Greater Vancouver Regional District

Watershed Management Plan

Prepared by the

Greater Vancouver Regional District

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Watershed Management Plan

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Greater Vancouver Regional District

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Purpose and Scope

This document is a management plan for the three watersheds from which the Greater Vancouver Regional District and its affiliate, the Greater Vancouver Water District supply water to their members. This Plan is consistent with the intent of the Crown leases providing a long-term source of water supply and will constitute the basis for more detailed watershed, five-year implementation plans as well as related activities such as the preparation of water use plans.

This Plan applies to both Crown and private lands held by the GVRD, that are on-drainage. The Lower Seymour Conservation Reserve (LSCR), is off-drainage and subject to a separate planning process. During the term of this Plan, the objectives for the Or Creek sub-watershed will be reviewed as the area is off-drainage and provides important fish habitat. In addition, the Grouse Mountain Recreation Area (GMRA) provides popular recreation facilities off-drainage and is not included in this Plan. The location of the GVRD's Capilano, Seymour and Coquitlam watersheds, as well as the LSCR, Or Creek sub-watershed and GMRA, are shown on Map 1.

The Plan is based upon the GVRD Board's overall vision statement, *Creating Our Future*, which states that "The purpose of Greater Vancouver's watersheds is to produce clean, safe water." It is also based upon the Board's regional growth strategy, the *Livable Region Strategic Plan*, which includes the watersheds in the regional Green Zone that is to be protected from urban development. These lands are included in the Green Zone because they are important to community health (water supply) and are ecologically important lands that are part of an integrated system of park/wilderness areas in the region.

This Plan is an integral part of the multiple barrier approach that minimizes the risk to drinking water. The multiple barrier approach includes steps to protect the water at the source and throughout the system to the consumer. GVRD's *Drinking Water Management Plan* is currently being developed to provide comprehensive long-term strategies for regional water supply.

GOAL

The Board's overall Goal in this Plan is **"Watersheds that provide clean, safe water and are managed and protected as natural assets of the highest importance to the Greater Vancouver region."**

PRINCIPLES

The management strategy for the watersheds will be based upon an ecologically sensitive and minimum intervention approach. The management strategies will be based on the five Principles endorsed by the GVRD Board in November 1999.

1. The primary purpose of Greater Vancouver's watersheds is to provide clean, safe water.

Managing the watersheds on a risk management approach is used to minimize risks to water quality. Water quality issues occasionally initiate in the watersheds from time-to-time that can only be resolved by water treatment and by temporarily isolating the degraded water supply from the distribution system by switching the water supply to a cleaner and safer source.

2. The watersheds will be managed to reflect and advance the region's commitment to the environmental stewardship and protection of those lands and their biological diversity.

As stated within the Green Zone Strategy Livable Region Strategic Plan, the watersheds provide an important opportunity for conserving lands in a natural state. Management strategies will promote forest conservation to maintain ecosystem integrity. Environmental stewardship initiatives will be undertaken to support fish, wildlife and biodiversity objectives.

3. The region's Management Plan will be based upon the minimum intervention absolutely necessary to achieve the Board's objectives.

