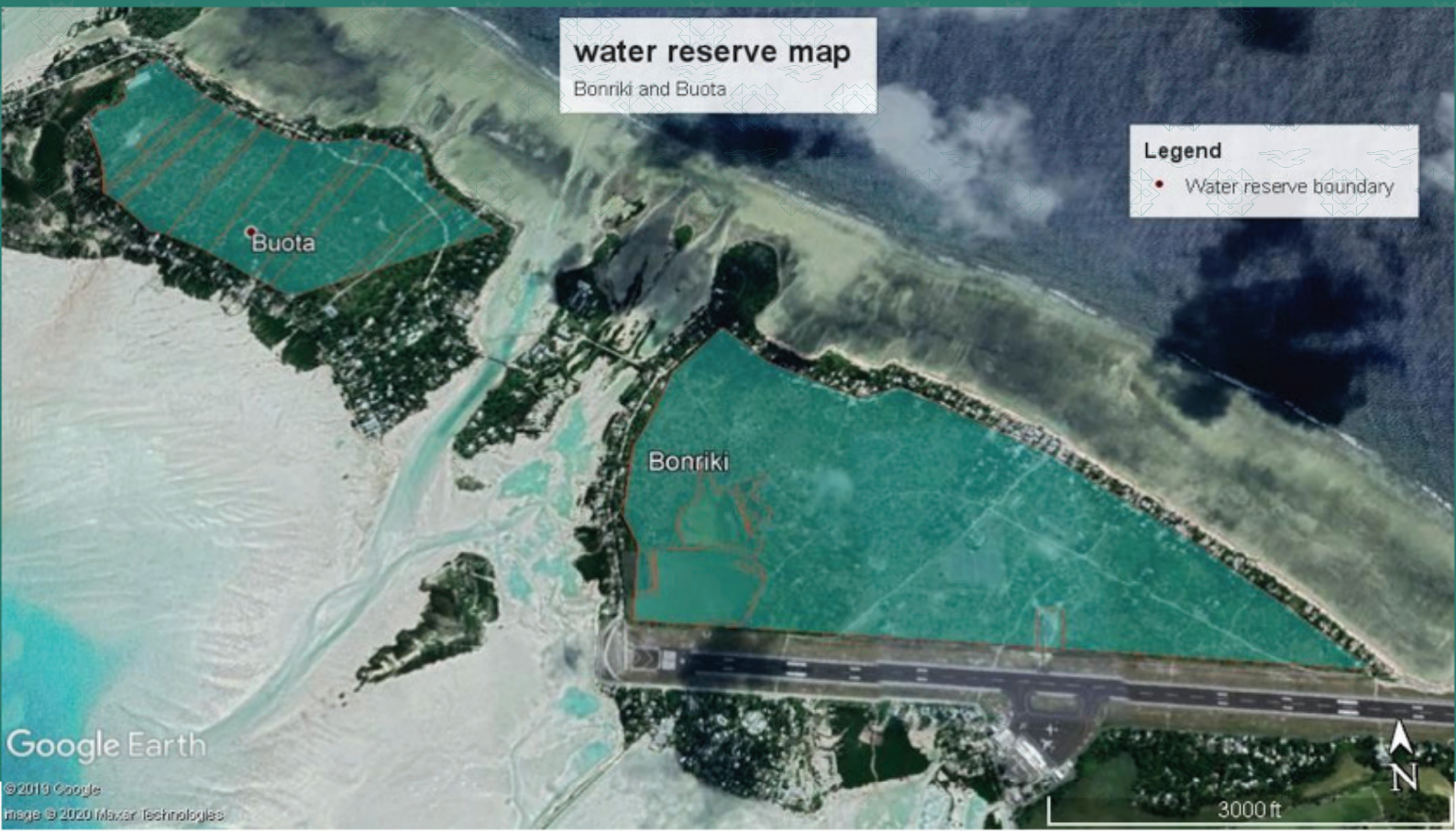
Nei Akoako
Ngkoa, Ngkai, ao n Taai Nako
Environment and Conservation Division

Pacific R2R
Ridge to Reef

GEF/SPC INTERNATIONAL WATERS (IW)
RIDGE TO REEF (R2R) PROGRAMME
KIRIBATI NATIONAL IW R2R PROJECT

BONRIKI & BUOTA
WATER RESERVES WATER QUALITY
SAMPLING / MONITORING PLAN



Prepared by
Samasoni Sauni | Teema Biko

June 2020

Pacific Community
Communauté du Pacifique

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GEF/SPC INTERNATIONAL WATERS (IW) RIDGE TO REEF (R2R) PROGRAMME

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BONRIKI & BUOTA WATER RESERVES WATER QUALITY SAMPLING/ MONITORING PLAN

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Jointly supported and funded by the SPC Regional IW R2R Project and the Ministry of Environment, Lands, Agriculture Development (MELAD), Kiribati Government, Tarawa.

Pacific R2R
Ridge to Reef

June 2020

CONTENTS

ABBREVIATIONS

ANZECC	Australian and New Zealand Environment and Conservation Council
BOD	Biological Oxygen Demand (BOD)
DLT	Dry litter technology
DO	Dissolved Oxygen
GEM	Geoscience Energy and Maritime
ICM	Integrated Coastal Management
IW R2R	International Waters Ridge to Reef Project
KI	Kiribati
MELAD	Ministry of Environment, Lands, Agriculture Development
MHMS	Ministry of Health and Medical Services
MISE	Ministry of Infrastructure and Sustainable Energy
ORP	Oxygen-Reduction Potential
RPCU	Regional Programme Coordination Unit
SPC	Pacific Community
TDS	Total Dissolve Solids
USP	The University of the South Pacific
WHO	World Health Organization

1. CONTACT INFORMATION

Table 1: Relevant project contact information.

