of the Project area that are already vulnerable (eg., high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?	☒	☐	Mainly poor and vulnerable groups are living here, in the Project command area. Migrants come back to the project area from abroad. Illegal settlements are very common.
▪ Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., by encouraging settlement in areas that will be more affected by floods in the future, or encouraging settlement in earthquake zones)?	☐	☒	

Note: Hazards are potentially damaging physical event

APPENDIX 3. ORNITHOLOGICAL SURVEY REPORT

BASELINE ENVIRONMENTAL SURVEYS-ORNITHOLOGICAL SURVEY IN DAHLA DAM

February 2019

TA-9273 AFG: Preparing the Arghandab Integrated Water Resources Development Investment Project

CONTENTS

EXECUTIVE SUMMARY

Based on the request of the Ministry of Energy and Water, a team of specialists from the National Environmental Protection Agency (NEPA) carried out a baseline survey of waterfowl at Dahla Dam's reservoir from November 5 to November 12, 2018. The objective was to identify waterfowl populations and their habitats that might be affected by a construction contract for the dam raise and during the operation of the dam.

On November 5, 2018, a team of experts from NEPA in Kabul met the Directorate of National Environmental Protection (DNEP), Directorate of Agriculture, Irrigation and Livestock (DAIL) and Directorate of Water and Energy (DWE) to share the survey work plan, and to review existing reports and information referring to waterfowl species.

The survey team drove to Dahla Dam and conducted the survey in the shorelines, situated to the Northwest, West, South, and Southwest of the dam. The eastern shoreline of the dam was not included due to security issues: the dam security police did not permit walking there, but the survey team visited the eastern shoreline by using a motor boat. The survey was conducted by two methods: (i) collecting data through direct observations; (ii) interviewing local hunters (three hunters from surrounding villages) by using a specialized questionnaire (see Appendix 3). The questions concerned the presence of water birds, main threats, and hunting practices at Dahla Dam.

The survey team identified 14 waterfowl species,17 individual birds from other species, and two mammals – Jungle cat (*Felis chaus*) and Golden Jackal (*Canis aureus*) (both in the Red List of Afghanistan).

The questionnaire investigations and direct observations showed that the inhabitants of the area extensively hunt waterfowl during fall and winter seasons. Spring and summer are breeding seasons, during which time hunting is uncommon.

Overall, the observations confirmed that Dahla Dam is an important area for waterfowl and other wildlife species in the south west of Afghanistan. Water birds use this area as an aquatic habitat for shelter, foraging, roosting and breeding.

I. BACKGROUND AND INFORMATION ON DAHLA DAM

A. Background

1. Dahla Dam (31°52'59.86"N, 65°55'5.01"E) is the largest dam in Kandahar Province, and the second largest in Afghanistan, which is located 34 km (21 mi) north of Kandahar City in Kandahar Province. It was built on the Arghandab River which flows over a length of 250 miles (400 km).

2. Dahla Dam was first built with full funding and technical support provided by the United States Government, between 1950 and 1952 during the reign of Zahir Shah, the last King of Afghanistan. The dam is an embankment structure made of earth and rock fill. It is 55 metres (180 ft) in height. The length of the dam at the crest is about 535 metres (1,755 ft). In the periphery of the dam, six saddle dams have been built, which together measure 2,040 metres (6,690 ft) and with varying heights of 15-25 metres (49-82 ft). To pass the design flood discharge, two spillway structures have been built. To release water for irrigation to the canal system, low-level sluices have been built at the downstream toe of the dam with two control valves of the Howell-Bunger type, which function as energy dissipation bypass valves. The reservoir created by the dam has a storage capacity of 314 MCM. The irrigation system was designed to provide irrigation to 30,000 hectares (74,000 acres) of land in Kandahar Province consisting of 77.6 km (48.2 mi) of the main canal and 415 km (258 mi) of branch canals; with the main canal designed to carry a discharge of 42.5 m^3 (1,500 ft^3) per second.

3. The Government of the Islamic Republic of Afghanistan (the government) requested the Asian Development Bank (ADB) for transaction technical assistance (TRTA) to support the preparation of the Arghandab Integrated Water Resource Management Investment Project (the project). The aim is to improve water resources management, irrigated agriculture, domestic and industrial water supply, and to augment electric power in Kandahar City and surrounding areas.

4. The Ministry of Energy and Power officially requested NEPA to help the TRTA team to conduct the waterfowl and fish surveys in Dahla Dam, which is located in Shah Wali Kot district of Kandahar province. Thus, based on an official letter from the Ministry of Energy and Water, NEPA introduced a professional team from the Natural Heritage Protection Division (NHP/NEPA) to conduct two surveys (the fish survey is presented in a separate report). The survey area shown in Figure 4 included hotspots for waterfowl.

B. Human Settlement

5. According to the Energy and Power Directorate, in Kandahar province; there are 18 villages distributed in the north, north-east, west and south of Dahla Dam, with the populations largely consisting of farmers.

C. Hunting

6. Dahla Dam is located 34 km (21 mi) north of the Kandahar city in the Kandahar province. Most people go to Dahla Dam as a picnic spot, causing disturbance to waterfowl, including hunting. According to interviews with local hunters, waterfowl hunting (using motor boats) by security police residing at Dahla Dam is the biggest threat.

D. Waterfowl

7. The TRTA environmental specialists carried out the survey at Dahla Dam on 10 July 2018 and identified some birds (e.g., Great Cormorants (*Phalacrocorax carbo),* Grey Heron (*Ardea cinerea)* and Large Egret (*Ardea alba*). In November 2018, the NEPA team identified 14 waterfowl species at Dahla Dam. This survey appears to be the first waterfowl documentation from the south-west of Afghanistan with Kandahar province being of special relevance in the study.

E. Other Birds

8. Besides the waterfowl, the survey team identified 17 other bird species (see Appendix 2), not studied before. Some of these birds belong to the Red List Category in Afghanistan. In ecology, interaction of fauna and their environment are functions of an ecosystem, with living organisms growing in association with each other and forming the food chain. Other birds are part of the ecosystem and should be preserved during the construction at Dahla Dam.

II. OJECTIVES OF THE SURVEY

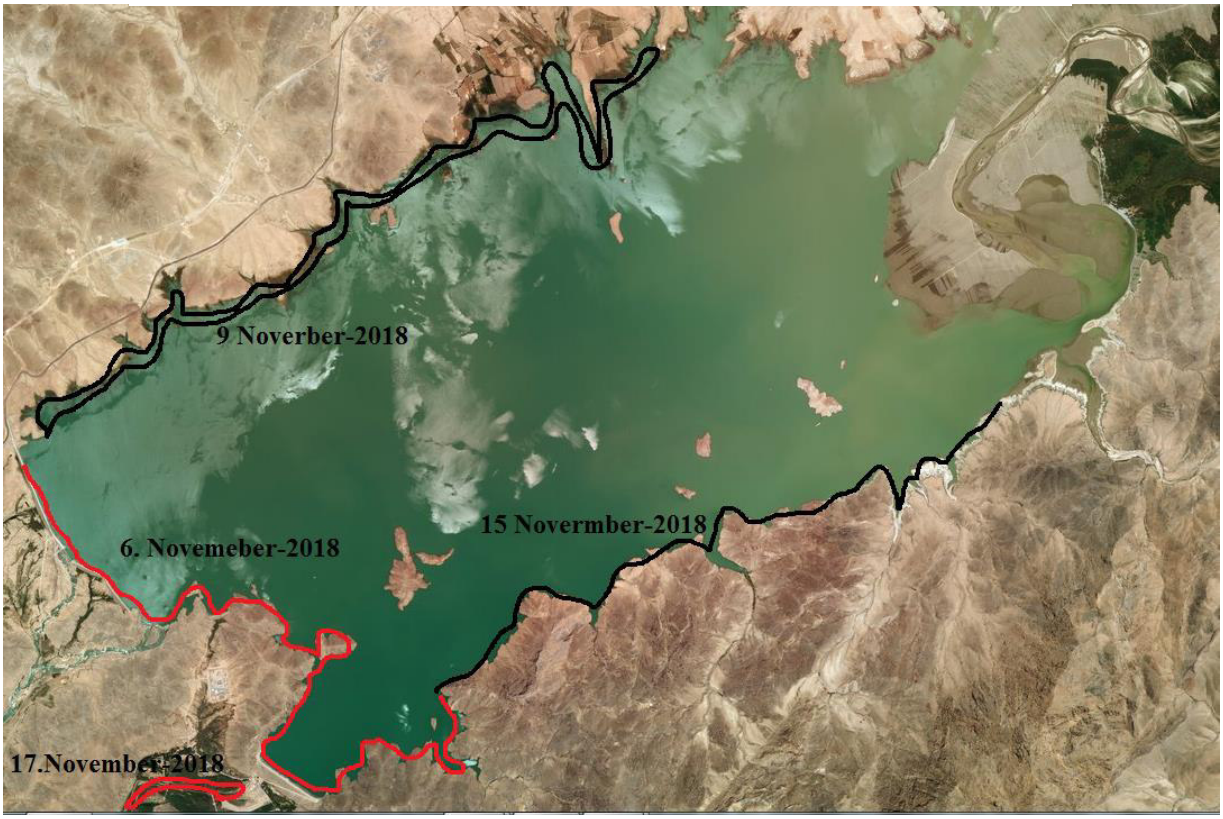
9. Dahla Dam is the largest dam in Kandahar province, the second largest in Afghanistan, and a very important area for migratory and native water bird species. Bird species that migrate seasonally from south to north and from north to south, choose the area as a short-term or long-term roosting, foraging or breeding habitat. The main objective of this baseline waterfowl survey was to identify the existing populations of waterfowl and their habitats that might be affected during construction and operation of the Dahla Dam reservoir.

III. METHODS

A. Date of Survey

10. The waterfowl survey was scheduled to be conducted within 8 days, including interviews with local hunters and meetings with the Kandahar Agricultural Department. According to the survey work plan, the waterfowl survey was to be carried out with a one-week gap. Thus, the survey was conducted on 6, 8, 12, 15 and 17 November 2018 (Figure 1). The survey was completed in accordance with the schedule. Data analysis and reporting took 11 days, inclusive of the submission to NEPA and TRTA.

Figure 1. Dates of the Waterfowl Survey at Dahla Dam



Source: NEPA surveyors, 2018

B. Survey Area and Transport

11. For the waterfowl survey, the survey team focused on the west, the south, and the north-west of the dam as better security was provided in these areas as compared to the east, north, and north-east (Figure 1). The survey team travelled by airplane from Kabul to Kandahar province and then rented a taxi and drove to Dahla Dam. The shorelines of the dam were visited on foot, or by motor boats for the interviews with local hunters.

C. Desk Study

12. On 5 November 2018, the survey team from NEPA met the TRTA delegates in Kandahar province to share the survey workplan and discuss other important issues. Then, NEPA and TRTA met the Kandahar Directorates of Environment Protection (DEP), Agriculture, Irrigation and Livestock (DAIL), Energy and Water (DEW) to share the survey work plan and request waterfowl data. The survey team expected the requested data would relate to waterfowl of Kandahar province, especially at Dahla Dam but no such data were available. During the survey, the survey team shared updates on activities, and progress of the survey was shared with Kandahar DEP and DAIL.

D. Data Collection and Analysis

13. With few exceptions, the survey team intend to provide primary data derived from field observations and from questionnaire surveys carried out with selected subsets of local hunters. The report is a snapshot of the occurrence of waterfowl and other wildlife in the area at the time of the survey.

E. Interviews

14. The survey team collected data on hunting practices and occurrence in the area of selected waterfowl by interviewing three hunters from different villages. The team conducted the interviews in the Pashto language. Each interview lasted around 15 minutes and consisted of 11 predetermined questions about the respondent. This included biographic information (name, locality, GPS location), and hunting practices (do you hunt?, where, what kind of birds, why, in which season, what kind of them do you like to hunt and why, which kind have increased or decreased during past ten years and why?, what are the main threats to water birds?). See Appendix-3 for full questionnaire.

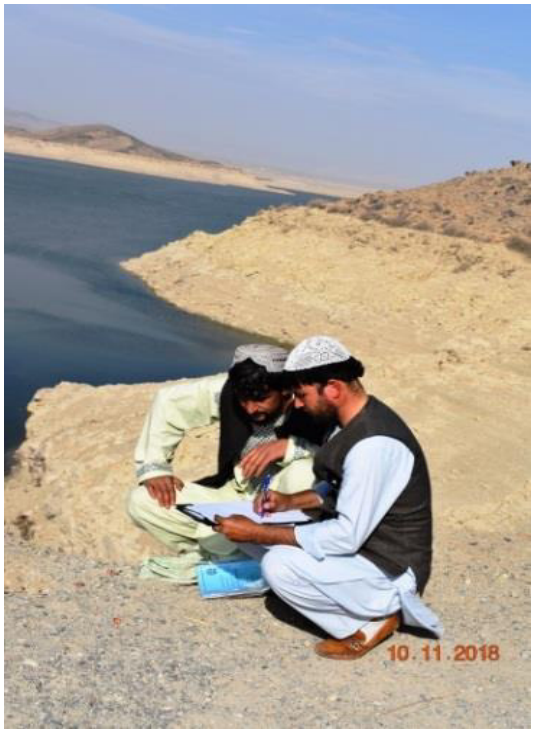
15. The present report only takes into account the questions dealing with hunting practices and the occurrence of waterfowl in the area.

F. Direct Observation

16. Every day, the survey team visited Dahla Dam shorelines and downstream for snapshots by walking and using a motor boat for 5 hours (from 9:00 am to 2:00pm). With the survey equipment (a simple binocular, GPS, and Camera the survey team identified 14 individual waterfowl species at Dahla Dam (see Annex 1).

17. Beside waterfowl, many other amphibians, mammals (Jungle cat (*Felis chaus*), Golden Jackal (*Canis aureus*), reptiles and birds were identified. This included some that are in the Red List of Afghanistan (see Appendix 2). Bird surveys should be conducted in all four seasons to help identify availability and distribution of species. Nevertheless, the survey team could identify the above-mentioned waterfowl during 8 workdays with a one-week break. Overall, our observations confirmed that Dahla Dam is a very important area for waterfowl for Afghanistan which should be preserved.

Figure 2. Interview with a Local hunter



Source: NEPA Surveyors, 2018

IV. RESULTS AND INTERPRETATION

A. Hunting

18. All interviewed people admitted hunting, but they appreciate having wildlife (especially waterfowl) at Dahla Dam, because different kinds of birds give more beauty to the area. Culturally, people in Kandahar like to picnic, therefore, Dahla Dam is a special picnic site in Kandahar province and must be protected from any damage.

19. Indeed, all proclaimed hunters mentioned that previously many people were coming to Dahla Dam for hunting, but the hunting pressure in the area has decreased for the past ten years. The main reason for this deficiency is the hunting prohibition by the Kandahar authority. Hunting is prohibited for everyone at Dahla Dam. Our observations and the interviewers' statements showed that currently, the security police engage in hunting at Dahla Dam and they use motor

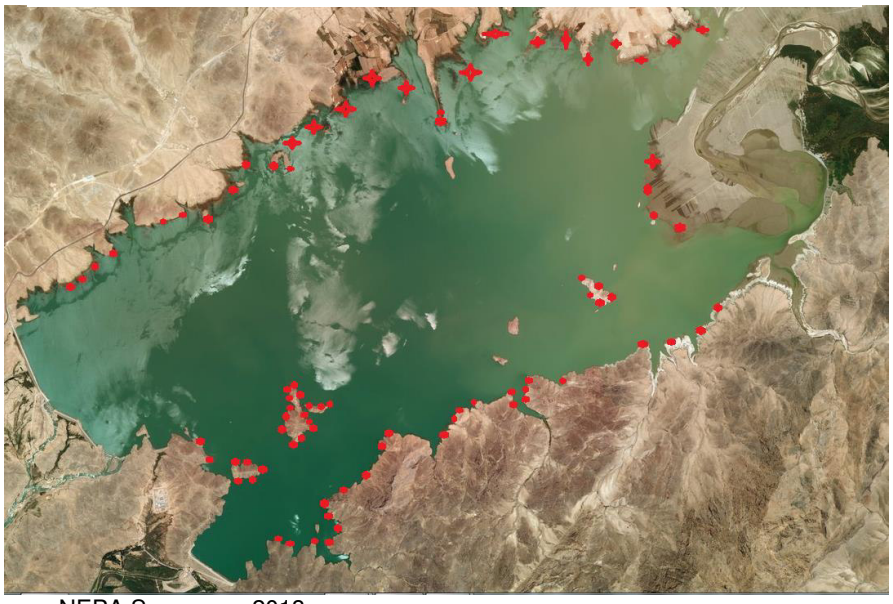
boats for shooting water birds, especially Mallards *(Anas platyhynchos)* and Black Coots *(fulica atra*), because of the specific taste of their meat (see Figure 3).

20. According to hunters' statements, people start hunting waterfowl in the fall and winter seasons when most migratory species come to the area. Spring and summer are breeding seasons for waterfowl, and times when hunters do not prefer hunting. Waterfowl species are hunted for daily consumption and not for market (i.e. selling birds in a bazaar).

Figure 3. Hunted Mallard and Black Coot at Dahla Dam

Source: NEPA Surveyors, 2018

Figure 4. Waterfowl Habitats at Dahla Dam



Source: NEPA Surveyors, 2018

B. Waterfowl

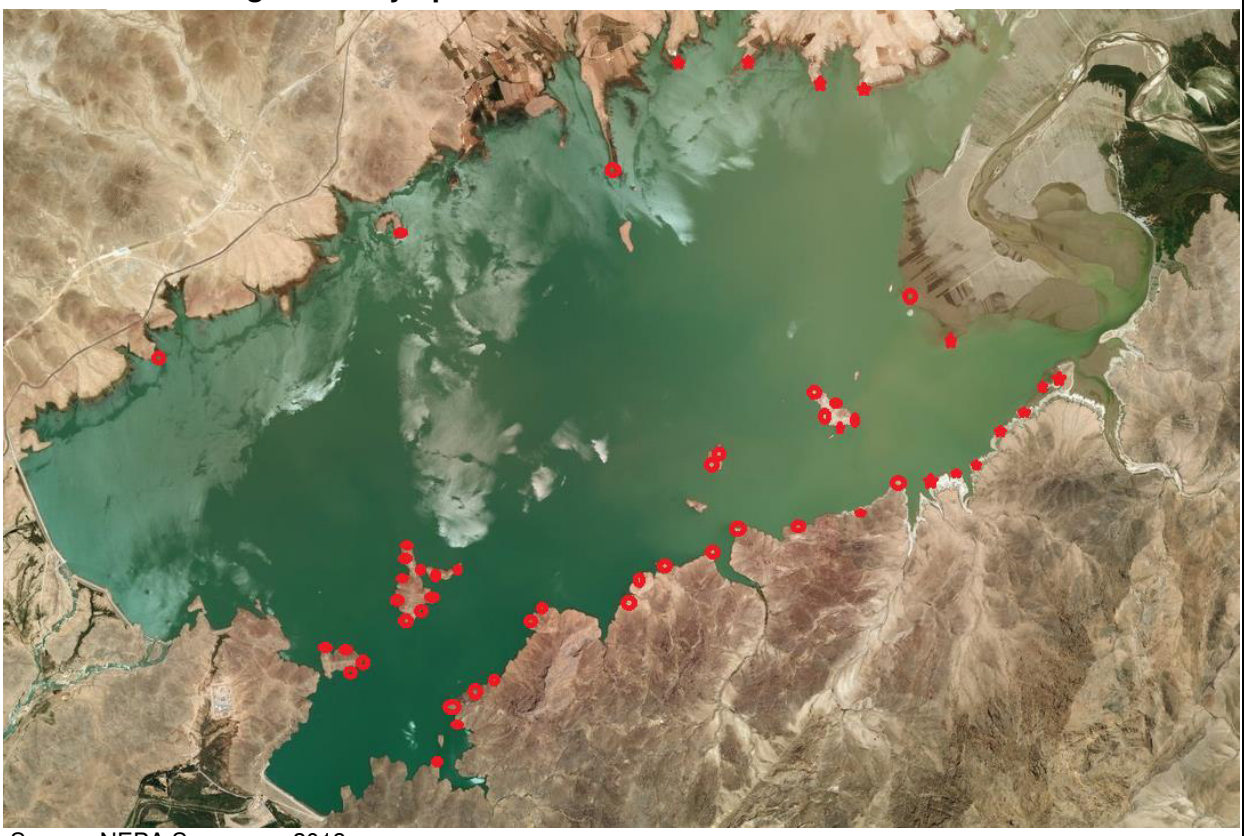
21. The relationship between water and waterfowl is shaped by many factors. These include the availability, depth, and quality of water; the availability of food and shelter; and the presence or absence of predators. Waterfowl that use water for breeding, food, and rest depend on the physical and biological attributes of the water. According to local hunters and the remarks of local people, Dahla Dam is said to receive thousands of migratory water birds of various species each year (see Figure 4).

22. Our observations and interviews showed that Dahla is one of the aquatic habitats in the south of Afghanistan for migratory waterfowl, which use this area for resting, feeding and breeding during different seasons of the year.

23. Without east and north east shorelines of the dam, the survey team could observe the remaining shorelines of the dam by walking or by using a motor boat. The security police of the dam did not permit the survey team to observe the east and north east shorelines by walking. During the waterfowl survey some key species were identified in their habitats (see Figure 4).

24. The keystone species has a functional role. It means that if the species disappears from the ecosystem, no other species can fill its ecological niche and the ecosystem would be forced to radically change, allowing new and possibly invasive species to populate the habitat. The key species at Dahla Dam are Pelicans, Herons, Large Egret, Great Cormorants and Mallards which all have an important role in the ecosystem. For example, Pelicans play an important ecological role in food chains, consuming primarily fish and invertebrates, but also some small vertebrates. Their eggs (young or adult) are consumed by birds of prey, reptiles, rats, cats, and canines, the herons control fish and insect populations in many different habitats. They are also an important source of food for the animals that prey on them. The Large Egret plays a very important role in controlling the population of amphibians, insects, and small mammals. They have no real predators as adults. However, their eggs can provide a food source for animals such as raccoons. Mallards are generalist feeders. They are known to eat insect larvae, aquatic invertebrates, earthworms, acorns, the seeds of wild millet, marsh smartweed, bulrushes, sedges, and pondweeds, corn, wheat, soybeans, barley, and oats. Great Cormorants are generally gregarious, appear collectively, gather in flocks, nest in colonies and can feed on a relatively large area on various aquatic ecosystems simultaneously, they may constitute a very important biological factor triggering environmental changes. Therefore, the impact of cormorants on various elements of both the terrestrial and aquatic environment has been largely addressed in different studies. The birds breed on land but forage on water, so they represent a very important intermediate link in some food webs.

Figure 5. Key Species Habitats at Dahla Dam



Source: NEPA Surveyors, 2018

25. These habitats are very strategic points for key species, because they are predators and they get food easily from these points and protect themselves from other predators, day and night.

26. This report is the first report about waterfowl from the south-west of Afghanistan, specifically from Kandahar province. This report will be used as new data about waterfowl for preparing the National reports to the Conventions of Biological Diversity (CBD) that Afghanistan has already signed.

27. During the survey the surveyors carried out direct observation of waterfowl at the dam site and downstream as well. Some waterfowl habitats were located downstream and needed to be surveyed. In total, 14 individual waterfowl were identified directly and indirectly and by hunters' investigations (see Appendix 1). Each species is described below with more information on their habitats, feeding, and national and international conservation status.

C. Great Cormorant

Common name: Helamdy Helly

Scientific Name: *Phalacrocorax carbo*

Description

28. The Great Cormorant is a large black bird (Figure 6), with a wide variation in size of the species. Weight is reported to vary from 1.5 kg (3.3 lb.) to 5.3 kg (12 lb.). This is a very common and widespread bird species.

29. The Great Cormorant feeds in sea waters, in estuaries, and in other types of wetland environment, such as freshwater lakes and rivers.

30. Northern birds migrate to the south and winter along any coast that is well-supplied with fish. The Great Cormorant often nests in colonies near wetlands, rivers, and sheltered inshore waters. Pairs use the same nest-site to breed year after year. The bird builds its nest (made of sticks) in trees, on the ledges of cliffs, and on the ground – on rocky islands that are free of predators. Great Cormorants are mostly silent, but they make various guttural noises at their breeding colonies.

31. Their usual habitat represents open water bodies in lowlands. The main threats to Great Cormorant are fighting, hunting, other types of disturbances by visitors, and drought. Furthermore, the current status of birds is unknown, with consequential missing evaluation data.

Figure 6. Great Cormorant *(Phalacrocorax carbo)*

Source: NEPA Surveyors, 2018

D. Mallard

Common Name: Zarghon Sare Helly

Scientific Name: *Anas Platyrhynchos*

Description

32. The Mallard is undoubtedly the most recognized waterfowl in the world. The familiar duck morphology is complemented with an iridescent blue speculum on the wings in both sexes. On the male, the notable characteristics are the green iridescent plumage on the head and neck and curled black feathers on the tail. The female's plumage is drab brown (Figure 7).

33. Mallards can be found almost anywhere in the world. They dominate the Northern Hemisphere, and can be found easily in Oceana, Asia, Africa, South America and many islands.

Figure 7. Mallards (Anas platyrhynchos)

Source: NEPA Surveyors, 2018

Habitat

34. Mallards prefer wetlands, where highly productive waters produce large amounts of floating, emergent, and submerged vegetation. Wetlands also produce a significant number of aquatic invertebrates on which Mallards feed.

35. Mallards consume a wide variety of foods, including vegetation, insects, worms, gastropods and arthropods, although they are not restricted to these.

36. They also take advantage of human food sources, such as gleaning grain from crops. The main threats to Mallards in Dahla Dam are war, hunting, disturbance caused by visitors- in particular on the western shorelines of the dam. The conservation status is unknown in Afghanistan; therefore, it has not been evaluated up to now.

E. Great White Pelican

Common Name: Kotan

Scientific Name: *Pelecanus Onocrotalus*

Figure 8: Great White Pelican *(Pelecanus Onocrotalus)*

Source: NEPA Surveyors, 2018

Description

37. The Great White Pelican is a huge bird – only the Dalmatian pelican is on average larger among pelicans. It measures 140 to 180 cm (55 to 71 in) in length with a 28.9 to 47.1 cm (11.4 to 18.5 in) enormous pink and yellow bill, and a dull pale-yellow gular pouch.

38. The wingspan measures 226 to 360 cm (7.41 to 11.81 ft), the latter measurement being the largest among extant flying animals other than the Great Albatross.

39. The adult male measures about 175 cm (69 in) in length; it weighs from 9 to 15 kg (20 to 33 lb). Larger species from the Palearctic are usually around 11 kg (24 lb), with few exceeding 13 kg (29 lb). It has a bill measuring 34.7 to 47.1 cm (13.7 to 18.5 in). The female measures about 148 cm (58 in) in length, and is considerably less bulky, weighing 5.4 to 9 kg (12 to 20 lb)/ It has a bill that measures 28.9 to 40.0 cm (11.4 to 15.7 in) in length.

40. The breeding range of the great white pelican extends to Ethiopia, Tanzania, Chad, northern Cameroon, and Nigeria, and has been observed or reported breeding in Zambia, Botswana, and South Africa. In the 1990s, 6700 to 11,000 breeding pairs were found in 23 to 25 breeding sites of the Palearctic region. The short strong legs and webbed feet propel it in water and aid a rather awkward takeoff from the water surface (Figure 8). The breeding season commences in April or May in temperate zones, and it is essentially year-long in Africa. In India, the breeding season runs from February to April. Large numbers of these pelicans breed together in colonies.

Habitat

41. Great white pelicans usually prefer shallow, (seasonally or tropical) warm fresh water. Well scattered groups of breeding pelicans occur through Eurasia from the Eastern Mediterranean to Vietnam. In Eurasia, fresh or brackish waters may be inhabited, and the pelicans may be found in lakes, deltas, lagoons and marshes, usually with dense reed beds nearby for nesting purposes. The main threats to the Great White Pelican are drought and fighting in the area. Recently drought and fighting directly affected the bird in Afghanistan, especially at Dahla Dam. As to the conservation status, research shows that the Great White Pelican is under threat in Afghanistan. Thus, it is listed as a protected species in the country.

F. Red-Necked Grebe

Common Name: Ghotayee Helly

Scientific Name: *Podiceps grisegena*

Figure 9: Red-necked Grebe *(Podiceps grisegena)*

Source: NEPA Surveyors, 2018

Description

42. The Red-necked Grebe is a medium-sized aquatic bird that is 13-17 inches in length with a wingspan of around 32 inches. It has a long neck, a straight, long black bill that is yellow at the base, and black legs and feet that are set far back on its body (Figure 9). It has a black cap, grayish-white cheeks, and a brown body. During the breeding season, it has a rusty red neck and breast. In the non-breeding season, it has a gray neck and breast. Young red-necked grebes have black and white zebra-striped heads and necks. Males and females look alike, but males are a little larger.

Range

43. The Red-necked Grebe's breeding ground runs from Alaska and Northern Canada south to Oregon, Idaho, Southern Minnesota, and Ontario. It winters along both coasts south to California and Georgia. It is also found in Europe and Asia, including Afghanistan.

Habitat

44. The Red-necked Grebe lives in marshy ponds and lakes in the summer. In winter and during migration, it is found on large lakes, coastal bays, and estuaries.

Behavior

45. The Red-necked Grebe is a great diver and swimmer. It often swims with just its head above the water. It rarely leaves the water for land: except for when it migrates, it rarely flies. The main threats to the Red-necked Grebe are drought and hunting and the conservation status is unknown in Afghanistan. Therefore, it has not been evaluated.

G. Slender Gull

Common Name: Cabkhowaronkai

Scientific Name: *Larus Genei*

Figure 10. Slender-billed Gull *(Larus Genei)*

Source: NEPA Surveyors, 2018

Description

46. The Slender-billed Gull (Larus genei) is most easily identified by its distinctive profile, with a long, sloping forehead and a long, slightly drooping beak, for which it is named. The head, neck, rump and tail are white, while the back and the upper surface of wings are grey, with a white leading edge to the wings and black tips to the outer primary feathers (Figure 10). The underparts are white, sometimes with a rosy tinge. The Slender-billed Gull has long, blackish-red legs, a dark red beak, and yellowish-white eyes, with a red eye ring.

Range

47. The Slender-billed Gull breeds at widely scattered, isolated locations, from Senegal and Mauritania and the south and east of the Iberian Peninsula, through the Mediterranean, Black Sea and Middle East, and into Asia, as far as Kazakhstan, Afghanistan, Pakistan and northwestern India. Only some populations migrate with birds from central Asia generally moving south to the Arabian Peninsula and into the Horn of Africa for the winter. Some Slender-billed Gulls also winter at the Caspian and Black Seas and around the Mediterranean. The species is sometimes recorded outside of its normal range, for example in other parts of Europe.

Habitat

48. This species breeds on the coast around the Mediterranean Sea, Black Sea, Caspian Sea and Arabian Gulf, as well as on inland seas, steppe lakes (inland lakes which do not drain into the ocean), and on beaches, islands and sand-spits in shallow, tidal water. The Slender-billed Gull also uses meadows, grasslands and freshwater or brackish marshes near river deltas during the breeding season. In winter, this gull is almost always found on the coast, generally using shallow, inshore waters and salt pans. The main threats to the Slender-billed Gull is a recent drought in Afghanistan – especially in the south-west. The conservation Status is unknown in Afghanistan; therefore, it has not been evaluated.

H. Grey Heron

Common Name: Zarghon Komol

Scientific Name: *Ardea Cinerea*

Figure 11. Grey Heron *(Ardea cinerea)*

Source: NEPA Surveyors, 2018

Description

49. The Grey Heron is a large bird, standing up to 100 cm (39 in) tall and measuring 84–102 cm (33–40 in) long with a 155–195 cm (61–77 in) wingspan (Figure 11). The body weight can range from 1.02–2.08 kg (2.2–4.6lbs). The plumage is largely ashy-grey above, and greyish-white below with some black on the flanks. Adults have the head and neck white with a broad black super cilium that terminates in the slender, dangling crest, and bluish-black streaks on the front of the neck.

50. The scapular feathers are elongated and the feathers at the base of the neck are also somewhat elongated. Immature birds lack the dark stripe on the head and are generally duller in appearance than adults, with a grey head and neck, and a small, dark grey crest. The pinkish-yellow beak is long, straight and powerful, and is brighter in color in breeding adults. The iris is yellow and the legs are brown and very long.

Distribution

51. The Grey Heron has an extensive range throughout most of the Palearctic ecozone. The range of the nominate subspecies The Grey Heron's range extends to 70° North in Norway and 66° North in Sweden, but otherwise its northerly limit is around 60° North across the rest of Europe and Asia eastwards as far as the Ural Mountains.

52. To the south, its range extends to northern Spain, France, central Italy, the Balkans, the Caucasus, Iraq, Iran, India and Myanmar (Burma). It is also present in Africa south of the Sahara Desert, the Canary Islands, Morocco, Algeria, Tunisia and many of the Mediterranean Islands.

53. Within its range, the Grey Heron can be found anywhere with suitable watery habitat that can supply its food. The water body needs to be either shallow enough or have a shelving margin in which it can wade (Figure 11). Although most common in the lowlands, it also occurs in mountain tarns, lakes, reservoirs, large and small rivers, marshes, ponds, ditches, flooded areas, coastal lagoons, estuaries and the sea shore. It sometimes forages away from water in pasture, and it has been recorded in desert areas, hunting for beetles and lizards. Breeding colonies are usually near feeding areas but exceptionally may be up to 8 km (5 mi) away. Birds sometimes forage as much as 20 km (12 mi) from the nesting site. The main threats to the Grey Heron at Dahla Dam are the hunting by police and a recent drought. The conservation status is unknown in Afghanistan; therefore, it has not been evaluated.

I. Great Egret

Common Name: Speen Komol

Scientific Name: *Egretta Alba*

Figure 12. Great Egret *(Egretta Alba)*

Source: NEPA Surveyors, 2018

Description

54. The Great Egret is a large heron with all-white plumage. Standing up to 1 m (3.3 ft) tall, this species can measure 80 to 104 cm (to 41 in) in length and have a wingspan of 131 to 170 cm (52 to 67 in). Body mass can range from 700 to 1,500 g (1.5 to 3.3 lb), with an average around 1,000 g (2.2 lb) (Figure 12). It is thus only slightly smaller than the Great Blue Heron or Grey Heron (A. cinerea). Apart from size, the Great Egret can be distinguished from other white Egrets by its yellow bill and black legs and feet, though the bill may become darker and the lower legs lighter in the breeding season. In breeding plumage, delicate ornamental feathers are borne on the back. Males and females are identical in appearance; juveniles look like nonbreeding adults.

Range

55. Great Egret is a species with a large and expanding range, occurring worldwide in temperate and tropical habitats. The bird feeds in shallow waters or drier habitats, feeding mainly on fish, frogs, small mammals, and occasionally small reptiles and insects.

Habitat and Threats

56. The Great Egret's habitat includes marshes, ponds, shores, mudflats. It usually forages in open settings – along edges of lakes, large marshes, shallow coastal lagoons and estuaries; also, along rivers in wooded countrysides. It usually nests in trees or shrubs near water, sometimes in thickets with some distance from water, and sometimes low in marshes. The main threats to the Great Egret at Dahla Dam are drought and hunting. The conservation status is unknown in Afghanistan; therefore, it has not been evaluated.

J. Common Black-headed Gull

Common Name: Cabkhowaronkai

Scientific Name: Larus *ridibundus*

Figure 13: Black-headed Gull
(Larus ridibundus)

Source: NEPA Surveyors, 2018

Description

57. This gull is 38-44 cm (15-17 in) long with a 94-105 cm (37-41 in) wingspan. In flight, the white leading edge to the wing is a good field mark. The summer adult has a chocolate-brown head (not black, although it does look black from a distance), pale grey body, black tips to the primary wing feathers, and red bill and legs. The hood is lost in winter, leaving just 2 dark spots (Figure 13). Immature birds have a mottled pattern of brown spots over most of the body. It breeds in colonies in large reed beds or marshes, or on islands in lakes, nesting on the ground. Like most gulls, it is highly gregarious in winter, both when feeding or in evening roosts. It is not a pelagic species and is rarely seen at sea far from coasts.

58. The Black-headed Gull is a bold and opportunistic feeder. It eats insects, fish, seeds, worms, scraps, and carrion in towns or invertebrates in ploughed fields with equal relish. It is a noisy species, especially in colonies, with a familiar *kree-ar* call. Its scientific name means 'a laughing gull'.

59. This species takes two years to reach maturity. First-year birds have a black terminal tail band, more dark areas in the wings, and, in summer, a less fully-developed dark hood. Like most gulls, Black-headed Gulls are long-living birds, with a maximum age of at least 32.9 years recorded in the wild, in addition to an anecdote now believed of dubious authenticity regarding a 63-year-old bird.

60. The common Black-headed Gull is found over much of Europe, except Spain, Italy and Greece. It is also found in Japan and China. It is an occasional visitor to the East Coast of North America.

Habitat and Threats

61. In winter, the Black-headed Gull is found in a wide range of habitats including coastal marshes, farmland, landfills, urban parks, gardens and playing fields. Its usual breeding habitats include marshes, ponds, lakes, bogs, gravel pits and dry sites next to water bodies, such as sand-dunes and moorland. The main threats to the common Black-headed Gull in Afghanistan are fighting, and drought. The conservation status is unknown in Afghanistan currently; therefore, it has not been evaluated up to now.

K. Caspian Gull

Common Name: Cabkhowaronkai

Scientific Name: *Larus cachinnans*

Figure 14: Caspian Gull

Source: NEPA Surveyors, 2018

Description

62. It is a large gull at 56-68 cm (22-27 in) long, with a 137 to 155 cm (54 to 61 in) wingspan and a body mass of 680-1,590 g (1.50-3.51 lbs.). Among standard measurements, the wing chord is from 38.5 cm to 48 cm (15.2 to 18.9 in), the bill is from 4.6 to 6.4 cm (1.8 to 2.5 in) and the tarsus is from 5.8 to 7.7 cm (2.3 to 3.0 in). The Caspian Gull has a long, slender bill, accentuated by the sloping forehead (Figure 14). The legs, wings and neck are longer than those of Herring Gull and Yellow-legged Gull. The eye is small and often dark; the legs vary from pale pink to a pale-yellowish color. The back and wings are a slightly darker shade of grey than the Herring Gull but slightly paler than the Yellow-legged Gull. The outermost primary feather has a large white tip and a white tongue running up the inner web. First-winter birds have a pale head with dark streaking on the back of the neck. The underparts are pale, and the back is greyish. The greater and median wing-coverts have whitish tips forming two pale lines across the wing.

Distribution

63. The Caspian Gull breeds around the Black and Caspian Seas, extending eastwards across Central Asia to north-west China. In Europe, it has been spreading north and west and now breeds in Poland and eastern Germany. Some birds migrate south as far as the Red Sea and Persian Gulf, while others disperse into Western Europe, in countries such as Sweden, Norway and Denmark or the Benelux and even Northern France. Small numbers are now seen regularly in Britain, especially in south-east England, East Anglia and the Midlands.

Breeding

64. It typically nests on flat, low-lying ground by water unlike the Yellow-legged Gull which mainly nests on cliffs in areas where the two overlap. The breeding season starts from early April. Two or three eggs are laid and incubated from 27 to 31 days.

Feeding

65. Caspian Gulls are scavengers and predators with a very varied diet. During the breeding season, they often eat rodents such as ground squirrels, flying some distance into the steppes to find them.

Habitat

66. During the breeding season, the species nest near lakes surrounded by reed beds, steppe and semi-desert (Central Asia), reservoirs, rivers, and on grassy or shrubby river islands. They also form colonies on sea cliffs, rocky and sandy offshore islands, rocky coasts, sandy beaches, sand dunes, and saltpans. The main threats to the Caspian Gull are fighting, and drought. The conservation status is unknown in Afghanistan currently; therefore, it has not been evaluated.

L. Black Coot

Common Name: Obeez Charg

Scientific Name: *Fulica atra*

Figure 15: Black Coot *(Fulica atra)*

Source: NEPA Surveyors, 2018

Description

67. The Black Coot is 32-42 cm (13-17 in) long and weighs 585-1,100 g (1.290-2.425 lbs) and is largely black except for small amounts of white. As a swimming species, the Black Coot has partial webbing on its long strong toes (Figure 15).

68. The juvenile is paler than the adult, has a whitish breast, and lacks the facial shield; the adult black plumage develops when about 3-4 months old, but the white shield is only fully developed at about one year old. This is a noisy bird with a wide repertoire of crackling, explosive, or trumpeting calls, often heard at night.

Behavior

69. The Black Coot is much less secretive than most of the rail family and can be seen swimming on open water or walking across waterside grasslands. It is an aggressive species, and strongly territorial during the breeding season, and both parents are involved in territorial defense. During the non-breeding season, they may form large flocks, possibly related to predator avoidance.

Breeding

70. This species builds a nest of dead reeds or grasses, but also pieces of paper or plastic near the water's edge or on underwater obstacles protruding from the water, laying up to 10 eggs, sometimes 2 or 3 times per season. Usually only a few young survive. They are frequent prey for birds such as herons and gulls.

Distribution

71. The species breeds in temperate Asia, moving to East Asia, South Asia and the northern part of South-East Asia in the non-breeding period.