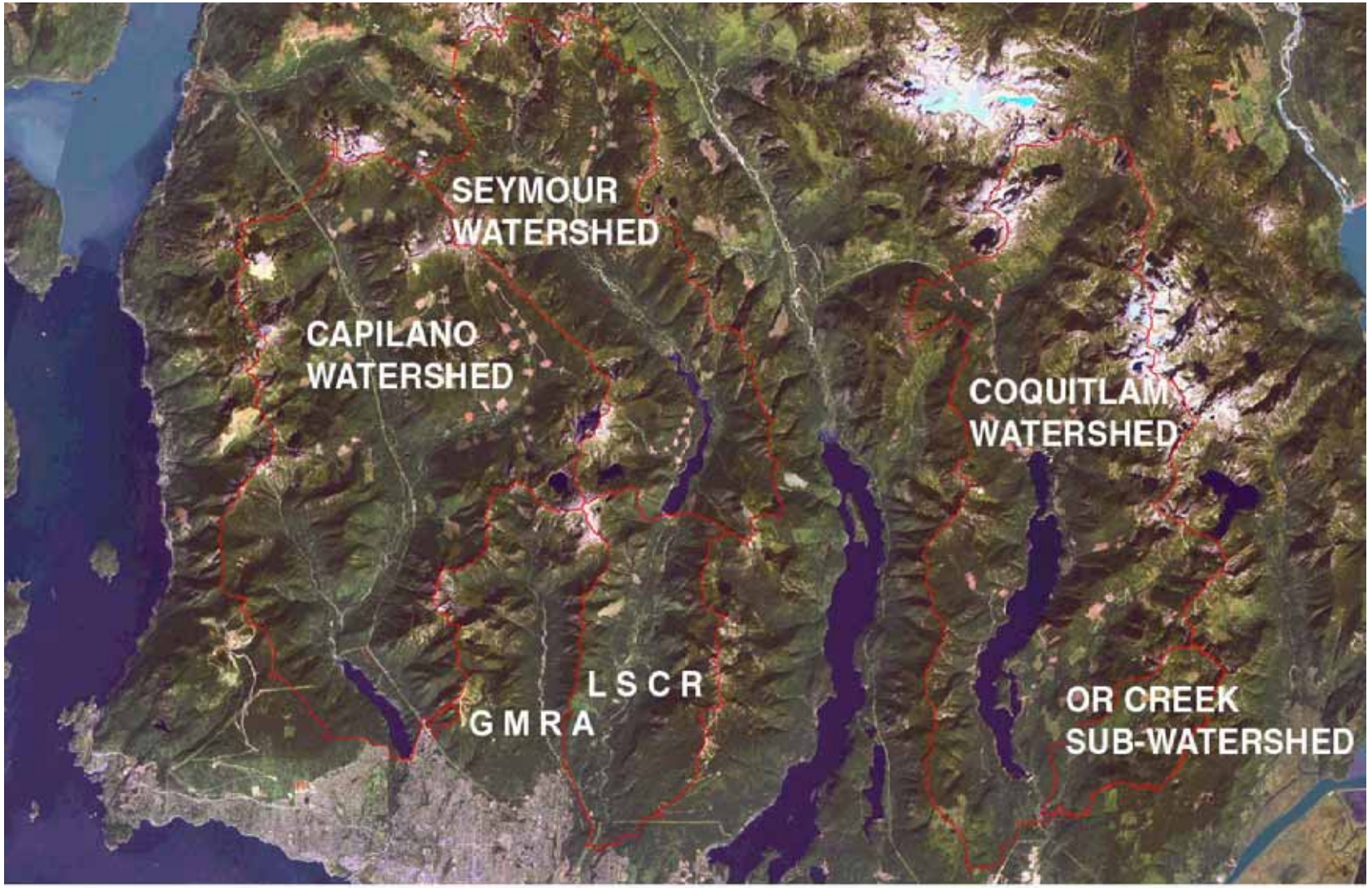
Minimum intervention is an effective means to manage the watershed. Strategies will focus on monitoring rather than intervention. Intervention strategies will only be prescribed after monitoring clearly identifies a need for intervention. Intervention will be continuously monitored to gauge the environmental performance of management activities. Knowledge gained from the monitoring will allow for adaptive management approaches to be implemented.

4. The Management Plan will contain policies to return areas disturbed by human activities as close as possible to the pre-disturbance state consistent with the primary goal of protecting water quality.

Disturbances in the watersheds initiated by human activities can result in impacts to water quality. Areas disturbed by human activities will be restored to their natural state where the disturbances are impacting water quality. Management activities will be based on approaches that mimic ecosystem processes.

5. The decision making process will be transparent and open to the public.

In addition to being involved in watershed management planning processes, the public will be invited to participate in community watershed stewardship initiatives. These will include the involvement of interest groups and education and research organizations to engage in activities such as monitoring programs. Information regarding the management activities will be widely available and openly discussed.



MAP 1: GREATER VANCOUVER WATERSHEDS

MANAGEMENT STRATEGIES

The five Principles allow natural processes to prevail to the greatest possible extent, given the overall Goal. The management strategies link the Goal and Principles to specific implementation programs. Monitoring of water and ecosystem processes will guide these management strategies.

1. Adaptive management

The GVRD will manage the watersheds through an adaptive approach, in which incremental steps will be taken and periodically assessed to ascertain whether they are consistent with the Goal and Principles of this Plan.

2. Water infrastructure development consistent with the Goal

In constructing works within the watersheds, the GVRD and other utilities (e.g. BC Hydro, Centra Gas) will have regard to the Goal and the Principles of this Plan.

3. Restoration of natural systems

The GVRD will, over time, re-establish the natural regimes that existed in the watersheds prior to their disturbance by human activity if the disturbance is impacting water quality, including watercourses, roads and cleared areas.

4. Support for natural processes consistent with water quality, safety and environmental quality

The GVRD will permit natural processes, such as forest succession, interactions of plants and animals, wildfires, and erosion, to take place without intervention unless these processes constitute a threat to water quality, public safety or the environment. These natural processes support biodiversity and provide for valuable ecosystem services.

5. Stewardship guided by research, monitoring and public involvement

The GVRD will continually develop and disseminate the body of knowledge about the watersheds and will engage the public in understanding the implications of this information for watershed management.

6. Cost-effective management

The GVRD will plan and implement its watershed management strategies and programs in a way that balances the achievement of the Goal with the financial constraints of the GVRD.

7. Co-ordinate with Provincial strategies and policies

The GVRD will consider legislation and policy in its planning and operations, and will meet or exceed applicable standards for maintaining ecosystems in the watersheds.

IMPLEMENTATION PROGRAMS

Palisade Lake – alpine reservoir

This strategic Plan will guide the direction of the watershed implementation programs. Programs will be conducted cautiously by utilizing adaptive management, risk assessment and ongoing monitoring to measure the consequences of the implementation program. This will ensure that appropriate management practices are continually employed and revised as necessary. Results of the implementation programs will be documented in an annual *state of the watershed* report.

