

**UPSTREAM WATCH MOTION (3-1-21) TO AUGMENT RECORD, OR,
IN THE ALTERNATIVE, REMAND TO THE BELFAST PLANNING BOARD
FOR FURTHER PROCEEDING
SUBMISSIONS ON CONCERNS RELATED TO USE OF PUBLIC WATER**

NOTE: This is a merged file that includes the 15 documents listed below.

Upstream Watch has submitted 15 documents regarding this Motion:

- D1 - Motion from Upstream Watch (3-1-21) requesting the ZBA to Augment the Record or to Remand to the Planning Board certain concerns regarding Nordic's use of water from the Belfast Water District. - 12 pages.
- D2 - Appendix A. Upstream Watch prepared record of selected discussion at the January 8, 2019, February 5, 2019, May 13, 2019, July 8, 2019 and July 15, 2019 Planning Board meetings. - 2 pages
- D3 - Appendix B. Selected page from a report prepared by A.E. Hodson Engineers. Report for Belfast Water District. - 1 page
- D4 - Appendix C. Pump Test and Delineation Plan Guidance for New Well Sources for Large Community Water Systems. - 5 pages
- D5 - Appendix D. Map of Swanville Landfill & Transfer Station in relation to well sources on the Goose River. Map is from a State website, however, the source of the map is not specifically identified. - 1 page
- D6 - Appendix E. Swanville Landfill EM Survey prepared by CES. The specific date and source of this information is not identified. - 3 pages.
- D7 - Appendix F. Letter dated March 29, 1994 from Ronald Howes, C.G., Project Manager to Charles Mikovich, First Selectmen, Town of Swanville. - 2 pages.
- D8 - Note. There is no document D8.
- D9 - Appendix G. Aerial Photo that identifies the location of the Swanville Landfill and Transfer Station in relation to the Talbot Well. No source information provided for this aerial photo. - 1 page.
- D10 - Appendix H. Document entitled: 'Maine Public Drinking Water Program, Source Water Assessment Program' developed by the Maine Dept of Human Services, January 2000. - 52 pages.
- D11 - Appendix I. Excerpt from City Code of Ordinances, Chapter 90, Site Plan. - 1 page.

- D12 - Appendix J. Belfast Water District Public Statement to its Customers and the City of Belfast regarding the sale of Belfast Water District property to Nordic Aquafarms (10-26-18 Statement) - 3 pages.
- D13 - Appendix K. Upstream Watch prepared record of Planning Board meetings that Upstream states occurred between January and December 2020 regarding Groundwater concerns and concerns associated with operation of the Talbot Well. (Note 1 - highlighting used by Upstream Watch on the document may make some of the document difficult to read; and Note 2 - the dates of the specific meetings are not identified) - 9 pages.
- D14 - Appendix L. Report dated October 24, 2019 from the County Governor of Oslo and Viken regarding the operations at the Fredrikstad Seafood facility - 5 pages.
- D15 - Appendix M. Article entitled: "You can buy a land-based facility, but it will fail tomorrow if you do not have the right people" written by Steve Olsen that was published on March 3, 2020 in an unidentified publication. - 4 pages.
- D16 - Appendix N. Article entitled: "7 million share issued raised, Fredrikstad Seafoods celebrates first harvest for land-based salmon" written by Steve Olsen that was published on April 20, 2020 in an unidentified publication. - 2 pages.

CITY OF BELFAST, MAINE
ZONING BOARD OF APPEALS

Document D1
12 Pages

March 1, 2021

APPEAL OF UPSTREAM WATCH FROM DECISIONS OF THE BELFAST PLANNING BOARD CONCERNING THE APPLICATIONS OF NORDIC AQUAFARMS, INC.

Applications for:

1. Site Plan Approval
2. Shoreland Zoning Permit
3. Significant Ground Water Wells Permit
4. Significant Water Intake and Significant Water Discharge/Outfall Pipes Permit
5. Zoning Use Permit

**MOTION TO AUGMENT RECORD OR, IN THE ALTERNATIVE, REMAND TO THE BELFAST PLANNING BOARD FOR FURTHER PROCEEDINGS NECESSARY TO EL-
THER:**

- a. **COMPLETE THE RECORD IN THE EVENT THE BOARD FINDS IT UNABLE TO RENDER A DECISION DUE TO THE ABSENCE OF CRITICALLY IMPORTANT FACTUAL INFORMATION; OR**
- b. **REMAND FOR FURTHER PROCEEDINGS CONSISTENT WITH THE ORDER OF THE ZONING BOARD OF APPEALS.**

Appellant herein, Upstream Watch (“Upstream”), respectfully Moves the Belfast Zoning Board of Appeals to augment the record of the Belfast Planning Board, or to remand the matter to the Planning Board and to direct or provide an opportunity for the Planning Board to augment its record, as follows and for the reasons set forth herein.

During the Planning Board process, it seemed obvious that Nordic had not provided some of the required materials when it filed its application. It also was made clear to all interested parties by Wayne Marshall, who we presume is authorized to do so, that the Planning Board's "preliminary" determination of completeness was just that – preliminary. The point was made repeatedly that "preliminary" was not a final determination of completeness but rather was a determination that the application was complete enough to proceed to hearings where all issues including completeness would be explored and decided. It also was clear that any standard for determination of preliminary completeness was wholly subjective and was not based on any written criteria. see transcript, Appendix A. Consequently, Upstream Watch determined not to ask a court to consider the planning Board's determination of preliminary completeness because, first, the decision would not be a "Final Decision" from which an appeal would lie and second, the court would have no standards on which to base that review. It would be a waste of the court's time and a delay in processing Nordic's application which would serve no purpose except for delay. Upstream Watch was not interested in pursuing such a course.

After the preliminary findings of completeness, several regulatory application requirements remained unmet. However, Planning Board members seemed aware of Nordic's omissions and began to ask Nordic to supply additional information in an apparent attempt to make Nordic's insufficient application into something which could be approved. Upstream observed as the Planning Board continued to try to assist Nordic by asking Nordic to produce specific information and/or materials which would allow the planning board to determine that Nordic had met the application requirements. By asking those questions, the Planning Board signaled that the application was incomplete and unsatisfactory. Why else would members of the Planning Board persist in asking the same questions over and over, making the same request repeatedly and even restating the request from time to time as though the problem rested with the Planning Board's questions and not with Nordic's responses or non-responses? Without Nordic's response on the record there was little to which Upstream could react. Rather, Upstream assumed that the Planning Board could not and would not approve an application in which the fundamental predicate

demonstrations had not been made by the applicant. Those questions had to have been answered or, as a matter of law, the Planning Board had to deny the application.

When the Board announced it was on the verge of deciding on the permit applications and the questions still had not been answered, Upstream began to look for answers on its own to try and understand why Nordic would not answer the questions the Planning Board members asked. Upstream learned a lot. Nordic claims those answers could not be considered by the Planning Board because the Planning Board record was closed, and cannot be considered by the Zoning Board of Appeals because this is a “record appeal”. However, what Upstream found was disturbing. That disturbing information can be considered if the Zoning Board of Appeals remands this matter to the Planning Board with instruction to at least consider what Upstream found and to make sure Nordic’s previously provided information is correct, candid, and accurate. Consider the examples below.

Nordic claimed the Belfast Water District could provide to Nordic 500 gallons per minute. That was based on the “Hodsdon report” which affirmed that that water was available if the Talbot Well was turned on. What the report did not say, and what Nordic did not disclose, was that the Talbot Well is not licensed for public water consumption, but rather must be subjected to a significant testing in order to be so licensed. Those tests include rigorous pumping to see how far the well inflow reaches and whether the reach of the pumping well will draw in pollutants. That is especially important because near the Talbot Well is an old, closed landfill from which, in 1993, a plume of pollution was detected, headed toward the Talbot Well that had proceeded 460 feet off-site. In the intervening 25 years, how much farther has that plume gone, how much closer is it to the Talbot Well, and will vigorous pumping of the Talbot Well induce that pollution into the Talbot Well? No one knows because no testing appears in the record of DEP or DHHS. So, for Nordic to simply say that they “have” and are assured of 500 gallons of water from the Belfast Water District is not entirely accurate. If the Talbot Well is not licensed, the Talbot Well cannot be used. Nordic might have that water at some point in the future if the Belfast Water District and/or Nordic perform the testing on the Talbot Well and the testing reveals that under the

state-mandated testing regimen the Talbot Well will not bring pollution into the Belfast drinking water supply. That testing has not been done. Nordic's answers were not candid. Nordic's lack of candor jeopardizes the public water supply for the city of Belfast. That is not a Nordic issue. That is a City of Belfast public drinking water issue. At one point in the proceedings, someone mentioned that Belfast treats the water it delivers to its customers. No doubt that is so. But it is not possible to determine if the treatment applied to the water is appropriate if the water has not been tested to determine whether landfill leachate has polluted it and, if so, the constituents of the landfill leachate must be identified and compared to the treatment systems in place to determine if the existing treatment facility is adequate or whether additional treatment would be required before allowing that water to be passed on to the citizens of Belfast. When Upstream discovered this deception, it asked the Planning Board to reopen the record in order to explore this issue. The Planning Board refused. And now Nordic's position seems to be, "Look, we got away with it before the Planning Board, so we are entitled to continue to get away with it." Upstream's response is twofold: 1. The truth will come out; it always does, and 2. This deception is so serious that it is not a Nordic issue, it is a citizens of Belfast issue. The imperative is more than compliance with the law; it is a moral imperative.

It is in the spirit of that frustration and that concern that Upstream offers this Motion to Remand this proceeding back to the Planning Board with an instruction to conduct a public hearing to obtain satisfactory answers to its questions, the answers to which are mandated, and consider adding to its record the information discovered by Upstream and perhaps from members of the public that was omitted from Nordic's application..

PROPOSED RECORD ADDITIONS PERTAINING TO:

1. AVAILABILITY OF WATER FROM THE BELFAST WATER DISTRICT
2. TECHNICAL COMPETENCE

AVAILABILITY OF GROUNDWATER FROM THE BELFAST WATER DISTRICT

1. Add to the record of the Planning Board the following:

- a. The A. E. Hodsdon report entitled “2018 Capacity Evaluation” already in the record provides that in order to supply water to the Nordic Aquafarms project at the rate of 500 gallons per minute (GMP) it will be necessary to employ the “Talbot Well” installed in 2005 but not currently in service (Hodsdon Report p. 6 Appendix B).
- b. The Talbot Well is not licensed by the State of Maine for use as a potable water well.
- c. The Talbot Well has not been tested within the last five years as required by the State of Maine to apply to be licensed as a potable water well. See: [State of Maine Pump Test and Delineation Plan Guide](#), Appendix C.
- d. In 2005, when the Talbot Well was installed it was subjected to a “pump test” for 24 hours. The industry standard and the standard imposed by the State of Maine was and is a 72-hour pump test. We now know they did a 72-hour pump test but with a smaller pipe. Neither test met the State of Maine Standard and neither test was conducted within 5 years of application as required by the State of Maine Standards.
- e. The unlicensed Talbot Well is located near the closed Swanville Town Dump (now referred to as a “Landfill”). See MAP attached, Appendix D . This dump is not mentioned in the Hodson Report. However, the landfill location relative to Belfast’s existing Municipal wells (Jackson Pit and Smart Road) has long been known. Consider the letter from Swanville’s Engineering firm CES to the Swanville selectmen in which the Consultants said “The greatest potential concern with the landfill is whether it has any potential of impacting the Belfast Water District’s Jackson Pit and Smart Road wells.” Inexplicably, the Talbot Well was drilled in spite of this warning and at closer proximity to the landfill than the Smart Rd. well. See Appendix E.
- f. As of 1993, a plume of leachate had travelled from the bottom of the dump 460 feet downstream toward the Goose River aquifer. See Appendix F. No tests have

been conducted to determine how deep the plume resides or how far the plume has traveled toward the Talbot Well in the last 28 years.

- g. The Talbot Well is approximately 2,400 feet downstream from the dump.
- h. Next to the dump is an operating transfer station. See Map attached, Appendix G.
- i. No tests have been conducted to determine if the Transfer Station has produced a plume of contamination and, if so, how far, how deep and in what direction it has traveled, but the CES Consultant advised against putting a well on the Transfer Station property.
- j. The Talbot Well has not been evaluated as it must be under the Maine Public Drinking Water Source Water Assessment Program. See Appendix H, ([Maine Public Drinking Water Assessment Program documents](#)).
- k. The Talbot Well has not been developed and tested under the “Pump Test and Delineation Plan Guidance: New Well Sources for Large Community Water Systems”. See Appendix C. Specifically, records for the Talbot Well are missing descriptions of:
 - i. Aquifer flow;
 - ii. Hydraulic boundaries;
 - iii. Recharge conditions;
 - iv. The interaction of the source of the withdrawal with surrounding water resources;
 - v. The estimated zone of contribution; A well’s “zone of contribution” sometimes called its “cone of depression” is estimated by setting monitors around a well at different distances and then pumping the well at maximum capacity for 72 hours to observe the drawdown characteristics revealed in the monitoring wells. From these observations it is possible to estimate whether known sources of contamination are likely to pollute the well. See [Maine DHHS Application](#) for New System or Well and Ground

Water Handbook for the State of Maine, Maine Geological Survey, Bulletin 39.

vi. Any and all potential sources of contamination within the zone of contamination;

- l. The Belfast Water District has not filed an application for activation of the Talbot Well, which will require, in part, a disclosure of the zone of influence of the well under 72-hour pumping conditions and disclosure of the nearby landfill and the impact of the landfill on the Talbot Well.
- m. Nordic was required to provide this information as part of its application. Nordic failed or refused to do so. See: Sec. 90-42 (b) (1) (Pollution) and Sec. 90-42(b) (28) Protection of Public Health and Safety, Appendix I.
- n. Instead, Nordic provided a letter from the Belfast Water District assuring the Planning Board that it had enough water to serve Nordic's needs as well as the needs of the citizens of Belfast. Appendix J.
- o. The information in that letter was false because the letter presumed use of the unlicensed and untested Talbot Well.
- p. The Belfast Planning Board asked Nordic to verify it had enough water. Appendix K.
- q. Nordic never revealed the truth about the inability of the Belfast Water District to supply water to the Nordic Project, but rather they both attempted to deceive the Planning Board. In fact, in a letter to the "Customers and the Residents of the City of Belfast" Keith Pooler, Superintendent of the Belfast Water District, said, "Fortunately, our aquifer and wells have more than 50 years of data history. We know the amount of water that was pumped, the precipitation during that time, and the drawdown history taken from the many test wells in the aquifer that surround the two wells. Two extensive pump tests have been performed on the aquifer and wells, one when the wells were drilled back in 1957 and 1965, and another in 1989." Appendix J. Note that in December 2020 Upstream Watch requested to see that data and the test results and Mr. Pooler refused to show them to Upstream

Watch. Concerned about what the Belfast Water District is hiding, Upstream Watch has filed a complaint with the Office of the Attorney General. Note further, Mr. Pooler said two tests were conducted and then listed three dates. So, was it two tests or three? By refusing to show the data, that confusion and inconsistency continues. Mr. Pooler referred to “the many test wells” that surround the production wells. Where are they? If they exist at all, their locations seem to be a secret. Worse, the last test was performed in 1989. Since the Talbot Well was installed in 2005, the tests could not possibly have revealed anything about the Talbot Well. Yet it is the Talbot Well that must come online to serve Nordic or the Belfast Water District will not have enough water. Mr. Pooler said, “We asked the leading hydrologist in the state of Maine to give us an evaluation of water capacity of our system. His findings were that there is a safe yield of 699 million gallons per year.” Please note, “the leading hydrologist in the State of Maine” missed the fact that in the same aquifer as the wells he evaluated were a landfill and a transfer station, two “potential point sources of groundwater contamination” (according to the State of Maine) that he never mentioned in his report. His “safe yield” calculations may be accurate, but they include all water, not just water that is safe to drink. “The leading hydrologist in the State of Maine” never tested the water quality to see if it was polluted.

- r. The Belfast Water District does not have the demonstrated capacity to supply Nordic’s needs as it represented to the Planning Board.
- s. Therefore, Nordic’s application fails to meet the above requirement and should have been denied as a matter of law. This the Planning Board failed to do. For the health and safety of the residents of Belfast, as well as to comply with the Belfast City Code and State statutes, the Zoning Board of Appeals must remand this matter to the Planning Board for further proceeding not inconsistent with this Order.

AS REASONS THEREFOR, UPSTREAM WATCH ASSERTS:

1. Nordic was required to provide proper evidence that it had enough water to operate its planned facility. Part of its planned water supply was 500 gallons of potable water per minute from the Belfast Water District. That water is only available if the Talbot Well is employed and the water is clean. For the reasons shown above, the Talbot Well cannot be used. Without the planned 500 gallons per minute from the Belfast Water District, Nordic will not have the 1,200 gallons of water per minute it requires.
2. If the Belfast Water District turns on the Talbot Well without properly obtaining a license, preceded by the proper testing, there is a reasonable likelihood that the large 1,200 gallon per minute pump in the Talbot Well will draw into the Talbot Well leachate from the bottom of the old nearby Swanville Dump or Landfill. The landfill leachate that has already escaped at least 460 feet from the landfill has not been characterized, so no one knows what constituents are contained therein. There could be gas, oil, grease and other petroleum hydrocarbons, volatile organic compounds like industrial solvents often found in common household cleaners, metals of all sorts leaching off old household dump deposits and "PFAS", the ubiquitous chemicals found in almost every landfill. Without knowing what constituents are in the landfill leachate, it is not possible to know if the existing treatment plant is equipped to treat the chemicals likely to be found in the water. PFAS, for example, have only been recognized in the last couple of years, long after the Belfast Water District treatment facility was constructed. According to the Hodgdon Report, the Talbot Well "communicates" with one of the existing wells, the Smart Road Well. "Communicates" means that when either well is pumped, both wells are drawn down. Water flows from one to the other and to both simultaneously. So, if the Talbot Well becomes polluted from the landfill leachate, the Smart Road Well is likely to be polluted as well. There has been no test showing whether the Talbot Well communicates with the third Belfast Well, the Jackson Pit Well. Whether it does or it does not, pollution of two of the three Belfast wells presents a danger to the citizens of Belfast and, Nordic or no Nordic, the citizens of Belfast are entitled to know that the wells serving them are free of pollu-

tion or, at the very least, if their wells are polluted by landfill leachate, the Belfast Water Treatment facility is equipped to remove the pollutants and is actually doing so. Further, the current Belfast Water District water supply has not been tested for certain industrial chemicals, often found in a landfill, because the Belfast Water District was granted a waiver. That waiver was predicated on there being no pollution source within 2640 feet of any well. As the State of Maine's record show, the Jackson Pit well and the Talbot well are within 2400 feet . The waiver is improvidently granted.

TECHNICAL COMPETENCE

1. Add to the record of the Planning Board the following:
 - a. Record of environmental violations, entitled Inspection at Fredrikstad Seafoods, AS. Appendix L.
 - b. Information that Nordic's Fredrikstad facility failed financially and is being turned over to a University as a research center. Appendix M.

The Belfast Regulations, at Sec. 90-42(b)(10) require the applicant to demonstrate it has the technical capability to perform the work necessary to create and operate the facility proposed:

Section 90 – 42 (B) (10) financial and technical capacity. The developer has adequate financial and technical ability to develop project in a manner consistent with state and local performance, environmental and tactical standards.

Nordic assured the Planning Board that it could meet the requirements because it had a wonderful team and had successfully created an operated such facilities in Fredrikstad, Norway and elsewhere in Europe. Nordic claimed:

“4.0 technical ability

the project team assembled for this development brings together national and international recirculating aquaculture systems (RAS) farm capabilities, combined with local civil engineering expertise. Assembled project team is highly qualified with extensive experience in developing, permitting, constructing, managing, stopping large-scale developments projects, including land-based fish farms. This project has been under this Nordics your project and technical staff.

4.1 applicant's prior experience

Nordic Aquafarms, based in Norway, is one of the world's largest investors and developers of land-based seafood production. We are dedicated to the highest environmental quality standards in the industry, and already have development of three facilities in Europe behind us (Maximus, sashimi well and Fredrikstad Seafoods). Our company has grown rapidly since its establishment in 2014 with a total of 54 employees at the time this application is filed. In 2017, we established a new subsidiary in the U.S., Nordic Aquafarms Inc., to pursue expansion in the US. The Belfast project is the company's fourth expansion step, with a fifth location in progress in Eureka California.”

The truth is a little different.

In August of 2019, Heim asserted to the planning board that their Fredrikstad facility, Fredrikstad Seafoods, was producing 3000 mt and that the proposed phase one in Belfast would be a scaling-up by a factor of three. Upstream urged the planning board to have a 3rd party evaluate the Fredrikstad facility. If that step had been taken it would have uncovered several facts:

1. Fredrikstad Seafoods is permitted for only 2400 mt., Appendix L.

2. Fredrikstad Seafoods has produced far less than what is permitted and has no plans to ever produce 2400 mt. ,Appendix N.

3. Fredrikstad Seafoods exists primarily for research purposes due to an inability to be profitable. , Appendix M

4. Fredrikstad seafoods was inspected by the Norwegian government in the fall of 2019 and was cited for 6 violations, some of them serious. Appendix L.

There is no credible or competent evidence in the record that Nordic Aquafarms has the technical capacity to design and operate a facility of this size and apparent complexity. It's clear that the planning board was uncomfortable with this as they continued to ask for a 3rd party RAS expert as last as December of 2020 but none was ever provided. The planning board was advised to only consider the record in front of them. The record in front of them was incomplete and insufficient.



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MAINE PUBLIC DRINKING WATER SOURCE WATER ASSESSMENT PROGRAM

"Providing Maine people with information about their drinking water supplies"

Developed by:

MAINE DEPARTMENT OF HUMAN SERVICES

DRINKING WATER PROGRAM

under the guidance of the:

SOURCE WATER ASSESSMENT PROGRAM

CITIZENS AND TECHNICAL ADVISORY COMMITTEE

January, 2000

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1.0 Introduction

Maine has 2200 public water systems which serve drinking water to half a million people by drawing water from more than 2600 individual water sources (wells and surface water intakes). These sources include:



- A seasonal boys and girls camp in the western Maine mountains withdrawing water from a great pond to supply the cabins, lodge, and shower houses.

- A mid-coast village comprised of 120 homes, a church, a fire station and a general store, all supplied by a single bedrock well.

- A southern Maine municipality of more than 10,000 residents supplied by three high-yield gravel packed wells.

- An elementary school of 125 students and staff in northeastern Maine supplied by a dug well.

- A bowling alley in central Maine supplied by a single, 6"-diameter bedrock well.



Public water suppliers are required to periodically test the water they serve and, if necessary, to treat it. For this reason, you can be reasonably sure that the water you pour into your glass today is safe to drink. But sometimes Maine public water supply wells do get contaminated by human and animal waste, gasoline and other volatile organic compounds, nitrate from fertilizers, and landfill leachate, among other pollutants. Diminished water quality in some lakes has led some public water suppliers to build facilities to filter and disinfect the water or to abandon the surface water source in favor of wells. Developing a new ground water supply can cost a town more than half a million dollars. How can water supply contamination and such costly remedies be prevented?



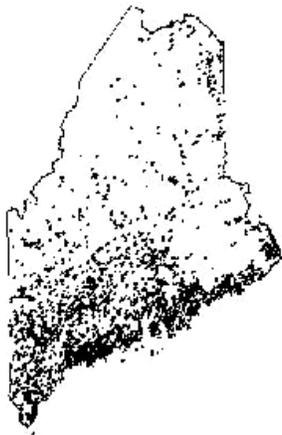
The responsibility for protecting public water supply sources from contamination falls largely to public water suppliers. However, land use decisions are made by municipal officials, not water suppliers. This means that protection of public water supplies requires a partnership between water suppliers, regulators, local land owners, and municipalities. The lengths to which Maine communities have gone to protect the public water sources in their towns vary greatly from place to place - from land purchases at one extreme to

no action at the other. In some cases no action may be necessary, as when the source is surrounded by protected land such as a state park. In others, however, ensuring that existing sources of drinking water are available for our children will require action. The type and selected course of action taken should be proportional to the level of risk.