Project Title:	***GEF Pacific Ridge to Reef*** – Testing the Integration of Water, Land, Forest & Coastal Management to Preserve Ecosystem Services, Store Carbon, Improve Climate Resilience and Sustain Livelihoods in Pacific Island Countries
Organisation name:	Environment and Conservation Division, MELAD
Contact Persons:	Teema Biko Nenenteiti Teariki - Ruatu
Phone Number:	(689) 75028000/75028425
Email:	teemab@environment.gov.ki nenenteitit@environment.gov.ki
Postal address:	IWR2R Kiribati Project, Environment & Conservation Division, MELAD Tarawa, Kiribati

2. OBJECTIVES & GOALS

The primary purpose and intent of this plan is to test the effectiveness of the Kiribati International Waters Ridge to Reef Project intervention at the demonstration sites atBuota and Bonriki Water Reserves - relative to capacity building for sustainable piggery waste management, improved information management, and reduced pathogen and nutrient offload into the receiving environment of aquifers and underground water in the Reserves. The target is a 5% reduction in total nitrogen from nutrient and pathogen loads from pig effluent discharging directly into the receiving environment. This is equivalent to 955 kg TN per year and to be achieved through construction of 30 dry litter technology (DLT) piggeries in the demonstration site areas by end of the project duration. The DLT piggeries are in the peripheries of the Bonriki Water Reserve communities.

Water quality monitoring also provides the opportunity to maintain the level of skills among the relevant officials and stakeholders responsible for monitoring water quality in the country. This includes collaboration and coordination efforts with other relevant line ministries like Ministry of Infrastructure and Sustainable Energy (MISE), and entities like The University of the South Pacific (USP) in the planning and monitoring of water quality sampling and assessment work in the Water Reserves, and elsewhere. This monitoring plan compliments other current ongoing water quality monitoring programs particularly that of the Ministry of Health and Medical Services (MHMS) and MISE.

2.1 Research & Management Questions

The underlying research questions, include: -

- Does the dry litter technology (DLT) reduce pathogen and nutrient offloads into the aquifers and underground water in the Buota/ Bonriki Water Reserves?
- Is there sufficient resources and capacity to carry out water quality testing and provide robust and accurate scientific advice for decision making?
- Is current level of municipal waste pollution in the Water Reserves within the thresholds and, therefore, the water is not contaminated or polluted?

Equally important is the need to address management questions relative to public health, incidence & outbreak of diseases linked to pollution and contaminated water, coordination, and monitoring. The management questions include: -

- What are the major influences of water contamination at the Reserves?
- Are there positive changes to the quality of water at the Reserves?
- What are the relationships between land-use activities and pollution trends and dry litter piggeries?
- What are additional sources of funding or co-funding?
- What other partners can support the ongoing water quality monitoring?
- Is there a possibility of streamlining water quality monitoring to avoid unnecessary waste of resources and duplication of efforts?
- What is the best modality for planning and organizing monitoring?
- What is the best means of collecting information from partners and stakeholders?
- How do we best structure a monitoring plan?
- How can we best explain why monitoring is needed to encourage “buy-in” and support from stakeholders?

3. PROJECTS & INFORMATION MANAGEMENT

There are other water quality monitoring programs and activities carried out by the Ministry of Infrastructure (MISE), Ministry of Public Health and Ministry of Environment, Lands an Agricultural Development (MELAD). These monitoring efforts link to several projects that are focused on understanding and addressing the causal link between land-use activities and water pollution and contamination. The monitoring also assists in the determination of the efficacy and the successful application of mitigation measures and innovative technologies such as the impacts of sanitation system upgrades and dry litter piggeries.

In the past there have been research and technical investigations into the potential of fresh underground water recharge and modelling (Galvis-Rodriguez, Post, Werner, & Sinclair, 2017). There are also other long- standing projects dealing with other forms of water pollution influenced by metals and hydrocarbons (Redfern, 2006; Kuruppu, 2009). The information and data collected will be stored, analysed, and written up for publication. The key results provide useful science and an evidence-base for Integrated Coastal Management (ICM) planning, and policies and legislations approved and gazetted.

4. SCOPE & RATIONALE

The Kiribati International Waters Ridge to Reef Project (Kiribati IW R2R Project) will be conducting Water Quality Sampling at the Bonriki Water Reserve and Buota Water Reserve from May 2020 to May 2021. The information collected will be used to test the effectiveness of IW R2R project intervention on DLT in reducing pathogen and nutrient offloads into the aquifers and underground water of the Water Reserves.

The scope is limited to only the demonstration sites at Bonriki and Buota though there is relevant information on boreholes in other spatial areas outside the water reserves. The monitoring is also confined to boreholes and wells, and does not extend to quality of water after it has been treated and transported to households on the island.

The plan outlines the site selection, sampling methods, frequency, and reporting requirements for water quality monitoring only. The associated templates and worksheets to be used with this plan include: -

- Water quality worksheet;
- KorDSS data management;
- MS Excel Water Quality Database; and
- MS Word Water Quality Report.

5. SAMPLING SITES & DESIGN

The Bonriki and Buota Water Reserves are geographically separated but in relative proximity to each other. The Bonriki Water Reserve is in South Tarawa, and Buota Reserve in North Tarawa. A narrow channel that provides for the exchange of water mass between the lagoon and the ocean side, separates South and North Tarawa. Therefore, the two reserves do not necessarily share the same characteristics of aquifers and underground water lenses. The communities living in the periphery or close to both reserves are also different. The construction of 30 DLT (dry litter technology) targets the Bonriki Water Reserve only.

Table 2: Water Quality Monitoring Sites

Site location	#	Code	Site Type (borehole or well)	Brief Description of the site location	GPS Coordinates	
Buota	1	BU2	Borehole	North side of reserve toward Abatao	1° 23' 46.3”	173° 7' 41.1''
	2	BU4	Borehole	South side of reserve close to residential area	1° 23' 35.3”	173° 7' 45.1''
	3	BU12	Borehole	Close to residential area toward the Buota Bridge	1° 23' 41.1”	173° 7' 36.0''
	4	BU13	Borehole	Middle of reserve to Abatao side	1° 23' 36.4”	173° 7' 56.9''
	5	TBC	Well	TBC	TBC	TBC
	6	TBC	Well	TBC	TBC	TBC
	7	TBC	Well	TBC	TBC	TBC
	8	TBC	Well	TBC	TBC	TBC
Bonriki	1	BN1	Borehole	North side of North reserve near intersection of ocean road and north from PUB compound	1° 23' 12.7”	173° 8' 48.2''
	2	BN2	Borehole	≈ 1-2 meters from small cemetery, close to few houses	1° 23' 9.0”	173° 8' 43.6''
	3	BN7	Borehole	≈2 meters from road, near residential area		
	4	BN11	Borehole	≈ 1 meter from house	1° 23' 16.8”	173° 8' 24.3”
	5	BN13	Borehole	≈40meters from >7 houses	1° 22' 57.8”	173° 8' 59.6”
	6	BN15	Borehole	≈4 meters from houses	1° 23' 4.7”	173° 8' 51.0”
	7	BN19	Borehole	≈4-5 meters from few houses, close to pond	Need to find	
	8	BN20	Borehole	Close to few houses >4	Need to find	
	9	NB23	Borehole	≈ 10 meters from cemetery	Need to find	
	10	BN24	Borehole	≈ 50 meters from cemetery	1° 23' 1.3”	173° 8' 56.1''
	11	W1	Well	Well at BN15	1° 23' 4.7”	173° 8' 51.0”
	12	W2	Well	Well at BN20	TBC	TBC
	13	W3	Well	Well at BN19	TBC	TBC
	14	W4	Well	Well near BN1	TBC	TBC

