



LANDSCAPE DESIGN GUIDELINES

Vision, Themes, and Images

for

• *Seattle-Tacoma International Airport* •

Prepared for: PORT OF SEATTLE
Aviation Division

Seattle, Washington

February 28, 2000

LANDSCAPE DESIGN GUIDELINES: *Vision, Themes and Images*
for
•Seattle - Tacoma International Airport•
February 23, 2000

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EXECUTIVE SUMMARY

The Port of Seattle's Aviation Division hired a planning and design team to develop landscape themes and images which could be used to assist expansion and development at Seattle-Tacoma International Airport.

The primary goal was to create a functional, visually riveting vision of the airport that would immerse visitors in the unique natural and cultural environment of the Pacific Northwest.

To accomplish this goal, the planning team explored all aspects of the visitor experience at Seattle-Tacoma International Airport—from the moment of arrival, through the terminal, along roadways, and out into the cityscape beyond.

To ensure that the airport maintains a cohesive image throughout its future development, the team developed a principal theme and supporting themes, identified a design vocabulary to implement the themes, and created a conceptual plan showing how these design recommendations could be applied to future airport projects.

This document is intended to be used in conjunction with the Port of Seattle (POS) Landscape Design Standards to help guide the vision of future development at Seattle-Tacoma International Airport. Where any conflicts occur between these two documents, the Landscape Design

Standards shall take precedence over any recommendations presented in these Guidelines.

This document contains three parts. The first part introduces the set of themes and images—each symbolizing some aspect of the Pacific Northwest—for use throughout the airport site, buildings and access areas.

The second part is a conceptual plan which demonstrates creative ways these themes could be applied to specific locations within the airport's jurisdiction, and also complement the proposed city plans of its neighboring communities.

The third part, the appendices, contain technical papers associated with this project. They include more detailed information on planings and the implementation of the theme. The appendices should be used as recommendations for further exploration, not as specific requirements. Refer to the Landscape Design Standards for specific requirements for development at the airport.

The images, plans, and ideas contained within this document are intended to be examples that communicate the themes and inspire the development of design concepts, while still leaving room for exploration by future design teams. Specific design concepts proposed by future design teams will need to be coordinated with the FAA, the Port of Seattle and other governing agencies at Sea-Tac International Airport.

When used together, the three parts of this document will help future design professionals solidify the airport's role as the primary gateway to the Pacific Northwest—through which millions of visitors will pass each year.

Principal theme

The singular, enduring image of the Pacific Northwest is the lush green forest that covers our mountains, spills into the foothills, through the cities, and down to the shores of Puget Sound and the Pacific Ocean. To capture this image, the *Northwest Evergreen Forest* was selected as the principal theme to guide the development of the airport.

What makes the *Northwest Evergreen Forest* a particularly appropriate theme is the role it plays in defining the three geographic landscapes that lie between the Cascade Mountains and Puget Sound: mountains and foothills, forests and clearings, sound and ocean. Each of these landscapes allow us to experience the forest environment in a different way.

The distinct physical characteristics of the *Northwest Evergreen Forest* can be used to project a strong regional image throughout the airport. These include immense vertical scale, richly textured floor, glimpses and vistas, and drizzle and mists.

Supporting themes

Two supporting themes provide a repository of evocative elements of the Pacific Northwest. The *Natural Environment* includes land, water, plants, and wildlife. The *Cultural Environment* includes Northwest faces, arts, trade and technology, landmarks, and outdoor recreation.

Emotional choreography

Travelers often approach a trip with a blend of excitement, concern, and anxiety. As a result, this document suggests locations, forms and intensities of thematic emphasis that are based on the various states of mind travelers experience in an airport.

The vocabulary of spaces

To exemplify how themes and images can be applied to specific areas within the airport site, the team developed a vocabulary of spaces. *Unifying elements* are continuous applications of consistently designed elements that help unify the overall sense of the place. *Gateways and portals* offer sensory experiences using visual, aural or other elements to heighten the traveler's awareness of important transition points and entries. *Focal points* are highly designed elements that create interior or exterior landmarks.

Applying the themes and vocabulary

Future facility designers should apply the principal theme and supporting themes using the design vocabulary described above, in conjunction with the Airport Design Guidelines and Standards, Landscape Design Standards and other reports/studies relevant to development at Seattle-Tacoma International Airport, to create a convenient and pleasant experience for travelers at the airport.

The plan describes concepts for the exterior of the airport, with possible applications to interior locations. It concludes with recommendations for applying the themes to the airfield. However, the airport is a very transitory environment. As such, future designers will need to coordinate their efforts with other planning and design projects, current guidelines and standards for both interior and exterior elements, current regulations and codes at the airport, and other designers at the airport to create a coherent and consistent lasting image of Seattle-Tacoma International Airport.

The use and application of the design concepts found in this document will provide guidance to aviation staff and design consultants over the next decade, as they plan the redevelopment of the airport. Implementation of these design guidelines, through the relevant standards and codes at Sea-Tac International Airport, should provide residents, employees and travelers with an indelible image of the people and environment of the Pacific Northwest.

1.0 THE MODERN AIRPORT

1.1 DESIGN PHILOSOPHY

As the 21st century dawns, a major transition is underway in the relationship between urban airports and the communities they serve. The airport's role as a highly specialized exchange between air and ground transportation is changing rapidly. Business meetings and transactions, specially shopping and restaurants, recreation and exhibitions are entwining airports into the daily life of communities and regions.

As a gateway to the Pacific Northwest, the airport needs a comprehensive set of design directions to give it new energy and unite the many elements of the capital improvement program being implemented during the next decade into a coherent whole.

A renewed airport will be more than a premier, world class facility. It will be an integral part of the community and a vivid symbol of the region. As a gateway to the Pacific Northwest, it could also be a visually exciting and memorable place for the millions of travelers who will pass through each year.

To prepare this document, the planning team explored all aspects of the visitor experience at Seattle-Tacoma

International Airport—from the moment of arrival, through the terminal, along roadways, and out into the cityscape beyond.

To ensure that the airport maintains a cohesive image throughout its future development, the team developed a principal theme and supporting themes, identified a design vocabulary to implement the themes, and created a conceptual plan showing how these design recommendations could be applied to future airport projects.

The document also explores ways for the airport to be a good neighbor to the communities it adjoins. As each continues to grow and mature, better pedestrian and vehicular connections are recommended to enhance the access between the airport and its neighbors. The Regional Transit Authority's proposed light rail line and stations provide further opportunities to strengthen this relationship.

1.2 CREATING A MEMORABLE PLACE

Like a memorable individual or a vivid natural landscape, Seattle-Tacoma International Airport should emanate a strong, confident sense of itself and the region it serves. By having a dynamic physical presence—combined with high quality service, courteous communications, and ease of movement—the airport can provide a satisfying and memorable experience for visitors.

This document explores the expression of key Northwest values that will provide a foundation for the thematic organization of the airport. In brief, these values include the important role of the environment, the rich diversity of cultures, an independent and entrepreneurial work ethic, and a fervor for active outdoor recreation (Exhibit 1).



Exhibit 1: Northwest thematic icons



The region's natural and built environments contain a rich source of thematic symbols that capture Northwest values. The distinctive Northwest culture—derived from the diversity and energy of people—can be expressed in faces, arts, and symbols of resource-based industries, high technology, and trade around the Pacific Rim and globe. As the principal theme and supporting themes in this document are developed, they form a sequence of dramatic, memorable experiences for airport users.

1.3 PLANNING PROCESS

This document was produced in the process of assessing Seattle-Tacoma International Airport's present design conditions and planning for its future. The design team comprehensively reviewed all airport property (interior and exterior) and off-site approach roads.

The goal was to develop an overall theme and supporting images for the facility, and to demonstrate how these could be applied to specific locations within the airport to achieve a cohesive and classical Northwest design.

In applying the concepts and recommendations provided in this report, future designers will need to consider the Landscape Design Standards and the Airport Design Standards and Guidelines for more specific requirements guiding development at the airport.

Key planning and design criteria included environmental enhancement, customer satisfaction, safety, and the creation of a truly memorable Northwest experience—sustainable over time.

Public involvement during the planning process included airport users, neighbors, adjacent city governments, and other related public agencies.

This work is both visionary and practical. The key to its successful implementation lies with how future design teams use it to develop design concepts and details specific to each project.

Future designers will be responsible for addressing maintainability, sustainability and operational constraints for their projects. These issues should be addressed through life cycle cost analyses, conservation, maintenance guidelines and the development of an arts infrastructure. An understanding of FAA and Port of Seattle safety concerns including plant palettes, wildlife attractants and vertical intrusions into runway safety areas and airline operations, as well as close coordination with the FAA and other governing agencies and departments, such as adjacent city governments and airport operations, will be critical to the successful implementation of this plan.

PART 1: PERTINENT THEMES AND IMAGES

2.0 THEMATIC DEVELOPMENT

2.1 PRINCIPAL THEME

One of Seattle-Tacoma International Airport's primary roles is as a gateway to the Pacific Northwest. As such, it can introduce people to the unique physical characteristics found in this part of the world. For this purpose, the concepts and themes presented in this report were selected to symbolize, explain, and reinforce the physical qualities that set us apart from other places.

The widely varied natural landscapes of the Pacific Northwest offer windows to our past, present, and future. The singular, enduring image of western Washington—known throughout the world—is the rich, green, seemingly continuous forest of tall trees covering our mountains, spilling down into the foothills, extending into our cities, and down to the shores of Puget Sound and the Pacific Ocean (Exhibit 2).

