STATE OF MAINE
DEPARTMENT OF HUMAN SERVICES
BUREAU OF HEALTH, DIVISION OF HEALTH ENGINEERING
161 CAPITOL STREET
11 STATE HOUSE STATION
AUGUSTA, MAINE
04333-0011

JOHN ELIAS BALDACCI
GOVERNOR

JOHN R. NICHOLAS
COMMISSIONER

July 14, 2004

Presby Environmental, Inc.
Attn.: David W. Presby, President
P. O. Box 617
Sugar Hill, New Hampshire 03585

Subject: Product Registration Modification, Presby Enviro-Septic

Dear Mr. Presby:

It is my understanding from our conversations and information submitted recently that you wish to modify the Division's acceptance of the Enviro-Septic.

Product Description

The modification consists of revising the separation distance from the seasonal high groundwater table or other limiting factor to the bottom of the sand layer beneath the products, to the bottom of the Enviro-Septics themselves.

Claim

According to the information you provided, including third party test data, the Enviro-Septic performs sufficiently well that the previously required increased separation distance is no longer required..

Determination

On the basis of the foregoing and a sample of the product provided to the Division, the Division has determined that the this modification is acceptable for use in the State of Maine.

Because installation and owner maintenance has a significant effect on the working order of onsite sewage disposal systems, including their components, the Division makes no representation or guarantee as to the efficiency and/or operation of Presby Enviro-Septic. Further, registration of these products for use in the State of Maine does not represent Division preference or recommendation for this product over similar products.

If you have any questions please feel free to contact me at (207) 287-5695.

Sincerely,

James A. Jacobsen

James A. Jacobsen, Environmental Specialist IV
Wastewater and Plumbing Control Program
Division of Health Engineering
e-mail: james.jacobsen@state.me.us

/jaj
xc: Product File

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JOHN ELIAS BALDACCI
GOVERNOR

JOHN R. NICHOLAS
COMMISSIONER

April 8, 2003

Presby Environmental, Inc.
Attn.: David W. Presby, President
P. O. Box 617
Sugar Hill, New Hampshire 03585

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James A. Jacobsen, Environmental Specialist IV
Wastewater and Plumbing Control Program
Division of Health Engineering
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John Elias Baldacci
Governor

State of Maine
Department of Human Services
Division of Health Engineering
11 State House Station
Augusta, Maine
04333-0011

DATE 7/13/04	TIME AM/PM
TO: Dave Presby	
FROM: Jim Jacobsen	

PAGES INCLUDING THIS COVER SHEET: 2

MESSAGE:
hardcopy follows via snail mail

PRESBY ENVIRONMENTAL, INC.
INNOVATIVE SEPTIC TECHNOLOGIES

Route 117 PO Box 617 Sugar Hill, NH 03586
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www.presbyenvironmental.com

RECEIVED
JUL 07 2004
WASTEWATER &
PLUMBING PROGRAM

July 6, 2004

Mr. James A. Jacobson, Environmental Specialist IV
State of Maine Department of Human Services
Wastewater and Plumbing Control Program
Division of Health Engineering
11 State House Station
Augusta, ME 04333-0011

Subject: Seasonal Ground Water Table Requirement for In-ground Enviro-Septic® Wastewater Treatment systems

Dear Mr. Jacobson:

Background	For a period of one year and nine months, 3rd party testing in Stoke, Canada, has compiled extensive test data on effluent exiting pipe and stone and Enviro-Septic® wastewater treatment systems. The results dramatically prove what we have known from experience. The unique design and function of Enviro-Septic® wastewater treatment systems demonstrate that they operate in a far more efficient and effective manner, producing an effluent quality that consistently and continuously exceeds that of sophisticated mechanical treatment systems and conventional pipe and stone installations. I am attaching a copy of the reports documenting these test results for your appraisal.
Current Maine requirement	Currently the State of Maine requires that Enviro-Septic® wastewater treatment systems installed below grade add an additional 6 inches to the normally required vertical separation distance to the seasonal ground water table or restrictive horizon.
Our position	We have ample proof that the Enviro-Septic® wastewater treatment system is far superior in reducing effluent contaminants to other systems being used in the State of Maine.
Our request	Please consider this letter and the attached testing documentation my request for the removal of the requirement for the Enviro-Septic® wastewater treatment systems installed below grade to add an additional 6 inches to the normally required vertical separation distance to the seasonal ground water table or restrictive horizon. Please note that this request does not apply to Simple-Septic® installations.

Sincerely yours

David W. Presby

David Presby, President
Presby Environmental, Inc.

Enclosures

Please log in as product review "revised separation distance", Enviro-Septic thanks! Jim

Treatment of Septic Tank Effluent: Comparison of Enviro-Septic® and Conventional Pipe and Stone Leaching Systems

Research Report March 1, 2004

Joselle Germano-Presby, Ph.D.[1], David W. Presby[1], Denis Boucher[2], Benoit Boucher[2], François R. Côté[2], Helene B. Balkin[3], Robert E. Mooney[4], Aaron B. Margolin, Ph.D.[5]

Summary

Many new technical devices have been devised to improve the function of standard septic systems. The Enviro-Septic® leaching system, manufactured by Presby Environmental, Inc., is purported to surpass conventional leaching systems for wastewater treatment. The purpose of the research projects described herein was to compare the performance of Enviro-Septic® systems to that of conventional pipe and stone leaching systems. Some of the research was carried out in collaboration with the Virology and Waterborne Disease Laboratory, Department of Microbiology, at the University of New Hampshire (UNH), Durham, NH, and with DBO Expert Inc., Magog, Quebec, Canada. The UNH project involved miniature model systems housed inside a laboratory on campus, whereas DBO Expert Inc., utilized larger underground model systems. Analyses of wastewater components, including ammonia, biochemical oxygen demand (BOD), chemical oxygen demand (COD), fecal coliforms (e.g. *E. coli*), nitrate, phosphorus, total Kjeldahl nitrogen (TKN), total suspended solids (TSS), and viral particles were conducted on the septic tank effluent (entering) and the leachate (exiting) of the model systems. The large-scale Enviro-Septic® model system set up by DBO Expert Inc., demonstrated percent removal values for TSS and fecal coliforms that were significantly greater ($P < 0.001$) than those of the conventional pipe and stone model system, suggesting that Enviro-Septic® performs better than conventional systems at filtering out these septic components. Furthermore, Enviro-Septic® in the large-scale models displayed significantly greater percent removal values of COD, BOD, TKN, phosphorus and ammonia ($P < 0.001$) and significantly greater production levels of nitrate ($P < 0.001$), suggesting that it treats wastewater better by promoting a more substantial aerobic microbial ecosystem than conventional systems. These results were consistent with findings from the small-scale systems in the UNH project, where the Enviro-Septic® models displayed significantly greater percent removal values of COD and ammonia ($P < 0.05$) than the pipe and stone models. In a study of wastewater flow through the DBO Expert Inc., model systems, it took approximately six months for septic tank effluent to flow through 60' of Enviro-Septic® pipe, whereas it took more than a year for effluent to flow through 40' of conventional perforated leaching pipe. These results suggested that more of the Enviro-Septic® pipe functions at treating wastewater over time, and that it distributes a more dilute leachate to a greater area of underlying soils than conventional systems.

[1] Presby Environmental, Inc., Sugar Hill, NH 03585
[2] DBO Expert Inc., Magog, Quebec, Canada J1X 4V9
[3] Senior Laboratory Technician, Virology and Waterborne Disease Laboratory, Department of Microbiology, University of New Hampshire, Durham, NH 03824
[4] Analytical Instrumentation Scientist, Department of Microbiology, University of New Hampshire
[5] Professor, Virology and Waterborne Disease Laboratory, Department of Microbiology, University of New Hampshire

Introduction

Background Information

Residential septic systems are the largest source (by volume) of wastewater disposed to the land (Linsley *et al.*, 1992). Nearly 40% of new homes in the United States use them (Hallahan, 2002). Much attention has been focused on improving the performance of standard systems as their impact on the environment has been addressed. In fact, the U.S. Environmental Protection Agency, National Water Quality Inventory: 1996 Report to Congress (U.S. Environmental Protection Agency, 1998) states, "Improperly constructed and poorly maintained septic systems are believed to cause substantial and widespread nutrient and microbial contamination to ground water."

A standard septic system is defined here as the combination of a septic tank and leach field. The septic tank serves as a temporary holding tank for raw wastewater. It traps much of the solid waste by allowing it to settle. The solid waste must be emptied from the tank periodically as part of routine maintenance of the system. Little dissolved oxygen is available inside the septic tank; its environment is anoxic (anaerobic). Partial decomposition of waste within the tank is accomplished by anaerobic bacteria (bacteria that can tolerate or require the absence of oxygen). This partially treated wastewater then passes out to the leach field and is referred to as septic tank effluent (STE) (Winneberger, 1984).

A leach field typically consists of a series of subsurface perforated pipes arranged horizontally within a rocky or sandy medium. It functions to treat STE and distribute it under the surface to the underlying soils. The pipes and soils act as filters of wastes and allow further chemical breakdown and biodegradation of the STE before it is discharged to the environment. A conventional leach field is defined here as a pipe and stone system constructed of perforated PVC pipe (4" diameter) laid within a bed of crushed stone.

It is a priority of the U.S. Environmental Protection Agency and other environmentalists to improve the performance of standard septic systems and prevent groundwater contamination (U.S. Environmental Protection Agency, 2003). Therefore, many new septic system technologies have been introduced. Most of these innovations operate either inside the septic tank or between the tank and the leach field (Heufelder and Rask, 2001). Enviro-Septic® Leaching Systems by Presby Environmental, Inc., however, take a different approach to improving septic system function.

The unique design of Enviro-Septic® components is purported to enhance the efficiency of wastewater treatment within the leach field (Figure 1). Enviro-Septic® systems consist of corrugated, high-density plastic pipe with a 9.5" interior diameter. Exterior ridges on the peak of each corrugation are thought by Presby Environmental, Inc., to facilitate the flow of effluent around the circumference of the pipe. This, in addition to the large inner surface area and the relative thinness of the plastic, allow effluent to cool quickly within the pipe. Upon cooling, STE separates into its components: scum floats to the top and sludge sinks to the bottom. The liquid component of the STE flows through the pipe perforations, while the scum and sludge are retained within the pipes. Furthermore, plastic "skimmers" extend inwards from each hole. The skimmers are thought by Presby Environmental, Inc., to help capture grease and suspended solids, preventing them from escaping through the perforations. A thick layer of coarse, randomly-oriented plastic fibers surrounds the pipe. This layer serves as an attached culture system providing an extensive surface area on which microbial biofilms can grow. Moreover, a geo-textile fabric surrounds the plastic fiber layer, further supporting the growth of microbial biofilms. Finally, Enviro-Septic® systems are installed in clean medium-coarse sand (washed concrete sand).

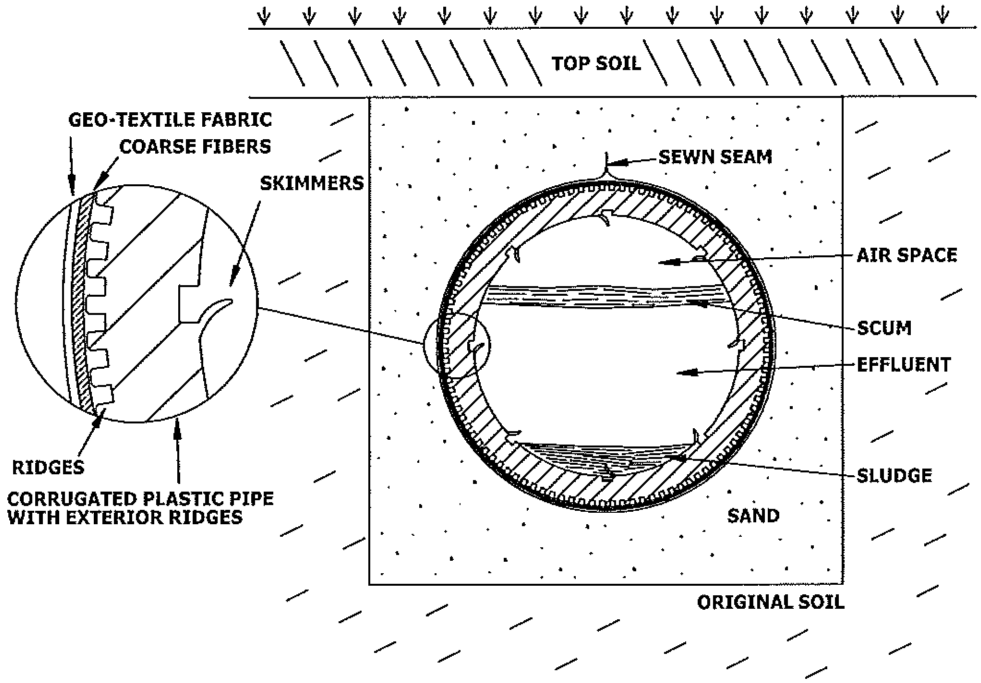


Figure 1. Components of the Enviro-Septic® pipe (from the Enviro-Septic® & Simple-Septic® Leaching Systems Design and Installation Manual, 2003).

Research Projects: Experimental Design

Two individual research projects were designed to compare the performance of Enviro-Septic® leaching systems to conventional pipe and stone leaching systems. Several hypotheses were tested.

- Hypothesis 1: The unique design of Enviro-Septic® pipe and the surrounding sand enable the system to filter total suspended solids, bacteria, and viruses better than conventional systems.

It is desirable to prevent bacteria, viruses, and other components of wastewater from escaping the leach field and contaminating the underlying groundwater. Filtering action can be measured by comparing the amount of these components in the STE to the amount in the leachate (wastewater leaving the leach field) and estimating the percent removal.

- Hypothesis 2: Enviro-Septic® systems accomplish decomposition of wastewater faster and more efficiently than conventional systems by promoting and maintaining a more substantial aerobic microbial ecosystem (microorganisms that require oxygen to live).

Aerobic decomposition works faster and more efficiently to break down natural and synthetic organic substances than anaerobic decomposition (Heufelder and Rask, 2001) (Grady *et al.*, 1999).

- Hypothesis 3: Enviro-Septic® systems distribute wastewater over a larger surface area than conventional systems because more of the system functions at any given time.

It has been observed that in a serially distributed conventional leaching system, only the first line or lines of pipe (and their underlying soils) take most of the burden of wastewater treatment most of the time (Winneberger, 1984). If leachate were to be distributed across a larger surface area, then it would be discharged to the environment in a more dilute form. This would allow the underlying soils to better filter and treat the wastewater before it enters the water table.

Presby Environmental, Inc., has participated in two individual research projects. The purposes of these were to test the above hypotheses by comparing the performance of Enviro-Septic® to conventional pipe and stone systems under controlled conditions. The first research project was carried out in collaboration with Aaron Margolin, Ph.D., Helene Balkin, and Robert Mooney at the Virology and Waterborne Disease Laboratory, Department of Microbiology, University of New Hampshire (UNH), Durham, NH. It involved small-scale model Enviro-Septic® and pipe and stone systems that were maintained in a UNH laboratory. The experiments of the UNH project were designed to test Hypotheses 1 and 2; they were conducted and completed in 2002.

A second research project is being carried out in collaboration with Denis Boucher, Benoit Boucher, and François R. Côté of DBO Expert Inc., Magog, Quebec, Canada. It involves larger, in-ground models that are more representative of real life systems. These systems were set up in Stoke, Quebec. The experiments were designed to test Hypotheses 1, 2 and 3; they were begun in 2002 and are ongoing.

Testing Hypothesis 1: Hypothesis 1 was tested by comparing the amount of total suspended solids, number of coliform organisms, and number of viral particles detected in the STE and leachate of the model systems. The amount of total suspended solids (TSS) is a direct measure (in mg/L) of solid septic components (dissolved and undissolved).

There are approximately 100 billion microorganisms present in every gram of human feces (Cano and Colomé, 1988). Among the natural flora that inhabit the intestine are the coliform bacteria including *Escherichia* such as *E. coli*. An aerobic leach field supports a wide variety of organisms including aerobic bacteria, rotifers, protozoans, and fungi (Heufelder and Rask, 2001). Bacteria are the smallest of these septic system-dwelling microbes (Fenchel *et al.*, 1998) and are, therefore, the most likely to escape filtration. The amount of bacteria in wastewater is measured by the most probable number of coliform organisms (MPN; presented as number per 100 mL). Some pathogenic (disease-causing) bacteria enter septic systems from residences, and it is especially desirable to prevent these types of bacteria from reaching the water table. There are so many different species of pathogenic bacteria, however, it is not feasible to test for each one individually. Therefore, MPN is often used in wastewater testing as a guideline to indicate the *possible* presence of pathogenic bacteria.

Viruses, some pathogenic, are also present in wastewater. The capacity of a leach field to filter out viruses can be determined by "spiking" a known quantity of viral particles (measured in plaque forming units; PFU) into the STE at a single point in time. The number of PFU in the leachate is then measured for a period of time following the initial spiking. Theoretically, the better the filtering action of the leaching system, the lower the amount of suspended solids, bacteria, and viruses there will be leaving the system.

Testing Hypothesis 2: Hypothesis 2 was tested by comparing levels of TSS, carbon-, nitrogen-, and phosphorous-containing compounds in STE to the levels in leachate. The increase of some and decrease of other particular substances in a septic system would be indicative of aerobic decomposition.

TSS – Total suspended solids were tested because the biodegradation of TSS is carried out, in part, by aerobic microorganisms. A reduction of TSS in the leachate compared with the STE would be consistent with the presence of an aerobic microbial ecosystem in the leaching system.

COD – Chemical oxygen demand is a measure of the amount of oxygen required to stabilize the waste in a sample of wastewater completely. Carbon-containing organic compounds can be chemically oxidized (broken down) to yield carbon dioxide. This is what is meant by "stabilize." The amount of oxygen required for stabilization is proportional to the amount of carbonaceous compounds in the sample. COD is therefore an indirect measure of the amount of carbon-containing compounds in a sample. One would expect the COD of the leachate to be less than the COD of the STE if carbon-containing compounds are chemically broken down in the leaching system.

BOD – Biochemical oxygen demand is a measure of the amount of oxygen required to stabilize carbonaceous waste biologically (through the metabolic action of aerobic microorganisms). The BOD is therefore another indirect measure of the amount of carbon-containing compounds in a sample. The BOD_5 refers to the amount of oxygen utilized by a sample over a five-day period. Carbonaceous compounds are oxidized to carbon dioxide during aerobic microbial metabolism; therefore a reduction in COD and BOD would be consistent with the presence of an aerobic microbial ecosystem in a leaching system.

TKN and ammonia – Total Kjeldahl nitrogen is the amount of nitrogen contained within organic compounds (such as nucleic acids, amino acids, and urea) and in ammonia (NH_3). Ammonia is a natural bi-product of the breakdown of nitrogen-containing organic compounds during aerobic metabolism.

Nitrate and nitrite – Nitrate (HNO_3) and nitrite (HNO_2) are products of the process of nitrification, which involves the oxidation of ammonia by the following (unbalanced) chemical reactions:

$$NH_3 + O_2 \rightarrow HNO_2 + H_2O \quad (O_2 \text{ is oxygen; } H_2O \text{ is water})$$

$$HNO_2 + O_2 \rightarrow HNO_3 + H_2O$$

The reactions of nitrification are carried out by aerobic bacterial species of *Nitrosomonas* and *Nitrobacter*, natural occupants of septic systems. Theoretically, as aerobic microbial metabolism proceeds, amounts of ammonia and TKN decrease, while levels of nitrate increase.

Phosphorus – Phosphorus is a constituent of wastewater that is contained in organic compounds such as sugar phosphates, phospholipids and nucleotides, and in inorganic compounds such as polyphosphates (used in synthetic detergents) and orthophosphates. Phosphorus and nitrogen are the nutrients responsible for eutrophication (massive growth of algae in lakes). Therefore it is desirable to prevent their release into the environment.

Testing Hypothesis 3: Hypothesis 3 was tested by the DBO Expert Inc., research project. The model leaching systems were set up in Stoke, Quebec, such that leachate was collected from separate sections of each system. This enabled researchers to monitor when wastewater reached various sections of the systems, and hence when sections of each system were operational.

Materials and Methods

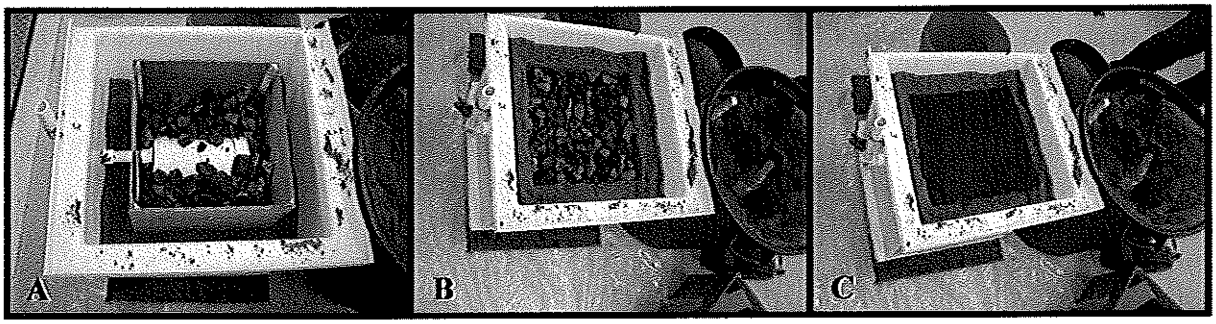
Research Project 1: UNH

Two model Enviro-Septic® systems (deemed ES 1 and ES 2) and two model conventional pipe and stone leaching systems (deemed P&S 3 and P&S 4) were assembled (Figure 2). Each model was housed in a square 18" × 18" × 18" polypropylene container fitted with PVC pipe (1" diameter) and an injection port in the center of one side. Each container contained 3" of washed concrete sand at the bottom.

For the P&S systems, an 8" length of Standard Pipe Schedule 20 (4" diameter) distribution line was positioned horizontally in the center of the square container, attached to the 1" PVC pipe at one end, and capped at the other end. Clean washed 1-1.5" crushed stone was distributed around the distribution line as follows: 6" underneath, 4" on either side along its length, 2” on each capped end and 2” on top. This distribution line/stone unit occupied a total of one cubic foot in the center of the square container. A black polypropylene fabric was placed over the distribution line/stone unit (to prevent sand from falling into the void spaces of the stone), and the remainder of the square container was filled with washed concrete sand.

For the ES systems, a 12” length of Enviro-Septic® pipe, capped at one end, was positioned horizontally in the center of the square container and attached to the 1” PVC pipe. The pipe was then surrounded by washed concrete sand.

Assembling the pipe and stone model system



Assembling the Enviro-Septic® model system

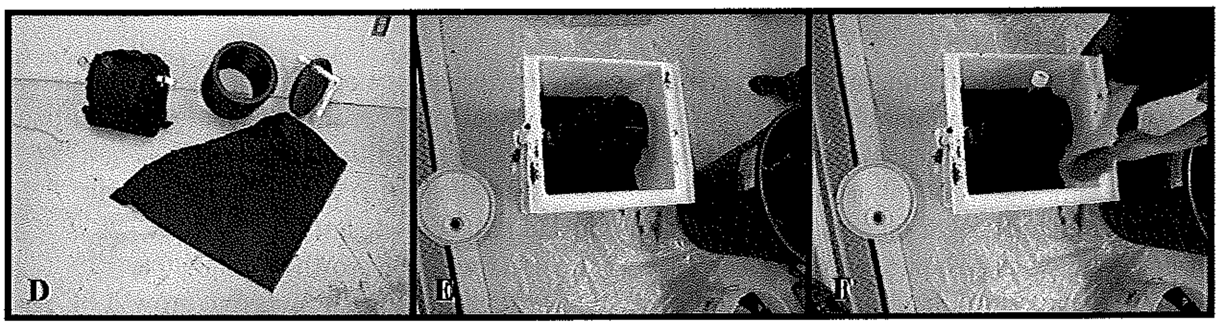


Figure 2. Assembly of the model leaching systems used in the UNH research project. A) An 8” length of distribution line is surrounded by a cubic foot of washed stone atop 3” of washed concrete sand in a square container. B) The stone is surrounded by sand. C) A piece of fabric prevented sand from falling into the spaces between the stones. D) The components of the 12” length of Enviro-Septic® pipe and how they were assembled. The clear tubes were put in place to enable viewing the inside of the system. E) The Enviro-Septic® pipe was placed atop 3” of washed concrete sand in a square container and F) surrounded by sand.

A 1.5 quart chamber was mounted above each model unit and attached to the 1" PVC pipe. A timer-controlled diaphragm pump delivered STE to each of the chambers from a common holding tank. The bottom of each model system was equipped with a plastic screen and grid to enable the systems to drain. Drains were emptied into four individual recovery tanks via silicon tubing. The systems were housed in a temperature-controlled room in Rudman Hall on the campus of UNH and maintained at 18°C (Figure 3).

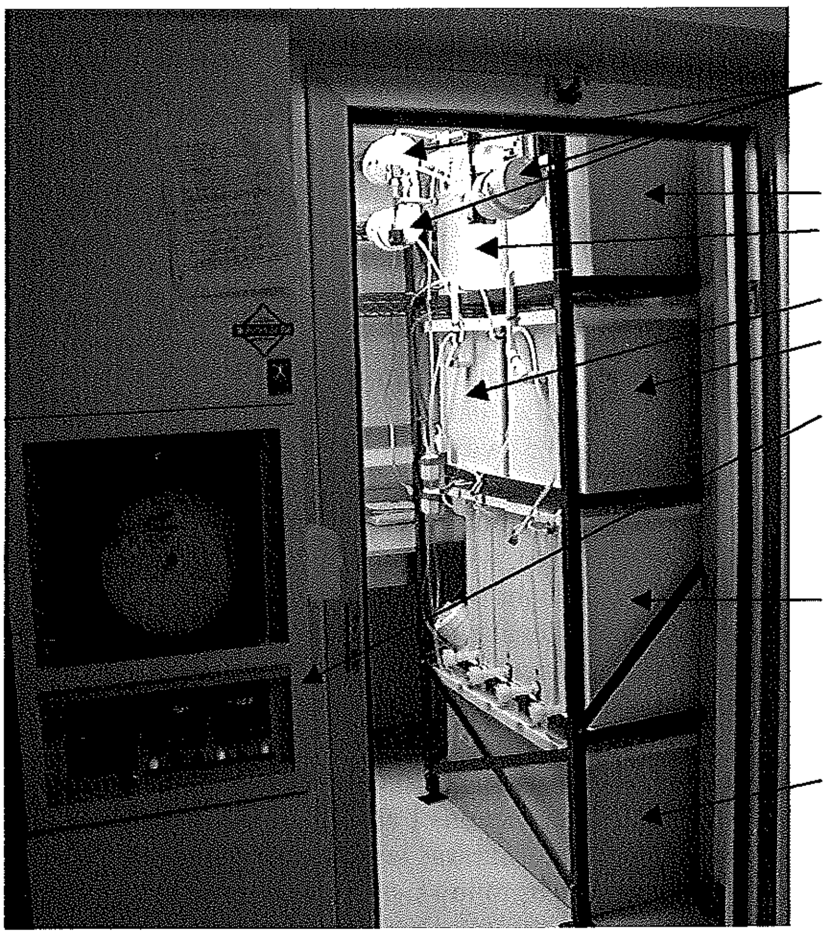


Figure 3. Model leaching systems were housed in a temperature-controlled room in Rudman Hall on the campus of UNH.

Septic tank effluent was supplied on a weekly basis from a residence in Sugar Hill, NH. Upon every new STE delivery, the old STE remaining in the holding tank was discarded and replaced with fresh STE. One and a half quarts of STE were pumped to each model system from the holding tank four times a day: 7:00 am, 8:00 am, 4:00 pm and 5:00 pm. The systems were fed for a period of at least two months before sample testing was begun. Samples of STE and leachate were collected weekly at the time of STE delivery. Once the STE in the holding tank was replaced with fresh STE, an additional pumping cycle was carried out. The STE sample was taken directly from the pump, and the leachate samples were taken directly from the model system drains immediately following this pump cycle.

Samples were transported on ice to Eastern Analytical, Inc., Concord, NH, where they were analyzed for ammonia, BOD, COD, nitrate, nitrite, TKN, and TSS. Tests for ammonia, BOD, COD, and TKN were begun after nine weeks of STE feeding and carried out for 22 weeks. Tests for TSS were begun after 14 weeks of STE feeding and carried out for 18 weeks. Tests for nitrate and nitrite were begun after 19 weeks of STE feeding and carried out for 12 weeks. Samples were also analyzed for fecal coliforms following ten weeks of STE feeding, for a total of 21 weeks. For the first 14 weeks of bacterial testing, MPN of fecal coliforms was determined by the Virology and Waterborne Disease Laboratory, UNH. For the final seven weeks, testing for *E. coli* was performed by Eastern Analytical, Inc. A Student's *t* test (NIST/SEMATECH e-Handbook of Statistical Methods, 2004) was done to assess statistical significance of the results.

After 28 weeks of feeding STE into the systems, known quantities of MS-2 virus (a bacteriophage or virus whose host is a bacterium) and poliovirus were "spiked" into the systems via their injection ports. The amounts of these viruses in the leachate were analyzed for 14 days following the initial spike. Virus spiking and enumeration were conducted by the Virology and Waterborne Disease Laboratory, UNH.

Research Project 2: DBO Expert Inc.

Installation of the Model Leaching Systems: A model Enviro-Septic® system and a model conventional pipe and stone leaching system were installed underground in Stoke, Quebec, Canada (Figures 4 and 5). Two trenches, 60' long by 3.5' wide, were dug side by side and encased in plywood. One trench would house the Enviro-Septic® system, while the other would house the conventional system. The bottom of each trench was divided lengthwise into three 20'sections. The first and second sections were 4.5' deep, while the third section was 5' deep (Figure 4A). The plywood trenches were made water-tight with an impermeable membrane liner (Soprema Inc., Wadsworth, OH; Figure 4B). An additional plastic canvas (yellow) was placed at the bottom of each trench in order to protect the membrane liner (Figure 4B). Perforated PVC pipes, 3" in diameter, were installed to drain the bottom of each trench section (Figures 4B and 4C). Eight inches of ¾" crushed stone were placed at the bottom of each trench. Then, 4" of ¼" crushed stone were laid over the larger stone in order to prevent sand from clogging the drainage pipes (Figure 4D). Clean medium-coarse sand (6" over sections 1 and 2, 12" over section 3) was then placed over the crushed stone so that the top of the sand was level over all three sections (Figure 4E, Figure 5). The properties of the sand were as follows: nominal diameter $D10 \approx 0.36$ mm, coefficient of uniformity ≈ 4.8. At this point, the two trenches were identical to each other.

For the conventional pipe and stone system, a 6" layer of ¾" crushed stone was laid over the sand. A single 60' length of standard 4" diameter perforated PVC pipe was installed and surrounded by another 6" layer of ¾" crushed stone (Figure 4F, Figure 5). For the Enviro-Septic® system, six 10' lengths of Enviro-Septic® pipe were installed in one continuous line within a 16" layer of sand (Figure 4G, Figure 5). The remaining top portion of each trench was backfilled, and grass was planted atop the trenches.

The trench sections were deemed ESP 1, ESP 2, and ESP 3 for the first, second and third 20' of the Enviro-Septic® system and CPC 1, CPC 2, and CPC 3 likewise for the conventional system (Figure 4D). Leachate from each trench section was drained to a separate drainage receptacle located approximately 5' from the ends of the trenches (Figure 4H). Here, the leachate volume was monitored continually, and samples were taken for comparative analysis. Leachate in the drainage receptacles was then pumped to the Stoke municipal sewage treatment area located just downhill from the test site.

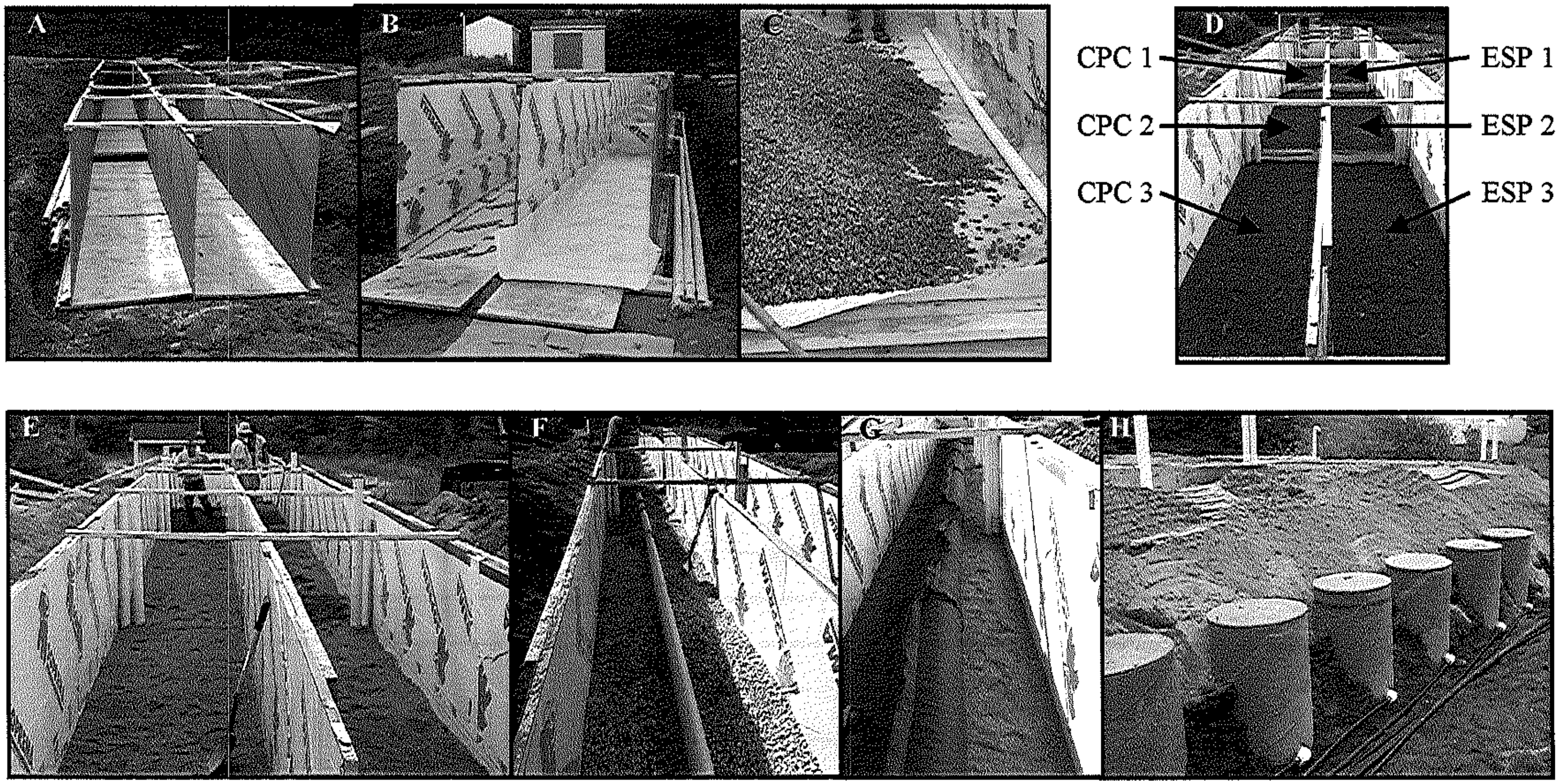


Figure 4. Installing model Enviro-Septic® and conventional pipe and stone leaching systems in Stoke, Quebec. A) Plywood-encased trenches, 60' long × 3.5' wide, were divided lengthwise into three sections. Note the final 20' sections are 6" deeper than the first two 20' sections. B) A waterproof membrane and plastic canvas were applied to both trenches, and drain pipes attached to each section. C) Stone and 3" perforated PVC pipe allowed leachate to drain from the bottom of each trench section. D) The same amount of stone covered each section's bottom. The sections, deemed CPC 1, 2 and 3, and ESP 1, 2 and 3, can be seen here. E) A layer of clean medium-coarse sand covered the stone. The two trenches are identical at this point. F) For the conventional model system, a 60' length of standard 4" perforated PVC pipe was installed in crushed stone. G) In the other trench, sixty feet of Enviro-Septic® pipe were installed within a layer of sand. H) Leachate from each trench section drained to a separate drainage receptacle (green cylinders), where its volume was continually measured, and samples were taken for comparative analysis. Leachate in the drainage receptacles was then pumped (via black hoses) to the Stoke municipal sewage treatment area located just downhill from the test site.

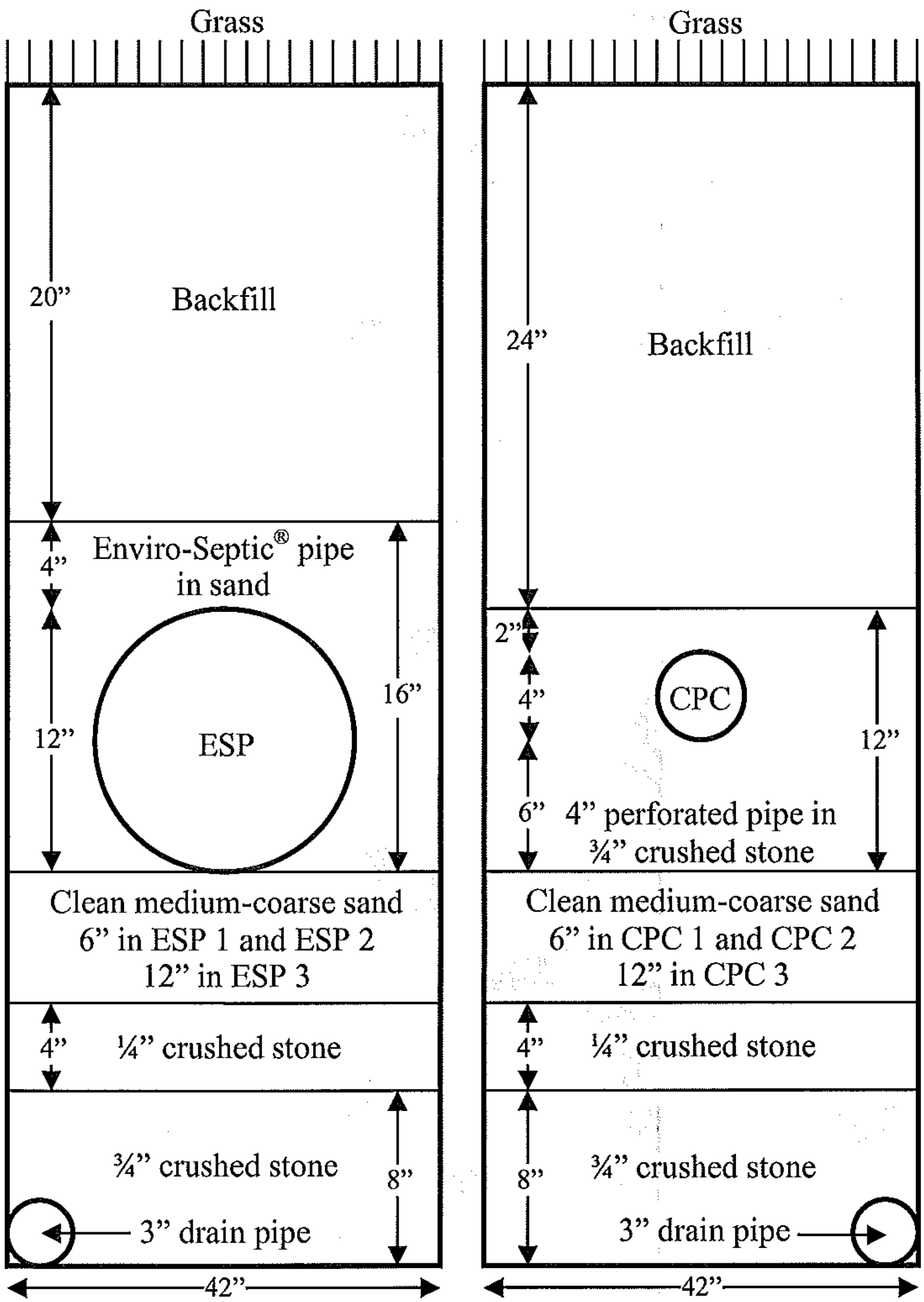


Figure 5. Diagram showing layers of materials and relative locations of drainage and leaching pipes as they were installed in each trench. The box on the left represents the Enviro-Septic® model system; the box on the right represents the conventional pipe and stone model system. Diagram is not to scale.

Loading Septic Tank Effluent into the Model Systems: Sewage from the town of Stoke's sewer was fed into a 6868 gal (26 m^3) septic tank on the test site. Effluent from this large tank was gravity fed to a small 264 gal (1 m^3) waiting tank. Whenever the waiting tank was full, the overflow STE was gravity fed to the Stoke municipal sewage treatment area. Different amounts of STE were pumped to the feeding tank from the waiting tank several times a day. A schedule was set up such that STE was pumped to the feeding tank three times daily: 233 gal (880 L) in the morning, 166 gal (630 L) midday, and 267 gal (1010 L) in the evening. These volumes were chosen because they mimic a ratio of 35%:25%:40% that is typical of residential usage (NSF International, 1999).

When the feeding tank was filled with the set volume, the STE was then gravity fed to a distribution box with equalizers. The STE, however, was not fed to the distribution box all at once. Instead, the draining of the feeding tank was controlled in a manner such that different amounts of STE were released to the distribution box a time, over the course of about an hour. This was done in order to mimic the way a septic tank would receive wastewater from a typical household.

This loading schedule was carried out every day for 171 days, from October 2002 to March 2003. During this time, the volumes of STE leaving the feeding tank were monitored daily to make sure that the pumping/loading system was operating properly. It was determined that an average of 240 gal (908 L), 178 gal (673 L), and 273 gal (1035 L) were actually being delivered to the distribution box in the morning, midday, and in the evening, respectively. This was considered acceptable since the actual volumes were never below the preset volumes. After this 171-day period, an additional pumping of 267 gal (1010 L) to the feeding tank and its subsequent draining to the distribution box was carried out each night.

Once at the distribution box, the STE was divided equally among four model leaching systems at the test site (the ESP and CPC systems described here, plus two other systems). Therefore, following March 2003, the ESP system and the CPC system were *each* fed 58 gal (220 L) in the morning, 42 gal (158 L) midday, 67 gal (253 L) in the evening, and 67 gal (253 L) at night. In other words, a minimum of 933 total gallons per day were divided among the four model systems at the test site. Therefore, the conventional and the Enviro-Septic® model systems *each* received a minimum of 233 gal (880 L) per day.

Comparative Analysis of Leachate to Septic Tank Effluent: Leachate leaving each 20' section of each model test system was fed to an individual drainage receptacle. The volume of leachate reaching each drainage receptacle was measured daily. Samples of STE (from the feeding tank) and leachate (from the drainage receptacles) were collected bi-weekly to monthly (May 14, May 28, June 3, July 9, July 29, Aug 27, September 29, November 4, November 18, and December 16, 2003). These samples were analyzed for ammonia, BOD, COD, fecal coliforms, nitrate, nitrite, total phosphorus, TKN, and TSS by Biolab Division Thetford, Robertsonville, Quebec. Statistical averages and standard deviations were estimated using samples collected from *all* functioning sections of the ESP and CPC systems. A Student's t test was performed in order to assess the statistical significance of the results.

Results and Discussion

Research Project 1: UNH

Test	Average concentration of STE or leachate		Number of samples	% Removal
TSS	STE	300 mg/L	18[6]	
	ES	8 mg/L	35	98%
	P&S	10 mg/L	36	97%
MPN *E. coli*	STE	126,000 per 100 mL	9	
	ES	2,100 per 100 mL	18	98%
	P&S	5,100 per 100 mL	18	96%
MPN Fecal Coliforms	STE	185,264 per 100 mL	12	
	ES	10,000 per 100 mL	24	94%
	P&S	14,000 per 100 mL	24	92%
COD	STE	450 mg/L	21	
	ES	51 mg/L*[7]	43	89%
	P&S	59 mg/L	44	87%
BOD	STE	240 mg/L	21	
	ES	43 mg/L	41	82%
	P&S	48 mg/L	42	80%
TKN	STE	75 mg/L	21	
	ES	8 mg/L	43	89%
	P&S	11 mg/L	44	86%
Ammonia	STE	61 mg/L	21	
	ES	7 mg/L*	43	88%
	P&S	10 mg/L	44	83%
Nitrate	STE	0.5 mg/L	12	
	ES	54 mg/L	24	NA[8,9]
	P&S	52 mg/L	24	

Table 1. Summary of septic component analysis results from Research Project 1 conducted at the University of New Hampshire.

[6] The same STE was distributed to each of two ES models and each of two P&S model systems, therefore the number of samples of STE differs from the number of samples of leachate by a factor of two.

[7] * The difference between ES and P&S leachate values is statistically significant at the 95% confidence level ($P < 0.05$).

[8] NA: Not applicable

[9] Levels of nitrate are expected to rise as a result of aerobic microbial metabolism, therefore percent removal is not applicable.

Research Project 2: DBO Expert Inc.

Test	Average concentrations of STE / leachate		Number of samples	% Removal
TSS	STE	125 mg/L	10[10]	
	ES	2 mg/L***[11]	30	98%
	P&S	25 mg/L	22	80%
MPN Fecal Coliforms	STE	3,091,000 per 100 mL	10	
	ES	2,300 per 100 mL***	30	>99%
	P&S	190,000 per 100 mL	22	94%
COD	STE	441 mg/L	10	
	ES	9 mg/L***	30	98%
	P&S	87 mg/L	22	80%
BOD	STE	172 mg/L	10	
	ES	2 mg/L***	30	99%
	P&S	21 mg/L	22	88%
TKN	STE	45 mg/L	10	
	ES	2 mg/L***	30	95%
	P&S	26 mg/L	20	42%
Ammonia	STE	27 mg/L	10	
	ES	1 mg/L***	30	96%
	P&S	17 mg/L	20	30%
Phosphorus	STE	5 mg/L	10	
	ES	1 mg/L***	30	74%
	P&S	2 mg/L	20	59%
Nitrate	STE	0.1 mg/L	9	
	ES	23 mg/L***	27	NA[12]
	P&S	5 mg/L	20	

Table 2. Summary of septic component analysis results from Research Project 2 conducted in Stoke, Quebec by DBO Expert Inc.

[10] The same STE was distributed to the ESP and CPC model systems, while leachate was collected the three different sections individually. This is why the number of samples of STE differs from the number of samples of leachate. The number of ESP leachate samples varies from the number of CPC samples because until November 2003, wastewater had reached all three ESP sections, but had only reached the first and second CPC sections.

[11] *** The difference between ESP and CPC values is statistically significant at the 99.9% confidence level ($P < 0.001$).

[12] NA: Not applicable

Septic Component Analyses

Results of the septic component analyses from Research Projects 1 and 2 are presented in Tables 1 and 2. The raw data from Research Project 2 are included in Appendix 1. In both projects, the Enviro-Septic® model systems demonstrated greater TSS removal than the conventional systems. In the UNH project, the difference in TSS removal between the systems was small. An average of 8 mg/L TSS exited the ES systems (98% removal), whereas an average of 10 mg/L TSS exited the P&S systems (97% removal). In the large-scale systems of the DBO Expert Inc., project however, ESP leachate contained over ten times less TSS than the CPC leachate (ESP 2 mg/L, 98% removal; CPC 25 mg/L, 80% removal). The difference in leachate clarity between the two systems is visually evident (Figure 6). This difference between the ESP and CPC systems is statistically significant at the 99.9% confidence level ($P < 0.001$); i.e. the probability of the difference being by chance is less than 0.001.

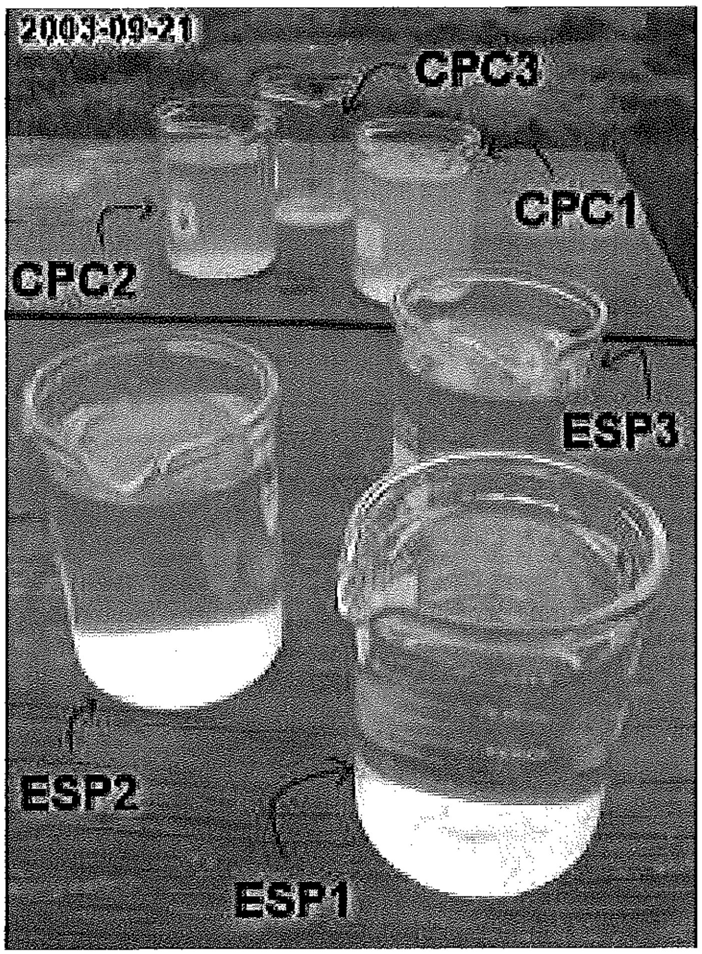


Figure 6. Photograph showing leachate samples from the three different sections of each model leaching system in Stoke, Quebec. The leachate coming out of the Enviro-Septic® system looks clear to the naked eye, whereas the leachate exiting the conventional pipe and stone system is brown in color and cloudy. The beaker labeled CPC 3 is empty because STE had not reached the third 20' section of the conventional system at the time this photograph was taken.

Enviro-Septic® removed fecal coliforms from STE better than pipe and stone systems. Throughout the UNH test, ES leachate contained an average of 10,000 MPN fecal coliforms per 100 mL (94% removal), whereas P&S leachate contained an average of 14,000 MPN per 100 mL (92% removal). This difference is small, but in the DBO Expert Inc., test, the difference is dramatic. Of the average 3 million MPN per 100 mL in the STE, only an average of 2,300 MPN per 100 mL remained in the ESP leachate (>99% removal), compared to 190,000 MPN per 100 mL remaining in the CPC leachate (94% removal). This constitutes a difference of almost two orders of magnitude and is statistically significant ($P < 0.001$). The TSS and fecal coliform results suggest that Enviro-Septic® leaching systems perform significantly better than conventional systems at filtering suspended solids and bacteria from STE, hence supporting Hypothesis 1.

In both research projects, the Enviro-Septic® systems demonstrated greater COD and BOD reduction (Tables 1 and 2) than the conventional systems. In the UNH tests, ES leachate had an average of 51 mg/L COD, whereas P&S leachate had 59 mg/L ($P < 0.05$). In the DBO Expert Inc., results, the COD difference is ten-fold (ESP 9 mg/L, 98% removal; CPC 87 mg/L, 80% removal; $P < 0.001$). The BOD results are similar. The difference between ES and P&S is small in the UNH results, but it is ten-fold in the DBO Expert Inc., tests (ESP 2 mg/L, 99% removal; CPC 21 mg/L, 88% removal; $P < 0.001$).

Results for nitrogen-containing compounds are also significant, with Enviro-Septic® facilitating the decomposition of organic nitrogen compounds and promoting nitrification more than conventional systems. In the DBO Expert Inc., results (Table 2), ESP leachate contained ten times less TKN than CPC leachate (ESP 2 mg/L, 95% removal; CPC 26 mg/L, 42% removal; $P < 0.001$). For ammonia, leachate from the UNH ES systems contained 7 mg/L (88% removal), whereas P&S leachate contained 10 mg/L (83% removal). While this difference is significant at the 95% confidence level ($P < 0.05$), the difference in ammonia values between the DBO Expert Inc., ESP and CPC results are much more pronounced (ESP 1 mg/L, 96% removal; CPC 17 mg/L, 30% removal; $P < 0.001$). The dramatic disappearance of ammonia suggests a high rate of nitrification in the Enviro-Septic® systems. Since nitrate is a product of nitrification, its levels increase dramatically in the Enviro-Septic® systems. While slightly more nitrate was present in the UNH ES system leachate than the P&S leachate (ES 54 mg/L; P&S 52 mg/L), much more was present in the DBO Expert Inc., ESP leachate (ESP 23 mg/L; CPC 5 mg/L; $P < 0.001$). Levels of nitrite in the STE and leachate of the model systems from both research projects were very low (approaching the limits of detection; data not shown), therefore no conclusions were drawn from them.

Finally, Enviro-Septic® systems were more effective at removing phosphorus-containing compounds from STE than conventional systems. From the DBO Expert Inc., results, ESP displayed a 74% removal of phosphorus, compared to a 59% removal by the CPC system ($P < 0.001$).

A decrease in leachate levels of TSS, COD, BOD, TKN, phosphorus, and ammonia, in addition to an increase in nitrate levels, indicate the presence of aerobic microbial metabolism. Such a dramatic decrease of these septic components by the Enviro-Septic® leaching systems suggests that the magnitude of the aerobic microbial ecosystem is extensive. Therefore, these results support Hypothesis 2, that Enviro-Septic® systems accomplish decomposition of wastewater faster and more efficiently than conventional pipe and stone systems by promoting and maintaining a more substantial aerobic microbial ecosystem. Although the Enviro-Septic® systems out-performed conventional systems with respect to all the septic compounds analyzed in both the UNH and DBO Expert Inc., tests, the results from DBO Expert Inc., were much more dramatic. This is likely because the model systems in Stoke, Quebec, are larger and, therefore, better representative models of real-life systems.

