SOUTH WEST SHORE DEVELOPMENT AUTHORITY

ENVIRONMENTAL ASSESSMENT APPLICATION FOR BACK LAKE BOG

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JULY 2001

The proponent of this project is:

South West Shore Development Authority
P.O. Box 131
Yarmouth Nova Scotia
B5A 4B1

Chief Executive Officer	**Contact person for purposes of environmental assessment**
Frank Anderson South West Shore Development Authority phone: (902) 742 - 3210 fax: (902) 742 - 3107	Richard Cottingham Vaughan Engineering Limited 1505 Barrington St., Suite 1100 P.O. Box 2045, Stn. M. Halifax Nova Scotia B3J 2Z1 phone: (902) 425 - 3980 fax: (902) 423 - 7593 rcottig@mgnet.ca

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1.0 INTRODUCTION

The South West Shore Development Authority (SWSDA) is seeking environmental approval for a proposed cranberry growing operation to be located at a site known as Back Lake Bog in Shelburne County, Nova Scotia. Because the operation will disrupt a wetland site exceeding two hectares in size, environmental assessment approval is required from the Nova Scotia Department of Environment. Vaughan Engineering Limited (Vaughan) has been retained by the SWSDA to carry out a comprehensive environmental assessment of the proposed operation. This report is submitted pursuant to the provincial *Environmental Assessment Regulations* and presents all of the findings of the study.

This report has been prepared in a manner that addresses all of the criteria established in the *Guide of the Environmental Approvals for Cranberry Operations* issued by the Nova Scotia Department of the Environment on October 17, 1997. The format of the report closely adheres to that outlined in the Guide.

2.0 PROPONENT DESCRIPTION

2.1 CONTACT INFORMATION

The proponent of this undertaking is:

South West Shore Development Authority
P.O. Box 131
Yarmouth, Nova Scotia
B5A 4B1

Telephone: 902-742-3210
Facsimile: 902-742-3107

E-mail: swsday@auracom.com

Web site www.swsda.com

The Chief Executive Officer of the Authority is:

Mr. Frank Anderson

Mr. Anderson may be reached at the SWSDA (details above).

Inquiries related to this assessment may also be directed to:

Mr. Richard Cottingham
Vaughan Engineering Limited
P.O. Box 2045, Stn. M
Halifax, Nova Scotia
B3J 2Z1

Telephone: 902-425-3980
Direct Line: 902-425-3999 Ext. 231
Facsimile: 902-423-7593

or

Mr. Trent Webster
Vaughan Engineering Limited
P.O. Box 2045, Stn. M
Halifax, Nova Scotia
B3J 2Z1

Telephone: 902-425-3980
Direct Line: 902-425-3999 Ext. 255
Facsimile: 902-423-7593

E-mail: rcotting@mgnet.ca E-mail: twebster@mgnet.ca

2.2 ABOUT THE PROPONENT

The Governments of Canada and Nova Scotia have initiated a joint effort to carry out community economic development activities. The South West Shore Development Authority (SWSDA) was established as the regional agency for Shelburne and Yarmouth Counties. The eight municipal units within these counties each appoint one representative to the Board and share together one-third of the operating cost based on population. Two-thirds funding is provided by the Provincial and Federal Governments. Two additional appointments are made by the Yarmouth County Industrial Commission to create equality of votes between the two counties. The Board is expected to create a cooperative environment for promoting economic stability and growth through:

- implementation of a strategic action plan,
- support of business investment,
- marketing the region as a good place to visit, live and work.

The direction that has been set is action-oriented and some of the key goals include:

- Rationalization of services, marketing and communication,
- Improving cost-effectiveness in support of economic development,
- Recognizing the importance of communities, citizens and sustainable development,
- Presenting a joint response to government on issues,
- Promoting the region as a whole.

The SWSDA believes that cooperation is the key mechanism for facilitating stability and growth. It is for these reasons that the Authority has chosen to promote this region as an ideal location for future cranberry developments.

In this instance, the SWSDA is taking the lead role to perform Environmental Impact Assessments (EIAs) on the behalf of interested proponents. Due to the high initial cost for performing EIAs and also due to the uncertainty of the outcome, the SWSDA had chosen to undertake this first step in the development process at the request of interested developers.

3.0 NATURE OF THE UNDERTAKING

3.1 PURPOSE/RATIONALE/NEED FOR THE UNDERTAKING

3.1.1 The Purpose

The Purpose of this Environmental Approval request is to ultimately grow cranberries for today's increasingly health conscious consumer. Peat bogs, such as Back Lake Bog, are ideally suited for the agricultural production of cranberries. This site exhibits all the appropriate conditions for the wild, natural growth of cranberries, and hence is ideal for the commercial cultivation of the wonderful berry.

Cranberries and cranberry juice have been recently "discovered" by health conscious individuals across North America and beyond, as a natural cure to urinary tract infections, and more.

First Response, a medical test kit company, recommends that women drink at least 10 ounces of cranberry juice cocktail each day to maintain good urinary tract health.

Cranberry juice has long been used in the treatment and prevention of urinary tract infection. Recently, attention has turned to the relationship between cranberry consumption and cardiovascular health. Preliminary results show that drinking cranberry juice is a heart-healthy activity.

Researchers believe that polyphenol compounds called flavonoids, associated with foods such as red wine, are responsible for reduction in cardiovascular disease. Flavonoids act by inhibiting blood clotting, promoting vasodilation (increased interior blood vessel diameter, which improves blood flow and reduces blood pressure), and protecting oxidation of cholesterol in the bloodstream (thus, reducing atherosclerosis, or clogging of the arteries).

According to Dr. Ted Wilson, Department of Exercise and Sport Science at the University of Wisconsin - La Crosse, cranberry contains high levels of flavonoids. He conducted the first research on the effect of cranberry juice consumption on cardiovascular health.

Nutritionists and many in the medical community believe there is a clear association between a diet high in fruits and vegetables and low risk of chronic disease. As a fruit, cranberries are a good choice for the health-conscious consumer. As a functional food powerhouse, packed full of antioxidants and other natural compounds, they promote health and wellness.

Cranberries have properties that protect our bodies against certain kinds of bacteria, including E. coli associated with urinary tract infections, and other bacteria which can cause gum disease and stomach ulcers. In addition, cranberries contain potent plant chemicals such as polyphenols and flavonoids that have been shown to ward off cancers and prevent heart disease.

The Rationale

The rationale behind this proposal is the desire of the SWSDA to promote economic development in the counties of Yarmouth and Shelburne. The natural potential for commercial cranberry production in this southwest corner of the province of Nova Scotia has been identified many times over in the past 100 years or more, by many knowledgeable individuals.

There is evidence of early commercial cranberry production in the southwest region of Nova Scotia. For example, just north of Pubnico may be found the abandoned remnants of a 35 acre, hand ditched cranberry bog, aptly named on the 1:50,000 topography maps the “Cranberry Bog”. This bog was in full commercial production in 1910.

In Port Mouton, Queens County, a six-acre cranberry bog operated from 1908 until approximately the 1970s. This bog was last commercially operated by the Burgess Family.

It has been documented that cranberry production in the province peaked at about 300 acres in the 1950. These were mainly managed wild cranberry stands, with low input costs and low production per acre. The cranberry market crashed in 1959 and the industry faded away as well, due to uneconomic returns for the effort.

Provincially here in Nova Scotia, production steadily dwindled from 1959 until the late 1960s and finally stabilized at around 50 acres from the 1970s until the mid 1990s.

Up to this point in the history of the southwest Region, the fisheries had represented a better economic opportunity then agriculture, and therefore agricultural development of the area has been extremely limited. With the recent downturn in the fisheries industry, coupled with high cranberry prices during the mid to late 1990's, interest in cranberry industry development has been renewed.

Strong market pricing, fierce competition for fruit, and the perception of endless market product development potential, drove cranberry prices skyward and this has driven the development interest.

Strong market pricing has collapsed since late 1998. Supply has now exceeded demand, and the market is now correcting itself. The upside of this situation is that it takes five years to develop a cranberry site to its fullest potential, and by the time that the bogs are in full production in Nova Scotia, the market correction should have taken place.

The Need

The need for this project is simply an economic development issue. By obtaining environmental approvals for these sites, the way will be paved for potential new development in the local economy. This new development spurs new services in the local area, and hence, new jobs. This is the primary focus of this type of development activity, new jobs in an old and sluggish economy.

3.1.2 Other Methods for Carrying Out the Undertaking

For cranberry development, primarily there are two site selection options, either upland or peat bog types of settings.

Initial development of cranberry bogs in Cape Cod occurred in locations where the cranberries occurred naturally. This was invariably on peat bogs. The bogs, being generally flat, were relatively easy to devegetate, exposing the natural sphagnum peat. Cranberry vines were set into the peat, where they rapidly filled in.

These developments occurred in the mid 1800s, and nearly all cranberry development occurred in peat bogs until the 1950s.