To capture this image, the *Northwest Evergreen Forest* was selected as the principal theme to guide the design development of the airport.

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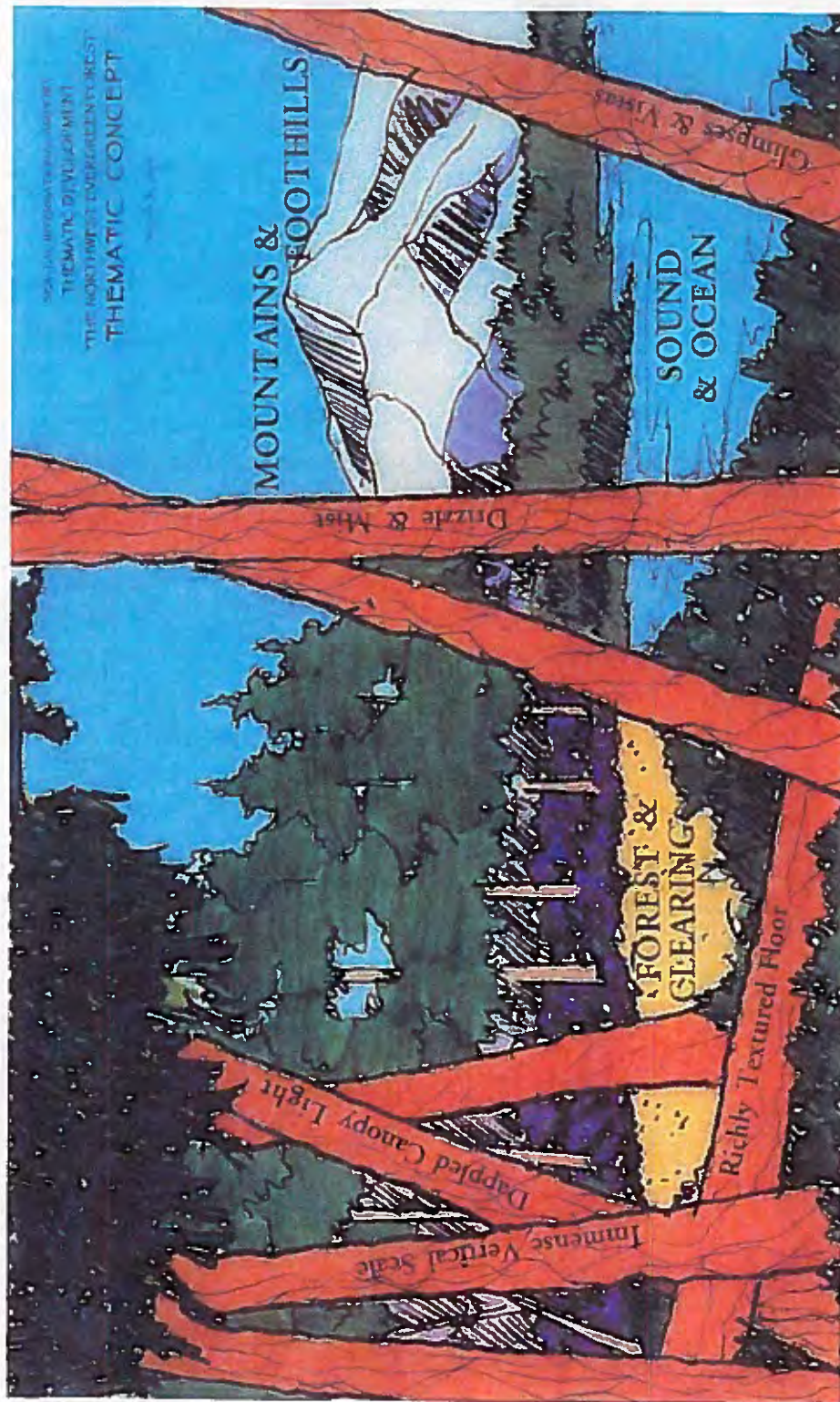


Exhibit 2: The Northwest Evergreen Forest

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What makes the *Northwest Evergreen Forest* a particularly appropriate theme is the role it plays in defining the three geographic landscapes that lie between the Cascade Mountains and Puget Sound (Exhibit 3). In less than a hundred miles, the land descends from a height of 14,000 feet to depths of several thousand feet below sea level. Within this unique geographic setting, three archetypal landscapes support the *Northwest Evergreen Forest* theme. Designers can use the components found in each landscape to convey this principal guiding theme in different ways.

Mountains and foothills

The wall of the Cascade Mountains, with its two volcanic sentinels, Mount Rainier and Mount Baker, and the wilderness of the Olympic Mountains, are among the Northwest's most striking icons.

Forests and clearings

A walk through a Northwest forest is marked by the distinct contrast between the intimate, mystical enclosure of dark green trees, punctuated by the sunlit openings and vistas of clearings.

Sound and ocean

A source of food, transport, and recreation, the region's saltwater surroundings and islands provide a refreshing addition to the mountain peaks and dark green veils of evergreen forest.

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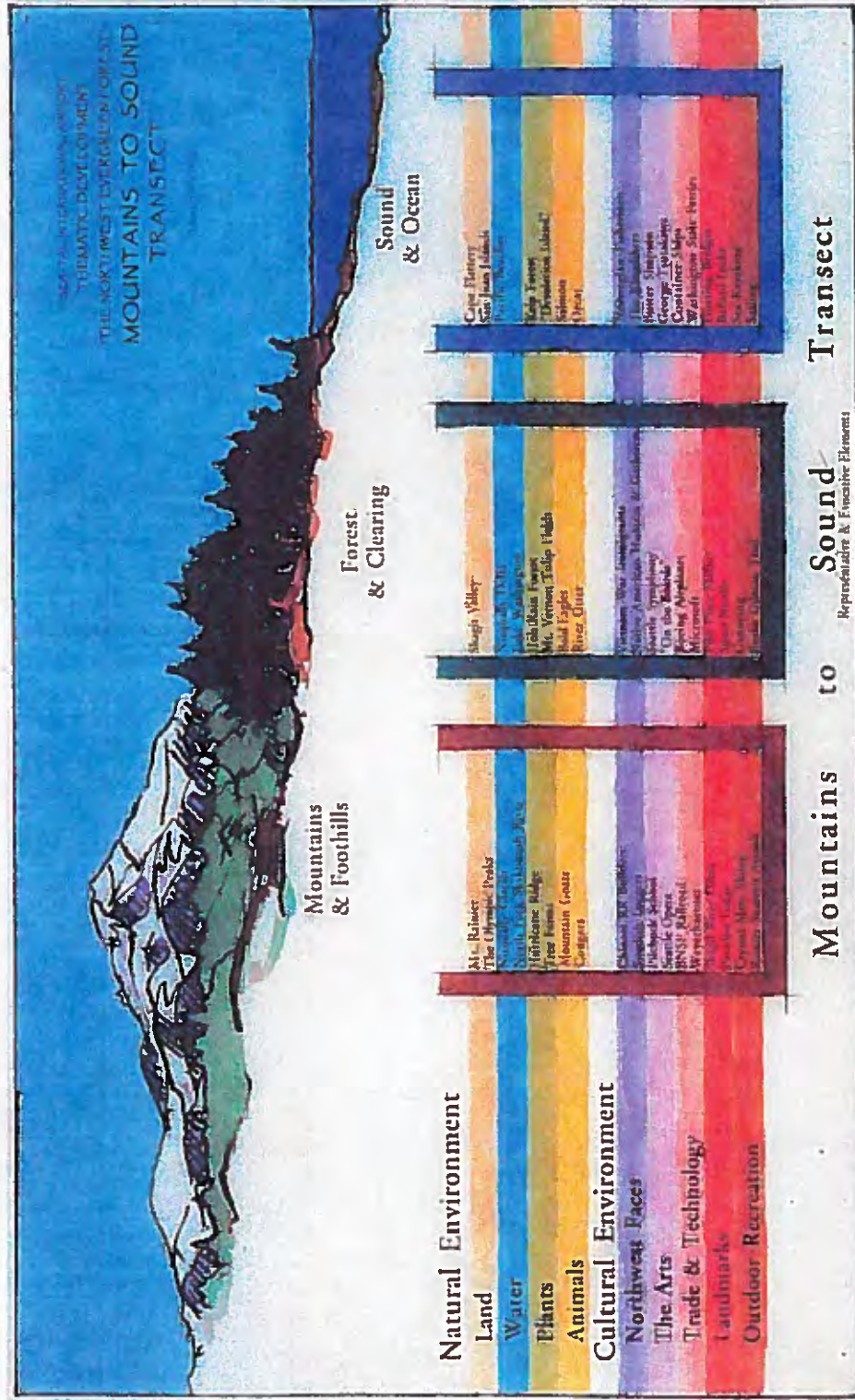


Exhibit 3: Mountains to sound transect

2.2 SUPPORTING THEMES

The principal theme of the *Northwest Evergreen Forest* leads to two supporting themes: *Natural Environment* and *Cultural Environment*. These two themes are used in their broadest sense to encompass geography, people, technology, commerce, and the arts. Each is described below by a selection of representative and evocative elements.

Elements of the Natural Environment

- *Land*

This includes a wide range of forms, from the majestic heights of Mount Rainier and the Olympic Mountains to the fertile Skagit Valley lowlands. The San Juan Islands and the islands of southern Puget Sound serve as introductions to the rocky headlands of Cape Flattery and the expansive, sandy beaches of Gray's Harbor and Long Beach.