Aerobic Microbial Biofilms and System Treatment Capacity

The role of the perforated pipe in a conventional leaching system is basically to distribute the wastewater to the underlying soils. Although the stone bed offers some surface area upon which waste-treating microbes can grow, it too functions primarily to distribute wastewater. Therefore in a conventional system, the majority of wastewater treatment likely takes place in the sand and native soils below the system. Enviro-Septic® systems are different. The primary function of Enviro-Septic® pipe is to provide an ideal environment for the growth of aerobic microbes, which are highly efficient at treating waste. It accomplishes this by providing extensive surface area for microbial biofilms, and by allowing air, and hence oxygen, to penetrate the system. Sewage treatment plants across the nation employ a similar technology by using attached culture systems to support microbial biofilms and supplying oxygen to them. Since the aerobic microbes grow within the pipe, this is where the majority of wastewater treatment likely takes place. The fact that there was no statically significant increase in wastewater treatment (with respect to all tested parameters except phosphorus) in the section of the DBO Expert Inc., ESP model system with twelve inches of sand compared to the sections with six inches of sand (data not shown) further supports the theory that most of the wastewater treatment happens within the Enviro-Septic® pipe, and not in the soils below it.

In New England, each state provides specific guidelines for septic system design and installation. For example, the allowable loading rate of a system (gallons of wastewater per square foot of soil footprint per day; gal/ft^2/day) is dependent upon 1) the percolation rate (minutes per inch; min/in) of a site's native soils and on 2) the design flow (gallons per day), which is the amount of wastewater that can be expected to be discharged to the system by the facility on site. A designer can determine the necessary size of an individual leach field once the allowable loading rate is established. For conventional stone bed leaching systems, the State of Vermont allows a maximum loading rate of 1.2 gal/ft^2/day in soils with a percolation rate of 4 min/in, but only 0.31 gal/ft^2/day in soils with a percolation rate of 60 min/in (Vermont Agency of Natural Resources, 2002). In New Hampshire, loading rates of 0.71 and 0.20 gal/ft^2/day are allowable for 4 and 60 min/in soils, respectively, for a two-bedroom residence (New Hampshire Department of Environmental Services, 1999). The State of Massachusetts would allow a loading rate of 0.74 gal/ft^2/day for Class I soils with a percolation rate of 4 min/in (Massachusetts Department of Environmental Protection, 1996).

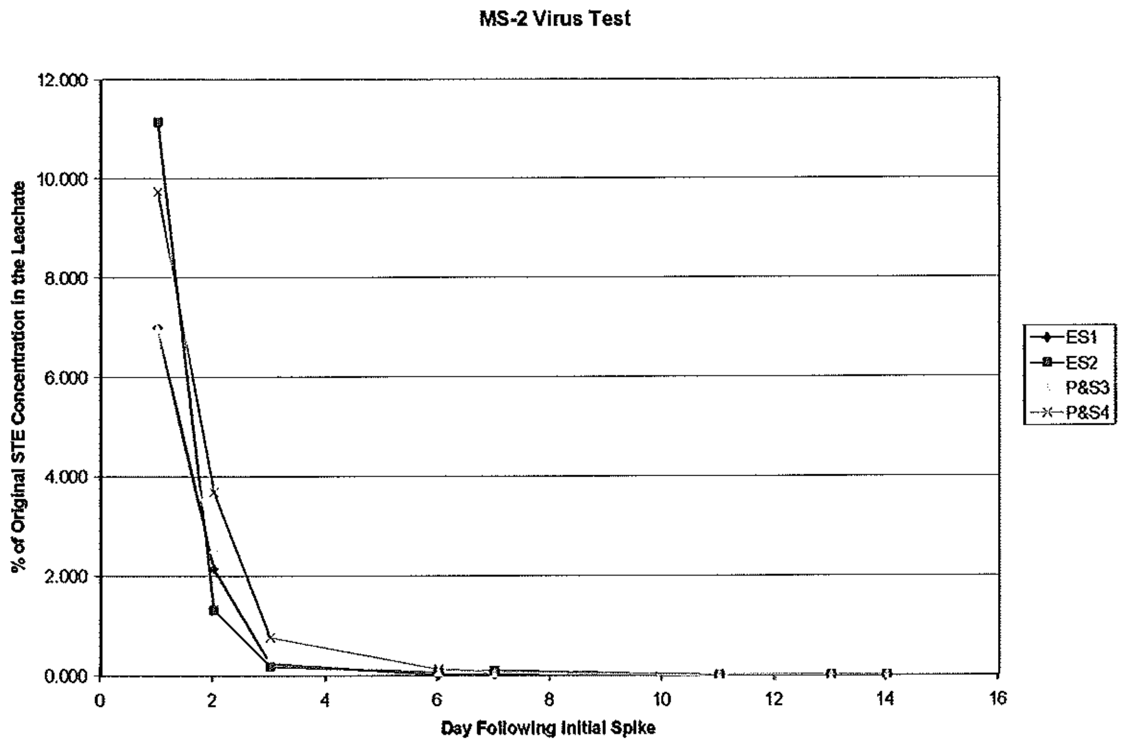
Since Enviro-Septic® systems do not primarily rely on the underlying soils to treat wastewater like pipe and stone bed leaching systems do, it does not make sense to define their allowable loading rates in terms of gallons per square foot of soil footprint per day. Instead, the loading rate could be expressed by dividing gallons per day by the surface area of the microbial biofilms supported by the pipe. In order to determine the biofilm surface area, sensors were installed in the model systems at the Stoke, Quebec test site to determine the levels of liquid inside of them. Over the course of one year, the model ESP system reached a steady state such that the STE remained at a depth at or below four inches inside the pipe. Therefore, a microbial biofilm existed on the bottom 17 inches of the inside circumference of the pipe. Since the system is sixty feet in length, the biofilm surface area is 85 ft^2, and the biofilm loading rate is 2.7 gal/ft^2/day.

A biofilm loading rate of 2.7 gal/ft^2/day is over twice the maximum allowable rate for stone bed leaching systems in Vermont, and it is nearly four times greater than New Hampshire's and Massachusetts' allowable loading rates for stone bed leaching systems in permeable soils. Moreover, Enviro-Septic® systems could function at an even higher biofilm loading rate because the maximum depth that liquid can reach inside Enviro-Septic® pipe is eight inches. Therefore, it could theoretically support a 35% larger microbial biofilm that could treat an 80% greater load volume than the model system in Stoke, Quebec.

In New Hampshire, the minimum required center-to-center pipe spacing for an Enviro-Septic® system is only 1.5 feet (slope must be 0-10% and percolation rate 1-10 min/in; Enviro-Septic® & Simple-Septic® Leaching Systems Design and Installation Manual, 2003). The ability to space pipes only six inches apart allows for a smaller soil footprint. This is possible because the Enviro-Septic® pipe carries out the majority of the treatment, and the role of the underlying soils is basically to carry the treated wastewater away. Furthermore, soils beneath an Enviro-Septic® system are less burdened than those under a conventional system because treated wastewater is more easily distributed than untreated wastewater.

UNH Virus Tests

For the virus tests conducted at UNH, the STE used to spike the systems contained 2.0-3.8 million PFU/mL live MS-2 viral particles and 200,000-410,000 PFU/mL live poliovirus particles. Over a 14-day period, the rate at which these particles were discharged from the systems steadily declined. By the final day of the test, the concentration of MS-2 in the leachate was approximately 0.005% of the initial STE concentration, and the concentration of poliovirus in the leachate was approximately 0.0006% of the initial STE concentration. The rate at which both types of virus escaped from the leaching systems was essentially the same for both ES and P&S (Figure 7). <u>Therefore it can be concluded that Enviro-Septic® leaching systems perform as well as conventional systems at filtering viruses from STE</u>.



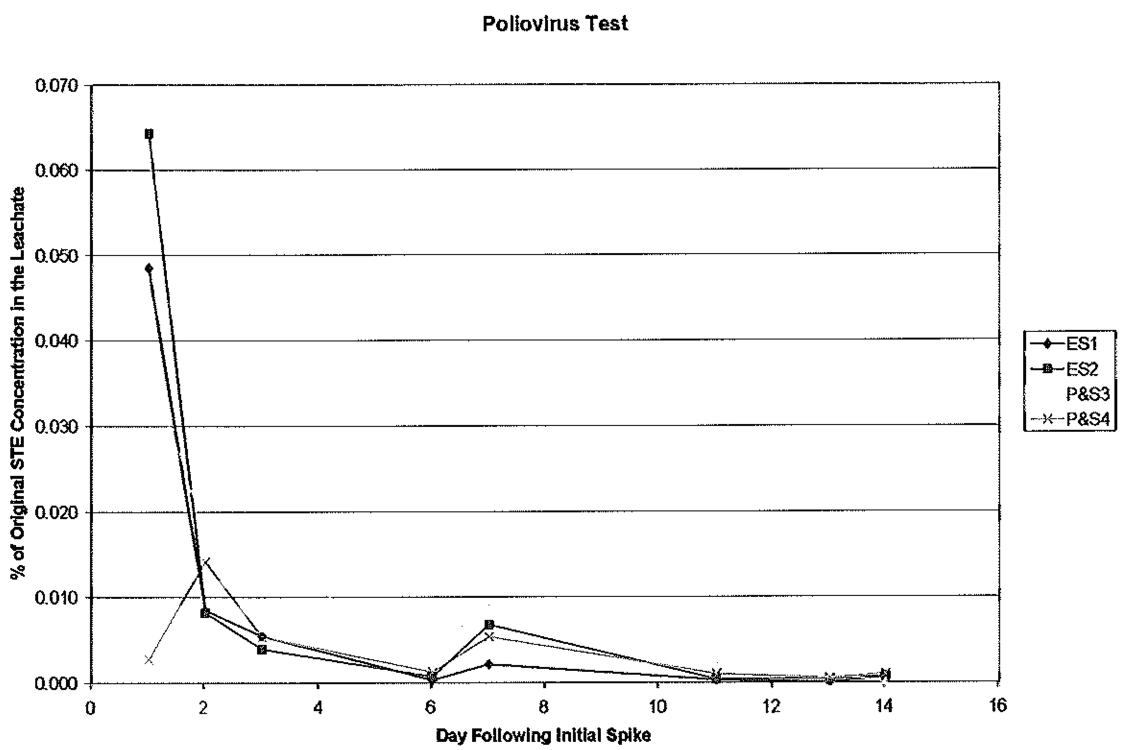


Figure 7. Results of the virus tests. Leachate virus concentrations are presented in terms of percent of the virus concentration in the original spiked STE. There is no significant difference between the ES and P&S systems for filtering viruses from wastewater.

Research Project 2: DBO Expert Inc., Wastewater Flow Tests

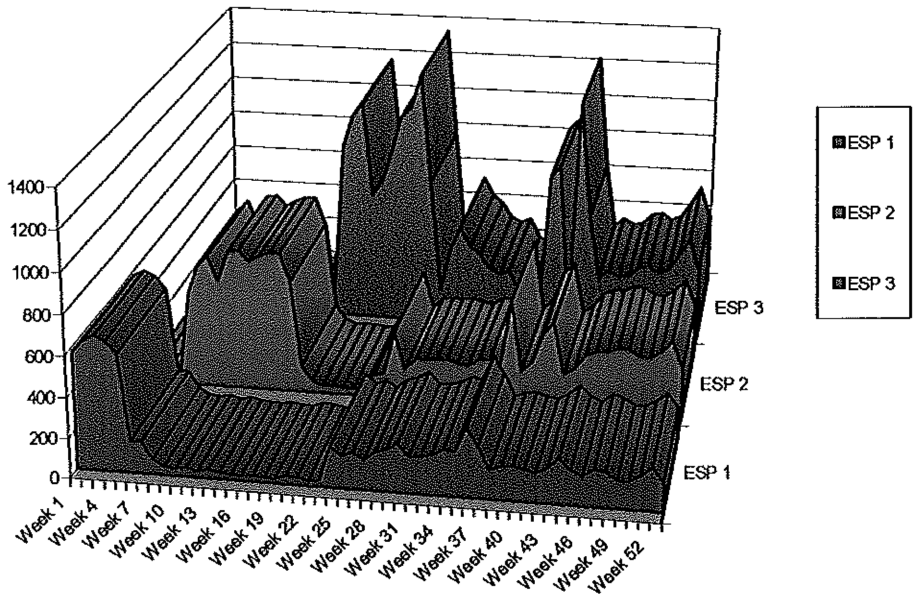
The progress of system function, i.e. the extent of flow of STE through the leaching pipes, has been monitored by DBO Expert Inc., since delivery of STE into the model systems began in October 2002. It was possible to determine when and how much STE reached the second and third 20' lengths of pipe because the bottom of each of the systems' sections were drained individually. The results of this experiment are presented in Figure 8. The data from the ESP system indicate the STE started flowing into the second section of the Enviro-Septic® pipe by Week 6, and that it reached the third section of the system by Week 17. By Week 30, the volumes of STE being treated by the three different sections began to equalize. Interestingly in the conventional system, it took about 36 weeks for STE to reach the second section of pipe and the third section remained non-functional for over a year.

These results support Hypothesis 3, that Enviro-Septic® systems distribute wastewater better, i.e. over a larger surface area, than conventional systems. The improved wastewater distribution of Enviro-Septic® systems may be due to their pipes' design, but it may also be due in part to the medium (sand) in which they are installed. It is probable that sand takes greater advantage of the surface tension of water and hence exhibits greater wicking action than the crushed stone in conventional pipe and stone systems. Since more of the Enviro-Septic® pipe is functioning at any given time, this means that there are more microbial biofilms treating the waste at a time. Furthermore, if Enviro-Septic® leaching systems distribute wastewater over a larger area, then more of the underlying soils are sharing the burden of further treating and distributing it as it percolates through them. This in turn would prevent any one area of the underlying soils from becoming saturated (and hence, less efficient), and may extend the lifetime of the leach field.

Final comments

The results of the experiments described above clearly demonstrate that the Enviro-Septic® leaching system performs as well as conventional pipe and stone systems in all tested aspects of wastewater treatment, and significantly better than conventional systems in most areas of treatment. This can be primarily attributed to the design of the Enviro-Septic® system, which supports aerobic microbial growth, and to the use of sand as a surrounding medium.

Volume (L) of leachate recovered from each 20' section of the Enviro-Septic® model system, Stoke, Quebec



Volume (L) of leachate recovered from each 20' section of the conventional model system, Stoke, Quebec

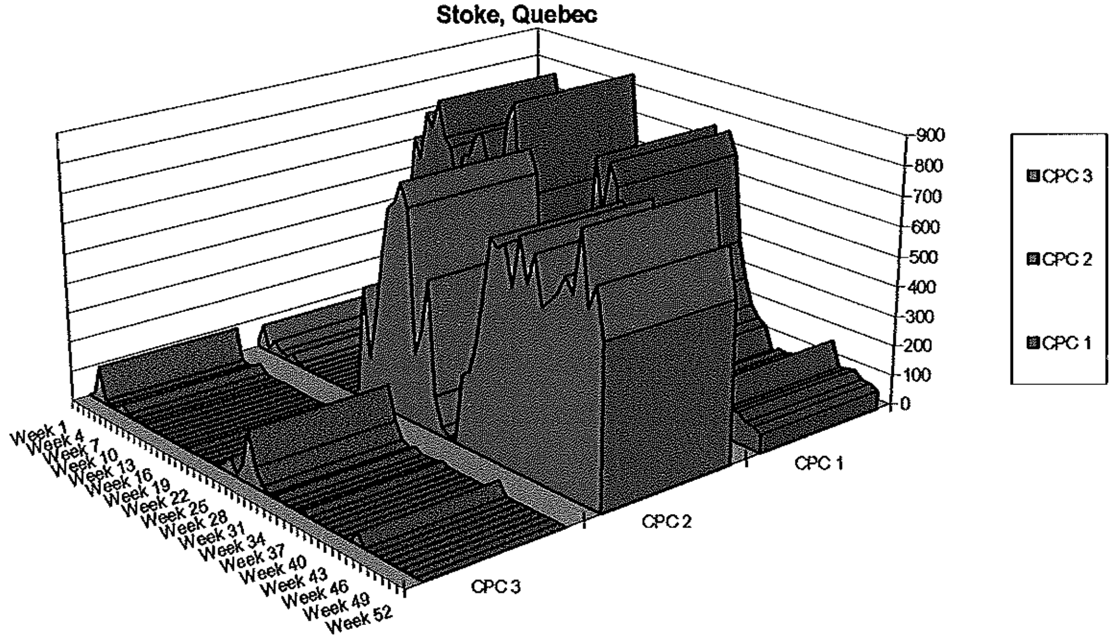


Figure 8. Volumes of leachate that reached the various sections of each model system in Stoke, Quebec, over one year. ESP 1, 2, and 3 refer to the first, second and third 20' lengths of the Enviro-Septic® model system, respectively, while CPC 1, 2, and 3 refer to the first, second, and third 20' lengths of the conventional pipe and stone system, respectively. The volumes include rainwater that infiltrated the systems.

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Appendix 1. Raw data from DBO Expert Inc., wastewater component analyses and estimated statistical results.

TSS (mg/L)	5/14/03	5/28/03	6/3/03	7/9/03	7/29/03	8/27/03	9/29/03	11/4/03	11/18/03	12/16/03	n	AVE	SD	%red	d.f.	t 99.9%	difference	t test 99.9%
STE	67	74	70	112	144	173	131	118	207	151	10	124.70	46.32					
CPC1	7	8	9	45	60	91	20	2	3	40	22	25.14	23.11	79.84	50	3.26	22.84	11.27
CPC2	7	15	9	25	17	34	54	27	15	9								*Signif
CPC3									51	5								
ESP1	1	1	2	1	1	2	2	5	7	3	30	2.30	1.51	98.16				
ESP2	2	2	4	1	2	1	1	1	1	3								
ESP3	3	3	4	2	3	1	1	1	3	5			ave SD					
													12.31					
Ammonia	(mg/L)										n	AVE	SD	%red	d.f.	t 99.9%	difference	t test 99.9%
STE	15	21	14	23	27	31	29	36	35	36	10	26.70	8.23					
CPC1	4.9	14	2.8	19	30	33	38	39			20	18.64	10.87	30.19	48	3.27	17.65	5.85
CPC2	0.5	13	9.6	19	18	11	24	16	15	15								*Signif
CPC3									25	26								
ESP1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	30	0.99	1.53	96.30				
ESP2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.9								
ESP3	2.3	0.5	0.5	1	1.4	0.5	0.5	0.5	3.8	8.2			ave SD					
													6.20					
TKN	(mg/L)										n	AVE	SD	%red	d.f.	t 99.9%	difference	t test 99.9%
STE	26	31	29	36	39	45	47	67	81	51	10	45.20	17.48					
CPC1	13	20	12	24	33	41	50	56			20	26.40	14.04	41.60	48	3.27	24.35	7.95
CPC2	0.9	18	14	26	22	12	33	24	30	22								*Signif
CPC3									47	30								
ESP1	0.9	0.9	0.9	0.9	0.9	1.5	0.9	0.9	0.9	0.9	30	2.05	2.81	95.47				
ESP2	0.9	0.9	0.9	0.9	0.9	1.8	0.9	0.9	0.9	1.6								
ESP3	5.4	1.1	0.9	5	3	0.9	1	0.9	11	12			ave SD					
													8.42					
BOD5	(mg/L)										n	AVE	SD	%red	d.f.	t 99.9%	difference	t test 99.9%
STE	98	152	47	211	205	275	190	168	203	172	10	172.10	63.26					
CPC1	8	17	8	57	7	98	4	2	5	4	22	21.36	24.61	87.59	50	3.26	19.10	11.73
CPC2	2	27	12	33	15	14	16	16	19	18								*Signif
CPC3									75	13								
ESP1	2	2	2	2	2	2	2	2	2	2	30	2.27	1.01	98.68				
ESP2	2	2	2	2	2	2	2	2	2	2								
ESP3	2	2	2	2	2	2	2	2	6	6			ave SD					
													12.81					

COD	(mg/L)										n	AVE	SD	%red	d.f.	t 99.9%	difference	t test 99.9%
STE	213	432	270	448	518	691	541	391	478	431	10	441.30	134.89					
CPC1	18	166	17	154	64	207	121	30	46	37	22	86.77	60.71	80.34	50	3.26	78.24	32.14
CPC2	3	142	46	96	90	92	144	41	63	69								*Signif
CPC3									207	56								
ESP1	3	3	3	3	6	6	3	6	17	6	30	8.53	9.51	98.07				
ESP2	3	3	6	3	3	17	3	3	29	6								
ESP3	6	3	6	19	3	6	17	6	46	12			ave SD					
													35.11					
Phosphorus	(mg/L)										n	AVE	SD	%red	d.f.	t 99.9%	difference	t test 99.9%
STE	3.6	4.3	3.8	5.4	5.8	6.1	6.2	5.4	5.8	5.6	10	5.20	0.95					
CPC1	1.8	2.9	2.1	0.3	1.7	3.1	0.4	0.3			20	2.15	1.07	58.75	48	3.27	0.82	0.72
CPC2	0.3	2.8	2.5	3.4	2.7	2.8	4	2.7	2.4	1.9								*Signif
CPC3									2.4	2.4								
ESP1	1.1	1.1	1.2	1.7	1.8	1.8	1.4	1.9	1.4	1.9	30	1.32	0.45	74.55				
ESP2	0.9	0.8	0.8	1.7	1.7	1.4	1.8	1.9	1.2	1.5								
ESP3	0.8	0.5	0.4	0.7	1.3	0.9	1.2	1.4	1.7	1.8			ave SD					
													0.76					
Coliforms	(MPN per 100 mL)										n	AVE	SD	%red	d.f.	t 99.9%	difference	t test 99.9%
STE	2600000	2400000	2100000	520000	16000000	1800000	1600000	1600000	1800000	490000	10	3091000	4588605					
CPC1	320000	400000	150000	100000	260000	370000	340	230	1100	40	22	189669	264295	93.86	50	3.26	187410	123083.76
CPC2	9	1100000	170000	550000	54000	4900	4100	37000	160000	51000								*Signif
CPC3									430000	10000								
ESP1	120	2800	390	21000	160	36	36	18	9	120	30	2259	4641	99.93				
ESP2	140	4100	730	180	250	130	2000	150	480	200								
ESP3	99	9	1500	12000	1800	18	90	2900	11000	5300			ave SD					
													134468					
Nitrate	(mg/L)										n	AVE	SD		d.f.	t 99.9%	difference	t test 99.9%
STE	0.05	0.05	0.05	0.05	0.05		0.05	0.18	0.1	0.05	9	0.07	0.04					
CPC1	8.9	4.7	6.8	0.05	0.05		0.05	0.05	0.05	0.05	20	5.28	6.30		45	3.28	18.02	6.44
CPC2	24	4.3	5.3	0.38	4.3		8.5	8.7	12	15								*Signif
CPC3									0.11	2.3								
ESP1	24	25	20	16	16		28	15	23	26	27	23.30	7.00					
ESP2	29	25	26	21	17		28	15	27	17								
ESP3	30	45	33	25	15		27	17	25	14			ave SD					
													6.65					

ENVIRONNEMENT ESA

ASSESSMENT OF THE LOADS AND EFFECTIVENESS OF REMOVAL FOR THE SECTION ENVIRO-SEPTIC® (Esp 1-2-3)

July 29, 2003

Point			Tank of loading	ESP 1		ESP 2		ESP 3		SUMMON ESP 1-2-3		EFFECTIVENESS Of REMOVAL
Volume recovered by cell			N/A	185 L/d		186 L/d		265 L/d		636 L/d		
Effective volume (without the rain)			N/A	185 L/d		186 L/d		265 L/d		635 L/d		
Parameters to be analyzed	Units	LDM	mg/L	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	(%)
TSS	mg/L	1	144	1	0.0002	2	0.0004	3	0.0008	2.1	0.0014	98.5%
BOD5 C	mg/L	2	205	< 2	0.0002	< 2	0.0002	< 2	0.0003	1.0	0.0006	99.5%
BOD5 C soluble	mg/L	2	167	< 2	0.0002	< 2	0.0002	< 2	0.0003	1.0	0.0006	99.4%
COD total	mg/L	3	518	6	0.0011	< 3	0.0003	< 3	0.0004	2.8	0.0018	99.5%
COD soluble	mg/L	3	294	< 3	0.0003	< 3	0.0003	< 3	0.0004	1.5	0.0010	99.5%
TKN	mg N/L	0.9	39	< 0.9	0.00008	< 0.9	0.0001	3	0.0008	1.5	0.0010	96.1%
NH4	mg N/L	0.5	27	< 0.5	0.00005	< 0.5	0.00005	1	0.0004	0.7	0.0005	97.3%
NO2	mg N/L	0.05	< 0.05	19	0.0035	23	0.0043	22	0.0058	21.4	0.0136	N/A
NO3	mg N/L	0.05	< 0.05	16	0.0030	17	0.0032	15	0.0040	15.9	0.0101	N/A
NO2-NO3	mg N/L	0.05	< 0.05	35	0.0065	40	0.0074	37	0.0098	37.3	0.0237	N/A
P total	mg P/L	0.3	5.8	1.8	0.0003	1.7	0.0003	1.3	0.0003	1.6	0.0010	73.0%
			Concentration	Conc.	Removal	Conc.	Removal	Conc.	Removal	Conc.	Units	
Coli. Fecal	UFC/100 mL	10	16 000 000	160	99.999%	250	99.998%	1 800	99.989%	870	UFC/100 mL	99.995%
Coli. Fecal filtered	UFC/100 mL	10	1 500 000	99	99.993%	210	99.986%	220	99.985%	182	UFC/100 mL	99.988%

Note :

When the concentration is lower than the limit of detection (LDM), one uses half of limit LDM for the calculation of the loads.

The gross loads of each cell are calculated by using the total volume of leachate recovered with the cell (including the volume of rainwater). The load

brute total (nap ESP 1-2-3, column kg/d) is obtained by adding the gross loads with each cell.

The total average concentrations (Nap ESP 1-2-3, column mg/L) are obtained by multiplying the total gross loads by 106, the whole divided by the effective volume of leachate (excluding rainwater). This way of making eliminates the effect of dilution connected to the rain by putting forth the assumption that the contents of rainwater (in mg/L) are null.

ASSESSMENT OF THE LOADS AND EFFECTIVENESS OF REMOVAL FOR PIPE AND STONE (CPC 1-2-3)

July 29, 2003

Point			Tank of loading	CPC 1		CPC 2		CPC 3		SUMMON CPC 1-2-3		EFFECTIVENESS Of REMOVAL
Volume recovered by cell			N/A	97 L/d		746 L/d				843 L/d		
Effective volume (without the rain)			N/A	97 L/d		746 L/d				843 L/d		
Parameters to be analyzed	Unités	LDM	mg/L	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	(%)
TSS	mg/L	1	67	60	0.0058	27	0.0201	---	---	30.8	0.0260	54.0%
BOD5 C	mg/L	2	98	7	0.0007	15	0.0112	---	---	14.1	0.0119	85.6%
BOD5 C soluble	mg/L	2	51	< 2	0.0001	4	0.0030	---	---	3.7	0.0031	92.8%
COD total	mg/L	3	213	64	0.0062	90	0.0672	---	---	87.0	0.0734	59.1%
COD soluble	mg/L	3	73	< 3	0.0001	26	0.0194	---	---	23.2	0.0195	68.2%
TKN	mg N/L	0.9	26	33	0.0032	22	0.0164	---	---	23.3	0.0196	10.5%
NH4	mg N/L	0.5	15	30	0.0029	18	0.0134	---	---	19.4	0.0163	-29.2%
NO2	mg N/L	0.05	---	< 0.05	0.000002	2.2	0.0016	---	---	2.0	0.0016	N/A
NO3	mg N/L	0.05	---	< 0.05	0.000002	4.3	0.0032	---	---	3.8	0.0032	N/A
NO2-NO3	mg N/L	0.05	< 0.05	< 0.05	0.000002	6.5	0.0049	---	---	5.8	0.0049	N/A
P total	mg P/L	0.3	3.6	1.7	0.0002	2.7	0.0020	---	---	2.6	0.0022	28.2%
			Concentration	Conc.	Removal	Conc.	Removal	Conc.	Removal	Conc.	Units	
Coli. Fecal	UFC/100 mL	10	2 600 000	260 000	89.986%	54 000	97.923%	---	---	77 693	UFC/100 mL	97.012%
Coli. Fecal filtered	UFC/100 mL	10	120 000	200	99.833%	10 000	91.665%	---	---	8 875	UFC/100 mL	92.604%

Note :

When the concentration is lower than the limit of detection (LDM), one uses half of limit LDM for the calculation of the loads.

The gross loads of each cell are calculated by using the total volume of leachate recovered with the cell (including the volume of rainwater). The load

brute total (nap ESP 1-2-3, column kg/d) is obtained by adding the gross loads with each cell.

The total average concentrations (Nap ESP 1-2-3, column mg/L) are obtained by multiplying the total gross loads by 106, the whole divided by the effective volume of leachate (excluding rainwater). This way of making eliminates the effect of dilution connected to the rain by putting forth the assumption that the contents of rainwater (in mg/L) are null.

ASSESSMENT OF THE LOADS AND EFFECTIVENESS OF REMOVAL FOR THE SECTION ENVIRO-SEPTIC® (Esp 1-2-3)

August 27, 2003

Point			Tank of loading	ESP 1		ESP 2		ESP 3		SOMME ESP 1-2-3		EFFECTIVENESS Of REMOVAL
Volume recovered by cell			N/A	244 L/d		344 L/d		362 L/d		949 L/d		
Effective volume (without the rain)			N/A	212 L/d		313 L/d		331 L/d		855 L/d		
Parameters to be analyzed	Units	LDM	mg/L	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	(%)
TSS	mg/L	1	173	2	0.0005	1	0.0003	< 1	0.0002	1.2	0.0010	99.3%
BOD5 C	mg/L	2	275	< 2	0.0002	2	0.0007	< 2	0.0004	1.5	0.0013	99.5%
BOD5 C soluble	mg/L	2	131	< 2	0.0002	< 2	0.0003	< 2	0.0004	1.1	0.0009	99.2%
COD total	mg/L	3	691	6	0.0015	17	0.0058	6	0.0022	11.1	0.0095	98.4%
COD soluble	mg/L	3	253	6	0.0015	17	0.0058	6	0.0022	11.1	0.0095	95.6%
TKN	mg N/L	0.9	45	2	0.0004	2	0.0006	< 0.9	0.0002	1.3	0.0011	97.0%
NH4	mg N/L	0.5	31	< 0.5	0.0001	< 0.5	0.0001	< 0.5	0.0001	0.3	0.0002	99.1%
NO2	mg N/L	0.05	---	---	---	---	---	---	---			N/A
NO3	mg N/L	0.05	---	---	---	---	---	---	---			N/A
NO2-NO3	mg N/L	0.05	< 0.05	23	0.0056	24	0.0083	24	0.0087	26.4	0.0225	N/A
P total	mg P/L	0.3	6.1	1.8	0.0004	1.4	0.0005	0.9	0.0003	1.5	0.0012	76.1%
			Concentration	Conc.	Removal	Conc.	Removal	Conc.	Removal	Conc.	Units	
Coli. Fecal	UFC/100 mL	10	1 800 000	36	99.998%	130	99.992%	18	99.999%	69	UFC/100 mL	99.996%
Coli. Fecal filtered	UFC/100 mL	10	300 000	9	99.997%	18	99.993%	< 10	99.998%	12	UFC/100 mL	99.996%

Note :

When the concentration is lower than the limit of detection (LDM), one uses half of limit LDM for the calculation of the loads.

The gross loads of each cell are calculated by using the total volume of leachate recovered with the cell (including the volume of rainwater). The load

brute total (nap ESP 1-2-3, column kg/d) is obtained by adding the gross loads with each cell.

The total average concentrations (Nap ESP 1-2-3, column mg/L) are obtained by multiplying the total gross loads by 106, the whole divided by the effective volume of leachate (excluding rainwater). This way of making eliminates the effect of dilution connected to the rain by putting forth the assumption that the contents of rainwater (in mg/L) are null.

ASSESSMENT OF THE LOADS AND EFFECTIVENESS OF REMOVAL FOR PIPE AND STONE (CPC 1-2-3)

August 27, 2003

Point			Tank of loading	CPC 1		CPC 2		CPC 3		SUMMON CPC 1-2-3		EFFECTIVENESS Of REMOVAL
Volume recovered by cell			N/A	399 L/d		493 L/d				892 L/d		
Effective volume (without the rain)			N/A	368 L/d		461 L/d				829 L/d		
Parameters to be analyzed	Units	LDM	mg/L	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	(%)
MES	mg/L	1	67	91	0.0363	34	0.0167	---	---	64.0	0.0531	4.5%
DBO5 C	mg/L	2	98	98	0.0391	14	0.0069	---	---	55.5	0.0460	43.4%
DBO5 C soluble	mg/L	2	51	55	0.0220	9	0.0044	---	---	31.8	0.0264	37.6%
DCO totale	mg/L	3	213	207	0.0827	92	0.0453	---	---	154.3	0.1280	27.5%
DCO soluble	mg/L	3	73	115	0.0459	52	0.0256	---	---	86.3	0.0715	-18.2%
NTK	mg N/L	0.9	26	41	0.0164	12	0.0059	---	---	26.9	0.0223	-3.3%
NH4	mg N/L	0.5	15	33	0.0132	11	0.0054	---	---	22.4	0.0186	-49.5%
NO2	mg N/L	0.05	---	---	---	---	---	---	---			N/A
NO3	mg N/L	0.05	---	---	---	---	---	---	---			N/A
NO2-NO3	mg N/L	0.05	< 0.05	< 0.05	0.00001	16	0.0079	---	---	9.5	0.0079	N/A
P total	mg P/L	0.3	3.6	3.1	0.0012	2.8	0.0014	---	---	3.2	0.0026	12.3%
			Concentration	Conc.	Removal	Conc.	Removal	Conc.	Removal	Conc.	Units	
Coli. Fecal	UFC/100 mL	10	2 600 000	370 000	84.558%	4 900	99.799%	---	---	168 537	UFC/100 mL	93.518%
	UFC/100 mL	10	120 000	180	99.837%	310	99.724%	---	---	263	UFC/100 mL	99.780%

Note :

When the concentration is lower than the limit of detection (LDM), one uses half of limit LDM for the calculation of the loads.

The gross loads of each cell are calculated by using the total volume of leachate recovered with the cell (including the volume of rainwater). The load

brute total (nap ESP 1-2-3, column kg/d) is obtained by adding the gross loads with each cell.

The total average concentrations (Nap ESP 1-2-3, column mg/L) are obtained by multiplying the total gross loads by 106, the whole divided by the effective volume of leachate (excluding rainwater). This way of making eliminates the effect of dilution connected to the rain by putting forth the assumption that the contents of rainwater (in mg/L) are null.

ASSESSMENT OF THE LOADS AND EFFECTIVENESS OF REMOVAL FOR THE SECTION ENVIRO-SEPTIC® (ESP 1-2-3)

September 29, 2003

Point			Tank of loading	ESP 1		ESP 2		ESP 3		SUMMON ESP 1-2-3		EFFECTIVENESS Of REMOVAL
Volume recovered by cell			N/A	181 L/d		344 L/d		441 L/d		967 L/d		
Effective volume (without the rain)			N/A	164 L/d		327 L/d		424 L/d		915 L/d		
Parameters to be analyzed	Units	LDM	mg/L	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	(%)
TSS	mg/L	1	131	2	0.0004	< 1	0.0002	1	0.0004	1.1	0.0010	99.2%
BOD5 C	mg/L	2	190	< 2	0.0002	< 2	0.0003	< 2	0.0004	1.1	0.0010	99.4%
BOD5 C soluble	mg/L	2	105	< 2	0.0002	< 2	0.0003	< 2	0.0004	1.1	0.0010	99.0%
COD total	mg/L	3	541	< 3	0.0003	< 3	0.0005	17	0.0075	9.1	0.0083	98.3%
COD soluble	mg/L	3	156	< 3	0.0003	< 3	0.0005	6	0.0026	3.8	0.0034	97.6%
TKN	mg N/L	0.9	47	< 0.9	0.0001	< 0.9	0.0002	1	0.0004	0.7	0.0007	98.4%
NH4	mg N/L	0.5	29	< 0.5	0.0000	< 0.5	0.0001	< 0.5	0.0001	0.3	0.0002	99.1%
NO2	mg N/L	0.05	< 0.05	2	0.0004	2	0.0007	2	0.0009	2.2	0.0020	N/A
NO3	mg N/L	0.05	< 0.05	28	0.0051	28	0.0096	27	0.0119	29.1	0.0266	N/A
NO2-NO3	mg N/L	0.05	< 0.05	30	0.0054	30	0.0103	29	0.0128	31.2	0.0286	N/A
P total	mg P/L	0.3	6.2	1.4	0.0003	1.8	0.0006	1.2	0.0005	1.5	0.0014	75.3%
			Concentration	Conc.	Removal	Conc.	Removal	Conc.	Removal	Conc.	Units	
Coli. Fecal	UFC/100 mL	10	1 600 000	36	99.998%	2 000	99.868%	90	99.994%	800	UFC/100 mL	99.950%
Coli. Fecal filtered	UFC/100 mL	10	320 000	9	99.997%	45	99.985%	9	99.997%	23	UFC/100 mL	99.993%

Note :

When the concentration is lower than the limit of detection (LDM), one uses half of limit LDM for the calculation of the loads.

The gross loads of each cell are calculated by using the total volume of leachate recovered with the cell (including the volume of rainwater). The load

brute total (nap ESP 1-2-3, column kg/d) is obtained by adding the gross loads with each cell.
The total average concentrations (Nap ESP 1-2-3, column mg/L) are obtained by multiplying the total gross loads by 106, the whole divided by the effective volume of leachate (excluding rainwater). This way of making eliminates the effect of dilution connected to the rain by putting forth the assumption that the contents of rainwater (in mg/L) are null.

ASSESSMENT OF THE LOADS AND EFFECTIVENESS OF REMOVAL FOR PIPE AND STONE (CPC 1-2-3)

September 29, 2003

Point			Tank of loading	CPC 1		CPC 2		CPC 3		SUMMON CPC 1-2-3		EFFECTIVENESS Of REMOVAL
Volume recovered by cell			N/A	75 L/d		633 L/d				708 L/d		
Effective volume (without the rain)			N/A	57 L/d		615 L/d				673 L/d		
Parameters to be analyzed	Units	LDM	mg/L	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	(%)
TSS	mg/L	1	67	20	0.0015	54	0.0342	---	---	53.0	0.0357	20.9%
BOD5 C	mg/L	2	98	4	0.0003	16	0.0101	---	---	15.5	0.0104	84.2%
BOD5 C soluble	mg/L	2	51	2	0.0001	3	0.0019	---	---	3.0	0.0020	94.0%
COD total	mg/L	3	213	121	0.0091	144	0.0911	---	---	148.9	0.1002	30.1%
COD soluble	mg/L	3	73	12	0.0009	40	0.0253	---	---	39.0	0.0262	46.6%
TKN	mg N/L	0.9	26	50	0.0037	33	0.0209	---	---	36.6	0.0246	-40.8%
NH4	mg N/L	0.5	15	38	0.0028	24	0.0152	---	---	26.8	0.0180	-78.7%
NO2	mg N/L	0.05	---	< 0.05	0.000002	1.4	0.0009	---	---	1.3	0.0009	N/A
NO3	mg N/L	0.05	---	0.05	0.000004	8.5	0.0054	---	---	8.0	0.0054	N/A
NO2-NO3	mg N/L	0.05	< 0.05	0.05	0.000004	9.9	0.0063	---	---	9.3	0.0063	N/A
P total	mg P/L	0.3	3.6	0.40	0.00003	4.0	0.0025	---	---	3.8	0.0026	-5.7%
			Concentration	Conc.	Removal	Conc.	Removal	Conc.	Removal	Conc.	Units	
Coli. Fecal	UFC/100 mL	10	2 600 000	340	99.983%	4 100	99.838%	---	---	3 806	UFC/100 mL	99.854%
Coli. Fecal filtered	UFC/100 mL	10	120 000	9	99.990%	250	99.786%	---	---	231	UFC/100 mL	99.808%

Note :

When the concentration is lower than the limit of detection (LDM), one uses half of limit LDM for the calculation of the loads.

The gross loads of each cell are calculated by using the total volume of leachate recovered with the cell (including the volume of rainwater). The load

brute total (nap ESP 1-2-3, column kg/d) is obtained by adding the gross loads with each cell.
The total average concentrations (Nap ESP 1-2-3, column mg/L) are obtained by multiplying the total gross loads by 106, the whole divided by the effective volume of leachate (excluding rainwater). This way of making eliminates the effect of dilution connected to the rain by putting forth the assumption that the contents of rainwater (in mg/L) are null.

6.5.2 Average concentrations calculated for the total effluent of Enviro-Septic® pipe vs. the total effluent of pipe and stone

The table on the following page summarizes the average concentrations calculated for the total effluent of the 3 cells of EnviroSeptic® pipe (ESP 1-2-3) and of the 3 cells of pipe and stone (CPC 1-2-3).

The total average concentration is obtained by adding the total load of effluent for the cells ESP 1-2-3 or CPC 1-2-3 divided by the volume of leachate recovered after subtraction of the rain. This way of making enables us to obtain the real concentration coming from the system of treatment without the impact of the rain. While proceeding, we put forth the assumption that the concentrations present in the rain are null. The fact of using the volume of leachate recovered after subtraction of the rain causes an increase to the concentration of effluent actually treated vs. the analyzed concentrations (the effect of dilution because of the eliminated rain).

The following equation summarizes the way in which the total average concentrations were obtained:

Conc. Moy. = { [Somme(Conc. ESP"X"*Vol. tot."X"*10-6)] * 106}/Vol. early without rain

You will note that we calculated the average concentrations for all of the sampling from May 14 to September 29, 2003, just by excluding the results from July 3 when the bacterial surface was lost in the Enviro Septic® section.

6.5.3 Assessment of the effectiveness of the treatment in pipe Enviro-Septic® vs. pipe and stone

The table on the following page summarizes the results of the average effectiveness of the treatment in the 3 cells of Enviro-Septic® pipe (ESP 1-2-3) compared to the average effectiveness of the treatment in the 3 cells of pipe and stone (CPC 1-2-3).

The effectiveness of the treatment is calculated on the removal of the loads for each parameter. You will see that we calculated the average effectiveness for all of the sampling from May 14 to September 29, 2003.

Lastly, the columns at the extreme right-hand side of the table show the average of the results by excluding the results on July 3 when the bacterial surface was lost in the Enviro-Septic® section.

ASSESSMENT OF THE EFFECTIVENESS OF REMOVAL ENVIRO-SEPTIC® (Esp 1-2-3) vs PIPE AND STONE (CPC 1-2-3)																	AVERAGE ASSESSMENT (MAY 14 TO SEPTEMBER 29, 2003)			
Period	14-May-03		28-May-03		3-June-03		3-july-03		9-july-03		29-july-03		27-August-03		29-sept-03		INCLUDING 3/07/03		EXCLUDING 3/07/04	
Parameter	ESP	CPC	ESP	CPC	ESP	CPC	ESP	CPC	ESP	CPC	ESP	CPC	ESP	CPC	ESP	CPC	ESP	CPC	ESP	CPC
TSS	97%	89%	97%	86%	95%	86%	69%	69%	99%	58%	99%	54%	99%	4%	99%	21%	94%	58%	98%	57%
BOD5 C	99%	92%	99%	80%	99%	90%	86%	90%	100%	62%	100%	86%	99%	43%	99%	84%	98%	78%	99%	77%
BOD5 C sol.	98%	92%	99%	82%	98%	89%	95%	98%	99%	75%	99%	93%	99%	38%	99%	94%	98%	83%	99%	80%
COD total	98%	92%	100%	22%	98%	85%	75%	53%	98%	50%	99%	59%	98%	28%	98%	30%	96%	52%	99%	52%
COD sol.	98%	84%	99%	-7%	98%	81%	70%	16%	97%	15%	99%	68%	96%	-18%	98%	47%	94%	36%	98%	38%
TKN	89%	52%	98%	22%	98%	49%	53%	7%	93%	0%	96%	10%	97%	-3%	98%	-41%	90%	12%	96%	13%
NH4	92%	69%	99%	5%	98%	59%	51%	-4%	96%	-28%	97%	-29%	99%	-49%	99%	-79%	91%	-7%	97%	-7%
P total	74%	51%	81%	18%	80%	35%	63%	45%	77%	18%	73%	28%	76%	12%	75%	-6%	75%	25%	77%	22%
C. F. (E.Coli)	100%	96%	100%	69%	100%	94%	87%	97%	98%	87%	100%	94%	100%	92%	100%	100%	98.0%	91.1%	99.7%	90.3%
C. F. filtered	100%	98%	100%	65%	100%	89%	83%	86%	99%	65%	100%	96%	100%	100%	100%	100%	97.7%	87.3%	99.8%	87.5%

AVERAGE EFFLUENT CONCENTRATIONS CALCULATED IN THE ENVIRO-SEPTIC® TEST BED (Esp 1-2-3) vs PIPE AND STONE (CPC 1-2-3)																	AVERAGE ASSESSMENT (MAY 14 TO SEPTEMBER 29, 2003)			
Period	14-May-03		28-May-03		3-June-03		3-july-03		9-july-03		29-jlyl-03		27-August-03		29-sept-03		INCLUDING 3/07/03		EXCLUDING 3/07/04	
Parameter	ESP	CPC	ESP	CPC	ESP	CPC	ESP	CPC	ESP	CPC	ESP	CPC	ESP	CPC	ESP	CPC	ESP	CPC	ESP	CPC
TSS	2.2	7.1	2.0	9.6	3.5	9.2	29.4	20.7	1.2	28.2	2.1	30.8	1.2	64.0	1.1	53.0	5.3	27.8	1.9	28.8
BOD5 C	1.0	7.7	1.0	19.4	1.4	10.1	29.3	10.0	1.0	36.9	1.0	14.1	1.5	55.5	1.1	15.5	4.7	21.1	1.2	22.7
BOD5 C sol.	1.0	3.9	1.0	9.3	1.0	5.6	8.3	1.0	1.0	12.8	1.0	3.7	1.1	31.8	1.1	3.0	1.9	8.9	1.0	10.0
COD totale	3.7	17.4	1.6	166.5	4.7	31.3	128.9	99.1	10.0	105.6	2.8	87.0	11.1	154.3	9.1	148.9	21.5	101.3	6.1	101.6
COD sol.	1.5	11.5	1.6	78.3	1.5	14.1	81.7	61.4	7.1	62.3	1.5	23.2	11.1	86.3	3.8	39.0	13.7	47.0	4.0	44.9
TKN	2.8	12.4	0.7	20.2	0.6	13.2	17.9	24.2	2.6	25.9	1.5	23.3	1.3	26.9	0.7	36.6	3.5	22.8	1.5	22.6
NH4	1.2	4.7	0.3	14.2	0.3	6.1	10.2	-15.6	0.8	19.2	0.7	19.4	0.3	22.4	0.3	26.8	1.8	16.0	0.5	16.1
P total	0.9	1.8	0.8	3.0	0.8	2.3	1.5	2.0	1.2	3.0	1.6	2.6	1.5	3.2	1.5	3.8	1.2	2.7	1.2	2.8
C. F. (E.Coli)	119	292 642	2 333	544 406	942	160 966	152 632	144 390	10 162	485 306	870	77 693	69	168 537	800	3 806	20 991	234 718	2 185	247 622
C. F. filtered	11	5 396	203	36 600	99	12 489	94 381	30 600	1 811	54 189	182	8 875	12	263	23	231	12 090	18 580	334	16 863

Note 1 : The effectiveness of removal is based on the average of cells ESP 1-2-3

Note 2 : The lower effectiveness of removal on July 3 is explained by the loss of the bacterial surface (too low flow and high temperature which seems to have activated the work of the bacteria). The combination of these two aspects seem to have involved the loss of the bacterial surface, mainly of cell 3 where the majority of the volume of effluent was recovered, causing a fall of effectiveness in the removal of the loads in contaminants.

7.0 Conclusion

We have presented in this report the details around the installation and the procedures followed for the Enviro-Septic® bench test in Stoke, Quebec, in regard to the measures of samples and surveillance that was taken in the course of the first 53 weeks of operation between October 2002 and October 2003. The goals seen by the bench test by our firm are as follows:

- To testify that the installation of the test bed is in accordance with the protocol of the report submitted by DBO Expert in August 2002. (In respect to the dimensions specified and the materials used.)
- To validate the results of recovered volumes of leachate intended to show the capacities of distribution of the Enviro-Septic® system. With this intention, we had the mandate to carry out the calibrations of the system of loading and the stations of pumping, in addition to following the behavior of the distribution boxes and equalizers;
- To take piezometric measurements of levels in the various cells of recovery
- To carry out testing from different cells of treatment and to coordinate the results of analysis in the laboratory in compliance with the protocol.
- To produce the obtained results and comment according to the capacity of the Enviro-Septic® pipe with regard to the health of the leachate in the fine sand surrounding it after pre-treatment at a distance of 18.3 meters.

7.1 Agreement of the bench test installation to the protocol specifications.

7.1.1 Documentation of agreement of the installation with regard to dimensions and thicknesses

In section 2 of the report we have presented a summary of verifications taken during the installation of the test bed in September 2002. During these verifications we targeted the steps and the items during installation that are the most important, these being the dimensions and the nature of the different compositions (length and width of the cells, thickness of the different layers of material, granules of filtering sand) and even the care taken of the placement of the piping and components, etc.

We have been able to note that the company DBO Expert takes great care in the installation of the material in the way of packaging these materials beforehand and notably when cleaning the gravel in the truck beds before being put in the test cells.

There were small differences observed in the thicknesses of the different layers of material that came primarily from the unit of measure used in the field versus the units of the metric system. In effect the dimensions used in the field are measured in feet and inches by the installation equipment, (ie., 8", 4", 6", 12") whereas 6 in. doesn't equal 15cm exactly, but more like 15.2 cm. All these differences are not significant taking into account the accuracy acceptable in the field (vertical measuring stick, thickness of the gravel, etc.).

Let us mention that the English system (feet and inches) is usually used by contractors in the field. This type of gap proves that the conversion of the metric system to the English system (ie., 15 cm = 6 in) is generally known.

We testify that the installation of the Enviro-Septic® test bed is in accordance with the specifications of the protocol presented in August 2002.

7.1.2 Difficulties encountered with regard to the nature of the filtering sand

Despite all the steps that were taken to find a filtering sand that represented the criteria specified in the regulations Q-2, r.8, and despite the fact that the supplier was trying to find a sand that would meet the criteria, it is proven that the results of the analysis granulometriques that was done on 3 samples removed from different portions of sand that was put in place in the cells, ESP 1-2-3 and CPC 1-2-3 and that 2 out of 3 samples did not meet all the criteria. We noticed that the principle difference resided in the portion of the bigger grains of sand bigger than 2.5 mm. In sample #1 (conformed) the percentage retained by the sieve 2.5 mm is 20% while the percentage is 27% in the 2 other samples. It is also this portion that makes it so that Cu is > 4.5 for these the last two samples.

Though it is, one can say there are great similarities between the three samples starting from the graphic layout of the grading curves and that these three curves are very close at answering all the criteria.

A coefficient uniformly elevated indicates that the granulometry of the grains is spread out resulting in a reduction of free space. The reduction of free space reduces the soaking of the layer of sand and raises the risks of premature filling of the purifying element.

Logically, we could wait until the granules spread out having a better distribution longitudinal and horizontally which would cause the leachate to be retained longer in the layer of sand. One could also expect that the slower drainage of the leachate supports an accelerated establishment of the bacterial surface where the work of the bacteria is carried out. A reduced permeability of the sand could also have a consequence of better leachate treatment because the sand acts as a filter whose meshes are woven tighter retaining easier the materials contained in leachate.

It is significant however to stress that the sand used is very close to respecting all the criteria established for a filtering sand as specified in the rules Q-2,r.8. Only the percentage passing through the sieve 2.5 mm is more than 20% and the uniform coefficient bigger than 4.5 does not answer to the criteria for 2 of the 3 samples. If it had proven at the time the samples were taken that a small fraction more of the course grains was used (bigger than 2.5mm) then the analyses would have shown that the sand used respects the criteria established for filter sand in conformity with the requirements of the Q-2 r.8. In our opinion, one should therefore not have to over-estimate the impact of the slight deviances met by the sand used at the bench test in Stoke compared to the criteria specified with the Q-2, r.8.

7.2 Record of the data from the recovered leachate

7.2.1 Distribution of system leachate

In section 3 of this report we have shown that the leaching system starting from the tank provided a level of distribution to the volumes of leachate very precise largely inside the range of precision expected.

Indeed, whereas the protocol limited the inaccuracy of the system to 10%, the following results were obtained on October 8, April 2002, and 11 2003:

Volume Variation

Summary of the results of calibration of the septic tank					
Calibration of October 8, 2002			Calibration of April 11, 2003		
Volume	Measure	Difference	Volume	Measure	Difference
1010 L	1034 L	2.4%	1263 L	1272 L	0.7%
880 L	907 L	3.1%	1100 L	1100 L	0.0%
630 L	673 L	6.9%	788 L	841 L	6.8%

7.2.2 Verification of the distribution boxes and equalizers

In section 3.2 of this report we discussed the verifications we carried out in regards to the distribution boxes and equalizers that serve to divide as uniformly as possible the effluent volume into the different sections. These verifications show the level of effluent in the equalizers at different times during the day of the test.

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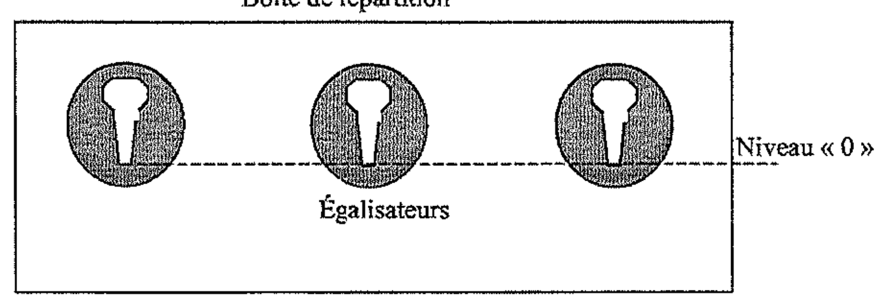
Rapport de distribution longitudinale – 1 an

était bien au niveau « 0 » des égalisateurs avant le début du délestage du matin et était au



Note : Un niveau sous le niveau « 0 » des égalisateurs auraient indiqué une fuite

It was also mentioned that though the use of a distribution box with equalizers is more sophisticated and reliable than a system in the form of "T" (commonly used in practice, in particular for the traditional installations), it remains that differences in division of the discharges in the various cells is possible.