During the 1950s, the Habblemens of Wisconsin, decided to build on an upland sand site, with a natural high water table present. The cranberry community thought that this was not the thing to do. However, the approach worked, and the Habblemens now have some 550 acres of the best upland cranberry fields in all of Wisconsin. These beds are level, weed free, highly managed, very productive and profitable.

The downside to planting cranberries in upland sandy soils is the potential for fertilizers and pesticides to migrate into the local groundwater. In the 1950s and 1960s, these issues were not considered. Several studies have been undertaken which show limited movement of pesticides and nitrates from these upland sites. However, there is potential risk.

Upland sites usually exhibit pH values which are too high for the acidic-loving plants. Ideal pH for cranberries is between 4.5 - 5.5 and most upland sites are in the 6.5 to 7.5 range. Cranberries do not grow in the wild in soils with pH's of 7 or higher. Therefore, while upland sites can be managed to provide the appropriate environment for production of cranberries, it is not the *natural* environment for cranberry production. The pH is perfect in peat bogs, as well are moisture and drainage conditions.

The potential for groundwater contamination is absolutely minimal in a peat bog, due to the extremely high cation exchange capacity of peat materials. The high cation exchange capacity and natural absorbency of peats has been demonstrated by the use of packaged peats for emergency response absorbency materials, for the accidental spillage of hydorcarbons, i.e., if a diesel tank is spilled, one of the best absorbent materials available to contain the spill, is peat moss.

The primary reasons for the request to develop agricultural production on this peat bog location are:

- the peat bogs are the natural habitant for cranberries;
- the minimized potential for groundwater contamination when compared to upland sites; and
- more economical construction on peat bog versus upland sites.

4.0 DESCRIPTION OF THE UNDERTAKING

4.1 SITE LOCATION MAPPING

Figure 01 shows the location of Back Lake Bog, from a Nova Scotia provincial perspective (Key Plan) and as well in greater detail on the base map.

The bog's exact location is circled in Figure 01. The site is located approximately 27 kilometres up Highway 203, driving in a northerly direction from the Town of Shelburne. When travelling this way, the bog itself is located on the right-hand side and is barely visible from the road.

The center of the property is located on the 1:50,000 scale map sheet 21A/3, Lake Rossignol, at the Military Grid Location 045 747. The property covers more than one square inch of area on the 1:50,000 scale mapping. Therefore, the center of the property is provided as the map reference.

Figure 02 is an aerial photograph of the area. This photo shows the relatively open bog area, the Roseway River on the northeast boundary, Back Lake on the southeast side and Highway 203 on the western boundary of the area of interest.

It has been observed from the available mapping that the surface area of Back Lake is roughly four to five times the proposed bog development area. When planning a cranberry development of this magnitude, adequate water volumes are essential, and this site obviously has more than adequate water volumes.

Figure 03 shows the property mapping information and PID numbers as obtained from the Nova Scotia Housing and Municipal Affairs Land Information Services. The property of interest is outlined in Figure 03 in red, is approximately 450 acres in total, with 110 acres of peat bog, and the potential to develop 90 acres of cranberry bog.

The PID mapping indicates that the properties of interest are currently Crown Land. The main property PID is 80000011, which is part of a much larger parcel of land equal to 54,920 acres. As well, property 80005291 is requested to be part of the development, in order to allow access to the Roseway River. The 450 acres include the upland area between the bog and Highway 203. This area provides adequate space for the farmstead location and provides a natural buffer zone between the development area and the general public.

4.2 CONSTRUCTION DETAILS

General Overview

Figure 04 presents the conceptual site overview for Back Lake Bog. The layout proposes the construction of 17 - 5.3 acre beds on the site, for 90 acres of cranberries in total.

In general terms, the site consists of:

- the cranberry production beds,
- dykes around each bed, used for holding floods and for roads,
- flood ditches which supply flood waters to the beds,
- drainage ditches which drain each bed,
- a supply of fresh, high quality, low pH water,
- a tailwater holding pond for water recycling,
- an area for housing and for buildings to support the operation, and
- a buffer zone around the entire development.

The individual bed dimensions as shown are 36.6 m (120 ft) × 586.7 m (1,925 ft), which equals 5.3 acres per bed. The beds are built parallel to one another, separated and surrounded by a dyke or berm, created at the initial construction phase from the removal of the vegetative mat from the peat bog.

Figure 05 shows the individual bed typical construction in Plan View. On this diagram we note the typical bed width of 36.6 metres (120 ft) with a total dyke centerline to centerline width of 50 metres (164 ft). Each bed has individual inlet and outlet water level control structures, referred to as flumes, to control flooding and drainage of the beds. Typically the dyke roads are six metres wide (20 ft) to allow for vehicle movement around the beds themselves.

In this design, the bed width remains constant and the length of the bed is varied to suit the site. Relatively large flood ditches with a top width of six metres (approximately 20 ft) are

used to provide flood water to the beds.
Drainage ditches are usually smaller. An approximately four metre (13 ft) top width ditch would suffice.

The flood ditch will be supplied from the pumping station located between Back Lake and the tailwater pond. Irrigation water will be provided from the same location. The pumping station would be built to pump primarily from the tailwater pond, and alternatively from Back Lake, when required.

The drainage ditch will drain to the tailwater pond, and water will be recycled on site, as much as is practically possible.

Figure 06 shows the Typical Bed Cross Section A-A as depicted from Figure 05. Again the bed width is generally a constant value of 36.6 metres (120 ft). This has become a common design in Quebec, chosen for minimal construction costs and ease of construction with conventional excavation equipment. This width also represents the maximum bed width that can be efficiently irrigated with a two-pipe lateral system.

Perimeter ditches around the beds are typically 0.6 m (2 ft) deep, these ditches provide the aerated root zone that the plants require. The dykes are a minimum of 0.75 metres (2.5 ft) higher than the beds to allow for 0.45 metres (1.5 ft) of flooding for winter protection of the crop. Side slopes on the ditches are typically somewhere between 2:1 (horizontal: vertical) and 1:1.

A full design including a base elevation and topographic map, surface and groundwater flow directions, the proposed design elevation details regarding the drainage and flood ditches, tailwater pond, access roads, farmstead area, pump and pump house areas, pesticide storage's and other features shall be provided prior to the initial site development.

4.2.1 Vegetation Removal

Back Lake Bog is covered primarily with low lying vegetative growth, consisting of grasses, sedges and small woody stemmed plants. Occasionally small pine trees may be found. This site is not heavily wooded and is best described as a doamed open bog with the occasional scattered pine and spruce tree.

It is estimated that the tree density is under 100 per acre of stunted, slow growing softwoods, of little economic significance.

These trees will be either cut and piled on the upland areas, or they may be simply piled in the dykes along with the vegetative mat, since there are so few. Normally the vegetative mat is removed down to the bed design elevation by an excavator and piled in the dykes themselves. This vegetative root mat normally does not exceed one foot in thickness from the top of the peat surface.

Ditching

Ditching of the site would occur very early on in the development. The main flood and drainage ditches would be constructed first, to a depth of 1 metre (3.3 ft). Then lateral ditches would be dug 50 metres (164 ft) apart, again at a depth of 1 metre (3.3 ft). This ditching would effectively drop the watertable 1 metre, to allow for easier construction of the beds. Once the water is removed from the peat through the drainage ditches, the peat can dry out and provide a much more stable foundation for the excavation equipment to work on.

Discharge of Water

During the main ditch construction, the lateral ditches would drain to the main drainage ditch, which would then lead to the tailwater pond area. Sedimentation would settle out in the tailwater pond prior to discharge into Back Lake. Sedimentation and erosion control is discussed in greater detail in Section 6.1.3.

Application of Sand

In these new peat developments, sand would not be applied at all until year three after planting.

In Quebec, sand is not used until year three on peat sites, because of the weed seed contamination associated with the application of sand. Very few upland weed species survive in the acidic peat soils, until sand is applied.

The peat soils at Back Lake Bog are highly porous, once they are drained. Sand is not required for drainage purposes and therefore it will not be applied, until year three.

Planting

Planting will occur in the peat bog exactly the same as would be done in an upland sand situation.

Short cut vines are to be scattered about the newly prepared bed at the rate of 1.5 to 2.5 tons per acre and will be pressed into the peat surface with a standard vine setter. These vine setters consist of a series of blunt disks which press the vines two to three inches into the soil. A trailing compactor roller would set the soil gently in around the newly set vines.

4.2.2 Construction Period

It is anticipated that once the proper approvals are in place, the development will be completed within five years of the first construction related activity.

4.2.3 First Construction Related Activity

The first physical construction related activity on this site are expected to occur after all the approvals are in place, either in the fall of 2001 or in the spring of 2002.

4.3 OPERATIONS

4.3.1 Water Requirements

Source and Amount of Water Available

The proposed source of water for the cranberry development is Back Lake, as shown in Figure 04, the Conceptual Site Layout. Back Lake is part of the Roseway River system, and as such experiences all the same flow conditions of the river. Back Lake has a surface area of 160 hectares (400 acres), which provides an excellent water storage estimated at 1,200 acre feet, for a 36 - hectare (90 acre) cranberry development.