- *Water*

Northwest waters begin with the snows that feed the Nisqually glacier and the rains which fill the North Fork Skykomish River. They descend in mountain streams to form rivers in lowland valleys, feeding the rich Nisqually delta and the depths of Lake Washington, before reaching Puget Sound and the Pacific Ocean.



- *Plants*

The alpine wildflowers of Hurricane Ridge lie in contrast to the immense Western red cedars of the Hoh Rain Forest, whose stream-born silts feed the kelp forests of Desolation Island off Cape Flattery. Inland, Mount Vernon's tulip fields bring flashes of intense color to the deep evergreens of the lowlands.

- *Wildlife*

Mountain goat and pika live in the mountains, while cougar, black bear, blacktail deer, and bald eagles inhabit the forest. Schools of salmon, pods of orca, and sea lions ply our waters.

Elements of the Cultural Environment

- **Northwest faces**
The Puget Sound's first inhabitants—the Coast Salish tribes—now share this temperate region with descendants of Swedish loggers, Norwegian fishermen, Chinese, Japanese and African American immigrants, and more recent immigrants from Southeast Asia. As Seattle's reputation as a special and livable place spreads, the next century will bring more newcomers with different customs, ideas, and talents.
- **Arts**
Mark Toby, Morris Graves, Jacob Lawrence and George Tsutakawa brought early national attention to Northwest art. In the 1970s and 1980s Dale Chihuly and the Pilchuck Glass School, and author Tom Robbins made their mark. The Seattle Opera and several dozen live theater companies join Nirvana and other pop bands to create the popularity of Seattle music.
- **Trade and technology**
With its vast natural resources, this region supports companies such as Weyerhaeuser and Burlington Northern Santa Fe Railroad, as well as Alaska fishing fleets and shipbuilders. More recently, by changing the way people travel and communicate, Boeing and Microsoft have become household words. Our
- location in the Pacific Rim makes this region a key port for container ships and airplanes delivering and receiving products from Asia and other parts of the world.
- **Landmarks**
The rugged, complex landscape has produced many unique landmarks. Perhaps the two most famous symbols, the Space Needle and the Washington State Ferries are instantly recognizable. Others include City Light dams along the upper Skagit River, floating bridges across Hood Canal and Lake Washington, and the Hiram Chittenden Locks in Ballard. Mount Rainier hosts Paradise Lodge, and the quirky Pike Place Market attracts people from all over the world.
- **Recreation**
Hiking, skiing, climbing Mount Rainier, bicycling the Burke Gilman trail, sea kayaking, and sailing on Lake Union all offer strong, enduring images of regional lifestyle.
- These examples of the Northwest's natural and cultural environment provide a rich set of images that can be expressed in many ways through the design of the airport. Some expressions may be literal and obvious, while others are subtle and referential.

3.0 BUILDING A DESIGN VOCABULARY

3.1 FOREST ARCHITECTURE

This section suggests images that could be used by future designers of the airport to help translate the principal theme of the *Northwest Evergreen Forest*.

The physical structure of the *Northwest Evergreen Forest* includes dimensions and attributes that can create an evocative airport environment—a place that vividly projects the Pacific Northwest (Exhibit 4).

The primary characteristics of the indigenous forest include:

Immense vertical scale

The daunting heights of old growth forests engender awe and respect in all who see them.

Richly textured floor

From nurse logs to devil's club, and the white glimmer of trilliums, the deep woody patterns and primeval feeling of the forest floor leave an indelible impression.



Glimpses and vistas

The contrast of forests and clearings—along with the dramatic topography of hills, mountains, lakes, and sea—combine to create classic Northwest views.

Drizzle and mist

The region's weather does not go unnoticed. Countless shades of gray and endless variations of rain often veil the region, punctuated with periods of crisp, clear blue sky that bring over a month of summer sunshine.

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FOREST ARCHITECTURE

Immense Vertical Scale



Drizzle
and
Mist

SEA-TAC INTERNATIONAL AIRPORT
"THE NORTHWEST EVERGREEN FOREST"



Glimpses and Vistas



Richly Textured Floor



3.2 EMOTIONAL CHOREOGRAPHY

One way to organize an airport thematically is by acknowledging the traveler's state of mind, and ability to absorb information during the stressful processes of arrival and departure.

Travelers often approach a trip with a blend of excitement, concern, and anxiety. The design of an airport can actually make the experience of a traveler smooth, predictable and supportive.

A traveler experiences a sequence of emotional states while moving through the airport: anticipation, decision, arrival and relaxation. Each of these states suggests a different location, form, and intensity of thematic emphasis (Exhibits 5 and 6).

Anticipation

This emotional state occurs when traveling to the airport. The traveler is preoccupied with searching for clues about the approaching destination and contemplating the next major decision point. The long stretches of highway leading to the airport are suitable locations for presenting scenery, art, or large scale interpretive elements that frame views and offer mild distraction, but do not demand attention.

Decision

This emotional state occurs at points that require attention in order to determine the next direction or course of action. Examples are finding a route through the garage, searching for an airline ticket counter, and approaching security. Thematic presentation can assist decisions by making choices and pathways memorable. Thematic communication, however, must not confuse or obstruct the decision-making process.

Arrival

Turning from the freeway onto the airport entry road, crossing the sky bridges to enter the main terminal, or emerging from a jetway for a first glimpse of the real Northwest, are places that should include a celebration of having arrived. Here is an opportunity to apply major statements which present our principal and supporting themes, and leave a lasting impression on the traveler.

Relaxation

Much of one's time in an airport is spent waiting—in lines and in seats. The traveler's attention turns to resting, reading, thinking, or conversing to fill the time. Thematic presentations in areas of the airport where travelers congregate and wait can help make this period of time memorable. Often the amount of time involved in waiting allows for shopping, which also presents entrepreneurial opportunities for the airport and its tenants.

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for

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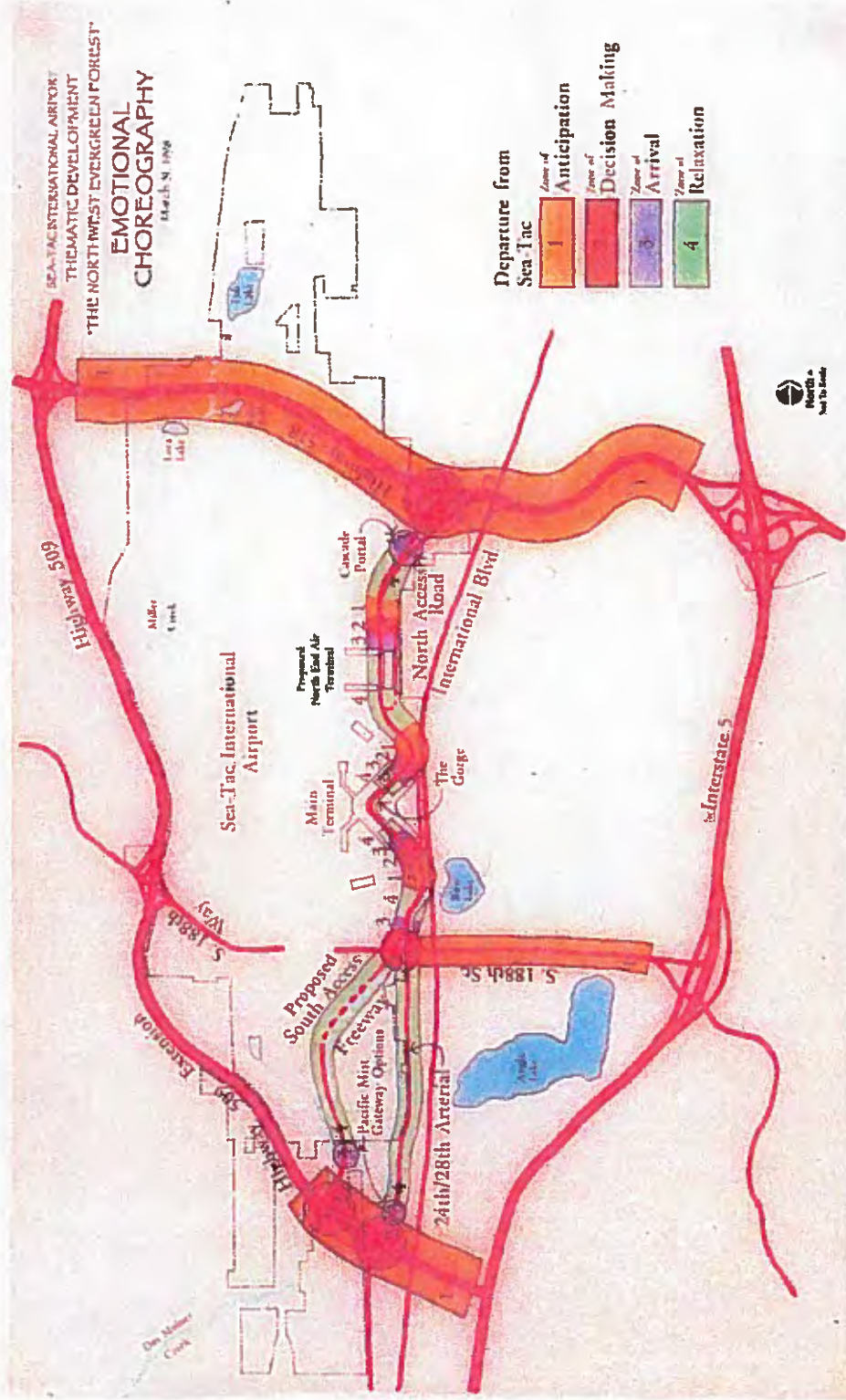


