

Bow Lake Joint-Use Facilities Study

City of SeaTac



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EXECUTIVE SUMMARY

Introduction

The City of SeaTac has prepared this Joint-Use Facilities Study to examine the feasibility of designing and developing public recreation and stormwater treatment facilities at Bow Lake, a private lake located in the City of SeaTac. Within the context of both the City of SeaTac's Comprehensive Plan (City of SeaTac 1998) and recent City Center Plan (City of SeaTac 2000), the Bow Lake area has been identified as a potential recreation resource for the City. Bow Lake itself has been identified as a regional stormwater facility with capability to handle regional stormwater discharges within the Des Moines Creek Basin (Des Moines Creek Basin Committee 1997).

The immediate Bow Lake site comprises approximately 126 acres of privately owned property. The project area boundaries for this study are loosely defined by the private property boundaries of those parcels contiguous with Bow Lake, but extend to include some of the surrounding private property. The boundaries of these parcels meet in the middle of the lake, making it an entirely privately owned lake. Starting at the south end and moving clockwise around the lake, these properties include: the DoubleTree Hotel, Chevron Services Company surface lot, the Washington Mutual Bank, airport parking, the SeaTac West Coast hotel, the Wyndham Gardens, the Kilroy office complex, a large mobile home park, and an unimproved site known as the Colacurcio property.

The SeaTac City Center Plan identifies Bow Lake as a potential recreational amenity for the City. Despite the density of this planned City Center, there are very few public open space opportunities for either office workers, visitors, including hotel guests, or local residents. It is the City's intent to plan for increasing the amount of open space available. One possibility for increasing open space is to create facilities at Bow Lake that are compatible with present or future land uses there. They would be thought of as joint-use facilities, because they would serve both public and private use. The visitor-serving industries in particular would benefit from having such facilities available for their guests. Other facility needs in the area include stormwater detention structures as properties redevelop, as well as to ensure that water quality standards are met. It may be possible to combine development of stormwater facilities and recreation facilities as a single joint-use project, either through public-private partnerships, as a public capital improvement project, or as part of private redevelopment.

Hydrology

Bow Lake is located in the Des Moines Creek drainage basin. The entire Bow Lake drainage sub-basin contains approximately 445 acres, which comprises about 15 percent of the entire 2,936 acres in the Des Moines Creek drainage basin. Existing land uses within the basin include a mix of commercial and residential uses, including single and multi-family residential, office buildings, hotels, a mobile home park, several parking lots for long-term parking, car rental, and auto sales.

Bow Lake's water surface elevation fluctuates depending on the intensity of storm events. Modeling for Bow Lake shows that the level of the lake will rise approximately 2 feet during a 2-year storm event and slightly more than 3 feet during a 100-year storm event. During the summer months, the water surface level decreases slightly.

Water quality monitoring at the outlet from Bow Lake conducted in December 1991 (Parametrix 1992) indicate that pH and dissolved oxygen levels fall below minimum criteria for release to Class AA streams

(Des Moines Creek), and fecal coliform bacteria concentrations are higher than the maximum criteria. Low pH values would be expected in a peatland bog where acidic organic soils are present.

Wetland and Wildlife Habitat Assessment

The Bow Lake site is a wetland complex composed of a variety of wetland habitat types including scrub-shrub, forested wetlands, and open water. The Bow Lake wetland complex contains a total of 22.5 acres of palustrine wetlands. The City of SeaTac identifies this wetland complex as a sensitive area.

The entire Bow Lake wetland complex, as well as connected riparian zones, is exposed to increasing storm water discharge events from expansion of off-site and upslope impervious surfaces in the area. The site falls within the King County-identified 100 year floodplain. Annual winter flooding of this area is highly possible. Storm water discharge is a major contributor to the degraded water quality of the Bow Lake site.

Buffer zones surrounding the entire Bow Lake site are highly disturbed due to current land uses and range in width from zero to over 100 feet. Pollution, invasive species, vegetation removal, placement of impervious surfaces, grazing, and recreational use have all contributed to these degraded buffers. Stormwater directly flows into the wetland complex in these areas. Pollution appears to be a significant issue, as reflected in the sub-standard water quality of the wetlands. Untreated run-off from streets and parking lots surrounding the site flows directly into the wetland complex and eventually into Des Moines Creek.

Stormwater Facility Needs due to Land Use Changes

Proposed changes in land use within the Bow Lake basin will necessitate substantial investment in on-site stormwater controls both for new development on greenfields sites and for re-development of built land parcels. Based on the requirements of the 1998 King County Surface Water Design Manual (KCSWDM), it is estimated that new development and re-development in the Bow Lake basin would be required to incorporate substantial on-site infrastructure to control the quality and peak rates of stormwater discharge from those sites.

Considering the cumulative requirements for flow control, it is estimated that developers would need to construct approximately 6 acre-feet of on-site flow control (detention) storage within the Bow Lake basin to handle future detention needs over the next 20 years. In addition, these developments will cumulatively need to provide water quality treatment facilities with a functional equivalent of 5 acre-feet of storage volume in water quality vaults, tanks, and ponds over that same period of time. Because of the intensity of the proposed land uses in the basin, it is expected that the majority of this on-site detention storage and treatment volume would be constructed in the form of underground vaults.

Table ES-1 summarizes the facility requirements to treat runoff from the three sub-basins within the Bow Lake drainage, including all existing and proposed development. To allow for comparisons to the on-site requirements cited above, the water quality facility requirements are sized based on treatment using ponds or vaults consistent with current City stormwater standards.

Table ES-1. Basin-wide Water Quality Treatment Requirements

Sub-Basin	Basin Area (acres)	Water Quality Treatment Facility Volume (acre-feet)
North	276	15.5
East	121	6.8
South	38	2.7
Total	445	25.0

Source: EarthTech, Inc.

Bow Lake's Role in Regional Flow Control

Bow Lake currently provides significant flow control benefits to the Des Moines Creek system. The lake attenuates large storm flows by storing the runoff volume in the lake. Runoff is released from the lake through the 36-inch diameter pipe outlet at less than one-half the rate at which it enters the lake.

During development of SeaTac's Surface Water Plan (EarthTech 1997), different approaches were investigated to further utilize the storage available in Bow Lake for peak flow reduction downstream. Based on those analyses, it was recommended that the City pursue a strategy that lowers the static level of the lake by 2 feet during the winter months to make available an additional 25 acre-feet of active storage volume to attenuate peak storm flows during the wet season.

Ongoing evaluation of the Des Moines Creek Basin Plan has since relegated the Bow Lake strategy to a lower priority from a regional standpoint based on cost effectiveness. Consideration was given to developing the additional active storage within the lake for another purpose. Analyses were performed to assess the feasibility of using the additional storage in the lake to relax on-site flow control requirements for development activity in the Bow Lake basin. This concept was explored as a means of engaging the private sector in implementing the joint-use facility.

From the results of the hydrologic model analyses, it was concluded that effective lake discharge rate reduction could be achieved for smaller, more frequent storms with smaller runoff volumes. It therefore appears feasible to reduce on-site detention requirements and compensate for that reduction by using the additional active storage in Bow Lake by the relatively simple means of lowering the lake 2 feet. In consideration for the relaxation of on-site detention requirements, developers could be required to either: (1) contribute financially to the planning, design, and construction of the joint-use project or other regional infrastructure; or (2) provide enhanced water quality treatment facilities on-site.

Open Space Assets

Existing recreation assets within the City of SeaTac were summarized and compared against current city LOS standards. Only certain categories of facilities have an identified LOS standard. LOS standards are not required under the Growth Management Act (GMA) for public recreation facilities and are adopted at a jurisdiction's discretion. Once a jurisdiction formally adopts a given LOS, it is required to maintain that LOS and show a link between population growth and the Capital Improvements Plan.

Comparing the current population of the City, as well as the GMA forecast for 20-year population growth, against the adopted LOS standards as shown in Table ES-2, yields the impression that the current supply of recreation opportunity is adequate for the City's needs overall. However, none of these parks and open space assets are located within the City Center, which contains approximately 15 percent of the City's population. Consequently, the City Center is currently failing when compared against City standards, as

shown in the bottom half of Table ES-2. Unless addressed, the situation can be expected to deteriorate. The City Center Plan has identified some possible acquisition areas to alleviate this shortfall, including areas around Bow Lake.

Table ES-2: Current and Future Recreation Levels of Service

Resource	City – Current Population (23,761)		City – 20-Year Forecast (36,250)	
	Actual LOS	Adopted LOS	Actual LOS*	Adopted LOS
Citywide				
Total Park Land (including playing fields)	6.78 acres per 1,000 population	5.46 acres per 1000 population	4.44 acres per 1,000 population	5.46 acres per 1,000 population
Trails	9,164 LF per 1,000 population	2,506 LF per 1000 population	6,007 LF per 1,000 population	2,506 LF per 1,000 population
City Center				
Total Park Land (including playing fields)	0 acres per 1,000 population	5.46 acres per 1000 population	0 acres per 1,000 population	5.46 acres per 1,000 population
Trails	0 LF per 1,000 population	2,506 LF per 1000 population	0 LF per 1,000 population	2,506 LF per 1,000 population

* assumes no growth in area of recreation assets

Source: City of SeaTac

LF = linear feet

Alternatives Development

Three plan alternatives are presented, identified as: (1) the Neighborhood Access Plan, (2) the Natural Open Space Plan, and (3) the Urban Focus Plan. These alternatives represent three different levels of intensity of facilities development, with dramatically different cost and finance implications. They developed naturally from analysis of the capabilities of the site, coupled with the desire on the part of the City to have the opportunity to explore in depth the consequences, both positive and negative, of choosing any one course of action.

Alternative A – Neighborhood Access Plan

This alternative is a modest proposal to allow access to the natural amenities of the Bow Lake environs for passive recreation purposes, while providing some minor cost-effective water quality enhancements. The alternative would have a fairly minimal impact on current land use and can be developed in phases naturally as the private property around the lake redevelops. Although Alternative A can be viewed as the minimalist solution to providing joint-use facilities at Bow Lake, it can also be seen as an initial development phase for either of the other, more complex Alternatives B or C. Nothing would result from the implementation of Alternative A that would interfere with the City's ability to implement either of the other alternatives.

The basis focus of this alternative is a trail system that circles the majority of the lake and extends out to make strategic connections into the neighborhoods. The presence of the extensive structures of the DoubleTree Hotel at the south end of the lake prevents the trail from entirely circling the lake. While the trail system would provide a useful recreation opportunity, it would also provide a pedestrian connection between the medium density residential neighborhoods to the east and the employment opportunities along International Boulevard and SeaTac Airport. The trail along the west side of the lake would be paved and well lit to better serve hotel guests. Elsewhere, the trail would consist of a low-impact porous design to minimize wetland impacts. Two wooden pier/overlook features are proposed for the lake.

Four stormwater facilities are identified to improve water quality and runoff as part of this alternative. The first of these consists of installing a control structure at the outfall of the large box culvert on the Kilroy property to remove debris, solids, and oils from runoff. The next two proposed improvements consist of enhancing the two drainage ditches located in the small patch of fringe forest adjacent the north end of the lake. These ditches currently convey stormwater directly into the lake, including all water from the large box culvert in the Kilroy parking lot. They were created for drainage only and do nothing to detain or slow runoff, while providing no water quality treatment. The intent would be to restore some natural wetland functions to these ditches, while simultaneously slowing and cleansing runoff. The fourth proposed improvement consists of creating a functional bioswale to the east of Bow Lake Mobile Home Park.

Impacts or changes to existing wildlife habitat would be minimal under this alternative. There would inevitably be some impacts to wetlands due to trail construction, as all of Bow Lake, as well as the related fringe vegetation, is classified as a Class 1 wetland. Some intrusion into the largely intact Colacurcio wetlands would occur due to trail construction. Impacts would be at least partially offset by other City actions to restore this habitat, such as removing invasive species and eliminating large domestic animals from the wetlands.

Alternative B – Open Space Plan

Alternative B is based on maximizing the restoration of a natural environment around Bow Lake, while simultaneously expanding the potential trail network. It provides a more complete trails network than Alternative A, including trails that circle the entire lake, and provides several trail loops within that network. This plan assumes some open space land acquisition by the City at the north end of the lake to provide area for stormwater treatment and neighborhood connections. A new road connection between International Boulevard and South 180th Street is proposed based on the City Center Plan. This road helps define some of the boundaries of this new open space, which would not be used as an active park, but would allow for expansion of the trails network and development of more natural area. More extensive capability for stormwater retention and cleansing would be incorporated into Alternative B, including joint-use retention ponds in the Colacurcio property, water-cleansing ponds on the drainage way north of Bow Lake, and water quality control structures distributed through the surrounding neighborhoods.

In Alternative B, the recreational trail circles the entire lake through the use of an elevated boardwalk across the south end of the lake. A direct connection could be made to the DoubleTree Hotel to enhance access by its guests. A trail loop is proposed for the Colacurcio wetlands, rather than a single linear access path as in Alternative A to provide a greater variety of experience, as well as more opportunities for educational and interpretive activities. These activities could be coupled with programs for habitat restoration on the site. The increased land area at the head of the lake as a consequence of land acquisition provides the opportunity to incorporate several small trail loops, including a hard surface trail connecting to South 180th Street. A meandering boardwalk/bridge structure is proposed to provide a trail connection across the lake. An additional wooden pier/overlook feature is proposed for the lake, near the trail entry from the Colacurcio wetlands.

Alternative B includes a number of additional stormwater treatment elements, in addition to those identified by Alternative A. Along with the control structure in the Kilroy parking lot and the bioswale improvements west of 38th Avenue South, additional natural and man-made stormwater improvement features include a series of stepped wet pond cells along the drainage ditch at the north end of the lake, several joint use detention ponds on the Colacurcio property, and a number of wet tank/vault structures distributed through the neighborhood.

The north wet pond cells are seen primarily as features that slow the rate at which water flows into the lake and provide some cleansing effect as debris and sediment settles out. The joint-use detention features on the Colacurcio property would be placed within the wetlands buffer zone, so that they don't intrude into either wetland or buildable area. They would be sized larger than needed for the multi-family development, with the City paying for a share to buy capacity for the regional stormwater system. The constructed bioswale would terminate into one of these wet ponds, where the water would be retained for sediment settlement prior to being released into the wetland. The wet tank/vault structures to be placed in the streets would likewise allow for removal of debris, sediment, and oils. These structures are proposed for the DoubleTree parking lot, a low point in South 186th Street, and immediately west of a low point on 38th Avenue South.

Alternative C – Urban Focus Plan

Of the three alternatives, Alternative C envisions the greatest level of human intervention and use of the Bow Lake area. An extensive trail network, much of it paved and lit, is combined with an series of actions designed to provide joint-use stormwater facilities capable of providing all runoff treatment and flow control required within the Bow Lake basin. Part of this strategy involves the development of natural stormwater control features on the Colacurcio wetlands site. Alternative C assumes a major redevelopment of the Bow Lake Mobile Home Park at some point within a 20-year planning horizon, as envisioned in the City Center Plan, and assumes that perhaps the highest and best use of the site would include some type of commercial use on that part of the site nearest the lake. Consequently, an engineered edge is shown along the lake at that site to accommodate a future building footprint. Like Alternative B, this alternative proposes a major open space expansion at the north end of the lake. However, this time the open space is seen as a combination of urban people-oriented space and restored wetland area. Underneath this open space would be a major regionally sized stormwater vault to ensure downstream water quality.

A major difference with this alternative is that the trail around the lake is almost entirely paved. The trail along the west side of the lake is identified as a boardwalk trail. The trail network through the Colacurcio wetland is more extensive than that found in the other alternatives, with several loops. A major boardwalk/bridge structure is proposed to provide a trail connection across the south end of the lake. An additional wooden pier/overlook feature is proposed for the head of the lake as part of a small urban park. This park is really a stormwater control feature but is envisioned as providing outdoor paved areas, seating, and perhaps some other public use features as well, in addition to a large wetland restoration area, created as mitigation for wetlands impacts elsewhere on site.

The measures proposed for the control and treatment of stormwater runoff are more extensive than those featured in the other alternatives. A major wet vault is proposed for installation under the Kilroy parking lot, sized as a regional facility. The intent would be to collect and treat the majority of the runoff from the north and east of the lake in this vault, eliminating the need to treat water on individual parcels. In addition to the minor vault structures proposed in Alternative B, a fourth structure is proposed under South 182nd Street. The level of the lake itself would be dropped by 2 feet seasonally to create additional stormwater storage capacity, buffering the Des Moines Creek system from small storms at the 10-year and under intensity threshold. This would be done by installation of a new 18-inch outlet pipe at the south end of the lake. Lastly, a large part of the Colacurcio wetlands is proposed for reconstruction to increase its ability to function as a stormwater treatment and flow control feature.

In addition to the wet vaults/tanks, Alternative C includes revising the outlet from Bow Lake to allow for the lowering of the lake by 2 feet during the winter months. The final component of Alternative C is the

reconstruction of the wetland located on the Colacurcio site into a multi-cell wetland instead of a single cell. The multiple cells would occupy roughly the same area as the current wetland.

Impacts or changes to existing wildlife habitat, both positive and negative, would be greatest under this scheme. There would be some loss of fringe wetlands around the lake to accommodate the trail itself. Of the 3 alternatives, impacts would be greatest due to alteration of the nature of the Colacurcio wetlands habitat. While this area would remain a wetlands, wetland functions would be altered specifically to increase the ability to hold and cleanse stormwater. As with Alternative B, this alternative would work to increase open space at the head of the lake, although it would be designed to attract more people. Impacts to wetlands due to trail construction would be greater, as trails would be more extensive, including the boardwalk.

Estimated Costs of the Conceptual Plans

Conceptual costs are summarized in Table ES-3. These figures include soft costs such as design and permitting, as well as a substantial contingency amount. This contingency will be reduced as planning advances and the project becomes more defined. In particular, one major cost item that needs further investigation is the cost of land acquisition, currently unidentified for Alternatives B and C. There is a great deal of uncertainty with this item, as actual cost will be largely a function of market value and can fluctuate widely over time.

Table ES-3. Estimated Order-of-Magnitude Cost Summary

Facility Element	Construction Cost Estimate		
	Alternative A	Alternative B	Alternative C
Trails	\$56,840	\$96,520	\$98,300
Structures	\$87,500	\$143,000	\$136,250
Signage	\$13,000	\$13,000	\$29,000
Furnishing	\$55,000	\$64,000	\$92,500
Other Site Work	\$24,384	\$115,700	\$360,556
Wetland Restoration	\$15,000	\$101,000	\$200,000
<i>Subtotal – Site Costs</i>	<i>\$251,724</i>	<i>\$533,220</i>	<i>\$916,606</i>
Associated project soft costs and contingencies	\$209,424	\$443,618	\$762,579
Stormwater Facility costs	\$580,200	\$1,916,192	\$12,895,610
Total Estimated Cost	\$1,041,348	\$2,893,030	\$14,574,795

Source: EDAW/EarthTech

Public and Private Benefits

An effort has been made to identify and quantify private property development benefits related to regional stormwater facilities. Therefore, a comparison of actual private sector stormwater costs in the Bow Lake basin, both with and without the joint-use stormwater facilities, can be made.

Avoided Water Quality Treatment Facility Costs: Provision of regional water quality treatment facilities would provide treatment of runoff to address both existing development and future development (including redevelopment of currently built-on parcels). Future private development would avoid having to construct almost 8 acre-feet of water quality treatment volume at project costs¹ estimated to cumulatively total approximately \$4.2 million. This estimate assumes that stormwater treatment would

¹ Project costs include construction, design, permitting, construction management, sales tax and a contingency to account for the planning level of the analysis.

be provided in the form of water quality vaults that are best accommodated within higher density developments.

In addition, the City of SeaTac would be expected to incur some costs for retrofit of public drainage infrastructure serving existing private development throughout the watershed in response to Clean Water Act and Endangered Species Act requirements. The regional water quality treatment facilities would constitute such a retrofit, and the avoided costs (which were not estimated as a part of this study scope) represent a savings to all City stormwater utility ratepayers.

Avoided Stormwater Detention Facility Costs: Under current City stormwater design standards, development must provide control of runoff to Level 1 criteria, which requires matching of peak discharge rates for the 2- and 10-year return period storms. The cumulative volume of stormwater detention facilities needed to service future private development in the basin is estimated to total 10 acre-feet at project costs estimated to total approximately \$5.5 million.

There are two scenarios under which future development could realize substantial cost savings by implementing the seasonal lowering of Bow Lake:

- Should plans to construct the Des Moines Creek Regional Detention Facility be significantly delayed or abandoned and the City must revise the flow control criteria to Level 2 to protect Des Moines Creek; or
- Should stormwater design standards be revised to require Level 2 flow control criteria in responding to Endangered Species Act 4(d) rule implementation. This new requirement is uncertain pending NMFS final 4(d) rule implementation.

Under either of these scenarios, the seasonal lowering of Bow Lake would provide a basis for maintaining the Level 1 flow control standard and avoiding the added facility size and cost of complying with Level 2 criteria. If Level 2 control were to be required of future development, the cumulative detention requirements would grow by another 17 acre-feet to a total of 27 acre-feet. The added incremental private project costs for increasing on-site detention facilities from Level 1 to Level 2 control to total approximately \$9.4 million.

These costs are summarized in Table ES-4. The upper half of the table, identified as public stormwater improvements, represents the estimated cost of the joint-use stormwater facilities identified in this study. The lower half of the table represents the estimated costs to private property owners within the Bow Lake basin for stormwater facilities associated with property redevelopment. Observe that the cost for private development goes down proportionally as the public investment rises. The total costs (bottom line) identify the sum of these two costs. Alternative C actually has the lowest estimated future costs due to an economy of scale, as all stormwater is treated through just a few structures, rather than many distributed ones.

Table ES-4. Stormwater Management Alternatives Cost Estimate Summary

Element	Construction Cost Estimate		
	Alternative A	Alternative B	Alternative C
Potential Public Stormwater Improvements			
Facility construction costs	\$316,710	\$1,045,979	\$7,039,242
Associated project costs, contingency	\$263,490	\$870,213	\$5,856,368
Subtotal, Public Capital Cost	\$580,200	\$1,916,192	\$12,895,610
Future Private On-site Stormwater Development Costs			
Flow Control	\$14,893,796	\$14,893,796	\$5,516,221
Water Quality Treatment	\$ 4,213,013	\$ 3,385,580	-
Subtotal, Private Capital Cost	\$19,106,809	\$18,279,376	\$5,516,221
Total, Public and Private Capital Costs	\$19,687,009	\$20,195,568	\$18,411,831

Source: EarthTech, Inc. 2000

Conclusions

This study presents the City with a variety of courses of action that can be followed with regards to public facilities development in the Bow Lake area. However, it does not identify a preferred course of action. This is due primarily to the lack of environmental review and adequate public discussion/input on these alternatives to date, an important fact considering that most of the properties affected are in private hands.

Some parties will question the advisability of the City planning for public development on what is currently private property. However, within the context of a 20-year planning horizon for the City Center area, it is wise to step back and review the entire range of possible outcomes that could occur from such a joint public-private planning partnership. This conclusion appears to be borne out by the potential financial benefits of a regional stormwater facility. In addition, there is clearly a deficit of open space and recreation facilities within the City Center area, based on adopted standards. Insofar as development of green spaces is often an integral part of public strategies for creating a city image, promoting urban livability, and enhancing economic development, it is appropriate for the City to be exploring such avenues for addressing these needs.