Some consideration has been given to pumping from the Roseway River, upstream of Back Lake. Due to a potential protected area boundary dispute with the recently expanded Tobeatic Wildlife Management Area, the pumping location on the Roseway River has been avoided altogether.

Daily/Weekly Requirement

Cranberries have three principle modes of water use which include flooding, frost protection and irrigation.

Water for flooding the beds is to be provided primarily from the tailwater pond and when required from Back Lake, as shown in Figure 04. The water is to be pumped to the west side of the development through the main flood ditch. Each bed will have its own inlet and outlet water control structure, for control of the water levels within each bed. After flooding, the water shall be released from the beds to the eastern drainage ditch, and the water will be directed to the tailwater pond, prior to its ultimate discharge into Back Lake.

Winter flooding is the major water requirement, which occurs around December, when the entire crop is covered with up to 45 cm (18 inches) of water. The best flooding systems flood the beds completely in 20 hours, taking advantage of weather forecasts and advancing cold fronts to quickly form ice. With three to four days of freezing weather, the ice is sufficiently deep to allow the remainder of the water to be drained out from under the ice, minimizing the submergence time of the crop.

In order to flood 45 cm (18 inches) of water on 36 hectares (90 acres) in 20 hours, a flood pumping rate of 139 cubic meters per minute (36,650 United States Gallons Per Minute-USGPM) would be required.

Ninety acre feet of water for the winter flood would come from the tailwater pond, and the remainder, 45 acre feet, would come form Back Lake. Water volumes in the Roseway River at this time of year would not be a problem. The good thing about the winter flooding is that by this time of year the rains have generally replenished all the provinces watercourses to nearly full capacity. The Roseway River monthly volumes are presented below in Table 1. December average monthly flows in the Roseway at Back Lake are calculated to be 870 cubic meters per minute (230,000 USGPM), approximately six times the required flood pumping rate.

Harvest flooding begins near the end of September and throughout the entire month of October. This consists of flooding the beds to a depth of 20 cm (8 inches) only, and generally not more than two beds would be flooded for harvest at one time.

The harvest flooding should occur quickly to avoid the fruit being in the water for too long a period of time. If 4.25 hectares (10.6 acres) were flooded to a depth of 20 cm (8 inches) in two hours, a pumping rate of 72.6 cubic meters per minute (19,200 USGPM) would be required. This volume would be recycled entirely from the tailwater pond.

In spring and fall, the crop is frost protected via sprinkler irrigation at the rate of 72 USGPM per acre. To frost protect 90 acres at the same time would require a water withdraw rate of 24.5 cubic meters per minute (6,480 USGPM). This volume would be recycled from the tailwater pond.

The frost protection period is normally the months of May and June in the spring and the months of August and September in the fall. Frost protection of the crop usually starts just after dusk on a cloudless night and lasts until shortly after sunup, after the ice has been melted from the crop. Hence, the sprinkler system usually doesn't run for more than eight to 12 hours per night and this may go on for many nights, upwards of 10 to 20 nights in a row, depending on the weather.

The same system that is used for frost protection is also used for irrigation of the crop during the summer months. The water requirement for this crop is stated to be 5 cm (2") per week. This water can be applied over seven days a week, therefore reducing the total instantaneous pumping rate.

To irrigate two inches over 90 acres, over a seven-day cycle, pumping eight hours a day would require a pumping rate of 5.5 cubic meters per minute (1,454 USGPM), when precipitation does not provide these quantities naturally. This water would be recycled from the tailwater pond.

Method of Obtaining Water

For flooding purposes, two approximately 19,000 USGPM pumps would be utilized. These pumps would be capable of performing both the winter floods and the harvest floods. These would be high volume, low head pumps.

For frost protection, sprinkler irrigation systems would be driven by medium head, medium volume pumps, providing 6,480 USGPM at approximately 100 psi at the pump. This may be provided by a single pump, but would more than likely be delivered by two diesel pumping units. These same units would be capable of delivering the irrigation water requirements, however, at much reduced volumes, around 1,454 USGPM per application.

Frequency That Water Will be Obtained

This has been previously discussed under the daily/week requirements section and is summarized in the water budget table, which may be found in the Appendix A titled Estimate of per Acre Water Use on Cranberry Bogs.

Discharge of Water

One of the features of a cranberry bog is its tremendous ability to control water flow on site. Besides rice production, few other types of agriculture have such a high degree of control over the water flow to and from their production acreage.

This provides cranberry growers a decisive advantage over other forms of agriculture, in their ability to hold water onsite after critical pesticide applications, for example. If a specific pesticide calls for a two week holding period prior to release, a cranberry farmer can adhere to this rule, regardless of the weather.

When water is released from the production beds, it travels out the drainage ditch to the tailwater pond, and eventually into Back Lake.

Dimensions and Volume of Storage Reservoirs

Back Lake represents the alternative water supply storage. It has an area of 400 acres and an average assumed average depth of 3 feet. This would provide a very rough estimate of 1,200 acre-feet of water potentially stored as a supply. Actually, if only the top foot was accessible, then 400 acre feet would be readily available.

The cranberry beds themselves may be considered to be a temporary storage area for water. The perimeter ditches are two feet deep around the beds, and the soil pore space exceeds 50% of the soil volume. Therefore each bed has approximately a foot of water storage, for a total of 90 acre feet of water storage in the cranberry beds themselves. This storage volume is critical, as it allows the pesticides to be fully contained, during their entire half life periods.

A sediment pond would be located immediately upstream of the tailwater pond. This sedimentation pond would be built long (100 feet) and narrow (30 feet), to facilitate the easy cleaning of sediment from the pond. This pond would be inspected for sediment buildup on a routine basis, and would be cleaned of sediment as required. The sediment would be stockpiled, drained, and could be returned to the unplanted beds for disposal. This need to clean and maintain this pond would diminish, as the site development is completed.

The tailwater pond would involve an approximately 5-foot high embankment built at the lowest point on the property. The tailwater pond itself is shown in Figure 04, and as shown would have a surface area of 28.5 acres. Water from the pond would be assessable from the pump location, as shown. Any water required for the operation would be obtained from this location, first. This pond would be constructed to contain an average depth of 4 feet, for a total storage volume in excess of 110 acre feet.

Detailed drawings of the proposed tailwater features would be provided prior to the construction of this proposed facility, and would be included as part of the subsequent operational approval application.

The volume of the tailwater pond would easily contain a full foot of water from the cranberry beds, if necessary. This large capacity ensures that water containing high amounts of pesticides need not be released into Back Lake.

The construction of this pond for the recycling of water represents a huge cost to the cranberry developer, especially when large volumes are already stored nearby the site. Many cranberry operations simply withdraw water from the watercourse, and return it back to the watercourse after use. Very few problems have been documented with the direct return of water to the watercourse, for cranberry operations. Fertilizer and pesticide impacts are covered in greater detail in section 6.1.3.

Ability of the Source to Meet Requirements

The tailwater pond will be sized to hold 110 acre feet, and the majority of the facilities water needs will be obtained by recycling water from this pond.

Back Lake has an estimated 400 acre feet of water storage available in its top foot, and there is considerable stream flow in the Roseway River. The availability of water volume at this site, would never be an issue.

The Roseway River drainage basin flow is measured and recorded at a stream gauging station at Lower Ohio, and has a total drainage area of 495 square kilometres (km^2). The drainage area between Back Lake Bog and the measuring station in Lower Ohio is approximately 195 km^2. Therefore, the Roseway River watershed area above Back Lake Bog is approximately 300 km^2.

One other cranberry operation has been proposed downstream of this location, and this is the only other known water user on the watercourse, other than a power dam near Lower Ohio, to the authors knowledge. The other cranberry facility has its own tailwater recycling pond. The Roseway River is relatively large, and the combined water use effect of these two proposed cranberry facilities are relatively insignificant, compared to the total flows generated in the Roseway River.

The mean annual flow data for the Roseway River at Lower Ohio is presented below in Table 1. This table shows the average monthly flows in m^3/s. These have been converted to USGPM for the entire watershed, and finally the percentage contributed by the watershed upstream of Back Lake Bog have been calculated. The flow at Back Lake Bog is approximately $^3/_5$ of the total flow measured at Lower Ohio. These calculations of average monthly flows at Back Lake show the lowest average monthly flow to be in August, and it is calculated to be equal to 54,000 USGPM.