Exhibit 5: Site emotional choreography

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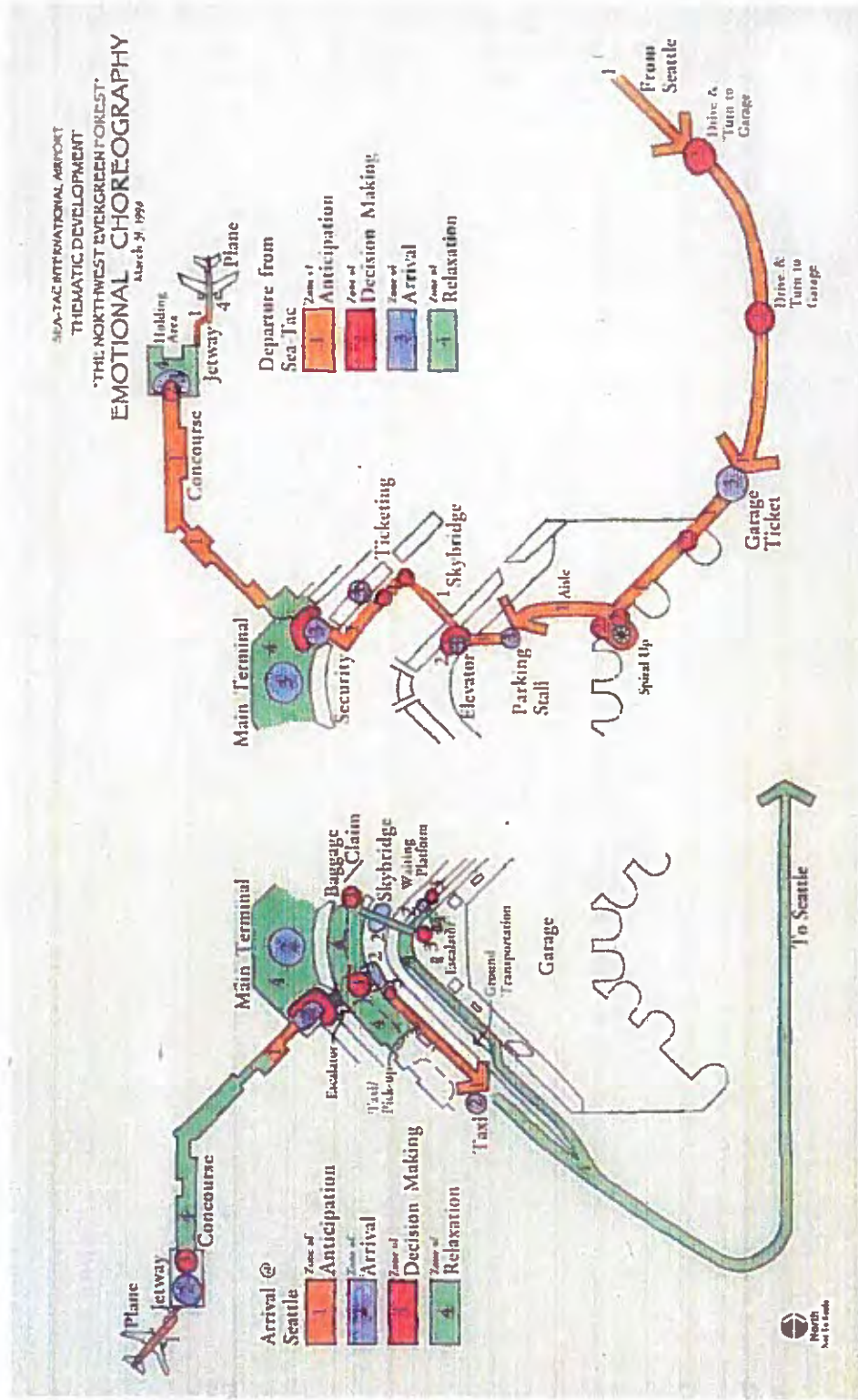


Exhibit 6: Main terminal and parking garage emotional choreography

3.3 VOCABULARY OF SPACES

This section uses a simple vocabulary of spaces and their treatment as tools to implement the principal and supporting themes at Seattle-Tacoma International Airport.

The team applied these tools to specific places in the airport, determined by analyzing the emotional choreography described in the preceding section.

Exhibits 7, 8 and 9, illustrate how this vocabulary was applied to the three archetypal landscapes (mountains and foothills, forests and clearings, sound and ocean).

Unifying element

A continuous application of consistently designed elements that helps unify the overall sense of the place.

Examples

- Specially designed lighting, flooring and seating.
- Visually prominent structural system.
- Distinctive color of glass.

Gateway and portal

A sensory experience using visual, aural, or other elements to heighten the visitor's awareness of important transition points and entryways.

Examples

- Entering the main terminal from the sky bridges.
- Entering the main terminal from the concourses.
- Moving from the Satellite Transit System(STS) lobbies to the STS tunnels.
- Passing under the 160th Street overpass heading to the airport.

Focal point

A concentrated use of highly dramatic art, architecture, landscape architecture, and/or engineering to create an interior or exterior landmark. It may frame a view, draw special attention to a particular location, or create an identifiable juncture. It may also be a similar feature interpreted in different ways throughout the facility to help orient visitors.

Examples

- Sculpture placed at a main hub of a concourse.
- Floor medallions at escalator landings.
- Designs on and around the elevators.

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A SIMPLE VOCABULARY OF SPACES

PORTALS & GATEWAYS

These are spaces that are defined by a series of vertical elements that create a sense of enclosure and direction. They are often used to mark the entrance to a new space or to create a sense of transition between two spaces.

UNIFYING TREATMENTS

These are spaces that are defined by a series of horizontal elements that create a sense of enclosure and direction. They are often used to mark the entrance to a new space or to create a sense of transition between two spaces.

FOCAL POINTS

These are spaces that are defined by a series of vertical elements that create a sense of enclosure and direction. They are often used to mark the entrance to a new space or to create a sense of transition between two spaces.

Unifying Treatment

Project: International Airport Gateway, CO

Portals & Gateways

Project: International Airport Gateway, CO

Focal Point

Project: International Airport Gateway, CO

Exhibit 7: Vocabulary of spaces, mountains and foothills

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A SIMPLE VOCABULARY OF SPACES

PORTALS & GATEWAYS

UNIFYING TREATMENT

PORTALS & GATEWAYS

UNIFYING TREATMENT

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PORTALS & GATEWAYS

UNIFYING TREATMENT

Exhibit 8: Vocabulary of spaces, forests and clearings

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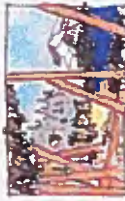
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A SIMPLE VOCABULARY OF SPACES

PORTALS & GATEWAYS
Portals and gateways are the primary means of defining and organizing space. They are the visual and physical transitions between different areas of the airport. They should be designed to be clear, simple, and easy to understand.

FOCAL POINTS
Focal points are the visual anchors of the airport. They are the places where people naturally look and where they feel a sense of direction. They should be designed to be prominent, memorable, and easy to find.

UNIFYING TREATMENT
Unifying treatment is the visual and physical consistency that ties the airport together. It is the common language that makes the airport feel like a single, cohesive whole. It should be designed to be simple, clear, and easy to understand.



SEATTLE-TACOMA INTERNATIONAL AIRPORT
THEMATIC DEVELOPMENT
"THE NORTHWEST EVERGREEN FOREST"
SOUND & OCEAN



Unifying Treatment



Seattle Airport
Terminal



Seattle
Airport
Terminal



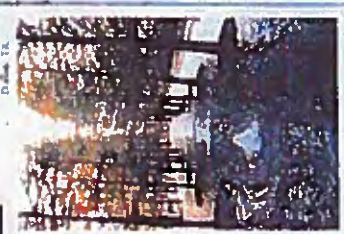
Seattle
Airport
Terminal



Portals & Gateways



Seattle
Airport
Terminal



Seattle
Airport
Terminal



Focal Point



Seattle
Airport
Terminal



Seattle
Airport
Terminal



Seattle
Airport
Terminal



Exhibit 9: Vocabulary of spaces, sound and ocean

PART 2: A CONCEPTUAL PLAN

4.0 APPLYING THE THEMES

4.1 USING THE DESIGN VOCABULARY

The purpose of this section is to guide design professionals through the process of applying the principal theme and supporting themes, using the vocabulary of spaces discussed in the previous section. This conceptual plan helps create a context for future engineering, architecture, landscape architecture, graphic design, art, and lighting projects at Seattle-Tacoma International Airport.

The photographic images, plans, sketches, and narrative text in this section illustrate one interpretation of how the thematic approach could work to improve the airport. This conceptual plan communicates the principal theme and supporting themes, while leaving room for exploration by future design teams.

Along with design exploration, future teams must also address maintainability, sustainability, and operational constraint issues through life cycle cost analyses, conservation, maintenance guidelines, development of an arts infrastructure, and an understanding of FAA and Port of Seattle safety concerns. This includes an understanding of how planting types and water features may attract wildlife or create vertical intrusions into runway areas and impact airline/passenger safety.