The Maine Drinking Water Program wants to ensure that when a water supply is at risk of contamination, the citizens of Maine are made aware so that appropriate steps can be taken at the local level to minimize or eliminate the risk. That is the purpose of the **Source Water Assessment Program or SWAP**. By implementing SWAP over the next 3 years, the Drinking Water Program will *evaluate* each of the 2600 public water supply sources, assess for each the likelihood of contamination by existing or future activities, and *make the results of these studies widely available* to the public. At that point the assessment process ends and the time for protection action begins.

And that is up to you. The DWP will be available to provide technical and in some cases financial assistance to protection efforts, but these efforts will have to be initiated locally. It is you who live in the town who work the land; benefit from the revenues generated by the restaurants, camps, and businesses; drink water supplied by the utility; and send your children to the school. To ensure that that water is always safe to drink, you must also become involved in overseeing the activities that could contaminate it.

2.0 An Overview of Maine Public Water Supplies



Maine has more than 2200 public drinking water systems, ranging in size and function from large community systems serving entire cities or towns to seasonal restaurants and camping facilities which serve only a few hundred people for the summer. The vast majority of these water systems utilize one or more wells drilled in fractured bedrock. However, most large community water systems are supplied by a well or wells installed into loose, unconsolidated materials such as sand and gravel or by water drawn through an intake in a lake or pond. Protecting these resources, therefore, requires that a plan be based on a system-specific evaluation which identifies the nature of the water source, the number of customers served, and the land use activities around the well.

Based on federal and state regulations, a public water system is one which serves 25 or more people for 60 or more days per year. There are three types of public water systems and for each there is a different set of requirements. These system types are:

- **Community Water Systems** which serve people in their place of residence;
- **Non-Transient, Non-Community Water Systems** such as schools or office buildings; and
- **Transient Water Systems** which serve a constantly changing, transient population.

A brief discussion and statistics for each type of water system are given below.

2.1 Community Water Systems

A Community Water System (CWS) is defined as a public water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year round residents (10-144E CMR 231). Examples include water districts and departments, privately owned water companies, mobile home parks, and apartment buildings. Table 2.1 summarizes important statistics about the numbers and types of CWSs in Maine.

Table 2.1: Statistics on Maine Community Water Systems (CWSs):

Number of CWSs in Maine.....	417
Number of Surface Water Intakes supplying CWSs.....	71
Number of Wells supplying CWSs:	
Surficial (sand and gravel) Wells.....	167
Fractured Bedrock Wells.....	368
Dug Wells and Springs.....	24

2.2 Non-transient, Non-community Water Systems

Non-transient, Non-community public water systems (NTNCs) are defined as non-community water systems which serve at least 25 *of the same persons* for six months or more per year (10-144E CMR 231). Examples of NTNCs include schools, factories, industrial parks, and office buildings. Table 2.2 summarizes important statistics about the numbers and types of NTNCs in Maine.

Table 2.2: Statistics on Maine Non-transient, Non-community Water Systems (NTNCs):

Number of NTNCs in Maine.....	374
Number of Surface Water Intakes supplying NTNCs.....	1
Number of Wells supplying NTNCs:	
Surficial (sand and gravel) Wells.....	129
Fractured Bedrock Wells.....	811
Dug Wells and Springs.....	9

2.3 Transient Water Systems

Transient public water systems (Transients) are defined as non-community water systems which serve at least 25 persons, *but not necessarily the same persons* for at least 60 days per year (10-144E CMR 231). Examples include highway rest stops, restaurants, motels, campgrounds, golf courses, and boys and girls camps. Table 2.3 summarizes important statistics about the numbers and types of Transients in Maine.

Table 2.3: Statistics on Maine Transient Water Systems (Transients):

Number of Transients in Maine -	1366
Number of Surface Water Intakes supplying Transients -	31

Number of Wells supplying Transients: Surficial (sand and gravel) Wells - 184 Fractured Bedrock Wells - 1489 Dug Wells and Springs - 156

2.4 Regulation of Maine Public Water Systems

The operation of a public water system is governed by the federal Safe Drinking Water Act (SDWA). As with 48 other states, the federal government has delegated authority for enforcing the SDWA in Maine to a state agency - the Maine Drinking Water Program (DWP). The DWP is part of the Bureau of Health in the Department of Human Services. At present there are approximately 30 full time professional and support staff in the DWP.

The DWP is further subdivided into five sections serving distinct functions:

- The Compliance Section makes sure systems take the required water tests.
- The Enforcement Section is responsible for taking legal action for non-compliance.
- The Field Services Section inspects water systems and responds to emergencies.
- The State Revolving Fund Section administers loans to water systems.
- The Source Water Protection Section coordinates initiatives to prevent contamination.

The SDWA was first passed in the 1970s and amended in 1986 and 1996. As initially written, the focus of the SDWA was on determining safe levels for drinking water contaminants (Maximum Contaminant Levels or MCLs), outlining schedules and methods for testing, and requiring treatment for MCL violations. With each reauthorization, the focus of the SDWA has expanded to emphasize proactive measures to prevent contamination of public water supplies. This led to the establishment of the Source Water Protection Section in 1998. The Source Water Assessment Program is the first major initiative of the newly established section.

3.0 From Statute to Program: The Development of SWAP

The Maine Source Water Assessment Program represents the end product of a year-long public process involving the deliberations of a Citizens and Technical Advisory Committee (SWAP Advisory Committee) and associated work groups; public meetings held throughout the state attended by water systems, municipal officials and citizens; and presentations at numerous conferences and conventions. Such public involvement is both required by law and vital to the development of a program which will meet its obligation to be "for the protection and benefit of public water systems." The process began when the federal Safe Drinking Water Act (SDWA) was reauthorized in 1996.

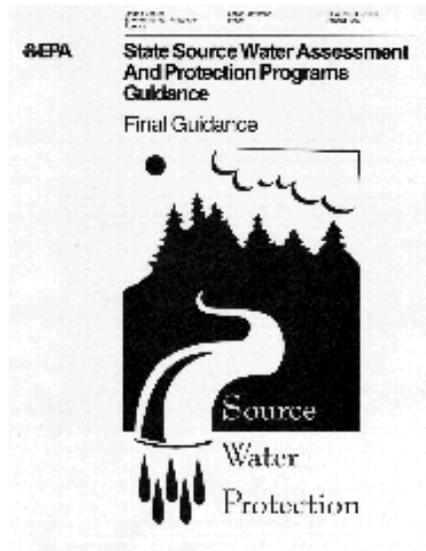
3.1 The Statute

The Source Water Assessment Program has its origin in the latest Amendments to the SDWA, passed by the U.S. Congress in August, 1996. Based on the belief that consumers have a right to know about the water they drink, the Amendments require each state to develop a program for assessing the susceptibility to contamination of each public drinking water source in the state. The SWAP is to be "for the protection and benefit of public water systems" and the results of the

assessments are required by the law to be made "available to the public." To aid states in meeting this obligation, Congress appropriated more than one billion dollars in fiscal year 1997 and authorized appropriation of more than 500 million in succeeding years, portions of which are available to states to set aside for the support of assessment projects.

3.2 The Guidance from EPA

In guidance materials provided by the federal Environmental Protection Agency to aid states in developing and implementing a SWAP, several required elements of an acceptable state program were outlined. These include:



- A **delineation** of the recharge area of a well or watershed of a surface water body;
- An **inventory** of land uses and potential contamination sources which exist, or could occur, within the delineated source water protection area;
- An **evaluation** of the susceptibility to contamination of the water source to the potential hazards that are identified in the inventory; and
- a process for **communicating** the assessment results to the public.

In addition to these program elements, EPA guidance also lists several process requirements for states to meet when designing the SWAP. Most significantly, the guidance requires each state to involve the public in a comprehensive and meaningful way in the design and implementation of the SWAP. The DWP has accomplished this in several ways including convening a Citizens and Technical Advisory Committee and holding public meetings throughout the state. Implementation of the SWAP will be done over a period of several years and the program is designed to engage citizens and officials at the local level throughout that implementation period. Rather than an end in itself, the SWAP is expected by EPA to be a catalyst for protection action initiated locally.

3.3 The SWAP Advisory Committee

The goal of SWAP is to produce assessments which are both meaningful and understandable so that citizens can use the results to make informed decisions about protecting the public water supplies in their town. To ensure that this is so, the DWP convened a SWAP Advisory Committee, with technical and citizen representatives, which met five times beginning in May 1998. In addition, the SWAP Advisory Committee meetings were managed by a professional process facilitator. The involvement of a professional facilitator was deemed crucial to ensuring that advisory committee meetings would be conducted fairly and even-handedly and that all viewpoints would be considered and incorporated into the process.

To form the committee, the DWP first created a list of potential participants by researching Maine's environmental, public health, political, and economic professionals and organizations through such available resources as Internet postings and web sites; regional newsletters, newspapers, and trade publications; statewide yellow pages; and the institutional knowledge of DWP staff. Following the compilation of names and organizations resulting from the review process described above, invitations to join the SWAP Advisory Committee were issued to

approximately forty parties in early April 1998. Invitees were given the option of declining the invitation, recommending an alternate organization, attending themselves, or designating another individual to participate in their place.

At the first SWAP Advisory Committee meeting, participants were asked to identify individuals, interests, or organizations which should be added to the committee. Also, interested parties not initially invited who later learned of SWAP and sought to become involved were encouraged to join the process. Three additional members were added to the committee in this way: a consultant, a private citizen, and a community regional water resources representative. The table on the following page identifies organizations which sent a representative to at least one of the Advisory Committee meetings.

The work of the advisory committee was supported and enhanced through the formation, convening, and meeting of three subcommittees which considered and made recommendations on specific SWAP subtopics.

Table 3.1 Affiliations of The Maine SWAP Advisory Committee Members

Public and Conservation Interests

1. Saco River Corridor Commission
2. China Region Lakes Alliance
3. Maine Association of Conservation Commissions
4. Northeast Rural Community Assistance Program
5. Private Citizens

Public Health and Vulnerable Population Interests

1. Maine Bureau of Health / Infectious Epidemiology Program
2. The AIDS Project
3. Maine Association of Retirees

Business, Industry, and Commerce

1. Maine Chamber and Business Alliance
2. Maine Pulp and Paper Association
3. Maine Real Estate and Economic Development Association

Local Government

1. Maine Municipal Association
2. Androscoggin Valley Council of Governments

Public Drinking Water Suppliers

1. Maine Rural Water Association
2. Maine Water Utilities Association
3. Newport Water District
4. Norway Water District
5. Lincoln Water District
6. Portland Water District

7. Great Salt Bay Utility District
8. Maine Youth Camping Association
9. Maine Campground Owners Association

Wastewater Treatment Plant Operators

1. Maine Wastewater Control Association

Agricultural Interests

1. Maine Farm Bureau Association
2. Maine Potato Board

Other State and Federal Agencies

1. Maine Department of Environmental Protection
2. Maine State Planning Office
3. Maine Department of Inland Fisheries and Wildlife
4. Maine Department of Economic and Community Development
5. Maine Department of Transportation
6. University of Maine Cooperative Extension Service
7. United States Geological Survey

These work groups were:

- The Surface Water Workgroup
- The Public Involvement and Education Workgroup
- The Public Meeting Planning Workgroup

3.4 Program Philosophy and Definition of Susceptibility

The Safe Drinking Water Act requires public water systems to periodically test the water for a variety of contaminants and to respond immediately if contaminant limits are exceeded. This "test and treat" approach is the fundamental means of ensuring customers of the safety of their drinking water. The Source Water Assessment Program is designed to be predictive rather than diagnostic. It seeks to evaluate the likelihood that a public water supply, safe to drink now, will continue to be so into the future.

Predicting whether or not an aquifer or surface water body will become contaminated is imprecise at best. Basing the likelihood of contamination on the number of potential sources of contamination near a well, for example, ignores the fact that one unlined landfill could contaminate several wells in one town while ten underground storage tanks in another may never contaminate a single well. Predicting the likelihood of future contamination reliably is made difficult by many factors, some of which are not known: hydrogeology, facility management practices, future development and growth, human error, rainfall, etc.

Because of this imprecision, Maine's Source Water Assessment Program is based on the philosophy that a source will be considered highly susceptible to contamination (at high risk) only if there are potential sources of contamination near the source AND water quality data from the well or surface water body or other observations which indicate that some contaminants have

been introduced. If evidence for only one of these factors is documented, the risk of contamination will be considered moderate. If the data indicate that neither is true, the risk of contamination will be labeled low.

4.0 Assessment Methodology for Groundwater Sources

4.1 Required SWAP Elements

The Amendments permit each state to develop an assessment methodology which is tailored to its unique geological and hydrologic characteristics and land use activities. However, there are certain required elements as described in the August, 1997, final guidance from EPA to states. These include a **delineation** of the source water protection area, an **inventory** of potential sources of contamination within the source water protection area, and an **assessment** of the susceptibility of the drinking water source to contamination. States are directed to utilize existing sources of information wherever practical. For ground water sources, the first two required elements, delineation and inventory, are already a part of Maine's approved Wellhead Protection Program and most community and NTNC water systems have already submitted this information to the Drinking Water Program. Therefore, the work of the SWAP Advisory Committee was focused on methods to assess this information.

4.2 Ground Water Systems in Maine

4.2.1 Transient Ground Water Systems



A public water system is defined as any publicly or privately owned system of pipes and facilities through which water is served to 15 or more service connections or to 25 or more persons per day for at least 60 days per year. A transient public water system is one that serves a constantly changing population of customers. Examples included restaurants, camps and campgrounds, and motels. As would be expected in a largely rural state, most Maine public water systems are transients. Because in theory no individual is exposed to water from a transient water system for an extended period of time, transients are regulated only for acute contaminants

(pathogens and nitrate/nitrite). The vast majority of the transient systems in Maine are supplied by a single, 6"-diameter bedrock well and most test the well once per year for coliform bacteria and nitrate/nitrite. The numbers of systems and sources change constantly as businesses open and close and new wells are drilled. As of May, 1998, there were 1366 transient public water systems in Maine and all but 31 of these utilize ground water. Taken as a group, transient water systems utilize 1320 bedrock and surficial wells and 156 dug wells and springs.

4.2.2 Non-Transient, Non-community Ground Water Systems

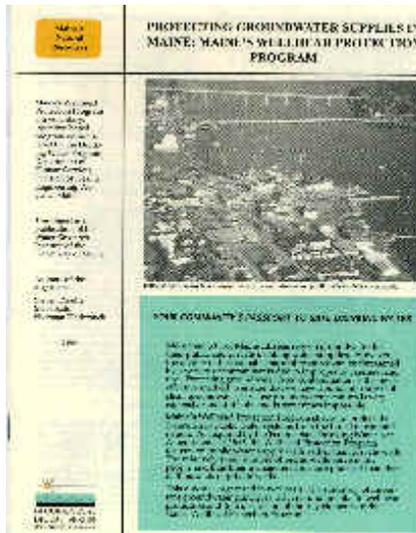
A non-transient, non-community (NTNC) public water system is a non-community system that serves at least 25 of the same persons for at least six months per year. As of May, 1998, there were 374 NTNC systems in Maine, mostly schools, and all but one has a ground water source or sources. These water systems utilize a total of 413 bedrock and surficial wells and 9 dug wells and springs. NTNC systems are regulated for both acute and chronic (i.e. chemical) drinking water contaminants.

4.2.3 Community Ground Water Systems

A community public water system serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents. Examples include water districts and departments, mobile home parks, and nursing homes. As of May, 1998, there were 417 community public water systems in Maine. Of these, approximately 350 utilize primarily a ground water source or sources. Together, community systems utilize 167 surficial wells (gravel packed, gravel developed or well points); 368 bedrock wells; and 24 dug wells or springs. Community systems are regulated for both acute and chronic drinking water contaminants.

4.3 Data to be Compiled and Considered

4.3.1 The Maine Wellhead Protection Program



The Maine Wellhead Protection Program (WHPP) was established to comply with the 1986 Amendments to the Safe Drinking Water Act. As with SWAP, the statute required states to establish a program with certain required elements but gave states the flexibility to craft a program tailored to the state's needs. The DWP hired a planning consultant who convened a series of technical advisory committee meetings during 1992, 1993, and 1994. These advisory committees included representatives of large and small water utilities, well drillers, mobile home parks, campground owners, youth camp owners, business and agricultural interests, municipalities, and state regulatory and natural resource agencies. What emerged from these committee meetings was a voluntary program with required components for water systems choosing to participate. Because participation in the program made a water system eligible for waivers to some water tests, most community and non-transient, non-community water systems chose to participate. To date,

transient public water systems have not been sent application materials. Among other things, participating systems submitted the following information:

● *Delineation*

Systems were required to delineate a protection area around each well or group of wells. For transient systems, an arbitrary fixed radius of 300 feet was used. For all other systems, a calculated fixed radius method was used. The circular protection areas range from a minimum radius of 300 feet to a maximum of 2500 feet, based on population served or pumping rate. Some large utilities chose to contract for a rigorous hydrogeologic delineation resulting in irregularly shaped protection areas based on ground water flow and response of the aquifer to pumping.

● *Inventory*

The WHPP advisory committees agreed on a list of 76 potential contamination sources which should be identified on a map if they are identified within the delineated wellhead protection area. To facilitate identifying them on the map, each was assigned a number and water systems were instructed to simply put the number in the appropriate location on the map. The list of potential contamination sources is reproduced in Appendix G.

4.3.2 Phase II/V Waiver Program



Community and NTNC water systems are required to monitor their water for 89 regulated contaminants. Contaminants have been added to the list in phases over the past 10 years and a group of them, mostly synthetic organic compounds including many herbicides and pesticides, are referred to collectively as the 'Phase II/V Parameters.' Maine has a Phase II/V Waiver Program which permits systems to test their water once, and then apply for a waiver from further testing. To receive a waiver, systems must provide documentation about the following land use activities within a 2500 foot radius of their well: A system which completes one satisfactory round of testing and documents that none of these activities occur within 2500 feet of the well (Phase II/V Waiver Radius) is granted a waiver from additional testing for these compounds. Partial waivers (waivers for some but not all tests) are granted to systems which document that some of these activities occur within 2500 feet of the well but others do not.

<p>Table 4.1: Land Use Activities Inventoried as part of Phase II/V Waiver</p>	<ul style="list-style-type: none"> Asphalt, Tar, Coal companies. Fertilized Fields, Agricultural areas Forestry areas Golf Courses Grain (Bulk) Storage Site Commercial Municipal Incinerator Landfill or Dump Military Base or Depot Paper Mill Discharge Pesticide Sales Pesticide Storage Pesticide Spill Sludge Spreading Superfund Site Wastewater Treatment Plant Wood Preserving Facility
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4.3.3 The SWAP Gravel Well Delineation Project

The Wellhead Protection Program permits systems to utilize a circular wellhead protection area. For low-yielding bedrock wells, this is probably the only feasible approach given the cost of determining a more geologically reasonable protection area. However, methods for delineating gravel wells through hydrogeological modeling of pump test drawdown data are well established and relatively inexpensive, particularly if monitoring wells are already installed. In addition, many high-yielding gravel wells in Maine are located in esker deposits and many have wellhead protection areas which depart dramatically from a circle.

The Drinking Water Program retained the services of a consulting hydrogeologist and entered into a Memorandum of Understanding with the Maine Geological Survey to delineate the 200-day and 2500-day time-of-travel zones for gravel wells serving community water systems serving 250 or more customers. There are approximately 150 gravel wells of this type and approximately half have already been delineated. At the conclusion of the 18-month project all will have a hydrogeologic delineation to be used for conducting assessments.

The delineation approach uses the results of a prolonged pump test to construct a MODFLOW (a finite-difference model developed by the US Geological Survey) model using GMS (Groundwater Modeling System) software. This model simulates ground water flow through the geological materials around the well, and provides a flow field. MODPATH, a particle tracking computer

program used with MODFLOW, calculates contributing (recharge) areas and estimates time of travel to the well.

4.3.4 The Maine Drinking Water Program GIS

Over the past 5 years the DWP has developed a desktop geographic information system (GIS). The GIS incorporates basemap data from the Maine Office of GIS (OGIS); coverages of potential threats to water quality, primarily developed by the Maine Department of Environmental Protection (DEP); and a coverage of all public water supply wells and intakes created by the DWP. A wellhead protection area coverage has also recently been created. Table 4.2 lists data types in the Drinking Water Program GIS.

One of the required elements of a SWAP assessment is a map of source protection areas and potential contamination sources. The Drinking Water Program GIS is an ideal means to accomplish this objective since much of the data have already been collected. The GIS is equipped to produce both paper maps for distribution and to organize geographic data for distribution by electronic means, including the Internet.

Table 4.2: Drinking Water Program GIS data coverages

BASEMAP DATA (MAINE OGIS) Hydrology Roads Utility Rights-of-way Wetlands Sand and Gravel Aquifers Topography Watershed Boundaries
--

POTENTIAL CONTAMINATION SOURCES (MAINE DEP)	
Underground fuel storage tank leak	
Aboveground fuel storage tank leak	
Municipal landfill	
Commercial landfill	
Special waste landfill	Compost site
Demolition debris	Ash utilization site
Septage storage or disposal hazardous waste site	Superfund
Sand/salt storage spill	Surface petroleum
Hazardous waste site treatment facility	Wastewater
Residuals (food) utilization site hazardous waste site	Uncontrolled
Tank farm	Industrial complex
Non-point pollution source (golf course)	Transfer station
Sludge utilization site graveyard	Automobile
Engineered subsurface wastewater dispose (wood chips, etc.)	Woodyard
Underground injection impoundment	Surface
Mining or mineral processing site	
DRINKING WATER DATABASES (DWP)	
Well and Intake Locations and Descriptions	
Wellhead Protection Areas	

4.4 The Ground Water Assessment Methodology

The Amendments require that SWAP assessments be "for the protection and benefit of public water systems." EPA SWAP guidance states that assessments are "a tool for further efforts" which are envisioned to be locally driven. To be useful to citizens or municipalities, assessments must be detailed and at the same time easy to understand. For example, a determination that a well is "high risk" will not be an effective tool for local protection action unless the nature of the risk is clear and recommendations for action are provided.

