Date: January 10, 2011

TO: **Board Members – Vancouver Park Board**
FROM: **General Manager – Parks and Recreation**
SUBJECT: **Stanley Park Ecological Action Plan**

RECOMMENDATION

A. That the Board approve the recommended actions identified in this report and summarized in Appendix E to improve the ecological integrity of Stanley Park in the following five priority areas of concern: Beaver Lake's rapid infilling; Lost Lagoon's water quality; invasive plant species; fragmentation of habitat; and Species of Significance.

B. That the Board approve a consultancy to develop a vision and implementation strategy for Beaver Lake in 2011 to ensure the lake's long-term viability, to be funded from the 2011 Capital Budget.

POLICY

The Park Board's Strategic Plan 2005 – 2010 includes five strategic directions, one of which is Greening the Park Board. The plan states that that the "preservation and enhancement of the natural environment is a core responsibility of the Park Board" and that the Board "will develop sustainable policies and practices that achieve environmental objectives while meeting the needs of the community". It includes actions relevant to the ecological integrity of Stanley Park, such as: advocate for a healthy urban environment, integrate sustainability concepts into the design, construction and maintenance of parks, preserve existing native habitat and vegetation and promote and improve natural environments.

The Stanley Park Forest Management Plan, approved on June 15, 2009, includes relevant Goals and Management Emphasis Areas. It identifies Wildlife Emphasis Areas, areas of the forest as having high importance to the ecological integrity of the park, and recommends facilitating projects that protect or enhance wildlife and their habitats.

In October 2009, the Greenest City Action Team released 'Vancouver 2020: A Bright Green Future', an action plan for becoming the world's greenest city by 2020. It identified ten long-term goals for environmental sustainability including increased access to nature. Under Restoring Ecological Services, it suggests the City should contribute to the protection and recovery of endangered species and ecosystems, the restoration and protection of wetlands, streams and riverbanks, and a program to monitor and control harmful invasive species.

BACKGROUND

On April 8, 2010, the Stanley Park Ecology Society (SPES) presented to the Planning and Environment Committee the report they authored entitled State of the Park Report for the Ecological Integrity of Stanley Park (SOPEI). The report is intended to serve as the sound basis for a future Stanley Park Stewardship Plan and provides a large step towards the long-term maintenance and restoration of the park's ecological health and diversity. The primary purposes of the SOPEI report are to: establish a framework to assess the ecological integrity of Stanley Park; provide a description of what is occurring in the park's major ecosystems and the potential stressors acting on them; and to identify gaps in ecological knowledge.

At that meeting, the Committee requested that the report be sent to the Board for information and that staff report back on short-term restoration and enhancement activities to benefit the ecological health and biodiversity of the park's ecosystems.

At the following Planning and Environment Committee meeting on May 6, 2010, staff was directed to form a working group in conjunction with SPES to prioritize identified options for action. Staff was also asked to report back on what would be required for the Park Board to create a stewardship plan for Stanley Park, including details on the timeline and cost.

Relevant directions from the State of the Park Report for the Ecological Integrity of Stanley Park, the 2005 – 2010 Strategic Plan and the Stanley Park Forest Management Plan (2009) are included in Appendix A.

DISCUSSION

Stewardship Plan for Stanley Park

A stewardship plan for the park would provide more comprehensive direction for the management of the park. It could largely be based on approved Park Board plans, e.g. the 2005 – 2010 Strategic Plan and the Forest Management Plan, but would likely also address a broader range of concerns such as heritage and architectural design. Staff will report back at a future Planning and Environment Committee meeting to more fully discuss with the Board its content and direction.

Priority Areas for Restoration and Enhancement Activities

The working group comprised of SPES representatives and Park Board staff identified five priority areas of concern for restoration and enhancement activities in Stanley Park:

A. Beaver Lake's rapid infilling;
B. Lost Lagoon's water quality;
C. invasive plant species;

D. fragmentation of habitat; and
E. Species of Significance.

Short- and long-term actions for each have been proposed within the context of the guiding principles laid out in the SOPEI report for the conservation of Stanley Park. These principles are based on the idea that protecting biodiversity and ecosystem integrity is fundamental to the long-term health and function of natural ecosystems and their associated communities. These principles and relevant Park Board directions are included in Appendix A.

A discussion of the problem and a remedial strategy with proposed actions for each of the five priority areas of concern follows. The first two projects, Beaver Lake and Lost Lagoon, will require major funding to be determined subsequent to recommended consultant studies. Estimated costs are included for the other actions requiring funding. No additional costs are identified for recommended policies or procedural changes. A consolidated list of all of these actions is included in Appendix E.

A. Beaver Lake's Rapid Infilling

A.1 The Problem

The rapid infilling of Beaver Lake was identified as a top priority for short-term restoration and enhancement. Studies have shown that the lake appears to be undergoing rapid infilling due to non-natural alterations to its watershed over the last century, such as logging, construction of roads, trails and the overflow weir, disruption to surrounding hydrology, and the introduction of invasive plant species, mainly fragrant water lilies.

Beaver Lake was originally a marshy pond whose water levels likely rose and fell seasonally and would have provided good habitat for ducks and other wetland animals harvested by local First Nations populations. The lake became a popular recreational area in 1911 after a perimeter trail and an outflow weir were built. The lake bottom was dredged in 1929 and over 100,000 m^3 of mud were removed. The construction of the Stanley Park causeway divided the watershed by half in 1938 and invasive water lilies were introduced the year before. These and other alterations to the watershed resulted in the surface area of the lake shrinking by over 40% from 6.7 ha to 3.9 ha between 1936 and 1997. Today, despite ongoing volunteer efforts to control invasive species, there is virtually no open water except where resident beavers have cleared the water lilies. Various studies have concluded that the water has become so low in oxygen and warm in the summer that it is no longer suitable for salmonids. Without the continued infusion of municipal water, the lake would dry up most summers to the obvious detriment of fish and other aquatic and riparian species.

At current rates of infill, there will be no open water within ten or twenty years. The large marshy portion presently covered with water during the wet season will soon evolve into a shrubby meadow similar to what is present at the south side of the lake and then continue to evolve into a wet forest similar to that growing on the outside of the paths

surrounding the lake. The small remnant bog on the south side of the lake is in danger of disappearing as it is already being invaded by forest plants and being degraded by unsanctioned access.

A more complete summary of the ecological issues facing Beaver Lake, studies cited and current management activities are included in Appendix B.

A.2 Remediation Strategy

The working group considered a number of options for Beaver Lake and was unanimous that allowing the lake to evolve into a shrub bog/forest would result in a considerable and unacceptable loss of biodiversity and aesthetic amenity. Park Board directions are to preserve existing native habitat and vegetation and to promote and improve natural environments, to not allow them to degrade and disappear. The Stanley Park Forest Management Plan specifically identified riparian areas and wetlands as having a particularly high value to wildlife and that protection and enhancement activities for them are to be given a higher level of consideration than in other areas of the forest. Beaver Lake is a much visited riparian and wetland feature unique to Stanley Park and in the City of Vancouver. Consequently, the option of "doing nothing" is counter to the Park Board's current Strategic Plan, the Forest Management Plan and the conclusions and concerns raised in the SOPEI report.

Dredging an appreciable portion of the lake to a prescribed depth would have the immediate effect of improving the aquatic habitat. The improvements to the lake done a century ago had the effect of providing decades of wildlife and aesthetic amenity; a similar or greater longevity of effectiveness could be expected again.

Modern hydraulic dredging technology employs a vacuum system which draws sludge from the bottom of a lake and pumps it through a series of filtration systems that separates out particulates and then sends back oxygen-enhanced water. Accumulated contaminants such as heavy metals can thereby be safely removed from the aquatic ecosystem. Although traditional scoop dredging may be preferred under some circumstances, hydraulic dredging has advantages such as greater flexibility, a large on-site presence of equipment is not required and particulates in suspension are not released back into the lake. The collected sediment can be used as an organic planting medium elsewhere within the park.

The City of Burnaby chose a hydraulic dredging system to deal with a sedimentation problem in the biologically sensitive Burnaby Lake, a situation similar to Beaver Lake. The working group investigated this project and found results are successfully meeting stringent environmental performance standards.