Table 1
Average Roseway River Monthly Flows at Lower Ohio and Back Lake

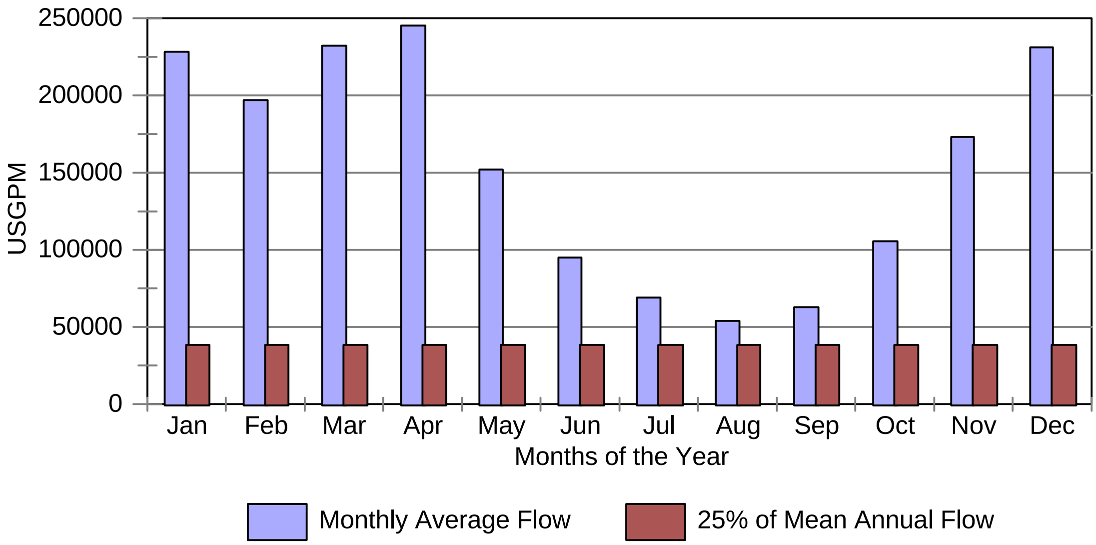
	Cubic Meters Per Second	Lower Ohio (USGPM)	Back Lake (USGPM)
January	24.00	380,448	228,269
February	20.70	328,136	196,882
March	24.40	386,789	232,073
April	25.80	408,982	245,389
May	16.00	253,632	152,179
June	9.99	158,361	95,017
July	7.26	115,086	69,051
August	5.68	90,039	54,024
September	6.62	104,940	62,964
October	11.10	175,957	105,573
November	18.20	288,506	173,104
December	24.30	385,204	231,122

The data from Table 1 has been utilized to prepare the following Figure 07, a graph of the monthly river flow versus the calculated 25% of the mean annual flow.

Figure 07 clearly shows that if water is required from Back Lake for winter flooding purposes, the river flow greatly exceeds the minimum 25% of mean annual flows in December and January.

In the summer period, when the river flow is down somewhat, all water required for the operation will be obtained from the tailwater pond, making the Roseway River low flow situation, a non issue.

Figure 07 - Roseway River at Back Lake
25% Mean Annual & Mean Monthly Flow



4.3.2 Sand

Source

There are several sources of sand commercially available, one of them being Harlow Sand and Gravel from Shelburne. Sand will be purchased from commercial providers, when required. These providers will have Industrial Permits to allow their operation under the Environment Act.

Sand will not be obtained form local beaches, and therefore should not disturb the Piping Plover nesting areas.

Amount Required Per Year

Initially no sand will be applied. After three years an inch will be applied, equal to about 150 yards of sand per acre. If this were repeated every three years, the annual requirement would be 50 yards/acre/year.

Distance of Source to Nearest Residential/Watercourse

At this time the sand is intended to be obtained from a commercial source that is currently licensed and meets the NSDOE regulations and guidelines. The setback distances from residents and watercourses for these commercial operations would already be in place.

4.3.3 Pesticides

Pesticides to be Used

"Pesticides" are a very general term that have been applied to a broad range of chemicals that include; Fungicides, for the control of fungal growth; Herbicides, for the control of herbacious weeds; and Insecticides, for the control of insects.

Two lists of pesticides that are currently registered for use on cranberries in Canada are included in Appendix B.

The first list has been provided from the Cranberry Institute and is a summary of the pesticides registered for use in Canada for the year 2000. This list indicates the relative toxicity to certain types of wildlife for each registered pesticide. The label requirements for the pesticide applications will be adhered to in order to minimize the contact with the wildlife potentially affected by the compound. For example, insecticides extremely toxic to bees would only be applied when the bees are not foraging, or expected not to be visiting the treated cranberry beds.

The second list is an up-to-date offering from Agriculture Canada, which includes all new registrations for the year 2000.

It is literally impossible to state in advance which of the pesticides from the general list will definitely be used annually on an existing and future cranberry development. Any of the pesticides from the list could potentially be used, depending on the particular situation to be dealt with.

Of greatest concern to the general public is the potential for surface and groundwater contamination from pesticides used. Prior to the registration of a pesticide, a rigorous certification program is performed. It is required that all pesticides be registered by the Pest Management Regulatory Agency of Health Canada before use in Canada.

It is through the registration process that the purpose of the chemical is demonstrated, and its application timing, and restrictions are documented. All precautions for the use of the chemical are clearly identified and labelled, such as the maximum single application rate, preharvest intervals, any restricted entry intervals after application, and the maximum number of applications, for example. Only products registered and approved for use on cranberries will be utilized on the crop, and when used they will be applied according to the label instructions. This approach should minimize any potential water contamination concerns.

Frequency of Application for Typical Operation

The frequency of application of any particular pesticide would be dictated according to the need. For example, insecticides will not be applied, if insects are not present. The same with fungicides and the herbicides, although some growers spray fungicides pre-emptively, in an effort to prevent fungal outbreaks.

The presence or absence of insects, for example, will be determined by utilizing IPM techniques, or Integrated Pest Management. In this instance, weekly to biweekly visits are made to the bog with a sweep net. The net is swept through the bog in a set pattern and upon completion, the insects collected in the net are identified and counted. A certain threshold amount of insects are acceptable. When these threshold values are exceeded, then action to protect the crop is considered.

Under IPM, sprays are not the only answer to protect crops. Successful insect protection techniques include the selective use of flooding, sanding, baiting and nematodes. Only when all other control options are ruled out, will pesticides be considered for use. When pesticides are used, they will be used according to the label instructions only.

Similarity, fungicide and herbicide needs are evaluated with IPM techniques, alternatives are considered when certain thresholds are exceeded, and appropriate actions are taken.

Receiving Watercourse

Applied pesticides will not be returned directly to the receiving watercourse. Following application, these chemicals will be held within the cranberry bed as long as possible.

Initially, the restricted entry intervals will be observed. Beyond that, the chemicals will be impounded as long as reasonably possible, depending on other management requirements of the bog. As stated earlier under the water management section of this report, cranberry farms exhibit the greatest ability to manage water movement within the production area of the crop.

After a pesticide spray, for example, water could be prevented from leaving the bed for as much as a month or more, if required. After it leaves the bed, the water would be stored in the tailwater pond and again recycled. There are few other types of agriculture crops that exhibit this high degree of water management on site.

Methods of Application

There are several methods of pesticide application which include hand application and spreading, backpack application, small powered wipers and sprayers, larger spray boom systems, irrigation systems and helicopters are utilized as well.

All applicators of pesticides at the site will be certified by the province. All pesticides shall be transported, stored, handled, used and disposed of in according to the Nova Scotia General Pesticide Safety Manual (1995).

To minimize the threat of drift to sensitive environments, pesticides should only be applied under the following meteorological conditions: wind speeds should be between two and 10 km/h; the air temperature should not be forecast to exceed 25 °C on the day of application; and the relative humidity should be above 50%. In addition, pesticide spraying should not be carried out if it has rained in the last four hours or if rain is forecast in the next four hours.

Hand applications are useful for point source applications such as “Roundup” to eliminate very specific targets that are located irregularly through the bed. If weeds have taken over the cranberry bed, small wheeled propelled equipment helps to cover relatively large areas quickly. A 12-foot wide roundup wiper is a good example of this type of equipment used to eliminate weeds that have grown significantly taller that the cranberry vines themselves.

Larger commercial cranberry farmers utilize spray boom systems that are capable of both granular and liquid applications. These booms generally cover ½ the width of the beds. The sprayer travels up both sides of the beds for complete coverage of the crop. These systems provide the growers the ultimate in application control, provided that their sites are built to accommodate this modern equipment.

In Massachusetts, where the cranberry beds are very irregular in shape and not conducive to boom spraying, the irrigation system is the primary applicator of chemicals. Close attention is paid to the Coefficient of Uniformity (CU) of the system to ensure the uniform application of the chemicals.

Again, due to the irregular shape of the fields, small helicopters are utilized to apply certain pesticides in Massachusetts. This practice has not been used in Nova Scotia to date, due to the relatively small size of our local industry.

Cultural Practices to be Used to Minimize Pesticide Use

As previously discussed, IPM techniques will be utilized with other known cultural practices to keep pesticide use to an absolute minimum. Prior to the initiation of this development an Integrated Pest Management (IPM) Program will be prepared by a qualified agriculture consultant that will include, but shall not be limited to; a list of insects, diseases, and primary weeds that will be monitored; and a list of monitoring techniques and controls to be used when required. This guideline can be provided under the Operational Approval application.