Habitat and Threats

72. Open island waters such us lakes, reservoirs, ponds. The main threats to Black Coot at Dahla Dam are drought, fighting and hunting. The conservation status is unknown in Afghanistan currently; therefore, it has not been evaluated.

M. Common Moorhen

Common Name: Obeez Charg

Scientific Name: *Gallinula Chloropus*

Figure 16. Common Moorhen *(Gallinula Chloropus)*

Source: NEPA Surveyors, 2018

Description

73. The Common Moorhen is a medium-sized member of the rail family found in aquatic environments. It is 12-15 inches in length and has a wingspan of a little less than two feet. It has gray-black feathers and a red bill with a yellow tip. It has white stripes on its sides. It has long chicken-like toes that help it walk on the top of floating vegetation and the mud. Males and females are similar, but males are a little larger.

Range

74. In the western United States, the Common Moorhen breeds in California, New Mexico, Nevada and Arizona. In the eastern United States and Canada, it breeds from Minnesota to New Brunswick and south to the Gulf Coast and Florida. In the United States, Common Moorhen winters in California and Arizona, along the Gulf Coast and on the east coast from Virginia to Florida. It is also found in South America, Europe, and parts of Asia and Africa.

Behavior

75. When the Common Moorhen swims, it bobs its head back and forth. It is a better swimmer and walker than flier, although in some parts of its range it does migrate long distances.

Habitat and Threats

76. The Common Moorhen lives in freshwater and brackish marshes, lakes, canals and ponds with cattails and other aquatic vegetation (Figure 16). The main threats to the Common Moorhen are drought, fighting and hunting at Dahla Dam. The conservation status is unknown in Afghanistan currently; therefore, it has not been evaluated.

N. Black-crowned Night Heron

Common Name: Dandez Komol

Scientific Name: *Nyclicorax nycticorax*

Figure 17. Black-crowned Night Heron (Nyclicorax nycticorax)

Source: NEPA Surveyors, 2018

Description

77. Adults are approximately 64 cm (25 in) long and weigh 800 g (28 oz). They have a black crown and back with the remainder of the body white or grey, red eyes, and short yellow legs. They have pale grey wings and white under parts. Two or three long white plumes, erected in greeting and courtship displays, extend from the back of the head. The sexes are similar in appearance although the males are slightly larger. Black-crowned Night Herons do not fit the typical body form of the Heron family. They are relatively stocky with shorter bills, legs, and necks than their more familiar cousins, the egrets and 'day' herons. Their resting posture is normally somewhat hunched but when hunting, they extend their necks and look more like other wading (Figure 17).

Distribution

78. The breeding habitat is fresh and salt-water wetlands throughout much of the world. The subspecies N. n. hoactli breeds in North and South America from Canada as far south as northern Argentina and Chile, N. n. obscurus in southernmost South America, N. n. falklandicus in the Falkland Islands, and the nominate race N. n. nycticorax in Europe, Asia and Africa. Black-crowned Night Herons nest in colonies on platforms of sticks in a group of trees, or on the ground in protected locations such as islands or reed beds. Three to eight eggs are laid.

79. This heron is migratory in the northernmost part of its range, but otherwise resident (even in the cold Patagonia). The North American population winters in Mexico, the southern United States, Central America, and the West Indies, with the Old-World birds wintering in tropical Africa and southern Asia.

80. They are among the seven herons observed to engage in bait fishing; luring or distracting fish by tossing edible or inedible buoyant objects into water within their striking range – a rare example of tool use among birds. During the day they rest in trees or bushes. N. n. hoactli is more gregarious outside the breeding season than the nominate race.

81. The Black-crowned Night Heron habitat occurs in a broad range of fresh, brackish and salt-water habitats, from rivers, lakes and swamps to lagoons, mudflats, and salt marshes. Aquatic and marginal vegetation such as reed beds, bamboo, mangroves and other trees are important for nesting and roosting. The main threats are fighting, drought and hunting. The conservation status is unknown in Afghanistan currently; therefore, it has not been evaluated.

O. Water Rail

Scientific Name: *Rallus aquaticus*

Description

82. Water Rails are thrush-sized short-tailed rails. Their olive brown backs have black speckles, and their cheeks, throat and chest are dark grey. Their flanks are marked with black and white stripes, and they have bright white patches on their vents. Their long, slender, slightly down curved beaks are reddish on mature birds (with a black tip and ridge on the upper mandible) but brown on juvenile birds. Juvenile birds also differ in that their underparts lack the dark grey coloring of adults, and are instead paler, with dark stripes on their bellies. Water Rails have reddish brown legs with very long toes. Their irises may be red or reddish brown. Water Rails spend most of the time concealed in dense waterside vegetation, and are only seldom seen, but more often heard. They are able to move with great agility through wetland vegetation.

Figure 18. Water Rail *(Rallus aquaticus)*

Source: NEPA Surveyors, 2018

Distribution

83. The species is found in reed beds and bulrushes around lakes and sea bays. Breeding: 6-11 eggs lay in May, incubated by both parents for 19–21 days. Fledglings leave their nest immediately after hatching, learn to find food for themselves within about 5 days, and learn to fly within 42–49 days.

Migration

84. Water Rail is a nocturnal migrant. Autumn migration starts as early as August but may continue until late autumn. Spring migration begins at the end of March or early April. The breeding habitat of the water rail is permanent wetland with still or slow-moving fresh or brackish water and dense, tall vegetation, which may include common reed, reedmace, irises, bur-reeds or sedges (Figure 18). The main threats to water rail are drought at Dahla Dam. The conservation status is unknown in Afghanistan currently; therefore, it has not been evaluated.

P. Common Kingfisher

Common Name**:** Shentaghy

Scientific Name: *Alcedo attis*

85. Common Kingfishers measure 17-19 cm in length, weigh between 34-46 grams and have a wingspan of 25 cm. Their beak is around 4 cm long and pointed. Kingfishers have short, orange colored legs. Kingfishers are very brightly colored. The color of their wings is a blue/green colored and their upperparts, rump and tail are a bright blue colored. Their underparts are bright orange and they have a small, white bib underneath their beaks, on their throats. The Common Kingfisher's head is blue with orange marks in front and behind the bird's eyes and a white mark on each side of the head. These bright, beautiful colors are more apparent when the bird is in flight.

Habitat

86. In temperate regions, Common Kingfisher inhabits clear, slow-flowing streams and rivers and lakes with well-vegetated banks. Kingfishers are often found in scrubs and bushes with overhanging branches close to shallow open waters in which they hunt. In winter, the species is more coastal, often feeding in estuaries or harbors and along rocky seashore.

Behavior

87. Like all kingfishers, the Common Kingfisher is highly territorial. Since it must eat around 60% of its body weight each day, it is essential to have control over a suitable stretch of river. It is solitary for most of the year, roosting alone in heavy cover. If another kingfisher enters its territory, both birds 'display' from perches and fights may occur. One bird will grab the others beak and try to hold it under water. Pairs form in the autumn but each bird retains a separate territory, generally at least 1 km long.

Conservation

88. Kingfishers are very sensitive to cold weather, and a particularly harsh winter can seriously reduce the populations. Kingfisher populations fluctuate greatly because of this. However, they are not in the IUCN Red List. The main threats Common Kingfisher are drought and fighting. The conservation status is unknown in Afghanistan currently; therefore, it has not been evaluated.

Q. Other Birds

89. Other birds need water for drinking and bathing and they use aquatic biodiversity for food. Their existence is loosely intertwined with other organisms in the ecosystem. In addition, they have close relationship according to ecosystem. Beside the Waterfowl 'survey at Dahla Dam, the survey team could identify 17 other bird species (Appendix 2). These species use fishes, waterfowl and other aquatic microorganism as food.

V. RECOMENDATIONS

90. The construction of Dahla Dam as a reservoir will affect biodiversity in the dam and downstream as well. This is explained by the fact that the construction activity may include movement of earth and rock, the presence of humans and machinery, transportation of construction materials, use of explosives, noise, reduction or the cutting of river flows and increasing turbidity.

91. The recommendations include the following:

(i) Avoid the coincidence of environmental impacts of dam with area rich in waterfowl (hotspots).
(ii) Prevent disturbance of wildlife especially to waterfowl species during dam construction.
(iii) Keep water flow cycle downstream during dam construction.
(iv) Avoid cumulative effects of the dam: limit their number and proximity.
(v) Take into account the impacts of other human activities during construction of the dam.
(vi) Avoid hunting events during the construction period.
(vii) Apply high environmental impact assessment standards.
(viii) Involve environmental staff early and at high level in planning and construction period to monitor dam closely.
(ix) Reduce the impact of dam on biodiversity;
(x) Keep certain amount of water at dam during shortage of water to prevent all aquatic diversity from destruction.
(xi) Do not wash vehicles at the dam and downstream during construction.
(xii) Prevent mixing oil with water during dam construction.
(xiii) Preventing throwing waste in water during dam construction.
(xiv) Avoid area of high biodiversity. Reducing impacts on biodiversity calls for knowing where species, ecosystems and ecological functions are located.
(xv) Avoid hotspots and hot portions of gradients. The avoidance of area rich in species and endemic species needs to be given high priority in section criteria. That includes both choosing watersheds and sides within watersheds, considering hotspots and gradients in the biodiversity.
(xvi) Avoid hotspots on land. While this study focuses on waterfowl species, the impacts of dam, as well as, roads and transmission lines on terrestrial biodiversity should not be neglected.
(xvii) Avoid hotspots of species at risk. List and databases produced by the IUCN can be used to identify area where there are clusters of species at risk. Endangered species list prepared by individual countries, including Afghanistan may be helpful at a national level. Species at risk, especially clusters of them are to be avoided because additional stresses are likely to push them over into extinction. During this short survey the survey team could identify one species – Great White Pelican (*Pelecanus onocrotalus*), on the Red List of Afghanistan, with estimated exposure to threats and pressures.

VI. APPENDIXES

Appendix 1. Waterfowl Species Recorded during the Survey, November 2018

Common name	English Name	Latin name	IUCN Red list	Conservation status
Helmandai helae	Great cormorant	*Phalaracrocorax carbo*	LC	Not listed on the Red List
Zarghon Sare Helly	Mallard	*Anas platyrhynchos*	LC	Not listed on the Red List
Kotan	Great White Pelican	*Pelecanus onocrotalus*	LC	On the Red List of Afghanistan
Ghotayee Helly	Red necked Grabe	*Podiceps grisegena*	LC	Not listed on the Red List
Zarghon Komol	Grey Heron	*Ardea cinerea*	LC	Not listed on the Red List
Cabkhowaronkai	Slender-billed Gull	*Larus genei*	LC	Not listed on the Red List
Speen Komol	Great Egret	*Egretta alba*	LC	Not listed on the Red List
Cabkhowaronkai	Black-headed Gull	Larus ridibundus	LC	Not listed on the Red List
Cabkhowaronkai	Caspian Gull	*Larus cachinnans*	LC	Not listed on the Red List
Obez Charg	Black Coot	*Fulica atra*	LC	Not listed on the Red List
Obez charg	Common Moorhen	*Gallinula chloropus*	LC	Not listed on the Red List
Dandez Komol	Black -crowned Night heron	*Nyclicorax nycticorax*	LC	Not listed on the Red List
	Water Rail	*Rallus aquaticus*	LC	Not listed on the Red List
Shentaghy	Common Kingfisher	*alcedo attis*	LC	Not listed on the Red List

LC= Least Concern

Appendix 2. Other Species Recorded During Survey, November 2018

Common name	English Name	Latin name	Habitat	Conservation status
Jal	Crested Lark	*Galerida cristatata*	Terrestrial	Not listed on the Red List
Ababel	Barn Swallow	*Hirundo rustica*	Terrestrial	Not listed on the Red List
Balbal	White-eared bulbul	*Pycnonotus leucotis*	Terrestrial	Not listed on the Red List
Jal	Eurasian skylark	*Alauda arvensis*	Terrestrial	Not listed on the Red List
	Pied wheatear	*Oenanthe pleschanka*	Terrestrial	Not listed on the Red List
Gul Sar	Red-fronted Sarin	*Serinus pusillus*	Terrestrial	Not listed on the Red List
	Hume's wheatear	*Oenanthe albonigra*	Terrestrial	Not listed on the Red List
Keshkara	Eurasian Magpie	*Pica*	Terrestrial	Not listed on the Red List
Myna	Common Myna	*Acridotheres tristis*	Terrestrial	Not listed on the Red List
Totee	Rose-ringed Parakeet	*Psittacula kramer*	Terrestrial	Not listed on the Red List
Sangkoyake	Eastern rock-nuthatch	*Sitta tephronota*	Terrestrial	Not listed on the Red List
Gorbata	Bonelli's Eagle	*Aquila fasciata*	Terrestrial	On the Red List of Afghanistan
Oqabe Telayee	Golden Eagle	*Aquila Chrysaetos*	Terrestrial	On the Red List of Afghanistan
Sesae	See-see Partridge	*Ammoperdix griseogularis*	Terrestrial	Not listed on the Red List
Chatkai	Bright-green warbler	*Phylloscopus nitidus*	Terrestrial	Not listed on the Red List
Basha	Common Buzzard	*Buteo*	Terrestrial	On the Red List of Afghanistan
Basha	Booted Eagle	*Hieraaetus pennatus*	Terrestrial	Not listed on the Red List

Appendix 3. Coordinates of Waterfowl Survey

Survey points	GPS POINTS	
	North	East
1	31.51’059	065. 53.244
2	31.58’ 926	065.53.083
3	31.51’123	065.52.058
4	31.50’926	065.53.085
5	31.52’107	065.52.938
6	31.52’208	065.73.331
7	31.52’159	065.53.608
8	31.50’957	065.52.787
9	31.52’277	65.53.21.1
10	31.51’4972	31.51.49.72
11	31.51’287	65.53.36.12
12	31.52’5472	65.54.8.95
13	31.51’5320	65.53.50.06
14	31.50’38.06	65.52.17.89
15	31.50’55.98	65.52.46.97
16	31.51’37.00	65.54.23.80
17	31.51’43.99	65.53.56.86
18	31.52’45.57	65.53’41.86
19	31.50'49.64	65.51'54.51
GPS = Global Positioning System		

Appendix 4. Waterfowl Survey Questionnaire

QUESTIONNAIRE Waterfowl Survey at Dahla Dam, Kandahar Province HUNTER INTERVIEWS								
Name of Village					Date			
UTM					Altitude			
INFORMANT								
Name					Age			
Sex		Occupation			Phone			
WATERFOWL								
Has this Dam Waterfowl?	Yes		No					
How you seen any Waterfowl yourself? If yes;								
a- in which season?	Spring		Summer		Fall		Winter	
b- What kind of them?								
c- Which of them have increased in the past ten years?								
Why?								
d- Which of them have decreased in the past ten years?								
Why?								
How you ever-hunted waterfowl? If yes,								
a-Where								
b- What kind?								
c- Why do you hunt?								
d- In which season	Spring		Summer		Fall		Winter	
What kind of birds do you like to hunt?								
a- Why?								
Do you like waterfowl?	Yes		No					
Why?								
Should people protect waterfowl?	Yes		No					
a- Why								
b- How								
c- Who								
b- What are the main threats to waterfowl?								
Who hunts?	Local people		Out sider		Other			
a- Why?								
Comments								

Appendix 5. Waterfowl Photo Inventory

Common Name	Scientific Name	Location	Date	Description
Caspian Gull	*Larus cachinnans*	Dahla Dam, Kandahar Province – Afghanistan	Saturday, 17 November 2018 (2 pm)	A Caspian Gull at Dahla Dam. (the western shorelines of the dam). Source: National Environmental Protection Agency (NEPA) survey team

Common Name	Scientific Name	Location	Date	Description
Caspian Gull	*Larus cachinnans*	Dahla Dam, Kandahar Province – Afghanistan	Saturday, 17 November 2018 (12:14 am)	A Caspian Gull at Dahla Dam. Source: National Environmental Protection Agency (NEPA) survey team

Common Name	Scientific Name	Location	Date	Description
Common Moorhen	*Gallinula chloropus*	Dahla Dam, Kandahar Province- Afghanistan	Thursday, 8 November 2018 (11:41 am)	A Common Moorhen at the downstream of Dahla Dam. Source: National Environmental Protection Agency (NEPA) survey team

Common Name	Scientific Name	Location	Date	Description
Grey Heron	*Ardea cinerea*	Dahla Dam, Kandahar Province – Afghanistan	Sunday, 11 November 2018 (12:44 am)	A Grey Heron, representing a key species of Dahla Dam. Source: National Environmental Protection Agency (NEPA) survey team

Common Name	Scientific Name	Location	Date	Description
Great Cormorant	*Phalacrocorax carbo*	Dahla Dam, Kandahar Province – Afghanistan	Sunday, 11 November 2018 (10:56A am)	A Great Cormorant hunted by local hunters at Dahla Dam. Source: National Environmental Protection Agency (NEPA) survey team

Common Name	Scientific Name	Location	Date	Description
Great Cormorant	*Phalacrocorax carbo*	Dahla Dam, Kandahar Province – Afghanistan	Tuesday, 8 November 2018 (11:24 am)	The Great Cormorant is a large black bird, but there is a wide variation in size. Weight is reported to vary from 1.5 kg (3.3 lb.) to 5.3 kg (12 lb.). This is a very common and widespread bird species. Source: National Environmental Protection Agency (NEPA) survey team

Common Name	Scientific Name	Location	Date	Description
Grey Heron	*Ardea cinerea*	Dahla Dam, Kandahar Province – Afghanistan	Sunday, 11 November 2018 (11:36 am)	The Grey Heron is a large bird, standing up to 100 cm (39 in) tall and measuring 84-102 cm (33-40 in) long with a 155–195 cm (61–77 in) wingspan. It is one of the key species at Dahla Dam. Source: National Environmental Protection Agency (NEPA) survey team

Common Name	Scientific Name	Location	Date	Description
Grey Heron	*Ardea cinerea*	Dahla Dam, Kandahar Province – Afghanistan	Sunday, 11 November 2018 (11:44 am)	Hotspots of Grey Heron in the eastern shorelines of Dahla Dam. Source: National Environmental Protection Agency (NEPA) survey team

Common Name	Scientific Name	Location	Date	Description
Grey Heron	*Ardea cinerea*	Dahla Dam, Kandahar Province – Afghanistan	Sunday, 11 November 2018 (11:44 am)	Hotspots of Grey Heron in the eastern shorelines of Dahla Dam Source: National Environmental Protection Agency (NEPA) survey team

Common Name	Scientific Name	Location	Date	Description
Grey Heron	*Ardea cinerea*	Dahla Dam, Kandahar Province – Afghanistan	Thursday, 8 November 2018)9:04 am)	A Grey Heron is one of the key species of Dahla Dam. Source: National Environmental Protection Agency (NEPA) survey team

Common Name	Scientific Name	Location	Date	Description
Caspian Gull	*Larus cachinnans*	Dahla Dam, Kandahar Province – Afghanistan	Saturday, 17 November 2018 (2:00 pm)	A Caspian Gull at the western shorelines of Dahla Dam Source: National Environmental Protection Agency (NEPA) survey team

Common Name	Scientific Name	Location	Date	Description
Grey Heron	*Ardea cinerea*	Dahla Dam, Kandahar Province – Afghanistan	Sunday, 11 November 2018 (11:33 am)	A Grey Heron in eastern shorelines of Dahla Dam. This species is one of the key species of at the dam. Source: National Environmental Protection Agency (NEPA) survey team

Common Name	Scientific Name	Location	Date	Description
Grey Heron	*Ardea cinerea*	Dahla Dam, Kandahar Province – Afghanistan	Sunday, 11 November 2018 (10:56 am)	A Grey Heron: the bird was hunted by local people at Dahla Dam. Source: National Environmental Protection Agency (NEPA) survey team

Common Name	Scientific Name	Location	Date	Description
Mallard	*Anas platyrhynchos*	Dahla Dam, Kandahar Province – Afghanistan	Sunday, 11 November 2018 (12:30 am)	A flock of Mallards at Dahla Dam Source: National Environmental Protection Agency (NEPA) survey team

Common Name	Scientific Name	Location	Date	Description
Mallard	Anas platyrhynchos	Dahla Dam, Kandahar Province- Afghanistan	Thursday, 8 November 2018)11:41 am)	A Mallard at Dahla Dam Source: National Environmental Protection Agency (NEPA) survey team

Common Name	Scientific Name	Location	Date	Description
Slender-billed Gull	*Larus genei*	Dahla Dam, Kandahar Province – Afghanistan	Tuesday, 6 November 2018 (11:44 am)	A Slender-billed Gull at Dahla Dam Source: National Environmental Protection Agency (NEPA) survey team

Common Name	Scientific Name	Location	Date	Description
Slender Gull	*Larus genei*	Dahla Dam, Kandahar Province – Afghanistan	Monday 12 November 2018 (10:20 am)	A Slender Gull Source: National Environmental Protection Agency (NEPA) survey team

Common Name	Scientific Name	Location	Date	Description
Water Rail	*Rallus aquaticus*	Dahla Dam, Kandahar Province – Afghanistan	Thursday, 8 November 2018 (11:41 am)	A water rail at Dahla Dam Source: National Environmental Protection Agency (NEPA) survey team

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APPENDIX 4. FISH SURVEY REPORT

BASELINE ENVIRONMENTAL SURVEYS - FISH SURVEY

February 2019

TA-9273 AFG: Preparing the Arghandab Integrated Water Resources Development Investment Project

EXECUTIVE SUMMARY

The Government of the Islamic Republic of Afghanistan (Government) requested the Asian Development Bank (ADB) for Transaction Technical Assistance (TRTA) to prepare a project to improve water resources management, irrigated agriculture, domestic and industrial water supply for Kandahar City, and to augment electrical power in Kandahar City and surrounding areas. The contract for consulting services for TA-9273 AFG: Preparing the Arghandab Integrated Water Resources Development (AIWRD) Investment Project (formerly: Preparing the Helmand Basin Project) was signed on 20 September 2017 between ADB and FCG ANZDEC, Prime Nimmo Bell Partners, Finnish Consulting Group Asia, Afghan Tarin Engineering Services, and CMS Engineering Consult. The executing agency (EA) is the Ministry of Finance (MOF) and the main implementing agency (IA) is the Ministry of Energy and Water (MEW) at the central level, and the Arghandab Sub-Basin Authority (ASBA) at the provincial level. The outcome of the project will be the improved management and use of water resources in the Arghandab River basin. The ensuing project is envisaged to have four components:

(i) Component 1- Raising Dahla Dam and six saddle dams;
(ii) Component 2 - Climate smart productive use of water;
(iii) Component 3- Water supply to Kandahar City and peri-urban areas along the water transmission line;
(iv) Component 4- Hydropower generation and transmission.

An environmental survey of any dam should be done before its construction. After carrying out the survey, the collected data and figures are included in the Environmental Impact Assessment Report (EIA). As none of the organizations have carried out any survey or studies in the area on the Aquatic Species of the Dahla Dam (due to insecurity), there was a need for such data and information. Meetings were held among the officials of the National Environmental Protection Agency (NEPA), Ministry of Water and Energy, FCG ANZDEC and Afghan Tarin. The Ministry of Water and Energy officially requested NEPA to carry out the environmental survey and thus two staff members from the Natural Heritage Protection Division were selected to conduct the environmental survey of Dahla Dam on birds and fish. The survey team official submitted two reports to the Ministry of Water and Energy, FCG and Afghan Tarin.

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I. INTRODUCTION

1. Afghanistan is a landlocked country, which covers an area of 652,225 km^2, nearly 75% of which is mountainous. The average elevation is 1300m. The climate varies sharply between highlands and lowlands. It is sub-polar in the mountainous northeast with dry, cold winters, with temperatures falling to -26°C or lower in the Hindu Kush range. South of the highlands lies an arid, virtually uninhabited southwestern plateau. There are three great river basins: the Amu-Darya (Oxus), which forms the boundary with Tajikistan, Uzbekistan and Turkmenistan in the north; the Kabul in the northeast, which enters Pakistan in the east where it has a confluence with the Indus; and the Helmand in the southwest, which ends in Iran in a desert lake immediately after crossing the border in the southwest. The source of surface water in all rivers is precipitation, and consequent snow melt, over the central mountain ranges extending from the Pamir mountains at the western end of the Karakoram, the Hindu Kush and its outliers, and the ranges of Hazarajat.

2. There are a few freshwater lakes in Afghanistan, the largest of them is Sistan which lies mostly in Iran but is hydrographically part of Afghanistan. Major perennial rivers include the Amu Darya, Qonduz (Kunduz), Kowcheh (Kokcha), Band-e Amir, Kabul, Lowgar (Logar), Panjsher, Laghman, Konar (Kunar), Sorkh Ab, Helmand, Arghandab, Hari Rud, and Morghab (Murgab). The following notes deal only with the major rivers and their major tributaries. There are some artificial lakes in Afghanistan similar to Daronta Dam, Naghlo, Sarubi, Salma, Kajakey, Kamal Khan, Mchalgho, Band Awal and Dow Pul Khumri, Shah and Arush and Dahla reservoir. These are good areas for fish species.

3. Afghanistan has in total around 139 different fish species; of which 101 are recorded to exist, and 38 species have not been recorded. During the fish survey in the Dahla Dam, the fish survey team was able to identify three species out of 101 which are currently existing in the Dahla Dam in Kandahar province.

II. SURVEY GOALS AND OBJECTIVES

4. The goal of the survey was to carry out the basic identification and preparation of the inventory of fish species in Dahla Dam of Kandahar province.

A. Objectives

5. The objectives of the study were to identify the existing fish species of Dahla Dam, to initiate the fish inventory for the dam, and to identify and map the fish habitat.

B. Methodology

6. The survey team collected the data by three methods: (1) interviews, (2) meetings with aquaculture owners and related governmental organizations, and (3) fish catches in nets.

1. Interviews

7. The survey team identified three fishermen from three different villages near the dam who regularly fish in the dam and interviewed them. They were interviewed regarding the hunting season, the method and season of catching fish, and the main threats to fish according to the questionnaire (Appendix 1).

2. Meetings with Aquaculture Owners in Kandahar Province

8. Based on the information from the Department of Livestock of Agriculture, Division of Kandahar province, aquaculture has grown in Kandahar from 1391 to 1397. Aquaculture is promoted in 10 out of 18 districts of Kandahar province because it brings in good income and in addition has a good market. Most of the aquaculture farms in Kandahar raise Common Carp and Grass Carp.

3. Fish Nets

9. The survey team used fish nets for three days at nine sites in Dahla Dam reservoir and one site downstream of Dahla Dam reservoir. On the first day, the team caught around 1,122 fish using three nets. On the second day, the survey team caught 356 fish. On the third day, 250 fish were caught. A total number of 1728 of fishes were caught over the course of three days. The survey team also measured the total length of each fish (head to tail) and took GPS coordinates of all the sites where fishing nets were set.

10. Over the course of three days, the survey team used fish nets in different areas where there may be an effect on fish species during the construction of the dam. A 100-meter-long fish net was used at three representative pelagic sections (deep-water zones) and at six representative shallow water zones (Figure 1).

Figure 1. Shallow and Deep-Water Zones

Source: Google Earth.

C. Day One

11. On the first day, the survey team threw three fish nets (100 m) in the starting section of the dam near the main embankment. Two fish nets were thrown in the southern section (one in a shallow water zone, and one in deep water zone) and one fish net in the southwest section (Deep zone) near the overflow and valve tower. A total of 1,122 fish were caught and counted in all three fish nets. In the first net, the caught fish were identified of which 33 of them were Sheer Mahi. GPS coordinates were taken, and fish were released back into the water.

12. In the second net, around 11 fish were caught of which 2 species were Common Carp and 9 others were Sheer Mahi. GPS coordinates were taken, and fish were released back into the water. In the third net, around 1078 different fish were caught from which 1068 were Mola Carplet (*Amblypharyngodon mola*) fish and 10 others were Sheer Mahi.

D. Day Two

Figure 2. Fish Nets Used on the First Day of Catching Fish

Source: Google Earth

13. On the second day, the survey team caught around 356 fish using three nets in the shallow water zone. In the first net, 66 fish were counted and identified; of which 44 were Sheer Mahi and 22 others were identified Mola Carplet fish. In the second net, 8 fish were caught from which 6 species were identified as Sheer Mahi and 2 others were Common Carp. GPS coordinates were taken, and fish were released back into the water.

14. In the third net, the survey team caught 282 fish, of which 278 species were identified as Sheer Mahi, 2 fish were identified as Common Carp, and 2 others were identified as Mola Carplet fish. GPS coordinates were taken the fish were released. The areas in which fish nets were set are show in Figure 3.

Figure 3. Fish Nets Used on Second Day of Catching Fish

Source: Google Earth

E. Day Three

15. On the third day, the survey team threw one fish net downstream of the dam, one fish net in the southern section of the dam, and one fish net in the western section of the dam. In total 250 fish were caught in the four fish nets, of which 210 fish were caught in the first net. All of them were Common Carp. 17 Sheer Mahi were caught in the second net. 18 Sheer Mahi were caught in the third net and 5 Sheer Mahi were caught in the fourth net. All the fish were released back into their habitats after their counting, identification and determination of length (head to end tail) (Figure 4).

Figure 4. Fish Nets Used on the Third Day of Catching Fish

Source: Google Earth

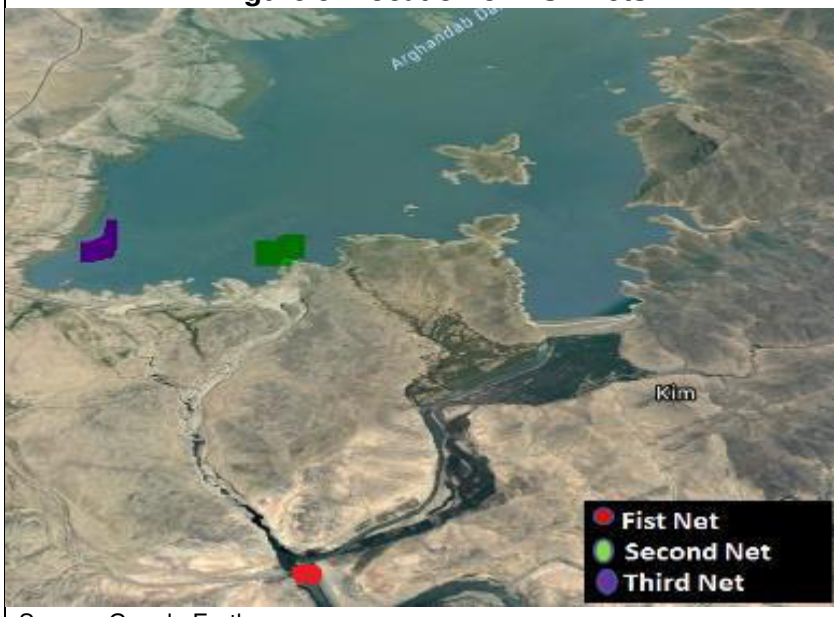
III. IDENTIFIED FISH

16. During the fish survey, the team used fish nets at two representative shallow water zones (depth 2m), pelagic zones of the Dahla Dam reservoir, as well as in the downstream. Different

fish species were identified in the mentioned areas. Fish nets were used in the downstream because some fish species were there and needed to be surveyed. One of the fishermen interviewed noted that there are two kinds of fish species in the downstream. One is Sheer Mahi and the other is Sag Mahi. Unfortunately, no specimen of Sag Mahi were caught using the fish net.

17. In total, around 3 species were identified directly by the fish survey team from which 2 *(Amblypharyngodon mola* and *clupisoma naziri)* were native to Afghanistan and another *(Cyprinus carpio)* is introduced. One of the aquaculture owners interviewed told the survey team that the Common Carp was introduced during the era of King Zaher Shah in Dahla Dam. Each of the above identified species is explained bellow:

Figure 5: Location of Fish Nets



Source: Google Earth

A. Sheer Mahi

18. Listing:

(i) Global IUCN listing: Not Evaluated;
(ii) National Listing: Not Evaluated;

19. Species Information:

(i) Order: Carnivora;
(ii) Family: Schilbeidae;
(iii) Genus/Species: *Clupisoma naziri;*
(iv) Common Name(s): Sheer Mahi, Catfish.

Figure 6. Sheer Mahi Photo 1

Source: NEPA Surveyors, 2018

Figure 7. Sheer Mahi Photo 2

Source: NEPA Surveyors, 2018

20. *Clupisoma naziri* belongs to family Schilbeidae found as native catfish species in the Indus, and Kabul Rivers Pakistan. This fish is distributed in Asia, i.e., Pakistan (Mirza and Awan, 1973) and Afghanistan (Coad, 1981). In India, it is popular for its flavor and for its oil contents.

21. Being a potamodromous fish, it migrates upstream in the lower reaches of the Rivers Swat, Kabul and Indus during the months of May to August. At this time the total catch increases; as it is being consumed in the region. As winter approaches, it gradually disappears from the Indus and Kabul Rivers due to its downstream migration. The head of *C. naziri* (Sheer Mahi) is moderate in size and oval and blunt in shape. The head length was measured as 15.3% of the total body length. The eyes are smaller than those of *Eutropiichthys vacha* and are latterly situated in the middle of the head.

22. The mouth is sub-terminal overhung by bluntly slightly pointed snout and the upper jaw covers the lower jaw. The mouth opens at a 40-degree angle with thin lips and surrounded with eight barbles.

23. The stomach is J-shaped having thin walls, however, it is very muscularized and possesses a well-developed grinding function. The species presented some degree of food intake

in all periods of the year. Eighteen different types of invertebrate prey and seven algae taxa indicated that C. naziri is predominantly insectivorous. Two-thirds (i.e. 66.2%) fish had small aquatic and terrestrial insects.

24. The survey team also measured the total length of each catfish. The total length from head to end of tail was on average about 20cm. Some Sheer Mahi were found with a length of up to 55cm.

1. Regional Distribution:

25. This species is commonly found in Pakistan and Afghanistan.

2. Extent of Occurrence

26. Sheer Mahi was caught in all the fish nets used during the three days in different parts of the dam (shallow water zones and pelagic zones). The extent of occurrence of this species is high and exists in all parts of the dam. It mostly exists in the south-west part of the dam, shown in Figure 8.

Figure 8. Occurrence of Sheer Mahi

Source: Google Earth

3. Threats

27. Major threats to the Sheer Mahi include fishery, trade and drought. Trade of Sheer Mahi is also a problem or threat in Dahla Dam. One of the fishermen interviewed regarding the trade of Sheer Mahi stated, “this species is traded from Dahla Dam to Pakistan.” Use of pesticides by farmers around the area is a threat, which may affect this important fish species in Pakistan and Afghanistan.

28. The reason why the local people hunt catfish and trade them from Afghanistan to Pakistan is it has delicious meat. During the interview with one of the fishermen in Dahla Dam, he mentioned the meat of the fish was delicious, and therefore was of interest to local fishermen.

B. Common Carp

29. Listing:

(i) Global IUCN listing: Not Evaluated;
(ii) National Listing: Not Evaluated;

30. Species Information:

(i) Order: Cypriniformes;
(ii) Family: Cyprinidae;
(iii) Genus/Species: *Cyprinus carpio;*
(iv) Common Name(s): Common Carp, German Carp, European Carp.

Figure 9: The Common Carp

Source: NEPA Surveyors, 2018

1. Morphological Description

31. The Common Carp is a large omnivorous fish. They have large scales, a long dorsal fin base, and two pairs of long barbels (whiskers) in its upper jaw. Native to Europe and Asia, it was intentionally introduced into Midwest waters as a game fish in the 1880s. There is also a native look-a-like: “bigmouth buffalo” which looks like a carp without barbells. Common Carp are one of the most damaging aquatic invasive species due to its wide distribution and severe impacts in shallow lakes and wetlands. Their feeding disrupts shallowly rooted plants, muddying the water. They release phosphorus that increases algae abundance. Carp induced declines in water quality in turn causes a decline of aquatic plants needed by waterfowl and other fish.

32. The color of the body varies from gray through silver to bronze with a yellowish or reddish belly.

33. Common Carp has one long dorsal fin which possesses 2-3 hard and 17-22 soft rays. The first (largest) hard ray is sharp and is serrated on its posterior margin. Additional morphological characteristics include 2-3 anal spines, 5-6 anal rays and 36-37 vertebrae.[1]

34. The mouth is large and opens in an accordion-like fashion. There are two pairs of barbels, one pair on the upper lip and the other pair at the corners of the mouth. There are 5-5 molar-like pharyngeal teeth used to grind food. Common Carp occur within the temperature range of 3-35 C.[2] The optimum water temperature for growth and propagation is 20–25 C. In nature, Common Carp live in the middle and lower sections of rivers and in areas where the water is shallow (only a few meters deep) and the bottom is muddy.

35. Common Carp has been introduced into practically all countries where there is a chance for successful reproduction. In many of the natural waters where it has been introduced, the Common Carp is considered as an invasive species whose populations should be reduced or even eliminated. Still, Common Carp is one of the most widely cultured freshwater fish species in the world.[3]

Figure 10. Common Carp

Source: NEPA Surveyors, 2018

2. Introduction of Species:

36. The Common Carp which currently exists in the Dahla Dam is one of the introduced species to the dam. Based on the interview we had with agriculture division of Kandahar province and Afghan Cab (Afghan Fish) Aquaculture Owner, He told us this species was introduced during the era of King Zaher Shah in to Dahla Dam.

37. During the survey, the total length from head to end of tail of the Common Carp was measured.

3. Habitat

38. This species is found in warm, deep, slow-flowing and still waters, such as lowland rivers and large, well-vegetated lakes and has been introduced in all types of water bodies. The species

[1] Froese and Pauly, 2011
[2] García-Berthou, E., 2001
[3] Welcomme, 1988

spawns along shores or in backwaters, where larvae successfully survive only in very warm water among shallow submerged vegetation.

4. Global Distribution

39. This species was introduced from the Black, Caspian and Aral Sea basins throughout the world. It is cultivated in large quantities for human food and is stocked for sport fishing.

5. Extent of Occurrence

40. The Common Carp was caught in four out of nine fish nets that were used to catch the fish in the dam. The species mostly exists in the southern parts of the dam. Only 216 fish were caught in the four fish nets. The areas in which the species exists are shown in Figure 11.

Figure 11. Occurrence of Common Carp

Source: Google Earth

6. Threats

41. Drought and fishery are the big threats to the Common Carp. One of the local fishermen stated that this species was mostly hunted because its meat is very delicious and has a good demand in the market.

C. Mola Carplet

42. Listing:

(i) Global IUCN listing: Not Evaluated
(ii) National Listing: Not Evaluated

43. Species Information:

(i) Order: Cypriniformes
(ii) Family: Cyprinidae
(iii) Genus/Species: Amblypharyngodon mola
(iv) Common Name(s): Mola Carplet or Pale Carplet

Figure 12: Mola Carplet

Source: NEPA Surveyors, 2018

1. Morphological Description:

44. *Amblypharyngodon mola*, commonly known as Mola Carplet or Pale Carplet is a popular food, mainly in the Indian sub-continent, due to its high nutritional value.

45. Hoque and Rahman (2008) have reported that males and females are different in color; and that males are comparatively brighter than females. The color of females is light, and they are large. In mature females, the abdomen is soft and swollen, pelvic fins are smooth and caudal fin is deeply forked. During the spawning season mature females are with distended abdomen by which they can be easily recognized.

46. The average sex-ratio in the population of *A. mola* (Mola Carplet) as 1:1.67 males to female,[4] with significant female dominance over male. Piska and Waghray (1986) also have observed predominance of females in the population of this fish species. Azadi and Mamun (2004) also have reported the significant dominance of females over males in the population of A. mola. They documented the monthly variation of sex ratio between males and females to be ranged from 1:1.15 to 1:3.64 with an average value of 1:2.078. Suresh et al. (2007) have reported

[4] Afroze and Hossain, 1983

significant variation in sex ratio of A. mola in different months from the expected ratio of 1:1 and the ratio of male and female fish have been reported to vary from 1:1 to 1:12. The number of males has been reported to be very low to nil during spawning and post-spawning season; and they have concluded that this may be due to the spawning and post spawning mortality of males. Hoque and Rahman (2008) have also reported the female dominance in the population of *A. mola;* they have reported an average ratio of 1:1.71 for males and females of this fish species. Saha et al. (2009) have reported the average sex-ratio in the population of *A. mola* as 1:2.03 for males and females. Gupta and Banerjee (2013a) have reported the average sex ratio of 1:3.04 for males and females of this fish species while Mondal and Kaviraj (2013) have documented the ratio of 1:1.9 for the same.

47. The length at first maturity for male and female of A. mola as 5.1-5.6 cm and 3.9-4.4 cm.[5]

2. Feeding Biology

48. *A. mola* is a surface feeder; with unicellular and filamentous algae, protozoans and rotifers as the preferred food types for this fish species. It is also reported as a bottom feeder with algae documented as the main food for this fish species. [6]

3. Habitat:

49. *A mola* is a freshwater fish species; a natural inhabitant of ponds, canals, slow-moving streams, ditches, and reservoirs.

4. Regional Distribution:

50. The species is found in India, Bangladesh, Pakistan, Myanmar and Afghanistan.

5. Extent of Occurrence

51. 1,092 of Mola Carplet *(A. mola)* were caught in only three of the fish nets among all 9 nets in the western part of the dam near the over flow and valve tower and eastern part of the dam. most of them were 5.5cm and 5cm when measured. This species is likely to be most affected during the construction of the over flow and valve tower because the population of this species is very high in this part of the reservoir and is mostly found in this area. The density of this species is shown in Figure 13.

