

New Caledonia

Country Briefing Paper

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Government of New Caledonia

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VETERINARY FOOD AND RURAL AFFAIRS DEPARTMENT

Service de l'eau et des statistiques et études rurales

GESTION DE LA RESSOURCE EN EAU
EN NOUVELLE CALEDONIE

WATER MANAGEMENT
IN NEW CALEDONIA

Water resources observatory
Observatoire de la ressource en eau

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I. PRESENTATION OF NEW-CALEDONIA

New-Caledonia is a french territory of South Pacific. It is made up of the main land, "the Great Land" which is 400 km long and 50 km wide. East of the Great Land, there is the Loyalty archipelago, made up of raised limestone islands: Maré, Lifou, Ouvea and Tiga. South of the Great Land, there is the Pines Island and north, the Belep Islands.

Nouméa, situated in the south of the Great Land, is the administrative, political and economical city of the country.

Nouméa counts with the three peripheral townships Mont Dore, Dumbéa and Païta, about 130 000 inhabitants out of the 210 000 of New-Caledonia.

Politically and administratively, New-Caledonia has a unique french status. There are four authorities which share various competencies and responsibilities:

- the French state
- New-Caledonia
- the 3 provinces: South, North and Loyalty Islands
- the 33 municipalities

The growth of the population is important with an average of 2 %. These territories are characterised by a strong demographic unbalance : for example, on a surface of 1 % of their related territories, there is a concentration of 60 % of the population in Nouméa and a concentration of 60 % of the population in Papeete. So, the human pressure on the environment is very unequal.

The yearly Internal Product of New Caledonia is around 4.5 Billions US S, due essentially to the Nickel mines (3rd in the world), agriculture (coffee, coconuts and breeding) and tourism.

Climate

The yearly normal rainfall ranges from 1 500 mm to 7 000 mm. Several droughts are related to ENSO (El Nino Southern Oscillation) especially in 1993 when the annual rainfall deficit was between 50 % and 70 %.

II. GESTION DE LA RESSOURCE EN EAU

The territories are characterised by a large diversity of climate and hydrological conditions between the rainy mountainous islands which have various rivers, and the flat islands and atolls which have only water tables.

The water resources in New Caledonia come from rivers in Grande-Terre and from aquifers in the coral islands of Mare and Lifou (Loyalty Islands).

II.1 AVAILABILITY OF THE RESOURCE AND MANAGEMENT OF THE AQUIFERES

Grande-Terre

The hydrographic network is very dense in Grande-Terre. The largest catchment has a surface of 437 km² (Yate river).

Hydrologic regimes and water resources are very different according to the diversity of orography and exposition to prevailing winds. Eastern basins are more productive than western.

The water resources strongly depend on the distribution of rainfalls in space and in time. The flash floods can be very sudden with an increasing of discharges from 1 to 100 in less than one hour. The maximum discharges of the normal yearly floods are between 4 and 7 m³/s/km².

The total consumption of water is more than 21 Millions of cubic meters ; half of them are used by the city of Nouméa. The average consumption in Grande-Terre is very important : around 500l/inhabitant/day.

Mare and Lifou

There is no hydrographic network on Mare and Lifou islands.

Water resources are supplied by various water tables vulnerable to pollution (domestic discharges and pigs breeding) and to saline intrusion.

On Ouvéa Island, water is supplied by rainfall catchment and desalinisation unit

water survey : Water resources observatory supported by New-Caledonia government

The first hydrometric network has been installed by ORSTOM (now IRD – Institute of Research for Development) in 1954.

Presently this network is managed by the **Direction of Agriculture and Forest** (DAVAR). 23 catchment basins are equipped by 24 water level recorders and 52 raingauges.

Several stations were equipped with remote system (phone system). Data were transmitted several times per day to an automatic Collecting Station in Nouméa.

HYDROM and PLUVIOM software developed by IRD (formerly ORSTOM) permit collecting, archiving and processing data managed by DAVAR.

There is a need for improved co-ordination and data transfer among hydrological database owners, and quality assurance, data analysis and summary need to be further developed. There appears to be a risk of data loss. Migration from HYDROM to a modern hydrologic software is encountering problems.

The observatory of water resource (ORE), is works for of all the public bodies of New Caledonia, private organisations and private individuals.