4.3.4 Fertilizers

The fertilizer requirements of cranberries are relatively low. Nitrogen (N) requirements on producing bogs are in the range of 20 to 60 lbs/acre. Phosphorous (P) and Potassium (K) is generally delivered in an N-P-K ratio of 1:2:1 or 1:2:2.

Fertilizer use is summarized in Appendix C in a three-page 1999 report by Carolyn De Moranville. These fertilizers may be applied by any of the previously mentioned pesticide application methods.

The annual fertilizer requirements are generally applied in either weekly or biweekly applications. These split applications are usually timed to coincide with specific crop growth stages.

The high cation exchange capacity of the peat bogs themselves prevents these nutrients from migrating much beyond the immediate root zone of the crop.

4.3.5 Wildlife Control

Wildlife will be encouraged to inhabit the site. Nesting birds, bees, geese, foxes and fish will all be welcome. Bird nest box's will be installed to encourage their visitation.

Muskrats however will be removed, should they decide to occupy the many dykes and ditches at the site. The appropriate nuisance wildlife operators will be contacted, permits obtained, the removal and disposal will follow the current Department of Natural Resources procedures.

4.4 OCCUPATIONS

It is generally accepted that a 25-acre cranberry bog will support 3-4 full time persons on a year round basis and will require an additional 15 to 25 persons seasonally for maintenance, weeding, and harvest. Therefore, the 90-acre site could employ upwards of 11 to 15 persons on a full-time basis. The construction of these facilities employ surveyors, engineers, accountants and lawyers, heavy equipment owners, operators, and many different material suppliers.

This type of construction creates jobs in the local economy for the supply of all of the above-mentioned trades, materials, and more. For example, aluminum water control structures are critical for longevity, since the aluminum surface oxidizes in the acidic peat environment, and becomes chemically stable. These specialized control structures are nearly always custom fabricated locally. This type of work helps support the local aluminum fabricators.

This type of development has been demonstrated to require 1/3 of a full time job off the site for every full time job created on site, in order to support the business. Therefore, it is estimated that four to five full time positions will be either created or supported by this new development.

5.0 DESCRIPTION OF THE ENVIRONMENT

5.1 BIOPHYSICAL ENVIRONMENT

The Department of Mines and Energy Bulletin 6, titled "Evaluation of Nova Scotia's Peatland Resources " indicates that Nova Scotia is blessed with more than 400,000 acres of peatland. Shelburne County alone, where this site is located, has 64,100 acres of peatland. This request, to develop 110 acres of peatland into 90 acres of cranberry bog, represents the utilization of 0.17 percent of the peatland resource in Shelburne County.

This land, simply because it is peatland, falls under the general heading of "wetland". To assess the quality of this wetland, a Department of Lands and Forests publication was referred to, titled "Important Freshwater Wetlands and Coastal Wildlife Habitats". The following is excerpted directly from this reference.

Freshwater wetlands provide habitat essential for more than 50 wildlife species. In addition, wetlands are valuable because of their actions in serving as flood and stream controls, protecting subsurface water resources, serving as pollution treatment sites, controlling erosion and providing recreational, educational and scientific opportunities.

All freshwater wetlands within the province have been inventoried and. based on a scoring system, rated from 37 up to 108 according to their value to wildlife. Those wetlands with total scores above 65 should receive consideration as important wildlife areas when alternate land uses are proposed.

Wetlands scoring 80+	*- Best wetlands. Areas of outstanding wildlife value which are of provincial significance. Wetlands in this category should be completely protected.*
Wetlands scoring 70-79.5	*- Better wetlands. Areas of local wildlife value or ones that*

	have outstanding wildlife potential. Wetlands in this category should be reserved for wildlife unless a high priority use justifies other developments on these sites.
Wetlands scoring 65-69.5	*- Good wetlands. Areas of value to wildlife which often have the potential for development as better wildlife habitats. The value of wetlands in this category to wildlife should be reviewed before considering any developments on these sites.*

This site was not delineated nor numbered in the "Important Freshwater Wetlands and Coastal Wildlife Habitats". Therefore, it was rated less than 65, indicating that as a wetland, there are better examples to be found, and protected from development. We concur with this wetland rating assessment.

It may be seen from the site location maps, Figure 01; the aerial photography, Figure 02; the property PID mapping, Figure 03; and from the Conceptual Site Layout, Figure 04 that the site is located in a remote location, with relatively few neighbours nearby.

The overall terrain consists of gently undulating relatively level topographic relief. The vegetative cover on the majority of the land area is timberland, of varying degrees of quality. Interspersed amongst the upland forest area, are many peat bog areas, watercourses and lakes. This particular portion of the province has 10% of the total land area covered with peat bogs.

The immediate area of interest is a relatively large, slightly domed peat bog, as shown in Figure 02. Surface and groundwater flow on the site are dictated by the topography of the domed bog. It is surrounded by upland forest to the west and by water to the north, east, and south.

The property of interest is part of a nearly 55,000 acre parcel of Crown Land and for this reason the proposed property boundaries are presented in Figure 03. The western boundary is proposed to be the existing, readily identifiable 203 Highway, which provides access to the site. The southern boundaries are already in place with existing property lines and the edge of Back Lake. The northern boundary is proposed to sever this section of the land from the remainder of the huge property.

Very few neighbours are physically within a one kilometre radius of this property and those that are, are on the opposite site of Back Lake from the proposed development area. So few people live here, in fact, that single phase power does not come completely up Highway 203 to the site.

It is believed that the cottages and hunting camps that appear on the south side of Back Lake either obtain their water from shallow dug wells on the properties, or have no running water at all.

5.2 AREA TO BE AFFECTED BY THE UNDERTAKING

The area to be affected is shown in Figure 02, the aerial photograph; in Figure 03, the Proposed Property Boundaries; and again in Figure 04, the Conceptual Site Layout.

Within the boundaries proposed in Figure 03, the development is proposed to unfold as shown in Figure 04. In total, 90 acres of cranberry bogs could be constructed entirely on the surface of the domed peat bog. In the adjacent upland, some forested area would need to be cleared to facilitate the construction of a house, machinery storage, pesticide and fertilizer storage, and berry handling buildings that would be necessary to support the cranberry business development. These details would be provided for the Operational Approval application, in the detailed site design.

These are the two primary areas to be affected within the property, with physical disturbances. Some physical modifications would occur at the proposed pump location, and at the tailwater pond as well, in order to create the pond.

5.3 SENSITIVE ENVIRONMENTAL DESCRIPTIONS

5.3.1 Survey of Flora

The site was surveyed by a professional botanist, Jim Jotchum, October 7th, 1997. Mr. Jotchum's botanical survey report may be found in Appendix D. The review found the presence of the Round Leaf Sundew, but not the Thread Leaf Sundew.

Mr. Jotchum's concluding remarks in his report state that "no rare or unusual plants were observed. The site is typical of bogs in southwest Nova Scotia. There are no floristic reasons for delaying further development".

Regulatory authorities in the past have indicated that the fall is too late to assess the presence or absence of the Thread Leaf Sundew. While it is certainly easier to find the plant when it is in full bloom around mid July, the tall stem and colonies of these plants are relatively easy to locate in the fall when one knows what to look for.

Mr. Jotchum knows what to look for, and has shown us personably these plant colonies at the Barrington Bog, the same time of year that this bog was assessed. The primary reason for the bog botanical assessment was to ensure that the Thread Leaf Sundew specifically was not present, as this plant species has stopped potential peat bog developments in the past.

Mr. Jotchum was specifically hired because of his knowledge and ability to find and identify the Tread Leaf Sundew. None were found on this site.

Appendix E contains a recent letter from Mr. Jotchum, again stating that in his professional opinion, there no Tread Leaf Sundew to be found at Back Lake Bog.

However, to ensure that there were no overlooked rare plant species, another botanical assessment will be performed prior to the site development, at the appropriate time of the year.

5.3.2 Survey for Fauna

Reg Newell of Acadia University has completed a faunal analysis of Back Lake Bog. The report concludes that the development should not have any detrimental impact on any mammals currently considered at risk in Nova Scotia. It further concludes that the site development should not substantially reduce the habitat type and alternative sites should be available to those wildlife species affected. The report is attached in Appendix F.

Mr. Newell's evaluation was considered acceptable for the previous environmental approval for Duncanson's Savannah, provided that botanical surveys for the Four-Toed Salamanders and the Northern Ribbon Snakes were conducted prior to the development of the site.

As stated, more than 10% of the land area in this region is peatland, with similar habitat for potentially displaced fauna. Therefore, it is reasonable to believe that this development will have very limited impact on fauna that may inhabit this peat bog type of environment. Unlike rare plants, fauna have to distinct advantage of being able to move, should their environment not suit them anymore.

The Canada Land Inventory for Waterfowl rate this site as $7_{T.}$ The class 7 definition states *Lands in this class have such severe limitations that almost no waterfowl are produced. Capability on these lands is negligible or nonexistent. Limitations are so severe that waterfowl production is precluded or nearly precluded*. The subclass T represents - *Adverse topography - either steepness or flatness of the land may limit the development or permanency of wetlands*.