Within the framework of the test bed, the arrival of effluent to the distribution box is done by sudden surges of effluent that undergoes occasionally turbulence in the box, being able to involve differences in the distribution through the equalizers, in particular at the beginning of the opening of the pnuematique valve. As the duration of each diversion is short (+/-15 to 25 sec), it is possible that one or more of the pipes is receiving more effluent than is desired.

In practice, this situation does not present a problem because the surges of effluent are originating from a residence and are absorbed inside the septic system.

Though it is, these distribution boxes and equalizers are not used to determine the flows and the loads recovered in each cell. Those calculations are done by using individual pumping stations that recover leachate at the exit of each test bed.

7.2.3 Pumping station consistency used to recover the leachate from each test cell.

It is important that samples are taken from each pumping station and the results are calculated. Therefore, it is important to carefully follow the increase of the pumping capacity of each pump used in the test bed.

It is described in section 3.3 that the capacity of the pumping is affected by different factors, mostly by the accumulation of material in the pipes that inhibits the use of the pumps. To compensate for the variations in length of time it takes for the pumps to pump, we carried out regular calibrations during the first year of the follow-up of the bench test.

We know that the capacity of the pumping of the pumps varies in time, but we can't know if this variation is gradual or if it occurs by sudden starts. It could be a combination of both. In an ideal world, with the time or the costs being non-existent, it would have been interesting to monitor the pumping capacities more frequently because we would have been able to re adjust each day with different variations of pump flow from each pump. Anyway, as this is not the case it was necessary to find ways to limit the impact of these variations on the leachate recovered.

For this purpose the document "Assumptions of Longitudinal Distribution", composed by DBO Expert, explains well how daily volumes of leachate per test cell were calculated. We have shown the method used to correct the capacities of pumping using the times of pumping obtained at the time of complete cycles. The pumping times vary with time while the level of activation of the pumping and the stopping of the pump are stable. This indicates a modification of the capacity of the pumping over time. A correction factor can be obtained by taking the average over a 7-day period and dividing it by the time obtained during the last calibration of the pump.

This method, we believe, permits us to level the variations of discharged pumping which can influence the capacity of pumps.

7.2.4 Considering the impact of precipitation

In the document "Compilation of the Results of Enviro-Septic® Distribution Over One Year", (written by DBO Expert) the section explaining "Climatic Data" of this document and "Assumptions of Longitudinal Distribution" considers the impact of the pumps on the volumes of leachate recovered in each cell of test. The weather data recorded at two stations near the site were used, in addition to the data collected starting from a pilot cell arranged on the site, just as starting from the pluviometric readings taken on a pluviometer installed above the pilot cell.

In its document, DBO Expert calculated an average rate of infiltration being established to 42% starting from all of the data collected along with the pilot cell vs. the potential volume that could have been recovered according to precipitations (rain + snow) and of the melting of snow, all multiplied by surface. The snowdrifts were converted into equivalent of rain by multiplying them by a factor of 0.1 (10 cm of snow = 1 cm of rain). The method employed in the DBO Expert document appears very exact to us and clever considering that it is not possible to calculate all the factors being able to influence the real infiltration of precipitation and the melting of snow inside the cells of test.

Though the data of the pilot cell were recorded only during an estimated period, the rate of infiltration calculated from this period was applied to all of the data of precipitations recorded during the first year of the follow-up.

However, this method appears very conservative to us since it over-estimates in our opinion the volume of effluent allotted to the water infiltration connected to precipitations, in particular at the time of the winter period. We believe indeed that the rate of infiltration in summer is higher than what would have been obtained in winter taking into account freezing on the surface. A cold surface becomes in our opinion non-permeable and all received precipitations (rain or melting snow) should stream out of the site, or at least not significantly infiltrate into the cells.

However, we cannot support in exact our assumption of streaming on the surface for the winter period, in particular because low volumes of leachate were recovered all the same in January, February and March 2003 with cell CPC 3 whereas effluent coming from the tank did not reach this cell yet.

In the absence of guarantee that there is no infiltration in winter, the method recommended by Expert DBO is thus advisable, more especially as it is preserving in the sense that it does not improve the results, in particular on the recovered concentrations and real loads. It is therefore possibly penalizing for the promoter since it could cause to increase the real concentrations presented in the report.

7.3 Follow-up of the peizometric leachate levels (in Enviro-Septic® versus pipe and stone)

With section 4 of the report, we addressed the difference in the measurements taken in the various piezometers installed with the test bed to follow the development of the effluent levels in the layer of clear stone above the filter sand in the case of pipe and stone and inside Enviro-Septic®. Many factors being able to influence measurements were identified, but in the light of the reasoning brought, in addition to the human errors (misreading or taking notes in the field), we believe that measurements could be taken with less than 5 mm of inaccuracy.

7.3.1 Progression of the effluent level in the various cells of Enviro-Septic®

In the case of Enviro-Septic®, pipe is continuous and horizontal for a distance of 18.3 meters (3 successive cells of 6.1 meters) and the openings to make it possible to infiltrate effluent are located at 20 mm from the bottom of pipe. An effluent level higher than 20 mm in the piezometers of the pipe Enviro-Septic® should indicate than the distribution is done in the three cells of recovery. An equal effluent level (or about, in particular according to the possible depression of cell ESP3) indicates that effluent reached the entire length of the path of contact.

You will see by consulting the graphics of section 4.4 that for the Enviro-Septic® test cells ESP 1-2-3 the effluent level was practically equal along all of the Enviro-Septic® pipe for the majority of the test days between May 14 and September 29 (after rise in load of the system), except for July 3 when it is noticed that the effluent level was null with section ESP3.

7.3.2 Progression of the effluent level in the various cells of pipe and stone

You will see by consulting the graphics of section 4.4, that the effluent level of pipe and stone cell CPC 1 increased gradually during the first year of the follow-up. In fact, if one excludes the surprising measured value from the evening of July 3 (0 mm) since the level was largely higher that morning, the level is in constant rise in this cell since the beginning in February 2003. According to data collected, effluent in the layer of stone has never sufficiently reached the foundation raft of perforated pipe.

Curiously, since the layers of stone of the 3 cells follow one another without separation (the top of the low wall which separates the cells where the boundary meets the filter sand), the effluent level in the layer of pipe and stone cells CPC 2 and CPC 3 is almost null at any time. It is the same for the volume of leachate recovered in cells CPC 2 and CPC 3 before May 27. You will see in section 7.4 of the assumptions that we explain the situation.

7.3.3 Level of accumulation of effluent in Enviro-Septic® with regard to length of time and of a reasonable space of concerning sudden in-rush of effluent

In the letter written on October 23, 2003, the Committee on new technologies of treatment of effluent (MENV and MAMM) questioned as for the accumulation of water inside pipe Enviro-Septic® vs. a reasonable space of reserve and the longevity of the system.

<u>**Reserve for sudden in-rush of effluent:**</u>

In its letter of October 23, the Committee mentioned that a reserve corresponding to 20% of the daily output appears reasonable to be able to support an in-rush of effluent, for example, the draining of a bath.

We calculated that to allow a reserve of 20% of the daily volume of effluent, the effluent level accumulated in Enviro-Septic® should not exceed 250 liters during the first year of the follow-up. The maximum effluent level measured in the pipe at the time of the tests did not exceed 130 liters. On this level, the amount of reserve would make it possible to receive an in-rush of effluent corresponding to the daily volume of effluent (43.3 L/m, for 96% of the daily volume of effluent).

Longevity of the system vs level of accumulation of effluent:

It is difficult to rule on the longevity of the system in connection with the level of accumulation of effluent in pipe given that the flow of loading was increased during last months of the voluntary follow-up at a rate of 4 cycles per day instead of 3. It was decided to act therefore with an aim of allowing a handing-over in load of the system whose bacterial surface had been regenerated following a stop of effluent in mid-June.

At first sight, it would seem that the system needs high concentrations of effluent to maintain the bacterial surface necessary to support the propagation of effluent over the entire length of pipe in an estimated period. This aspect would be therefore reassuring as for the longevity of the system vs the accumulation of effluent in the pipe given that the increased bacterial activity in hot weather allows for the lowering of the effluent strength during the first year because of the increase in the permeability of the bacterial surface. This lowering of the effluent strength even occurs following the loss of the bacterial surface one would get over the entire length of pipe. One could therefore to some extent speak about recovery of the system, which avoids the possibility of accumulation of effluent in year one in the pipe.

It is not known however how the system would have reacted if the effluent had not been stopped in mid-June whereas the system was with a distribution at approximately 18.3 meters of pipe, while functioning with 3 cycles per day. Alone the increase in temperature and the increased bacterial activity would have slowly brought a recovery of the system after June 15? Would this recovery have occurred at a point such as the distribution can be affected as much for it than what was noted at the end of June?

Contrary, one notices an increase in the level of liquid in pipe as from July to October. The increase in the level of liquid could be explicable because of the fact that it had been agreed to function with 4 cycles of loading per day instead of three. The cooling of the temperatures in September and October perhaps with the increase in the level of liquid if it is considered that the bacteria are less active during a fall of temperature. In fact, a stop of feeding to the system in the winter period when the activity of the bacteria is very reduced, would possibly allow the same recovery.

In short, we believe, in the light of the results obtained, that the Enviro-Septic® system allows (at the time of a stop of food or an increase in the activity of the bacteria) offers a significant advantage since it makes it possible to lower the level of liquid in pipe. This recovery would be more likely to occur at the time of the summer period where the temperature of the effluent is higher. It is therefore reassuring with regard to longevity of the system and sudden in-rush of effluent. The recovery of the system involves however a disadvantage in the sense that it would temporarily affect the function distribution of the system.

7.4 Discussion on the resultants of leachate volumes recovered vs. longitudinal Distribution

Various elements being attached to the results of longitudinal distribution were addressed in the previous sections. In the following sections, we will try to connect these various elements.

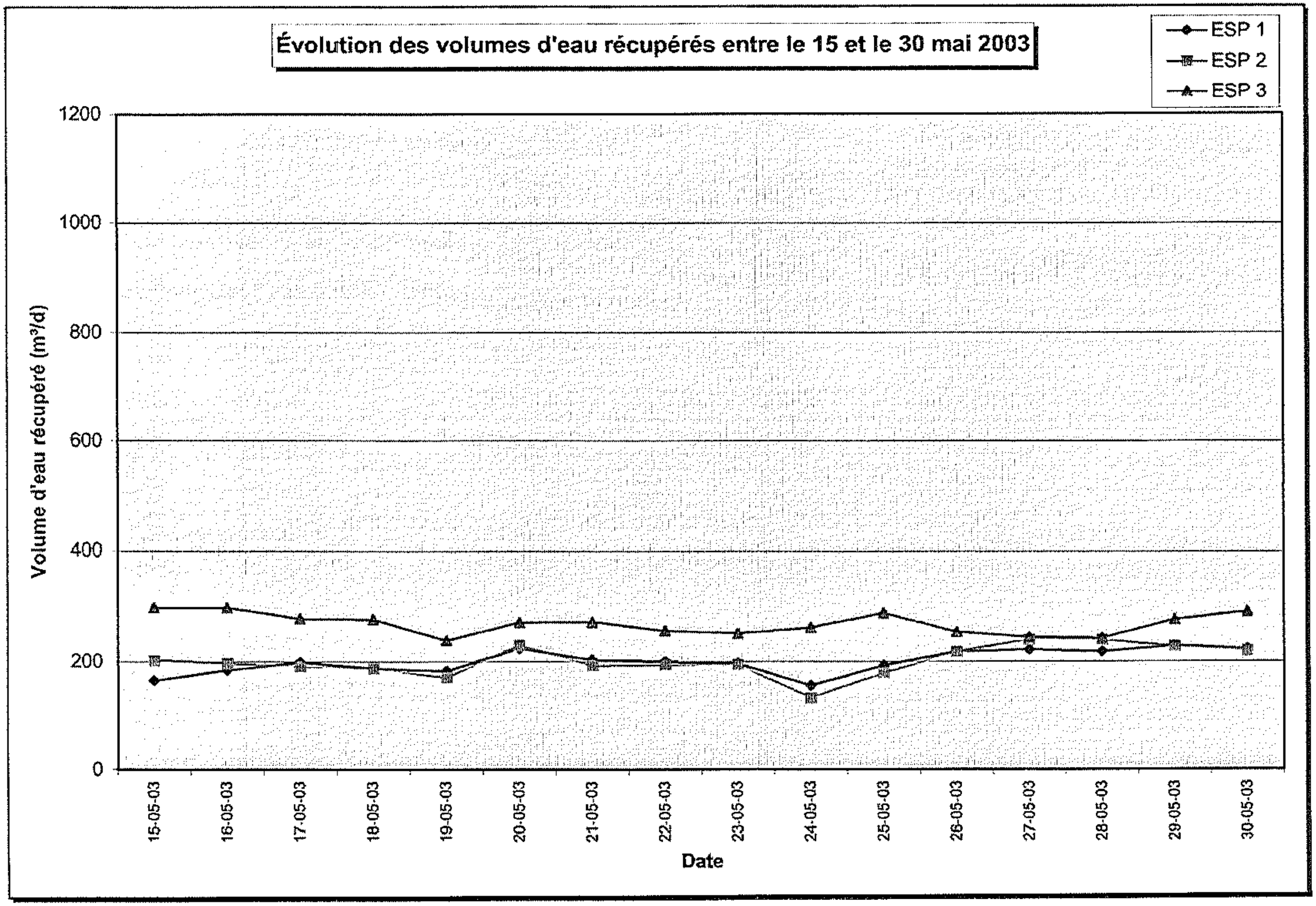
7.4.1 Longitudinal distribution of effluent in the various cells of Enviro-Septic® (cells ESP 1-2-3)

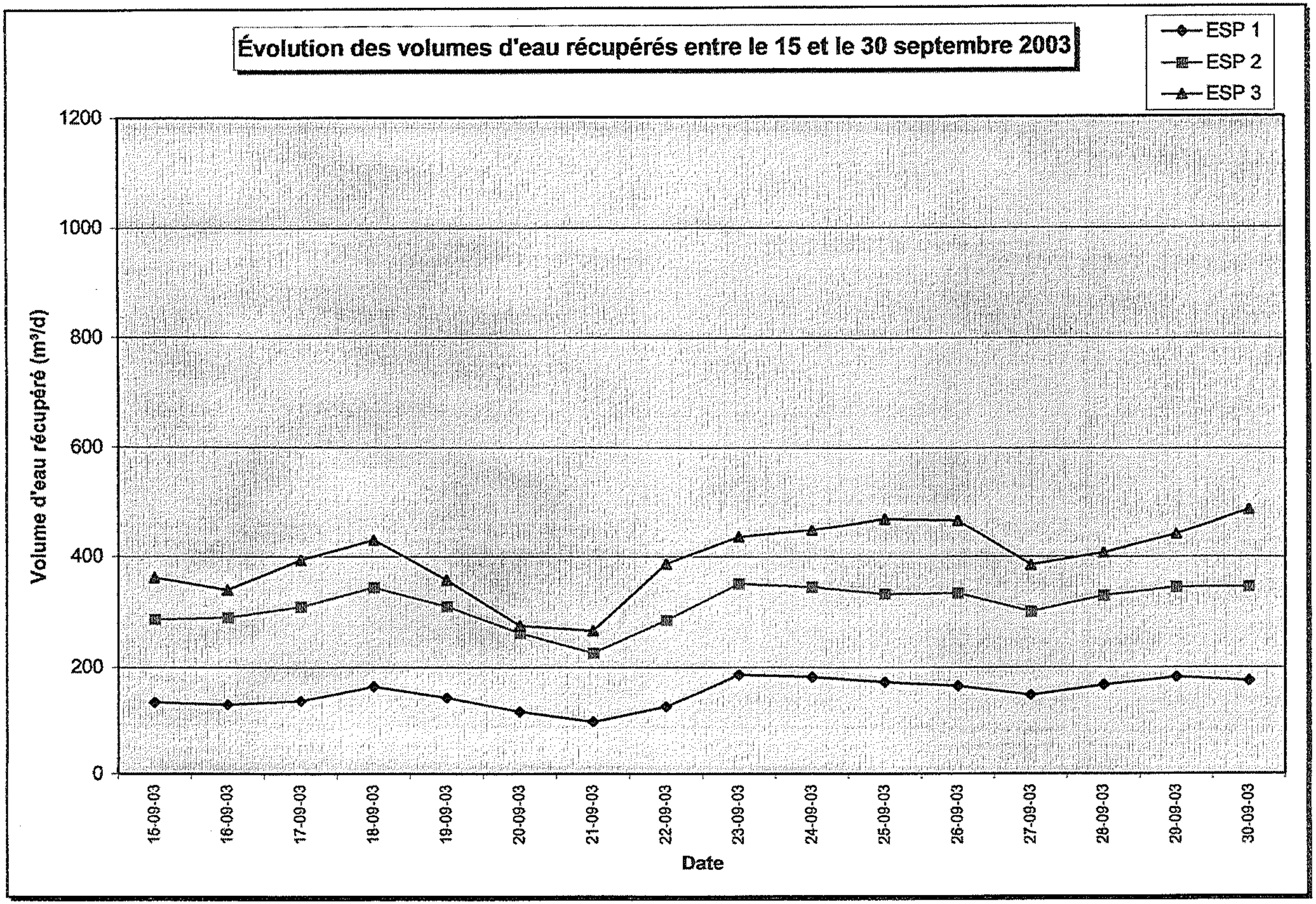
With section 7.3.1, we mentioned the fact that the level of liquid reaches more than 20 mm in the content of the Enviro-Septic® cell indicates, by supposing that pipe is installed level, that one should appreciably have the same water level in the three cells. This aspect does not guarantee however that the effluent infiltration is uniform in the three cells since the latter is influenced by the permeability of the area of infiltration, which varies in particular according to the state of the bacterial surface.

According to any probability, this bacterial surface would be established on the circumference of Enviro-Septic® pipe, with the interface between sand and the geotextile fabric surrounding the pipe. It is therefore possible that this bacterial surface is established around the entire pipe, therefore connected with a channel transporting the effluent from one end to the other, without this bacterial surface not having however the same permeability over all its length. A less dense bacterial surface should logically have a permeability a little higher and support the drainage pipe of the adjacent layers.

However, when you look at the measured data from the piezometers in parallel from the Enviro-Septic® pipe (ESP1, ESP2 and ESP3) and the volume of effluent recovered in each cell, one realizes that there is always a little more effluent which infiltrates in the cells downstream, in particular inside cell ESP3. This reality would be due to the fact that a certain treatment is carried out inside the pipe (deposit of the settleable solids in particular). While arriving effluent will be digested in the pipe, effluent being charged will have a longer time than is necessary for the establishment of a denser bacterial surface. As long as the cells digest there will be a less dense bacterial surface, therefore more permeable, it would be logical that the volume of effluent infiltrated in the digested portions is more significant since water uses the easiest way.

The purpose of the following graph is to show the advancement of the volumes of recovered effleunt from May 15th to May 30th and September 15th to September 30th on the following pages show the tendency of cells ESP 2 and ESP 3 to infiltrate more effluent.


Évolution des volumes d'eau récupérés entre le 15 et le 30 mai 2003
ESP 1
ESP 2
ESP 3
Volume d'eau récupéré (m³/d)
1200
1000
800
600
400
200
0
15-05-03
16-05-03
17-05-03
18-05-03
19-05-03
20-05-03
21-05-03
22-05-03
23-05-03
24-05-03
25-05-03
26-05-03
27-05-03
28-05-03
29-05-03
30-05-03
Date

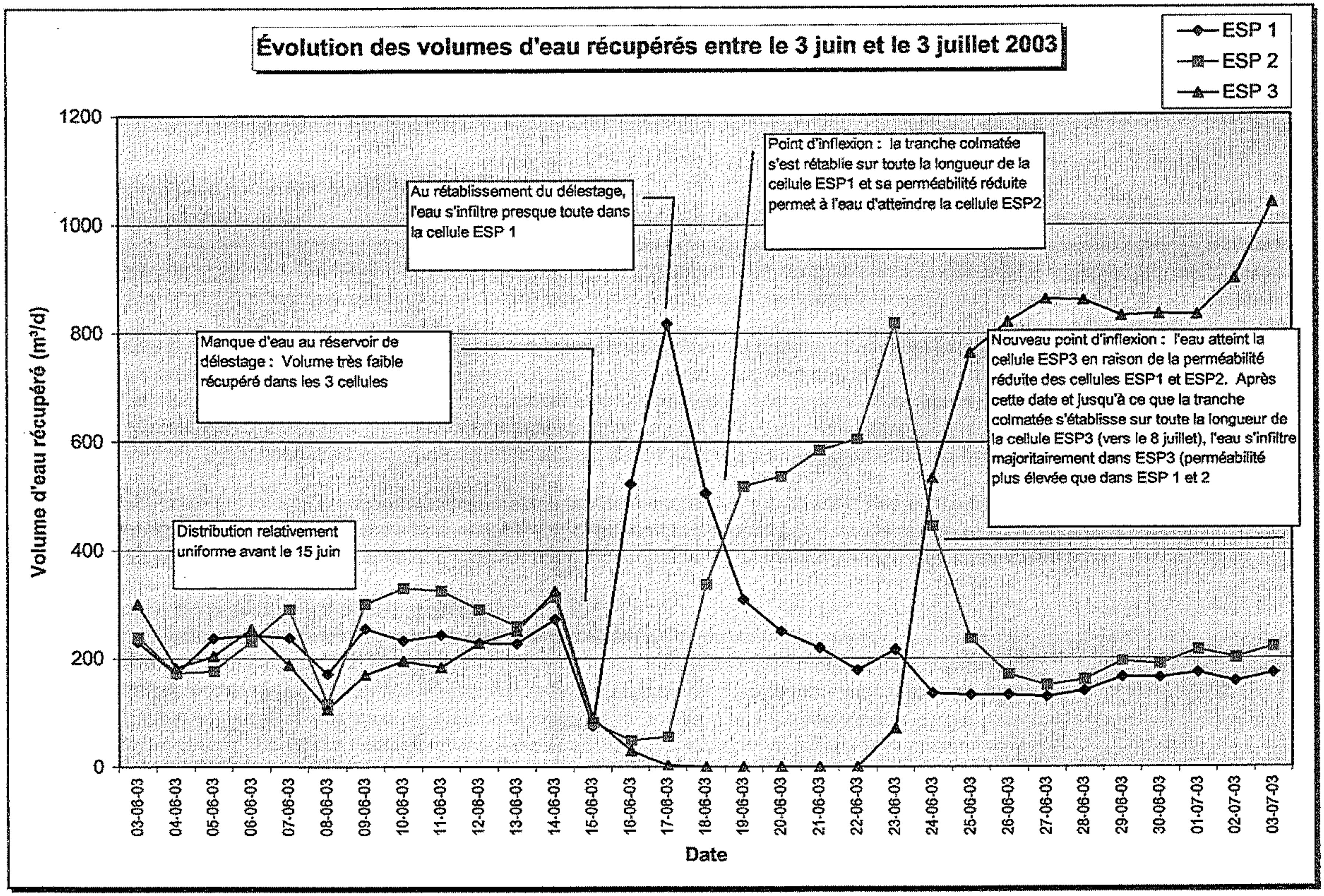

Évolution des volumes d'eau récupérés entre le 15 et le 30 septembre 2003
ESP 1
ESP 2
ESP 3
Volume d'eau récupéré (m³/d)
1200
1000
800
600
400
200
0
15-09-03
16-09-03
17-09-03
18-09-03
19-09-03
20-09-03
21-09-03
22-09-03
23-09-03
24-09-03
25-09-03
26-09-03
27-09-03
28-09-03
29-09-03
30-09-03
Date

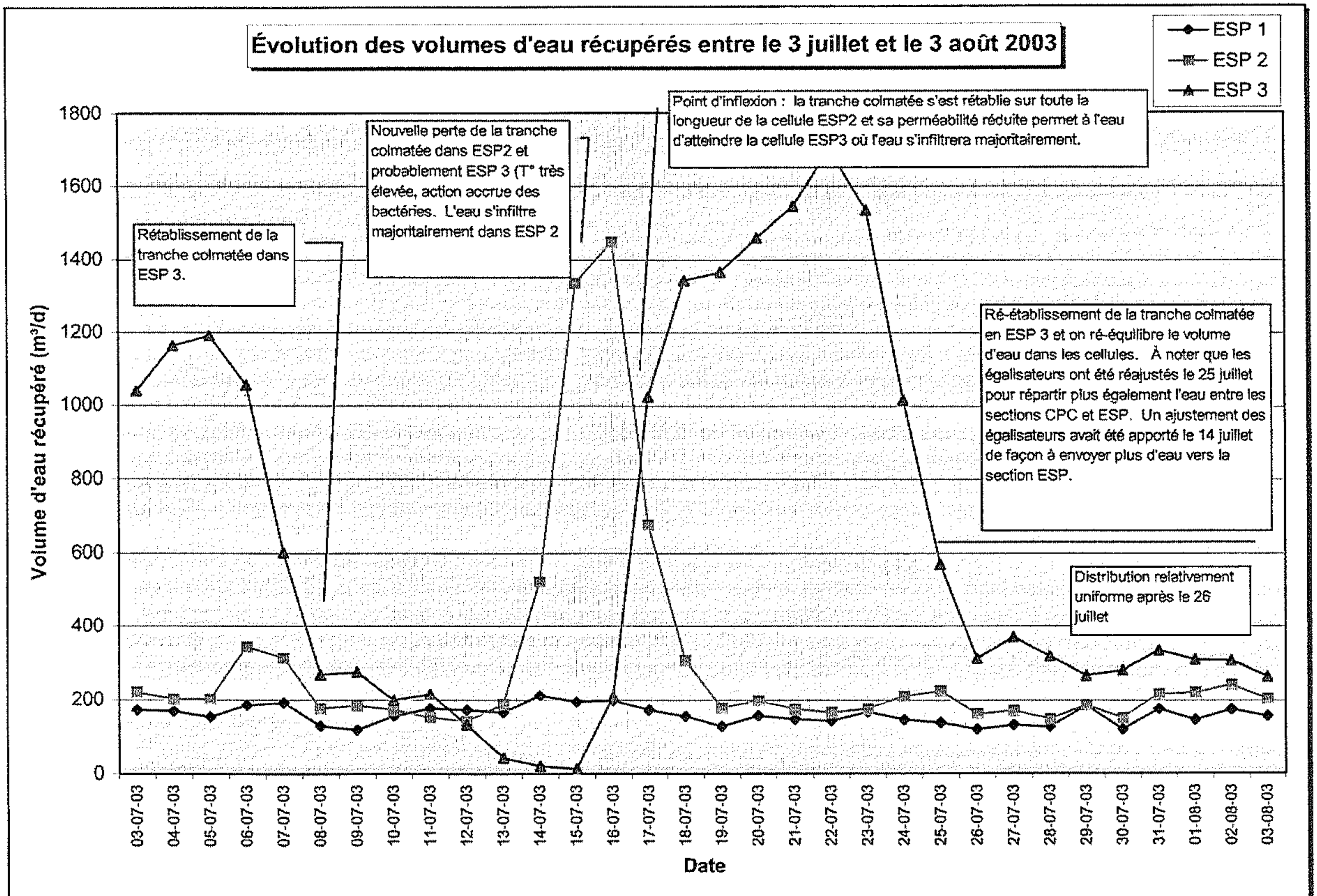
The situation however became very unequal between June 15 and July 8, following an event that seems to have caused a lack of effluent to the septic tank (Father's Day). Indeed, when one consults the graphics of the following page "Evolution of the Volumes of Effluent Recovered in Section ESP of June 3 and July 3", one notes that practically all the volume of effluent was infiltrated in section ESP1 immediately after the stop of effluent on June 15. After a few days of supported effluent, it seems that the regeneration of the bacterial surface with cell ESP 1 involved a reduction in the permeability opposite this cell and that the infiltration of effluent was easier with cell ESP 2. In only a few days the bacterial surface is restored on the entire cell of ESP 2 and the phenomenon of reduced permeability towards cell ESP 3 where the very great majority of the volume of effluent was infiltrated. Let us recall that the majority of effluent was infiltrated in cell ESP 3 on July 3 and there was no effluent accumulated at the bottom of the pipe of this cell.

This observation therefore comes to support the thesis that the uniformity of the distribution of effluent in Enviro-Septic® pipe depends upon the state of the bacterial surface over its length (presence/absence and difference in permeability over the length of the path of contact). The state of the bacterial surface would be influenced by the effluent supply and the degree of activity of the bacteria, and even by temperature.

According to us, a high temperature during a prolonged period, with a steady state of effluent supplied, should reduce the density of the bacterial surface, therefore increasing its permeability. This increase in permeability, as long as it does not involve the loss of the bacterial surface, should not have major impact on the distribution of effluent over the entire length of Enviro-Septic® pipe. However, as there is an increase in the permeability of the bacterial surface to the point where effluent can mainly infiltrate in the affected area, there is an unbalanced distribution. Logically, a gradual and slow reduction of bacteria within the pipe biomat (in period of high temperature for example), should yield increased permeability within that section of the pipe.

You will find that the graphs on the following pages will provide layouts and explanations that will enable you to better visualize the situation. These graphs initially cover the period of June 3 through July 3 when one sees well the effect of the stop of effluent on June 15 and the increase in load on the system that followed. The second graph shows a new loss of bacterial surface in July, this time more than likely because of the very high temperature that prevailed at this period. It is not known however if this high temperature would have had the same impact on the distribution if there had not been a stop of effluent in mid-June.


Évolution des volumes d'eau récupérés entre le 3 juin et le 3 juillet 2003
ESP 1
ESP 2
ESP 3
Volume d'eau récupéré (m³/d)
1200
1000
800
600
400
200
0
Distribution relativement uniforme avant le 15 juin
Manque d'eau au réservoir de délestage : Volume très faible récupéré dans les 3 cellules
Au rétablissement du délestage, l'eau s'infiltre presque toute dans la cellule ESP 1
Point d'inflexion : la tranche colmatée s'est rétablie sur toute la longueur de la cellule ESP1 et sa perméabilité réduite permet à l'eau d'atteindre la cellule ESP2
Nouveau point d'inflexion : l'eau atteint la cellule ESP3 en raison de la perméabilité réduite des cellules ESP1 et ESP2. Après cette date et jusqu'à ce que la tranche colmatée s'établisse sur toute la longueur de la cellule ESP3 (vers le 8 juillet), l'eau s'infiltre majoritairement dans ESP3 (perméabilité plus élevée que dans ESP 1 et 2
03-06-03
04-06-03
05-06-03
06-06-03
07-06-03
08-06-03
09-06-03
10-06-03
11-06-03
12-06-03
13-06-03
14-06-03
15-06-03
16-06-03
17-06-03
18-06-03
19-06-03
20-06-03
21-06-03
22-06-03
23-06-03
24-06-03
25-06-03
26-06-03
27-06-03
28-06-03
29-06-03
30-06-03
01-07-03
02-07-03
03-07-03
Date


Évolution des volumes d'eau récupérés entre le 3 juillet et le 3 août 2003
ESP 1
ESP 2
ESP 3
Volume d'eau récupéré (m³/d)
1800
1600
1400
1200
1000
800
600
400
200
0
Rétablissement de la tranche colmatée dans ESP 3.
Nouvelle perte de la tranche colmatée dans ESP2 et probablement ESP 3 (T° très élevée, action accrue des bactéries. L'eau s'infiltre majoritairement dans ESP 2
Point d'inflexion : la tranche colmatée s'est rétablie sur toute la longueur de la cellule ESP2 et sa perméabilité réduite permet à l'eau d'atteindre la cellule ESP3 où l'eau s'infiltrera majoritairement.
Ré-établissement de la tranche colmatée en ESP 3 et on ré-équilibre le volume d'eau dans les cellules. À noter que les égalisateurs ont été réajustés le 25 juillet pour répartir plus également l'eau entre les sections CPC et ESP. Un ajustement des égalisateurs avait été apporté le 14 juillet de façon à envoyer plus d'eau vers la section ESP.
Distribution relativement uniforme après le 26 juillet
03-07-03
04-07-03
05-07-03
06-07-03
07-07-03
08-07-03
09-07-03
10-07-03
11-07-03
12-07-03
13-07-03
14-07-03
15-07-03
16-07-03
17-07-03
18-07-03
19-07-03
20-07-03
21-07-03
22-07-03
23-07-03
24-07-03
25-07-03
26-07-03
27-07-03
28-07-03
29-07-03
30-07-03
31-07-03
01-08-03
02-08-03
03-08-03
Date

7.4.2 Longitudinal distribution of effluent in the various cells of pipe and stone (cells CPC 1-2-3)

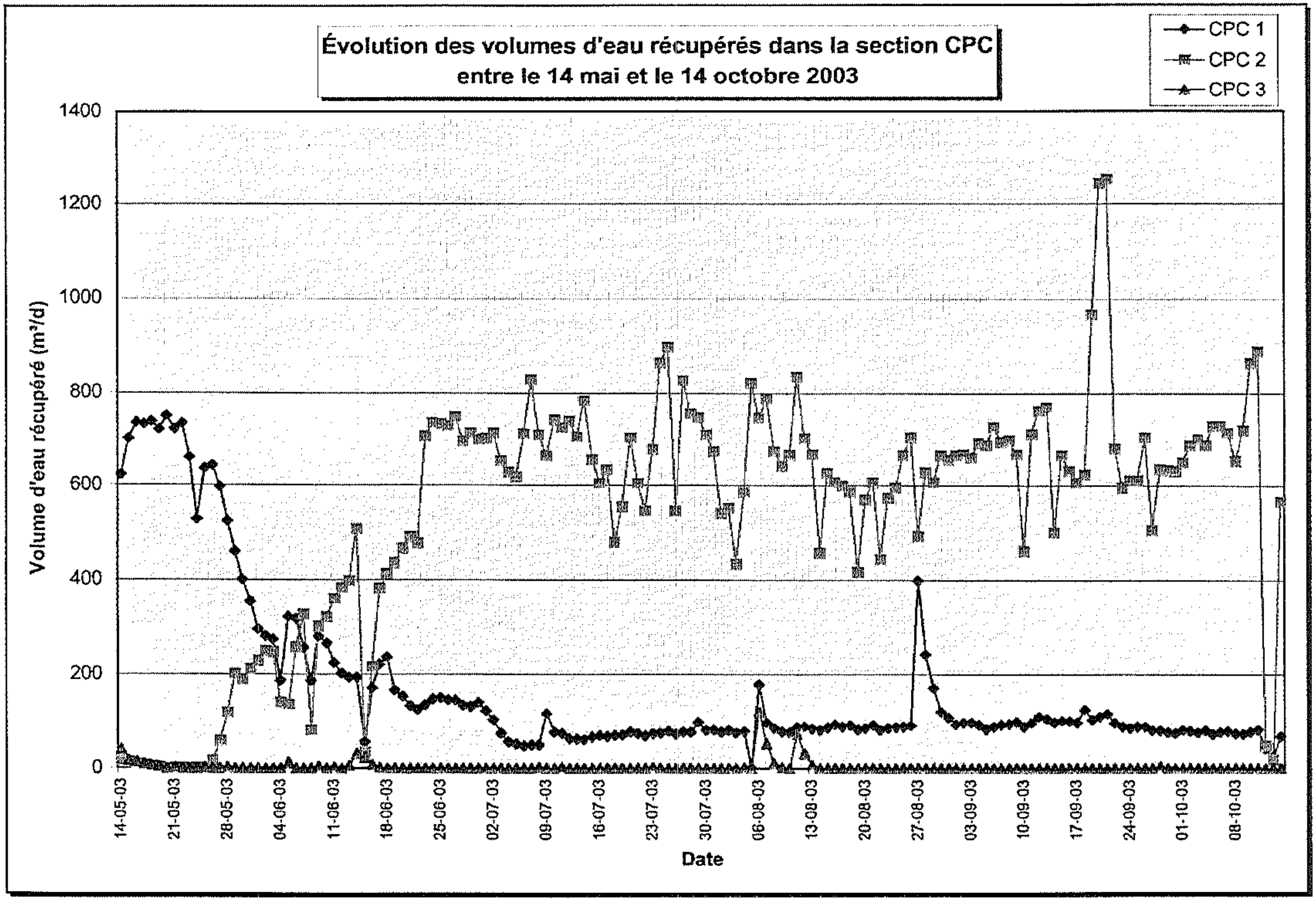
With section 7.3.2, we raised the question of whether the effluent can accumulate in a significant way in the layer of stone crushed of cell CPC 1 without there being a transfer towards cell CPC 2, with regard to the level measured with the piezometer rather than the volume of effluent which infiltrates there.

This aspect leads us to think that effluent arriving at cell CPC 1 falls through the layer of stone starting from the first holes of pipe. It would be improved in this cell as long as the pipe allows and does not get too clogged with sand. The fact that effluent is not quickly spread in the layer of stone of cell CPC 2 lets us believe that the permeability of the layer of stone decreases in the course of time, in the sense that it is extremely probable that the layers of stone are clogged gradually in the course of time. Effluent would be retained there as much as the permeability of the stone allows - sand is sufficient to infiltrate the rest of the effluent to the next section of CPC.

If this were not the case, effluent would travel into the area of stone from section CPC 1 and would infiltrate the layer of stone and end up reaching the next cell where the bacterial surface is not yet established where the stone meets the sand. According to what one can draw from the results, this transition towards cell CPC 2 would have occurred about May 27 Starting from this date and until at the beginning of July, the volume of effluent recovered in cell CPC 1 decreased in a gradual way, whereas that of cell CPC 2 increased in a gradual way.

The permeability of the layer of stone of cell CPC 2 however would have been sufficient so that there is no accumulation in that layer, at least for the period going from May 14 to October 14, 2003. One can however expect that a similar situation occurs after October 14, that is to say that the boundary between the stone and sand of cell CPC 2 will be clogged, reducing its permeability, causing a rise of the effluent level in the piezometer of cell CPC 2. Slowly, the layers of the stone area will fill with matter (silt and organic matter) and when the permeability of the boundary is insufficient to infiltrate all the effluent that the cell receives is propagated laterally for possibly reaching the third cell.

The graphics of the following page make it possible to a little better visualize the assumptions stated in the preceding paragraphs.


Évolution des volumes d'eau récupérés dans la section CPC
entre le 14 mai et le 14 octobre 2003
CPC 1
CPC 2
CPC 3
Volume d'eau récupéré (m³/d)
1400
1200
1000
800
600
400
200
0
14-05-03
21-05-03
28-05-03
04-06-03
11-06-03
18-06-03
25-06-03
02-07-03
09-07-03
16-07-03
23-07-03
30-07-03
06-08-03
13-08-03
20-08-03
27-08-03
03-09-03
10-09-03
17-09-03
24-09-03
01-10-03
08-10-03
Date

7.5 As for the lateral distribution of both systems

Though we did not have results as for the capacity of side distribution of the two systems in this report, we provide, inside the sections which follow, our interpretation of the results obtained following the measurements of moisture, as presented inside the report of the promoter entitled "Longitudinal Distribution of Enviro-Septic® vs Pipe and Stone".

Let us mention that the measurements of moisture were taken by DBO Expert personnel using a specialized instrument. DBO Expert company indicated some factors being able to affect the results and this is why they suggests not looking at the results in a too specific way, but rather emphasizing the broad outline.

The method of presenting the results (graphs and tables) appears very suitable to us and we consider that the conclusions drawn by DBO Expert on the results are logical.

7.5.1 Side distribution of effluent in the various cells of Enviro-Septic® (cells ESP 1-2-3) according to the results of moisture profiles

Indeed the form of the graph indicates that leachate is distributed in a relatively uniform way inside the filter sand.

The points get closer in measurement in the morning and the evening, which was before the full rise in load of the system, indicating that there is no honest increase in the leachate content in the sand. Parallel to measurements of moisture, let us recall that the piezometric measurements indicated a very low effluent level in the Enviro-Septic® pipe for this same period.

On the other hand, when one consults the diagrams of June 3, 2003, whereas the distribution of effluent was done over the entire length of the Enviro-Septic® pipe, one notes a much clearer layout between the morning and the evening, the layout of the evening showing higher effluent contents. The bacterial surface being established on the circumference of the pipe over the entire length supports, we believe, the migration of effluent by capillarity between the sand grains. The more significant the effluent level will be in the pipe the more favored the side distribution will be.

We agree therefore with the analogy of the promoter when it compares the sand surrounding the Enviro-Septic® system with a sponge.

7.5.2 Side distribution of water in the various cells of the pipe and stone (cells CPC 1-2-3) according to the results of moisture profiles

The readings of moisture carried out with section CPC are in logical relationship to infiltrated volumes of effluent and the effluent levels accumulated in the layer of stone above the filter sand.

Indeed, one notices, starting from the readings at a level of 100 mm and 200 mm whose tubes are located in the layer of stone, that very little moisture is measured on these levels, except for the measurement of June 3 when one notes a significant increase in the effluent content to cell CPC 1.2. This result is in relation to the fact that the effluent level was more than 50 mm in the layer of stone, which is much higher than during the measurement of October 22, 2002.

In regards to the tubes located in the filter sand (levels 300 mm and 400 mm), one notes that the leachate content is more significant in the cells where there is infiltration. One notices moreover that the variations between the evening and the morning are more significant in these levels on October 22 than it was the case on June 3. We believe this is due to the difference in permeability between the stone and sand.

Indeed, if one refers to the piezometric data of cell CPC 1, one notices that there was significant accumulation of effluent between the stone and the sand on June 3 whereas it was not the case on October 22 at the beginning of the follow-up. In the same way, by consulting the graph of the growth of the volumes of effluent recovered in section CPC, one notices that it is about June 3 that the permeability of cell CPC 1 decreased given that effluent started to reach cell CPC 2 in equal volumes from cell CPC 1. Effluent was present regularly above the boundary between the stone and the sand where the permeability reduced because it infiltrates very slowly through the sand, without too many variations throughout the day.

7.6 Comparison of the results and the effectiveness of treatment of both systems

Samples intended to evaluate the quality of the effluent of each section of the cell of treatment were taken by our firm according to requirements of the *Guide of Sampling at Ends of Environmental Analyses, book 2; Sampling of the Liquid Rejections*. The analyses for their part were carried out by a laboratory accredited according to the standard methods in force. In fact, only one adaptation was necessary with regard to the analyses of filtered fecal coliformes since this analysis does not form part of the standardized parameters. The goal of these analyses was to collect data that would enable us to evaluate the impact of the stone used to constitute the area of recovery on the results of analyses.

The contents of the effluent of the sections of the test beds respected as a whole the awaited values. It is noted however that the values obtained at the time of the test of May 14 and June 3 did not respect in all points the criteria given in the protocol, the values of BOD5C, COD, NH4 and total phosphorus being slightly under the awaited values.

One could note beginning with the results obtained from the various cells, that the level of treatment inside the cells of Enviro-Septic® pipe is higher than that obtained with the pipe and stone.

7.6.1 Effectiveness of the effluent treatment in the various cells of Enviro-Septic® (cells ESP 1-2-3)

The properties supporting the longitudinal and side distribution of effluent over the entire length of Enviro-Septic® pipe also allows this system a better effectiveness of treatment.

Indeed, when the bacterial surface is well established on the entire length of Enviro-Septic® pipe, it is noticed that the effectiveness of the treatment in this section becomes very close to perfection. In fact, when one consults the results obtained during the last months of the follow-up (May 14 - September 29), one notes that the percentage of effectiveness of removal is higher than 90% for all of the parameters except for total phosphorus where removal is about 75 to 80%.

For the parameters of reference prone to a standard under Q-2 regulation, r.8, is them TSS, BOD5C and fecal coliformes, the effectiveness of removal is 94%, 98% and 98% respectively for each one of these parameters. The total average concentrations obtained have been 5.3 mg/L for TSS, 4.7 mg/L for the BOD5C and of almost 21 000 UFC/100 ml for the fecal coliformes.

If one excludes the results obtained on July 3 when the great majority of the effluent infiltrated was stopped in cell ESP 3 where the bacterial surface of this cell had been lost, the percentage of effectiveness climbs beyond 96% for all of the parameters with exception to total phosphorus where removal is again about 75 to 80%. The effectiveness of removal of TSS, BOD5C and fecal coliformes passes respectively at 98%, 99% and 99.7%. The total average concentrations decrease for their part with 1.9 mg/L for TSS, 1.2 mg/L for the BOD5C and of 2185 UFC/100 ml for the fecal coliformes.

7.6.2 Effectiveness of the effluent treatment in the various cells of pipe and stone (cells CPC 1-2-3)

The results of the analyses obtained during last months of the follow-up indicate that the effectiveness of removal of the loads from the traditional system is largely lower than the Enviro-Septic® system.

In addition to being much more unpredictable in time, one notes that the average percentage of effectiveness of removal of the units of the parameters is sufficiently weaker than the Enviro-Septic® system. One notices even increases in concentrations, in particular of ammonia nitrogen (NH4) for the 5 last days of test, and only small total nitrogen removals kjeldhal (NTK) during these same days. The effectiveness of the removal of total phosphorus is also small.

For the parameters of reference prone to a standard under Q-2 regulation, r.8, the effectiveness of removal to the traditional system is a little less than 60% for TSS, a little less than 80% for the BOD5C and a little more than 90% for the fecal coliformes. The total average concentrations calculated are for their part of about 28 mg/L for TSS, of 22 mg/L for the BOD5C and about 235,000 to 250,000 UFC/100 ml, dependent upon whether or not the results of July 3rd are considered.

8.0 Recommendations

In light of the observations drawn from the results of the bench test in Stoke after one year of operation, we recommend that Enviro-Septic® systems be installed at 18.3 meters in length for a system with a daily loading rate of 3240 liters or less for the wastewater treatment of residences (q-2, r.8).

We also recognize the capacity of Enviro-Septic® pipe installed with a filtering sand surrounding it to distribute effluent laterally to the entire leach field, thus acting as a sponge which draws out the effluent contained in the pipe by capillarity. This characteristic of the pipe is also interesting since it makes it possible to distribute effluent to be infiltrated on the entire circumference of the pipe, limiting the possibilities of overloads on certain portions of the ground. This aspect also emphasizes the importance to install Enviro-Septic® pipe directly in sand and not in the crushed stone. The installation in the crushed stone would delay in a significant way or even make it impossible to establish a bacterial surface along the circumference of the pipe. Let us recall that a bacterial surface is formed around the entire circumference of the Enviro-Septic® pipe that supports the uniform distribution along the pipe since it acts like a channel.

Even though this element was not validated within the framework of the bench test of Stoke, we believe that the idea concerning the establishment of the bacterial surface around the Enviro-Septic® pipe would make it possible to uniformly distribute effluent at a larger distance, as long as the volume of effluent that reaches the pipe is maintained sufficient. The promoter aims at this idea to make installations include a leach field length of up to 30.5 meters, or the same length as the maximum length allowed for pipe and stone installations of more than 3240 liters per day.

Lastly, we also recognize the highly interesting capacities of effluent treatment in the Enviro-Septic® system when the distribution is uniform to the entire leach field (a bacterial surface established around the entire circumference of the pipe). According to our observations, the establishment of the bacterial surface is gradually made during the fluctuating levels of liquid in the pipe. As long as the volume of effluent leading to the pipe is sufficient and the bacterial activity is not too strong, the presence of the bacterial surface ensures a very interesting effectiveness of treatment. In the situations where there are thinning or destruction of the bacterial surface (stopping of or insufficient volume of effluent), the effectiveness of treatment becomes less, but will return gradually to normal as the bacterial surface is restored over the entire length. If this characteristic is harmful temporarily on the effectiveness of the treatment, it may however have a very interesting aspect since it makes it possible to release the effluent level in the pipe, therefore ensuring it to handle a sudden in-rush of effluent throughout the year.