One can summarise the missions of the ORE thus:

- 1 * To collect all the data and information quantitative and qualitative in the field of water:
 - hydrometric (heights of water - liquid level recorders, ladders of raw – rating curves);
 - pluviometry;
 - piezometry (level of the ground water);
 - of quality (physicochemical - bacteriological - biological index).
- 2 * To carry out hydrological studies and flooded areas mapping.
- 3 * To develop information on the topic of the water resource

Meteorology department

The meteorology department has a network of coastal recording rain-gauges, and a radar of rain. This service works out statistics in climatology and regularly communicate about climatic events.Private activity

Several commercial and quasi-commercial organisations such as Enercal operate in the water sector and collect data as they require. A2EP is a consultant office which provides hydrometry services (especially related to groundwater). and the Meteo-France office in NC is very well.

The survey of the quality of water by gouvernement

The observatory of the water resource (ORE) of the service of water and the statistics and rural studies (SESER) of the DAVAR has the role to survey the water resource quantity and quality.

The survey of the quality of water of the principal rivers of New Caledonia began in 1992. Various work was undertaken in parallel.

1) from 1992 to 1999:

The service of water carried out samplings of water of river and physicochemical and bacteriological analyses of approximately 150 points, distributed per annum on all the territory. These sampling were carried out in period of low water level i.e. when the flows of the rivers are lowest. They made it possible to know the natural physicochemical characteristics of water and to highlight certain chronic, primarily bacteriological pollution. It is not possible for the dry periods to highlight pollution due to the scrubbing of the grounds or the suspended matter.

2) from 1991 to 1993:

The DAVAR was given the responsibility to set up a general study of the water resources of the islands Maré and Lifou, the basic data-gathering for this study consisted of a quarterly survey of the quality of underground water of the two islands; taking away and analyses

physicochemical and bacteriological were carried out on all the access points to the water table (drillings, well and holes of water).

This study had highlighted the bacteriological pollution of the drillings not protected by perimeters from protection and the water pollution by chlorides in the event of too intensive exploitation from the tablecloth. This study had allowed the development of a chart of vulnerability and exploitability of freshwater lense, the evaluation of the resource available and the definition of the rules of working and protection of the ressource.

The work of survey on the Islands was assumed of 1994 to 2000 by the province of the Loyalty Islands; the latter having emitted for 2001, the wish that this work is again completed by the DAVAR.

3) from 1996 to 1997:

Elaboration of a biological index grid was the thesis object of doctorate financed by the DAVAR and directed by the University of New Caledonia.

This grid makes allows to qualify the quality of water of a river with the families of invertebrates (towards, larvae of insects...) which are in water. There are 5 classes of classification of the rivers.

More than 164 physicochemical analyses, bacteriological and biological distributed on 12 rivers with a quarterly frequency were realised for this work which ended in May 1999. The provinces north and south financed the development and the edition of a handbook of recognition of the invertebrates.

4) In 2000 and 2001:

Sampling and analyses:

The DAVAR carries out several types of monitorings.

- an annual survey of the resource on 70 to 100 sites with collect and analyses of samples for determination of the biological index.

- interventions on request for communities of certain sites with search for physicochemical or bacteriological pollution.

The commune of the Island of the Pines was the subject of sampling and analyses following concerns of managed which feared the water pollution by the fertilisation of the forest plates.

In case off accidents of pollution waters of river, some interventions and diagnoses were carried out, at the request of communities or private individuals.

Base data "quality of water"

A significant work of installation of a mapped data base, integrating and classifying by area catchment more than 1000 points of physicochemical and bacteriological analyses and 350 points of biological analyses was undertaken by the ORE. This data base was supplemented

by a data base concerning all drillings and wells of the main land (approximately 700 points). These data are easily given to the public and private organisations on maps and numerical documents .

CONCLUSION:

The ORE has carried out for soon 10 years a qualitative follow-up of the water resource in New Caledonia.

Its objective is to describe and observe the quality of the water of the rivers and underground water with a primarily environmental approach. This excludes the systematic survey of water distribution, and the medical follow-up of the sites of bathes.

The observations carried out since 1992 made it possible to characterise well certain mediums which do not require any more one annual follow-up if no project or development is carried out on the catchment basin. On the other hand, the basins slopes concerned with the great mining projects or of development of activities in general will be the subject of a brought closer monitoring.