To meet these dual goals, Maine’s ground water assessment methodology will produce risk rankings for each public water supply well in the state in several categories. Risks to wells for transient water systems will be ranked (high, moderate, or low) in three categories:

- Risk based on well type and site geology
- Existing risk of acute contamination
- Future risk of acute contamination

Table 4.3: Assessment Methodology for Transient Ground Water Sources

RISK BASED ON WELL TYPE AND SITE GEOLOGY		RISK FACTORS FOR ACUTE CONTAMINANTS		
			Existing	Future
HIGH RISK	(1) dug well (1) spring	HIGH RISK	(2) coliform bacteria positive within previous 3 years OR (2) nitrate >5 ppm within previous 3 years	(1) Do not own or have legal control of all land within 150 feet of well
MODERATE RISK	(1) well points (1) gravel well (1) bedrock well, <20' overburden (1) bedrock well, overburden unknown	MODERATE RISK	(1) nearest acute PCS <300 feet from well OR	(1) Do not own or have legal control of all land within 300 feet of well
LOW RISK	(1) bedrock well, >20' overburden	LOW RISK	(1) nearest acute PCS >300 feet from well AND (2) NO coliform bacteria positive within previous 3 years AND (2) NO nitrate >5 ppm within previous 3 years	(1) Own or have legal control of all land within 300 feet of well

NOTES

Sources of Information:

- (1) Wellhead Self Evaluation Forms, Sanitary Surveys, OR DWP Source database
- (2) DWP Sample Water database

PCS = Potential source of pathogens, including:

- septic system leach fields
- manure pile or manure spreading
- barnyard
- animal grazing

Table 4.4: Assessment methodology for Community and NTNC Ground Water Sources

RISK BASED ON WELL TYPE AND SITE GEOLOGY		RISK FACTORS FOR ACUTE CONTAMINANTS		
			Existing	Future
HIGH RISK	(1) dug well (1) spring	HIGH RISK	(2) coliform bacteria positive within previous 3 years OR (2) nitrate >5 ppm within previous 3 years	(1) Do not own or have legal control of all land within 150 feet of well
MODERATE RISK	(1) well points (1) gravel well (1) bedrock well, <20' overburden (1) bedrock well, overburden unknown	MODERATE RISK	(1) nearest acute PCS <300 feet from well OR	(1) Do not own or have legal control all land within 300 feet of well OR 200-day draw-of-travel zone
LOW RISK	(1) bedrock well, >20' overburden	LOW RISK	(1) nearest acute PCS >300 feet from well AND (2) NO coliform bacteria positive within previous 3 years AND (2) NO nitrate >5 ppm within previous 3 years	(1) Own or have legal control all land within 300 feet of well OR 200-day draw-of-travel zone

NOTES

Sources of Information:

- (1) Wellhead Self Evaluation Forms, Sanitary Surveys, OR DW P Source database
- (2) DW P Sample Master database
- (3) DEP Water Resources database

acute PCS = Potential source of pathogens, including:
septic system leach fields
manure pile or manure spreading
barnyard
animal grazing

chronic PCS = potential source of chemical contaminants.

RISK FACTORS FOR CHRONIC CONTAMINANTS		
	Existing	Future
HIGH RISK	(1), (3) 4 or more "significant" chronic PCS's within WHPA AND (2) detection of regulated/unregulated chronic contaminants	(1) Do not own or have legal control of entire WHPA
MODERATE RISK	(1), (3) 4 or more "significant" chronic PCS's within WHPA OR (2) detection of regulated/unregulated chronic contaminants	(1) Own or have legal control of entire WHPA but NOT 250-foot Phase IIV well radius
LOW RISK	(1), (3) 3 or fewer "significant" chronic PCS's within WHPA AND (2) NO detection of regulated/unregulated chronic contaminants	(1) Own or have legal control of WHPA AND 250-foot Phase IIV well radius

The assessment method for transient ground water systems is illustrated in Table 4.3 and described beginning in Section 4.4.1 below.

In addition to acute contaminants, NTNC and community water systems are also regulated for chronic (mostly chemical) contaminants since water from these systems can be consumed by individuals for many years. Therefore NTNC and community wells will be ranked in two additional risk categories:

- Existing risk of chronic contamination
- Future risk of chronic contamination

The assessment method for NTNC and community ground water systems is illustrated in Table 4.4 and described beginning in Section 4.4.1 below.

In addition to risk rankings, recommendations will be provided for action to be taken at the local level to protect each well from contamination.

4.4.1 Risk Based on Well Type and Site Geology



No drinking water source is completely free from threats to water quality. However, some are more likely to become contaminated than others just by the nature of their construction and the geology of the site. For example, dug wells and springs more frequently test positive for the presence of coliform bacteria than do wells drilled into fractured bedrock covered by a thick layer of low permeability silty clay.

Low Risk: Bedrock wells in areas overlain by more than 20 feet of overburden will be deemed low risk in this category.

Moderate Risk: Well points, gravel wells, and bedrock wells with less than 20 feet of overburden will be deemed moderate risk in this category.

High Risk: Dug wells and springs will be deemed high risk in this category.

4.4.2 Existing Risk of Acute Contamination

Acute contaminants (such as pathogens and nitrate/nitrite) are those which can make consumers sick immediately after being consumed. Many acute contaminants originate in human or animal wastes. Possible sources include septic system leach fields, animal feed lots, manure piles, etc. The risk ranking in this category is based on the results of water tests of the well for the previous two years and the presence or absence of potential sources of acute contamination in the Wellhead Protection Area.

Low Risk: A well for which the nearest potential source of acute contaminants is more than 300 feet from the well AND all nitrate tests in the previous 2 years are below 5 parts per million (one-half the maximum contaminant level of 10 ppm) AND all coliform bacteria tests are negative for the same period will be deemed low risk in this category.

Moderate Risk: A well which has one or more potential sources of acute contamination within 300 feet.

High Risk: A well which has revealed nitrate at a concentration greater than 5 ppm OR which has tested positive for coliform bacteria will be deemed high risk in this category.

4.4.3 Existing Risk of Chronic Contamination



Chronic contaminants are those which pose a health risk if consumed (even sometimes at very low doses) over many years. There are 89 contaminants which by law must not be present in public drinking water or which can only be present below some specified level (the Maximum Contaminant Level). Examples of chronic contaminants include MTBE and other gasoline additives, chlorinated solvents, many herbicides and pesticides, gross alpha radiation, lead, arsenic, and many others. The risk ranking in this category is based on the water testing history of the

well and on the presence or absence of at least 4 significant potential sources of chronic contamination (as indicated on a Wellhead Protection Program Self Evaluation Form) in the Wellhead Protection Area.

Low Risk: A well which does not have four or more significant potential sources of chronic contaminants in the Wellhead Protection Area AND which has had no detections of regulated or unregulated chronic contaminants (herbicides, pesticides, volatile and semi-volatile organics, and certain inorganic parameters) during Phase II/V compliance testing will be deemed low risk in this category.

Moderate Risk: A well which has at least four significant potential sources of chronic contaminants in the Wellhead Protection Area .

High Risk: A well which has had significant detections of regulated or unregulated chronic contaminants during Phase II/V compliance testing will be deemed high risk in this category, unless the Department determines that the contaminant(s) detected are likely to have been naturally occurring (i.e. Arsenic).

4.4.4 Future Risk of Acute Contamination

Risk rankings in this category are meant to evaluate the likelihood that potential sources of acute contaminants could be introduced near the well in the future. As such the ranking is based on the ownership or legal control by zoning of land within 300 feet of the well (or the 200-day time-of-travel zone for gravel wells).

Low Risk: A well for which the public water system owns or the municipality legally controls (through zoning, for example) all land within 300 feet of the well (or 200 day time-of-travel zone) will be deemed low risk in this category.

Moderate Risk: A well for which the public water system owns or the municipality legally controls all land within 150 feet of the well BUT NOT all land within 300 feet of the well will be deemed moderate risk in this category.

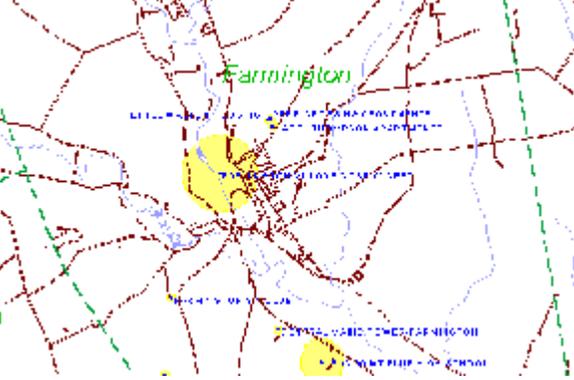
High Risk: A well for which the public water system DOES NOT own nor does the municipality control through appropriate zoning all land within 150 feet of the well will be deemed high risk in this category.

4.4.5 Future Risk of Chronic Contamination

Risk rankings in this category are meant to evaluate the likelihood that potential sources of chronic contaminants could be introduced near the well in the future. As such the ranking is based on the ownership or control by zoning of land within the Wellhead Protection Area and within the Phase II/V Waiver Radius (2500 feet).

Low Risk: A well for which the public water system owns or the municipality legally controls virtually all land within the Wellhead Protection Area AND a 2500'-radius circle around the well (the Phase II/V Waiver Radius) will be deemed low risk in this category.

Moderate Risk: A well for which the public water system owns or the municipality legally controls virtually all land within Wellhead Protection Area BUT NOT the Phase II/V Waiver Radius will be deemed moderate risk in this category.



High Risk: A well for which the public water system DOES NOT own nor does the municipality legally control virtually all land within the Wellhead Protection Area will be deemed high risk in this category.

For gravel wells which have had a time-of-travel based delineation, the 2500-day time-of-travel zone will be used in place of the Phase II/V Waiver Radius to evaluate the future risk of chronic contamination.

4.4.6 Recommendations

Each assessment report will include suggested recommendations for local action to address potential risks. Appendix A includes an example of an assessment report and includes recommendations for protection actions.

4.5 The Assessment Process

4.5.1 Compile Necessary Information

Some of the information required to complete the assessments described in the previous section has been collected through the Wellhead Protection Program, the Phase II/V Waiver Program, or in developing the Drinking Water Program GIS. Other information (for example, an inventory of potential sources of acute contaminants near transient water supply wells) will be collected through mass mailings to water systems. Community water systems will be given an opportunity to identify local agencies or individuals who may be useful partners in any protection planning or action which could result from distribution of the assessment report (e.g. planning board, school board, code enforcement officer, regional planning commission).

4.5.2 Provide Opportunity for Review

Once the necessary information has been compiled, a draft assessment will be completed. Attached as Appendix E is a sample assessment report for a NTNC public water system (a school). It lists **data about the water system and the well, a map** of the Wellhead Protection Area, **risk rankings** in each of the five categories described in the previous section, and **recommendations for protection** actions which could be undertaken at the local level. When completed, a report such as this will be provided for comment and review to the public water supplier and other identified local interests to ensure that the information in it is accurate.

4.5.3 Release Final Assessment Report

After a review period, the assessment report will be finalized and the results made available to the general public. Chapter 6.0 describes how the results will be distributed.

5.0 Assessment Methodology for Surface Water Sources

5.1 Required SWAP Elements

EPA guidance identifies the three required elements of a SWAP assessment: a delineation of the source water protection area; an inventory of potential contamination sources; and a determination of the susceptibility of the public water supply to the potential contamination sources which were inventoried. States were directed to develop a state-specific methodology which includes at least these required elements.

5.2 The SWAP Surface Water Work Group

For ground water supplies, Maine's approved Wellhead Protection Program established delineation and inventory methods. These methods were developed by advisory committees which met during 1993 and 1994. No analogous surface water protection program exists in Maine. Therefore, the DWP convened a Surface Water Work Group (SWWG) to consider delineation, inventory and assessment approaches for surface water supplies and to recommend a SWAP methodology to the SWAP Advisory Committee. In addition to representatives of the Maine Department of Environmental Protection and the DWP, the SWWG included representatives of large community water systems (CWS). The participants in the SWWG are listed in Table 5.1. This SWWG met twice in June, 1998, and made recommendations which were later presented to the SWAP Advisory Committee.

Table 5.1 : Representatives on the SWAP Surface Water Work Group	
● Auburn Water District	● Bangor Water District
● Bath Water District Water Co.	● Biddeford and Saco
● Dept. of Environmental Protection Assoc.	● Maine Water Utilities
● Milo Water District	● Portland Water District
● York Water District	

5.3 Surface Water Systems in Maine

5.3.1 Community Surface Water Systems



Many of Maine's largest community public water systems are supplied by surface water bodies, including the Portland Water District's Greater Portland System. The five largest community surface water suppliers serve a total of more than 200,000 people, one-sixth of the state's population. Several systems have intakes on more than one surface water body (e.g. Augusta Water District, Limestone Water & Sewer District) and some share the same surface water source (e.g. Anson Water District and Madison Water District). In all there are 58 different community water systems utilizing surface water sources. Four of these systems are planning to or have

begun the process of drilling a well to replace the surface supply (Andover Water District, Limestone Water & Sewer District, Waldoboro Water Company, and Winter Harbor Water District). A fifth (Damariscotta Mills Water System) may interconnect with Great Salt Bay Water District. A total of 64 different water bodies are used as sources. If the changes described above are all realized, this number will be reduced to 59 water bodies. It is likely that over the next several years, as SWAP is implemented, these numbers will continue to change.

5.3.2 Non-transient, Non-community Surface Water Systems

There is only one non-transient, non-community public water system in Maine which is supplied by surface water - the S.D. Warren mill in Hinckley Township. The mill is supplied by water from the Kennebec River. Non-transient, non-community water systems are regulated for both acute and chronic contaminants.



5.3.3 Transient Surface Water Systems

There are 22 transient public water systems with a surface water supply. Most of these are boys and girls camps or camping lodges. As a group transient surface supplies utilize 16 different surface water bodies; Sebago Lake is a source for five of them and Cobbosseecontee Lake for three. All transient surface water supplies are required to

filter and disinfect the water before delivering it to consumers. Transient public water systems are regulated for acute contaminants (pathogens and nitrate/nitrite) only.

5.4 Data to be Compiled and Considered

The Surface Water Work Group identified five categories of information which, **if available**, should be considered during an assessment. Each of the categories is listed and discussed beginning in text section 5.3.1 below. It is expected that no public water system will have all of this information available, particularly the water quality information. It is hoped that systems will attempt to gather as much information as is feasible. The assessment will be based on the best available information.

5.4.1 Data Element 1 » Physical Characteristics of Watershed

The purpose of compiling information about the physical characteristics of the watershed is to describe the water body in sufficient detail so that the water quality, potential contamination source, land use and assessment information provided later can be put into an appropriate context for the person reviewing or evaluating it.

Table 5.2 : Watershed Physical Characteristics to be Considered in Assessment

Data Element	Comment
Watershed Boundaries, Area	both direct and indirect watershed
Area of Water Body	in acres
Tributaries	will be located on map
Watershed topography.....	20' contours, if available
Wetlands	National Wetlands Inventory data are digitized
Water body depth	maximum and/or average depth

Sand and Gravel Aquifers.....Boundaries defined by >10 GPM potential yield
Location and depth of intake
Length of Shoreline
Soil Types.....consider erodibility and slope

5.4.2 Data Element 2 » Raw Water Quality

When available, raw water quality data measured at the intake is preferred. In some cases, systems have no water quality information except the samples required under the Safe Drinking Water Act. **No additional monitoring by public water systems of raw water quality will be required by the DWP as part of the SWAP.** However, it is hoped that systems will attempt to collect samples and test for some of the parameters listed below in anticipation of an assessment and, after the assessment, into the future to guide protection decisions. These data, if available, will be used to evaluate the existing condition of the water body and, if historical data are available, to establish improving or worsening trends in water quality. Such evidence can help establish the urgency with which individuals and municipalities should act to protect the source.

Table 5.3 : Raw Water Monitoring Parameters Recommended by the Surface Water Work Group	
● Transparency (Secchi)	● Total coliform and E-coli
● Turbidity	● Dissolved Oxygen
● pH	● Temperature
● Phosphorous	● VOC's
● Pesticides & herbicides	● Chlorophyll-a
● Color	● Total Organic Carbon

5.4.3 Data Element 3 » Potential Contaminant Source Inventory

DEP has a developed Ground Water Resources database - a GIS coverage of sites which have the potential for impacting water quality. DEP also maintains a database of NPDES discharges in Maine. This database will be utilized for assessments, including compliance data for each permit holder. Maps produced to accompany assessments will include data from these coverages. However, most of the sites identified in these coverages are DEP-licensed sites and there are other activities, not regulated by DEP, which have the potential to impact water quality (such as agricultural sites, boat launches, etc.). Water systems and municipalities may be the best source of information about these other PCS sites. Table 5.4 identifies the potential contamination source types to be considered in surface water assessments.

Table 5.4 : Potential Contamination Sources to be Considered in Surface Water Assessments
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From DEP Databases:	
Underground fuel storage tank leak site	Tank farm Industrial complex Non-point pollution source Transfer station Sludge utilization site Automobile graveyard Engineered subsurface wastewater disposal system Woodyard (e.g. wood chips, etc.) Underground injection well Surface impoundment Mining or mineral processing site Overboard discharges (rivers) Active Underground Fuel Storage Tanks
Aboveground fuel storage tank leak site	
Municipal landfill	
Commercial landfill	
Special waste landfill	
Compost site	
Demolition debris	
Ash utilization site	
Septage storage or disposal	
Superfund hazardous waste site	
Sand/salt storage	
Surface petroleum spill site	
Hazardous waste site	
Wastewater treatment facility	
Residuals (food) utilization site	
Uncontrolled hazardous waste site	
From OGIS Database:	
Roadways	Utility rights-of-way
Railroads	Boat Launches
Other Data not Presently in Statewide Databases:	
Commercial Farms	Airports Bathing Beaches Combined Sewage Overflows
Concentrated Animal Feeding Operations	
Commercial Forest Operations	
Private Septic systems	
Home heating oil tanks	

Table 5.5 : Land Uses and Zoning to be considered in a SWAP Assessment	
Restricted Areas (e.g. no-contact zone)	Percent with Protective Zoning
Residential Density	Recreational Uses (heavy-moderate-light):
Percent Ownership by PWS	Ice Fishing
Compatible Uses (e.g. public lands)	Boating
Percent Forested	Swimming
Percent Impervious Surface	Recreational Vehicles
Percent Agricultural Land	

5.4.4 Data Element 4 » Land Uses and Zoning

Information about land uses and zoning is not available in any statewide database. It will be difficult to obtain in a digital form for incorporation into a GIS map. It may only be possible for the DWP to obtain estimates of watershed percentages for each category and to use those percentages to make judgments about potential for future water quality impacts. Table 5.5 lists the activities and zoning types identified by the SWWG.

Table 5.6 : Zones to be Assessed for Each Surface Water Source		
ZONE	ASSESSMENT ITEMS	COMMENTS
WATERSHED: (direct watershed)	Identify activities of highest risk Recommendations for action Identify potential for future risk Recommendations for action	Focus on chemical contaminants and non-point sources Based on ownership/control For PWS; municipalities
SHORELAND ZONE: (250' from high water)	Identify Activities of highest risk Recommendations for Action Identify potential for future risk Recommendations for action	Focus on non-point sources Based on ownership/control For PWS; municipalities
INTAKE ZONE: (1000'-radius circle)	Identification activities of highest risk	Focus on pathogens, human activities

	Recommendations for Action	
	Identify potential for future risk	Based on ownership/control
	Recommendations for action	For PWS; municipalities

5.4.5 Data Element 5 » Other Analyses

Vulnerability has been evaluated in other ways for other reasons for some of Maine’s larger water bodies. The results of these analyses can be included in the SWAP assessments and can help form the basis of susceptibility determinations. Examples include Trophic State Index, Vulnerability Index, and Build-out Analysis.

5.5 The Surface Water Assessment Methodology

It was the consensus of the SWWG and agreed to by the Advisory Committee that an assessment for a surface water supply should include more than one evaluation in more than one category since no single score or ranking could take into account the many factors which must be considered when evaluating susceptibility. As with ground water sources, surface water sources will be evaluated in discrete zones and for both existing and future risk. The following approach will be followed:

5.5.1 Community and Non-transient, Non-community Water Suppliers

A zoned assessment format is proposed for community and non-transient, non-community surface water suppliers as follows:

5.5.2 Transient Surface Water Suppliers

Transient water systems are regulated only for acute contaminants (pathogens and nitrate/nitrite) since the individuals consuming the water are not the same ones from one day to the next. In general, no individual consumes the water for an extended period of time and therefore contaminants which pose a long-term health risk are not significant. For this reason, evaluations only of the intake zone will be completed. A map of the whole watershed, however, will be created and made available.

5.5.3 Segmentation of River and Stream Watersheds

There are 18 public water suppliers in Maine which utilize a river, stream or brook source. In some cases, the upstream watershed extends more than 50 miles from the intake. For these sources, the entire watershed will be delineated and a map produced from statewide GIS data illustrating potential contamination sources in the watershed. For the purposes of assessment, however, the watershed and shoreland zone will be evaluated for a minimum of one mile upstream. In addition, each source will be evaluated on a case-by-case basis to determine if the assessment area should be extended further upstream.

5.5.4 Conjunctive Delineation

In 1995, Maine completed evaluation of all community ground water sources and identified those which are under the direct influence of surface water. Through testing it was determined that these wells draw in surface water which does not receive adequate natural filtration. Evaluation

of non-community ground water sources is underway. For those wells which are determined to be under the direct influence of surface water, both the wellhead protection area and the watershed of the adjacent surface water body will be delineated and assessed.

5.5.5 Interstate and International Source Protection Areas

At least three of Maine's community surface water suppliers draw water from sources with watersheds which cross state or country borders. These include the Berwick Water Department (Salmon Falls River), Biddeford-Saco Water Company (Saco River), and Madawaska Water District (St. John River). Others may be identified as the drinking Water Program completes a GIS coverage of public water supply watersheds. The State of New Hampshire is developing GIS databases for SWAP Assessments similar to that being compiled in Maine. This information will be shared and the data from New Hampshire used to complete the Berwick and Biddeford-Saco assessments. Both states are working with the New England Interstate Water Pollution Control Commission (NEIWPCC) to facilitate the sharing of this information. NEIWPCC has begun the process of identifying a contact or contacts in New Brunswick, Canada, for a similar cooperative effort.

5.6 The Assessment Process

Maine's surface water supplies are a diverse group, ranging from a former bedrock quarry to the Saco River. For this reason, a program for assessing their susceptibility needs to be flexible enough to be applied to each source and significant site-specific data collection and stakeholder contact is required. The DWP will seek to enter into a contract with a qualified individual or agent with experience evaluating surface water bodies (Contractor) to conduct the assessments and produce a written report for each. Conducting an assessment will be accomplished via the following steps:

5.6.1 Contact Letter

The DWP or Contractor will send a letter to each surface supplier describing the assessment process and listing required or desirable information. A letter will also be sent to the chief elected official of each municipality in the watershed. That individual will be encouraged to identify other local stakeholders (code enforcement officer, conservation commission, planning board, lake association, etc.). The letter will recommend (though not require) initiation of raw water quality data collection if little or none exists.

5.6.2 Site Visit

The DWP or Contractor will schedule a site visit. The visit will include a meeting with the PWS and municipal designees, a windshield survey of the watershed, and gathering of any available information.

5.6.3 DWP Evaluate Each Zone

The DWP or Contractor will complete an evaluation of each assessment zone (watershed, shoreland zone, and intake zone) by reviewing available data. For each zone, significant existing threats will be identified and the potential for future threats will be evaluated. Unlike Maine's groundwater assessments, surface water assessments will not include rankings of "high, medium or low". Instead, each *significant* potential or existing source of contamination, water quality monitoring result(s), or water quality parameter identified will be prioritized, using the guidelines outlined in Tables 5.6, 5.7, 5.8 and 5.9, and will include recommendations for actions by the system operator, municipal officials or other involved parties to remove or mitigate for the identified threat.

For example: in the intake zone, those activities which may introduce pathogens to a source water would be a higher priority than non-point sources, while non-point sources in the watershed zone would be a higher priority than a new, properly constructed and maintained underground storage tank located on the edge of the watershed. The recommendations for each identified threat will reflect the seriousness of that threat.

Table 5.7: Guidelines Prioritizing Risks to Surface Supplies	
Priority	Known water quality impacts
Higher	Proximity to intake and shoreline
	Nature of contaminant [pathogen>>turbidity>>chemical]
Priority	Nature and extent of control of PCS site [abandoned >>managed]
Lower	Slope of land at PCS site
	Other factors

5.6.4 Potential Threats To Surface Water Sources

Table 5.4 lists the potential contamination sources which will be considered within each assessment zone. All of these potential sources will be identified in each zone. Those posing the greatest risk within each zone will be prioritized based on the contaminant type, the zone it's located in, and its proximity to the surface intake as follows:

Intake Zone (1,000 foot radius around intake): Acute contaminants, i.e. sources of viral, bacteriological or Nitrate/Nitrite contamination, represent the most significant threats in the intake zone.