Beyond the technology, the greater challenge is to determine what interventions are required to allow for the long-term maintenance of the lake and its values while reducing the amount of municipal water required. These could include increasing the depth of the lake to thwart the spread of lilies and reduce the existing invasive aquatic plant species

with the help of staff and volunteer park stewards. The working group considered undertaking a consultancy to provide direction for Beaver Lake to be a top priority for funding in 2011. The results of this consultancy should, subsequent to public consultation, provide a vision of what the lake can and should be well into the next century. In the short-term, it will provide direction for both major and minor capital improvements in 2012 – 2014 and for continued stewardship activities in and around the lake.

Steps will have to be taken after dredging to slow renewed infilling of the lake, such as reducing the inflow of inorganic materials by possibly reducing the silt content of the trail screenings, moving trails, controlling access to sensitive habitat with boardwalks, paving trails and installing catch basins and sumps. The continued use of stewardship groups to manage areas of remnant exotic vegetation would also be warranted. Their attention would also be useful in the short term to ensure the viability of the existing bog, for example, the construction of a boardwalk and viewing platform to allow controlled access to this important ecological resource. These activities would be beneficial and should proceed regardless of other initiatives to restore the lake.

A.3 Proposed Actions for Beaver Lake

1. Undertake a consultancy to:

(a) conduct an assessment of Beaver Lake's environment including gathering any additional information that may be required (e.g. core sampling for accurate information on depth of deposits in the lake and inventory of wildlife resources);

(b) develop options for a public visioning process for the future of the lake to lead to its long-term viability (criteria should include biodiversity and aesthetic values as well as reducing reliance on potable water); and

(c) report back to the Board with a recommended vision and strategy for implementation.

Estimated budget: $100,000.

2. Commence implementation of the approved plan for the restoration of Beaver Lake, costs to be determined subsequent to the consultancy.

3. Update baseline of information on the Beaver Lake bog and monitor changes since the original survey as a first step to prevent the disappearance of the bog. Estimated budget: $5,000.

4. Install a boardwalk and viewing platform with signage to allow public access while reducing further damage to the bog from off-trail activities. Estimated budget: $42,000.

5. Restore the bog's size and habitat values by removing encroaching trees and transplanting bog plants into damaged areas. Estimated budget: $5,000.

6. Continue to maintain water levels in the lake with municipal water until alternative sources can be found.

7. Collaborate with SPES to develop a concurrent strategy for invasive plant species management during and following lake restoration.

8. Develop a maintenance strategy to control the rate of future infilling to ensure the retention of this valuable habitat and aesthetic resource.

B. Lost Lagoon's Water Quality

B.1 The Problem

Lost Lagoon is a shallow (1.2 m average depth) body of water with an area of 16 ha and a perimeter of 1.79 km. The lagoon was once a tidal mudflat open to the ocean but it was converted into a freshwater lake when a causeway was constructed in 1916 and municipal water was streamed in from an outflow valve located at the head of Ceperley Creek. A flap gate-control valve under the causeway is designed to let water out while preventing the inflow of salt water from Coal Harbour. Nonetheless, saline intrusions occur. The water in the lagoon is usually fresh but can sometimes be brackish or saline. While a lack of water in the summer is a concern, intense rainfalls or high tides can result in occasional flooding episodes in the winter months.

After taking a series of water depth measurements several years ago, Park Board maintenance staff concluded the lagoon may be showing signs of progressive infilling. This is due to runoff sediments and the build up of waterfowl fecal material. The decreasing water depth reduces water quality and disrupts biological processes on a microbial scale.

These factors have led to toxin-secreting algal blooms that further degrade water quality and threaten larger organisms. An unpleasant odour is given off at these times. The occasional incursions of salt water caused by malfunctions of the flap gate-control valve also exacerbate the aquatic ecosystem dysfunction. Trees and other adjacent plant life have been killed on occasion as a result.

An engineered wetland was constructed in the northeast corner of Lost Lagoon in 2001 as part of the storm water management plan for the Stanley Park Causeway to improve the quality of the roadway runoff prior to its discharge into Lost Lagoon. The wetland includes a forebay, biofiltration pond/marsh zone and bermed area and was planted with a variety of trees, shrubs and perennials.

Although the fountain, built in 1936 to celebrate the city's Golden Jubilee, positively contributes to aeration of the lagoon, it also increases evaporation.

A more complete summary of the water quality issues facing Lost Lagoon and current management activities is included in Appendix C.

B.2 Remediation Strategy

There are two general directions to deal with the low water quality and the resulting concern of unsustainable water use issues in Lost Lagoon. One is to continue with current practices which attempt to temper water quality problems through ongoing maintenance and minor interventions (e.g. flap gate maintenance, riparian planting, replacement of dead trees along the shore). The other option is to consider more dramatic interventions to improve water quality as well as aesthetic and habitat values and to reduce dependency on municipal water.

The working group proposes that proactive interventions, primarily identified through an engineering assessment of the lagoon, be undertaken in order to counter the consistently worsening water quality. Major interventions could include dredging the lagoon to increase water depth; construction of more sanctuary islands with shade trees and understorey planting for wildlife; increased edge vegetation cover and other riparian improvements; and capturing and directing more storm water from more sources into the lagoon via biofiltration ponds to increase flushing rate and frequency. In the short term, however, the sedimentation forebay of the biofiltration ponds, which opened in April 2001, should be cleaned out in 2011 and the water quality tested as this was intended to happen after ten years of operation. Analysis of the sediments and water quality should provide useful background information for the engineering assessment of Lost Lagoon proposed for funded in the 2012 – 2014 Capital Plan.

B.3 Proposed Actions for Lost Lagoon

1. Undertake a consultancy to:

(a) conduct an engineering assessment of Lost Lagoon, including information gathering (e.g. water quality parameters, bottom profile, etc);

(b) develop short-term options for remediation;

(c) develop longer-term options to lead to improved water quality, enhanced wildlife habitat and aesthetics, and reduced reliance on potable water (e.g. dredging, creating habitat islands, large-scale riparian restoration in disturbed areas and redirecting storm water from the West End and other sources into the lagoon); and

(d) report back to the Board with a recommended strategy and plan for implementation.

Estimated budget: $100,000.

2. Conduct required 10-year forebay sediment removal and water quality testing on the lagoon's existing biofiltration pond. Estimated budget: $8,500.

3. Undertake implementation of the approved plan to address the water quality of Lost Lagoon, costs to be determined subsequent to the consultancy.

4. Continue with short-term, on-going restoration of existing shoreline vegetation and other environmental improvements, such as removing invasive species (blackberries, yellow flag iris and morning glory) and planting new trees to replace aging and dying willows along the south shore. Estimated budget: $7,000.

5. Maintain the Jubilee Fountain and continue to maintain water levels in the lagoon in the interim using municipal water until alternatives can be found.

6. Develop protocols to prevent sedimentation into the lagoon from trail and road runoff and operational activities wherever possible.

C. Invasive Plant Species

C.1 The Problem

Invasive exotic plants are introduced species, typically far from their natural geographic range, that pose undesired or negative impacts on native biota and ecosystems, managed landscapes and/or human health. These species can spread quickly, grow rapidly, and thrive in their new environments, resulting in negative impacts to environmental, economic and social systems.

Invasive species are considered one of the greatest threats to biodiversity in the world today, second only to habitat loss. Many invasive plants are able to shade-out, smother and displace native plants that provide valuable habitat in our ecosystems. Some produce toxic substances that inhibit the growth of native species, while others are poisonous to local wildlife or humans. Others can cause damage to abiotic elements of an ecosystem, altering water flows, causing erosion, or increasing fire hazard.

Invasive plants causing these problems are all present in Stanley Park‘s forests. Stressors such as soil disturbance and climate change have further exacerbated their impacts. At least thirty-seven invasive plant species have become established in the park. The most potentially serious colonizers include fast-spreading and harmful plants such as Japanese knotweed, giant hogweed, purple loosestrife and English ivy.

Taking current as well as future conditions into consideration, a rigorous and adaptive invasive plant management plan is needed to ensure that the Stanley Park‘s ecological integrity is maintained. In 1998, the Park Board adopted a Volunteer Policy that describes the relationship between volunteer work and union work. Invasive plant pulling and monitoring in the park has been conducted within that policy since that time.