It is the recommendation of this report that the next phase of this study address the following needs:

- Develop and carry out a public input process: the voices of landowners, businesses, residents, and tenants need to be heard with regarding the pros and cons of each alternative developed in this study.
- Conduct an agency outreach process: the regulatory agencies responsible for resource protection and permitting, such as the State Department of Ecology, need to be brought into the planning process to advise the City regarding plan refinements. Such refinements can often help make sure that any plan chosen can be implemented.
- Further characterize economic impacts and benefits: Additional review of the financial implications of the alternative should be undertaken, resulting in more detailed quantification of such elements as private property benefits, impacts to rate-payers charges, and costs of land acquisition.
- Identify a preferred alternative: With the above input, the City should be able to identify a preferred direction with regards to joint-use facility development. A preferred alternative will not necessarily be one of the 3 alternatives presented in this report, but may be some combination of elements contained within all three.

- Environmental Review: With a preferred alternative identified, necessary environmental review can begin. At a minimum, this should involve preparation of a SEPA checklist and an attendant threshold determination.

With the input from the above planning steps, it is felt that the City Council will be adequately informed to commit SeaTac to an appropriate course of action.

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1.0 INTRODUCTION

The City of SeaTac has prepared this Joint-Use Facilities Study to examine the feasibility of designing and developing public recreation and stormwater treatment facilities at Bow Lake, a private lake with multiple ownership located in the City Center of the City of SeaTac, immediately across International Boulevard from the SeaTac International Airport. Within the context of both the City of SeaTac's Comprehensive Plan (City of SeaTac 1998) and recent City Center Plan (City of SeaTac 2000), the Bow Lake area has been identified as a potential recreation resource for the City. Bow Lake itself has been identified as a regional stormwater facility with capability to handle regional stormwater discharges within the Des Moines Creek Basin (Des Moines Creek Basin Committee 1997). As an exploratory effort to examine potential joint-use public facility development options for this site, the City of SeaTac has initiated a study of alternative Bow Lake development scenarios. In February 2000, EDAW, Inc. was contracted by the City of SeaTac, to undertake this study of Bow Lake. EarthTech, Inc. is a subconsultant to EDAW providing expertise in stormwater facilities and stormwater handling requirements.

The entire Bow Lake site comprises approximately 126 acres of privately owned property. The approximate boundaries of the entire site are the Kilroy Office Towers Office Complex parking lot to the north, the DoubleTree Hotel to the south, West Coast Hotel parking lots to the west, and a trailer park and undeveloped wetland site to the east (see Figure 1.1). The project area boundaries for this report are loosely defined by the private property boundaries of those parcels contiguous with Bow Lake, but extend to include some of the surrounding private property. The boundaries of these parcels meet in the middle of the lake, making it an entirely privately owned lake. Starting at the south end and moving clockwise around the lake, these properties include: the DoubleTree Hotel, Chevron Services Company, the Washington Mutual Bank, airport parking, the SeaTac West Coast hotel, the Wyndham Gardens, the Kilroy office complex, a large mobile home park, and an unimproved site known as the Colacurcio property.

Bow Lake is a part of the Des Moines Creek watershed, which covers 5.8 square miles. Des Moines Creek itself is approximately 3.5 miles in length and empties in Puget Sound south and west of SeaTac. The Bow Lake sub-basin, one of 10 in the Des Moines Creek watershed, encompasses 407 acres. It drains through a 36-inch pipe that daylights west of the street end of South 192nd Street, becoming the East Fork of Des Moines Creek.

The intent of this study is to explore options for developing joint-use public facilities in the Bow Lake area. In this instance, joint-use can have several meanings. It refers to the joint development of property for both recreation and stormwater handling purposes. It also refers to the development of public-use facilities on private property, with both public and private benefits arising from this development. For instance, trails construction around the lake may require easements across private land, such as the existing hotels, but would also make recreational access to the lake possible for hotel guests. Currently the lake is an underutilized asset as a recreation resource.



Source: City of SeaTac GIS, 2000; Nies Mapping Group, Inc. 1999;
 National Wetlands Inventory USFWS, 1999; EDAW, Inc., 2000.
 P:\0e002.01\GIS\APR\BOW.APR



200 0 200 400 600 Feet

FIGURE 1.1
Property Ownership

Three alternative plan options were developed to explore different intensities and combinations of recreation and stormwater facilities. These plans represent a wide range in costs and benefits. In simplistic terms, the higher the costs, the greater the benefits in terms of public facilities capability. Also, in the case of stormwater facilities, the greater the investment in facilities, the more private benefit and the more ability for a revenue stream to be captured to help finance the investment.

At the same time, the greater the investment, the higher the impact on privately owned land. While this impact could result in increased property values for individual property owners, as well as other benefits, it may not be in keeping with the owners' vision for their property. This study draws no conclusions with regards to identifying a preferred alternative, but rather tries only to define the alternatives at a conceptual level, assign an order-of-magnitude cost figure to each, and identify some of the impacts and benefits for each alternative.

Future phases of study should include public outreach efforts, both to private property owners and to the various regulatory agencies, particularly the Washington Department of Ecology. There are numerous advantages in creatively exploring the potential of joint-use facilities in the Bow Lake environs, both public and private benefits. This study represents a first step in exploring that potential in keeping with the spirit and intent of the City Center Plan and the Comprehensive Plan.

2.0 SITE ANALYSIS

2.1 Existing Physical Conditions

The project area boundaries for this Joint-Use Facilities Study are defined by the private property boundaries of those parcels contiguous with Bow Lake, which is an entirely privately owned lake. A description of the site development on each property is as follows, beginning from S. 188th Street, and proceeding clockwise around the lake:

DoubleTree Hotel: this parcel consists of 15.35 acres extensively developed with mid-rise and high-rise buildings forming an extensive hotel complex, located at the northeast corner of the intersection of International Boulevard (Highway 99) and South 188th Street (Photo 1).



Photo 1 – View of Bow Lake from the DoubleTree Hotel, SeaTac, Washington.

Most of the property not covered by building footprint is covered with extensive surface parking lots. There is minimal buffer area (<10 feet) between the parking lots and the Bow Lake open water surface. Several of the hotel buildings are placed on piles and extend some distance out over open water, approximately 7 to 8 feet above the water surface. They block access on foot around the south end of the

wetland. Because these structures are connected to a larger complex behind them, there is no pedestrian way around the lake that does not require entering the hotel complex. This hotel complex is bordered on the east by an established single-family residential neighborhood. A portion of the property extending around the lake to the east is undeveloped and consists predominantly of a forested wetland buffering the lake from the Colacurcio property. A stormwater structure at the southwest corner of the lake adjacent the DoubleTree parking lot provides the entrance to the lake outlet pipe.

Chevron Service Co.: This parcel consists of 0.7-acre developed as surface parking lot. It is elevated approximately 10 to 15 feet above the lake surface. A scrub-shrub wetland buffers this area from Bow Lake.

Washington Mutual Bank: This parcel consists of 1.65 developed acres with a single-story bank building and surface parking. It is elevated approximately 10 feet above the lake surface. A grassy bank drops down from the parking lot to a fringe of scrub-shrub wetland that extends around the lake at this point.

Airport Parking: Two parcels consisting of 1.14 and 1.42 acres each developed as a surface parking lot. They are elevated approximately 10 to 15 feet above the lake surface. A scrub-shrub wetland buffers Bow Lake from this use.

SeaTac West Coast Hotel: This parcel consists of 2.17 acres largely developed with a high-rise hotel structure, structured parking, and surface parking. The surface parking lot at the south end of the parcel is raised approximately 15 to 20 feet above the lake surface. A steep gravel-faced bank drops from the parking lot to a narrow forested wetland fringe at the lake edge. The northern half of the site contains the hotel structure and structured parking extending around it. The surface deck on top of the parking structure extends around the hotel and allows for vehicular circulation approximately 15 to 20 feet above the lake surface. There is a narrow (± 15 feet) scrub-shrub wetland fringe at the lake edge between the open water and the face of the parking structure.

Wyndham Gardens: This parcel consists of 5.84 acres largely developed with a high-rise hotel structure and structured parking, as well as an outdoor swimming pool on a deck between the hotel and the lake edge. The surface of the deck is 5 to 8 feet below the deck of the West Coast Hotel, which abuts it to the south. The east face of the structure is aligned with the face of the parking structure to the south, with a narrow ($\pm 15'$) scrub-shrub wetland fringe at the lake edge.

Kilroy Office Complex: This parcel consists of 15.12 acres developed as an office complex, including two towers and a low-rise structure housing the SeaTac City Hall. Most of the remainder of the property is developed as surface parking. The office structures are on that part of the site closest to International Boulevard, while the surface parking is to the east, located directly north of the lake. The level of the surface lots is only slightly elevated above the lake level. A block of scrub-shrub wetland marks the interface between the parking area and the lake itself. This is one of the widest blocks of fringe wetlands around the lake. An open ditch conveys stormwater through these forested wetlands into the lake. The forested wetlands are separated from the parking area by an 8 foot cyclone fence. The hillside on the eastern portion of the property is vegetated. There may be opportunities within the site during future development to create a more natural environment to convey stormwater to the lake while simultaneously improving water quality. There is a development agreement allowing construction of a multi-story parking structure on the northeast corner of the site (Craig Ward, personal communication).

Mobile Home Park: This parcel consists of 38.56 acres developed as a private mobile home park. There is a single access point on the northwest corner of the property that is gated and served by a gatehouse. A fence encircles the entire property. The topography of the site slopes naturally down to the lake level at a gentle grade. Of that portion of the uplands adjacent the lake, the southern half consists of private open

space for the residents, while the northern half consists of a large cattail marsh. The private open space area is mostly covered in lawn and includes a recently installed path system. The lakeshore adjacent this private open space consists of a low (1 to 2 foot high) revetment constructed of recycled concrete slabs. Although physically there are opportunities to access the lake edge, the public currently has no way of doing so due to the private nature of this property. There is an additional parcel of 4.86 acres in area that appears to have been developed as a part of the mobile home park. This parcel may have changed ownership recently.

Colacurcio Property: This parcel consists of 17.1 acres. It is largely undeveloped, with the exception of a single residential structure. Roughly a third of the parcel consists of wetlands, while the remainder is upland, currently maintained in pasture. The parcel is bordered by single-family residences on the east and south sides, and the mobile home park on the north side. This property is the only one in the study area that does not actually include surface waters of Bow Lake. The property line stops short of the lake, and the undeveloped wetland portion of the DoubleTree Inn property intervenes. However, the on-site wetlands have a natural association with the lake and is the highest quality wetland habitat remaining in the Bow Lake basin. Most of the property nearest the lake is included in the wetlands area. There are two access points into the property from the City street system—one from the northeast and one from the southeast. These are the natural access points should the site be developed in the future. Multi-family development is the most likely future land use for the upland portion of the site, as expressed by the property owner. Recent negotiations with the City over development standards could result in the ultimate conveyance of wetlands to the City (City of SeaTac 2000b). The City Center Plan (City of SeaTac 2000) identifies a future road alignment passing through the property.

2.2 Description of Joint-Use Facilities

The SeaTac City Center Plan identifies Bow Lake as a potential recreational amenity for the City, despite its private ownership. Both the Comprehensive Plan and the City Center Plan designate the area adjacent to International Boulevard north of South 188th Street as a City Center with fairly intense levels of urban development over the next 20 years, particularly commercial and visitor-serving land uses. Despite the density of this planned City Center, there are very few public open space opportunities for either office workers, visitors, including hotel guests, or local residents. It is the City's intent for increasing the amount of open space available to users of the City Center area. One possibility for increasing open space is to create facilities at Bow Lake that are compatible with present or future land uses there. These might include walking trails that circumnavigate the lake, trails that border a portion of the lake, short boardwalks that go through wetland areas or even extend out into the lake for viewing, or small viewing platforms adjacent to parking lots or other access points. Such facilities could also be used for environmental education and interpretation opportunities. They would be thought of as joint-use facilities, because they would serve both public and private use. The visitor-serving industries in particular could benefit from having such facilities available for their guests.

Other facility needs in the area include stormwater detention structures as properties redevelop, as well as to ensure that water quality standards are met. The possibility exists that some of these needs could be met in or adjacent Bow Lake. It may even be possible to combine development of stormwater facilities and recreation facilities as a single joint-use project, either through public-private partnerships, as a public capital improvement project, or as part of private redevelopment. The wetlands to be deeded to the City as part of the redevelopment agreement for the Colacurcio property need to be investigated in this light. Other possibilities might include development of limited bioswales or stream restoration on the south end of the Kilroy office complex, improving the quality of the water entering Bow Lake at the north end; and/or eventual stormwater facilities on the mobile home park site should it redevelop in the future.

2.3 Environmental Conditions

There are some specific site conditions that influence the development of alternatives for this Joint-Use Facilities Study (Figure 2.1). Very different land use conditions exist from one side of the lake to the other. On the west and south sides, development consists of large hotels and speculative office space. On the east side, residential land uses are entirely dominant. The lake, once a pristine peat wetland, is largely hemmed in by development, with many of its natural functions reduced. Development intrudes into the lake itself, with the DoubleTree Inn on the south side built on piles over the lake, and the shore adjacent the mobile home park on the east side armored with what appears to be pieces of recycled concrete pavement. A large 36-inch stormwater pipe drains the lake overflow at the south end, conveying excess stormwater into Des Moines Creek. Even this is not large enough to prevent occasional flooding during peak storm events. There are other areas of flooding concern within the immediate vicinity of the lake, in particular an area north of the intersection of 38th Avenue South and South 183rd Street. Some of the existing major stormwater conveyance system is not publicly owned. For instance, a large box culvert draining much of the commercially zoned area immediately north of the lake along International Boulevard is privately owned.

Transportation systems in the City Center area are not capable of supporting the vision developed for the neighborhood in the City Center Plan. There is no east-west connection between the residential neighborhoods to the east and the employment and entertainment land uses along International Boulevard, including SeaTac Airport, and no north-south road connection exists between International Boulevard and 42nd Street many blocks to the east. The City Center Plan identifies some conceptual ideas for completing both north-south and east-west connections. EDAW has attempted to respond to these concepts in developing the alternatives presented in this report.

2.3.1 Hydrology

Special Hydrological Characteristics of Bow Lake: Bow Lake is a 12-acre lake located in the Des Moines Creek drainage basin. The lake is located approximately 300 feet east of International Boulevard and 800 feet north of South 188th Street. According to the Water Supply Bulletin No. 14 - Lakes of Washington, Volume 1, Western Washington (Wolcott 1961), the lake is estimated to be 20 feet deep. Historically the lake was mined for peat. The Bow Lake drainage basin contains approximately 445 acres, which comprises about 15 percent of the entire 2,936 acres in the Des Moines Creek drainage basin. Existing land uses within the Bow Lake drainage basin include a mix of commercial and residential uses, including single and multi-family residential, office buildings, hotels, a mobile home park, several parking lots for long-term parking, car rental, and auto sales.

Bow Lake's water surface elevation fluctuates depending on the intensity of storm events. Modeling for Bow Lake shows that the level of the lake will rise approximately 2 feet during a 2-year storm event and slightly more than 3 feet during a 100-year storm event. During the summer months, the water surface level decreases slightly.

Des Moines Creek has two main tributaries—the East and the West Forks. Bow Lake is located near the upstream end of the East Fork. According to the November 1997 Des Moines Creek Basin Plan, there is little evidence of a stream system at all above Bow Lake. Most of the Bow Lake drainage basin is developed, with relatively little vacant land remaining. Much of the construction within the basin was done prior to 1979, at a time when King County had no requirements for storm water detention/retention or water quality treatment for new developments. Projects developed prior to 1979 would likely have discharged directly to the lake or existing drainage systems without provisions for water quantity control or water quality treatment.



Source: City of SeaTac GIS, 2000; Nies Mapping Group, Inc. 1999; National Wetlands Inventory USFWS, 1999; EDAW, Inc., 2000. P:\0e002.01\GIS\APR\BOW.APR



200 0 200 400 Feet

FIGURE 2.1
Site Analysis

Those projects permitted for construction between 1979 and 1990 that exceeded a prescribed size were required under King County standards to provide limited stormwater quantity control but no water quality treatment. The detention requirements under the 1979 Manual resulted in stormwater facilities much smaller than those required under today's standards.

In 1990, King County adopted a new storm drainage manual that required both water quality treatment and quantity control for both new and re-development. Under this manual, runoff that discharged to the lake would for the first time have to be treated to maintain water quality standards in addition to the rate of discharge being limited to existing conditions. Again in 1998, King County adopted a new drainage manual that contains even more stringent water quality treatment and water quantity control. (Note: The City of SeaTac has adopted the current 1998 King County Surface Water Design Manual as their standards.)

In 1995, Barrett Consulting Group in conjunction with Nies Mapping Group, Inc. created drainage maps for the City of SeaTac. These drainage maps identified a total of five discharge points to Bow Lake. Three of the discharge points are located near the north end of the lake, and two are located near the south end. No discharge point from the existing trailer park on the east side of the lake is shown, but it is likely that one exists. A single lake outlet point, consisting of a 36-inch diameter concrete culvert at the southwest corner of the lake, is identified on these maps.

In the Des Moines Creek Detention Facility Site Assessment, dated June 22, 1995 (Seattle University 1995), it was stated that no additional detention could be provided at Bow Lake. While it is true that no additional detention is available above the current lake level, a strategy to increase detention volume in the lake was proposed in both the Des Moines Creek Basin Plan and the City of SeaTac Surface Water Plan. This strategy involved modifying the outlet structure at Bow Lake to lower the lake level by 2 feet, which would result in approximately 25 acre-feet of additional storage.

The lowering of the lake could be accomplished by at least two different approaches. The first approach would be the construction of a second outlet pipe together with a control structure at a lower elevation than the existing outlet. The control structure would allow the rate of flow and the timing of flow to be controlled. The second would involve the installation of a pump located in a sump that would be designed to pump flow from the lake at a controlled rate between storm events. The lake could be lowered permanently or only seasonally (e.g., during the critical winter months). The lowering of the lake only seasonally would reduce the impacts that the lowering of the lake would have on the recreational use of the lake.

Water Quality Parameters Typically Associated with Urban Runoff: Urban runoff can adversely affect aquatic systems by altering stream and lake normal hydrologic regimes, destroying fish habitat, and degrading water quality. Urban runoff subjects streams and lakes to higher flows during storm events, as well as to substantially reduced flows between storms. Higher flow can impair stream habitat by eroding streambanks, while decreased flow can make the habitat unsuitable for many aquatic animals. Suspended solids, nutrients, metals, oils and greases, bacteria, and toxins are all constituents found in urban runoff that degrade water quality in Bow Lake and its downstream receiving waters, including Des Moines Creek and Puget Sound (refer to Bow Lake Technical Memo #1 [EDAW 2000a] for an in-depth discussion of each constituent and its effects on Bow Lake and Des Moines Creek). A number of studies have been conducted of water quality in the Bow Lake and Des Moines Creek basins. These studies date back to the mid 1970s, and are sponsored by Federal, State, and local jurisdictions including the United States Geological Survey (USGS), Department of Ecology, King County, SeaTac, and Des Moines. Following is a summary of water quality data sampled within the Bow Lake Basin.

Bow Lake: Historically, Bow Lake was a peat bog that is now used as regional detention for flood attenuation in Des Moines Creek. Most peat bogs are classified as oligotrophic, meaning they have relatively low nutrient levels with relatively clear water, little algae, little sediment deposited on the bottom, and very few plants. The Department of Ecology's 305(b) Report (Ecology 1995) concludes that Bow Lake's water quality supports similar beneficial uses to nearby Angle Lake: aesthetic enjoyment and the rearing, harvesting, and spawning of fish. This assessment was based on data collected by the USGS and Ecology in 1985. Water quality monitoring at the outlet from Bow Lake conducted in December 1991 (Parametrix 1992) indicate that pH and dissolved oxygen levels fall below minimum criteria for release to Class AA streams (Des Moines Creek), and fecal coliform bacteria concentrations are higher than the maximum criteria. Low pH values would be expected in a peatland bog where acidic organic soils are present. In 1996, a total petroleum hydrocarbon (TPH) evaluation was completed for the Seattle-Tacoma International Airport (STIA) including Bow Lake, although no drainage from the STIA enters Bow Lake. TPH evaluation is a measure of motor oils and other gasolines found in the sediments deposited in Bow Lake. Tests showed approximately 85 percent of the TPH in Bow Lake to be motor oil, and 15 percent to be weathered diesel.

Bow Lake Basin: Stormwater runoff in the Bow Lake Basin was sampled in October 1999 by the City of SeaTac, with results summarized in Tables 2.3-1 and 2.3-2. Also included in Tables 2.3-1 and 2.3-2 are the State's water quality criteria and water quality statistics for *streams* in the Seattle metropolitan area for comparison.

Table 2.3-1: Water quality statistics from urban runoff in the Bow Lake Basin and Seattle Streams and Washington water quality criteria.

Sample	DO (mg/l)	BOD (mg/l)	pH	TSS (mg/l)	Fecals (#/100ml)	Total P (mg/l)	NO3+NO2 (mg/l)	Hardness (mgCaCO3/l)
10/27/99 ¹	9.5	8.82	6.4	19	98	0.123	0.211	37.1
Criteria ² Class AA	>9.5		6.5 – 8.5		50			
Criteria ² Class A	>8.0		6.5 – 8.5		100			
Seattle Streams Median ³	10.7		7.7		165	0.055	0.774	
Seattle Streams Minimum ³	6.0		7.0		7	0.016	0.053	
Seattle Streams Maximum ³	14.2		8.2		1219	0.214	4.20	

1. Sample taken from storm sewer outfall behind the DoubleTree Hotel, 10/27/99

2. Source: WAC-173-201. Acute / chronic criteria for ammonia assume worst-case conditions of pH (8.0) and temperature (20°C). Acute / chronic criteria for metals assume a hardness of 20 mg/L as CaCO₃

3. Source: Metro 1990. While statistics for metals are based on three samples collected during wet weather at 10 stations, other statistics are based on 12 samples collected monthly at 50 stations.

Note that the sampled storm is just one event and is not necessarily an indicator of average pollutant loadings to Bow Lake, but rather a snapshot in time from a relatively small area of the watershed. It does show, however, that there are areas within the watershed that are leading to the degradation of the water quality in both Bow Lake and Des Moines Creek.

Table 2.3-2: Water quality statistics from urban runoff in the Bow Lake Basin and Seattle Streams and Washington water quality criteria (metals & petroleum products)

Sample	DISSOLVED METALS			TOTAL METALS			NWTPH-DX	
	Copper (mg/l)	Lead (mg/l)	Zinc (mg/l)	Copper (mg/l)	Lead (mg/l)	Zinc (mg/l)	Diesel (mg/l)	Motor Oil (mg/l)
10/27/99 ¹	0.0092	<0.001	0.042	0.0164	0.0075	0.058	<0.05	1.28
Criteria ² Class AA				0.004 / 0.003	0.011 / 0.0004	0.03 / 0.027		
Criteria ² Class A				0.004 / 0.003	0.011 / 0.0004	0.03 / 0.027		
Seattle Streams Median ³				0.003	0.03	0.01		
Seattle Streams Minimum ³				<0.002	0.03	0.004		
Seattle Streams Maximum ³				0.012	0.05	0.085		

1. Sample taken from storm sewer outfall behind the DoubleTree Hotel, 10/27/99

2. Source: WAC-173-201. Acute / chronic criteria for ammonia assume worst-case conditions of pH (8.0) and temperature (20°C). Acute / chronic criteria for metals assume a hardness of 20 mg/L as CaCO₃

3. Source: Metro 1990. While statistics for metals are based on three samples collected during wet weather at 10 stations, other statistics are based on 12 samples collected monthly at 50 stations.

2.3.2 Wetland and Wildlife Habitat Assessment

The Bow Lake site is a wetland complex composed of a variety of wetland habitat types including scrub-shrub, forested wetlands, and open water (Photo 2).



Photo 2 - Bow Lake's open water habitat, City of SeaTac, Washington.