A study on quality water of rivers and water tables was launched in 1994 in order to draw maps on water quality in the Territory according to the normal standards.

REQUIREMENTS IN FUTURE ACTIONS

- control of the domestic wastes,
- organisation for poisons evacuation,
- improvement of the cleansing,
- rehabilitation of the old mining sites,
- control of the management of water on the current mines,
- survey of the pesticides,
- close control of the great mining projects impacts.

III. ISLAND VULNERABILITY :

III.1 WARNING SYSTEM : Flood, Damage, Cyclones,

SITUATION

Because of the small size of the catchment basins, the rainfall intensities ,and the difficulty in communicating in period of cyclone, there is no flood alarm system for the population in New Caledonia. The Enercal company, which produces electric power adopted an alarm system to control the floods on the dam Yaté.

ACTIONS CARRIED OUT

Rivers maintenance

The maintenance of the rivers of New Caledonia is financed by the government and makes it possible to improve the water run-off at the time for low period of return events.

This competence was delegated to the provinces North and South which are given the responsibility to work out the programs and to complete work

the cartography of the easily flooded zones.

The mapping of easily flooded zones. New Caledonia finances since 1990 a programme of cartography of the easily flooded zones in urban zone. Two methods are used:

1 - The mapping of the easily flooded zones by hydraulic method, in the areas with hydrometric data monitored on a long period,

2 - The mapping of the easily flooded zones by geomorphological method, coarser but faster and less expensive, which determines only the contour of the easily flooded zone in the zones where no data are available. This cartography must be associated with a cartography of the risks.

REQUIREMENTS IN FUTURE ACTIONS

- acquisition of radar weather,
- validation of model rain flow and the development of remote transmission on the network of observation with reliable means in cyclonic period,
- general cartography of New Caledonia by geomorphological method.

III.2 ADAPTATION TO CLIMATE - DROUGHT

SITUATION

New Caledonia is very sensitive to the fluctuation of El Nino, and is regularly subjected to drought which affect primarily agriculture. Until now, distribution of drinking water was always ensured on the West coast, part of the distribution being made from wells.

On the islands Maré and Lifou, the extracted water resources are largely lower than the annual rain contributions and the episodes of drought never had impact on water distribution.

On the Ouvéa island (10 000 inhabitants), a complement with rainwater is produced by desalinisation

ACTIONS CARRIED OUT

Regarding hydraulic constructions, the Northern province has 75 of them. Concerning "Hill reserves", there are 34 small dams of volume going from 3 000 to 20 000 m³. The majority of these works is used for the watering of the animals. Only 13 were dimensioned to also meet needs for irrigation (from 1 to 5 hectares). These works are located essentially at the Western North of the province.

We can however mention the will of Falconbridge within the framework of the project of factory of North, to set up a hydraulic work with capacity higher than the needs, in order to be autonomous and offer some profit for the communities.

In Southern province there is 246 pumps distributed on 216 exploitations covering a cultivable surface of 6 700 hectares. There are also two “Hill reserves” of 800 000 m³ arranged in the plains of Tamoia and of Ouaménie, which can thus irrigate from 100 to 400 hectares of cultures. The device of irrigation is supplemented by stopping salt dams, which make possible to store water (100 000 m³) and prevent the salted water increase.

Lastly, two rental perimeters of 35 hectares each, installed in Païta and Boulouparis allow the owners to have an irrigable piece far away from the water resource.

MEANS OF ACTIONS AND RESPONSIBILITIES

The scientific possibilities improved to observe and describe the interaction of the ocean and the atmosphere now envisage useful forecasts of some of these risks; for example, the conditions of drought related to the EL Niño 1997-98 were forecasted in New Caledonia.

The provinces are in charge of agricultural development. They set up programs called contracts of plans with the French State in the field of the irrigation.

IV. TECHNOLOGY

The water resource is generally obtained by collectings or drainage trenches, and by drillings. In Ouvéa, in addition to a drilling which feeds the dispensary exclusively, water is obtained from a unit of desalinisation of a capacity of 250 m³ per day, and tanks.