Methodology concerning the best management practices for the removal of invasive plants has been created and used by SPES Stewardship Programs and was adopted into the 2009 Stanley Park Forest Management Plan. SPES began removing English ivy from Stanley Park in 2004 and now works on over eleven different species. SPES is also conducting ongoing collaborative research projects in the park concerning the spread and impact of English ivy on native biodiversity. The Park Board provides ongoing ‘in kind’ support of SPES’s invasive species management programs.

Preliminary mapping surveys for all invasive plant species have been undertaken by SPES staff and volunteers in Stanley Park since 2007. Much of the data was collected by

volunteers trained in species identification as they walked all of the roads and trails in the park. Additional data was collected by SPES staff and a Park Board GIS technician working in the park during the 2007 – 2008 restoration. The cooperative relationship between the Park Board and SPES has been helpful in ensuring that the strategies are applied effectively.

Two weeds currently found in Stanley Park that have resisted all mechanical means of removal and are posing a risk for expansion and destruction of habitat are giant hogweed and Japanese knotweed. Giant hogweed is native to Asia and was likely introduced to North America as a horticultural oddity. Tenacious and invasive, it can rapidly grow to a height of 6 metres or more. Resembling the native cow parsnip, giant hogweed is not only invasive but also a concern for human health. The sap of the hogweed will sensitize skin to ultraviolet radiation which can result in severe burns and scarring. Controlling hogweed has proven difficult as the plant will readily re-grow unless all the root stock is removed.

Japanese knotweed, also native to Asia, is an escaped ornamental that will very aggressively take over a landscape. It will spread rapidly, out-competing all other plants by forming dense thickets and an extensive rhizome network. As a result, once this plant colonizes an area, it destroys the native habitat. In Stanley Park, knotweed has been aggressively moving into the blowdown areas and along trails and roadsides. While the knotweed stands found in the park are still young, they have resisted the various control measures applied to them and are now starting to spread even further. These control measures include: cut and cover techniques (where the plants were cut down and the root stock buried at least 0.6 m deep in wood chips, then covered with a landscape fabric), repetitive cutting, pulling and digging.

C.2 Remediation Strategy

As the management of invasive species is both an acute and ongoing problem, there are several options to address this problem in both the short and long term. In the short term, it is necessary to get the most threatening species under control and at the same time and for the long term, prevent the spread of existing species and the introduction of new species into the park.

Management of invasive plants should take a multi-pronged approach that recognizes the immediacy and extent of the treatment. While established plants like English ivy and blackberry can only be managed, some newly introduced and expanding plants, including knotweed, hogweed, loosestrife and lamium, should be eradicated quickly. Current manual control methods have proven to be ineffective for these latter species and if they are not controlled soon, the cost of their impacts will exponentially increase (refer to table on page 21 in the Forest Management Plan).

Chemical control, i.e. focussed stem injection, is considered the most effective way to control hogweed and knotweed in particular. Since they have resisted mechanical removal, the use of root crown/stem injections is proposed to control them. This would be a three-year program, where the herbicide glyphosate would be injected into the stems or

root crowns of hogweed and knotweed stands. The procedure would first involve cutting the stems down, then injecting the herbicide into the hollow chamber of the stem just below the first or second node. The treatment will likely need to be repeated for one to two years after the initial treatment to deal with dormant stands and the extensive rhizomes found below ground. This method has been used successfully in other jurisdictions, including Surrey, West Vancouver and Cypress Provincial Park, and since the herbicide is injected directly into the target plant, it poses little risk to the surrounding environment. To further prevent the possibility of exposure, the treated areas will be taped off and warning signs posted. While glyphosate is not on the City's permitted pesticides list, Section 2.10 of the Health By-Law (No. 9535) allows application of a pesticide to destroy a health hazard (hogweed) and a pest infestation that would damage property (a knotweed infestation will result in loss of wildlife habitat and park land).

Purchasing chemical control equipment for hogweed and knotweed in 2011 should be a priority to limit the spread of these species in the park as soon as possible. Purchasing the equipment for use by staff in Stanley Park and elsewhere in the park system is considered a much better investment than contracting this work; the capital cost is relatively low and follow-up monitoring and treatment especially in the second and third years will be required to ensure extermination.

Updating mapping of invasive species in Stanley Park should be a first priority for invasive species management to ensure effective ongoing management and monitoring of invasive controls and to evaluate the success of restoration programs. Operational systems need to be developed to allow consistent ongoing updating of mapping.

C.3 Proposed Actions for Invasive Plant Species

1. Purchase equipment to be used by staff in Stanley Park and elsewhere in the park system for chemical control (i.e. stem injection) of hogweed and knotweed. Estimated budget: $12,000.

2. Update mapping of invasive species in Stanley Park and develop operational systems to allow consistent updating of mapping to ensure effective ongoing management and monitoring of invasive controls and to evaluate the success of restoration programs. Estimated budget: $10,000.

3. Develop a program to increase awareness within Park Board staff, contractors and other park stakeholders (e.g. Stanley Park Horse Tours) about invasive plant management (e.g. information sessions, posters for break rooms and work sites, information sheets for contractors, etc). Estimated budget: $10,000.

4. Provide material support for SPES's efforts to control the majority of species (e.g. for English ivy, blackberry and loosestrife). Estimated budget: $10,000.

5. Use Best Management Practices outlined in the Forest Management Plan for the control of other invasive plants in the park.

D. Fragmentation of Habitat

D.1 The Problem

Habitat fragmentation has serious impacts on an ecosystem‘s functions and biodiversity. Intensification of land uses can divide large areas of habitat into smaller, isolated patches, which are then often subjected to high levels of disturbance from human activities. This is the case with the Stanley Park forest which has been dissected over time into dozens of small sections. The reduced size and increased isolation of forest patches can lead to decreases in many plant and animal species populations and affects the dispersal of seeds, movement of small mammals and breeding of forest birds. Other negative effects of fragmentation include changes in microclimate and species composition, loss of gene flow resulting in inbreeding, increased competition and predation, and degradation of the existing habitat due to edge effects and invasions of exotic species. The long-term viability and resilience of the remaining fragmented populations must be improved through the establishment of ecological connectivity, for example, creating corridors to support ecological flow by linking isolated habitat patches.

The most disruptive causes of ecosystem fragmentation in Stanley Park are the public throughways such as the causeway, the seawall and park roads and large expanses of lawns. Most of these park throughways are critical to the movement of people and goods, or are essential emergency/service access routes. There are ways, however, to create corridors or bypasses for wildlife and there may be some throughways that could be altered or even removed.

SPES surveys have determined freshwater courses are also wildlife corridors and were therefore recognized as being wildlife emphasis areas within the Forest Management Plan. These wildlife corridors are often pinched through narrow drain pipes unsuitable for wildlife movement and should be replaced with larger gauge culverts.

Cathedral Trail is a functional linkage to other trails that crosses a particularly beautiful and uniquely rich section of marshy forest. Its footprint upon the forest floor is significant as it represents a loss of a locally rare ecosystem. The December 2007 Restoration Progress Report indicated that a boardwalk would be built along portions of Cathedral Trail in 2008 to lighten its environmental impact but construction wasn’t undertaken.

Unofficial trails created mostly for the purposes of unsanctioned or illegal activities continue to pose a threat to habitat connectivity and forest health. They can have a negative effect on the less mobile but nonetheless important species of fauna and increase the risk of forest fire by inviting people away from patrolled areas. Bicycle use of unofficial trails is particularly damaging to the environment. Past attempts at closing such paths were not entirely successful but did help to curtail some damaging activity. If controls are not kept vigilant, then path making will continue to proliferate.

Park Board staff manage trail flooding by improving and cleaning drain pipes and try to close down unsanctioned BMX bicycle paths as they are constructed.

D.2 Remediation Strategy

The working group concluded that there are a number of actions that can contribute to alleviating the problems of habitat fragmentation.