Wetland Complex: Wetlands are considered valuable to public safety and welfare due to their inherent attributes and the biophysical processes that they can perform within their landscape. Among the important ecological functions provided by wetlands are food chain support; habitat for foraging, nesting, and rearing for aquatic, terrestrial, and avian species; enhancement of water availability and quality; service as recharge and discharge areas for groundwater aquifers; and attenuation of surface and stormwater flows. Despite the degraded nature of the area (as described below), the wetland complex at the Bow Lake site provides many important ecological functions. In addition to providing stormwater quality improvement functions for wetlands on site, Bow Lake wetlands provide waterflow for Des Moines Creek. For recreational and aesthetic functions, Bow Lake currently provides for a limited number of people. With the addition of a proposed trail, the Bow Lake wetland complex could provide passive recreational, aesthetic, and educational opportunities for the larger public.

The Bow Lake wetland complex contains a total of 22.5 acres of palustrine wetlands. Palustrine systems include “all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens...” (Cowardin et al. 1979). Broken down by National Wetlands Inventory (NWI) wetland habitat type, the complex is made up of 0.43 acre of POWH (Palustrine Open Water Permanently Flooded), 13.06 acres of POWHX (Palustrine Open Water Permanently Flooded Excavated), 4.85 acres of PPS/FOC (Palustrine Scrub-Shrub/Forested Seasonally Flooded), and 4.13 acres of PSSC (Palustrine Scrub-Shrub Seasonally Flooded) areas (USFWS 1981-1999) (Figure 2.2). This wetland complex is considered a sensitive area by the City of SeaTac (Casey, G., personal communication). Orthophoto examination confirms the approximate area and existence of NWI and SeaTac wetland areas.

Of the total wetland complex, 9.01 acres are either scrub-shrub or forested wetlands (USFWS 1981-1999). Table 2.3-3 lists the plant species observed, documented, or likely to occur in the area. Documented species include: redbud (*Agrostis alba*), tall fescue (*Festuca arundinacea*), hardhack (*Spirea douglasii*), red-osier dogwood (*Cornus stolonifera*), willow species (*Salix sitchensis* and *S. lasiandra*), velvet grass (*Holcus lanatus*), creeping buttercup (*Ranunculus repens*), black cottonwood (*Populus balsamifera*), red alder (*Alnus rubra*), and slough sedge (*Carex obnupta*) (B-twelve Associates, Inc. 1998). In the 1998 wetland delineation report, the existing shrub-scrub and forested wetlands are said to be degraded due to land use impacts associated with adjacent urban development (B-twelve Associates, Inc. 1998).

The two open water components of the wetland complex found on site cover 13.49 acres. The 13.06-acre open water area, commonly referred to as Bow Lake, has been excavated due to peat mining (USFWS 1981-1999; Richard Schaefer, Personal Communication). The second open water component is a small 0.43-acre area nested in the scrub-shrub and forested wetlands in the southeast corner of the complex.

The entire Bow Lake wetland complex, as well as connected riparian zones, are exposed to increasing storm water discharge events from expansion of off-site and upslope impervious surfaces in the area. The site falls within the King County-identified 100 year floodplain (King County DNR 1998). Field observations made on March 3, 2000 include the evidence of flooding in Des Moines Creek. Annual winter flooding of this area is highly possible. Storm water discharge is a major contributor to the degraded water quality of the Bow Lake site. The water quality of the Bow Lake wetland complex and, in turn, Des Moines Creek is identified as failing to meet State water quality standards (Earth Tech 1997; Des Moines Creek Basin Committee 1997). Puget Sound receives direct flow from Des Moines Creek and hence degraded water from the above sources.

Buffer Zones: Buffer zones surrounding the entire Bow Lake site are highly disturbed due to current land uses and range in width from zero to over 100 feet. Pollution, invasive species, vegetation removal, placement of impervious surfaces, grazing, and recreational use have all contributed to these degraded buffers. The 1996 orthophoto coverage shows this lack of wetland buffer to be most evident along the



Source: City of SeaTac GIS, 2000; Niles Mapping Group, Inc. 1999; National Wetlands Inventory USFWS, 1999; EDAW, Inc., 2000. P:\0e002.01\GIS\APR\BOW.APR

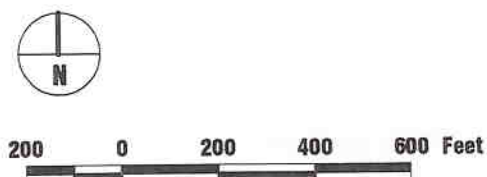


FIGURE 2.2
Bow Lake and
National Wetland Inventory Data

Table 2.3-3: Plant species documented or likely to occur in or adjacent to the Bow Lake wetland complex, City of SeaTac, King County, Washington

Stratum	Scientific Name	Common Name	Native (N)/ Introduced (I)
Tree	<i>Alnus rubra</i>	Red Alder	N
Tree	<i>Populus balsamifera</i> ssp. <i>trichocarpa</i>	Black Cottonwood	N
Tree	<i>Pseudotsuga menziesii</i>	Douglas-fir	N
Tree	<i>Salix</i> sp.	Willow sp.	N
Tree	<i>Thuja plicata</i>	Western Red-cedar	N
Shrub	<i>Cornus sericea</i> var. <i>sericea</i>	Red-osier Dogwood	N
Shrub	<i>Corylus cornuta</i> var. <i>californica</i>	Pacific Hazelnut	N
Shrub	<i>Cytisus scoparius</i>	Scotchbroom	I
Shrub	<i>Rubus discolor</i>	Himalayan Blackberry	I
Shrub	<i>Spirea douglasii</i>	Hardhack	N
Graminoid	<i>Agropyron repens</i>	Bentgrass	I
Graminoid	<i>Agrostis alba</i>	Redtop	N
Graminoid	<i>Agrostis</i> sp.	Bentgrass	N
Graminoid	<i>Agrostis tenuis</i>	Quackgrass	I
Graminoid	<i>Carex obnupta</i>	Slough sedge	N
Graminoid	<i>Dactylis glomerata</i>	Orchard Grass	I
Graminoid	<i>Elymus glaucus</i> var. <i>breviaristatus</i>	Blue Wild Rye	N
Graminoid	<i>Festuca arundinacea</i>	Tall Fescue	I
Graminoid	<i>Holcus lanatus</i>	Common Velvetgrass	I
Graminoid	<i>Iris pseudoacorus</i>	Yellow-flag Iris	N
Graminoid	<i>Juncus effusus</i>	Common Rush	N
Graminoid	<i>Lolium perenne</i>	Ryegrass	I
Graminoid	<i>Phalaris arundinacea</i>	Reed Canarygrass	I
Graminoid	<i>Phleum pratense</i>	Common Timothy	I
Graminoid	<i>Poa pratensis</i>	Kentucky Bluegrass	I
Graminoid	<i>Scirpus microcarpus</i>	Small-Fruit Bulrush	N
Herb	<i>Calystegia sepium</i>	Hedge Bindweed	I
Herb	<i>Impatiens capensis</i>	Spotted Touch-Me-Not	I
Herb	<i>Lotus formosissimus</i>	Seaside Trefoil	N
Herb	<i>Melilotus alba</i>	White Sweet Clover	I
Herb	<i>Plantago lanceolata</i>	English Plantain	I
Herb	<i>Polygonum cuspidatum</i>	Japanese Knotweed	I
Herb	<i>Ranunculus repens</i>	Creeping Buttercup	I
Herb	<i>Taraxacum officinale</i>	Dandelion	N
Herb	<i>Trifolium dubium</i>	Suckling Clover	I
Herb	<i>Trifolium pratense</i>	Red Clover	I
Herb	<i>Typha latifolia</i>	Common Cattail	N
Herb	<i>Xanthium strumarium</i>	Common Cockle-Bur	I

(Data sources: field observations; B-twelve Associates, Inc. 1998)

southern and western edge, as well as along the trailer home park region (Photo 3). Stormwater directly flows into the wetland complex in these areas. Pollution appears to be a significant issue, as reflected in the sub-standard water quality of the wetlands. Untreated run-off from streets and parking lots surrounding the site flows directly into the wetland complex and eventually into Des Moines Creek. As B-twelve Associates described in their reference to the eastern wetland area: "...there is currently no effective functioning buffer on this wetland" (B-twelve Associates Inc. 1998).

There is a more significant buffer along the northern edge of the Bow Lake wetland; however, field observations showed this area to be suffering from a high level of pollution in the form of garbage dumping and construction material storage. The region with the most buffering function opportunities is the southeastern corner of the site, where there is an area of undeveloped land. In this area, the scrub-shrub and forested wetlands are surrounded by an upland vegetation buffer (Photo 4).



Photo 3 – Western buffer on Bow Lake, SeaTac, Washington.

2.3.3 Wetlands Regulatory Context

At least three levels of government have jurisdiction over the Bow Lake wetland complex: the Federal government, Washington State, and the City of SeaTac. Site-specific design of the recreational trail plan and any associated development will guide the regulatory and permitting process. The primary issues are likely to focus on wetland alterations, such as filling, hydrology alterations, or over-water shading.



Photo 4 – Southeastern upland buffer area of Bow Lake with DoubleTree Hotel in far background, SeaTac, Washington.

Federal Jurisdiction

Federal jurisdiction for the Bow Lake site is authorized under the Clean Water Act, the Endangered Species Act, and the Migratory Bird Treaty Act.

Clean Water Act, Section 404 & 401: As described above, the geographic extent of waters of the United States, including wetlands, indicate that 22.5 acres of the Bow Lake site are waters/wetlands. These wetlands need to be officially delineated and approved by the U.S. Army Corps of Engineers (COE), Seattle District, before a final jurisdictional determination is made.

The Clean Water Act (CWA) was enacted with the objective of maintaining and restoring the chemical, physical, and biological integrity of waters of the United States. Section 404 of the CWA authorizes the Secretary of the COE, acting via the Chief of Engineers, to issue permits for the discharge of dredged or fill material into waters of the United States, including wetlands. Wetlands are defined as “those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas” (33 CFR 328.3). COE permitting procedures must comply with the National Environmental Policy Act (NEPA).

The Washington State Department of Ecology (DOE) administers the Federal Clean Water Act Section 401, Water Quality Certification Program. Any discharges of dredged or fill materials to waters/wetlands

on the site must be reviewed by the DOE for consistency with the State 401 Water Quality Certification Program. The COE must have DOE certification prior to issuance of any Section 404 permit. The need for 404 and 401 permits, and the extent of the permit review process, will vary depending on the level of impact of any project proposed for Bow Lake. It is standard practice for EDAW, Inc. to recommend notification to the COE, Seattle District of impending discharges regardless of acreage, since COE permitting is discretionary.

Endangered Species Act: The Endangered Species Act is enforced by the U.S. Fish and Wildlife Service (USFWS), whose mandate is protect and rehabilitate Federally listed Threatened or Endangered species. Consultation is required between COE and USFWS or the National Marine Fisheries Service (NMFS) to determine that no threatened or endangered species or critical habitats are located in the project area before a Section 404 Clean Water Act permit can be issued. Any project with the potential to affect endangered species and/or critical habitats must have current surveys made for their presence. For the Bow Lake site, no Threatened or Endangered species are known or expected on site. However, there are two species with special status off-site. A bald eagle nest located near Angle Lake is outside of the Washington Department of Fish and Wildlife (WDFW) recommended buffer widths; however, the USFWS may want to examine the potential impacts of any Bow Lake development on eagle habitat quality. The second species with special status is coho salmon in Des Moines Creek. This species is currently listed as a Candidate species (NMFS 1999). Depending on the timing of listing, this species could become Federally listed during the design of a trail system. Any projected impacts to Des Moines Creek coho could be examined by NMFS, especially if the Bow Lake project is tied to a larger stormwater detention project.

If development is limited to a proposed trail development, then it is expected to have little impact on salmonid species in the Bow Lake and the Des Moines watershed basin. Changes in area hydrology and wetland function would be minimal and would effect no material change in habitat quality for salmonid species. Any wetland and stream-bank restoration accompanying a trail development could enhance habitat quality for salmonids by improving wetland functions, especially water quality and fluctuation.

Migratory Bird Treaty Act: The Migratory Bird Treaty Act provides protection to migratory birds, as well as their nests sites and eggs. It is unlawful to take, possess, buy, sell, purchase, transport, barter a species protected under the act or any part of it, including feathers or other parts, nests, eggs, or other products. Under this act, potential impacts to wintering waterfowl at Bow Lake could be regulated. Field observations indicate that a variety of waterfowl use the Bow Lake wetlands.

Washington State Jurisdiction

Washington State jurisdiction for the Bow Lake site is authorized under the Hydraulic Projects Approval program, the Washington State Environmental Policy Act, and the Shoreline Management Act.

Hydraulic Projects Approval: The WDFW administers the Hydraulic Project Approvals (HPA) program in the state of Washington (RCW 75.20). The HPA permit process ensures that development in fish-bearing waters and associated wetlands does not significantly degrade overall water and/or fish habitat quality. It is the best professional judgment of EDAW that the wetlands on the Bow Lake site are associated with fish-bearing waters of the state, specifically Des Moines Creek. However, formal determination of association with waters/wetlands is at the discretion of the WDFW. The WDFW will review any proposed plans to ensure that overall water and/or fish habitat quality is not compromised by proposed activities. As stated above, fish impacts associated with a trail project are expected to be minimal. Furthermore, site enhancement and mitigation measures suggested in this report may lead to an overall improvement for fish-bearing water quality.

Washington State Environmental Policy Act: The Washington State Environmental Policy Act (SEPA) provides a process to assess the environmental impacts of proposed development projects. SEPA requires evaluation of the likely significant adverse impacts of a proposed project and identification of ways to mitigate or reduce those impacts. A SEPA review is made by the local jurisdiction. In this case, the City of SeaTac assumes SEPA responsibility. An environmental impact statement (EIS), which analyzes project impacts, is required for proposals predicted to have significant adverse impacts on the environment. Projects with little or no predicted impacts are required to prepare a SEPA checklist (WAC 197-11960). This checklist process involves the documentation of the exact development proposal and its environmental impacts. A recreational trail around Bow Lake is not likely to be determined a significant impact to the environment, in which case a SEPA checklist could be required. However, if the project is tied to a larger stormwater project, the significance could increase and could require a full EIS.

State Shoreline Management Act: The Washington State Department of Ecology (DOE) oversees the Shoreline Management Program in the state of Washington (RCW 90.58). Local governments have the primary responsibility for initiating the planning and administering of the regulatory program. DOE acts primarily in a supportive and review capacity with an emphasis on providing assistance to local government and ensuring compliance with the policy and provisions of this chapter. Under the act, "shorelines" are defined as "the water areas of the state, and associated shorelands, together with the lands underlying them; except (i) shorelines of state-wide significance; (ii) shorelines on segments of streams upstream of a point where the mean annual flow is twenty cubic feet per second or less and the wetlands associated with such upstream segments; and (iii) shorelines on lakes less than twenty acres in size and wetlands associated with such small lakes" (RCW 90.58.030). Because Bow Lake's open water component of the wetland complex is less than 20 acres, the Shoreline Management Act does not apply to this project. Hence, construction around the lake would not be subject to a Shoreline Substantial Development Permit.

SeaTac Jurisdiction

The City of SeaTac jurisdiction for the Bow Lake site is authorized under the Sensitive Areas Ordinance, and the Shoreline Management Code.

Sensitive Areas Ordinance: Sensitive areas are defined, identified, and protected under the City of SeaTac's Zoning Code (Ord. 99-1031, Title 15). Sensitive areas are defined as "areas in the City which are subject to natural hazards or those land features which support unique, fragile or valuable natural resources including fishes, wildlife and other organisms and their habitat, and such resources which carry, hold or purify water in their natural state. Sensitive areas include coal mine hazard areas, erosion hazard areas, flood hazard areas, landslide hazard areas, seismic hazard areas, steep slope hazard areas, streams, volcanic hazard areas and wetlands" (Title 15). In relation to Bow Lake development, wetlands and wildlife habitat are sensitive areas that will need to be addressed. The wetlands at the Bow Lake site fit into SeaTac's wetland definition. Further, these wetlands fulfill the Class 1 wetland category, as defined in the City's Municipal Code, since the acreage is greater than ten and the site has three or more wetland classes, one of which is open water. SeaTac has set 100-foot buffer zones for Class 1 wetlands. The use of hazardous substances, pesticides, or fertilizers in wetland area may be regulated by the City of SeaTac. SeaTac has further regulations regarding stormwater, including allowing certain types of stormwater facilities within Class 1 wetlands. This issue will have to be examined by the City if stormwater facilities are included with this project. Subject to approval by SeaTac, the development of a trail may be allowed within the wetland buffer as the Sensitive Areas Ordinance allows for uncovered decks within the buffer (Title 15.30.159). In accordance with Title 15, a special report regarding sensitive areas maybe required previous to wetland alterations (Title 15.30.110).

Shoreline Management Code: The City of SeaTac is charged by the State to administer the Shoreline Management Program. Currently, the King County Shoreline Management Code is implementing this program for the City. As stated above, construction around the lake would not be subject to a Shoreline Substantial Development Permit.

2.3.4 Fish and Wildlife Species

EDAW reviewed various data sources for information on fish and wildlife including publicly available government databases, especially the WDFW Priority Habitats and Species (PHS), City of SeaTac area reports, and B-twelve Associates' Wetland Analysis Report. A one-day visual survey of species and habitats was made. Refer to Technical Memo #1 for additional information on plants and animal species of Bow Lake.

Bird Species: A review of the available information, coupled with a site visit on March 3, 2000, produced a list of avian species that potentially use the Bow Lake area for foraging and nesting. Species observed in the field include: red-winged blackbird (*Agelaius phoeniceus*), mallard (*Anas platyrhynchos*), ruddy duck (*Oxyura jamaicensis*), American coot (*Fulica americana*), ring-necked duck (*Aythya collaris*), bufflehead (*Bucephala albeola*), northern shoveler (*Anas clypeata*), pied-billed grebe (*Podiceps nigricollis*), double-crested cormorant (*Phalacrocorax auritus*), Canada goose (*Branta canadensis*), bushtit (*Psaltirparus minimus*), black-capped chickadee (*Parus atricapillus*), American robin (*Turdus migratorius*), and Bewick's wren (*Thryomanes bewickii*). The PHS database indicates a bald eagle (*Haliaeetus leucocephalus*) nest approximately 0.6 mile from Bow Lake, along Angle Lake, recorded as active in 1999.

Fish Species: Fish species documented and possibly occurring in the lake include introduced pumpkinseed sunfish (*Lepomis gibbosus*) and largemouth bass (*Micropterus salmoides*), as well as native cutthroat trout (*Oncorhynchus clarki*) (Des Moines Creek Basin Committee 1997). Largemouth bass are listed as a Washington State Priority Species (WDFW 2000).

Des Moines Creek is identified as supporting runs of several Washington State Priority species: searun cutthroat (*Oncorhynchus clarki*), steelhead (*O. mykiss*), coho (*O. kisutch*), and possibly pink salmon (*O. gorbuscha*) (Des Moines Creek Basin Committee 1997). Coho salmon runs in the Puget Sound are a candidate for listing under the Endangered Species Act (ESA). While these PHS fish species are not known to directly utilize Bow Lake, water quality in the lake affects conditions downstream (John Hansen, personal communication).

Amphibian and Reptile Species: According to available data, no amphibian or reptile species have been documented for the Bow Lake site. Amphibian and reptile species occurrences are expected to be limited due to habitat degradation in the region. Water quality problems, flooding, and lack of emergent vegetation all lessen the quality of the habitat for these species. Possible species include: long-toed salamander (*Ambystoma macrodactylum*), red-legged frog (*Rana aurora*), rough-skinned newt (*Taricha granulosa*), Pacific treefrog (*Hyla regilla*), bullfrog (*Rana catesbeiana*), northern alligator lizard (*Elgaria coerulea*), and garter snake species (*Thamnophis* sp.) (Dvornich et al. 1997; Leonard et al. 1993; Brown et al. 1995). It should be noted that the presence of bullfrogs, a non-native species, can have disastrous effects on native amphibians, especially on pond-breeding species, due to their great size, opportunistic ways, and adaptability. No amphibians or reptiles are noted in the PHS database.

Mammal Species: According to available data, no mammal species have been documented for the Bow Lake site. Mammal species occurrences are expected to be limited due to habitat degradation and lack of habitat corridors in the region. Potential mammals for the Bow Lake site are identified in Technical

Memo #1. Townsend's big-eared bat (*Plecotus townsendii*) and mink (*Mustela vison*) are the only possible Washington State Priority Species on site (WDFW 2000). There are no official database entries for mammal species in the Washington PHS database for Bow Lake.

3.0 CAPITAL FACILITY DEMAND

The purpose of this chapter is to determine a realistic program to support public facility planning scenarios by developing an estimate of facility needs and demand for both stormwater facilities and recreation opportunities. The proposal to develop a recreational trail at Bow Lake presents an opportunity to accomplish a joint-use facility where recreational and surface water objectives are mutually supported and the elements of the facility plan enhance one another. Improving shoreline access through a trail system will increase the visibility and knowledge of the lake within the community. This would create an opportunity to increase public awareness of and stewardship for water quality within the basin. The implementation of surface water control facilities is intended to improve water quality, thereby enhancing aesthetic qualities of Bow Lake and drawing users to the trail system. Improvements to surface water conditions in Bow Lake can also be considered mitigation for potential impacts of the trail construction.

3.1 Stormwater Facility Needs

The purpose of this task is to identify the driving forces behind the need for additional stormwater runoff treatment within the Bow Lake basin, develop alternative strategies to meet those needs, and define the specific control structures required by each strategy. Each strategy is linked to one of the three alternatives developed as part of this task, and described in Section 4.0. This discussion recognizes that both water quantity and water quality must be taken into account, and that each of these two factors generates different facilities needs.

3.1.1 Stormwater Management Objectives

The following are identified objectives for managing surface water in the Bow Lake drainage that may be supported by constructing improvements as part of a joint-use facility with the recreational trail:

- Controlling the presence of debris in the lake
- Providing capability to prevent waste spills from entering the lake
- Reducing contaminant loading to the lake for parameters of concern
- Enhancing control of peak discharge rates to Des Moines Creek
- Reducing cumulative costs of public/private stormwater treatment and control.

3.1.2 Stormwater Facility Needs due to Land Use Changes

Proposed changes in land use within the Bow Lake basin will necessitate substantial investment in on-site stormwater controls both for new development on undeveloped sites and for re-development of built land parcels. Based on the requirements of the 1998 King County Surface Water Design Manual (KCSWDM),

it is estimated that new development and re-development in the Bow Lake basin would be required to incorporate substantial on-site infrastructure to control the quality and peak rates of stormwater discharge from those sites. It should be noted, however, that the 1998 KCSWDM has different requirements for stormwater quality and quantity control depending on the downstream drainage system.

Considering the cumulative requirements for flow control, it is estimated that developers would need to construct approximately 6 acre-feet of on-site flow control (detention) storage within the Bow Lake basin to handle future detention needs over the next 20 years. In addition, these developments will cumulatively need to provide water quality treatment facilities with a functional equivalent of 5 acre-feet of storage volume in water quality vaults, tanks, and ponds over that same period of time. Because of the intensity of the proposed land uses in the basin, it is expected that the majority of this on-site detention storage and treatment volume would be constructed in the form of underground vaults to preserve use of parcel area for other uses, such as parking. The costs of on-site infrastructure requirements would fall primarily on developers of multi-family and commercial properties, as the scale of single-family residential construction is generally below the thresholds triggering the control requirements. Runoff from existing development in the Bow Lake basin not undergoing redevelopment is not subject to water quality treatment or flow control facilities. It is therefore reasonable to consider constructing regional facilities as an alternative to on-site controls to effectively treat all runoff draining to the lake and possibly achieve economies of scale in construction.

