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Georgia Basin Node:

Recommended Sites for the

Ecological Monitoring and Assessment Network

(EMAN)

**Prepared on contract for
the Pacific & Yukon Region, Environment Canada by:**

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31 March 1995

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Assessment Network (EMAN)

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Summary

Environment Canada is currently spearheading an initiative called the **Ecological Monitoring and Assessment Network (EMAN)** in partnership with other federal departments, the provinces, universities, industry and other stakeholders. This endeavor will emphasize long term monitoring, research and experimentation on selected ecozones throughout Canada to answer questions about what is changing in our ecosystems and why. EMAN is a national system of "nodes" or regions made up of individual sites at which research and monitoring activities are taking place. The Georgia Basin is being proposed for node development during the early phase of this program. Issues to be addressed by EMAN include the effects of climate change, stratospheric ozone depletion, and persistent toxic chemicals on ecosystem health. Current stressors in the Basin include habitat conversion, regional pollution sources and resource harvesting. In the future, stressors like climate change, UVb increases and problems with exotic species may be locally important. When fully developed, EMAN sites will offer the ability to measure both stressors and their wider ecosystem effects.

The Georgia Basin covers approximately 44 000 sq. km and is comprised of the watersheds draining into the Georgia Strait from the east coast of Vancouver Island from west of Sooke to north of Campbell River and from the mainland from Desolation Sound south to the Canada/US border, and includes the tributaries in the Fraser River drainage west of Hope. The marine environments of the Georgia Strait and the Strait of Juan de Fuca at the southern tip of Vancouver Island are included in this region.

The initial approach of the Georgia Basin Node was to hold independent Aquatic, Marine, Terrestrial, Climate and Air Quality component meetings to recommend secure sites at which research and monitoring activities are taking place or have the potential to take place. To complete the evaluation, a joint component meeting was held for selected participants from each individual component meeting to assess recommended sites.

Although there are several locations meeting criteria for EMAN site selection, the level of research and long term monitoring occurring at these sites is often not significant. There are some notable exceptions which are being recommended for EMAN enhancement. DOE's comprehensive climate and air quality station on Saturna Island, combined with Forestry Canada's ARNEWS/biomonitoring plot is recommended as an EMAN site. Department of National Defense land at Rocky Point/Mary Hill on the southern tip of Vancouver Island has existing terrestrial studies which could form the basis for another site. The Victoria Watershed, with its water quality data and Forestry Canada Chronosequence study could be incorporated into an EMAN site. On the mainland, both the Seymour Watershed and the UBC Malcolm Knapp Research Forest have a variety of current and historical datasets, including ARNEWS/biomonitoring plots and weather stations. Further analysis is required to choose between these two areas.

Two marine regions are recommended for EMAN enhancement. The permanent subtidal benthic animal and periphyton community monitoring station at Race Rocks (adjacent to the Rocky Point terrestrial site) could anchor a polygon encompassing the ocean disposal site off Victoria and the seabird and cormorant colonies at Chain Islands. A second site could encompass Boundary Bay, incorporating an existing US National Ocean and Atmospheric Administration site and build on FREMP data from the area. It is the goal of EMAN to participate as an intensive subset of the Marine Ecosystem Monitoring Network in the Pacific Ecozone.

The formation of formal partnerships and the development of short and long term goals, objectives and deliverables for each recommended site are the next steps for EMAN development in the Georgia Basin.

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Table of Contents

SUMMARY

1.0 INTRODUCTION	1
2.0 BACKGROUND	1
2.1 EMAN National Meeting	2
3.0 ECOSYSTEM COMPONENTS	5
3.1 Component Meetings	6
3.1.1 Aquatic Component	6
3.1.2 Climate and Air Quality Components	6
3.1.3 Terrestrial Component	6
3.1.4 Marine Component	7
3.2 Joint Component Meeting	7
4.0 RECOMMENDED SITES	8
4.1 Land-based Sites	9
4.1.1 Saturna Island	9
4.1.2 Rocky Point/Mary Hill	9
4.1.3 Victoria Watershed	9
4.1.4 UBC Malcolm Knapp Research Forest or GVRD Seymour Watershed/Seymour Demonstration Forest	10
4.2 Marine Sites	10
4.2.1 Race Rocks/Chain Islands/Pedder Bay	10
4.2.2 Boundary Bay	10
4.4 Potential EMAN Enhancement	11
4.3.1 Agassiz Agricultural Research Station	11
4.4.1 Alaksen NWA	11
4.4.2 Southern Gulf Islands (Marine)	11
4.4.3 Others	11
5.0 NEXT STEPS	12
6.0 ACKNOWLEDGEMENTS	13
7.0 BIBLIOGRAPHY	14

Table of Appendices

Appendix A. British Columbia participants at the EMAN National Meeting in Burlington, Ontario January 16-20, 1995.	15
Appendix B. Participants at the Georgia Basin Node Joint Component Meeting March 15, 1995.	17
Appendix C. Site selection criteria sent to participants prior to March 15 Joint Component Meeting.	19
Appendix D. Proposed sites for discussion sent to participants prior to March 15 Joint Component Meeting.	21

List of Figures

- | | | |
|------------------|---|---|
| Figure 1. | Ecoregions of the Georgia Basin. | 3 |
| Figure 2. | Ecoregions of the Georgia Basin showing major watersheds. | 4 |

1.0 INTRODUCTION

Environment Canada is currently spearheading an initiative called the **Ecological Monitoring and Assessment Network (EMAN)** in partnership with other federal departments, the provinces, universities, industry and other stakeholders. This endeavor will emphasize long term monitoring, research and experimentation on selected ecozones throughout Canada to answer questions about what is changing in ecosystems and why. In British Columbia, the Georgia Basin has been chosen for preliminary EMAN development.