On this basis, the boreholes and wells at the Bonriki Water Reserve will be treated as target sites, and those at Buota Water Reserve as control sites (sampling location data entry sheet found in Appendix A). Accordingly, water samples will be collected from 34 sites[1], and 2-replicate water samples per site, as follows: -

(i) 10 boreholes and 4 wells in Bonriki; and,

(ii) 4 boreholes and 4 wells in Buota 6.

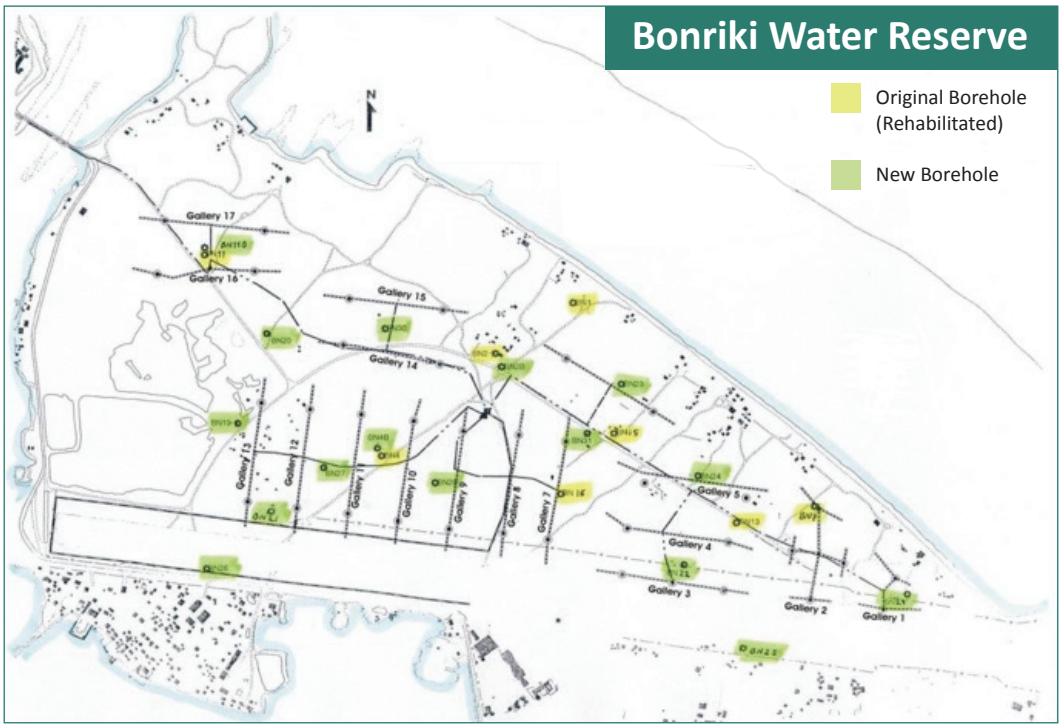

Figure 1 Map of Bonriki Water Reserve

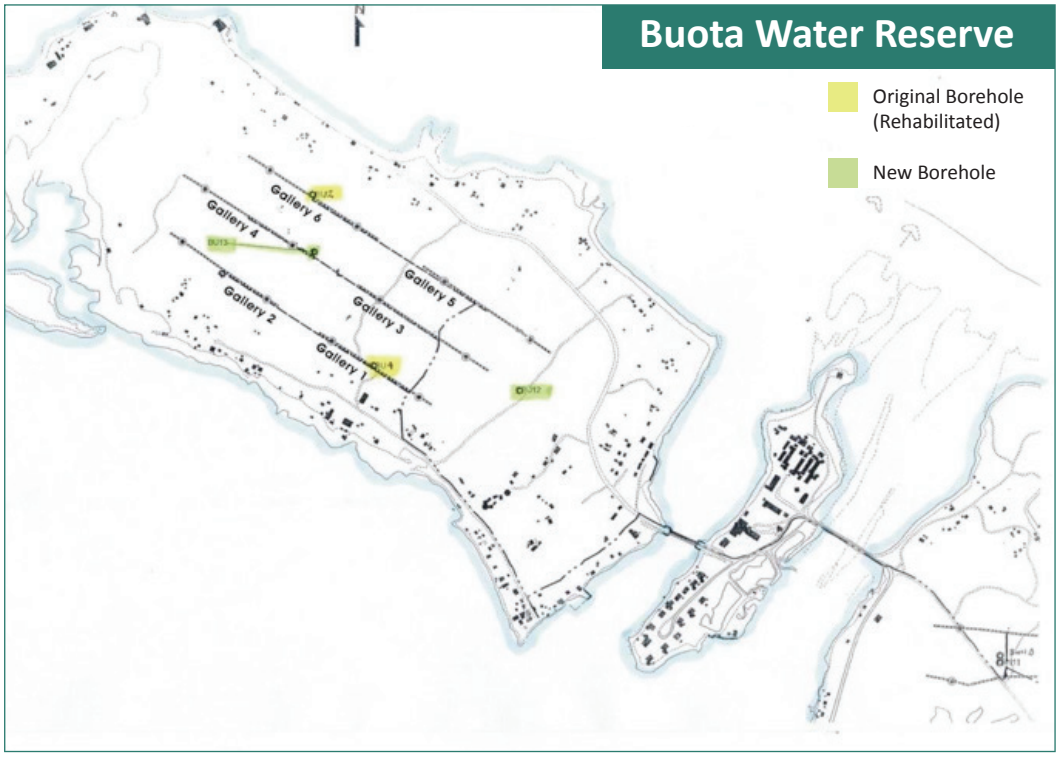

Figure 2: Map of Buota Water Reserve and boreholes

1. Note that there are 9 boreholes in Buota and 25 in Bonriki Water Reserve, and not all are functional or operational in terms of ability to extract water samples through the monitoring tubes; 5 boreholes in Buota are not functional

6. SAMPLING STRATEGY

6.1 Frequency/ Schedule/ Duration

Sampling and water quality assessment shall be done quarterly for the next 12 months, starting in May 2020 till May 2021. Each sampling and assessment of all the 22 sites are expected to occur within four (4) weeks noting unforeseen circumstances that may delay work. Details of sampling are set out in Appendix B, while associated data entry sheet in Appendix C.