Construction of approximately 130 m of raised boardwalk along Cathedral Trail and connecting to Rawlings Trail is proposed for construction in 2011 for environmental enhancement reasons, to restore the integrity of a divided wetland in this biologically rich section of forest. The approximately 50 m connection of Cathedral Trail to Rawlings Trail will enhance the ecology of this area but also improve pedestrian safety as the sightlines at the current access to Cathedral Trail at North Lagoon Drive are very poor. Approximately 100 m of existing gravel trail will be removed and the existing entrance to the trail at North Lagoon Drive will be closed off. Elevated boardwalks over habitat protect plants and wildlife from crushing human feet. They also help to keep park visitors on the path and to not venture into the fragile wetland habitat.

A program to replace existing undersized culverts beneath trails, especially to better accommodate all-season water courses, is also proposed to begin in 2011.

The north portion of Pipeline Road from the wood bridge to its northern terminus is no longer required for vehicular traffic. The North Pipeline road could be downgraded to trail status which would reduce the level of fragmentation in this area of the park while still allowing access to services. Eagle Trail could become obsolete and decommissioned completely, presenting an opportunity for reforestation and increased connectivity.

D.3 Proposed Actions for Fragmentation of Habitat

1. Remove a gravel section of Cathedral Trail and reconstruct it with a raised boardwalk connecting to Rawlings Trail for environmental enhancement and improved pedestrian safety. Estimated budget: $90,000.

2. Replace fifty existing undersized culverts beneath trails, especially for those accommodating all-season water courses, with culverts large enough to better facilitate the flows of both water and wildlife. Estimated budget: $25,000.

3. Increase vigilance against off-trail bicycle usage and introduce bicycle barriers at the heads of minor official trails where erosion or other environmental impacts are occurring in particularly sensitive habitats (e.g. North Creek Trail).

4. Obstruct unofficial trails with fallen trees in conjunction with forest stand thinning operations and as part of routine forest maintenance.

5. Report back on downgrading North Pipeline Road to trail status, potentially using dredged materials from other projects in the park for planting medium.

E. Species of Special Significance in Stanley Park

E.1 The Problem

Several Species of Significance in Stanley Park are of particular concern because they are protected by law and/or because they are of special importance as features of Stanley Park's natural heritage. Other than the great blue heron colony and bald eagle nests in the park, these species are not afforded any particular management objectives or special protection by the Park Board. These species not only contribute to the park's rich but declining biodiversity but also enhance the visitor experience and are essential to the overall ecological health of the park and, in some cases, the greater city. These species, which should be recognised as having special significance in Stanley Park, include the following groups:

1. Species at Risk;
2. keystone species;
3. nesting bald eagles;
4. locally declining species; and
5. migrating birds.

There is confusion around responsibility for and how wildlife is managed in Stanley Park and other areas of the park system. In 1996, the roles and responsibilities of the Park Board concerning urban wildlife issues were outlined in the Wildlife in the City report which included a discussion of responsibilities for inventory and monitoring, problem wildlife control, emergency response, habitat enhancement and research.

Some areas were addressed following the release of this report but in recent years many issues have ceased to be recognised or addressed formally by Park Board staff. SPES is currently trying to maintain some of the roles with some support from Park Board staff, Park Rangers deal with some emergency response in the summer months, and the Park Board has maintained funding and support for problem wildlife initiatives such as the Canada goose egg addling and Co-Existing with Coyotes programs. However, no one with specific expertise in wildlife management is designated to address issues that arise, such as media concerns or oil spill response, and there is little inventory, monitoring, research or habitat enhancement outside of Stanley Park. With increasing wildlife and human populations in the city and the retirement of the key wildlife staff within the Park Board, there is an increased need to address these issues.

A complete description of each group of species having special significance in Stanley Park and current management activities can be found in Appendix D.

E.2 Remediation Strategy

The working group determined that the best way to respond to the issue of Species of Significance was through the development and application of Best Management Practices

guidelines for each group of species and for all Species at Risk that are commonly using the park. An example of a Best Management Practice is included in Appendix D.

The need to clarify responsibilities around wildlife management in the park was also identified, especially the need for a co-ordinated, one point of contact approach for the public and staff.

E.3 Proposed Actions for Species of Special Significance

1. Produce Best Management Practices for each group of Species of Significance to be written in collaboration by Park Board and SPES staff. Estimated budget: $10,000.

2. Develop a program to increase awareness within Park Board staff and contractors to prevent often unintentional harmful behaviours (e.g. information sessions, posters for break rooms and work sites) and to integrate Best Management Practices into operations (e.g. information sheets for contractors, etc). Estimated budget: $5,000.

3. Review and report back on the roles and responsibilities of the Park Board in wildlife management.

FUNDING

Staff recommends that a consultancy for environmental assessment and development of options for Beaver Lake be a first priority in 2011 to ensure the lake's long-term viability, to be funded from the 2011 Capital Budget. Some of the other recommended actions will also be undertaken in 2011 as funds are available in the 2011 Capital Budget. Staff will include other actions in a Stanley Park submission to the 2012-2014 Capital Plan. Staff will also pursue any additional funding that may be available from other levels of government or other agencies. A consolidated list of recommended actions is included in Appendix E.

SUMMARY

This report recommends that the Board approve the actions identified in this report and summarized in Appendix E to improve the ecological integrity of Stanley Park in the following five priority areas of concern: Beaver Lake's rapid infilling; Lost Lagoon's water quality; invasive plant species; fragmentation of habitat; and Species of Significance and that a consultancy for an environmental assessment and development of options for Beaver Lake to ensure its long-term viability be undertaken in 2011.

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AD/ad

Appendix A

Relevant Directions from the State of the Park Report for the Ecological Integrity of Stanley Park; the 2005 – 2010 Strategic Plan; and, the Stanley Park Forest Management Plan (2009)

Stanley Park Ecology Society (from the State of the Park Report for the Ecological Integrity of Stanley Park)

"SPES believes that ecological sustainability should be a fundamental objective of the management of Stanley Park. The planning and implementation of management practices in accordance with the following guiding principles will help ensure the future ecological viability of Stanley Park's remaining temperate rainforest and the species that depend on it. These principles are based on the idea that protecting biodiversity and ecosystem integrity is fundamental to the long-term health and function of natural ecosystems and their associated communities".

Guiding Principles for the Conservation of Stanley Park (Summary):

- Assess and protect existing native habitat
- Protect native biodiversity and the ecological health of the park
- Designate key areas of ecological significance and allocate specific best management practice objectives for each.
- Adopt the 'precautionary principle' in the face of proposed developments in the park, favouring conservation as the first priority even when there is no known proof of negative consequences to the park's ecological health from those developments.
- Adopt and implement a policy of "No Net Loss" of native species habitat
- Provide for the long-term protection of natural areas in the park with decision-making and ongoing monitoring to track ecological trends

Vancouver Park Board

Applicable 'Actions' in the 2005 – 2010 Park Board Strategic Plan

- "Preserve existing native habitat and vegetation"
- "Strengthen and expend natural park environments: local wildlife, storm water management, native biodiversity"
- "Train staff in sustainable maintenance and environmental best management practices"
- "Promote and improve natural environments in the city through partnerships and public education programs"
- "Provide a forum for information on urban wildlife"

Applicable Sections of the Stanley Park Forest Management Plan

"There is an increased global understanding of the importance of all organisms and processes within a forest, not only its trees. The Stanley Park Ecology Society has been leading monitoring programs that continue to yield informative local results. This new information can be infused into forest management decision making activities in order to offer improved protection and enhancement strategies for all the [native] forest flora and fauna."

(Applicable) Goals of the Stanley Park Forest Management Plan:

- Maintain the conditions that foster a resilient forest with a diversity of native tree and other species and habitats within the forest
- Protect the forest from large disturbances or from ecological threats
- Manage the forest in such a way that wildlife species and their habitats are protected or enhanced
- To provide a legacy of maps, data, and information that will form a baseline of ecosystem monitoring and public education

Management Emphasis Areas:

Management Emphasis Areas (MEAs) are those sites where park usage patterns, distinctive work environments, or ecological preconditions suggest that a similar emphasis be placed upon management objectives. The objectives do not exclude each other, but can act to guide decision making. They may utilize unique sets of work practices or restrictions, or may be used to set activity priorities.

Wildlife MEAs: Riparian areas and wetlands, bogs, forest edges, deciduous stands, bluffs, veteran trees, and ephemeral raptor nesting trees have been identified as having a particularly high value to wildlife. Protection and enhancement activities are given a higher level of consideration than in other areas of the forest.