The Bow Lake basin and the three major sub-basins that are tributaries to the lake are graphically depicted in Figure 3.1. Table 3.1-1 summarizes the facility requirements to treat runoff from the three sub-basins within the Bow Lake drainage, including all existing and proposed development. The boundaries of the sub-basins were determined using the drainage maps prepared in 1995. To allow for comparisons to the on-site requirements cited above, the water quality facility requirements are sized based on treatment using ponds or vaults consistent with current City stormwater standards. The required water quality volume for a basic wetpond/wet vault is 3 times the basin runoff from the mean annual storm (mean annual storm is a conceptual storm defined by dividing the annual precipitation by the total number of storm events per year). The 1998 KCSWDM identifies the mean annual storm for the SeaTac area at 0.47 inch, which was used to derive the requirements shown in Table 3.1.1.

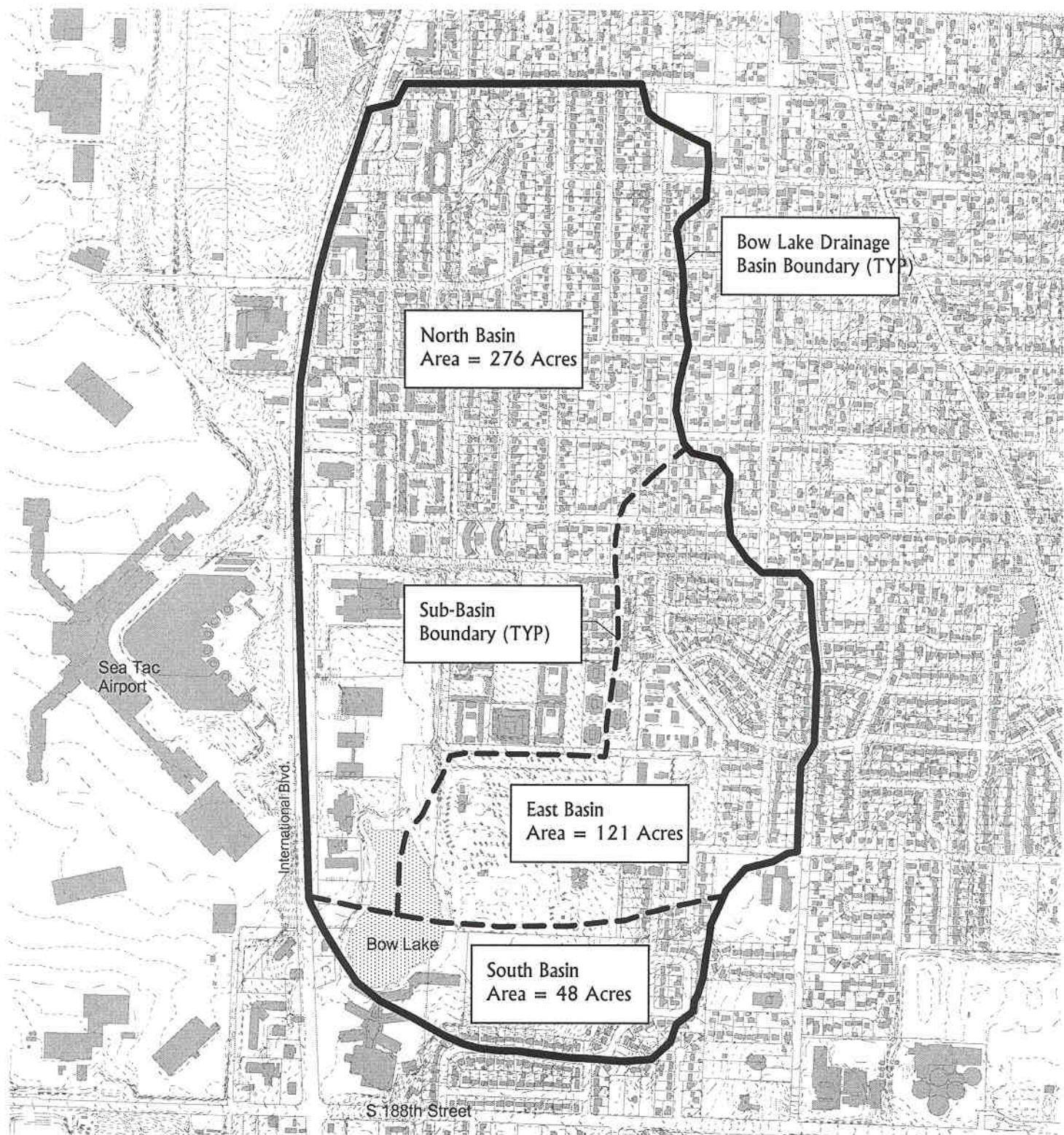
Table 3.1-1. Basin-wide Water Quality Treatment Requirements

Sub-Basin	Basin Area (acres)	Water Quality Treatment Facility Volume (acre-feet)
North	276	15.5
East	121	6.8
South	38	2.7
Total	445	25.0

Source: EarthTech, Inc.

3.1.3 Bow Lake's Role in Regional Flow Control

Bow Lake currently provides significant flow control benefits to the Des Moines Creek system. The lake attenuates large storm flows by storing the runoff volume in the lake. Runoff is released from the lake through the 36-inch diameter pipe outlet at less than one-half the rate at which it enters the lake. The reduced rate of discharge allows flows to pass through smaller pipe systems and helps control scour in downstream channels.



Source: City of Seatac GIS, 2000; Nies Mapping Group, Inc. 1999;
 National Wetlands Inventory USFWS, 1999; EDAW, Inc., 2000.
 P:\0e002.01\GIS\APRIBOW.APR



500 0 500 1000 Feet

A horizontal scale bar with four segments. The first segment is labeled '500', the second '0', the third '500', and the fourth '1000 Feet'.

FIGURE 3.1
Bow Lake
Drainage Sub-Basins

During development of SeaTac's Surface Water Plan (EarthTech 1997), different approaches were investigated to further utilize the storage available in Bow Lake for peak flow reduction downstream. Alternatives included various combinations of flow diversions into Bow Lake and outlet modifications. Based on those analyses, it was recommended that the City pursue a strategy that lowers the static level of the lake by 2 feet during the winter months to make available an additional 25 acre-feet of active storage volume to attenuate peak storm flows during the wet season. In the spring, the water level would be returned to its current static level to avoid potential impacts to shoreline related uses. Lowering the lake would be achieved through one of two alternate methods: (1) constructing a gravity outlet with a smaller diameter pipe, or (2) installing a pump in a sump that would pump down the lake between storm events. This lake lowering strategy was subsequently incorporated as an element in the Des Moines Creek Basin Plan.

Ongoing evaluation of the Des Moines Creek Basin Plan has since relegated the Bow Lake strategy to a lower priority from a regional standpoint as it was found to be less cost effective than other approaches in protecting the most sensitive segments of Des Moines Creek from high flows. Although the availability of the Bow Lake storage volume is considered an asset in the context of adaptive management of flows in the watershed, it is not critical to attaining flow control objectives in Des Moines Creek (David Master, personal communication).

Because the creation of additional active storage is not critical to addressing downstream flow control issues in Des Moines Creek, consideration was given to developing the storage within the lake for another purpose. Analyses were performed to assess the feasibility of using the additional storage in the lake to relax on-site flow control requirements for development activity in the Bow Lake basin. This concept was explored as a means of engaging the private sector in implementing the joint-use facility.

From the results of the hydrologic model analyses, it was concluded that effective lake discharge rate reduction could be achieved for smaller, more frequent storms with smaller runoff volumes. A storm exceeding approximately 0.7 inches would fill the 25 acre-feet of additional storage, and the balance of any larger storms would then pass through the existing 36-inch outlet pipe essentially as it would have prior to lowering the lake level. It therefore appears feasible to provide capacity for on-site detention requirements while providing equivalent peak flow attenuation to Des Moines Creek through the relatively simple means of lowering the lake 2 feet. In consideration, developers would either: (1) contribute financially to the planning, design, construction, and maintenance of the joint-use project; or (2) provide enhanced water quality treatment facilities on-site.

3.2 Parks and Recreation Needs

The purpose of this section is to review existing recreation and open space assets in the City of SeaTac, more specifically in the City Center area, and analyze the relationship between population and recreation assets in light of any adopted Levels of Service (LOS) standards with regards to recreation-oriented public facilities that currently exist within the City. Identified shortfalls were used to inform specific strategies with regards to alternatives development.

3.2.1 Open Space Assets

Existing recreation assets within the City of SeaTac are summarized in Table 3.2-1. Assets are broken down by a number of different categories and compared against current city LOS standards.

Only certain categories of facilities have an identified LOS standard. LOS standards for public recreation facilities are adopted at a jurisdiction's discretion. Once a jurisdiction formally adopts a given LOS, it is required to maintain that LOS and show a link between population growth and the Capital Improvements Plan.

Comparing both the current population of the City as well as the GMA forecast for 20-year population growth against the adopted LOS standards, as shown in Table 3.2-2, yields the impression that the current supply of recreation opportunity is more than adequate for the City's needs, at least measured against its own LOS standards.

Table 3.2-1: Existing Recreation Assets in SeaTac

Resource	Current Inventory of Resource Within City*	Current City Level of Service (LOS) Commitment**
Total Area of Park Land	7,015,905 Square Feet (161.1 acres)	None Identified
Metropolitan and Community Parks	457,275 Square Feet (10.5 acres)	2.6 acres per 1,000 population
Linear Trails	217,750 Lineal Feet (5.0 acres)	2,506 lineal ft per 1,000 population
Athletic Fields and Playgrounds/Neighborhood Parks	2,630,420 Square Feet (60.4 acres)	Athletic Fields and playgrounds = 2.6 ac/1,000 pop Neighborhood Parks = 0.26 ac/1,000 pop
Recreation Centers	457,275 Square Feet (10.5 acres)	3.4 acres per 1,000 population
		None Identified

* Source: City of SeaTac Internal Preliminary Needs Assessment - July 1999

** Source: City of SeaTac Comprehensive Plan 1994

Table 3.2-2: Current and Future Recreation Levels of Service

Resource	City – Current Population (23,761)		City – 20-Year Forecast (36,250)	
	Actual LOS	Adopted LOS	Actual LOS*	Adopted LOS
Citywide				
Total Park Land (including playing fields)	6.78 acres per 1,000 population	5.46 acres per 1000 population	4.44 acres per 1,000 population	5.46 acres per 1,000 population
Trails	9,164 LF per 1,000 population	2,506 LF per 1000 population	6,007 LF per 1,000 population	2,506 LF per 1,000 population
City Center				
Total Park Land (including playing fields)	0 acres per 1,000 population	5.46 acres per 1000 population	0 acres per 1,000 population	5.46 acres per 1,000 population
Trails	0 LF per 1,000 population	2,506 LF per 1000 population	0 LF per 1,000 population	2,506 LF per 1,000 population

* assumes no growth in area of recreation assets

Source: City of SeaTac

LF = linear feet

However, although roughly 2 percent of the City's area is classified as parks and open space, none of these assets are located within the City Center, which contains approximately 15 percent of the City's population. Consequently, the City Center is currently failing when compared against City standards, as shown in the bottom half of Table 3.2-2. Unless addressed, the situation can be expected to deteriorate. The City Center Plan has identified some possible acquisition areas to alleviate this shortfall, including areas around Bow Lake.

3.2.2 City Open Space Policy

The City Comprehensive Plan was examined for adopted Goal and Policy language related to open space and recreation lands relevant to this Bow Lake Study. A number of policies were found, many of which place an emphasis on protection of natural areas and habitat; on using natural hydrologic features as opportunities for open space development; on working with private landowners to develop useable open space areas; and on development of systems and networks, not just specific areas. Lastly, Policy 9.9F specifically identifies public access to Bow Lake as a priority for the City. The results of this policy research are summarized in Table 3.2-3.

Table 3.2-3: Comprehensive Plan Open Space Policies Relevant to Bow Lake

Goals	Policies
Goal 9.2 – To preserve and acquire land for a comprehensive system, Open Spaces and Trails that responds to the recreational, environmental and aesthetics needs and desires of park users.	Policy 9.2A - Identify lands appropriate for park and open space purposes including: <ul style="list-style-type: none"> • Natural areas and features with outstanding scenic or recreational value; • Lands that may provide public access to creeks and lakes; • Lands that visually or physically connect natural areas, or provide important linkages for recreation, and plant communities and wildlife habitat; • Lands valuable for active and passive recreation, such as athletic fields, trails, fishing, swimming or picnic activities on a regional or community-sized scale; • Lands that provide an appropriate setting and location for community center facilities, if the needs evaluation reflects a deficiency; and • Park land that enhances the surrounding land uses.
Goal 9.3 – To provide a balanced, quality park and recreational system and make available a wide range of park and recreational facilities for citizens and visitors of various ages and physical capabilities, cultural backgrounds, abilities, income, and participation levels.	Policy 9.3E - Provide multiple open space benefits for lands preserved for public parks or open space whenever possible. Multiple benefits include but are not limited to, active or passive recreation opportunities accessible to all visitors, scenic vistas, and fish or wildlife habitat, many of which can be provided by natural surface water drainage systems, including wetlands. Policy 9.3G - Coordinate the development of parks, open space, pedestrian walkways, bike paths, and an urban trail system, with the area's unique open space settings including wetlands, creeks, greenbelts, and other environmentally sensitive and historic sites.
Goal 9.6 – To enhance the aesthetic quality and visual character of the community.	Policy 9.6A - Allocate space in commercial districts and business park developments for open space (excluding parking). Open space may include landscaping, watercourses, street furniture, paths, sites for fountains or other outdoor works of art, or other visual/environmental features.
Goal 9.7 – To cooperate with governmental agencies, non-profit organizations and private business in providing open space, park facilities, and recreation services beneficial to the public.	Policy 9.7A - Collaborate with agencies, special districts, and other cities in developing and utilizing the community's recreational capabilities. Policy 9.7C - Encourage cooperative planning and use of recreational facilities with private businesses, nonprofit organizations and other groups in the City.
Goal 9.8 – To invite, encourage, and involve the community in the planning and locating of parks and recreational services and facilities.	Policy 9.8A - Maintain contact with citizens, especially those with an interest in park and open space planning, and encourage their participation in the City's park and open space process.
Goal 9.9 – To develop community wide recreational resources that respond to and are consistent with the unique characteristics of the site and community desires.	Policy 9.9F - Seek public accesses to waterfront area(s) of Bow Lake.

Source: City of SeaTac Comprehensive Plan, 1998 update

3.3 Typical Project Elements

As used in this study, the term “public facility” refers to facilities developed by public agencies using public funds for public use and benefits. These facilities may or may not be developed in partnership with private entities, in which case they will also confer private benefit as well. In the case of Bow Lake, most of the property involved is in private ownership and any of the scenarios, if developed, would involve public-private partnership and private benefit.

Each of the alternatives presented in the subsequent chapter is made up of a series of different elements that can be considered public facilities. Each alternative has a unique character, but each has, to some degree, all of the same elements. Images identifying a ‘look and feel’ of some of these elements are shown in Figure 3.2 and briefly discussed below.

Trails: There are three types of trails proposed for use in the Bow lake area:

- Paved trail
- Non-paved trail
- Boardwalk trail

Each of these has distinct advantages and disadvantages. Hard-surfaced paths, such as asphalt, accommodate a wider range of visitor needs and dress styles than softer surfaced paths, such as crushed stone or shredded bark. At the same time, these more porous paths are less expensive and less intrusive environmentally, both during construction and over time. Boardwalk trails have the functional advantages of both, although at greater expense and maintenance requirements. All three of these trail types might be used, depending on function and location. A trail along the west side of the lake would have the most direct connection to the hotels and would be of the greatest use to the visitor-serving industry of SeaTac. To this end, any such trail is envisioned as being a hard-surfaced, well-lit path, either asphalt or a boardwalk path, or similar materials, depending on the outcome of final design studies. This trail would weave through a wetland environment, and construction techniques would need to account for those circumstances, including regulatory requirements. Trails elsewhere around Bow Lake may be developed to lower standards. Typically, trails would expected to be 3 to 4 feet wide.

Structures: Several types of structures are potentially envisioned for Bow Lake related to trails development – an elevated boardwalk bridge as a means of crossing the lake, and covered overlooks as a means of accessing the lake for viewing. Examples of both types of structures are given in Figure 3.2. An elevated boardwalk is believed to be the most practical solutions to crossing the south end of the lake without intruding on the DoubleTree Inn.

Site Furnishings: Site furnishings include such items as benches, trash receptacles, wayfinding signage, lighting, and other such functional furnishings. No effort has been made to define imagery for these items at this conceptual planning stage. While preliminary locations for seating locations have been identified on all plans, it is anticipated that these ideas will evolve during the design phase, should the project proceed that far. There is potential for interpretational signage to form a vital part of the project, as part of an environmental education component. An example of an interpretational signage is included in Figure 3.2.

Water Features: There are a number of different situations that may be encountered during facility development at Bow Lake with respect to design treatment of water features. These range from development of wet retention ponds to lake edge treatments to bioswale development to wetland design or



Boardwalk Bridges

Lake & Retention Pond Images



Interpretive Signage



Boardwalk Paths



Lake Overlook

restoration. Each situation raises different questions with regards to permit issues, design issues, and ultimately the community character of the Bow Lake neighborhood. It is possible to imagine a future where development extends to the edge of Bow Lake, which in turn is modified with a built edge that functions as a retaining wall and a waterside esplanade. It is equally possible to imagine a future wherein the natural integrity of the lake is reinforced and the wetland forest fringe retained. Much depends on the choices of individual property owners, as well as the desires of the SeaTac community. Regardless, the physical design of the entire hydrological system needs to be taken into account, from the upland stormwater collection points down to the lake outfall.

Open Space: Previous plans such as the City Center Plan and the Comprehensive Plan identify future public open space as a desirable element to be located at Bow Lake. The conceptual alternative planning explores multiple options for creation of Bow Lake public open spaces. There is an emphasis on strengthening existing open space systems and using public efforts to create a healthier ecosystem in SeaTac. This includes ideas such as land acquisition to create public habitat areas and public parks, as well as trail easements and stormwater bioswales as part of an open space system.

Stormwater Facilities: A number of creative solutions with regards to stormwater facilities are identified, including natural or semi-natural solutions such as bioswales and wet ponds, to underground facilities such as vaults and debris separators, to lake level manipulation to create stormwater storage capacity. An effort has been made in this study to integrate park/trails and stormwater planning, while separating out the discussion and presentation of these two aspects of open space planning so that the physical design and cost issues can be more readily understood. Therefore, a separate discussion of stormwater facility planning issues follows the presentation of the overall alternatives in the following chapter.

3.4 Opportunities and Design Parameters

3.4.1 Opportunities

Based on a review of the regulatory and biological arena for the development of a recreational trail along the Bow Lake wetland complex, the following opportunities have been identified:

- Water quality improvements are possible as a component of a trail development project. Through the promotion of dense native vegetation, water filtering capabilities may be increased. This would have to be coupled with stormwater treatment enhancements and pollution enforcement. Not only would this improve Bow Lake wetland water quality, but also salmon habitat in Des Moines Creek.
- Educational opportunities in the form of environmental educational and interpretive signage and trail experience can improve local environmental awareness. Educational issues could include waterfowl ecology, wetland function, water quality, and salmon issues.
- The natural experience provided by the trail would be an amenity for the local hotels and City of SeaTac residents, providing an aesthetically pleasing environment with opportunities for wildlife observation.
- Through enhancement and mitigation, native wildlife could be augmented in the site through the addition of bird nest boxes, bat houses, snag placement, and woody debris placement.
- Buffer function improvement opportunities exist throughout the site. Degraded, narrow, and polluted existing buffers can be cleaned up, replanted, and protected. Existing upland buffers in the southeast corner of the site can be protected from development and managed for native plant species and

wildlife habitat. More extensive trail interpretative work could be achieved in the upland portion of the southeast corner without wetland impact issues.

3.4.2 Design Parameters

Based on a review of the regulatory and biological arena for the development of a recreational trail along the Bow Lake wetlands complex, the following constraints have been identified:

- Any trail or lake access project will have to be planned and undertaken only with the full knowledge and consent of private property owners.
- Trail placement needs to be set in the buffer zones of the wetlands as much as possible, entering wetland areas only where no alternatives are possible. This placement will allow for maintenance of the highest degree of habitat connectivity and least amount of wetland intrusion. This is especially important in the larger wetland area in the southeastern corner of the site.
- Pet access to the trail should be discouraged or prohibited to minimize disturbance of wildlife and to protect water quality.
- Native vegetation should be used in any plantings; exotic species should be controlled. In locating native plants to use in the Bow Lake site, care should be taken to find plants that are indigenous to the local region and from local seed stock.
- Disturbance to on-site vegetation during trail construction should be limited to the immediate construction area.
- A boardwalk elevated above the water surface should be used in all seasonally and permanently flooded areas.
- Boardwalk construction should use recycled products or other non-toxic materials, without harmful chemical treatments.
- Visual barriers of native vegetation should be established in selected areas between the trail and open water to minimize waterfowl disturbances. Viewpoints will be provided in a controlled manner to allow for waterfowl observations and environmental education.
- Access to trail-less portions of the wetland should be prohibited due to potential wildlife disturbance, erosion, and trampling of vegetation.
- The use of lawn areas should be carefully managed to minimize water quality impacts of turf management.
- Trail construction should occur during WDFW recommended fish windows to minimize potential impacts of sedimentation run-off.
- Avoid use of toxic biocides.
- Sedimentation control should be rigorous during construction periods.
- Trailheads should be located in areas of current disturbed or developed areas to lessen habitat disruption.

Likely permits for a trail development include: Nationwide 404 and 401 permits (depending on trail design and placement), and a state HPA permit, as well as compliance with SeaTac's Sensitive Areas Ordinance. According to SeaTac's Sensitive Areas Ordinance, the placement of a boardwalk may be allowed without mitigation within the wetland buffer, as "uncovered decks" are acceptable. Final

ordinance interpretation regarding allowable uses for a wetland buffer must be made by SeaTac's Planning Department. Coordination with the lead permitting agency and careful trail design are essential for finalizing any permits required for the project.

3.4.3 Conclusions and Recommendations

A passive use recreational trail development that is placed along the edge of the Bow Lake wetland complex is not projected to cause significant impacts to wetland functioning if design parameters are satisfied. Opportunities for wetland enhancement, recreational lake access, environmental education, and water quality improvements at the site associated with trail development make a trail project desirable for the City of SeaTac. Some degree of wetland impacts would result from any form of development, and the appropriate permits must be obtained and mitigation plans carried through. The project needs to be clearly defined in terms of whether the trail project will stand alone or undertaken in concert with stormwater facilities development. The associated impacts of development significantly increase if another project is undertaken in conjunction with the trail. This report would have to be amended if other projects were proposed.