[5] Suresh et al., 2007

[6] Piska et al., 1991

Figure 13. The Occurrence of Mola Carplet

Source: Google Earth

6. Threats

52. The big threats that this species faces are fishing and drought. Most of the species are caught in long fish nets (around 100m long) when the nets are thrown into the water.

D. Technical Tools

53. The equipment used for fish survey included:

(i) GPS
(ii) Camera- (Nikon D3400 DSLR Camera with AF-P DX NIKKOR 18-55mm f/3.5-5.6G VR and AF-P DX NIKKOR 70-300mm f/4.5-6.3G ED)
(iii) Fish net (100m length – mesh size 1cm^2)
(iv) Boat (for throwing the fish net and catching fish)

E. Data Collected

54. Two forms of data were collected:

(i) Qualitative: Qualitative data including comments of the fishermen interviewed
(ii) Quantitative: Quantitative data including number of fishes caught using the fish net in the different points of the dam, counting each kind of species separately and determining their lengths.

F. Results

55. The surveyors carried out the fish survey at Dahla Dam in Kandahar province. During the survey, the surveyors interviewed local fishermen and met the owners of aquaculture businesses in the center of Kandahar province. The surveyors also met with the Division of Environment

Protection, Division of Agriculture of Kandahar and Division of Water and Energy and asked them about the existence of data and information on native and introduced species in Kandahar province, but unfortunately, surveyors were not able to find any kind of existing information and data.

56. When the surveyors started fish sampling using fish nets, different kinds of fish species were found. A total of 1728 of different kinds of fish were identified within the period of three days. The surveyors were identified 3 kinds of species, of which one of them is introduced and two of them are native to Afghanistan. Furthermore, the survey team identified and mapped the fish habitats and took GPS location of the caught fish species.

IV. RECOMMENDATIONS

(i) Include fish conservation measures in Dahla Dam Construction Strategy and Action Plan;
(ii) Do not block movement of fish species up and down spillway;
(iii) Maintain natural seasonal and daily river flow cycles;
(iv) Sustain water quality;
(v) Take into account the impact of other human activities during construction periods;
(vi) Explore and reduce the impacts of the dam on the aquatic ecosystem;
(vii) Do not permit fishing by laborers during the dam construction;
(viii) Prevent washing of vehicles and equipment in the upstream and downstream of the dam;
(ix) Do not put kitchen or other garbage into water;
(x) Sustain water quality –temperature, oxygen, sediment and other levels;
(xi) Avoid cumulative effects of dams – limit their number and proximity;
(xii) Take into account the impacts of other human activities when planning dams;
(xiii) Maintain water quality and control the flow of patterns downstream;
(xiv) Apply high environmental impact standards;
(xv) Involve environmental staff in planning and construction early and at high level;
(xvi) Enhance delivery and construction in extant dams;
(xvii) Decommission ineffective dams and restore river ecosystem, especially fish species;
(xviii) Use landscape management to make dam more effective and to protect fish.

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VI. APPENDIXES

Appendix 1. Fish Survey Questionnaire

Fish Survey at Dahla Dam, Kandahar Province FISHERMEN INTERVIEWS								
Name of Village				Date				
UTM				Altitude				
INFORMANT								
Name				Age				
Sex		Occupation			Phone			
Fish								
Has your river/ Stream/ Dam any fish?	**Yes**			**No**				
a- What kind of fish?								
Have you caught any fish yourself? If yes,								
a- In which method?								
C- in which season?	**Spring**		**Summer**		**Fall**		**Winter**	
d-How many?	**Per day (kg)**		**Monthly(kg)**		**Yearly(kg)**			
e- Where								
f-for yourself/ selling								
Should we protect fish if; yes why?								
a- Why								
b- How								
c- Who								
What are the main threats to fishes?								
Is fishing done by local people or outsider?								
comments and suggestion								

Appendix 2. List of Identified Fish Species

No	Local name	Common name	Scientific Name	Quantity	GPS Point				Sampling				Days
					N	E	Elevation	Date	1st Net	2nd Net	3rd Net	4th Net	
First day													
1	Toghandy	Sheer Mahi	*Clupisoma naziri*	33	31 50.994	065 53 513	1117m	07 Nov	√				Wednesday
2	Gulpam	Common Carp	*Cyprinus carpio*	2	31 50 964	065 53 414	1116m			√			
3	Toghandy	Sheer Mahi	*Clupisoma naziri*	9	31 50 964	065 53 414	1116m			√			
4	*Yaqubyan*	Mola Carplet	*Amblypharyngodon mola*	1068	31 51 059	065 53 244	1117m				√		
5	Toghandy	Common Carp	*Clupisoma naziri*	10	31 51 059	065 53 244	1117m				√		
Second day													
1	Toghandy	Sheer Mahi	*Clupisoma naziri*	44	31 50 817	065 51 926	1089m	10 Nov	√				Saturday
2	*Yaqubyan*	Mola Carplet	*Amblypharyngodon mola*	22	31 50 817	065 51 926	1089m		√				
3	Toghandy	Sheer Mahi	*Clupisoma naziri*	6	31 51 666	065 53 439	1113m			√			
4	Gulpam	Common Carp	*Cyprinus carpio*	2	31 51 666	065 53 439	1113m			√			
5	Toghandy	Sheer Mahi	*Clupisoma naziri*	278	31 52 149	065 53 553	1115m				√		
6	Gulpam	Common Carp	*Cyprinus carpio*	2	31 52 149	065 53 553	1115m				√		
Third day													
1	Gulpam	Common Carp	*Cyprinus carpio*	210	31 51.058	065 53. 561	1120m	11Nov	√				Sunday
2	Toghandy	Sheer Mahi	*Clupisoma naziri*	17	31 51.149	065 53. 660	1122m			√			
3	Toghandy	Sheer Mahi	*Clupisoma naziri*	18	31 51.150	065 53. 840	1125m				√		
4	Toghandy	Sheer Mahi	*Clupisoma naziri*	5	31 51. 355	065 53. 456	1124m					√	

Appendix 3. List of all Fish Species and Aquaculture Farms

List of Aquaculture Farms of Kandahar Province					
No	Pashtu name	Common name	Scientific Name	District	Number of farms
	Golpam	Common Carp	Cyprinus carpio	Zherey	80
	Grass	Grass carp	Ctenopharyngodon idella		
	Golpam	Common Carp	Cyprinus carpio	Dand	68
	Grass	Grass carp	Ctenopharyngodon idella		
	Golpam	Common Carp	Cyprinus carpio	Daman	83
	Grass	Grass carp	Ctenopharyngodon idella		
	Golpam	Common Carp	Cyprinus carpio	Arghandab	49
	Grass	Grass carp	Ctenopharyngodon idella		
	Golpam	Common Carp	Cyprinus carpio	Maiwand	27
	Grass	Grass carp	Ctenopharyngodon idella		
	Grass	Grass carp	Ctenopharyngodon idella	Regestan	1
	Golpam	Common Carp	Cyprinus carpio	Pangwayee	13
	Grass	Grass carp	Ctenopharyngodon idella		
	Golpam	Common Carp	Cyprinus carpio	Takhta pul	1
	Golpam	Common Carp	Cyprinus carpio	Spen Buldak	7
	Grass	Grass carp	Ctenopharyngodon idella		13
	Golpam	Common Carp	Cyprinus carpio	District 8	4
	Grass	Grass carp	Ctenopharyngodon idella		
	Golpam	Common Carp	Cyprinus carpio	District 11	3
	Grass	Grass carp	Ctenopharyngodon idella		1
	Golpam	Common Carp	Cyprinus carpio	District 7	2
	Grass	Grass carp	Ctenopharyngodon idella		
	Golpam	Common Carp	Cyprinus carpio	Center of Kandahar	1
	Grass	Grass carp	Ctenopharyngodon idella		

Appendix 4. Photo Gallery

1. Sheer Mahi






Local Name	Common name	Scientific name	Description
Toghanday	Sheer Mahi	*Clupisoma naziri*	This species was caught in the three deep and seven shallow water zone during the survey by Surveyors during the three days survey

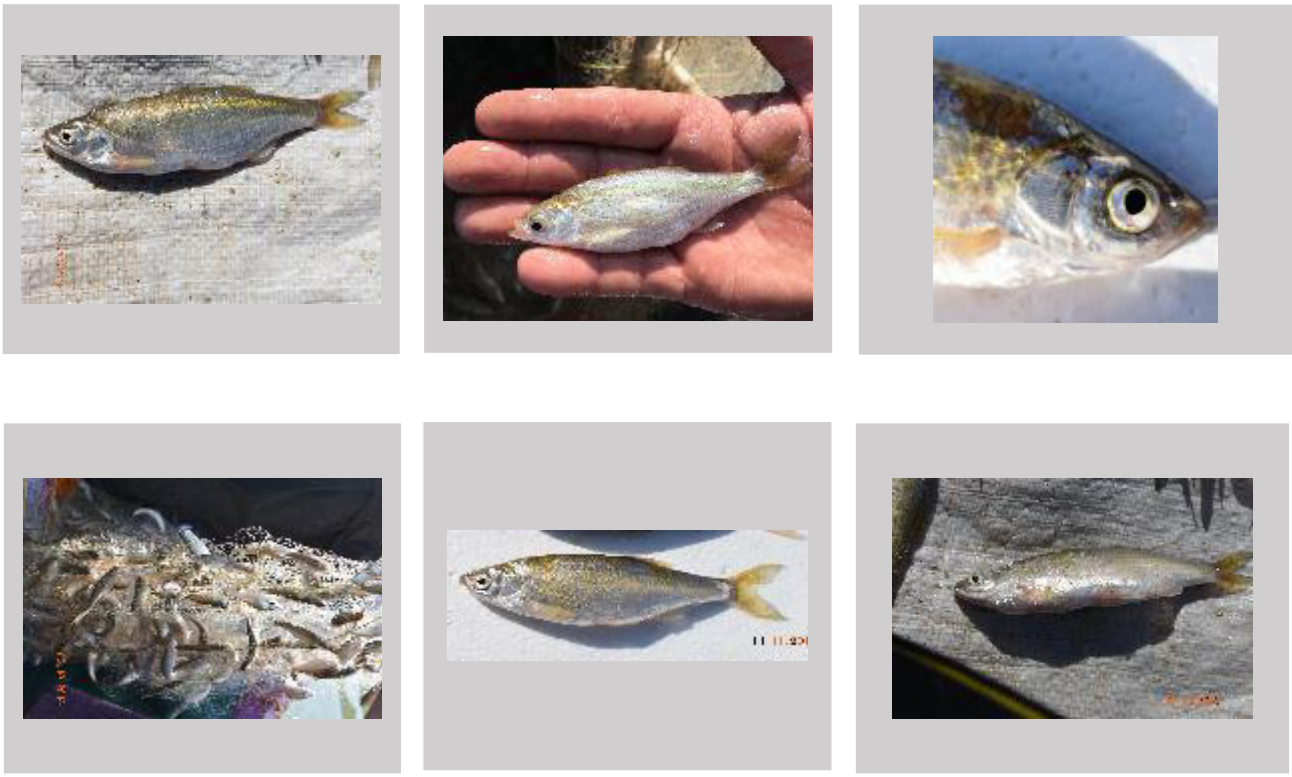
2. Common Carp






Local Name	Common name	Scientific name	Description
Gulpam	Common Carp	*Cyprinus carpio*	This species was caught in four nets of all nine fish nets that were used in the shallow water zone of Dahla Dam. The survey team did not catch any specimen of them in the deep-water zone.

3. Mola Carplet



Local Name	Common name	Scientific name	Description
Yaqubi	Mola Carplet	*Amblypharyngodon mola*	The Mola Carplet is one of the native species in Afghanistan. It is found in two deep-water zones in Dahla Dam.

APPENDIX 5. WATER QUALITY SURVEY REPORT

WATER QUALITY SURVEY

February 2019

TA-9273 AFG: Preparing the Arghandab Integrated Water Resources Development Investment Project

CONTENTS

I. INTRODUCTION

World Health Organization (WHO), and the Government of Afghanistan have water quality standards. These standards establish the acceptable levels of pH, TDS, arsenic, sulphates etcetera which most have been tested for in the performed water quality assessment. The standards are presented in Table 1.

A survey team visited the project site to do water sampling for both surface water and groundwater in 2017-2018 and 2019. The team have also tested for regional substances that could decrease the water quality. A Spectrophotometer Palintest 8000 was used for the tests. The test locations are presented in Table 2 and Figures 1, 2 and 3.

Table 1. WHO and Afghanistan Drinking Water Quality Standards

Parameters	Afghanistan National Water Quality Standard	WHO (4th edition 2017)
Micro-biological (e.g. E coli)	0 CFU/100 mL	<1 CFU/100 mL
Turbidity	5 NTU	5 NTU
pH	6.5-8.5	6.5-8.5
TDS	1000 to 2000 mg/L	-
Total Hardness	500 mg/L	-
Nitrate (as NO_3^-)	50 mg/L	50 mg/L
Nitrite (as NO_2^-)	3 mg/L	3 mg/L
Barium	0.7 mg/L	1.3 mg/L
Boron	2.4 mg/L	2.4 mg/L
Arsenic	0.05 mg/L	0.01 mg/L
Fluoride	1.5 mg/L	1.5 mg/L
Lead	0.01 mg/L	0.01 mg/L
Cyanide	0.05 mg/L	previously 0.07 mg/L
Nickel	0.07 mg/L	0.07 mg/L
Nitrate as Nitrogen	11 mg/L	11 mg/L
Zinc	3 mg/L	-
Selenium	3 mg/L	0.04 mg/L
Chloride	250 mg/L	-
Sulphate	250 mg/L	-

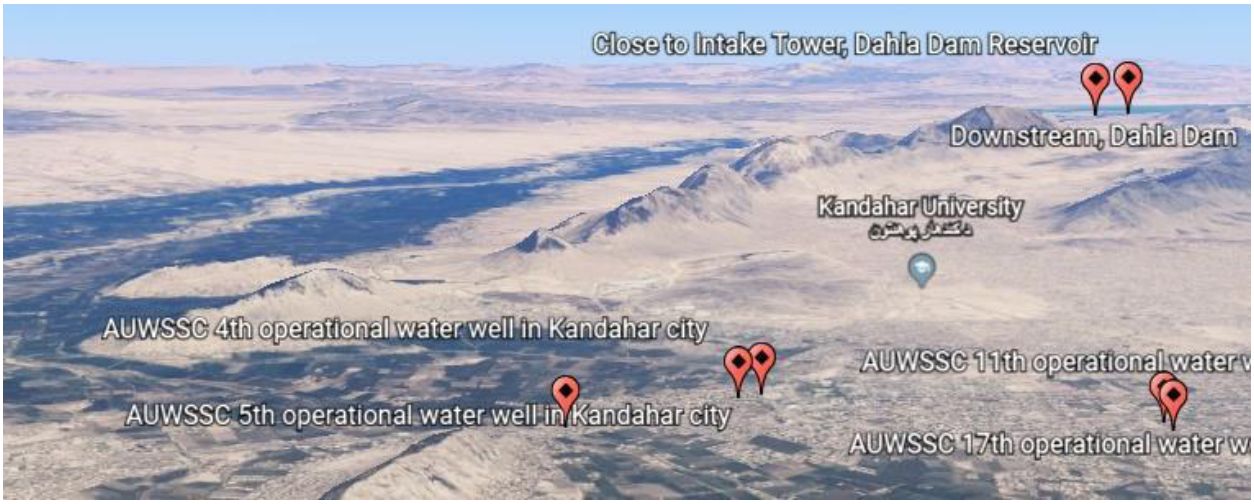
Table 2. Water Sampling and Field Activity Report

No.	Date Time	Location	GPS Coordinates Latitude (N)	GPS Coordinates Longitude (E)	LAB Testing
A	**Surface Water**				
1	26-Feb-18 1-Jan-19	Close to Intake Tower, Dahla Dam Reservoir, Shah Wali Kot district, Kandahar Province	31.8517	65.8875	AUWSSC DACAAR
2	26-Feb-18 1-Jan-19	Downstream, Dahla Dam, Shah Wali Kot district, Kandahar Province	31.8492	65.8769	AUWSSC DACAAR
B	**Groundwater AUWSSC Operational Water Well in Kandahar city**				
1	1-Nov-17 9-Jan-19	AUWSSC 1st operational water well in Kandahar city. Maikhanik High School, District 2, Kandahar Province	31.6024	65.6925	AUWSSC DACAAR
2	25-Oct-17 9-Jan-19	AUWSSC 3rd operational water well in Kandahar city. AUWSSC Office, District 2, Kandahar City	31.6021	65.6851	AUWSSC DACAAR
3	31-Oct-17 9-Jan-19	AUWSSC 4th operational water well in Kandahar city. Fazal Kandahari High School, District 8, Kandahar City	31.6202	65.6755	AUWSSC DACAAR
4	12-Nov-17 9-Jan-19	AUWSSC 5th operational water well in Kandahar city. Dand Chowk (Square), District 8, Kandahar City	31.6206	65.6767	AUWSSC DACAAR
5	30-Oct-17 9-Jan-19	AUWSSC 8th operational water well in Kandahar city. Sra Miasht Clinic, District 14, Kandahar City	31.6200	65.7258	AUWSSC DACAAR
6	20-Nov-17 9-Jan-19	AUWSSC 10th operational water well in Kandahar city Mirwais Nika High School, District 14, Kandahar City	31.6208	65.7300	DACAAR
7	23-Oct-17 9-Jan-19	AUWSSC 11th operational water well in Kandahar city. Ahmad Shah Baba High School, District 2, Kandahar City	31.6117	65.6886	DACAAR
8	29-Nov-17 9-Jan-19	AUWSSC 12th operational water well in Kandahar city. Kandahar Mahbas (Prison), District 8, Kandahar City	31.6178	65.6672	AUWSSC DACAAR
9	7-Nov-17 9-Jan-19	AUWSSC 16th operational water well in Kandahar city. In front of Aino Mina, District 5, Kandahar City	31.6137	65.7697	AUWSSC DACAAR
10	25-Oct-17 9-Jan-19	AUWSSC 17th operational water well in Kandahar city. AUWSSC Office, District 2, Kandahar City	31.6128	65.6892	AUWSSC DACAAR

Figure 1. All Project Locations

Source: Google Earth, 2019

Figure 2. Project Locations



Source: Google Earth, 2019

Figure 3. Project Locations

Source: Google Earth, 2019

II. 2017-2018 WATER TESTS

Well No.	Date	Source of Water	Chemical and Bacteriological Parameters						
			pH	Conductivity (ms /cm)	Turbidity (NTU)	Temperature (°C)	Salinity	TDS (mg/l)	Fecal / Total Coliform (CFU/100ml)
11	23/10/17	Ahmad Shah Baba High School Well	7.7	738	0.9	20	0.4	121	Negative
3	25/10/17	AUWSSC well	7.4	701	0.3	19	0.3	338	Negative
17	25/10/17	PRT well	7.5	664	0.7	20	0.3	321	Negative
8	30/10/17	Sra Miasht well	7.5	999	0.6	20	0.6	277	Negative
4	31/10/17	Fazle Kandahari well	7.4	572	0.5	20	0.3	291	Negative
1	01/11/17	Mechanical School Well	7.3	634	0.7	20	0.3	305	Negative
LW1	05/11/17	MPW Well	7.2	**2160**	0.9	23	1.1	**1088**	Negative
16	07/11/17	Ansari Mena Well	7.4	**2020**	0.5	24	1.0	**1010**	Negative
5	12/11/17	Dand Chawk Well	7.3	610	0.3	19	0.3	297	Negative
15	18/11/17	School Aino number 2, Well	7.5	780	0.6	21	0.4	380	Negative
10	20/11/17	Mirwas Neke School Well	7.5	1070	0.3	23	0.5	526	Negative
12	29/11/17	Mahbas Well	7.3	644	0.3	19	0.3	312	Negative
-	26/02/18	Loya Wale Irrigational Canal	7.9	538	1.7	15	0.3	259	Negative
-	26/02/18	Dahla Dam	8.0	384	**13.0**	16	0.2	383	Negative

Nitrate, Residual chlorine, Iron, Fluoride, Arsenic, Sodium, Oxidation Reduction Potential = Not Tested
Odor, Taste = Unobjectionable
Color = Colorless
Source: AUWSSC and TRTA Consultants, 2018

III. 2019 SURFACE WATER TESTS

1. Close to Intake Tower, Dahla Dam Reservoir

Sample collection: 01/01/2019
GPS Coordinates: Latitude (N): 31.85166667, Longitude (E): 65.8875

DACAAR Water Quality Analysis Report

Physical Parameters

Physical Parameters				WHO recommendation	ANSA recommendation	
EC	**653**	µS/cm		1500	3000	
TDS*	**449**	mg/l	0.688	1000	2000	* From Conductivity
ORP	**215**	mV				
Turbidity	**60.01**	NTU		5	5	<1 for chlorination
PH	**8.15**			6.5-8	6.5-8.5	<8 for chlorination
^{O}T	**9.8**	^{O}C		-	-	

Chemical Determination

Anions		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Total Alkalinity	($asCACO_3$)	**190**			-	-	
Alkalinity P	($asCACO_3$)	**5**			-	-	
Alkalinity M	($asCACO_3$)	**200**			-	-	
Bicarbonate	HCO_3^-	**190**	0.01639	3.114	-	-	
Carbonate	CO_3^{2-}	**10**	0.03333	0.333	-	-	
Hydroxide	OH^-	**0**	0.05880	0.000	-	-	
Chloride	Cl^-	**16**	0.02820	0.451	250	250	Taste
Sulphate	SO_4^{2-}	**134**	0.02082	2.790	250	250	Taste
sulphide	SO_3^{2-}	**8**	0.02498	0.200	-	-	
sulphide	S^{2-}	**0**	0.06250	0.000	-	-	
Fluoride	F^-	**0.83**	0.05263	0.044	1.5	1.5	Fluorosis

Anions		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Nitrate	NO_3^-	**8.6**	0.01613	0.139	50	50	Blue baby syndrome
Nitrite	NO_2^-	**0.03**	0.02174	0.001	0.2-3	3	Long- short term exposure
Phosphate	PO_4^{3-}	**0.02**	0.03159	0.001	-	-	
Boron	B	**0.5**	0.09247	0.046	2.4	2.4	Testicular lesion
Bromide	Br^-	**0.4**	0.01251	0.005	-	-	

Cations		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Total Hardness	($asCACO_3$)	**166**			300	500	Taste and incrustation
Calcium	($asCACO_3$)	**90**			-	-	
Sodium	Na^+	**81**	0.04348	3.525	200	200	Taste
Potassium	K^+	**2.5**	0.02558	0.064	-	-	
Calcium	Ca^{2+}	**36**	0.0499	1.796	-	-	
Chromium	$Cr_{6+\ Diss}$	**0**	0.11539	0.000	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	**21**	0.08224	1.727	-	-	
Ammonium	NH_4^+	**0.01**	0.05543	0.001	1.5-35		Odor -taste threshold
Manganese	Mn^{2+}	**0**	0.03641	0.000	0.4		>0.1 affects and stains laundry
Copper	Cu_{Total}	**0.14**	0.03148	0.004	2	2	Taste
Aluminum	Al_{Total}	**0.03**	0.1112	0.003	-	0.2	
Total Iron	Fe^{2+} and Fe^{3+}	**0.06**	0.3581	0.002	0.3	0.3	Taste and odor
Total Arsenic	$As^{3+}$and Ar^{5+}	**0**			0.01	0.05	

Other Components		Mg/l	WHO recommendation	ANSA recommendation	Comments
Silica	SiO_2	**8.8**	-	-	
Hydrogen Sulphide	H_2S	**0**	0.100	-	Taste and odor
Residual Chlorine	Cl_2	**0**	0.2-0.5	0.2-2.5	

Bacteriological Determination

H_2S determination			WHO recommendation	ANSA recommendation	Comments
Total Coliforms	**>250**	Col/100ml	0	-	(Incubation time: 24 hrs @ 37^0)
Fecal coliforms	**>250**	Col/100ml	0	-	(Incubation time: 24 hrs @ 44^0)

Comments and Recommendations (SAR 2.7)

(i) Bacteriological analysis are not pure, disinfection treatment is recommended.

(ii) According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in physical parameters, Turbidity is high.

(iii) According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in chemical determination analysis results, the water is acceptable.

2. Downstream of Dahla Dam

Sample collection: 01/01/2019
GPS Coordinates: Latitude (N): 31.84916667, Longitude (E): 65.87694444

DACAAR Water Quality Analysis Report

Physical Parameters

Physical Parameters					WHO recommendation	ANSA recommendation	
EC	**776**	µS/cm			1500	3000	
TDS*	**534**	mg/l		0.688	1000	2000	* From Conductivity
ORP	**237**	mV					
Turbidity	**1.77**	NTU			5	5	<1 for chlorination
PH	**7.88**				6.5-8	6.5-8.5	<8 for chlorination
^{O}T	**15.6**	^{O}C			-	-	

Chemical Determination

Anions		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Total Alkalinity	(as$CACO_3$)	**300**			-	-	
Alkalinity P	(as$CACO_3$)	**10**			-	-	
Alkalinity M	(as$CACO_3$)	**360**			-	-	
Bicarbonate	HCO_3^-	**340**	0.01639	5.573	-	-	
Carbonate	CO_3^{2-}	**20**	0.03333	0.667	-	-	
Hydroxide	OH^-	**0**	0.05880	0.000	-	-	
Chloride	Cl^-	**24**	0.02820	0.677	250	250	Taste
Sulphate	SO_4^{2-}	**101**	0.02082	2.103	250	250	Taste
sulphide	SO_3^{2-}	**5**	0.02498	0.125	-	-	
sulphide	S^{2-}	**0.01**	0.06250	0.001	-	-	
Fluoride	F^-	**0.71**	0.05263	0.037	1.5	1.5	Fluorosis
Nitrate	NO_3^-	**6.46**	0.01613	0.104	50	50	Blue baby syndrome
Nitrite	NO_2^-	**0.013**	0.02174	0.000	0.2-3	3	Long- short term exposure

Anions		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Phosphate	PO_4^{3-}	**0.07**	0.03159	0.002	-	-	
Boron	B	**0.5**	0.09247	0.046	2.4	2.4	Testicular lesion
Bromide	Br^-	**0.28**	0.01251	0.00	-	-	

Cations		mg/l	Conv	me/l	WHO recommendations	ANSA recommendations	Comments
Total Hardness	as$CACO_3$	**245**			300	500	Taste and incrustation
Calcium	as$CACO_3$	**178**			-	-	
Sodium	Na^+	**86**	0.04348	3.731	200	200	Taste
Potassium	K^+	**2.5**	0.02558	0.064	-	-	
Calcium	Ca^{2+}	**71**	0.0499	3.543	-	-	
Chromium	$Cr_{6+\ Diss}$	**0.01**	0.11539	0.001	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	**24**	0.08224	1.974	-	-	
Ammonium	NH_4^+	**0.22**	0.05543	0.012	1.5-35		Odor -taste threshold
Manganese	Mn^{2+}	**0.006**	0.03641	0.000	0.4		>0.1 affects and stains laundry
Copper	Cu_{Total}	**0.28**	0.03148	0.009	2	2	Taste
Aluminum	Al_{Total}	**0.03**	0.1112	0.003	-	0.2	
Total Iron	Fe^{2+} and Fe^{3+}	**0.03**	0,3581	0,001	0.3	0.3	Taste and odor
Total Arsenic	$As^{3+}$and Ar^{5+}	**0**			0.01	0.05	

Other Components		mg/l	WHO recommendation	ANSA recommendation	
Silica	SiO_2	**14.5**	-	-	
Hydrogen Sulphide	H_2S	**0.0106**	0.100	-	Taste and odor
Residual Chlorine	Cl_2	**0**	0.2-0.5	0.2-2.5	

Bacteriological Determination

H_2S determination			WHO recommendation	ANSA recommendation	
Total Coliforms	**>250**	Col/100ml	0	-	(Incubation time: 24 hrs @ 37^0)
Fecal coliforms	**>250**	Col/100ml	0	-	(Incubation time: 24 hrs @ 44^0)

Comments and Recommendations (SAR 2.2)

(i) <u>Bacteriological analysis are not pure, disinfection treatment is recommended.</u>

(ii) According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in physical parameters and in chemical determination analysis the water is acceptable.

IV. 2019 GROUNDWATER TESTS: AUWSSC OPERATIONAL WATER WELL IN KANDAHAR CITY

1. AUWSSC 1st operational water well in Kandahar city. Mechanical High School, District 2, Kandahar Province

Sample collection: 09/01/2019
GPS Coordinates: Latitude (N): 31.6023611111111, Longitude (E): 65.6925277777778

DACAAR Water Quality Analysis Report

Physical Parameters

Physical Parameters				WHO recommendation	ANSA recommendation	
EC	**744**	µS/cm		1500	3000	
TDS*	**512**	mg/l	**0.688**	1000	2000	* From Conductivity
ORP	**228**	mV				
Turbidity	**1.13**	NTU		5	5	<1 for chlorination
PH	**7.63**			6.5-8	6.5-8.5	<8 for chlorination
^{O}T	**20.6**	^{O}C		-	-	

Chemical Determination

Anions		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Total Alkalinity	as$CACO_3$	**230**			-	-	
Alkalinity P	as$CACO_3$	**5**			-	-	
Alkalinity M	as$CACO_3$	**265**			-	-	
Bicarbonate	HCO_3^-	**255**	0.01639	4.179	-	-	
Carbonate	CO_3^{2-}	**10**	0.03333	0.333	-	-	
Hydroxide	OH^-	**0**	0.05880	0.000	-	-	
Chloride	Cl^-	**55**	0.02820	1.551	250	250	Taste
Sulphate	SO_4^{2-}	**82**	0.02082	1.707	250	250	Taste
sulphide	SO_3^{2-}	**8**	0.02498	0.200	-	-	
sulphide	S^{2-}	**0.01**	0.06250	0.001	-	-	

Anions		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Fluoride	F^-	**0.74**	0.05263	0.039	1.5	1.5	Fluorosis
Nitrate	NO_3^-	**47.8**	0.01613	0.771	50	50	Blue baby syndrome
Nitrite	NO_2^-	**0.07**	0.02174	0.000	0.2-3	3	Long- short term exposure
Phosphate	PO_4^{3-}	**0.06**	0.03159	0.002	-	-	
Boron	B	**0.35**	0.09247	0.032	2.4	2.4	Testicular lesion
Bromide	Br^-	**0.48**	0.01251	0.006	-	-	

Cations		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Total Hardness	($asCACO_3$)	**360**			300	500	Taste and incrustation
Calcium	($asCACO_3$)	**126**			-	-	
Sodium	Na^+	**39**	0.04348	1.705	200	200	Taste
Potassium	K^+	**2.6**	0.02558	0.067	-	-	
Calcium	Ca^{2+}	**50**	0.0499	2.515	-	-	
Chromium	$Cr_{6+\ Diss}$	**0.02**	0.11539	0.002	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	**55**	0.08224	4.523	-	-	
Ammonium	NH_4^+	**0**	0.05543	0.000	1.5-35		Odor -taste threshold
Manganese	Mn^{2+}	**0**	0.03641	0.000	0.4		>0.1 affects and stains laundry
Copper	$Cu\ \_\ _{Total}$	**0.14**	0.03148	0.004	2	2	Taste
Aluminum	$Al\_\ _{Total}$	**0.01**	0.1112	0.001	-	0.2	
Total Iron	Fe^{2+} and Fe^{3+}	**0.11**	0,3581	0,004	0.3	0.3	Taste and odor
Total Arsenic	$As^{3+}$and Ar^{5+}	**0**			0.01	0.05	

Other Components		mg/l	WHO recommendation	ANSA recommendation	Comments
Silica	SiO_2	**25.5**	-	-	
Hydrogen Sulphide	H_2S	**0.0106**	0.100	-	Taste and odor
Residual Chlorine	Cl_2	**0.06**	0.2-0.5	0.2-2.5	

Bacteriological Determination

H_2S determination			WHO recommendation	ANSA recommendation	
Total Coliforms	**0**	Col/100ml	0	-	(Incubation time: 24 hrs @ 37^0)
Fecal coliforms	**0**	Col/100ml	0	-	(Incubation time: 24 hrs @ 44^0)

Comments and Recommendations (SAR 0.9)

(i) Bacteriological analysis are pure.

(ii) According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in physical parameters, the water is acceptable.

(iii) According to WHO recommendation in chemical determination analysis results, Total Hardness is high, but according to Afghanistan National Drinking Water Quality Standards in chemical determination analysis results, the water is acceptable.

2. AUWSSC 3rd operational water well in Kandahar city. AUWSSC Office, District 2, Kandahar City, Kandahar Province

Sample collection: 09/01/2019
GPS Coordinates: Latitude (N): 31.6021111111111, Longitude (E): 65.685125

DACAAR Water Quality Analysis Report

Physical Parameters

Physical Parameters				WHO recommendation	ANSA recommendation	
EC	**802**	µS/cm		1500	3000	
TDS*	**552**	mg/l	0.688	1000	2000	* From Conductivity
ORP	**233**	mV				
Turbidity	**0.25**	NTU		5	5	<1 for chlorination
PH	**7.52**			6.5-8	6.5-8.5	<8 for chlorination
^{O}T	**20.9**	^{O}C		-	-	

Chemical Determination

Anions		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Total Alkalinity	as$CACO_3$	**250**			-	-	
Alkalinity P	as$CACO_3$	**5**			-	-	
Alkalinity M	as$CACO_3$	**355**			-	-	
Bicarbonate	HCO_3^-	**345**	0.01639	5.655	-	-	
Carbonate	CO_3^{2-}	**10**	0.03333	0.333	-	-	
Hydroxide	OH^-	**0**	0.05880	0.000	-	-	
Chloride	Cl^-	**90**	0.02820	2.538	250	250	Taste
Sulphate	SO_4^{2-}	**58**	0.02082	1.208	250	250	Taste
sulphide	SO_3^{2-}	**7**	0.02498	0.175	-	-	
sulphide	S^{2-}	**0.02**	0.06250	0.001	-	-	
Fluoride	F^-	**0.96**	0.05263	0.051	1.5	1.5	Fluorosis
Nitrate	NO_3^-	**49.8**	0.01613	0.803	50	50	Blue baby syndrome

Anions		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Nitrite	NO_2^-	**0.016**	0.02174	0.000	0.2-3	3	Long- short term exposure
Phosphate	PO_4^{3-}	**0.13**	0.03159	0.004	-	-	
Boron	B	**0.35**	0.09247	0.032	2.4	2.4	Testicular lesion
Bromide	Br^-	**0.73**	0.01251	0.009	-	-	

Cations		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Total Hardness	as$CACO_3$	**390**			300	500	Taste and incrustation
Calcium	as$CACO_3$	**123**			-	-	
Sodium	Na^+	**88**	0.04348	3.819	200	200	Taste
Potassium	K^+	**3.4**	0.02558	0.087	-	-	
Calcium	Ca^{2+}	**49**	0.0499	2.455	-	-	
Chromium	$Cr_{6+\ Diss}$	**0**	0.11539	0.000	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	**54**	0.08224	4.441	-	-	
Ammonium	NH_4^+	**0.05**	0.05543	0.003	1.5-35		Odor -taste threshold
Manganese	Mn^{2+}	**0.001**	0.03641	0.000	0.4		>0.1 affects and stains laundry
Copper	$Cu\__{Total}$	**0.02**	0.03148	0.001	2	2	Taste
Aluminum	$Al\__{Total}$	**0**	0.1112	0.000	-	0.2	
Total Iron	Fe^{2+} and Fe^{3+}	**0.12**	0,3581	0.004	0.3	0.3	Taste and odor
Total Arsenic	$As^{3+}$and Ar^{5+}	**0**			0.01	0.05	

Other Components		mg/l	WHO recommendation	ANSA recommendation	Comments
Silica	SiO_2	**22**	-	-	
Hydrogen Sulphide	H_2S	**0.0212**	0.100	-	Taste and odor
Residual Chlorine	Cl_2	**0.08**	0.2-0.5	0.2-2.5	

Bacteriological Determination

H_2S determination			WHO recommendation	ANSA recommendation	Comments
Total Coliforms	**20**	Col/100ml	0	-	(Incubation time: 24 hrs @ 37^0)
Fecal coliforms	**10**	Col/100ml	0	-	(Incubation time: 24 hrs @ 44^0)

Comments and Recommendations (SAR 2.1)

(i) Bacteriological analysis are not pure, disinfection treatment is recommended.

(ii) According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in physical parameters, the water is acceptable.

(iii) According to WHO recommendation in chemical determination analysis results, Total Hardness is high, but according to Afghanistan National Drinking Water Quality Standards in chemical determination analysis results, the water is acceptable.

3. AUWSSC 4th operational water well in Kandahar city. Fazal Kandahari High School, District 8, Kandahar City, Kandahar Province

Sample collection: 09/01/2019
GPS Coordinates: Latitude (N): 31.6201722222222, Longitude (E): 65.67545

DACAAR Water Quality Analysis Report

Physical Parameters

Physical Parameters				WHO recommendation	ANSA recommendation	
EC	**663**	µS/cm		1500	3000	
TDS*	**456**	mg/l	0.688	1000	2000	* From Conductivity
ORP	**221**	mV				
Turbidity	**0.03**	NTU		5	5	<1 for chlorination
PH	**7.85**			6.5-8	6.5-8.5	<8 for chlorination
^{O}T	**20**	^{O}C		-	-	

Chemical Determination

Anions		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Total Alkalinity	(as$CACO_3$)	**185**			-	-	
Alkalinity P	(as$CACO_3$)	**5**			-	-	
Alkalinity M	(as$CACO_3$)	**215**			-	-	
Bicarbonate	HCO_3^-	**205**	0.01639	3.360	-	-	
Carbonate	CO_3^{2-}	**10**	0.03333	0.333	-	-	
Hydroxide	OH^-	**0**	0.05880	0.000	-	-	
Chloride	Cl^-	**27**	0.02820	0.761	250	250	Taste
Sulphate	SO_4^{2-}	**100**	0.02082	2.082	250	250	Taste
sulphide	SO_3^{2-}	**5**	0.02498	0.125	-	-	
sulphide	S^{2-}	**0.02**	0.06250	0.001	-	-	
Fluoride	F^-	**0.95**	0.05263	0.050	1.5	1.5	Fluorosis
Nitrate	NO_3^-	**5.3**	0.01613	0.085	50	50	Blue baby syndrome

Anions		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Nitrite	NO_2^-	**0.001**	0.02174	0.000	0.2-3	3	Long- short term exposure
Phosphate	PO_4^{3-}	**0.07**	0.03159	0.002	-	-	
Boron	B	**0.7**	0.09247	0.065	2.4	2.4	Testicular lesion
Bromide	Br^-	**0.21**	0.01251	0.003	-	-	

Cations		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Total Hardness	($asCACO_3$)	**175**			300	500	Taste and incrustation
Calcium	($asCACO_3$)	**67**			-	-	
Sodium	Na^+	**72**	0.04348	3.151	200	200	Taste
Potassium	K^+	**2.8**	0.02558	0.072	-	-	
Calcium	Ca^{2+}	**27**	0.0499	1.337	-	-	
Chromium	$Cr_{6+\ Diss}$	**0.01**	0.11539	0.001	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	**28**	0.08224	2.303	-	-	
Ammonium	NH_4^+	**0**	0.05543	0.000	1.5-35		Odor -taste threshold
Manganese	Mn^{2+}	**0**	0.03641	0.000	0.4		>0.1 affects and stains laundry
Copper	$Cu\ \_\ _{Total}$	**0.02**	0.03148	0.001	2	2	Taste
Aluminum	$Al\_\ _{Total}$	**0.03**	0.1112	0.003	-	0.2	
Total Iron	Fe^{2+} and Fe^{3+}	**0**	0,3581	0.000	0.3	0.3	Taste and odor
Total Arsenic	$As^{3+}$and Ar^{5+}	**0**			0.01	0.05	

Other Components		mg/l	WHO recommendation	ANSA recommendation	Comments
Silica	SiO_2	**18**	-	-	
Hydrogen Sulphide	H_2S	**0.0212**	0.100	-	Taste and odor
Residual Chlorine	Cl_2	**0**	0.2-0.5	0.2-2.5	

Bacteriological Determination

H_2S determination			WGO recommendation	ANSA recommendation	Comments
Total Coliforms	**>250**	Col/100ml	0	-	(Incubation time: 24 hrs @ 37^0)
Fecal coliforms	**250**	Col/100ml	0	-	(Incubation time: 24 hrs @ 44^0)

Comments and Recommendations (SAR 2.3)

(i) Bacteriological analysis are not pure, disinfection treatment is recommended.

(ii) According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in physical parameters and in chemical determination analysis the water is acceptable.