6.2 Water Quality Parameters

pH

Conductivity (salinity)

[2]Dissolved Oxygen (DO) / Oxygen-Reduction Potential (ORP)

Temperature

Total Dissolve Solids (TDS)

Nutrients (Nitrate, Nitrite, Phosphate & Ammonia)

Biological Oxygen Demand (BOD)

Microbiology (faecal coliforms, Escherichia coli)

Rainfall (SI Meteorology for daily/weekly)

Data entry sheet for the water quality parameters found in Appendix D.

6.3 Materials & Methods

Field Measurements

The following measurements to be undertaken at project sites include – pH, Conductivity, Dissolved Oxygen (DO), ORP, Temperature, Total Dissolve Solids (TDS). These tests are conducted using the YSI professional multi-meter and test kits. The methods are as follows (also see details in Anon., 2019):

- Follow the MISE method to extract the water from the boreholes and wells (Sauni et al., 2020).Attain approximately 500mL of water into site labelled bottle, for microbial testing and put in the cooler box.Place the YSI multimeter into the remaining sample water. Ensure all the probes are fully submerged, and samples being tested are catalogued and programmed correctly into the multimeter. Allow for the numbers on the YSI multimeter screen to stabilize and then run the test and read off/ record the readings.
- Remove the multimeter from the sample water and dry out before placing back in carry bag.
- Note the site description and other observation (i.e. weather etc.) in the sampling form (see details Annex D & E).

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2. (Pacific IW Ridge to Reef Project Water Quality Monitoring Guide, 2019)

Equipment (checklist)

- YSI, sample bottles, labels & pens, sampling form.
- Consult the list in Appendix E.

Micro-Sampling & Laboratory Measurements

The measurements to be will be undertaken in laboratory include the microbial test – E. coli and faecal coliform, nitrate, nitrite, phosphate and ammonia. The method is as follows.

- Pour out 500ml of sample water into a labeled storage bottle for microbiology, and nutrient (phosphate, nitrate, ammonia and nitrite) [Appendix F, G, H, I respectively] test, and place them directly in the cooler.
- For microbiology test – BRING THE SAMPLES TO THE LABORATORY FOR INCUBATION (note: inform laboratory 1 day prior).
- For nutrient test, refer to Appendix G and H.
- Place the YSI multimeter into the remaining sample (in the basket) ensure all probes are fully submerged. Wait for the numbers to stabilize and run the test.
- Record the reading and at the same time, save it on the multimeter.

6.4 Guidelines/ Standards/ Evaluation Criteria

Use existing standards accessible and available at the WHO & ANZECC, or local standards where such standards have been approved and gazetted for use by the Kiribati Government.

Table 3: Guideline values for determinands/ physical or chemical stressors for ecosystems like underground water lenses or aquifers.

Determinands	Guideline Value (GV)	Max. acceptable value (MAV)	Unit	Remarks	Source
Ammonia (NH_4)	0.1		mg/ L	aesthetic	(ANZECC & ARMCANZ, 2000)
	10.0		µg/ L		ANZECC & ARMCANZ (2018)
pH	7.0 – 8.5			< 8 preferred; aesthetic	ANZECC & ARMCANZ. (2000)
	6.0 – 8.0			upper & lower limit	ANZECC & ARMCANZ (2018)
Turbidity	2.5		NTU		(ANZECC & ARMCANZ, 2000)
[3]Nitrate, short-term		50	mg/ L	Inorganic	ANZECC & ARMCANZ (2018)
Nitrite, short-term		0.2	mg/ L	Inorganic	ANZECC & ARMCANZ (2018)
Nitrite, long-term		3.0	mg/ L	Inorganic	ANZECC & ARMCANZ (2018)
Nitrite	10		µg/ L	Default trigger value	ANZECC & ARMCANZ (2018)
[4]Salinity	90 - 900		mg/ L	Lakes, reservoirs wetlands; nutrient concentration	ANZECC & ARMCANZ (2018)
Phosphate	<0.1		mg/ L	Freshwater farm species	ANZECC & ARMCANZ (2000)

7. DATA & INFORMATION MANAGEMENT

A workplan for sampling and monitoring progress towards water contamination and waste pollution reduction in the Water Reserves and demo sites is described below. Monitoring schedules may change due to cost or personnel constraints, however, a minimum of baseline monitoring and annual indicator monitoring must be adhered to. The general monitoring program for the project is outlined in Appendix C.

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3. Results of nutrient analyses can be reported in two ways – as the whole compound or as the principal element in the compound. For example, nitrate may be reported as nitrate (NO3) or nitrate as nitrogen (NO3-N). When assessing results against guidelines and standards, or when comparing data from different sources, it is important to compare like with like and convert the results if needed.

4 Default trigger value for electrical conductivity of water that increases/decreases with salinity (EC, salinity) varies between places. The unit of measurement for conductivity is siemens (S) per unit of length of water that the current is passed through. The Kiribati DC adopted a salinity threshold of 1,500 micro siemens per centimetre (µS/cm) as the acceptable upper limit for potable use of water. Higher values than the threshold is considered unacceptable for potable use of water pumped from the Bonriki Water Reserve Treatment/Storage facility.

7.1 Data Collection

Collection of data is essential for water quality monitoring plans. Effective planning using a Gantt chart ensures time management of data collection activities. Table 3 depicts time periods associated, and each data collection activity.

Table 4: Gantt chart of project data collection activities.