1. Water Monitoring & Forecasting

Objective: *Verify that the watersheds will continue to provide an adequate supply of clean safe water for the water system.*

Water monitoring and forecasting will provide essential data to forecast water supply quantities. Currently the watersheds provide approximately 400 million cubic meters of drinking water to the region, which represents 21 percent of the mean annual inflow. Water quality is continuously assessed at various locations throughout the watersheds to evaluate the effectiveness of management strategies.

Seymour River – hydrometric Station

A series of weather, hydrometric, and sediment monitoring stations within the watersheds provide valuable information for watershed management decision-making. Weather stations measure rainfall and snow accumulations. The maintenance of long-term weather data is important to evaluate potential impacts from climate change. Hydrometric stations provide information on water inflow to the reservoirs, sediment input from various sub-drainages within the watersheds, and early warning of high turbidity events. Sediment stations characterize water quality conditions and assist in determining if mitigation measures are warranted. Periodic water samples from various locations in the watersheds are also analyzed for microorganisms that may provide risk to water quality.

2. Forest Ecosystem Management

Objective: *Minimize the amount of human induced disturbances to the forest ecosystem.*

The forest ecosystem will be conserved to ensure that the complexities, interactions and functions are sustained into the future that will maintain biodiversity and provide for ecosystem services. In addition, the forest ecosystem regulates runoff and minimizes soil erosion.

Conserving forest ecosystems throughout the watersheds supports the Green Zone Strategy, Livable Region Strategic Plan by maintaining important ecological functions for habitats and biodiversity. Other

watershed resources influenced by the forest ecosystems include aquatic ecosystems, fish, wildlife, sensitive areas and cultural sites. These stewardship values are important both regionally and provincially due to the protected or endangered designation of some of resources. As an example, these forest ecosystems are managed to a standard that exceeds the habitat objectives, as described in the *Spotted Owl Management Plan – Strategic Component.* Provincial fish and wildlife strategies will be implemented in appropriate implementation plans

The forests within the watersheds reflect a legacy of natural and human disturbances. Disturbances will be monitored as to their extent and impact to watershed resources. Ecosystem stressors and forest health will be monitored to provide early warning for assessment of whether any intervention is warranted. Pest management strategies will be coordinated with adjacent jurisdictions, including urban and recreation properties, and provincial forest and provincial park lands. The pest management implementation plan will consider appropriate integrated pest management strategies. For example, an appropriate strategy to maintain forest health is to conserve the complex interactions between organisms within the ecosystem. The need for intervention is not expected to be frequent and will consist of the following primary activities, among others:

Capilano Reservoir

- increase the level of monitoring of a potential disturbance;
- planting of deciduous and coniferous tree species to establish diverse healthy stands following a disturbance; and
- intensive insect trapping to control and monitor populations.

3. Fire Management

Objective: *Suppress wildfires only when and where necessary to ensure water quality, protect public safety and property, and maintain air quality.*

Although extensive wildfires are rare in the watershed, evidence exists of natural fires occurring in the warmer and drier zones located at low elevations in the watersheds. In contrast, the colder and wetter climatic zones located at higher elevations in the watersheds have minimal evidence of natural fires. The biogeoclimatic system of ecosystem classification characterizes this range in climatic conditions. The annual precipitation in the watersheds ranges from approximately 2000 mm to 5000 mm. Biogeoclimatic zones in the watersheds include Coastal Western Hemlock (CWH) Zone, Mountain Hemlock (MH) Zone and Alpine Tundra (AT) Zone representing regional climate and topographic conditions (see Map 2).

The consequences of wildfires in the drier zones include risks to water quality, public safety and property, and air quality. Wildfires in the higher elevation zones pose minimal risks to the public and air quality. The fire management program will utilize the ecosystem classification by applying the appropriate management activities to the various zones.

Fire management encompasses a range of public values while considering ecosystem processes. Wildfires are recognized to play a positive role in minimizing the impacts of larger fires, creating habitat and influencing forest health. When appropriate, natural occurring wildfires will not be suppressed during appropriate periods and in suitable zones within the watersheds.

The fire management program will consist of the following activities:

- calculation of fire weather indices and monitoring of ventilation indices;
- prevention and detection of fires;
- suppression of fires when and where appropriate, will rely more upon aerial attack rather than methods requiring road access;
- monitoring wildfire activity and any potential effect on water quality; and
- evaluation and development of fire management strategies.

Wildfires will be allowed to occur in suitable portions of the MH Zone during periods of appropriate fire weather and ventilation indices. The southern portions of the MH Zone that are adjacent to recreation facilities are not suitable for allowing wildfires to occur. Over the term of this Plan, information on fire behaviour in forest types located in the watersheds will be developed to move the management regime towards allowing wildfires to occur in selected portions of the CWH Zone, Montane Very Wet Maritime Variant, and in higher zones as shown on Map 2. Memorandums of Understanding will be developed with other agencies to coordinate effective implementation of the fire management program.