Should wildlife species at risk be found during the development process, the department of Natural Resources personnel shall be contacted immediately, in order to ensure that appropriate mitigative measures are taken.

5.3.3 Survey of Receiving Watercourse

The receiving watercourse is Back Lake on the Roseway River, which flows south from Roseway Lake to Shelburne Harbour. According to local Department of Fisheries and Oceans (DFO) officials (Com with Peter Winchester, June 1998), the Roseway River is home to a number of species of fish. They include sea run and speckled trout, yellow and white perch, eels, a variety of forage fish (bull minnows, for example) and is a potential spawning area for gaspereau. The pH of the river inhibits salmonoid (trout and salmon) spawning.

The habitat in this river is characterized by a sand and cobble river bed with some large granite boulders strewn at random. The velocity of the river scours the bottom of detritus and silts with the exception of those areas around the head of Back Lake, where the velocity is reduced upon entering the lake. This rough bottom provides shelter and protection for small forage fish upon which larger species prey.

A survey of fish and fish habitat was also conducted at representative sections of the Roseway in May of 1998 by Richard Van Ingen, B.Sc., a consultant in salmonoid habitat. The study supports the comments of DFO and concludes that salmonid spawning would be limited in this area of the Roseway. Depending on pH, the section could contain brook trout and possibly Atlantic salmon. The complete report is included in Appendix G.

From the Van Ingen report it is stated that Atlantic salmon are the most sensitive and eggs will not survive in areas where the pH is below 5.0. The brook trout will not successfully spawn in areas below pH 4.5.

Indian Fields was the upstream location where the Van Ingen (May 23, 1998) evaluation was performed. An October 1997 visit to Indian Fields, Back Lake Bog, and Indian Brook Bog was performed by Trent Webster, P.Ag., P.Eng., with water samples taken during the visits. The water samples were collected in the Roseway River and its lakes, and the results are tabulated in Table 2, presented going downstream from Indian Fields.

Table 2 - Water pH in the Roseway River

Location	pH's	Salmonid Habitat
Roseway River at Indian Fields (Upstream of Back Lake)	4.2	Not likely
Back Lake	4.4	Not likely
Roseway River at Philip Lake (Downstream of Back Lake)	4.7	Possibly

Referring to the quote from the Van Ingen report regarding pH's, it seems highly probable that salmon spawning does not occur in these parts of the Roseway River, since all pH's are under 5.0.

Also, it seems probable that brook trout do not spawn in or upstream of Back Lake due to the pH's being under 4.5. It seems possible that brook trout spawning might occur in the Roseway River in or below Philip Lake, due to the pH's being more suitable, and just over the 4.5 pH limit for successful spawning. It is our belief that the Roseway River, at Back Lake, does not represent a sensitive salmon or trout spawning area, based on the pH values of the water alone.

The pumps utilized at the site will all be equipped with intake screens that the current Department of the Environment and Labour pump intake screen guidelines. In addition, a second larger screen will be utilized to prevent the primary from screen from blocking in the first place. These measures shall ensure that all fish habitat will be protected from accidental suction into the on site pumps.

As well, water discharged from the site shall be monitored for quality on a regular basis, to ensure that pesticides potentially harmful to fish habitat are not released into the environment.

5.3.4 Description of Existing Groundwater Resources

The primarily site consists of a mix both upland and peat topography.

The upland areas are best described as having a topography of flat to rolling, with many surface boulders; and underlying multiple till layers. The thickness of this till ranges from two to 20 meters, generally. No surface excavations or drillings were performed to determine the extent of the till thickness at the site.

The till itself is described as a stony, sandy matrix material derived from local bedrock sources. It is described as siltier due to erosion and incorporation of older till units by glaciers. Below the till is bedrock, potentially consisting of Granitic rocks, meta greywacke and slate. These bedrock formations are typically very poor producers of water, and the majority of the groundwater in this area consists of gravitational water that is located primarily in the surficial till layers.

Within the peat bog itself, the groundwater movement simply flows from the higher portions of the bog, to the lower portions, through the peat. Trent Webster, P. Ag., P. Eng., has visited the site personally many times, by helicopter. One observation of Back Lake Bog, as is true of any of the peat bogs that are suitable for agriculture development, is the complete absence of any open bodies of water within the bog itself. There are no visible watercourses anywhere on the bog.

Peat bogs are formed initially in shallow ponded areas. Domed bogs, such as Back Lake Bog, have grown over thousands of years from a level ponded area. The fact that the bog started from a pond, implies that the soil under the bog is relatively impermeable. Water enters this bog through the surface, moves through the peat's surface by gravity from the higher doamed area to the lower areas by Back Lake, and exits the bog as seepage in these lower areas.

Deeper groundwater, below the surface of the bog, is trapped in place and is relatively stagnant simply due to the physical ponding characteristics of the soils that underlay the peat, that created the pond, and the bog in the first place.

There are no residences that use groundwater for drinking water in the immediate vicinity of this potential development. The nearest resident is 1,250 feet to 2,000 feet away from the southernmost boundary of this potential development. They are located across Back Lake from the development. Due to the large distance from the actual development, these sites were not visited. The probability of these wells being impacted by this development is extremely remote.

While the PID mapping shows many smaller lots along the southern shore of Back Lake, currently very few of them are developed. These residents were not visited as the mapping suggests that these are either cottages or hunting camps, with their owners on site infrequently. These local landowners would have the opportunity to comment during the public notification period of the registration of this proposal.

Prior to the sites development, these property owners would be visited, and their water supplies documented. Water samples would be obtained and tested to establish a baseline water quality for later comparison.

6.0 ENVIRONMENTAL IMPACTS

6.1 POTENTIAL IMPACTS

This environmental assessment has not identified any environmental impacts which cannot be readily mitigated during construction and operation of the facility. Mitigation practices in this industry are well defined and will be utilized as required.

6.1.1 Groundwater Impacts

Groundwater will be used in this operation only as a single household water supply. Groundwater in the upland area would be more than sufficient to meet this need, similar to other cottages and residences in the general area.

To ensure that the groundwater is not impacted by the development, two groundwater monitoring wells shall be installed and monitored as stated in Section 7.

6.1.2 Surface Water

Surface water from the Roseway River at Back Lake will be used occasionally to supplement the available water from the tailwater pond, primarily for the winter flood. As is indicated in Section 4.3.1, this volume of withdrawal from Back Lake will not be a problem at that time of the year.

Since such a small percentage of water is required from the watercourse, versus the actual flows and storage volumes, there are no anticipated potential impacts on organisms that depend on this watercourse for all or part of their life cycle.

This development will not directly affect any other watercourse.

6.1.3 Discharge Water to Receiving Watercourses

The main concern from this operation would be the potential for fertilizer, pesticide or sediment contamination of the water supply. All discharges from the site must meet current NSDOE guidelines.

Fertilizer Discharge Potential

Fertilizer usage on a cranberry bog was previously described in Section 4.3.4. Sixty pounds per acre per year of actual nitrogen are typically applied to a mature cranberry bog in full production. Nitrogen is applied several times throughout the growing season, in small 10 lb/acre doses. As discussed in Section 4.3.1 as many as seven feet or more of water is applied annually to a cranberry bog in full production.

If we were to assume that the entire 60 lbs per acre of nitrogen were washed away with the 7 feet of water annually applied to the crop, the resultant nitrogen contamination would equal three ppm's. These low levels would still meet the Canadian Drinking Water Guidelines. The figures would be similar for N, P and K.

Firstly, most nitrogen is taken up by the plant, and 100% would never leave the site. Most fertilizer applications do not exceed 10 lbs per acre at a time.

Secondly, after fertilizer application, during the growing season, water usually stays within the production bed.

Thirdly, drainage water from the beds would be returned to the tailwater pond and held, prior to release to the receiving watercourse itself.

Finally, cranberry farmers demonstrate more control over water on their sites than any other farmers. We believe that fertilizer contamination of watercourses from cranberry beds to be a non issue, simply due to the relatively small amounts in use at anyone time.

Pesticide Discharge Potential

In regard to pesticide usage, and sedimentation; similar to fertilizer usage, the mobility of these items is more restricted on a cranberry farm than any other form of agriculture.

Pesticides will be held in the bed upon application, according to label requirements. Due to tailwater pond containment and recirculation of water, these pesticides would remain in the system even longer to further breakdown, prior to release to the receiving watercourse.

A number of studies have been conducted by the Cranberry Institute in Massachusetts and various cranberry grower associations to determine the impacts, if any, of cranberry operations on surrounding water supplies.