A vast programme of water supply and cleansing of an amount of 1,6 billion Francs CFP was undertaken by the town of Nouméa over the period 1993-1999. To guarantee supply water in the agglomeration of Nouméa to the horizon 2030, the four communes concerned (Nouméa, Mount-Dore, Dumbéa and Païta) gathered in an Inter-commune Trade union with Single Vocation (SIVU), in order to concretise a project of provisioning water by pumping in the Tontouta river. They built a pipe of Drinkable Water (AEP) of 50 km.

The realisation of the work, its financing and its management for the fifty years to come were entrusted to the Limited company Water of Tontouta (SADET), subsidiary of Suez, created on this occasion. The investment, from an amount of 7,7 billion Francs CFP profits to a total value of 30% from defiscalisation procedure and generated for the consumers an increase in the average cost of the cubic meter of water of 25%, counterpart of the insurance of the cover of the needs. Work began in 1999 and the new adduction is operational since October 1, 2001.

IV.1 DRINKING WATER

All over the country, the public distribution water is characterised by crude waters from collecting and drilling, disinfected by addition of gaseous chlorine.

At Nouméa, crude water is brought to the Mount Et where it undergoes a conventional treatment in 4 steps:

- Flocculation
- Decantation
- Filtration
- Disinfection by chlorine addition

The average water consumption in the city of Nouméa is of 550 litres per day per inhabitant. Water availability per family, for each province is as follow:

PROVINCES	Running water in house	Outdoor running water	Collective water place
SOUTH	95%	4%	1%
NORTH	60%	36%	4%
ISLANDS	25%	66%	9%

Source ITSEE 1996

Drinking water control

Regulations

A 1979 territorial decree defines the standards of drinking waters. However, the organisations which control the water quality generally apply French standards. The various standards per parameter and per regulation are shown in the following table:

PARAMETERS	STANDARDS	
	FRENCH	LOCAL
PHYSICO-CHEMICAL PARAMETERS		
ORGANOLEPTIC PARAMETERS		
TASTE and ODOR	NOT DETECTABLE	NOT DETECTABLE
COLOR (mg/l éch. Pt/Co)	15	20
TURBIDITY (NTU)	2	2
WATER NATURAL STRUCTURE PARAMETERS		
pH	6,5 < pH < 9	
SODIUM (mg/l Na)	150	
POTASSIUM (mg/l K)	12	
MAGNESIUM (mg/l Mg)	50	
CHLORIDE (mg/l Cl)	250	
SULFATE (mg/l SO ₄)	250	
ALUMINIUM (mg/l Al)	0,2	
TOTAL DISSOLVED SOLIDS (mg/l)	1500	2000
UNDESIRABLE ELEMENTS PARAMETERS		
NITRATE (mg/l en NO ₃)	50	50
NITRITE (mg/l en NO ₂)	0,1	0,1
AMMONIA (mg/l en NH ₄)	0,5	0,5
NITROGEN TOTAL KJELDAHL (mg/l en N)	1	
IRON (µg/l en Fe)	200	200
MANGANESE (µg/l en Mn)	100	100
PHOSPHORUS (mg/l en PO ₄)	6,7	6,7
PHENOLS (µg/l C ₆ H ₅ OH)	0,5	0
COPPER (mg/l en Cu)	1,0	1,0
FLUORIDE (mg/l en F)	0,7	1,0
SILVER (µg/l en Ag)	10	
ZINC (mg/l en Zn)	5,0	
KMnO ₄ OXYDABILITY (mg/l en O ₂)	5	

TOXIC ELEMENTS PARAMETERS		
ARSENIC (µg/l As)	50	50
CADMIUM (µg/l Cd)	5	
CYANIDE (µg/l CN)	50	50
CHROMIUM TOTAL (µg/l Cr)	50	50
MERCURY (µg/l Hg)	1	
NICKEL (µg/l Ni)	50	50
LEAD (µg/l Pb)	50	100
ANTIMONY (µg/l Sb)	10	
SELENIUM (µg/l Se)	10	50
HYDROCARBON (µg/l for 6 elements)	0,2	
BENZO 3, 4, PYRENE (µg/l)	0,01	
PESTICID (µg/l by single element)	0,1	
ALDRIN, DIELDRIN (µg/l)	0,03	
HEPTACHLOR and H. EPOXIDE (µg/l)	0,03	
TOTAL PESTICID (µg/l)	0,5	
MICROBIOLOGICAL PARAMETERS		
REVIVIFIABLE AEROBIC BACTERIA 22 °C / ml	100	
REVIVIFIABLE AEROBIC BACTERIA 37 °C / ml	20	
TOTAL COLIFORMS / 100 ml	0 (95 % result)	
E. COLI or TERMOTOLERANT COLIFORMS / 100 ml	0	0
FECAL STREPTOCOCCUS / 100 ml	0	0 / 50 ml
SULFIT REDUCT ANAEROBIC BACTERIA / 20 ml	0	0