2.0 BACKGROUND

The EMAN initiative has grown out of previous attempts by Environment Canada to evaluate the health of Canadian ecosystems. The first Ecological Science Centres (ESCs) were initiated by State of Environment Reporting (SOER) in 1993. The Ecological Monitoring Coordinating Office (EMCO) was begun in May of 1994 to continue this work of SOER. EMCO plans to link these Centres, or Cooperatives as they are now referred to, by way of the Ecological Monitoring and Assessment Network. ESCs were started to provide the necessary information to SOER for compilation of their State of the Environment Reports, and will continue to do so as ecosystem-level information is collected across the country. SOER's ultimate goal of at least one ESC in each ecozone in the country is upheld by EMCO. A short term goal is to have at least one ESC in each province and territory.

The Georgia Basin is being proposed for attention during the early phase of the EMAN initiative in British Columbia. There are several reasons for this. The region is experiencing rapid population growth which is generating impacts on the terrestrial and marine environments. As well, transboundary movement of sea water and air make it important for the federal government to be aware of potential ecosystem effects from interchanges of pollutants. Both matters need sound ecosystem-level science to form responsible management policies and decisions. In addition, no other area in British Columbia has the relatively high level of research and monitoring activity that is necessary for EMAN site enhancement at this time.

The Georgia Basin covers approximately 44 000 sq. km in southwestern British Columbia and is comprised of the watersheds draining into the Georgia Strait from the east coast of Vancouver Island from west of Sooke to north of Campbell River and from the mainland from Desolation Sound south to the Canada/US border, including the tributaries in the Fraser River drainage west of Hope. The marine environments of the Georgia Strait and the Strait of Juan de Fuca at the southern tip of Vancouver Island are included in this region (Fig. 1 and 2).

Issues to be addressed by EMAN include the effects of climate change, stratospheric ozone depletion, and persistent toxic chemicals on ecosystem health, with relative priorities to be locally determined. Current stressors in the Basin include habitat

conversion, regional pollution sources and resource harvesting. Future stressors may include climate change, UVb increases and problems with exotic species.

The topography of the Georgia Basin with its mountains and lowlands is unique among current EMAN nodes. The interpretation of the EMAN concept and how the Georgia Basin Node will incorporate it is constantly evolving. As more feedback is obtained from potential partners and more time is spent discussing how to implement EMAN in the Georgia Basin, the subtle but necessary tailoring of EMAN to meet regional needs will continue to take place.

Organizational duties and expenses must be shared in order for EMAN to be effective. EMAN can only operate successfully within the context of partnerships as it does not have money to fund research and monitoring activities on its own. The Department of Environment has taken the lead to initiate the networking process, but cannot proceed independently. Increased fiscal restraint makes it necessary to combine resources to carry out the desired ecosystem-level research and monitoring.

Sites with existing studies are necessary. Forestry Canada's Acid Rain Early Warning System (ARNEWS) biomonitoring plots provide national information of vegetative and soil parameters, including tree diameter, height and condition, understory vegetation and its characteristics, and soil chemistry (G.A. Van Sickle, pers. comm.). Forestry Canada's Coastal Forest Chronosequences on southern Vancouver Island describe the soil fauna and flora, small vertebrates and plant diversity, as well as changes in the nature and fluxes of carbon and nutrients in forest stands representing four general stages of development (regeneration, immature, mature and old growth). The information collected at these stages is used to evaluate the effects of converting old-growth forests into managed forests. For both of these Forestry Canada initiatives, a common protocol is used at all sites.

Agriculture Canada has twenty-two Benchmark sites across Canada for comparative studies of soil quality and environmental degradation indicators for major agricultural practices. One site exists in British Columbia at this time. The site is on a privately owned dairy farm in Chilliwack. Information collected such as soil moisture and compaction, water movement and earthworm numbers and species could be used as extensive information in the Georgia Basin Node. The site could also be used in combination with other nearby sites in the future.

A Smithsonian Biodiversity Plot established at Rocky Point is part of a growing network of sites in Canada and the United States using a common protocol to evaluate biodiversity. The plot at Rocky Point is administered by the Ministry of Environment, Lands and Parks.

2.1 EMAN National Meeting

An EMAN National Meeting was held January 16-20, 1995 in Burlington, Ontario with three main objectives:

ECOREGIONS OF THE GEORGIA BASIN

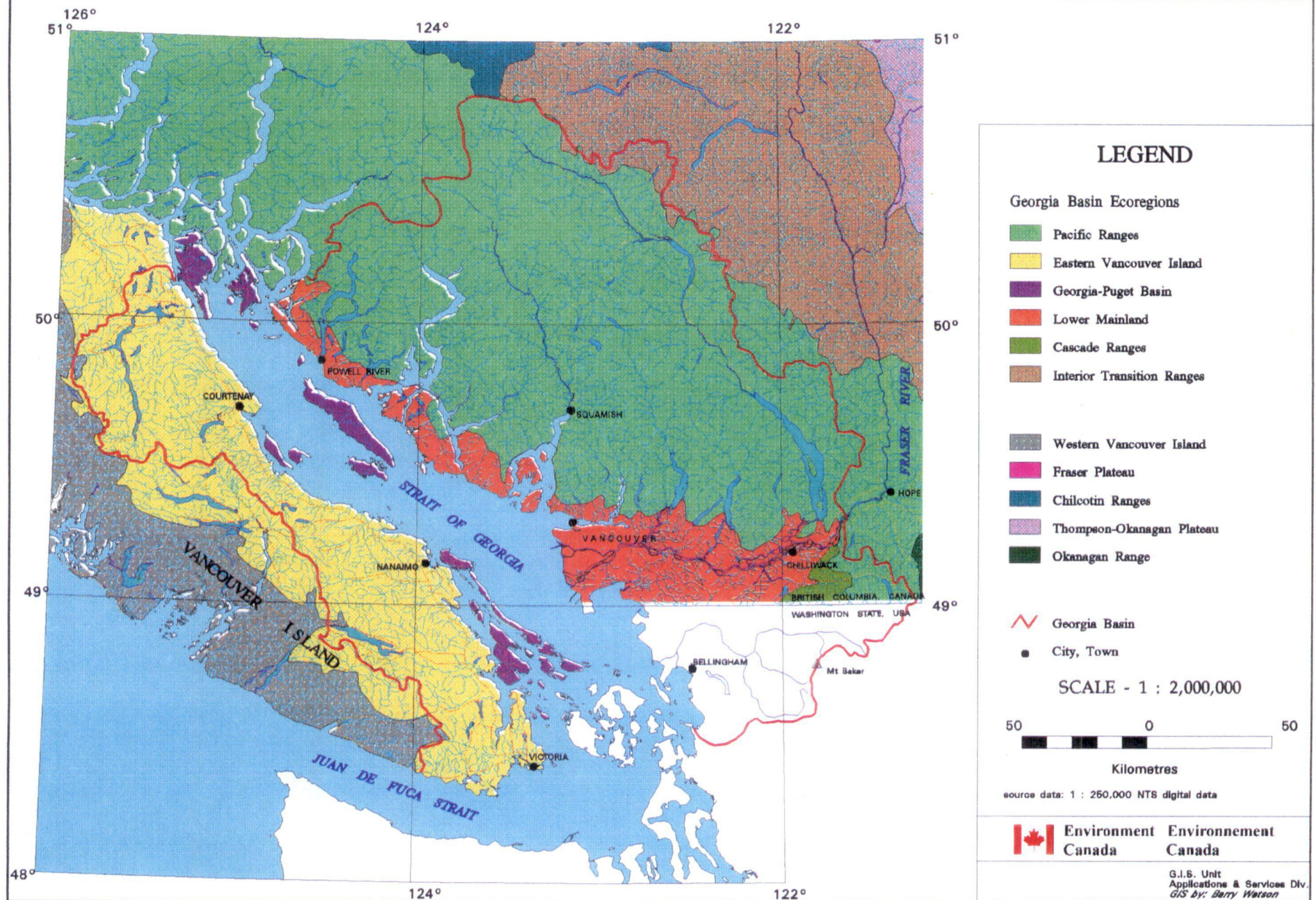


Figure 1. Ecoregions of the Georgia Basin.