Shoreland Zone (250 feet from high water): Acute contaminants, i.e. sources of viral, bacteriological or Nitrate/Nitrite contamination, represent the most significant threats in the intake zone.

Watershed Zone (the direct watershed, including the intake and shoreland zones): Sources of chemical contaminants are the most significant sources to be considered in the remainder of the watershed.

Table 5.8 lists the potential sources of contamination that will be considered during the evaluations. *Please note: the Department reserves the right to amend this list as needed should new, previously unidentified sources of contamination are identified.*

5.6.5 Indicators of Ambient Risks To Surface Water Sources

Ambient water quality will be assessed for each surface water source for the Intake, Shoreland, and Watershed zones. Existing water quality problems will be used to assess the current state of the source, and its likelihood of continued water quality degradation. The detection of chemical contaminants, the erodibility of soils near the water body, and the ability of the water body to meet

State and federal water quality classifications will be used to make these determinations of susceptibility.

Table 5.8: Significant Potential Sources of Contamination for Surface Water Sources

Sources of Contamination to be Identified in all Zones			
		PETROLEUM/HYDROCARBON USE (VOCS OR SEMI-VOCS)	OTHER
Contaminants With Significant Susceptibility for the Watershed Zone	HERBICIDE/PESTICIDE USE Agricultural chemical spreading or spraying Agricultural chemical storage Bulk grain storage Chemically fertilized agricultural field Golf course Herbicide sales or applicator Nursery or garden shop Pesticide sales or applicator High voltage transmission lines	Aboveground oil storage tank (including home heating oil tanks)	Abandoned well
		Underground oil storage tank	Boat builder, refinisher, maintenance
		Airport fueling area	Chemical reclamation
		Airport maintenance	Food processor
		Auto chemical supply wholesaler	Graveyard and cemetery
		Auto repair	Heat treater, smelter, annealer, descaler
		Body shop	Incinerator
		Concrete, asphalt, tar, coal company	Industrial discharge
		Dry cleaner	Industrial manufacturing
		Furniture stripper	Industrial waste disposal
		Gas station, service station	Landfill, dump, transfer station
		Junk or salvage yard	Metal plating
		Machine shop	Military facility
		Oil pipeline	Monitoring well
		Painters, finisher	Railroad yard or line
		Parking lot	Recycling or processing center (other than beverages)
		Photo processor	Research laboratory
		Printer	
		Sand and gravel mining, other mining	

		<p>Small engine repair shop</p> <p>Snow dump (large commercial or municipal)</p> <p>Stormwater impoundments or run-off area</p> <p>Truck terminal</p>	<p>Residential home</p> <p>Rust proofer</p> <p>Salt pile or sand and pile</p> <p>Wood preserver</p>
<p>Contaminants With Significant Susceptibility for the Shoreland Intake Zones</p>	<p style="text-align: center;">BACTERIA AND INORGANICS SUCH AS NITRATES/NITRITES</p> <p>Animal burial (large scale site)</p> <p>Animal grazing</p> <p>Barnyard</p> <p>Manure pile</p> <p>Manure spreading</p> <p>Meat packer, slaughter house</p> <p>Municipal wastewater treatment plant</p> <p>Septic system</p> <p>Sewer line</p>		

	<p>Sludge disposal or spreading</p> <p>Wastewater impoundment</p> <p>Wastewater treatment plants, discharge</p>
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The above contaminants shall, at a minimum, include those regulated under Section 1412 of the Safe Drinking Water Act.

Intake Zone: The presence, or lack of detections for chemical contaminants will be used to evaluate whether a surface source has a low, moderate, or significant level of susceptibility to water quality problems with no detections in the previous three years being low, and MCL exceedences being significant.

Shoreland Zone: SCS soil survey and classification information will be used to assess the potential for soils and nutrients to wash into the surface source. Soils unlikely to erode will result in a low susceptibility, while highly erodible soil will be considered significantly susceptible. Soil surveys and classifications include this information. For example, the Scio series is described in the Kennebec County Soil Survey as follows:

"The Scio series consists of deep, moderately well drained, gently sloping to sloping soils that formed in lacustrine or marine sediments. Low to medium permeability; poor to good stability and compaction characteristics; susceptible to piping; erodible."

Watershed Zone: Failing to meet a CWA water quality standard or having a state water quality classification of B or having a trophic class of eutrophic will yield a significant susceptibility determination. Having a state water quality classification of A or having a trophic class of mesotrophic will be considered a moderate level susceptibility. While a state water quality classification of AA and having a trophic class of oligotrophic will be considered a low level of susceptibility.

Table 5.9 summarizes the criteria to be used to assess the susceptibility of surface water sources using existing water quality, soil, and water quality classification information.

Table 5.9: Ambient Water Quality Assessment Criteria			
	Significant Susceptibility	Moderate Susceptibility	Low Susceptibility

Intake Zone	MCL Exceedence for One or More Chemical Contaminants in the Previous Three Years	Chemical Contaminant Detections in the Previous Three Years with no Exceedences	No Chemical Detections in the Previous Three Years
Shoreland Zone	Highly Erodible Soil Type	Moderately Erodible Soil Type	Soil Erodibility not Probable
Watershed Zone	Failing to Meet a CWA Water Quality Standard or Having a State Water Quality Classification of B or Having a Trophic Class of Eutrophic Or Greater than 30% of the land area has been developed for any combination of urban or agricultural land use	Having a State Water Quality Classification of A or Having a Trophic Class of Mesotrophic Or Between 20% and 30% of the land area has been developed for any combination of urban or agricultural land use	Having a State Water Quality Classification of AA and Having a Trophic Class of Oligotrophic Or Less than 20% of the land area has been developed for any combination of urban or agricultural land use
	Particular attention shall be given to Clean Water Act (CWA) water quality parameters that are also regulated under the Safe Drinking Water Act		

5.6.6 Overall Susceptibility Evaluation

Significant Overall Susceptibility: Any surface water source zone, which receives both significant ambient and potential contaminant susceptibility ratings, will be determined to be significantly susceptible to water quality problems.

Low Overall Susceptibility: Any surface water source zone, which receives both low ambient and not significant potential contaminant susceptibility ratings, will be determined to have a low overall susceptibility to water quality problems.

Moderate Overall Susceptibility: Any surface water source zone, which receives either a moderate ambient or significant potential contaminant susceptibility rating will be determined to have a moderate overall susceptibility to water quality problems.

5.6.7 DWP and PWS Review Evaluation and Develop Recommendations

A second meeting will be scheduled to allow the PWS and municipal representatives to review and comment on the evaluation and to request revisions if necessary. Recommendations for action will be developed for inclusion in the final report.

5.6.8 Release Final Report

The DWP or Contractor will compile the information, evaluation, and recommendations in a bound report. The report will be reviewed by PWS and municipal representatives prior to being finalized and made available to the public.

5.6.9 Contractor Progress

The DWP will monitor the progress of contractors using existing State regulations and policies for insuring contractor performance.

6.0 Moving from Assessment to Protection: Making the SWAP Results Available to the Public

According to the enabling federal legislation, SWAP is to be implemented "for the protection of benefit of public water systems." In Maine, protecting public water sources is largely the responsibility of water systems and municipalities. Awareness is the first step in developing a local protection plan. Therefore, for SWAP to be effective, the results must be made known to water systems and their customers as well as municipalities and their citizens. In addition, there are state agencies (such as the Department of Environmental Protection) and quasi-municipal organizations (such as the Maine Water Utilities and Maine Rural Water Associations) which include as part of their mission the protection of public water supplies. No single method of publicizing the SWAP results is going to be effective at communicating to all of these audiences. For this reason, the DWP will utilize several diverse means to communicate the results.

6.1 Report to Public Water System and Customers

A summary report, including a map, a description of the system, the assessment results, and recommendations for action, will be provided to each water system. Community water systems are required to make known the existence of the assessment in their annual consumer confidence report (CCR). The customers will be given a brief summary of the assessment in the CCR and also given instructions on how to get a copy of the complete report on their water system.

6.2 Report to Selected Municipalities

There is at least one public water source in 462 of Maine's municipalities. The total number of public water sources in any single town ranges from one to 47 (Naples). In an effort to facilitate local planning to protect these resources, the DWP will provide a map and summary assessment report on all public water sources in their town to the chief elected official in each of the 156 towns with 5 or more public water sources. Summary reports to other municipalities will be provided on request.

6.3 Executive Summary Report

When all SWAP assessments have been completed, the DWP will produce a bound Executive Summary report describing and analyzing the results. In contrast to the system-specific reports to be provided to water systems and towns, the summary report will evaluate the information state-wide and describe trends and important patterns. The purpose of this summary report will be to assist interested agencies and parties to prioritize their protection activities in areas where such activities will be most effective. For example, grant funding for non-point source projects could be directed toward watersheds with sites which have been identified as presenting a significant risk to water quality. Or inspections for floor drains could be prioritized in wellhead protection areas of wells identified as at high existing risk for chronic contamination.

Copies of the Executive Summary report will be distributed to the Governor, the Maine Legislature, the SWAP Advisory Committee members, the Department of Environmental Protection, regional planning commissions, and other state resource and planning agencies.

6.4 Press Releases and Regional Meetings

When the Executive Summary report is distributed it will be accompanied by a press release and copies will be made available to Maine's largest newspapers. In addition, the DWP will schedule regional meetings at selected sites throughout Maine to describe the methodology, the results, and to explain the accompanying recommendations.

6.5 The Internet

Progress has already been made in making public water supply source information available over the Internet. The Maine Office of GIS has created an Internet mapping site using the wells and intakes coverage created by the DWP. Using this site, anyone with an Internet browser can produce a map of any location in Maine showing wells and intakes, roads, town boundaries, and water bodies. More recently, the DWP has created a web site which allows the user to click on any Maine county and view a list, organized by town, of all public water supply sources. Both of these projects are designed to give interested individuals and organizations information they can use to protect public water sources. Both of these sites can be accessed through links on the DWP homepage (www.state.me.us/dhs/eng/water). As assessments are completed, the DWP will continue to work to make available over the Internet the assessment results and the information used to make susceptibility determinations.

6.6 DWP Role After SWAP

For the next several years, assessing and reporting on Maine's public water sources will be a primary task of the Drinking Water Program. Once the results are made available, the responsibility for responding to the assessments with protection efforts is a local one. The DWP role will then be that of facilitator - linking interested local parties with state and federal resources (including technical and financial assistance). To help make this happen, the DWP will produce a guidebook for distribution to Maine municipalities and water suppliers. The purpose of the guidebook will be to bring together under one cover the names and responsibilities of the various resources available to assist in local protection efforts.

7.0 SWAP Implementation Schedule

The Maine Drinking Water Program will evaluate the susceptibility to contamination of each public water source by accurately locating it; delineating the contributing area; completing an inventory of potential contamination sources; reviewing water quality data and other information; and, finally, evaluating all of this information. As much as possible, this information will be drawn from existing databases collected through existing programs. For this reason, implementation is already underway. Completion of this document initiates a 3+ year process of evaluating the completeness and accuracy of existing information, communicating with water systems and municipalities, filling data gaps, compiling data into appropriate databases, conducting assessments, and then reporting the results in a variety of formats.

As described in previous sections, all 2600 public water sources in Maine will be evaluated. The type of information collected, level of detail, extent of contact with the water system, and method of assessment will vary depending on the type of system, type of water source, and population served. Based on these factors, the water systems can be grouped in six categories. The process of conducting these six groups of assessments will be concurrent. As assessments are completed, the results will be made available as soon as feasible, initially to the water systems.

Ultimately, all assessment results will be compiled in an executive summary report in the winter of 2002-3.

Table 7.1 is a generalized chart identifying process goals for each group of systems for each of the 3+ years of implementation.

Table 7.1: SWAP Implementation Schedule

	CWS Surface Water	Large CWS Ground Water	Transients Surface Water	Transients Ground Water	Non-Transient Ground Water	Small CWS Ground Water
Jan - Jun 1999	Negotiate Contract	Complete Delineations	Site Visits	Mass Mailing	Inventory	Inventory
Jul - Dec 1999	Data Collection	Complete Delineations	Data Compilation	Data Compilation	Inventory	Inventory
Jan - Jun 2000	Site Visits	Site Visits/Inventory	Site Visits	Mass Mailing #2	Data Compilation	Data Compilation
Jul - Dec 2000	Data Analysis	Site Visits/Inventory	Data Analysis	Data Compilation	Data Compilation	Data Compilation
Jan - Jun 2001	Data Analysis	Data Analysis	Data Analysis	Data Compilation	Data Analysis	Data Analysis
Jul - Dec 2001	Reports Completed	Data Analysis	Reports Completed	Data Analysis	Data Analysis	Data Analysis
Jan - Jun 2002		Reports Completed		Reports Completed	Reports Completed	Reports Completed
Jul - Dec 2002						
Jan - Jul 2003	REGIONAL PUBLIC MEETINGS	INTERNET SITE COMPLETED	EXECUTIVE SUMMARY REPORT ISSUED			

APPENDICES

APPENDIX A: ACRONYMS AND DEFINITIONS

CCR - Consumer Confidence Report

CWS - Community Water System

DEP - Maine Department of Environmental Protection

DHS - State of Maine Department of Human Services

DWP - State of Maine Drinking Water Program, within DHS

EPA - U.S. Environmental Protection Agency

GIS - Geographic Information System

GPM - gallons per minute

MCL - Maximum Contaminant Level

MTBE - methyl-tertiary-butyl-ether

NPS - Nonpoint Source

NTNC - Non-transient, Non-Community Public Water System

OGIS - Maine Office of Geographic Information Systems

PCS - Potential Contamination Source

PWS - Public Water System

SDWA - Safe Drinking Water Act

SWAP - Source Water Assessment Program

SWWG - Maine Surface Water Workgroup

TOT - Time-of-Travel

USGS - U.S. Geological Survey

UST - Underground Storage Tank

VOC - Volatile Organic Compounds

WHPP - Wellhead Protection Program

WHPA - Wellhead Protection Area

Acute Contaminants Compounds which, if in water which is consumed, can immediately make an individual sick. These include nitrate/nitrite and bacteria/pathogens.

Chronic Contaminants Compounds, which, if in water which is consumed over a long duration (years to decades), may eventually make an individual sick. These include chemical contaminants such as metals, gasoline and other volatile organic compounds, pesticides/herbicides, and so forth

Community Water System (CWS). A public water system that serves at least 15 service connections used by year-round residents of the area served by the system or regularly serves at least 25 year-round residents.

Conservation Easements. Easements are an interest in land that entitles a person to use the land possessed by another (affirmative easement), or to restrict uses of the land subject to the easement (negative easement). A conservation easement restricts the owner to uses that are compatible with conservation environmental values. Easements are one technique for exercising Legal Control over land.

Contamination Source Inventory. The process of identifying, locating, and verifying contaminant sources within delineated source water protection areas

Drinking Water State Revolving Fund (DWSRF). Under section 1452 of the SDWA, EPA awards capitalization grants to states to develop drinking water revolving loan funds to help finance drinking water system infrastructure improvements, SWP, to enhance operations and management of drinking water systems, and other activities to encourage PWS compliance and protection of public health.

Dug Wells and Springs These are sources which both involve drawing from a source at or near where the water table is expressed into the open atmosphere. Because both draw water from locations at or near the ground surface, both are categorically at high relative risk to contamination as compared to gravel and bedrock wells.

Fractured Bedrock Well A well which is drilled into, and draws from, groundwater found in networks of fractures in bedrock. Bedrock wells are commonly drilled to depths of several hundred feet below the ground surface, and typically yield less water than a gravel well.

Geographic Information System (GIS) A GIS is a collection of computer hardware, software, and geo-referenced data which permits storage, retrieval, and analysis of spatial information.

Legal Control A mitigating factor to minimize a source's future risk for contamination; typically an option available only to municipalities, legal control strategies (here, to limit certain land use practices or activities within a source water protection area) include, but may not be limited to zoning, comprehensive planning, resource protection district establishment, and conservation easements.

Maximum Contaminant Level (MCL). In the SDWA, an MCL is defined as "the maximum permissible level of a contaminant in water which is delivered to any user of a public water system."

Non-Transient, Non-Community Water Systems (NTNC) Public water systems which regularly serve at least 25 of the same non-resident persons per day for more than 6 months per year. Non-transient non-community systems typically include schools, offices, churches, factories, etc.

Primacy State. State that has the responsibility for ensuring a law is implemented, and has the authority to enforce the law and related regulations. State has adopted rules at least as stringent

as federal regulations and has been granted primary enforcement responsibility. Maine is a primacy state for the federal Safe Drinking Water Act (SDWA).

Source Water Protection Area (SWPA). The area delineated by the state for a PWS or including numerous PWSS, whether the source is ground water or surface water or both, as part of the state SWAP approved by EPA under section 1453 of the SDWA.

Surface Water Treatment Rule (SWTR). A section of the SDWA. The rule specified maximum contaminant level goals for Giardia lamblia, viruses and Legionella, and promulgated filtration and disinfection requirements for PWSs using surface water sources or by ground water sources under the direct influence of surface water. The regulations also specified water quality, treatment, and watershed protection criteria under which filtration may be avoided.

Surficial Well A well drilled typically in sand and gravel deposits, a surficial well is one which draws water from unconsolidated (non-bedrock) geologic materials at or near the ground surface.

Susceptibility Analysis. A required element of SWAP; an analysis of the likelihood of contamination of a PWS.

Transient Water Systems Transient Water Systems (Transients) are non-community water systems which serve at least 25 persons, but not necessarily the same persons, for at least 60 days per year. They serve a constantly changing population of individuals whose exposure to the water is of short duration. Examples include highway rest stops, restaurants, motels, campgrounds, among others.

Watershed. A topographic boundary area that is the perimeter of the catchment (drainage) area of a stream, river, lake or pond.

Watershed Area. A topographic area that is within a line drawn connecting the highest points uphill of a drinking water intake, from which overland flow drains to the intake.

Wellhead Protection Area (WHPA). The surface and subsurface area surrounding a well or well field, supplying a PWS, through which contaminants are reasonably likely to move toward and reach such water well or well field.

APPENDIX B: ADVISORY COMMITTEE DOCUMENTS

APPENDIX C: PUBLIC OUTREACH INITIATIVES

APPENDIX D: PRESS CLIPPINGS

APPENDIX E: SAMPLE ASSESSMENTS

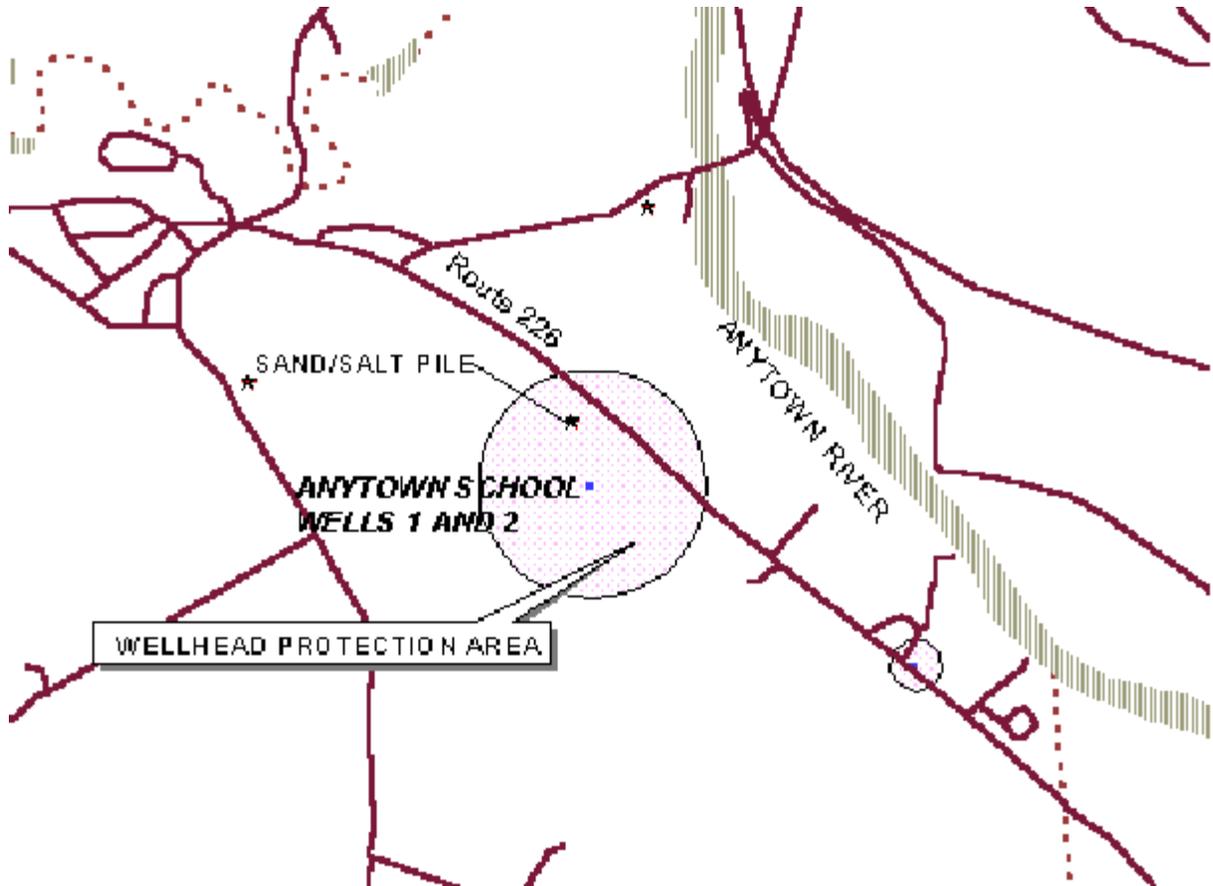
ANYTOWN SCHOOL: DRINKING WATER SOURCE ASSESSMENT

INTRODUCTION:

The Maine Drinking Water Program, a state agency within the Department of Human Services-Bureau of Health, has completed an assessment of the susceptibility to contamination of the drinking water source serving ANYTOWN SCHOOL, a public water system located in Anytown, Maine. The assessment is a requirement of the Federal Safe Drinking Water Act, a law originally passed in 1974 in an effort to ensure the safety of public water supplies. The water system has voluntarily cooperated with the Drinking Water Program in completing this assessment. In the

following sections the water system and sources are described, a map of the source locations is provided, the risk of contamination of the source(s) is evaluated, and recommendations for action on the part of the water supplier, citizens, and municipal officials are provided.

MAP OF THE SOURCE:



WATER SYSTEM DESCRIPTION:

Water System Name: Anytown School

Water System Type: Non-transient, Non-community system

Location: Anytown, Maine

Number of Individuals served daily: 282

Number of Ground Water Sources: 2

Number of Surface Water Sources: 0

Type of Treatment: chlorination

Estimated Daily Water Use 7050 Gallons per day

Source 1 of 2

Description: Drilled Well 485'

Location: on right side of school

Well Type: bedrock

Well Depth: 485 feet

Estimated Thickness of Overburden: 60 feet

Estimated Yield: Unknown

Type of Wellhead Protection Area: Circle

If circle, what diameter: 300 feet

Source 2 of 2

Description: Drilled Well 231'

Location: near flagpole

Well Type: bedrock

Well Depth: Unknown

Estimated Thickness of Overburden: 42 feet

Estimated Yield: Unknown

Type of Wellhead Protection Area: Circle

If circle, what diameter: 300 feet

SUSCEPTIBILITY TO CONTAMINATION:

In completing this assessment, the Drinking Water Program has considered the following types of information from the following sources:

Information Type	Information Source
well type and site geology	DWP databases, public water supplier
potential sources of contamination	DEP databases, public water supplier
water quality data	public water supplier
ownership and zoning	public water supplier

In general, potential risk of contamination is evaluated (high, moderate, or low risk) in five categories. These are:

Future Risk of Acute Contamination: HIGH RISK

Future Risk of Chronic Contamination

Chronic contaminants are those which pose a health risk if consumed (even sometimes at very low doses) over many, many years. There are 89 contaminants which by law must not be present in public drinking water or which can only be present below some specified level (the Maximum Contaminant Level). Examples of chronic contaminants include MTBE and other gasoline additives, chlorinated solvents, many herbicides and pesticides, gross alpha radiation, lead, arsenic, and many others. Risk rankings in this category are based on the ownership or control by zoning of land within the defined Wellhead Protection Area and out to a circular zone with a radius of 2500' around the well.