Drinking water surveillance analysis are carried out at two levels of the production:

- Control of crude waters at the resource level
- Control after treatment and disinfection on the public distribution networks

Analysis carried out include chemico-physical and microbiological parameters, as well as parameters of disinfectants level control.

The following table shows, for the year 2000, the total number of samples taken in each province and the percentage of correct results:

PROVINCES	Number of samples	Results in standards
SOUTH	2750	98%
NORTH	110	72%
ISLANDS	171*	75%

* 1999 data: samples taken on crude waters, before treatment

Last year, 36% of the townships of the country undertook analysis or had analysis undertaken for drinking water surveillance.

Analysis laboratories

The main public laboratories which carry out water analysis related to health are:

- The laboratory of the Mines and Energy Department. (Administrative department of the country). This laboratory carries out chemico-physical analysis.
-
- The laboratory of Water Quality Surveillance of the Nouméa City Council Hygiene Department. This laboratory carries out chemico-physical and bacteriological analysis.
- The laboratory of the Pasteur Institut of New-Caledonia. This part government-owned laboratory carries out bacteriological analysis.

There is also a private laboratory of a company subsidiary to la Lyonnaise des Eaux

- The laboratory of the Caledonian Waters Company. This laboratory carries out chemico-physical and bacteriological analysis.

About 15 qualified to very qualified persons work in these laboratories and apply analytical methods which refer to french standards or ISO standards.

Equipment

The main equipment of these laboratories are:

- 1 ICP Inductively coupled plasma spectrometry Varian Vista Ax
- 2 CIA Capillary Ion Analyser Waters
- 1 HPLC High Pressure Liquid Chromatograph Waters
- 2 AAS Atomic Absorption Spectrophotometer : Varian 20plus and 300plus graphic oven
- 1 IS Infrared Spectrophotometer Nicolet 410
- 2 UVS UV Spectrophotometer Hach 890 and DR4000
- 2 Turbidimeter Hach 2100
- 4 Conductivitymeter Hach
- 8 Incubators (22°C, 37°C, 44°C)
- 4 Autoclaves
- 7 Electronics phmeters (Hach,WTW)
- 6 Electronics scales(Sartorius, Mettler)
- 2 Vapodest 40 for N kjeldahl Gerhardt
- 1 Microplate reader Dynex
- 9 Bacteriological incubators (Memmert, Jouan)

Analysis parameters

With these various equipments, it is possible to measure the following parameters:

PHYSICO-CHEMICAL PARAMETERS
ORGANOLEPTIC PARAMETERS
Color, Turbidity, conductivity
WATER NATURAL STRUCTURE PARAMETERS
pH, sodium, potassium, magnesium, chloride, sulfate, aluminium, total dissolved solids

silica, Hardness total, alkalinity total, oxygen dissolved
UNDESIRABLE ELEMENTS PARAMETERS
Chlorine total, chlorine free, nitrate, nitrite, ammonia, nitrogen total kjeldahl, iron, manganese, phosphorus, phenols, copper, silver, zinc, KMnO4 oxydability, boron, barium, cobalt
TOXIC ELEMENTS PARAMETERS
Arsenic, cadmium, cyanide, chromium total, mercury, nickel, lead, antimony, selenium Hydrocarbon total, vanadium, thalium, molybdenum, lithium, beryllium
MICROBIOLOGICAL PARAMETERS
Revivifiable aerobic bacteria 37°C and 22°C, total coliforms, thermotolerant coliforms Fecal streptococcus, sulfite reduct anaerobic bacteria, clostridium

IV.2 RESIDUAL WATER TREATMENT

The main purification system used is individual installation. The typical plan is a septic tank or an all-waters-tank followed by a filter and a spreading bed when the topography allows it.

In urban regions, wastewaters are more frequently treated by collective systems: purifying stations with activated muds.