4.2 OVERALL SITE CONCEPTS

A number of concepts have been developed that illustrate how the airport could be developed to reflect the theme of the *Northwest Evergreen Forest*. These concepts use the metaphor of clearings within the forest. For example, runways and urban/industrial areas may be seen as a series of clearings framed by the forest, with access roads seen as connecting corridors.

The four major sectors of the airport correspond to five different types of Northwest forests (Exhibit 10):

- A **dry Puget Sound upland forest** is suggested along the north access roads.
- For the south access, a **coastal forest** is suggested in low-lying areas, and a **southern Puget Sound pine/oak forest** in the drier upland portions.
- Along the west side, a **riparian forest** alongside Miller Creek is suggested, as is a **dry Puget Sound upland forest** over the upper slopes.
- The east side could reflect notions of the **urban forest**.

Each of these plant and location associations is described in more detail throughout this section and in Appendix B. The concepts suggested can be applied from the outside to the inside, and from the surrounding community context to the interior of the terminal.

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Seattle - Tacoma International Airport
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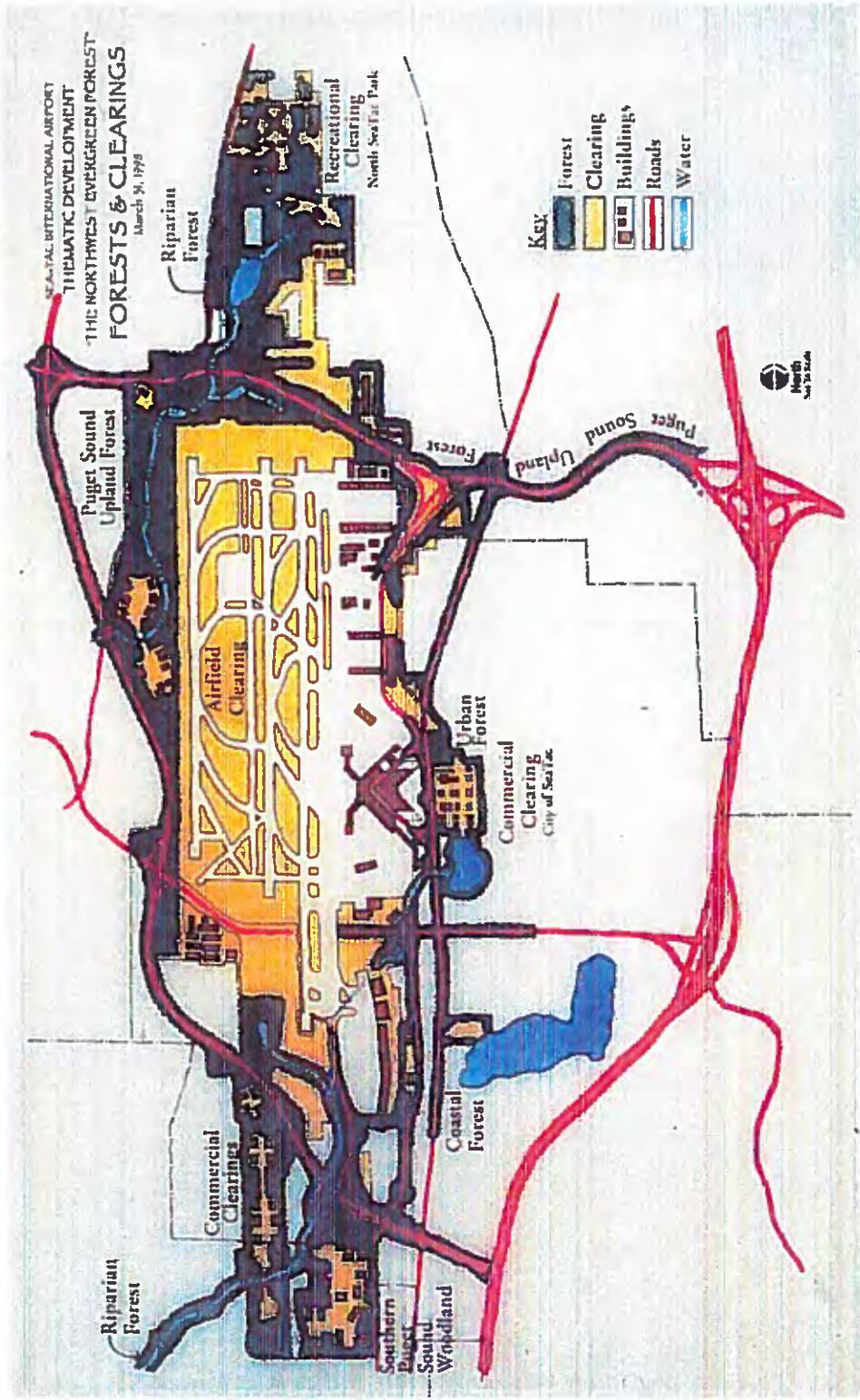


Exhibit 10: Site concept

5.0 APPLYING THEMES TO THE SITE

5.1 North Side : SR 518 Corridor

Overall thematic emphasis

The SR 518 corridor to the airport and along its edges (Exhibit 11) represent aspects of the Puget Sound upland forest and the riparian forest.

Unifying elements

The SR 518 corridor, from SR 509 on the west to Interstate 5 on the east, could be planted with a multi-level evergreen Puget Sound upland forest along its margins and within its center median. This would set the principal theme of the *Northwest Evergreen Forest* for arriving passengers from the moment they begin their final approach to the airport. Coordination with the State would be a critical factor in developing the Northwest Evergreen Forest concept along the State highway.

Miller Creek, which crosses this area and collects drainage, could serve as a unifying element if planted with a riparian forest of native red alder, in contrast to the surrounding upland forest of western red cedar, Douglas-fir, hemlock and understory. Refer to the Landscape Design Standards for a list of approved plants to be used throughout these areas.

Gateway

Playful applications of art could focus around or enhance the superscaled steel structures holding guideway lights for

the runway approaches (existing and future) to form a gateway entrance to the airport. Any proposed work on, around or near these structures would need approval from FAA, airport operations and other regulatory agencies.

Focal point

The eastbound downhill approach toward the guideway structure, and the roadway's subtle turn to the south, points the traveler to the dramatic view of rapidly descending aircraft on their final approach to the airport. This focal point could be enhanced by unified plantings along the corridor that eliminate other visual distractions.

Other features

Travelers could be given clues of prevailing wind direction, with an interpretative display at the terminal to explain the relationship between our dominant north and south winds, and their influence on directions of arriving and departing aircraft passing overhead.

Consider screening the upper and lower retaining walls supporting the proposed relocation of South 154th Street with evergreen plantings of incense cedar and varieties of western red cedar at the base of the walls. See Appendix B for suggested plant species, height, and planting compositions.

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for
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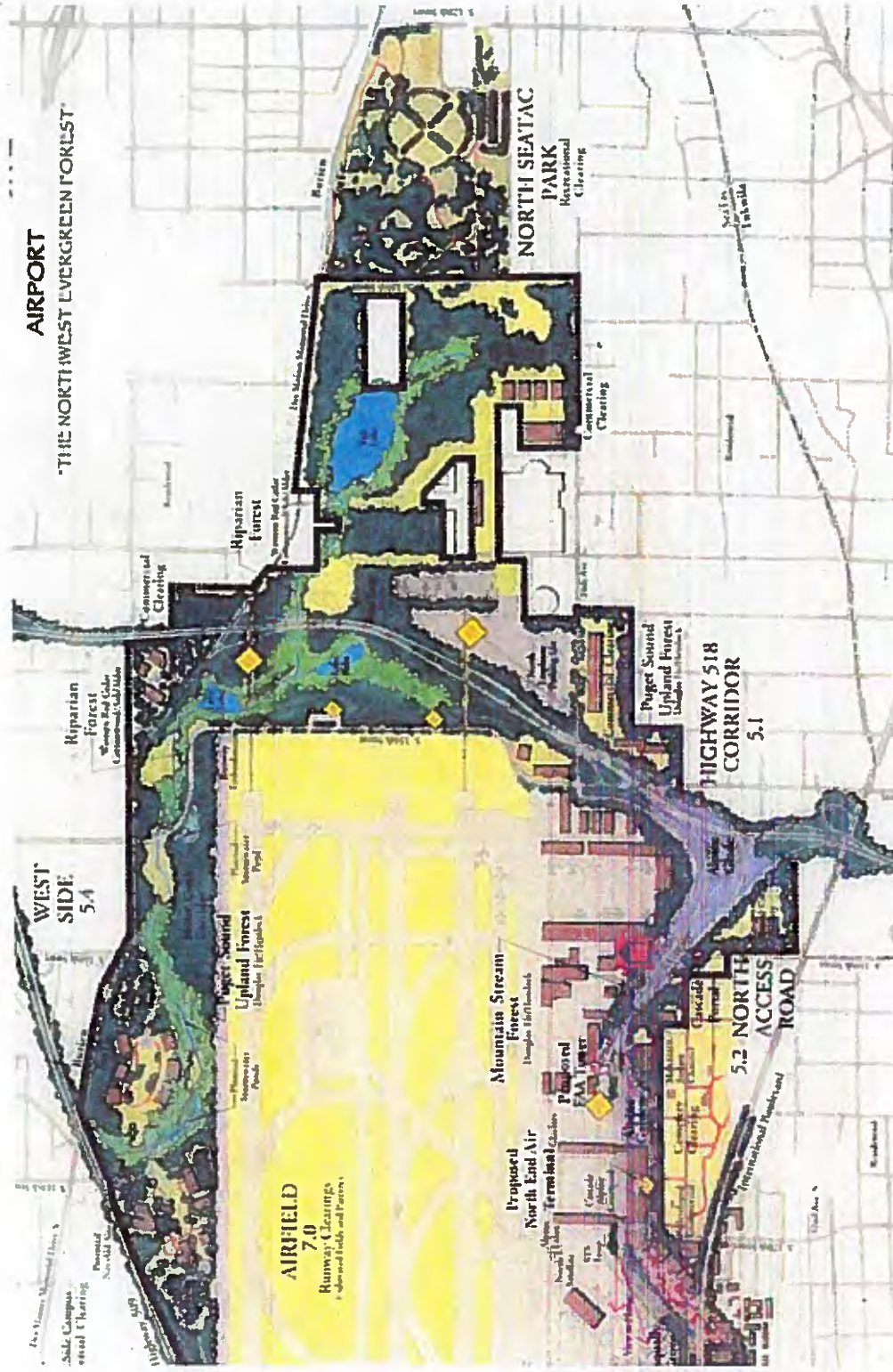