4. AUWSSC 5th operational water well in Kandahar city. Dand Chowk (Square), District 8, Kandahar City, Kandahar Province

Sample collection: 09/01/2019
GPS Coordinates: Latitude (N): 31.6205555555556, Longitude (E): 65.6766666666667

DACAAR Water Quality Analysis Report

Physical Parameters

Physical Parameters				WHO recommendations	ANSA recommendations	
EC	**732**	µS/cm		1500	3000	
TDS*	**504**	mg/l	0.688	1000	2000	* From Conductivity
ORP	**236**	mV				
Turbidity	**0.56**	NTU		5	5	<1 for chlorination
PH	**7.58**			6.5-8	6.5-8.5	<8 for chlorination
^{O}T	**20.1**	^{O}C		-	-	

Chemical Determination

Anions		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Total Alkalinity	as$CACO_3$	**235**			-	-	
Alkalinity P	as$CACO_3$	**5**			-	-	
Alkalinity M	as$CACO_3$	**285**			-	-	
Bicarbonate	HCO_3^-	**275**	0.01639	4.507	-	-	
Carbonate	CO_3^{2-}	**10**	0.03333	0.333	-	-	
Hydroxide	OH^-	**0**	0.05880	0.000	-	-	
Chloride	Cl^-	**58**	0.02820	1.636	250	250	Taste
Sulphate	SO_4^{2-}	**96**	0.02082	1.999	250	250	Taste
sulphide	SO_3^{2-}	**8**	0.02498	0.200	-	-	
sulphide	S^{2-}	**0.02**	0.06250	0.001	-	-	
Fluoride	F^-	**0.69**	0.05263	0.036	1.5	1.5	Fluorosis
Nitrate	NO_3^-	**32.82**	0.01613	0.529	50	50	Blue baby syndrome

Anions		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Nitrite	NO_2^-	**0.007**	0.02174	0.000	0.2-3	3	Long- short term exposure
Phosphate	PO_4^{3-}	**0.15**	0.03159	0.005	-	-	
Boron	B	**0.45**	0.09247	0.042	2.4	2.4	Testicular lesion
Bromide	Br^-	**0.82**	0.01251	0.010	-	-	

Cations		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Total Hardness	($asCACO_3$)	**250**			300	500	Taste and incrustation
Calcium	($asCACO_3$)	**99**			-	-	
Sodium	Na^+	**72**	0.04348	3.119	200	200	Taste
Potassium	K^+	**3**	0.02558	0.077	-	-	
Calcium	Ca^{2+}	**40**	0.0499	1.976	-	-	
Chromium	$Cr_{6+\ Diss}$	**0.02**	0.11539	0.002	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	**50**	0.08224	4.112	-	-	
Ammonium	NH_4^+	**0**	0.05543	0.000	1.5-35		Odor -taste threshold
Manganese	Mn^{2+}	**0**	0.03641	0.000	0.4		>0.1 affects and stains laundry
Copper	Cu _ Total	**0.16**	0.03148	0.005	2	2	Taste
Aluminum	Al_ Total	**0.01**	0.1112	0.001	-	0.2	
Total Iron	Fe^{2+} and Fe^{3+}	**0.17**	0,3581	0.006	0.3	0.3	Taste and odor
Total Arsenic	$As^{3+}$and Ar^{5+}	**0**			0.01	0.05	

Other Components		mg/l	WHO recommendation	ANSA recommendation	Comments
Silica	SiO_2	**27**	-	-	
Hydrogen Sulphide	H_2S	**0.0212**	0.100	-	Taste and odor
Residual Chlorine	Cl_2	**0.06**	0.2-0.5	0.2-2.5	

Bacteriological Determination

H_2S determination			WHO recommendation	ANSA recommendation	
Total Coliforms	**0**	Col/100ml	0	-	(Incubation time: 24 hrs @ 37^0)
Fecal coliforms	**0**	Col/100ml	0	-	(Incubation time: 24 hrs @ 44^0)

Comments and Recommendations (SAR 1.8)

(i) Bacteriological analysis are pure.
(ii) According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in physical parameters and in chemical determination analysis the water is acceptable.

5. AUWSSC 8th operational water well in Kandahar city. Sra Miasht Clinic, District 14, Kandahar City, Kandahar Province

Sample collection: 09/01/2019
GPS Coordinates: Latitude (N): 31.6200, Longitude (E): 65.7258333333333

DACAAR Water Quality Analysis Report

Physical Parameters

Physical Parameters				WHO recommendation	ANSA recommendation	
EC	**1295**	µS/cm		1500	3000	
TDS*	**891**	mg/l	0.688	1000	2000	* From Conductivity
ORP	**202**	mV				
Turbidity	**0.56**	NTU		5	5	<1 for chlorination
PH	**7.91**			6.5-8	6.5-8.5	<8 for chlorination
^{O}T	**23**	^{O}C		-	-	

Chemical Determination

Anions		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Total Alkalinity	($asCACO_3$)	**200**			-	-	
Alkalinity P	($asCACO_3$)	**10**			-	-	
Alkalinity M	($asCACO_3$)	**240**			-	-	
Bicarbonate	HCO_3^-	**220**	0.01639	3.606	-	-	
Carbonate	CO_3^{2-}	**20**	0.03333	0.667	-	-	
Hydroxide	OH^-	**0**	0.05880	0.000	-	-	
Chloride	Cl^-	**185**	0.02820	5.217	250	250	Taste
Sulphate	SO_4^{2-}	**170**	0.02082	3.539	250	250	Taste
sulphide	SO_3^{2-}	**3**	0.02498	0.075	-	-	
sulphide	S^{2-}	**0**	0.06250	0.000	-	-	
Fluoride	F^-	**0.96**	0.05263	0.051	1.5	1.5	Fluorosis
Nitrate	NO_3^-	**13.92**	0.01613	0.225	50	50	Blue baby syndrome

Anions		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Nitrite	NO_2^-	**0.03**	0.02174	0.001	0.2-3	3	Long- short term exposure
Phosphate	PO_4^{3-}	**0.06**	0.03159	0.002	-	-	
Boron	B	**0.6**	0.09247	0.055	2.4	2.4	Testicular lesion
Bromide	Br^-	**0.48**	0.01251	0.006	-	-	

Cations		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Total Hardness	as$CACO_3$	**145**			300	500	Taste and incrustation
Calcium	as$CACO_3$	**76**			-	-	
Sodium	Na^+	**258**	0.04348	11.220	200	200	Taste
Potassium	K^+	**2.1**	0.02558	0.054	-	-	
Calcium	Ca^{2+}	**15**	0.0499	0.758	-	-	
Chromium	$Cr_{6+\ Diss}$	**0.01**	0.11539	0.001	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	**17**	0.08224	1.398	-	-	
Ammonium	NH_4^+	**0**	0.05543	0.000	1.5-35		Odor -taste threshold
Manganese	Mn^{2+}	**0**	0.03641	0.000	0.4		>0.1 affects and stains laundry
Copper	Cu _ Total	**0.31**	0.03148	0.010	2	2	Taste
Aluminum	Al_ Total	**0.01**	0.1112	0.001	-	0.2	
Total Iron	Fe^{2+} and Fe^{3+}	**0.02**	0,3581	0.001	0.3	0.3	Taste and odor
Total Arsenic	$As^{3+}$and Ar^{5+}	**0**			0.01	0.05	

Other Components		mg/l	WHO recommendation	ANSA recommendation	Comments
Silica	SiO_2	**9.5**	-	-	
Hydrogen Sulphide	H_2S	**0**	0.100	-	Taste and odor
Residual Chlorine	Cl_2	**0**	0.2-0.5	0.2-2.5	

Bacteriological Determination

H_2S determination			WHO recommendation	ANSA recommendation	Comments
Total Coliforms	37	Col/100ml	0	-	(Incubation time: 24 hrs @ 37^0)
Fecal coliforms	17	Col/100ml	0	-	(Incubation time: 24 hrs @ 44^0)

Comments and Recommendations (SAR 10.8)

(i) <u>Bacteriological analysis are not pure, disinfection treatment is recommended.</u>

(ii) According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in physical parameters the water is acceptable.

(iii) According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in chemical determination analysis results, Sodium is above the limit.

6. AUWSSC 10th operational water well in Kandahar city. Mirwais Nika High School, District 14, Kandahar City, Kandahar Province

Sample collection: 09/01/2019
GPS Coordinates: Latitude (N): 31.6208333333333, Longitude (E): 65.7300

DACAAR Water Quality Analysis Report

Physical Parameters

Physical Parameters				WHO recommendations	ANSA recommendations	
EC	**1237**	µS/cm		1500	3000	
TDS*	**851**	mg/l	0.688	1000	2000	* From Conductivity
ORP	**224**	mV				
Turbidity	**0.32**	NTU		5	5	<1 for chlorination
PH	**7.67**			6.5-8	6.5-8.5	<8 for chlorination
^{O}T	**20**	^{O}C		-	-	

Chemical Determination

Anions		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Total Alkalinity	($asCACO_3$)	**270**			-	-	
Alkalinity P	($asCACO_3$)	**10**			-	-	
Alkalinity M	($asCACO_3$)	**290**			-	-	
Bicarbonate	HCO_3^-	**270**	0.01639	4.425	-	-	
Carbonate	CO_3^{2-}	**20**	0.03333	0.667	-	-	
Hydroxide	OH^-	**0**	0.05880	0.000	-	-	
Chloride	Cl^-	**150**	0.02820	4.230	250	250	Taste
Sulphate	SO_4^{2-}	**150**	0.02082	3.123	250	250	Taste
sulphide	SO_3^{2-}	**2**	0.02498	0.050	-	-	
sulphide	S^{2-}	**0**	0.06250	0.000	-	-	
Fluoride	F^-	**0.9**	0.05263	0.047	1.5	1.5	Fluorosis
Nitrate	NO_3^-	**17.04**	0.01613	0.275	50	50	Blue baby syndrome

Anions		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Nitrite	NO_2^-	**0.007**	0.02174	0.000	0.2-3	3	Long- short term exposure
Phosphate	PO_4^{3-}	**0.09**	0.03159	0.003	-	-	
Boron	B	**0.75**	0.09247	0.069	2.4	2.4	Testicular lesion
Bromide	Br^-	**0.35**	0.01251	0.004	-	-	

Cations		Mg/l	Conv	Me/l	WHO recommendation	ANSA recommendation	Comments
Total Hardness	as$CACO_3$	**150**			300	500	Taste and incrustation
Calcium	as$CACO_3$	**63**			-	-	
Sodium	Na^+	**188**	0.04348	8.191	200	200	Taste
Potassium	K^+	**1.3**	0.02558	0.033	-	-	
Calcium	Ca^{2+}	**52**	0.0499	2.605	-	-	
Chromium	$Cr_{6+\ Diss}$	**0**	0.11539	0.000	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	**25**	0.08224	2.056	-	-	
Ammonium	NH_4^+	**0**	0.05543	0.000	1.5-35		Odor -taste threshold
Manganese	Mn^{2+}	**0**	0.03641	0.000	0.4		>0.1 affects and stains laundry
Copper	Cu _ Total	**0.26**	0.03148	0.008	2	2	Taste
Aluminum	Al_ Total	**0**	0.1112	0.000	-	0.2	
Total Iron	Fe^{2+} and Fe^{3+}	**0.02**	0,3581	0.001	0.3	0.3	Taste and odor
Total Arsenic	$As^{3+}$and Ar^{5+}	**0**			0.01	0.05	

Other Components		mg/l	WHO recommendation	ANSA recommendation	Comments
Silica	SiO_2	**6.5**	-	-	
Hydrogen Sulphide	H_2S	**0**	0.100	-	Taste and odor
Residual Chlorine	Cl_2	**0**	0.2-0.5	0.2-2.5	

Bacteriological Determination

H_2S determination			WHO recommendation	ANSA recommendation	Comments
Total Coliforms	**0**	Col/100ml	0	-	(Incubation time: 24 hrs @ 37^0)
Fecal coliforms	**0**	Col/100ml	0	-	(Incubation time: 24 hrs @ 44^0)

Comments and Recommendations (SAR 5.4)

(i) Bacteriological analysis are pure.

(ii) According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in physical parameters and in chemical determination analysis the water is acceptable.

7. AUWSSC 11th operational water well in Kandahar city. Ahmad Shah Baba High School, District 02, Kandahar City, Kandahar Province.

Sample collection: 09/01/2019
GPS Coordinates: Latitude (N): 31.6177777777778, Longitude (E): 65.6672222222222

DACAAR Water Quality Analysis Report

Physical Parameters

Physical Parameters				WHO recommendations	ANSA recommendations	
EC	**839**	µS/cm		1500	3000	
TDS*	**577**	mg/l	0.688	1000	2000	* From Conductivity
ORP	**239**	mV				
Turbidity	**0.61**	NTU		5	5	<1 for chlorination
PH	**7.92**			6.5-8	6.5-8.5	<8 for chlorination
^{O}T	**20.6**	^{O}C		-	-	

Chemical Determination

Anions		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Total Alkalinity	as$CACO_3$	**260**			-	-	
Alkalinity P	as$CACO_3$	**15**			-	-	
Alkalinity M	as$CACO_3$	**310**			-	-	
Bicarbonate	HCO_3^-	**280**	0.01639	4.589	-	-	
Carbonate	CO_3^{2-}	**30**	0.03333	1.000	-	-	
Hydroxide	OH^-	**0**	0.05880	0.000	-	-	
Chloride	Cl^-	**72**	0.02820	2.030	250	250	Taste
Sulphate	SO_4^{2-}	**100**	0.02082	2.082	250	250	Taste
sulphide	SO_3^{2-}	**3**	0.02498	0.075	-	-	
sulphide	S^{2-}	**0.01**	0.06250	0.001	-	-	
Fluoride	F^-	**0.88**	0.05263	0.046	1.5	1.5	Fluorosis
Nitrate	NO_3^-	**29.7**	0.01613	0.479	50	50	Blue baby syndrome

Anions		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Nitrite	NO_2^-	**0.007**	0.02174	0.000	0.2-3	3	Long- short term exposure
Phosphate	PO_4^{3-}	**0.05**	0.03159	0.002	-	-	
Boron	B	**0.7**	0.09247	0.065	2.4	2.4	Testicular lesion
Bromide	Br^-	**0.43**	0.01251	0.005	-	-	

Cations		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Total Hardness	($asCACO_3$)	**115**			300	500	Taste and incrustation
Calcium	($asCACO_3$)	**51**			-	-	
Sodium	Na^+	**172**	0.04348	7.496	200	200	Taste
Potassium	K^+	**1.5**	0.02558	0.038	-	-	
Calcium	Ca^{2+}	**20**	0.0499	1.018	-	-	
Chromium	$Cr_{6+\ Diss}$	**0.02**	0.11539	0.001	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	**22**	0.08224	1.809	-	-	
Ammonium	NH_4^+	**0**	0.05543	0.000	1.5-35		Odor -taste threshold
Manganese	Mn^{2+}	**0**	0.03641	0.000	0.4		>0.1 affects and stains laundry
Copper	$Cu\ \_\ _{Total}$	**0.31**	0.03148	0.010	2	2	Taste
Aluminum	$Al\_\ _{Total}$	**0.01**	0.1112	0.001	-	0.2	
Total Iron	Fe^{2+} and Fe^{3+}	**0.02**	0,3581	0.001	0.3	0.3	Taste and odor
Total Arsenic	$As^{3+}$and Ar^{5+}	**0**			0.01	0.05	

Other Components		mg/l	WHO recommendation	ANSA recommendation	Comments
Silica	SiO_2	**5.5**	-	-	
Hydrogen Sulphide	H_2S	**0.0106**	0.100	-	Taste and odor
Residual Chlorine	Cl_2	**0**	0.2-0.5	0.2-2.5	

Bacteriological Determination

H_2S determination			WHO recommendation	ANSA recommendation	Comments
Total Coliforms	**0**	Col/100ml	0	-	(Incubation time: 24 hrs @ 37^0)
Fecal coliforms	**0**	Col/100ml	0	-	(Incubation time: 24 hrs @ 44^0)

Comments and Recommendations (SAR 8.3)

(i) Bacteriological analysis are pure.

(ii) According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in physical parameters and in chemical determination analysis the water is acceptable.

8. AUWSSC 12th operational water well in Kandahar city. Kandahar Mahbas (Prison), District 8, Kandahar City, Kandahar Province

Sample collection: 09/01/2019
GPS Coordinates: Latitude (N): 31.6177777777778, Longitude (E): 65.6672222222222

DACAAR Water Quality Analysis Report

Physical Parameters

Physical Parameters				WHO recommendation	ANSA recommendation	
EC	**742**	µS/cm		1500	3000	
TDS*	**510**	mg/l	0.688	1000	2000	* From Conductivity
ORP	**176**	mV				
Turbidity	**0.26**	NTU		5	5	<1 for chlorination
PH	**7.62**			6.5-8	6.5-8.5	<8 for chlorination
^{O}T	**19.3**	^{O}C		-	-	

Chemical Determination

Anions		mg/l	Conv	me/l	WHO recommendation	WHO recommendation	Comments
Total Alkalinity	(as$CACO_3$)	**260**			-	-	
Alkalinity P	(as$CACO_3$)	**10**			-	-	
Alkalinity M	(as$CACO_3$)	**305**			-	-	
Bicarbonate	HCO_3^-	**285**	0.01639	4.671	-	-	
Carbonate	CO_3^{2-}	**20**	0.03333	0.667	-	-	
Hydroxide	OH^-	**0**	0.05880	0.000	-	-	
Chloride	Cl^-	**60**	0.02820	1.692	250	250	Taste
Sulphate	SO_4^{2-}	**110**	0.02082	2.290	250	250	Taste
sulphide	SO_3^{2-}	**8**	0.02498	0.200	-	-	
sulphide	S^{2-}	**0.02**	0.06250	0.001	-	-	
Fluoride	F^-	**1.04**	0.05263	0.055	1.5	1.5	Fluorosis
Nitrate	NO_3^-	**23.56**	0.01613	0.380	50	50	Blue baby syndrome

Anions		mg/l	Conv	me/l	WHO recommendation	WHO recommendation	Comments
Nitrite	NO_2^-	**0.013**	0.02174	0.000	0.2-3	3	Long- short term exposure
Phosphate	PO_4^{3-}	**0.15**	0.03159	0.005	-	-	
Boron	B	**0.35**	0.09247	0.032	2.4	2.4	Testicular lesion
Bromide	Br^-	**0.46**	0.01251	0.006	-	-	

Cations		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Total Hardness	($asCACO_3$)	360			300	500	Taste and incrustation
Calcium	($asCACO_3$)	100			-	-	
Sodium	Na^+	87	0.04348	3.789	200	200	Taste
Potassium	K^+	3.4	0.02558	0.087	-	-	
Calcium	Ca^{2+}	40	0.0499	1.996	-	-	
Chromium	$Cr_{6+\ Diss}$	0	0.11539	0.000	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	50	0.08224	4.112	-	-	
Ammonium	NH_4^+	0.06	0.05543	0.003	1.5-35		Odor -taste threshold
Manganese	Mn^{2+}	0	0.03641	0.000	0.4		>0.1 affects and stains laundry
Copper	$Cu\ \_\ _{Total}$	0.14	0.03148	0.004	2	2	Taste
Aluminum	$Al\_\ _{Total}$	0.01	0.1112	0.001	-	0.2	
Total Iron	Fe^{2+} and Fe^{3+}	0.16	0,3581	0.006	0.3	0.3	Taste and odor
Total Arsenic	As^{3+} and Ar^{5+}	0			0.01	0.05	

Other Components		mg/l	WHO recommendation	ANSA recommendation	Comments
Silica	SiO_2	**21.5**	-	-	
Hydrogen Sulphide	H_2S	**0.0212**	0.100	-	Taste and odor
Residual Chlorine	Cl_2	**0.07**	0.2-0.5	0.2-2.5	

Bacteriological Determination

H_2S determination			WHO recommendation	ANSA recommendation	Comments
Total Coliforms	**0**	Col/100ml	0	-	(Incubation time: 24 hrs @ 37^0)
Fecal coliforms	**0**	Col/100ml	0	-	(Incubation time: 24 hrs @ 44^0)

Comments and Recommendations (SAR 2.2)

(i) Bacteriological analysis are pure.

(ii) According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in physical parameters and in chemical determination analysis the water is acceptable.

9. AUWSSC 16th operational water well in Kandahar city. In front of Aino Mina, District 5, Kandahar City, Kandahar Province

Sample collection: 09/01/2019
GPS Coordinates: Latitude (N): 31.6136722222222, Longitude (E): 65.7696638888889

DACAAR Water Quality Analysis Report

Physical Parameters

Physical Parameters				WHO recommendation	ANSA recommendation	
EC	**2460**	µS/cm		1500	3000	
TDS*	**1692**	mg/l	0.688	1000	2000	* From Conductivity
ORP	**208**	mV				
Turbidity	**43.55**	NTU		5	5	<1 for chlorination
PH	**7.77**			6.5-8	6.5-8.5	<8 for chlorination
^{O}T	**26.8**	^{O}C		-	-	

Chemical Determination

Anion		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Total Alkalinity	as$CACO_3$	**225**			-	-	
Alkalinity P	as$CACO_3$	**10**			-	-	
Alkalinity M	as$CACO_3$	**300**			-	-	
Bicarbonate	HCO_3^-	**280**	0.01639	4.589	-	-	
Carbonate	CO_3^{2-}	**20**	0.03333	0.667	-	-	
Hydroxide	OH^-	**0**	0.05880	0.000	-	-	
Chloride	Cl^-	**510**	0.02820	14.382	250	250	Taste
Sulphate	SO_4^{2-}	**380**	0.02082	7.912	250	250	Taste
sulphide	SO_3^{2-}	**12**	0.02498	0.300	-	-	
sulphide	S^{2-}	**0**	0.06250	0.000	-	-	
Fluoride	F^-	**2.5**	0.05263	0.132	1.5	1.5	Fluorosis
Nitrate	NO_3^-	**16.64**	0.01613	0.268	50	50	Blue baby syndrome

Anion		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Nitrite	NO_2^-	**0.003**	0.02174	0.000	0.2-3	3	Long- short term exposure
Phosphate	PO_4^{3-}	**0.03**	0.03159	0.001	-	-	
Boron	B	**0.7**	0.09247	0.065	2.4	2.4	Testicular lesion
Bromide	Br^-	**0.29**	0.01251	0.004	-	-	

Cations		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Total Hardness	as$CACO_3$	**560**			300	500	Taste and incrustation
Calcium	as$CACO_3$	**65**			-	-	
Sodium	Na^+	**453**	0.04348	19.704	200	200	Taste
Potassium	K^+	**9**	0.02558	0.230	-	-	
Calcium	Ca^{2+}	**26**	0.0499	1.297	-	-	
Chromium	$Cr_{6+\ Diss}$	**0.01**	0.11539	0.001	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	**86**	0.08224	7.073	-	-	
Ammonium	NH_4^+	**0.03**	0.05543	0.002	1.5-35		Odor -taste threshold
Manganese	Mn^{2+}	**0**	0.03641	0.000	0.4		>0.1 affects and stains laundry
Copper	Cu _ Total	**0.28**	0.03148	0.009	2	2	Taste
Aluminum	Al_ Total	**0**	0.1112	0.000	-	0.2	
Total Iron	Fe^{2+} and Fe^{3+}	**0.08**	0,3581	0.003	0.3	0.3	Taste and odor
Total Arsenic	$As^{3+}$and Ar^{5+}	**0**			0.01	0.05	

Other Components		Mg/l	WHO recommendation	ANSA recommendation	Comments
Silica	SiO_2	**18**	-	-	
Hydrogen Sulphide	H_2S	**0**	0.100	-	Taste and odor
Residual Chlorine	Cl_2	**0.07**	0.2-0.5	0.2-2.5	

Bacteriological Determination

H_2S determination			WHO recommendation	ANSA recommendation	Comments
Total Coliforms	0	Col/100ml	0	-	(Incubation time: 24 hrs @ 37^0)
Fecal coliforms	0	Col/100ml	0	-	(Incubation time: 24 hrs @ 44^0)

Comments and Recommendations (SAR 9.6)

(i) Bacteriological analysis are pure.

(ii) According to WHO recommendation in physical parameters: EC (Electrical Conductivity), TDS (Total Dissolved Solid) and Turbidity are high, but according to Afghanistan National Drinking Water Quality Standard, only Turbidity is high.

(iii) According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in chemical determination analysis results, Chloride, Sulphate, Fluoride, Total hardness and Sodium are high.

10. AUWSSC 17th operational water well in Kandahar city. AUWSSC Office, District 2, Kandahar City, Kandahar Province

Sample collection: 09/01/2019
GPS Coordinates: Latitude (N): 31.6127777777778, Longitude (E): 65.6891666666667

DACAAR Water Quality Analysis Report

Physical Parameters

Physical Parameters				WHO recommendations	ANSA recommendations	
EC	**785**	µS/cm		1500	3000	
TDS*	**540**	mg/l	0.688	1000	2000	* From Conductivity
ORP	**235**	mV				
Turbidity	**5**	NTU		5	5	<1 for chlorination
PH	**7.55**			6.5-8	6.5-8.5	<8 for chlorination
^{O}T	**20.9**	^{O}C		-	-	

Chemical Determination

Anions		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Total Alkalinity	($asCACO_3$)	**230**			-	-	
Alkalinity P	($asCACO_3$)	**5**			-	-	
Alkalinity M	($asCACO_3$)	**255**			-	-	
Bicarbonate	HCO_3^-	**255**	0.01639	5.655	-	-	
Carbonate	CO_3^{2-}	**10**	0.03333	0.333	-	-	
Hydroxide	OH^-	**0**	0.05880	0.000	-	-	
Chloride	Cl^-	**37**	0.02820	2.538	250	250	Taste
Sulphate	SO_4^{2-}	**67**	0.02082	1.208	250	250	Taste
sulphide	SO_3^{2-}	**4**	0.02498	0.175	-	-	
sulphide	S^{2-}	**0.01**	0.06250	0.001	-	-	
Fluoride	F^-	**0.76**	0.05263	0.051	1.5	1.5	Fluorosis
Nitrate	NO_3^-	**11.5**	0.01613	0.803	50	50	Blue baby syndrome

Anions		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Nitrite	NO_2^-	**0.002**	0.02174	0.000	0.2-3	3	Long- short term exposure
Phosphate	PO_4^{3-}	**0.07**	0.03159	0.004	-	-	
Boron	B	**0.3**	0.09247	0.032	2.4	2.4	Testicular lesion
Bromide	Br^-	**0.27**	0.01251	0.009	-	-	

Cations		mg/l	Conv	me/l	WHO recommendation	ANSA recommendation	Comments
Total Hardness	($asCACO_3$)	**390**			300	500	Taste and incrustation
Calcium	($asCACO_3$)	**115**			-	-	
Sodium	Na^+	**35**	0.04348	3.819	200	200	Taste
Potassium	K^+	**2**	0.02558	0.087	-	-	
Calcium	Ca^{2+}	**46**	0.0499	2.455	-	-	
Chromium	$Cr_{6+\ Diss}$	**00.1**	0.11539	0.000	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	**42**	0.08224	4.441	-	-	
Ammonium	NH_4^+	**0**	0.05543	0.003	1.5-35		Odor -taste threshold
Manganese	Mn^{2+}	**0**	0.03641	0.000	0.4		>0.1 affects and stains laundry
Copper	$Cu\ \_\ _{Total}$	**0.02**	0.03148	0.001	2	2	Taste
Aluminum	$Al\_\ _{Total}$	**0.03**	0.1112	0.000	-	0.2	
Total Iron	Fe^{2+} and Fe^{3+}	**0**	0,3581	0.004	0.3	0.3	Taste and odor
Total Arsenic	$As^{3+}$and Ar^{5+}	**0**			0.01	0.05	

Other Components		mg/l	WHO recommendation	ANSA recommendation	Comments
Silica	SiO_2	**25**	-	-	
Hydrogen Sulphide	H_2S	**0.0106**	0.100	-	Taste and odor
Residual Chlorine	Cl_2	**0**	0.2-0.5	0.2-2.5	

Bacteriological Determination

H_2S determination			WHO recommendation	ANSA recommendation	Comments
Total Coliforms	**11**	Col/100ml	0	-	(Incubation time: 24 hrs @ 37^0)
Fecal coliforms	**11**	Col/100ml	0	-	(Incubation time: 24 hrs @ 44^0)

Comments and Recommendations (SAR 0.9)

(i) <u>Bacteriological analysis are not pure, disinfection treatment is recommended.</u>

(ii) According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in physical parameters, the water is acceptable.

(iii) According to WHO recommendation in chemical determination analysis results, Total Hardness is high, but according to Afghanistan National Drinking Water Quality Standards in chemical determination analysis results, the water is acceptable.

V. RESULTS SUMMARY

The main characteristics of all tests performed in 2017, 2018 and 2019 exceeding either WHO, or Afghanistan standard for physical, chemical or bacteriological characteristic are summarized in the table below.

Sample Location	Sampling date	Physical *turbidity: 5 EC: 1500 (WHO) - 3000 (ANSA)*	Chemical *Chloride: 250 Sulphate: 250 Fluoride: 1.5 Hardness: 300 (WHO) - 500 (ANSA) Sodium: 200 (WHO, ANSA)*	Bacteriological *Total coliforms: 0 (WHO) Fecal coliforms: 0 (WHO)*	Preliminary recommendations
Surface Water					
Close to Intake Tower, Dahla Dam Reservoir, Shah Wali Kot district, Kandahar Province	26/02/2018	Turbidity: 13 NTU	-	?	Disinfection treatment required
	1/01/2019	Turbidity: 60 NTU	-	Total Coliform and Fecal coliform : > 250 col/100ml	
Downstream, Dahla Dam, Shah Wali Kot district, Kandahar Province	26/02/2018	-	-	?	Disinfection treatment required
	1/01/2019	-	-	Total Coliform and Fecal coliform : > 250 col/100ml	
Groundwater Well					
AUWSSC 1st operational water well in Kandahar city. Maikhanik High School, District 2, Kandahar Province	1/11/2017	-	-	?	
	9/01/2019	-	Total Hardness: 360 mg/l	-	
AUWSSC 3rd operational water well in Kandahar city. AUWSSC Office, District 2, Kandahar City	25/10/2017	-	-	?	Disinfection treatment recommended
	9/01/2019	-	Total Hardness: 390 mg/l	Total Coliform: 20 col/100ml Fecal Coliform: 10 col/100ml	
AUWSSC 4th operational water well in Kandahar city. Fazal Kandahari High School, District 8, Kandahar City	31/10/2017	-	-	?	Disinfection treatment required
	9/01/2019	-	-	Total Coliform and Fecal coliform : > 250 col/100ml	
AUWSSC 5th operational water well in Kandahar city. Dand Chowk (Square), District 8, Kandahar City	12/11/2017	-	-	?	
	9/01/2019	-	-	-	
AUWSSC 8th operational water well in Kandahar city. Sra Miasht Clinic, District 14, Kandahar City	30/10/2017	-	-	?	Disinfection treatment recommended
	9/01/2019	-	Sodium: 259 mg/l	Total Coliform: 37 col/100ml Fecal Coliform: 17 col/100ml	
AUWSSC 10th operational water well in Kandahar city. Mirwais Nika High School, District 14, Kandahar City	20/11/2017	-	-	?	
	9/01/2019	-	-	-	

AUWSSC 11th operational water well in Kandahar city. Ahmad Shah Baba High School, District 2, Kandahar City	23/10/2017 9/01/2019	- -	- -	? -	
AUWSSC 12th operational water well in Kandahar city. Kandahar Mahbas (Prison), District 8, Kandahar City	29/11/2017 9/01/2019	- -	- -	? -	
AUWSSC 15th operational water well in Kandahar city. School Aino number 2, Kandahar City	18/11/2017	-	-	?	
AUWSSC 16th operational water well in Kandahar city. In front of Aino Mina, District 5, Kandahar City	7/11/2017 9/01/2019	EC: 2020 µS/cm TDS: 1010 mg/l EC: 2460 µS/cm TDS: 1692 mg/l Turbidity: 43.55 NTU	- Chloride: 510 mg/l Sulphate: 380 mg/l Fluoride: 2.5 mg/l Total Hardness: 560 mg/l Sodium: 453 mg/l	? -	
AUWSSC 17th operational water well in Kandahar city. AUWSSC Office, District 2, Kandahar City	25/10/2017 9/01/2019	- -	- Total Hardness: 390 mg/l	? Total Coliform: 11 col/100ml Fecal Coliform: 11 col/100ml	Disinfection treatment recommended
MPW Well	5/11/2017	TDS: 1088 mg/l	-	?	

Note: (i) WHO and ANSA standards are indicated below the first row for the characteristics exceeded. (ii) 2017 results indicate negative bacteriological results for all tests. This may be incorrect and this test has been classified as invalid.

APPENDIXES

Appendix 1. 2017-2018 Water Quality Analysis Report

د سهیل لویدیځ(کندهار) زون د ښاري اوبو رسولو او کانالیزاسیون ریاست

د لابراتوار مدیریت

WATER QUALITY ANALYSIS REPORT / د اوبو د تجزیې د کیفیت راپور

WATER SOURCE INFORMATION / د اوبو د سرچینې معلومات			
1/8/1396	Sampling Date: د سمپل اخستلو نېټه	1	Report Sr. No: د راپور ورکولو شمیره
9:30 pm	Sampling Time: د سمپل اخستلو وخت		Client Name: د سمپل استولو د خاتګي نوم
1/8/1396	Sample receipt Date: د سمپل د رسیدو نېټه و لابراتوار ته	د احمد شاه بابا لیسې څاه	Water source Add: د اوبو د سرچینې پته
2/8/1396	Date of analysis: د سمپل د لابراتوار نېټه	عمیق څاه	Source of Water: د اوبو د سرچینې ډول
2/8/1396	Reporting Date: د راپور ورکولو نېټه	N: E:	GPS reading: جي پي اس پته

نتیجه Results	حد مجاز Permissible limits	د کټي اخستلو تګ لاره Ref. method	تر ټولو ټیټ اندازه MDL/	واحد/ unit	د اوبو د کیفیت پارامترونه Parameters	شمیره Sr.#
PHYSICAL PARAMETERS / فزیکي پارامترونه						
بې رنګه	Colorless / بې رنګ	Sensory evaluation	-	-	Color / رنګ	1
له نیوکې پرته	له نیوکې پرته Unobjectionable/	Sensory evaluation	-	-	Odor / بوی	2
له نیوکې پرته	له نیوکې پرته Unobjectionable/	Sensory evaluation	-	-	Taste / خوند	3
738	NGVS	APHA, 20th Edition	0.01	µS/cm	E.C	4
7.7	6.5-8.5(ANSA)	APHA, 20th Edition	0.001	-	pH	5
0.9	≤5(ANSA)	APHA, 20th Edition	0.2	NTU	Turbidity / مکدریت	6
20	NGVS	-	-	c	Temperature/ د حرارت درجه	7
CHEMICAL PARAMETERS / کیمیاوي پارامیترونه						
357	1000(ANSA)	APHA, 20th Edition	0.01	ppm	TDS / دحل شوی جامداتو مجموع	8
NT	11(WHO)	APHA, 20th Edition	0.06	ppm	Nitrate(N) / نایتریت	9
NT	0.2 -0.5(ANSA)	APHA, 20th Edition	0.5	ppm	Residual Chlorine/ پاته کلورین	10
NT	1.5(WHO)	APHA, 20th Edition	0.03	ppm	Fluoride / فلوراید	11
NT	0.30(ANSA)	APHA, 20th Edition	0.02	ppm	Total Iron / اوسپنه	12
NT	50(ANSA)	APHA, 20th Edition	10	ppb	Arsenic / ارسنیک	13
NT	200(ANSA)	APHA, 20th Edition	0.2	ppm	Sodium / سودیم	14
0.4	NGVS	APHA, 20th Edition	0.001	g/Kg	Salinity	15
NT	NGVS	APHA, 20th Edition	0.01	mV	Oxidation Reduction Potential (ORP)	16
BACTERIOLOGICAL PARAMETERS / باکتریالوژي پارامترونه						
منفي	-Ve (WHO)	Wagtech	+Ve/-Ve		Total coliform	17
منفي	-Ve (WHO)	Wagtech	+Ve/-Ve		Fecal Coliform / فیکل کلي فارم	18

Abbreviation / مخففات:

WHO=World Health Organization E.C=Electrical Conductivity NGVS=No Guideline Value Set
BDL=Below Detection Level NT=Not Tested ANSA=Afghan National Standard Authority

نتیجه / Results:

کیمیاوي او فزیکي لابراتوار: د نوموړي اوبو سمپل کیمیاوي پارامیترونه معاینه شول او ټول نتایج په لاس راغلل (په ستندر طریقه سره اوبه د استعمال ور دي)

باکتریالوژي لابراتوار : د نوموړي اوبو سمپل باکتریالوژي معاینه تر سره شول او نتایج منفي دي (د درو رکمو باکتریا کلي فارم شتون نلري اوبه د استعمال ور دي)

ترتیب کوونکی: مدیر لابراتوار عبدالدني (ابدل)

تصدیق کوونکی: ...

لاسلیک:

لاسلیک:

د سمپل ټولیدنې (کښینځار) زون د ښاري اوبو رسولو او کانالیزاسیون ریاست

د لابراتوار مدیریت

WATER QUALITY ANALYSIS REPORT / د اوبو د تجزیې د کیفیت راپور

WATER SOURCE INFORMATION / د اوبو د سرچینې معلومات

Report Sr. No: د راپور ورکولو شمیره	2	Sampling Date: د سمپل اخستلو نیټه	3/8/1396
Client Name: د سمپل استولو د خاوند نوم		Sampling Time: د سمپل اخستلو وخت	09:45pm
Water source Add: د اوبو د سرچینې پته	د ریاست څاه	Sample receipt Date: د سمپل د رسیدو نیټه و لابراتوار ته	3/8/1396
Source of Water: د اوبو د سرچینې ډول	عمیق څاه	Date of analysis: د سمپل د لابراتوار نیټه	4/8/1396
GPS reading: جي پي اس پته	N: E:	Reporting Date: د راپور ورکولو نیټه	4/8/1396

شمیره Sr.#	د اوبو د کیفیت پارامترونه Parameters	واحد/ unit	تر ټولو لږ اندازه MDL/	د کښې اخستنې تګ لاره Ref. method	حد مجاز Permissible limits	نتیجه Results
	PHYSICAL PARAMETERS / فزیکي پارامترونه					
1	Color / رنګ	-	-	Sensory evaluation	Colorless / بی رنګه	بی رنګه
2	Odor / بوی	-	-	Sensory evaluation	نه نیوکې پرته Unobjectionable/	له نیوکې پرته
3	Taste / خوند	-	-	Sensory evaluation	نه نیوکې پرته Unobjectionable/	له نیوکې پرته
4	E.C	µS/cm	0.01	APHA, 20th Edition	NGVS	701
5	pH	-	0.001	APHA, 20th Edition	6.5-8.5(ANSA)	7.4
6	Turbidity / مکدریت	NTU	0.2	APHA, 20th Edition	≤5(ANSA)	0.3
7	Temperature/ د حرارت درجه	c	-	-	NGVS	19
	CHEMICAL PARAMETERS / کیمیا وي پارامیترونه					
8	TDS / د حل شوي جامداتو مجموع	ppm	0.01	APHA, 20th Edition	1000(ANSA)	338
9	Nitrate(N) / نایتریت	ppm	0.06	APHA, 20th Edition	11(WHO)	NT
10	Residual Chlorine/ پاته کلورین	ppm	0.5	APHA, 20th Edition	0.2-0.5(ANSA)	NT
11	Fluoride / فلوراید	ppm	0.03	APHA, 20th Edition	1.5(WHO)	NT
12	Total Iron / اوسپنه	ppm	0.02	APHA, 20th Edition	0.30(ANSA)	NT
13	Arsenic / ارسنیک	ppb	10	APHA, 20th Edition	50(ANSA)	NT
14	Sodium / سودیم	ppm	0.2	APHA, 20th Edition	200(ANSA)	NT
15	Salinity	g/Kg	0.001	APHA, 20th Edition	NGVS	0.3
16	Oxidation Reduction Potential (ORP)	mV	0.01	APHA, 20th Edition	NGVS	NT
	BACTERIOLOGICAL PARAMETERS / باکتریالوژي پارامترونه					
17	Total coliform		+Ve/-Ve	Wagtech	-Ve (WHO)	منفي
18	Fecal Coliform / فیکل کلي فارم		+Ve/-Ve	Wagtech	-Ve (WHO)	منفي

Abbreviation / مخففات:

WHO=World Health Organization **E.C**=Electrical Conductivity. **NGVS**=No Guideline Value Set. **BDL**=Below Detection Level. **NT**=Not Tested. **ANSA**=Afghan National Standard Authority

: Results / نتیجه

کیمیاوي او فزیکي لابراتوار: د نوموړي اوبو سمپل کیمیاوي پارامیترونه معاینه شول او لوړ نتایج په لاس راغلل (په سټنډر طریقه سره اوبه د استعمال وړ دي)

باکتریالوژي لابراتوار: د نوموړي اوبو سمپل باکتریالوژي معاینه تر سره شول او نتایج ښي چې (د درو رکمو باکتریا کلي فارم شتون نلري اوبه د استعمال وړ دي)

ترتیب کوونکی: مدیر لابراتوار عبدالنبي (نبیل).