Appendix B

Background on Beaver Lake Rapid Infilling

Beaver Lake is a small body of water located in the centre of Stanley Park with a surface area of 3.95 ha and a maximum depth of 1.5 m (Hatfield, 1985). The Beaver Lake watershed is the largest in the park, draining an area of approximately 112 ha of mainly coniferous forest with a total stream channel length of 1.9 km (Kerr et al. 1999) including tributaries (North Creek and several unnamed creeks). The lake is drained by Beaver Creek into Burrard Inlet (Kerr et al. 1999).

Beaver Lake is undergoing rapid infilling due to alterations to the watershed, primarily construction of the Stanley Park Causeway in 1938 and the introduction of invasive plant species, primarily fragrant water lilies (*Nymphaea odorata*) but also yellow flag iris and purple loosestrife. Other alterations to the watershed included clear-cut logging which was undertaken on the south side of the lake down to Lost Lagoon in the 1860s, construction of a perimeter trail and outflow weir in 1911, introduction of a fish hatchery in 1916 and removal of 50% of the alder trees from the area south of Beaver Lake in the 1980s (Beese, 1989b).

These alterations have resulted in the overall shrinking of the lake from 6.7 ha recorded in 1938 (Steele, 1988) to 3.9 ha in 1997 (Stewart, 1997). The extent of water lilies is reported to have grown from 50% of the lake in 1984 (Hatfield, 1985) to 70% in 1999 (Kim et al., 1999). The surface area of the lake is now almost entirely covered in vegetation in the summer months except for a few small areas including the open water in front of the outflow weir which is kept open by resident beavers. No measures have been taken to increase the size or depth of the lake since 1929.

In 1984, initial studies were completed on the lake and its associated creeks by Hatfield Consultants Ltd. for the Vancouver Park Board and the Department of Fisheries and Oceans. The study was done to determine the technical and economic feasibility of enhancement opportunities. Several significant findings included:

- The maximum depth of the lake was 2 m, but 80-90% of the lake was less than 0.5 m deep.
- Through probing studies it was found that sediments were up to 4 m deep but ranged from 3 to 4 m over 75% of the basin.
- From pollen analysis the rate of sedimentation was found to be roughly 1.36 cm/year, which would result in a 36.8 year expected lifespan of the lake having open water.
- The increasing sedimentation was said to result in the water being very warm in the summer and low in oxygen to the point that it was unsuitable for salmonids. It was estimated that the lake would fill in by 2020.

- The study recommended, among other things, the dredging of at least half of the lake to improve water quality and habitat for fish.

A comprehensive study of the Beaver Lake watershed was undertaken in 1999 by students from UBC's Environmental Sciences program (Zimmermann et al. 1999). The detailed report looked at the sedimentation, ecology, and hydrology of the system and used modelling to predict trends and outcomes. Their major findings included:

- The natural seasonal fluctuations of Beaver Lake are eliminated due to the municipal water supply inflow. Without this water source, the lake would lower in the summer months and Beaver Creek would essentially dry up. This would negatively impact fish species (due to decreased oxygen and increased temperatures) and increase the infilling of the lake from terrestrial plant species.
- The sedimentation rates found were not comparable to those in the Hatfield study's findings, but they concluded their rates were more accurate than Hatfield's because they had ensured that the cores were taken from areas of the lake that were never dredged.
- The sediments found were 40% organic and 60% inorganic, and the inorganic sediments had increased by 160 times the amount present prior to the building of roads and trails in the watershed. This is compared to an increase of only 10 times the amount of organic sediments since the introduction of invasive water lilies, leading them to believe that inorganic sedimentation was a greater concern. They recommended not dredging the lake to reduce the infilling process but instead trying to reduce the rate of inorganic sedimentation by altering the trail materials or creating settling ponds.

The Beaver Lake Environmental Enhancement Project (BLEEP) was formed in 1996 as a multi-agency action group including representatives of the Vancouver Park Board, SPES, the Vancouver Aquarium, the Department of Fisheries and Oceans, local universities and other interested parties. The group made recommendations to the Park Board about potential restoration opportunities, created awareness in the community and conducted studies around Beaver Lake. Following the creation of BLEEP, several actions were undertaken. The most significant was the enhancement of Beaver Creek for salmonid spawning and rearing habitat.

Current Management Activities

SPES has ongoing programs for riparian habitat restoration and enhancements, invasive species management (purple loosestrife and iris seed pod removal), and wildlife and habitat monitoring. Park Board enhances summer water levels by introducing municipal water and has prevented the beavers from flooding the trail by installing a subsurface bypass pipe. The beavers are assisting this work by continually digging up sediment and placing it over the outflow grate in an attempt to raise water levels. Staff remove this debris on a regular basis.

Appendix C

Background on Lost Lagoon Poor Water Quality

Lost Lagoon is a shallow (1.2 m average depth) body of water with an area of 16 ha and a perimeter of 1.79 km. The Lagoon was once an arm of the sea and was artificially turned into a lake with the construction of the causeway in 1916. It was envisioned the lagoon would support a sport fishery of trout and salmon. The limited natural freshwater drainage into Lost Lagoon could not maintain it as a freshwater lake so freshwater is added from a municipal water source in Ceperley Meadows at a rate of 466 litres per minute. A flap gate-control valve under the causeway is designed to let water out while preventing the inflow of salt water from Coal Harbour (Coast River, 1995). Nonetheless, saline intrusions occur and although the water in the lagoon is usually fresh it can sometimes become brackish or saline.

After taking a series of water depth measurements several years ago, Park Board maintenance staff concluded the lagoon may be showing signs of progressive infilling (Eric Meagher, pers. comm.). This may be due to runoff sediments and the build up of fecal material from the presence of large numbers of waterfowl in the lagoon. The decrease in the depth of a water body may alter its physical and chemical characteristics (including increasing temperature and decreasing dissolved oxygen) and thus affect the distribution, growth and reproduction of many aquatic organisms.

A large number of introduced carp died in 1994 as a result of sea water entering the lagoon due to a malfunction in the Coal Harbour control valve. Subsequently, a water quality test and proposal for an ongoing monitoring program was submitted to the Stanley Park Zoo the same year (EVS, 1994). The study by EVS Environmental Consultants showed that in late July the dissolved oxygen content decreased between the lagoon's inflow (11.2 mg/L; 12 °C) and outflow (6 mg/L; 23 °C). The lowest level of dissolved oxygen was only marginally lower than that generally recommended for freshwater aquatic life. A monitoring proposal was submitted to the Park Board because the recent die-offs of fish in the lagoon had caused concern for Park Board wildlife staff but also for other water quality concerns, including:

- incidents of algal blooms likely associated with poor water quality;
- frequency of salt water incursions;
- possible point sources of contamination from undocumented storm sewers; and
- recent evidence of plant die-off around the margins of the lagoon and of severe stress in willow trees and various types of bushes.

EVS also recommended the implementation of a water quality monitoring program but it was not implemented due to financial constraints.

Students of Capilano College's Environmental Science and Management Program undertook studies for SPES and the Park Board in February and March, 2004 which

focused on Lost Lagoon. The main results of these studies were as follows (Brown, 2004):

- The lagoon seems to be turning moderately eutrophic (nutrient rich) and shallower over time and those trends are likely to continue.
- The lagoon‘s natural water supply is not sufficient to maintain the water level during the summer noting the Park Board regularly provides supplementary municipal water.
- The aquatic vegetation within the lagoon is very limited, and wetlands around the lagoon are quite restricted; the stone walls and rip rap areas at the water’s edge contribute to these conditions.
- The terrestrial vegetation around Lost Lagoon is also very limited but is ecologically important and sensitive to further disturbance; the best of the terrestrial habitat, at the southwest end of the lagoon, is deteriorating due to multiple informal paths and the presence of the invasive plant Himalayan blackberry.

Another water quality test at Lost Lagoon conducted in 2004 gave some insight into the levels of bacteria in the water at that time. ALS Environmental found high levels of fecal conliform including E. Coli bacteria. Although the effects of the high concentration of coliform bacteria in the lagoon on wildlife are not well understood, there have been several deaths of wildlife that may have been caused by contamination. Necropsies of deceased mute swans and cygnets in recent years have shown very high levels of E. coli, aeromonas and streptococcus. One cygnet is presumed to have died because a small wound became infected by the deadly bacteria. In 2001, several scaup (a wintering duck) were found dead in the lagoon. Tests showed they were loaded with E. coli, clostridium, and salmonella species of bacteria (Ziggy Jones, pers. comm.).