Anytown School

Future Risk of Chronic Contamination: HIGH RISK

DISCUSSION AND RECOMMENDATIONS

No water system in the United States can legally serve water to the public which does not meet drinking water standards. Therefore, almost invariably, water from a public drinking water system is safe to drink. However, conditions can change over time and that is why systems test their water daily, monthly, annually, etc., as appropriate. This assessment is an evaluation of how likely the system is to become contaminated now and into the future. It is based on available information at the date listed in the title. It is subject to change if conditions changes, for example if new development is initiated near the well or an existing potential source of contamination is removed. The most favorable outcome is five LOW RISK rankings. This means that it is unlikely that the drinking water source will become contaminated. The least favorable outcome is five HIGH RISK rankings. This means that there have already been unfavorable water quality results from the system, there are existing potential sources of contamination too near the well, and that the system does not own or control the land around the well considered necessary to protect the source.

The purpose of this assessment is to provide the water system, the individuals drinking the water, land owners near the well, and municipal officials from the town or towns encompassing the source protection area, with basic information to make decisions about activities existing or proposed near the well. A cooperative relationship among these individuals is the important first step toward a plan for protecting the well and therefore for protecting the health of the people who drink the water. Based on the results of the assessment, the following general recommendations should be considered:

High or Moderate Risk Based on Well Type and Site Geology

Often a system has no choice about the type of well it uses as a source and certainly site geology is a given. However, in some cases a dug well or spring could be replaced with a bedrock well. In general, if your drinking water source is determined to have high or moderate risk based on well type and site geology, you should prepare a CONTINGENCY PLAN. This is a plan for quickly switching to another source of drinking water if the existing one becomes contaminated. Examples include a second well or wells, an agreement with another water supplier, or arrangements for temporarily supplying bottled water.

High or Moderate Existing Risk of Acute Contamination

A high or moderate ranking in this category means that there are existing sources of acute contaminants near the well, that the water has tested unfavorably for acute contaminants in the recent past, or both. If there are existing potential sources of pathogens near the well, it would be wise to plan how to prevent contaminants from reaching the well. This could include purchasing land and removing septic system leach fields; connecting to public sewer (if possible); having the septic tank pumped at least annually; etc. If the presence of acute contaminants has already been detected in the water, the water is probably already being tested more frequently to be sure future contamination will be detected early. An investigation should be undertaken to determine the source of the contamination and reduce or eliminate the risk (as described above).

If the water supplier does not own or control through all of the "sanitary zone" around the well (usually within 300 feet) then there is some risk that a future potential source of contamination will be installed there (such as a new leach field on your neighbor's property). The sure way to ensure that this doesn't happen is to buy the property. Short of that, purchasing an easement or at least communicating with your neighbor about the proximity of your well to his property can help mitigate the risk.

High or Moderate Existing Risk of Chronic Contamination

A high or moderate ranking in this category means that there are more than 4 existing sources of chronic contaminants near the well, that the water has tested unfavorably for chronic contaminants in the recent past, or both. If your water supply source is determined to have existing risk of chronic (chemical) contamination, you should evaluate each potential source individually and determine the level of risk posed by each. The level of risk will differ for different activities and based on many factors including the distance from the well; geology and hydrogeology; level of care with which the activity is managed (as with the storage or use of lubricating chemicals, for example); the water system or town's authority to control the activity (as with the storage or use of lubricating chemicals, for example); and other factors. The risk can only be truly eliminated through purchasing land and ceasing the activity. Less drastic (and expensive) measures include communicating with your neighbors to make them aware of the risk their activity poses. A water supplier or town may want to inspect facilities periodically to ensure that on-site practices will not impact ground water and, ultimately, reach the well.

High or Moderate Future Risk of Chronic Contamination

A high or moderate ranking in this category indicates that the water suppliers does not own or control all the land encompassed by the Wellhead Protection Area and/or the land encompassed by a 2500'-radius circle around the well. If part of the Wellhead

Protection Area is not owned or controlled by the water supplier, future activities could occur in these areas and impact the well. Short of purchasing all land which contributes to the well, a water supplier in conjunction with the municipality could purchase easements from abutters, could pass protective ordinances to limit the types of activities which could occur there, could be granted authority by a planning board or other local entity to review and comment on projects proposed in this protection area, could work with proposed developers to help them design projects so that they pose lesser risk to ground water, etc.

If you have questions about the information in this assessment, please contact:

Maine Drinking Water Program

Anytown School

10 State House Station

PO Box 55

Augusta, Maine 04333-0010

Anytown, Maine

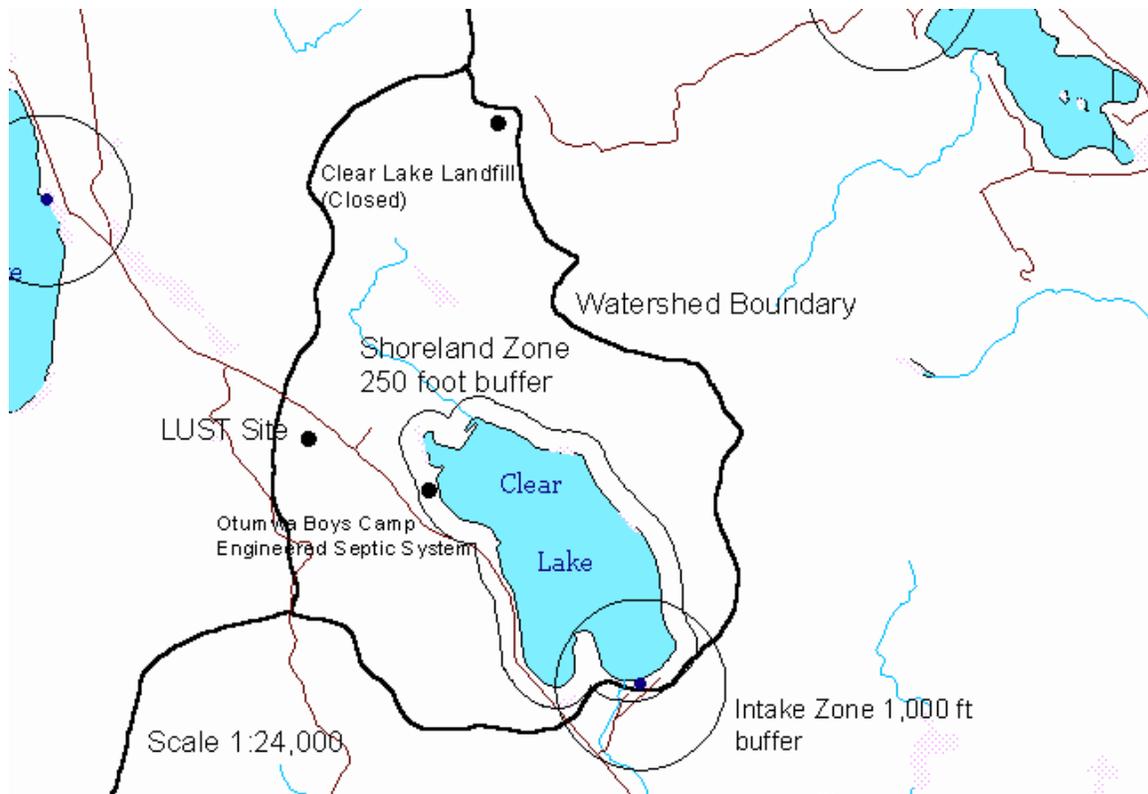
DRAFT SURFACE WATER ASSESSMENT

Clear Lake Village Water Company: Drinking Water Source Assessment

Introduction

The Maine Drinking Water Program, a state agency within the Department of Human Services, Bureau of Health, in cooperation with Watershed Consulting Services and the Clear Lake Village Water Company, has completed an assessment of the susceptibility to contamination of the drinking water source serving Clear Lake Village, a public water system located in Clear Lake, Maine. The assessment is a requirement of the Federal Safe Drinking Water Act, a law originally passed in 1974 in an effort to ensure the safety of public water supplies. The Public Water Supplier (PWS) has voluntarily cooperated with the Drinking Water Program in completing this assessment. In the following sections, the water system and sources are described, a map of the source locations is provided, the risk of contamination of the source(s) is evaluated, and recommendations for action on the part of the water supplier, citizens, and municipal officials are provided.

Map of the Source



Water System Description

Water System Name: Clear Lake Village Water Company

Water System Type: Non-transient, Community system

Location: Clear Lake, Maine

Number of individuals served daily: 2,500

Number of Ground Water Sources: 0

Number of Surface Water Sources: 1

Type of Treatment: ozonation

Filtration: Filtration avoidance through waiver

Estimated Daily Water Use: 275,000 Gallons per day

Source 1

Description: Clear Lake

Location: Clear Lake outlet.

Susceptibility to Contamination

In completing this assessment, the following types of information from the following sources were considered.

Information Type	Information Source
Watershed Characteristics	DWP GIS, USGS 24K coverage
Raw Water Quality	PWS monitoring, DEP databases
Potential Contamination Sources	DEP, OGIS, Windshield survey
Land Use and Zoning	PWS data, USGS 24K coverage, Windshield survey
Other Analyses	DEP/U. Maine Databases

More detail about these data sources is available in Appendix A and the Methodology section.

Assessment Zones

The assessment was performed for three zones, listed below. The potential contamination sources considered vary among the zones.

Zone	Measure	Findings	Risk level
Watershed	Ambient water	Classified as AA, in compliance	Low

	quality	LUST site, closed landfill	Significant
	Potential threats	Roadway zoned for development	Moderate
	Future Threats		Moderate
	Overall		
Shoreland	Lake classification	Mesotropic	Moderate
	Soils	Buxton	Moderate
	Potential Threats	Boys camp engineered septic system	Significant
	Future Threats	Undeveloped lots west of lake	Moderate
	Overall		Moderate
Intake	Raw water quality	meets MCL's	Low
	Ownership/control	PWS owns 100% of shorefront	Low
	Potential Threats	None	Low
	Future Threats	Increased recreational pressure	Low
	Overall		Low
Overall			Moderate

Discussion and Recommendations

Clear Lake Water Company has taken some important steps to conserve its supply. The PWS owns the intake shoreland area, and raw water quality is good. The PWS should consider purchasing any parcels, which may become available in the shoreland zone. There are areas in the shoreland and watershed zones that require ongoing management and vigilance. Much of the shoreland zone is underlain by moderately erodible soils. Both current and future shorefront developments require careful erosion and sedimentation control to minimize the risk to water quality. The PWS should work with Clear Lake to assure enforcement of shoreland zoning and NRPA regulations. The seasonal boy's camp, with its large engineered septic system also presents a potential for bacterial and nutrient contamination of the lake. The system should be inspected for proper function on a regular schedule, and be pumped out at least biannually.

Although the watershed is not highly developed, the closed landfill for the Town of Clear Lake and an identified leaking underground storage tank site are present in the watershed. The LUST site has had tank and soil removal performed, but it is likely that low-level hydrocarbons are present in the area. The landfill has a monitoring well network. The PWS should ensure that monitoring requirements at these sites are fulfilled, and review the data for possible adverse changes in water quality. Any future development within the watershed should prefer uses that are compatible with water quality conservation.

The road along the west side of Clear Lake is zoned for development. There are undeveloped lots within the shoreland zone, as well as in the watershed zone. The Town and the PWS should work together to reduce development pressures in this area, either through purchase, easement, or re-zoning.

Methodology

The Drinking Water Program, in cooperation with Maine DEP, Water Districts, and Watershed Associates, has evaluated existing information and collected new information about three zones around each surface water source. The data, assembled in a GIS, was used to perform an assessment of threats to the source based on the guidelines listed in the table below. Many of the data types are continuous, like drainage basin size. For these items, a comparative range was used. For items with discrete standards, like MCL's, the standard was used as a yardstick to judge potential risks. Further detail concerning the methodology for the assessment is included in the SWAP document, chapter 5.

Table of Assessment Guidelines

Risk to the source

Assessment Item/threat	low	moderate	significant
Physical Characteristics of the Watershed.			
Watershed boundary, area	Smaller	>>	Larger
Area of water body	"	>>	"
Tributaries	few	>>	many
Watershed Topography	low	moderate	steep, rugged
Wetlands	many	>>	few
Water body depth	deep	>>	shallow
Sand and Gravel Aquifers	few	some	many
Soil types (erodibility and slope)	low	moderate	high
Raw Water Quality			
Secchi Disk Transparency	<8 M	4-8 M	> 4 M
Turbidity pH	<1 NTU	<5 NTU	>5 NTU
Phosphorus	6.5-8.5	N/A	<6.5 or >8.5
Pesticides and Herbicides	<10 ppb	<20 ppb	>30 ppb

Color	ND	N/A	detected
Total Coliform and E Coli	< 5	5-15	>15
Dissolved Oxygen	> 29/ 100 ml	occasional	>142/100 ml
Temperature	>7 mg/l	5-7 mg/l	<5 mg/l
VOC's	ambient	-	>10o C ambient
Chlorophyll-a	absent	N/A	Detected
Total Organic Carbon	<2 ppb	2-6 ppb	>6 ppb
	< 4 mg/l	4-8 mg/l	>8 mg/l
Potential Contamination Source Inventory	Absent from watershed or actively monitored and controlled	Present in watershed, some operational deficiencies and/or remediation is underway.	Present and unmonitored and/or unremediated.
UST/AST leak sites			
Municipal/Comm/Special Landfill			
Compost sites Demolition Debris sites			
Ash/ Septage storage/utilization	or fully remediated		
Superfund site			
Sand/Salt storage sites			
Petroleum Spill sites			
Hazardous Waste sites			
Wastewater Treatment facilities			
Food residuals utilization sites			
Uncontrolled Hazardous sites			
Tank farms			
Industrial complexes			
Non-point pollution sources			
Transfer stations			

<p>Sludge utilization sites</p> <p>Automobile graveyards</p> <p>Engineered subsurface systems</p> <p>Woodyards</p> <p>Underground injection wells</p> <p>Surface impoundments</p> <p>Mining/mineral processing sites</p> <p>Overboard discharges to rivers</p> <p>Active UST sites</p> <p>Roadways</p> <p>Railroads</p> <p>Utility Rights-of-way</p> <p>Boat Launches</p> <p>Commercial farms</p> <p>CAFO's</p> <p>Commercial Forest Operations</p> <p>Private Septic Systems</p> <p>Home heating oil tanks</p> <p>Airports</p> <p>Bathing Beaches</p> <p>Combined Sewage overflows</p>	<p>If present, at low density, properly installed and operated. In compliance with applicable local, state, and federal regulations.</p>	<p>>>>></p>	<p>High density, little evidence of active management, documented incidence of problems and failures</p>
<p>Land Uses and Zoning</p> <p>Residential Density</p> <p>Percent of watershed</p>	<p>>2 A/lot</p>	<p>1-2 A/lot</p> <p>intake and</p>	<p><1A/lot</p> <p>critical areas</p>

Owned by PWS	total >80%	shoreland protected, others developed	(intake, shoreland) unprotected or developed
Public Lands or conservation	for all		
Forested	protected		
With Protective zoning	uses		
Agricultural	<20% total	20-30% total	>30% total of three
Impervious cover	<20% "	20-30% "	>30% "
Industrial/commercial	<20% "	20-30% "	>30% "
Waterbody uses: Restricted areas			
Ice Fishing	large, posted	intake zone	Small to none
Boating	limited to	moderate, well-managed	Prevalent, uncontrolled
Swimming	absent		
Recreational vehicles			
Other Analyses			
Trophic State Index	<25	25-60	>60
Vulnerability Index	Low	Moderate	High
Build-out analysis	Fully developed	>>>	High potential for development

If you have questions about the information in this assessment, please contact

Maine Drinking Water Program Clear Lake Village Water Company

10 State House Station P.O. Box 100

Augusta, Maine 04333-0010 Clear Lake, Maine

(207) 287-2070 (207) 555-1212

Appendix A: Detailed list of information sources considered

Information Type	Information Source
Physical Characteristics of the Watershed.	DWP GIS, USGS 24K coverages
Watershed boundary, area	"
Area of water body	"
Tributaries	"
Watershed Topography	"
Wetlands	Digitized NWI maps
Water body depth	DWP GIS from DEP database
Sand and Gravel Aquifers	DWP GIS from MGS maps
Soil types (erodibility and slope)	DWP GIS - NRCS Maps
Raw Water Quality	Water District, Existing DEP monitoring
Secchi Disk Transparency	"
Turbidity	"
pH	"
Phosphorus	"
Pesticides and Herbicides	"
Color	"
Total Coliform and E Coli	"
Dissolved Oxygen	"
Temperature	"
VOC's	"
Chlorophyll-a	"
Total Organic Carbon	"
Potential Contamination Source Inventory	
UST/AST leak sites	DEP Database, District Data where available
Muni/Comm/Special Landfill	"
Compost sites	"
Demolition Debris sites	"
Ash/Septage storage/utilization	"
Superfund sites	"

Sand/Salt storage sites	"
Petroleum Spill sites	"
Hazardous Waste sites	"
Wastewater Treatment facilities	"
Food residuals utilization sites	"
Uncontrolled Hazardous sites	"
Tank farms	"
Industrial complexes	"
Non-point pollution sources	"
Transfer stations	"
Sludge utilization sites	"
Automobile graveyards	"
Engineered subsurface systems	"
Woodyards	"
Underground injection wells	"
Surface impoundments	"
Mining/mineral processing sites	"
Overboard discharges to rivers	"
Active UST sites	"
Roadways	DWP/OGIS Database
Railroads	"
Utility Rights-of-way	"
Boat Launches	"
Commercial farms	Windshield Survey, Dept. of Agriculture data.
CAFO's	"
Commercial Forest Operations	"
Private Septic Systems	"
Home heating oil tanks	"
Airports	"
Bathing Beaches	"
Combined Sewage	"

overflows	
Land Uses and Zoning	
Residential Density	Topographic maps, Windshield survey
Percent of watershed:	Inventory, PWS interview
Owned by PWS	
Public Lands or conservation	
Forested	
Agricultural	
Impervious cover	
With Protective zoning	
Waterbody uses:	Inventory, PWS interview
Restricted areas	
Ice Fishing	
Boating	
Swimming	
Recreational vehicles	
Other Analyses	
Trophic State Index	DEP files, PEARL
Vulnerability Index	DEP files, PEARL
Build-out analysis	DEP files

APPENDIX F: SIGNIFICANT COMMENTS AND RESPONSES

APPENDIX G: MAINE WELLHEAD PROTECTION PROGRAM SELF-EVALUATION FORM

APPENDIX H: POTENTIAL SOURCES OF CONTAMINATION

HERBICIDE/PESTICIDE USE

1. _____ Agricultural chemical spreading or spraying
2. _____ Agricultural chemical storage
3. _____ Bulk grain storage
4. _____ Chemically fertilized agricultural field
5. _____ Golf course
6. _____ Herbicide sales or applicator
7. _____ Nursery or garden shop
8. _____ Pesticide sales or applicator
9. _____ High voltage transmission lines

PETROLEUM/HYDROCARBON USE (VOCS OR SEMI-VOCS)

10. _____ Aboveground oil storage tank (including home heating oil tanks)

41. _____ Animal grazing
42. _____ Barnyard
43. _____ Manure pile
44. _____ Manure spreading
45. _____ Meat packer, slaughter house
46. _____ Municipal wastewater treatment plant

OTHER

50. _____ Abandoned well
51. _____ Boat builder, refinisher, maintenance
52. _____ Chemical reclamation
53. _____ Food processor
54. _____ Graveyard and cemetery
55. _____ Heat treater, smelter, annealer, descaler

- 11. _____ Underground oil storage tank
- 12. _____ Airport fueling area
- 13. _____ Airport maintenance
- 14. _____ Auto chemical supply wholesaler
- 15. _____ Auto repair
- 16. _____ Body shop
- 17. _____ Concrete, asphalt, tar, coal company
- 18. _____ Dry cleaner
- 19. _____ Furniture stripper
- 20. _____ Gas station, service station
- 21. _____ Junk or salvage yard
- 22. _____ Machine shop
- 23. _____ Oil pipeline
- 24. _____ Painters, finisher
- 25. _____ Parking lot
- 26. _____ Photo processor
- 27. _____ Printer
- 28. _____ Sand and gravel mining, other mining
- 29. _____ Small engine repair shop
- 30. _____ Snow dump (large commercial or municipal)
- 31. _____ Stormwater impoundments or run-off area
- 32. _____ Truck terminal

BACTERIA AND INORGANICS SUCH AS NITRATES/NITRITES

- 40. _____ Animal burial (large scale site)

- 56. _____ Incinerator
- 57. _____ Industrial discharge
- 58. _____ Industrial manufacturer
- 59. _____ Industrial waste disposal
- 60. _____ Landfill, dump, transfer station
- 61. _____ Metal plating
- 62. _____ Military facility
- 63. _____ Monitoring well
- 64. _____ Railroad yard or line
- 65. _____ Recycling or processing center (*other than beverages*)
- 66. _____ Research laboratory
- 67. _____ Residential home
- 68. _____ Rust proofer
- 69. _____ Salt pile or sand and salt pile
- 70. _____ Septic system, septic waste disposal
 - a. _____ Beauty parlor
 - b. _____ Car wash
 - c. _____ Laundromat
 - d. _____ Medical, dental, veterinarian office
 - e. _____ Mortuary/funeral parlor
 - f. _____ Multi-unit housing
 - g. _____ Single-family housing
 - h. _____ Other _____
- 71. _____ Sewer line
- 72. _____ Sludge disposal or spreading
- 73. _____ Wastewater impoundment area
- 74. _____ Wastewater treatment plants, discharge
- 75. _____ Wood preserver

APPENDIX I: EPA APPROVAL LETTER

90-42 b. The criteria for review are as set out in this subsection. No development shall be approved unless the planning board makes an affirmative finding that the development meets or exceeds the following enumerated criteria:

1. Pollution. The proposed development will not result in undue water or air pollution.

28. Protection of public health and safety. The proposed development shall provide for safe and healthful conditions. No proposed use may be approved which creates a substantial risk of causing damage to the public health or welfare.

APPENDIX I

Belfast Water District's Public Statement to Its Customers and the Residents of the City of Belfast

There have been many questions raised during the past year regarding the proposed sale of Belfast Water District property and water to Nordic Aquafarms. The Board of Trustees and myself as Superintendent have attempted to answer these questions promptly and completely. I recently was asked how a large user would benefit the water district and our customers. I was then asked if I would consider making a public statement as to why we made the decision to sell and explain the process that led to our decision.

I was first asked if we would consider selling the Little River property in the fall of 2017. I inquired about the intended use for the property and was told that it was for a land-based salmon farm by a company named Nordic Aquafarms. I told them that the Board might consider a sale and that they should attend the next scheduled board meeting to speak to the Trustees directly.