ECOREGIONS OF THE GEORGIA BASIN

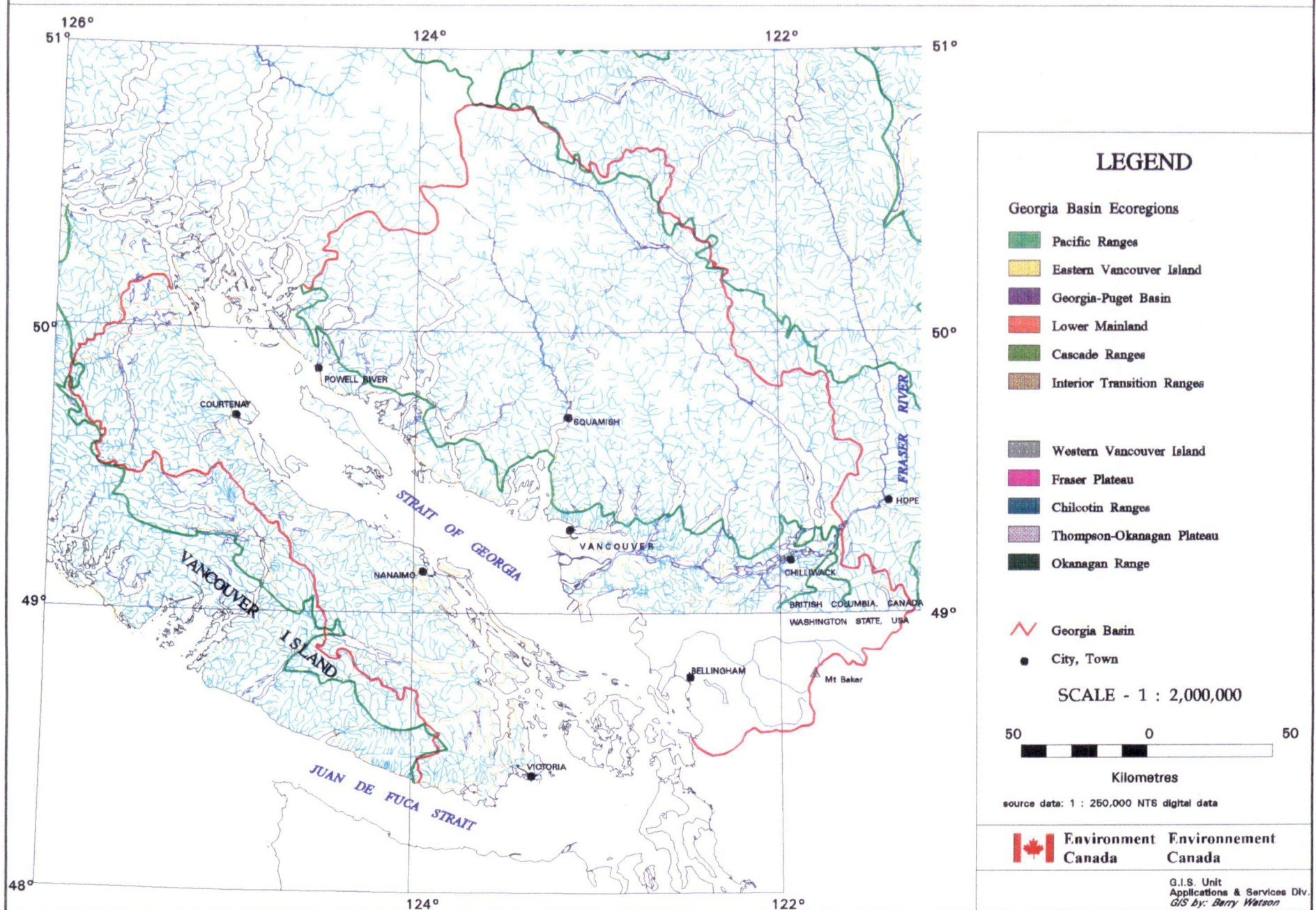


Figure 2. Ecoregions of the Georgia Basin showing major watersheds.

1. To determine knowledge gaps and associated ecological information requirements for national and regional environmental issues;
2. To examine the use and implementation of the ecosystem approach and ecosystem science; and
3. Through a series of lectures and workshops, to define explicitly the goals, objectives, and deliverables to focus the Ecological Monitoring and Assessment Network (EMAN).

The meeting was attended by representatives from across Canada. For many, it was their first exposure to the EMAN concept. There were twelve representatives from British Columbia at the meeting, most with interests in the Georgia Basin (Appendix A). They represented provincial and federal governments, as well as universities. The meeting provided participants with the national vision of EMAN, as well as insights into how other regions in the country have begun to implement, or plan to implement, EMAN. Nodes presented tended to be significantly smaller than the Georgia Basin Node, and sites were frequently oriented around few issues.

The meeting was helpful in developing a framework and providing a common knowledge base for people across Canada and in British Columbia to develop their perceptions of EMAN and the associated implications of participating in such a network.

3.0 ECOSYSTEM COMPONENTS

The Georgia Basin Node was divided into five components of ecosystem research and monitoring for organizational purposes in the early phases of Node development. Specifically they are the Aquatic, Marine, Terrestrial, Climate and Air Quality Components, each with their own DOE coordinator. The Marine component was facilitated with the Department of Fisheries and Oceans. Each component was responsible for holding independent meetings to discuss such issues as current research and monitoring activities in the region, gaps in knowledge and criteria for site selection, the goal being to bring recommendations for EMAN enhancement sites to the Joint Component Meeting March 15, 1995.

The Component Coordinators are:

Aquatic	Colin Gray , Science Division (Regional EMAN Coordinator)
Marine	Lee Harding , Wildlife Ecology Division
	Bob Wilson , Institute of Ocean Sciences (DFO)
Terrestrial	Michael Dunn , Wildlife Ecology Division
Climate	Eric Taylor , Science Division
Air Quality	Bruce Thomson , Science Division

3.1 Component Meetings

3.1.1 Aquatic Component

The Aquatic Component met January 10, 1995 with the goals of increasing awareness of EMAN in the Georgia Basin aquatic research community, soliciting feedback on potential involvement by partners and beginning discussions on possible EMAN site locations. Participants related their research and intensive monitoring activities, and discussions of suitable locations for enhancement ensued. Because of impacts originating outside of the Georgia Basin, the Fraser River was considered unsuitable to include in the EMAN framework. It was agreed that the selection of terrestrial sites is likely more difficult than that of aquatic research sites due to the issue of land tenure. Also, since it is easier to incorporate the aquatic component into a terrestrial site than the reverse, emphasis should be placed on terrestrial rather than aquatic sites chosen at component meetings.

Following the meeting, a matrix was circulated to potential researchers in the Basin requesting information regarding research or intensive monitoring activities in defined habitats and habitat components. The completed matrix was used as the basis for a summary report of current aquatic research and monitoring activities in the Georgia Basin (Reis, 1995).

3.1.2 Climate and Air Quality Components

The Climate and Air Quality Components held a paired component meeting February 7, 1995 to assess current knowledge in the Georgia Basin and identify research and monitoring gaps. The workshop included an introduction to the EMAN concept and discussion about how the Air Quality and Climate components could work in the EMAN framework. The general consensus was that climate and air quality stations can be located in chosen EMAN sites which are convenient for other components with less flexibility regarding site selection and that climate and air quality research and monitoring efforts could be continued within the Basin at other sites. It was recommended to include an elevational transect of sites within the Basin to observe a gradient of effects of geography. A report has been generated containing further recommendations from this meeting (Faulkner *et al.*, 1995).

3.1.3 Terrestrial Component

The Terrestrial Component met March 1, 1995 to discuss criteria for site selection and to apply criteria to identified sites. These sites are on a computer database which can be queried by specified criteria. The majority of the workshop was spent discussing criteria. The validity of designing criteria to choose sites before selecting what ecosystem types and stressors were important to monitor and research was questioned. This led to the recognition that transects were the best method to evaluate climate change and air pollution stressors. In contrast, the urban sprawl stress did not seem amenable to the

single site approach of EMAN. The database and report produced are available (Tera Planning Ltd. and Jacqueline Booth & Associates, 1995).