تصدیق کوونکی: عملیاتي آمر عبدالحبیب (بارک)

لاسلیک:

لاسلیک:

د جمهوریت

د سپین لوړنۍ (کندهار) زون د ښاری اوبو رسولو او کانالیزاسیون ریاست

د لابراتوار مدیریت

WATER QUALITY ANALYSIS REPORT / د اوبو د تجزیې د کیفیت راپور

WATER SOURCE INFORMATION / د اوبو د سرچینې معلومات

6/8/1396	Sampling Date: د سمپل اخستلو نیټه	3	Report Sr. No: د راپور ورکولو شمیره
9:30 pm	Sampling Time: د سمپل اخستلو وخت		Client Name: د سمپل استولو د خلکو نوم
6/8/1396	Sample receipt Date: د سمپل د رسیدو نیټه و لابراتوار ته	PRT څاه	Water source Add: د اوبو د سرچینې پته
7/8/1396	Date of analysis: د سمپل د لابراتوار نیټه	عمیق څاه	Source of Water: د اوبو د سرچینې نوع
7/8/1396	Reporting Date: د راپور ورکولو نیټه	N: E:	GPS reading: جی پی اس پته

PHYSICAL PARAMETERS / فزیکي پارامترونه

نتیجه Results	حد مجاز Permissible limits	د کتنې اخستنې تګ لاره Ref. method	تر ټولو لږ اندازه MDL/	واحد/ unit	د اوبو د کیفیت پارامترونه Parameters	شمیره Sr.#
بې رنګه	Colorless / بې رنګه	Sensory evaluation	-	-	Color / رنګ	1
نه نیوکې وړ	نه نیوکې وړ Unobjectionable/	Sensory evaluation	-	-	Odor / بوی	2
نه نیوکې وړ	نه نیوکې وړ Unobjectionable/	Sensory evaluation	-	-	Taste / خوند	3
664	NGVS	APHA, 20th Edition	0.01	µS/cm	E.C	4
7.5	6.5-8.5(ANSA)	APHA, 20th Edition	0.001	-	pH	5
0.7	≤5(ANSA)	APHA, 20th Edition	0.2	NTU	Turbidity / مکدریت	6
20	NGVS	-	-	c	Temperature/ د حرارت درجه	7
CHEMICAL PARAMETERS / کیمیاوي پارامترونه						
321	1000(ANSA)	APHA, 20th Edition	0.01	ppm	TDS / د حل شوي جامداتو مجموع	8
NT	11(WHO)	APHA, 20th Edition	0.06	ppm	Nitrate(N) / نایتریت	9
NT	0.2-0.5(ANSA)	APHA, 20th Edition	0.5	ppm	Residual Chlorine/ پاته کلورین	10
NT	1.5(WHO)	APHA, 20th Edition	0.03	ppm	Fluoride / فلوراید	11
NT	0.30(ANSA)	APHA, 20th Edition	0.02	ppm	Total Iron / اوسپنه	12
NT	50(ANSA)	APHA, 20th Edition	10	ppb	Arsenic / ارسنیک	13
NT	200(ANSA)	APHA, 20th Edition	0.2	ppm	Sodium / سودیم	14
0.3	NGVS	APHA, 20th Edition	0.001	g/Kg	Salinity	15
NT	NGVS	APHA, 20th Edition	0.01	mV	Oxidation Reduction Potential (ORP)	16
BACTERIOLOGICAL PARAMETERS / بکتریالوژي پارامترونه						
منفي	-Ve (WHO)	Wagtech	+Ve/-Ve		Total coliform	17
منفي	-Ve (WHO)	Wagtech	+Ve/-Ve		Fecal Coliform / فیکل کلي فارم	18

Abbreviation / مخففات: WHO=World Health Organization E.C=Electrical Conductivity NGVS=No Guideline Value Set BDL=Below Detection Level NT=Not Tested. ANSA=Afghan National Standard Authority

نتیجه / Results :

کیمیاوي او فزیکي لابراتوار: د نوموړي اوبو سمپل کیمیاوي پارامیترونه معاینه شول او لوړ نتایج په لاس راغلل (په ستندر طریقه سره اوبه د استعمال وړ دي)

بکتریالوژي لابراتوار: د نوموړي اوبو سمپل باکتریالوژي معاینه تر سره شول او نتایج منفي دي (د درو رکمو باکتریا کلي فارم شتون نلري اوبه د استعمال وړ دي)

ترتیب کوونکی: مدیر لابراتوار عبدالغني (...)

لاسلیک:

تصدیق کوونکی: عملیاتو امر عبدالحبیب (بارک)

لاسلیک:

د هیلمند لویدیځ(کشمار) زون د ښاري اوبو رسولو او کانالیزاسیون ریاست

د لابراتوار مدیریت

WATER QUALITY ANALYSIS REPORT / د اوبو د تجزیې د کیفیت راپور

WATER SOURCE INFORMATION / د اوبو د سرچینې معلومات			
8/8/1396	Sampling Date: د سمپل اخستلو نیټه	4	Report Sr. No: د راپور ورکولو شمیره
9:45pm	Sampling Time: د سمپل اخستلو وخت		Client Name: د سمپل استولو د څښتن نوم
8/8/1396	Sample receipt Date: د سمپل د رسیدو نیټه و لابراتوار ته	د سري میاشتې څاه	Water source Add: د اوبو د سرچینې پته
9/8/1396	Date of analysis: د سمپل د لابراتوار نیټه	عمیق څاه	Source of Water: د اوبو د سرچینې ډول
9/8/1396	Reporting Date: د راپور ورکولو نیټه	N: E:	GPS reading: جي پي اس پته

نتیجه Results	حد مجاز Permissible limits	د کتنې اخستنې تګ لاره Ref. method	تر ټولو لږ اندازه MDL/	واحد/ unit	د اوبو د کیفیت پارامترونه Parameters	شمیره Sr.#
PHYSICAL PARAMETERS / فزیکي پارامترونه						
بې رنګه	Colorless / بې رنګ	Sensory evaluation	-	-	Color / رنګ	1
له نیوکې پرته	له نیوکې پرته Unobjectionable/	Sensory evaluation	-	-	Odor / بوی	2
له نیوکې پرته	له نیوکې پرته Unobjectionable/	Sensory evaluation	-	-	Taste / خوند	3
999	NGVS	APHA, 20th Edition	0.01	µS/cm	E.C	4
7.5	6.5-8.5(ANSA)	APHA, 20th Edition	0.001	-	pH	5
0.6	≤5(ANSA)	APHA, 20th Edition	0.2	NTU	Turbidity / مکدریت	6
20	NGVS	-	-	c	Temperature/ د حرارت درجه	7
CHEMICAL PARAMETERS / کیمیاوي پارامیترونه						
277	1000(ANSA)	APHA, 20th Edition	0.01	ppm	TDS / د حل سوي جامداتو مجموع	8
NT	11(WHO)	APHA, 20th Edition	0.06	ppm	Nitrate(N) / نایتریت	9
NT	0.2 -0.5(ANSA)	APHA, 20th Edition	0.5	ppm	Residual Chlorine/ پاته کلورین	10
NT	1.5(WHO)	APHA, 20th Edition	0.03	ppm	Fluoride / فلوراید	11
NT	0.30(ANSA)	APHA, 20th Edition	0.02	ppm	Total Iron / اوسپنه	12
NT	50(ANSA)	APHA, 20th Edition	10	ppb	Arsenic / ارسنیک	13
NT	200(ANSA)	APHA, 20th Edition	0.2	ppm	Sodium / سوډیم	14
0.6	NGVS	APHA, 20th Edition	0.001	g/Kg	Salinity	15
NT	NGVS	APHA, 20th Edition	0.01	mV	Oxidation Reduction Potential (ORP)	16
BACTERIOLOGICAL PARAMETERS / باکتریالوژي پارامترونه						
منفي	-Ve (WHO)	Wagtech	+Ve/-Ve		Total coliform	17
منفي	-Ve (WHO)	Wagtech	+Ve/-Ve		Fecal Coliform / فیکل کلي فارم	18

Abbreviation / مخففات: WHO=World Health Organization E.C=Electrical Conductivity NGVS=No Guideline Value Set. BDL=Below Detection Level NT=Not Tested. ANSA=Afghan National Standard Authority

Results / نتیجه :

کیمیاوي او فزیکي لابراتوار: د نوموړي اوبو سمپل کیمیاوي پارامیترونه معاینه سول او لوړ نتایج په لاس راغلل (په سټندرډ طریقه سره اوبه د استعمال ور دي)

باکتریالوژي لابراتوار: د نوموړي اوبو سمپل باکتریالوژي معاینه تر سره سول او نتایج ښئ چې (د درو رکمو باکتریا کلي فارم شتون نلري اوبه د استعمال ور دي)

ترتیب کوونکی: مدیر لابراتوار عبدالغني (نیل)

تصدیق کوونکی: [illegible]

لاسلیک:

لاسلیک:

د سیمې لوېدیځ(کندهار) زون د ښاري اوبو رسولو او کانالیزیشن ریاست
د لابراتوار مدیریت

WATER QUALITY ANALYSIS REPORT / د اوبو د تجزیې د کیفیت راپور

WATER SOURCE INFORMATION / د اوبو د سرچینې معلومات				
9/5/1396	Sampling Date: د سمپل اخستلو نېټه	5	Report Sr. No: د راپور ورکولو شمیره	
5:30 pm	Sampling Time: د سمپل اخستلو وخت		Client Name: د سمپل استولو د خاوند نوم	
9/5/1396	Sample receipt Date: د سمپل د رسیدو نېټه و لابراتوار ته	فاضل کندهاري لیسې څاه	Water source Add: د اوبو د سرچینې پته	
10/5/1396	Date of analysis: د سمپل د لابراتوار نېټه	عمیق څاه	Source of Water: د اوبو د سرچینې ډول	
10/5/1396	Reporting Date: د راپور ورکولو نېټه	N: E:	GPS reading: جي پي اس پته	

نتیجه Results	حد مجاز Permissible limits	د کتې اخستلو تګ لاره Ref. method	تر ټولو ټیټ اندازه MDL/	واحد/ unit	د اوبو د کیفیت پارامترونه Parameters	شمیره Sr.#
PHYSICAL PARAMETERS / فزیکي پارامترونه						
بې رنګه	Colorless / بې رنګه	Sensory evaluation	-	-	Color / رنګ	1
نه نفرت کوونکې	نه نفرت کوونکې Unobjectionable/	Sensory evaluation	-	-	Odor / بوی	2
نه نفرت کوونکې	نه نفرت کوونکې Unobjectionable/	Sensory evaluation	-	-	Taste / خوند	3
572	NGVS	APHA, 20th Edition	0.01	µS/cm	E.C	4
7.4	6.5-8.5(ANSA)	APHA, 20th Edition	0.001	-	pH	5
0.5	≤5(ANSA)	APHA, 20th Edition	0.2	NTU	Turbidity / مکدریت	6
20	NGVS	-	-	c	Temperature/ د حرارت درجه	7
CHEMICAL PARAMETERS / کیمیاوي پارامیترونه						
290	1000(ANSA)	APHA, 20th Edition	0.01	ppm	TDS / د حل شوي جامداتو مجموع	8
NT	11(WHO)	APHA, 20th Edition	0.06	ppm	Nitrate(N) / نایتریت	9
NT	0.2-0.5(ANSA)	APHA, 20th Edition	0.5	ppm	Residual Chlorine/ پاتې کلورین	10
NT	1.5(WHO)	APHA, 20th Edition	0.03	ppm	Fluoride / فلوراید	11
NT	0.30(ANSA)	APHA, 20th Edition	0.02	ppm	Total Iron / اوسپنه	12
NT	50(ANSA)	APHA, 20th Edition	10	ppb	Arsenic / ارسنیک	13
NT	200(ANSA)	APHA, 20th Edition	0.2	ppm	Sodium / سودیم	14
0.3	NGVS	APHA, 20th Edition	0.001	g/Kg	Salinity	15
NT	NGVS	APHA, 20th Edition	0.01	mV	Oxidation Reduction Potential (ORP)	16
BACTERIOLOGICAL PARAMETERS / باکتریالوژي پارامترونه						
صفر	-Ve (WHO)	Wagtech	+Ve/-Ve		Total coliform	17
صفر	-Ve (WHO)	Wagtech	+Ve/-Ve		Fecal Coliform / فیکل کلي فارم	18

Abbreviation / مخففات: WHO=World Health Organization E.C=Electrical Conductivity NGVS=No Guideline Value Set BDL=Below Detection Level NT=Not Tested. ANSA=Afghan National Standard Authority

نتیجه / Results :
کیمیاوي او فزیکي لابراتوار: د نوموړي اوبو سمپل کیمیاوي پارامیټرونه معاینه سول او لوړ نتایج په لاس راغلل (په ستندر طریقه سره اوبه د استعمال وړ دي)
باکتریالوژي لابراتوار : د نوموړي اوبو سمپل باکتریالوژي معاینه تر سره سول او نتایج منفي دي (د درو رکمو باکتریا کلي فارم شتون نلري اوبه د استعمال وړ دي)

ترتیب کوونکی: مدیر لابراتوار عبدالنبي (نبيل)

تصدیق کوونکی: عملیاتي امر عبدالحبیب (بارک)

لاسلیک:

لاسلیک:

د سهیل لودیځ(کندهار) زون د ښاری اوبو رسولو او کانالیزاسیون ریاست

د لابراتوار مدیریت

WATER QUALITY ANALYSIS REPORT / د اوبو د تجزیې د کیفیت راپور

WATER SOURCE INFORMATION / د اوبو د سرچینې معلومات			
10/8/1396	Sampling Date: د سمپل اخستلو نیټه	6	Report Sr. No: د راپور ورکولو شمیره
9:30 pm	Sampling Time: د سمپل اخستلو وخت		Client Name: د سمپل استولو د څښتن نوم
10/8/1396	Sample receipt Date: د سمپل د رسیدو نیټه و لابراتوار ته	د میخانیک لیسې څاه	Water source Add: د اوبو د سرچینې پته
11/8/1396	Date of analysis: د سمپل د لابراتوار نیټه	عمیق څاه	Source of Water: د اوبو د سرچینې ډول
11/8/1396	Reporting Date: د راپور ورکولو نیټه	N: E:	GPS reading: جی پی اس پته

نتیجه Results	حد مجاز Permissible limits	د ګټو اخستلو تګ لاره Ref. method	تر ټولو لږ اندازه MDL/	واحد/ unit	د اوبو د کیفیت پارامترونه Parameters	شمیره Sr.#
PHYSICAL PARAMETERS / فزیکی پارامترونه						
بې رنګه	Colorless / بې رنګه	Sensory evaluation	-		Color / رنګ	1
نه بیوکی پرته	نه بیوکی پرته Unobjectionable/	Sensory evaluation	-	-	Odor / بوی	2
نه بیوکی پرته	نه بیوکی پرته Unobjectionable/	Sensory evaluation	-	-	Taste / خوند	3
634	NGVS	APHA, 20th Edition	0.01	µS/cm	E.C	4
7.3	6.5-8.5(ANSA)	APHA, 20th Edition	0.001	-	pH	5
0.7	≤5(ANSA)	APHA, 20th Edition	0.2	NTU	Turbidity / مکدریت	6
20	NGVS	-	-	c	Temperature/د حرارت درجه	7
CHEMICAL PARAMETERS / کیمیاوی پارامیترونه						
305	1000(ANSA)	APHA, 20th Edition	0.01	ppm	TDS / دحل سوی جامداتو مجموع	8
NT	11(WHO)	APHA, 20th Edition	0.06	ppm	Nitrate(N) / نایتریت	9
NT	0.2 -0.5(ANSA)	APHA, 20th Edition	0.5	ppm	Residual Chlorine/پاته کلورین	10
NT	1.5(WHO)	APHA, 20th Edition	0.03	ppm	Fluoride / فلوراید	11
NT	0.30(ANSA)	APHA, 20th Edition	0.02	ppm	Total Iron / اوسپنه	12
NT	50(ANSA)	APHA, 20th Edition	10	ppb	Arsenic / ارسنیک	13
NT	200(ANSA)	APHA, 20th Edition	0.2	ppm	Sodium / سودیم	14
0.3	NGVS	APHA, 20th Edition	0.001	g/Kg	Salinity	15
NT	NGVS	APHA, 20th Edition	0.01	mV	Oxidation Reduction Potential (ORP)	16
BACTERIOLOGICAL PARAMETERS / باکتریالوژی پارامترونه						
منفی	-Ve (WHO)	Wagtech	+Ve/-Ve		Total coliform	17
منفی	-Ve (WHO)	Wagtech	+Ve/-Ve		Fecal Coliform / فیکل کلی فرم	18

Abbreviation / مخففات: WHO=World Health Organization E.C=Electrical Conductivity NGVS=No Guideline Value Set BDL=Below Detection Level NT=Not Tested. ANSA=Afghan National Standard Authority

نتیجه / Results :

کیمیاوی او فزیکی لابراتوار: د نوموری اوبو سمپل کیمیاوی پارامیترونه معاینه سول او لور نتایج یې لاس ته راغلل (په ستندر طریقه سره اوبه د استعمال ور دی)

باکتریالوژی لابراتوار : د نوموری اوبو سمپل باکتریالوژی معاینه تر سره سول او نتایج یې چې (د درو رکمو باکتریا کلی فارم شتون نلري اوبه د استعمال ور دی)

ترتیب کوونکی: د لابراتوار مدیر عبدالنبی (نقل)

لاسلیک:

تصدیق کوونکی: عملیاتی امر عبدالحسیب (بارک)

لاسلیک:

د سهیل لویدیځ(کندهار) زون د ښاري اوبو رسولو او کانالیزاسیون ریاست
د لابراتوار مدیریت

WATER QUALITY ANALYSIS REPORT / د اوبو د تجزیې د کیفیت راپور

WATER SOURCE INFORMATION / د اوبو د سرچینې معلومات			
14/8/1396	Sampling Date: د سمپل اخستلو نیټه	7	Report Sr. No: د راپور ورکولو شمیره
9:30 pm	Sampling Time: د سمپل اخستلو وخت	-	Client Name: د سمپل استولو د خاوند نوم
14/8/1396	Sample receipt Date: د سمپل د رسیدو نیټه و لابراتوار ته	د فواید عامې ځاه	Water source Add: د اوبو د سرچینې پته
15/8/1396	Date of analysis: د سمپل د لابراتوار نیټه	عمیق څاه	Source of Water: د اوبو د سرچینې ډول
15/8/1396	Reporting Date: د راپور ورکولو نیټه	N: E:	GPS reading: جی پی اس پته

نتیجه Results	حد مجاز Permissible limits	د کتنې اخستلو ټګ لاره Ref. method	تر ټولو لږ اندازه MDL/	unit /واحد	د اوبو د کیفیت پارامترونه Parameters	شمیره Sr.#
PHYSICAL PARAMETERS / فزیکي پارامترونه						
بې رنګه	Colorless / بې رنګ	Sensory evaluation	-	-	Color / رنګ	1
له نیوکې پرته	له نیوکې پرته Unobjectionable/	Sensory evaluation	-	-	Odor / بوی	2
له نیوکې پرته	له نیوکې پرته Unobjectionable/	Sensory evaluation	-	-	Taste / خوند	3
2160	NGVS	APHA, 20th Edition	0.01	µS/cm	E.C	4
7.2	6.5-8.5(ANSA)	APHA, 20th Edition	0.001	-	pH	5
0.9	≤5(ANSA)	APHA, 20th Edition	0.2	NTU	Turbidity / مکدریت	6
23	NGVS	-	-	c	Temperature/ د حرارت درجه	7
CHEMICAL PARAMETERS / کیمیاوي پارامیترونه						
1088	1000(ANSA)	APHA, 20th Edition	0.01	ppm	TDS / دحل سوي جامداتو مجموع	8
NT	11(WHO)	APHA, 20th Edition	0.06	ppm	Nitrate(N) / نایتریت	9
NT	0.2-0.5(ANSA)	APHA, 20th Edition	0.5	ppm	Residual Chlorine/ پاته کلورین	10
NT	1.5(WHO)	APHA, 20th Edition	0.03	ppm	Fluoride / فلوراید	11
NT	0.30(ANSA)	APHA, 20th Edition	0.02	ppm	Total Iron / اوسپنه	12
NT	50(ANSA)	APHA, 20th Edition	10	ppb	Arsenic / ارسنیک	13
NT	200(ANSA)	APHA, 20th Edition	0.2	ppm	Sodium / سودیم	14
1.1	NGVS	APHA, 20th Edition	0.001	g/Kg	Salinity	15
NT	NGVS	APHA, 20th Edition	0.01	mV	Oxidation Reduction Potential (ORP)	16
BACTERIOLOGICAL PARAMETERS / باکتریالوژي پارامترونه						
منفي	-Ve (WHO)	Wagtech	+Ve/-Ve		Total coliform	17
منفي	-Ve (WHO)	Wagtech	+Ve/-Ve		Fecal Coliform / فیکل کلي فارم	18

Abbreviation / مخففات: WHO=World Health Organization E.C=Electrical Conductivity. NGVS=No Guideline Value Set BDL=Below Detection Level. NT=Not Tested. ANSA=Afghan National Standard Authority

نتیجه / Results :
کیمیاوي او فزیکي لابراتوار: د نوموړي اوبو سمپل کیمیاوي پارامیترونه معاینه سول او لور نتایج په لاس راغلل (په ستندر طریقه سره اوبه د استعمال ور دي)
باکتریالوژي لابراتوار : د نوموړي اوبو سمپل باکتریالوژي معاینه تر سره سول او نتایج ښي چي (د درو رکمو باکتریا کلي فارم شتون نلري اوبه د استعمال ور دي)

ترتیب کوونکی: مدیر لابراتوار عبدالنبي (نبیل)   تصدیق کوونکی: عملیاتي امر عبدالحسیب (بارک)

لاسلیک: لاسلیک:

د سهیل لویدیځ (کندهار) زون د ښاری اوبو رسولو او کانالیزاسیون ریاست

د لابراتوار مدیریت

WATER QUALITY ANALYSIS REPORT / د اوبو د تجزیې د کیفیت رپور

WATER SOURCE INFORMATION / د اوبو د سرچینې معلومات			
16/8/1396	Sampling Date: د سمپل اخستلو نیټه	8	Report Sr. No: د رپور ورکولو شمیره
9:30 pm	Sampling Time: د سمپل اخستلو وخت		Client Name: د سمپل ستولو د خاوند نوم
16/8/1396	Sample receipt Date: د سمپل د رسیدو نیټه و لابراتوار ته	د انصاری مینې څاه	Water source Add: د اوبو د سرچینې پته
17/8/1396	Date of analysis: د سمپل د لابراتوار نیټه	عمیق څاه	Source of Water: د اوبو د سرچینې ډول
17/8/1396	Reporting Date: د رپور ورکولو نیټه	N: E:	GPS reading: جی پی اس پته

نتیجه Results	حد مجاز Permissible limits	د کتې اخستلې ټګ لاره Ref. method	تر ټولو لږ اندازه MDL/	واحد/ unit	د اوبو د کیفیت پارامترونه Parameters	شمیره Sr.#
PHYSICAL PARAMETERS / فزیکي پارامترونه						
بې رنګه	Colorless / بې رنګ	Sensory evaluation	-	-	Color / رنګ	1
له نیوکې پرته	له نیوکې پرته Unobjectionable/	Sensory evaluation	-	-	Odor / بوی	2
له نیوکې پرته	له نیوکې پرته Unobjectionable/	Sensory evaluation	-	-	Taste / خوند	3
2020	NGVS	APHA, 20th Edition	0.01	µS/cm	E.C	4
7.4	6.5-8.5(ANSA)	APHA, 20th Edition	0.001	-	pH	5
0.5	≤5(ANSA)	APHA, 20th Edition	0.2	NTU	Turbidity / مکدریت	6
24	NGVS	-	-	c	Temperature/ د حرارت درجه	7
CHEMICAL PARAMETERS / کیمیاوی پارامیترونه						
1010	1000(ANSA)	APHA, 20th Edition	0.01	ppm	TDS / دحل سوی جامداتو مجموع	8
NT	11(WHO)	APHA, 20th Edition	0.06	ppm	Nitrate(N) / نایتریت	9
NT	0.2-0.5(ANSA)	APHA, 20th Edition	0.5	ppm	Residual Chlorine/ پاتې کلورین	10
NT	1.5(WHO)	APHA, 20th Edition	0.03	ppm	Fluoride / فلوراید	11
NT	0.30(ANSA)	APHA, 20th Edition	0.02	ppm	Total Iron / اوسپنه	12
NT	50(ANSA)	APHA, 20th Edition	10	ppb	Arsenic / ارسنیک	13
NT	200(ANSA)	APHA, 20th Edition	0.2	ppm	Sodium / سوډیم	14
1	NGVS	APHA, 20th Edition	0.001	g/Kg	Salinity	15
NT	NGVS	APHA, 20th Edition	0.01	mV	Oxidation Reduction Potential (ORP)	16
BACTERIOLOGICAL PARAMETERS / باکتریالوژی پارامترونه						
منفی	-Ve (WHO)	Wagtech	+Ve/-Ve		Total coliform	17
منفی	-Ve (WHO)	Wagtech	+Ve/-Ve		Fecal Coliform / فیکل کلی فارم	18

مخففات / Abbreviation: WHO=World Health Organization. E.C=Electrical Conductivity. NGVS=No Guideline Value Set. BDL=Below Detection Level. NT=Not Tested. ANSA=Afghan National Standard Authority

نتیجه / Results :

کیمیاوی او فزیکی لابراتوار: د نوموړی اوبو سمپل کیمیاوی پارامیترونه معاینه سول او لوړ نتایج په لاس راغلل (په ستندر طریقه سره اوبه د استعمال ور دی)

باکتریالوژی لابراتوار : د نوموړی اوبو سمپل باکتریالوژی معاینه تر سره سول او نتایج نې جی (د درو رکمو باکتریا کلی فارم شتون نلری اوبه د استعمال ور دی)

ترتیب کوونکی: مدیر لابراتوار عبدالهادی (نیل)

لاسلیک:

تصدیق کوونکی: مسئول آمر عبدالحبیب (بارک)

لاسلیک:

[illegible]

د سیمه لوییځ(کسعار) زون د ښاري اوبو رسولو او کانالیزاسیون ریاست

د لابراتوار مدیریت

WATER QUALITY ANALYSIS REPORT / د اوبو د تجزیې د کیفیت راپور

WATER SOURCE INFORMATION / د اوبو د سرچینې معلومات				
21/8/1396	Sampling Date: د سمپل اخستلو نېټه	9	Report Sr. No: د راپور ورکولو شمېره	
11:10 pm	Sampling Time: د سمپل اخستلو وخت		Client Name: د سمپل استولو د خاوند نوم	
21/8/1396	Sample receipt Date: د سمپل د رسېدو نېټه و لابراتوار ته	د بند چوک څاه	Water source Add: د اوبو د سرچینې پته	
22/8/1396	Date of analysis: د سمپل د لابراتوار نېټه	عمیق څاه	Source of Water: د اوبو د سرچینې نوع	
22/8/1396	Reporting Date: د راپور ورکولو نېټه	N: E:	GPS reading: جي پي اس پته	

Results / نتیجه	Permissible limits / حد مجاز	Ref. method / د کتنې اخستنې تګ لاره	MDL/ تر ټولو لږ اندازه	unit / واحد	Parameters / د اوبو د کیفیت پارامترونه	Sr.# / شمېره
PHYSICAL PARAMETERS / فزیکي پارامترونه						
بې رنګه	Colorless / بې رنګ	Sensory evaluation	-	-	Color / رنګ	1
له نیوکې پرته	له نیوکې پرته Unobjectionable/	Sensory evaluation	-	-	Odor / بوی	2
له نیوکې پرته	له نیوکې پرته Unobjectionable/	Sensory evaluation	-	-	Taste / خوند	3
610	NGVS	APHA, 20th Edition	0.01	µS/cm	E.C	4
7.3	6.5-8.5(ANSA)	APHA, 20th Edition	0.001	-	pH	5
0.3	≤5(ANSA)	APHA, 20th Edition	0.2	NTU	Turbidity / مکدریت	6
19	NGVS	-	-	c	Temperature/ د حرارت درجه	7
CHEMICAL PARAMETERS / کیمیاوي پارامیترونه						
297	1000(ANSA)	APHA, 20th Edition	0.01	ppm	TDS / د حل شوي جامداتو مجموع	8
NT	11(WHO)	APHA, 20th Edition	0.06	ppm	Nitrate(N) / نایتریت	9
NT	0.2-0.5(ANSA)	APHA, 20th Edition	0.5	ppm	Residual Chlorine/ پاته کلورین	10
NT	1.5(WHO)	APHA, 20th Edition	0.03	ppm	Fluoride / فلوراید	11
NT	0.30(ANSA)	APHA, 20th Edition	0.02	ppm	Total Iron / اوسپنه	12
NT	50(ANSA)	APHA, 20th Edition	10	ppb	Arsenic / ارسنیک	13
NT	200(ANSA)	APHA, 20th Edition	0.2	ppm	Sodium / سودیم	14
0.3	NGVS	APHA, 20th Edition	0.001	g/Kg	Salinity	15
NT	NGVS	APHA, 20th Edition	0.01	mV	Oxidation Reduction Potential (ORP)	16
BACTERIOLOGICAL PARAMETERS / باکتریالوژي پارامترونه						
منفي	-Ve (WHO)	Wagtech	+Ve/-Ve		Total coliform	17
منفي	-Ve (WHO)	Wagtech	+Ve/-Ve		Fecal Coliform / فیکل کلي فارم	18

Abbreviation / مخففات: WHO=World Health Organization. E.C=Electrical Conductivity. NGVS=No Guideline Value Set. BDL=Below Detection Level. NT=Not Tested. ANSA=Afghan National Standard Authority

Results / نتیجه :

کیمیاوي او فزیکي لابراتوار: د نوموړي اوبو سمپل کیمیاوي پارامیترونه معاینه شول او لوړ نتایج به لاس راغلل (په ستندر طریقه سره اوبه د استعمال وړ دي)

باکتریالوژي لابراتوار : د نوموړي اوبو سمپل باکتریالوژي معاینه تر سره شول او نتایج منفي دي (د درو رکمو باکتریا کلي فارم شتون نلري اوبه د استعمال وړ دي)

ترتیب کوونکی: مدیر لابراتوار [illegible]

لاسلیک:

تصدیق کوونکی: [illegible]

لاسلیک:

د ... رياست

د سهیل لوېديځ (کندهار) زون د ښاري اوبو رسولو او کاناليزاسيون رياست

د لابراتوار مديريت

WATER QUALITY ANALYSIS REPORT / د اوبو د تجزيې د کيفيت راپور

WATER SOURCE INFORMATION / د اوبو د سرچينې معلومات			
23/8/1396	Sampling Date: د سمپل اخستلو نېټه	10	Report Sr. No: د راپور ورکولو شميره
9:40 pm	Sampling Time: د سمپل اخستلو وخت		Client Name: د سمپل استولو د خاوند نوم
23/8/1396	Sample receipt Date: د سمپل د رسيدو نېټه و لابراتوار ته	د محبس څاه	Water source Add: د اوبو د سرچينې پته
24/8/1396	Date of analysis: د سمپل د لابراتوار نېټه	عميق څاه	Source of Water: د اوبو د سرچينې ډول
24/8/1396	Reporting Date: د راپور ورکولو نېټه	N: E:	GPS reading: جي پي اس پته

Results نتيجه	Permissible limits حد مجاز	Ref. method د کتنې اخستلو لارې	MDL/ تر ټولو لږ اندازه	unit /واحد	Parameters د اوبو د کيفيت پارامترونه	Sr.# شميره
PHYSICAL PARAMETERS / فزيکي پارامترونه						
بې رنګه	Colorless / بې رنګه	Sensory evaluation	-	-	Color / رنګ	1
نه ليوکې پرته	نه ليوکې پرته Unobjectionable/	Sensory evaluation	-	-	Odor / بوی	2
نه ليوکې پرته	نه ليوکې پرته Unobjectionable/	Sensory evaluation	-	-	Taste / خوند	3
644	NGVS	APHA 20th Edition	0.01	µS/cm	E.C	4
7.3	6.5-8.5(ANSA)	APHA 20th Edition	0.001	-	pH	5
0.3	≤5(ANSA)	APHA 20th Edition	0.2	NTU	Turbidity / مکدريت	6
19	NGVS	-	-	c	Temperature/ د حرارت درجه	7
CHEMICAL PARAMETERS / کيمياوي پارامترونه						
312	1000(ANSA)	APHA 20th Edition	0.01	ppm	TDS / د حل سوي جامداتو مجموع	8
NT	11(WHO)	APHA 20th Edition	0.05	ppm	Nitrate(N) / نايتريت	9
NT	0.2-0.5(ANSA)	APHA 20th Edition	0.5	ppm	Residual Chlorine/ پاته کلورين	10
NT	1.5(WHO)	APHA 20th Edition	0.03	ppm	Fluoride / فلورايد	11
NT	0.30(ANSA)	APHA 20th Edition	0.02	ppm	Total Iron / اوسپنه	12
NT	50(ANSA)	APHA 20th Edition	10	ppb	Arsenic / ارسنيک	13
NT	200(ANSA)	APHA 20th Edition	0.2	ppm	Sodium / سوديم	14
0.3	NGVS	APHA 20th Edition	0.001	g/Kg	Salinity	15
NT	NGVS	APHA 20th Edition	0.01	mV	Oxidation Reduction Potential (ORP)	16
BACTERIOLOGICAL PARAMETERS / باکتريالوژي پارامترونه						
منفي	-Ve (WHO)	Wagtech	+Ve/-Ve		Total coliform	17
منفي	-Ve (WHO)	Wagtech	+Ve/-Ve		Fecal Coliform / فيکل کلي فارم	18

Abbreviation / مخففات:
WHO=World Health Organization E.C=Electrical Conductivity NGVS=No Guideline Value Set
BDL=Below Detection Level NT=Not Tested. ANSA=Afghan National Standard Authority

نتيجه / Results :
کيمياوي او فزيکي لابراتوار: د نوموړي اوبو سمپل کيمياوي پارامترونه معاينه سول او لوړ نتايج په لاس راغلل (په ستندر طريقه سره اوبه د استعمال ور دي)
باکتريالوژي لابراتوار: د نوموړي اوبو سمپل باکتريالوژي معاينه تر سره سول او نتايج ښي چي (د درو رکمو باکتريا کلي فارم شتون نلري اوبه د استعمال ور دي)

ترتيب کوونکی: مدير لابراتوار عبدالنبي (نبيل)

تصديق کوونکی: عملياتي آمر عبدالحبيب (بارک)

لاسليک:

لاسليک:

د ... لوښيې (کندهار) زون د ښارې اوبو رسولو او کاناليزاسيون رياست
د لابراتوار مديريت

WATER QUALITY ANALYSIS REPORT / د اوبو د تجزيې د کيفيت راپور

WATER SOURCE INFORMATION / د اوبو د سرچينې معلومات			
27/8/1396	Sampling Date: د سمپل اخستلو نيټه	11	Report Sr. No: د راپور ورکولو شميره
9:30 pm	Sampling Time: د سمپل اخستلو وخت		Client Name: د سمپل استولو د خاوند نوم
27/8/1396	Sample receipt Date: د سمپل د رسيدو نيټه و لابراتوار ته	عينو دوهم تميزليسي څاه	Water source Add: د اوبو د سرچينې پته
28/8/1396	Date of analysis: د سمپل د لابراتوار نيټه	عميق څاه	Source of Water: د اوبو د سرچينې ډول
28/8/1396	Reporting Date: د راپور ورکولو نيټه	N: E:	GPS reading: جي پي اس پته

نتيجه Results	حد مجاز Permissible limits	د کتنې اخستلو تګ لاره Ref. method	تر ټولو لږ اندازه MDL/	واحد/ unit	د اوبو د کيفيت پارامترونه Parameters	شميره Sr.#
PHYSICAL PARAMETERS / فزيکي پارامترونه						
بې رنګه	Colorless / بې رنګ	Sensory evaluation	-	-	Color / رنګ	1
نه نيوکې پړنه	نه نيوکې پړنه Unobjectionable/	Sensory evaluation	-	-	Odor / بوی	2
نه نيوکې پړنه	نه نيوکې پړنه Unobjectionable/	Sensory evaluation	-	-	Taste / خوند	3
780	NGVS	APHA, 20th Edition	0.01	µS/cm	E.C	4
7.5	6.5-8.5(ANSA)	APHA, 20th Edition	0.001	-	pH	5
0.6	≤5(ANSA)	APHA, 20th Edition	0.2	NTU	Turbidity / مکدريت	6
21	NGVS	-	-	c	Temperature/ د حرارت درجه	7
CHEMICAL PARAMETERS / کيميا وي پارامترونه						
380	1000(ANSA)	APHA, 20th Edition	0.01	ppm	TDS / د حل شوي جامداتو مجموع	8
NT	11(WHO)	APHA, 20th Edition	0.06	ppm	Nitrate(N) / نايتريټ	9
NT	0.2-0.5(ANSA)	APHA, 20th Edition	0.5	ppm	Residual Chlorine/ پاتې کلورين	10
NT	1.5(WHO)	APHA, 20th Edition	0.03	ppm	Fluoride / فلورايډ	11
NT	0.30(ANSA)	APHA, 20th Edition	0.02	ppm	Total Iron / اوسپنه	12
NT	50(ANSA)	APHA, 20th Edition	10	ppb	Arsenic / ارسنيک	13
NT	200(ANSA)	APHA, 20th Edition	0.2	ppm	Sodium / سوډيم	14
0.4	NGVS	APHA, 20th Edition	0.001	g/Kg	Salinity	15
NT	NGVS	APHA, 20th Edition	0.01	mV	Oxidation Reduction Potential (ORP)	16
BACTERIOLOGICAL PARAMETERS / بکتريالوژي پارامترونه						
منفي	-Ve (WHO)	Wagtech	+Ve/-Ve		Total coliform	17
منفي	-Ve (WHO)	Wagtech	+Ve/-Ve		Fecal Coliform / فيکل کلي فارم	18

Abbreviation / مخففات: **WHO**=World Health Organization **E.C**=Electrical Conductivity. **NGVS**=No Guideline Value Set **BDL**=Below Detection Level **NT**=Not Tested. **ANSA**=Afghan National Standard Authority

نتيجه / Results :
کيمياوي او فزيکي لابراتوار: د نوموړي اوبو سمپل کيمياوي پارامترونه **معاينه شول او لوړ** نتايج په لاس راغلل (په سټنډر طريقه سره اوبه د استعمال وړ دي)
بکتريالوژي لابراتوار : د نوموړي اوبو سمپل بکتريالوژي معاينه تر سره شول او نتايج منفي دي (د درو رکمو باکتريا کلي فارم شتون نلري اوبه د استعمال وړ دي)

ترتيب کوونکی: مدير لابراتوار عبدالهادي (ايوب)

لاسليک:

تصديق کوونکی: عملياتي امر عبدالحبيب (بارک)

لاسليک:

د افغانستان اسلامي جمهوري دولت
د افغانستان د ښاري اوبو رسولو او کانالیزاسیون شرکت لوی ریاست
د کندهار ولایت
د سهیل لوېدیځ (کندهار) زون د ښاري اوبو رسولو او کانالیزاسیون ریاست
د لابراتوار مدیریت

WATER QUALITY ANALYSIS REPORT / د اوبو د تجزیې د کیفیت راپور

WATER SOURCE INFORMATION / د اوبو د سرچینې معلومات			
29/8/1396	Sampling Date: د سمپل اخستلو نېټه	12	Report Sr. No: د راپور ورکولو شمیره
10:00 pm	Sampling Time: د سمپل اخستلو وخت		Client Name: د سمپل استولو د خاوند نوم
29/8/1396	Sample receipt Date: د سمپل د رسېدو نېټه و لابراتوار ته	دمیرویس نیکه لیسې څاه	Water source Add: د اوبو د سرچینې پته
30/8/1396	Date of analysis: د سمپل د لابراتوار نېټه	عمیق څاه	Source of Water: د اوبو د سرچینې ډول
30/8/1396	Reporting Date: د راپور ورکولو نېټه	N: E:	GPS reading: جي پي اس پته

Results نتیجه	Permissible limits حد مجاز	Ref. method د کتنې اخستلو تګ لاره	MDL/ تر ټولو لږ اندازه	unit / واحد	Parameters د اوبو د کیفیت پارامترونه	Sr.# شمیره
PHYSICAL PARAMETERS / فزیکي پارامترونه						
بې رنګه	Colorless / بې رنګ	Sensory evaluation	-	-	Color / رنګ	1
له نیوکې پرته	له نیوکې پرته Unobjectionable/	Sensory evaluation	-	-	Odor / بوی	2
له نیوکې پرته	له نیوکې پرته Unobjectionable/	Sensory evaluation	-	-	Taste / خوند	3
1070	NGVS	APHA, 20th Edition	0.01	µS/cm	E.C	4
7.5	6.5-8.5(ANSA)	APHA, 20th Edition	0.001	-	pH	5
0.3	≤5(ANSA)	APHA, 20th Edition	0.2	NTU	Turbidity / مکدریت	6
23	NGVS		-	c	Temperature/ د حرارت درجه	7
CHEMICAL PARAMETERS / کیمیاوي پارامیترونه						
526	1000(ANSA)	APHA, 20th Edition	0.01	ppm	TDS / د حل سوي جامداتو مجموع	8
NT	11(WHO)	APHA, 20th Edition	0.06	ppm	Nitrate(N) / نایتریت	9
NT	0.2-0.5(ANSA)	APHA, 20th Edition	0.5	ppm	Residual Chlorine/ پاته کلورین	10
NT	1.5(WHO)	APHA, 20th Edition	0.03	ppm	Fluoride / فلوراید	11
NT	0.30(ANSA)	APHA, 20th Edition	0.02	ppm	Total Iron / اوسپنه	12
NT	50(ANSA)	APHA, 20th Edition	10	ppb	Arsenic / ارسنیک	13
NT	200(ANSA)	APHA, 20th Edition	0.2	ppm	Sodium / سوډیم	14
0.5	NGVS	APHA, 20th Edition	0.001	g/Kg	Salinity	15
NT	NGVS	APHA, 20th Edition	0.01	mV	Oxidation Reduction Potential (ORP)	16
BACTERIOLOGICAL PARAMETERS / باکتریالوژي پارامترونه						
منفي	-Ve (WHO)	Wagtech	+Ve/-Ve		Total coliform	17
منفي	-Ve (WHO)	Wagtech	+Ve/-Ve		Fecal Coliform / فیکل کلي فارم	18

Abbreviation / مخففات:
WHO=World Health Organization **E.C**=Electrical Conductivity **NGVS**=No Guideline Value Set
BDL=Below Detection Level **NT**=Not Tested. **ANSA**=Afghan National Standard Authority

نتیجه / Results :
کیمیاوي او فزیکي لابراتوار: د نوموړي اوبو سمپل کیمیاوي پارامیترونه معاینه سول او لور نتایج په لاس راغلل (په ستندر طریقه سره اوبه د استعمال ور دی)
باکتریالوژي لابراتوار: د نوموړي اوبو سمپل باکتریالوژي معاینه تر سره سول او نتایج ښي چې (د درو رکمو باکتریا کلي فارم شتون نلري اوبه د استعمال ور دی)

ترتیب کوونکی: مدیر لابراتوار عبدالنبي (نبیل)
لاسلیک:

تصدیق کوونکی: عملیاتي امر عبدالحبیب (بارک)
لاسلیک:

د افغانستان اسلامي جمهوري دولت
د افغانستان د ښاري اوبو رسولو او کانالیزاسیون شرکت لوی ریاست
د کندهار ولایت
د سپین لوبدیځ(کندهار) زون د ښاري اوبو رسولو او کانالیزاسیون ریاست
د لابراتوار مدیریت

WATER QUALITY ANALYSIS REPORT / د اوبو د تجزیې د کیفیت راپور

WATER SOURCE INFORMATION / د اوبو د سرچینې معلومات			
29/8/1396	Sampling Date: د سمپل اخستلو نیټه	12	Report Sr. No: د راپور ورکولو شمیره
10:00 pm	Sampling Time: د سمپل اخستلو وخت		Client Name: د سمپل استولو د خاوند نوم
29/8/1396	Sample receipt Date: د سمپل د رسیدو نیټه و لابراتوار ته	دمیرویس نیکه لیسې ځاه	Water source Add: د اوبو د سرچینې پته
30/8/1396	Date of analysis: د سمپل د لابراتوار نیټه	عمیق ځاه	Source of Water: د اوبو د سرچینې نوع
30/8/1396	Reporting Date: د راپور ورکولو نیټه	N: E:	GPS reading: جی پی اس پته

نتیجه Results	حد مجاز Permissible limits	د کټې اخستنې تګ لاره Ref. method	تر ټولو لږ اندازه MDL/	واحد/ unit	د اوبو د کیفیت پارامترونه Parameters	شمیره Sr.#
		PHYSICAL PARAMETERS / فزیکي پارامترونه				
بې رنګه	Colorless / بې رنګه	Sensory evaluation	-	-	Color / رنګ	1
له نیوکې پرته	له نیوکې پرته Unobjectionable/	Sensory evaluation	-	-	Odor / بوی	2
له نیوکې پرته	له نیوکې پرته Unobjectionable/	Sensory evaluation	-	-	Taste / خوند	3
1070	NGVS	APHA, 20th Edition	0.01	µS/cm	E.C	4
7.5	6.5-8.5(ANSA)	APHA, 20th Edition	0.001	-	pH	5
0.3	≤5(ANSA)	APHA, 20th Edition	0.2	NTU	Turbidity / مکدریت	6
23	NGVS	-	-	C	Temperature/ د حرارت درجه	7
		CHEMICAL PARAMETERS / کیمیاوي پارامیترونه				
526	1000(ANSA)	APHA, 20th Edition	0.01	ppm	TDS / د حل سوي جامداتو مجموع	8
NT	11(WHO)	APHA, 20th Edition	0.06	ppm	Nitrate(N) / نایتریت	9
NT	0.2 -0.5(ANSA)	APHA, 20th Edition	0.5	ppm	Residual Chlorine/ پاته کلورین	10
NT	1.5(WHO)	APHA, 20th Edition	0.03	ppm	Fluoride / فلوراید	11
NT	0.30(ANSA)	APHA, 20th Edition	0.02	ppm	Total Iron / اوسپنه	12
NT	50(ANSA)	APHA, 20th Edition	10	ppb	Arsenic / ارسنیک	13
NT	200(ANSA)	APHA, 20th Edition	0.2	ppm	Sodium / سودیم	14
0.5	NGVS	APHA, 20th Edition	0.001	g/Kg	Salinity	15
NT	NGVS	APHA, 20th Edition	0.01	mV	Oxidation Reduction Potential (ORP)	16
		BACTERIOLOGICAL PARAMETERS / باکتریالوژي پارامیترونه				
منفي	-Ve (WHO)	Wagtech	+Ve/-Ve		Total coliform	17
منفي	-Ve (WHO)	Wagtech	+Ve/-Ve		Fecal Coliform / فیکل کلي فارم	18

Abbreviation / مخففات:
WHO=World Health Organization. **E.C**=Electrical Conductivity. **NGVS**=No Guideline Value Set.
BDL=Below Detection Level. **NT**=Not Tested. **ANSA**=Afghan National Standard Authority.