Elizabeth Ransom came to the board meeting in October 2017 to ask the Board if they would consider selling to Nordic. We told her that we would consider selling, but only under the following conditions:

1. The sale of the property would have to generate enough money to allow us to move our operation without any cost to our customers.
2. Nordic would need to purchase a minimum of 100 million gallons of water annually at the same price every other customer pays, and they would need to purchase that amount for an extended period of time.
3. Nordic would have to agree to continued public use of the walk-trail on the property.
4. The Belfast Water District would be allowed to retain ownership of the property where the Bayside Meter Vault sits.

The Belfast Water District and Nordic Aquafarms, through their respective legal representatives, negotiated a Purchase Agreement for the property and a Water Purchase Agreement, which was signed on January 30th 2018. These agreements are available on the Belfast Water District website. A paper copy is available at the Belfast Water District office weekdays during regular business hours.

Here is a brief explanation of the agreements:

Nordic Aquafarms will pay the Belfast Water District \$1,059,000 for 30 +/- acres of land and the buildings at closing. Also, the City of Belfast will pay the Belfast Water District \$100,000 to purchase 12 +/- acres of property that surrounds the Lower Reservoir for conservation, a 250-foot wide strip of land that encompasses both the walk trails. This will ensure that the trails will remain intact and available to the public.

The Belfast Water District will retain ownership of the Lower Dam for up to two years from the date of closing and provides Nordic the option to purchase the dam for \$1.00 dollar at any time within that two-year period. (Note – Nordic has verbally committed to exercise the option.)

The Water Supply and Purchase Agreement states that Belfast Water District will supply up to 262 million gallons of water annually to Nordic Aquafarms. Nordic agrees to pay for a minimum of 100 million gallons of water annually from the District, at the same rate that all our customers pay, for the first six years regardless of whether they use any of that water or not. They also agree to pay the Belfast Water District for the first 100 million gallons of the six-year contract at closing. The agreement also has ten additional one-year renewal terms in it.

What will this mean for additional revenues to the Belfast Water District?

100 million gallons per year sold to Nordic at current rates is \$287,500. We calculate the cost to pump and treat that amount of water annually to be approximately \$25,000. This will provide estimated annual net revenue of \$262,500 from Nordic at minimum.

Where will the Belfast Water District move their headquarters after closing?

The Belfast Public Works Department purchased land on Crocker Road to build and relocate their new operations facility. After a site search, we purchased five acres of this property from the City for \$1 to build our new water district headquarters, which is close to the center of town and most of our infrastructure. This will save fuel and provide quicker response time for our customers.

How much will new buildings cost, and who will pay for it?

The preliminary building and site plans have an estimated budget of \$1.2 million for a 3,200 square foot office and attached 6,000 square foot garage. The proceeds at closing will provide the funds necessary to build the new facility and relocate.

What does the District plan to do with the additional revenue it would receive from the sale of water to Nordic?

The Belfast Water District has more than 39 miles of water main that supplies our 2,000 plus water services and 5,500 customers. They also supply the water to 250 plus fire hydrants and four water storage tanks that store three million gallons of water to the system for high demand such as large fires. We know that our system has at least 13 miles of old and undersized cast iron water main, which are more than 100 years old. Some of the water mains are more than 130 years old and in extremely poor condition. Just this past winter a section of six-inch cast iron water main on High Street ruptured six times within a five week span. Four breaks happened in just one 30-foot span. The pipe in this span was so weak that it couldn't be repaired and had to be replaced in order to restore service. Present water rates allow for \$190,000 worth of improvements to be made annually to the entire system, which includes mains, wells, pumps, tanks, buildings, vehicles, equipment, and fire hydrants. The average cost at today's prices to replace one mile of water main is \$687,000. The extra revenue from the sale of water to Nordic will allow us to begin immediately replacing as much of this old main as possible while keeping our rates to our customers steady.

Can the Goose River Aquifer, Belfast's water source, safely supply all of our existing customers and the additional amount that Nordic would need?

This was the first question we asked ourselves last fall when considering this sale. The sale was also a major consideration for the Maine Public Utilities Commission when they approved the agreement. Fortunately, our aquifer and wells have more than 50 years of data history. We know the amount of water that was pumped, the precipitation during that time, and the drawdown history taken from the many test wells in the aquifer that surround the two wells. Two extensive pump tests have been performed on the aquifer and wells. One when the wells were drilled back in 1957 and 1965, and another in 1989.

We asked the leading hydrologist in the State of Maine to give us an evaluation of water capacity for our system. His findings were that today there is a safe yield of 699 million gallons per year. Our demand has averaged 234 million gallons per year for the past 17 years. Considering the maximum amount of the Nordic water supply agreement of 262 million gallons per year, we would pump 496 million gallons per year if we were at the maximum. This leaves an operating reserve of 192 million gallons annually. The precipitation records taken from 1960 to 2018 show an annual average rainfall of 49 inches locally. He reports that 50% of annual precipitation will actually recharge ground water, or 24.65 inches of precipitation, over the recharge area of Goose River Aquifer that covers 3,888 acres or six square miles. Those 24.65 inches of precipitation will provide the aquifer with an annual recharge of 876 million gallons of water per year. The report also shows that 2001 was the worst drought year on record in this same 50-year period with 27.16 inches of precipitation, which gave a recharge of 482 million gallons that year. 2001 was the last year that Stinson Canning was open and the pumping for that year was 339 million gallons. The two wells are 45 feet deep in the aquifer. Our records show that the average static water level around those wells, since we began keeping records in 1989 is 7 feet. (This means that 7 feet down from the surface of the ground you will strike water). Our records also show that in August of 2001 the static water level was 12 feet. In conclusion what this means that in the driest month of the driest year we have on record the aquifer still had a more than ample supply of water.

How would Belfast Water handle an extreme drought condition, if ever faced with it?

There has been a rumor circulating that the Belfast Water District would supply water to Nordic before it would provide for human consumption in an extreme drought. This is false. The Belfast Water District is currently drafting a drought plan. It will be implemented as part of our Terms and Conditions, and approved by the MPUC and Maine Drinking Water Program, in late 2019. The plan has 11 water use priorities to be implemented in the event of a drought. The priorities and most critical to supply start at #1 and goes to the least critical to supply #11: (1. Hospitals) (2. Nursing homes) (3. Human consumption at residences, drinking water, cooking, bathing, toilet) (4. Fire protection) (5. Pets and Livestock) (6. Aquatic habitat) (7. Commercial uses Restaurants and offices) (8. Industry, FISH FARMS, and other manufacturing processes) (9. Pools) (10. Watering lawns) (11. Washing cars) Human consumption is third most critical and Industry is eighth.

The Board of Trustees, the staff of the Belfast Water District and I, want our customers and the entire City of Belfast to know that we understand there are strong feelings about this development and the desire to maintain our property as green space because we love coming to work each day in such a picturesque place too. We had the responsibility to consider the question of what would benefit all of the customers of the Belfast Water District. When considering whether to keep our picturesque office, while facing the prospect of spending money on dams that haven't been necessary for 38 years, the answer was clear, to sell the property, relocate and agree to supply water to a large user to benefit our customers.

In conclusion, we want everyone to know the Belfast Water District will be here to serve you whatever the future holds, just like we have for the past 106 years.

Thank You

Keith Pooler, Superintendent
Belfast Water District

**Water Sufficiency Questions, Record Review Planning Board Meetings 2020, from
Appendix 1. Excerpts from Planning Board Meeting Transcripts (January – December 2020):
Groundwater and Talbot Well**

Yellow highlight: Planning Board

Green highlight: City official/expert (e.g. Mandy Olver, Matt Reynolds)

Blue highlight: Nordic (e.g. Ed Cotter, Elizabeth Ransom)

Planning Board request more info.

Public Comment

See p. 1 Appendix 1. Excerpts from Planning Board Meeting Transcripts (January – December 2020): Groundwater and Talbot Well

I. SITE PLAN PERMIT RELEVANT REQUIREMENTS

Sec 90-42(b)(1) Pollution. The proposed development will not result in undue water or air pollution. In making this determination, consideration shall be given to:

...

e. The applicable state and local health and water resource rules, regulations and codes.

Sec. 90-42(b)(2) Sufficient water. The proposed development has sufficient water available for the reasonable foreseeable needs of the development and will not unreasonably affect other existing local drinking water resources.

Sec. 90-42(b)(3) Municipal water supply. The proposed development will not cause an unreasonable burden on an existing municipal water supply, if one is to be used.

Sec. 90-42(b)(12) Groundwater. The proposed development will not, alone or in conjunction with existing activities, adversely affect the quality or quantity of groundwater or any public or private water source.

Sec. 90-42(b)(28) Protection of public health and safety. The proposed development shall provide for safe and healthful conditions. No proposed use may be approved which creates a substantial risk of causing damage to the public health or welfare.

See p. 22, Appendix 1. Excerpts from Planning Board Meeting Transcripts (January – December 2020): Groundwater and Talbot Well

Planning Board asked: “What are your concerns, if any, about the Belfast Water District being able to provide enough water for Belfast, Northport, Northern Farms and other potential customers in the future, example drought, Goose River flow, competition from competing communities...”

what are your concerns if

00:15:11 any un

00:15:12 about the belfast water district being

00:15:14 able to provide enough water for belfast
00:15:16 north port
00:15:17 northern farms and other potential
00:15:19 customers in the future
00:15:20 example drought goose river flow uh
00:15:23 competition from competing communities
00:15:24 or what's the same demand another thing
00:15:26 would be if the if one of the drilled
00:15:28 wells at nordic farms
00:15:30 failed then you would be there you'd be
00:15:33 their go-to for water so your ability to
00:15:37 increase capacity is going to be based
00:15:38 on having tablet well online
00:15:40 and then is it is that is that the
00:15:43 simple math then
00:15:44 um tablet jackson and um
00:15:48 and the uh smart road wells all working
00:15:52 together it is the simple math
00:15:55 again if you do the math of
00:15:59 of the 462 million
00:16:02 gallons annually with nordic
00:16:05 as a customer um and we
00:16:08 we do have the information that shows
00:16:10 that the district could go up
00:16:14 to 600 million gallons and still have a
yield
00:16:18 in the aquifer uh so
00:16:23 we uh you know we feel comfortable with
00:16:26 that uh we have a lot of
00:16:28 a lot of information that backs it up um
00:16:33 i don't know if that answers the
00:16:34 question
00:16:36 okay number four

00:19:22 if we go over what what is expected now
00:19:25 if there is another customer for
00:19:26 instance comes online correct um
00:19:29 or if nordic all of a sudden has a
00:19:31 higher demand
00:19:33 uh is there a way of testing that pipe
00:19:34 to see if it if it's going to be
00:19:36 adequate for the if
00:19:38 if nordic or any customer had a higher
00:19:41 demand
00:19:44 we would definitely have to study that
00:19:46 water main yeah
00:19:47 that would be the first thing that would
00:19:48 happen
00:19:50 um how big of a process would that be to
00:19:54 to study it it's not a huge process rick
00:19:57 maybe can
00:19:58 answer that easier than i can yeah it's
00:20:01 a

00:20:02 hydraulic model of the water system
00:20:04 there and we could run it under various
00:20:05 scenarios
00:20:06 i am not sure if tim has one developed
00:20:08 by for the belfast water display i think
00:20:10 he does
00:20:10 he does yeah sure i was more involved in
00:20:13 the geology aspects in the engineering

00:20:15 aspects but
00:20:16 i have done some modeling and it's it's
00:20:18 a matter of uh getting
00:20:20 a good accurate model of your system and
00:20:21 then testing it
00:20:23 with various flows so the model exists
00:20:26 the model does exist but it would need
00:20:28 to be updated i believe
00:20:29 yeah i think the last time it may have
00:20:30 been updated was five or six years ago
00:20:32 yes
00:20:33 so it's all a computer process a lot of
00:20:36 it would be a computer process
00:20:39 i personally would want to see the
00:20:42 physical
00:20:43 aspects of it too to be comfortable yep
00:20:46 to get it very accurate we'd have to do
00:20:47 some flow testing out there on hydrants
00:20:49 to see what that would that be
00:20:52 that would go along with for instance if
00:20:54 nordic did come online

See p. 29 - 30 Appendix 1. Excerpts from Planning Board Meeting Transcripts (January – December 2020): Groundwater and Talbot Well

Planning Board asked Nordic: “And saltwater intrusion, you drop the water table 200 feet. How much effect do you think that will have for saltwater intrusion?”

02:15:12 um and saltwater intrusion you drop the
02:15:15 water table
02:15:16 200 feet how much effect do you think
02:15:18 that will have for
02:15:19 saltwater intrusion just that's the
02:15:23 that's the reason or one of the reasons
02:15:25 why we've got this monitoring plan
02:15:26 because it's
02:15:27 hard to tell because you don't know what
02:15:29 the geology is and the connectivity
02:15:32 yeah like i said the testing we've done
02:15:34 so far indicates
02:15:36 that this one well has a high connection
02:15:39 rate to salt water so it's drawing in

02:15:41 salt water
02:15:42 it but it doesn't show any indication
02:15:45 that that means any other well is
02:15:46 impacted by it we spent a year studying
02:15:50 that
02:15:50 that question actually to arrive at a
02:15:52 very confident answer there are over
02:15:54 two million pieces of data taken under
02:15:56 consideration
02:15:58 i mean a huge network of monitoring
02:16:00 points in this area
02:16:01 um to try and answer that with high
02:16:04 confidence it's not a guess
02:16:05 i mean we spent over a year and a lot of
02:16:08 time and a lot of resources
02:16:10 asking and trying to answer that
02:16:11 question and we've had two rounds of
02:16:14 conversations and memos back and forth
02:16:16 with
02:16:17 dr hoppeck at the dep on this issue and
02:16:21 you know to get to the point where we
02:16:23 think that hopefully he's
02:16:25 ready to advise the board that he's
02:16:27 ready to approve the permit i don't know
02:16:28 if he is yet but that's where we're
02:16:29 hoping we're getting to
02:16:31 through those memos and that's mostly
02:16:33 based on
02:16:35 the use of the resource monitoring plan
02:16:38 which he has given us input on
02:16:40 that he wants certain parameters in
02:16:42 there and
02:16:44 you know he's given us some input on how
02:16:46 to form that so that he's comfortable
02:16:48 with it
02:16:49 i should note also that monitoring
02:16:51 hasn't stopped it's still going on right
02:16:53 now there are still monitors in private
02:16:54 wells
02:16:55 right now collecting data
02:16:58 and so part of the conditions for this
02:17:01 permit would include
02:17:03 monitoring for loss of groundwater for
02:17:06 the adjacent wells but also saltwater
02:17:08 intrusion and i assume that that plan
02:17:09 would develop
02:17:10 between in detail enough detail for the
02:17:13 permit
02:17:13 between now and when the permit would be
02:17:17 approved what we've discussed with at
02:17:19 the dep
02:17:20 level is that if we receive a draft
02:17:23 permit that within two months we would
02:17:25 finalize that

02:17:26 monitoring plan um so that that way
02:17:29 we can put in any new monitoring that we
02:17:32 are responsible for
02:17:33 and start that background monitoring and
02:17:36 then and also
02:17:38 you monitor but then you also have plans
02:17:40 for how you deal with potential results
02:17:42 yes then those and those inc they're
02:17:45 clearly laid out that we take
02:17:47 responsibility to make sure that
02:17:48 no customers no neighbors are um
02:17:52 impacted so that we were responsible for
02:17:55 whatever measures it
02:17:56 takes to correct the situation those are
02:17:58 also coupled with
02:17:59 warning thresholds so you you identify
02:18:02 the impact before you get to
02:18:04 an actionable level so you can identify
02:18:06 it up here before it gets to that point
02:18:09 you have a real issue where you have to
02:18:12 bring an
02:18:12 amendment in ahead of time okay

See p. 33 Appendix 1. Excerpts from Planning Board Meeting Transcripts (January – December 2020): Groundwater and Talbot Well

Planning Board asked Nordic: You must have an idea where saltwater intrusion might happen, if it did happen, compared to that well? You saw the signature, do you have well monitors in the zone where the worst case scenario would most likely by?

02:27:32 you must have an idea where salt
02:27:33 intrusion might happen if it did happen
02:27:36 compared to that well
02:27:37 you saw the signature do you have um
02:27:40 well monitors in that zone where that
02:27:43 that worst case scenario
02:27:44 would most likely be yeah the um
02:27:47 you know just like you would expect we
02:27:49 we think that the
02:27:51 most at-risk areas are closest to the
02:27:53 shore so that happens to be
02:27:56 over in the north
02:28:04 [Applause]
02:28:07 over on the north part line east of
02:28:09 route 1 or south of vermont r1
02:28:12 you know the closer you are to saltwater
02:28:15 the higher the risk
02:28:16 so those those are the ones that we
02:28:18 would like to be able to monitor
02:28:20 and very closely watch those
02:28:23 characteristics early when we're pumping

02:28:25 low volumes and
02:28:26 make sure that everything's reacting the
02:28:28 way we expect it to

Planning Board request: “I would like as part of our review process that we would look at all of the monitoring that you would be expecting to be required to participate in before, during, and after construction.”

i mean i have a similar
02:34:17 question about monitoring
02:34:18 um we've talked loosely about monitoring
02:34:21 in
02:34:22 different areas about discharge piping
02:34:24 intake piping
02:34:26 salt water intrusion uh
02:34:29 wells and private wells public worlds
02:34:33 but um i would like as part of
02:34:37 um our review process that we would look
02:34:40 at all of the monitoring
02:34:41 that would that you would be expecting
02:34:43 to
02:34:46 be required to participate in uh
02:34:49 before during and after construction
02:34:52 and that on on on the spreadsheet so
02:34:57 that we can see
02:34:59 among all of us and we can judge how the
02:35:01 how the facility is going to be
02:35:03 monitored uh after we pass it up

02:35:49 the the tricky part is we've laid out
02:35:52 what our proposal is and what we think
02:35:54 is a good plan we've reacted to dep's
02:35:57 request to change that to increase
02:35:59 frequency but as far as minimum wells
02:36:04 like we were talking about before these
02:36:05 are private wells we have to ask
02:36:07 permission to
02:36:08 monitor them we've we've sent out a
02:36:11 blanket letter
02:36:12 to all butters within a thousand feet
02:36:15 yeah i'm not looking for individual well
02:36:16 information i'm looking for
02:36:18 an overall monitoring schedule showing
02:36:21 okay all motoring
02:36:22 yep and that's that is in the
02:36:24 application um and it'll be amended

See p. 53 Appendix 1. Excerpts from Planning Board Meeting Transcripts (January – December 2020): Groundwater and Talbot Well

Planning Board asked Nordic to respond to some of the issues raised: “Do you guys have a response or do you guys want to deal with what he brought up?”

...

01:56:51 uh that's how we selected to represent
01:56:53 that boundary
01:56:54 uh but we also make a generalization of
01:56:58 the
01:56:58 fractured bedrock system uh within the
01:57:01 model that
01:57:02 uh is it's a limitation of
01:57:05 modeling techniques it's impractical or
01:57:07 infeasible
01:57:08 to specifically model each individual
01:57:12 weakness and water bearing fracture
01:57:15 within a bedrock system because you
01:57:16 really
01:57:17 you cannot characterize them at the
01:57:19 level they exist so we simplify the
01:57:21 system we treat it
01:57:22 in a way that has properties that are

01:57:27 unconsolidated materials sands and
01:57:29 gravels but we use
01:57:31 lower hydraulic property values and
01:57:33 we're able to calibrate the model and
01:57:35 show that
01:57:36 in you know where we have data the model
01:57:38 responds in the way the system did
01:57:40 but that particular step allows
01:57:43 potentially a more free connection to
01:57:45 that coastal boundary
01:57:47 um so we're not able to
01:57:51 specifically specifically reflect the
01:57:53 direct connection or the lack thereof to
01:57:56 that coastal boundary
01:57:58 ultimately the model does predict inflow
01:57:59 from that boundary but is that
01:58:01 a realistic proportion of what those
01:58:03 wells receive
01:58:04 we really we don't know for sure

01:58:08 um we do know is that at least
01:58:11 one of the wells uh one in particular
01:58:14 showed
01:58:15 an antecedent saltwater signature when
01:58:17 we tested
01:58:18 uh ransom tested the water quality in
01:58:21 that well so
01:58:22 **in that particular case it's not a**

01:58:23 matter of causing
01:58:25 salt water intrusion as much as there is
01:58:27 already an existing condition
01:58:30 that may not change as it's pumped it's
01:58:32 a matter of where that well
01:58:34 receives its water as its pump um and it
01:58:37 very well

See p. 58 Appendix 1. Excerpts from Planning Board Meeting Transcripts (January – December 2020): Groundwater and Talbot Well

Planning Board raised the issue of monitoring the Goose River wells.

um i was just
00:44:01 in the last paragraph in section three
00:44:03 it says the board indicate
00:44:04 indicated its intent to require the
00:44:06 district to establish a good quality
00:44:08 monitoring program of weather usage from
00:44:09 the chris river wells (Goose River)
00:44:11 i didn't really remember i'm having
00:44:14 trouble
00:44:14 recalling what that's about i mean is it
00:44:17 part of the application that we would
00:44:18 require the district to do something
00:44:20 um apparently the uh um
00:44:23 the goose river wells um are are going
00:44:27 to be
00:44:28 uh need to be monitored so that um the
00:44:31 goose river itself
00:44:32 is not impacted by the extraction of too
00:44:34 much water
00:44:35 so the monitoring i think at our last
00:44:38 meeting we we discussed our
00:44:40 problem with the last one at a recent
00:44:42 meeting we discussed
00:44:43 uh that uh problem and
00:44:47 the fact that the monitoring of the
00:44:49 boost river itself
00:44:50 and the wells was going to be important
00:44:52 to
00:44:54 the the way that the water district is
00:44:57 extracting water
00:44:58 um traditionally in the past
00:45:02 war district has had no trouble getting
00:45:03 the water from those wells
00:45:05 but they didn't have to contend with the
00:45:08 lowering of the goose river
00:45:11 whereas now if the goose river is
00:45:13 substantially impacted
00:45:15 then they have this they have to cut
00:45:17 back on their level of extraction

00:45:18 as i understand it does anybody else
00:45:20 have a different memory
00:45:26 uh bill here if i just my recollection
00:45:28 of this
00:45:29 it's an it's an interesting issue that
00:45:33 it was indicated that there's some
00:45:35 discussion at the state level
00:45:37 i believe about this issue in terms of
00:45:40 having monitoring be required
00:45:44 of the goose river water levels
00:45:51 and yet the water district is
00:45:54 regulated and the jurisdiction for that
00:45:56 regulation is with the public utilities
00:45:58 commission so
00:46:01 my thought is that on this particular
00:46:02 issue it'll be very interesting to see
00:46:05 what um the dep bep decisions say about

The county governor of Oslo and Viken

Place: Oslo Date: October 24, 2019

Our ref. (Please state by answer): 2019/50837 Their ref .: Roger Fredriksen

FREDRIKSTAD SEAFOODS AS c / o Øra Industripark AS, Øraveien 2 1630 Gamle Fredrikstad

Case manager: Anette Strømme

Inspection report Inspection at Fredrikstad Seafoods AS - Land-based salmon farming Control number: 2019.045.I.FMOV

Inspection report Inspection at Fredrikstad Seafoods AS - Land-based salmon farming Control number: 2019.045.1.FMOV

Contact persons at the inspection: From the company: Roger Fredriksen

From the County Governor of Oslo and Viken: Anette Strømme

Other participants from the company: Simen Haaland

Other participants from the County Governor of Oslo and Viken: Marte Rosnes

Results from the inspection This report deals with the result from the inspection at Fredrikstad Seafoods AS - Land-based salmon farming (Fredrikstad Seafoods AS) on 16.10.2019. The report is considered final if we do not receive feedback on actual errors within two weeks of receiving the report.