4. Erosion Control

Objective: *Minimize the impact of soil erosion on the quality of the water entering the water distribution system.*

Soil erosion occurs in the watersheds as a natural process and as a result of human disturbance. Sources of soil erosion are from landslides, stream banks and surface erosion, including some sources resulting from past harvesting and road construction. During winter storms, erosion of fine textured soils and organic matter may become suspended in the reservoir and impact water quality throughout the water supply system.

Analysis of water monitoring data will identify any need for erosion control to protect water quality. Erosion control projects will include the following activities:

- excavation of landslide deposits containing fine textured material that have the potential to be carried into the water supply reservoirs;
- stabilization of stream banks where appropriate to minimize the rate of bank erosion;
- decommissioning of roads

- re-vegetation of landslide scars, gully sidewalls and reservoir drawdown zones to minimize surface erosion; and
- evaluation and development of erosion control strategies.

Monitoring water quality and the rate of erosion after a project is completed will document its effectiveness.

5. Road Network

Objective: *Reduce the amount of roads in the watersheds to a level consistent with the Goal and Principles of this Plan.*

Much of the 300-kilometer road network in the watersheds is a legacy of the discontinued sustained yield logging program that started in the 1960's. Some of these roads exist on unstable terrain and require frequent maintenance. Portions of the road network are no longer necessary while the remaining are essential for vehicle access.

The long-term road network will comprise of essential roads providing vehicle access to:

Deactivated Road

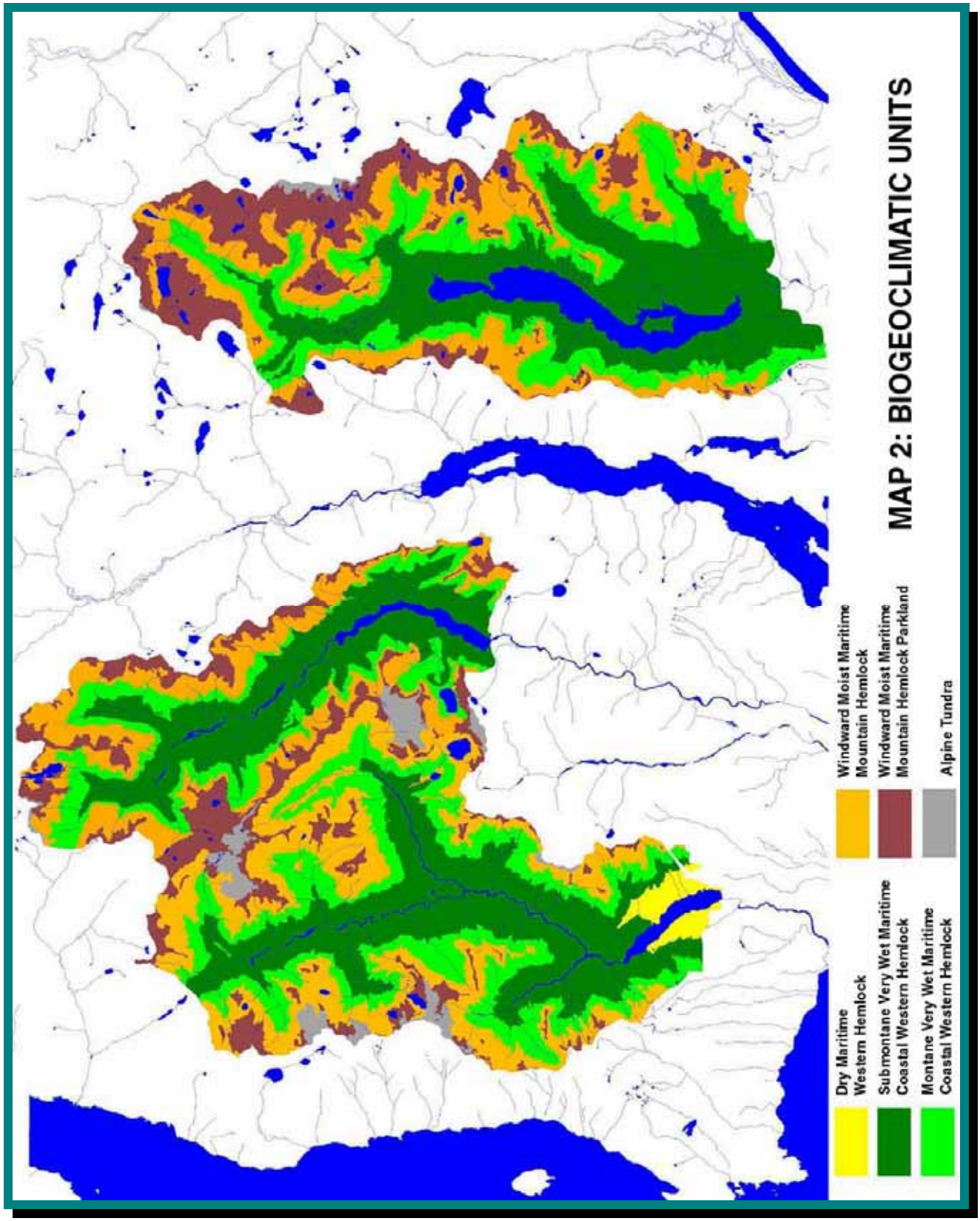
- water supply and water quality monitoring sites;
- site developments for water system infrastructure as described in Section 6-Water System Infrastructure;
- natural gas right-of-way and BC Hydro facilities in Coquitlam watershed; and
- search and rescue requirements adjacent to Cypress Bowl Provincial Park.