3.1.4 Marine Component

The Marine Component of the Georgia Basin Node has been established as a subset of the Pacific Marine Ecozone Monitoring Network. Although this Network has existed since 1988, it has only become cohesive in the last two years. The First Annual Pacific Marine Ecozone Monitoring Workshop was held in February 1994, and the proceedings are available (Harding *et al.*, 1995). The second workshop will take place at the end of March 1995. Consequently, the marine component did not meet before the March 15 Joint Component Meeting. Sites proposed for EMAN enhancement have therefore not been formally evaluated by marine representatives other than at the March 15 meeting, and may be open to further discussion.

3.2 Joint Component Meeting

A Joint Component Meeting was held March 15, 1995 to bring together representatives from each of the five identified components to interact and discuss the sites to be recommended for EMAN enhancement. A list of participants can be found in Appendix B.

Tom Brydges (EMCO Director) attended the meeting and outlined EMAN's intentions. EMAN is to determine what is changing in Canada's ecosystems and why by attaining the following goals:

- define the effects of stresses on the Canadian environment;
- define ecosystem responses to control measures implemented as a result of particular environmental stressors;
- establish the scientific rationale for future policies supporting sustainable development;
- develop adaptation measures to compensate for unmanageable ecosystem stresses;
- provide an early warning system to identify new stresses on the environment; and
- provide the scientific rationale for development of indicators of environmental change.

By linking intensive research and monitoring sites across the country with extensive sites, it is expected that information gathered will help answer ecosystem-level questions. Although there are limited amounts of money available for clearing bottlenecks or enhancing existing infrastructures in order to achieve these goals, money is not available for funding research or initiating new sites. Partnerships are a necessity in such a network where no single agency has the mandate or the budget to monitor the entire ecosystem.

Part of the challenge when choosing sites is linking the various components. The Air Quality and Climate components link all ecosystem constituents, but it is also desirable to use streams or rivers to link the Terrestrial, Aquatic and Marine components. Not all sites will have all components represented.

Component leaders gave brief presentations of results of independent meetings and in some cases put forth recommended sites that were supported at their meetings. Many of these sites were also on the A list of sites to be recommended at the Joint Component Meeting. Sites recommended for evaluation at the Joint Component Meeting were developed from sites that were discussed at the Terrestrial and Aquatic meetings, as well as sites put forth by Marine Component representatives in absence of a prior EMAN component meeting. The Climate and Air Quality component groups evaluated the suggested A list of sites and recommended those that were appropriate for climate and air quality studies.

The A list of sites recommended for EMAN enhancement was made up of sites meeting most general criteria regarding land tenure, accessibility, ability to monitor more than one parameter, and existing research and monitoring history, while trying not to overlap similar sites. B list sites were considered less preferred than A list sites for one reason or another, but were not eliminated from being up-graded to A list sites given feedback by participants. The list of proposed sites was circulated prior to the meeting in order to obtain feedback for any additional sites or recategorization of sites. General criteria for site selection circulated prior to the meeting are in Appendix C.

The afternoon of the meeting was spent discussing A list sites and criteria for evaluation of site suitability. It was generally considered preferable in these early stages to focus our efforts on fewer rather than more sites in order to concentrate research and monitoring resources and hence establish a good example for developing future sites in the Georgia Basin. This means that the entire Georgia Basin will not be represented with the presently recommended sites.

Although there was not enough time at this meeting, it is important at some future point to establish the most effective procedure for formalizing partnerships at each site, at which time goals, objectives and deliverables for site activities can be developed.

4.0 RECOMMENDED SITES

Six land-based "A" list sites and sixteen land-based "B" list sites were put forward for consideration at the Joint Component Meeting. Three marine "A" list sites were put forward. Proposed A and B site lists (both land-based and marine) can be found in Appendix D. Due to time constraints at the meeting, only A list sites were discussed in any detail. Each site was discussed individually, and information was written on a blackboard as discussion took place. Once all A list sites were discussed, sites were evaluated and compared using the information on the blackboard.

There were no comprehensive ecosystem component monitoring or research projects at any of the sites. The potential for undertaking monitoring and research of structural and functional aspects of the ecosystem components at these sites varied depending on the breadth of habitats included at the site. In general, the monitoring taking place was of the structural type with little work on functional processes.

The criterion for choosing a site from the A list was a very practical one. Those candidate sites with more than two active monitoring and research programs were elevated to recommended status.

The following sites are being recommended for EMAN enhancement at this time. Note that this list is not in priority order and should be considered as a package.

4.1 Land-based Sites (see Appendix D for more details)

4.1.1 Saturna Island

This Gulf Island in the Strait of Georgia has the most comprehensive weather and air quality station in British Columbia. It is currently the only site in the province to have a Brewer Spectrophotometer which monitors stratospheric ozone and UVb. The island is also home to an ARNEWS/biomonitoring plot maintained by the Pacific Forestry Centre. There is an ecological reserve on this island, as well as on neighbouring islands, such that if it was deemed necessary to increase the size of the site to include local islands, secure nearby land is available.

4.1.2 Rocky Point/Mary Hill

Situated on Department of National Defense lands at the southern tip of Vancouver Island, Rocky Point/Mary Hill currently has several terrestrial studies in progress, including a Smithsonian Biodiversity Plot, a permanent migratory bird monitoring station and a unique forest canopy research on arthropods. There is active community involvement as well as post-secondary school and provincial and federal government partnerships. There has recently been approval to install a micro-climate station at this site. Although there is no air quality monitoring at the present time, Rocky Point would be a good site to determine the upwind characteristics of the air quality component of the ecosystem of the Georgia Basin. The marine site at Race Rocks is adjacent to Rocky Point.