The county governor of Oslo and Viken revealed 6 non-conformities and gave 2 remarks during the inspection.

Deviation:

Fredrikstad Seafoods AS lacks emission control

Fredrikstad Seafoods AS lacks monitoring of recipient

Fredrikstad Seafoods AS lacks action plan for risk-reducing measures

Fredrikstad Seafoods AS must risk assess all conditions at its lye tank

Fredrikstad Seafoods AS lacks routine for waste declaration

Fredrikstad Seafoods AS lacks energy management system

Remarks:

Fredrikstad Seafoods AS's deviation system can be improved

Fredrikstad Seafoods AS's notification routines can be improved

1. Information about the controlled business

Responsible unit Name: FREDRIKSTAD SEAFOODS AS

Organization no .: 913245873

Owned by: 913235967

Industry no. (NACE code): 03.211 - Production of food fish, molluscs, crustaceans and echinoderms in marine and coastal aquaculture

Controlled unit Name: Fredrikstad Seafoods AS - Land-based salmon farming Municipality:

Fredrikstad Construction activity: Salmon fish production on land Permit granted: 30.10.2015

Construction no .: 0106.0174.04 County: Østfold

Last changed:

2. Background for the inspection The inspection was carried out to check whether the applicable requirements laid down in or pursuant to the Pollution Control Act are complied with. The inspection is part of the County Governor's risk-based industrial inspection for this year. The audit was carried out in accordance with the Pollution Control Act § 48.

Inspection topic • Permit dated 30.10.2015

(permit no: 2015.0720.T)

Internal control Process and cleaning equipment

• •

Emissions to water Emissions to air Waste Chemicals

The report deals with deviations and remarks that were discovered during the inspection and does not provide a complete condition assessment of the company's environmental work or environmental status.

Definitions Deviations: Failure to comply with requirements laid down in or pursuant to law.

Note: A factor that the supervisory authorities believe is necessary to point out in order to safeguard the external environment, but which is not covered by the definition of non-conformance. Other matters: Cases that emerged during the inspection and that it may be useful for the company and caseworkers to know. This may also include comments on topics that were raised during the inspection, but where no deviations or remarks were made.

Follow-up after the inspection Fredrikstad Seafoods AS is obliged to rectify the deviations described in this report as soon as possible. In order for the County Governor to be able to close the case, Fredrikstad Seafoods AS must send a written statement by 31 January 2020 showing how deviations have been corrected.

We ask that you send the reply letter or e-mail (fmovpost@fylkesmannen.no) to the County Governor of Oslo and Viken by Anette Strømme.

4. Decision on fees We refer to notice and information about the fee obligation that was given to the company on 20 September 2019. Companies must pay a fee for inspections carried out by the County Governor in accordance with § 39-3 of the Pollution Control Regulations. The fee shall cover costs of preparation, implementation and follow-up of the inspection. Fee rates for control of businesses according to the Pollution Control Act are stipulated in the Pollution Control Regulations §§ 39-7 and 39-8.

On the basis of used and expected use of resources, Fredrikstad Seafoods AS will be charged a fee of NOK 26,300 for the inspection, cf. the pollution regulations §§ 39-7 and 39-8. This corresponds to fee rate 2 for inspections of up to one day's duration. The company will receive an invoice from the Norwegian Environment Agency for payment to the Treasury. We also refer to Chapter 39 of the Pollution Control Regulations for further information on the collection of fees to the Treasury.

Right of appeal The decision on a fee may be appealed to the Norwegian Environment Agency, cf. section 28 of the Public Administration Act. Any complaint should be justified in writing and addressed to the Norwegian Environment Agency, but sent via the County Governor of Oslo and Viken. The county governor will consider changing the decision or forward the case to the Norwegian Environment Agency for a final decision. Any complaint will not have a suspensive effect, and the fee stipulated above must be paid. If the Norwegian Environment Agency accepts the complaint, the overpaid amount will be refunded.

5. Access This report will be available to the public via the postal journal of the County Governor of Oslo and Viken (cf. the Public Administration Act).

6. Deviations We found the following deviations during the inspection:

Deviation 1 Fredrikstad Seafoods AS lacks emission control
Deviation from:

The permit pursuant to the Pollution Control Act for the operation of a land-based aquaculture facility dated 30.10.2015 (the permit), item 11 Emission control and reporting to the pollution authority.

Comments: The permit required Fredrikstad Seafoods AS to have discharge control. The company will carry out measurements of emissions to air and water. Measurements include volume flow measurement, sampling, analysis and calculation. The measurement program must be included in the company's documented internal control.

Measurements shall be performed so that they are representative of the company's actual emissions and shall as a minimum include:

Components that are explicitly regulated through limit values in

the permit or regulations. Other components that are covered by the reporting obligation in accordance with the Norwegian Environment Agency's guide to the companies' own control reporting

Fredrikstad Seafoods AS 'measurement program for its emissions is deficient. The results from measurements of effluent are not calculated and the company lacks an overview of its discharge to the municipal wastewater network.

Fredrikstad Seafoods AS does not take measurements of sludge that they release on the municipal wastewater network. Fredrikstad Seafoods AS has a discharge agreement with Fredrikstad municipality and the sludge goes to the Frevar sewage treatment plant on Øra. As the company does not take samples of the sludge, they thus also do not know whether they are complying with the discharge agreement with Fredrikstad municipality.

Deviation 2 Fredrikstad Seafoods AS lacks monitoring of the recipient

Deviation from: Permit point 12 Monitoring of recipient with reporting to the pollution authority.

Comments: The permit requires Fredrikstad Seafoods AS to carry out regular inspections and monitoring of Glomma. The monitoring can be carried out in-house or in collaboration with others who carry out monitoring in the same area.

The company does not have a routine / plan for monitoring according to the water regulations in Glomma and has not taken samples in the recipient.

The results of the monitoring shall be entered in the Aquatic Environment Database. All sampling results in the recipient must be entered in the subject database Water Environment to contribute to increased information about the environmental condition of the recipient. A good knowledge base is important for further work with water management and follow-up of the water regulations.

The county governor can, if necessary, contribute to creating new localities in the Aquatic Environment for the relevant test points. The laboratory used can enter the analysis results directly into the form which is then imported into the Aquatic Environment. The import form to be used for entering data can be downloaded from Vannmiljø.

Deviation 3 Fredrikstad Seafoods AS lacks an action plan for risk-reducing measures

Deviations from: The permit section 10.2 Preventive measures. Regulations on systematic health, environmental and safety work in enterprises (Internal Control Regulations) § 5 items 6 and 8.

Comments: The permit and the internal control regulations require that an environmental risk assessment be prepared to identify hazards and problems and on this basis assess risk. On the basis of the environmental risk analysis, an action plan shall be prepared with measures that reduce the risk conditions with set deadlines for implementation, as well as who is responsible for implementing risk-reducing measures. This shall be part of the company's internal control and shall be audited regularly to ensure that the internal control, including environmental risk assessment and action plan, functions as intended.

Fredrikstad Seafoods AS has prepared an environmental risk assessment and has several risk-reducing measures, but lacks an overall action plan.

Deviation 4 Fredrikstad Seafoods AS must risk assess all conditions at its lye tank

Deviations from: Pollution Control Regulations (Pollution Regulations) Chapter 18 Tank Storage of Hazardous Chemicals and Hazardous Waste (Tank Storage Regulations) § 18-4 Environmental Risk

Comments: The tank storage regulations require that the environmental risk analysis must include all conditions during tank storage, including the tank, barrier, connected pipes and equipment and more. The environmental risk assessment shall also include an assessment of the vulnerability of the environment that may be affected by pollution from tank storage. Fredrikstad Seafoods AS has a 15 m³ tank with lye. The company has a risk assessment for filling lye, but lacks a risk assessment of all other conditions during tank storage

Deviation 5 Fredrikstad Seafoods AS lacks a routine for waste declaration

Deviation from: Permit point 9 Waste and sludge. Regulations on recycling and treatment of waste (Waste Regulations) Chapter 11 Hazardous waste, § 11-8 Obligation to deliver and § 11-12 The companies' declaration obligation on the content of the waste.

Internal Control Regulations § 5 2nd paragraph item 7.

Comments: From Fredrikstad Seafoods AS's facility, hazardous waste is generated, such as waste oil, oil-contaminated material and chemicals. Hazardous waste was stored in marked containers in a closed container. The company's routine for hazardous waste has not been updated with regard to storage, electronic declaration and delivery of hazardous waste.

The hazardous waste must be delivered to legal reception at least once a year and declared in avfallseklarer.no upon delivery. The obligation arises when the total amount exceeds 1 kg.

Deviation 6 Fredrikstad Seafoods AS lacks an energy management system

Deviation from: The permit section 8.1 Energy management system

Comments: The permit requires the company to have a system for continuous assessment of measures that can be implemented to achieve the most energy-efficient production in the facilities. The energy management system must be in writing and included in the company's internal control.

During the audit, the company could not document that they have an energy management system.

7. Remarks The following conditions were noted during the inspection:

Note 1 Fredrikstad Seafoods AS's deviation system can be improved

Comments: Fredrikstad Seafoods AS has a deviation system. Definition of what a deviation is, as well as a written routine for handling deviations can be improved. **Incidents such as neighbor complaints about noise are not captured in the current non-conformance handling.**

Follow-up of nonconformities can be improved by setting up those responsible for closing each nonconformity.

Note 2 Fredrikstad Seafoods AS's notification routines can be improved

Comments: Fredrikstad Seafoods AS has not included notification of Fredrikstad municipality in the event of extraordinary discharges to the municipal wastewater network that goes to the Frevar wastewater treatment plant on Øra.

8. Other matters Fredrikstad Seafood AS started production in May 2019. Production was in the start-up phase with 90 tonnes of total biomass under supervision. The plant is designed for 2400 tonnes of biomass per year, divided into two modules.

A possible expansion of the plant is planned with increased biomass and its own slaughterhouse. An updated application with actual conditions must be sent to the County Governor of Oslo and Viken before the plant expands or at the start of the slaughterhouse / smolt plant.

9. Documentary basis The legal basis for the inspection was:

. Act on protection against pollution and on waste (the Pollution Control Act) with

underlying regulations

Regulations on the limitation of pollution (the Pollution Control Regulations) • Regulations on the recycling and treatment of waste (the Waste Regulations) • Regulations on systematic health, safety and environmental work in enterprises

(Internal Control Regulations) Permit for activities pursuant to the Pollution Control Act from the County Governor dated 30.10.2015 (permit no: 2015.0720.T)

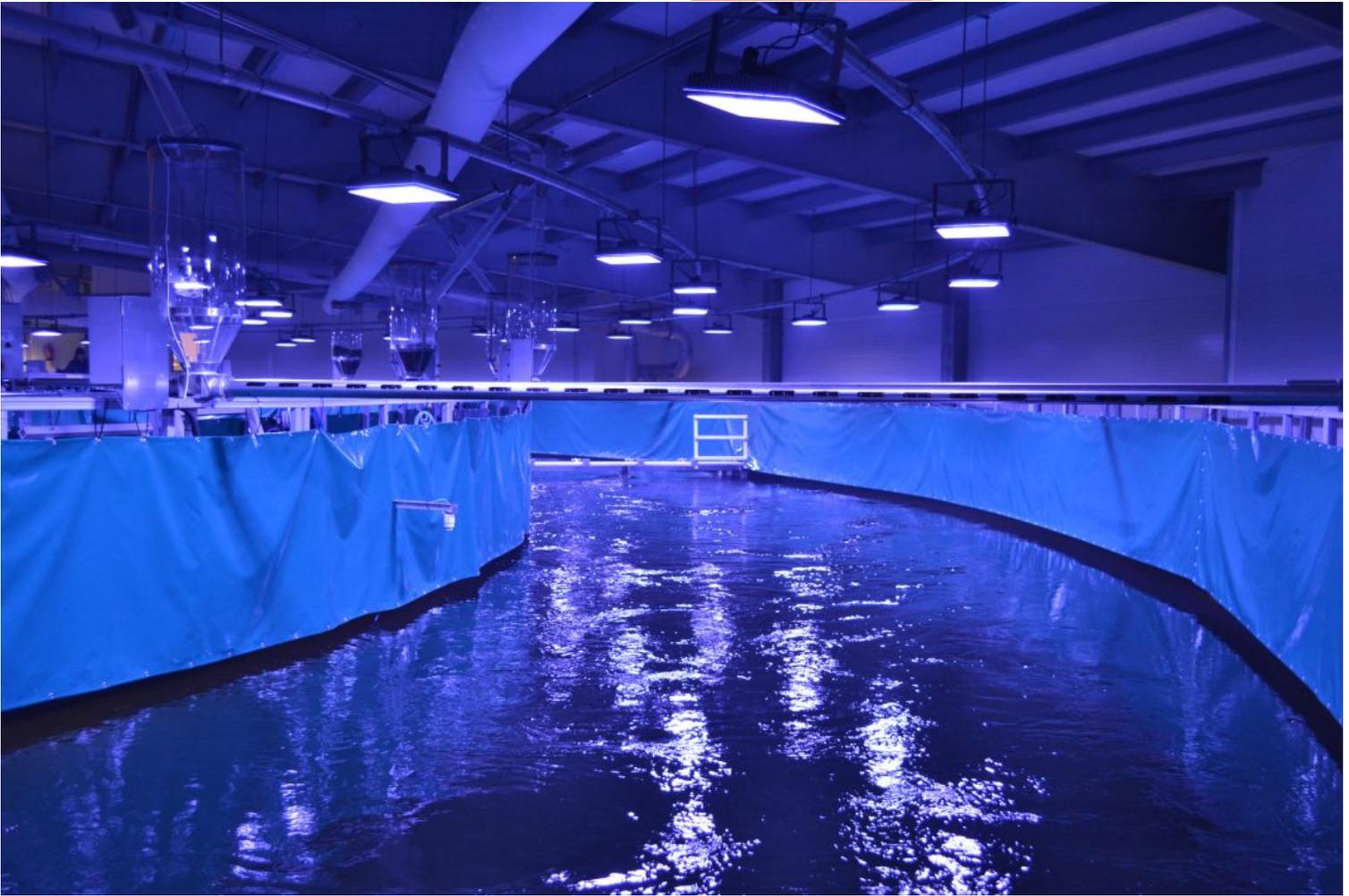
10. Information to the company Regulations about which it was informed:

• Act on protection against pollution and on waste (the Pollution Control Act) • Regulations on the limitation of pollution (the Pollution Control Regulations) • Regulations on the recycling and treatment of waste (the Waste Regulations) • Regulations on systematic health, safety and environmental work in enterprises

(internal control regulations)

Brochures / info sheets distributed:

• Fee at inspection (M-297)



“You can buy a land-based facility, but it will fail tomorrow if you do not have the right people”

News by **Stian Olsen** - 3 March 2020

Fredrikstad Seafoods first and foremost wants to use its land-based salmon farm in Norway as a research and training centre.

When SalmonBusiness visited Fredrikstad Seafood’s land-based plant in February 2019, there were only empty tanks to see. When we visit the facility a year later, there are fish in both module 1 and module 2. Salmon from the first module are soon ready for harvest.

So how can parent company Nordic Aquafarms, which plans a series of land-based salmon farms, make money?

“There are no facilities to date that are what one would call commercial size, not really our plant in Fredrikstad. It’s getting a little too small. We feel confident that we will make money from it, but it requires a certain size. In Fredrikstad, it is limited to plot size. It

is not without reason that we say that we focus on the large facilities outside Europe, where you do not have to fly the fish,” said CEO Bernt Olav Røttingsnes to SalmonBusiness.



Outside the facility at Fredrikstad Seafoods. PHOTO: Stian Olsen

A good team is required

Røttingsnes has previously told SalmonBusiness that construction phase 2 in Fredrikstad has been put on hold because the company is concentrating its USA sites.

What is the purpose of the land-based salmon farm here in Fredrikstad?

“The plant in Fredrikstad is regarded as an important facility for Nordic Aquafarms, both as a research and training centre. Norway is by far the best at salmon in research environments and people. We want to use Fredrikstad actively in this context to develop the facilities outside Norway,” says Røttingsnes, adding that they are cooperating with the Norwegian University of Environmental and Life Sciences (NBMU).

“It is the only facility near NBMU. We have to hold back a little on everything they want to do with us,” said Røttingsnes.

In addition to volume and capital, Røttingsnes said he believes that a good team is required to succeed in land-based salmon farming. In total, 15 people with different backgrounds work at the plant, plus three new employees will be employed at the harvest plant.

“Those who can succeed on land-based are those who are able to attract good teams. You can buy a facility, but it can fail

Bernt Olav Røttingsnes. PHOTO: Stian Olsen

tomorrow if you do not have the right people. You must have both fishing expertise, water expertise and technical expertise,” Røttingsnes emphasised.

According to Røttingsnes, it is too early to say anything about production costs as they are still building up.

“What we can say is that the most important variable cost is feed. We are well below what we had budgeted. We are on the pre-factor below 1. While very many of the other costs, the semivariable ones, there we have to see what the capacity will be before we can say more about this,” he said.

Fish inside on module 2. PHOTO: Stian Olsen

Some of the equipment is not on the cheap side

But it's not just about finding the right staff. Røttingsnes did not hide the fact that there have been challenges along the way, including when it comes to technical equipment.

“There are conditions at the facility that we are still learning, and it will be better,” said Røttingsnes, adding:

“We see that on the equipment side it is not worthwhile to buy the cheapest equipment when the facility will last for several years. The facility is characterised by some of the equipment being on the cheapest side,” concluded Røttingsnes.



Fredrikstad Seafoods harvest plant is located in the same building as the administration. PHOTO: Stian Olsen

€7 million share issue raised, Fredrikstad Seafoods celebrates first harvest for land-based salmon

News by **Stian Olsen** - 20 April 2020

Nordic Aquafarms subsidiary described success of its first test salmon harvest

“In addition to good support from existing shareholders, several new, capital-intensive shareholders have subscribed to the share issue, including companies connected to the aquaculture industry. We are very pleased with this and show that our strategy of developing land-based facilities close to the major markets has good support among investors”.

This is what CEO Bernt Olav Røttingsnes told SalmonBusiness after the company raised almost EUR 7.1 million in a share issue, where Carnegie was the financial advisor during the process.

“The capital will go to developing the plants in the US, and to further develop the plants in Denmark,” Røttingsnes added.

In addition to the land-based plant in Fredrikstad, Nordic Aquafarms has come a long way in the process of a land-based plant in Belfast, Maine, which will produce 33,000 tonnes of salmon annually. Construction plans are also being worked on in California. Nordic Aquafarms has also indicated to SalmonBusiness that they are looking at the possibility of producing salmon in Asia.

Earlier this week, the subsidiary Fredrikstad Seafoods harvested 50 fish at Norway’s first commercial land-based salmon farming facility. About the same number will be harvested next week. The salmon was delivered to selected restaurants and shops as well as shareholders and employees.

“We have had a good test of the harvest plant in Fredrikstad and have had sensory tests of the salmon, with consistently good feedback. The fish has great colour, smell, texture and not least taste. We expect to start the sale of the first salmon farmed on land in Norway in a few weeks. We are looking forward to it,” said Røttingsnes.

Around 15-20 tonnes per week will then be produced. In March, Nordic Aquafarms hired experienced Patrick Lorenzi from Cermaq, who is helping speed up salmon sales.

“In general, there is very good interest in salmon from Fredrikstad, but we do not want to comment more on the status of the sales work,” concluded Røttingsnes.



Bernt Olav Røttingsnes inside the land-based facility in Fredrikstad. PHOTO: Stian Olsen

From the test harvest of the week. PHOTO: Nordic Aquafarms

Board member Petter Borg in Nordic Aquafarms. PHOTO: Nordic Aquafarms

Jan 8, item 4 (p. 6)

again the board is going to be
00:06:24 transitioning this process it doesn't
00:06:26 mean there will not be future hearings
00:06:28 because if this board makes a decision
00:06:30 for example that this project satisfies
00:06:32 the requirements for a preliminary site
00:06:34 plan
00:06:35 this project then has to go to a final
00:06:37 site plan review and when you change
00:06:39 what the review processes are gone from
00:06:41 a preliminary stage to a final stage
00:06:43 there will be at least one additional
00:06:44 hearing on that if there is additional
00:06:47 information that comes forward is
00:06:48 submitted by nordic aqua farms
00:06:50 then that's things that we would also
00:06:52 bring create an opportunity for
00:06:54 a hearing on those potential issues
00:06:56 don't know when those may occur

2/5/2019, p.340

00:05:40 you have your final hearing
00:05:43 after this preliminary stage is over on
00:05:45 the site at least on the site plan side
00:05:46 of things
00:05:47 so i just want to make that clear that
00:05:50 things that are new or different
00:05:52 uh will there should be an opportunity
00:05:53 for further submissions on those
00:05:55 to the extent that the clarifying
00:05:57 questions involve new information
00:05:59 and the record would be open for those
00:06:00 submissions thanks

5/13/2019, p. 797

01:43:47 and we're at the end of it to me what it
01:43:51 would do is you'd be
01:43:52 saying that yes that you've deemed that
01:43:54 the plan is complete for purposes of
01:43:56 board review that the
01:43:57 the board has found uh substantial
01:44:00 compliance with preliminary plan
01:44:01 criteria
01:44:02 subject to board review of
01:44:06 all remaining issues at the final plan
01:44:09 something to that effect
01:44:10 i'll work with attorney kelly to try and
01:44:12 put together
01:44:14 an initial finding as well and again
01:44:17 i do not intend to go point by point
01:44:20 but to look at this

01:44:23 project being able to move from step one
01:44:25 to step two
01:44:27 right but you are going to put together
01:44:29 a summary of
01:44:30 the conditions that we recognize so far
01:44:34 yes which we will be bringing back for
01:44:36 your meeting on the 27th

7/8/2019 p.988

00:11:20 the other thing which i did not mention
00:11:22 up front which i should have
00:11:23 is that these are your findings on the
00:11:25 preliminary plan
00:11:27 and the board clearly has an opportunity
00:11:29 to revisit
00:11:30 these issues during your final plan
00:11:32 review based upon new information that
00:11:35 may come in
00:11:36 so these are sort of a stepping stone
00:11:40 to say whether or not they nordic has
00:11:42 met
00:11:44 the basic test to be able to move on to
00:11:46 the next stage of the permitting process
00:11:48 although typically if the board has
00:11:50 found that something is in compliance
00:11:53 during the preliminary plan review
00:11:54 unless there was something pretty
00:11:56 drastic that came up
00:11:58 uh in the final plan there would be some
00:12:00 expectation that the
00:12:01 the preliminary finding would pretty
00:12:03 much carry over into the final

7/15/2019 P. 1100

01:20:58 planning board action on the preliminary
01:20:59 site plan application
01:21:01 means that nordic can submit a final
01:21:04 site plan application for board review
01:21:06 pursuant to chapter 90 article 4
01:21:10 final plan can i have a motion to that
01:21:14 effect

With Nordic Aquafarms using water at their maximum contractual rate of 500 GPM, the average demand would increase to 878 GPM (1,264,000 gallons) and the peak day demand would increase to 1,000 GPM (1,440,000). The Jackson Pit Well could not keep up with these demands if there was a failure of the Smart Road Well. It is, therefore, recommended that the Belfast Water District connect the unused Talbot Well to the system. With the Talbot Well on-line, the Water District could continue to meet peak demand with any one of the three wells off-line.

SAFE YIELD

Safe yield can be defined as the amount of water that can be continuously pumped from the aquifer without causing negative effects on the aquifer or adjacent surface water sources. Safe yield is variable as it depends primarily on precipitation which is known to be variable on both a seasonal and year to year basis.