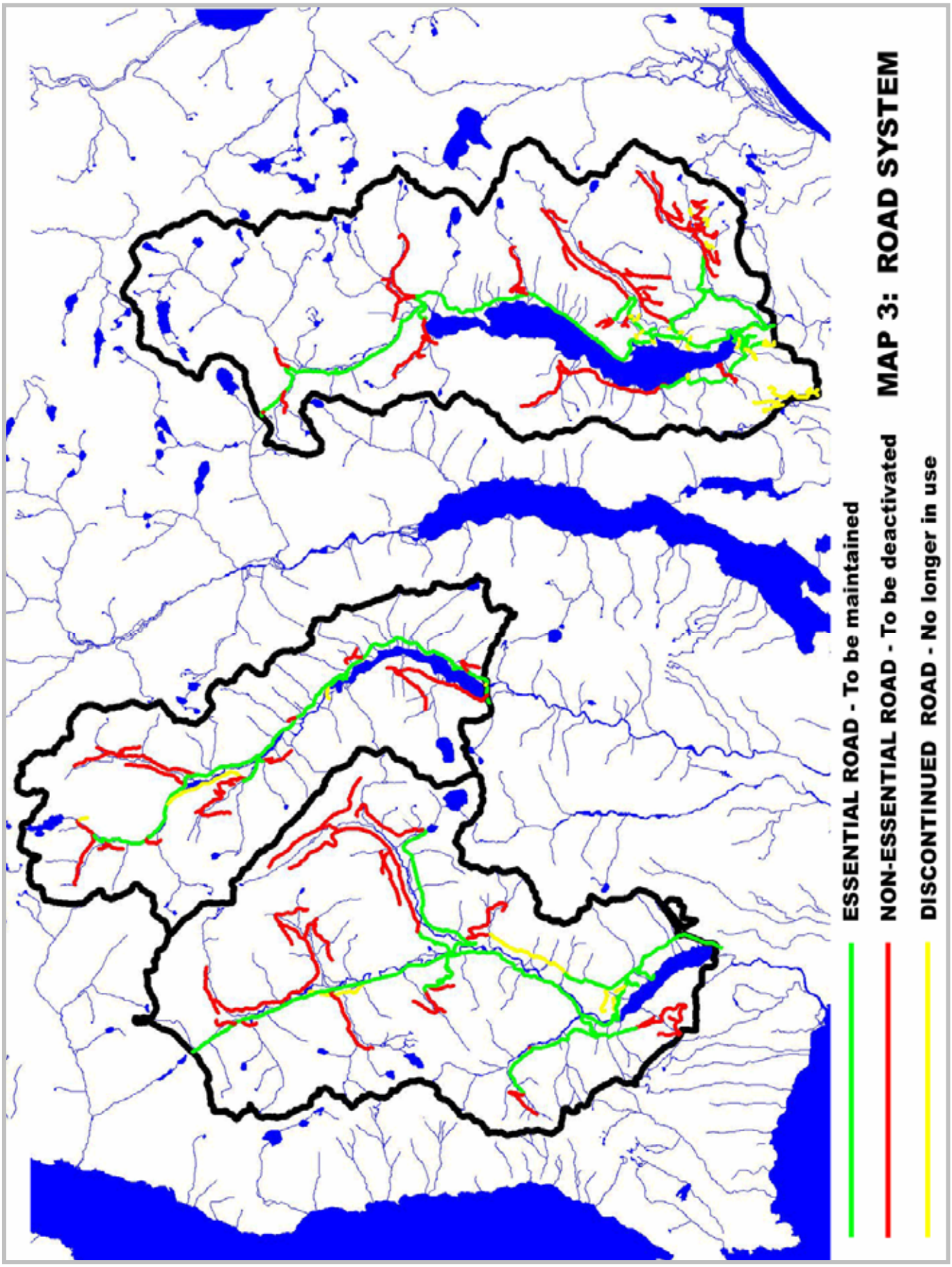
The road program is illustrated on Map 3 and will consist of the following:

Maintained Road

- Essential roads will be maintained to avoid the initiation of landslides and surface erosion.
- Non-essential roads will be deactivated to minimize sources of erosion and reduce long-term maintenance costs.
- Discontinued roads that are already overgrown with vegetation and may not require activity.

For both long-term essential roads and non-essential roads that will be deactivated, annual audits and monitoring will occur to ensure that risks to water quality are minimized while access to water supply infrastructure is maintained.