4.1.3 Victoria Watershed

This land belongs to the Greater Victoria Water District and as such has extensive water quality data available. In addition, the Ministry of Environment, Lands and Parks monitor an "acid rain lake" in the watershed. The watershed is also the location of an ARNEWS/biomonitoring plot and a Chronosequence study, both of which are sponsored

and maintained by the Pacific Forestry Centre in Victoria. The Ministry of Environment, Lands and Parks presently monitors Old Wolf Lake for potential acid rain effects.

4.1.4 UBC Malcolm Knapp Research Forest or GVRD Seymour Watershed/Seymour Demonstration Forest

These sites are quite similar and only one need be enhanced at this time. Forestry Canada ARNEWS/biomonitoring plots can be found in both the Seymour Watershed (two) and the UBC Research Forest (one). Both sites have climate/weather stations and a history of research and monitoring activities. Seymour has a greater elevational gradient than the UBC Research Forest, but the Research Forest has more small lakes in its watershed. Jacobs (also called Marion) Lake in the UBC Research Forest was part of the network of lakes monitored by the Ministry of Environment, Lands and Parks for potential acid rain effects. The Seymour site is currently undergoing an extensive terrestrial inventory and has historical water quality information. Public access is controlled at the UBC Research Forest and Seymour Demonstration Forest and is forbidden at the Seymour Watershed.

4.2 Marine Sites

Due to time constraints, the following sites were not discussed in detail at the Second Annual Marine Ecosystem Monitoring Network Meeting.

4.2.1 Race Rocks/Chain Islands/Pedder Bay

This marine site covers a polygon at the southern tip of Vancouver Island in the Strait of Juan de Fuca. There is a permanent subtidal marine monitoring station using standard methods at Race Rocks off Rocky Point. Sea bird colonies on Chain Islands will be used to monitor marine contamination. Pollution effects of the ocean dump site off Victoria will be monitored. In addition, a long term climate record is available from lighthouse keeper data, although imminent automation may disrupt its continuity. The area is at high risk of contamination by oil spills which may be problematic for identifying subtle climate change effects.

4.2.2 Boundary Bay

The marine site at Boundary Bay provides a firm opportunity to enhance partnerships with American researchers. There is existing work carried out by the US National Ocean and Atmospheric Administration at this site, as well as data collected by the Puget Sound Water Quality Authority. Boundary Bay meets the international criteria for Ramsar site designation. The Fraser River Estuary Management Program, a multi-agency water quality program, also collects data from Boundary Bay annually. The site has potential to be linked to terrestrial systems in the future by developing a land-based EMAN site along a tributary to the Bay.

4.3 Potential EMAN Enhancement

4.3.1 Agassiz Agricultural Research Station

The Agassiz Agricultural Research Station supports the longest climate records in the province, having an operating station since 1889, and is therefore important for climate change research and monitoring in the Lower Fraser Valley. There are soil temperature records from 1892 which may contribute to soil ecology information. Agriculture Canada's Benchmark site is located nearby and there may be potential to combine information from the sites in the future. In addition, the habitat type represented by this site is lacking in the presently recommended list of sites. The current status of the Station is under review due to budget constraints and it is possible the site may be reduced to a substation of the Summerland Research Station.

4.3.2 Alaksen NWA

Although the existing infrastructure of the Canadian Wildlife Service is present at the Alaksen National Wildlife Area on Westham Island, there is not a critical mass of research and monitoring taking place for enhancement as an EMAN site at this time. It is possible and in fact desirable for this site to be enhanced at some time in the future as several issues and land types not represented in the current suite of sites recommended for EMAN enhancement can be addressed at this location. For example the long term quality of delta soils could be monitored here.

4.3.3 Southern Gulf Islands (Marine)

The southern Gulf Islands marine site may be too diffuse for immediate EMAN enhancement. The overwhelming effect of the Fraser River, considered too large to address in the EMAN context by the Aquatic component, may make this site difficult to link with other components. That is not to say it doesn't have merit on its own and may become enhanced in the future. There are currently shellfish monitoring and Puget Sound Water Quality Authority monitoring sites in the area.

4.3.4 Others

Many of the sites provided on the B list will likely become enhanced as EMAN sites in the future. It is important not only to analyze a site on its own, but also in the context of the network. This entails predicting how a site may contribute to gaps in knowledge not addressed at other sites or representative habitat types, or how it may help confirm information collected at other sites.

5.0 NEXT STEPS

Choosing sites for enhancement is the beginning of the EMAN process. A detailed site by site inventory of current research and monitoring activities and their objectives should be carried out along with an analysis of ecological components and processes which need to be addressed. Researchers at those sites must be brought together soon to discuss how their research and monitoring activities will contribute to EMAN and, more importantly to them, what they can gain from being a part of this network. One of the benefits could be the identification of needed infrastructure which could be considered for funding by EMAN directly or by its influence on other funding agencies. The formation of formal partnerships and corresponding site goals, objectives and deliverables should take place early in the site development process.

To facilitate these processes in the Georgia Basin effectively, there needs to be a person who can act as coordinator in a three-quarter to full time capacity. The position would be responsible for drafting goals, objectives and deliverables; identifying infrastructure requirements; producing and updating research and monitoring inventories; setting up meetings of site collaborators and semi-annual Georgia Basin Node meetings; and responding to EMCO as required.