نتیجه / Results :
کیمیاوي او فزیکي لابراتوار: د ټوموري اوبو سمپل کیمیاوي پارامیترونه معاینه سول او لور نتایج په لاس راغلل (په سټندر طریقه سره اوبه د استعمال ور دي)
باکتریالوژي لابراتوار: د ټوموري اوبو سمپل باکتریالوژي معاینه تر سره سول او نتایج ښي چي (د درو رکمو باکتریا کلي فارم شتون نلري اوبه د استعمال ور دي)

ترتیب کوونکی: مدیر لابراتوار عبدالنبی (نبیل). — **تصدیق کوونکی:** عملیاتي امر عبدالحبیب (بارک)

لاسلیک: — لاسلیک:

د افغانستان اسلامی جمهوری دولت
د افغانستان د ښاری اوبو رسولو او کانالوزاسیون شرکت لوی ریاست
د کندهار ولایت
د سهیل لوېدیځ(کندهار) زون د ښاری اوبو رسولو او کانالوزاسیون ریاست
د لابراتوار مدیریت

WATER QUALITY ANALYSIS REPORT / د اوبو د تجزیې د کیفیت راپور

WATER SOURCE INFORMATION / د اوبو د سرچینې معلومات			
7/11/1396	Sampling Date: د سمپل اخستلو نېټه	1	Report Sr. No: د راپور ورکولو شمیره
2:30pm	Sampling Time: د سمپل اخستلو وخت		Client Name: د سمپل استولو د خلکي نوم
7/11/1396	Sample receipt Date: د سمپل د رسیدو نېټه و لابراتوار نه	د دالي دیم	Water source Add: د اوبو د سرچینې پته
8/11/1396	Date of analysis: د سمپل د لابراتوار نېټه	دیم	Source of Water: د اوبو د سرچینې ډول
8/11/1396	Reporting Date: د راپور ورکولو نېټه	N: E:	GPS reading: جي پي اس پته

PHYSICAL PARAMETERS / فزیکي پارامترونه						
نتیجه Results	حد مجاز Permissible limits	د کتنې اخستنې تګ لاره Ref. method	تر ټولو لږ اندازه MDL/	واحد/ unit	د اوبو د کیفیت پارامترونه Parameters	شمیره Sr.#
بې رنګه	Colorless / بې رنګ	Sensory evaluation	-	-	Color / رنګ	1
له ټوکې پرته	له ټوکې پرته Unobjectionable/	Sensory evaluation	-	-	Odor / بوی	2
له ټوکې پرته	له ټوکې پرته Unobjectionable/	Sensory evaluation	-	-	Taste / خوند	3
384	NGVS	APHA, 20th Edition	0.01	µS/cm	E.C	4
8	6.5-8.5(ANSA)	APHA, 20th Edition	0.001	-	pH	5
13	≤5(ANSA)	APHA, 20th Edition	0.2	NTU	Turbidity / مکدریت	6
16	NGVS	-	-	c	Temperature/ د حرارت درجه	7
CHEMICAL PARAMETERS / کیمیا وی پارامیترونه						
183	1000(ANSA)	APHA, 20th Edition	0.01	ppm	TDS / د حل سوی جامدانو مجموع	8
NT	11(WHO)	APHA, 20th Edition	0.06	ppm	Nitrate(N) / نایټریټ	9
NT	0.2 -0.5(ANSA)	APHA, 20th Edition	0.5	ppm	Residual Chlorine/ پاتې کلورین	10
NT	1.5(WHO)	APHA, 20th Edition	0.03	ppm	Fluoride / فلورایډ	11
NT	0.30(ANSA)	APHA, 20th Edition	0.02	ppm	Total Iron / اوسپنه	12
NT	50(ANSA)	APHA, 20th Edition	10	ppb	Arsenic / ارسنیک	13
NT	200(ANSA)	APHA, 20th Edition	0.2	ppm	Sodium / سودیم	14
0.2	NGVS	APHA, 20th Edition	0.001	g/Kg	Salinity	15
NT	NGVS	APHA, 20th Edition	0.01	mV	Oxidation Reduction Potential (ORP)	16
BACTERIOLOGICAL PARAMETERS / باکټریالوژی پارامترونه						
	-Ve (WHO)	Wagtech	+Ve/-Ve		Total coliform	17
	-Ve (WHO)	Wagtech	+Ve/-Ve		Fecal Coliform / فیکل کلي فارم	18

Abbreviation / مخففات:
WHO=World Health Organization. E.C=Electrical Conductivity. NGVS=No Guideline Value Set.
BDL=Below Detection Level. NT=Not Tested. ANSA=Afghan National Standard Authority.

Results / نتیجه :
کیمیاوی او فزیکي لابراتوار: د ټوموري اوبو سمپل کیمیاوی پارامیترونه معاینه سول او لور نتایج په لاس راغلل
باکټریالوژی لابراتوار : د ټوموري اوبو سمپل باکټریالوژی معاینه تر سره سول

د افغانستان اسلامي جمهوري دولت
د افغانستان د ښاري اوبو رسولو او کانالیزاسیون شرکت لوی ریاست
د کنډهار ولایت
د سهیل لویدیځ(کنډهار) زون د ښاري اوبو رسولو او کانالیزاسیون ریاست
د لابراتوار مدیریت

WATER QUALITY ANALYSIS REPORT / د اوبو د تجزیې د کیفیت راپور

WATER SOURCE INFORMATION / د اوبو د سرچینې معلومات				
7/11/1396	Sampling Date: د سمپل اخستلو نیټه	2	Report Sr. No: د راپور ورکولو شمېره	
2:30pm	Sampling Time: د سمپل اخستلو وخت		Client Name: د سمپل استولو د خاوند نوم	
7/11/1396	Sample receipt Date: د سمپل د رسیدو نیټه و لابراتوار ته	لویه ویاله	Water source Add: د اوبو د سرچینې پته	
8/11/1396	Date of analysis: د سمپل د لابراتوار نیټه	لویه ویاله	Source of Water: د اوبو د سرچینې نوع	
8/11/1396	Reporting Date: د راپور ورکولو نیټه	N: E:	GPS reading: جي پي اس پته	

نتیجه Results	حد مجاز Permissible limits	د کتې اخستلو تګ لاره Ref. method	تر ټولو لږ اندازه MDL/	واحد/ unit	د اوبو د کیفیت پارامترونه Parameters	شمېره Sr.#
PHYSICAL PARAMETERS / فزیکي پارامترونه						
بې رنګه	Colorless / بې رنګ	Sensory evaluation	-	-	Color / رنګ	1
له نیوکې پرته	له نیوکې پرته Unobjectionable/	Sensory evaluation	-	-	Odor / بوی	2
له نیوکې پرته	له نیوکې پرته Unobjectionable/	Sensory evaluation	-	-	Taste / خوند	3
538	NGVS	APHA, 20th Edition	0.01	µS/cm	E.C	4
7.9	6.5-8.5(ANSA)	APHA, 20th Edition	0.001	-	pH	5
1.7	≤5(ANSA)	APHA, 20th Edition	0.2	NTU	Turbidity / مکدریت	6
15	NGVS	-	-	c	Temperature/ د حرارت درجه	7
CHEMICAL PARAMETERS / کیمیاوي پارامترونه						
259	1000(ANSA)	APHA, 20th Edition	0.01	ppm	TDS / دحل سوي جامدات مجموع	8
NT	11(WHO)	APHA, 20th Edition	0.06	ppm	Nitrate(N) / نایتریت	9
NT	0.2 -0.5(ANSA)	APHA, 20th Edition	0.5	ppm	Residual Chlorine/ پاته کلورین	10
NT	1.5(WHO)	APHA, 20th Edition	0.03	ppm	Fluoride / فلوراید	11
NT	0.30(ANSA)	APHA, 20th Edition	0.02	ppm	Total Iron / اوسپنه	12
NT	50(ANSA)	APHA, 20th Edition	10	ppb	Arsenic / ارسنیک	13
NT	200(ANSA)	APHA, 20th Edition	0.2	ppm	Sodium / سوډیم	14
0.3	NGVS	APHA, 20th Edition	0.001	g/Kg	Salinity	15
NT	NGVS	APHA, 20th Edition	0.01	mV	Oxidation Reduction Potential (ORP)	16
BACTERIOLOGICAL PARAMETERS / باکتریالوژي پارامترونه						
منفي	-Ve (WHO)	Wagtech	+Ve/-Ve		Total coliform	17
منفي	-Ve (WHO)	Wagtech	+Ve/-Ve		Fecal Coliform / فیکل کلي فارم	18

مخففات / Abbreviation:
WHO=World Health Organization. E.C=Electrical Conductivity. NGVS=No Guideline Value Set. BDL=Below Detection Level. NT=Not Tested. ANSA=Afghan National Standard Authority.

نتیجه / Results :
کیمیاوي او فزیکي لابراتوار: د نوموړي اوبو سمپل کیمیاوي پارامیترونه معاینه سول او لور نتایج په لاس راغلل (په ستندر طریقه سره اوبه د استعمال وړ دي)
باکتریالوژي لابراتوار : د نوموړي اوبو سمپل باکتریالوژي معاینه تر سره سول او نتایج بنی چی (د درو رکمو باکتریا کلي فارم شتون نلري اوبه د استعمال وړ دي)

ترتیب کوونکی: مدیر لابراتوار عبدالنبی (نبیل).

تصدیق کوونکی: عملیاتي امر عبدالحبیب (پارک)

لاسلیک:

لاسلیک:

Appendix 2. 2019 Water Surface Quality Analysis Report

1. Close to Intake Tower, Dahla Dam Reservoir

DACAAR

WATER QUALITY ANALYSIS REPORT

Project	FCG ANZDEC	**Source**	Dahla Dam	**Analysis n.**	010 /2019
Province	Kandahar	**District**	Shahwali Kot	**Village**	Close to Intake Tower Dahla Dam
Latitude	31.85166667	**Longitude**	65.887500	**Sampled date & time:**	01.01.2019/ 2.40PM
				Sampled by:	Client

Physical parameters				WHO recc	ANSA recc	
EC	653	µS/cm		1500	3000	
TDS *	449	mg/l	0.688	1000	2000	* From Conductivity
ORP	215	mV				
Turbidity	60.01	NTU		5	5	< 1 for chlorination
pH	8.15			6.5 - 8	6.5 - 8.5	< 8 for chlorination
°T	9.8	°C		-	-	

Chemical determination — *Spectrophotometer Paintest 5000*

Anions		mg/l	conv	me/l	WHO recc	ANSA recc	Comments
Total Alkalinity	(as $CaCO_3$)	190			-	-	
Alkalinity P	(as $CaCO_3$)	5			-	-	
Alkalinity M	(as $CaCO_3$)	200			-	-	
Bicarbonate	HCO_3^-	190	0.01639	3.114	-	-	
Carbonate	CO_3^{2-}	10	0.03333	0.333	-	-	
Hydroxide	OH^-	0	0.05880	0.000	-	-	
Chloride	Cl^-	16	0.02820	0.451	250	250	Taste
Sulphate	SO_4^{2-}	134	0.02082	2.790	250	250	Taste
Sulphite	SO_3^{2-}	8	0.02498	0.200	-	-	
Sulphide	S^{2-}	0	0.06250	0.000	-	-	
Fluoride	F^-	0.83	0.05263	0.044	1.5	1.5	Fluorosis
Nitrate	NO_3^-	8.6	0.01613	0.139	50	50	Blue baby syndrom
Nitrite	NO_2^-	0.03	0.02174	0.001	0.2 - 3	3	long - short term exposure
Phosphate	PO_4^{3-}	0.02	0.03159	0.001	-	-	
Boron	B	0.5	0.09247	0.046	2.4	2.4	Testicular lesions
Bromide	Br^-	0.4	0.01251	0.005	-	-	

Cations		mg/l	conv	me/l	WHO recc	ANSA recc	
Total Hardness	(as $CaCO_3$)	186			300	500	Taste and incrustation
Calcium Hardness	(as $CaCO_3$)	90			-	-	
Sodium	Na^+	81	0.04348	3.525	200	200	Taste
Potassium	K^+	2.5	0.02558	0.064	-	-	
Calcium	Ca^{2+}	36	0.0499	1.796	-	-	
Chromium	$Cr^{6+}{}_{diss}$	0	0.11539	0.000	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	21	0.08224	1.727	-	-	
Ammonium	NH_4^+	0.01	0.05543	0.001	1.5 - 35		Odour - taste treshold
Manganese	Mn^{2+}	0	0.03641	0.000	0.4		> 0.1 affects taste and stains laundary
Copper	Cu_{total}	0.14	0.03148	0.004	2	2	Taste
Aluminum	Al_{total}	0.03	0.1112	0.003	-	0.2	
Total iron	Fe^{2+} and Fe^{3+}	0.06	0.03581	0.002	0.3	0.3	Taste and odour
Total Arsenic	As^{3+} and As^{5+}	0			0.01	0.05	

Other components		mg/l	WHO recc	ANSA recc	
Silica	SiO_2	8.8	-	-	
Hydrogen Sulphide	H_2S	0	0.100	-	Taste and odour
Residual Chlorine	Cl_2	0	0.2-0.5	0.2-0.5	

Bacteriological Determination

			WHO recc	ANSA recc	
H_2S determination		Y/N	N	-	
Total Coliforms	> 250	Col/100 ml	0	-	(Incubation time: 24 hrs @ 37°)
Fecal coliforms (e-Coli)	> 250	Col/100 ml	0	0	(Incubation time: 24 hrs @ 44°)

Comments & recommendations — SAR 2.7

Bacteriological analysis are not pure disinfection treatment is recommended.

According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in physical parameters, Turbidity is high.

According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in chemical determination analysis results, the water is acceptable.

WET CENTRE — Water Quality Control — DACAAR

Analyzed by: [signature]

Date: 06, 01, 2019

Checked by: [signature]

Date: 01, 01, 2019.

2. Downstream of Dahla Dam

DACAAR

WATER QUALITY ANALYSIS REPORT

Project	FCG ANZDEC	Source	Dahla Dam	Analysis n.	009 /2019
Province	Kandahar	District	Shahwali Kot	Village	Downstream. Dahla Dam
Latitude	31.84916667	Longitude	65.87694444	Sampled date & time:	01.01.2019/ 3.15PM
				Sampled by:	Client

Physical parameters

				WHO recc	ANSA recc	
EC	776	µS/cm		1500	3000	
TDS *	534	mg/l	0.688	1000	2000	* From Conductivity
ORP	237	mV				
Turbidity	1.77	NTU		5	5	< 1 for chlorination
pH	7.88			6.5 - 8	6.5 - 8.5	< 8 for chlorination
°T	15.8	°C		-	-	

Chemical determination

Spectrophotometer Palintest 8000

Anions		mg/l	conv	me/l	WHO recc	ANSA recc	Comments
Total Alkalinity	(as $CaCO_3$)	300			-	-	
Alkalinity P	(as $CaCO_3$)	10			-	-	
Alkalinity M	(as $CaCO_3$)	360			-	-	
Bicarbonate	HCO_3^-	340	0.01639	5.573	-	-	
Carbonate	CO_3^{2-}	20	0.03333	0.667	-	-	
Hydroxide	OH^-	0	0.05680	0.000	-	-	
Chloride	Cl^-	24	0.02820	0.677	250	250	Taste
Sulphate	SO_4^{2-}	101	0.02082	2.103	250	250	Taste
Sulphite	SO_3^{2-}	5	0.02498	0.125	-	-	
Sulphide	S^{2-}	0.01	0.06250	0.001	-	-	
Fluoride	F^-	0.71	0.05263	0.037	1.5	1.5	Fluorosis
Nitrate	NO_3^-	6.46	0.01613	0.104	50	50	Blue baby syndrom
Nitrite	NO_2^-	0.013	0.02174	0.000	0.2 - 3	3	long - short term exposiure
Phosphate	PO_4^{3-}	0.07	0.03159	0.002	-	-	
Boron	B	0.5	0.09247	0.046	2.4	2.4	Testicular lesions
Bromide	Br^-	0.28	0.01251	0.004	-	-	

Cations		mg/l	conv	me/l	WHO recc	ANSA recc	
Total Hardness	(as $CaCO_3$)	245			300	500	Taste and incrustation
Calcium Hardness	(as $CaCO_3$)	178			-	-	
Sodium	Na^+	86	0.04348	3.731	200	200	Taste
Potassium	K^+	2.5	0.02558	0.064	-	-	
Calcium	Ca^{2+}	71	0.0499	3.543	-	-	
Chromium	Cr^{3+} diss	0.01	0.11539	0.001	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	24	0.08224	1.974	-	-	
Ammonium	NH_4^+	0.22	0.05543	0.012	1.5 - 35		Odour - teste treshold
Manganese	Mn^{2+}	0.006	0.03641	0.000	0.4		> 0.1 affects taste and stains laundary
Copper	Cu_{total}	0.28	0.03148	0.009	2	2	Taste
Aluminum	Al_{total}	0.03	0.1112	0.003	-	0.2	
Total Iron	Fe^{2+} and Fe^{3+}	0.03	0.03581	0.001	0.3	0.3	Taste and odour
Total Arsenic	As^{3+} and As^{5+}	0			0.01	0.05	

Other components		mg/l	WHO recc	ANSA recc	
Silica	SiO_2	14.5	-	-	
Hydrogen Sulphide	H_2S	0.0106	0.100	-	Taste and odour
Residual Chlorine	Cl_2	0	0.2-0.5	0.2-0.5	

Bacteriological Determination

H_2S determination		Y/N	WHO recc	ANSA recc	
			N	-	
Total Coliforms	> 250	Col/100 ml	0	-	(incubation time: 24 hrs @ 37°)
Fecal coliforms (e-Coli)	> 250	Col/100 ml	0	0	(incubation time: 24 hrs @ 44°)

Comments & recommendations

SAR 2.2

Bacteriological analysis are not pure disinfection treatment is recommended.

According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in physical parameters, and in chemical determination analysis results, the water is acceptable.

Analyzed by: .....

Date: 06.01.2019

Checked by: .....

Date: 07.01.2019.

Appendix 3. 2019 Groundwater Quality Analysis Report

1. AUWSSC 1st operational water well in Kandahar city. Mechanical High School, District 2, Kandahar Province

DACAAR

WATER QUALITY ANALYSIS REPORT

Project	FCG ANZDEC	Source	Tube Well	Analysis n.	39 /2019
Province	Kandahar	District	02nd	Village	Mechanic High School
Latitude	31.3685	Longitude	65.41331	Sampled date & time:	09.01.2019
				Sampled by:	Client

Physical parameters

				WHO recc	ANSA recc	
EC	744	µS/cm		1500	3000	
TDS *	512	mg/l	0.688	1000	2000	* From Conductivity
ORP	228	mV				
Turbidity	0.13	NTU		5	5	< 1 for chlorination
pH	7.63			6.5 - 8	6.5 - 8.5	< 8 for chlorination
T	20.6	°C		-	-	

Chemical determination

Spectrophotometer Palintest 8000

Anions		mg/l	conv	mel	WHO recc	ANSA recc	Comments
Total Alkalinity	(as $CaCO_3$)	230			-	-	
Alkalinity P	(as $CaCO_3$)	5			-	-	
Alkalinity M	(as $CaCO_3$)	265			-	-	
Bicarbonate	HCO_3^-	255	0.01639	4.179	-	-	
Carbonate	CO_3^{2-}	10	0.03333	0.333	-	-	
Hydroxide	OH^-	0	0.05880	0.000	-	-	
Chloride	Cl^-	55	0.02820	1.551	250	250	Taste
Sulphate	SO_4^{2-}	82	0.02092	1.707	250	250	Taste
Sulphite	SO_3^{2-}	6	0.03498	0.200	-	-	
Sulphide	S^{2-}	0.01	0.06200	0.001	-	-	
Fluoride	F^-	0.74	0.05263	0.039	1.5	1.5	Fluorosis
Nitrate	NO_3^-	47.8	0.01613	0.771	50	50	Blue baby syndrom
Nitrite	NO_2^-	0.007	0.02174	0.000	0.2 - 3	3	long - short term exposition
Phosphate	PO_4^{3-}	0.06	0.03159	0.002	-	-	
Boron	B	0.35	0.09247	0.032	2.4	2.4	Testicular lesions
Bromide	Br^-	0.48	0.01251	0.006	-	-	

Cations		mg/l	conv	mel	WHO recc	ANSA recc	
Total Hardness	(as $CaCO_3$)	360			300	500	Taste and incrustation
Calcium Hardness	(as $CaCO_3$)	126			-	-	
Sodium	Na^+	39	0.04348	1.705	200	200	Taste
Potassium	K^+	2.6	0.02558	0.067	-	-	
Calcium	Ca^{2+}	50	0.0499	2.515	-	-	
Chromium	Cr^{2+} diss.	0.02	0.11539	0.002	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	55	0.08224	4.523	-	-	
Ammonium	NH_4^+	0	0.05543	0.000	1.5 - 35		Odour - taste treshold
Manganese	Mn^{2+}	0	0.03641	0.000	0.4		> 0.1 affects taste and stains laundery
Copper	Cu_{total}	0.14	0.03148	0.004	2	2	Taste
Aluminum	Al_{total}	0.01	0.1112	0.001	-	0.2	
Total iron	Fe^{2+} and Fe^{3+}	0.11	0.03581	0.004	0.3	0.3	Taste and odour
Total Arsenic	As^{3+} and As^{5+}	0			0.01	0.05	

Other components		mg/l	WHO recc	ANSA recc	
Silica	SiO_2	25.5	-	-	
Hydrogen Sulphide	H_2S	0.0108	0.100	-	Taste and odour
Residual Chlorine	Cl_2	0.06	0.2-0.5	0.2-0.5	

Bacteriological Determination

H_2S determination		Y/N	WHO recc	ANSA recc	
			N	-	
Total Coliforms	0	Col/100 ml	0	-	(Incubation time: 24 hrs @ 37°)
Fecal coliforms (e-Coli)	0	Col/100 ml	0	0	(Incubation time: 24 hrs @ 44°)

Comments & recommendations — SAR 0.9

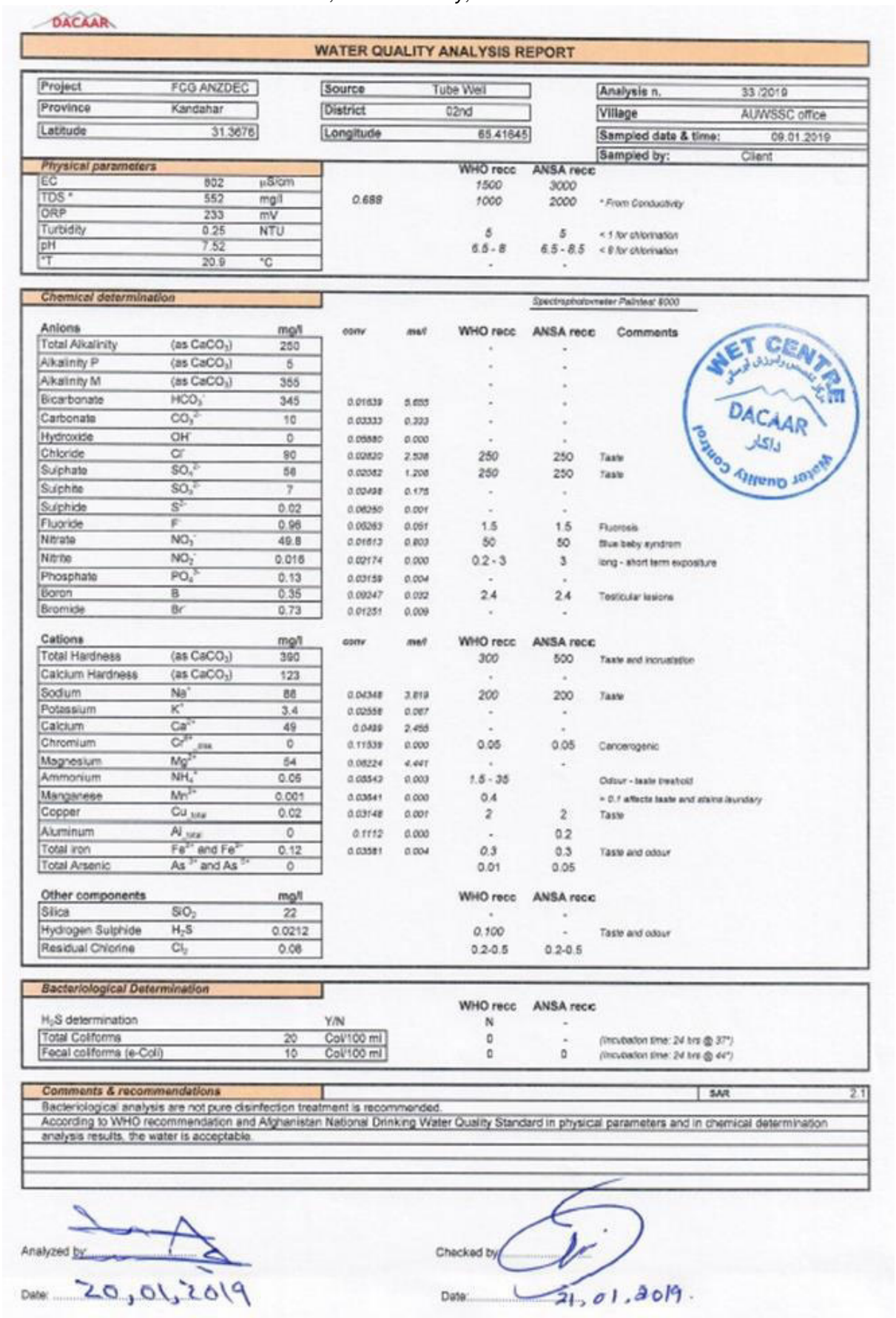
Bacteriological analysis are pure.
According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in physical parameters, the water is acceptable.
According to WHO recommendation in chemical determination analysis results, Total Hardness is high, but according to Afghanistan National Drinking Water Quality Standard in chemical determination analysis results, the water is acceptable.

WET CENTRE — DACAAR — Water Quality Control

Analyzed by: _____ Date: 20,01,2019

Checked by: _____ Date: 21,01,2019.

2. AUWSSC 3rd operational water well in Kandahar city. AUWSSC Office, District 2, Kandahar City, Kandahar Province



DACAAR

WATER QUALITY ANALYSIS REPORT

Project	FCG ANZDEC	Source	Tube Well	Analysis n.	33 /2019
Province	Kandahar	District	02nd	Village	AUWSSC office
Latitude	31.3676	Longitude	65.41645	Sampled date & time:	09.01.2019
				Sampled by:	Client

Physical parameters

				WHO recc	ANSA recc	
EC	802	µS/cm		1500	3000	
TDS *	552	mg/l	0.688	1000	2000	* From Conductivity
ORP	233	mV				
Turbidity	0.25	NTU		5	5	< 1 for chlorination
pH	7.52			6.5 - 8	6.5 - 8.5	< 8 for chlorination
°T	20.9	°C		-	-	

Chemical determination

Spectrophotometer Palintest 8000

Anions		mg/l	conv	me/l	WHO recc	ANSA recc	Comments
Total Alkalinity	(as $CaCO_3$)	250			-	-	
Alkalinity P	(as $CaCO_3$)	5			-	-	
Alkalinity M	(as $CaCO_3$)	355			-	-	
Bicarbonate	HCO_3^-	345	0.01639	5.655	-	-	
Carbonate	CO_3^{2-}	10	0.03333	0.333	-	-	
Hydroxide	OH^-	0	0.05880	0.000	-	-	
Chloride	Cl^-	90	0.02820	2.538	250	250	Taste
Sulphate	SO_4^{2-}	58	0.02052	1.206	250	250	Taste
Sulphite	SO_3^{2-}	7	0.02498	0.175	-	-	
Sulphide	S^{2-}	0.02	0.06250	0.001	-	-	
Fluoride	F^-	0.96	0.05263	0.051	1.5	1.5	Fluorosis
Nitrate	NO_3^-	49.8	0.01613	0.803	50	50	Blue baby syndrom
Nitrite	NO_2^-	0.016	0.02174	0.000	0.2 - 3	3	long - short term exposure
Phosphate	PO_4^{3-}	0.13	0.03159	0.004	-	-	
Boron	B	0.35	0.09247	0.032	2.4	2.4	Testicular lesions
Bromide	Br^-	0.73	0.01251	0.009	-	-	

Cations		mg/l	conv	me/l	WHO recc	ANSA recc	
Total Hardness	(as $CaCO_3$)	390			300	500	Taste and incrustation
Calcium Hardness	(as $CaCO_3$)	123			-	-	
Sodium	Na^+	88	0.04348	3.819	200	200	Taste
Potassium	K^+	3.4	0.02558	0.087	-	-	
Calcium	Ca^{2+}	49	0.0499	2.456	-	-	
Chromium	Cr^{6+} total	0	0.11539	0.000	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	54	0.08224	4.441	-	-	
Ammonium	NH_4^+	0.05	0.05543	0.003	1.5 - 35		Odour - taste treshold
Manganese	Mn^{2+}	0.001	0.03641	0.000	0.4		> 0.1 affects taste and stains laundary
Copper	Cu total	0.02	0.03148	0.001	2	2	Taste
Aluminum	Al total	0	0.1112	0.000	-	0.2	
Total iron	Fe^{3+} and Fe^{2+}	0.12	0.03581	0.004	0.3	0.3	Taste and odour
Total Arsenic	As^{3+} and As^{5+}	0			0.01	0.05	

Other components		mg/l	WHO recc	ANSA recc	
Silica	SiO_2	22	-	-	
Hydrogen Sulphide	H_2S	0.0212	0.100	-	Taste and odour
Residual Chlorine	Cl_2	0.06	0.2-0.5	0.2-0.5	

Bacteriological Determination

			WHO recc	ANSA recc	
H_2S determination		Y/N	N	-	
Total Coliforms	20	Col/100 ml	0	-	(Incubation time: 24 hrs @ 37°)
Fecal coliforms (e-Coli)	10	Col/100 ml	0	0	(Incubation time: 24 hrs @ 44°)

Comments & recommendations

SAR 2.1

Bacteriological analysis are not pure disinfection treatment is recommended.
According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in physical parameters and in chemical determination analysis results, the water is acceptable.

WET CENTRE — DACAAR — Water Quality Control

Analyzed by: ..... Date: 20,01,2019

Checked by: ..... Date: 21,01,2019.

3. AUWSSC 4th operational water well in Kandahar city. Fazal Kandahari High School, District 8, Kandahar City, Kandahar Province

DACAAR

WATER QUALITY ANALYSIS REPORT

Project	FCG ANZDEC	Source	Tube Well	Analysis n.	35 /2019
Province	Kandahar	District	8th	Village	Fazal Kandahari High School
Latitude	31.371262	Longitude	65.403162	Sampled date & time:	09.01.2019
				Sampled by:	Client

Physical parameters

				WHO recc	ANSA recc	
EC	663	µS/cm		1500	3000	
TDS *	456	mg/l	0.688	1000	2000	* From Conductivity
ORP	221	mV				
Turbidity	0.03	NTU		5	5	< 1 for chlorination
pH	7.85			6.5 - 8	6.5 - 8.5	< 8 for chlorination
°T	20	°C		-	-	

Chemical determination

Spectrophotometer Palintest 8000

Anions		mg/l	conv	me/l	WHO recc	ANSA recc	Comments
Total Alkalinity	(as $CaCO_3$)	185			-	-	
Alkalinity P	(as $CaCO_3$)	5			-	-	
Alkalinity M	(as $CaCO_3$)	215			-	-	
Bicarbonate	HCO_3^-	205	0.01639	3.360	-	-	
Carbonate	CO_3^{2-}	10	0.03333	0.333	-	-	
Hydroxide	OH^-	0	0.05880	0.000	-	-	
Chloride	Cl^-	27	0.02820	0.761	250	250	Taste
Sulphate	SO_4^{2-}	100	0.02092	2.092	250	250	Taste
Sulphite	SO_3^{2-}	5	0.02498	0.125	-	-	
Sulphide	S^{2-}	0.02	0.06250	0.001	-	-	
Fluoride	F^-	0.95	0.05263	0.050	1.5	1.5	Fluorosis
Nitrate	NO_3^-	5.3	0.01613	0.085	50	50	Blue baby syndrom
Nitrite	NO_2^-	0.001	0.02174	0.000	0.2 - 3	3	long - short term expositure
Phosphate	PO_4^{3-}	0.07	0.03159	0.002	-	-	
Boron	B	0.7	0.08247	0.065	2.4	2.4	Testicular lesions
Bromide	Br^-	0.21	0.01251	0.003	-	-	

Cations		mg/l	conv	me/l	WHO recc	ANSA recc	
Total Hardness	(as $CaCO_3$)	175			300	500	Taste and incrustation
Calcium Hardness	(as $CaCO_3$)	67			-	-	
Sodium	Na^+	72	0.04348	3.151	200	200	Taste
Potassium	K^+	2.8	0.02558	0.072	-	-	
Calcium	Ca^{2+}	27	0.0499	1.337	-	-	
Chromium	Cr^{3+} tot	0.01	0.11539	0.001	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	28	0.08224	2.303	-	-	
Ammonium	NH_4^+	0	0.05543	0.000	1.5 - 35		Odour - taste treshold
Manganese	Mn^{2+}	0	0.03641	0.000	0.4		> 0.1 affects taste and stains laundary
Copper	Cu_{total}	0.02	0.03148	0.001	2	2	Taste
Aluminum	Al_{total}	0.03	0.1112	0.003	-	0.2	
Total iron	Fe^{2+} and Fe^{3+}	0	0.03581	0.000	0.3	0.3	Taste and odour
Total Arsenic	As^{3+} and As^{5+}	0			0.01	0.05	

Other components		mg/l	WHO recc	ANSA recc	
Silica	SiO_2	18	-	-	
Hydrogen Sulphide	H_2S	0.0212	0.100	-	Taste and odour
Residual Chlorine	Cl_2	0	0.2-0.5	0.2-0.5	

Bacteriological Determination

H_2S determination		Y/N	WHO recc	ANSA recc	
		N	-	-	
Total Coliforms	>250	Col/100 ml	0	-	(Incubation time: 24 hrs @ 37°)
Fecal coliforms (e-Coli)	250	Col/100 ml	0	0	(Incubation time: 24 hrs @ 44°)

Comments & recommendations

SAR 2.3

Bacteriological analysis are not pure disinfection treatment is recommended.
According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in physical parameters and in chemical determination analysis results, the water is acceptable.

WET CENTRE — DACAAR — Water Quality Control

Analyzed by: ..... Checked by: .....

Date: 20,01,2019 Date: 21,01,2019.