Exhibit 11: SR 518 conceptual site plan

LANDSCAPE DESIGN GUIDELINES: Vision, Themes and Images

for
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February 23, 2000

Unified planting
of Puget Sound
upland evergreen
forest along
SR margins

NORTH ENTRY/ SR 518

SEA-TAC INTERNATIONAL AIRPORT
"THE NORTHWEST EVERGREEN FOREST"



Existing view
eastbound
on SR 518



evergreen
cedar planting
forms lush walls
along the
riparian corridor

5.2 North Side : North Access Road

Unifying element

The North Access Road corridor could be unified by continuing along its margins the same evergreen Puget Sound upland forest planting used on SR 518 (Exhibit 13). This would screen out undesirable views of parking and loading docks, and provide occasional glimpses of planes, the Air Traffic Control Tower and proposed North Terminal.

As part of the conceptual plan's sustainability goal for the airport, the utilization and reuse of roadway stormwater runoff is recommended along the North Access Road. Cleaning oil and debris associated with reuse of stormwater will need to be considered early in the design phase to meet all regulations and requirements associated with development at the Port. The mountains to foothills theme suggests the development of a natural-looking mountain stream channel in the center median. The channel could be filled with rounded glacial stream cobbles and boulders, suggesting a connection to Mount Rainier and Olympic Mountain views. Adequate sight distance and setbacks from the freeway will need to be considered, per all relevant regulations, codes and standards at the Port.

Standing open water should be avoided, and special design consideration should be given to reduce the potential for wildlife attractants associated with any water feature at the airport.

Gateway

The 160th Street overpass offers an opportunity to create a dramatic Cascade Portal. This could be a misty, sculptural waterfall embracing the overpass structure and framing the roadway. The sight and sound of water cascading over large water-polished boulders, with a foreground of alpine understory vegetation and flanking multi-level evergreen trees, could present a powerful entry to the airport. Alternatively, the portal could also be a sculptural arrangement of rock, reminiscent of a talas slope high in the Cascades (Exhibit 14). Multi-level evergreen plantings are preferred, as are those which do not produce fruits or berries that might attract wildlife.

Focal points

The proposed Air Traffic Control Tower, on axis with a segment of the roadway, will offer a dramatic vertical expression. This is an opportunity to employ bold architectural elements to reinforce its visual impact. Large sculptural shapes, highlighted with color and accent lighting, could transform this otherwise standard form into a unique landmark that reinforces an airport arrival.

Another dramatic focal point is the view of Mount Rainier seen along the approach road between the proposed North Terminal and the existing terminal complex. This view could be enhanced by developing a major linear open space, oriented to the southwest toward the mountain and the city of SeaTac. Airport-related buildings could flank the east side of the space, while the west side could offer views to parked aircraft at Concourse D and the North Satellite.

Other features

Consider creating special, large-scale landscape features in front of the main terminal and proposed North Terminal.

An alpine meadow of low flowering shrubs and

groundcovers could be placed in front of the new terminal.

A Nisqually Grove of multi-level evergreen trees could be placed where the north access road turns toward the existing terminal.

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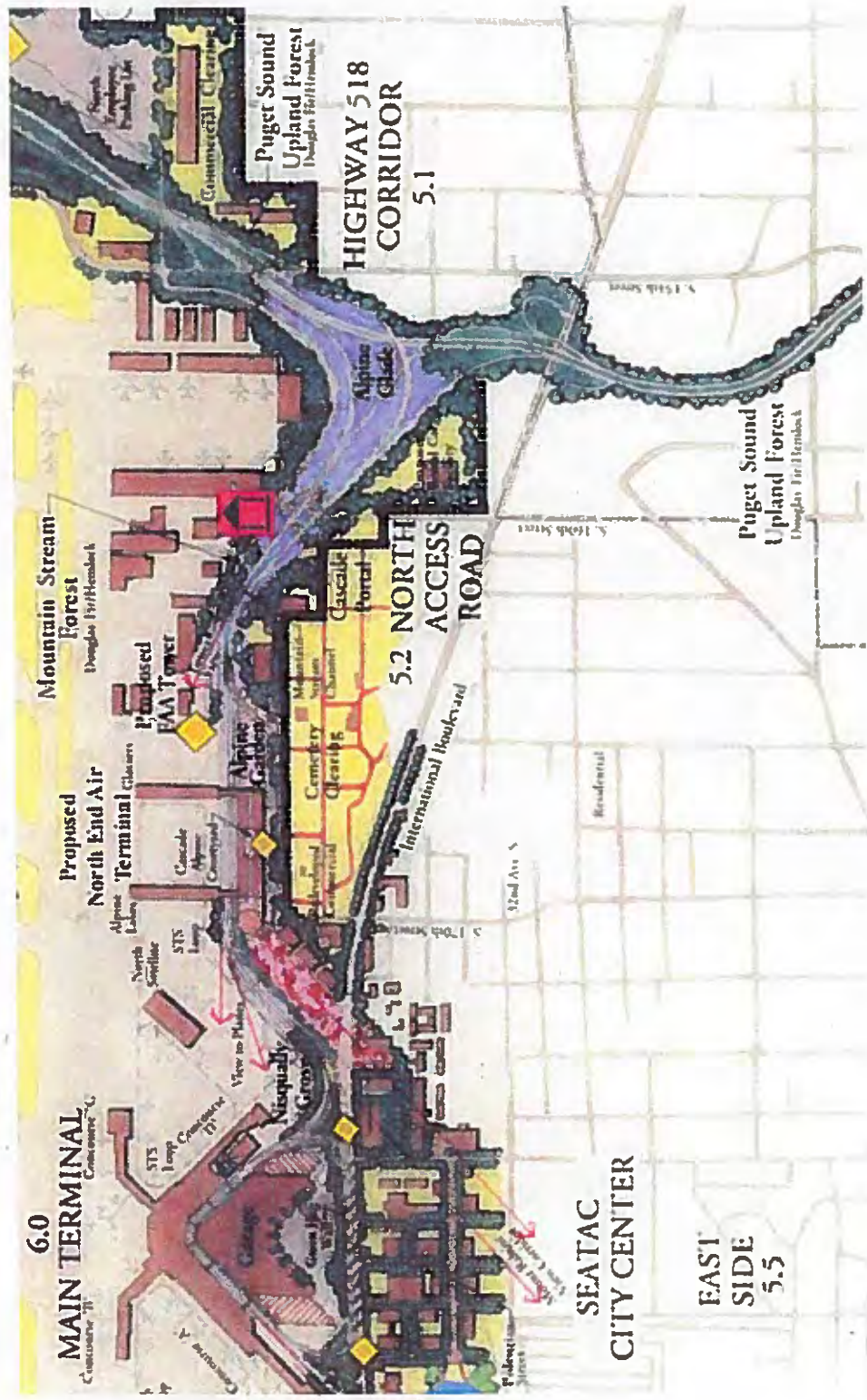


Exhibit 13: North Access Road conceptual plan

LANDSCAPE DESIGN GUIDELINES: Vision, Themes and Images

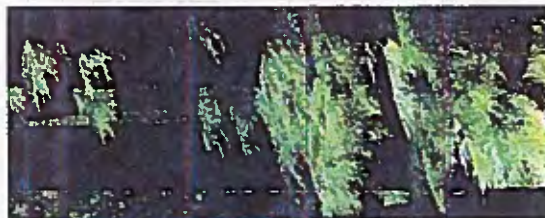
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CASCADE PORTAL

Evergreen forest walls frame mountain streams
tumbling down moss clad rock and stream bed



SEA-TAC INTERNATIONAL AIRPORT
"THE NORTHWEST EVERGREEN FOREST"



Exuberant masses of
wildflowers enliven
highway roadsides



Existing view Westbound
on North Access Road



Exhibit 14: Cascade Portal images

5.3 South Side

Overall thematic emphasis

The coastal forest is proposed as an organizing structure for the south side of the airport (Exhibit 15).

Unifying elements

The expanse of land to the west of the South 188th Street tunnel could be converted into a rhododendron valley and planted with a variety of seasonally colorful plantings that would visually tie the area together.