4.0 ALTERNATIVES DEVELOPMENT

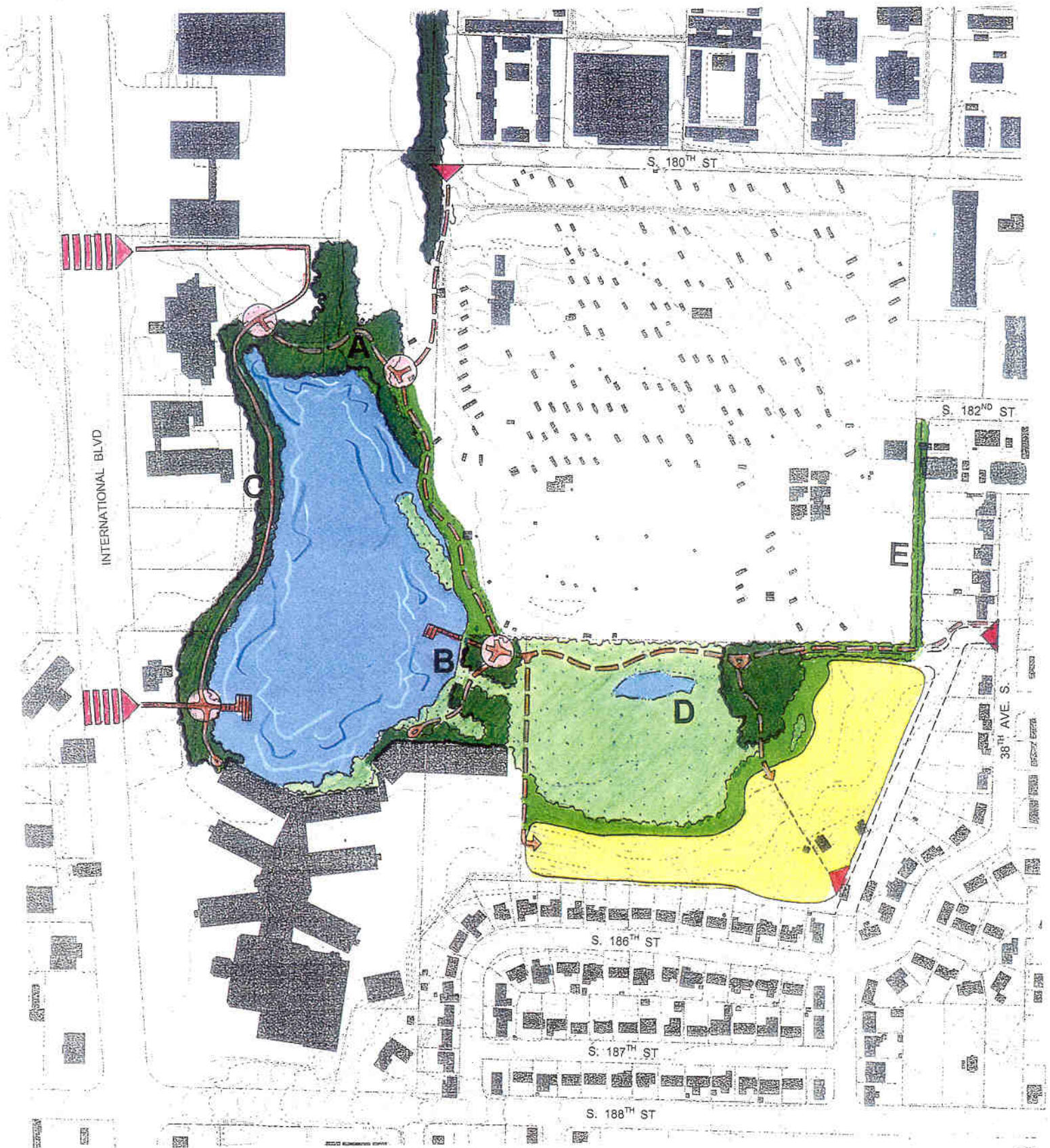
This section identifies and describes the conceptual joint-use public facility alternatives. Three plan alternatives are presented, identified as: (1) the Neighborhood Access Plan, (2) the Natural Open Space Plan, and (3) the Urban Focus Plan. Each alternative presents a very different direction for the City to move in, and each presents a different set of issues and solutions.

These alternatives represent three different levels of intensity of facilities development, with dramatically different cost and finance implications. They developed naturally from analysis of the capabilities of the site, coupled with the desire on the part of the City to have the opportunity to explore in depth the consequences, both positive and negative, of choosing any one course of action. All three options evolved potential stormwater and open space facility development scenarios hand-in-hand. However, for the sake of clarity, detailed discussion of the stormwater elements is in a separate section following the general plan discussion.

4.1 Alternative A – Neighborhood Access Plan

This alternative is a modest proposal to allow access to the natural amenities of the Bow Lake environs for passive recreation purposes, while providing some minor cost-effective water quality enhancements (Figure 4.1). The alternative would have a fairly minimal impact on current land uses and could be developed in phases incrementally as the private property around the lake redevelops. Although Alternative A can be viewed as the minimalist solution to providing joint-use facilities at Bow Lake, it can also be seen as an initial development phase for either of the other, more complex Alternatives B or C. Nothing would result from the implementation of Alternative A that would interfere with the City's ability to implement either of the other alternatives. Below is a summary of the plan elements and impacts. Refer to section 4.4 for a more complete description of stormwater facilities.

Trails: The basis focus of this alternative is a trail system that circles the majority of the lake and extends out to make strategic connections into the neighborhoods. The presence of the extensive structures of the DoubleTree Hotel at the south end of the lake prevents the trail from entirely circling the lake. There are four side trails leading away from the lake. A main spur trail runs east through the Colacurcio wetlands (ownership of which will be transferred to the City in the future), as well as on easements to be granted to the City under the Colacurcio development agreement. This spur would connect the lake to 38th Avenue South. Another spur goes to the northeast and connects to the intersection of 32nd Avenue South and South 180th Street. Connections would be made to International Boulevard via sidewalk improvements alongside the existing driveway between the Wyndham Gardens and the Kilroy Property, as well as a connection across the Washington Mutual Bank property. While the trail system would provide a useful recreation opportunity, it would also provide a pedestrian connection from the medium density residential neighborhoods to the east to the employment opportunities along International Boulevard and SeaTac Airport to the west. This connection currently does not exist. It is envisioned that the trail along the west side of the lake would be paved and well-lit to better serve hotel guests. Elsewhere, the trail would consist of a low-impact porous design to minimize wetland impacts.



PLAN ELEMENTS

- A - Restoration of Lake Inlet Stream
- B - Lake Overlook Piers Accessible to the Public
- C - Paths on Western Edge of Lake Paved and Lit
- D - Public Trail Through Colacurcio Wetlands
- E - Development of Grassy Bioswale

GRAPHIC LEGEND

- Proposed Trees
- Wetland
- Access Point
- Paved Trail
- Non-Paved Trail
- Elevated Trail
- Interpretive/Seating Areas

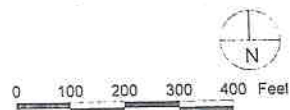


FIGURE 4.1
ALTERNATIVE A
Neighborhood Access Plan

Access: As mentioned above, there are five basic connections into the trail network from City streets – two from the west along International Boulevard, one from the northeast at the intersection of 32nd Avenue South and South 180th Street, and two from the east from 38th Avenue South. There is only limited public parking opportunities near these access points.

Other Urban Amenities: Two wooden pier/overlook features are proposed for the lake. Four areas have been identified as opportunities for placement of seating and/or interpretive signage. These are typically at or near the intersections of trails near the lake. Other opportunities will likely be identified as more detailed design proceeds.

Habitat: Impacts or changes to existing wildlife habitat would be minimal under this alternative. There would be some loss of fringe wetlands around the lake to accommodate the trail itself. Some intrusion into the largely intact Colacurcio wetlands would occur due to trail construction. Impacts would be at least partially offset by other City actions to restore this habitat, such as removing invasive species and eliminating large domestic animals from the wetlands. Other impacts may result due to disturbance of waterfowl from the presence of humans on the pier overlooks.

Wetlands Impacts: There would inevitably be some impacts to wetlands due to trail construction, as all of Bow Lake, as well as the related fringe vegetation, is classified as a Class 1 wetland. It is probable that an Army Corps of Engineers 404 Wetlands Permit as well as a Washington Department of Ecology Hydraulic Action Permit will be required prior to construction. If so, due to recent changes in the administration of wetland permits, a Nationwide 404 Permit will not be available and a full permit will be required. Actual mitigation requirements will be difficult to ascertain prior to entering into the permit process.

Impacts to Private Property: The proposed access trail will provide value to the hotels as a recreational amenity for their guests. While portions of it will be built on their property, it is property that is underutilized at this time. Current hotel designs turn their backs almost entirely on the lake and provide few if any exterior amenities for their guests, possibly due to their design purpose, which presumably was focused on short stay travelers from the adjacent airport. There is some impact to the Washington Mutual property due to need for proper site design for the access route. This access route is sited at the location of a future major International Boulevard crossing identified in the City Center Plan. The proposed stormwater-related improvements to the drainage ditches at the north end of the lake would impact private property, but it is property that is currently underutilized. Much of the land around the lake on which these trails would be sited is land that is difficult for property owners to draw value from, due to the limited area as well as the cost and regulatory obstacles to development. The greatest impact from Alternative A is to the Bow Lake Mobile Home Park. The spur trail to 32nd Avenue South would cut across land that is currently used for automobile storage. In addition, the lake-front trail as shown crosses a number of home sites, as well as the private lake front park. However, this joint-use study follows the lead of the City Center Plan, and a basic assumption is that eventually this site will be redeveloped within the 20-year planning horizon due in part to land values that will rise with corresponding development in the City Center. This study assumes that some configuration of lakefront and neighborhood access trails will be reviewed as part of that redevelopment effort, although the actual siting may be very different. With regards to the Colacurcio property, the trails are an additional amenity and it is felt that they will stimulate high quality development there. The wetland is currently slated for conveyance to the City as the result of the development agreement with the property owner. The construction of an extensive trails network with multiple connections to the Colacurcio uplands will make any multi-family dwellings constructed there that much more attractive on the marketplace.

4.2 Alternative B – Open Space Plan

Alternative B develops the theme of maximizing the restoration of a natural environment around Bow Lake, while simultaneously expanding the potential trail network (Figure 4.2). It provides a more complete trail network than Alternative A, including trails that circle the entire lake, and provides several trail loops within that network. This plan assumes some open space land acquisition by the City at the north end of the lake to provide area for stormwater treatment and neighborhood connections. As shown in Figure 4.2, a new road connection between International Boulevard and South 180th Street is proposed based on the City Center Plan. This road helps define some of the boundaries of this new open space, which would not be used as an active park, but would allow for expansion of the trails network and development of more natural area. More extensive capability for stormwater retention and treatment would be incorporated into Alternative B, including joint-use retention ponds in the Colacurcio property, water-cleansing ponds on the drainage way north of Bow Lake, and water quality control structures distributed through the surrounding neighborhoods. Refer to Section 4.4 for a more complete description of stormwater facilities.

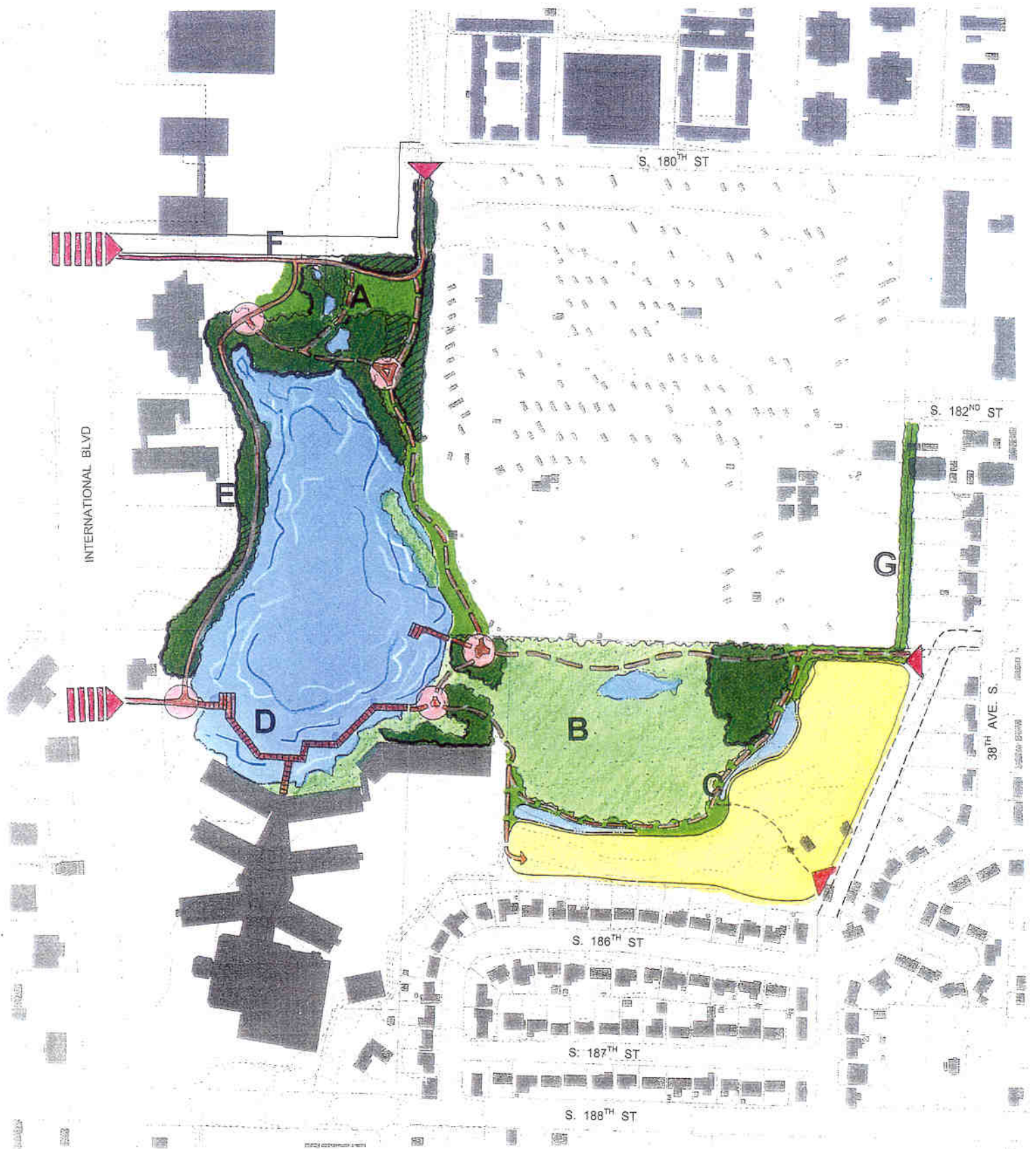
Trails: In Alternative B, the recreational trail circles the entire lake by proposing the use of an elevated boardwalk across the lake surface to avoid the obstacle presented by the DoubleTree Inn. A direct connection could be made to the DoubleTree to enhance access by its guests. A trail loop is proposed for the Colacurcio wetlands, rather than a single linear access path as in Alternative A to provide a greater variety of experience, as well as more opportunities for educational and interpretive activities. These activities could be coupled with programs for habitat restoration on the site. The increased land area at the head of the lake as a consequence of land acquisition provides the opportunity to incorporate several small trail loops, including a hard surface trail connecting to South 180th Street. As with Alternative A, the surfacing material for most of the trail network would be softer and porous, with the west side being paved and well lit to serve hotel guests. There would also be a paved and lit path between South 180th Street and International Boulevard, establishing a pedestrian connection between that neighborhood and the airport area.

Access: Pedestrian access would be essentially the same as from Alternative A, although the connection from S 180th Street would be related to the new roadway and paved.

Other Urban Amenities: A meandering boardwalk/bridge structure is proposed to provide a trail connection across the lake. This boardwalk could have features such as benches, and interpretational signage. An additional wooden pier/overlook feature is proposed for the lake, near the trail entry from the Colacurcio wetlands. Five areas have been identified on the plan as opportunities for placement of site furnishings such as seating, trash receptacles, and/or interpretive signage.

Habitat: Impacts or changes to existing wildlife habitat, both positive and negative, would be greater under this scheme than under Alternative A. As with A, there would be some loss of fringe wetlands around the lake to accommodate the trail itself. There would be more of an intrusion into the largely intact Colacurcio wetlands due to construction of a loop trail. Impacts due to disturbance of waterfowl or aquatic species such as fish from the construction and presence of the boardwalk/pier overlooks would be greater due to its greater extent and encroachment deeper into the lake. Again, impacts would be at least partially offset by other City actions to restore this habitat, as discussed under Alternative A. Also, this alternative would do much to restore the natural environment at the head of the lake, while attracting fewer people into that area.

Wetlands Impacts: There will inevitably be some impacts to wetlands due to trail construction, as all of Bow Lake, as well as the related fringe vegetation, is classified as a Class 1 wetland. It is probable that an Army Corps of Engineers 404 Wetlands Permit as well as a Washington Department of Ecology



PLAN ELEMENTS

- A- Stream Enhancements & Public Open Space Connection
- B- Habitat Enhancements & Loop Trail
- C- Co-located Private / Regional Stormwater Detention Facilities
- D- Boardwalk Connection Across South End Of Lake
- E- Path on Western Edge of Lake Paved & Lit
- F- Connector Road Built
- G- Development of Grassy Bioswale

GRAPHIC LEGEND

- Proposed Trees
- Wetland
- Access Point
- Paved Trail
- Non-Paved Trail
- Elevated Trail
- Interpretive/Seating Areas

FIGURE 4.2
ALTERNATIVE B
Natural Open Space Plan

Hydraulic Action Permit will be required prior to construction. If so, due to recent changes in the administration of wetland permits, a Nationwide 404 Permit will not be available and a full permit will be required. Actual mitigation requirements will be difficult to ascertain prior to entering into the permit process. Impacts due to trail construction would be greater under Alternative B, as trails would be more extensive, including the boardwalk. The issues would be more complicated as Alternative B involves stream restoration at the head of the lake, although the total area impacted is small. However, the permitting authorities may regard the impacts as being offset by the greater water quality and runoff improvements.

Impacts to Private Property: In addition to the impacts identified under Alternative A, Alternative B would have other impacts to private property. Construction of a boardwalk across the south end of the lake would intrude into the view of the lake from the DoubleTree Hotel. At the same time, the boardwalk can be constructed to give direct access to the trail around the lake from the hotel, which would be a positive benefit. The creation of a public/private detention pond system on the Colacurcio property would require additional time and effort to coordinate planning and design. However, this buffer area is unavailable to the owner for developing parking or building footprint due to environmental restrictions, and the joint-use aspects could reduce the costs of development of required stormwater treatment facilities through cost-sharing.

Inclusion of a larger open space area at the head of the lake would likely require the City to acquire property at the market-rate price in compensation, the property would no longer be available to the owner for their own purposes. Due to the topography of the site, it appears to have some limitations as a redevelopment parcel due to flooding and access difficulties. It should be noted that current City development regulations require a minimum 10% open space set-aside as parcels redevelop. An alternative to City acquisition of this parcel could be to grant the City an open space easement in partial fulfillment of the 10% requirement.

4.3 Alternative C – Urban Focus Plan

Of the three alternatives, Alternative C envisions the greatest level of human intervention and use of the Bow Lake area (Figure 4.3). An extensive trail network, much of it paved and lit, is combined with an aggressive series of actions designed to provide joint-use stormwater facilities capable of providing all runoff treatment and flow control required within the Bow Lake basin. Part of this strategy involves the development of natural stormwater control features on the Colacurcio wetlands site, a strategy with some precedent in King County, which may result in a healthier ecosystem as a whole within the Des Moines Creek basin. Alternative C assumes a major redevelopment of the Bow Lake Mobile Home Park at some point within a 20-year planning horizon, as envisioned in the City Center Plan, and assumes that perhaps the highest and best use of the site would include some type of commercial use on that part of the site nearest the lake. Consequently, an engineered edge is shown along the lake at that site to accommodate a future building footprint. Like Alternative B, this alternative proposes a major open space expansion at the north end of the lake. However, the open space is seen as a combination of urban people-oriented space and restored wetland area. Within this open space would be a major regionally sized stormwater vault to ensure downstream water quality. Refer to Section 4.4 for a more complete discussion of stormwater facilities.

Trails: A major difference between this alternative and the others is that the trail around the lake is almost entirely paved. The trail along the west side of the lake is identified as a boardwalk trail. The trail network through the Colacurcio wetland is not, however, and it is more extensive than that found in the other alternatives, with several loops.



PLAN ELEMENTS

- A - Public Park and Stormwater Treatment Facility
- B - Redevelopment Opportunity with Architectural Edge
- C - Major Enhancement of Wetland Functioning
- D - Boardwalk Connection / Double Tree Exterior Amenity Development
- E - Paths on East and West Side Paved and Lit
- F - Connector Road Built
- G - Lake Outfall Lowered 2 Feet - Controlled Seasonally
- H - Development of Grassy Bioswale
- I - General Area for Regional Stormwater Vault

GRAPHIC LEGEND

- Proposed Trees
- Wetland
- Access Point
- Paved Trail
- Non-Paved Trail
- Elevated Trail
- Interpretive/Seating Areas

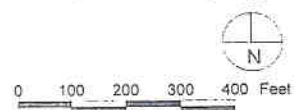


FIGURE 4.3
ALTERNATIVE C
Urban Focus Plan

Access: pedestrian access would be essentially the same as with Alternative A, although the connection from S 180th Street would be related to the new roadway and paved.

Other Urban Amenities: a major boardwalk/bridge structure is proposed to provide a trail connection across the south end of the lake. This boardwalk could have features such as benches, interpretational signage, and fishing areas. As shown, it is integrated into the DoubleTree Hotel, providing an extensive deck/outdoor plaza for the use of hotel guests. An additional wooden pier/overlook feature is proposed for the head of the lake as part of a small urban park. This park is primarily a stormwater control facility with outdoor paved areas, seating, and other public use features, in addition to a large wetland restoration area, created as mitigation for wetlands impacts elsewhere on site. Six specific areas have been identified on the plan as opportunities for placement of site furnishings such as seating, trash receptacles, and/or interpretive signage.

Habitat: Impacts or changes to existing wildlife habitat, both positive and negative, would be greatest under this scheme. There would be some loss of fringe wetlands around the lake to accommodate the trail itself. Other impacts, such as disturbance of waterfowl or fish, are likely due to construction and presence of the boardwalk/pier overlooks. Of the 3 alternatives, impacts would be greatest due to alteration of the nature of the Colacurcio wetlands habitat. While this area would remain a wetlands, wetland functions would be altered specifically to increase the ability to hold and cleanse stormwater. As with Alternative B, this alternative would work to increase open space at the head of the lake, although it would be designed to attract more people.

Wetlands Impacts: Same comments as Alternatives A and B. Impacts due to trail construction would be greater, as trails would be more extensive, including the boardwalk. Implementation issues for Alternative C would be even more complicated than Alternative B due to the extensive impacts to the Colacurcio wetlands. This alternative would provide wetlands restoration to mitigate wetlands disturbance elsewhere on-site. Even so, should this alternative be selected, the wetland will have to be reconfigured to increase its capacity to treat stormwater. Additional studies would be required prior to wetland design.

Impacts to Private Property: Like Alternative B, Alternative C would require acquisition of the parcel at the head of the lake by the City or use under an open space easement arrangement. Construction of the regional wet vault under the Kilroy parking lot could affect the owners use of that site, as it would likely be under construction for a minimum of 8 to 12 months. However, the facility to be developed in that location could result in major long-term advantages to all private property owners in the area, allowing them to avoid the need to dedicate land area to on-site water treatment facilities, as currently required by the 1998 King County Storm Water Design Manual. Installation of a wet vault and new lake outlet could affect the DoubleTree Hotel's use of their northwest parking lot for the duration of the construction period. Again, it would conceivably result in long-term benefits at some unspecified future date, as renovation or redevelopment of the site would offset the need for on-site detention facilities control features. The area identified with the letter B in Figure 4.3 is seen as having potential to become an important feature as part of a well-designed redevelopment scheme for the mobile home park site. A mixed-use commercial/retail/hotel development featuring a terrace overlooking the lake would be very attractive at this site, and entirely compatible with Alternative C.

4.4 Stormwater Elements in Joint-Use Facility Alternatives

Stormwater control elements are incorporated into each of the joint-use facility alternative presented in this study. The scopes of the stormwater improvements were selected consistent with the physical extent and level of investment proposed for the recreational trail facilities. Table 4.4-1 summarizes the stormwater control standards implications of each alternative.