4. AUWSSC 5th operational water well in Kandahar city. Dand Chowk (Square), District 8, Kandahar City, Kandahar Province

DACAAR

WATER QUALITY ANALYSIS REPORT

Project	FCG ANZDEC	Source	Tube Well	Analysis n.	32/2019
Province	Kandahar	District	08th	Village	Dand Chawk
Latitude	31.3714	Longitude	64.4036	Sampled date & time:	09.01.2019
				Sampled by:	Client

Physical parameters				WHO recc	ANSA recc	
EC	732	µS/cm		1500	3000	
TDS *	504	mg/l	0.688	1000	2000	* From Conductivity
ORP	236	mV				
Turbidity	0.56	NTU		5	5	< 1 for chlorination
pH	7.58			6.5 - 8	6.5 - 8.5	< 8 for chlorination
T°	20.1	°C		-	-	

Spectrophotometer Palintest 8000

Chemical determination							
Anions		**mg/l**	**conv**	**maf**	**WHO recc**	**ANSA recc**	**Comments**
Total Alkalinity	(as $CaCO_3$)	235			-	-	
Alkalinity P	(as $CaCO_3$)	5			-	-	
Alkalinity M	(as $CaCO_3$)	285			-	-	
Bicarbonate	HCO_3^-	275	0.01639	4.507	-	-	
Carbonate	CO_3^{2-}	10	0.03333	0.333	-	-	
Hydroxide	OH^-	0	0.05880	0.000	-	-	
Chloride	Cl^-	56	0.02820	1.636	250	250	Taste
Sulphate	SO_4^{2-}	96	0.02082	1.999	250	250	Taste
Sulphite	SO_3^{2-}	8	0.02498	0.200	-	-	
Sulphide	S^{2-}	0.02	0.05250	0.001	-	-	
Fluoride	F^-	0.69	0.05263	0.036	1.5	1.5	Fluorosis
Nitrate	NO_3^-	32.82	0.01613	0.529	50	50	Blue baby syndrom
Nitrite	NO_2^-	0.007	0.02174	0.000	0.2 - 3	3	long - short term expositure
Phosphate	PO_4^{3-}	0.15	0.03158	0.005	-	-	
Boron	B	0.45	0.09247	0.042	2.4	2.4	Testicular lesions
Bromide	Br^-	0.82	0.01251	0.010	-	-	

Cations		**mg/l**	**conv**	**maf**	**WHO recc**	**ANSA recc**	
Total Hardness	(as $CaCO_3$)	250			300	500	Taste and incrustation
Calcium Hardness	(as $CaCO_3$)	99			-	-	
Sodium	Na^+	72	0.04348	3.119	200	200	Taste
Potassium	K^+	3	0.02558	0.077	-	-	
Calcium	Ca^{2+}	40	0.0499	1.976	-	-	
Chromium	Cr^{3+} tot	0.02	0.11539	0.002	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	50	0.08224	4.112	-	-	
Ammonium	NH_4^+	0	0.05543	0.000	1.5 - 35		Odour - taste treshold
Manganese	Mn^{2+}	0	0.03641	0.000	0.4		> 0.1 affects taste and stains laundary
Copper	Cu_{total}	0.16	0.03148	0.005	2	2	Taste
Aluminum	Al_{total}	0.01	0.1112	0.001	-	0.2	
Total iron	Fe^{2+} and Fe^{3+}	0.17	0.03581	0.006	0.3	0.3	Taste and odour
Total Arsenic	As^{3+} and As^{5+}	0			0.01	0.05	

Other components		**mg/l**	**WHO recc**	**ANSA recc**	
Silica	SiO_2	27	-	-	
Hydrogen Sulphide	H_2S	0.0212	0.100	-	Taste and odour
Residual Chlorine	Cl_2	0.06	0.2-0.5	0.2-0.5	

Bacteriological Determination			WHO recc	ANSA recc	
H_2S determination		Y/N	N	-	
Total Coliforms	0	Col/100 ml	0	-	(Incubation time: 24 hrs @ 37°)
Fecal coliforms (e-Coli)	0	Col/100 ml	0	0	(Incubation time: 24 hrs @ 44°)

Comments & recommendations	SAR 1.8
Bacteriological analysis are pure.	
According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in physical parameters and in chemical determination analysis results, the water is acceptable.	

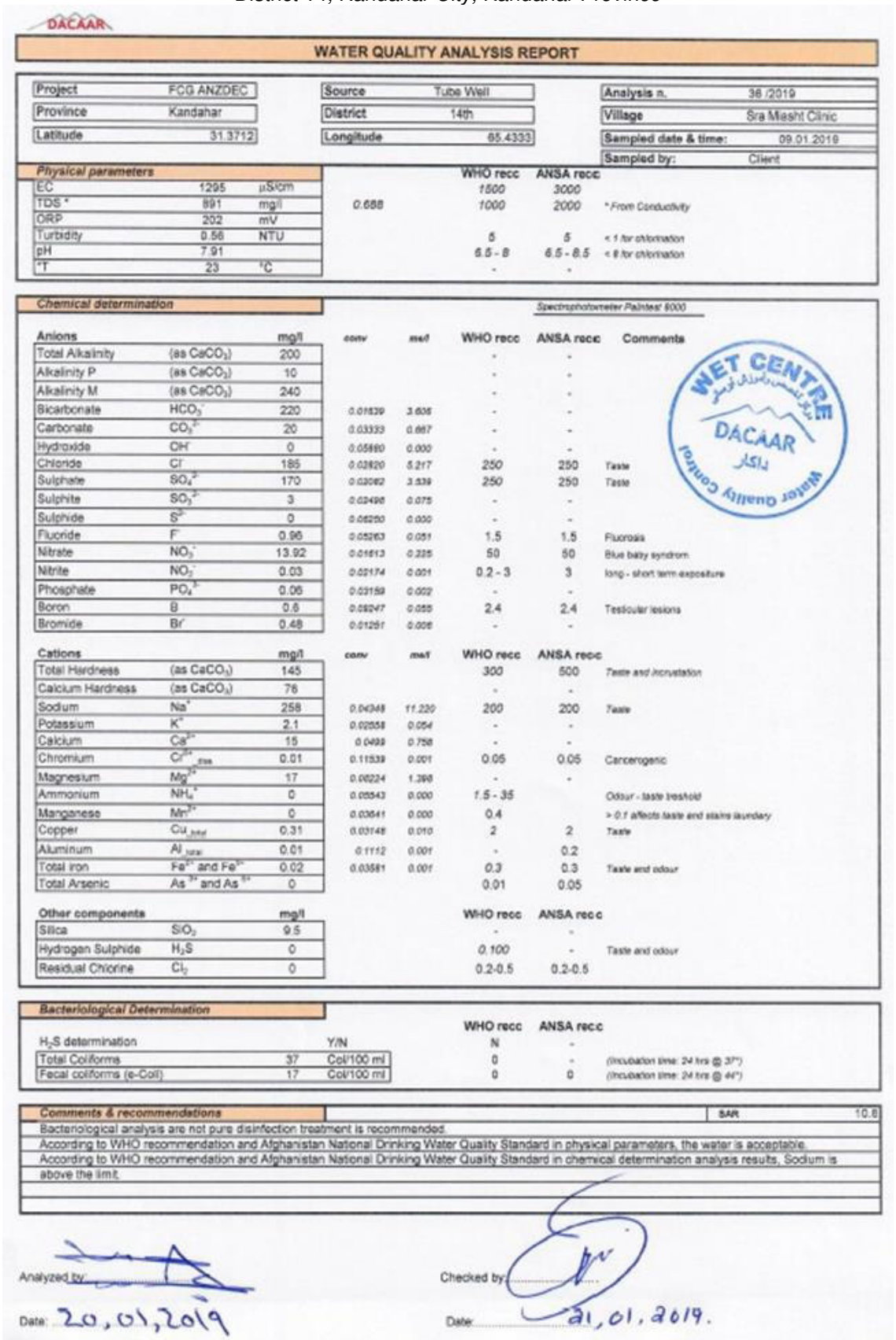
Analyzed by: .....

Date: 20,01,2019

Checked by: .....

Date: 21,01,2019.

5. AUWSSC 8th operational water well in Kandahar city. Sra Miasht Clinic, District 14, Kandahar City, Kandahar Province



DACAAR

WATER QUALITY ANALYSIS REPORT

Project	FCG ANZDEC	Source	Tube Well	Analysis n.	36 /2019
Province	Kandahar	District	14th	Village	Sra Miasht Clinic
Latitude	31.3712	Longitude	65.4333	Sampled date & time:	09.01.2019
				Sampled by:	Client

Physical parameters

				WHO recc	ANSA recc	
EC	1295	µS/cm		1500	3000	
TDS *	891	mg/l	0.688	1000	2000	* From Conductivity
ORP	202	mV				
Turbidity	0.56	NTU		5	5	< 1 for chlorination
pH	7.91			6.5 - 8	6.5 - 8.5	< 8 for chlorination
°T	23	°C		-	-	

Chemical determination

Spectrophotometer Palintest 8000

Anions		mg/l	conv	me/l	WHO recc	ANSA recc	Comments
Total Alkalinity	(as $CaCO_3$)	200			-	-	
Alkalinity P	(as $CaCO_3$)	10			-	-	
Alkalinity M	(as $CaCO_3$)	240			-	-	
Bicarbonate	HCO_3^-	220	0.01639	3.606	-	-	
Carbonate	CO_3^{2-}	20	0.03333	0.667	-	-	
Hydroxide	OH^-	0	0.05880	0.000	-	-	
Chloride	Cl^-	185	0.02820	5.217	250	250	Taste
Sulphate	SO_4^{2-}	170	0.02082	3.539	250	250	Taste
Sulphite	SO_3^{2-}	3	0.03496	0.075	-	-	
Sulphide	S^{2-}	0	0.06250	0.000	-	-	
Fluoride	F^-	0.96	0.05263	0.051	1.5	1.5	Fluorosis
Nitrate	NO_3^-	13.92	0.01613	0.225	50	50	Blue baby syndrom
Nitrite	NO_2^-	0.03	0.02174	0.001	0.2 - 3	3	long - short term exposure
Phosphate	PO_4^{3-}	0.06	0.03159	0.002	-	-	
Boron	B	0.6	0.09247	0.055	2.4	2.4	Testicular lesions
Bromide	Br^-	0.48	0.01251	0.006	-	-	

Cations		mg/l	conv	me/l	WHO recc	ANSA recc	
Total Hardness	(as $CaCO_3$)	145			300	500	Taste and incrustation
Calcium Hardness	(as $CaCO_3$)	76			-	-	
Sodium	Na^+	258	0.04348	11.220	200	200	Taste
Potassium	K^+	2.1	0.02558	0.054	-	-	
Calcium	Ca^{2+}	15	0.0499	0.758	-	-	
Chromium	Cr^{3+} tot	0.01	0.11539	0.001	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	17	0.00224	1.398	-	-	
Ammonium	NH_4^+	0	0.05543	0.000	1.5 - 35		Odour - taste treshold
Manganese	Mn^{2+}	0	0.03641	0.000	0.4		> 0.1 affects taste and stains laundary
Copper	Cu_{total}	0.31	0.03148	0.010	2	2	Taste
Aluminum	Al_{total}	0.01	0.1112	0.001	-	0.2	
Total Iron	Fe^{2+} and Fe^{3+}	0.02	0.03581	0.001	0.3	0.3	Taste and odour
Total Arsenic	As^{3+} and As^{5+}	0			0.01	0.05	

Other components		mg/l	WHO recc	ANSA recc	
Silica	SiO_2	9.5	-	-	
Hydrogen Sulphide	H_2S	0	0.100	-	Taste and odour
Residual Chlorine	Cl_2	0	0.2-0.5	0.2-0.5	

Bacteriological Determination

			WHO recc	ANSA recc	
H_2S determination		Y/N	N	-	
Total Coliforms	37	Col/100 ml	0	-	(Incubation time: 24 hrs @ 37°)
Fecal coliforms (e-Coli)	17	Col/100 ml	0	0	(Incubation time: 24 hrs @ 44°)

Comments & recommendations — SAR 10.6

Bacteriological analysis are not pure disinfection treatment is recommended.
According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in physical parameters, the water is acceptable.
According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in chemical determination analysis results, Sodium is above the limit.

WET CENTRE — DACAAR — Water Quality Control

Analyzed by: .....

Date: 20,01,2019

Checked by: .....

Date: 21,01,2019.

6. AUWSSC 10th operational water well in Kandahar city. Mirwais Nika High School, District 14, Kandahar City, Kandahar Province

DACAAR

WATER QUALITY ANALYSIS REPORT

Project	FCG ANZDEC	Source	Tube Well	Analysis n.	31 /2019
Province	Kandahar	District	14th	Village	Mirwais Nika High School
Latitude	31.3715	Longitude	64.4348	Sampled date & time:	09.01.2019
				Sampled by:	Client

Physical parameters

				WHO recc	ANSA recc	
EC	1237	µS/cm		1500	3000	
TDS *	851	mg/l	0.688	1000	2000	* From Conductivity
ORP	224	mV				
Turbidity	0.32	NTU		5	5	< 1 for chlorination
pH	7.67			6.5 - 8	6.5 - 8.5	< 8 for chlorination
°T	20	°C		-	-	

Chemical determination

Spectrophotometer Palintest 8000

Anions		mg/l	conv	me/l	WHO recc	ANSA recc	Comments
Total Alkalinity	(as $CaCO_3$)	270			-	-	
Alkalinity P	(as $CaCO_3$)	10			-	-	
Alkalinity M	(as $CaCO_3$)	290			-	-	
Bicarbonate	HCO_3^-	270	0.01639	4.425	-	-	
Carbonate	CO_3^{2-}	20	0.03333	0.667	-	-	
Hydroxide	OH^-	0	0.05880	0.000	-	-	
Chloride	Cl^-	150	0.02820	4.230	250	250	Taste
Sulphate	SO_4^{2-}	150	0.02082	3.123	250	250	Taste
Sulphite	SO_3^{2-}	2	0.02498	0.050	-	-	
Sulphide	S^{2-}	0	0.06250	0.000	-	-	
Fluoride	F^-	0.9	0.05263	0.047	1.5	1.5	Fluorosis
Nitrate	NO_3^-	17.04	0.01613	0.275	50	50	Blue baby syndrom
Nitrite	NO_2^-	0.007	0.02174	0.000	0.2 - 3	3	long - short term exposiure
Phosphate	PO_4^{3-}	0.09	0.03159	0.003	-	-	
Boron	B	0.75	0.09247	0.069	2.4	2.4	Testicular lesions
Bromide	Br^-	0.35	0.01251	0.004	-	-	

Cations		mg/l	conv	me/l	WHO recc	ANSA recc	
Total Hardness	(as $CaCO_3$)	150			300	500	Taste and incrustation
Calcium Hardness	(as $CaCO_3$)	63			-	-	
Sodium	Na^+	188	0.04348	8.191	200	200	Taste
Potassium	K^+	1.3	0.02558	0.033	-	-	
Calcium	Ca^{2+}	52	0.0499	2.605	-	-	
Chromium	Cr^{3+} diss.	0	0.11539	0.000	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	25	0.08224	2.056	-	-	
Ammonium	NH_4^+	0	0.05543	0.000	1.5 - 35		Odour - taste treshold
Manganese	Mn^{2+}	0	0.03641	0.000	0.4		> 0.1 affects taste and stains laundary
Copper	Cu_{total}	0.26	0.03148	0.008	2	2	Taste
Aluminum	Al_{total}	0	0.1112	0.000	-	0.2	
Total iron	Fe^{2+} and Fe^{3+}	0.02	0.03581	0.001	0.3	0.3	Taste and odour
Total Arsenic	As^{3+} and As^{5+}	0			0.01	0.05	

Other components		mg/l	WHO recc	ANSA recc	
Silica	SiO_2	6.5	-	-	
Hydrogen Sulphide	H_2S	0	0.100	-	Taste and odour
Residual Chlorine	Cl_2	0	0.2-0.5	0.2-0.5	

Bacteriological Determination

			WHO recc	ANSA recc	
H_2S determination		Y/N	N	-	
Total Coliforms	0	Col/100 ml	0	-	(Incubation time: 24 hrs @ 37°)
Fecal coliforms (e-Coli)	0	Col/100 ml	0	0	(Incubation time: 24 hrs @ 44°)

Comments & recommendations

SAR 5.4

Bacteriological analysis are pure.

According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in physical parameters and in chemical determination analysis results, the water is acceptable.

Analyzed by: .....

Date: 20.01.2019

Checked by: .....

Date: 21.01.2019

7. AUWSSC 11th operational water well in Kandahar city. Ahmad Shah Baba High School, District 02, Kandahar City, Kandahar Province

DACAAR

WATER QUALITY ANALYSIS REPORT

Project	FCG ANZDEC	Source	Tube Well	Analysis n.	30 /2019
Province	Kandahar	District	2nd	Village	Ahmad Shah Baba High School
Latitude	31.3642	Longitude	65.4119	Sampled date & time:	09.01.2019
				Sampled by:	Client

Physical parameters

				WHO recc	ANSA recc	
EC	839	µS/cm		1500	3000	
TDS *	577	mg/l	0.688	1000	2000	* From Conductivity
ORP	239	mV				
Turbidity	0.61	NTU		5	5	< 1 for chlorination
pH	7.92			6.5 - 8	6.5 - 9.5	< 8 for chlorination
°T	20.6	°C		-	-	

Chemical determination

Spectrophotometer Palintest 8000

Anions		mg/l	conv	me/l	WHO recc	ANSA recc	Comments
Total Alkalinity	(as $CaCO_3$)	260			-	-	
Alkalinity P	(as $CaCO_3$)	15			-	-	
Alkalinity M	(as $CaCO_3$)	310			-	-	
Bicarbonate	HCO_3^-	260	0.01639	4.589	-	-	
Carbonate	CO_3^{2-}	30	0.03333	1.000	-	-	
Hydroxide	CH^-	0	0.05880	0.000	-	-	
Chloride	Cl^-	72	0.02820	2.030	250	250	Taste
Sulphate	SO_4^{2-}	100	0.02082	2.082	250	250	Taste
Sulphite	SO_3^{2-}	3	0.02498	0.075	-	-	
Sulphide	S^{2-}	0.01	0.06250	0.001	-	-	
Fluoride	F^-	0.88	0.05263	0.046	1.5	1.5	Fluorosis
Nitrate	NO_3^-	29.7	0.01613	0.479	50	50	Blue baby syndrom
Nitrite	NO_2^-	0.007	0.02174	0.000	0.2 - 3	3	long - short term exposiure
Phosphate	PO_4^{3-}	0.05	0.03159	0.002	-	-	
Boron	B	0.7	0.09247	0.065	2.4	2.4	Testicular lesions
Bromide	Br^-	0.43	0.01251	0.005	-	-	

Cations		mg/l	conv	me/l	WHO recc	ANSA recc	
Total Hardness	(as $CaCO_3$)	115			300	500	Taste and incrustation
Calcium Hardness	(as $CaCO_3$)	51			-	-	
Sodium	Na^+	172	0.04348	7.496	200	200	Taste
Potassium	K^+	1.5	0.02558	0.038	-	-	
Calcium	Ca^{2+}	20	0.0499	1.018	-	-	
Chromium	$Cr^{6+}{}_{diss}$	0.01	0.11539	0.001	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	22	0.08224	1.809	-	-	
Ammonium	NH_4^+	0	0.05543	0.000	1.5 - 35		Odour - taste treshold
Manganese	Mn^{2+}	0	0.03641	0.000	0.4		> 0.1 affects taste and stains laundery
Copper	Cu_{total}	0.31	0.03148	0.010	2	2	Taste
Aluminum	Al_{total}	0.01	0.1112	0.001	-	0.2	
Total iron	Fe^{2+} and Fe^{3+}	0.02	0.03581	0.001	0.3	0.3	Taste and odour
Total Arsenic	As^{3+} and As^{5+}	0			0.01	0.05	

Other components		mg/l	WHO recc	ANSA recc	
Silica	SiO_2	5.5	-	-	
Hydrogen Sulphide	H_2S	0.0106	0.100	-	Taste and odour
Residual Chlorine	Cl_2	0	0.2-0.5	0.2-0.5	

Bacteriological Determination

			WHO recc	ANSA recc	
H_2S determination		Y/N	N	-	
Total Coliforms	0	Col/100 ml	0	-	(Incubation time: 24 hrs @ 37°)
Fecal coliforms (e-Coli)	0	Col/100 ml	0	0	(Incubation time: 24 hrs @ 44°)

Comments & recommendations

SAR 8.3

Bacteriological analysis are pure.
According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in physical parameters and in chemical determination analysis results, the water is acceptable.

WET CENTRE — DACAAR — Water Quality Control

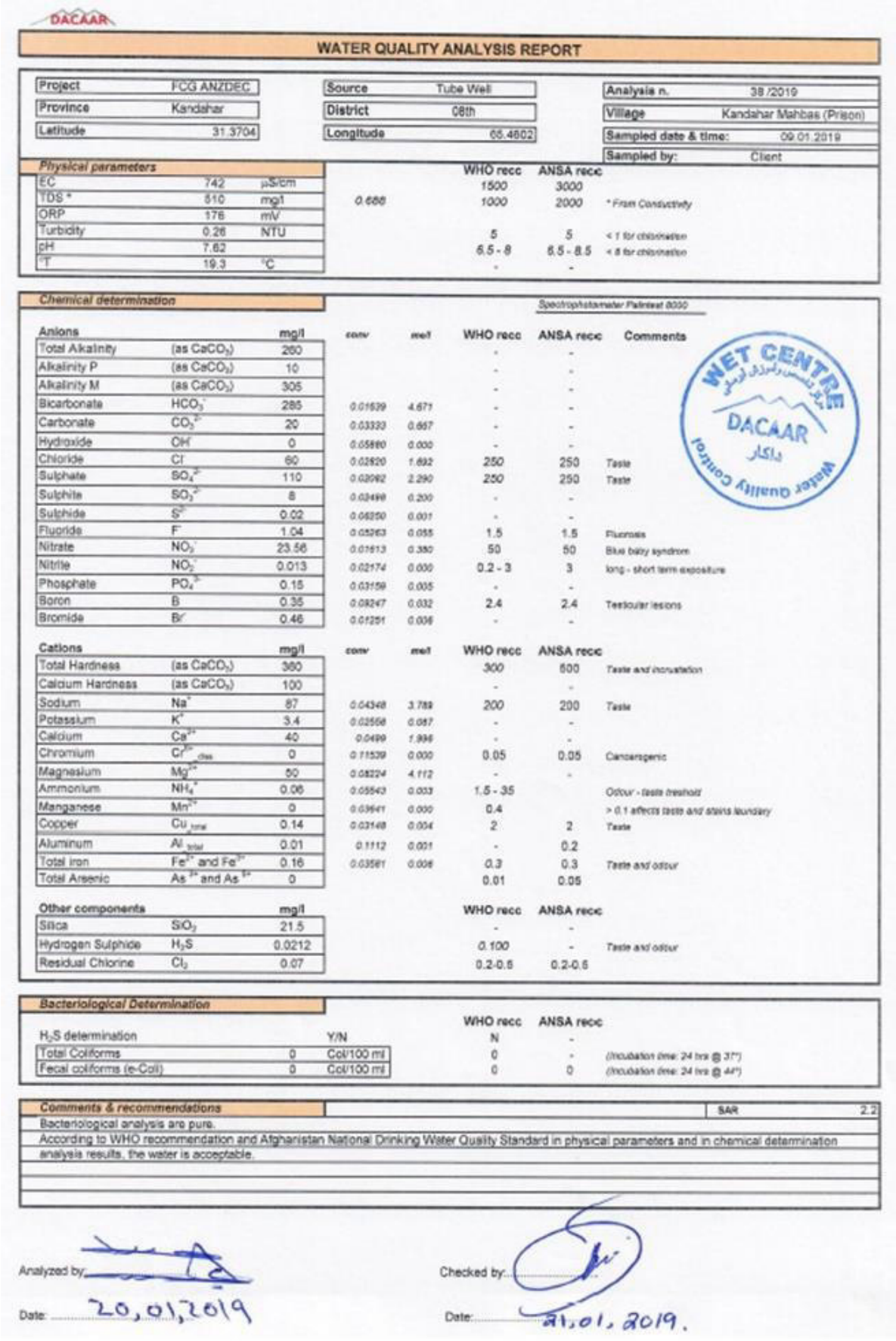
Analyzed by: .....

Date: 20,01,2019

Checked by: .....

Date: 21,01,2019.

8. AUWSSC 12th operational water well in Kandahar city. Kandahar Mahbas (Prison), District 8, Kandahar City, Kandahar Province



DACAAR

WATER QUALITY ANALYSIS REPORT

Project	FCG ANZDEC	Source	Tube Well	Analysis n.	38 /2019
Province	Kandahar	District	08th	Village	Kandahar Mahbas (Prison)
Latitude	31.3704	Longitude	65.4602	Sampled date & time:	09.01.2019
				Sampled by:	Client

Physical parameters				WHO recc	ANSA recc	
EC	742	µS/cm		1500	3000	
TDS *	510	mg/l	0.688	1000	2000	* From Conductivity
ORP	176	mV				
Turbidity	0.26	NTU		5	5	< 1 for chlorination
pH	7.62			6.5 - 8	6.5 - 8.5	< 8 for chlorination
T	19.3	°C		-	-	

Chemical determination — Spectrophotometer Palintest 8000

Anions		mg/l	conv	me/l	WHO recc	ANSA recc	Comments
Total Alkalinity	(as $CaCO_3$)	260			-	-	
Alkalinity P	(as $CaCO_3$)	10			-	-	
Alkalinity M	(as $CaCO_3$)	305			-	-	
Bicarbonate	HCO_3^-	285	0.01639	4.671	-	-	
Carbonate	CO_3^{2-}	20	0.03333	0.667	-	-	
Hydroxide	OH^-	0	0.05880	0.000	-	-	
Chloride	Cl^-	60	0.02820	1.692	250	250	Taste
Sulphate	SO_4^{2-}	110	0.02092	2.290	250	250	Taste
Sulphite	SO_3^{2-}	8	0.03499	0.280	-	-	
Sulphide	S^{2-}	0.02	0.06250	0.001	-	-	
Fluoride	F^-	1.04	0.05263	0.055	1.5	1.5	Fluorosis
Nitrate	NO_3^-	23.56	0.01613	0.380	50	50	Blue baby syndrom
Nitrite	NO_2^-	0.013	0.02174	0.000	0.2 - 3	3	long - short term exposure
Phosphate	PO_4^{3-}	0.15	0.03159	0.005	-	-	
Boron	B	0.35	0.09247	0.032	2.4	2.4	Teeloulter lesions
Bromide	Br^-	0.46	0.01251	0.006	-	-	

Cations		mg/l	conv	me/l	WHO recc	ANSA recc	
Total Hardness	(as $CaCO_3$)	380			300	600	Taste and incrustation
Calcium Hardness	(as $CaCO_3$)	100			-	-	
Sodium	Na^+	87	0.04348	3.789	200	200	Taste
Potassium	K^+	3.4	0.02558	0.087	-	-	
Calcium	Ca^{2+}	40	0.0499	1.996	-	-	
Chromium	Cr^{3+} tot	0	0.11539	0.000	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	50	0.08224	4.112	-	-	
Ammonium	NH_4^+	0.06	0.05543	0.003	1.5 - 35		Odour - taste treshold
Manganese	Mn^{2+}	0	0.09641	0.000	0.4		> 0.1 affects taste and stains laundary
Copper	Cu_{total}	0.14	0.03148	0.004	2	2	Taste
Aluminum	Al_{total}	0.01	0.1112	0.001	-	0.2	
Total iron	Fe^{2+} and Fe^{3+}	0.16	0.03581	0.006	0.3	0.3	Taste and odour
Total Arsenic	As^{3+} and As^{5+}	0			0.01	0.05	

Other components		mg/l	WHO recc	ANSA recc	
Silica	SiO_2	21.5	-	-	
Hydrogen Sulphide	H_2S	0.0212	0.100	-	Taste and odour
Residual Chlorine	Cl_2	0.07	0.2-0.6	0.2-0.6	

Bacteriological Determination

			WHO recc	ANSA recc	
H_2S determination		Y/N	N	-	
Total Coliforms	0	Col/100 ml	0	-	(Incubation time: 24 hrs @ 37°)
Fecal coliforms (e-Coli)	0	Col/100 ml	0	0	(Incubation time: 24 hrs @ 44°)

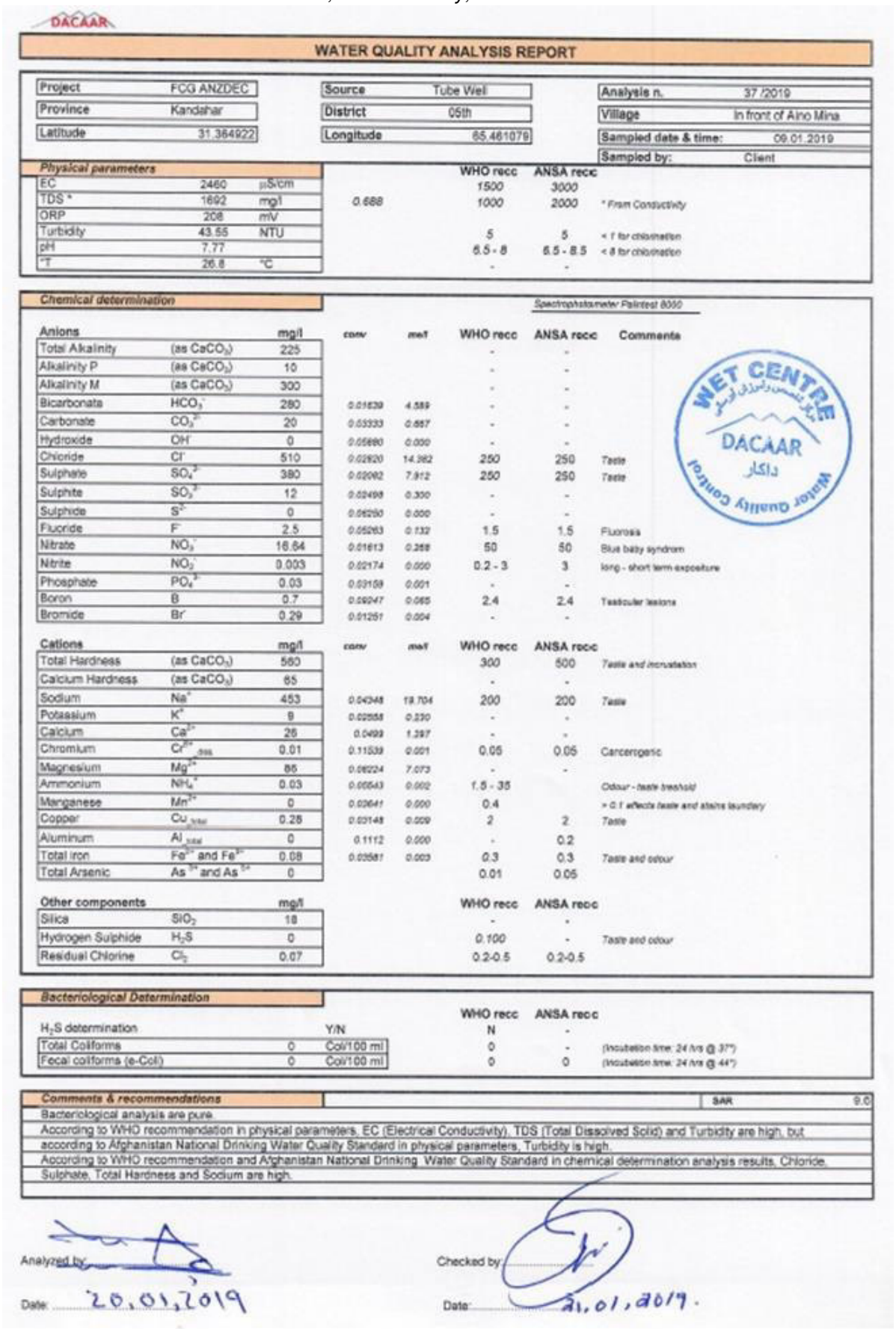
Comments & recommendations — SAR 2.2

Bacteriological analysis are pure.
According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in physical parameters and in chemical determination analysis results, the water is acceptable.

Analyzed by: ..... Date: 20,01,2019

Checked by: ..... Date: 21,01,2019.

9. AUWSSC 16th operational water well in Kandahar city. In front of Aino Mina, District 5, Kandahar City, Kandahar Province



DACAAR

WATER QUALITY ANALYSIS REPORT

Project	FCG ANZDEC	Source	Tube Well	Analysis n.	37 /2019
Province	Kandahar	District	05th	Village	In front of Aino Mina
Latitude	31.364922	Longitude	65.461079	Sampled date & time:	09.01.2019
				Sampled by:	Client

Physical parameters				WHO recc	ANSA recc	
EC	2460	µS/cm		1500	3000	
TDS *	1692	mg/l	0.688	1000	2000	* From Conductivity
ORP	208	mV				
Turbidity	43.55	NTU		5	5	< 1 for chlorination
pH	7.77			6.5 - 8	6.5 - 8.5	< 8 for chlorination
°T	26.8	°C		-	-	

Chemical determination — Spectrophotometer Palintest 8000

Anions		mg/l	conv	me/l	WHO recc	ANSA recc	Comments
Total Alkalinity	(as $CaCO_3$)	225			-	-	
Alkalinity P	(as $CaCO_3$)	10			-	-	
Alkalinity M	(as $CaCO_3$)	300			-	-	
Bicarbonate	HCO_3^-	280	0.01639	4.589	-	-	
Carbonate	CO_3^{2-}	20	0.03333	0.667	-	-	
Hydroxide	OH^-	0	0.05880	0.000	-	-	
Chloride	Cl^-	510	0.02820	14.382	250	250	Taste
Sulphate	SO_4^{2-}	380	0.02082	7.912	250	250	Taste
Sulphite	SO_3^{2-}	12	0.02498	0.300	-	-	
Sulphide	S^{2-}	0	0.06250	0.000	-	-	
Fluoride	F^-	2.5	0.05263	0.132	1.5	1.5	Fluorosis
Nitrate	NO_3^-	16.64	0.01613	0.268	50	50	Blue baby syndrom
Nitrite	NO_2^-	0.003	0.02174	0.000	0.2 - 3	3	long - short term exposure
Phosphate	PO_4^{3-}	0.03	0.03158	0.001	-	-	
Boron	B	0.7	0.09247	0.065	2.4	2.4	Testicular lesions
Bromide	Br^-	0.29	0.01251	0.004	-	-	

Cations		mg/l	conv	me/l	WHO recc	ANSA recc	
Total Hardness	(as $CaCO_3$)	560			300	500	Taste and incrustation
Calcium Hardness	(as $CaCO_3$)	65			-	-	
Sodium	Na^+	453	0.04348	19.704	200	200	Taste
Potassium	K^+	9	0.02558	0.230	-	-	
Calcium	Ca^{2+}	26	0.0499	1.297	-	-	
Chromium	Cr^{2+} tris	0.01	0.11538	0.001	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	86	0.08224	7.073	-	-	
Ammonium	NH_4^+	0.03	0.05543	0.002	1.5 - 35		Odour - taste treshold
Manganese	Mn^{2+}	0	0.03641	0.000	0.4		> 0.1 effects taste and stains laundary
Copper	Cu_{total}	0.25	0.03148	0.009	2	2	Taste
Aluminum	Al_{total}	0	0.1112	0.000	-	0.2	
Total iron	Fe^{2+} and Fe^{3+}	0.08	0.03581	0.003	0.3	0.3	Taste and odour
Total Arsenic	As^{3+} and As^{5+}	0			0.01	0.05	

Other components		mg/l	WHO recc	ANSA recc	
Silica	SiO_2	18	-	-	
Hydrogen Sulphide	H_2S	0	0.100	-	Taste and odour
Residual Chlorine	Cl_2	0.07	0.2-0.5	0.2-0.5	

WET CENTRE — DACAAR — Water Quality Control

Bacteriological Determination

H_2S determination		Y/N	WHO recc	ANSA recc	
		N	N	-	
Total Coliforms	0	Col/100 ml	0	-	(Incubation time: 24 hrs @ 37°)
Fecal coliforms (e-Coli)	0	Col/100 ml	0	0	(Incubation time: 24 hrs @ 44°)

Comments & recommendations — SAR 9.0

Bacteriological analysis are pure.
According to WHO recommendation in physical parameters, EC (Electrical Conductivity), TDS (Total Dissolved Solid) and Turbidity are high, but according to Afghanistan National Drinking Water Quality Standard in physical parameters, Turbidity is high.
According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in chemical determination analysis results, Chloride, Sulphate, Total Hardness and Sodium are high.

Analyzed by: Date: 20.01.2019

Checked by: Date: 21.01.2019.

10. AUWSSC 17th operational water well in Kandahar city. AUWSSC Office, District 2, Kandahar City, Kandahar Province

DACAAR

WATER QUALITY ANALYSIS REPORT

Project	FCG ANZDEC	Source	Tube Well	Analysis n.	34 /2019
Province	Kandahar	District	2nd	Village	AUWSSC office
Latitude	31.3646	Longitude	65.4121	Sampled date & time:	09.01.2019
				Sampled by:	Client

Physical parameters

				WHO recc	ANSA recc	
EC	785	µS/cm		1500	3000	
TDS *	540	mg/l	0.688	1000	2000	* From Conductivity
ORP	235	mV				
Turbidity	5	NTU		5	5	< 1 for chlorination
pH	7.56			6.5 - 8	6.5 - 8.5	< 8 for chlorination
°T	20.9	°C		-	-	

Chemical determination

Spectrophotometer Paintest 8000

Anions		mg/l	conv	mef	WHO recc	ANSA recc	Comments
Total Alkalinity	(as $CaCO_3$)	230			-	-	
Alkalinity P	(as $CaCO_3$)	5			-	-	
Alkalinity M	(as $CaCO_3$)	265			-	-	
Bicarbonate	HCO_3^-	255	0.01639	4.179	-	-	
Carbonate	CO_3^{2-}	10	0.03333	0.333	-	-	
Hydroxide	OH^-	0	0.05880	0.000	-	-	
Chloride	Cl^-	37	0.02820	1.043	250	250	Taste
Sulphate	SO_4^{2-}	67	0.02082	1.395	250	250	Taste
Sulphite	SO_3^{2-}	4	0.02498	0.100	-	-	
Sulphide	S^{2-}	0.01	0.08250	0.001	-	-	
Fluoride	F^-	0.76	0.05263	0.040	1.5	1.5	Fluorosis
Nitrate	NO_3^-	11.5	0.01613	0.185	50	50	Blue baby syndrom
Nitrite	NO_2^-	0.002	0.02174	0.000	0.2 - 3	3	long - short term exposure
Phosphate	PO_4^{3-}	0.07	0.03159	0.002	-	-	
Boron	B	0.3	0.09247	0.028	2.4	2.4	Testicular lesions
Bromide	Br^-	0.27	0.01251	0.003	-	-	

Cations		mg/l	conv	mef	WHO recc	ANSA recc	
Total Hardness	(as $CaCO_3$)	380			300	500	Taste and incrustation
Calcium Hardness	(as $CaCO_3$)	115			-	-	
Sodium	Na^+	35	0.04348	1.505	200	200	Taste
Potassium	K^+	2	0.02556	0.051	-	-	
Calcium	Ca^{2+}	46	0.0499	2.295	-	-	
Chromium	Cr^{3+} / Cr^{6+}	0.01	0.11539	0.001	0.05	0.05	Cancerogenic
Magnesium	Mg^{2+}	42	0.08224	3.454	-	-	
Ammonium	NH_4^+	0	0.05543	0.000	1.5 - 35		Odour - taste threshold
Manganese	Mn^{2+}	0	0.03641	0.000	0.4		> 0.1 affects taste and stains laundary
Copper	Cu_{total}	0.02	0.03148	0.001	2	2	Taste
Aluminum	Al_{total}	0.03	0.1112	0.003	-	0.2	
Total iron	Fe^{2+} and Fe^{3+}	0	0.03581	0.000	0.3	0.3	Taste and odour
Total Arsenic	As^{3+} and As^{5+}	0			0.01	0.05	

Other components		mg/l	WHO recc	ANSA recc	
Silica	SiO_2	25	-	-	
Hydrogen Sulphide	H_2S	0.0106	0.100	-	Taste and odour
Residual Chlorine	Cl_2	0	0.2-0.5	0.2-0.5	

WET CENTRE — Water Quality Control — DACAAR

Bacteriological Determination

H_2S determination		Y/N	WHO recc	ANSA recc	
Total Coliforms	11	CoV100 ml	N	-	
Fecal coliforms (e-Coli)	11	CoV100 ml	0	-	(Incubation time: 24 hrs @ 37°)
			0	0	(Incubation time: 24 hrs @ 44°)

Comments & recommendations

SAR 0.9

Bacteriological analysis are not pure disinfection treatment is recommended.
According to WHO recommendation and Afghanistan National Drinking Water Quality Standard in physical parameters and in chemical determination analysis results, the water is acceptable.

Analyzed by: ..... Date: 20,01,2019

Checked by: ..... Date: 21.01.2019.

APPENDIX 6. AIR QUALITY SURVEY REPORT

AIR QUALITY MONITORING SURVEY

February 2019

TA-9273 AFG: Preparing the Arghandab Integrated Water Resources Development Investment Project

CONTENTS

I. INTRODUCTION

Degenerating air quality is a serious problem worldwide and especially in developing countries such as Afghanistan. The World Health Organization (WHO), estimates that 26% of all deaths in Afghanistan are due to environmental risks, and worldwide the single most important environmental health risk factor is Household Air Pollution (HAP).[1] According to WHO estimates HAP causes approximately 27 000 deaths per year in Afghanistan. Ambient Air Pollution (AAP), is closely interlinked to HAP and refers to outdoor air pollution. This is a serious threat as well and causes more than 4.2 million premature deaths annually, of which approximately 3000 occurs in Afghanistan.

Air pollution has long term effects and can cause cardiovascular and respiratory issues. Hence, improving and monitoring air quality is an important addition to every project involving infrastructure. The WHO Air Quality Guidelines: Global Update 2005 outlines the threshold levels for harmful pollution levels and 91% of the world population was living in conditions not met by the guidelines in 2016.[2] Therefore, this study was carried out with the objective to measure the air quality on the locations of interest to the main project.

A common proxy indicator for air pollution is particulate matter (PM). It is composed of sulfate, ammonia, nitrates, black carbon, sodium chloride, mineral dust and water. Therefore, it consists of both liquid and solid, as well as inorganic and organic materials suspended in the air. Particles with the diameter of 10 microns or less (≤ PM_{10}) are considered a hazard, however particles with a diameter of 2.5 microns or less (≤ $PM_{2.5}$) are even more health-damaging. These can enter the blood system by penetrating the lung barrier.[3]

Measurements of air quality are most often reported in terms of annual or daily mean concentrations of PM_{10}/air volume m^3. It is then interpreted and described as micrograms per m^3, ($\mu g/m^3$). When there is access to sensitive measurement tools it is common to report concentrations of fine particles (≤ $PM_{2.5}$), instead of or together with ≤ PM_{10}.