The best available estimate for the safe yield of the Smart Road Well is from the computer modeling of the aquifer (Jacques Whitford, 1999). This ground water model was developed, calibrated and used to run various operational scenarios for the Smart Road and Talbot wells pumping intermittently, continuously, alone and together (Jacques Whitford, 1999). The basis for the calibration of the model was a pumping test run on the Smart Road Well in 1989 (CEH, 1989). The modeling study concluded that the safe yield of the Smart Road Well running by itself is 800 GPM.

The safe yield of the Jackson Pit Well has not been estimated previously. We used an estimate of 530 GPM which is the average rate the well was pumped for the period of 1969 to 1986 when the well was operated nearly continuously.

Using the 800 GPM safe yield capacity as the maximum sustainable yield available from the Smart Road Well and 530 GPM from the Jackson Pit Well allows us to show how it will be possible for BWD to operate reliably and deliver up to 720,000 gallons of water per day to the proposed Nordic Aquafarms facility.

- Safe Yield – 1,915,000 GPD (699 MGY)
- Current Demand – 547,845 GPD (200 MGY)
- Additional NVC Obligation – 40,000 GPD (14.6 MGY)
- Current Reserve Capacity – 1,327,155 GPD (484.4 MGY)

With proposed sale of 262.9 MGY to Nordic Aquafarms, the Belfast Water District will be left with an operating reserve of approximately 221.5 MGY. This is equal to twice their current average daily demand.

Document D3
1 Page

**Pump Test and Delineation Plan Guidance
New Well Sources for
Large (>250 served) Community Water Systems**

This document is intended as guidance in the preparation of pump test and delineation plans. The recent revisions to the Drinking Water Regulations, Section 3 G adds requirements for community wells. The goal of the process is to reliably identify the sustainable yield of the well and the location and extent of its contributing area. Applicants are encouraged to develop site-specific plans based on the local hydrogeologic conditions. The guidance in this document represents the minimum acceptable practice for pump testing and delineation. While this document is intended for large community sources, and is focused on unconfined sand and gravel wells, it is also generally applicable to large-capacity bedrock well development and testing. Confined aquifers may require different assessment techniques.

A previous version of this document was provided to consultants for comments. This revision reflects their comments. It draws on both current practice in Maine, and on standards and regulations in other New England states. Comments and suggestions for further improvement are encouraged. We expect that this guidance will be revised periodically, as our experience base grows.

Process Overview:

The applicant and their geologist will contact the DWP and schedule a pre-exploration meeting before expending significant resources on land acquisition, exploration, and/or testing. Potential sites will be reviewed, and preliminary approval for an exploration plan will be provided.

Once exploration has identified a likely development site, a certified geologist will develop a conceptual hydrogeologic model of the source of water for the proposed site. This model provides the basis for developing the pump test and delineation plan. Elements of a **conceptual hydrogeologic model** include:

- 1) Provide a description of the geology and geologic history of the area.
- 2) Generalized geologic cross-sections through the aquifer based on available information such as well logs, geologic reports, maps, and subsurface data.
- 3) A description of:
 - a) Aquifer flow;
 - b) Hydraulic boundaries;
 - c) Recharge conditions;
 - d) The interaction of the source of the withdrawal with surrounding water resources;
 - e) The estimated zone of contribution;
 - f) And any potential sources of contamination within the zone of contribution.
- 4) A conceptual groundwater flow net map for the aquifer and its recharge areas based on available data, which shows:
 - a) Hydraulic head contours; and
 - b) Groundwater flow directions in both horizontal and vertical planes under average, ambient, non-pumping conditions for the aquifer being considered and its recharge areas.

The conceptual hydrogeologic model will be refined based on results of the pumping test performed in accordance with the pump test plan and presented in the final report.

The pump test plan should contain location, construction, and purpose of at least three (and usually five or more) monitoring wells. It shall also include the planned pumping rate, duration, and frequency of monitoring. Pump tests should not be scheduled during the late winter/early spring season, as significant recharge events are likely to make data interpretation difficult. A minimum test shall include:

- 1) Confirm the adequacy of any existing Monitoring Wells (MWs).
- 2) Establish additional MWs so that a near field (2-10 ft from the pumping well) and at least two far field (~100 ft from a pumping well) MWs in the primary direction of ground water flow. MWs should be installed to monitor the flow system that feeds the well. MWs should be screened within 10 ft of the observed water table for shallow gravel wells. In some cases, driven points may be successful. Wells must have an adequate diameter (2 inch minimum) to allow installation of transducers for water level measurement.
- 3) Locate or establish a monitoring well to document background water levels in an area of the aquifer (or adjacent aquifer) that will not be influenced by pumping the well.
- 4) Ground water near surface waters that may represent sources of induced recharge should be monitored.
- 5) If significant potential contamination sources are identified, monitoring wells shall be installed to assess the potential for interaction between the source and the proposed well.
- 6) Survey the location and elevation of the MWs relative to the existing well(s) to the nearest 1 ft horizontal and 0.01 ft vertical. Where applicable, survey distance and elevation of all adjacent streams/lakes/rivers/wetlands.
- 7) For sites with potential surface water connection, establish a staff gage or transducer in nearby surface water bodies at the point of survey.
- 8) Monitor water levels in the MWs for two weeks on a daily basis to establish a level and trend. Read staff gage daily throughout this period, and at least twice daily during pumping.
- 9) Install transducers and data loggers capable of collecting water level data within the expected range of variation to a precision of 0.01 ft, unless the expected variation requires a lesser precision. Loggers must be capable of collecting data in log-cycle intervals for pump test analysis. (See time list below)
- 10) Conduct a step test, as required, to assess the hydraulic characteristics of the well itself. Allow the well to recover completely from the step test.
- 11) For all surficial wells the pump test shall be run for at least 48 hours and continue until stabilization has been reached or for 5 days, whichever is less. Stabilization is considered to be reached when the drawdown reading at an observation well near the production well or the production well has not varied by more than 1/2 inch (0.04 feet) during the preceding 24 hour period. An alternative definition of stabilization may be proposed by the applicant and must be reviewed and approved by the Department prior to implementation. The proposal must be prepared by an appropriately qualified person or firm. (*Note: this is an excerpt from the regulations, inserted here for clarity*)

- 12) Measure and record flow from well to the nearest gallon per minute. Also note operation times and flows of any other nearby wells, gravel mining dewatering operations, or other withdrawals (e.g. spring flows) from the aquifer during the entire period of observation.
- 13) The well should then be shut down for a period equivalent to the length of the pump test to observe recovery of water levels.
- 14) Observe precipitation during the period of monitoring. Either use a nearby National Weather Service station or establish an informal rain gage at the site and note timing and amount of precipitation during the pump test.
- 15) During the background, pumping, and recovery periods, collect water level data from the MW's and, if possible, from the pumping well, using the guidelines below.
- 16) Based on the conceptual hydrogeologic model, the DWP may require additional testing and evaluation or otherwise modify these parameters.

Recommended minimum data collection pattern

Time since pumping started/stopped	Minimum frequency of measurement
0-10 minutes	Once per minute
10-100 minutes	Every five minutes
100-1000 minutes	Every 30 minutes
1000 + minutes	Every 60 minutes

Additional data may be collected beyond these minimums if the particular data logger program, or local site conditions require different steps. For more complex sites, additional monitoring locations may be required to gain an adequate understanding of the flow system. Data analysis and reduction should be guided by methods outlined in Lohman (USGS PP 761) and Driscoll (Groundwater and Wells), or other standard hydrogeologic references. The plan should include the proposed methods of pump test analysis.

Safe Yield Evaluation

Data analysis should include an analysis of safe yield of the aquifer and well based upon some or all of the following:

- Analysis of recharge to the site under normal and drought conditions.
- Potential for contamination by existing contaminant sources.
- Potential for salt water intrusion.
- Potential for full zone of groundwater contribution to extend into areas where land uses cannot reasonably be controlled.
- Extrapolation of drawdown to 180 days without significant recharge.
- Significant adverse impacts (quality or quantity) on neighboring wells.

Delineation of contributing areas to a community water supply well requires the application of appropriate geologic information and methods to assess ground water flow and the influence of boundary conditions. Unless the aquifer is homogeneous and isotropic and no near-field boundary conditions are present, analytical methods (e.g., WHPA, stagnation point calculations) will not provide realistic results. For most sand and gravel wells, surface water bodies provide positive (recharge) boundaries, and the edges of the deposit provide negative (barrier)

boundaries. These conditions influence the contributing area significantly, and cannot be adequately simulated by common analytical methods.

A Maine Certified Geologist who is familiar with the conditions at the well site shall perform the delineation. The Department encourages the Geologist to consult with Source Protection staff in the selection of an appropriate delineation method. The goal of wellhead delineation is to provide the public water supplier with an area that is most likely to provide recharge to the well. This area must be reasonably sized, and appropriate to the anticipated yield of the well.

Department policy requires the use of delineation methods that allow for the calculation of travel time boundaries at 200 and 2,500 days, as a minimum for all wells located in surficial deposits that supply community systems with populations serving greater than 250 people. Evaluation of pump test data, well logs, surficial mapping, and hydrogeologic evaluation all should be inputs to the delineation. Methods must be at least as rigorous as those used in the Maine Geological Survey delineation project. Such methods may include both semi-analytical models like WHAEM and fully discrete models like MODFLOW-MODPATH. Delineations derived from WHPA code models are not acceptable, unless the responsible geologist can explicitly demonstrate that there are no boundary conditions that will influence the contributing area to the well.

For new large community supplies in bedrock, the method applied shall be at least as rigorous as that used in the MGS bedrock delineation project. This method does not attempt to calculate travel times, but does perform a structured sensitivity analysis that yields a series of probability zones for contributing areas.

MGS Delineation Protocol

This protocol is intended to be descriptive of a method shown to be effective in a number of settings. There are other methods that will also produce time-of-travel zones for community water supplies. Use of this or other delineation protocols should be reviewed with DWP staff during the pump test design stage of well development.

The MGS used MODFLOW and MODPATH, well-documented USGS models, with the Groundwater Modeling System, developed by the US Army Corps and Brigham Young University, as a pre- and post-processor. Regional aquifer, well and surficial coverages from MGS mapping along with USGS digital elevation models provided starting points for discretization. All locations were geo-referenced to UTM coordinates to match the DWP GIS database.

Developing a digital (numerical) model of the aquifer allows for the simulation of boundary conditions as well as heterogeneity within the aquifer. Digital modeling is appropriate for projects with sites where there are clear indications of near-field boundary conditions or large aquifer heterogeneity. Modeling offers a more precise delineation of travel times, which may also be more accurate if the aquifer and boundary condition types are well defined.

In order to make digital modeling feasible, the MGS used a standard set of GIS coverages, aquifer characteristics, and hydrologic parameters to develop simulations for each site. Details of these assumptions are shown in the attached samples of surficial and bedrock delineations.

Reporting

Key reports in this process are the Pump Test/Delineation Plan and the Hydrogeologic Report documenting the results of the pump test and delineation. The Plan is required to obtain preliminary approval for well development. The Report is required for final approval of the well. The submission also must fulfill all other requirements of the Drinking Water Regulations for New Source Approval.

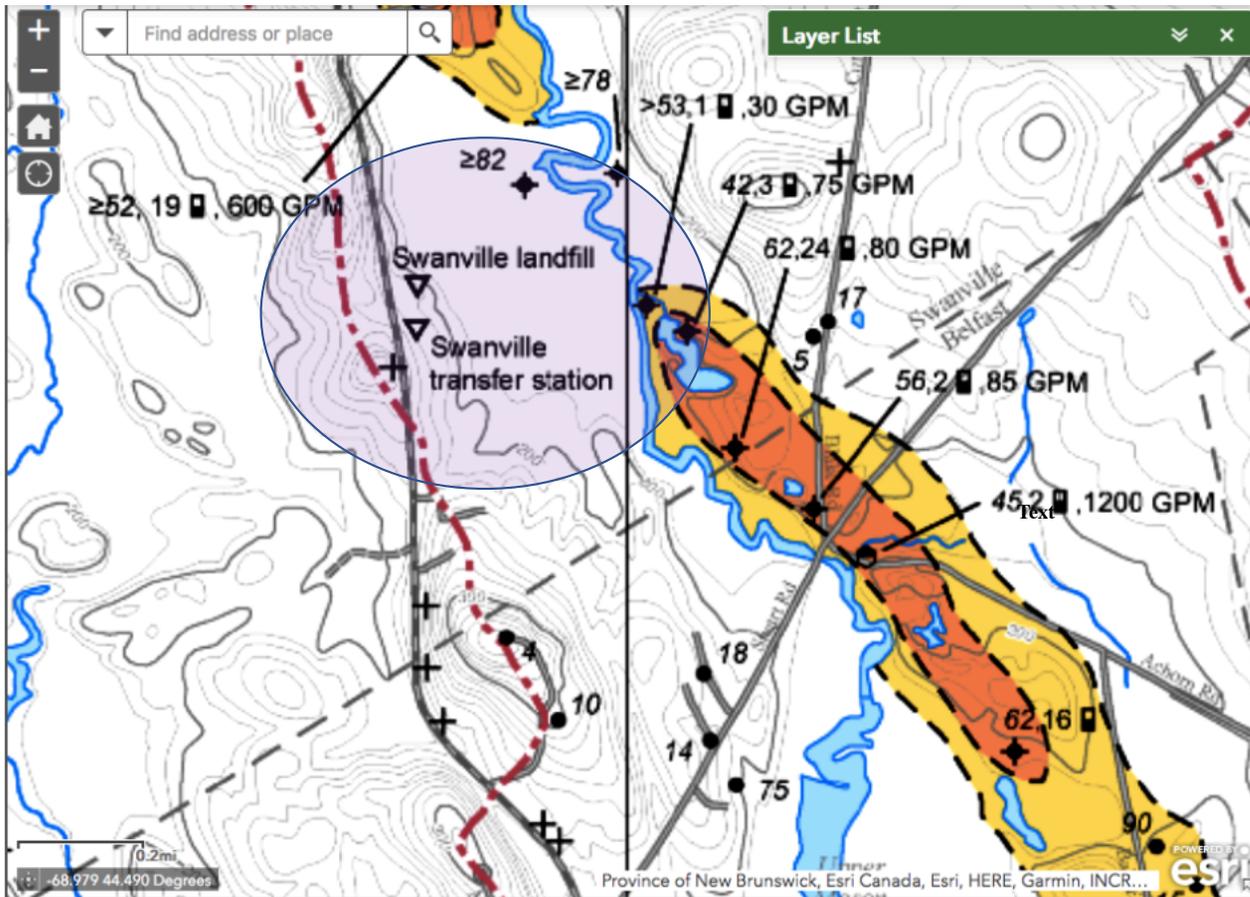
The water quality data submission should be bound separately from the Hydrogeologic-Delineation Report, as they are filed separately at the DWP.

The DWP encourages PWSs and their consultants to meet with DWP staff early in the exploration process in order to minimize the potential for expending resources inappropriately. During exploration and development, conditions are often encountered that lead to a change in approach. This is also a good time to meet with DWP staff.

<https://www.maine.gov/dacf/mgs/pubs/digital/aquifers.htm>



GEOLOGIC AND WELL INFORMATION



- 56 Depth to bedrock, in feet below land surface
- ≥ 13 Penetration depth of boring; ≥ symbol refers to minimum depth to bedrock base on boring depth or refusal
- 6 Depth to water level in feet below land surface (observed in well, spring, test)
- ⊗ Gravel pit (overburden thickness noted in feet, e.g. 5-12')
- ⊗ Quarry
- GPM Yield (flow) of well or spring in gallons per minute (GPM)
- ♣ Spring, with general direction of flow
- Drilled overburden well
- Dug well
- ◆ Observation well (project well if labeled; nonproject well if unlabeled)
- ◇ Test boring (project boring if labeled; nonproject boring if unlabeled)
- ↓ Driven point
- ⊙ Test pit
- Drilled bedrock well
- ▽ Potential point source of ground-water contamination
- + Bedrock outcrop
- ⊡ Surface-water drainage-basin boundary; surface-water divides generally correspond to ground-water divides. Horizontal direction of ground-water flow generally is away from divides and toward surface-water bodies.

SWANVILLE LANDFILL EM SURVEY

SITE LOCATION

The site location plan depicts the location of the Swanville Landfill which is on the east side of Route 141 in Swanville. The landfill is located on an approximately 6% eastern slope.

SITE GEOLOGY

Reconnaissance Surficial Geologic Mapping of the Belfast Quadrangle by Woodrow Thompson, Parker Calkin, Kenneth Fahnestock, and Geoffrey Smith, 1986, Maine Geological Survey Open-File 86-7, maps the site as shallow to bedrock with less than 10 feet of till.

On the Sand and Gravel Aquifers Map 19, Maine Geological Survey Open File #79-14, compiled by W. Bradford Caswell, in 1979, the nearest sand and gravel aquifer is an esker located approximately .6 mile south of the landfill. This is an important aquifer in that the Belfast Water District has two wells drilled into it: The Jackson Pit well which is 51 feet deep and yields 600 gallons per minute (gpm) of water, and the 42 foot deep Smart Road well which yields 1200 gallons per minute. The Jackson pit well is approximately 2500 feet north of the Swanville Landfill and the Smart Road well approximately 4300 feet southeast of the landfill.

OBJECTIVE

CES conducted an electromagnetic (EM) terrain conductivity survey at the Swanville Landfill on 9/9/93 and 9/30/93. The purpose of the EM survey investigation was to determine the existence and the lateral extent of any leachate emanating from the landfill.

SURVEY LINE LOCATION

The enclosed drawing #1414.1 depicts the area of investigation at the Swanville Landfill and the location of the EM survey lines. Approximately 2720 feet of EM-34 horizontal and vertical dipole data was collected. Ten meter coil spreads were run along the EM-34 lines.

EM CONDUCTIVITY METHODOLOGY

EM terrain conductivity measures the subsurface electrical conductivity. It is a geophysical technique which can be used to differentiate between areas of clean versus contaminated ground water. Increased ion concentrations in the subsoil and ground water can result in increased conductivity values. Therefore, typically, leachate conductivity values would be greater than that of clean ground water. As such, areas of leachate are characterized by anomalous higher conductivity results than non-contaminated areas. Metallic objects and power lines can also affect conductivity results and can even produce negative readings.

The transmitting coil, energized with an alternating current, generates a time-varying magnetic field. This field in turn induces small currents in the earth. A secondary magnetic field generated by these currents is sensed by the receiving coil. At the Swanville Landfill, the EM-34, which is a two-man unit, was used. The attached Geonics article in the Appendix provides a more detailed discussion of electromagnetic theory and EM-34 equipment operation.

The Geonics EM-34 conductivity meter allows terrain conductivity to be measured to an approximate depth of 50 feet in the horizontal coil configuration, and 25 feet in the vertical coil orientation when there is a 10-meter separation between the receiving and transmitting coils. A 20-meter separation allows conductivity to be measured to a depth of 100 feet for the horizontal coil and 50 feet for the vertical coil.

DISCUSSION OF EM RESULTS

The EM-34 conductivity readings are recorded on drawing #1414.1, at the location of each station. The data is depicted as 2.1/2.4 with the top number (2.1 by way of example) being the horizontal coil reading in milliSiemens per meter; the bottom number (2.4) is the vertical coil reading. Again, the horizontal coil records conductivity to twice the depth of the vertical coil.

The landfill was encircled by the conductivity lines in order to determine likely locations of any leachate generation. Line segments are designated by their lettered end points with line AB for example, the line between points A and B. Lines AB, BC, CD, DE, DF, EI, FG, GH, and IJ line segments were run with the EM-34 unit. No significant negative readings were recorded.

Anomalies of 5 or greater are hatched on the drawing. A distinct break in conductivity values is noted between impacted versus non-impacted areas. Anomalies

are depicted along lines DE, DF, FG, GH and a portion of GJ. Line GH and to a lesser extent line DE was run somewhat perpendicular to the perimeter lines in an attempt to track the extent of leachate migration. Line GH was run over 460 feet and the last 5 stations are actually east of the eastern limit of the area depicted on the plan. On line DE, at the 4 most northwestern stations, slightly anomalous values were detected in the vertical coil configuration when horizontal coil readings were either only slightly above, or below, 5 ppm. In consideration of the break in topography we elected to not extend the interpreted leachate plume boundary as far as these last 4 stations. It appears that the leachate is flowing easterly and downslope on top of the relatively shallow bedrock, which is mapped as having less than 10 feet of till overburden, and starts to express itself in the swamp deposits located at the toe of the waste slope. The anomaly is persistent and wide ranging; for example in the case of line GH, the line extends 240 feet before conductivity values start to diminish from the 10 range down to the 6.5 to the 7.7 range.

Fortunately, the ICAG water analysis did not indicate landfill impact on the Dunham residences well which confirms the conductivity results. Once the landfill is properly graded, closed, and capped, the potential for future leachate generation will be minimized. Even though the leachate plume is headed toward the Goose River, we believe there is a strong likelihood that any River impact will be minimal due to the potential bioremediation from the Goose River Bog.

The greatest potential concern with this landfill is whether it has any potential of impacting the Belfast Water District Jackson Pit and Smart Road wells. To definitely answer that question is beyond the scope of this study and would require further research. Based upon what limited evidence we have, it appears that the only avenue by which the landfill could impact these wells, would be by leachate flowing into the Goose River and then recharging the aquifer. Based upon our understanding of typical esker water flow we would conjecture that this is a rather unlikely possibility, but again this question needs further study in terms of water quality analysis of Goose River and further hydrogeological investigation.

A well is to be installed at the adjacent lot to the south where the Swanville Transfer Station is located; C.E.S. has recommended a location for this well based upon our Conductivity Study and site knowledge, which should minimize the likelihood of impact from the landfill. We do recommend, however, the well be routinely sampled and analyzed to confirm the lack of any contamination, since prior to drilling there is no guarantee that the water bearing fractures intersected by the well are orientated so there is no potential of landfill recharge.



March 29, 1994

Mr. Charles M. Mikovich
Swanville First Selectman,
RR 2 Box 280
Belfast, ME 04915

Re: Electromagnetic Terrain Conductivity Survey, Swanville Landfill

Dear Mr. Mikovich:

Herein is the report on the electromagnetic terrain conductivity survey that C.E.S. Inc. conducted at the Swanville Landfill.

We find that the survey data are rather conclusive, and they suggest that **off site leachate contamination from the landfill is trending in a east, northeasterly direction away from the landfill. The plume can be traced over 460 feet from the landfill.** The migration pattern is fortuitous in that it is moving away from the Route 141 houses and toward the Goose River Marsh; some natural bioremediation is likely to occur in the marsh.

Sample analysis of the proximate local well, specifically the Dunham household, does not indicate that the well has been affected by the landfill. This is consistent with the survey results which show the landfill leachate plume moving away from the Dunham well. Since we do not anticipate any likelihood the landfill would affect existing Route 141 household wells, we do not recommend that the Dunham well be continued to be tested. However, we do recommend that the new well to be installed at the adjacent Swanville transfer station be tested quarterly. Although CES did have some input in recommending, what we believed to be the most preferable location for the well on the Transfer Station property; an ongoing concern, in light of the wells proximity to the landfill, is a possibility that the cone of depression from the well could intersect water bearing fractures recharged under the landfill. As such, routine sample analysis would be prudent.



Mr. Charles M. Mikovich
March 29, 1994
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We believe that ICAG grading and capping of the landfill will minimize future leachate production. C.E.S. is pleased to perform this survey for Swanville and please feel free to call should you have questions or need further assistance.

Yours Truly,

C.E.S., Inc.

A handwritten signature in black ink that reads "Ron Howes". The signature is written in a cursive, flowing style.

Ronald C. Howes, C.G.
Project Manager

RCH/

cc: Robert Birk

JN: 1414.1

Landfill



Transfer Station



Goose River

TAIbot WELL