Table 4.4-1. Stormwater Control Elements Within Each Alternative

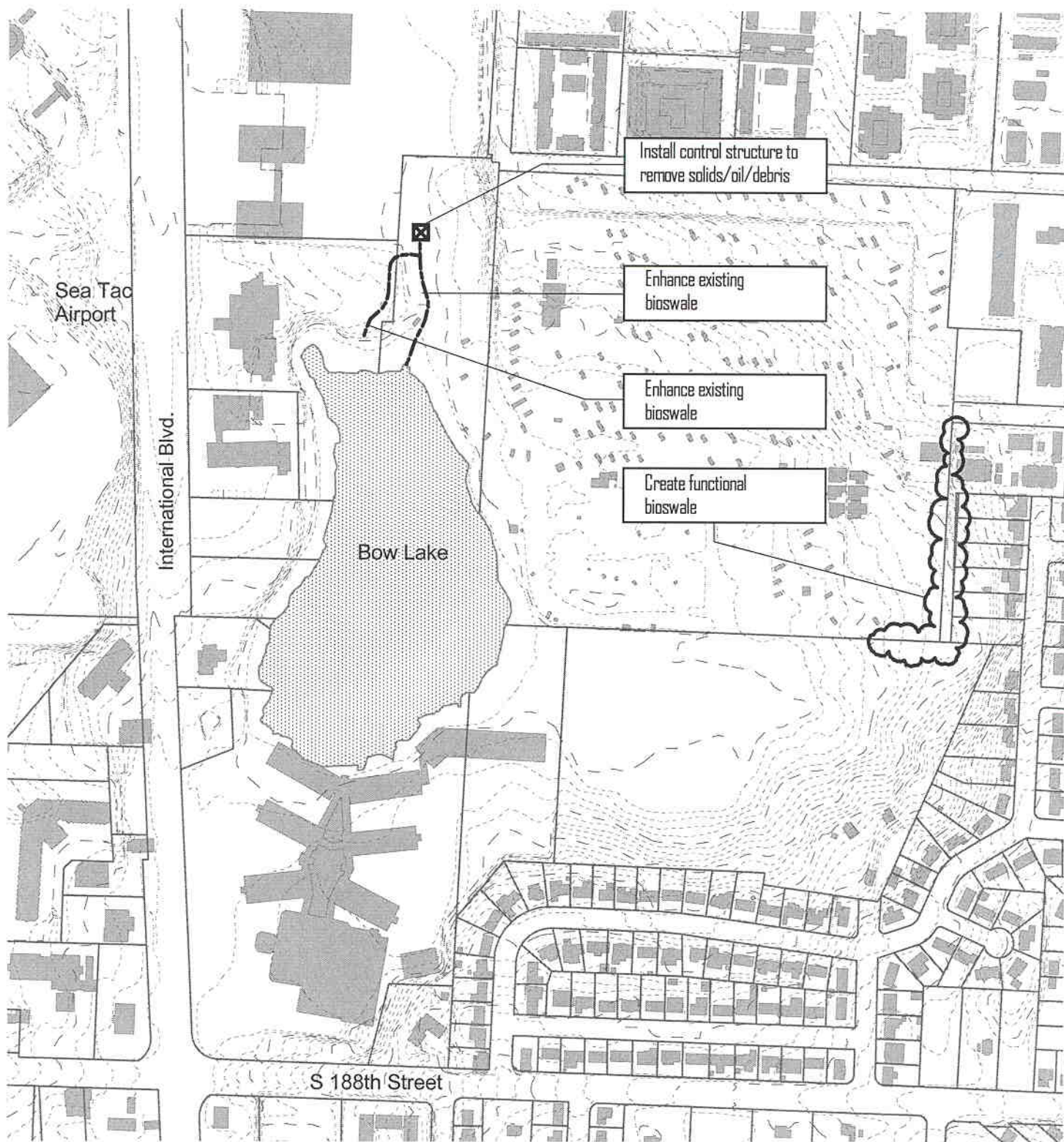
Alter-native	Flow Control Measures		Water Quality Treatment	
	On-site	Regional	On-site	Regional
A	Current standards	N/A	Current standards	Enhance function of existing bioswales adjacent to lake Debris/oil-water control at outfalls into lake
B	Current standards Co-locate w/ regional facilities near lake	N/A	Current standards Co-locate w/ regional facilities near lake	Enhance wetland on Colacurcio parcel Stepped treatment ponds at north end of lake Retrofit south sub-basin systems with wet vaults/tanks or bioswales
C	Relax 10-year storm control Co-locate w/ regional facilities near lake	Seasonally lower lake level	Current or enhanced standard Co-locate w/ regional facilities near lake	Regional water quality vaults below parking areas Reconstruct wetlands on Colacurcio parcel to increase treatment function

Source: EarthTech, Inc.

4.4.1 Alternative A

Stormwater Control Elements: Four stormwater facilities are identified to improve water quality and runoff as part of this alternative (Figure 4.4). The first of these consists of installing a control structure at the outfall of the large box culvert on the Kilroy property to remove debris, solids, and oils from runoff. These contaminants currently flow directly into the lake, whereas a control structure could intercept and treat them. The next two proposed improvements consist of enhancing the two drainage ditches located in the small patch of fringe forest adjacent the north end of the lake. These ditches currently convey stormwater directly into the lake, including all water from the large box culvert in the Kilroy parking lot. They were created for drainage only and do nothing to detain or slow runoff, while providing no water quality treatment. The intent would be to restore some natural wetland functions to these ditches, while simultaneously slowing and cleansing runoff. The fourth proposed improvement consists of creating a functional bioswale to the east of the Bow Lake Mobile Home Park. This area is currently a natural runoff channel for part of its length but does not truly conduct and cleanse stormwater over its full length. Along the southern half of its length, water spills out and runs through the mobile home park, picking up contaminants from roads and vehicles, and draining into the lake. The intent is to create properly engineered biofiltration swales (bioswales), which cleanses stormwater before releasing it into the Colacurcio wetlands.

Currently the majority of the stormwater runoff entering Bow Lake enters the lake through one of two bioswales located near the north end of the lake. (A bioswale is an open, gently sloped, vegetated channel designed for treatment of stormwater.) Both of the existing bioswales, each of which is several hundred feet long, are overgrown and in need of maintenance.



Source: City of SeaTac GIS, 2000; Nies Mapping Group, Inc. 1999;
 National Wetlands Inventory USFWS, 1999; EDAW, Inc., 2000.
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200 0 200 400 Feet

FIGURE 4.4
Stormwater Facilities for
Neighborhood Access Plan
(Alternative A)

Under Alternative A the two existing bioswales would be enhanced and enlarged to provide better water quality function. The actual size of the swales to be constructed will depend on how the stormwater flows are routed to the bioswales. If all flows, including those from the higher intensity storm events, are routed through the bioswales, the bioswales will have to be considerably larger than if only the flows from a "water quality storm" (defined as the 6-month, 24-hour storm) are routed through them. If only the water quality storm is routed through the larger of the two swales, the swale would have to be approximately 5 feet wide and 1.5 feet deep.

The treatment capability of a bioswale is severely impaired by stormwater runoff carrying high concentrations of oil and grease. Based on TPH levels observed in sediments at the north end of the lake, runoff originating north of the lake is high in oil and grease. To provide protection for the bioswale and additional water quality treatment, Alternative A includes the installation of a debris/oil/solids control structure. There are several proprietary devices on the market today that will provide debris/oil/solids control. One of the devices available is a Vortechs™ System. The Vortechs™ Model 16000 would be capable of providing treatment for the water quality storm for the north basin, while the larger storms would be routed around the facility. The system would be contained in a vault that is 18 feet long by 12 feet wide by 7 feet high. The vault could be constructed under existing pavement.

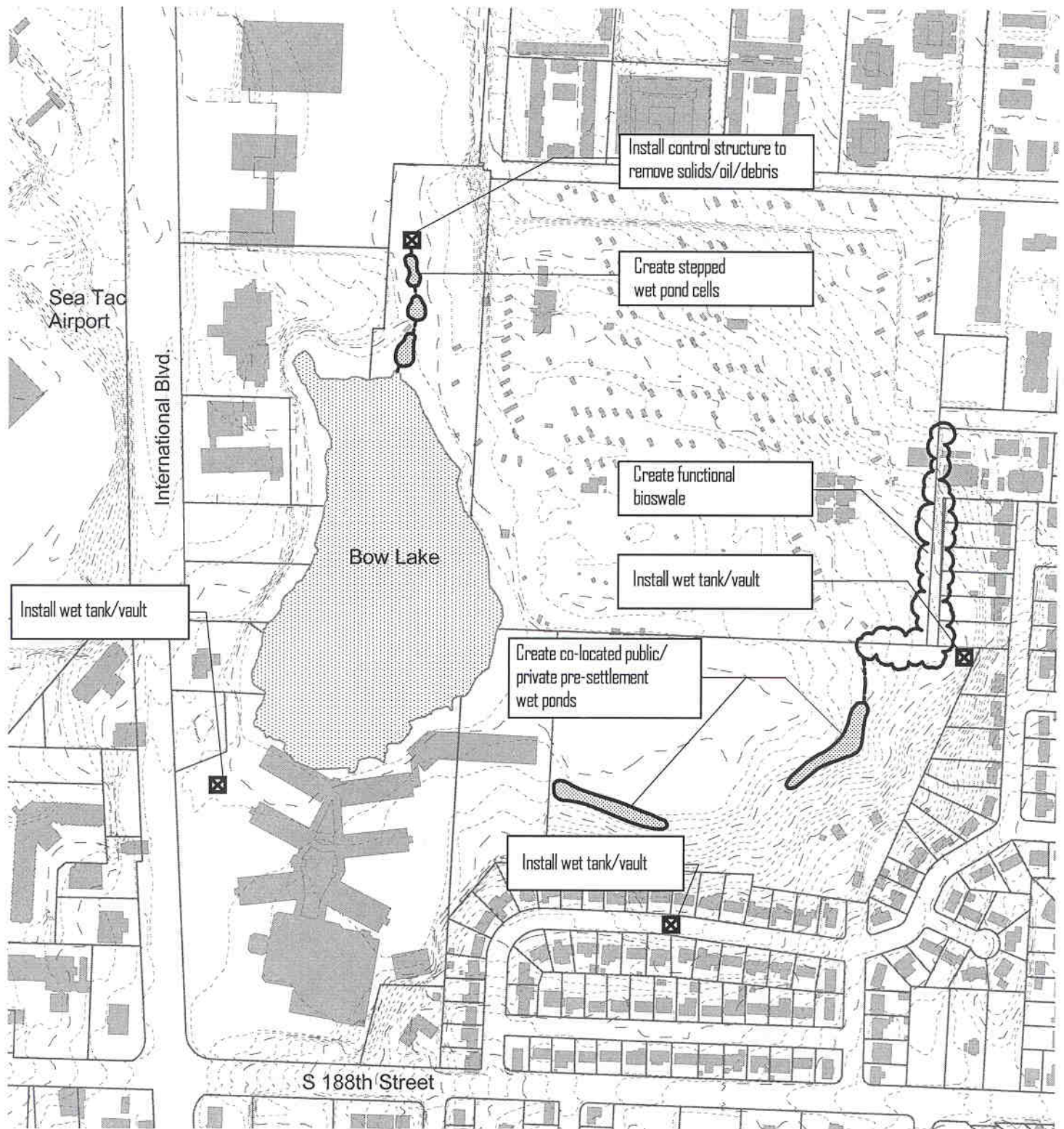
4.4.2 Alternative B

Stormwater Control Elements: Alternative B includes a number of additional stormwater treatment elements (Figure 4.5). Along with the control structure in the Kilroy parking lot and the bioswale improvements west of 38th Avenue South, a number of additional natural and man-made stormwater improvement features are identified. These include a series of stepped wet pond cells along the drainage ditch at the north end of the lake, several joint use detention ponds on the Colacurcio property, and a number of wet tank/vault structures distributed through the neighborhood.

The north ponds are seen primarily as features that slow the rate at which water flows into the lake and provide some cleansing effect as debris and sediment settles out. The joint-use detention features on the Colacurcio property would be placed within the wetlands buffer zone, so that they would not intrude into either wetland or buildable area. They would be sized larger than needed for the multi-family development, with the City paying for a share to buy capacity for the regional stormwater system. The constructed bioswale would terminate into one of these wet ponds, where the water would be retained for sediment settlement prior to being released into the wetland. The wet tank/vault structures to be placed in the streets would likewise allow for removal of debris, sediment, and oils. These vaults would require additional maintenance effort on behalf of the City Public Works Department. These structures are proposed for the DoubleTree parking lot, a low point in South 186th Street, and immediately west of a low point on 38th Avenue South.

Alternative B includes the use of the same type of a debris/oil/solids control structure under Alternative A to treat the runoff from the north end of the lake, but also recommends the construction of stepped wetland pond cells in lieu of the bioswale enhancement. The stepped wetland pond cells would be constructed in an area approximately 400 feet long by 100 feet wide.

In addition to the treatment facilities proposed for treating runoff from the north basin, Alternative B includes the installation of several wet tanks/vaults to provide water quality treatment for the remainder of the basin. The actual size of the wet tanks/vaults will depend on the size of the basin that contributes runoff to them and the land use within the basin and the size can only be approximated at this time. The approximate sizes and locations of the wet tanks/vaults proposed under Alternative B are shown in Table 4.4-2.



Source: City of SeaTac GIS, 2000; Nies Mapping Group, Inc. 1999;
 National Wetlands Inventory USFWS, 1999; EDAW, Inc., 2000.
 P:\0e002.01\GIS\APR\BOW.APR



200 0 200 400 Feet

FIGURE 4.5
Stormwater Facilities for
Natural Open Space Plan
(Alternative B)

Table 4.4-2. Approximate Wet Tank/Vault Size for Alternative B

Approximate Location	Approx. Basin Area (acres)	Water Quality Treatment Facility Volume (acre-feet)	Approximate Vault Size (feet)
3400 S. 186 th Street	10	0.60	70 x 50 x 8 deep
DoubleTree Hotel	9	0.80	90 x 50 x 8 deep
18400 38 th Avenue South	9	0.60	70 x 50 x 8 deep
3800 182 nd Street South	10	0.60	70 x 50 x 8 deep

Source: EarthTech, Inc.

Alternative B includes the enhancement of the existing wetland on the Colacurcio property by constructing a presettlement basin (pond) to remove sediment from the stormwater runoff prior to the runoff being discharged to the wetland and ultimately Bow Lake. Presettling basins are designed to settle out sediments for storm events up to the 6-month, 24-hour design storm. For planning purposes, the surface area of a presettling basin can be approximated by using a ratio of the basin surface area to the drainage basin area. Assuming that the runoff volume for a 6-month, 24-hour storm is 1.0 inch, the ratio would be 0.52% (per Table III-4.5 of the 1992 Ecology manual). This would result in a presettling basin with a surface area of approximately 11,000 square feet. Using a length to width ratio for the pond of 3:1, which results in a more effective pond, the basin size would be roughly 65 feet wide by 195 feet long.

4.4.3 Alternative C

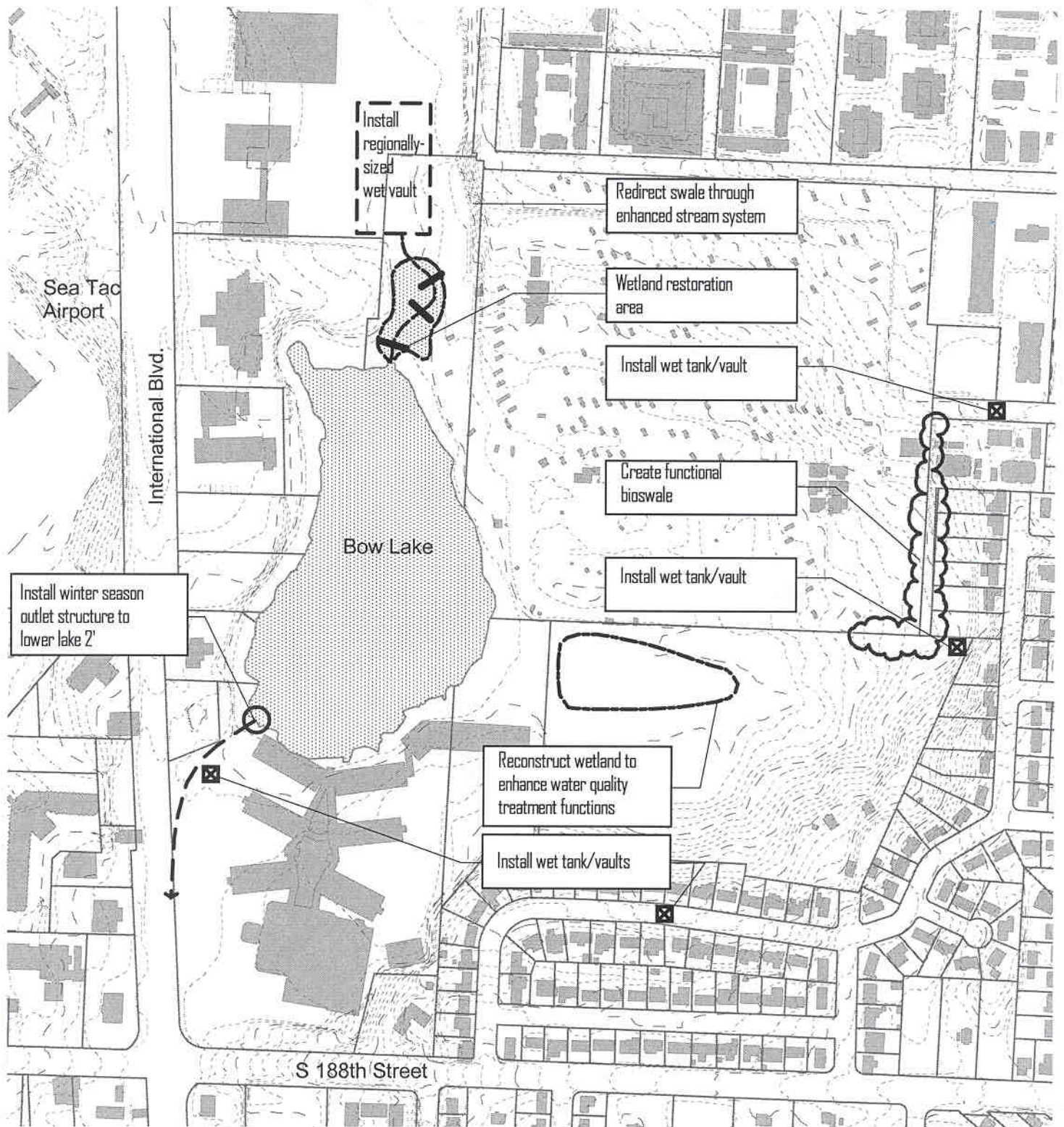
Stormwater Control Elements: The measures proposed for the control and treatment of stormwater runoff are more extensive than those featured in the other alternatives (Figure 4.6). A major wet vault is proposed for installation under the Kilroy parking lot, sized as a regional facility. The intent would be to collect and treat the majority of the runoff from the north and east of the lake in this vault, eliminating the need to treat water on individual parcels. In addition to the minor vault structures proposed in Alternative B, a fourth structure is proposed under South 182nd Street. The level of the lake itself would be dropped by 2 feet seasonally to create additional stormwater storage capacity, buffering the Des Moines Creek system from small storms at the 10-year and under intensity threshold. This would be done by installation of a new 18-inch outlet pipe at the south end of the lake. Lastly, a large part of the Colacurcio wetlands is proposed for reconstruction to increase its ability to function as a stormwater treatment and flow control feature.

Alternative C includes the construction of several wet vaults/tanks, including a large regional facility at the north end of the lake. As in Alternative B, the actual size of the wet tanks/vaults would depend on the size of the basin that contributes runoff to them and the land use within the basin and can only be approximated at this time. The approximate sizes and locations of the wet tanks/vaults proposed under Alternative C are shown in Table 4.4-3.

Table 4.4-3. Approximate Wet Tank/Vault Size for Alternative C

Approximate Location	Approx. Basin Area (acres)	Water Quality Treatment Facility Volume (acre-feet)	Approximate Vault Size (feet)
North end Bow Lake	276	18.0	100 x 900 x 8 deep
DoubleTree Hotel	9	0.80	90 x 50 x 8 deep
3800 182 nd St S	10	0.60	70 x 50 x 8 deep

Source: EarthTech



Source: City of SeaTac GIS, 2000; Nies Mapping Group, Inc. 1999;
 National Wetlands Inventory USFWS, 1999; EDAW, Inc., 2000.
 P:\0e002.01\GIS\APRIBOW.APR



200 0 200 400 Feet

FIGURE 4.6
Stormwater Facilities for
Urban Focus Plan
(Alternative C)

In addition to the wet vaults/tanks, Alternative C includes revising the outlet from Bow Lake to allow for the lowering of the lake by 2 feet during the winter months. The final component of Alternative C is the reconstruction of the wetland located on the Colacurcio site into a multi-cell wetland instead of a single cell. The multiple cells would occupy roughly the same area as the current wetland.

4.5 Comparison of Alternatives

Table 4.5-1 summarizes and compares the specific built features of each alternative. It summarizes only the program (i.e., the designed and built features currently envisioned for each conceptual site development alternative). Program elements are summarized by five categories: trails, access points, urban amenities, runoff control features, and water quality control features.

Permit Issues: The entire Bow Lake complex is classified as a single Class 1 wetland, including the open water area. The regulatory agencies will view it as a single functional unit and review permit decisions for physical intervention in the lake environs accordingly. The lake is under the 20-acre Shoreline Management Act size threshold, so no Shoreline Substantial Development Permits would be required to implement any of the 3 alternatives presented above. However, both a Section 404 Permit, administered by the Army Corps of Engineers, and a Hydraulic Action Permit, administered by the State Department of Ecology, would be needed to implement any one of these alternatives due to the wetlands issues. It is not possible to predict what the outcome of a permit application would be. Although several of the alternatives propose significant interventions in the landscape, in the long run the intention is to improve the ecological functioning of the system, at least from the point of view of improving flow retention and water quality throughout the Des Moines Creek basin. Although the regional Northwest Ponds project proposed for Des Moines Creek below Bow Lake as part of the Des Moines Creek Basin Plan will act as a treatment facility for the lower stream, the higher in the basin water can be treated, the better off the entire system is. And while retention and water quality improvement are not the only functions provided by wetlands, they receive intense scrutiny due to the Endangered Species Act. With the presence of coho salmon in lower Des Moines Creek, these issues are doubly important.

It is recommended that ACOE and DOE personnel be brought into the project at the earliest possible stages in the future, preferably while it is still in the planning stages, rather than after it has gone into design. They will give the City a sense of what issues need to be addressed so that any additional specific long-term studies, such as boring profiles or focused hydrological studies among others, can be started. In that way, planning and design can be focused at least partly around developing a design that is acceptable to the agencies and will shorten permit time.

An additional summary comparison of the different features of the 3 alternatives is presented in Table 4.5-2. This table focuses on all elements of each alternative tangibles and intangibles alike. It provides a broad summary of all aspects of the plans.