The potential borrow and industrial areas to the south could be unified by integrating open spaces with plantings of Western red cedars and understory that reinforce the coastal forest image. To assure the site's attractiveness for future commercial development, creative grading plans could be prepared for the borrow area prior to excavation. Grading plans could even incorporate large scale art in the form of unusual earthworks and earth sculpture.

Gateways

At the new south entry to the airport there could be a Pacific-Mists-Gateway (Exhibit 16). This could involve some active form of water, possibly with the effect of a mist or light spray, or localized fog. Special considerations for detracting wildlife will need to be considered, such as

avoiding open or standing water and the use of chemicals to deter wildlife from water features. Refer to the Landscape Design Standards for more specific requirements regarding water features at the airport. Two locations can be recommended for the Mists Gateway, both north of the proposed SR 509 extension. The first is astride the proposed south access freeway. If this new entry is not built, the second option could be developed astride the South 24th/28th Street arterial.

Another gateway is the South 188th Street tunnel under the runway. The tunnel could be lined with lights or a sculptural element that might provide an engaging and unexpected experience for people in vehicles. The entrance at the west end could be designed as a portal to the city of SeaTac and the east end to Puget Sound. Long-term maintenance and vehicle/driver safety should also be considered in designing this gateway.

Until either the SR 509 extension or south access freeway is built, an interim southern gateway feature could be developed at the intersection of South 188th Street and 28th Avenue. An Olympic Grove of multi-level cedar trees might be appropriate here.

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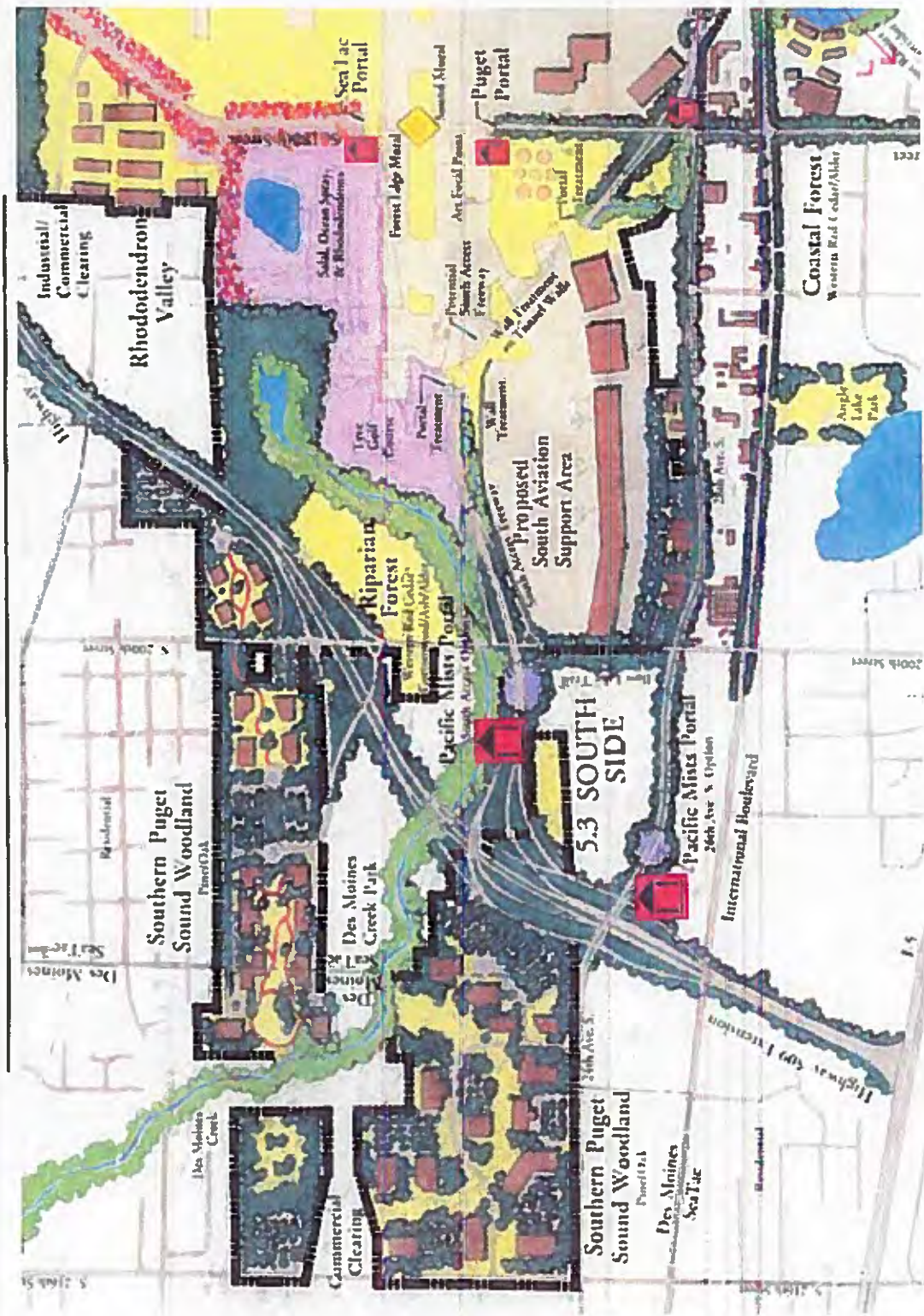


Exhibit 15: South Access Road conceptual site plan

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PACIFIC MIST GATEWAY

SEA-TAC INTERNATIONAL AIRPORT
"THE NORTHWEST EVERGREEN FOREST"

An "Olympic Grove" of cedar trees



Water
... mist
... light spray
... localized fog



Existing view
North on 24th
Ave. S.



5.4 West Side

Overall thematic emphasis

This sector could embody aspects of a riparian forest adjacent to a stream along the Miller Creek corridor and the Puget Sound upland forest on its upper slopes (Exhibit 17).

Unifying Elements

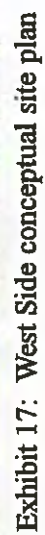
Planting could enhance the embankment of the fill area for the third runway. Although there are side slope restrictions in compliance with FAA standards, as well as other regulatory requirements, the descending hillside could allow for the introduction of successive tiers of multi-level trees. Evergreens along the upper levels would screen views of aircraft from the west. This evergreen forest would provide a familiar green foreground to the view of the Olympic Mountains from the terminal and concourses. A riparian forest environment could be established at the base of the slope.

Close coordination with adjacent cities, FAA restrictions and potential wildlife attractants will be essential to the future development of the embankment and Miller Creek areas.

Other features

Careful site planning and planting design would ensure that any commercial development expresses the character of clearings within the overall forest setting—and a strong spatial and visual connection to the Miller Creek corridor (Exhibit 18). New structures should include plantings around them to create the impression of small clearings within the forest.

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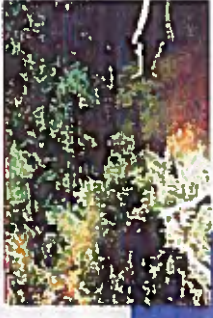
for
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February 23, 2000

WEST SIDE

... a riparian forest of
native red alder



... buildings and spaces set in clearings
within the overall
forest setting



SEA-TAC INTERNATIONAL AIRPORT
"THE NORTHWEST EVERGREEN FOREST"



the descending hillside would allow for
the introduction of
successive tiers of trees



Existing Miller Creek corridor

Exhibit 18: West Side images

5.5 East Side

Overall thematic emphasis

In the International Boulevard corridor, with its predominance of signs and parking, the idea of an urban forest could be promoted by both the airport and the city of SeaTac (Exhibit 19).

The city of SeaTac's recent improvements to International Boulevard—including plantings, sidewalks, and bus stops—begin to set the stage for the urban forest treatments recommended in this airport access area.

Unifying elements

An extension of the airport's *Northwest Evergreen Forest* plantings into the adjacent city center of SeaTac would blur the distinction between the city and the airport and help provide a more unifying element between them.

Gateways

Bridge structures could incorporate artists' designs and substantial vegetation (Exhibit 20). The RTA station(s) and pedestrian overpasses could serve as dramatic gateways, framing the city center core and symbolizing the transportation connections.

Focal points

The large scale of the parking structure at the airport could be softened by the introduction of major scale plantings. This would create the effect of a hanging garden behind a slice of evergreen forest, located between the ticket booth structure and the north access road ramps.

The narrow strip of land between the access roadway and International Boulevard could contain a long, lushly planted green wall, composed of vines growing over a trellis armature. A new wall of uniform height might screen speeding cars and trucks from the view of pedestrians along International Boulevard and workers within the office buildings to the east. The wall could also support a series of super-sized international flags as a bold symbol of the airport and the boulevard.

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for
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Exhibit 19: East Side conceptual site plan

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February 23, 2000

EAST SIDE

SEA-TAC INTERNATIONAL AIRPORT
"THE NORTHWEST EVERGREEN FOREST"



... a "hanging garden"
behind a slice of
evergreen forest

Existing Garage



super-sized international
flags that would be a
bold symbol



6.0 APPLYING THEMES TO THE TERMINAL

6.1 The Zone of Arrival and Departure:

Main Terminal/Parking Garage

Overall thematic emphasis

Various parts of the present terminal and parking garage could express aspects of the principal theme of the *Northwest Evergreen Forest*. Thematic elements could be introduced within the garage, the Gorge between the garage and the terminal, and the ticket lobby and baggage claim areas (Exhibits 21 and 22). Concepts and ideas presented here would need to be coordinated with the overall Airport Design Guidelines prior to any further development to ensure a consistent, coherent design both inside and outside the terminal structures.