This survey only reports the (≤ $PM_{2.5}$). WHO guidelines can be viewed in Figure 1 below and the WHO recommendation is levels lower than 25 µg/m3 24-hour mean or 10 µg/m3 annual mean.[4] The national air quality standards for Afghanistan on the other hand allows 75 µg/m3 24-hour mean or 35 µg/m3 annual mean and is displayed in Figure 2.[5]

[1] WHO, 2019. *Afghanistan: Environmental health [online].* Available through: http://www.emro.who.int/afg/programmes/eh.html

[2], WHO, 2018. *Ambient (outdoor air quality and health) [online].* https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health

[3] Ibid.

[4] WHO, 2005. *WHO Air quality guidelines for particulate matter, ozone and sulfur dioxide [PDF].* https://apps.who.int/iris/bitstream/handle/10665/69477/WHO_SDE_PHE_OEH_06.02_eng.pdf;jsessionid=E43A649D4185EE2075E0823DFABAADD1?sequence=1

[5] Torabi, E., & Nogami, A., 2016. *Environmental Assessment of Suspended Particulate Matter over Kabul City, Afghanistan [online].* https://www.researchgate.net/publication/311843739_Environmental_Assessment_of_Suspended_Particulate_Matter_over_the_Kabul_City_Afghanistan

Table 1. WHO Air Quality Standards

WHO air quality guidelines and interim targets for particulate matter: annual mean concentrations[1]			
	PM10 (µg/m³)	**PM2.5 (µg/m³)***	**Basis for the selected level**
Iinterim target-1 (IT-1)	70	35	These levels are associated with about a 15% higher long-term mortality risk relative to the AQG level.
Interim target-2 (IT-2)	50	25	In addition to other health benefits, these levels lower the risk of premature mortality by approximately 6% [2–11%] relative to theIT-1 level.
Interim target-3 (IT-3)	30	15	In addition to other health benefits, these levels reduce the mortality risk by approximately 6% [2-11%] relative to the -IT-2 level.
Air quality guideline (AQG)	20	10	These are the lowest levels at which total, cardiopulmonary and lung cancer mortality have been shown to increase with more than 95% confidence in response to long-term exposure to PM2.5

Table 2. National Air Quality Standards for Afghanistan

Parameter	**Unit**	**Time-weighted average**	**Maximum allowable concentration**
TSP	µg/m³	24h	300
PM_{10}	µg/m³	Annual	70
		24h	150
$PM_{2.5}$	µg/m³	Annual	35
		24h	75
Nitrogen dioxide (NO_2)	µg/m³	Annual	40
		24h	80
Sulfur dioxide (SO_2)	µg/m³	24h	50
Ozone (O_3)	µg/m³	8h	100
Carbon monoxide (CO)	µg/m³	8h	10
		1h	30
		Half hour	60
Lead (Pb)	µg/m³	Annual	0.5

Air quality can be measured and monitored in several ways and many factors affects which method is most suitable for that specific situation and goal. For the scope of this survey the team chose the Kaiterra Laser Egg 2 Air Monitor which is widely used and fits the purpose of this survey.

Monitoring took place on six locations which are mapped out in Figure 2 below. Locations 1 through 6 are; Right Abutment Dahla Dam, Shah Wali Kot district; Downstream, Dahla Dam, Shah Wali Kot district; water supply station compound (C-3), Kotal-e-Murcha, Arghandab district; Highway, Shah re Naw, District 6, Kandahar City; Sub Road (1), Shah re Naw, District 6, Kandahar City; and Sub Road (2), Shah re Naw, District 6, Kandahar City. All locations are in Kandahar.

A total of 60 tests were conducted from 4 January 2019 to 8 January 2019 in the six locations and the surveying took place during the day except location 6 which was done during the night and early morning. The results are interpreted and explained in the sections that follow.

Figure 1. Project Locations

Source: Google Maps, 2019

II. RIGHT ABUTMENT DAHLA DAM, SHAH WALI KOT DISTRICT, KANDAHAR

The amounts of PM exceeding WHO standards are marked with orange and the amounts exceeding both WHO and Afghanistan standards are marked with red.

Sample collection: 04/01/2019
GPS Coordinates: Latitude (N): 31.8566033, Longitude (E): 65.8885967

No of Sampling	Date	Time	PM 2.5 µg/m^3	> 0.3µm	Temperature (Celsius)	Humidity %	Weather Condition During Monitoring
1	4-Jan-19	9:37	13	1866	11	57%	Sunny with no wind
2	4-Jan-19	10:43	24	2394	13	53%	Sunny with no wind
3	4-Jan-19	11:35	13	1800	16	45%	Sunny with no wind
4	4-Jan-19	12:36	15	2010	16	42%	Sunny with a little bit wind
5	4-Jan-19	13:33	17	2593	17	38%	Partially Sunny and Windy
6	4-Jan-19	14:54	35	3838	17	39%	Partially Sunny and Windy
Mean		**5h17min**	**19.5**	**2416.8**	**15**	**46%**	

WHO Standard: 25 µg/m^3 24-hour mean.
Afghanistan Standard: 75 µg/m^3 24-hour mean.

Comments and Results

1. The results show that the location is within the WHO standards. The mean after five hours is already below both standards which indicates good air quality. Hence the air quality in the area is generally good.

III. DOWNSTREAM, DAHLA DAM, SHAH WALI KOT DISTRICT, KANDAHAR

Sample collection: 05/01/2019
GPS Coordinates: Latitude (N): 31.8448033, Longitude (E): 65.8674583

No of Sampling	Date	Time	PM 2.5 µg/m³	> 0.3µm	Temperature (Celsius)	Humidity %	Weather Condition During Monitoring
1	5-Jan-19	9:00	13	1500	14	38%	Sunny with no wind
2	5-Jan-19	10:10	10	1350	9	46%	Sunny with no wind
3	5-Jan-19	11:05	9	1200	12	38%	Sunny with no wind
4	5-Jan-19	12:07	7	1032	13	35%	Sunny with no wind
5	5-Jan-19	13:02	7	1221	15	34%	Sunny with no wind
6	5-Jan-19	14:03	8	1200	15	31%	Sunny with no wind
7	6-Jan-19	15:15	13	2090	18	29%	Sunny with no wind
Mean		**6h15min**	**9.6**	**1370.4**	**14**	**36%**	

WHO Standard: 25 µg/m^3 24-hour mean.
Afghanistan Standard: 75 µg/m^3 24-hour mean.

Comments and Results

2. The results show that the mean PM 2.5 µg/m^3 level for six hours is below both the WHO and Afghanistan levels and there are no sudden significant drops or increases in the results. The air quality is therefore considered to be of high quality in this location.

IV. WATER SUPPLY STATION COMPOUND (C-3), KOTAL-E-MURCHA, ARGHANDAB DISTRICT, KANDAHAR

Sample collection: 06/01/2019
GPS Coordinates: Latitude (N): 31.6956467, Longitude (E): 65.7059767

No of Sampling	Date	Time	PM 2.5 µg/m^3	> 0.3µm	Temperature (Celsius)	Humidity %	Weather Condition During Monitoring
1	6-Jan-19	8:10	13	2080	12	37%	Sunny with Smog
2	6-Jan-19	9:10	190	19695	13	35%	Sunny with Smog
3	6-Jan-19	10:10	36	8301	13	36%	Sunny with Smog
4	6-Jan-19	11:15	12	2240	16	38%	Sunny
5	6-Jan-19	12:10	11	1500	12	35%	Sunny
6	6-Jan-19	13:10	28	3780	13	34%	Sunny
7	6-Jan-19	14:10	54	5580	19	33%	Sunny
8	6-Jan-19	15:10	38	5304	14	31%	Sunny
9	6-Jan-19	16:10	21	2540	12	34%	Cloudy and Windy
10	6-Jan-19	16:47	25	3669	14	30%	Cloudy and Windy
Mean		**8h37min**	**42.8**	**5468.9**	**14**	**34%**	

WHO Standard: 25 µg/m^3 24-hour mean.
Afghanistan Standard: 75 µg/m^3 24-hour mean.

Comments and Results

3. The results show one peak at 9:10am which is reasonably due to increased morning traffic and it peaks slightly again at 2:10pm. The mean for 8h37min is PM 42.8 µg/m^3 which is over the WHO guideline but not Afghanistan standard. In addition, this level is expected to drop during nighttime. Air quality is acceptable.

V. HIGHWAY, SHAH RE NAW, DISTRICT 6, KANDAHAR CITY, KANDAHAR

Sample collection: 07/01/2019
GPS Coordinates: Latitude (N): 31.6119617, Longitude (E): 65.6808433

No of Sampling	Date	Time	PM 2.5 µg/m^3	> 0.3µm	Temperature (Celsius)	Humidity %	Weather Condition During Monitoring
1	7-Jan-19	7:10	162	16296	9	43%	Partially Cloudy and Foggy (Vehicle Pollution)
2	7-Jan-19	8:07	164	1900	9	43%	Partially Cloudy and Foggy (Vehicle Pollution)
3	7-Jan-19	9:01	226	27522	9	56%	Partially Cloudy and Foggy (Vehicle Pollution)
4	7-Jan-19	10:01	131	39204	13	41%	Partially Cloudy and Foggy (Vehicle Pollution)
5	7-Jan-19	11:01	112	18930	17	32%	Cloudy
6	7-Jan-19	12:04	68	6498	18	22%	Cloudy
7	7-Jan-19	13:01	38	13797	20	19%	Cloudy
8	7-Jan-19	14:06	25	1881	23	15%	Cloudy
9	7-Jan-19	14:55	18	2265	15	22%	Cloudy
10	7-Jan-19	16:09	24	6927	16	21%	Cloudy and Foggy (Vehicle Pollution)
11	7-Jan-19	16:58	61	10599	15	26%	Cloudy and Foggy (Vehicle Pollution)
12	7-Jan-19	18:04	252	31686	16	30%	Cloudy and Foggy (Vehicle Pollution)
13	7-Jan-19	19:04	223	25527	14	22%	Cloudy and Foggy (Vehicle Pollution)
Mean		**11h54min**	**115.7**	**15617.9**	**15**	**30%**	

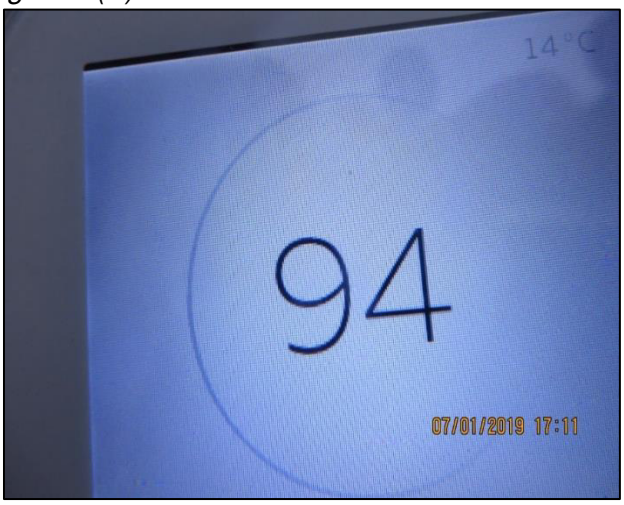
WHO Standard: 25 µg/m^3 24-hour mean.
Afghanistan Standard: 75 µg/m^3 24-hour mean.

Comments and Results

4. The results are that the PM 2.5 µg/m^3 levels frequently peaks throughout the measured time. The levels peaks especially around 9:00am and 6:00pm. Since the location is a highway it is reasonable to assume that the peaks occur at the same time as traffic increases. The mean for 11h54min is PM 115.7 µg/m^3. The levels are expected to decrease during late evening and night-time, however the mean is not likely to decrease to PM 75 µg/m^3 or PM 25 µg/m^3. Hence the air quality is low.

VI. SUB ROAD (1), SHAH RE NAW, DISTRICT 6, KANDAHAR CITY, KANDAHAR

Sample collection: 07/01/2019
GPS Coordinates: Latitude (N): 31.6131983, Longitude (E): 65.6811950



No of Sampling	Date	Time	PM 2.5 µg/m³	> 0.3µm	Temperature (Celsius)	Humidity %	Weather Condition During Monitoring
1	7-Jan-19	7:18	98	11784	7	49%	Partially Cloudy and Foggy (Vehicle Pollution)
2	7-Jan-19	8:08	136	16002	6	50%	Partially Cloudy and Foggy (Vehicle Pollution)
3	7-Jan-19	9:12	136	27536	9	50%	Partially Cloudy and Foggy (Vehicle Pollution)
4	7-Jan-19	10:06	448	43533	12	39%	Partially Cloudy and Foggy (Vehicle Pollution)
5	7-Jan-19	11:09	182	9471	19	28%	Cloudy
6	7-Jan-19	12:11	22	2598	18	22%	Cloudy
7	7-Jan-19	13:15	21	2316	22	15%	Cloudy
8	7-Jan-19	14:11	10	1446	21	16%	Cloudy
9	7-Jan-19	15:20	10	1650	15	20%	Cloudy
10	7-Jan-19	16:20	24	3435	15	10%	Cloudy and Foggy (Vehicle Pollution)
11	7-Jan-19	17:08	94	11211	14	26%	Cloudy and Foggy (Vehicle Pollution)
12	7-Jan-19	18:14	315	34233	14	27%	Cloudy and Foggy (Vehicle Pollution)
13	7-Jan-19	19:10	223	24537	14	24%	Cloudy and Foggy (Vehicle Pollution)
Mean		**11h52min**	**132.2**	**14596.3**	**14**	**29%**	

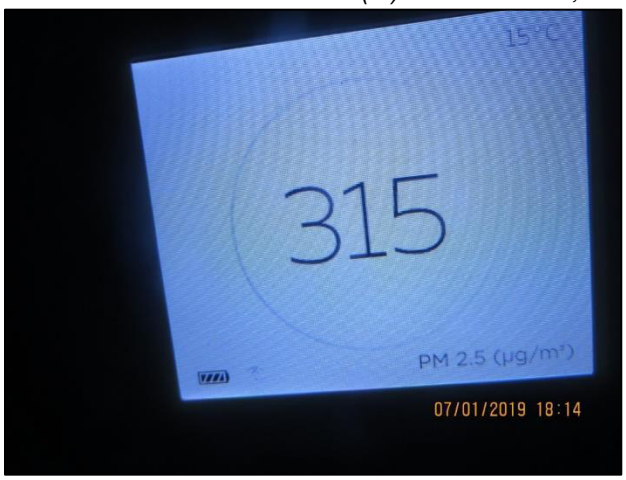
WHO Standard: 25 µg/m³ 24-hour mean.
Afghanistan Standard: 75 µg/m³ 24-hour mean.

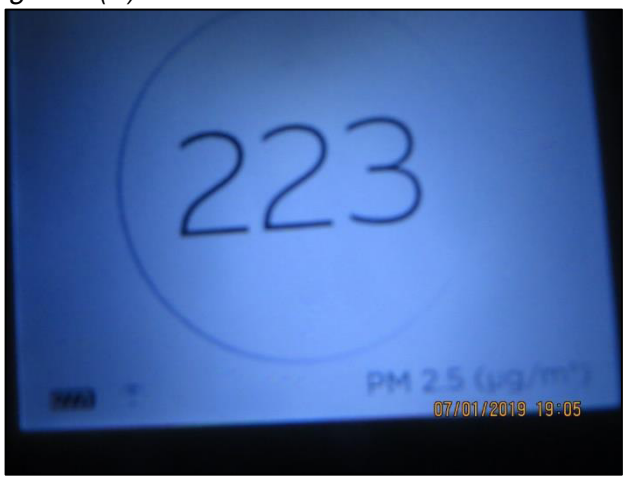
Comments and Results

5. The results are that the PM 2.5 µg/m³ levels are very high around 9am and 6pm which is during the time when traffic is expected to be heavy. The mean for 11h52min is PM 132.2 µg/m³ and the 24h-mean is also expected to exceed both WHO and Afghanistan standards. Hence, the air pollution at the location is low.

VII. SUB ROAD (2), SHAH RE NAW, DISTRICT 6, KANDAHAR CITY, KANDAHAR

Sample collection: 07/01/2019-08/01/2019
GPS Coordinates: Latitude (N): 31.6148750, Longitude (E): 65.6809600





No of Sampling	Date	Time	PM 2.5 µg/m³	> 0.3µm	Temperature (Celsius)	Humidity %	Weather Condition During Monitoring
1	7-Jan-19	20:00	101	14469	16	27%	
2	7-Jan-19	21:02	84	10800	15	36%	
3	7-Jan-19	22:04	135	15252	15	36%	
4	7-Jan-19	23:00	43	5418	13	35%	
5	8-Jan-19	0:05	23	5364	13	34%	
6	8-Jan-19	1:00	23	2709	13	34%	
7	8-Jan-19	2:00	19	1904	13	34%	
8	8-Jan-19	3:03	11	1335	16	23%	
9	8-Jan-19	4:19	13	1632	14	35%	
10	8-Jan-19	5:01	13	1536	14	38%	
11	8-Jan-19	6:04	45	5271	13	33%	
Mean		10h04min	46.4	5971.8	14	33%	

WHO Standard: 25 µg/m³ 24-hour mean.
Afghanistan Standard: 75 µg/m³ 24-hour mean.

Comments and Results

The results for Location 6 are recorded during night and early morning, hence the mean is expected to be lower than during daytime. When comparing the mean with Location 5 which is the same highway during the day, this holds true. The 10h04min mean at Location 6 is acceptable according to Afghanistan standards but not when combining the results for Location 5 and 6. The 21h56min mean would be PM 92.9 µg/m³which exceeds both standards.

The levels at Location 6 peak at 10:04pm and not one time after that, which indicates that traffic decreases during the night. The mean is PM 46.4 µg/m³ during this time period which exceeds WHO standards but not Afghanistan standards. In conclusion, the 10h04min mean suggests levels above WHO standard but not Afghanistan standard, adding the daytime both standards are exceeded. Hence should the area be considered to have low air quality.

VIII. RESULTS SUMMARY

The air samples tested were in most cases below the WHO Interim target-1 (75 µg/m^3) and Afghanistan maximum allowable concentration (75 µg/m^3) over 24 hours, even on a shorter timeframe. Indeed, measurements have been conducted mostly during daytime due to security reasons and therefore 24 hours measurements were not possible.

As per the table below, in two cases for roads in Kandahar city, the concentration was higher, however, it was only recorded over 13 hours (day-time). One of the measurement was done for a road during night-time. Averaging both results for the 24 hours period, the results is estimated to be close to the standard.

Air Quality Results Summary

Location	Date	Time	Number of samples / hours	Mean PM2.5 (µg/m^3)
Right Abutment Dahla Dam	4/01/2019	9:37 - 14:54	6	19.5
Downstream, Dahla Dam	5/01/2019	9:00 - 15:15	7	9.6
Water Supply Station Compound (C-3)	6/01/2019	8:10 - 16:47	10	42.8
Highway, Shah re Naw, District 6	7/01/2019	7:10 - 19:04	13	**115.7**
Sub Road (1), Shah re Naw, District 6	7/01/2019	7:18 - 19:10	13	**132.2**
Sub Road (2), Shah re Naw, District 6	7/01/2019	20:00 - 06:04	11	46.4

APPENDIX 7. TERMS OF REFERENCE ARGHANDAB RIVER ENVIRONMENTAL STUDY

TERMS OF REFERENCE FOR ARGHANDAB RIVER ENVIRONMENTAL STUDY

A. Introduction

A detailed environmental survey is needed to determine the:

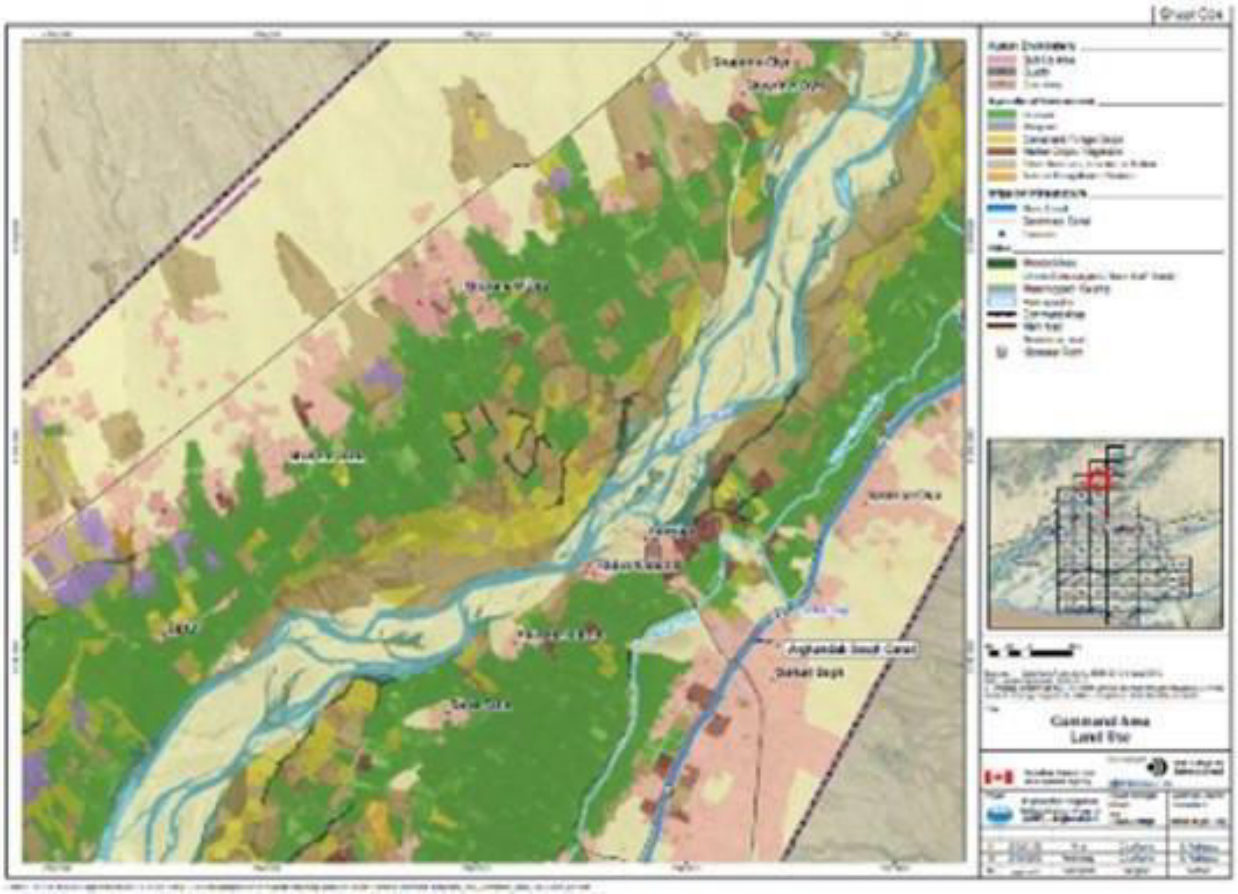
(i) **Immediate riparian impacts:** Any potential impacts upon wildlife, animal habitat and associated riparian vegetation caused by the raising of the dam wall by 13.6 m. The new wall is expected to result in an extension of the main dam and six saddle dams from an approximate length of 2,250 m to 3,000 m and a close assessment is required.

(ii) **Riparian ecology and ecological flows:** Ecological value of the Arghandab River basin below Dahla Dam and to define the environmental flow that is needed to be released from the dam to sustain and improve downstream aquatic habitats. Maps of Arghandab River provided by CIDA (Cartographic Atlas command area land use, 2012) show that the river itself has a natural, almost untouched morphology and numerous potential habitats for ground nesting birds, waterfowl and rheophilic fish species. These habitats may benefit considerably and be reactivated by the environmental flow. The EFs need to be attenuated as far as possible in close coordination with the water demand for irrigation and urban and rural water supply and the hydropower development.

(iii) **Revegetation plan:** Flora and faunal composition of any naturalised riparian habitat upstream of the Dahla Dam, including the immediate 'fan' and higher sloping lands, to assess the viability of re-establishing similar aquatic plant communities post construction.

(iv) **Cumulative Impact Assessment (CIA):** The CIA process is seen as an essential framework to improve risk management. To identify and positively address the integral issues requires an integrated intra-government approach. A dedicated process to raise the issues across government agencies is required, one where for example, the importance of EF's are highlighted and the challenges in achieving them clearly defined.

Arghandab River below the Dam Showing Meanders and Islands



Source: CIDA (2012), Cartographic atlas command area and land use

Arghandab River Upstream of the First Division Weir – Reeds and Potential Habitat for Ground Nesting Birds and Waterfowl

Source: TRTA Consultants, 2018

B. Surveys

1. Upstream Catchment Stabilization

Flying over the Hindu Kush between Kabul and Kandahar, and assessment through Google Earth indicates that the landscape supports limited grass and shrubs. Although it is unlikely that much can be done to stabilize the soil, it is suggested that at least a preliminary overview is undertaken in order to (i) define if particular areas are contributing large volumes of sediment to the Arghandab system, and (ii) assess if stabilization is feasible in some of these areas at least on a pilot basis. Security is a serious problem at present in much of the upper catchment, and this will need to be taken into account in defining whether such a component is feasible or not. If a peace agreement is reached during the project period, more detailed assessment could be considered. For success, any program will require management of the annual grazing regime which is a part of the Kuchi migration from the lowlands to the high. This annual migration can be a sensitive issue for sedentary communities and increasingly the cause of friction. The ARES will specifically therefore need to consult and gauge local perceptions and interest in the possibilities of such a program.

2. Vegetation Management and Community Mobilization Survey

Vegetation management and community mobilization survey will be conducted to:

(i) Identify major sedge, grasses, shrubs and trees associated with the perimeter of the dam, as well as those riparian species linked to the linear river tract (as well as the immediate associated higher land in the catchment) and to provide details on their associated ecology, habitat functions, propagation techniques and potential contribution to erosion control;
(ii) Identify plant material suitable for longer-term catchment stabilization and the immediate pre-conditions necessary for growth;
(iii) Consult with local communities to discern use of local plant material for medical, cuisine, fuel and fodder utilization; as well as ways to commence protecting the important function such vegetation performs should there be a revegetation program;
(iv) Gather indication from community as to their potential engagement in a long-term catchment management program with a major emphasis upon propagation and replanting of vegetation and control of fuel-wood, free-range grazing across the immediate catchment.

3. Ornithological Survey

Ornithological hotspots will be mapped and registered. The Cartographic Atlas command area and land use plan (CIDA 2012) will be essential to implement this task. A field visit from Dahla Dam to at least Qala-I-Bust including the Afghan/Iranian border is needed to identify these hotspots on site.

The ornithological survey shall be implemented twice (winter and summer half year) at selected ornithological hotspots of the Arghandab River downstream of Dahla Dam to the Iranian border (alternatively: to Qala-I-Bust). It will focus on waterfowl and on birds that live in the close vicinity of aquatic habitats. It will include the following activities:

(i) List of bird species (common and scientific names) and number of individuals recorded;
(ii) Short species description;
(iii) Conservation status for each species (national and international red lists);
(iv) Threat assessment for each species per hotspot;
(v) Habitat requirements for each species including specific habitat within the river as well as the reservoir;
(vi) Spatial map showing bird habitats;
(vii) Spatial map showing locations of birds mapped, one map for each hotspot;
(viii) Details of key bird species (birds of elevated conservation concern);
(ix) Observations and recommendations regarding ways in which development of new habitat can be supported through soil movement and revegetation during construction stages. This will include specific examination of the steps required to restore habitat in what will be the high water mark of the new water body. The process will include analysis of speciation, soils, propagation techniques along with ideal timing to minimise the longevity of impact.
(x) Details of all equipment used (binocular, telescope);
(xi) Detailed geographic information for all transects used during the survey (GPS coordinates);
(xii) A set of photographs for all specimens and survey sites taken during the survey, names of common and scientific names shown;
(xiii) A full itinerary of fieldwork and survey effort undertaken, including GPS localities of all surveys;
(xiv) Specific, practical and well-founded recommendations to improve biodiversity conservation management at hotspots.

Ornithological hotspots will be identified in collaboration with NEPA and verified with independent international stakeholders including for example, organisations Birdlife International.

The ARES survey will specifically offer recommendations regarding the redevelopment of suitable alternative habitat areas upon completion of the dam raise including details on suitable vegetation and soil. It is recommended that existing nutrient biologically rich top-soil will be removed and repositioned as part of initial site preparation as a basis of subsequent re-vegetation.

4. Fish Biological Survey

Fish biological hotspots shall be mapped and registered in close collaboration with NEPA, local fishermen and stakeholders. The fish biological survey shall be conducted above and below the dam in Arghandab River twice (summer half year and winter half year) to get an overview of the species inventory and to identify rheophile indicator species. Fish shall be caught in close collaboration with local fishermen. Different mesh size will be used. The fish biological survey will focus on the following activities:

(i) Mapping of spawning, feeding and breeding habitats and recommendations to improve the prevailing conditions;
(ii) Investigate and assess mitigation measures which could be applied to the fish habitats in the existing river estuary of the dam. These areas will be flooded and similar habitat conditions will need to be replicated upstream in what will be a new ‘estuary’. Recommendations regarding replication.

(iii) Mapping of the status of a representative number of non-degraded riparian areas downstream to both identify nodal points where real-time monitoring could be established, and complete detailed fish / aquatic specie surveys to inform the EF database and assist the detailed engineering design stage.
(iv) Determination of species variance in the river;
(v) Investigation and recommendations as to whether downstream fish habitat can be enhanced with accelerated sedimentation in the suitable areas (e.g. shallow water zones, reeds);
(vi) Catch protocols including location (coordinates), fish species caught, number of individuals per species, measurement total length (head to end of tail fin);
(vii) Young fish (fingerlings) shall be caught using small mesh size to find out breeding habitats (e.g. shallow water zones);
(viii) Recommendations regarding the ecological integrity and viability of introducing a 'fingerling' breeding and release program, particularly where the height of the existing dam wall precludes migration of certain species.

Additional information documented in a usable form regarding the existing species (preferred habitat conditions, techniques which could be used to mimic and generate favourable sub-aquatic habitat conditions, breeding cycle, predators, susceptibility to over-fishing, and their vulnerability to project activities) along with investigation to identify additional species. If the three predominant species in the Dahla Dam will be vulnerability to project activities, the survey should clearly outline appropriate mitigation measures which can be taken to minimise potential impact.

The survey should make recommendations as to how the existing and enlarged Dahla Dam water body could be improved in terms of habitat and representative speciation. Caution should prevail in this work and no consideration should be given to species which are not either endemic or indigenous.

Ecological requirements, including flow requirements of indicator fish, shall be identified. The ecological potential of hotspots will be assessed.

Survey will all specifically assess the (i) effectiveness of modified "fish-friendly" hydro turbines, (ii) identify fish endemic to this river system, and (iii) evaluate the potential for a fingerling program to be introduced into the dam to replenish fish stocks.

5. Hydraulic Model

Hydraulic calculations will focus on the Arghandab River below the dam to the Sistan basin. Hydraulic calculations e.g., according to Gauckler-Manning-Strickler will include (not limited to):

(i) Velocity;
(ii) Gradient;
(iii) Shear stress;
(iv) Roughness of the sediment;
(v) Infiltration losses;
(vi) Evaporation losses;
(vii) Water depth;
(viii) Width of water body;
(ix) Representative cross sections;
(x) Longitudinal sections;
(xi) Requirements of indicator species;

(xii) Future water abstraction for irrigation purposes;
(xiii) Future infiltration of irrigation and urban (waste) water.

Detailed calculations will be implemented for biodiversity hotspots. Hydraulic calculations will show whether the planned environmental flow will be sufficient to maintain the aquatic habitats of the whole river. The river will be considered section wise. The hydraulic model will focus on the season dependent ecological requirements of indicator species.

6. Topographical Survey

A topographical survey of the whole river and catchment is required to get baseline data for the hydraulic calculations. To the extent possible, secondary sources may be utilized.

7. Water Quality Investigations of Groundwater and Surface Water

A series of water quality investigations are suggested for the following:
A: Replication of water testing at all locations completed in 2018 (to assess any variables particularly for coliform in groundwater)

B: Water testing at the following locations:

(i) Spillways (2)
(ii) Proposed causeways for the route realignment (2)
(iii) Villages along water transmission line;
(iv) Arghandab River below the dam;
(v) Arghandab River at the last division weir (weir 13);
(vi) Arghandab River below weir 13;
(vii) Locations where water is available in the river below Kandahar City;
(viii) Existing groundwater wells.

C: Water quality analysis will be conducted against the following parameters depending on the laboratory capacity:

(i) pH;
(ii) Conductivity;
(iii) Oxygen concentration;
(iv) Temperature;
(v) TDS;
(vi) Nitrate;
(vii) Phosphate;
(viii) BOD5 or COD or TOC.

It is recommended that water quality sampling should subsequently be carried out on a quarterly basis as a key monitoring indicator.

8. Noise Levels

It is anticipated that concerns regarding noise associated with construction will specifically relevant close to existing settlement. Baseline noise levels will be collected at settlements along the re-alignment of the Route Bearer Highway during day-light hours.

9. Air Quality

Base-line air quality data will be collected from the following.

i. Main dam (replication of previous testing)
ii. Construction camp site (Location where some workers will be living)
iii. Route Bearer Highway (current alignment of the road)
iv. Route Bearer Highway (proposed – at the level of the village)
v. Canals (Specifically where the shops are for C2)
vi. Villages (Specifically where the relevant C3 settlement is located).

10. Groundwater Investigations

Monthly ground water investigations will focus on existing groundwater wells in Kandahar City and key irrigation areas. Construction of deep wells (piezometers) is recommended to monitor the decline of groundwater levels as well as plotting rainfall / percolation dynamics in a number of “assigned indicator wells” adjacent the river.

11. Environmental Flow Measurements During Dam Operation

The variables in assessment of appropriate environmental flows present a challenge. The Arghandab River is an ephemeral system in an arid zone where increasing demands have been made on adjacent groundwater resources with the result of levels dropping dramatically in parts. The increasing demands upon the river combined with the anticipated uncharacteristic weather events and more rapid spring melt-down associated with climate change all contribute to change the potential dynamics of the river. In some areas, flows to the river can be expected to percolate to depleted groundwater levels, compromising the immediate utilization of the flows.

Assembling real-time datasets across the catchment and downstream using remote stations is considered to be an important step in refining a workable and responsive approach to environmental flows.

It is recommended that an appropriate environmental flow can be arrived at by utilizing long-term monitoring and recording and will be established and modified in an ongoing manner during years of dam operation. It is therefore recommended that the detailed design shall define the number and location of monitoring units to log with greater accuracy the needs over time during dam operation. Rehabilitation of water gauging stations will be required in advance. If rehabilitation cannot be completed, temporary measurements will be required at these locations (e.g. use of Ott SLD – side-looking doppler sensor). Procurement of mobile measuring devices would be required.

During the dam operation, long-term monitoring and recording in an ongoing manner is recommended. Appropriate environmental flow could be identified by (i) maintaining a record of what has voluntarily gone across the spillway - annual melt-down flooding (if any), added to (ii) flows from hydro and (iii) monitored along the downstream course of the river. Calculation of what is possible to make up any deficit each year given the compounding set of circumstance would follow. This model could deliver scenarios where a range of 4-8 years out of 10 years may see no environmental flows at all - assuming that dry conditions prevail in the mountains. It is this year-by-year range combined with the limitations in the dam which will ultimately determine the environmental flows that are possible.

Based on the collected data, the assessment shall include: (i) combining real-time spring time data from the Hindu Kush (detailing temperature, commencement and time interval of snow melt), with (ii) existing water held in the dam post-construction, along with (iii) downstream deficits at various nodal points to identify what flows have occurred and whether these will adequately support environmental flow requirements.

The results of the assessment will also help to identify: (i) how the rise in the dam can improve the contribution to water availability for the Helmand River given the arid / ephemeral characteristics of the river; (ii) the contribution and limitations required for a Helmand Basin wide response; (iii) how improved seasonal management of the flow can improve availability of environmental flows and identify a series of nodal points which could be used as indicators; (iv) how various datasets can be used to mimic and support wet/dry year phenomena through deployment of stand-alone, real-time measurement stations; and (v) how any shortfalls can be mitigated against.

C. Recommendations

The environmental assessment should lead to a number of recommendations, as follows:

(i) A plan for catchment management to reduce erosion and sediment transport to Dahla Dam, including details on utilization of appropriate indigenous vegetation, application of bio-engineering techniques, consultation with communities to establish the parameters for managing and protecting any catchment management infrastructure;
(ii) Systems for the ongoing monitoring and management of groundwater;
(iii) Recommendations regarding implementation of environmental flows using the two tiered approach: (i) develop the methodology to commence an appropriate pilot environmental flow which is calibrated against seasonal conditions, and (ii) identify a methodology for tracking upstream and downstream datasets required to produce a matrix which can be used as support data to inform over a longer time-scale environmental flows;
(iv) Recommendations on ways to improve environmental flows to the Sistan basin and hamouns, and ensure that Afghanistan can meet its obligations under the 1973 Afghan-Iranian Helmand River Water Treaty;
(v) Methods to establish regular monitoring of environmental conditions in the reservoir and downstream.

Survey	Area	Duration**	TRTA	Timeframe	Resources	Cost*	Preliminary requirements
Upstream catchment stabilization	Catchment above existing reservoir	2 months		Summer	Environmental planner accompanied by soil and water conservation expert (NEPA staff and local firm)	TBA	Strategic catchment assessment to assist protection and management
Vegetation management and community mobilization	Representative zones in Riparian, fan and upper catchment areas linked to topographic variance	2 months		(2 surveys: winter and summer)	1 arid zone botanist/ ecologist, 1 community facilitator	TBA	Identification of relevant species and process to develop and implement re-vegetation program.
Ornithological survey	Dahla Dam to Qala-I-Bust (250km) / Iranian Border (800km)	2 months		6 months (2 surveys: winter and summer)	1 ornithological expert accompanied by NEPA	TBA	Identification of hotspots (with NEPA and stakeholders)
Fish survey	Upstream and downstream	2 months		6 months (2 surveys: winter and summer)	1 fish expert, accompanied by NEPA and fishermen	TBA	Identification of hotspots (with NEPA and fishermen)
Hydraulic	Downstream (up to Qala-I-Bust)	1 month		1 month	Local firms	TBA	Results from ornithological and fish surveys
Topographic survey	Whole river to Helmand. Selected on ground measurement to verify Google Earth data	1 month		1 month	Local firms	TBA	Google Earth elevation data
Water quality assessment	Dahla Dam, Downstream, last diversion weir, below weir 13, below Kandahar city, groundwater wells	2 months		1 year (on a quarterly basis, 2 weeks every 3 months)	Locals firms and labs	TBA	Baseline information on existing
Noise levels assessment	Settlements along the proposed Route Bearer Highway	1 month		During daylight hours	Local firms	TBA	Baseline data
Air quality assessment	As per 6 sites	1 month		During daylight hours	Local firms	TBA	Baseline data
Groundwater level assessment	Existing wells in Kandahar City, key irrigation area	Ongoing		-	Local firms	60,000	Purchase of piezometers (6 at 10,000 each)
Environmental flow measurements	Existing gauging stations	Ongoing		1 year (monthly measurements)	TRTA, NEPA staff and local firm	TBA	Rehabilitation of stations / procurement of mobile measuring devices.

* The cost for the survey would need to be assessed separately as major components would be put out to tender.

** In some cases, it is envisaged that stations could be established to record and relay data to a centralized station for constant monitoring.

APPENDIX 8. DRAFT EMERGENCY RESPONSE FRAMEWORK

DRAFT EMERGENCY RESPONSE FRAMEWORK

The following outlines steps to take to develop a response to any accident or hazard that occurs which could threaten lives.

The emergency response aims to protect:

(i) Employees, visitors, contractors and anyone else involved during the construction of the raise of the dam, saddle dams, spillways and route bearer highway realignment;
(ii) Communities downstream of the dam wall in the event of any natural hazard, seismic event, flooding, wall fracturing, failure, accidental incident which could cause a threat to life and/or livelihoods during operation of the dam.

The following steps provide a framework for an emergency response.

Primary Protective actions for life safety

When an emergency occurs, the first priority is always life safety. Establish procedures to follow in the case of accidents on site, particularly where life is threatened. Three critical steps are worth considering:

(i) Evacuation: methods and distances acknowledged by community;
(ii) Sheltering: spatial identification and knowledge established;
(iii) Shelter-In-Place: resources required to support people for the duration of the event.

This requires:

(i) Establishment of monitoring and early warning systems related to any potential failure in dam wall. Severe weather events can be forecast hours before they arrive, providing valuable time to protect both a facility and lives.
(ii) Identification of safety-zones and suitable sheltering areas associated with any necessary evacuation so community can be relocated / directed to safety.
(iii) Systematic approach developed including implementation of precautionary “evacuation drills” which include identification of resources and individuals responsible;
(iv) Approach necessary at the community level when faced with an act of violence associated with the dam;
(v) Identification of sources of first aid and CPR by trained employees and/or community members;
(vi) Training in use of fire extinguishers by trained employees / community members;
(vii) Development and understanding of methods to contain chemical spills to minimize damage and help prevent any environmental damage or threats to life.

Secondary actions for life safety

(i) Methodology to stabilize impacts of the incident and minimize any further potential damage after lives have been secured.
(ii) Clearly define a process for damage assessment, salvage, protection of undamaged property and clean-up following an incident.
(iii) Monitor and manage activities over life of emergency and feedback lessons learnt to modify emergency response as required.