LIST OF APPENDIXES

APPENDIX A: FORMS Of CALIBRATION OF THE STATIONS OF PUMPING

APPENDIX B: OFFICIAL CERTIFICATES OF THE LABORATORY ANALYSIS

ANNEXE A

FORMS Of CALIBRATION STATIONS OF PUMPING

ENVIRONNEMENT ESA

Système Enviro-Septic[MC]

Rapport de distribution longitudinale – 1 an

ESP#1 (P1)	Projet : DBO Expert inc.	RÉSUMÉ DES ÉTALONNAGES EFFECTUÉS ENTRE OCTOBRE 2002 ET OCTOBRE 2003
	Municipalité : Stoke (Québec)	

Dimensions du puits :

Longueur (m) : ______ Largeur (m) : ______ Diamètre (m) : 0.6096 Superficie (m²) 0.2919 291.8635 (Litres / m)

ITEM À RETRANCHER :	Quantité	Longueur	Largeur	Diamètre	Surface	Volume
Tuyau de refoulement 59 mm ø	1			0.059	0.0027	2.7340
					Total : (Litres / m)	2.7340

VOLUME UTILE (Volume total - Items à retrancher) : 289.1296 litres/m

CAPACITÉ HYDRAULIQUE			08-oct-02
Pompe (s) ESP#1 (P1)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.142	110.0	1.388
Arrêt	1.670		
Écart % :	2.4%	TOTAL 1 :	1.388
Départ	Avec compteur d'eau		1.357
Arrêt			
Écart % :	0.1%	TOTAL 2 :	1.357
Départ	Avec compteur d'eau		1.323
Arrêt			
Écart % :	2.4%	TOTAL 3 :	1.323
Moyenne :	0.528 m	110.0 sec.	1.356 L/s

CAPACITÉ HYDRAULIQUE			09-avr-03
Pompe (s) ESP#1 (P1)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.176	117.0	1.211
Arrêt	1.666		
Écart % :	2.2%	TOTAL 1 :	1.211
Départ	1.184	111.0	1.235
Arrêt	1.666		
Écart % :	1.4%	TOTAL 2 :	1.255
Départ	1.178	113.0	1.249
Arrêt	1.666		
Écart % :	0.8%	TOTAL 3 :	1.249
Moyenne :	0.487 m	113.7 sec.	1.238 L/s

CAPACITÉ HYDRAULIQUE			17-juin-03
Pompe (s) ESP#1 (P1)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.226	97.0	1.371
Arrêt	1.686		
Écart % :	0.4%	TOTAL 1 :	1.371
Départ	1.226	96.7	1.369
Arrêt	1.684		
Écart % :	0.3%	TOTAL 2 :	1.369
Départ	1.227	97.4	1.357
Arrêt	1.684		
Écart % :	0.7%	TOTAL 3 :	1.357
Moyenne :	0.458 m	97.0 sec.	1.366 L/s

CAPACITÉ HYDRAULIQUE			03-juil-03
Pompe (s) ESP#1 (P1)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ			
Arrêt			
Arrêt			
Écart % :		TOTAL 2 :	
Départ			
Arrêt			
Écart % :		TOTAL 3 :	
Moyenne :			

Pas étalonné le 3 juillet 2003

CAPACITÉ HYDRAULIQUE			29-juil-03
Pompe (s) ESP#1 (P1)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.209	100.3	1.303
Arrêt	1.661		
Écart % :	0.0%	TOTAL 1 :	1.303
Départ	1.209	100.5	1.315
Arrêt	1.666		
Écart % :	0.9%	TOTAL 2 :	1.315
Départ	1.210	100.9	1.292
Arrêt	1.661		
Écart % :	0.8%	TOTAL 3 :	1.292
Moyenne :	0.453 m	100.6 sec.	1.303 L/s

CAPACITÉ HYDRAULIQUE			28-oct-03
Pompe (s) ESP#1 (P1)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.190	98.5	1.359
Arrêt	1.655		
Écart % :	2.8%	TOTAL 1 :	1.359
Départ	1.197	100.4	1.296
Arrêt	1.647		
Écart % :	1.9%	TOTAL 2 :	1.296
Départ	1.199	99.8	1.309
Arrêt	1.651		
Écart % :	0.9%	TOTAL 3 :	1.309
Moyenne :	0.455 m	99.6 sec.	1.321 L/s

ENVIRONNEMENT ESA

Système Enviro-Septic[MC]

Rapport de distribution longitudinale – 1 an

ESP#2 (P2)	Projet : DBO Expert inc. Municipalité : Stoke (Québec)	RÉSUMÉ DES ÉTALONNAGES EFFECTUÉS ENTRE OCTOBRE 2002 ET OCTOBRE 2003

Dimensions du puits :

Longueur (m) ______ Largeur (m) ______ Diamètre (m) 0.6096 Superficie (m²) 0.2919 291.8635 (Litres / m)

ITEM À RETRANCHER :	Quantité	Longueur	Largeur	Diamètre	Surface	Volume
Tuyau de refoulement 59 mm ø	1			0.059	0.0027	2.7340
					Total : (Litres / m)	2.7340

VOLUME UTILE (Volume total - Items à retrancher) : 289.1296 litres/m

CAPACITÉ HYDRAULIQUE			08-oct-02
Pompe (s) ESP#2 (P2)	Distance vs eau (m)	TEMPS (sec)	DEBIT L / sec.
Depart	1.158	109.0	1.401
Arrêt	1.686		
Écart % :	0.3%	TOTAL 1 :	1.401
Depart	1.146	110.0	1.414
Arrêt	1.681		
Écart % :	0.7%	TOTAL 2 :	1.414
Depart	1.166	105.0	1.399
Arrêt	1.674		
Écart % :	0.4%	TOTAL 3 :	1.399
Moyenne :	0.525 m	108.0 sec.	1.404 L/s

CAPACITÉ HYDRAULIQUE			09-avr-03
Pompe (s) ESP#2 (P2)	Distance vs eau (m)	TEMPS (sec)	DEBIT L / sec.
Depart	1.160	123.0	1.175
Arrêt	1.660		
Écart % :	1.3%	TOTAL 1 :	1.175
Depart	1.172	118.0	1.196
Arrêt	1.660		
Écart % :	0.3%	TOTAL 2 :	1.196
Depart	1.174	117.0	1.206
Arrêt	1.662		
Écart % :	1.1%	TOTAL 3 :	1.206
Moyenne :	0.492 m	119.3 sec.	1.192 L/s

CAPACITÉ HYDRAULIQUE			17-juin-03
Pompe (s) ESP#2 (P2)	Distance vs eau (m)	TEMPS (sec)	DEBIT L / sec.
Depart	1.148	119.0	1.307
Arrêt	1.686		
Écart % :	0.4%	TOTAL 1 :	1.307
Depart	1.226	108.5	1.318
Arrêt	1.684		
Écart % :	0.4%	TOTAL 2 :	1.318
Depart	1.234	99.8	1.312
Arrêt	1.687		
Écart % :	0.0%	TOTAL 3 :	1.312
Moyenne :	0.483 m	106.4 sec.	1.312 L/s

CAPACITÉ HYDRAULIQUE			03-juil-03
Pompe (s) ESP#2 (P2)	Distance vs eau (m)	TEMPS (sec)	DEBIT L / sec.
Depart			
Arrêt			
Écart % :		TOTAL 1 :	
Depart			
Arrêt			
Écart % :		TOTAL 2 :	
Depart			
Arrêt			
Écart % :		TOTAL 3 :	
Moyenne :			

Pas étalonné le 3 juillet 2003

CAPACITÉ HYDRAULIQUE			29-juil-03
Pompe (s) ESP#2 (P2)	Distance vs eau (m)	TEMPS (sec)	DEBIT L / sec.
Depart	1.216	116.4	1.125
Arrêt	1.669		
Écart % :	0.2%	TOTAL 1 :	1.125
Depart	1.212	117.6	1.121
Arrêt	1.668		
Écart % :	0.5%	TOTAL 2 :	1.121
Depart	1.212	116.2	1.135
Arrêt	1.668		
Écart % :	0.7%	TOTAL 3 :	1.135
Moyenne :	0.455 m	116.7 sec.	1.127 L/s

CAPACITÉ HYDRAULIQUE			28-oct-03
Pompe (s) ESP#2 (P2)	Distance vs eau (m)	TEMPS (sec)	DEBIT L / sec.
Depart	1.232	102.6	1.186
Arrêt	1.633		
Écart % :	1.0%	TOTAL 1 :	1.186
Depart	1.234	100.9	1.209
Arrêt	1.636		
Écart % :	1.0%	TOTAL 2 :	1.209
Depart	1.238	100.9	1.198
Arrêt	1.636		
Écart % :	0.0%	TOTAL 3 :	1.198
Moyenne :	0.420 m	101.5 sec.	1.198 L/s

ESP#3 (P3)	Projet : DBO Expert inc.	RÉSUMÉ DES ÉTALONNAGES EFFECTUÉS ENTRE OCTOBRE 2002 ET OCTOBRE 2003
	Municipalité : Stoke (Québec)	

Dimensions du puits :

Longueur (m) : ______ Largeur (m) : ______ Diamètre (m) : 0.5920 Superficie (m²) 0.2753 275.2538 (Litres / m)

ITEM À RETRANCHER :	Quantité	Longueur	Largeur	Diamètre	Surface	Volume
Tuyau de refoulement 59 mm ø	1			0.059	0.0027	2.7340
					Total : (Litres / m)	2.7340

VOLUME UTILE (Volume total - Items à retrancher) : 272.5198 litres/m

CAPACITÉ HYDRAULIQUE			08-oct-02
Pompe (s) ESP#3 (P3)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.158	109.0	1.315
Arrêt	1.684		
Écart % :	0.9%	TOTAL 1 :	1.315
Départ	1.134	115.0	1.303
Arrêt	1.684		
Écart % :	0.0%	TOTAL 2 :	1.303
Départ	1.176	108.0	1.292
Arrêt	1.688		
Écart % :	0.9%	TOTAL 3 :	1.292
Moyenne :	0.529 m	110.7 sec.	1.303 L/s

CAPACITÉ HYDRAULIQUE			09-avr-03
Pompe (s) ESP#3 (P3)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.184	118.0	1.127
Arrêt	1.672		
Écart % :	0.6%	TOTAL 1 :	1.127
Départ	1.188	118.0	1.118
Arrêt	1.672		
Écart % :	0.2%	TOTAL 2 :	1.118
Départ	1.172	122.0	1.117
Arrêt	1.672		
Écart % :	0.3%	TOTAL 3 :	1.117
Moyenne :	0.491 m	119.3 sec.	1.121 L/s

CAPACITÉ HYDRAULIQUE			17-juin-03
Pompe (s) ESP#3 (P3)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.242	99.2	1.236
Arrêt	1.692		
Écart % :	0.4%	TOTAL 1 :	1.236
Départ	1.240	101.1	1.213
Arrêt	1.690		
Écart % :	1.5%	TOTAL 2 :	1.213
Départ	1.238	99.0	1.244
Arrêt	1.690		
Écart % :	1.1%	TOTAL 3 :	1.244
Moyenne :	0.451 m	99.8 sec.	1.231 L/s

CAPACITÉ HYDRAULIQUE			03-juil-03
Pompe (s) ESP#3 (P3)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.220	122.7	1.013
Arrêt	1.676		
Écart % :	2.0%	TOTAL 1 :	1.013
Départ	1.220	120.0	1.036
Arrêt	1.676		
Écart % :	0.3%	TOTAL 2 :	1.036
Départ	1.220	118.3	1.050
Arrêt	1.676		
Écart % :	1.7%	TOTAL 3 :	1.050
Moyenne :	0.456 m	120.3 sec.	1.033 L/s

CAPACITÉ HYDRAULIQUE			29-juil-03
Pompe (s) ESP#3 (P3)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.215	144.3	0.844
Arrêt	1.662		
Écart % :	0.3%	TOTAL 1 :	0.844
Départ	1.215	144.3	0.848
Arrêt	1.664		
Écart % :	0.2%	TOTAL 2 :	0.848
Départ	1.218	142.8	0.847
Arrêt	1.662		
Écart % :	0.1%	TOTAL 3 :	0.847
Moyenne :	0.447 m	143.8 sec.	0.846 L/s

CAPACITÉ HYDRAULIQUE			28-oct-03
Pompe (s) ESP#3 (P3)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.233	119.5	1.042
Arrêt	1.670		
Écart % :	0.7%	TOTAL 1 :	1.042
Départ	1.212	118.6	1.050
Arrêt	1.669		
Écart % :	0.1%	TOTAL 2 :	1.050
Départ	1.212	117.5	1.055
Arrêt	1.667		
Écart % :	0.6%	TOTAL 3 :	1.055
Moyenne :	0.456 m	118.5 sec.	1.049 L/s

CPC#1 (P6)

Projet : DBO Expert inc.
Municipalité : Stoke (Québec)

RÉSUMÉ DES ÉTALONNAGES EFFECTUÉS ENTRE OCTOBRE 2002 ET OCTOBRE 2003

Dimensions du puits :

Longueur (m) ______ Largeur (m) ______ Diamètre (m) : 0.5920 Superficie (m²) 0.2753 275.2538 (Litres / m)

ITEM A RETRANCHER :	Quantité	Longueur	Largeur	Diamètre	Surface	Volume
Tuyau de refoulement 59 mm ø	1			0.059	0.0027	2.7340
					Total : (Litres / m)	2.7340

VOLUME UTILE (Volume total - Items à retrancher) : 272.5198 litres/m

CAPACITÉ HYDRAULIQUE			08-oct-02
Pompe (s) CPC#1 (P6)	Distance vs eau (m)	TEMPS (sec)	DEBIT L / sec.
Depart	1.136	121.0	1.221
Arrêt	1.678		
Écart % :	1.1%	TOTAL 1 :	1.221
Depart	1.130	120.0	1.249
Arrêt	1.680		
Écart % :	1.2%	TOTAL 2 :	1.249
Depart	1.152	117.0	1.234
Arrêt	1.682		
Écart % :	0.0%	TOTAL 3 :	1.234
Moyenne :	0.541 m	119.3 sec.	1.235 L/s

CAPACITÉ HYDRAULIQUE			17-juin-03
Pompe (s) CPC#1 (P6)	Distance vs eau (m)	TEMPS (sec)	DEBIT L / sec.
Depart	1.226	159.5	0.779
Arrêt	1.682		
Écart % :	1.1%	TOTAL 1 :	0.779
Depart	1.225	157.5	0.787
Arrêt	1.680		
Écart % :	0.1%	TOTAL 2 :	0.787
Depart	1.230	154.8	0.797
Arrêt	1.683		
Écart % :	1.2%	TOTAL 3 :	0.797
Apres déblocage	0.455 m	157.3 sec.	0.788 L/s
Avant déblocage	0.452 m	173.4 sec.	0.710 L/s

CAPACITÉ HYDRAULIQUE			29-juil-03
Pompe (s) CPC#1 (P6)	Distance vs eau (m)	TEMPS (sec)	DEBIT L / sec.
Depart	1.200	182.4	0.686
Arrêt	1.659		
Écart % :	0.3%	TOTAL 1 :	0.686
Depart	1.202	182.9	0.687
Arrêt	1.663		
Écart % :	0.1%	TOTAL 2 :	0.687
Depart	1.202	181.5	0.691
Arrêt	1.662		
Écart % :	0.4%	TOTAL 3 :	0.691
Moyenne :	0.460 m	182.3 sec.	0.688 L/s

CAPACITÉ HYDRAULIQUE			09-avr-03
Pompe (s) CPC#1 (P6)	Distance vs eau (m)	TEMPS (sec)	DEBIT L / sec.
Depart	1.176	216.0	0.621
Arrêt	1.668		
Écart % :	0.1%	TOTAL 1 :	0.621
Depart	1.228	194.0	0.621
Arrêt	1.670		
Écart % :	0.1%	TOTAL 2 :	0.621
Départ	1.160	223.0	0.623
Arrêt	1.670		
Écart % :	0.3%	TOTAL 3 :	0.623
Moyenne :	0.481 m	211.0 sec.	0.622 L/s

CAPACITÉ HYDRAULIQUE			03-juil-03
Pompe (s) CPC#1 (P6)	Distance vs eau (m)	TEMPS (sec)	DEBIT L / sec.
Départ	1.207	200.6	0.594
Arrêt	1.664		
Écart % :	1.4%	TOTAL 1 :	0.594
Depart	1.207	207.2	0.579
Arrêt	1.647		
Écart % :	1.2%	TOTAL 2 :	0.579
Depart	1.208	212.5	0.585
Arrêt	1.664		
Écart % :	0.2%	TOTAL 3 :	0.585
Moyenne :	0.451 m	209.8 sec.	0.586 L/s

CAPACITÉ HYDRAULIQUE			28-oct-03
Pompe (s) CPC#1 (P6)	Distance vs eau (m)	TEMPS (sec)	DEBIT L / sec.
Depart	1.213	178.6	0.693
Arrêt	1.665		
Écart % :	2.0%	TOTAL 1 :	0.693
Depart	1.209	172.9	0.714
Arrêt	1.662		
Écart % :	1.0%	TOTAL 2 :	0.714
Depart	1.212	171.7	0.714
Arrêt	1.662		
Écart % :	1.0%	TOTAL 3 :	0.714
Moyenne :	0.452 m	174.4 sec.	0.707 L/s

CPC#2 (P5)	**Projet :** DBO Expert inc.	**RÉSUMÉ DES ÉTALONNAGES EFFECTUÉS ENTRE OCTOBRE 2002 ET OCTOBRE 2003**
	Municipalité : Stoke (Québec)	

Dimensions du puits :
Longueur (m) : ______ Largeur (m) : ______ Diamètre (m) : 0.5710 Superficie (m²) 0.2561 256.0720 (Litres / m)

ITEM À RETRANCHER :	Quantité	Longueur	Largeur	Diamètre	Surface	Volume
Tuyau de refoulement 59 mm ø	1			0.059	0.0027	2.7340
					Total : (Litres / m)	2.7340

VOLUME UTILE (Volume total - Items à retrancher) : 253.3381 litres/m

CAPACITÉ HYDRAULIQUE			08-oct-02
Pompe (s) CPC#2 (P5)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.136	120.0	1.144
Arrêt	1.678		
Écart % :	0.1%	TOTAL 1 :	1.144
Départ	1.346	117.0	1.152
Arrêt	1.678		
Écart % :	0.5%	TOTAL 2 :	1.152
Départ	1.124	123.0	1.141
Arrêt	1.678		
Écart % :	0.4%	TOTAL 3 :	1.141
Moyenne :	0.543 m	120.0 sec.	1.146 L/s

CAPACITÉ HYDRAULIQUE			09-avr-03
Pompe (s) CPC#2 (P5)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.156	141.0	0.927
Arrêt	1.672		
Écart % :	1.2%	TOTAL 1 :	0.927
Départ	1.156	143.0	0.907
Arrêt	1.668		
Écart % :	1.0%	TOTAL 2 :	0.907
Départ	1.152	144.0	0.915
Arrêt	1.672		
Écart % :	0.2%	TOTAL 3 :	0.915
Moyenne :	0.516 m	142.7 sec.	0.916 L/s

CAPACITÉ HYDRAULIQUE			17-juin-03
Pompe (s) CPC#2 (P5)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.230	113.9	0.996
Arrêt	1.678		
Écart % :	0.0%	TOTAL 1 :	0.996
Départ	1.232	114.5	0.991
Arrêt	1.680		
Écart % :	0.5%	TOTAL 2 :	0.991
Départ	1.232	114.2	1.000
Arrêt	1.683		
Écart % :	0.4%	TOTAL 3 :	1.000
Moyenne :	0.449 m	114.2 sec.	0.996 L/s

CAPACITÉ HYDRAULIQUE			03-juil-03
Pompe (s) CPC#2 (P5)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ			
Arrêt			
[illegible]		[illegible]	
[illegible]			
[illegible]			
Écart % :		TOTAL 2 :	
Départ			
Arrêt			
Écart % :		TOTAL 3 :	
Moyenne :			

Pas étalonné le 3 juillet 2003

CAPACITÉ HYDRAULIQUE			29-juil-03
Pompe (s) CPC#2 (P5)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.204	134.3	0.879
Arrêt	1.670		
Écart % :	2.3%	TOTAL 1 :	0.879
Départ	1.206	136.5	0.857
Arrêt	1.668		
Écart % :	0.2%	TOTAL 2 :	0.857
Départ	1.206	137.3	0.841
Arrêt	1.662		
Écart % :	2.1%	TOTAL 3 :	0.841
Moyenne :	0.461 m	136.0 sec.	0.859 L/s

CAPACITÉ HYDRAULIQUE			28-oct-03
Pompe (s) CPC#2 (P5)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.202	149.5	0.790
Arrêt	1.668		
Écart % :	0.5%	TOTAL 1 :	0.790
Départ	1.204	148.2	0.788
Arrêt	1.665		
Écart % :	0.3%	TOTAL 2 :	0.788
Départ	1.193	154.7	0.780
Arrêt	1.669		
Écart % :	0.8%	TOTAL 3 :	0.780
Moyenne :	0.468 m	150.8 sec.	0.786 L/s

CPC#3 (P4)	**Projet :** DBO Expert inc.	**RÉSUMÉ DES ÉTALONNAGES EFFECTUÉS ENTRE OCTOBRE 2002 ET OCTOBRE 2003**
	Municipalité : Stoke (Québec)	

Dimensions du puits :
Longueur (m) ______ Largeur (m) ______ Diamètre (m) 0.5920 Superficie (m²) 0.2753 — 275.2538 (Litres / m)

ITEM À RETRANCHER :	Quantité	Longueur	Largeur	Diamètre	Surface	Volume
Tuyau de refoulement 59 mm ø	1			0.059	0.0027	2.7340
					Total : (Litres / m)	2.7340

VOLUME UTILE (Volume total - Items à retrancher) : 272.5198 litres/m

CAPACITÉ HYDRAULIQUE			08-oct-02
Pompe (s) CPC#3 (P4)	**Distance vs eau (m)**	**TEMPS (sec)**	**DÉBIT L / sec.**
Départ	1.118	115.0	1.322
Arrêt	1.676		
Écart % :	1.7%	TOTAL 1 :	1.322
Départ	1.178	107.0	1.273
Arrêt	1.678		
Écart % :	2.1%	TOTAL 2 :	1.273
Départ	1.180	104.0	1.305
Arrêt	1.678		
Écart % :	0.4%	TOTAL 3 :	1.305
Moyenne :	0.519 m	108.7 sec.	1.300 L/s

CAPACITÉ HYDRAULIQUE			09-avr-03
Pompe (s) CPC#3 (P4)	**Distance vs eau (m)**	**TEMPS (sec)**	**DÉBIT L / sec.**
Départ	1.162	108.6	1.287
Arrêt	1.672		
Écart % :	1.8%	TOTAL 1 :	1.287
Départ	1.164	111.0	1.257
Arrêt	1.676		
Écart % :	0.6%	TOTAL 2 :	1.257
Départ	1.132	117.0	1.248
Arrêt	1.668		
Écart % :	1.2%	TOTAL 3 :	1.248
Moyenne :	0.519 m	112.0 sec.	1.264 L/s

CAPACITÉ HYDRAULIQUE			17-juin-03
Pompe (s) CPC#3 (P4)	**Distance vs eau (m)**	**TEMPS (sec)**	**DÉBIT L / sec.**
Départ	1.219	97.8	1.268
Arrêt	1.674		
Écart % :	0.1%	TOTAL 1 :	1.268
Départ	1.219	97.0	1.261
Arrêt	1.672		
Écart % :	0.6%	TOTAL 2 :	1.261
Départ	1.220	97.3	1.277
Arrêt	1.676		
Écart % :	0.7%	TOTAL 3 :	1.277
Moyenne :	0.455 m	97.7 sec.	1.269 L/s

CAPACITÉ HYDRAULIQUE			03-juil-03
Pompe (s) CPC#3 (P4)	**Distance vs eau (m)**	**TEMPS (sec)**	**DÉBIT L / sec.**
Départ			
Arrêt			
Écart % :		TOTAL 1 :	
Départ			
Arrêt			
Écart % :		TOTAL 2 :	
Départ			
Arrêt			
Écart % :		TOTAL 3 :	
Moyenne :			

Pas étalonné le 3 juillet 2003

CAPACITÉ HYDRAULIQUE			29-juil-03
Pompe (s) CPC#3 (P4)	**Distance vs eau (m)**	**TEMPS (sec)**	**DÉBIT L / sec.**
Départ	1.200	97.5	1.269
Arrêt	1.651		
Écart % :	1.1%	TOTAL 1 :	1.269
Départ	1.198	96.5	1.291
Arrêt	1.655		
Écart % :	0.6%	TOTAL 2 :	1.291
Départ	1.198	96.7	1.291
Arrêt	1.656		
Écart % :	0.6%	TOTAL 3 :	1.291
Moyenne :	0.456 m	96.9 sec.	1.283 L/s

CAPACITÉ HYDRAULIQUE			28-oct-03
Pompe (s) CPC#3 (P4)	**Distance vs eau (m)**	**TEMPS (sec)**	**DÉBIT L / sec.**
Départ	1.197	99.1	1.254
Arrêt	1.653		
Écart % :	1.2%	TOTAL 1 :	1.254
Départ	1.194	100.7	1.239
Arrêt	1.652		
Écart % :	0.0%	TOTAL 2 :	1.239
Départ	1.198	101.1	1.224
Arrêt	1.652		
Écart % :	1.2%	TOTAL 3 :	1.224
Moyenne :	0.456 m	100.3 sec.	1.239 L/s

MAZ#1 (P7)	Projet : DBO Expert inc.	RÉSUMÉ DES ÉTALONNAGES EFFECTUÉS ENTRE OCTOBRE 2002 ET OCTOBRE 2003
	Municipalité : Stoke (Québec)	

Dimensions du puits :

Longueur (m) : ________ Largeur (m) : ________ Diamètre (m) : 0.6140 Superficie (m²) 0.2961 296.0920 (Litres / m)

ITEM A RETRANCHER :	Quantité	Longueur	Largeur	Diamètre	Surface	Volume
Tuyau de refoulement 59 mm ø	1			0.059	0.0027	2.7340
					Total : (Litres / m)	2.7340

VOLUME UTILE (Volume total - Items à retrancher) : 293.3580 litres/m

CAPACITÉ HYDRAULIQUE			08-oct-02
Pompe (s) MAZ#1 (P7)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.114	144.0	1.112
Arrêt	1.660		
Écart % :	0.6%	TOTAL 1 :	1.112
Départ	1.164	130.0	1.124
Arrêt	1.662		
Écart % :	1.6%	TOTAL 2 :	1.124
Départ	1.136	142.0	1.083
Arrêt	1.660		
Écart % :	2.1%	TOTAL 3 :	1.083
Moyenne :	0.523 m	138.7 sec.	1.106 L/s

CAPACITÉ HYDRAULIQUE			09-avr-03
Pompe (s) MAZ#1 (P7)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.150	147.0	1.002
Arrêt	1.652		
Écart % :	0.5%	TOTAL 1 :	1.002
Départ	1.144	149.0	1.000
Arrêt	1.652		
Écart % :	0.6%	TOTAL 2 :	1.000
Départ	1.156	143.0	1.018
Arrêt	1.652		
Écart % :	1.1%	TOTAL 3 :	1.018
Moyenne :	0.502 m	146.3 sec.	1.007 L/s

CAPACITÉ HYDRAULIQUE			17-juin-03
Pompe (s) MAZ#1 (P7)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.223	132.8	1.010
Arrêt	1.680		
Écart % :	0.3%	TOTAL 1 :	1.010
Départ	1.223	132.3	1.013
Arrêt	1.680		
Écart % :	0.0%	TOTAL 2 :	1.013
Départ	1.221	132.5	1.016
Arrêt	1.680		
Écart % :	0.3%	TOTAL 3 :	1.016
Moyenne :	0.458 m	132.5 sec.	1.013 L/s

CAPACITÉ HYDRAULIQUE			03-juil-03
Pompe (s) MAZ#1 (P7)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ			
Arrêt			
Écart % :		TOTAL 1 :	
Départ			
Arrêt			
Écart % :		TOTAL 2 :	
Départ			
Arrêt			
Écart % :		TOTAL 3 :	
Moyenne :			

Pas étalonné le 3 juillet 2003

CAPACITÉ HYDRAULIQUE			29-juil-03
Pompe (s) MAZ#1 (P7)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.206	154.4	0.859
Arrêt	1.658		
Écart % :	0.2%	TOTAL 1 :	0.859
Départ	1.203	154.6	0.863
Arrêt	1.658		
Écart % :	0.3%	TOTAL 2 :	0.863
Départ	1.203	154.5	0.860
Arrêt	1.656		
Écart % :	0.1%	TOTAL 3 :	0.860
Moyenne :	0.453 m	154.5 sec.	0.861 L/s

CAPACITÉ HYDRAULIQUE			28-oct-03
Pompe (s) MAZ#1 (P7)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.206	163.9	0.818
Arrêt	1.663		
Écart % :	0.5%	TOTAL 1 :	0.818
Départ	1.202	164.2	0.818
Arrêt	1.660		
Écart % :	0.4%	TOTAL 2 :	0.818
Départ	1.203	161.7	0.829
Arrêt	1.660		
Écart % :	0.9%	TOTAL 3 :	0.829
Moyenne :	0.457 m	163.3 sec.	0.822 L/s

ENVIRONNEMENT ESA

Système Enviro-Septic[MC]

Rapport de distribution longitudinale – 1 an

MAZ#2 (P9)	Projet : DBO Expert inc. Municipalité : Stoke (Québec)	RÉSUMÉ DES ÉTALONNAGES EFFECTUÉS ENTRE OCTOBRE 2002 ET OCTOBRE 2003

Dimensions du puits :

Longueur (m) ______ Largeur (m) ______ Diamètre (m) 0.6060 Superficie (m^2) 0.2884 288.4265 (Litres / m)

ITEM A RETRANCHER :	Quantité	Longueur	Largeur	Diamètre	Surface	Volume
Tuyau de refoulement 59 mm ø	1			0.059	0.0027	2.7340
					Total : (Litres / m)	2.7340

VOLUME UTILE (Volume total - Items à retrancher) : 285.6925 litres/m

CAPACITÉ HYDRAULIQUE			08-oct-02
Pompe (s) MAZ#2 (P9)	Distance vs eau (m)	TEMPS (sec)	DEBIT L / sec.
Depart	1.161	140.0	1.049
Arrêt	1.678		
Écart % :	2.3%	TOTAL 1 :	1.049
Depart	1.140	141.0	1.094
Arrêt	1.680		
Écart % :	1.9%	TOTAL 2 :	1.094
Depart	1.168	135.0	1.079
Arrêt	1.678		
Écart % :	0.5%	TOTAL 3 :	1.079
Moyenne :	0.521 m	138.7 sec.	1.074 L/s

CAPACITÉ HYDRAULIQUE			09-avr-03
Pompe (s) MAZ#2 (P9)	Distance vs eau (m)	TEMPS (sec)	DEBIT L / sec.
Depart	1.170	133.6	1.078
Arrêt	1.672		
Écart % :	3.6%	TOTAL 1 :	1.078
Depart	1.158	143.0	1.027
Arrêt	1.672		
Écart % :	1.3%	TOTAL 2 :	1.027
Depart	1.172	140.0	1.016
Arrêt	1.670		
Écart % :	2.3%	TOTAL 3 :	1.016
Moyenne :	0.505 m	138.7 sec.	1.040 L/s

CAPACITÉ HYDRAULIQUE			17-juin-03
Pompe (s) MAZ#2 (P9)	Distance vs eau (m)	TEMPS (sec)	DEBIT L / sec.
Depart	1.222	165.6	0.790
Arrêt	1.680		
Écart % :	0.7%	TOTAL 1 :	0.790
Depart	1.220	164.3	0.800
Arrêt	1.680		
Écart % :	0.5%	TOTAL 2 :	0.800
Depart	1.221	164.5	0.797
Arrêt	1.680		
Écart % :	0.2%	TOTAL 3 :	0.797
Moyenne :	0.459 m	164.8 sec.	0.796 L/s

CAPACITÉ HYDRAULIQUE			03-juil-03
Pompe (s) MAZ#2 (P9)	Distance vs eau (m)	TEMPS (sec)	DEBIT L / sec.
Depart			
Arrêt			
Écart % :		TOTAL 1 :	
Depart			
Arrêt			
Écart % :		TOTAL 2 :	
Depart			
Arrêt			
Écart % :		TOTAL 3 :	
Moyenne :			

Pas étalonné le 3 juillet 2003

CAPACITÉ HYDRAULIQUE			29-juil-03
Pompe (s) MAZ#2 (P9)	Distance vs eau (m)	TEMPS (sec)	DEBIT L / sec.
Depart	1.205	188.0	0.688
Arrêt	1.658		
Écart % :	0.8%	TOTAL 1 :	0.688
Depart	1.205	186.5	0.691
Arrêt	1.656		
Écart % :	0.4%	TOTAL 2 :	0.691
Depart	1.205	183.4	0.703
Arrêt	1.656		
Écart % :	1.2%	TOTAL 3 :	0.703
Moyenne :	0.452 m	186.0 sec.	0.694 L/s

CAPACITÉ HYDRAULIQUE			28-oct-03
Pompe (s) MAZ#2 (P9)	Distance vs eau (m)	TEMPS (sec)	DEBIT L / sec.
Depart	1.197	239.7	0.554
Arrêt	1.662		
Écart % :	2.0%	TOTAL 1 :	0.554
Depart	1.203	241.8	0.534
Arrêt	1.655		
Écart % :	1.7%	TOTAL 2 :	0.534
Depart	1.204	238.4	0.542
Arrêt	1.658		
Écart % :	0.3%	TOTAL 3 :	0.542
Moyenne :	0.457 m	240.3 sec.	0.543 L/s

MAZ#3 (P8)	**Projet :** DBO Expert inc.	**RÉSUMÉ DES ÉTALONNAGES EFFECTUÉS ENTRE OCTOBRE 2002 ET OCTOBRE 2003**
	Municipalité : Stoke (Québec)	

Dimensions du puits :

Longueur (m) : ________ Largeur (m) : ________ Diamètre (m) : 0.6100 Superficie (m²) 0.2922 292.2467 **(Litres / m)**

ITEM À RETRANCHER :	**Quantité**	**Longueur**	**Largeur**	**Diamètre**	**Surface**	**Volume**
Tuyau de refoulement 59 mm ø	1			0.059	0.0027	2.7340
					Total :	**(Litres / m)** 2.7340

VOLUME UTILE (Volume total - Items à retrancher) : **289.5127 litres/m**

CAPACITÉ HYDRAULIQUE			08-oct-02
Pompe (s) MAZ#3 (P8)	**Distance vs eau (m)**	**TEMPS (sec)**	**DÉBIT L / sec.**
Départ	1.130	134.0	1.136
Arrêt	1.656		
Écart % :	1.0%	**TOTAL 1 :**	**1.136**
Départ	1.148	128.0	1.154
Arrêt	1.658		
Écart % :	0.5%	**TOTAL 2 :**	**1.154**
Départ	1.092	142.0	1.154
Arrêt	1.658		
Écart % :	0.5%	**TOTAL 3 :**	**1.154**
Moyenne :	**0.534 m**	**134.7 sec.**	**1.148 L/s**

CAPACITÉ HYDRAULIQUE			09-avr-03
Pompe (s) MAZ#3 (P8)	**Distance vs eau (m)**	**TEMPS (sec)**	**DÉBIT L / sec.**
Départ	1.152	134.0	1.076
Arrêt	1.650		
Écart % :	1.5%	**TOTAL 1 :**	**1.076**
Départ	1.148	133.0	1.093
Arrêt	1.650		
Écart % :	0.0%	**TOTAL 2 :**	**1.093**
Départ	1.150	131.0	1.109
Arrêt	1.652		
Écart % :	1.5%	**TOTAL 3 :**	**1.109**
Moyenne :	**0.501 m**	**132.7 sec.**	**1.093 L/s**

CAPACITÉ HYDRAULIQUE			17-juin-03
Pompe (s) MAZ#3 (P8)	**Distance vs eau (m)**	**TEMPS (sec)**	**DÉBIT L / sec.**
Départ	1.218	122.3	1.068
Arrêt	1.669		
Écart % :	0.6%	**TOTAL 1 :**	**1.068**
Départ	1.218	122.0	1.070
Arrêt	1.669		
Écart % :	0.4%	**TOTAL 2 :**	**1.070**
Départ	1.217	120.9	1.085
Arrêt	1.670		
Écart % :	1.0%	**TOTAL 3 :**	**1.085**
Moyenne :	**0.452 m**	**121.7 sec.**	**1.074 L/s**

CAPACITÉ HYDRAULIQUE			03-juil-03
Pompe (s) MAZ#3 (P8)	**Distance vs eau (m)**	**TEMPS (sec)**	**DÉBIT L / sec.**
Départ			
Arrêt			
Écart % :		**TOTAL 1 :**	
Départ			
Arrêt			
Écart % :		**TOTAL 2 :**	
Départ			
Arrêt			
Écart % :		**TOTAL 3 :**	
Moyenne :			

Pas étalonné le 3 juillet 2003

CAPACITÉ HYDRAULIQUE			29-juil-03
Pompe (s) MAZ#3 (P8)	**Distance vs eau (m)**	**TEMPS (sec)**	**DÉBIT L / sec.**
Départ	1.210	119.5	1.100
Arrêt	1.664		
Écart % :	0.8%	**TOTAL 1 :**	**1.100**
Départ	1.202	120.3	1.107
Arrêt	1.662		
Écart % :	0.1%	**TOTAL 2 :**	**1.107**
Départ	1.200	119.1	1.118
Arrêt	1.660		
Écart % :	0.9%	**TOTAL 3 :**	**1.118**
Moyenne :	**0.458 m**	**119.6 sec.**	**1.108 L/s**

CAPACITÉ HYDRAULIQUE			28-oct-03
Pompe (s) MAZ#3 (P8)	**Distance vs eau (m)**	**TEMPS (sec)**	**DÉBIT L / sec.**
Départ	1.201	132.5	0.981
Arrêt	1.650		
Écart % :	1.7%	**TOTAL 1 :**	**0.981**
Départ	1.201	131.2	1.004
Arrêt	1.656		
Écart % :	0.6%	**TOTAL 2 :**	**1.004**
Départ	1.204	130.4	1.008
Arrêt	1.658		
Écart % :	1.0%	**TOTAL 3 :**	**1.008**
Moyenne :	**0.453 m**	**131.4 sec.**	**0.998 L/s**

CPC#4-5 (P11)	**Projet :** DBO Expert inc. **Municipalité :** Stoke (Québec)	**RÉSUMÉ DES ÉTALONNAGES EFFECTUÉS ENTRE OCTOBRE 2002 ET OCTOBRE 2003**

Dimensions du puits :

Longueur (m) ______ Largeur (m) ______ Diamètre (m) 0.5950 Superficie (m^2) 0.2781 278.0506 (Litres / m)

ITEM À RETRANCHER :	Quantité	Longueur	Largeur	Diamètre	Surface	Volume
Tuyau de refoulement 59 mm ø	1			0.059	0.0027	2.7340
					Total : (Litres / m)	2.7340

VOLUME UTILE (Volume total - Items à retrancher) : 275.3166 litres/m

CAPACITÉ HYDRAULIQUE — 08-oct-02

Pas installé en octobre 2002

Pompe (s) CPC#4-5 (P11)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ			#DIV/0!
Arrêt			
Arrêt			
Écart % :	#DIV/0!	TOTAL 2 :	#DIV/0!
Départ			#DIV/0!
Arrêt			
Écart % :	#DIV/0!	TOTAL 3 :	#DIV/0!
Moyenne :		#DIV/0!	#DIV/0!

CAPACITÉ HYDRAULIQUE — 09-avr-03

Pompe (s) CPC#4-5 (P11)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.188	83.0	1.586
Arrêt	1.666		
Écart % :	2.8%	TOTAL 1 :	1.586
Départ	1.174	81.0	1.686
Arrêt	1.670		
Écart % :	3.6%	TOTAL 2 :	1.686
Départ	1.178	78.0	1.610
Arrêt	1.634		
Écart % :	1.1%	TOTAL 3 :	1.610
Moyenne :	0.477 m	80.7 sec.	1.627 L/s

CAPACITÉ HYDRAULIQUE — 17-juin-03

Pompe (s) CPC#4-5 (P11)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.234	78.6	1.597
Arrêt	1.690		
Écart % :	0.6%	TOTAL 1 :	1.597
Départ	1.233	79.5	1.583
Arrêt	1.690		
Écart % :	0.3%	TOTAL 2 :	1.583
Départ	1.234	79.4	1.581
Arrêt	1.690		
Écart % :	0.4%	TOTAL 3 :	1.581
Moyenne :	0.456 m	79.2 sec.	1.587 L/s

CAPACITÉ HYDRAULIQUE — 03-juil-03

Pas étalonné le 3 juillet 2003

Pompe (s) CPC#4-5 (P11)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ			
Arrêt			
Écart % :		TOTAL 2 :	
Départ			
Arrêt			
Écart % :		TOTAL 3 :	
Moyenne :			

CAPACITÉ HYDRAULIQUE — 29-juil-03

Pompe (s) CPC#4-5 (P11)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.210	83.1	1.501
Arrêt	1.663		
Écart % :	0.5%	TOTAL 1 :	1.501
Départ	1.209	83.4	1.482
Arrêt	1.658		
Écart % :	0.7%	TOTAL 2 :	1.482
Départ	1.210	83.2	1.496
Arrêt	1.662		
Écart % :	0.2%	TOTAL 3 :	1.496
Moyenne :	0.451 m	83.2 sec.	1.493 L/s

CAPACITÉ HYDRAULIQUE — 28-oct-03

Pompe (s) CPC#4-5 (P11)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.210	87.0	1.437
Arrêt	1.664		
Écart % :	0.0%	TOTAL 1 :	1.437
Départ	1.210	86.8	1.434
Arrêt	1.662		
Écart % :	0.2%	TOTAL 2 :	1.434
Départ	1.208	87.4	1.440
Arrêt	1.665		
Écart % :	0.2%	TOTAL 3 :	1.440
Moyenne :	0.454 m	87.1 sec.	1.437 L/s

ESP#4-5 (P12)	Projet : DBO Expert inc.	RÉSUMÉ DES ÉTALONNAGES EFFECTUÉS ENTRE OCTOBRE 2002 ET OCTOBRE 2003
	Municipalité : Stoke (Québec)	

Dimensions du puits :

Longueur (m) : ________ Largeur (m) : ________ Diamètre (m) : 0.5950 Superficie (m²) 0.2781 278.0506 (Litres / m)

ITEM À RETRANCHER :	Quantité	Longueur	Largeur	Diamètre	Surface	Volume
Tuyau de refoulement 59 mm ø	1			0.059	0.0027	2.7340
					Total : (Litres / m)	2.7340

VOLUME UTILE (Volume total - Items à retrancher) : 275.3166 litres/m

Pas installé en octobre 2002

CAPACITÉ HYDRAULIQUE			08-oct-02
Pompe (s) ESP#4-5 (P12)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ			#DIV/0!
Arrêt			
Écart % :	#DIV/0!	TOTAL 1 :	#DIV/0!
[illegible]			
[illegible]			
Écart % :	#DIV/0!	TOTAL 2 :	#DIV/0!
Départ			#DIV/0!
Arrêt			
Écart % :	#DIV/0!	TOTAL 3 :	#DIV/0!
Moyenne :		#DIV/0!	#DIV/0!

CAPACITÉ HYDRAULIQUE			09-avr-03
Pompe (s) ESP#4-5 (P12)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.186	91.0	1.543
Arrêt	1.696		
Écart % :	1.5%	TOTAL 1 :	1.543
Départ	1.186	87.0	1.570
Arrêt	1.682		
Écart % :	0.2%	TOTAL 2 :	1.570
Départ	1.188	79.0	1.589
Arrêt	1.644		
Écart % :	1.4%	TOTAL 3 :	1.589
Moyenne :	0.487 m	85.7 sec.	1.567 L/s

CAPACITÉ HYDRAULIQUE			17-juin-03
Pompe (s) ESP#4-5 (P12)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.242	77.7	1.623
Arrêt	1.700		
Écart % :	0.1%	TOTAL 1 :	1.623
Départ	1.243	77.3	1.621
Arrêt	1.698		
Écart % :	0.0%	TOTAL 2 :	1.621
Départ	1.246	77.2	1.619
Arrêt	1.700		
Écart % :	0.1%	TOTAL 3 :	1.619
Moyenne :	0.456 m	77.4 sec.	1.621 L/s

Pas étalonné le 3 juillet 2003

CAPACITÉ HYDRAULIQUE			03-juil-03
Pompe (s) ESP#4-5 (P12)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ			
Arrêt			
[illegible]			
[illegible]			
Arrêt			
Écart % :		TOTAL 2 :	
Départ			
Arrêt			
Écart % :		TOTAL 3 :	
Moyenne :			

CAPACITÉ HYDRAULIQUE			29-juil-03
Pompe (s) ESP#4-5 (P12)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.229	77.5	1.613
Arrêt	1.683		
Écart % :	1.4%	TOTAL 1 :	1.613
Départ	1.222	78.5	1.596
Arrêt	1.677		
Écart % :	0.3%	TOTAL 2 :	1.596
Départ	1.230	78.4	1.563
Arrêt	1.675		
Écart % :	1.7%	TOTAL 3 :	1.563
Moyenne :	0.451 m	78.1 sec.	1.590 L/s

CAPACITÉ HYDRAULIQUE			28-oct-03
Pompe (s) ESP#4-5 (P12)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.222	81.5	1.507
Arrêt	1.668		
Écart % :	0.9%	TOTAL 1 :	1.507
Départ	1.224	81.3	1.517
Arrêt	1.672		
Écart % :	0.2%	TOTAL 2 :	1.517
Départ	1.226	80.5	1.536
Arrêt	1.675		
Écart % :	1.0%	TOTAL 3 :	1.536
Moyenne :	0.448 m	81.1 sec.	1.520 L/s

ENVIRONNEMENT E.S.A

Système Enviro-Septic[MC]

Rapport de distribution longitudinale – 1 an

ESP#6-7 (P13)	Projet : DBO Expert inc.	RÉSUMÉ DES ÉTALONNAGES EFFECTUÉS ENTRE OCTOBRE 2002 ET OCTOBRE 2003
	Municipalité : Stoke (Québec)	

Dimensions du puits :

Longueur (m) ______ Largeur (m) ______ Diamètre (m) 0.5950 Superficie (m²) 0.2781 278.0506 (Litres / m)

ITEM A RETRANCHER :	Quantité	Longueur	Largeur	Diamètre	Surface	Volume
Tuyau de refoulement 59 mm ø	1			0.059	0.0027	2.7340
					Total : (Litres / m)	2.7340

VOLUME UTILE (Volume total - Items à retrancher) : **275.3166 litres/m**

CAPACITÉ HYDRAULIQUE			08-oct-02
Pompe (s) ESP#6-7 (P13)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ			#DIV/0!
Arrêt			
Écart % :	#DIV/0!	TOTAL 1 :	#DIV/0!
Pas installé en octobre 2002			
Écart % :	#DIV/0!	TOTAL 2 :	#DIV/0!
Départ			#DIV/0!
Arrêt			
Écart % :	#DIV/0!	TOTAL 3 :	#DIV/0!
Moyenne :		#DIV/0!	#DIV/0!

CAPACITÉ HYDRAULIQUE			09-avr-03
Pompe (s) ESP#6-7 (P13)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.388	82.0	1.497
Arrêt	1.634		
Écart % :	3.6%	TOTAL 1 :	1.497
Départ	1.388	74.0	1.577
Arrêt	1.612		
Écart % :	1.5%	TOTAL 2 :	1.577
Départ	1.388	77.0	1.588
Arrêt	1.632		
Écart % :	2.1%	TOTAL 3 :	1.588
Moyenne :	0.438 m	77.7 sec.	1.554 L/s

CAPACITÉ HYDRAULIQUE			17-juin-03
Pompe (s) ESP#6-7 (P13)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.228	80.6	1.547
Arrêt	1.681		
Écart % :	0.4%	TOTAL 1 :	1.547
Départ	1.228	81.4	1.539
Arrêt	1.683		
Écart % :	0.1%	TOTAL 2 :	1.539
Départ	1.229	81.5	1.537
Arrêt	1.684		
Écart % :	0.3%	TOTAL 3 :	1.537
Moyenne :	0.454 m	81.2 sec.	1.541 L/s

CAPACITÉ HYDRAULIQUE			03-juil-03
Pompe (s) ESP#6-7 (P13)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ			
Arrêt			
Pas étalonné le 3 juillet 2003			
Arrêt			
Écart % :		TOTAL 2 :	
Départ			
Arrêt			
Écart % :		TOTAL 3 :	
Moyenne :			

CAPACITÉ HYDRAULIQUE			29-juil-03
Pompe (s) ESP#6-7 (P13)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.205	82.6	1.543
Arrêt	1.668		
Écart % :	1.6%	TOTAL 1 :	1.543
Départ	1.209	82.7	1.508
Arrêt	1.662		
Écart % :	0.8%	TOTAL 2 :	1.508
Départ	1.210	83.1	1.507
Arrêt	1.665		
Écart % :	0.8%	TOTAL 3 :	1.507
Moyenne :	0.457 m	82.8 sec.	1.520 L/s

CAPACITÉ HYDRAULIQUE			28-oct-03
Pompe (s) ESP#6-7 (P13)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	1.215	92.3	1.342
Arrêt	1.665		
Écart % :	0.3%	TOTAL 1 :	1.342
Départ	1.212	94.4	1.318
Arrêt	1.664		
Écart % :	1.5%	TOTAL 2 :	1.318
Départ	1.208	92.7	1.354
Arrêt	1.664		
Écart % :	1.2%	TOTAL 3 :	1.354
Moyenne :	0.453 m	93.1 sec.	1.338 L/s

Retour (P14)	Projet : DBO Expert inc.	RÉSUMÉ DES ÉTALONNAGES EFFECTUÉS ENTRE OCTOBRE 2002 ET OCTOBRE 2003
	Municipalité : Stoke (Québec)	

Dimensions du puits :
Longueur (m) : ____ Largeur (m) : ____ Diamètre (m) : 0.4920 Superficie (m²) 0.1901 190.1166 (Litres / m)

ITEM À RETRANCHER :	Quantité	Longueur	Largeur	Diamètre	Surface	Volume
Tuyau de refoulement 59 mm ø	1			0.059	0.0027	2.7340
					Total : (Litres / m)	2.7340

VOLUME UTILE (Volume total - Items à retrancher) : **187.3827 litres/m**

Pas installé en octobre 2002

CAPACITÉ HYDRAULIQUE			08-oct-02
Pompe (s) Retour (P14)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ			#DIV/0!
Arrêt			
Écart % :	#DIV/0!	TOTAL 2 :	#DIV/0!
Départ			#DIV/0!
Arrêt			
Écart % :	#DIV/0!	TOTAL 3 :	#DIV/0!
Moyenne :		#DIV/0!	#DIV/0!

CAPACITÉ HYDRAULIQUE			09-avr-03
Pompe (s) Retour (P14)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	0.722	130.0	1.176
Arrêt	1.538		
Écart % :	1.1%	TOTAL 1 :	1.176
Départ	0.714	125.0	1.208
Arrêt	1.520		
Écart % :	1.6%	TOTAL 2 :	1.208
Départ	0.722	116.0	1.182
Arrêt	1.454		
Écart % :	0.5%	TOTAL 3 :	1.182
Moyenne :	0.785 m	123.7 sec.	1.189 L/s

CAPACITÉ HYDRAULIQUE			17-juin-03
Pompe (s) Retour (P14)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	0.774	119.6	1.184
Arrêt	1.530		
Écart % :	0.7%	TOTAL 1 :	1.184
Départ	0.794	115.4	1.195
Arrêt	1.530		
Écart % :	0.2%	TOTAL 2 :	1.195
Départ	0.798	114.3	1.200
Arrêt	1.530		
Écart % :	0.6%	TOTAL 3 :	1.200
Moyenne :	0.741 m	116.4 sec.	1.193 L/s

Pas étalonné le 3 juillet 2003

CAPACITÉ HYDRAULIQUE			03-juil-03
Pompe (s) Retour (P14)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ			
Arrêt			
Écart % :		TOTAL 2 :	
Départ			
Arrêt			
Écart % :		TOTAL 3 :	
Moyenne :			

CAPACITÉ HYDRAULIQUE			29-juil-03
Pompe (s) Retour (P14)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	0.744	122.5	1.172
Arrêt	1.510		
Écart % :	0.0%	TOTAL 1 :	1.172
Départ	0.742	122.5	1.166
Arrêt	1.501		
Écart % :	0.5%	TOTAL 2 :	1.166
Départ	0.742	122.2	1.178
Arrêt	1.510		
Écart % :	0.5%	TOTAL 3 :	1.178
Moyenne :	0.765 m	122.4 sec.	1.172 L/s

CAPACITÉ HYDRAULIQUE			28-oct-03
Pompe (s) Retour (P14)	Distance vs eau (m)	TEMPS (sec)	DÉBIT L / sec.
Départ	0.750	120.1	1.183
Arrêt	1.508		
Écart % :	0.2%	TOTAL 1 :	1.183
Départ	0.750	119.6	1.184
Arrêt	1.506		
Écart % :	0.0%	TOTAL 2 :	1.184
Départ	0.748	119.9	1.188
Arrêt	1.508		
Écart % :	0.2%	TOTAL 3 :	1.188
Moyenne :	0.758 m	119.9 sec.	1.185 L/s

APPENDIX B

OFFICIAL CERTIFICATES
ANALYSIS LABORATORY

OFFICIAL CERTIFICATES OF ANALYSES

EXIT OF THE RESERVE OF PROPORTIONING
(SEPTIC TANK)

OFFICIAL CERTIFICATES ANALYSES

ENVIRO-SEPTIC® EFFLUENT

CELL ESP 1

OFFICIAL CERTIFICATES

ANALYSES

EFFLUENT ENVIRO-SEPTIC®

CELL ESP 2

OFFICIAL CERTIFICATES

ANALYSES

EFFLUENT ENVIRO-SEPTIC®

CELL ESP 3

OFFICIAL CERTIFICATES

ANALYSES

EFFLUENT TRADITIONAL SYSTEM

CELL CPC 1

OFFICIAL CERTIFICATES ANALYSES

EFFLUENT TRADITIONAL SYSTEM

CELL CPC 2

OFFICIAL CERTIFICATES

ANALYSES

EFFLUENT TRADITIONAL SYSTEM

CELL CPC 3

ASSESSMENT OF THE LOADS AND EFFECTIVENESS OF REMOVAL FOR THE SECTION ENVIRO-SEPTIC® (Esp 1-2-3)

July 9, 2003

Point			Tank of loading	ESP 1		ESP 2		ESP 3		SUMMON ESP 1-2-3		EFFECTIVENESS Of REMOVAL
Volume recovered by cell			N/A	119 L/d		184 L/d		274 L/d		576 L/d		
Effective volume (without the rain)			N/A	115 L/d		180 L/d		270 L/d		566 L/d		
Parameters to be analyzed	Unités	LDM	mg/L	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	(%)
TSS	mg/L	1	112	< 1	0.00006	< 1	0.00009	2	0.0005	1.2	0.0007	98.9%
BOD5 C	mg/L	2	211	< 2	0.00012	< 2	0.00018	< 2	0.0003	1.0	0.0006	99.5%
BOD5 C soluble	mg/L	2	137	< 2	0.00012	< 2	0.00018	< 2	0.0003	1.0	0.0006	99.3%
COD total	mg/L	3	448	< 3	0.00018	< 3	0.00028	19	0.0052	10.0	0.0057	97.8%
COD soluble	mg/L	3	218	< 3	0.00018	< 3	0.00028	13	0.0036	7.1	0.0040	96.7%
TKN	mg N/L	0.9	36	< 0.9	0.00005	< 0.9	0.00008	5	0.0013	2.6	0.0015	92.9%
NH4	mg N/L	0.5	23	< 0.5	0.00003	< 0.5	0.00005	1	0.0004	0.8	0.0005	96.5%
NO2	mg N/L	0.05	0.06	18	0.00214	18	0.00331	24	0.0066	21.2	0.0120	N/A
NO3	mg N/L	0.05	0.05	16	0.00190	21	0.00386	25	0.0068	22.3	0.0126	N/A
NO2-NO3	mg N/L	0.05	0.11	34	0.00404	39	0.00716	49	0.0134	43.5	0.0246	N/A
P total	mg P/L	0.3	5.4	1.7	0.00020	1.7	0.00031	0.7	0.0002	1.2	0.0007	76.9%
			Concentration	Conc.	Removal	Conc.	Removal	Conc.	Removal	Conc.	Units	
Coli. Fecal	UFC/100 mL	10	520 000	21 000	95.842%	180	99.965%	12 000	97.663%	10 162	UFC/100 mL	98.046%
Coli. Fecal filtered	UFC/100 mL	10	90 000	81	99.907%	45	99.949%	3 700	95.837%	1 811	UFC/100 mL	97.988%

Note :

When the concentration is lower than the limit of detection (LDM), one uses half of limit LDM for the calculation of the loads.

The gross loads of each cell are calculated by using the total volume of water recovered with the cell (including the volume of rainwater). The load brute

total (nap ESP 1-2-3, column kg/d) is obtained by adding the gross loads with each cell.

The total average concentrations (Nap ESP 1-2-3, column mg/L) are obtained by multiplying the total gross loads by 106, the whole divided by the effective volume of leachate (excluding rainwater). This way of making eliminates the effect of dilution connected to the rain by putting forth the assumption that the contents of rainwater (in mg/L) are null.

ASSESSMENT OF THE LOADS AND EFFECTIVENESS OF REMOVAL FOR PIPE AND STONE (CPC 1-2-3)

July 3, 2003

Point			Tank of loading	CPC 1		CPC 2		CPC 3		SOMME CPC 1-2-3		EFFECTIVENESS Of REMOVAL
Volume recovered by cell			N/A	74 L/d		653 L/d				727 L/d		
Effective volume (without the rain)			N/A	73 L/d		653 L/d				726 L/d		
Parameters to be analyzed	Units	LDM	mg/L	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	(%)
TSS	mg/L	1	67	< 1	0.00004	23	0.01502	---	---	20.7	0.0151	69.1%
BOD5 C	mg/L	2	98	< 2	0.00007	11	0.00718	---	---	10.0	0.0073	89.8%
BOD5 C soluble	mg/L	2	51	< 2	0.00007	< 2	0.00065	---	---	1.0	0.0007	98.0%
COD total	mg/L	3	213	46	0.00339	105	0.06857	---	---	99.1	0.0720	53.5%
COD soluble	mg/L	3	73	20	0.00147	66	0.04310	---	---	61.4	0.0446	15.9%
TKN	mg N/L	0.9	26	8.4	0.00062	26	0.01698	---	---	24.2	0.0176	6.8%
NH4	mg N/L	0.5	15	2.8	0.00021	17	0.01110	---	---	15.6	0.0113	-3.8%
NO2	mg N/L	0.05	---	< 0.05	0.000002	< 0.05	0.00002	---	---	0.0	0.00002	N/A
NO3	mg N/L	0.05	---	11	0.00081	4.1	0.00268	---	---	4.8	0.0035	N/A
NO2-NO3	mg N/L	0.05	< 0.05	11	0.00081	4.1	0.00268	---	---	4.8	0.0035	N/A
P total	mg P/L	0.3	3.6	1.0	0.00007	2.1	0.00137	---	---	2.0	0.0014	44.7%
			Concentration	Conc.	Removal	Conc.	Removal	Conc.	Removal	Conc.	Units	
Coli. Fecal	UFC/100 mL	10	2 600 000	5 400	99.792%	160 000	93.844%	---	---	144 390	UFC/100 mL	94.447%
Coli. Fecal filtered	UFC/100 mL	10	120 000	330	99.724%	34 000	71.655%	---	---	30 600	UFC/100 mL	74.500%

Note :

When the concentration is lower than the limit of detection (LDM), one uses half of limit LDM for the calculation of the loads.