Data Collection Activities	May-Jul	Aug-Oct	Nov-Jan	Feb-Apr
Develop monitoring tools				
Baseline assessment data collection (target & control sites)				
Revise survey tools, calibrate and prep				
Data analysis & management				
Indicators monitoring				
Site condition surveys				

The allocation of project data collection activities ensure accountability, efficient distribution of tasks and outlines clear implications of the activities related to project data collection. Table 4 depicts the relevant parties allocated to the associated data collection activities.

Table 5: Allocation of project data collection activities.

Person responsible for developing monitoring tools:	Identify staff members or job title from R2R, MELAD, MISE, etc., that will conduct the monitoring.
Person responsible for data collection, baseline assessment incl. field sampling:	National IW R2R Project Manager.
Person responsible for revising survey tools, calibrate equipment and necessary preparations for fieldwork sampling, data analysis and management:	KI IW R2R staffs led by Project Manager (Teema BIKO), Other Environment Staff – Nenenteiti Teariki- Ruatu, David Jr, Sam.
Field samples storage location/s:	All field water samples properly stored away in iced cooler boxes in the field, and then transfer to refrigerator storage ready for laboratory work at the IW R2R Office.
Laboratory assessment & method:	Raw data from field and lab will be recorded on prepared forms, computerised, and stored in the hard drive of IW R2R Project Manager, and sent to the Regional IW Database.
Intended data use:	Data will be electronically stored and downloaded from the equipment, and/or manually recorded as field and lab results, then entered onto the database at the IW R2R Office. Scan copy of records and electronic version are then sent and placed in the Regional IW Database for use through the online portal and mapping, and the Results Tracking Tool.
Reporting type and frequency:	Annual reports of the quality of water at the Water Reserves or demo sites, Mid-term review and final project reports.
Report and/or communications recipient/s:	Technical Task Force, Project Steering Committee, Regional IW R2R, Other related GEM projects and programs on water etc.

7.2 Data Management

Water Quality Monitoring data management includes activities that help inform possible directions for future planning using communication materials and analyzed data. Effective planning using a Gantt chart ensures efficient and timely delivery of these activities. Table 5 depicts time periods associated with each data management activities.

Table 6: Gantt chart of data management activities.

Data Management Activities	May-Jul	Aug-Oct	Nov-Jan	Feb-Apr
Generate fact sheets & other communication materials				
Assess and consolidate existing data				
Populate national & regional dbases				
Data sharing				
Data process & analysis				

Water quality monitoring data has several implications and uses. Identifying the type of data ensures that data obtained is effectively used by the relevant parties of interest. Table 6 depicts types of data and the associated uses with the data users.

Table 7: Management and usage of data and the respective parties of interest.

Data User	Uses	Type
Environment Division	Evaluate effectiveness of on-ground management measures. To direct management objectives.	Raw data, summary reports.
Government of Kiribati	Improve management decisions. Direct funding and development partner projects.	Summary reports.
Community Stakeholder groups	To increase understanding of water quality & catchment health issue. Improve community relations & participation in management decisions.	Summary reports, outreach materials.
Researchers, students	Increase understanding of water quality & catchment health issue. Improve community relations & participation in management decisions.	Summary reports, outreach materials.

The allocation of data management and responsibilities ensures accountability, efficient distribution of tasks and outlines clear implications of the management of these datasets. Table 7 depicts data management responsibilities and the respective parties and individuals.

Table 8: Data management and the responsibilities of respective parties & individuals.

Person responsible for data management:	Identify staff members or job title from R2R, MELAD, MISE, etc., that will conduct the monitoring.
Person responsible for generating fact sheets etc:	National IW R2R Project Manager.
Person responsible for assessment & consolidation of existing data:	KI IW R2R staffs led by Project Manager, Other Environment Staffs – Teema, David Jr, Sam, etc.
Hard copy data storage location/s:	Hard copies of all field data will be stored in chronological and accessible filing system at the IW R2R Office.
Electronic data storage location/s and method:	Transcribed raw data will be stored in the hard drive of IW R2R Project Manager and sent to the Regional IW Database.
Intended data use:	Data will be used to generate annual reports, placed in the Regional IW Database for use through the online portal and mapping, and the Results Tracking Tool.
Reporting type and frequency:	Annual reports of the quality of water at the Water Reserves or demo sites, Mid-term review and final project reports.
Report and/or communications recipient/s:	Technical Task Force, Project Steering Committee, Regional IW R2R, Other related GEM projects and programs on water etc.

Data management: -

- Original field data sheets will be collated and input into water quality database at the completion of each monitoring event (including metadata).
- Raw data will be downloaded through KorDSS software from the YSI ProDSS units and exported to the Excel water quality database at the completion of each monitoring event.
- Lab data sheets for colorimeter results (nitrate and phosphate) will be collated and input into water quality database at the completion of each monitoring event.
- Original datasheets will be stored, by date, in archived lever folders at the IW R2R Project Office.
- Photographic records and habitat assessments will be stored also and filed at the IW R2R Project office.

Data interpretation: -

The Project Manager will: -

- Develop findings: based on the data. For example, identifying which sites exceed standards and when;
- Interpret: to explain why the data looks the way it does, and what conclusions can be made; and
- Develop recommendations: describe what action should be taken and what further information should be gathered.

7.3 Report Development

Development of project reports are essential for water quality monitoring plans. Effective planning using a Gantt chart ensures timely delivery of reports. Table 8 depicts development of project reports and the associated time periods.

Table 9: Gantt chart of development of project reports.

Activities	May-Jul	Aug-Oct	Nov-Jan	Feb-Apr
Develop dbase & establish reporting system				
Water quality training report				
Baseline assessment report				
Activity Report				
Site Condition Report				
Half-Yearly Monitoring and/or Maintenance Report				
Mid & Terminal evaluation report				
Dissemination				

The allocation of report development responsibilities ensures accountability, efficient distribution of tasks and outlines clear implications of the development of these reports. Table 9 depicts the allocation of relevant report development responsibilities and the associated parties and individuals.

Table 10: Allocation of relevant report development responsibilities.