Concerning the purification system, the communes are unequally equipped: four of them (2 communes of the northern province, Nouméa and Dumbéa) have one or more stations of purification, four other communes proceed by lagunage and finally, some use only septic tanks. Approximately 20 communes do not practise any cleansing and a third of the municipalities, whose Nouméa, affirm to reject the collective effluents in the sea.

The maintenance of the individual installations of cleansing, giving place to operations of pumping, does not have today a device of adapted treatment. Waste Water known of approximately 12 000 m³, for Large Nouméa, is indeed poured per annum on THIS (Technical Center of Hiding) of Ducos, called to close.

The city of Nouméa has 6 big municipal purifying stations which treat waters for 45 000 inhabitants.

95% of the analysis carried out during the year 2000 on discharged effluents quality were within European standards.

A research undertaken in 1996 by the Territorial Institute for Statistics and Economic Studies, about the number of main homes equipped with toilets showed that 52% of the main homes in the Loyalty Islands Province did not have toilets, 27% in the North Province, and 1% in the South Province

CARRIED OUT ACTIONS

Many communes of the NC adopted a directing diagram of cleansing aiming at equipping the communes with stations of purification in the 5 years to come.

V. INSTITUTIONAL ARRANGEMENTS (Policy, Planning and Legislation; Institutional Strengthening)

Several public bodies exist and cohabit in New Caledonia without hierarchical bond.

- the government of New Caledonia,
- the provinces North - South and Islands,
- communes.

These institutions all are implied in the sector of the water resource.

The government of New Caledonia is the owner of the water resource and the associated public domain (rivers, underground tablecloths etc...).

New Caledonia delegated the water management to the provinces:

- maintenance of the rivers,
- management of water collectings.

The government of New Caledonia, is currently occupied:

- the quantitative and qualitative follow-up of the water resource,
- the hydraulic dams (stoppings, tanks, hydroelectricity),
- the cartography of the easily flooded zones,
- the classified installations,
- the mines.

The police force of water is also one of attributions of New Caledonia (according to a text of 1968, but there is not identified structure in charge of this work).

The provinces are charged of:

- the economic development,
- the environment and the police force of the environment,
- the irrigation, the realization of works,

Provinces manage by delegation:

- maintenance of the rivers (with funds allocated by New Caledonia),
- authorizations of water collectings.

The communes are in charge of:

- the drinking water supply,
- the waste water,
- the public safety in general.

Police

To summarize the situation, the provinces exert a police force of the environment. The government is competent to exert a police force of water.

Regulation.

There is a large need of water regulation up-dating, the main texts concerning water sector are old (1968, 1979) and do not integrate all the actors implied in the water resource.

The new government set up in 2001, has fixed like objective to update the regulation on water at the end of 2003.

VI. FINANCE (Costs and Tariffs, Alternative models; Role of Donor Organisations and Financing Institutes)

It is very difficult to evaluate in an exhaustive way all the expenditure related to the water resource. In a clear way, each community assumes the expenditure related to its fields of competences.

One can quote for the government, 800 M FCFP/an for the observatory of the water resource, plus 200 to 300 M FCFP for the maintenance of the rivers.

The provinces obtain French state subventions for the significant projects in water supply, irrigation and cleaning.

VII. CONCLUSION

New Caledonia is a country which do not know real problems as regards water resource, except in period of severe drought, on the « main land, the water supply is assured permanently without difficulties by the surface and underground resources. The problems involved in the supply water on Ouvéa were solved by the installation of a dessalinisator.

The quantitative and qualitative monitoring of the resource is perennialized and modernized thanks to the development of the télétransmission. A first knowledge of the quality of surface water on the large ground, underground on Maré and Lifou allows to better know the urban and rural and industrial development impact on resource

As regards cleansing and water treatment, for 10 years, of large investments to improve quality of distributed and rejected water have been planned by the communes.

New Caledonia developed tools of observation and water management, and is very involved in the protection of the resource, particularly because of the mining industrial projects of great scale which will develop soon.

The objective in short-term (2003-2004) of New Caledonia government is to develop the implementation of a true policy of water in New Caledonia, associating the supply water of the populations and the economic projects water users (in the fields of agriculture, the mine, energy, tourism...) with the safeguard of the environment; i.e., by joining these two objectives of any modern society, with the concepts of durable development.