The gross loads of each cell are calculated by using the total volume of leachate recovered with the cell (including the volume of rainwater). The load

brute total (nap ESP 1-2-3, column kg/d) is obtained by adding the gross loads with each cell.

The total average concentrations (Nap ESP 1-2-3, column mg/L) are obtained by multiplying the total gross loads by 106, the whole divided by the effective volume of leachate (excluding rainwater). This way of making eliminates the effect of dilution connected to the rain by putting forth the assumption that the contents of rainwater (in mg/L) are null.

ENVIRONNEMENT ESA

ASSESSMENT OF THE LOADS AND EFFECTIVENESS OF REMOVAL FOR THE SECTION ENVIRO-SEPTIC® (Esp 1-2-3)

July 3, 2003

Point			Tank of loading	ESP 1		ESP 2		ESP 3		SUMMON ESP 1-2-3		EFFECTIVENESS Of REMOVAL
Volume recovered by cell			N/A	172 L/d		220 L/d		1038 L/d		1431 L/d		
Effective volume (without the rain)			N/A	172 L/d		220 L/d		1038 L/d		1430 L/d		
Parameters to be analyzed	Unités	LDM	mg/L	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	(%)
TSS	mg/L	1	94	2	0.0003	1	0.0002	40	0.0415	29.4	0.0421	68.7%
BOD5 C	mg/L	2	207	< 2	0.0002	< 2	0.0002	40	0.0415	29.3	0.0419	85.8%
BOD5 C soluble	mg/L	2	161	< 2	0.0002	< 2	0.0002	11	0.0114	8.3	0.0118	94.9%
COD total	mg/L	3	512	< 3	0.0003	< 3	0.0003	177	0.1838	128.9	0.1844	74.8%
COD soluble	mg/L	3	276	< 3	0.0003	< 3	0.0003	112	0.1163	81.7	0.1169	70.4%
TKN	mg N/L	0.9	38	1	0.0002	2	0.0004	24	0.0249	17.9	0.0256	53.0%
NH4	mg N/L	0.5	21	< 0.5	0.00004	< 0.5	0.0001	14	0.0145	10.2	0.0146	51.3%
NO2	mg N/L	0.05	< 0.05	< 0.05	0.000004	< 0.05	0.000006	< 0.05	0.000026	0.03	0.000036	N/A
NO3	mg N/L	0.05	0.3	35	0.0060	37	0.0081	12	0.0125	18.6	0.0266	N/A
NO2-NO3	mg N/L	0.05	0.3	35	0.0060	37	0.0081	12	0.0125	18.6	0.0266	N/A
P total	mg P/L	0.3	4.2	1.3	0.0002	1.5	0.0003	1.6	0.0017	1.5	0.0022	63.1%
			Concentration	Conc.	Removal	Conc.	Removal	Conc.	Removal	Conc.	Units	
Coli. Fecal	UFC/100 mL	10	530 000	240	99.955%	1 100	99.792%	210 000	60.367%	152 632	UFC/100 mL	71.202%
Coli. Fecal filtered	UFC/100 mL	10	260 000	27	99.990%	90	99.965%	130 000	49.987%	94 381	UFC/100 mL	63.700%

Note :

When the concentration is lower than the limit of detection (LDM), one uses half of limit LDM for the calculation of the loads.

The gross loads of each cell are calculated by using the total volume of leachate recovered with the cell (including the volume of rainwater). The load

brute total (nap ESP 1-2-3, column kg/d) is obtained by adding the gross loads with each cell.

The total average concentrations (Nap ESP 1-2-3, column mg/L) are obtained by multiplying the total gross loads by 106, the whole divided by the effective volume of leachate (excluding rainwater). This way of making eliminates the effect of dilution connected to the rain by putting forth the assumption that the contents of rainwater (in mg/L) are null.

ASSESSMENT OF THE LOADS AND EFFECTIVENESS OF REMOVAL FOR PIPE AND STONE (CPC 1-2-3)

June 3, 2003

Point			Tank of loading	CPC 1		CPC 2		CPC 3		SUMMON CPC 1-2-3		EFFECTIVENESS Of REMOVAL
Volume recovered by cell			N/A	274 L/d		246 L/d				520 L/d		
Effective volume (without the rain)			N/A	269 L/d		242 L/d				511 L/d		
Parameters to be analyzed	Units	LDM	mg/L	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	(%)
TSS	mg/L	1	67	9	0.0025	9	0.0022	---	---	9.2	0.0047	86.3%
BOD5 C	mg/L	2	98	8	0.0022	12	0.0030	---	---	10.1	0.0051	89.7%
BOD5 C soluble	mg/L	2	51	5	0.0014	6	0.0015	---	---	5.6	0.0028	89.1%
COD total	mg/L	3	213	17	0.0047	46	0.0113	---	---	31.3	0.0160	85.3%
COD soluble	mg/L	3	73	11	0.0030	17	0.0042	---	---	14.1	0.0072	80.7%
TKN	mg N/L	0.9	26	12	0.0033	14	0.0034	---	---	13.2	0.0067	49.3%
NH4	mg N/L	0.5	15	2.8	0.0008	9.6	0.0024	---	---	6.1	0.0031	59.2%
NO2	mg N/L	0.05	---	---	---	---	---	---	---			N/A
NO3	mg N/L	0.05	---	---	---	---	---	---	---			N/A
NO2-NO3	mg N/L	0.05	< 0.05	6.8	0.0019	5.3	0.0013	---	---	6.2	0.0032	N/A
P total	mg P/L	0.3	3.6	2.1	0.0006	2.5	0.0006	---	---	2.3	0.0012	35.3%
			Concentration	Conc.	Removal	Conc.	Removal	Conc.	Removal	Conc.	Units	
Coli. Fecal	UFC/100 mL	10	2 600 000	150 000	94.135%	170 000	93.340%	---	---	160 966	UFC/100 mL	93.809%
Coli. Fecal filtered	UFC/100 mL	10	120 000	5 400	95.425%	20 000	83.024%	---	---	12 489	UFC/100 mL	89.593%

Note :

When the concentration is lower than the limit of detection (LDM), one uses half of limit LDM for the calculation of the loads.

The gross loads of each cell are calculated by using the total volume of leachate recovered with the cell (including the volume of rainwater). The load

brute total (nap ESP 1-2-3, column kg/d) is obtained by adding the gross loads with each cell.

The total average concentrations (Nap ESP 1-2-3, column mg/L) are obtained by multiplying the total gross loads by 106, the whole divided by the effective volume of leachate (excluding rainwater). This way of making eliminates the effect of dilution connected to the rain by putting forth the assumption that the contents of rainwater (in mg/L) are null.

ASSESSMENT OF THE LOADS AND EFFECTIVENESS Of REMOVAL FOR THE SECTION ENVIRO-SEPTIC® (Esp 1-2-3)

June 3, 2003

Point			Tank of loading	ESP 1		ESP 2		ESP 3		SUMMON ESP 1-2-3		EFFECTIVENESS Of REMOVAL
Volume recovered by cell			N/A	230 L/d		239 L/d		299 L/d		768 L/d		
Effective volume (without the rain)			N/A	225 L/d		234 L/d		295 L/d		754 L/d		
Parameters to be analyzed	Unités	LDM	mg/L	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	(%)
TSS	mg/L	1	70	2	0.0005	4	0.0010	4	0.0012	3.5	0.0026	95.1%
BOD5 C	mg/L	2	113	< 2	0.0002	< 2	0.0002	2	0.0006	1.4	0.0011	98.7%
BOD5 C soluble	mg/L	2	47	< 2	0.0002	< 2	0.0002	< 2	0.0003	1.0	0.0008	97.8%
COD total	mg/L	3	270	< 3	0.0003	6	0.0014	6	0.0018	4.7	0.0036	98.2%
COD soluble	mg/L	3	78	< 3	0.0003	< 3	0.0004	< 3	0.0004	1.5	0.0012	98.0%
TKN	mg N/L	0.9	29	< 0.9	0.0001	< 0.9	0.0001	1	0.0003	0.6	0.0005	97.8%
NH4	mg N/L	0.5	14	< 0.5	0.0001	< 0.5	0.0001	< 0.5	0.0001	0.3	0.0002	98.2%
NO2	mg N/L	0.05	---	---	---	---	---	---	---			N/A
NO3	mg N/L	0.05	---	---	---	---	---	---	---			N/A
NO2-NO3	mg N/L	0.05	< 0.05	20	0.0046	26	0.0062	33	0.0099	27.4	0.0207	N/A
P total	mg P/L	0.3	3.8	1.2	0.0003	0.8	0.0002	0.4	0.0001	0.8	0.0006	79.5%
			Concentration	Conc.	Removal	Conc.	Removal	Conc.	Removal	Conc.	Units	
Coli. Fecal	UFC/100 mL	10	2 100 000	390	99.981%	730	99.965%	1 500	99.927%	942	UFC/100 mL	99.955%
Coli. Fecal filtered	UFC/100 mL	10	200 000	63	99.968%	90	99.954%	130	99.934%	99	UFC/100 mL	99.951%

Note: The total average concentrations (Nap ESP 1-2-3, column mg/L) are obtained by multiplying the total gross loads by 106, the whole divided by the effective volume of leachate (excluding rainwater).

This way of making eliminates the effect of dilution connected to the rain by putting forth the assumption that the contents of rainwater (in mg/L) are null.

The gross loads of each cell are calculated by using the total volume of leachate recovered with the cell (including the volume of rainwater).

The load brute total (nap ESP 1-2-3, column kg/d) is obtained by adding the gross loads with each cell.

ASSESSMENT OF THE LOADS AND EFFECTIVENESS OF REMOVAL FOR PIPE AND STONE(CPC 1-2-3)

28 May 2003

Not			Tank of loading	CPC 1		CPC 2		CPC 3		SUM CPC 1-2-3		EFFECTIVENESS Of REMOVAL
Volume recovered by cell			N/A	524 L/d		118 L/d		3 L/d		645 L/d		
Effective volume (without the rain)			N/A	515 L/d		109 L/d				623 L/d		
Parameters to be	Unit	LDM	mg/L	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	(%)
TSS	mg/L	1	67	8	0.0042	15	0.0018	---	---	9.6	0.0060	85.7%
BOD5 C	mg/L	2	98	17	0.0089	27	0.0032	---	---	19.4	0.0121	80.2%
BOD5 C soluble	mg/L	2	51	9	0.0047	9	0.0011	---	---	9.3	0.0058	81.8%
COD total	mg/L	3	213	166	0.0870	142	0.0168	---	---	166.5	0.1038	21.8%
COD soluble	mg/L	3	73	67	0.0351	116	0.0137	---	---	78.3	0.0488	-7.3%
TKN	mg N/L	0.9	26	20	0.0105	18	0.0021	---	---	20.2	0.0126	22.2%
NH4	mg N/L	0.5	15	14	0.0073	13	0.0015	---	---	14.2	0.0089	5.1%
NO2	mg N/L	0.05	---	---	---	---	---	---	---			N/A
NO3	mg N/L	0.05	---	---	---	---	---	---	---			N/A
NO2-NO3	mg N/L	0.05	< 0.05	4.7	0.0025	4.3	0.0005	---	---	4.8	0.0030	N/A
P total	mg P/L	0.3	3.6	2.9	0.0015	2.8	0.0003	---	---	3.0	0.0019	17.5%
			Concentration	Conc.	Removal	Conc.	Removal	Conc.	Removal	Conc.	Unit	
Coli. Fecal	UFC/100 mL	10	2 600 000	400 000	84.330%	1 100 000	53.985%	---	---	544 406	UFC/100 mL	79.061%
Coli. Fecal filtered	UFC/100 mL	10	120 000	34 000	71.142%	45 000	59.214%	---	---	36 600	UFC/100 mL	69.500%

Note: When the concentration is lower than the limit of detection (LDM), one uses half of limit LDM for the calculation of the loads.

The grossloads of each cell are calculated by using the total volume of leachate recovered with the cell (including the volume of rainwater).

The total grossload (nap CPC 1-2-3, column kg/d) is obtained by adding the grossloads with each cell.

The total average concentrations (Somme CPC 1-2-3, column mg/L) are obtained by multiplying the total grossloads by 106, the whole divided by the effective volume of leachate (excluding rainwater).

This way of making eliminates the effect of dilution connected to the rain by putting forth the assumption that the contents of rainwater (in mg/L) are null.

ASSESSMENT OF THE LOADS AND EFFECTIVENESS OF REMOVAL FOR THE SECTION ENVIRO-SEPTIC® (Esp 1-2-3)

May 28, 2003

Not			Tank of loading	ESP 1		ESP 2		ESP 3		SUM ESP 1-2-3		EFFECTIVENESS Of REMOVAL
Volume recovered by cell			N/A	217 L/d		238 L/d		242 L/d		698 L/d		
Effective volume (without the rain)			N/A	208 L/d		229 L/d		233 L/d		669 L/d		
Parameters to be	Unit	LDM	mg/L	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	(%)
TSS	mg/L	1	74	< 1	0.0001	2	0.0005	3	0.0007	2.0	0.0013	97.3%
BOD5 C	mg/L	2	152	< 2	0.0002	< 2	0.0002	< 2	0.0002	1.0	0.0007	99.3%
BOD5 C soluble	mg/L	2	73	< 2	0.0002	< 2	0.0002	< 2	0.0002	1.0	0.0007	98.6%
COD total	mg/L	3	432	< 3	0.0003	< 3	0.0004	< 3	0.0004	1.6	0.0010	99.6%
COD soluble	mg/L	3	298	< 3	0.0003	< 3	0.0004	< 3	0.0004	1.6	0.0010	99.5%
TKN	mg N/L	0.9	31	< 0.9	0.0001	< 0.9	0.0001	1	0.0003	0.7	0.0005	97.7%
NH4	mg N/L	0.5	21	< 0.5	0.0001	< 0.5	0.0001	< 0.5	0.0001	0.3	0.0002	98.8%
NO2	mg N/L	0.05	---	---	---	---	---	---	---			N/A
NO3	mg N/L	0.05	---	---	---	---	---	---	---			N/A
NO2-NO3	mg N/L	0.05	< 0.05	25	0.0054	25	0.0060	45	0.0109	33.3	0.0223	N/A
P total	mg P/L	0.3	4.3	1.1	0.0002	0.8	0.0002	0.5	0.0001	0.8	0.0006	80.9%
			Concentration	Conc.	Removal	Conc.	Removal	Conc.	Removal	Conc.	Unit	
Coli. Fecal	UFC/100 mL	10	2 400 000	2 800	99.878%	4 100	99.822%	9	100.000%	2 333	UFC/100 mL	99.903%
Coli. Fecal filtered	UFC/100 mL	10	380 000	200	99.945%	390	99.893%	< 10	99.999%	203	UFC/100 mL	99.947%

Note: When the concentration is lower than the limit of detection (LDM), one uses half of limit LDM for the calculation of the loads.

The grossloads of each cell are calculated by using the total volume of leachate recovered with the cell (including the volume of rainwater).

The total grossload (nap ESP 1-2-3, column kg/d) is obtained by adding the grossloads with each cell.

The total average concentrations (Nap ESP 1-2-3, column mg/L) are obtained by multiplying the total grossloads by 106, the whole divided by the effective volume of leachate (excluding rainwater).

This way of making eliminates the effect of dilution connected to the rain by putting forth the assumption that the contents of rainwater (in mg/L) are null.

ASSESSMENT OF THE LOADS AND EFFECTIVENESS OF REMOVAL FOR PIPE AND STONE (CPC 1-2-3)

May 14, 2003

Not			Tank of loading	CPC 1		CPC 2		CPC 3		SUMMON CPC 1-2-3		EFFECTIVENESSOf REMOVAL
Volume recovered by cell			N/A	624 L/d		18 L/d		40 L/d		682 L/d		
Effective volume (without the rain)			N/A	616 L/d		10 L/d		33 L/d		660 L/d		
Parameters to be	Unit	LDM	mg/L	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	(%)
TSS	mg/L	1	67	7	0.0044	7	0.00013	5	0.00020	7.1	0.0047	89.4%
BOD5 C	mg/L	2	98	8	0.0050	< 2	0.00002	< 2	0.00004	7.7	0.0050	92.2%
BOD5 C soluble	mg/L	2	51	4	0.0025	< 2	0.00002	< 2	0.00004	3.9	0.0026	92.4%
COD total	mg/L	3	213	18	0.0112	< 3	0.00003	6	0.00024	17.4	0.0115	91.8%
COD soluble	mg/L	3	73	12	0.0075	< 3	0.00003	< 3	0.00006	11.5	0.0076	84.3%
TKN	mg N/L	0.9	26	13	0.0081	< 0.9	0.00001	1.3	0.00005	12.4	0.0082	52.4%
NH4	mg N/L	0.5	15	4.9	0.0031	< 0.5	0.00000	< 0.5	0.00001	4.7	0.0031	69.0%
NO2	mg N/L	0.05	---	---	---	---	---	---	---			N/A
NO3	mg N/L	0.05	---	---	---	---	---	---	---			N/A
NO2-NO3	mg N/L	0.05	< 0.05	9	0.0056	24	0.00043	92	0.00372	14.7	0.0097	N/A
P total	mg P/L	0.3	3.6	1.8	0.0011	< 0.3	0.000003	1.2	0.00005	1.8	0.0012	50.6%
			Concentration	Conc.	Removal	Conc.	Removal	Conc.	Removal	Conc.	Unit	
Coli. Fecal	UFC/100 mL	10	2 600 000	320 000	87.543%	9	99.999%	240	99.989%	292 642	UFC/100 mL	88.745%
Coli. Fecal filtered	UFC/100 mL	10	120 000	5 900	95.024%	< 10	99.993%	9	99.991%	5 396	UFC/100 mL	95.503%

Note: When the concentration is lower than the limit of detection (LDM), one uses half of limit LDM for the calculation of the loads.

The grossloads of each cell are calculated by using the total volume of leachate recovered with the cell (including the volume of rainwater).

The total grossload (nap CPC 1-2-3, column kg/d) is obtained by adding the grossloads with each cell.

The total average concentrations (Somme CPC 1-2-3, column mg/L) are obtained by multiplying the total grossloads by 106, the whole divided by the effective volume of leachate (excluding rainwater).

This way of making eliminates the effect of dilution connected to the rain by putting forth the assumption that the contents of rainwater (in mg/L) are null.

ASSESSMENT OF THE LOADS AND EFFECTIVENESS OF REMOVAL FOR THE SECTION ENVIRO-SEPTIC® (ESP 1-2-3)

May 14, 2003

Not			Tank of loading	ESP 1ESP		2		ESP 3		SUM ESP 1-2-3		EFFECTIVENESS OF REMOVAL
Volume recovered by cell			N/A	156 L/d		230 L/d		336 L/d		722 L/d		
Effective volume (without the rain)			N/A	149 L/d		222 L/d		328 L/d		699 L/d		
Parameters to analyze	Unit	LDM	mg/L	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	(%)
TSS	mg/L	1	67	< 1	0.0001	2	0.0005	3	0.0010	2.2	0.0015	96.7%
BOD5 C	mg/L	2	98	< 2	0.0002	< 2	0.0002	< 2	0.0003	1.0	0.0007	98.9%
BOD5 C soluble	mg/L	2	51	< 2	0.0002	< 2	0.0002	< 2	0.0003	1.0	0.0007	98.0%
COD total	mg/L	3	213	< 3	0.0002	< 3	0.0003	6	0.0020	3.7	0.0026	98.3%
COD soluble	mg/L	3	73	< 3	0.0002	< 3	0.0003	< 3	0.0005	1.5	0.0011	97.9%
TKN	mg N/L	0.9	26	< 0.9	0.0001	< 0.9	0.0001	5	0.0018	2.8	0.0020	89.1%
NH4	mg N/L	0.5	15	< 0.5	0.00004	< 0.5	0.0001	2	0.0008	1.2	0.0009	91.7%
NO2	mg N/L	0.05	---	---	---	---	---	---	---			N/A
NO3	mg N/L	0.05	---	---	---	---	---	---	---			N/A
NO2-NO3	mg N/L	0.05	< 0.05	24	0.0037	29	0.0067	30	0.0101	29.3	0.0205	N/A
P total	mg P/L	0.3	3.6	1.1	0.0002	0.9	0.0002	0.8	0.0003	0.9	0.0006	74.3%
			Concentration	Conc.	Removal	Conc.	Removal	Conc.	Removal	Conc.	Unit	
Coli. Fecal	UFC/100 mL	10	2 600 000	120	99.995%	140	99.994%	99	99.996%	119	UFC/100 mL	99.995%
Coli. Fecal filtered	UFC/100 mL	10	120 000	27	99.976%	< 10	99.996%	< 10	99.996%	11	UFC/100 mL	99.991%

Note: When the concentration is lower than the limit of detection (LDM), one uses half of limit LDM for the calculation of the loads.

The grossloads of each cell are calculated by using the total volume of leachate recovered with the cell (including the volume of rainwater).

The total grossload (nap ESP 1-2-3, column kg/d) is obtained by adding the grossloads with each cell.

The total average concentrations (Nap ESP 1-2-3, column mg/L) are obtained by multiplying the total grossloads by 106, the whole divided by the effective volume of leachate(excluding rainwater).

This way of making eliminates the effect of dilution connected to the rain by putting forth the assumption that the contents of rainwater (in mg/L) are null.

6.5 Assessment of the loads and effectiveness of treatment

The following section presents the unit of mass assessments calculated for each section vs. treatment in the septic tank. One presents calculations of effectiveness of removal for each parameter by cell of treatment.

6.5.1 Assessment of the mass loads

The tables of this section summarize the results of the mass loads obtained during the follow-up by cell of treatment, of May 14 to September 29, 2003. The sampling campaigns preceding on May 14 were not considered taking into account the lack of data available, the bacterial surface not being established yet on the entire cell of treatment (ESP 1-2-3 and CPC 1-2-3).

To make the assessment, we used infiltrated volumes of effluent corresponding to the sampling days for each cell of treatment. To be able to establish the mass balance and the effectiveness of the treatment by each section of treatment, we calculated the loads in each section by multiplying the volume of effluent recovered (e.g.: Esp 1 + ESP 2 + ESP 3) by the concentration analyzed on the outlet side of the septic tank. We put forth the assumption that the concentration at the entry of each section of treatment is equal. Knowing that the flow reaching each section is not perfectly equal the loads were calculated in the following way:

Loads (kg/d) = Flow (L/d) X Concentration (mg/L) X 10^{-6}

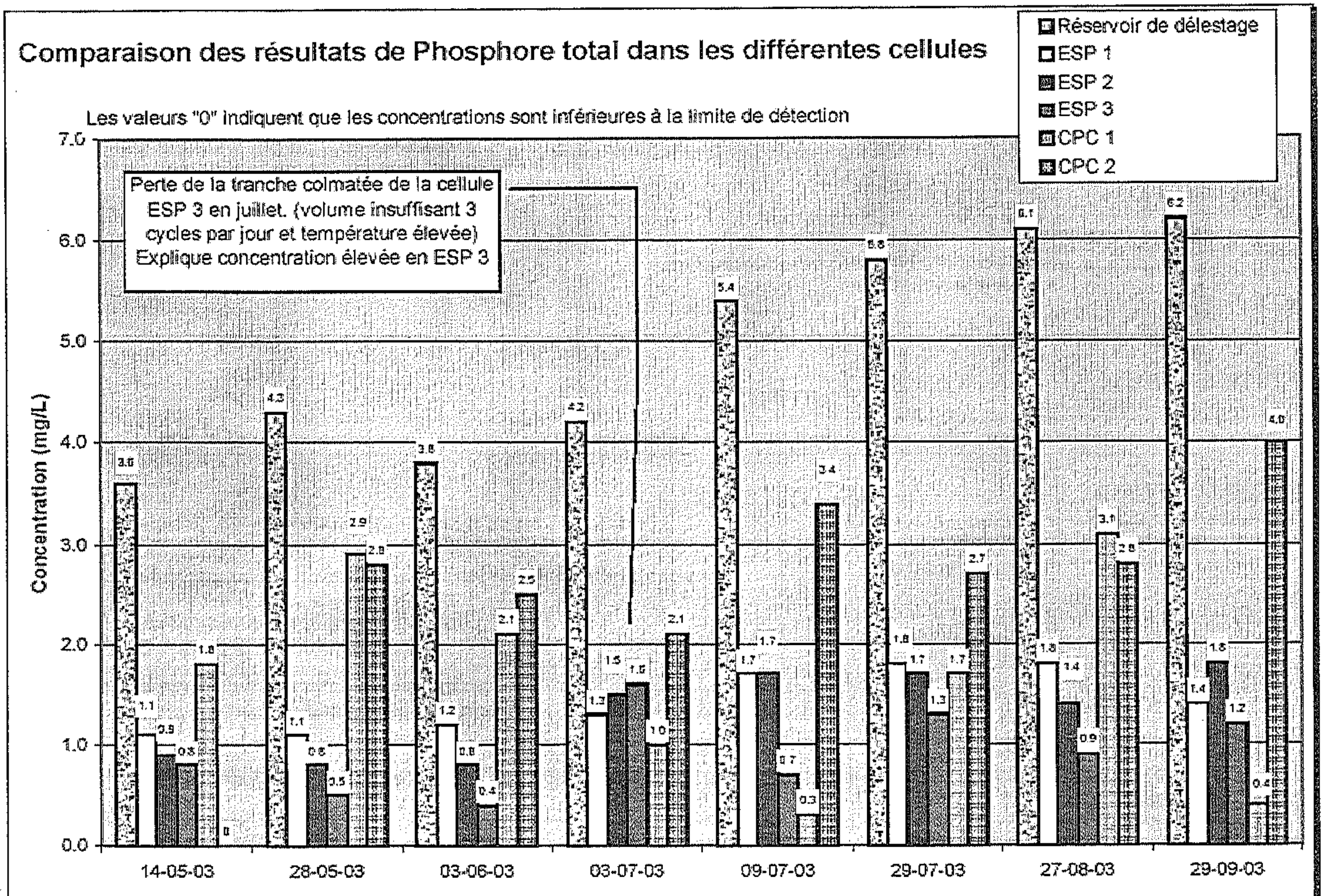
The multiplication factor of 10^{-6} is used to convert the units of milligrams (Mg) into kilogrammes (kg).

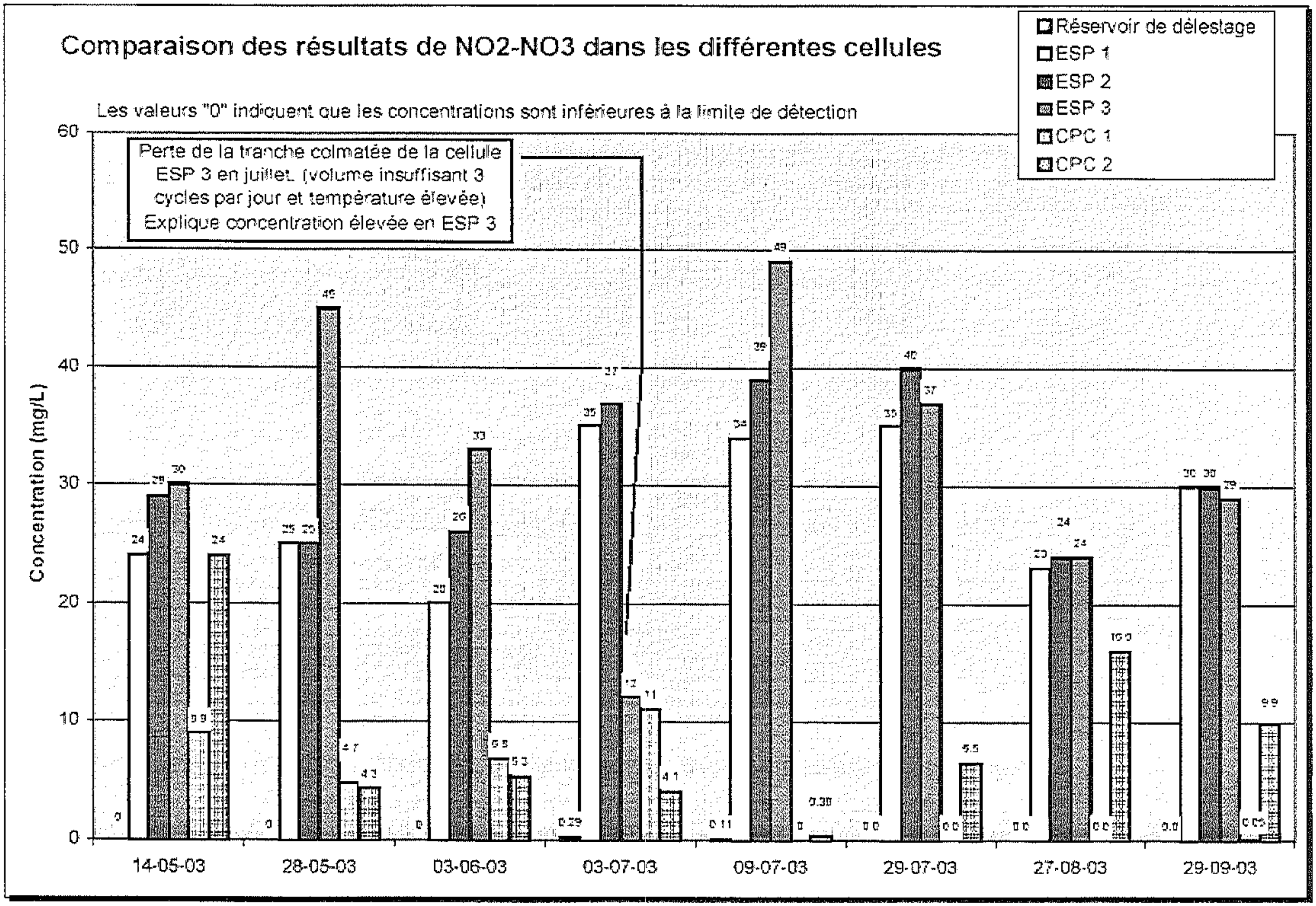
Significant:

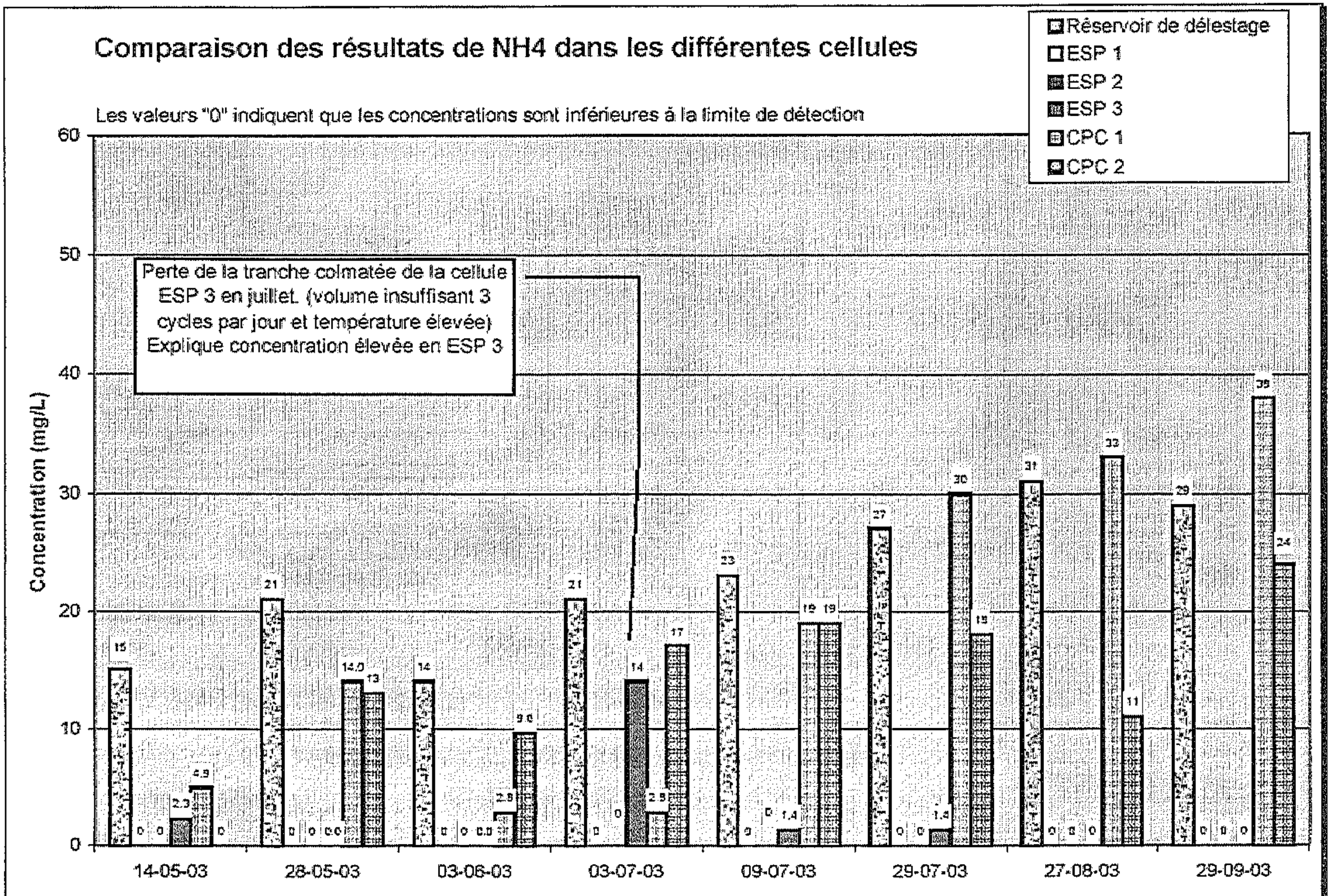
For the calculations of mass loads, we considered that the concentration was equal to half of the limit of detection at the time of the result appearing with the certificates under the limit of detection. This way of making appears to us most logical given that it corresponds to the median between the value being located right under the limit of detection and 0.

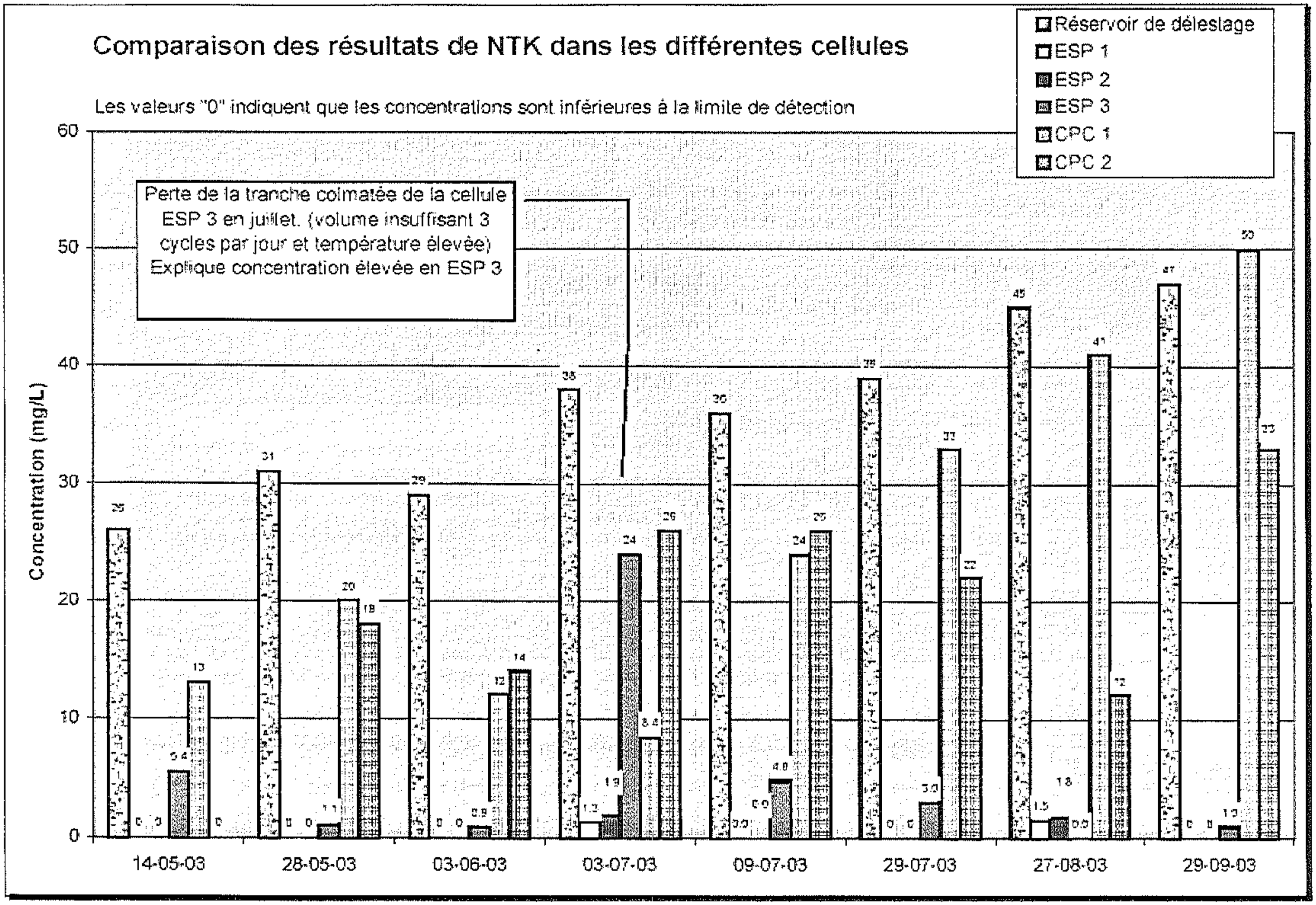
Let us mention that our vast experience in the field of the characterization of effluent would normally dictate us to consider a zero load when the concentration is not detected. It is at least this way of proceeding which is generally recommended by the MENV and Environment Canada, in particular the projects of characterization of 2nd Generation of the Effluents of the Factories of Pastes and Papers, just as the project carried out within the framework of program SLV 2000. These significant projects, carried out during 8 last years, are references in the field of the characterization of effluent.

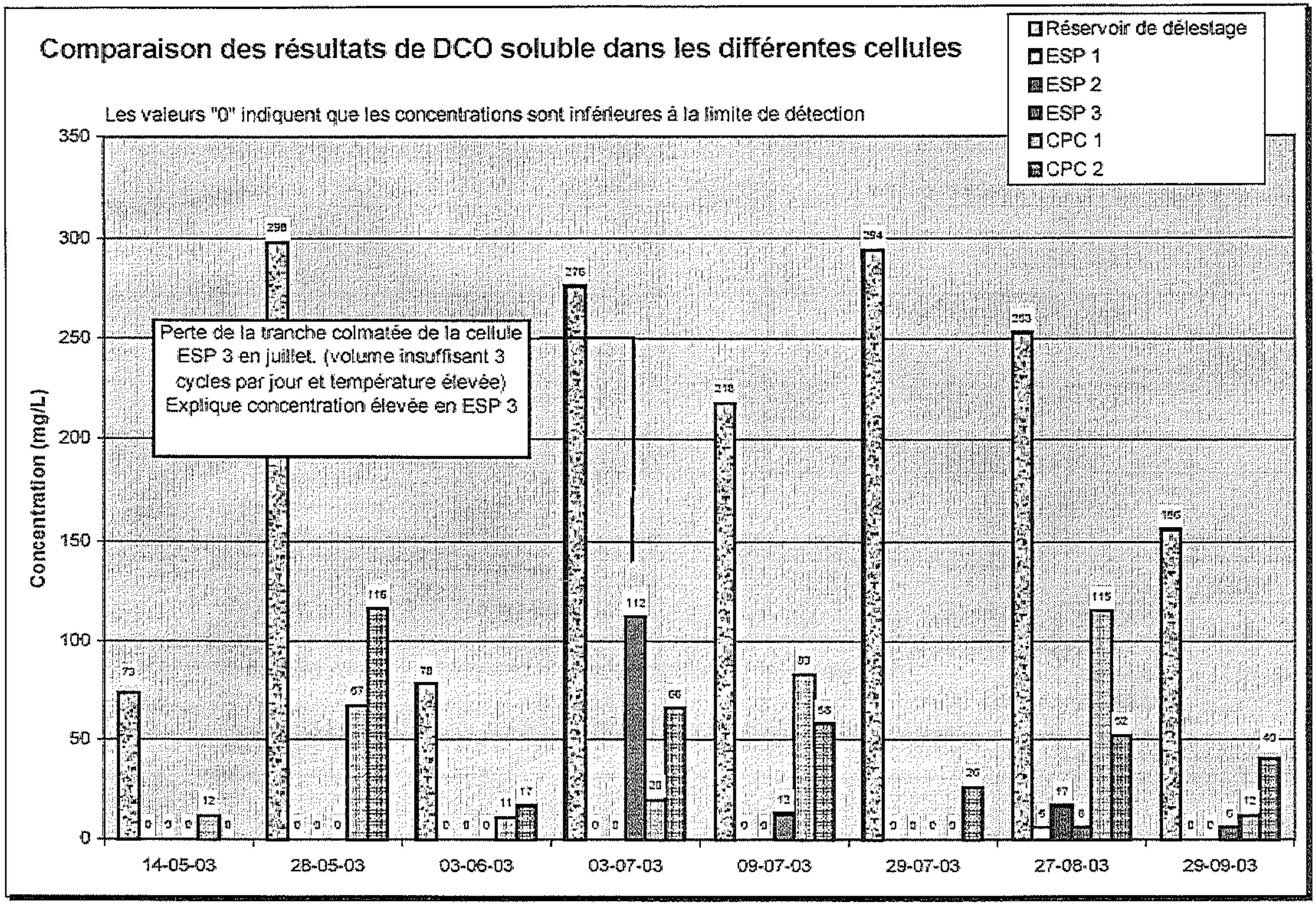
Our way of making with the present report is preserving in the sense that it does not improve the results and could even prove in extreme cases penalizing.

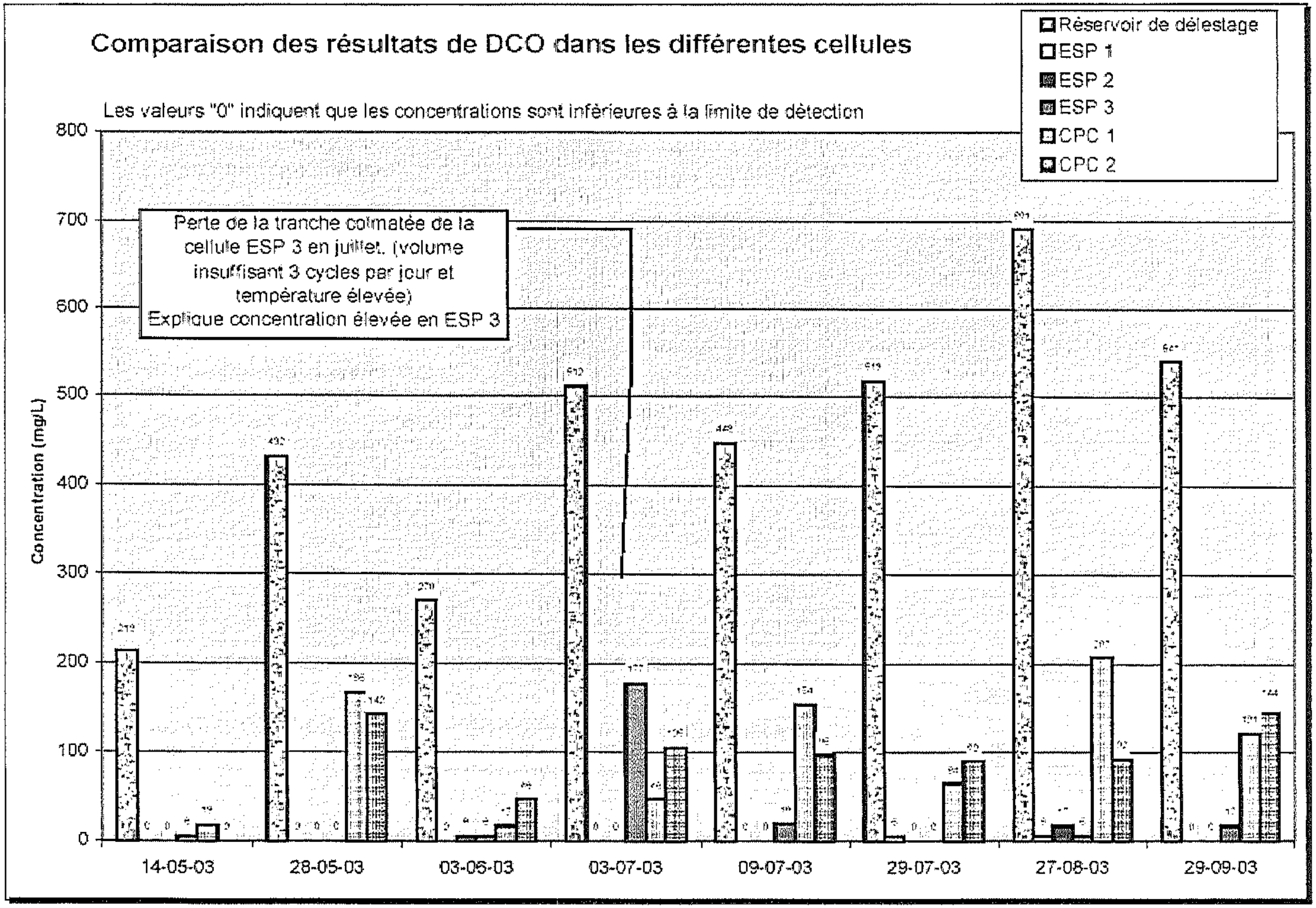

Comparaison des résultats de Phosphore total dans les différentes cellules
Les valeurs "0" indiquent que les concentrations sont inférieures à la limite de détection
Réservoir de délestage
ESP 1
ESP 2
ESP 3
CPC 1
CPC 2
Perte de la tranche colmatée de la cellule ESP 3 en juillet. (volume insuffisant 3 cycles par jour et température élevée) Explique concentration élevée en ESP 3
Concentration (mg/L)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
14-05-03
28-05-03
03-06-03
03-07-03
09-07-03
29-07-03
27-08-03
29-09-03

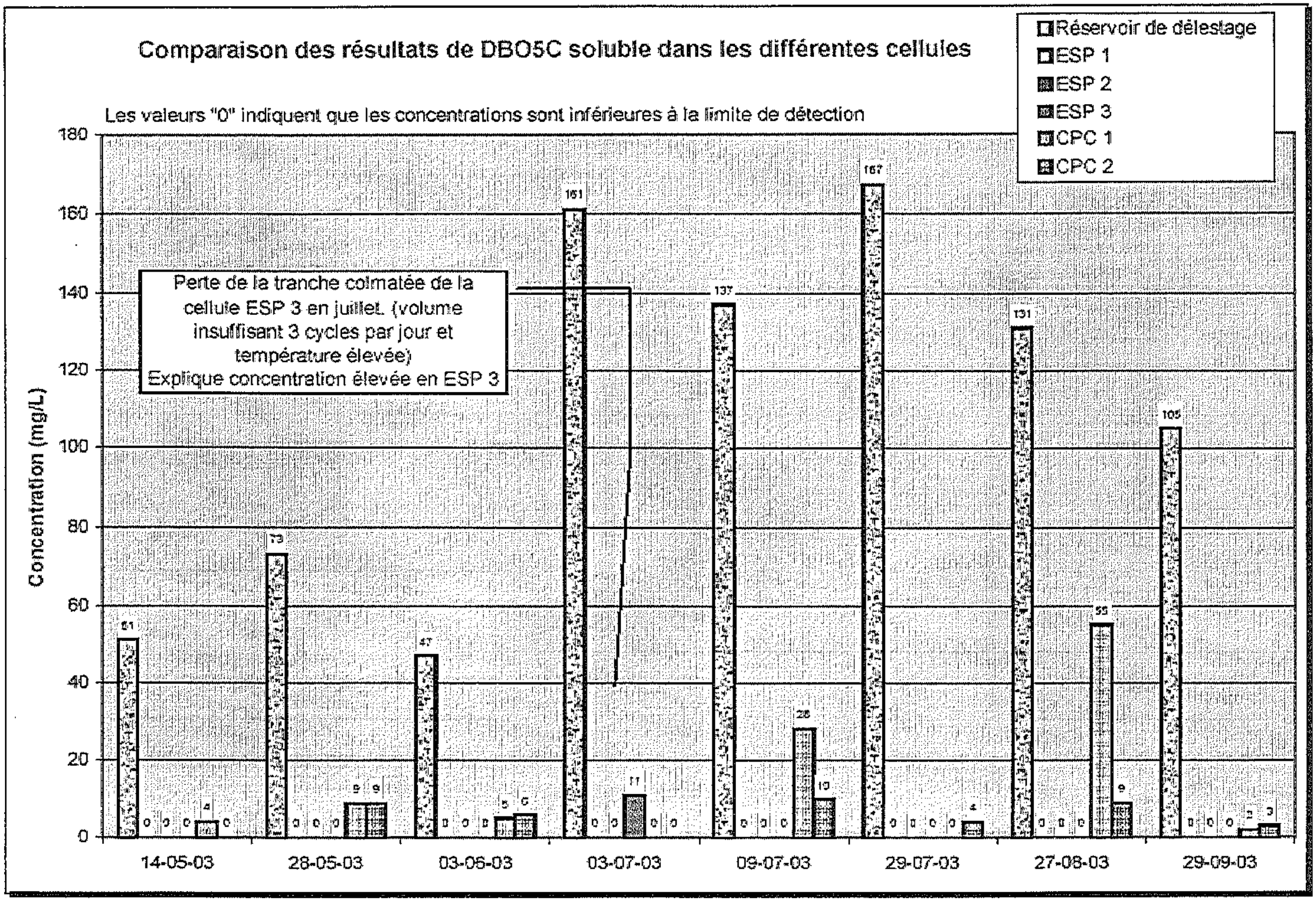

Comparaison des résultats de NO2-NO3 dans les différentes cellules
Les valeurs "0" indiquent que les concentrations sont inférieures à la limite de détection
Perte de la tranche colmatée de la cellule ESP 3 en juillet. (volume insuffisant 3 cycles par jour et température élevée) Explique concentration élevée en ESP 3
Réservoir de délestage
ESP 1
ESP 2
ESP 3
CPC 1
CPC 2
Concentration (mg/L)
60
50
40
30
20
10
0
14-05-03
28-05-03
03-06-03
03-07-03
09-07-03
29-07-03
27-08-03
29-09-03

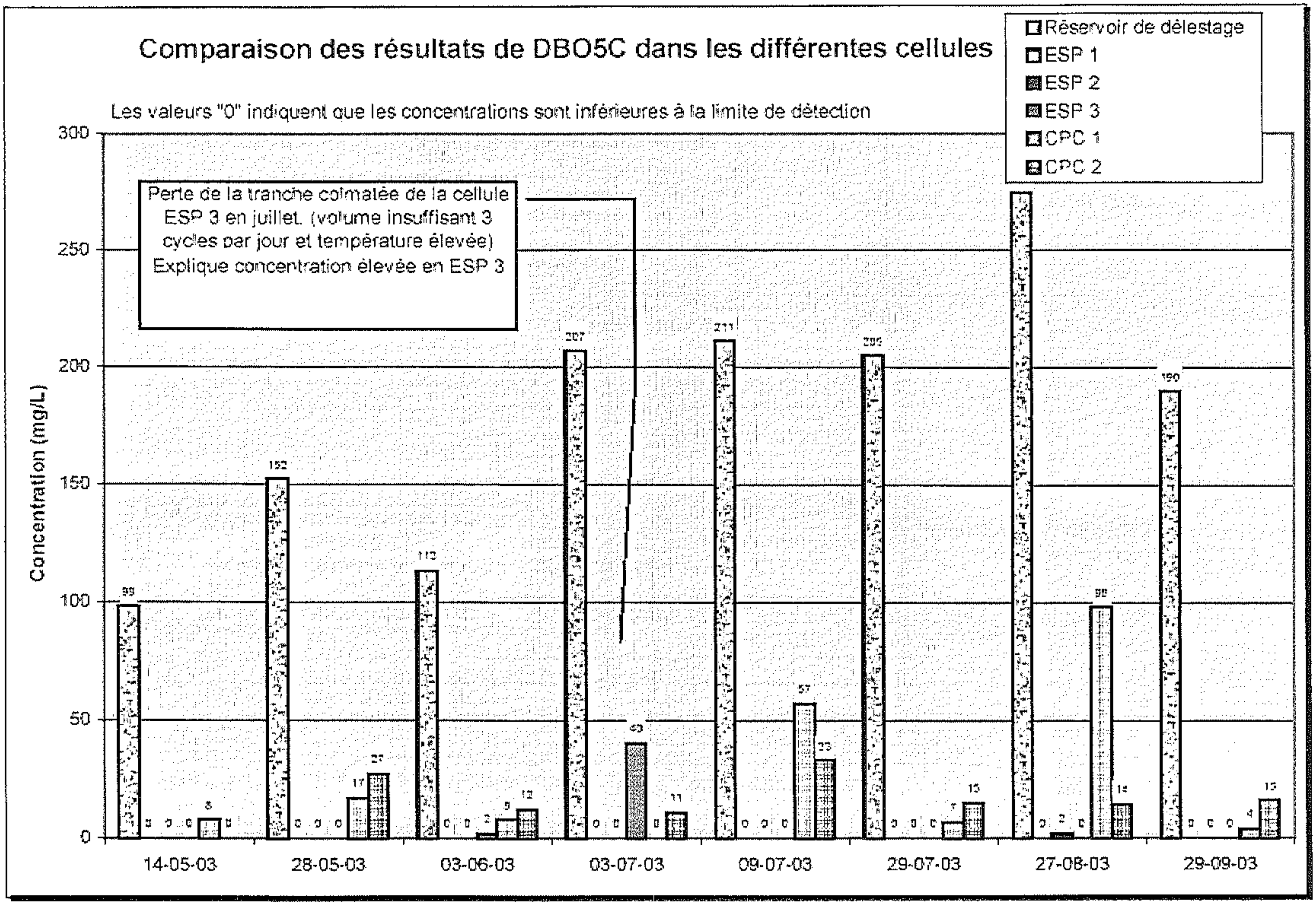

Comparaison des résultats de NH4 dans les différentes cellules
Les valeurs "0" indiquent que les concentrations sont inférieures à la limite de détection
Réservoir de délestage
ESP 1
ESP 2
ESP 3
CPC 1
CPC 2
Perte de la tranche colmatée de la cellule ESP 3 en juillet. (volume insuffisant 3 cycles par jour et température élevée) Explique concentration élevée en ESP 3
Concentration (mg/L)
60
50
40
30
20
10
0
14-05-03
28-05-03
03-06-03
03-07-03
09-07-03
29-07-03
27-08-03
29-09-03