The Cranberry Institute conducted a study to assess the water quality found in water bodies receiving drainage from cranberry developments. The conclusions were that there were no significant water quality differences between areas receiving drainage from these operations and areas that did not receive any input from cranberry operations. (Logan & Helmer, 1994)

In British Columbia, the Cranberry Institute funded a study designed to investigate the impact of cranberry developments on groundwater, which was conducted by a private environmental consulting firm. The study took place on a back swamp in the Fraser River flood plain where the peat was two to six metres deep. The study determined that there were no negative impacts to groundwater from pesticide use and that nitrate-nitrogen levels were well below drinking water standards - the greatest concentration being measured at three ppm. (Fugro East Inc., 1994)

The Wisconsin Cranberry Growers Association retained SDM Consultants to evaluate any previous studies and to conduct water quality studies of a cranberry bog at Zawistowski Marsh, Wisconsin. The study determined that the water in the lake receiving discharge from the bog had seen no measurable increase in nutrient levels as a result of the drainage from the operation during the period 1970-90. As well, pesticides could not be detected in samples that were collected in 1986 and 1987 from the lake sediment (SDM Consultants, 1990).

There are a number of reasons for these kinds of results. Typically, attenuation of nutrient and pesticide concentrations are a result of short half-lives and the typical ability of organic soils to absorb the pesticides and nutrients, and to retard the downward movement of water. As the water is slowed, the organic material (peat) has time to absorb and react with the compounds. Studies have shown that pesticides and excess nutrients are primarily retained in the upper 5 cm of the cranberry bed soil, within the dense root zone of the plants (G.A.F., 1998).

Sedimentation Discharge Potential

The sedimentation concerns are at their worst during the construction phase, and a multiple barrier approach will be adopted to prevent construction sedimentation from reaching Back Lake. The multiple barrier approach will consist of the diversion of the surface water away from the construction site, installing silt fences, tailwater ponds, utilizing large buffer zones, mulching, seeding, and finally sedimentation monitoring.

The first stage of construction, prior to the site devegetation, will involve the building the main ditches that will divert the surface water runoff around the site.

A silt fence will be established on the downstream perimeter of the construction area. This measure, together with the tailwater pond, will prevent sediment from leaving the site. These sedimentation control structures will be constructed prior to the initial bed devegetation.

Beyond the silt fence in the construction area, large vegetated buffer zones shall be maintained between the watercourse and the construction site. These large buffer zones are shown in Figure 04. Buffer zones greater than 50 feet from the watercourse would exceed most environmental guidelines.

The main drainage ditch will lead to the settling pond located just upstream of the tailwater/ pond, which would be constructed initially. This settling pond would be the primary location for sediments to be trapped, to prevent their discharge to the watercourse.

The outlet from the settling and tailwater ponds will be screened with a large fabric filter cloth during the construction phase. This filter cloth will have the approximate dimensions of 12 feet by 25 feet, and will be used primarily to trap the “floaties”, or particles light enough to float on the discharge water surface. Terrafix 270R, or equivalent, would be recommended for this application.

Construction work at the site will not proceed at times of extremely high precipitation, when high erosion potential is likely.

All erosion control structures shall be inspected and maintained after large precipitation events, to ensure that they are functioning properly.

Ditches will be inspected for stability, erosion, and sedimentation buildup on a regular basis. Areas that require attention will be appropriately maintained as soon as possible.

The exposed soil area shall be minimized by only developing the actual bed areas to be planted the following year. Once constructed, minimal soil erosion should occur on these sites, since they are built level, and are contained within their own dyked areas, or individual beds.

During the construction phase, as the individual cranberry beds are finish graded, the bed embankments will be suitably seeded, as soon as possible, to prevent the soil erosion of the dyke embankments.

Erosion control measures will be taken in sufficient time, prior to the winter freeze up, to allow them to be effective. For example, areas to be seeded for erosion protection shall be done as soon as practically possible in the year, to allow for the proper growth of the grass prior to freeze up. If the winter is setting in, and areas need to be protected from erosion, weed free straw shall be used as an alternative, to prevent erosion.

Any stockpiled soil shall be stabilized with an appropriate soil erosion control method prior to freeze up also, where required to prevent soil erosion from the pile.

Water discharge from the tailwater pond will be monitored to ensure that the suspended solids are at acceptable levels. Suspended solid concentrations within the effluent to be released from the sediment control structure should not exceed 25 mg/l on a monthly average, or not more than 50 mg/l on a single grab sample. Water sampling performed prior to working on site shall establish the background concentration levels for the local waters.

The receiving waters shall be monitored to ensure the maintenance of the CCME “Canadian Water Quality Guidelines” for the protection of aquatic life. This will again involve the collection of preliminary background water parameter levels, and the subsequent comparison of any potentially elevated levels to those background levels.

6.1.4 Wetland Location Impacts on Flora and Fauna

As previously stated in Section 5.3.1 there appear to be no significant impacts on flora in the affected area.

As well, the faunal analysis suggests that effects will be limited to the potential displacement of some habitat for certain animal species. Land use by various small mammals will be disrupted during the construction phase. Abundant acreage of similar types of habitat in the immediate area suggests that the impacts will be absolutely minimal.

6.1.5 Employment Impact

The employment impacts were previously described under Section 4.4. In summary, the development of this site is expected to bring upward of 9 to 12 full time jobs into the local economy, an additional 10 to 15 persons seasonally, and will spin off approximately $30,000 per acre, or approximately two million into the local economy during the construction phase. These new jobs could provide a significant positive improvement to the local economy.

Also, 3 to 4 jobs will be created to support this new development.

6.1.6 Land Use Impacts

Land use impacts relate to the compatibility of the development with adjacent and surrounding lands, including aesthetics.

In the long term, the project can be considered to have a positive impact on land use. The completed development will consist of a cultivated wetland creating agricultural land and manicured surroundings. The development should be completely compatible with other land use in the area.

The proponents of this project are not aware of any other industrial, commercial, or residential developments planned for this area, that would be adversely affected by this development.

The potential development of this property would not be expected to take away from the quiet enjoyment of others of this property. Should the Roseway River at Back Lake be used by fisherman, canoeist's, photographers, naturalists, and other members of the general public, we believe that their observation of a well-maintained cranberry facility would not detract significantly from their natural outing experience.

6.1.7 Archaeological/Historical Resources

This assessment has identified no historic resources that will be directly impacted by the project.

The Museum of Natural History was contacted and they believed that the bog itself would probably not contain archaeological artifacts. They felt the upland area adjacent to the peat bog might contain artifacts of cultural and historic significance, yet were some found, the upland area was deemed to be sufficiently large enough to allow for continued development in another area, while the artifacts were investigated by a trained archaeologist.

The proponents of this project will agree to halt construction in any area, if and when artifacts are found, and would contact the Museum of Natural History immediately.

6.1.8 Traffic

Construction of the development is expected to be complete within 5 years from the initiation of construction. During this period there will be an increase in traffic due to movement of materials and equipment, and construction workers commuting to the site. Traffic will also be intermittent, relying on site activity, weather conditions, and seasonality and will not occur through the year. This traffic would include both passenger cars/light trucks and heavy trucks for equipment delivery. It is estimated that the traffic would not exceed 20 vehicle trips per day.

Traffic will consist mainly of passenger vehicles and light trucks. Some heavier truck traffic will include single or tandem axle dump trucks, as well as flat beds delivering equipment and construction materials. The main traffic route will be from Shelburne via Route 203. This route is presently characterized by similar traffic. Normal weight restrictions will apply and no special allowances for school (or other) zones are necessary.

Once the cranberry beds are constructed, the traffic impacts would be minor. Larger trucks needed to transport freshly harvested fruit will access the site only during the harvest period. The roads are wide enough to accommodate this long term traffic.

Trucks transporting sand or other construction materials will be fitted with tarpaulins to cover the loads. The trucks leaving the site will be clean, and not dropping material as they travel.

All contracted truck haulers will have up to date vehicle inspections, have properly functioning engine mufflers, and must meet all current Nova Scotia Department of Transportation and Public Works approvals where required.

6.1.9 Noise

Construction will involve some noise impacts that will last throughout the construction period. Noise associated with construction of the cranberry bed is due to the individual pieces of construction equipment being used. Excavators will be used extensively. No impact tools such as jackhammers or pile drivers, which generate high noise levels, will be used.

During construction, the hours of operation at the site are to be limited to 0700 to 1900 hours, from Monday to Saturday.

The primary concern of construction noise is the proximity to sensitive receptors, i.e., such as facilities or locations in which adverse noise effects would be most noticeable. There are no schools or sensitive receptors other than residences near the project site.

In the long term, the main potential source of noise is the pumping equipment. The engines driving the pumps will be equipped with mufflers and will be located inside pump houses. In addition, sound deflectors will be installed. These pumps will be used only when irrigation, frost protection, harvest and flood water is needed which represents about 400 hours/year.

Everyday noise sources include traffic to and from the site and farm equipment used to cultivate and maintain the crop. All equipment used on site shall be operated with a factory installed muffler system and kept in good repair. Exhaust systems used on the bogs shall be directed upward, to avoid sparks from igniting the peat.

Should complaints be received regarding the operation, these shall be followed up by the owners personally. If the complaint is not cordially resolved immediately, the concern shall be documented in writing and dealt with accordingly.

6.1.10 Air Quality

Dust impacts will occur due to normal construction vehicle travel on unpaved surfaces. Minimizing open excavations and wetting roads with water will contribute to dust control. Oil shall not be used as a dust suppressant.