Person responsible for preparing reports:	Identify staff members or job title from R2R, MELAD, MISE, etc., that will conduct the monitoring
Person responsible research and drafting reports:	National IW R2R Project Manager
Person responsible for data analysis and management:	KI IW R2R staffs led by Project Manager, Other Environment Staffs – Teema, David Jr, Sam, etc.
Location/s and method:	Reports will be archived appropriately and stored in the hard drive of IW R2R Project Manager and send to the Regional Office for review. A final report will be uploaded online.
Intended use:	The reports will be placed on the R2R website and the Results Tracking Tool.
Reporting type and frequency:	Annual reports of the quality of water at the Water Reserves or demo sites, Mid-term review and final project reports.
Report and/or communications recipient/s:	Technical Task Force, Project Steering Committee, Regional IW R2R, Other related GEM projects and programs on water etc.

8. REFERENCES

Anon. 2020. Pacific IW Ridge to Reef Project Water Quality Monitoring Guide. Unpublish. report prepared by the Regional Program Coordination Unit (RPCU), Pacific Community (SPC), Suva, Fiji.

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9. APPENDICES

Date:.....

Time.....

A. Sampling locations:

Bonriki Water Reserve

Control Point & Site #	Brief description of Site Location	GPS Coordinates (Decimal degree format)
BN01	Distance from human activities/ houses/cemetery/etc.,	

B. Monitoring Programme

MONITORING SCHEDULES (12 Months; May 2020 to May 2021)

IWR2R Kiribati Project Operation Annual monitoring plan

	MAY 2020	JUL 2020	OCT 2020	JAN 2020	APR 2021	JUL 2021	OCT 2021
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Key

Bonriki Water Reserve

Buota Water Reserve

C. Frequency and Duration

Once a month or quarter ongoing for twelve (12) months (March 2020 to March 2021)

Control Point & Site	Frequency	Time of the year (season)	Time of the Day	Special weather conditions
BN1	quarterly			Rain & overcast

Key:

BN Bonriki Water Reserve

D. Monitoring Parameters (Field)

Date:.....

Time.....

Biological/Physical

Control point & Site	Coordinates	Turbidity (NTU)	Temperature (°C)	pH	Salinity	Density	Dissolve Oxygen	Total Dissolve Solids	Conductivity
BN1									

Other Parameters

Control point & Site	Coordinates	Solid wastes	Nutrients	Metals	Rainfall	Sediments	BOD
BN1							

Microbiology

Control point & Site	Coordinates	Total Coliforms	Escherichia Coli (E. coli)
BN1			

Metals

Control point & Site	Mercury mg/l	Arsenic mg/l	Cadmium mg/l	Copper mg/l	Lead mg/l	Zinc mg/l
BN1						

E. Packing List – Water Quality Monitoring (KIRIBATI)

Item	QTY	Pre-Depart	In country	Return
Black casing				
ProDSS-10 Meter 4 port Cable Assembly	1			
Black Backpack				
Stopwatch	2			
Ziplock bag	4			
Sample bottle	1			
Folding bucket	1			
Measuring tape	1			
Extech TISAB tablet	1			
EC standard solution – 400 mL	1			
Turbidity standard solution – 500 mL	2			
Blue Backpack				
pH buffer – 7.00 (1 litre)	1			
pH buffer – 4.00 (1 litre)	1			
pH buffer – 10.01 (1 litre)	1			
Conductivity standard solution (1 litre)	1			
Zobell's solution (250 mL)	2			
Secchi disk	1			
Hydrometer	1			
Fluoride meter	1			
Backpack lab manual	1			
Luggage Bag				
Carbon dioxide Test Kit	1			
Alkalinity Test Kit	1			
Salinity Test Kit	1			
DO Test Kit	1			
Acidity Test Kit	1			
Nitrate Reagent 2 Test Kit	1			
Nitrite Reagent 2 Test Kit	1			
Phosphate Reagent Test Kit	1			
Ammonia Reagent Test Kit	1			
YSI Pro Plus 4M	1			
YSI Pro Comm II Kit	1			
YSI polarographic DO sensor	1			
Colorimetric	1			
Handheld colorimeter – phosphorus	1			
Waterproof tester	2			
Sodium sulphite for zero DO (50 g)	1			
Scissors	1			
Batteries:				
Idc battery	8			
CSi	4			
AA	6			
AAA	4			

Instruction Manual

HI 3833
Phosphate Test Kit

www.hannainst.com

Dear Customer,

Thank you for choosing a Hanna Instruments Product.

Please read this instruction manual carefully before using the chemical test kit. It will provide you with the necessary information for correct use of the kit.

Remove the chemical test kit from the packing material and examine it carefully to make sure that no damage has occurred during shipping. If there is any noticeable damage, notify your Dealer or the nearest Hanna office immediately.

Each kit is supplied with:

- 1 plastic beaker (20 mL);
- 1 color comparator cube;
- **HI 3833-0** Phosphate Reagent (50 pcs.)

Note: Any damaged or defective item must be returned in its original packing materials.

Specifications

Range	0 to 5 mg/L (ppm) PO_4^{3-}
Smallest Increment	1 mg/L (ppm) PO_4^{3-}
Analysis Method	Colorimetric
Sample Size	10 mL
Number of Tests	50
Case Dimensions	220 x 145 x 55 mm (8.7 x 5.7 x 2.1")
Shipping Weight	160 g (6 oz.)

Significance and Use

Phosphates are widely introduced into the environment from such sources as agricultural fertilizers, cleaning and laundering products, boiler water conditioners, and drinking water treatment aids.

At high levels, phosphates stimulate the growth of photosynthetic organisms which may contribute to eutrophication of lakes, rivers, and ponds. This makes it important to monitor and control phosphate discharges into the environment.

Phosphates can be classified as ortho, condensed or organically bound. As with existing test kits on the market, the Hanna Phosphate Test Kit will only determine orthophosphate levels.

Note: mg/L is equivalent to ppm (parts per million).

Chemical Reaction

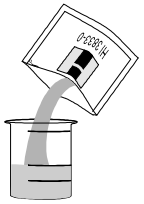
The orthophosphate level in mg/L (or ppm) is determined by a colorimetric method. Ammonium molybdate and potassium antimonyl tartrate react in acid medium with orthophosphate to form a phosphomolybdate complex, that is reduced to intensely colored molybdenum blue by ascorbic acid. The color intensity of the solution determines the phosphate concentration.