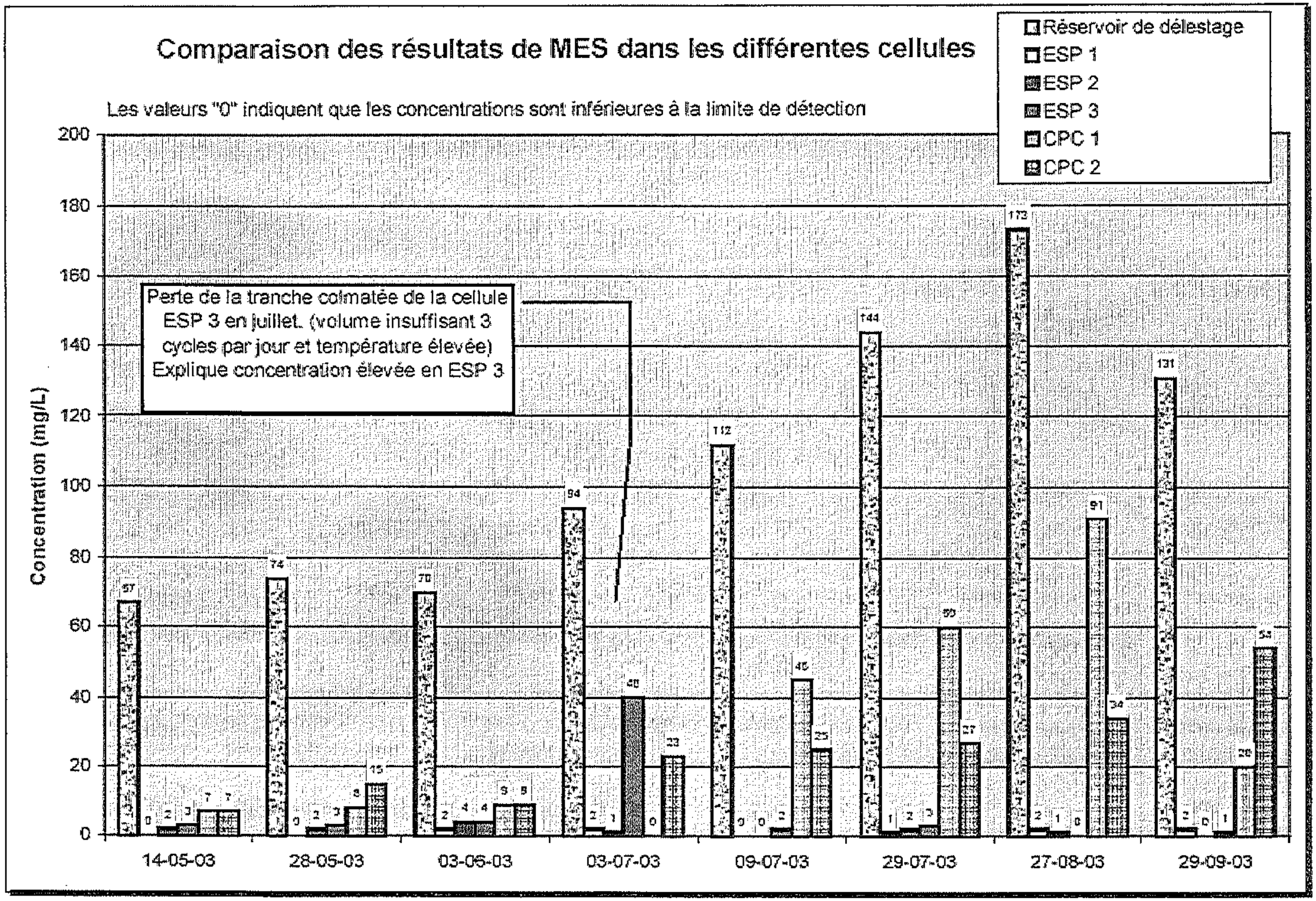

Comparaison des résultats de NTK dans les différentes cellules
Les valeurs "0" indiquent que les concentrations sont inférieures à la limite de détection
Réservoir de délestage
ESP 1
ESP 2
ESP 3
CPC 1
CPC 2
Perte de la tranche colmatée de la cellule ESP 3 en juillet. (volume insuffisant 3 cycles par jour et température élevée) Explique concentration élevée en ESP 3
Concentration (mg/L)
60
50
40
30
20
10
0
14-05-03
28-05-03
03-06-03
03-07-03
09-07-03
29-07-03
27-08-03
29-09-03


Comparaison des résultats de DCO soluble dans les différentes cellules
Les valeurs "0" indiquent que les concentrations sont inférieures à la limite de détection
Réservoir de délestage
ESP 1
ESP 2
ESP 3
CPC 1
CPC 2
Perte de la tranche colmatée de la cellule ESP 3 en juillet. (volume insuffisant 3 cycles par jour et température élevée) Explique concentration élevée en ESP 3
Concentration (mg/L)
350
300
250
200
150
100
50
0
14-05-03
28-05-03
03-06-03
03-07-03
09-07-03
29-07-03
27-08-03
29-09-03


Comparaison des résultats de DCO dans les différentes cellules
Les valeurs "0" indiquent que les concentrations sont inférieures à la limite de détection
Réservoir de délestage
ESP 1
ESP 2
ESP 3
CPC 1
CPC 2
Perte de la tranche colmatée de la cellule ESP 3 en juillet. (volume insuffisant 3 cycles par jour et température élevée)
Explique concentration élevée en ESP 3
Concentration (mg/L)
800
700
600
500
400
300
200
100
0
14-05-03
28-05-03
03-06-03
03-07-03
09-07-03
29-07-03
27-08-03
29-09-03


Comparaison des résultats de DBO5C soluble dans les différentes cellules
Les valeurs "0" indiquent que les concentrations sont inférieures à la limite de détection
Réservoir de délestage
ESP 1
ESP 2
ESP 3
CPC 1
CPC 2
Perte de la tranche colmatée de la cellule ESP 3 en juillet. (volume insuffisant 3 cycles par jour et température élevée)
Explique concentration élevée en ESP 3
Concentration (mg/L)
0
20
40
60
80
100
120
140
160
180
14-05-03
28-05-03
03-06-03
03-07-03
09-07-03
29-07-03
27-08-03
29-09-03


Comparaison des résultats de DBO5C dans les différentes cellules
Les valeurs "0" indiquent que les concentrations sont inférieures à la limite de détection
Réservoir de délestage
ESP 1
ESP 2
ESP 3
CPC 1
CPC 2
Perte de la tranche colmatée de la cellule ESP 3 en juillet. (volume insuffisant 3 cycles par jour et température élevée) Explique concentration élevée en ESP 3
Concentration (mg/L)
300
250
200
150
100
50
0
14-05-03
28-05-03
03-06-03
03-07-03
09-07-03
29-07-03
27-08-03
29-09-03


Comparaison des résultats de MES dans les différentes cellules
Les valeurs "0" indiquent que les concentrations sont inférieures à la limite de détection
Réservoir de délestage
ESP 1
ESP 2
ESP 3
CPC 1
CPC 2
Perte de la tranche colmatée de la cellule ESP 3 en juillet. (volume insuffisant 3 cycles par jour et température élevée) Explique concentration élevée en ESP 3
Concentration (mg/L)
0
20
40
60
80
100
120
140
160
180
200
14-05-03
28-05-03
03-06-03
03-07-03
09-07-03
29-07-03
27-08-03
29-09-03

6.4.2 Graphs of the analytical results by parameters

The present section summarizes the analytical results obtained during the follow-up in the form of graphs by parameter, of May 14 to September 29, 2003. Mentioned with section 6.4.1, the sampling campaigns preceding May 14 were not considered taking into account few data available, the bacterial surface not being established yet on the entire cell of treatment (ESP 1-2-3 and CPC 1-2-3).

The results are presented in the form of histograms and the measured values are posted directly on the graph.

ANALYTICAL RESULTS OBTAINED FOR THE FOLLOW-UP OF THE CELL							CPC 3		
Parameter	Unit	05-14-03	05-28-03	06-03-03	07-03-03	07-09-03	07-29-03	0-278-03	09-29-03
TSS	mg/L	5	---	---	---	---	---	---	--
BOD5 C	mg/L	< 2	---	---	---	---	---	---	--
BOD5 C sol.	mg/L	< 2	---	---	---	---	---	---	--
COD total	mg/L	6	---	---	---	---	---	---	--
COD sol.	mg/L	< 3	---	---	---	---	---	---	--
TKN	mg N/L	1.3	---	---	---	---	---	---	--
NH4	mg N/L	< 0.5	---	---	---	---	---	---	--
NO2	mg/L	---	---	---	---	---	---	---	--
NO3	mg/L	---	---	---	---	---	---	---	--
NO2-NO3	mg/L	92	---	---	---	---	---	---	--
P total	mg P/L	1.2	---	---	---	---	---	---	--
C. F. (E.Coli)	UFC/100	240	---	---	---	---	---	---	--
C. F. filtered	UFC/100	9	---	---	---	---	---	---	--
No sample		414 651	---	---	---	---	---	---	--
Type of taking away:		C.M.	---	---	---	---	---	---	--

AC: Composed automatic   C.M.: Composed manual   inst.: Instantaneous sample

ANALYTICAL RESULTS OBTAINED FOR THE FOLLOW-UP OF THE CELL CPC 2

Parameter	Unit	05-14-03	05-28-03	06-03-03	07-03-03	07-09-03	07-29-03	08-27-03	09-29-03
TSS	mg/L	7	15	9	23	25	27	34	54
BOD5 C	mg/L	< 2	27	12	11	33	15	14	16
BOD5 C sol.	mg/L	< 2	9	6	< 2	10	4	9	3
COD total	mg/L	< 3	142	46	105	96	90	92	144
COD sol.	mg/L	< 3	116	17	66	58	26	52	40
TKN	mg N/L	< 0.9	18	14	26	26	22	12	33
NH4	mg N/L	< 0.5	13	9.6	17	19	18	11	24
NO2	mg/L	---	---	---	< 0.05	0.25	2.2	---	1.4
NO3	mg/L	---	---	---	4.1	0.13	4.3	---	8.5
NO2-NO3	mg/L	24	4.3	5.3	4.1	0.38	6.5	16.0	9.9
P total	mg P/L	< 0.3	2.8	2.5	2.1	3.4	2.7	2.8	4.0
C. F. (E.Coli)	UFC/100	9	1 100 000	170 000	160 000	550 000	54 000	4 900	4 100
C. F. filtered	UFC/100	< 10	45 000	20 000	34 000	59 000	10 000	310	250
No sample		414 650	414 680	418 838	427 914	424 839	443 001	456 157	479 141
Type of taking away:		C.M.	C.M.	C.M.	C.M.	C.M.	C.M.	C.M.	C.M.

AC: Composed automatic C.M.: Composed manual inst.: Instantaneous sample

ANALYTICAL RESULTS OBTAINED FOR THE FOLLOW-UP OF THE CELL								CPC 1	
Parameter	**Unit**	**05-14-03**	**05-28-03**	**0-03-03**	**07-03-03**	**07-09-03**	**07-29-03**	**08-27-03**	**09-29-03**
TSS	mg/L	7	8	9	< 1	45	60	91	20
BOD5 C	mg/L	8	17	8	< 2	57	7	98	4
BOD5 C sol.	mg/L	4	9	5	< 2	28	< 2	55	2
COD total	mg/L	18	166	17	46	154	64	207	121
COD sol.	mg/L	12	67	11	20	83	< 3	115	12
TKN	mg N/L	13	20	12	8.4	24	33	41	50
NH4	mg N/L	4.9	14.0	2.8	2.8	19	30	33	38
NO2	mg/L	---	---	---	< 0.05	< 0.05	< 0.05	---	< 0.05
NO3	mg/L	---	---	---	11	< 0.05	< 0.05	---	0.05
NO2-NO3	mg/L	8.9	4.7	6.8	11	< 0.05	< 0.05	< 0.05	0.05
P total	mg P/L	1.8	2.9	2.1	1.0	0.3	1.7	3.1	0.4
C. F. (E.Coli)	UFC/100	320 000	400 000	150 000	5 400	100 000	260 000	370 000	340
C. F. filtered	UFC/100	5 900	34 000	5 400	330	25 000	200	180	9
No sample		414 649	414 679	418 837	427 913	424 838	443 000	456 156	479 140
Type of taking away:		C.M.	C.M.	C.M.	C.M.	C.M.	C.M.	C.M.	C.M.

AC: Composed automatic C.M.: Composed manual inst.: Instantaneous sample

ANALYTICAL RESULTS OBTAINED FOR THE FOLLOW-UP OF THE CELL **ESP 3**

Parameter	UniT	05-14-03	05-28-03	06-03-03	07-03-03	07-09-03	07-29-03	08-27-03	09-29-03
TSS	mg/L	3	3	4	40	2	3	< 1	1
BOD5 C	mg/L	< 2	< 2	2	40	< 2	< 2	< 2	< 2
BOD5 C sol.	mg/L	< 2	< 2	< 2	11	< 2	< 2	< 2	< 2
COD total	mg/L	6	< 3	6	177	19	< 3	6	17
COD sol.	mg/L	< 3	< 3	< 3	112	13	< 3	6	6
TKN	mg N/L	5.4	1.1	0.9	24	4.8	3.0	< 0.9	1.0
NH4	mg N/L	2.3	< 0.5	< 0.5	14	1.4	1.4	< 0.5	< 0.5
NO2	mg/L	---	---	---	< 0.05	24	22	---	2.0
NO3	mg/L	---	---	---	12	25	15	---	27
NO2-NO3	mg/L	30	45	33	12	49	37	24	29
P total	mg P/L	0.8	0.5	0.4	1.6	0.7	1.3	0.9	1.2
C. F. (E.Coli)	UFC/100	99	9	1 500	210 000	12 000	1 800	18	90
C. F. filtered	UFC/100	< 10	< 10	130	130 000	3 700	220	< 10	9
No sample laboratory.		414 656	414 686	418 836	427 921	427 902	443 007	456 163	479 147
Type of taking away:		C.M.	C.M.	C.M.	C.M.	C.M.	C.M.	C.M.	C.M.

A. C.: Composed automatic   C.M.: Composed manual   inst.: Instantaneous sample

ANALYTICAL RESULTS OBTAINED FOR THE FOLLOW-UP OF THE CELL								ESP 2	
Parameter	**Unit**	**05-14-03**	**05-28-03**	**06-03-03**	**07-03-03**	**07-09-03**	**07-29-03**	**08-27-03**	**09-29-03**
TSS	mg/L	2	2	4	1	< 1	2	1	< 1
BOD5 C	mg/L	< 2	< 2	< 2	< 2	< 2	< 2	2	< 2
BOD5 C sol.	mg/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
COD total	mg/L	< 3	< 3	6	< 3	< 3	< 3	17	< 3
DCO sol.	mg/L	< 3	< 3	< 3	< 3	< 3	< 3	17	< 3
TKN	mg N/L	< 0.9	< 0.9	< 0.9	1.9	< 0.9	< 0.9	1.8	< 0.9
NH4	mg N/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
NO2	mg/L	---	---	---	< 0.05	18	23	---	2.1
NO3	mg/L	---	---	---	37	21	17	---	28
NO2-NO3	mg/L	29	25	26	37	39	40	24	30
P total	mg P/L	0.9	0.8	0.8	1.5	1.7	1.7	1.4	1.8
C. F. (E.Coli)	UFC/100	140	4 100	730	1 100	180	250	130	2 000
C. F. filtered	UFC/100	< 10	390	90	90	45	210	18	45
No sample laboratory.		414 655	414 685	418 835	427 920	427 901	443 006	456 162	479 146
Type of taking away:		C.M.	C.M.	C.M.	C.M.	C.M.	C.M.	C.M.	C.M.

A.C.: Composed automatic   C.M.: Composed manual   inst.: Instantaneous sample

ANALYTICAL RESULTS OBTAINED FOR THE FOLLOW-UP OF THE CELL **ESP 1**

Parameter	Unit	05-14-03	05-28-03	06-03-03	07-03-03	07-09-03	07-29-03	08-27-03	09-29-03
TSS	mg/L	< 1	< 1	2	2	< 1	1	2	2
BOD5 C	mg/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
BOD5 C sol.	mg/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
COD totale	mg/L	< 3	< 3	< 3	< 3	< 3	6	6	< 3
COD sol.	mg/L	< 3	< 3	< 3	< 3	< 3	< 3	6	< 3
TKN	mg N/L	< 0.9	< 0.9	< 0.9	1.3	< 0.9	< 0.9	1.5	< 0.9
NH4	mg N/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
NO2	mg N/L	---	---	---	< 0.05	18	19	---	2.2
NO3	mg N/L	---	---	---	35	16	16	---	28
NO2-NO3	mg N/L	24	25	20	35	34	35	23	30
P total	mg P/L	1.1	1.1	1.2	1.3	1.7	1.8	1.8	1.4
C. F. (E.Coli)	UFC/100	120	2 800	390	240	21 000	160	36	36
C. F. filtered	UFC/100	27	200	63	27	81	99	9	9
No sample		414 654	414 684	418 834	427 918	427 900	443 005	456 161	479 145
Type of taking away:		C.M.	C.M.	C.M.	C.M.	C.M.	C.M.	C.M.	C.M.

A.C.: Composed automatic C.M.: Composed manual inst.: Instantaneous sample

ANALYTICAL RESULTS OBTAINED FOR the FOLLOW-UP OF the Septic tank

Parameter	Units	10-10-02	10-22-02	11-28-02	01-07-03	02-05-03	03-11-03	05-14-03	05-28-03	06-03-03	07-03-03	07-09-03	07-29-03	08-27-03	09-29-03
TSS	mg/L	111	67	51	76	77	87	67	74	70	94	112	144	173	131
BOD5 C	mg/L	198	160	50	137	149	184	98	152	113	207	211	205	275	190
BOD5 C	mg/L	---	---	---	---	---	---	51	73	47	161	137	167	131	105
COD total	mg/L	407	374	275	400	339	294	213	432	270	512	448	518	691	541
COD sol.	mg/L	---	---	---	---	---	---	73	298	78	276	218	294	253	156
TKN	mg N/L	60	55	48	58	55	47	26	31	29	38	36	39	45	47
NH4	mg N/L	34	37	26	38	34	32	15	21	14	21	23	27	31	29
NO2	mg/L	---	---	---	---	---	---	---	---	---	< 0.05	0.06	< 0.05	---	< 0.05
NO3	mg/L	---	---	---	---	---	---	---	---	---	0.29	0.05	< 0.05	---	< 0.05
NO2-NO3	mg/L	---	---	---	---	---	---	< 0.05	< 0.05	< 0.05	0.29	0.11	< 0.05	< 0.05	< 0.05
P total	mg P/L	6.4	4.5	3.4	5.8	5.9	6.6	3.6	4.3	3.8	4.2	5.4	5.8	6.1	6.2
C. F.	UFC/100	440 000	1 500 000	1 800 000	330 000	1 100 000	800 000	2 600 000	2 400 000	2 100 000	530 000	520 000	16 000 000	1 800 000	1 600 000
C. F.	UFC/100	---	---	---	---	---	---	120 000	380 000	200 000	260 000	90 000	1 500 000	300 000	320 000
No sample		333 751	334 545	334 551	334 561	334 559	334 566	414 644	414 667	418 833	427 908	424 832	442 995	456 151	479 135
Type of taking away:		C.A.	C.A.	C.A.	C.A.	C.A.	C.A.	C.A.	C.A.	C.A.	C.A.	C.A.	C.A.	C.A.	C.A.

A.C.: Composed automatic sample

C.M.: Composed manual

inst.: Instantaneous

6.4 Results of official analyses and certificates

The following section presents all of the analytical results obtained during the follow-up of the bench test between October 2002 and October 2003. The official certificates of analyses are presented in appendix taking into account their very great number.

6.4.1 Analytical results by cell of treatment

The present section summarizes the analytical results obtained during the follow-up by cell of treatment from October 10, 2002 to September 29, 2003 for the septic tank, and of May 4 to September 29, 2003 for the cells of treatment.

In the case of the cells of treatment, the sampling preceding May 14 were not considered taking into account few data available, the bacterial surface not being established yet on the entire cell of treatment (ESP 1-2-3 and CPC 1-2-3).

ANALYTICAL METHODS

Parameters	Flacon utilisé		Condom	Method	Description of the method
	Type	Volume	inserted	No.	(Reference to the standards methods, MENV, etc.)
TSS	Plastique	1000 mL	Aucun	AC233	SMEWW, 17th edition, method 2540 D
BOD5 C	Plastique	1000 mL	Aucun	AC227	SMEWW, 17th edition, method 5210 A,B
BOD5 C	Plastique	1000 mL	Aucun	AC227	SMEWW, 17th edition, method 5210 A, B beforehand filtered
COD totale	Plastique	250 mL	H2SO4	AC229	SMEWW, 17th edition, method 5220 B
COD soluble	Plastique	250 mL	H2SO4	AC229	SMEWW, 17th edition, method 5220 B beforehand filtered
TKN	Plastique	250 mL	H2SO4	AC209	MENVIQ.90.04/313-NTPT 1.1, 1991
NH4	Plastique	250 mL	H2SO4	AC244	MENVIQ.90.04/313-N 2.2, 1991
NO2	Plastique	250 mL	H2SO4	AC216	SMEWW, 17th edition, 4500-no2-b method
NO3	Plastique	250 mL	H2SO4	AC217	SMEWW, 17^{th} edition, method 4500 NO3H and 4500-no2-b
NO2-NO3	Plastique	250 mL	H2SO4	AC219	SMEWW, 17th edition, method 4500 NO3-H
P total	Plastique	250 mL	H2SO4	AC222	MENVIQ.90.04/313-NTPT 1.1, 1991
C. F. (E.Coli)	Plastique	250 mL	Na2S2O3	DA202	SMEWW, 17th edition, method 9222D
C. F. filtered	Plastique	250 mL	Na2S2O3	DA202	SMEWW, 17th edition, method 9222D beforehand filtered using a filter 93ÂH of which the porositépermet to retain the particles larger than 1,5 µm.

the case of the sampling of July 3 (one Thursday), the samples were delivered directly to the laboratory Friday morning, which did not involve any additional time.

6.3 Analytical methods

The following table establishes the methods used by the laboratory for the analysis of each parameter requested from the protocol of sampling:

5.5.2 Conservation

Once taken, the samples were quickly inserted in their respective coolers and placed on "ice packs" in order to preserve the samples. For the hotter periods, ice was used in order to maintain the samples inside the desired range of temperatures (1 with 10°C).

Given that the taking away of the majority of the sampling campaigns were carried out in evening, the samples had to be preserved at our buildings in the coolers during the night. The samples were subjected to a fast mail service (Dicom Express). The samples arrived the following day, that is to say approximately 36 hours following the taking away. To note that it was well specified on the forms and the bottles of analyses not to freeze the samples intended for the analyses of BOD5 (carbonaceous and soluble), practical current in the analysis laboratories, but which can cause to underestimate the results.

Lastly, given that the analyses of the fecal coliformes and filtered fecal coliformes are carried out by a laboratory subcontractor, the samples of coliformes were delivered directly to the laboratory subcontractor to avoid an extra day. We were to respect the times of conservation limited to 48 hours for this type of analysis.

6.0 Analyses and loads

6.1 Identification of the laboratory and accreditations

6.1.1 Identification of the laboratory

The laboratory responsible for the analyses is the Laboratory Biolab Inc. - Thetford Division. As mentioned with the preceding section, the analyses of the filtered fecal coliformes and the fecal coliformes were carried out by another division of the Laboratory Biolab Inc, Cape-of-the-Madeleine division.

6.1.2 Accreditations

The Laboratory Biolab Inc has all the necessary accreditations to carry out the analyses required in this project. This laboratory is also certified ISO 17025.

6.2 Analytical times

The laboratory was responsible to see that the analyses were carried out within the necessary times. On each information certificate appears dates referring to the sampling and reception of the samples at the laboratory, just as the date of analysis of the fecal coliformes for which the time is particularly significant (48 hours).

In order to facilitate the respect of the analytical times, all the sampling, except for that of July 3, were carried out on Monday, Tuesday or Wednesday. The samples arrived by mail at the latest on Friday morning, making it possible for the laboratory to undertake analyses without delay. In

5.4 Identification of the samples

Each well of pumping comprises an identification of the cell to which it is connected.

5.4.1 Identification of the wells of pumping

Each container used to collect the manually composed samples (20 L) is identified according to the test cell it refers to.

5.4.2 Identification of the containers

Each bottle used was identified beforehand at the laboratory using a classification that is new. The same number is used to identify all the bottles referring to the same point of sampling. In addition to the numbers on each bottle, the request forms for analyses are prepared by the laboratory. All the bottles prepared by the laboratory are inserted in individual coolers according to the point of sample, including the request form for analyses identified according to the number appearing on the bottles.

5.4.3 Identification of the bottles

The laboratory prepares a request form for analyses and each test sample is identified by the cell it was taken from and recorded on the request form and the cooler it is placed in is also noted.

5.5 Safeguarding and conservation of the samples

5.5.1 Safeguarding

All the bottles are prepared beforehand by the analysis laboratory according to the requirements of the Guide of Sampling at Ends of Environmental Analyses, Cahier 2: Sampling of the Liquid Rejections.

Thus, the bottles being used to receive the samples intended for the analyses of TSS and BOD5 (carbonaceous and carbonaceous soluble) did not contain any condom in accordance with the requirements of the guide. For their part, the bottles intended for the analyses of fecal coliformes and filtered fecal coliformes contained already thiosulfate of sodium (Na2SÒ3), condom inserted by the laboratory during the preparation of the bottles. Lastly, the whole of the other analyses (total and soluble COD, Nitrogenizes ammoniacal and kjeldahl, total phosphorus, just as nitrites and nitrates) were carried out starting from the same bottle preserved with sulphuric acid (H2SO4), also in accordance with the requirements of the guide.

the intervals used made it possible respectively to collect 10, 8 and 12 samples during the loadings of the morning, midday and evening.

These intervals were revised starting from January 7, 2003 for samples to be taken at 3:06am, 3:08pm and 8:05pm.

Thus, these new intervals of sampling made it possible to take 29 samples of 200 ml for a total of 5800 ml during the loading of the morning, 21 samples of 200 ml for a total of 4200 ml during the loading of midday and 34 samples of 200 ml for 6800 ml during the loading of the evening. The volume of each pumping (200 ml) and the quantity (84 samples over 9 hours) amply respected the criteria given in the Guide of Sampling at Ends of Environmental Analyses, Cahier 2: Sampling of the Liquid Rejections (minimum of 50 ml by taking away and minimum of 96 samples over a 24 hour period).

These intervals made it possible to make pumping effluent respective to the ratios of effluent volumes of 0,53% for the loading of the morning, of 0,53% for the loading of midday and of 0,54% for the loading of the evening.

5.3.2 Downstream of the cells of treatment

Before the sampling campaign of May 14, the sampling of the leachate at the exit of the various cells of treatment (at the pipe of entry of each station) was carried out in an instantaneous way during the loading corresponding to the flow of the evening.

Though we believe that the quality of the effluent of a cell is rather stable during the same period of a 3 hour loading, we revised the mode of composition of the samples starting from May 14 for a manual composition distributed for the entire period of effluent run-off at the stations of pumping. In this way, it was possible to make a mixture of allowed effluent at the stations of pumping and to level the differences in quality of effluents if it is necessary.

To make the composition of the samples, we installed a plastic container of 4 liters under the entering pipe of treated leachate with each station collecting leachate of each cell of treatment. Depending on the flow running out with each station, the leachate collected in the 64 liter container was placed inside a boiler of 20 liters also out of plastic.

In certain cases, the low flow made so that it was not necessary to transfer the sample collected from the container of 4 liters towards a container of 20 liters since it had not completely filled over the period of loading. In these cases, it was about total composition, indisputably the most reliable mode of the sampling.

As much as possible, the transfer of samples in the boiler of 20 liters was carried out as soon as the container of 4 liters was filled, in order to make a total composition. However, for the cells of which the flow was increased, the 4 liter container was emptied with regular intervals in order to compose a sample representative of the unit of the period.

5.0 Sampling

5.1 Installation requirements and equipment

5.1.1 Tank of pumping

With an aim of knowing the contents present in effluent upstream of the cells of treatment, the samples were taken from the pumping tank. The samples were taken on the outlet side of the tank, just upstream of the pneumatic valve being used to pipe the pumpings, using an automatic sampler of mark Isco, model 2900.

5.1.2 Downstream of the cells of treatment

The sampling downstream of each cell of treatment was carried out inside the stations of pumping being used for collecting and quantifying the leachate treated by the various respective cells of treatment. For the harvest of the samples, a plastic container was installed under the conduit bringing leachate to the station of pumping. The nature of the container used (plastic) is in conformity with the Guide of Sampling at Ends of Environmental Analyses, Cahier 2: Sampling of the Rejections Liquidate According to the Parameters to Analyze.

5.2 Periods of composition

5.2.1 Tank of pumping

The period of composition of the samples from the pumping tank were spread out over a 3 hour period of pumping (morning, midday and evening).

5.2.2 Downstream of the cells of treatment

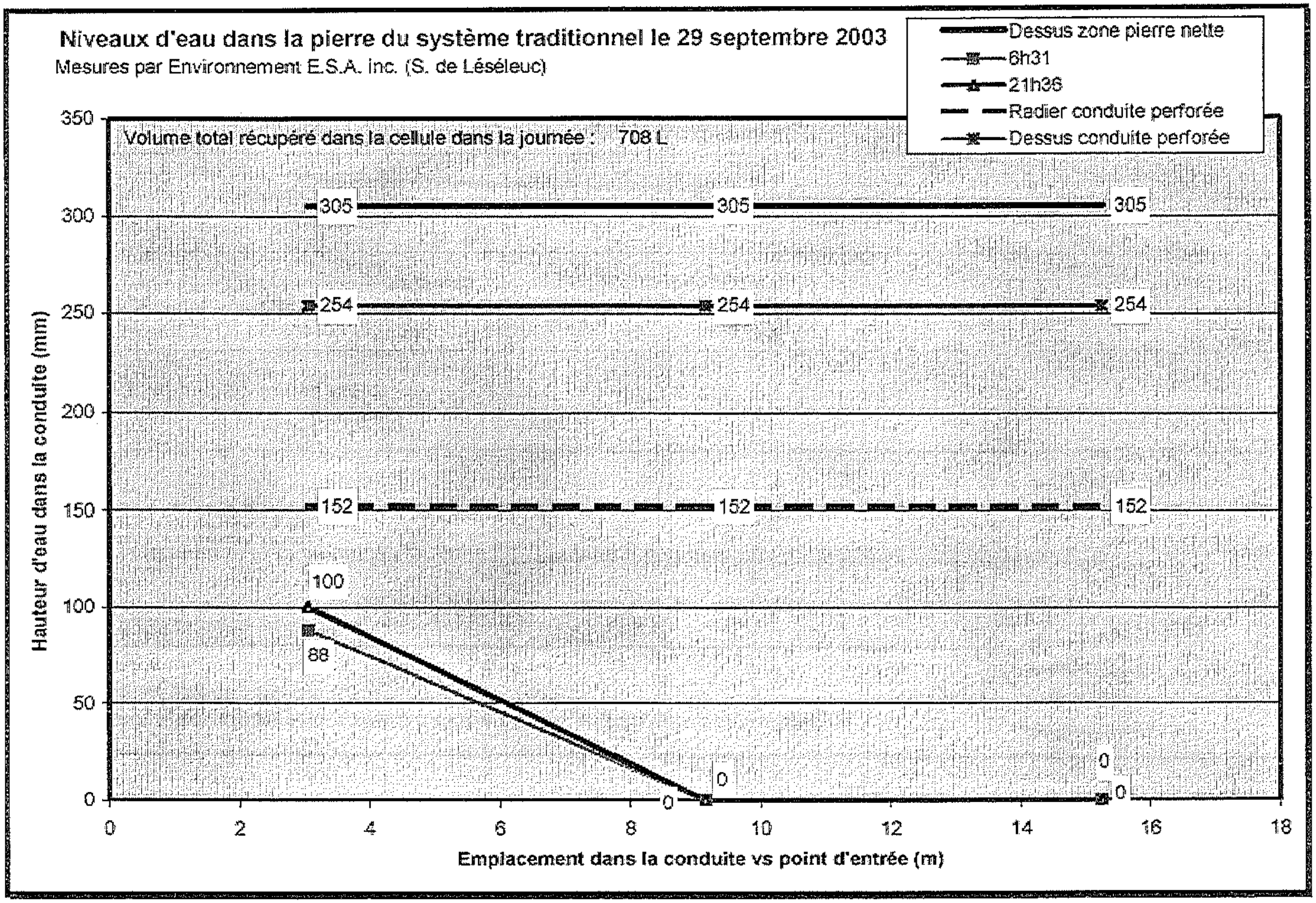
In accordance with the specifications of the test protocol, the realization of the sampling of leachate recovered from each cell of treatment was done at the time of the downloading of the evening, that is to say over the period when the daily flow is less.

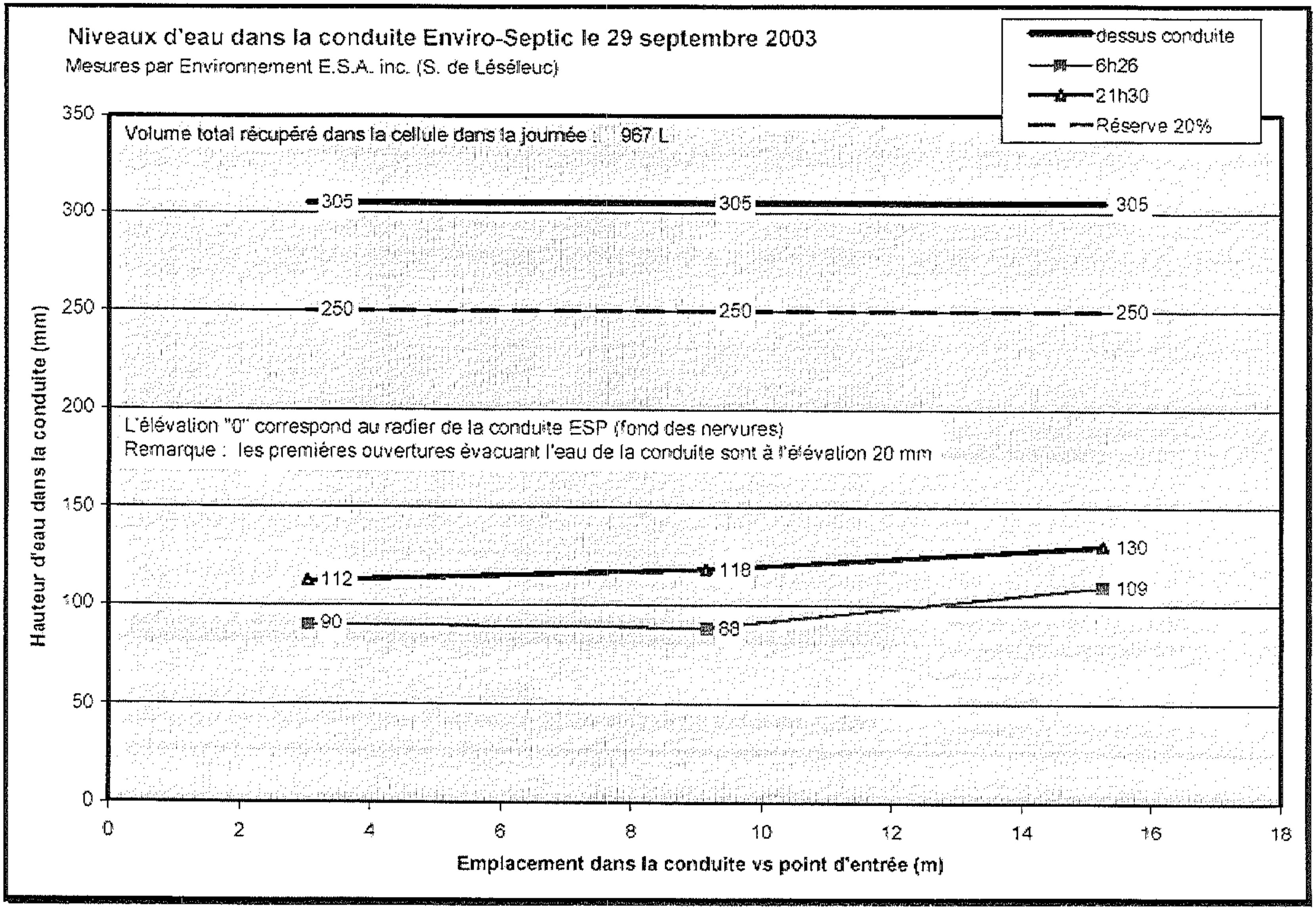
5.3 Modes of composition

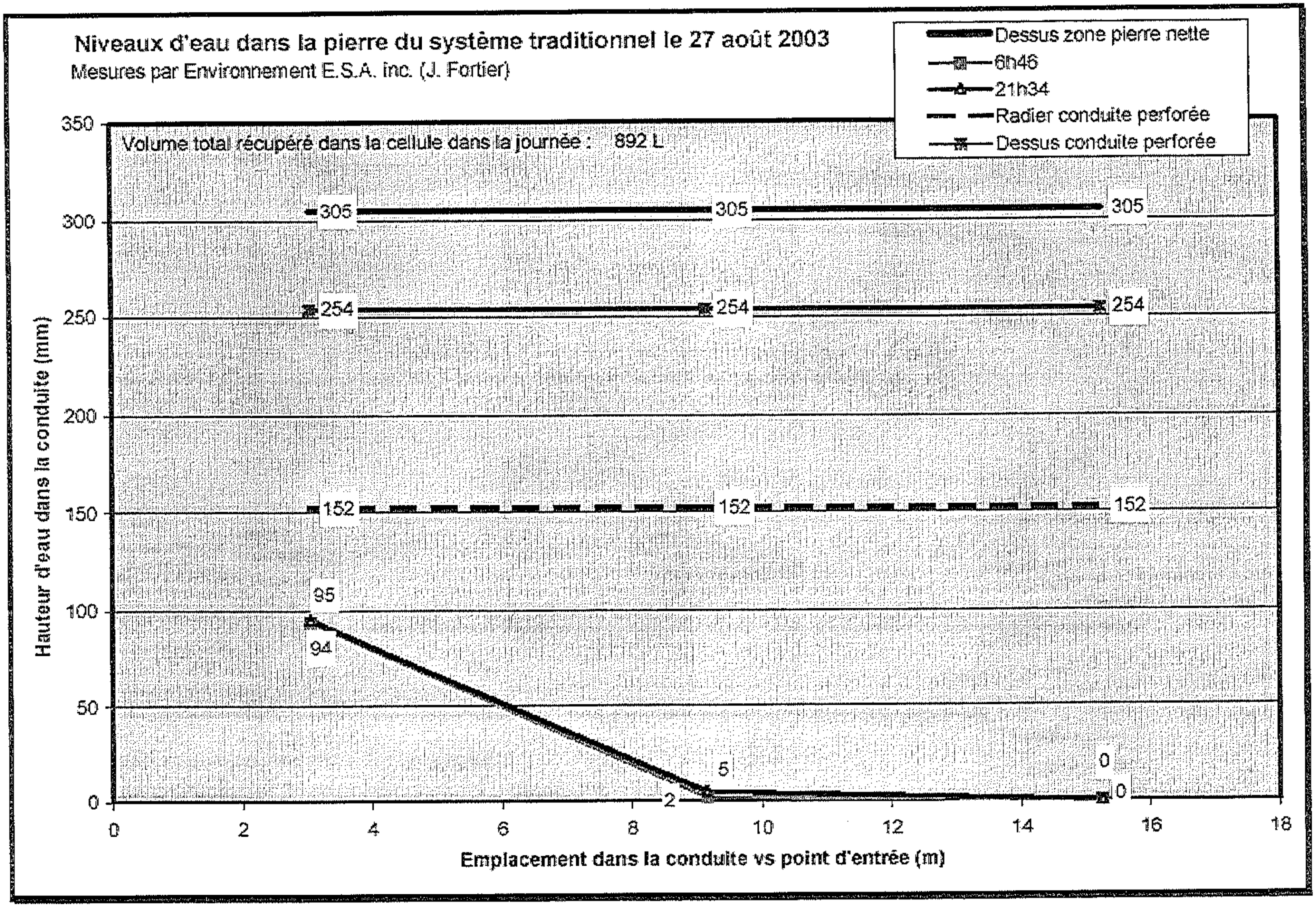
5.3.1 Tank of Pumping

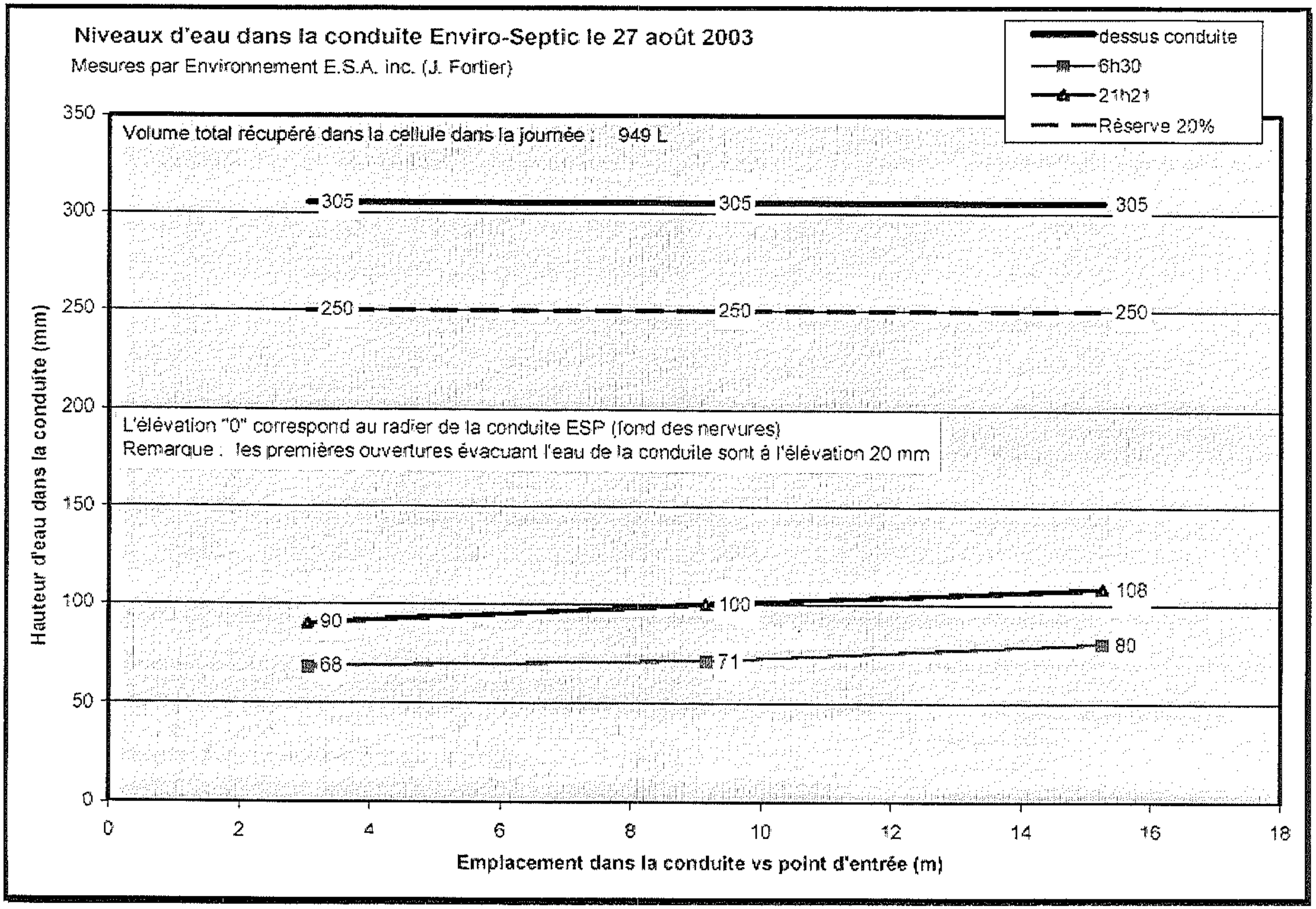
The mode of composition recommended for the pumping tank was to take samples at the beginning and continue with intervals of fixed times.

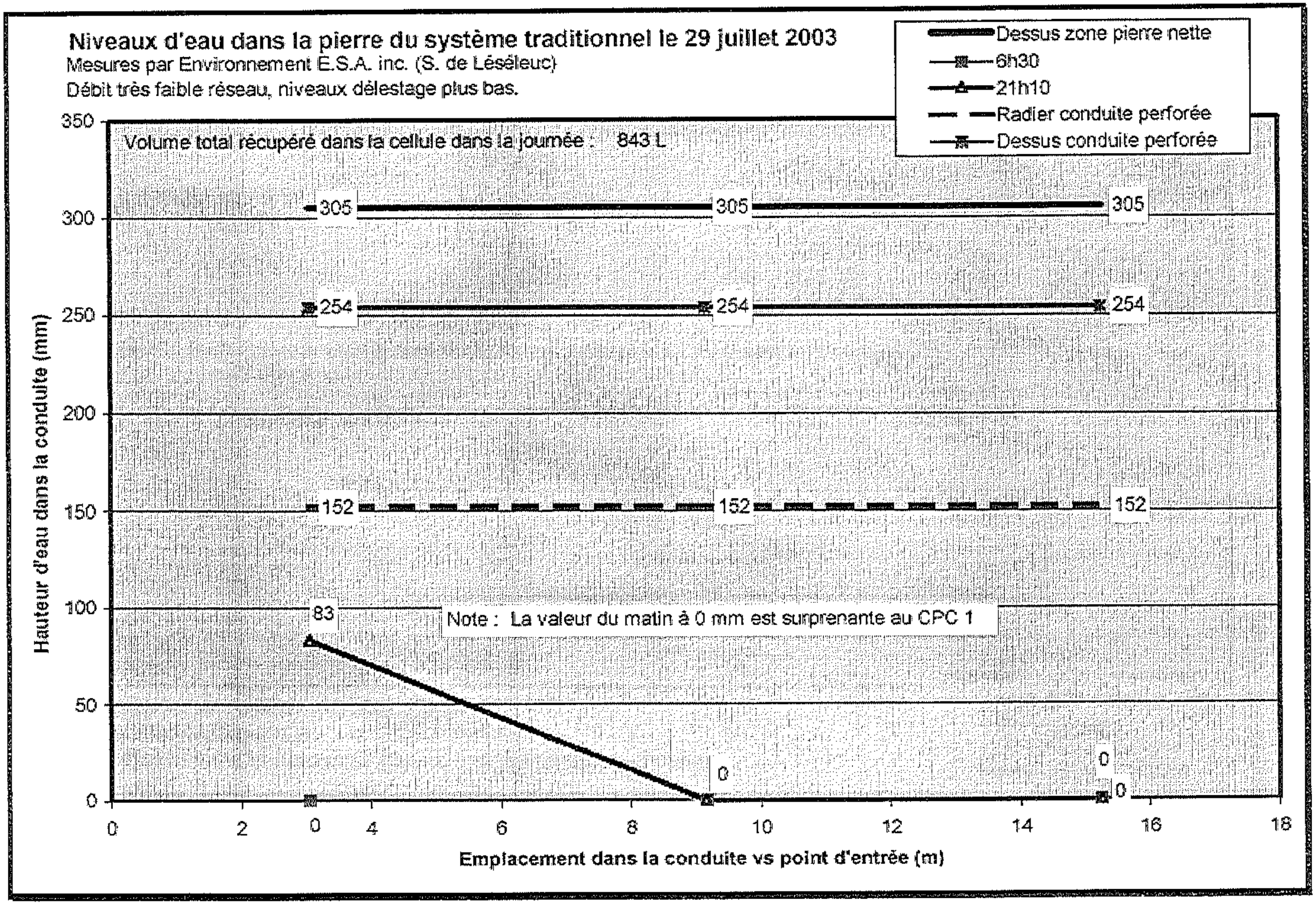
Various intervals of composition were used in the course of follow-up. For the sampling held on October 8 and 22 2002, and on November 28, 2002, at the time of the rise in load of the system,

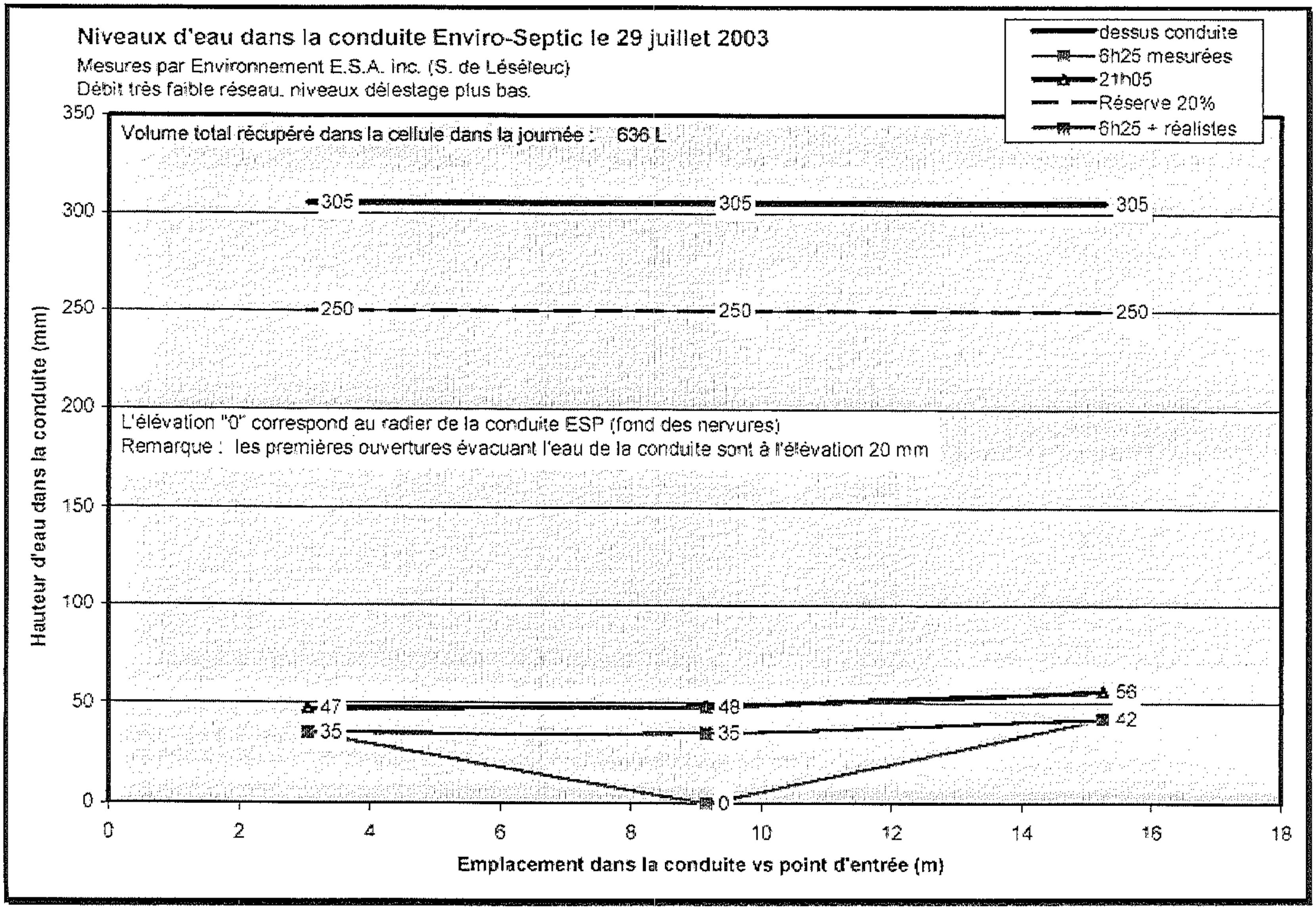

Niveaux d'eau dans la pierre du système traditionnel le 29 septembre 2003
Mesures par Environnement E.S.A. inc. (S. de Léséleuc)
Volume total récupéré dans la cellule dans la journée : 708 L
Dessus zone pierre nette
6h31
21h36
Radier conduite perforée
Dessus conduite perforée
305
305
305
254
254
254
152
152
152
100
88
0
0
0
0
Hauteur d'eau dans la conduite (mm)
Emplacement dans la conduite vs point d'entrée (m)
0
50
100
150
200
250
300
350
0
2
4
6
8
10
12
14
16
18