MAP 2: BIOGEOCLIMATIC UNITS
Windward Moist Maritime Mountain Hemlock
Windward Moist Maritime Mountain Hemlock Parkland
Alpine Tundra
Dry Maritime Western Hemlock
Submontane Very Wet Maritime Coastal Western Hemlock
Montane Very Wet Maritime Coastal Western Hemlock


MAP 3: ROAD SYSTEM
ESSENTIAL ROAD - To be maintained
NON-ESSENTIAL ROAD - To be deactivated
DISCONTINUED ROAD - No longer in use

Cleveland Dam

Seymour Falls Dam

Coquitlam Reservoir – wood debris removal

6. Water System Infrastructure

***Objective**: Provide infrastructure for the storage, transmission and treatment of the water supply while conserving watershed resources to the greatest extent possible.*

The water system infrastructure includes dams, reservoirs, water intakes, pipelines, water treatment facilities, buildings and roads as described in Section 5-Road Network. The dam and the reservoir in the Coquitlam watershed is the responsibility of BC Hydro. The development of infrastructure on watershed lands will be required to meet the overall Goal of providing clean, safe drinking water and is consistent with the guiding Principles of this Plan.

To support the maintenance and upgrade of the system infrastructure, areas within the watersheds may be used for the following activities:

- staging areas for the temporary and permanent storage of soils and construction materials;
- constructing dams, water intakes, pipelines, water treatment facilities, and buildings;
- seismic upgrading of the dams;
- utilization of aggregate and other mineral resources in a manner consistent with the Goal, Principles and Management Strategies; and
- providing road, helicopter and trail access to facilities.

Environmental and social values associated with the watershed resources will be considered when infrastructure within the watershed is developed for water supply purposes. As an example, no fuel will be stored on-drainage in the watershed and impacts to vegetation will be minimized when infrastructure is developed. In addition, planning of developments will utilize an Archeological Overview Assessment and conform to the regulations in the Heritage Conservation Act. All infrastructure works will be subject to full public and regulatory review.

7. Communication and Education

***Objective:** Develop and maintain confidence and trust that the GVRD is managing the watershed resources in an environmentally responsible and cost-efficient manner.*

The GVRD will disseminate information on the watershed management program and provide opportunities for the public to become involved in watershed stewardship initiatives. A variety of opportunities will be provided to facilitate public involvement in the management of the watersheds.

The communication and education program will include the following activities:

- public tours of the watersheds;
- public review and input on implementation plans;
- field trips for the public to view proposed management activities;
- participation of community watershed stewardship groups;
- guidelines to facilitate research in the watersheds; and
- a watershed data and information web site on the internet.
- GVRD education resources and programs.

8. Watershed Security

Objective: *Reduce the risk from microbiological or chemical contamination and the risk of fires by only allowing access to persons conducting activities previously authorized by the GVRD.*

Public access will be granted through watershed tours, academic projects and other initiatives pre-approved by the Board. Controlling access into the watershed is strongly supported through public opinion polls.

Security procedures are in place to minimize the risk of unauthorized entry into in the watersheds. The entrances to the watersheds are gated and each watershed is patrolled. Patrol persons provide a point of contact in the watersheds for emergencies, accidents and communication. Sanitary facilities will continue to be provided and maintained at all work sites in the watersheds.

9. Emergency Preparedness

Objective: *Execute an emergency management program to minimize potential threats involving the watersheds and adjacent lands.*

The emergency management program will be based upon a foundation of threat identification, risk assessment and impact analysis. For example, portions of the watersheds experience landslides and wildfires that have a range of potential consequences to public safety, water quality and water supply infrastructure. In addition, an emergency procedure is in place to respond to unauthorized activities. The foundation of the emergency management program will be site specific to reflect the geography, topography and land uses in and adjacent to each watershed. The emergency management program will include the following activities:

- produce a complete list of threats identified from potential hazards or perils;
- conduct risk analysis to determine the likelihood of an occurrence;

- complete an impact analysis to describe the consequence of any event occurring;
- develop a mitigation strategy to reduce the threat likelihood in a cost-efficient manner;
- increase the level of preparedness with contingency and response planning; and
- create a recovery plan to restore or continue the ability of the watersheds to meet their primary purpose.

PLANNING PROCESS

The watershed planning process involves the public, stakeholders, advisory committees, municipalities and government agencies. The watershed planning process will be on a recurring basis, with strategic plans prepared on a five year cycle and implementation plans prepared annually. Diagram A illustrates the planning process and the inter-relationship between the strategic planning and the implementation planning processes.

This strategic Plan will be reviewed and revised based upon the trends shown in the annual reports. The revision process will commence 18 months prior to the expiry of this Plan.

This strategic Plan forms an integral part of the Drinking Water Management Plan (DWMP) which is also expected to be revised on a five year cycle. The DWMP will provide long-range strategies for the entire drinking water system, from the water supply source to the municipal water distribution system.