Instructions

READ THE ENTIRE INSTRUCTIONS BEFORE USING THE KIT

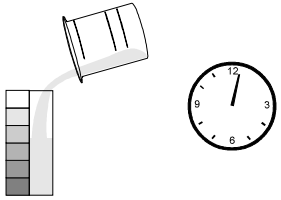
- Remove the cap from the plastic vessel. Rinse the plastic vessel with water sample, fill it to 10 mL mark.

- Add 1 packet of **HI 3833-0** Phosphate Reagent.

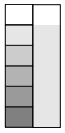


- Replace the cap and mix solution until solids dissolve.

- Remove the cap and transfer the solution into the color comparator cube. Let set for 1 minute.



- Determine which color matches the solution in the cube and record the result as mg/L (ppm) of phosphate (PO_4^{3-}).



References

- 1987 Annual Book of ASTM Standard, Volume 11.01 Water (1).
- Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998.

Accessories

HI 3833-050	Replacement kit (50 tests)
HI 740032P	Cap for 20 mL plastic beaker (10 pcs.)
HI 740037P	20 mL plastic beaker (10 pcs.)

Safety Data Sheets

The chemicals contained in this kit may be hazardous if improperly handled. Read the relevant Safety Data Sheet before performing this test.

ISTR3833 07/13

Instruction Manual

HI 3874
Nitrate
Test Kit

HANNA instruments

www.hannainst.com

Dear Customer,

Thank you for choosing a Hanna Instruments Product.

Please read the instructions carefully before using the chemical test kit. It will provide you with the necessary information for correct use of the kit.

Remove the chemical test kit from the packing material and examine it carefully to make sure that no damage has occurred during shipping. If there is any noticeable damage, notify your Dealer or the nearest Hanna office immediately.

Each kit is supplied with:

- **HI 3874-0** Nitrate Reagent, packets (100 pcs.);
- 1 glass cuvette;
- 1 color comparator cube.

Note: Any damaged or defective item must be returned in its original packing materials.

ISTR3874 07/13

Specifications

Range	0 to 50 mg/L (ppm) as NO_3^--N
Smallest Increment	10 mg/L (ppm) NO_3^--N
Analysis Method	Colorimetric
Sample Size	10 mL
Number of Tests	100
Case Dimensions	230 x 59 x 70 mm (9.0 x 2.3 x 2.8")
Shipping Weight	156 g (6.0 oz.)

Significance and Use

Nitrate ions are present in trace amounts in surface water and in higher levels in some groundwater. Nitrate is found only in small quantities in domestic wastewater but can reach higher concentration (up to 30 mg/L as nitrogen) in the outflow of nitrifying biological treatment plants. Excessive amounts can contribute to methaemoglobinemia: infant death and adult illness. In order to prevent this, a 10 mg/L limit (as nitrogen) has been imposed on drinking water.

Note: mg/L is equivalent to ppm (parts per million).

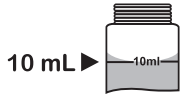
Chemical Reaction

Nitrates are reduced to nitrites in the presence of Cadmium. The nitrites thus produced react with the reagent to yield an orange compound. The amount of color developed is proportional to the concentration of nitrate present in the aqueous sample.

Instructions

READ THE ENTIRE INSTRUCTIONS BEFORE USING THE KIT

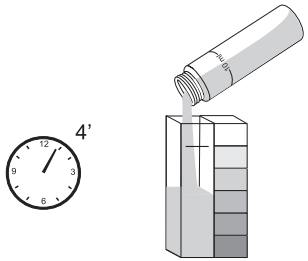
- Fill the glass cuvette with 10 mL of the sample, up to the mark.



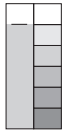
- Add 1 packet of **HI 3874-0** Nitrate Reagent.

- Replace the cap  and shake vigorously for exactly 1 minute. A deposit may remain, but it will not affect measurement. Time and manner of shaking can affect the results.

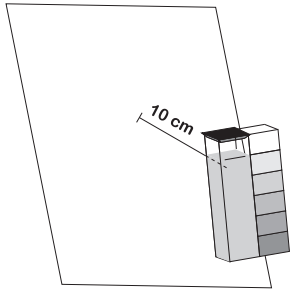
- Wait for 4 minutes to allow the color to develop. Remove the cap and fill the color comparator cube with 5 mL of the treated sample (to the mark).



- Determine which color matches the solution in the cube and record the result in mg/L (or ppm) of Nitrate-nitrogen.



- It is better to match the color with a white sheet at about 10 cm behind the comparator.



- To convert the reading to mg/L of Nitrate (NO_3^-), multiply the reading by a factor of 4.43.

References

Adaptation of the cadmium reduction method from Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998.

Accessories

HI 3874-100 Replacement kit (100 tests)

Safety Data Sheets

The chemicals contained in this kit may be hazardous if improperly handled. Read the relevant Safety Data Sheet before performing this test.

Instruction Manual

HI 3826
Ammonia Test Kit for Sea Water

HANNA instruments

www.hannainst.com

Dear Customer,

Thank you for choosing a Hanna Instruments Product.

Please read this instruction manual carefully before using the chemical test kit. It will provide you with the necessary information for correct use of the kit.

Remove the chemical test kit from the packing material and examine it carefully to make sure that no damage has occurred during shipping. If there is any noticeable damage, notify your Dealer or the nearest Hanna office immediately.

Each kit is supplied with:

- 1 plastic beaker (20 mL) with cap;
- 1 color comparator cube;
- Ammonia Reagent 1 for Sea Water, 1 bottle with dropper (20 mL);
- Nessler Reagent, 1 bottle with dropper (20 mL).

Note: Any damaged or defective item must be returned in its original packing materials.

ISTR3826 04/13

Specifications

Range	0.0 to 2.5 mg/L NH_3-N
Smallest Increment	0.5 mg/L NH_3-N
Analysis Method	Colorimetric
Sample Size	10 mL
Number of Tests	25 (average)
Case Dimensions	220 x 145 x 55 mm (8.7 x 5.7 x 2.1")
Shipping Weight	180 g (6.8 oz.)

Significance and Use

In nature, the ammonia level in water can vary. Ground water normally contains ammonia due to bacterial decay of plants and animals. However, the presence of ammonia in surface water may be evidence of sanitary pollution due to waste discharges or natural causes.