Table 4.5-1 - Summary of Alternatives

Element	Alternative A	Alternative B	Alternative C
Trails	<ul style="list-style-type: none"> Trail paved & lit on west side – pervious surfaces elsewhere Single trail on Colacurcio property Incomplete circuit around lake 	<ul style="list-style-type: none"> Trail paved & lit on west side – pervious surfaces elsewhere Loop trail on Colacurcio property Complete circuit around lake Connection to northeast neighborhood 	<ul style="list-style-type: none"> Trail paved & lit around lake - pervious surfaces elsewhere Loop trail on Colacurcio property Complete circuit around lake Connection to northeast neighborhood
Access Points	<ul style="list-style-type: none"> Five major access points: 2 from International Boulevard, one from South 180th Street, and 2 from the Colacurcio development site 	<ul style="list-style-type: none"> Same as Alternative A 	<ul style="list-style-type: none"> Same as Alternative A
Urban Amenities	<ul style="list-style-type: none"> 2 lake lookouts on piers Seating around lake 	<ul style="list-style-type: none"> 2 lake lookouts on piers Seating and interpretive signage Small park at north end of lake with minimal enhancements 	<ul style="list-style-type: none"> 2 lake lookouts on piers Seating and interpretive signage Large trail network Small urban park at north end of lake with paved areas and seating Potential retail/food service with public terrace on lake
Runoff control features	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Joint-use detention ponds located within Colacurcio wetlands buffer zone. 	<ul style="list-style-type: none"> 18” outlet control structure installed to provide 25-acre feet in extra lake storage Surge control device at mouth of current 36” outlet to prevent flooding in the case of very major storms
Water Quality Control Features	<ul style="list-style-type: none"> Bioswale east of mobile homes Debris/oil-water control at lake outfalls 	<ul style="list-style-type: none"> Bioswale improvements east of mobile homes Debris/oil-water control at lake outfalls South basin retrofitted with 3 wet vaults under roads and parking lots 3 small weirs/settlement ponds at north end ditch. Redesign of private box culvert on Kilroy property 	<ul style="list-style-type: none"> Bioswale east of mobile homes Debris/oil-water control at lake outfalls South basin retrofitted with 4 wet vaults under roads and parking lots Wetland restoration at north end lake Colacurcio wetland redesigned for maximal water quality treatment Regional-sized runoff treatment vault under Kilroy parking lot

Source: EDAW, Inc., EarthTech, Inc.

Table 4.5-2 Summary of Additional Components of the Alternatives

Alternative	Flow Control Measures	Water Quality Treatment	Habitat Values	Impacts to Wetlands	Environmental Education Opportunities	Permit Issues	Public Access	Implementation of City Center Plan	Value added to Private Property
A	<ul style="list-style-type: none">▪ Current standards for flow control by '98 Manual	<ul style="list-style-type: none">▪ Enhance function of existing bioswales adjacent to lake▪ Debris/oil-water control at outfalls into lake▪ Develop bioswale east of Bow Lake Mobile Home Park	<ul style="list-style-type: none">▪ Minimal alteration of habitat▪ Some intrusion due to trails	<ul style="list-style-type: none">▪ Minimal impacts to wetlands – least of all alternatives▪ Impacts due to trail construction▪ Construction of piers shading portions of Bow Lake.▪ Improvements to lake water quality	<ul style="list-style-type: none">▪ Limited opportunities for interpretive signage along trail system	<ul style="list-style-type: none">▪ Army Corps of Engineers 404 Wetlands Permit required▪ Dept. of Ecology Hydraulic Action Permit required	<ul style="list-style-type: none">▪ Provides public access to much of lake perimeter, as well as Colacurcio wetlands	<ul style="list-style-type: none">▪ Provides some lake access	<ul style="list-style-type: none">▪ Access trail provides some value to hotel guests▪ Trail is additional amenity for Colacurcio property
B	<ul style="list-style-type: none">▪ Current standards for flow control by 1998 Manual▪ Co-locate regional & private detention facilities near lake and wetland	<ul style="list-style-type: none">▪ Enhance wetland on Colacurcio parcel▪ Stepped treatment ponds at north end of lake▪ Retrofit south subbasin systems with wet vaults/tanks and/or bioswales▪ Modify private box culvert on Kilroy property for settlement.▪ Co-locate w/ regional facilities near lake▪ Debris/oil-water control at outfalls into lake▪ Develop bioswale east of Bow Lake Mobile Home Park	<ul style="list-style-type: none">▪ Enhancement of wetland habitat on Colacurcio property – control of invasives, some revegetation▪ Creation of additional habitat at north end of lake.	<ul style="list-style-type: none">▪ Moderate impacts to wetlands▪ Minor restoration of ditch at north end.▪ Eventual restoration of lake edge at mobile home park.▪ Construction of boardwalk shading areas of Bow Lake.▪ Improvements to lake water quality.▪ Mitigation requirements potentially fulfilled on site	<ul style="list-style-type: none">▪ Opportunities for interpretive signage on lake and wetlands along trail system. Greater access to wetlands than Alternative A	<ul style="list-style-type: none">▪ Army Corps of Engineers 404 Wetlands Permit required▪ Dept. of Ecology Hydraulic Action Permit required	<ul style="list-style-type: none">▪ Provides public access to entire lake perimeter, as well as a loop trail through the Colacurcio wetlands.▪ Provides public connection from neighborhood to east through to lake and Hghwy 99	<ul style="list-style-type: none">▪ Provides for full implementation of City Center vision with an open space focus	<ul style="list-style-type: none">▪ Access trail provides some value to hotel guests▪ Trail is additional amenity for Colacurcio property▪ Multi-family to northeast enhanced by connectivity
C	<ul style="list-style-type: none">▪ Lower lake level seasonally by 2 feet▪ Relax 2/5/10 year storm control standards▪ Co-locate regional & private detention facilities near lake and wetland	<ul style="list-style-type: none">▪ Reconstruct wetlands on Colacurcio parcel to increase treatment function▪ Regional water quality vaults below parking areas▪ Co-locate w/ regional facilities near lake▪ Debris/oil-water control at outfalls into lake▪ Develop bioswale east of Bow Lake Mobile Home Park	<ul style="list-style-type: none">▪ Major shift of habitat type on Colacurcio wetlands.▪ Some additional urban open space creation at north end	<ul style="list-style-type: none">▪ Greatest disturbance of wetlands▪ May require off-site mitigations▪ Major reconstruction of Colacurcio wetlands results in enhancement of certain functions.▪ Wetlands creation at north end of lake.▪ Construction of boardwalk shading areas of Bow Lake.▪ Improvements to water quality in lake and downstream	<ul style="list-style-type: none">▪ Modified Colacurcio wetlands and restored stream represents significant outdoor laboratory for education about urban hydrological systems, as well as general wetlands functioning.	<ul style="list-style-type: none">▪ Army Corps of Engineers 404 Wetlands Permit required▪ Dept. of Ecology Hydraulic Action Permit required	<ul style="list-style-type: none">▪ Provides public access to entire lake perimeter, as well as a loop trail through the Colacurcio wetlands.▪ Provides public connection from neighborhood to east through to lake and Hghwy 99	<ul style="list-style-type: none">▪ Provides for full implementation of City Center vision with an urban focus.	<ul style="list-style-type: none">▪ Provides major amenity for DoubleTree with structure over lake▪ Assumes a built edge along Bow Lake mobile homes with future mixed use/commercial edge.▪ Reduced seasonal flooding▪ Relaxed runoff requirements

5.0 ALTERNATIVES EVALUATION

5.1 Alternative Cost Estimates

The intent of this section is to provide a summary evaluation of the alternatives, including costs, public and private benefits, and impacts.

The purpose of this section is to estimate costs for the design, permitting, and construction of each of the three alternatives, based on the conceptual plans. Costs are summarized on an item-by-item, unit cost basis. The goal was to identify general order-of-magnitude costs to allow a comparison of the costs and benefits of the respective plan alternatives.

Method: The alternatives were developed to present varying intensities of improvement in ascending intensity from A to C. This is true for both open space/trail improvements as well as stormwater improvements. Stormwater improvement costs are presented separately from open space/trail improvements for the sake of clarity in costing. Although the 3 alternatives were developed as integrated unified plans, in actual practice the open space/trail portions of the plan can be implemented independently of the stormwater portions of the plan, and vice-versa.

Costs were developed based on specific cost items, such as a specific path, structure, or stormwater feature. General unit prices were developed. Unit price includes multiple pay items. For example, a concrete path at \$5 per square foot includes the cost of the labor, site preparation, subbase, and concrete. All major cost items are identified as a line item in the detailed cost estimates, and unit costs applied.

At this conceptual level of planning, there are a number of unknowns in the plan. To account for these unknowns, which will emerge as more detailed site knowledge, permit conditions, design parameters, and construction requirements become known, a relatively high contingency of 30% has been applied to these costs. Other soft costs (such as design fees, permit fees, legal fees for land acquisition, for example) and project administration costs are estimated at 25% for all alternatives. Legal and permit costs are expected to vary widely among alternatives.

Two of the alternatives (B and C) have land acquisition costs, which have not been estimated. Land value assessment is best done by a professional assessor and is outside of this scope of work. It can be noted, however, that the assessed value of the identified parcel (the 4.86 acre parcel at the head of the lake) is approximately \$750,000.

Conceptual Costs: Conceptual costs are summarized in Table 5.1-1. The detailed cost estimates from which these figures were extracted are included in Appendix A. As mentioned above, these figures include soft costs such as design and permitting, as well as a substantial contingency amount. This contingency will be reduced as planning advances and the project becomes more defined. In particular, one major cost item that needs further investigation is the cost of land acquisition, currently unidentified for Alternatives B and C. There is a great deal of uncertainty with this item, as actual cost will be largely a function of market value and can fluctuate widely over time.

Table 5.1-1. Estimated Order-of-Magnitude Cost Summary

Facility Element	Construction Cost Estimate		
	Alternative A	Alternative B	Alternative C
Trails	\$56,840	\$96,520	\$98,300
Structures	\$87,500	\$143,000	\$136,250
Signage	\$13,000	\$13,000	\$29,000
Furnishing	\$55,000	\$64,000	\$92,500
Other Site Work	\$24,384	\$115,700	\$360,556
Wetland Restoration	\$15,000	\$101,000	\$200,000
<i>Subtotal – Site Costs</i>	<i>\$251,724</i>	<i>\$533,220</i>	<i>\$916,606</i>
Associated project soft costs and contingencies	\$209,424	\$443,618	\$762,579
Stormwater Facility costs	\$580,200	\$1,916,192	\$12,895,610
Total Estimated Cost	\$1,041,348	\$2,893,030	\$14,574,795

Source: EDAW/EarthTech

5.2 Public and Private Benefits

Benefits would be expected to accrue to private property development and redevelopment should regional stormwater facilities be provided as part of the Bow Lake facility improvements. An effort has been made to identify and quantify those benefits, so that a comparison of actual private sector stormwater costs, both with and without the Bow Lake Joint-Use stormwater facilities, can be made.

Avoided Water Quality Treatment Facility Costs: Provision of regional water quality treatment facilities would provide treatment of runoff to address both existing development and future development (including redevelopment of currently built-on parcels). Future development would avoid having to construct almost 8 acre-feet of water quality treatment volume at project costs² estimated to cumulatively total approximately \$4.2 million. This estimate assumes that stormwater treatment would be provided in the form of water quality vaults that are best accommodated within higher density developments.

In addition, the City of SeaTac would be expected to incur some costs for retrofit of public drainage infrastructure serving existing private development throughout the watershed in response to Clean Water Act and Endangered Species Act requirements. The regional water quality treatment facilities would constitute such a retrofit, and the avoided costs (which were not estimated as a part of this study scope) represent a savings to all City stormwater utility ratepayers.

Avoided Stormwater Detention Facility Costs: Under current City stormwater design standards, development must provide control of runoff to Level 1 criteria, which requires matching of peak discharge rates for the 2- and 10-year return period storms. The cumulative volume of stormwater detention facilities needed to service future development is estimated to total 10 acre-feet at project costs estimated to total approximately \$5.5 million.

If the seasonal lowering of Bow Lake is implemented, there are two scenarios under which future development could realize substantial cost savings:

- In the event plans to construct the Des Moines Creek Regional Detention Facility are significantly delayed or abandoned and the City must revise the flow control criteria to Level 2 to protect Des Moines Creek; or

² Project costs include construction, design, permitting, construction management, sales tax and a contingency to account for the planning level of the analysis.

- The stormwater design standards are revised to require Level 2 flow control criteria in responding to Endangered Species Act 4(d) rule implementation. This new requirement is uncertain pending NMFS final 4(d) rule implementation.

Should either of these scenarios be realized, the lowering of Bow Lake seasonally would provide a basis for maintaining the Level 1 flow control standard and avoiding the added facility size and cost of complying with Level 2 criteria. If Level 2 control were to be required of future development, the cumulative detention requirements would grow by another 17 acre-feet to a total of 27 acre-feet. The added incremental private project costs for increasing on-site detention facilities from Level 1 to Level 2 control to total approximately \$9.4 million.

These costs are summarized in Table 5.2-1. The upper half of the table, identified as public stormwater improvements, represents the estimated cost of the joint-use stormwater facilities identified in this study. The lower half of the table represents the estimated costs to private property owners within the Bow Lake basin for stormwater facilities associated with property redevelopment. Observe that the cost for private development goes down proportionally as the public investment rises. The total costs (bottom line) identify the sum of these two costs. Alternative C actually has the lowest estimated future costs due to an economy of scale, as all stormwater is treated through just a few structures, rather than many distributed ones.

Table 5.2-1. Stormwater Management Alternatives Cost Estimate Summary

Element	Construction Cost Estimate		
	Alternative A	Alternative B	Alternative C
<i>Potential Public Stormwater Improvements</i>			
Facility construction costs	\$316,710	\$1,045,979	\$7,039,242
Associated project costs, contingency	\$263,490	\$870,213	\$5,856,368
Subtotal, Public Capital Cost	\$580,200	\$1,916,192	\$12,895,610
<i>Future Private On-site Stormwater Development Costs</i>			
Flow Control	\$14,893,796	\$14,893,796	\$5,516,221
Water Quality Treatment	\$ 4,213,013	\$ 3,385,580	-
Subtotal, Private Capital Cost	\$19,106,809	\$18,279,376	\$5,516,221
Total, Public and Private Capital Costs	\$19,687,009	\$20,195,568	\$18,411,831

Source: EarthTech, Inc. 2000

5.3 Overall Comparison of Alternatives

Alternative evaluation criteria were discussed with City staff and a total of 23 different criteria were identified, grouped into ten separate Areas of Evaluation by which each alternative was judged. The results for each of these ten Areas of Evaluation are discussed separately below. Specific criteria were worded in such a way that benefits could be compared for each alternative. The product is Table 5.3-1, an evaluation matrix providing an easily readable qualitative review of the relative merits of each alternative.

As identified in Table 5.3-1, there are a total of five possible ratings for each criteria: negative, neutral, least benefit, medium benefit, and most benefit. In general, every effort is made to apply ratings in terms of benefit. This allows for a more understandable visual rating system.

Table 5.3-1. Alternative Evaluation Matrix

CRITERIA	PLAN ALTERNATIVE RATINGS			
	No Action	Alternative A	Alternative B	Alternative C
Effect on private property				
• Avoids encumbering private property	●●	●●	●	⊖
• Adds value to private property	○	⊖	●	●●
• Reduces redevelopment costs	○	○	⊖	●●
Effect on all SeaTac residents				
• Provides public open space	○	⊖	●●	●●
• Provides useable recreation space	○	⊖	●	●●
Effect on City Center users				
• Adds to quality of worklife	○	⊖	●	●●
• Effect on visitor services	○	●	●●	●●
Effect on regional water quality				
• Volume of runoff treated	○	●	●	●●
• Degree of treatment provided	○	⊖	●	●●
Effect on storm flows to Des Moines Creek				
• Frequent storm peak flow reduction	○	○	○	●
• Major storm peak flow reduction	○	○	○	⊖
Effect on habitat values				
• Supports existing habitat	○	⊖	●	●
• Provides new habitat	○	○	●	●
• Potential increase in waterfowl populations	○	○	○	⊖
Effect on wetlands				
• Enhances existing wetlands functions & values (net) ⁽¹⁾	○	X	⊖	⊖
• Increases wetlands area	○	X	⊖	●
Permitability				
• Ease in obtaining wetlands permits	N/A	●●	●	⊖
• Provides mitigation area	N/A	○	⊖	●
Effect on public policy				
• Consistency with City Center Plan	X	●	●●	●●
• Helps implement DMC Basin Plan	X	○	●	●●

(1) While wetlands may be impacted, some wetland functions may be actually enhanced, while others degraded. How the regulatory agencies will view this combination of effects is difficult to forecast.
(EDAW 2000c)

BENEFIT RATING

- Most Benefit
- Medium Benefit
- ⊖ Least Benefit
- Neutral
- X Negative

There are very few instances in which negative ratings were given. In addition to the three alternatives developed during the course of the study, a No Action Alternative was also rated for comparison purposes.

Area of Evaluation - Effect on Private Property: The effect on private property looks at the impact that each alternative would have on private property around the lake. Three criteria are reviewed: the degree to which the private property is physically affected or encumbered by implementation of the alternative; the degree to which implementation is perceived as adding value to the property; and lastly, the degree to which an alternative reduces the cost of property redevelopment. This last benefit typically occurs because the need to develop stormwater facilities is avoided due to the presence of a public facility put in place by that alternative.

The No Action Alternative is seen as presenting a benefit only under the first criterion. This is because the less costly and less facility-intensive an alternative is, the more benefit it is seen to have from the aspect of encumbering private property (i.e., no impact is produced if nothing is built). Like the No Action Alternative, Alternative A is seen as having the most benefit in terms of avoiding private property impacts. In contrast, Alternatives B and C clearly have the most impact on private property, as they actually take private property into the public domain. In addition, these alternatives support implementation of a more complete public road network north of the lake, again impacting private land. Alternative C is seen as having greater effect on private property than Alternative B due to the construction period impacts for installing the stormwater vault under the Kilroy parking lot.

Alternative C would have the highest benefit in terms of adding value and reducing development costs. The benefit to both water quality improvement and runoff reduction of having such facilities as the regional vault under the Kilroy parking lot, as well as the seasonal lowering of the lake level by 2 feet, would be substantial to eligible properties.

Implementation of Alternative C has the potential to increase the attractiveness of certain properties from the perspective of the user or the developer. Only Alternative C proposes a man-made, urban edge on the lake, at the site of the Bow Lake Mobile Home Park, making it a prime redevelopment candidate as proposed in the SeaTac City Center Plan. Furthermore, Alternative C creates the greatest development of trails and open space, an attribute which has been shown by many studies to increase the value of property, particularly with respect to residential and visitor-serving uses.

Alternative B is anticipated to have some positive benefit with regards to property values, by making both hotel and residential properties more attractive to potential users through the provision of recreational and open space amenities, although not to the same degree as Alternative C. Alternative A provides some benefit as well, but less so than either B or C. Alternative B would reduce redevelopment costs, but only slightly, while Alternative A would provide no benefit in this area. Only Alternative C provides enough benefits from a water quantity/quality perspective to have a noticeable affect on redevelopment costs. Naturally, the No Action provides no benefit in terms of either increasing property values or reducing redevelopment costs.

Much of the private benefit from Alternative C would accrue from the presence of the vault. With it in place, redevelopment of private property within much of the basin could occur without the need to provide water quality treatment facilities on-site, as currently required by the 1998 King County Surface Water Design Manual (SeaTac's adopted standard).

Area of Evaluation - Effect on All SeaTac Residents: This Area of Evaluation attempts to identify the benefits that each alternative would have for all residents of SeaTac as a whole. Two criteria are identified: to what degree public open space is provided, and to what degree usable recreation space is

provided. No Action produces no benefit at all. While Alternative A is seen as producing some benefit, it is much less than either Alternative B or Alternative C. Alternative A provides no actual new public space, and less trail area is provided. While it does provide a recreational trail adjacent to the lake (beneficial for both hotel guests and residents), the trail does not create a loop around the lake, as would be provided by Alternatives B and C. Both Alternatives B and C would make new public open space available. Alternative C would provide the greatest amount of new trail area.

Area of Evaluation - Effect on City Center Users: As the Bow Lake project would occur in the heart of the City Center neighborhood of SeaTac, this area of evaluation attempts to measure the positive degree of impact the project would have on users of the City Center. The degree of benefit is judged proportional to the degree of development of open space and recreation facilities, suitable for use by workers and overnight visitors, i.e., hotel guests. Having appropriate facilities available for use by these two categories of user is the principal benefit. Consequently, No Action has the lowest benefit and Alternative C has the highest.

Area of Evaluation - Effect on Regional Water Quality: The impacts of each alternative on stormwater were evaluated for benefits to both water quality treatment and the control of discharge rates from Bow Lake downstream to the Des Moines Creek system. Water quality and stormflows were evaluated separately as they are treated separately from a regulatory perspective. With regards to water quality (i.e., the degree of cleanliness, or absence of debris, particulates, and dissolved chemicals), two evaluation criteria are identified: the actual volume of runoff subject to treatment, and the degree of treatment provided to that runoff. All of the action alternatives provide a positive benefit. Alternatives A and B are roughly equivalent in terms of runoff volume treated, as most flows enter the lake from the north or the east side, and would be treated to some degree by the bioswales or vaults identified as improvements in either alternative. Alternative A would provide a lesser degree of treatment than Alternative B, as the wet ponds provided by Alternative B at the north end of the lake and on the Colacurcio property would provide enhanced removal of sediment and associated contaminants. Alternative C would be measurably superior to all other alternatives due to the regionally sized wet vault under the Kilroy parking lot. Most stormwater entering the lake would be treated through this large vault, sized in accordance with the City's stormwater design standards. Wetland treatment cells on the Colacurcio property would treat most of the stormwater from the eastern subbasin.

Much of the private benefit from the plan would accrue from the presence of this vault. With it in place, redevelopment of private property within much of the basin could occur without the need to provide water quality treatment facilities on-site, as currently required by the 1998 King County Surface Water Design Manual (SeaTac's adopted standard).

Area of Evaluation - Effect on Storm Flows to Des Moines Creek: The effect of the different alternatives on storm flows considers only one major issue – controlling the peak rates of discharge from Bow Lake to the Des Moines Creek system. There is a distinction between the alternatives in their respective abilities to control discharge rates from storm events of varying magnitudes. From the perspective of larger storms (i.e., storms with statistical recurrence frequencies of 5-years or longer), none of the alternatives has the ability to dampen downstream peak flows in Des Moines Creek. The water quality structures developed under Alternatives A and B have no storage capacity to affect peak runoff rates to Bow Lake, and these alternatives do not propose to modify outlet controls from the lake. From the perspective of frequent storm events (i.e., storm magnitudes with statistical return frequencies of up to 5 years), Alternative C would provide at least a medium level of benefit. Alternative C would provide a new outlet at the south end of the lake that would be operated seasonally to lower the static lake level by 2 feet. Computer modeling performed in conjunction with the Des Moines Creek Basin Plan identified this depth as sufficient to provide adequate storage capacity to buffer more frequent storm events. If the lowering of the lake is pursued, further refinements to the outlet structure design may indicate that control of larger

storm flows may be achievable by restricting the discharge capacity of the existing 36-inch outlet pipe. Enhancing the flow control capability within Bow Lake itself may afford opportunity for the City to relieve landowners within the Bow Lake basin of the requirement to provide smaller storm peak flow control on site, as currently required by the 1998 Surface Water Design Manual. More rigorous stormwater provisions will be required under the new 4(d) rules proposed by the NMFS in response to the endangered species listing of Puget Sound chinook salmon, including new flow control requirements that exceed the City's current standard. However, the seasonal lowering of lake levels that could occur with Alternative C may allow the City to permit Bow Lake basin property owners to avoid complying with these measures on-site, by using capacity available in the lake itself.

Area of Evaluation - Effect on Habitat Values: One typical goal of an open space oriented plan, especially in a degraded urban environment, is environmental restoration (such as the enhancement of habitat values). Although Bow Lake will not suddenly become a major wildlife resource, it is reasonable to expect that smaller urban fauna, such as birds and small mammals, will find a more hospitable environment here. For certain larger species, such as waterfowl, the proximity of the airport makes it undesirable to increase the attractiveness of the environment for these unwanted birds. Three criteria were identified to measure the benefit to wildlife habitat of a given alternative: it supports existing habitat; it provides new habitat; and it provides for the potential to increase waterfowl populations. The No Action Alternative would provide no benefit under any of the three criteria. Alternative A was also judged as providing no benefit under most of the criteria, although it was noted that some benefit could be argued as the result of removal of exotic species from the Colacurcio wetland, thus benefiting native habitat. Alternative B would provide benefit to both existing and new habitat. Restoration of vegetation to the north end parcel not only creates additional habitat area, it creates a 'bridge' that connects Bow Lake habitat to the vegetated hillside running north along 32nd Avenue S. Similar benefit was noted for Alternative A. However, Alternative C was also judged to be more likely to increase waterfowl populations, if only slightly, due to the increased area of open water in the Colacurcio wetlands and the opportunities provided to design protected nesting areas.