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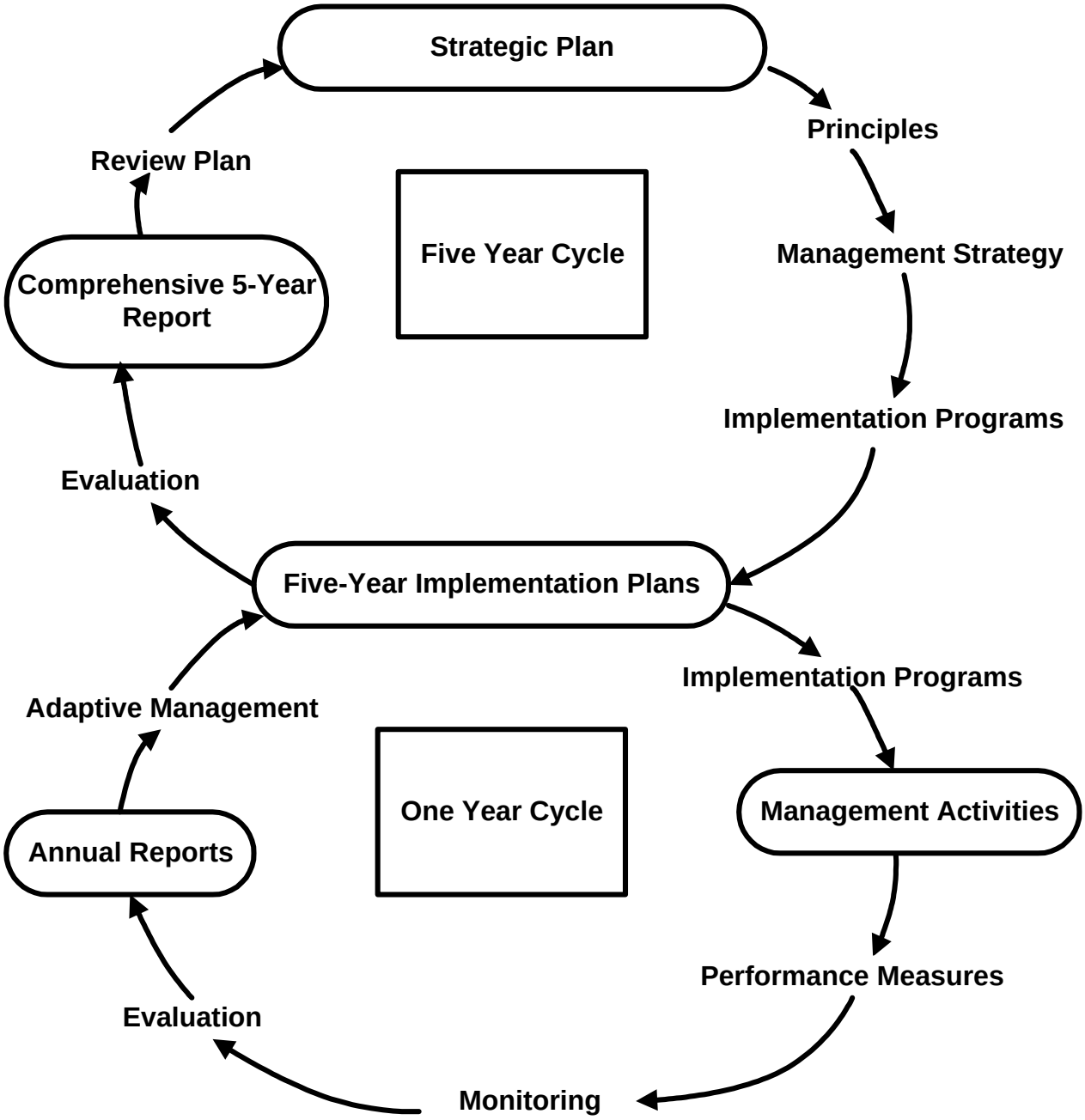
Diagram A: Watershed Planning Process



ADAPTIVE MANAGEMENT

The purpose of adaptive management is to develop improved techniques while conducting management activities, so the effectiveness and cost-efficiency will be improved for future activities. Watershed management contains a level of uncertainty due to the complex ecosystem processes within the watersheds and to climate change. Monitoring and documenting the state of the watersheds will allow for an adaptive management approach to watershed planning. The adaptive management approach to watershed planning will include the following steps:

- identify management issues by monitoring water quality and ecosystem disturbances;
- initiate an activity to resolve each issue identified as warranting treatment;
- treat the activity as a controlled experiment by monitoring and documenting the results; and
- revise the techniques used in future activities based upon knowledge gained from monitoring to improve the implementation of future activities.

FIVE-YEAR IMPLEMENTATION PLAN

During the period of this strategic Plan, five-year implementation plans will be produced to describe the proposed management activities for each of the implementation programs. The five-year implementation plan will provide the necessary guidance to ensure that management activities will be implemented reflecting the management strategies described in this strategic Plan.