Graduate students from Capilano College‘s Environmental Science program conducted a limnology study in May 2000 to assess the water quality of the lagoon using abiotic and biotic studies. This pivotal study was the first attempt at providing comprehensive baseline biological and chemical water testing data for Lost Lagoon. More importantly, it formulated a protocol for future testing and included recommendations for improving water quality in the lagoon. Their conclusion was that the lagoon has mostly eutrophic characteristics and there was a definite lack of species richness and abundance in the system.

Of growing concern has been the increasing frequency of algal blooms occurring every summer on the lagoon. Decreasing levels of zooplankton, usually visible on the surface of the water (Peter Woods, pers. comm.), have been reported with the algal blooms. Laboratory testing of water samples collected by the stone bridge and in front of the Nature House in July 2009 revealed the presence of green algae as well as cyanobacteria, including genera of Anabaena and Anacystis. No toxicology was performed.

Potential problems resulting from large blooms of these algae include: reduced sunlight penetration into the water which inhibits the growth of rooted aquatic plants, depletion of oxygen from the lower layers of the water affecting aquatic animals, and toxicity which poses a potential risk to wildlife which consume large amounts of untreated water daily.

Current Management Activities

SPES undertakes restoration and enhancement projects and conducts water quality testing including pH, dissolved oxygen, temperature, salinity, turbidity, nitrates, phosphates, coliform, and aquatic indicator species (plankton, micro and macro invertebrates). Park Board operates the 1936 fountain (which aerates the water) and constructed a biofiltration pond at the outflow of the causeway drainage system.

Appendix D

Background on Species of Special Significance in Stanley Park

Groups of Species Having Special Significance

Species which should be recognised as having special significance in Stanley Park include the following five groups:

1. Species at Risk (Committee on the Status of Endangered Wildlife in Canada, red listed and blue listed)
2. Keystone species (beaver, woodpeckers)
3. Nesting bald eagles (four pairs)
4. Locally declining populations, i.e. were once common in the park (small owl species, reptiles, amphibians, bats, wild bees, seabirds, wood ducks, arbutus trees, western white pine, veteran trees, salmonids)
5. Migrating birds, i.e. those protected under the Migratory Birds Convention Act, 1994 (waterfowl, wild pigeons, oystercatchers, coots, and rails; shorebirds, passerines, auks, guillemots, and murres; bitterns and herons, loons, gulls and terns; and grebes)

1. Species at Risk

Species at Risk (SAR) in Canada are native species listed by the Minister of the Environment based on recommendations from the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Species listed under Schedule 1 of the Species at Risk Act (SARA) are extirpated, endangered or threatened in Canada and are afforded protection under the law. The British Columbia government lists species that are imperilled in the province through the Conservation Data Centre (CDC). In BC, Species at Risk are designated as either red listed (extirpated, endangered, or threatened), blue listed (special concern) or yellow listed (secure). Species at Risk can be used as a measure of biodiversity and help to indicate where stresses are occurring on the natural system.

There are eight species which have been documented in Stanley Park and are listed on Schedule 1 of the SARA and there are thirty-two species that have been seen in Stanley Park which are listed by the CDC (either red or blue listed). Of these, twenty-one species are known to inhabit and/or breed in the park and several rely heavily on the park for breeding or wintering including the Pacific great blue heron, surf scoter, barn swallow and double-crested cormorant. SARA listed marbled murrelets and western screech-owls once commonly bred in the park but are now rarely seen and breeding has not been confirmed for many years. There are several species on record for the park but little is currently known about their population status (e.g., Johnson‘s hairstreak butterfly, red-legged frog) and at least another four SAR that are not on record in the park yet but are found in similar environments (e.g., Pacific water shrew and Oregon forest snail).

The first field surveys aimed at locating SAR in Stanley Park were undertaken as a part of the 2007 – 2008 Restoration Plan. During the restoration, potential shrew habitat and

other features such as wetlands and wildlife trees were protected in the interest of SAR and a task force was created to mitigate damage to their habitat. A comprehensive list and preliminary survey maps were created by SPES for all species occurrences and habitat preferences in the park.

2. Keystone Species

A keystone species is one whose very presence contributes to a diversity of life and whose extinction would consequently lead to the extinction of other forms of life. These species play a critical role in maintaining and supporting the park ecosystem often because they modify habitat on which many other species depend. Two animals in Stanley Park considered keystone species are woodpeckers and beavers; more keystone species may be identified in the future.

3. Nesting Bald Eagles

There are four known breeding pairs of bald eagles in Stanley Park. SPES has been monitoring bald eagle nesting in the park and other areas of Vancouver since 2004. SPES works in partnership with the Lower Mainland Wildlife Tree Stewardship program (WiTS) to use standardized protocols and mapping techniques to track the bald eagles throughout the breeding season. Information gathered during the season is shared with Park Board and BC government wildlife staff, the public and the media through the SPES website and regular printed updates.

The four active bald eagle nests in the park are located at Merilees Trail, near Brockton Oval, along Pipeline Road and on Cathedral Trail. The Cathedral Trail and Pipeline Road nests are two of the largest and oldest in the park and have been used since at least 1989. The newest nest near Brockton Oval was constructed in 2009 – 2010 and is likely occupied by the pair formerly at the Dining Pavilion.

Section 34(b) of the BC Wildlife Act provides year-round protection to a select group of birds' nests including those of bald eagles and great blue herons. These nests may not be disturbed during the breeding season unless permission is granted by the BC Ministry of Environment. The Park Board follows Best Management Practices for Raptor Conservation during Urban and Rural Land Development in British Columbia as a tool for deciding how to protect bald eagle nests and habitat. The raptor Best Management Practices is not law but provides a set of guidelines for development and activities taking place near raptor nests and is used as a tool by city planners and developers. The Best Management Practices must be considered for each nest on a case-by-case basis as many urban eagles have chosen to build nests in non-traditional locations (e.g., in parking lots or industrial areas).

4. Locally Declining Populations

Some populations of species not considered rare in other places are declining in Stanley Park. Most of these are not well documented but local naturalists and Park Board staff have witnessed these declines over the past decades. The best documented perhaps is the

decline in seabirds using the park foreshore and Lost Lagoon (mainly in winter). Seabird counts have recorded a change in status for many species from common and abundant, to uncommon and rare. These declines may be attributed to factors such as the decline of their food resources, the alteration of their breeding habitats, pollution or climate change. Some species may be avoiding areas they once used due to increased human presence and disturbance from boats and off-leash dogs. None of the potential causes for decline though have been officially studied. These locally declining populations may include but are not limited to small owl species, reptiles, amphibians, bats, wild bees, seabirds, wood ducks, arbutus trees, western white pine, round-leaved sundew, veteran trees and salmonids.

5. Migrating Birds

Migratory birds include a large number of species residing in and passing through Stanley Park. Located on the Pacific Migratory Flyway, the park is frequently used by birds moving north and south on migration. Species of neotropical migrants such as warblers, flycatchers and swallows leave their southern wintering grounds in the tropics to seek out northern and inland breeding areas in BC. Wilson's warblers, black-throated grey warblers, barn swallows, and tree swallows are some of the species that regularly pass through and breed in significant numbers in the park. Some migratory birds migrate from the south coast of BC to inland and northern breeding sites. Sea ducks such as Barrow's goldeneyes and surf scoter spend the winter off Stanley Park's shores and fly inland and northward to breed on interior lakes in the summer. Migratory bird species also include some resident birds such as Canada geese and American wigeons. These birds live in Vancouver year-round but are considered migratory species under the federal legislation.

The Migratory Birds Convention Act (1994) regulations ban the disturbance, destruction or removal of nests, eggs or duck boxes of migratory birds. However, some activities, such as egg addling, may be practiced with appropriate permits. The regulations also ban depositing oil, oil wastes or any other substance harmful to migratory birds in any waters or any area frequented by migratory birds. These laws protect the following species in Stanley Park: most waterfowl, wild pigeons, oystercatchers, coots, rails, shorebirds, passerines, auks, guillemots, murres, bitterns, herons, loons, gulls, terns and grebes.