The Hanna Ammonia Test Kit determines the ammonia concentration in water in several easy steps. The kit is portable and can be used in the field as well as in the laboratory.

* mg/l is equivalent to ppm (parts per million)

Chemical Reaction

The ammonia level in mg/L (or ppm), ammonia as nitrogen is determined by a colorimetric method.

The Nessler reagent reacts with ammonia, under strong alkaline conditions, to form a yellow colored complex (see equation below). An addition of Reagent 1 (EDTA solution) inhibits precipitation of calcium and magnesium ions due to the presence of the alkaline Nessler reagent.

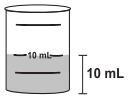
The color intensity of the solution determines the ammonia concentration.

$$2K_2HgI_4 + 2NH_3 \rightarrow NH_2Hg_2I_3 + NH_4I + 4KI$$

Instructions

READ THE ENTIRE INSTRUCTIONS BEFORE USING THE KIT

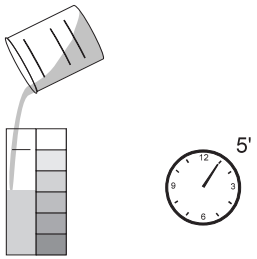
- Remove the cap from the plastic beaker. Rinse the plastic beaker with water sample before filling it up to the 10 mL mark.



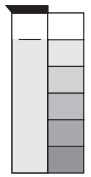
- Add 5 drops of Ammonia Reagent 1 for Sea Water, replace the cap and mix by carefully swirling the beaker in tight circles.

- Add 8 drops of Nessler Reagent, replace the cap and mix by carefully swirling the beaker.

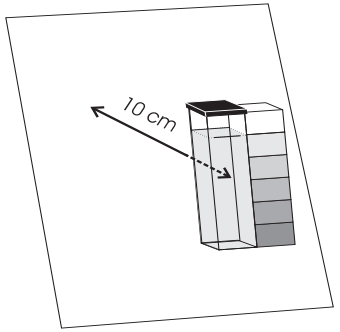
- Remove the cap and transfer the solution into the color comparator cube. Wait for 5 minutes to allow color to develop.



- Determine which color matches the solution in the cube, and record the results in mg/L (or ppm) NH_3-N.



- It is better to match the color with a white sheet at about 10 cm behind the comparator.



Accessories

HI 3826-025	replacement kit (25 tests average)
HI 3824-99	color cube for ammonia test kit
HI 740032P	cap for 20 mL plastic beaker (10 pcs.)
HI 740037P	20 mL plastic beaker (10 pcs.)

Bibliography

Standard Methods for the Examination of Water and Wastewater, 16th Edition, 1985, pages 379-382.

Health and Safety Data Sheets

The chemicals contained in this kit may be hazardous if improperly handled. Read Health and Safety Data Sheet before performing this test.

Instruction Manual

HI 3873
Nitrite
Test Kit

HANNA instruments®

www.hannainst.com

Dear Customer,

Thank you for choosing a Hanna Product.

Please read the instructions carefully before using the chemical test kit. It will provide you with the necessary information for correct use of the kit.

Remove the chemical test kit from the packing material and examine it carefully to make sure that no damage has occurred during shipping. If there is any noticeable damage, notify your Dealer or the nearest Hanna office immediately.

Each kit is supplied with:

- HI 3873-0 Reagent, packets (100 pcs);
- 1 glass cuvet;
- 1 color comparator cube.

Note: Any damaged or defective item must be returned in its original packing materials.

ISTR3873R2 01/07

Specifications

Range	0.0 to 1.0 mg/L (ppm) as NO_2^--N
Smallest Increment	0.2 mg/L (ppm) NO_2^--N
Analysis Method	Colorimetric
Sample Size	10 mL
Number of Tests	100
Case Dimensions	230x59x70 mm (9.0x2.3x2.8")
Shipping Weight	169 g (6.0 oz.)

Significance and Use

Nitrites are intermediate oxidation state of nitrogen (in the oxidation of ammonia to nitrate or in the reduction of nitrate). Such oxidation/reduction may occur in wastewater of treatment plants and in natural waters during the biological decomposition of nitrogen-compounds. In small quantities it can cause methaemoglobinemia among infants. Conversely, high levels are used to inhibit corrosion in cooling towers. Nitrosation reactions of nitrites can yield organic nitrosamines, which are known to be carcinogenic.

Note: mg/L is equivalent to ppm (parts per million).

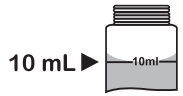
Chemical Reaction

Nitrites react with chromotropic acid reagent to form a pink tint in the sample. The amount of color developed is proportional to the concentration of nitrite present in the aqueous sample.

Instructions

READ THE ENTIRE INSTRUCTIONS BEFORE USING THE KIT

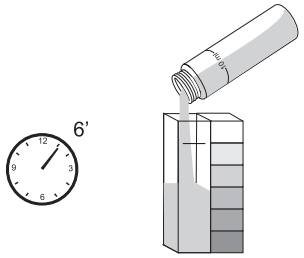
- Fill the glass cuvet with 10 mL of the sample, up to the mark.



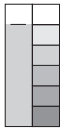
- Add 1 packet of HI 3873-0 Nitrite Reagent.

- Replace the cap  and shake gently for about 15 seconds.

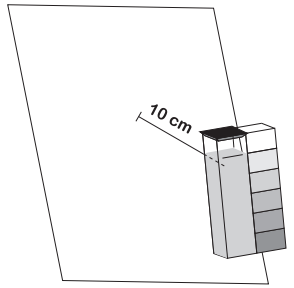
- Wait for 6 minutes to allow the color to develop. Remove the cap and fill the color comparator cube with 5 mL of the treated sample (to the mark).



- Determine which color matches the solution in the cube and record the result in mg/L (or ppm) of Nitrite-nitrogen.



- It is better to match the color with a white sheet at about 10 cm behind the comparator.



- To convert the reading to mg/L of Nitrite (NO_2^-), multiply the reading by a factor of 3.28.

Accessories

HI 3873-100	replacement kit (100 tests)
HI 740032P	cap for 20 ml plastic beaker (10 pcs)
HI 740037P	20 ml plastic beaker (10 pcs)

Safety Data Sheets

The chemicals contained in this kit may be hazardous if improperly handled. Read the relevant Safety Data Sheet before performing this test.