Next steps at a glance:

- site by site inventory of current research and monitoring activities, including information such as projected length of studies and funding sources
- analysis of structural and functional aspects of the ecological components represented at these sites and which are amenable to monitoring
- decide between GVRD Seymour Watershed and Demonstration Forest or UBC Malcolm Knapp Research Forest for EMAN enhancement at this time
- identification of infrastructure needs
- site goals, objectives and deliverables
- provision of a coordinator
- review of the ecosystem types not represented by the present suite of sites
ex. estuaries, low altitude forest and agricultural areas

6.0 ACKNOWLEDGEMENTS

Colin Gray has been the guiding force for this project in British Columbia and the large amounts of time he afforded it and me are appreciated. Input from Michael Dunn, Lee Harding, Eric Taylor, Bruce Thomson and Bob Wilson in their roles as component coordinators, as well as feedback from Bill Taylor, has been very helpful. The beautiful maps of the Basin would not have seen the light of day without the extra efforts of Barry Watson in the Monitoring and Systems Branch.

Members of the Ecological Monitoring Coordinating Office were always available for consulting and I appreciate Tom Brydges for coming from Burlington to attend the Joint Component Meeting. Thanks are owed to the consultants who collected information and held workshops for the other components as many of their results were used in the formation of this report.

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Appendix A. British Columbia Participants at the EMAN National Meeting in Burlington, Ontario January 16-20, 1995.

British Columbia Participants at the National EMAN Meeting in Burlington, Ontario
January 16-20, 1995.

Trudy Chatwin	Wildlife Branch, Ministry of Environment, Lands and Parks
Michael Dunn	Environmental Conservation Branch, Department of Environment
Colin Gray	Environmental Conservation Branch, Department of Environment
Lee Harding	Environmental Conservation Branch, Department of Environment
David Hutchinson	Bamfield Marine Station
Peter Jackson	Department of Geography, University of Western Ontario, present on behalf of University of Northern British Columbia
Bruce Pendergast	Wildlife Branch, Ministry of Environment, Lands and Parks
Kelly Reis	Environmental Conservation Branch, Department of Environment
John Richardson	Department of Zoology, University of British Columbia and Westwater Research Centre
Risa Smith	State of Environment Reporting, Ministry of Environment, Lands and Parks
Eric Taylor	Environmental Conservation Branch, Department of Environment
Neville Winchester	Department of Biology, University of Victoria

Appendix B. Participants at the Georgia Basin Node Joint Component Meeting March 15, 1995.

Participants at the Georgia Basin Node Joint Component Meeting March 15, 1995.

Tom Brydges	Director, Ecological Monitoring Coordinating Office, DOE
Greg Chin	Regional Planner, BC Parks
Andy Derocher	Wildlife Ecologist, MoF
Michael Dunn	Ecosystems Conservation, Terrestrial Component Coord., DOE
Kat Enns	Plant Ecologist, Larkspur Biological Consultants
Colin Gray	Regional EMAN Coordinator, Aquatic Component Coord., DOE
Lee Harding	Ecosystems Health, Marine Component Coord., DOE
Elizabeth Kenney	Benchmark Site Manager, Soils Scientist, Agriculture Canada
Colin Levings	Estuary & Foreshore Research, DFO
Kelly Reis	Regional EMAN Assistant Coordinator, DOE
John Richardson	Aquatics, Westwater Research Centre & Zoology Dept., UBC
Hans Roemer	Ecological Reserves, BC Parks
Brian Smiley	Data Assessment, DFO
Julie Stewart Payne	Protected Areas Strategy, BC Parks
Bill Taylor	Climate, DOE
Eric Taylor	Climate, Climate Component Coord., DOE
Bruce Thomson	Air Quality, Air Quality Component Coord., DOE
Allan Van Sickle	ARNEWS Biomonitoring, Forestry Canada
Jane Watson	Marine Consultant at Race Rocks
Paul Whitfield	Monitoring & Systems, Hydrology & Water Quality, DOE
Neville Winchester	Arthropod biodiversity, Biology Dept., UVic

Appendix C. Site selection criteria sent to participants prior to March 15
Joint Component Meeting.

Site selection criteria sent to participants prior to March 15 Joint Component Meeting.

Criteria for Site Selection - For Discussion:

Ideal Site for EMAN:

- elevation variance (transect across elevation)
- all components (Terrestrial, Aquatic, Marine, Air Quality and Climate) represented
- a range of impacts (high, med, low) caused by a variety of identifiable sources (habitat change, contaminants, etc.)
- land tenure secure or controllable
- within driving distance of urban centres
- historical data available and current work taking place
- issues identified as important are suitable to be studied at site
- results “extrapolatable” to other parts of the Basin

Realistic Requirement for Site:

- land tenure secure or known
- results “extrapolatable” to some other part(s) of Basin, or representative of “edge” habitat
- impact level definable (for comparisons) - at least one impact level
- suitable for approaching at least one important issue, preferably more

Minimal Requirement For Site:

- land tenure secure or known
- results “extrapolatable” to another part of the Basin, or representative of “edge” habitat
- suitable for approaching at least one important issue

Appendix D. Proposed sites for discussion sent to participants prior to March 15 Joint Component Meeting.

Proposed sites for discussion sent to participants prior to March 15 Joint Component Meeting (includes some information added at the meeting).