Current Management Activities

SPES has ongoing wildlife and habitat monitoring programs which include surveys for amphibians, reptiles, birds, bats, fish and owls. They have been conducting monthly bird counts in the park's major wetlands since 2006 and have been undertaking seasonal productivity surveys for bald eagles and great blue herons since 2004. In cooperation with the Park Board, SPES installed several bird nest and bee boxes in 2009, and in 2010 heron tree protection and raptor nesting tree signs were placed with the help of Park Board staff. SPES also has maps and reports concerning all Species at Risk found in the park. Other collaborations between SPES and Park Board staff to protect wildlife include

invasive species management efforts, habitat restoration activities and additions of the wildlife sections to the Forest Management Plan.

The Park Board has participated in wildlife habitat protection through its involvement in Beaver Creek salmonid enhancements in the 1990's, the creation of a heron colony management plan in 2006 and reestablishing rarer plants along Prospect Point cliffs (white pine, arbutus) during the 2007 – 2008 restoration. The new Forest Management Plan for Stanley Park also includes a table of operations timing to accommodate migratory birds, fisheries windows, eagle nests and the heron colony. The plan also helps existing wildlife habitat and important breeding areas through the creation of Wildlife Management Emphasis Areas, provisions to maintain and protect veteran trees and through planned maintenance and enhancement of coarse woody debris in forested areas.

Possible Format for Proposed Best Management Practices

To estimate the cost of producing Best Management Practices for all of the above mentioned Species of Significance, some test Best Management Practices were created based on a number of source documents as well as on current management practices and conditions in Stanley Park. The following pages are an example of a potential format for the proposed Best Management Practices focusing on the Western screech-owl.

Western Screech-Owl
Megascops kennicottii kennicottii

Photo by: Jerry Oldenettel
http://www.flickr.com/photos/jroldenettel

CDC: Blue
COSEWIC: Schedule 1, Special Concern (May 2002)
BREEDING STATUS IN STANLEY PARK: possible

Identification: Small owl with feathered 'ear tufts'; face pale with dark lateral border, underparts streaked and barred; yellow eyes and dark bills. Sexes alike in plumage characteristics; plumage brown or grey-brown in the northwest. Some populations in coastal regions of Pacific Northwest more variable in colour, often displaying reddish-brown morphs. Feet and toes are feathered in northern populations (BC CDC, 2007).

Behaviour: A nocturnal species, calling and feeding almost exclusively at night. Pairs are monogamous and territorial throughout the year, and can be heard calling in all seasons to varying degrees.

Habitat Requirements: Woodland, especially broadleaf and riparian woodland, and scrub; also mixed forests of northwest coastal regions consisting of Big-leaf Maple, Red Alder, Douglas-fir, Western Hemlock, and Western Red Cedar; also urban and suburban parks, and residential areas. Usually found at lower elevations; closely linked to riparian habitats; these areas often first habitat in any given area to suffer effects of urban development.

Breeding: Nests in natural tree cavity or abandoned woodpecker hole. Breeding populations continually threatened by rapid urbanization and degradation of habitat, and face possible competition from exotic species such as European starlings. Currently no official data on trends of population densities, however, populations probably declining slowly with habitat loss. This species lays a single clutch of two to seven eggs between mid-March and the end of May (SARA, 2010).

Food: Feeds mainly on small mammals (mice and shrews), insects, birds; sometimes also other small vertebrates such as fish and reptiles (BC CDC 2007; Cornell Lab. 2007; Univ. Michigan. 2007).

Threats: Major threat to the species is habitat loss to development. The relationship between these owls and forestry practices has not been studied, but it has been suggested that forestry operations negatively affect screech-owl habitat, both through

timber harvesting and the removal of dead trees that serve as potential nest-cavity sites. A severe loss and degradation of riparian habitats is the main reason for the decline of Western Screech-Owls in the Interior. Local declines have occurred in Vancouver but the reason for these declines is undetermined. The abundance of Barred Owl greatly increased in these areas during the same period as the Western Screech-Owl populations declined and predation by Barred Owl on Western Screech-Owl is one theory used to explain this decline. However, the Great Horned Owl population also increased near Victoria during the same period. They also occasionally collide with vehicles and windows.

Special significance of the species: The Western Screech-owl has been considered an indicator species for healthy riparian ecosystems throughout most of its range. Its dependence on older trees for roosting and nesting cavities and position near the top of the food chain make it an ideal choice for an umbrella species in multispecies conservation plans (SARA, 2010).

Wildlife Management Emphasis Areas:

- Riparian Areas - the areas of vegetation around Beaver Lake and Lost Lagoon as well as along all streams.
- Old Growth Patches - between Pipeline Road and Tunnel Trail east of Beaver Lake.
- Ecotones - located throughout the park and are areas where two structurally distinct habitat types meet.

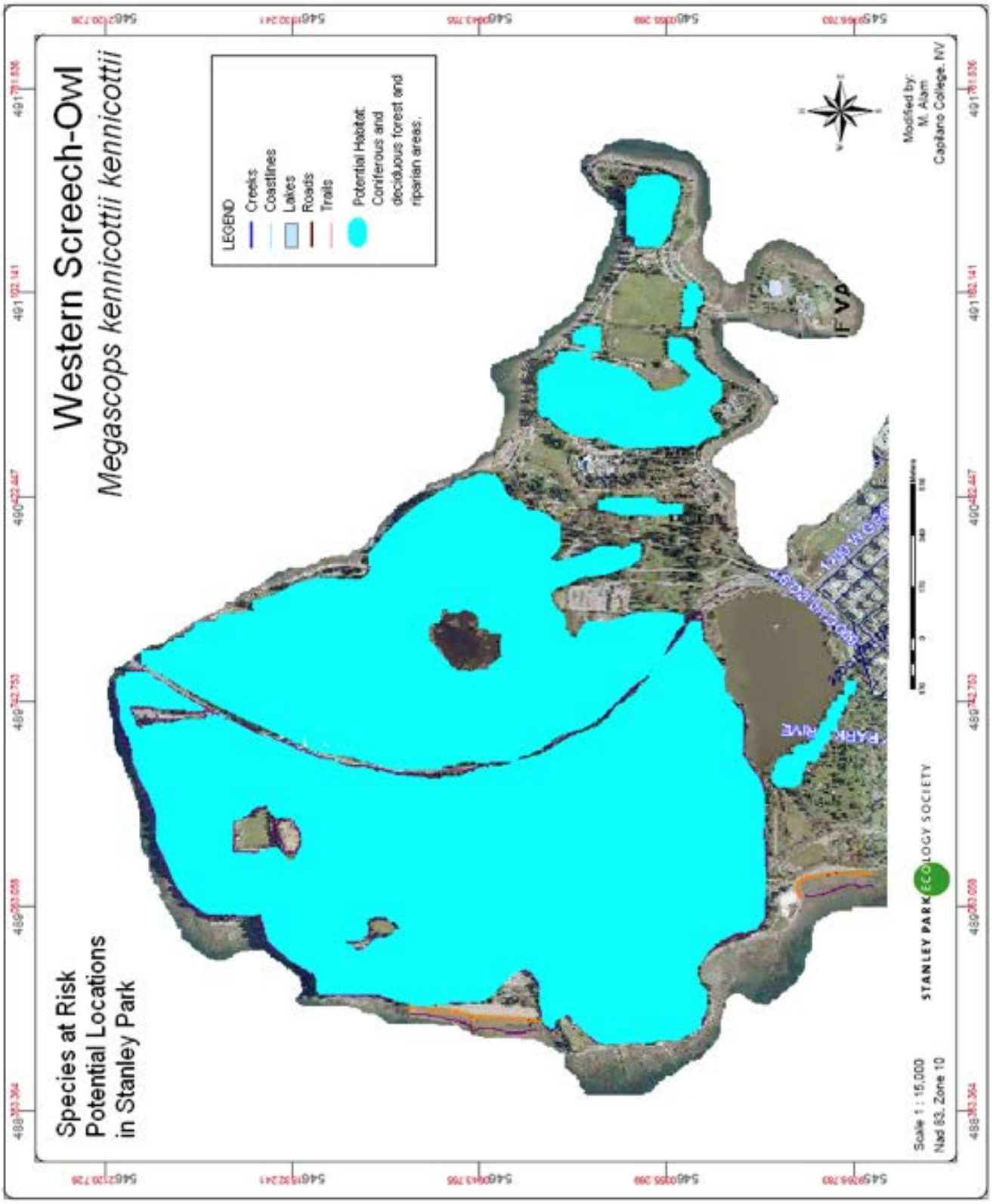
Applicable Wildlife Laws:

- BC Provincial Wildlife Act, 1996 - it is an offence to take, harm, or destroy the birds, their nests, or their eggs.
- Species at Risk Act , 2002

Documented Occurrences in Stanley Park:

- On list for study area (Robertson and Bekhuys 1995)
- Frequently heard in wooded parts of the Greater Vancouver area, and can be expected in Stanley Park (Robertson and Bekhuys 1995)
- Natural Areas Map - habitat for Western Screech Owl (Parks Canada 2002)
- Listed as uncommon in spring, summer, fall and winter (Weber et al. 1988)
- In the mid-1990s western screech owl nest boxes were erected in the Park. The boxes were monitored for the next three years but no owl nesting activity was observed (Mike Mackintosh, pers. comm.).
- Sightings of western screech owls and other species have been reported to the SPES Nature House staff over the years (Koren Johnston, pers. comm.).
- In 2007 during the restoration efforts, owl-call playback surveys were conducted by biologists and SPES staff in the Park. These surveys have been continued since then by SPES as a long-term monitoring program and in March 2008 a Western Screech-owl responded to a call playback near Blowdown area S2 (off south creek trail). The call appeared to be coming from the south corner of Beaver Lake (Worcester, 2010).

Species at Risk Best Management Practices 2010



Species at Risk Best Management Practices 2010

Best Management Practices for operations in Stanley Park:

- Retain edge habitats - especially small-medium openings in the forest canopy.
- Maximize retention of hedgerow and brushy thickets
- Protect riparian areas and snags within
- Preserve all trees and snags used or suspected of being used by owls as nesting sites
- Protect existing and potential nest sites, including veteran recruit trees and trees with natural cavities
- Reduce brushing in potential habitat
- Maintain a minimum buffer of 1.5 tree lengths, consisting of undisturbed natural vegetation, around nest sites in trees (BC MOE, 2009).

Habitat Enhancement Opportunities:

- Let grass grow longer to improve rodent habitat
- Install nest boxes where natural cavities are scarce especially in riparian areas
- Restore habitats where natural vegetation has been removed or altered, by removing invasives and/or planting using native plants
- Protect owls from crashing into windows by installing shapes in the window or closing blinds (BC MOE, 2009).

Operation Timing:

- Breeding from March - August - concentrated in April-June - avoid brushing, thinning, or hazard tree treatment in known or potential nesting locations.
- Restrict noisy activities (such as filming, parades and special events) as well as Park maintenance operations to 200m or greater away from nest sites from March - August.

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Appendix E

Consolidation of Actions to Improve the Ecological Integrity of Stanley Park

The following is a consolidation of the recommended actions for five priority areas of concern identified by a working group comprised of Park Board and SPES staff to improve the ecological integrity of Stanley Park.

A. Beaver Lake's Rapid Infilling

1. Undertake a consultancy to:
(a) conduct an environmental assessment of Beaver Lake and its environs, including information gathering (e.g. core sampling for accurate information on depth of deposits in the lake and inventory of wildlife resources);
(b) develop options for the future of the lake to lead to its long-term viability. Criteria should include biodiversity and aesthetic values as well as reducing reliance on potable water; and
(c) report back to the Board with a recommended strategy and plan for implementation.
Estimated budget: $100,000.

2. Commence implementation of the approved plan for the restoration of Beaver Lake, costs to be determined subsequent to the consultancy.

3. Update baseline of information on the Beaver Lake bog and monitor changes since the original survey as a first step to prevent the disappearance of the bog. Estimated budget: $5,000.

4. Install a boardwalk and viewing platform with signage to allow public access while reducing further damage to the bog from off-trail activities. Estimated budget: $42,000.

5. Restore the bog's size and habitat values by removing encroaching trees and transplanting bog plants into damaged areas. Estimated budget: $5,000.

6. Continue to maintain water levels in the lake with municipal water until alternative sources can be found.

7. Collaborate with SPES to develop a concurrent strategy for invasive plant species management during and following lake restoration.

8. Develop a maintenance strategy to control the rate of future infilling to ensure the retention of this valuable habitat and aesthetic resource.

B. Lost Lagoon's Water Quality

1. Undertake a consultancy to:

(a) conduct an engineering assessment of Lost Lagoon, including information gathering (e.g. water quality parameters, bottom profile, etc);

(b) develop short-term options for remediation;

(c) develop longer-term options to lead to improved water quality, enhanced wildlife habitat and aesthetics, and reduced reliance on potable water (e.g. dredging, creating habitat islands, large-scale riparian restoration in disturbed areas and redirecting storm water from the West End and other sources into the lagoon); and

(d) report back to the Board with a recommended strategy and plan for implementation.

Estimated budget: $100,000.

2. Conduct required 10-year forebay sediment removal and water quality testing on the lagoon's existing biofiltration pond. Estimated budget: $8,500.

3. Undertake implementation of the approved plan to address the water quality of Lost Lagoon, costs to be determined subsequent to the consultancy.

4. Continue with short-term, on-going restoration of existing shoreline vegetation and other environmental improvements, such as removing invasive species (blackberries, yellow flag iris and morning glory) and planting new trees to replace aging and dying willows along the south shore. Estimated budget: $7,000.

5. Maintain the Jubilee Fountain and continue to maintain water levels in the lagoon in the interim using municipal water until alternatives can be found.

6. Develop protocols to prevent sedimentation into the lagoon from trail and road runoff and operational activities wherever possible.

C. Invasive Plant Species

1. Purchase equipment to be used by staff in Stanley Park and elsewhere in the park system for chemical control (i.e. stem injection) of hogweed and knotweed. Estimated budget: $12,000.

2. Update mapping of invasive species in Stanley Park and develop operational systems to allow consistent updating of mapping to ensure effective ongoing management and monitoring of invasive controls and to evaluate the success of restoration programs. Estimated budget: $10,000.

3. Develop a program to increase awareness within Park Board staff, contractors and other park stakeholders (e.g. Stanley Park Horse Tours) about invasive plant management (e.g. information sessions, posters for break rooms and work sites, information sheets for contractors, etc). Estimated budget: $10,000.

4. Provide material support for SPES's efforts to control the majority of species (e.g. for English ivy, blackberry and loosestrife). Estimated budget: $10,000.

5. Use Best Management Practices outlined in the Forest Management Plan for the control of other invasive plants in the park.

D. Fragmentation of Habitat

1. Remove a gravel section of Cathedral Trail and reconstruct it with a raised boardwalk connecting to Rawlings Trail for environmental enhancement and improved pedestrian safety. Estimated budget: $90,000.

2. Replace fifty existing undersized culverts beneath trails, especially for those accommodating all-season water courses, with culverts large enough to better facilitate the flows of both water and wildlife. Estimated budget: $25,000.

3. Increase vigilance against off-trail bicycle usage and introduce bicycle barriers at the heads of minor official trails where erosion or other environmental impacts are occurring in particularly sensitive habitats (e.g. North Creek Trail).

4. Obstruct unofficial trails with fallen trees in conjunction with forest stand thinning operations and as part of routine forest maintenance.

5. Report back on downgrading North Pipeline Road to trail status, potentially using dredged materials from other projects in the park for planting medium.

E. Species of Special Significance in Stanley Park

1. Produce Best Management Practices for each group of Species of Significance to be written in collaboration by Park Board and SPES staff. Estimated budget: $10,000.

2. Develop a program to increase awareness within Park Board staff and contractors to prevent often unintentional harmful behaviours (e.g. information sessions, posters for break rooms and work sites) and to integrate Best Management Practices into operations (e.g. information sheets for contractors, etc). Estimated budget: $5,000.

3. Review and report back on the roles and responsibilities of the Park Board in wildlife management.