Exposed soils will be seeded. The cranberry beds will be planted in spring minimizing exposed soil during the drier season of the year.

The only long term operational air emission would be the exhaust from the engines driving the pumps and other equipment used sporadically throughout the year. The pumps are operated only as needed and are used about 400 hours/year.

6.1.11 Petroleum Storage on Site

A potential environmental hazard is the accidental spillage of the fuels to operate the on site pumps.

All fuel tanks shall have their own dedicated spill containment units. Hydrocarbon spill containment kits will be stored on the property to be on hand in the event of a spill.

6.1.12 Socioeconomic Considerations

Projects such as this provide obvious job creation opportunities and economic spinoff's. Environmentalists question whether this type of development is harmful to the environment, and in particular, the cumulative impact of multiple similar developments is under the scrutiny of the certain professionals. Cumulative impacts of these types of developments on watersheds and watercourses, while potentially significant, can be demonstrated to not be environmentally significant.

We have already referred to the extremely small percentage of total land area in Shelburne County to be affected, which is less than 0.2 percent on this proposal. On a provincial basis, if 0.25 percent of the entire peatland resource was developed, or 1000 acres out of a total of 400,000 acres, into cranberry production, this extensive development would exceed most regional development authorities and the most ardent agrologist's wildest dreams.

The incorporation of expensive tailwater recycling ponds and agreements to routinely monitor water quality have virtually eliminated watercourse impacts.

An economic analysis of the value of wetlands were not even suggested as a requirement when the *Guide to Environmental Approvals for Cranberry Operations* was developed in 1997 by the then NSDOE. It is for this reason that this type of analysis has not been included.

6.1.12 Decommissioning Plan

In the event of the failure of the proponent to complete the development, or if the site is abandoned for any reason, the site shall simply have the water levels set at the surface of the peat, similar to the initiation of the development. 80 percent of the cranberry plant material will be mowed, to allow for the reestablishment of the native plant species. Without routine maintenance of the cranberry vines, and with reduced competition for space and light, the native vegetation should reestablish quickly. Within 10 to 20 years the cranberry site will have returned back nearly to its natural state.

7.0 IMPACT MITIGATION

There are no special activities associated with this development that would fall outside of “normal” construction and operational practices. All potential activities taken on site, if perceived to be problematic in nature, can be mitigated in some fashion.

Groundwater Protection

It has been noted in Section 6.1.3 that the chemicals and fertilizers are generally found within the top 4 inches of the growing medium. To ensure that the groundwater is not subject to pesticide contamination, two monitoring wells will be placed between the cranberry beds and Back Lake. This would place the wells directly in the groundwater flow path, enabling groundwater sampling measurements to clearly demonstrate groundwater pesticide residue movement or not. These wells will be monitored on a routine basis, along with the surface water testing.

The well water samples will be analysed for the pesticides commonly used in cranberry growing operations. This testing will occur on an annual basis.

The Nova Scotia Cranberry Grower Association (NSCGA) has a project proposal currently registered with Bob Petrie of the NSDEL, titled *Tailwater Pesticide Monitoring Program*, (TPMP), designed to monitor groundwater pesticides and fertilizer levels. When this project is undertaken, the owners of this development could participate, should it still be ongoing. This project proposal has been on the books for some tome now, and the NSCGA has the funding set aside to perform the water sample analysis.

Surface Water Protection

The water quantities available or required are not problematic in any way. However, protection of the water quality is of some concern.

As has been stated in earlier sections, IMP practices shall keep pesticide and fertilizer use to a minimum. Very short pesticide half lives, coupled with excellent ability of the cranberry farmers to impound water in the production beds for long periods of time, ensure that pesticide contamination shall not be problematic.

Tailwater recycling at the site ensures that any pesticides shall be held in the system as long as possible, prior to release to the receiving watercourse. The exact duration of the water impoundment will be a direct function of the precipitation at that time of the year, however, generally, a 60 day retention of water within the field bed / tailwater system would be reasonable to expect.

Water sampling will be undertaken at the tailwater pond discharge point to Back Lake. The samples shall be checked for suspended solids, turbidity, colour, DO, pH, organic and inorganic compounds, fertilizers and pesticides that were in use within the past growing season. Samples taken before the development occurs, shall provide background levels for comparison purposes to allow for an assessment of the effectiveness of the mitigation procedures that are being put into practice at the facility.

The erosion and siltation control measures to be used are described in section 6.1.3.

Every effort shall be undertaken by the developer to stabilize all newly excavated materials as soon as possible after its initial disturbance.

Fisheries Concerns

Due to the low pH waters found at Back Lake, this site is not believed to be salmonoid habitat.

It is possible that other more mature fish inhabit these waters and they shall be protected from the pump intake by screening that more than meets the Nova Scotia Department of Environment pump intake screen guidelines.

In conjunction with the surface and groundwater monitoring program, the proponent would be prepared to incorporate a fish and invertebrate monitoring program that will periodically assess the possible effects of the cranberry operation to the biota at the site discharge location and downstream of the development.

Wetland Impacts on Flora and Fauna Mitigation

The reports indicated that there are no concerns regarding flora and fauna to mitigate.

However, to ensure that there were no overlooked rare plant species, another botanical assessment will be performed prior to the site development, at the appropriate time of the year.

Should wildlife species at risk be found during the development process, the department of Natural Resources personnel shall be contacted immediately, in order to ensure that appropriate mitigative measures ate taken.

Noise and Traffic

Traffic will be kept to a minimum on site. All vehicles and pumps on site shall be equipped with appropriate mufflers. Please refer to sections 6.1.8 and 6.1.9 for additional details.

Petroleum Storage

All on site fuel storage tanks shall be equipped with spill containment enclosures.

Contingency Plan

A plan shall be provided for the Operational Approval that includes, but not limited to, contingencies for spills or leaks of petroleum products, pesticides, fertilizers, or other hazardous materials or wastes, and the failure of the containment berms or the tailwater pond.

8.0 PROJECT RELATED DOCUMENTATION

All pertinent project related documents are enclosed in the following appendices:

Appendix A - Water Budget
Appendix B - Registered Pesticide Lists
Appendix C - Fertilizer Use
Appendix D - Botanical Survey of Back Lake Bog
Appendix E - Rare Plant Concerns
Appendix F - Faunal Analysis
Appendix G - Fish Habitat Report
Appendix H - Wetland Evaluation Guide

9.0 SCHEDULE

The first physical construction related activity on this site are expected to occur after all the approvals are in place, either in the fall of 2001 or in the spring of 2002.

It is anticipated that once the proper approvals are in place, the development will be completed within 5 years of the first construction related activity.

10.0 APPROVAL OF THE UNDERTAKING

This Environmental Approval Assessment represents the first level of approval required.

Following the initial Environmental Assessment Approval it is our understanding that an “Operational Approval” permit is required.

SWSDA shall be pursuing the land ownership, through the Department of Natural Resources by following up on an initiated by letter on March 31, 1998, to Mr. Peter Francis. It is our understanding that the land lease division of the NSDNR requires a legal survey of the property, as well as a detailed business plan, prior to delivering their approval recommendations to council for final approval by the province of NS.

These are the approval process steps to be taken, as we now understand.

11.0 FUNDING

Once this initial level of the environmental approval are in place, the developer will fund the project. Subsequent expenditures to finalize the approval process will be the responsibility of the developer. The developer plans to finance the project through existing equity and/or private investment.

12.0 CLOSURE AND SIGNATURE

The South West Shore Development Authority is most excited about the revitalization of what was once a leading agricultural industry in this region and, in fact, the country. The proponent has demonstrated through this environmental assessment that a cranberry-growing operation can be established at Back Lake Bog. The development will bring significant socio-economic benefits to the region in a manner which is harmonious with local area land use and the environment.

Signed by:

____________________________ ____________________________

Frank Anderson Date

Chief Executive Officer
South West Shore Development Authority

Please Note: Appendices can be found in hard copy versions only. Hard copies of the document can be found at:

- Bob and the Gang's Country Store, Highway 203, Lower Ohio, NS
- South West Shore Development Authority, 368 Main Street, Suite 203, Yarmouth, NS
- Clean Nova Scotia, 126 Portland Street, Dartmouth, NS
- Ecology Action Centre, Suite 31, 1568 Argyle St., Halifax, NS
- Nova Scotia Department of Environment and Labour, 13 First St., Yarmouth, NS
- Nova Scotia Department of Environment and Labour, 5th Floor Library, 5151 Terminal Road, Halifax, NS

The Environmental Assessment Branch

APPENDIX A

WATER BUDGET

APPENDIX B

REGISTERED PESTICIDE LISTS

APPENDIX C

FERTILIZER USE

APPENDIX D

BOTANICAL SURVEY OF BACK LAKE BOG

APPENDIX E

RARE PLANT CONCERNS

APPENDIX F

FANUAL ANALYSIS

APPENDIX G

FISH HABITAT REPORT

APPENDIX H

WETLAND EVALUATION GUIDE