Land-based A List Sites

- land tenure is secure in all of the following sites
- this set of sites allows for an east-west “transect”
- note that the GVRD Seymour Watershed and Demonstration Forest were elevated to the A list at the Joint Component Meeting, but are included on the B list here

Agassiz Agricultural Research Station (Agassiz) (Federal Department of Agriculture)

- longest climate record in the Basin (temperature and precipitation) (>100 yrs)
- soil temperature record
- solar radiation and evaporation information
- existing research and long term records
- existing infrastructure
- uncertain future; may become substation to Summerland Research Station

Alaksen NWA (Westham Island) (Department of Environment)

- marsh and salt marsh habitats monitoring (DOE)
- dyked farmlands, managed (DOE)
- migratory birds as indicators of climate change?
- although not currently present, would be good site for air quality station (some air quality data available)

Rocky Point/Church Hill (southern tip Vancouver Is.) (Department of National Defense)

- edge habitat (range boundary) - potential early indicator of climate change
- forest canopy arthropod research (UVic)
- application for remote climate station
- adjacent to marine study at Race Rocks
- Smithsonian biodiversity plot
- exotic species (broom) invasion
- although not currently present, would be good site for air quality station

Saturna Island (Department of Environment)

- ARNEWS/biomonitoring plot and forestry information (Forestry Canada)
- ecological reserve
- most comprehensive climate and air quality station in province (DOE)
- Canadian Air and Precipitation Monitoring Network (CAPMON) station (DOE)
- access may be difficult with ferry

UBC Malcolm Knapp Research Forest (Haney near Pitt Lake and Golden Ears Provincial Park) (University of British Columbia)

- ARNEWS/biomonitoring plot (Forestry Canada)
- history of research, although few long term continuous studies (UBC, etc.)
- existing infrastructure
- weather information available (UBC)
- acid rain lake monitoring at Jacobs/Marion Lake ended Jan/95 after 10 years data (MELP)
- moderate elevational variance

Victoria Watershed (west of Saanich Inlet) (Greater Victoria Water District)

- Chronosequence study in place (Forestry Canada)
- ARNEWS/biomonitoring plot (Forestry Canada)
- long term water quality information (GVWD)
- acid rain lake monitoring at Old Wolf Lake under threat of being discontinued after 10 years, data likely affected by logging in past (MELP)
- some amphibian work (UVic)
- exotic species (broom) invasion

Marine A List Sites (Marine B list sites not included)

- cooperators would include Washington State Puget Sound Water Quality Authority, US National Oceanographic and Atmospheric Administration, IOS, DOE, and FREMP

Boundary Bay

- existing studies, including NOAA Marine Environmental Quality Status and Trends Site
- Puget Sound Water Quality Authority and Fraser River Estuary Management Program data available
- soft, shallow bottom compared to other marine A list sites
- shorebird food web studies (DOE)

Race Rocks/Chain Islands/Pedder Bay (southern tip of Vancouver Island)

- long term climate record (lighthouse keepers) - will become automated
- at Race Rocks, permanent subtidal marine monitoring station (DFO, CWS and Pearson College using standard methods) and surface temperature time series (IOS)
- sea bird and cormorant colonies at Chain Islands - used to infer marine contamination (DOE)
- Race Rocks adjacent to Rocky Point terrestrial study

Southern Gulf Islands

- existing shellfish studies
- adjacent to climate/terrestrial studies on Saturna Island
- strong effect by Fraser River plume
- hard rocky substrate with swift currents - unlike Boundary Bay site

Land-based B List Sites**Lower Mainland** (south of Howe Sound)**Burnaby Lake Regional Park (GVRD)**

- existing studies, including BCIT and UBC
- large wetland
- exotic species (purple loosestrife)
- heavily used by public

Chilliwack River Watershed

- Pacific Giant Salamander (as sensitive species at edge of range)
- land tenure may be a problem - could investigate continuing lease of DND lands? (DND owns some lands)
- forest fragments
- agricultural and urban stressors

Little Campbell River

- drains to Boundary Bay, potential marine site
- some university work
- one stretch of river in park
- exotic species (purple loosestrife)
- fish hatchery
- stream flow data

Lynn Valley Headwaters Park (GVRD)

- old growth Coastal Douglas Fir
- amphibians and spotted owl sensitive species
- some studies

Pacific Spirit Park (GVRD)

- marine and terrestrial components possible
- great blue heron colony - toxic chemical monitor
- contains ecological reserve
- some studies in area
- heavily used by public

Serpentine Fen (WMA)

- marsh and salt marsh
- part manipulated, part natural
- farming stress
- Serpentine River: electronic stream flow and water quality instrumentation to be installed
- can follow effects to Mud Bay? (part of Boundary Bay)

GVRD Seymour Watershed and Demonstration Forest (North Vancouver)

- ARNEWS/biomonitoring plot
- existing studies, as well as intensive biodiversity, stream flow and water quality information
- weather station
- controlled access
- studies must be approved by GVRD

Surrey Bend/Douglas Island

- diversity of wetland types
- brings Fraser River into picture
- uncertain access and land tenure (proposed provincial park, currently privately owned)

“Upper Mainland” (north of Howe Sound)**Desolation Sound Marine Park**

- marine and terrestrial components possible
- mariculture a stress - could be biodiversity factor on west coast??
- few existing studies
- water access only

Garibaldi Provincial Park

- high elevation - measure early effects of climate change
- relatively northern site in southern dominated list
- public access not controlled - stressor on alpine and subalpine
- restoration in place - records and monitoring
- few existing studies

Okeover Inlet

- existing MELP investigations (watershed study)
- Marbled Murrelet study area
- part of Desolation Sound Marine Park
- may be difficult to access

Squamish River Watershed

- existing multi-agency investigations (MELP is lead) with community involvement
- Whistler development effects on water quality (MELP)

Vancouver Island**UBC Research Farm - Oyster River (near Courtenay)**

- existing research

Parksville/Qualicum WMA

- marine and terrestrial components possible
- waterfowl and fish studies
- biosphere reserve proposal
- encompasses Englishman River monitoring station that was managed by DFO

Qualicum NWA

- detailed vegetation and insect studies
- bird use over time
- tidal salt marsh

Strathcona Provincial Park (only part drains into Georgia Strait)

- high elevation (climate studies)
- mining and logging stresses
- relatively northern location
- few existing studies