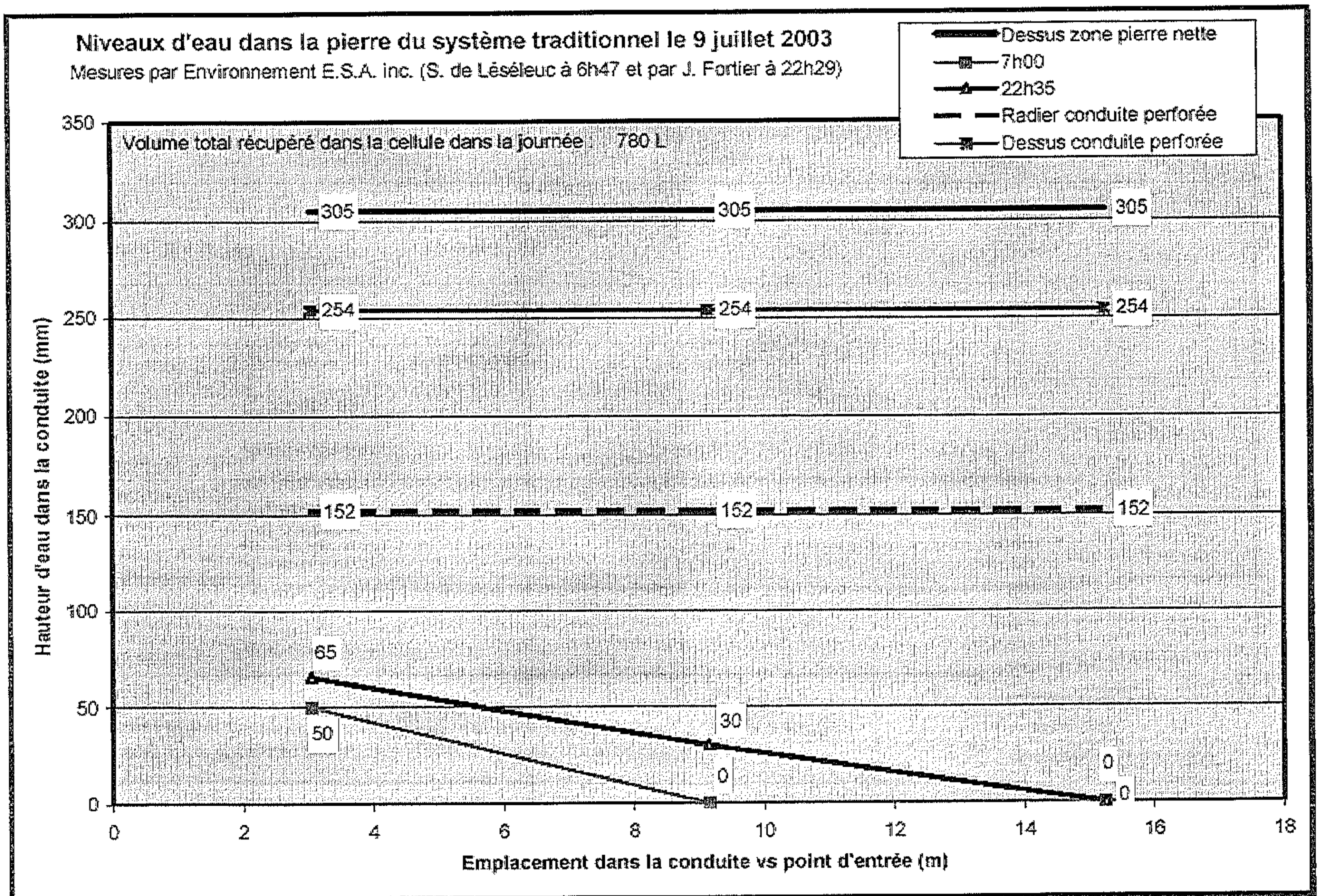

Niveaux d'eau dans la conduite Enviro-Septic le 29 septembre 2003
Mesures par Environnement E.S.A. inc. (S. de Léséleuc)
dessus conduite
6h26
21h30
Réserve 20%
Volume total récupéré dans la cellule dans la journée : 967 L
L'élévation "0" correspond au radier de la conduite ESP (fond des nervures)
Remarque : les premières ouvertures évacuant l'eau de la conduite sont à l'élévation 20 mm
305
305
305
250
250
250
112
118
130
90
88
109
Hauteur d'eau dans la conduite (mm)
0
50
100
150
200
250
300
350
0
2
4
6
8
10
12
14
16
18
Emplacement dans la conduite vs point d'entrée (m)

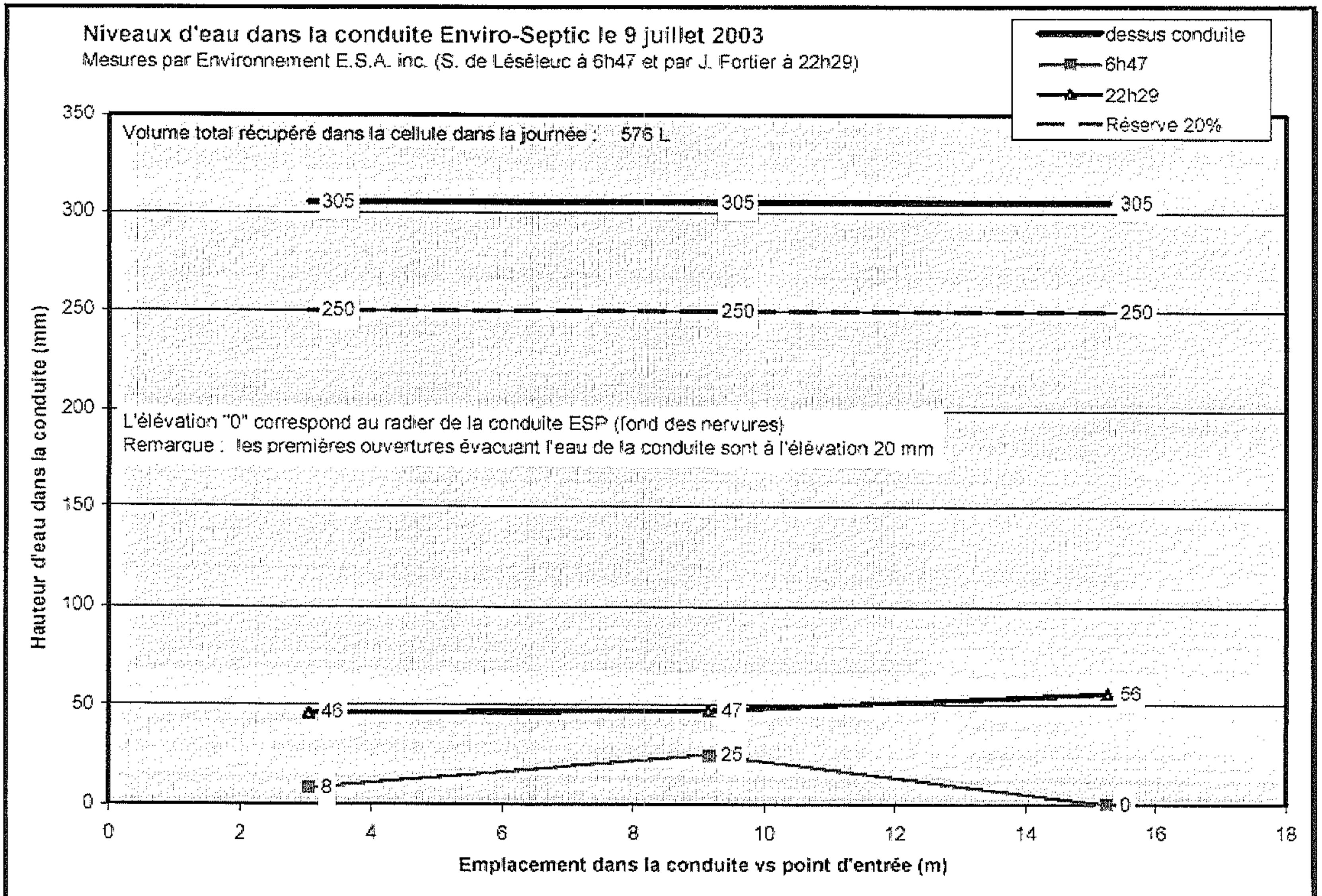

Niveaux d'eau dans la pierre du système traditionnel le 27 août 2003
Mesures par Environnement E.S.A. inc. (J. Fortier)
Volume total récupéré dans la cellule dans la journée : 892 L
Dessus zone pierre nette
6h46
21h34
Radier conduite perforée
Dessus conduite perforée
305
305
305
254
254
254
152
152
152
95
94
5
2
0
0
Hauteur d'eau dans la conduite (mm)
350
300
250
200
150
100
50
0
0
2
4
6
8
10
12
14
16
18
Emplacement dans la conduite vs point d'entrée (m)

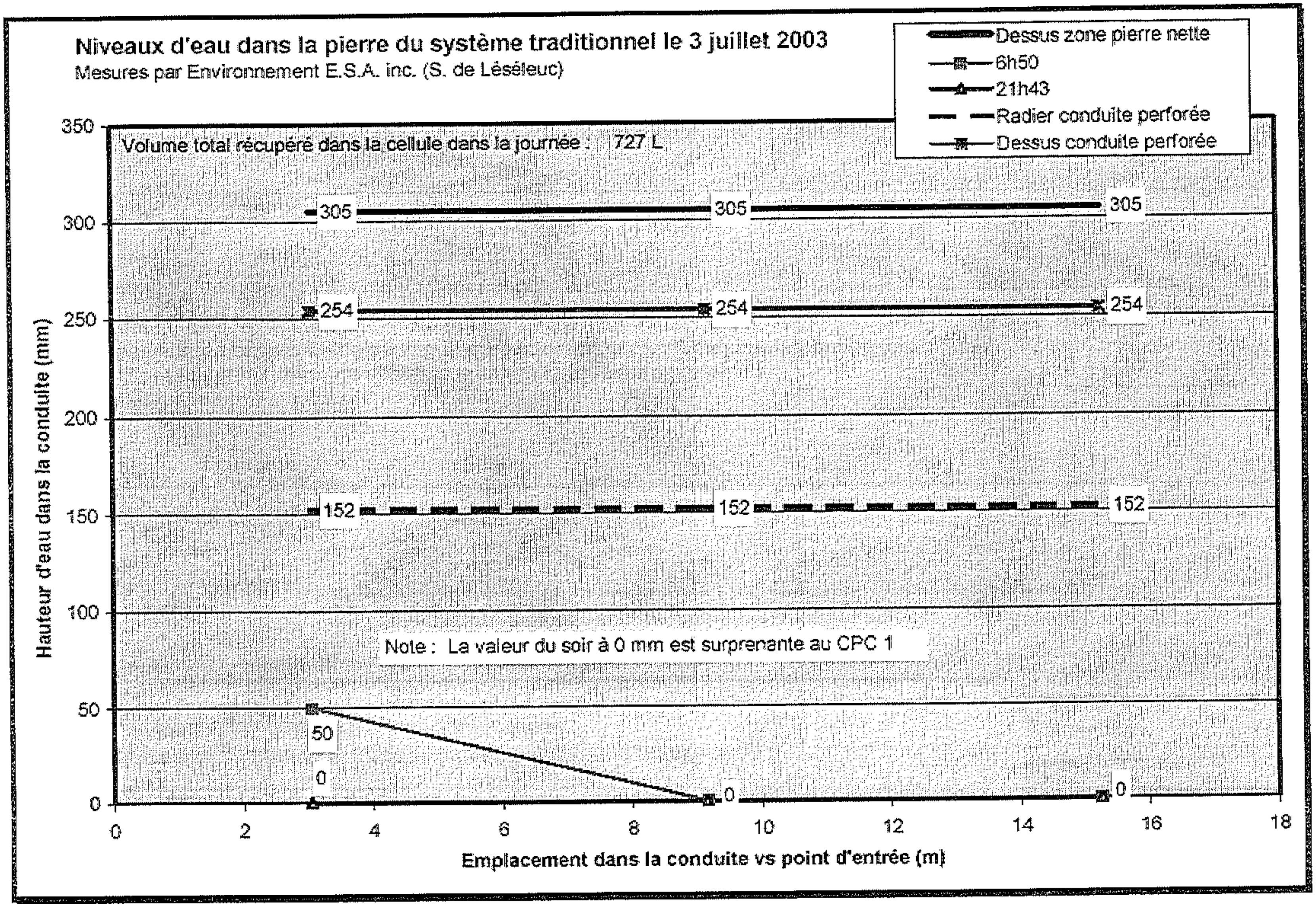

Niveaux d'eau dans la conduite Enviro-Septic le 27 août 2003
Mesures par Environnement E.S.A. inc. (J. Fortier)
dessus conduite
6h30
21h21
Réserve 20%
Volume total récupéré dans la cellule dans la journée : 949 L
305
305
305
250
250
250
L'élévation "0" correspond au radier de la conduite ESP (fond des nervures)
Remarque : les premières ouvertures évacuant l'eau de la conduite sont à l'élévation 20 mm
90
100
108
68
71
80
Hauteur d'eau dans la conduite (mm)
Emplacement dans la conduite vs point d'entrée (m)
0
50
100
150
200
250
300
350
0
2
4
6
8
10
12
14
16
18

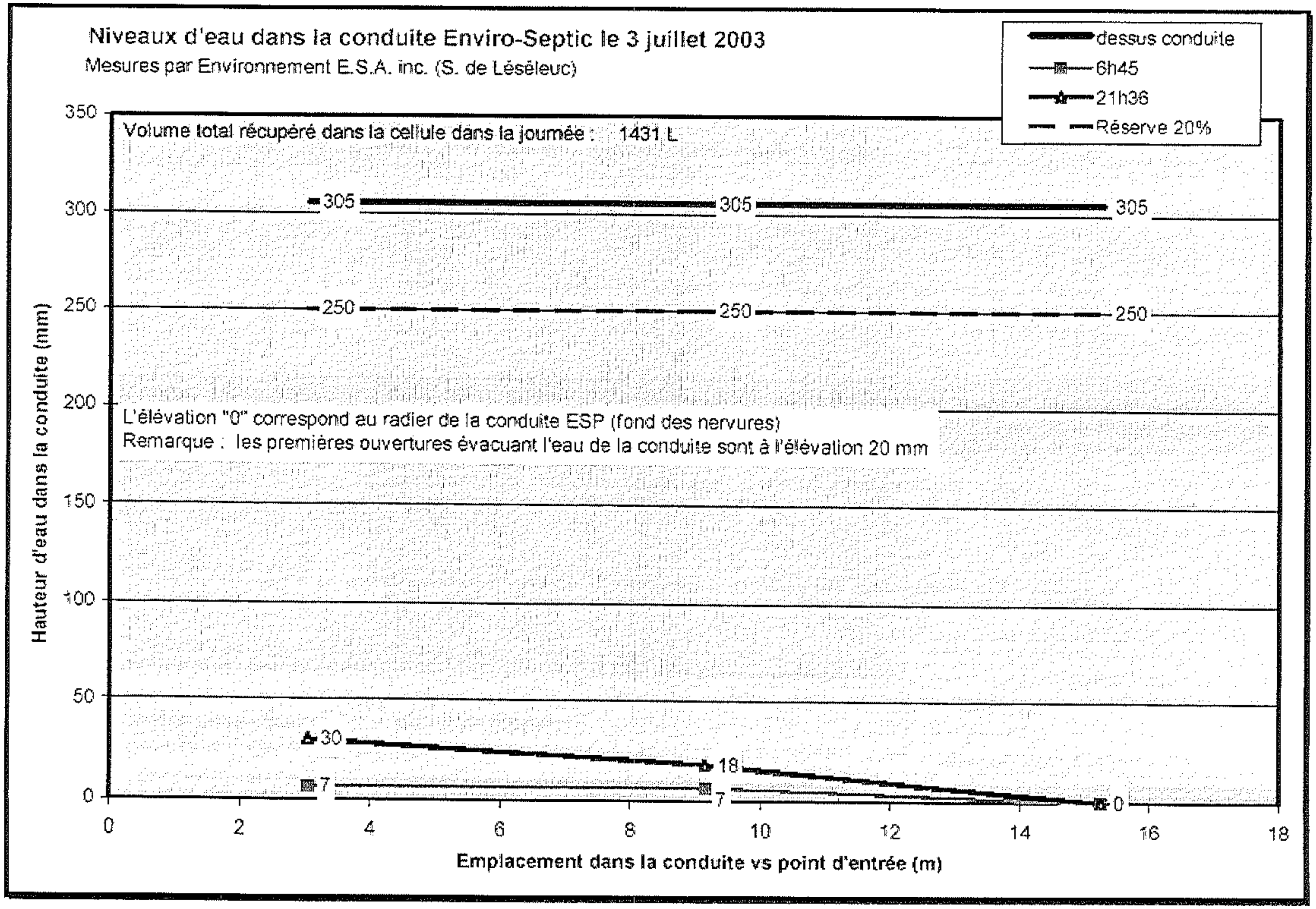

Niveaux d'eau dans la pierre du système traditionnel le 29 juillet 2003
Mesures par Environnement E.S.A. inc. (S. de Léséleuc)
Débit très faible réseau, niveaux délestage plus bas.
Volume total récupéré dans la cellule dans la journée : 843 L
Dessus zone pierre nette
6h30
21h10
Radier conduite perforée
Dessus conduite perforée
305
254
152
83
0
Note : La valeur du matin à 0 mm est surprenante au CPC 1
Hauteur d'eau dans la conduite (mm)
Emplacement dans la conduite vs point d'entrée (m)

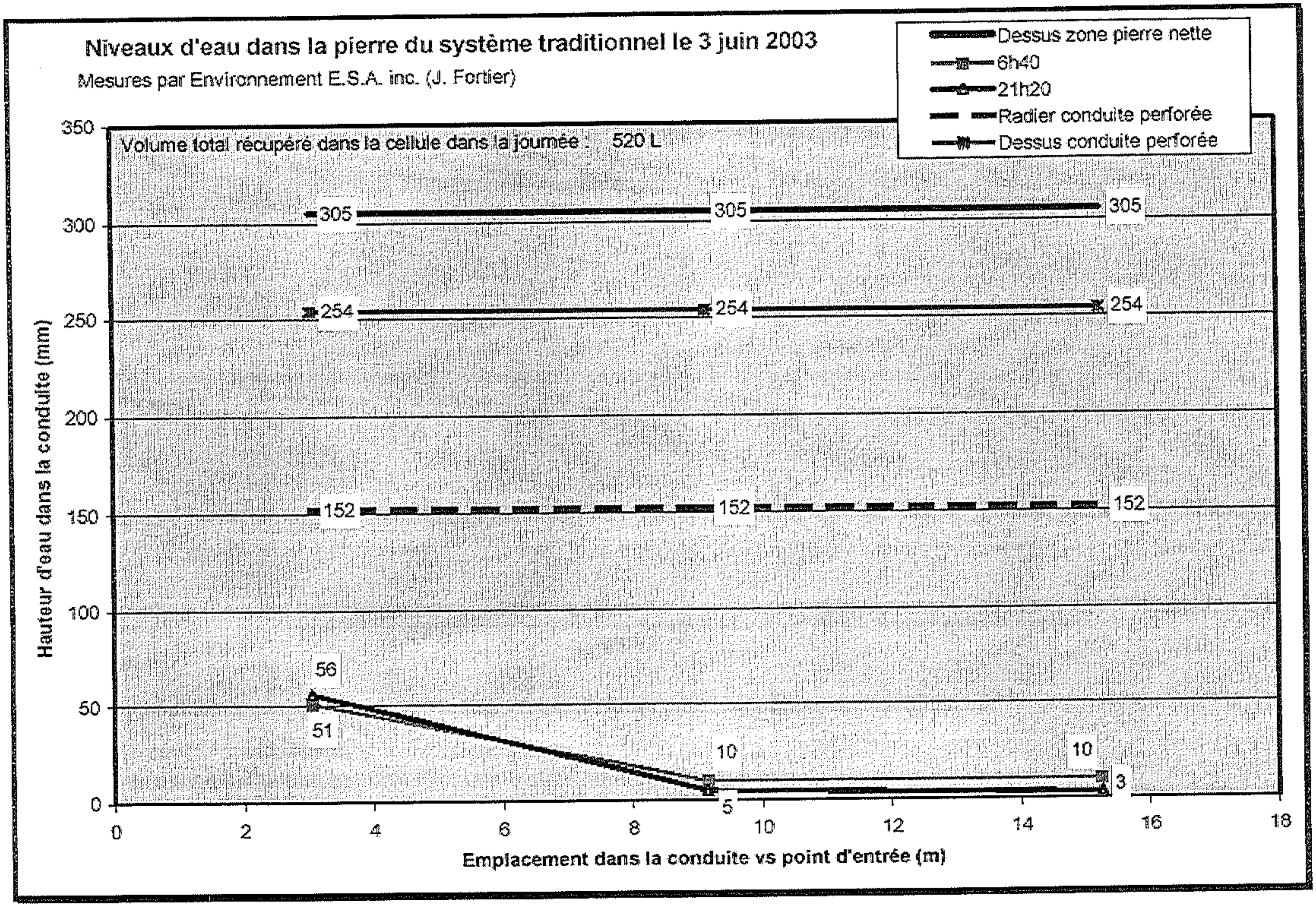

Niveaux d'eau dans la conduite Enviro-Septic le 29 juillet 2003
Mesures par Environnement E.S.A. inc. (S. de Léséleuc)
Débit très faible réseau, niveaux délestage plus bas.
Volume total récupéré dans la cellule dans la journée : 636 L
L'élévation "0" correspond au radier de la conduite ESP (fond des nervures)
Remarque : les premières ouvertures évacuant l'eau de la conduite sont à l'élévation 20 mm
dessus conduite
6h25 mesurées
21h05
Réserve 20%
6h25 + réalistes
305
250
47
48
56
35
42
0
Hauteur d'eau dans la conduite (mm)
Emplacement dans la conduite vs point d'entrée (m)

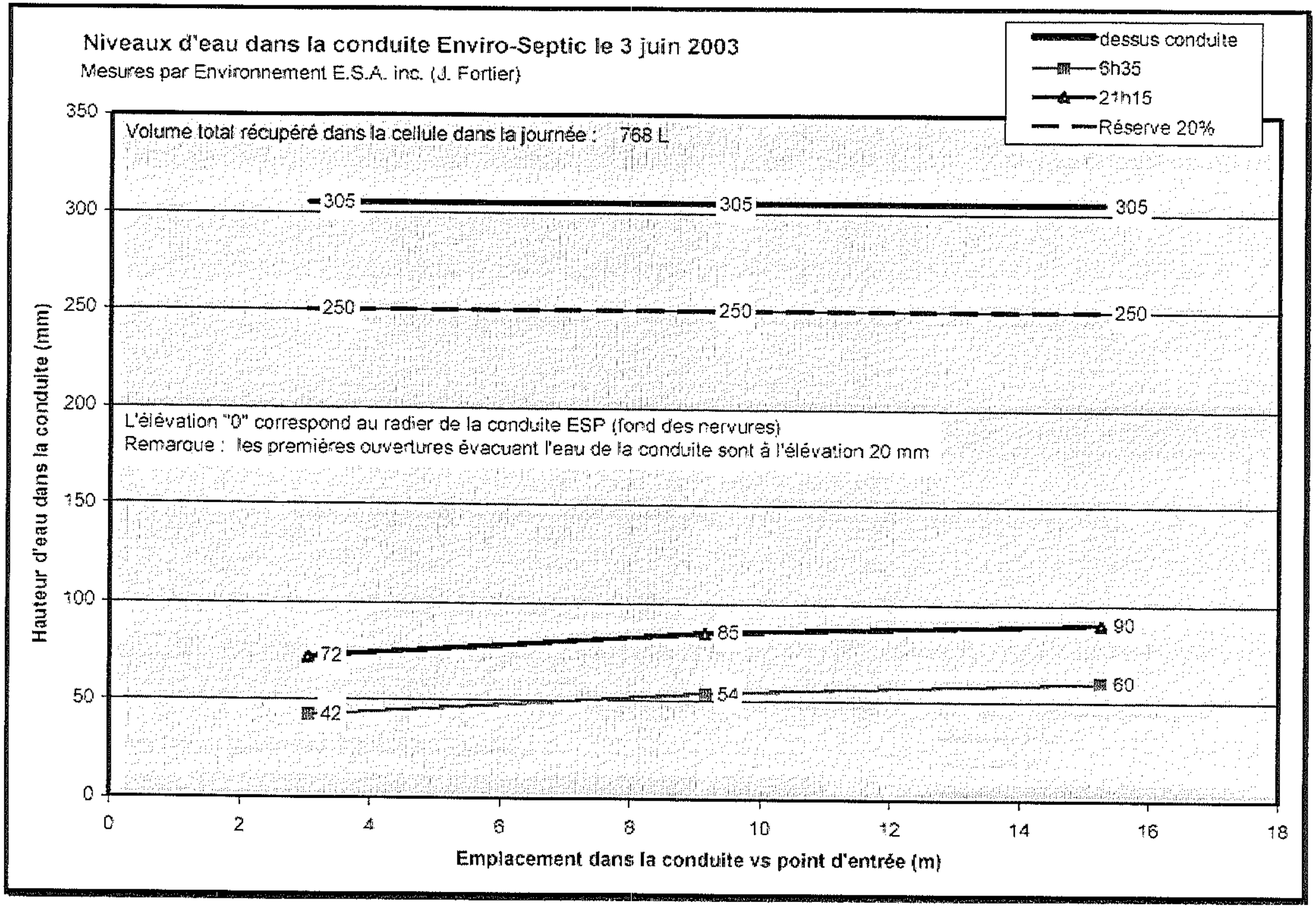

Niveaux d'eau dans la pierre du système traditionnel le 9 juillet 2003
Mesures par Environnement E.S.A. inc. (S. de Léséleuc à 6h47 et par J. Fortier à 22h29)
Dessus zone pierre nette
7h00
22h35
Radier conduite perforée
Dessus conduite perforée
Volume total récupéré dans la cellule dans la journée : 780 L
305
305
305
254
254
254
152
152
152
65
50
30
0
0
0
Hauteur d'eau dans la conduite (mm)
0
50
100
150
200
250
300
350
Emplacement dans la conduite vs point d'entrée (m)
0
2
4
6
8
10
12
14
16
18

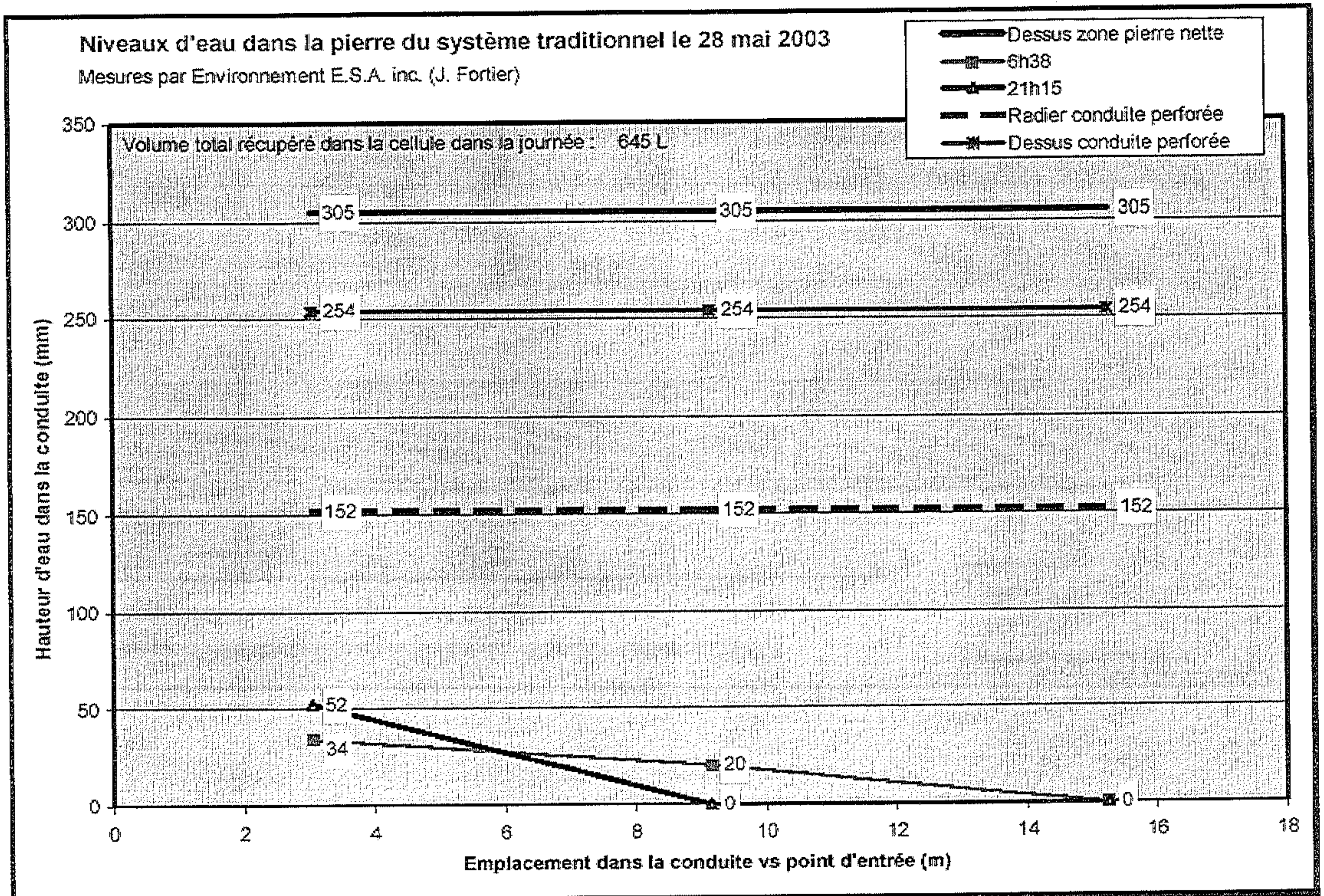

Niveaux d'eau dans la conduite Enviro-Septic le 9 juillet 2003
Mesures par Environnement E.S.A. inc. (S. de Léséleuc à 6h47 et par J. Fortier à 22h29)
dessus conduite
6h47
22h29
Réserve 20%
Volume total récupéré dans la cellule dans la journée : 576 L
L'élévation "0" correspond au radier de la conduite ESP (fond des nervures)
Remarque : les premières ouvertures évacuant l'eau de la conduite sont à l'élévation 20 mm
305
305
305
250
250
250
46
47
56
8
25
0
350
300
250
200
150
100
50
0
0
2
4
6
8
10
12
14
16
18
Hauteur d'eau dans la conduite (mm)
Emplacement dans la conduite vs point d'entrée (m)

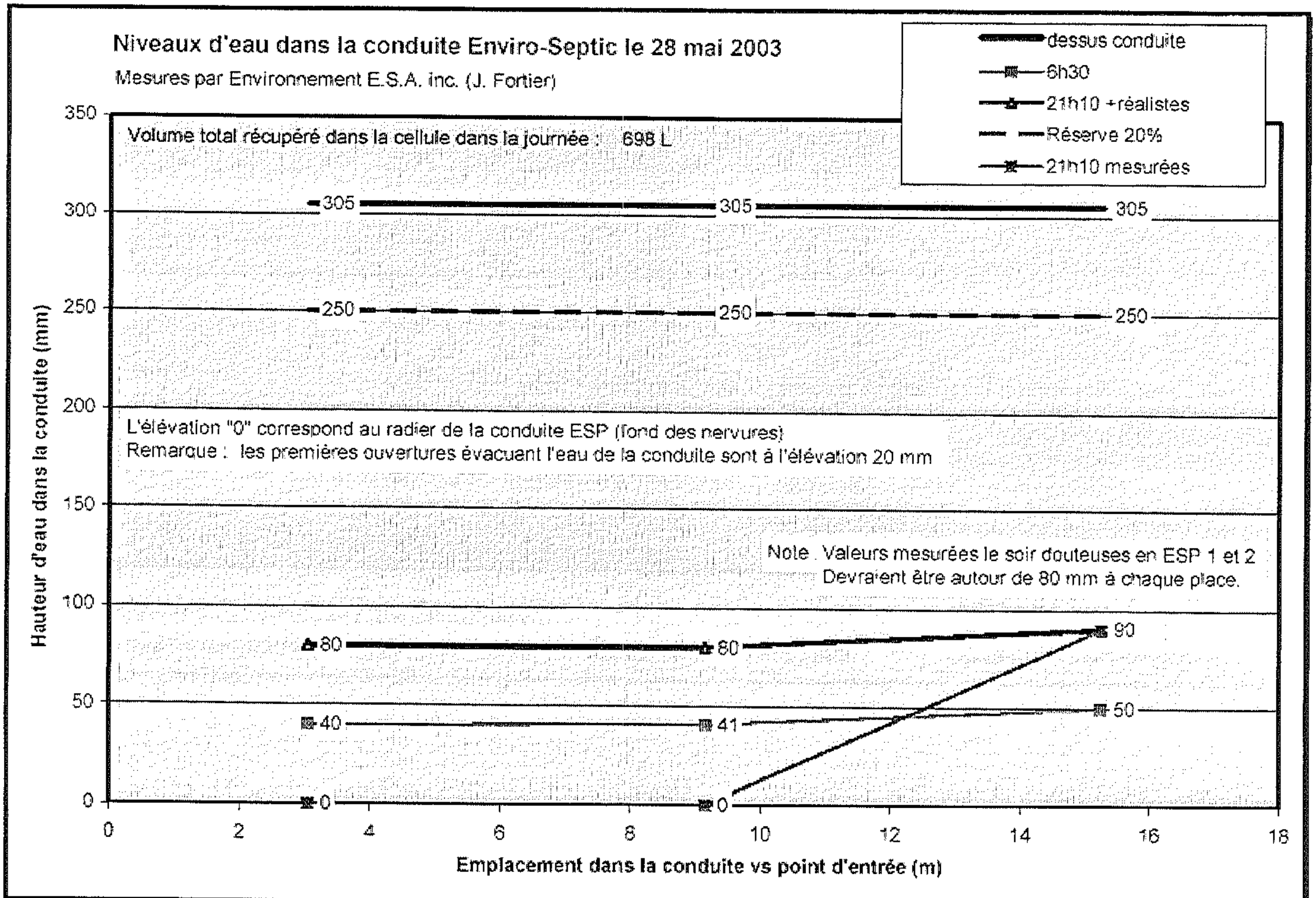

Niveaux d'eau dans la pierre du système traditionnel le 3 juillet 2003
Mesures par Environnement E.S.A. inc. (S. de Léséleuc)
Dessus zone pierre nette
6h50
21h43
Radier conduite perforée
Dessus conduite perforée
Volume total récupéré dans la cellule dans la journée : 727 L
305
305
305
254
254
254
152
152
152
50
0
0
0
Note : La valeur du soir à 0 mm est surprenante au CPC 1
Hauteur d'eau dans la conduite (mm)
350
300
250
200
150
100
50
0
0
2
4
6
8
10
12
14
16
18
Emplacement dans la conduite vs point d'entrée (m)

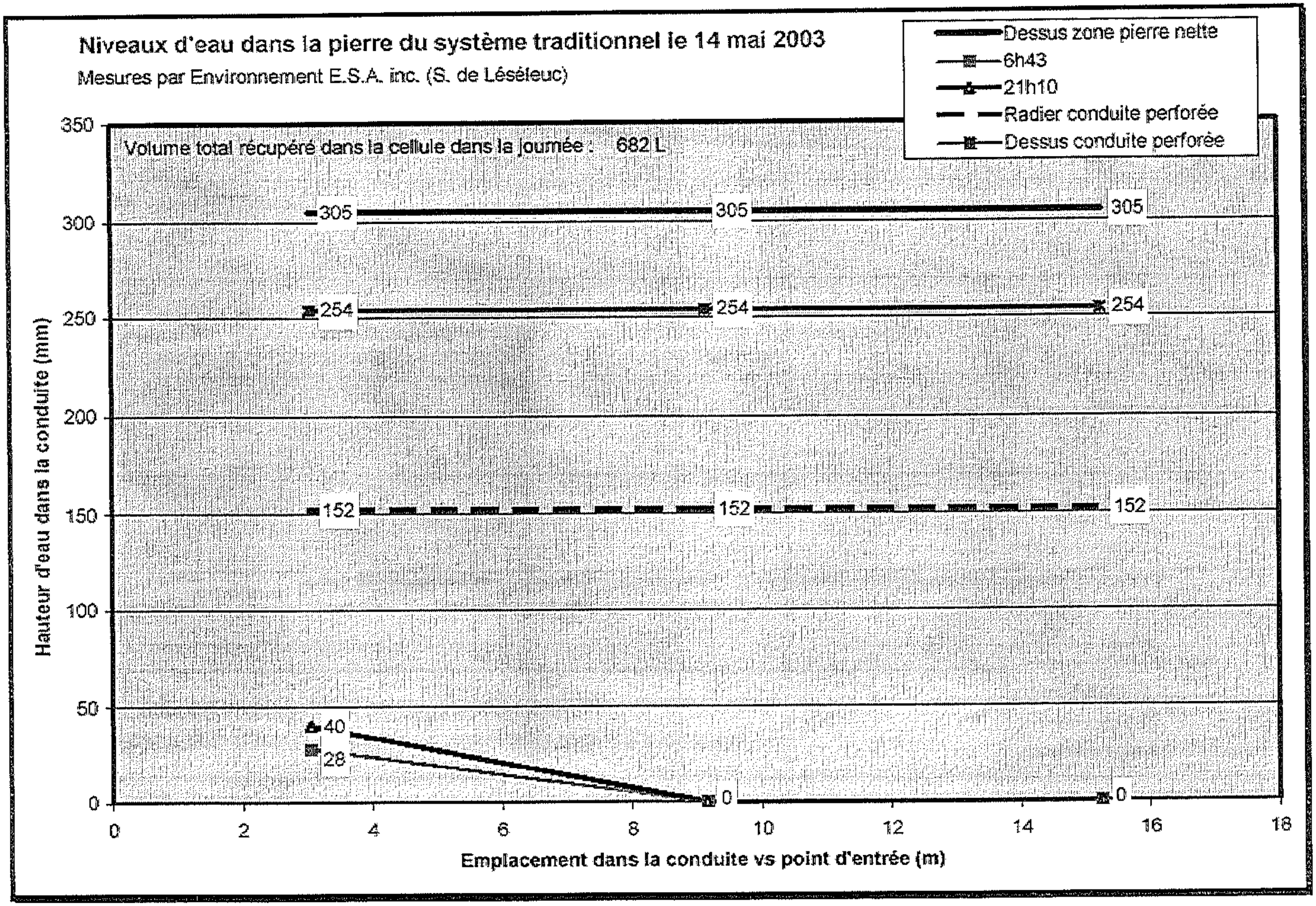

Niveaux d'eau dans la conduite Enviro-Septic le 3 juillet 2003
Mesures par Environnement E.S.A. inc. (S. de Léséleuc)
dessus conduite
6h45
21h36
Réserve 20%
Volume total récupéré dans la cellule dans la journée : 1431 L
305
305
305
250
250
250
L'élévation "0" correspond au radier de la conduite ESP (fond des nervures)
Remarque : les premières ouvertures évacuant l'eau de la conduite sont à l'élévation 20 mm
30
18
7
7
0
Hauteur d'eau dans la conduite (mm)
350
300
250
200
150
100
50
0
0
2
4
6
8
10
12
14
16
18
Emplacement dans la conduite vs point d'entrée (m)

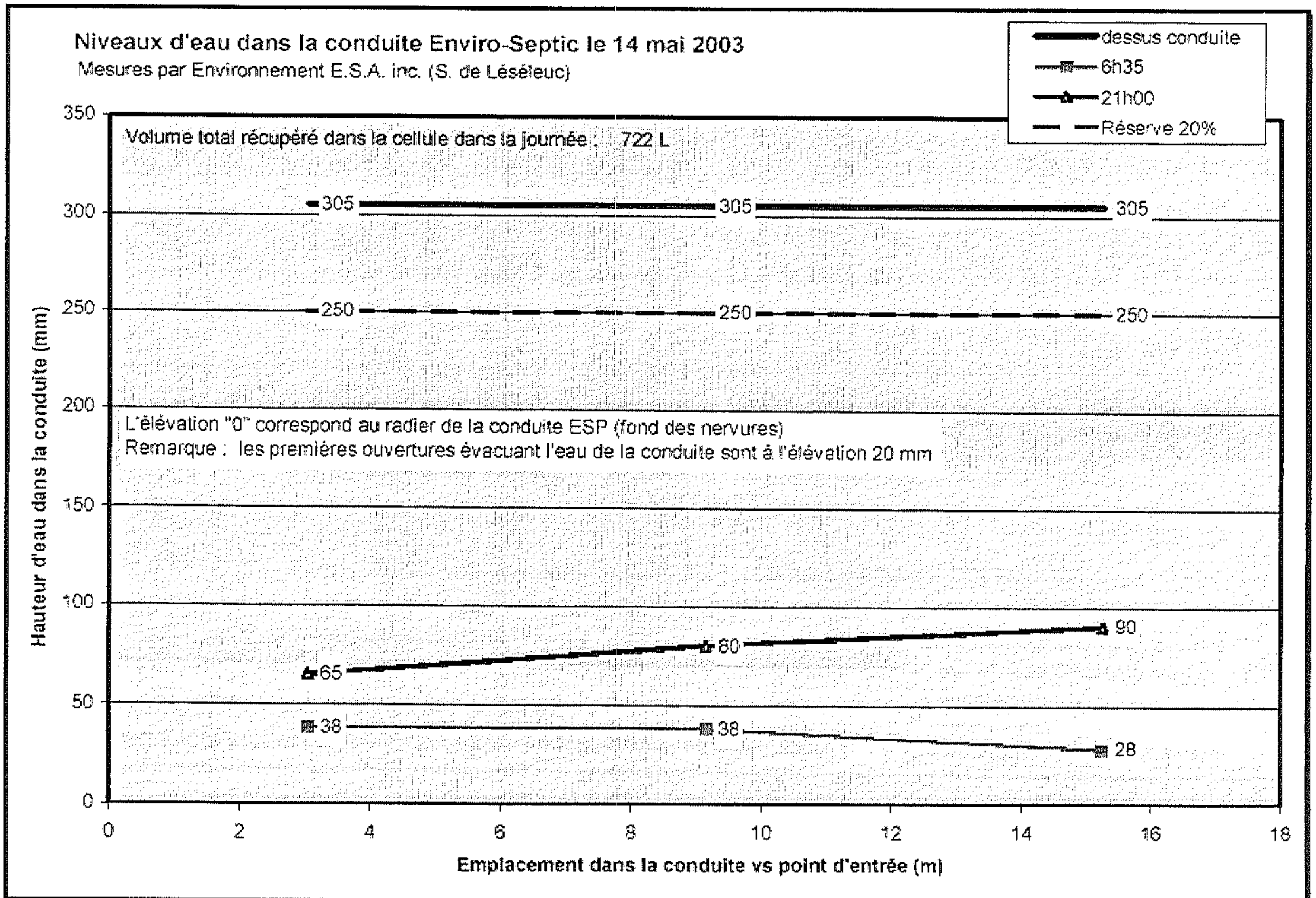

Niveaux d'eau dans la pierre du système traditionnel le 3 juin 2003
Mesures par Environnement E.S.A. inc. (J. Fortier)
Volume total récupéré dans la cellule dans la journée : 520 L
Dessus zone pierre nette
6h40
21h20
Radier conduite perforée
Dessus conduite perforée
305
305
305
254
254
254
152
152
152
56
51
10
5
10
3
Hauteur d'eau dans la conduite (mm)
Emplacement dans la conduite vs point d'entrée (m)
0
50
100
150
200
250
300
350
0
2
4
6
8
10
12
14
16
18

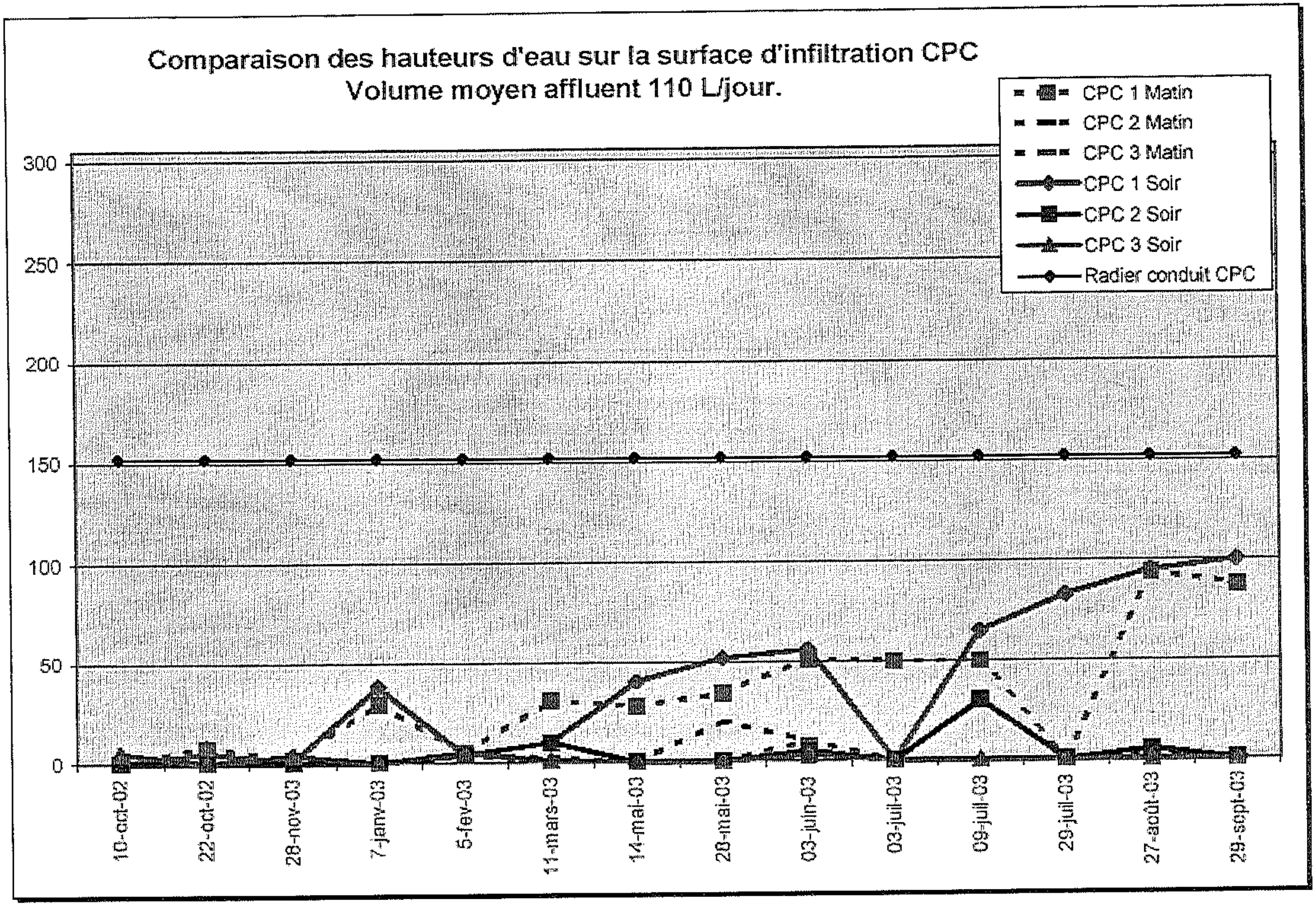

Niveaux d'eau dans la conduite Enviro-Septic le 3 juin 2003
Mesures par Environnement E.S.A. inc. (J. Fortier)
Volume total récupéré dans la cellule dans la journée : 768 L
L'élévation "0" correspond au radier de la conduite ESP (fond des nervures)
Remarque : les premières ouvertures évacuant l'eau de la conduite sont à l'élévation 20 mm
dessus conduite
6h35
21h15
Réserve 20%
305
305
305
250
250
250
72
85
90
42
54
60
Hauteur d'eau dans la conduite (mm)
350
300
250
200
150
100
50
0
0
2
4
6
8
10
12
14
16
18
Emplacement dans la conduite vs point d'entrée (m)

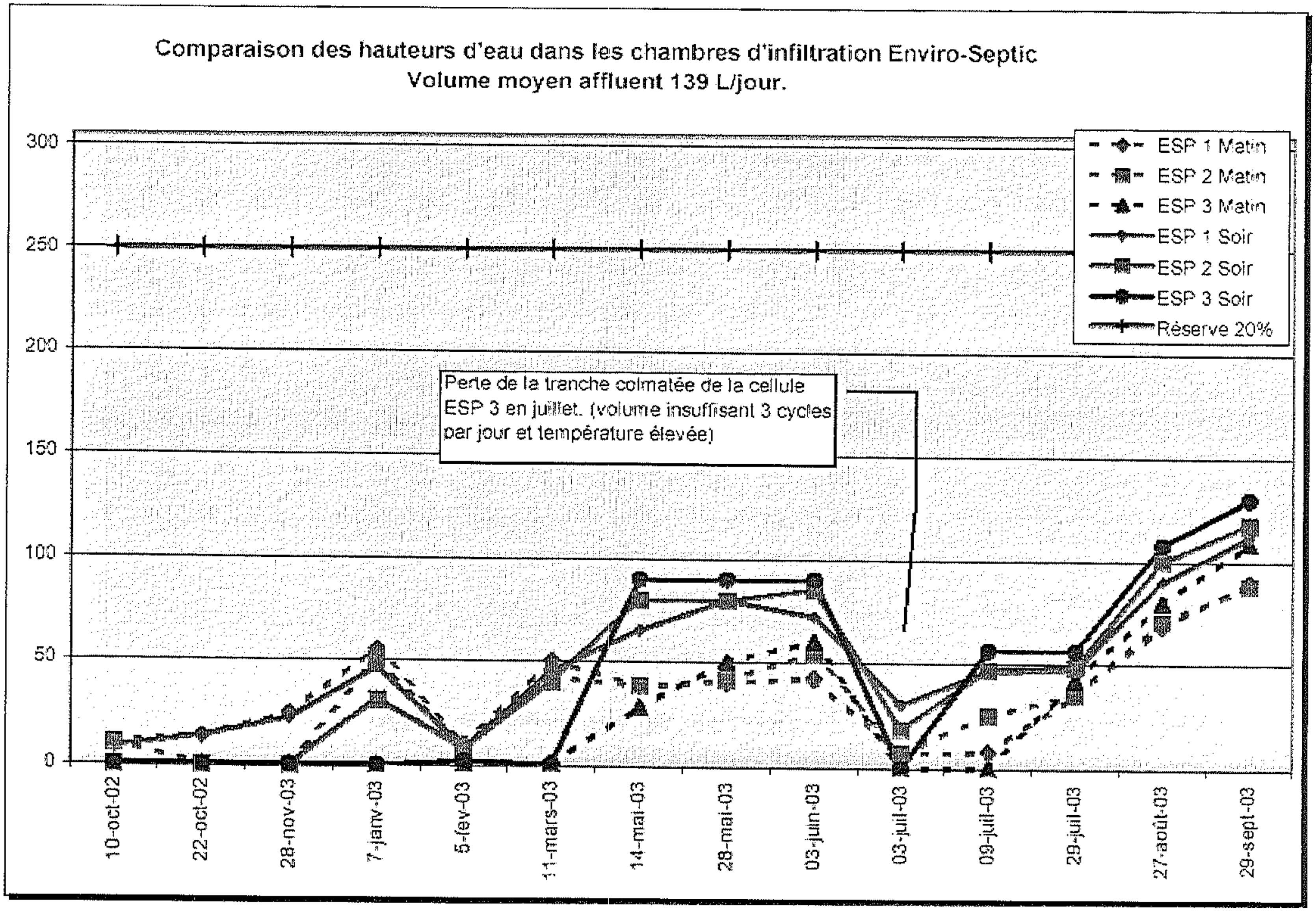

Niveaux d'eau dans la pierre du système traditionnel le 28 mai 2003
Mesures par Environnement E.S.A. inc. (J. Fortier)
Volume total récupéré dans la cellule dans la journée : 645 L
Dessus zone pierre nette
6h38
21h15
Radier conduite perforée
Dessus conduite perforée
305
254
152
52
34
20
0
Hauteur d'eau dans la conduite (mm)
Emplacement dans la conduite vs point d'entrée (m)
350
300
250
200
150
100
50
0
2
4
6
8
10
12
14
16
18


Niveaux d'eau dans la conduite Enviro-Septic le 28 mai 2003
Mesures par Environnement E.S.A. inc. (J. Fortier)
Volume total récupéré dans la cellule dans la journée : 698 L
L'élévation "0" correspond au radier de la conduite ESP (fond des nervures)
Remarque : les premières ouvertures évacuent l'eau de la conduite sont à l'élévation 20 mm
Note . Valeurs mesurées le soir douteuses en ESP 1 et 2
Devraient être autour de 80 mm à chaque place.
dessus conduite
6h30
21h10 +réalistes
Réserve 20%
21h10 mesurées
Hauteur d'eau dans la conduite (mm)
Emplacement dans la conduite vs point d'entrée (m)
305
250
80
40
0
41
90
50
0
2
4
6
8
10
12
14
16
18
100
150
200
300
350


Niveaux d'eau dans la pierre du système traditionnel le 14 mai 2003
Mesures par Environnement E.S.A. inc. (S. de Léséleuc)
Volume total récupéré dans la cellule dans la journée : 682 L
Dessus zone pierre nette
6h43
21h10
Radier conduite perforée
Dessus conduite perforée
305
305
305
254
254
254
152
152
152
40
28
0
0
Hauteur d'eau dans la conduite (mm)
Emplacement dans la conduite vs point d'entrée (m)
0
50
100
150
200
250
300
350
0
2
4
6
8
10
12
14
16
18


Niveaux d'eau dans la conduite Enviro-Septic le 14 mai 2003
Mesures par Environnement E.S.A. inc. (S. de Léséleuc)
dessus conduite
6h35
21h00
Réserve 20%
Volume total récupéré dans la cellule dans la journée : 722 L
L'élévation "0" correspond au radier de la conduite ESP (fond des nervures)
Remarque : les premières ouvertures évacuant l'eau de la conduite sont à l'élévation 20 mm
305
305
305
250
250
250
65
80
90
38
38
28
Hauteur d'eau dans la conduite (mm)
0
50
100
150
200
250
300
350
0
2
4
6
8
10
12
14
16
18
Emplacement dans la conduite vs point d'entrée (m)


Comparaison des hauteurs d'eau sur la surface d'infiltration CPC
Volume moyen affluent 110 L/jour.
CPC 1 Matin
CPC 2 Matin
CPC 3 Matin
CPC 1 Soir
CPC 2 Soir
CPC 3 Soir
Radier conduit CPC
300
250
200
150
100
50
0
10-oct-02
22-oct-02
28-nov-03
7-janv-03
5-fev-03
11-mars-03
14-mai-03
28-mai-03
03-juin-03
03-juil-03
09-juil-03
29-juil-03
27-août-03
29-sept-03


Comparaison des hauteurs d'eau dans les chambres d'infiltration Enviro-Septic
Volume moyen affluent 139 L/jour.
300
250
200
150
100
50
0
ESP 1 Matin
ESP 2 Matin
ESP 3 Matin
ESP 1 Soir
ESP 2 Soir
ESP 3 Soir
Réserve 20%
Perte de la tranche colmatée de la cellule ESP 3 en juillet. (volume insuffisant 3 cycles par jour et température élevée)
10-oct-02
22-oct-02
28-nov-03
7-janv-03
5-fev-03
11-mars-03
14-mai-03
28-mai-03
03-juin-03
03-juil-03
09-juil-03
29-juil-03
27-août-03
29-sept-03

4.4 Graphs of the results of measurements of piezometers high

The following graphs summarize measurements of piezometers "height". These piezometers measure the leachate levels accumulated in each test cell in the area of accumulation above the filtering sand. In Enviro-Septic® the accumulation area is in the pipe itself, whereas in pipe and stone (CPC) in the crushed stone area on top of the pipe.