Area of Evaluation - Effect on Wetlands: The entire Bow Lake complex, including the Colacurcio wetlands and the open waters of Bow Lake, is identified as a single jurisdictional wetland. Development within wetlands is highly constrained due to Federal, state, and local regulations. Therefore, development of a trails network as well as stormwater treatment facilities within the Bow Lake environs will almost certainly require a lengthy and complicated permit process. In keeping with the evaluation system of identifying where benefit lies, two criteria were developed to evaluate the positive impact on wetlands: the degree, if any, to which overall wetland functions were enhanced; and the degree to which overall wetland area was increased.

Wetlands provide a wide variety of beneficial effects to ecosystems, including stormwater storage, water cleansing, wildlife habitat, groundwater recharge, etc. Therefore, a given management intervention into a wetland can simultaneously enhance one function while degrading another. The intent here is to identify in a fairly simplistic manner whether an overall benefit can be identified or not. This will inevitably be somewhat subjective at this level of study, and only further plan development and agency consultation will confirm the judgement. The No Action Alternative is judged to be neutral, as it leaves the wetlands in their current degraded state. Alternative A would negatively impact the wetlands in both categories, as trails development reduces the wetland area and provides no mitigation other than removing of exotics from the Colacurcio property. Alternative B would have some small benefit due to measures that increase the quality of the water flowing into the wetlands, the enhancement of the drainage ditches at the north end of the lake, and the development of buffer area for the lake. The same holds true for Alternative C. However, Alternative C is given credit for actually increasing the size of the wetland at the north end of the lake and reclaiming land currently under pavement but that was historically wetland habitat.

Area of Evaluation - Permitability: Due to the presence of extensive wetlands throughout the study area, construction projects may require a lengthy permit process, depending on the nature and degree of construction proposed. New U.S. Army Corps of Engineers rules have recently increased the level of protection afforded to wetlands, while in the Puget Sound area the ESA listing of chinook salmon and other anadromous fish species has increased the length of time required to obtain necessary permits. With these factors in mind, two criteria related to permitting were identified and used to evaluate the alternatives: the difficulty a given alternative would have in obtaining wetlands permits; and the degree to which an alternative provides mitigation area to offset the impacts of the project.

This measure is obviously not applicable to the No Action Alternative. Alternative A was judged most beneficial in terms of obtaining permits, as permitting difficulty is typically the inverse of the degree of wetland disturbance anticipated. As wetland disturbance increases from Alternative A to C, Alternative A is seen as being the most beneficial, while Alternative C is the least beneficial. In this instance, the benefit is relief from the time and expense burdens of obtaining permits. None of the alternatives is projected to provide any excess mitigation area that could be used as a credit for by the City for other projects. However, Alternative C in particular provides some benefit with regards to mitigation due to the wetland restoration proposed for the north end of the lake. This may be looked on particularly favorably by the regulatory agencies as it restores existing areas to its historic wetland condition.

Area of Evaluation - Effect on Public Policy: Several approved public policy documents have bearing on Bow Lake, including the recent SeaTac City Center Plan and the Des Moines Creek Basin Plan. The Bow Lake improvements should be done in a manner consistent with these approved plans. Therefore, two criteria were identified to review this consistency: is an alternative consistent with the City Center Plan; and does an alternative help implement the Des Moines Creek Basin Plan. The No Action Alternative receives a negative rating, as it does nothing to implement these adopted plans. Alternative A provides a medium benefit to the goals of the City Center Plan as it provides some recreational facilities for visitors, employees, and residents in the City Center neighborhood. Alternatives B and C are perceived as providing the most benefit due to the presence of several important features that also featured prominently in the City Center Plan – new public open space at the head of Bow Lake, and an east-west transportation connector from International Boulevard to the neighborhoods to the east. This latter feature helps connect SeaTac’s major employer, the airport, with the residential areas, promoting a positive live-work connection.

Alternative C receives a most benefit rating with regards to implementing the Des Moines Creek Basin Plan, principally due to the proposal to seasonally lower the lake’s static water level to provide additional storage capacity for frequent smaller storms. Lake lowering was identified in the Des Moines Creek Basin Plan as a desirable strategy for addressing regional stormwater requirements, albeit less cost effective than some other measures.

5.4 Summary

There is typically a direct correlation between the benefit provided by a given alternative and the cost of that alternative, as presented in the cost evaluation discussion. This is to be expected in a standard investment/benefit model. In that model, Alternative C represents the greatest investment and provides the most benefits. However, this econometric model does not measure political or regulatory impacts, which must take into account private property rights as well as regional and national regulatory objectives related to wetlands, endangered species, and safety factors at SeaTac Airport. For that reason, it is believed to be premature for this study to identify a Preferred Alternative. Each of the alternatives has individual advantages from the above perspectives. It is our recommendation that these pros and cons be

explored further with the individual property owners and regulatory agencies before SeaTac makes any decision regarding the final definition of a Preferred Alternative.

6.0 IMPLEMENTATION

The purpose of this section is to identify the steps involved in implementing a joint-use facilities program, should the City decide to proceed on that path. Implementation steps include identifying a series of action items to move the plan forward; identifying potential sources of funds for the implementation of a Preferred Alternative plan, once such a plan is identified; and identifying a preliminary phasing plan, to identify a logical progression of work. The intent is to give City staff adequate direction to focus their efforts to fund and implement a selected alternative.

6.1 Implementation Strategy

This study has deliberately avoided making any recommendation regarding a Preferred Alternative, for several reasons. The amount of public outreach done to date, which is necessary to gather input on these concepts, is inadequate to allow a final recommendation to be reached. This outreach needs to gather input from both property owners and public agencies. Now that the preliminary effort to define a project range and feasibility has been done, it is possible to define and carry out a coherent outreach program. This can be done in the next phase of work. This outreach program is one of a number of implementation steps which need to be started. These are summarized below, in roughly the descending order of priorities.

- Begin a comprehensive public outreach program. The purpose of an outreach program should be two-fold: it should make every effort to educate interested parties with regards to the potential benefits of these alternatives, and it should attempt to gather the concerns of affected property owners, businesses, and residents with regards to the ultimate actions taken. This input will allow for the development of a stronger plan. Ideally, these stakeholders would be involved in the selection of a preferred plan.
- Begin agency outreach. This is a subset of the public outreach program identified above. A number of agencies have the power to hold this project up, based on permits or other means. A few of the critical agencies include: Washington Department of Ecology and Army COE, which will have to issue the necessary wetlands permits to allow the trails and other features to be built, and the Des Moines Creek Basin Committee, responsible for watershed stewardship in the Des Moines Creek basin.
- Identify a Preferred Alternative. The preferred plan will not necessarily be one of the 3 conceptual alternatives identified here. In fact, it is quite likely that based on stakeholder and agency input that a 4th alternative will emerge combining elements of all three existing alternatives. This alternative could be able to minimize undesirable impacts to private property while maximizing public and private benefits from the proposed investment.
- Develop a funding strategy. Investigations should begin with regard to the funding of the program elements. As will become evident in the next section, there are a number of potential funding sources. These programs should be investigated with regards to submittal requirements, limitations,

deadlines, and other parameters, so that the City is positioned to request funds once a final course of action has been decided.

- Review revenue potential. As a part of the public/private benefit discussion, the City should investigate how stormwater utility ratepayers would be affected by development of joint-use stormwater facilities. In addition, the City should identify the potential new charge options to ratepayers, as well as avoided costs related to Level 2 detention requirements.
- Begin programming specific elements. Within the City's annual budgeting cycle, there are opportunities to position portions of the program for implementation. Ongoing projects, such as transportation improvements and stormwater infrastructure development in the City Center area, offer opportunities related to the ideas identified in Chapter 4. It is time to begin refining the specifications of specific work items and moving them into long-term budgeting loops.
- Identify land costs. Several alternatives have incomplete costs due to the unknowns around the cost of land acquisition. The City should hire a qualified land assessor to get a sense of the market value of the property involved.
- Begin subsurface wetlands investigations: Although several wetland investigations have been done in the Bow Lake area, none of these involve development of subsurface soil profiles. These are likely to be necessary in the case of wetlands restoration work or placement of elevated boardwalks. Borings within the wetlands can be anticipated as a necessary part of design work for certain features.

6.2 Funding Mechanisms

There are a wide variety of funding sources available to assist the City finance a program of joint-use public facilities of this type. Table 6.2-1 summarizes these potential funding sources, organized by general type and specific program. The table further identifies the potential for those revenues to be applied to the three main areas of public facility development —stormwater facilities, recreation facilities, and transportation facilities (including non-motorized transportation). One aspect of this specific project is that certain portions of the building program – trails in particular – can be categorized as either recreation facilities or transportation facilities, depending how the City wants to position them for funding.

Of particular interest, three state agencies sponsor grant programs that benefit the City. The InterAgency Commission on Outdoor Recreation (IAC) distributes Federal Land and Water Conservation Funds for recreation and open space projects, including trails projects. Pending Federal legislation may greatly increase funding for this program in the near future. The Washington State Department of Transportation (WSDOT) administers Federal transportation funds under the TEA-21 program. In recent years, this program has become more flexible in terms of how it can be applied. A project such as this promoting neighborhood connectivity and “Smart Growth” patterns would appear to be an excellent candidate for this program. The Department of Ecology sponsors several programs to improve water quality. With the new Federal ESA 4(d) rules soon to appear, this is a very timely subject, likely to attract funding. Alternatives B and C in particular appear capable of attracting some of this funding.

In addition to the State-level grant and loan programs, there are a number of options for local funding of these projects. It is in part a question of how to position an improvement project. Much depends on the specifics of the total package. For example, although Alternative C is by far the most costly alternative to construct, it provides much more private benefit than the others, as was evidenced previously in Table 5.2-1. This private benefit can be captured as a revenue stream, through development of a Special Benefit District or similar mechanism that only impacts affected stormwater utility ratepayers to help make the alternative self-financing. Because of the number of intertwined elements presented in the plan, including

Table 6.2-1: Potential Funding Sources and Applications

Funding Type	Specific Sources	General Orientation and Notes	\$ Usable for Stormwater?	\$ Usable for Parks/Open Space?	\$ Usable for Transportation ?
Grants	Land and Water Conservation Funds <ul style="list-style-type: none"> Distributed by the IAC Annual grant - requires a Plan for award Used for habitat/open space/ env'l education/land acquisition 	<ul style="list-style-type: none"> Shoreline access Open space Transportation (pedestrian/bike access) 	NO	YES	YES
	TEA-21 <ul style="list-style-type: none"> Administered by WSDOT \$ can be used for parking/ roads/trails/signage 	<ul style="list-style-type: none"> Open space Transportation (pedestrian/bike) 	NO	YES	YES
	Ecology <ul style="list-style-type: none"> Centennial Fund Section 319 Nonpoint Source Grants 	<ul style="list-style-type: none"> Water quality 	YES	NO	NO
State loan programs	Ecology <ul style="list-style-type: none"> State Revolving Loan Fund 	<ul style="list-style-type: none"> Focused on improving water quality Funds a wide range of projects Requires matching grants Grant/loan combinations for 100% of cost 	YES	NO	NO
	Public Works Trust Fund	<ul style="list-style-type: none"> Funds a wide range of projects 	YES	YES	YES
Collaboration with other agencies	<ul style="list-style-type: none"> Des Moines Basin 	Plan Partners (Port of Seattle, King County, City of Des Moines)	Maybe	Doubtful	NO
Revenue, general obligation bonds	<ul style="list-style-type: none"> Stormwater utility 	<ul style="list-style-type: none"> Bond campaign required – \$ could probably be used only for improvements to City-owned land 	YES	NO	NO
	<ul style="list-style-type: none"> Parks 		NO	YES	NO
General government taxes		Would compete with other needs.	YES	YES	YES
Special or localized revenues	Local improvement district (LIDs)	<ul style="list-style-type: none"> City would have to define, create, and gain acceptance of landowners 	YES	YES	YES
	Special Benefit District	<ul style="list-style-type: none"> Applied city-wide Applied within basin 	YES	YES	YES
	Stormwater utility revenues		YES	NO	NO
	Parks Development Impact Fees	<ul style="list-style-type: none"> City would have to develop a fee system. Question – can fees fund improvements to non-city owned land? 	NO	YES	NO
	Parking Taxes		NO	NO	YES
One-time development/redevelopment fees	Hotel/Motel tax revenues		NO	YES	YES
	<ul style="list-style-type: none"> Fee in lieu of on-site improvements In-kind contributions System development charge (stormwater) 	<ul style="list-style-type: none"> Cash Land/easements Contributes improvements 	YES	YES	YES

trails, roads, potential open space acquisition, and stormwater facilities, a final plan could be developed in phases using multiple funding sources. As the 3 right hand columns in Table 6.2-1 make clear, many of the funding sources are limited in terms of what the City can do with the money.

6.3 Phasing

Phasing refers to the timing of construction for individual elements of the program. Unlike a specific facility, such as a city hall, it is unlikely that a program such as one represented by this plan will be implemented all at one time. There are so many individual program items, so many individual parcels and property owners, and so many potential funding sources that it is far more likely that the preferred plan would be implemented gradually over time. Another aspect of this timing is the fact that although the stormwater alternative plans are coordinated with the open space/trails portions, there is nothing to keep these separate functions from being independently implemented. Below are some of the critical phasing issues that have emerged to date.

- Alternative A as Phase 1: Alternative A could be developed as shown without interfering with the development of Alternatives B or C as subsequent phases. There are few stormwater facilities involved, none major. There would be no wasted investment as the result of the implementation of this plan.
- Role of Colacurcio Development: Development of joint-use facilities on the Colacurcio site should be coordinated with development of the adjacent multi-family housing, including for items such as trails connections, stormwater facilities, and landscaping. This may accelerate or delay implementation, depending on the private development schedule.
- Role of Kilroy Development: Development in the Kilroy parking lot north of Bow Lake is a critical factor in deciding the feasibility of the major regional wet vault. This vault could be constructed in phases, or multiple shapes, to accommodate these construction plans. It could also be constructed with appropriate footings and structural elements to accommodate a building mass above it. Design of this vault would need to be coordinated with the Kilroy development plans.
- Role of other City projects: Other public works projects, such as roadwork north and east of Bow Lake, should be reviewed for potential to develop identified plan elements, such as wet vaults under roads, or adjacent habitat and bioswale connections.
- Role of NMFS and 4(d) rule: Development of the major regional wet vault at the north end of the lake may proceed in stages. The final 4(d) rule decisions will have implications for the feasibility of sizing this wet vault, as they may dictate the need for Level 1 or Level 2 detention requirements. If only Level 1 is required, that is a difference of about \$5 million in savings. This may mean the difference between proceeding with lake lowering or not.
- Individual minor stormwater elements: Some of the minor stormwater elements can be implemented at any time, independently of other capital improvements, if public works funds became available.
- Trails development: This can be purely a function of the individual property owner. It makes little sense to develop a trail that does not have a clear defined beginning and end; therefore trail construction should be well coordinated, individuals can help or block critical pieces. Hotel owners could decide that a westside trail makes sense, and initiate design and construction independently of what happens elsewhere in Bow Lake.

6.4 Conclusions

This study presents the City with a variety of courses of action that can be followed with regards to public facilities development in the Bow Lake area. However, it does not identify a preferred course of action. This is due primarily to the fact that environmental review and adequate public discussion and input of these alternatives has not occurred, a fact that is even more important considering that most of the properties affected are in private hands.

All three of the alternatives would create some level of both public and private benefit. These benefits might be best reviewed in the context of a series of major changes that are confronting the City and its business community. First, with incorporation has come the ability for the City to control its own destiny. One expression of this is the emerging shape of the City Center, with the Bow Lake neighborhood being a vital part of that center. Secondly, the dramatic growth of Sea-Tac Airport in the years ahead, and development of light rail service, is sure to spur additional private sector growth in the City Center area. Thirdly, as this growth occurs, long-established hotels and businesses will be looking at how to reposition themselves competitively within this expanded market. Image and facility development will be part of that repositioning. Lastly, the ESA and related salmon recovery plans will affect land use and utility planning within the Des Moines Creek basin, and private land owners as well as jurisdictions should be prepared to be responsive to those plans.

Some parties will question the advisability of the City planning for public development on what is currently private property. However, within the context of a 20-year planning horizon for the City Center area, and in light of the changes identified above, it is wise to step back and review the entire range of possible outcomes that could occur from such a joint public-private planning partnership. This conclusion appears to be borne out by the potential financial benefits of regional stormwater facility presented in Chapter 5.2. In addition, there is clearly a deficit of open space and recreation facilities within the City Center area, based on adopted standards. Insofar as development of green spaces is often an integral part of public strategies for creating a city image, promoting urban livability, and enhancing economic development, it is appropriate for the City to be exploring such avenues for addressing these needs.

It is the recommendation of this report that the next phase of this study address the following needs:

- Develop and carry out a public input process: the voices of landowners, businesses, residents, and tenants need to be heard with regarding the pros and cons of each alternative developed in this study.
- Conduct an agency outreach process: the regulatory agencies responsible for resource protection and permitting, such as the State Department of Ecology, need to be brought into the planning process to advise the City regarding plan refinements. Such refinements can often help make sure that any plan chosen can be implemented.
- Further characterize economic impacts and benefits: Additional review of the financial implications of the alternative should be undertaken, resulting in more detailed quantification of such elements as private property benefits, impacts to rate-payers charges, and costs of land acquisition.
- Identify a preferred alternative: With the above input, the City should be able to identify a preferred direction with regards to joint-use facility development. A preferred alternative will not necessarily be one of the 3 alternatives presented in this report, but may be some combination of elements contained within all three.
- Environmental review: With a preferred alternative identified, necessary environmental review can begin. At a minimum, this should involve preparation of a SEPA checklist and an attendant threshold determination.

With the input from the above planning steps, it is felt that the City Council will have an adequate basis to commit SeaTac to an appropriate course of action.

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7.2 Personal Communications

Casey, Glynis. Associate Planner for City of SeaTac, Washington. Email communication under the subject heading of “RE: Data Request” with Joe Cloud of EDAW, Inc. March 7, 2000.

Hansen, John. King County Biologist, King County, Washington. Telephone conversation with Jennifer Seavey of EDAW, Inc. March 8, 2000

Master, David. Conversation with Debbie Maroon of EarthTech, Inc.

Schaefer, Richard. Vice President of Earth Tech. Verbal communication with Joe Cloud and Jennifer Seavey during site visit on March 3, 2000.

Ward, Craig. Principal Planner for City of SeaTac, Washington. Verbal communication with Joe Cloud on March 10, 2000.

APPENDIX A - COST ESTIMATES

Bow Lake Joint Use Facility Study				
Total Conceptual Plan Cost Estimate - Alternative A				
Cost Item	Quantity	Units	Unit Price	Amount
TRAILS				
Paved Trail (asphalt) - 4'				
-West Side trail	6320	SF	\$2	\$12,640
-Washington Mutual parcel	1000	SF	\$2	\$2,000
Permeable Trail (crushed stone) - 4'				
-North End	2280	SF	\$1	\$2,280
- East End	6520	SF	\$1	\$6,520
-Colacurcio parcel	8400	SF	\$1	\$8,400
Trail Bridge Structures	2	EA	\$5,000	\$10,000
Concrete Sidewalk - 6' (Kilroy Property)	3000	SF	\$5	\$15,000
STRUCTURES				
Boardwalk - 5'	500	SF	\$15	\$7,500
Lake Overlooks	2	EA	\$40,000	\$80,000
SIGNAGE				
Interpretive Signage	2	EA	\$4,000	\$8,000
Way-finding Signage Allowance	1	LS	\$5,000	\$5,000
FURNISHING				
Allowance for benches,etc.	20	LS	\$500	\$10,000
Lighting on paved paths	20	EA	\$1,500	\$30,000
Electrical system for lighting	1	LS	\$15,000	\$15,000
OTHER SITE WORK				
Mobilization & clean-up	1	LS	-	\$22,884
Reforestation	1000	SF	\$1.50	\$1,500
Trail Shoulder Hydro-Seeding	0	SF	\$0.25	\$0
WETLAND RESTORATION				
Habitat Improvements in Colacurcio Wetlands	1	LS	\$15,000	\$15,000
Subtotal				\$251,724
Tax 8.4%				\$21,145
Subtotal				\$272,869
Contingencies (30%) (1)				\$81,861
Estimated Construction Costs				\$354,729
Design, Permitting, Legal, Admin (25%) (2)				\$88,682
Construction Management (5%)				\$17,736
RELATED STORMWATER FACILITIES (3)	1	LS	-	\$580,199
LAND ACQUISITION				Not Applicable
TOTAL ESTIMATED COSTS				\$1,041,347

(1) Contingencies will typically be reduced as project becomes more defined.

(2) Soft costs estimated at 25%. Actual costs may vary widely depending on a number of circumstances.

(3) See attached separate cost estimate for stormwater facilities

Conceptual Stormwater Costs - Alternative A

Bow Lake Joint Use Facility Study				
Alternative A				
Project Description:				
Enhancement of 2 Existing Bioswales at North End of Lake				
Installation of Debris/Oil/Solids Control Structure at North End of Lake				
Installation of Debris/Oil/Solids Control Structure at End of 180th St. S.				
Installation of Debris/Oil/Solids Control Structure at End of 182nd St. S.				
Create Functional Bioswale from End of 182nd St S.Southerly to Colacurcio Property				
Item	Quantity	Units	Unit Price	Amount
Mobilization & Demobilization	1	LS	-	\$14,305
Traffic Safety	1	LS	\$2,000	\$2,000
Restoration & Cleanup	1	LS	-	\$14,305
Biofiltration Swale - Construction Only No Seeding	1600	LF	\$60	\$96,000
Biofiltration Swale - Seeding	0.73	Acres	\$4,500	\$3,306
Sawcutting Existing Pavement	400	LF	\$1	\$400
Removing Asphalt Concrete Pavement	350	SY	\$13	\$4,375
Pavement Restoration	350	SY	\$20	\$7,000
Curb and Gutter	150	LF	\$15	\$2,250
Roadway Excavation, Including Haul	146	CY	\$7	\$1,019
Storm Sewer Pipe 12-Inch Diameter	25	LF	\$25	\$625
Storm Sewer Pipe 18-Inch Diameter	50	LF	\$30	\$1,500
Storm Sewer Pipe 24-Inch Diameter	50	LF	\$40	\$2,000
Type 2 - 54" Diam. Catch Basins	4	EA	\$2,500	\$10,000
Concrete Vault (8 x 7 x 6)w/diversion weir	1	EA	\$15,000	\$15,000
Concrete Vault (8 x 7 x 6)	1	EA	\$12,500	\$12,500
Relocate Existing Utilities	1	LS	\$10,000	\$10,000
Trench Safety	125	LF	\$1	\$125
Vortechs Model 7000	2	EA	\$30,000	\$60,000
Vortechs Model 16000	1	EA	\$60,000	\$60,000
Subtotal				\$316,710
Tax 8.4%				\$26,604
Subtotal				\$343,313
Contingencies (30%)				\$102,994
Estimated Construction Costs				\$446,307
Engineering, Permitting, Legal, Admin. (25%)				\$111,577
Construction Management (5%)				\$22,315
Total				\$580,199

APPENDIX B - PRIVATE BENEFIT ESTIMATES