The five-year implementation plan will be updated annually, to provide detailed maps and work schedules prioritizing the activities proposed for the next five years in the watersheds. Designs and prescriptions will be provided for the management activities proposed for implementation in each successive year. The five-year implementation plan will receive input from the public and advisory committees.

ANNUAL REPORT

An annual report will be prepared describing the state of the watersheds and providing documentation on the results of the various management activities in each implementation program. The annual report will summarize information identifying issues and will summarize the results of management activities that are designed to resolve issues in the watersheds. Every five years a comprehensive report will summarize trends and management activities associated with this Plan. The annual report will be prepared by staff with input provided by advisory groups and stakeholders. The annual report will be submitted to the GVRD Board.

GLOSSARY

Adaptive Management	Planning and management strategies are modified frequently through "learning from experiences" and new scientific findings, in response to changing social, environmental, and economic expectations and demands. The process requires constant monitoring and analysis of the results of past actions to lead to new approaches and innovative decision-making.
Management Practices	A system of methods, measures, or practices designed to reserve, restore, enhance, avoid, or minimize deterioration of aquatic and terrestrial resources. Management Practices can use soft (e.g. planning) or hard approaches (engineering techniques) to achieve goals and objectives.
Biodiversity	The diversity of plants and animals and other living organisms in all their forms and levels of organization, including the diversity of genes, species, ecosystems, and the evolutionary and functional processes that link them.
Biogeoclimatic Classification	An ecological system that utilizes climate, vegetation, topography and soils data to produce a classification of ecosystems.
Crown Leases	The District leases Crown lands from the Province for the purpose of water supply for a term of 999 years. The leases originate in 1927 for the Capilano and Seymour watersheds and 1942 for the Coquitlam watershed.
Deactivated	Roads no longer required may be re-contoured to the natural side slope, cross ditched and/or have culverts and bridges removed.
Drainage	On-drainage is used to distinguish those lands that drain into the three main water supply storage reservoirs. GVRD also has jurisdiction over several off-drainage areas that do not drain into the reservoirs.
Ecosystem	A spatially explicit unit of the environment that includes all organisms, along with all components of the abiotic environment within its boundaries.
Ecosystem Integrity	Maintaining the functionality of ecosystems and its components even if disturbed by human or natural causes.
Ecosystem Services	The services of ecological systems critical to the functioning of the Earth's life-support system that contribute directly and indirectly to human welfare. Examples of ecological services include pollination; air and water purification; climate modification; drought and flood control; cycling of nutrients; and habitat.

Ecosystem Stressors	A physical (e.g. drought), biological (e.g. insect outbreak), or chemical (e.g. acid rain) condition that negatively impacts ecosystems or its components.
Environmental Stewardship	Caring for and attending to the natural environment to ensure it is managed for future generations.
Erosion	Erosion of rock and soil generally occurring during storms with high precipitation. Examples of erosion include landslides, debris torrents, eroding stream banks and surface erosion.
Forest Health	Biotic and abiotic factors in the forest that are usually naturally occurring components of forest ecosystems. Biotic influences include fungi, insects, plants, other animals, bacteria and nematodes. Abiotic influences include frost, snow, fire, wind, drought, nutrients and human-caused injury.
Forest Succession	A forest develops overtime forming distinct growth stages (shrub/herb, young forest, old forest etc.) following a disturbance such as fire or landslide.
Hazard	A source of danger that could result in a consequence to the water system.
Integrated Pest Management	A decision making process that uses a combination of techniques to suppress pests and that must include but is not limited to the following: planning and managing ecosystems to prevent organisms from becoming pests; identifying potential pest problems; monitoring populations of pests and beneficial organisms, pest damage and environmental conditions; using injury thresholds in making treatment decisions; reducing pest populations to acceptable levels using a combination of methods; and evaluating the effectiveness of treatments.
Multiple Barrier Approach	A multiple barrier approach to minimize risks to drinking water includes; protecting the water source through a closed watershed; appropriate water treatment; trained certified water system operators; well-maintained and safe water distribution systems; and effective monitoring of water quality at each step from source to tap.
Peril	An immediate danger that could result in a serious consequence to the water system.
State of the Watershed	A report that provides a summary on the condition of the watershed, especially as it relates to water quality, ecosystem integrity, environmental stewardship, and public participation. The report outlines the results of watershed activities, documents natural and human disturbances, and identifies trends on the overall health of ecosystems.

Watershed Management Plan	The Watershed Management Plan is a strategic plan for the area contained within the Capilano, Seymour, and Coquitlam watersheds that are used for water supply purposes. The watershed is determined from the height of land that provides the drainage basin contributing water, organic matter, dissolved nutrients, and sediments to a network of streams flowing into the Capilano, Seymour, and Coquitlam reservoirs. The Watershed Management Plan provides management strategies to achieve measurable objectives that support GVRD's overall goal in this Watershed Management Plan is **"Watersheds that provide clean, safe water and are managed and protected as natural assets of the highest importance to the Greater Vancouver Region"**. The management strategies are based upon natural, human and management sciences.

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