On each graph referring to the measures of cells ESP 1-2-3, the level "0" corresponds to the bottom of EnviroSeptic® pipe, with the bottom of the undulations of pipe. One traced there the effluent levels measured the morning before the loading (before 7h00) and those measured after the loading of the evening (after 21h00). The level corresponding to the reserve of 20% (see section 4.3) representing the top of the Enviro-Septic® pipe are also traced there.

For the graphs referring to the measurements taken for piezometer "height" of cells CPC (pipe and stone), the level "0" corresponds to the boundary filter sand and the crushed stone. We traced the levels corresponding to the foundation raft and above the perforated pipe, to the top of the layer of crushed stone.

As certain results presented readings with difficulty, we traced, in addition to the measured values, the values which we believe to be more realistic. You will see in the legend represents the types of layout for each item. These graphs do not aim solely at the period from May 14 to October 28, 2003. All preceding measurements of the follow-up have less interest given that the bacterial surface was not established yet on the entire Enviro-Septic® pipe.

Previously with the individual graphs showing the values measured along the sections of 18.3 meters, you will find 2 graphs showing the evolution in time of the piezometric levels, from October 2002 to October 2003.

4.5 Comments on the results

By traversing the various graphs, one notes that the effluent levels vary in time according to various factors. In addition to those mentioned in section 3.2, the volume of effluent (different according to 3 or 4 cycles per day), the temperature of effluent and accidental interruptions (example: Father's Day in June) had an impact on the piezometric levels. One notes moreover that the effluent levels in the piezometers of the Enviro-Septic® cells allowed, even in the highest levels reached for the period from October 2002 to October 2003, a reserve being equivalent to nearly 100% the daily flow.

CALCULATION OF THE TANK

Enviro-septic® Pipe

L

h

S

D = 0.3048 m
R = 0.1524 m
S = reserve

D

R

Note: Valid for the hemisphere superior only (Height of water deplus of 150 mm in pipe)

$S = R^2 \cos^{-1}((R-h)/R) - (R-h)*(2Rh-h^2)^{1/2}$

Calculations based on a daily volume of water of 45L/d.m (135 L/d for 3 m)

H reserves (m)	S reserve (L/m)	Reserve (% vol./d)	H reserves (m)	S reserve (L/m)	Reserve (% vol./d)	H reserve (m)	S reserve (L/m)	Reserve (% vol./d)
0.000	0.00 L/m	0.0%	0.052	8.27 L/m	18.4%	0.104	21.98 L/m	48.9%
0.002	0.07 L/m	0.1%	0.054	8.73 L/m	19.4%	0.106	22.56 L/m	50.1%
0.004	0.19 L/m	0.4%	0.056	9.20 L/m	20.4%	0.108	23.14 L/m	51.4%
0.006	0.34 L/m	0.8%	0.058	9.67 L/m	21.5%	0.110	23.73 L/m	52.7%
0.008	0.52 L/m	1.2%	0.060	10.16 L/m	22.6%	0.112	24.31 L/m	54.0%
0.010	0.73 L/m	1.6%	0.062	10.64 L/m	23.7%	0.114	24.90 L/m	55.3%
0.012	0.96 L/m	2.1%	0.064	11.14 L/m	24.7%	0.116	25.49 L/m	56.7%
0.014	1.20 L/m	2.7%	0.066	11.64 L/m	25.9%	0.118	26.09 L/m	58.0%
0.016	1.47 L/m	3.3%	0.068	12.14 L/m	27.0%	0.120	26.68 L/m	59.3%
0.018	1.75 L/m	3.9%	0.070	12.65 L/m	28.1%	0.122	27.28 L/m	60.6%
0.020	2.04 L/m	4.5%	0.072	13.17 L/m	29.3%	0.124	27.88 L/m	61.9%
0.022	2.35 L/m	5.2%	0.074	13.69 L/m	30.4%	0.126	28.48 L/m	63.3%
0.024	2.67 L/m	5.9%	0.076	14.21 L/m	31.6%	0.128	29.08 L/m	64.6%
0.026	3.01 L/m	6.7%	0.078	14.74 L/m	32.8%	0.130	29.68 L/m	66.0%
0.028	3.35 L/m	7.4%	0.080	15.28 L/m	33.9%	0.132	30.28 L/m	67.3%
0.030	3.71 L/m	8.2%	0.082	15.81 L/m	35.1%	0.134	30.89 L/m	68.6%
0.032	4.08 L/m	9.1%	0.084	16.36 L/m	36.3%	0.136	31.49 L/m	70.0%
0.034	4.46 L/m	9.9%	0.086	16.90 L/m	37.6%	0.138	32.10 L/m	71.3%
0.036	4.85 L/m	10.8%	0.088	17.45 L/m	38.8%	0.140	32.71 L/m	72.7%
0.038	5.24 L/m	11.7%	0.090	18.01 L/m	40.0%	0.142	33.32 L/m	74.0%
0.040	5.65 L/m	12.6%	0.092	18.57 L/m	41.3%	0.144	33.92 L/m	75.4%
0.042	6.07 L/m	13.5%	0.094	19.13 L/m	42.5%	0.146	34.53 L/m	76.7%
0.044	6.49 L/m	14.4%	0.096	19.69 L/m	43.8%	0.148	35.14 L/m	78.1%
0.046	6.92 L/m	15.4%	0.098	20.26 L/m	45.0%	0.150	35.75 L/m	79.4%
0.048	7.36 L/m	16.4%	0.100	20.83 L/m	46.3%	0.152	36.36 L/m	80.8%
0.050	7.81 L/m	17.4%	0.102	21.41 L/m	47.6%			

NOTE: To allow a reserve sufficient for an in-rush of effluent undergoes (let us say 20% of daily volume), one would need that there is an open space of at least 55 mm in pipe, therefore not more than 250 mm of water in Enviro-Septic® pipe (± 10 inches).

The levels of reserve under the level of accumulation in the load dispatching center is not presented in this table given that the interest is related to the reserve in the event of strong accumulations.

4.3 Accumulation in time vs sudden in-rush of effluent

Though it is important to have precise measurements, it remains significant to follow the evolution of the effluent level in time, in particular to make sure that the level of accumulation of effluent in Enviro-Septic® pipe offers a certain reserve making it possible to support an in-rush of effluent, for example, the draining of a bath.

For this purpose, the Committee on New Technologies of Treatment out of Effluent (MENV and MAMM) mentioned, in its document of analysis on the function of distribution of Enviro-Septic® pipe, that a reserve corresponding to 20% of the daily output appears reasonable.

The following table establishes, according to the effluent level accumulated in pipe and of an average volume of daily flow of 45 L/d.m (or 135 L/d by section of 3 meters), the reserve available (expressed as a percentage of the average volume of daily flow). You will note that the effluent level in pipe should not exceed 250 mm to allow a reserve of 20%.

In the high case of the piezometers of cells CPC, the content of the piezometer consists of sand. A sand bottom does not offer a hard surface and it is possible that there is depression of the ruler during measurements.

To limit the possibilities of errors, a detailed attention was taken at the time of the descent of the ruler so that it is done most slowly and slightly as possible. As soon as the sand was felt, our technologist stopped positioning the ruler and withdrew it to take its reading.

4.2.5 Difference in hour in the catch of measurement according to the loading of the evening

According to the loading of the evening, water infiltrates at its rate in the cells according to various factors, in particular according to the state of the bacterial surface of the section. Measurements which are carried out manually by a technologist cannot be made all simultaneously. It thus happens that several minutes separate the catches from measurements of various cells, being able to cause differences when one evaluates the distribution from one cell to another.

4.2.6 Obstruction of openings of the piezometer by silt for CPC

A simple assumption (since this aspect was not checked on the spot) that remains open for possibility in the presence of effluent remaining a long time at the same place and could be the case in the stone area crushed of cells CPC.

The effect of an obstruction of openings of piezometers could have as consequence to underestimate the height of effluent really present in the stone area. This aspect could explain variations with difficulty explicables between the levels of the various cells, in particular the values "0" in CPC 1 the morning before the loading of July 29.

4.2.7 Effect of compressing of pipe

In addition, it is impossible to install a pipe in sand perfectly level at a distance of 18 meters, but it is possible to fix pipe following a compressing of subjacent sand. The embankment load, combined with the effect of effluent and the fact that Enviro-Septic® pipe is not completely rigid, can cause a certain compressing, creating differences in level in the foundation raft of pipe.

4.2.8 Precision

Considering the significant number of differences that can have an impact the measures of level in the piezometers, it is difficult to rule on the precision of measurements.

If one excludes the possible phenomena from filling of piezometers, depression of pipe and shifted hours of loading (for which we do not have pipe), one could advance that the precision of measurements should be inside 5 mm by applying a great care in measurements.

The recommended method was to delicately soak the ruler at the bottom of the piezometer and withdraw it. The effluent leaves a clear mark on the ruler, enabling us to know the effluent level.

Of course, several factors can influence the precision of measurements:

- perpendicularity of measurements;
- position of the ruler at the bottom of the ESP pipe vs. its circular form;
- presence of corrugations at the bottom of the pipe for ESP;
- possible depression of the ruler in sand for CPC;
- difference in hour in the catch of measurement according to the pumping of the evening;
- obstruction of openings of the piezometer or the boundary of the stone area surrounding the piezometer by silt for the CPC;
- Effect of compressing of the pipe.

The sub-sections that follow indicate the precautions taken to limit the risks of inaccuracy connected to several of these factors of error.

4.2.1 Perpendicularity

The low diameter of the piezometers of cells CPC (76 mm) and of the tubes of access to pipe ESP (50 mm) limit the effect of nonperpendicularity if it is necessary.

Measurements

With the ruler having a width of 1 inch, the risk to obtain a bad effluent level reading is limited, more especially as the tubes of access to Enviro-Septic® pipe are prolonged until the bottom of pipe (an opening was practiced on each side at the end of the tubes to the meeting of pipe).

4.2.2 Position of the circular ruler vs. form of ESP pipe

Also because of the low diameter of the tubes of access and owing to the fact that the tubes of access to Enviro-Septic® pipe are prolonged until the bottom, the risks to measure on sites different from one measurement to another is very limited. This aspect thus guaranteed that measurements in the same piezometer are always made with the same site.

4.2.3 Presence of corrugations at the bottom of pipe ESP

In addition to the circular shape of pipe ESP, another element that can cause erroneous measurements is the presence of corrugations in pipe.

4.2.4 Possible depression of the ruler in sand for CPC

While descending the rule in pipe, our technologist was to ensure himself to be between the corrugations each time. To ensure this, the technologist turned the ruler a quarter of a turn and confirmed its site when it felt the ruler go down from approximately 20 mm. If while turning the rule there was no descent, but rather side contact, that would have meant that it was already at the bottom of a vein.

4.0 Measures of levels in the piezometers

4.1 Importance of measurements

In addition to the volumes of effluent recovered in the test cells, another indicator of distribution of effluent in the cells is the measurement of the effluent level in the various piezometers installed in the test cells.

Inside each cell of Enviro-Septic®(ESP 12-3) the piezometers gives access directly inside the pipe for a direct measurement of the effluent level. These piezometers, named ESP "X" - H (X for 1, 2 or 3, and H for top), make it possible to quantify the height of effluent present at the bottom of the pipe by a section of 6.1 meters and thus know the evolution of the effluent level in the course of time.

Theoretically, there is no significant accumulation of effluent in a pipe as long as the bacterial surface is not sufficiently established over the entire length of the pipe, by taking the easiest way, the effluent will tend to infiltrate into the zones where the permeability is largest. If the bacterial surface is well established on all of the pipe, since the permeability will be similar over the entire length, effluent is distributed uniformly over the entire length (equal flow recovered by cell) and the effluent level may increases in the pipe. Within the framework of the follow-up of the bench test, it became significant to follow the evolution of the effluent level in Enviro-Septic® pipe in order to rule on the long-term capacity of the system to infiltrate effluent.

Inside cells CPC 1-2-3, piezometers named CPC "X" - H, enable us to know the effluent level accumulated in the crushed stone zone where the perforated pipe is located (15 cm above the transition between the sand and stone). In this case, a cell having effluent at the height of the piezometer (or in increase in time) and very little effluent recovered in the content of collection could indicate that the boundary between the stone and sand is clogged. According to the logic effluent always takes the easiest way, effluent moves in the pipe (and/or the crushed stone horizon) towards the downstream and will infiltrate at a place which is not clogged yet. The situation becomes problematic when all the cells are clogged.

Logically, if the layers of materials and the conduits were installed perfectly on the level, one could expect that the effluent level in the various cells would be equal. However, it is impossible on the ground to in to be that precise, in particular because it is not simple to level a pipe in one sand that is compressed only by watering. For the cells of pipe and stone or the Enviro-Septic® cells, it is possible that there are differences in level in the foundation rafts of pipe.

4.2 Measurement techniques and precision

Measurements of water level were taken using a mean rule graduated in millimeters, directly descended to the bottom from the piezometer. Taking into account the depth of the piezometers, it was necessary to pair some rulers end to end. Also taking into account the depth, it was not possible to take a visual reading directly on the ruler.

SUMMARY OF THE CAPACITIES OF PUMPING

POINT	Oct-08-02	Apr09-03	Jun17-03		03-juil-03	Jul-29-03	Oct-28-03
ESP#1 (P1)	1.356 L/s	1.238 L/s	1.366 L/s			1.303 L/s	1.321 L/s
289.1296 L/m	110.0 sec.	113.7 sec.	97.0 sec.			100.6 sec.	99.6 sec.
'H :	0.528 m	0.487 m	0.458 m			0.453 m	0.455 m
ESP#2 (P2)	1.404 L/s	1.192 L/s	1.312 L/s			1.127 L/s	1.198 L/s
289.1296 L/m	108.0 sec.	119.3 sec.	106.4 sec.			116.7 sec.	101.5 sec.
'H :	0.525 m	0.492 m	0.483 m			0.455 m	0.420 m
ESP#3 (P3)	1.303 L/s	1.121 L/s	1.231 L/s		1.033 L/s	0.846 L/s	1.049 L/s
272.5198 L/m	110.7 sec.	119.3 sec.	99.8 sec.		120.3 sec.	143.8 sec.	118.5 sec.
'H :	0.529 m	0.491 m	0.451 m		0.456 m	0.447 m	0.456 m
				Releasing			
			Front	Afterwards			
CPC#1 (P6)	1.235 L/s	0.622 L/s	0.788 L/s	0.710 L/s	0.586 L/s	0.688 L/s	0.707 L/s
272.5198 L/m	119.3 sec.	211.0 sec.	157.3 sec.	173.4 sec.	209.8 sec.	182.3 sec.	174.4 sec.
'H :	0.541 m	0.481 m	0.455 m	0.452 m	0.451 m	0.460 m	0.452 m
CPC#2 (P5)	1.146 L/s	0.916 L/s	0.996 L/s			0.859 L/s	0.786 L/s
253.3381 L/m	120.0 sec.	142.7 sec.	114.2 sec.			136.0 sec.	150.8 sec.
'H :	0.543 m	0.516 m	0.449 m			0.461 m	0.468 m
CPC#3 (P4)	1.300 L/s	1.264 L/s	1.269 L/s			1.283 L/s	1.239 L/s
272.5198 L/m	108.7 sec.	112.0 sec.	97.7 sec.			96.9 sec.	100.3 sec.
'H :	0.519 m	0.519 m	0.455 m			0.456 m	0.456 m

The volume was obtained by measuring the useful surface of the well by the differential of level between the departure and the stopping of the pump. This useful surface is obtained by measuring the exact diameter of the pit by the amount of surface area that is not occupied by effluent. In this case, we will withdraw the effluent occupied by the discharge pipe since it remains full after each pumping.

Let us mention that the calibrations were carried out in conformity with the method specified with the Guide of Sampling at Ends of Environmental Analyses, Book 7: Measure Flow in Open Conduit. According to the method of the guide, at least three tests were to be carried out with each calibration and the maximum variation of a result compared to the average of the tests was to be lower than 5%.

3.3.2 Results

The following table summarizes the values obtained at the time of each calibration. They are summarized values that refer to a series of forms containing the data of ground (see appendix).

3.3 Stations of pumping

As mentioned in the preceding section, the official measurement of the flow recovered in the test cells were taken during the times of pumping of each station being used to collect the leachate in the respective cells. These times of pumping are done through the pipe panel of the pumps. This pipe panel is provided with a programmable automat that transfers the pumping data to an information processing system of data acquisition.

The amount of times of pumping is multiplied by the capacity of each pump. These capacities of pumping vary from one station to another according to various factors like the wear of the pumps, the height of the start and stop of a pumping, type and length of pipes downstream, etc. In the same way, the capacity of pumping of the same station can vary in time, in particular according to the wear of the pump but possibly even more according to the accumulation of matters on the walls that causes an additional friction.

Other factors can influence the behavior of the pumps and this is why it was decided to make a regular calibration of each station of pumping.

3.3.1 Method of calibration

To calibrate the system loading, the volumetric method was used to know the capacity of pumping of each station.

With this, we measured the times necessary to pump the effluent to lower the level between the pumping so that no effluent was allowed out during the test (no effluent coming from the test cell: an elbow of 90° was placed at the end of the pipe of entry at the station to retain effluent upstream). A pumping truck was used to fill the stations with effluent for the volumetric tests.

The effluent levels stop during the pumping tests and are measured in millimeters using a ribbon. The levels were obtained by measuring the distance between the level of effluent and a fixed reference point at the top of the pumping station. A detailed attention was taken so that the place of reference used is always the same one.

Times of pumping were obtained from the data recorded from the pipe panel within $1/10^{th}$ of a second. The data were validated using a stopwatch. This procedure enabled us to make sure that the recorded times of pumping were adequate.

The capacity of each pumping station was obtained by dividing the volume of effluent by the pumping time.

CHECKING OF THE LEVELS BEFORE AND DURING LOADING WITH THE DISTRIBUTION CHAMBERS

Boîtes de répartition : / ıte / tech.		SORTIE DU DÉLESTAGE					4E SECTION				
		Au niveau "0" de chacun des égalisateurs avant dosage ?		Niveau d'eau égal dans les égalisateurs durant dosage ?		Commentaires	Au niveau "0" de chacun des égalisateurs avant dosage ?		Niveau d'eau égal dans les égalisateurs durant dosage ?		
DATE	**TECHNOLOGUE**	**OUI**	**NON**	**OUI**	**NON**	**COMMENTAIRES**	**OUI**	**NON**	**OUI**	**NON**	**CO**
ıi 2003	J. Fortier	X		X			X		X		
ıi 2003	J. Fortier	X		X			X		X		
2003	J. Fortier	X		X			X		X		
let 2003	S. de Léséleuc	X		X			X		X		
let 2003	S. de Léséleuc	X		X			X		X		
llet 2003	S. de Léséleuc	X		X			X		X		
ût 2003	J. Fortier	X		X			X		X		
ɔtembre 2003	S. de Léséleuc	X		X			X		X		

3.2 Distribution box and equalizers

Upon the launching of the bench test in October 2002, the effluent on the outlet side of the tank was directed towards a distribution chamber where 4 connections made it possible to distribute effluent towards the various cells (2 for the Presby Maze: ±1260 L/d, 1 for CPC 1-2-3: ±630 L/d and 1 for ESP 1-2-3: ±630 L/d).

With the addition of the 4th section in April 2003, a new pipe was connected to the distribution box in order to feed cells CPC 4-5 (105 L/d) and ESP 4-5-6-7 (210 L/d). The new pipe takes the additional 630 L/d of effluent and distributes it into the new cells using a second distribution chamber provided with 6 exits, of which one is used to feed cells CPC 4-5 and two others are used to feed cells ESP 4-5 and ESP 6-7. To provide an equal distribution of 105 L/d by pipe, it was necessary to use the 3 other conduits to make a forward thrust (315 L/d) towards the municipal treatment. Inside each distribution box, equalizers in the form of a "V" were installed opposite each pipe. The purpose of these equalizers is to ensure a uniform distribution of flows to each cell.

3.2.1 Method of checking

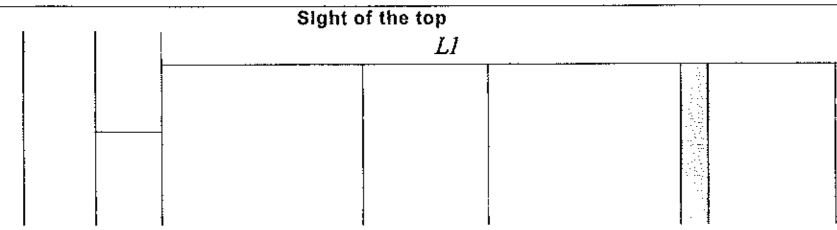
At each day of sampling, a technologist from our firm visually checked the uniformity of the division of the discharges in the equalizers. With each visit, we raised the lid of the distribution box and took care to make sure that the effluent level in the equalizers was on the "0" level before entering, indicating that the equalizers are installed in a tight way on the conduits (effluent not escaping). Also, it was to make sure that the effluent level is equal in the equalizers during the period of entering.

3.2.2 Results

Though the use of a distribution box and equalizers is more sophisticated and reliable than a system in the form of "T" (commonly used in practice, in particular for the traditional installations), it remains that differences in division of the discharges in the various cells are possible. The arrival of effluent to the distribution box was done by sudden in-rushes of effluent causing a certain turbulence in the box, relaying differences in the distribution toward the equalizers, in particular at the beginning of the openings of the pneumatic valve. As the entering time is short (15 - 25 sec.), it is possible that one of the pipes receive more effluent than desired.

Though it is, these distribution boxes and equalizers are not used to calculate the flows and the loads recovered in each cell. These calculations are done by the individual pumping stations that recover leachate at the exit of each test cell. These stations were regularly calibrated by our company wherein the times of pumping of each station, and the days of pumping were all recorded by the pipe panel, which made it possible to calculate the leachate flows recovered from each test cell.

Volumetric calibration of the septic tank - April 11, 2003



L1 : 1.308 m
L2 : 0.648 m
l *l :* 1.016 m

Septic tank + Septic tank - sight of the top addition 25% and levels with stems

Apr-11-03		Section 1			Section 2			Real volume	Variation vs stems
Test		h departure	h stop	'H	h departure	H stop	'H	(L)	(%)
1010 L + 25%			Note :	Distances between reference fixes top of the pit to water					
1263 L	#1-1	1.322 m	0.810	0.512 m	1.324 m	1.316 m	0.008 m	1270.4 L	0.6%
	#1-2	1.308 m	0.868	0.440 m	1.316 m	1.316 m	0.000 m		
	#2-1	1.322 m	0.838	0.484 m	1.316 m	1.316 m	0.000 m	1273.1 L	0.8%
	#2-2	1.310 m	0.836	0.474 m	1.316 m	1.316 m	0.000 m		
							Average:	1271.8 L	0.7%

Apr-11-03		Section 1			Section 2			Real volume	Variation vs stems
Test		H departure	h stop	'H	h departure	h stop	'H	(L)	(%)
880 L + 25%			Note :	Distances between reference fixes top of the pit to water					
1100 L	#1-1	1.312	0.81	0.496	1.312	0.840	0.472	1089.7 L	-0.9%
	#1-2	0.816	0.81	0.000	1.194	1.012	0.182		
	#2-1	1.316	0.81	0.502	1.312	0.866	0.446	1110.9 L	1.0%
	#2-2	0.814	0.81	0.000	1.196	0.968	0.228		
							Average:	1100.3 L	0.0%

Apr-11-03		Section 1			Section 2			Real volume	Variation vs stems
Test		H departure	h stop	'H	h departure	h stop	'H	(L)	(%)
630 L + 25%			Note :	Distances between reference fixes top of the pit to water					
788 L	#1	1.320	0.80	0.512	1.316	1.064	0.252	846.3 L	7.5%
	#2	1.312	0.81	0.500	1.318	1.058	0.260	835.6 L	6.1%
							Average :	841.0 L	6.8%

Volumetric calibration of the septic tank - October 8, 2002

Sight of the top

L1 *L2*

L1 :		1.308 m
l	*L2 :*	0.648 m
l :		1.016 m

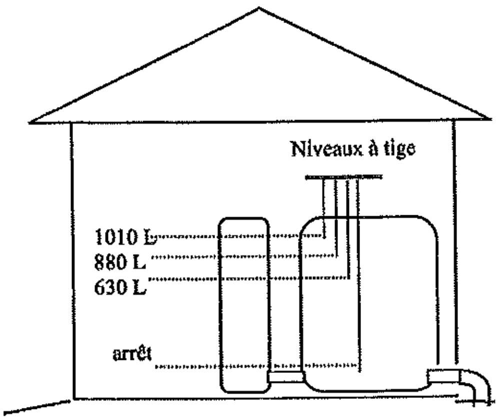
Septic tank Septic tank - sight of the top and levels with stems

Oct-8-02		Section 1			Section 2			Real volume	Vs. Variation stems
Test		h departure	h stop	'H	h departure	h stop	'H	(L)	(%)
		Note :	Distances between reference fixes top of the pit to water						
1010 L	#1	1.342 m	0.810 m	0.532 m	1.330 m	0.834 m	0.496 m	1033.5 L	2.3%
	#2	1.346 m	0.808 m	0.538 m	1.286 m	0.800 m	0.486 m	1034.9 L	2.5%
							Average:	1034.2 L	2.4%

Oct-08-02		Section 1			Section 2			Volume reality	Variation vs stems
Test		h departure	h stop	'H	h departure	h stop	'H	(L)	(%)
		Note :	Distances between reference fixes top of the pit to water						
880 L	#1	1.330 m	0.810 m	0.520 m	1.294 m	0.962 m	0.332 m	910 L	3.4%
	#2	1.348 m	0.810 m	0.538 m	1.278 m	0.990 m	0.288 m	905 L	2.8%
							Average :	907.1 L	3.1%

8-oct-02		Section 1			Section 2			Volume reality	Variation vs stems
Test		h departure	h stop	'H	h departure	h stop	'H	(L)	(%)
		Note :	Distances between reference fixestop of the pit to water						
630 L	#1	1.300 m	0.810 m	0.490 m	1.305 m	1.276 m	0.029 m	670 L	6.4%
	#2	1.294 m	0.810 m	0.484 m	1.276 m	1.226 m	0.050 m	676 L	7.3%
							Average :	673.2 L	6.9%

The following diagram shows the conditions of validation of the flows of the waiting tank:



During the installation of the bench test in October 2002, only one tank with a stem was present. On the other hand, following the addition of the 4th section, a second tank was connected to the primary waiting tank in order to add a capacity of additional effluent of 25% with the goal of feeding the 4th cell. A first calibration was made on October 8, 2002 and a second on April 11, 2003 following the installation of the second tank.

$V = S_{F.S.} \times 'H$
$V = [(L1 \times 'H_1) + (L_2 \times 'H_2)] \times l$

L = width of the pit = 1.016 m

3.1.2 Results

The following tables show the results of volumetric calibration of the waiting tank using the secondary septic tank located downstream from it. This secondary septic tank was to be used to adjust the loads if the loads of effluent became abnormally high. Given that the effluent loads were adequate during the follow-up, this tank was not used. The effluent ran directly towards the valve chamber without passing into the waiting tank using a set of valves.

You will note that the system of a primary tank, provided with stems, together with a second tank to increase the capacity of effluent (since April 2003), allows a very precise volume of effluent largely inside the tolerance of 10% specified in the test protocol.

3.0 Accuracy of the systems with regard to measurement of the flow

3.1 Waiting tank

The first component being measured for flow is the holding tank that receives effluent coming from the common septic tank of the municipality of Stoke.

This tank is provided with a stem that allows effluent to be supplied to the waiting tank. When the tank is full, effluent bypasses the waiting tank and continues to the Stoke treatment facility.

3.1.1 Method of calibration

Volumes of effluent from the waiting tank are distributed to a feeding tank using a volumetric stem that ensures proper volumes of effluent are being provided.

With this method of distribution, the effluent from the waiting tank (entering and exiting with volumes of 880 L, 630 L and 1010 L) was directed towards the secondary septic tank (feeding tank) on the site and was measured using principles of geometry.

A septic tank consists of simple geometrical surfaces (2 rectangular compartments) and it becomes easy to calculate the volume of effluent by multiplying the effluent level by the tank dimensions.

Initially effluent fills up the first section of the septic tank. When the effluent level reaches the height of passage that connects the two compartments of the tank the effluent ceases filling up the first compartment and flows into the second compartment.

Thus, for the tests carried out on October 8, 2002 where only one pumping tank was used, the calibration tests could be carried out because the volume of the pumping tank was sufficient to receive the necessary amounts of water.

However, taking into account the greater volume needed following the addition of the 4th section in April (25% more), we had to calibrate the tank twice. Beginning with the tests using 1010 L + 25% (1263 L), effluent fills the first compartment of the waiting tank and then passes into the second compartment. Then the pneumatic valve closes automatically to stop effluent from entering temporarily. The first compartment of the waiting tank is then emptied using a submerged pump. Once emptied the pneumatic valve opens again to fill the tank for the next feeding to the test beds. For the tests using 880 L + 25% on April 11, it was agreed to do this procedure twice by emptying the 2nd compartment instead of the first to save the time of draining the entire tank. Lastly, the test using 630 L + 25% on April 11 was done by using the volume given from the waiting tank as it was sufficient.

GéoLab inc.

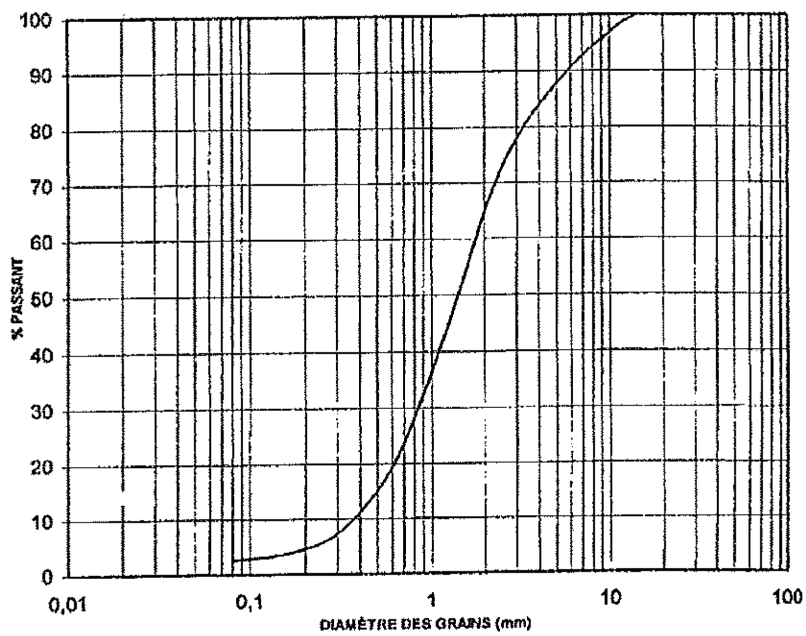
ESSAIS SUR MATÉRIAUX

CLIENT:	Environnement ESA	DOSSIER #:	02 09 204C
PROJET:	Essais en laboratoire	ÉCHANTILLON #:	03
PROVENANCE:		DESCRIPTION:	Sable filtrant (Q-2, r.8)
PRÉLEVÉ PAR:	Client	CALIBRE:	aucun
DATE:	04/09/2002	USAGE:	Sable filtrant (Q-2, r.8)
ENDROIT:	CPC # 3	CONTRAT #:	

GRANULOMÉTRIE NORME (LC 21-040)

TAMIS (mm)	% PASSANT CUMULATIF	% PASSANT EXIGENCES	*
112			
80			
56			
40			
31,5			
20			
14	100		
10	97		
5	88		
2,5	73		
1,25	45		
0,630	21		
0,315	8		
0,160	4		
0,080	2,5		
M.F.:	3,65		
% GRAVIER:	12,2		
%SABLE:	85,3		
%SILT:	2,5		
C_u:	5,1	< 4	*
C_c:	1,0		
D_{10}	0,35	$0,25 < D_{10} < 1$	
D_{60}	1,42		

COURBE GRANULOMÉTRIQUE



ESSAIS	NORMES	RÉSULTATS	*	EXIGENCES	ESSAIS	NORMES	RÉSULTATS	*	EXIGENCES
Teneur en eau					Densité sèche < 5 mm				
Los Angeles					Densité SSS < 5 mm				
Micro-Deval					Densité app. < 5 mm				
Particules plates					Absorption < 5 mm				
Particules allongées					Durabilité $MgSO_4$				
Fragmentation					Nombre pétro.				
Propreté (gravière)					Particules légères				
Matières organiques					Proctor modifié				
Valeur au bleu					Humidité optimale				
Indice colorimétrique					W_L / W_P		/		

REMARQUES: **Sable non conforme aux exigences d'un sable filtrant (Q-2, r.8, 20 juillet 2000)**
Les résultats sont représentatifs de l'échantillon reçu. **D_{60} = 1,79**

* : NON CONFORMITÉ

VERIFIE PAR: Luc Bertrand, ing. DATE: 09/09/2002

F076 (04.02)

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49, rue de l'Aqueduc Bur. 2
Victoriaville (Québec) G6P 1M2
Tél : (819) 751-2220
Fax : (819) 751-2228

Enregistré ISO-9002 (1994)

ENVIRONNEMENT ESA

GéoLab inc.

Système Enviro-Septic[MC]

Rapport de distribution longitudinale – 1 an

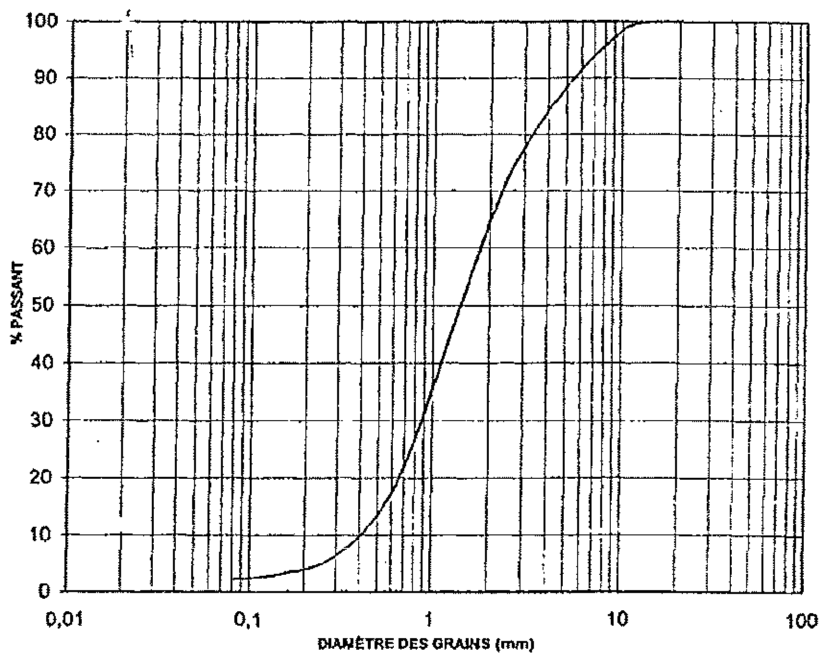
ESSAIS SUR MATÉRIAUX

CLIENT:	Environnement ESA	DOSSIER #:	02 09 204C
PROJET:	Essais en laboratoire	ÉCHANTILLON #:	02
PROVENANCE:		DESCRIPTION:	Sable filtrant (Q-2, r.8)
PRÉLEVÉ PAR:	Client	CALIBRE:	aucun
DATE:	04/09/2002	USAGE:	Sable filtrant (Q-2, r.8)
ENDROIT:	ESP # 2	CONTRAT #:	

GRANULOMÉTRIE NORME (LC 21-040)

TAMIS (mm)	% PASSANT CUMULATIF	% PASSANT EXIGENCES	*
112			
80			
56			
40			
31,5			
20			
14	100		
10	98		
5	88		
2,5	73		
1,25	46		
0,630	19		
0,315	7		
0,160	3		
0,080	2,2		
M.F.:	3,67		
% GRAVIER:	11,6		
%SABLE:	86,2		
%SILT:	2,2		
C_u:	4,8	< 4	*
C_c:	1,0		
D_{10}	0,38	$0,25 < D_{10} < 1$	
D_{50}	1,43		

COURBE GRANULOMÉTRIQUE



ESSAIS	NORMES	RÉSULTATS	*	EXIGENCES	ESSAIS	NORMES	RÉSULTATS	*	EXIGENCES
Teneur en eau					Densité sèche < 5 mm				
Los Angeles					Densité SSS < 5 mm				
Micro-Deval					Densité app. < 5 mm				
Particules plates					Absorption < 5 mm				
Particules allongées					Durabilité $MgSO_4$				
Fragmentation					Nombre pétro.				
Propreté (gravière)					Particules légères				
Matières organiques					Proctor modifié				
Valeur au bleu					Humidité optimale				
Indice colorimétrique					W_L / W_P		/		

REMARQUES: **Sable non conforme aux exigences d'un sable filtrant (Q-2, r.8, 20 juillet 2000)**

Les résultats sont représentatifs de l'échantillon reçu. **D_{60} = 1,82**

* : NON CONFORMITÉ

VERIFIE PAR: Luc Bertrand, ing. DATE: 09/09/2002

F076 (04.02)

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Enregistré ISO-9002 (1994)

GéoLab inc.

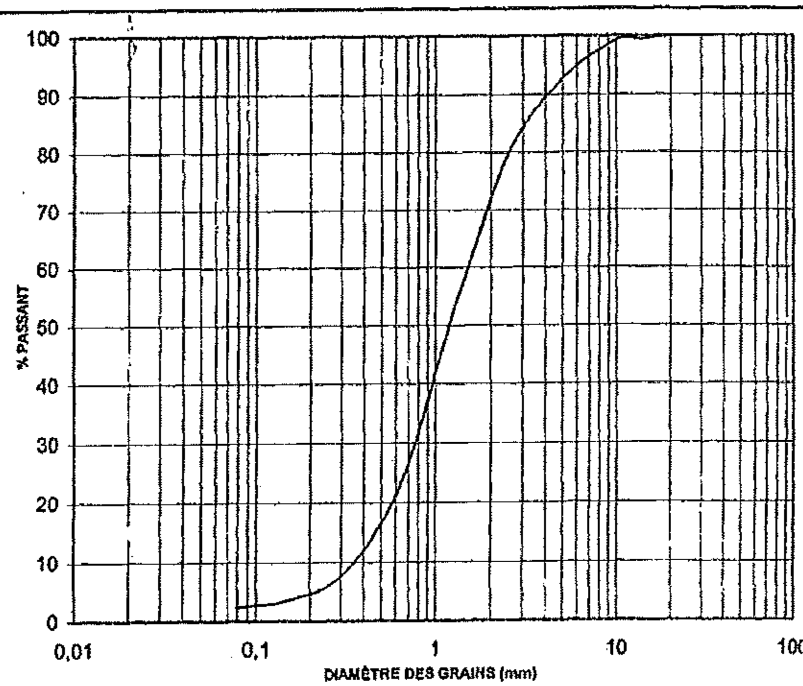
ESSAIS SUR MATÉRIAUX

CLIENT:	Environnement ESA	DOSSIER #:	02 09 204C
PROJET:	Essais en laboratoire	ÉCHANTILLON #:	01
PROVENANCE:		DESCRIPTION:	Sable filtrant (Q-2, r.8)
PRÉLEVÉ PAR:	Client	CALIBRE:	aucun
DATE:	04/09/2002	USAGE:	Sable filtrant (Q-2, r.8)
ENDROIT:	CPC #1	CONTRAT #:	

GRANULOMÉTRIE NORME (LC 21-040)

TAMIS (mm)	% PASSANT CUMULATIF	% PASSANT EXIGENCES	*
112			
80			
56			
40			
31,5			
20	100		
14	99		
10	99		
5	93		
2,5	80		
1,25	52		
0,630	23		
0,315	8		
0,160	4		
0,080	2,3		
M.F.:	3,43		
% GRAVIER:	7,3		
%SABLE:	90,3		
%SILT:	2,3		
C_u:	4,5	< 4	*
C_c:	1,1		
D_{10}	0,34	$0,25 < D_{10} < 1$	
D_{50}	1,20		

COURBE GRANULOMÉTRIQUE



ESSAIS	NORMES	RÉSULTATS	*	EXIGENCES	ESSAIS	NORMES	RÉSULTATS	*	EXIGENCES
Teneur en eau					Densité sèche < 5 mm				
Los Angeles					Densité SSS < 5 mm				
Micro-Deval					Densité app. < 5 mm				
Particules plates					Absorption < 5 mm				
Particules allongées					Durabilité $MgSO_4$				
Fragmentation					Nombre pétro.				
Propreté (gravière)					Particules légères				
Matières organiques					Proctor modifié				
Valeur au bleu					Humidité optimale				
Indice colorimétrique					W_L / W_P		/		

REMARQUES: **Sable non conforme aux exigences d'un sable filtrant (Q-2, r.8, 20 juillet 2000)**
Les résultats sont représentatifs de l'échantillon reçu. **D_{60} = 1,53**

* : NON CONFORMITÉ

VERIFIE PAR: Luc Bertrand, Ing. DATE: 09/09/2002

F076 (04.02)

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Enregistré ISO-9002 (1994)

2.3.2 Results

The grain size analysis, carried out by the firm Géolab Inc., on samples taken by our firm, are presented in the following pages.

You will note that it was very difficult to find a sand naturally answering all the wished criteria, even if the local suppliers claimed to hold such a sand, grading curves with the support.

Curiously, even if the samples have a very uniform appearance and they came from the same place, starting from only two trips for the sand laid out under the pipes, the curves lead to different conclusions according to the criteria given. Indeed, on the basis of the new criteria established in September 2002, sample No 1 has a granulometry in conformity, whereas the two others do not. One notices however that the principal difference lies in the portion of the grains more coarse than 2.5 mm. In the case of sample No 1 (conforms), the percentage retained with the sieve 2.5 mm is 20% whereas this percentage is 27% for the two other samples. It is also this portion that makes it so that Cu is > 4.5 for these last two samples.

2.2.3 Difference in measurements: Reality vs. protocol

The differences in the tables come mainly owing to the fact that dimensions were measured in feet and inches on the ground by the installation team (ie: 8 Po, 4 Po, 6 Po, 12 Po). However, 6in does not equal exactly 15 cm, but rather 15.2 cm.

All these differences are not significant taking into account the acceptable inaccuracy on ground (verticality of the stem of measurement, thickness of stones, etc).

Let us mention that the units of the English system (feet and inches) are still mainly used by the contractors in the field. This type of variation coming from the conversion of the metric system towards the English system (ie.: 15 cm = 6 in) is therefore usually recognized.

2.3 Sampling and reports in the laboratory on the filter sand

2.3.1 Criteria used

In order to meet the requirements of the test bench installation protocol, the filter sand used under the Enviro-Septic® pipes conformed to the regulation on drainage and wastewater treatment for insulated residences, Q-2, R.8.

The criteria of which we had at the moment of the installation of the cells required that the effective diameter (D10) of the filter sand be understood between 0.25 and 1 mm and that its coefficient of uniformity Cu (D60/D10) lies between 1 and 4. We learned after installation of the cells that these criteria had been modified by the MENV for the new criteria according to:

- 0.25 mm < D10 < 1 mm
- Cu < 4.5
- % passing 80 µm < 3%
- % selected 2.5 mm < 20%

Thus, with an aim of checking sand delivered on the spot, our firm took 3 random samples of sand at the time of its installation in cells ESP 2, CPC 1 and CPC 3. It acted in all the cases of a sand having the same source (only one or two trips was necessary to fill out sections ESP 1-2-3 and CPC 1-2-3).

2.2.2 Pipe and stone line

The following table shows the nature and the thickness of laid down materials, the report of materials installed as well as the measurements taken on the spot at the time of the installation of the line of pipe and stone.

CPC 1 and 2	Starting level (cm)		Final level (cm)		Thickness (cm)		Conformity
Material	Envisaged	Measured	Envisaged	Measured	Envisage	Measured	Yes/No
Pierre crushed 20 mm	0	0	20	20.5	20	20.5	Yes
Pierre crushed 5 mm	20	20.5	30	31	10	10.5	Yes
Filter sand	30	31	45	46.2	15	15.2	Yes
Pierre crushed 20 mmsous perforated pipe	45	46.2	60	61.4	15	15.2	Yes
Perforated pipe	60	61.4	70	72	10	10.6	Yes
Pierre clear 20 mm around etau-top of the perforated pipe	60	61.4	75	76.6	15	15.2	Yes
Thickness of ground of fill	75	76.6	135	136.6	60	60	Yes
CPC 3	Starting level (cm)		Final level (cm)		Thickness (cm)		Conformity
Material	Envisage	Measured	Envisa	Measured	Envisage	Measured	Envisaged
Pierre crushed 20 mm	0	0	20	20.5	20	20.8	Yes
Pierre crushed 5 mm	20	20.8	30	31.4	10	10.6	Yes
Filter sand	30	31.4	60	61.9	30	30.5	Yes
Pierre crushed 20 mmsous perforated pipe	60	61.9	75	77.1	15	15.2	Yes
Perforated pipe	75	77.1	85	87.7	10	10.6	Yes
Pierre clear 20 mm around etau-signal of the perforated pipe	75	77.1	90	92.3	15	15.2	Yes
Thickness of ground of fill	90	92.3	150	152.3	60	60	Yes

ESP 1 and 2	Starting level (cm)		Final level (cm)		Thickness (cm)		Conformity
Material	Envisage	Measured	Envisaged	Measured	Envisaged	Measured	Yes/No
Pierre crushed 20 mm	0	0	20	20.5	20	20.5	Yes
Pierre crushed 5 mm	20	20.5	30	30.8	10	10.3	Yes
Filter sand	30	30.8	45	46.2	15	15.4	Yes
Enviro-Septic® pipe	45	46.2	75	76.2	30	30	Yes
Thickness of sand surrounding Enviro-Septic	45	46.2	85	86.2	40	40	Yes
Thickness of the ground fill	85	86.2	135	136.2	50	50	Yes
ESP 3	Starting level (cm)		Final level (cm)		Thickness (cm)		Conformity
Material	Envisage	Measured	Envisage	Measured	Envisaged	Measured	Yes/No
Pierre crushed 20 mm	0	0	20	20	20	20	Yes
Pierre crushed 5 mm	20	20	30	30.1	10	10.1	Yes
Filter sand	30	30.1	60	60.8	30	30.7	Yes
Enviro-Septic® pipe	60	60.8	90	90.8	30	30	Yes
Thickness of sand surrounding Enviro-Septic®	60	60.8	100	100.8	40	40	Yes
Thickness of the ground fill	100	100.8	150	150.8	50	50	Yes

Date	Representative E.S.A.	Activity of checking
9-09-02	A. Bédard	Monitoring of the installation of the crushed stone and catch of the dimensions of rise in the stone horizon ¾ Po. washed before the installation of pipe CPC (washing stone in a bucket ensuring cleanliness).
9-09-02	A. Bédard	Monitoring of the installation of CPC and ESP pipes of the dimensions of rise in the top of the pipes.
9-09-02	A. Bédard	Monitoring of the installation of the stone covering the perforated pipe(CPC). Measure of the dimensions of elevation of the final stone horizon ¾ Po washed covering the pipe.
9-09-02	A. Bédard	Monitoring of the installation of sand surrounding the chambers of Enviro-Septic® (ESP), watering and taken dimensions of rise finales according to the installation.

2.2 Nature and thickness of the layers of materials

The treatment carried out by the purifying element is directly connected to the nature and the thickness of the materials which make the layer separating the ground water (or the rock or a layer of impervious materials) and the level of application of the effluent coming from the primary education device of treatment.

Moreover, in the case of Enviro-Septic®, since the bacterial surface is established around the circumference of the pipe, the nature of the materials which surround it also has importance.

A detailed attention was therefore paid to the checking of materials used and the thickness of the layers of materials in each test cell.

2.2.1 Enviro-Septic® Line

The following table shows the nature and the thickness of the laid down materials, the report of materials installed as well as the measurements taken on the spot at the time of the installation. The description of the layers of materials is done on the basis of bottom, i.e. bottom of each box of recovery of treated and infiltrated leachate. In order to facilitate the things, the level "0" is fixed at the level of the bottom of the boxes.

2.0 Conformity of the installation of the bench test to the protocol

2.1 Inspections on the building site

Inspections on the building site were made on several occasions during the installation of the bench test in September 2002. The table that follows introduces a synopsis of the visits, people who carried out them and of the activities of checking that took place. The goal of these visits was to check that the bench test was built as shown in the fields of the protocol. Environnement E.S.A. Inc was able to note that the team of DBO Expert, promoter of Enviro-Septic® technology, took care to carry out the bench test as specified in the plans.

Date	Representative E.S.A.	Activity of checking
4-09-02	A. Bédard	Summary inspection of dimensions of the cell (length and width) vs specified dimensions of the protocol
4-09-02	A. Bédard	Summary inspection of the installation of the membranes Soprema (for the sealing) and of the fabric or protection of the membranes, just as pipes of recovery and the piezometers etévents.
4-09-02	A. Bédard	Taken dimensions of rise in the bottom of cells ESP and CPC after the installation of the membranes (before installation of the stone composing the bottom of collection)
4-09-02	A. Bédard	Monitoring of the installation of the layers of stone ¾ Po et¼ Po Net composing the bottom of collection of the cells of ESP and CPC and catch of the dimensions of final rises.
4-09-02	A. Bédard	Monitoring of the installation of the ballasting and prised' samples for grain size analysis dusable in conformity with the requirements of the règlementQ-2, r.8.
4-09-02	A. Bédard	Monitoring of the watering of the ballasting etprise of the final dimensions of rise in the desable layer in each cell ESP and CPC.
9-09-02	A. Bédard	Summary inspection of the piping posed between leposte of loading and cells CPC and ESP, incluantles pits and valve chambers.

1.0 Introduction and summary of the mandate

We present to you in this report the details surrounding the installation and the follow-up épuratoire of the bench test of Enviro-Septic® in Stoke, Quebec according to measurements, samplings and monitoring carried out during the first 53 weeks of operations, between October 2002 and October 2003.

This report presents all the explanations on the checks, measurements and samplings carried out and for all of the results obtained during the follow-up effluent treatment.

The goals set by the follow-up of the bench test by our firm were as follows:

- to attest to the conformity of the installation of the bench test with regard to the protocol of the test submitted by DBO Expert in August 2002 (specified dimensions and materials used);

- to validate the results of recovered volumes of leachate intended to show the capacities of distribution of the Enviro-Septic® system. With this intention, we had the consent to carry out the calibrations of the system of pumping and the stations of pumping, in addition to following the behavior of the distribution boxes and the equalizers;

- to take piezometric measurements of levels in the various cells of recovery;

- to carry out samplings of the various cells of treatment and to coordinate the realization of the analyses in the laboratory, all in conformity with the code of practice;

- to produce, beginning with the results obtained, comments as for the capacity of Enviro-Septic® pipe surrounded by filtering sand to distribute leachate, after pretreatment in a septic tank, for a distance of 18.3 meters.

The more specific details of the description of the Enviro-Septic® technology, the description of the bench test in Stoke and all of the data and the results obtained as for compilation of volumes of effluent, effluent content, etc, are presented in documents which were provided by DBO Expert Inc., a Canadian company, promoter of Enviro-Septic® technology.

Lastly, you will find, mainly in the Conclusion at the end of the report, our interpretation of the results and our recommendations of the Enviro-Septic® technology, according to the results obtained during the first 53 weeks of operation of the bench test in Stoke.

We make a point of thanking the personnel of DBO Expert Inc. company for their immense collaboration with the realization of this expertise, all in a very large compliance with the code of practice and with the profit of the scientific rigour which require the realization of such a mandate.

LIST OF APPENDIXES

TABLE OF CONTENTS

ENTREPRISE ENREGISTRÉE BNQ ISO 9001 (2000) REGISTERED FIRM

Report of Measurements and Monitoring

Bench Test of Enviro-Septic® at Stoke in Quebec

In conformity with the Test Protocol

October 2002 to October 2003

To the attention of: Mr François R.Côté, ing.
Director Research and Expert Development DBO Inc. 1650
boul. Industrial Magog
(Quebec) J1X 4V9

Presented by: Environment E.S.A. Inc.
205, Street Leger Sherbrooke
(Quebec) J1L 2H4

File No: S-01 11 05
S-03 01 05
S-04 01 28

Date: March 25, 2004

PREPARED BY: ______________________

Alain Bédard, ing.
Coordinator Quality &
Person in Charge of Projects

ᵓPROVED BY: ______________________

Pierre Roller, ing.
Vice President

Sherbrooke, March 25, 2004

Expert DBO Inc. 1650
boul. Industrial Magog
(Quebec) J1X 4V9

To the attention of Mr François R. Côté, ing., Director of Research and Development

Object: Report of measurements and monitoring of the bench test in Stoke after 1 year of operation

File No.: S-01 11 05 S-03 01 05 S-04 01 28

Dear Sir,

You will herewith find the report of measurements and monitoring of the bench test of Stoke after 1 year of operation, all of which was carried out in conformity with your protocol of test.

Two hard copies and an electronic copy of this report/ratio containing a summary description of the study and the unit of the results obtained over the complete duration of the study accompany this sending.

Hoping this report is to your full satisfaction, we transmit to you, Sir, the expression of our best greetings.

Environment E.S.A. Inc.

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Alain Bédard, ing.
Coordinator quality &
person in charge of projects