With an intent similar to the five major vegetation associations described for the overall site concept, the Gorge could evoke vivid images of the dramatic Columbia River gorge, another Northwest landscape.

In addition, the multi-level terminal and garage structure is akin to the multi-level forest metaphor emphasized in this conceptual plan. The plan recommends a forest floor treatment for the ground plane and an understory treatment for the mid-level.

The plan also suggests using the three geographic components of the *Northwest Evergreen Forest* (mountains and foothills, forest and clearing, sound and ocean) as tools for guiding pedestrian circulation throughout the garage and terminal.

Unifying elements

The supporting themes of the Pacific Northwest's natural environment and cultural environment (geography, people, technology, commerce and the arts), could be expressed in aspects of gateways, portals, and focal points.

The existing terminal is an example of the international style of architecture. Characteristic of this style are smooth, precision-crafted industrial connections, materials, and surfaces. Compatible new additions and touches can infuse the existing spaces with new vitality, and still maintain the integrity of the international style.

The floor of the terminal building could incorporate patterns that reinforce the theme of the *Northwest Evergreen Forest*. It may also be possible to embellish portions of the ceiling and columns with features that reflect this theme.

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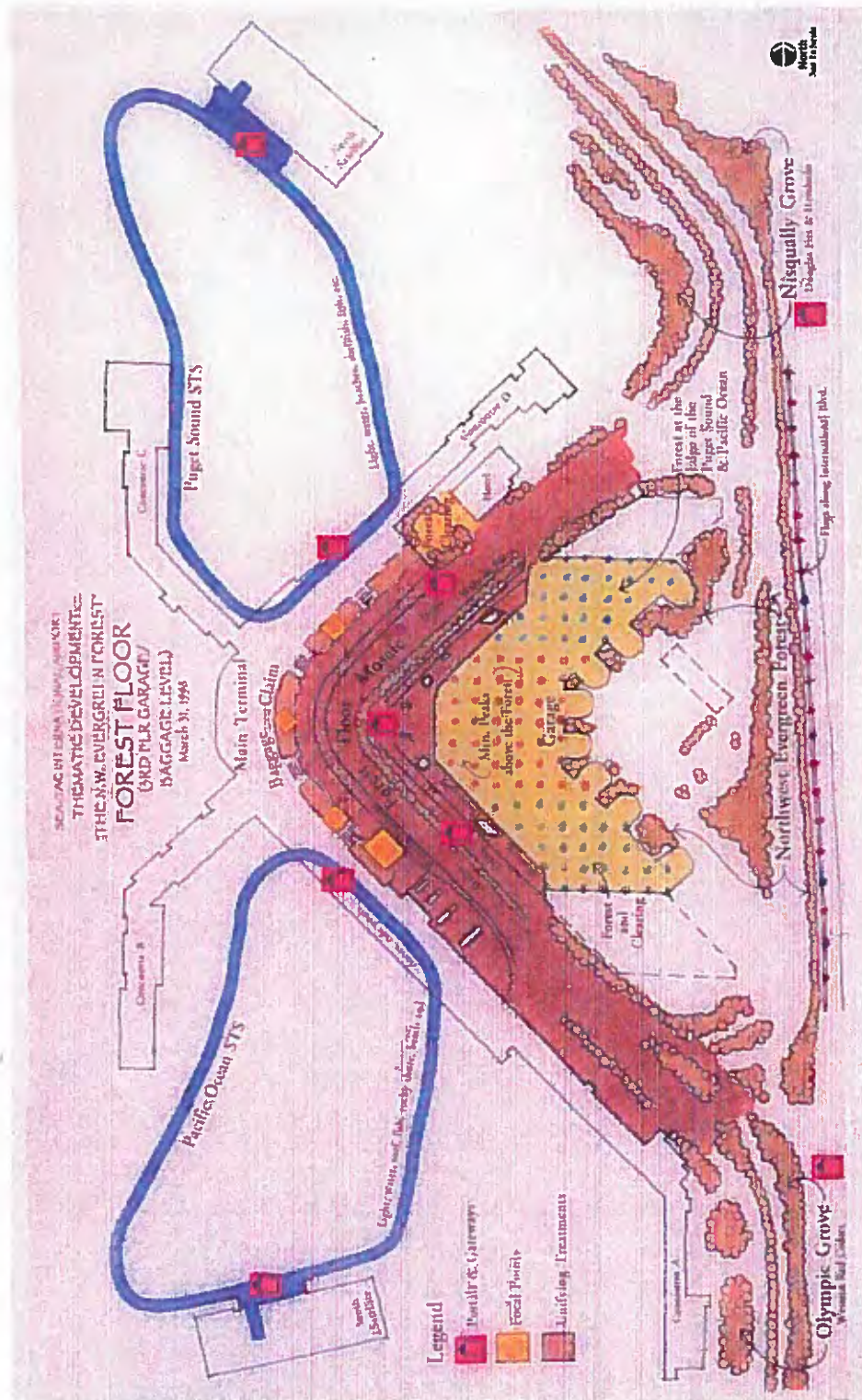


Exhibit 21: The Main Terminal/Garage plan forest floor level

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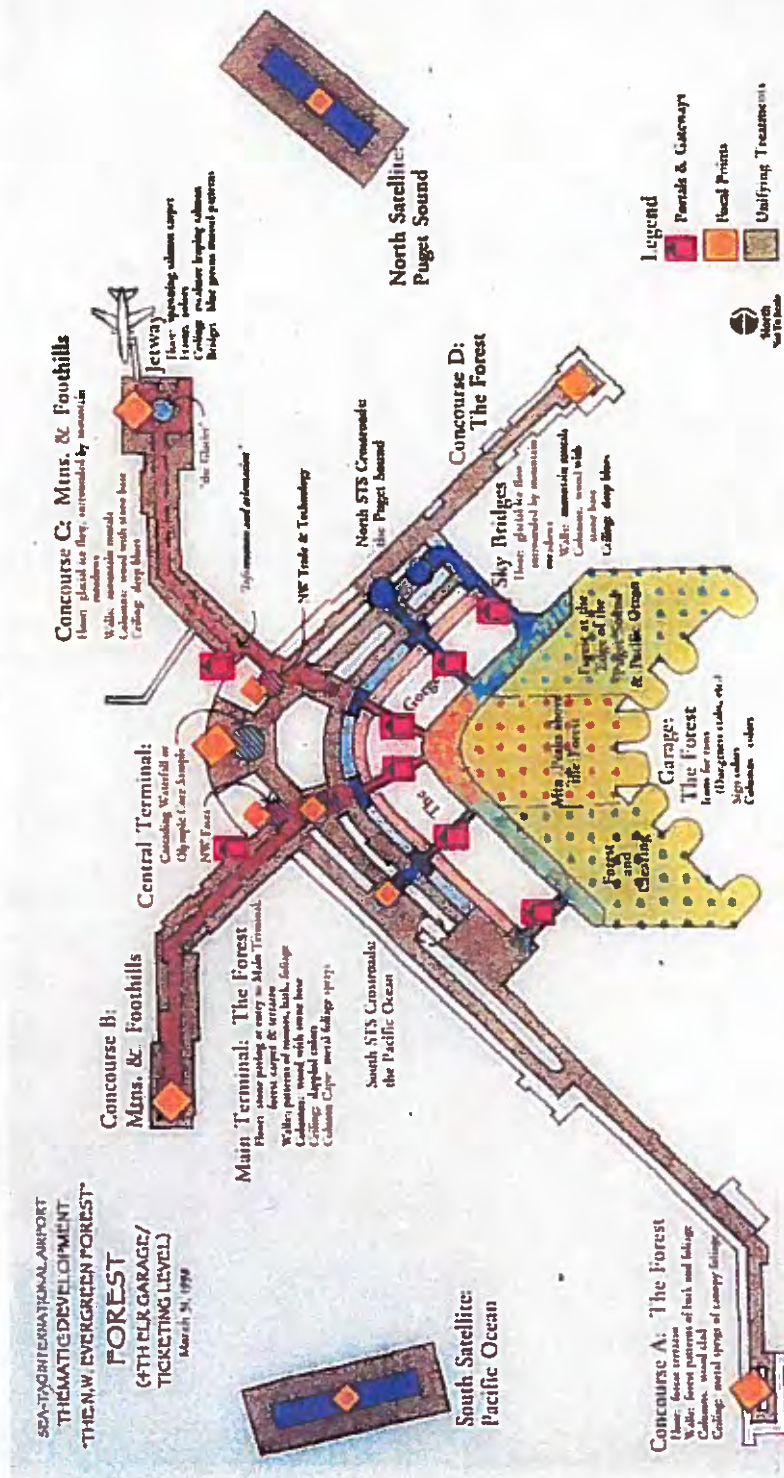


Exhibit 22: The Main Terminal/Garage plan mid-forest level

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While most visitors remember the garage floor on which they parked, it is easy to lose track of the stall location within the uniformity of the area. This can lead to tense and frenetic searches that diminish the excitement of returning home.

This conceptual plan suggests using the three components of the mountains to sound transect to orient travelers to the locations of elevators, aisles, and pedestrian overpasses. The southern third of the garage could express themes related to mountains and foothills, the central third forests and clearings, and the northern third sound and ocean.

In addition, the various levels of the garage—particularly the ceiling, walkways, and elevator cores—could be treated with lighting, colors, signs, and art that convey aspects of the principal theme and supporting themes.

The exterior platform and drives at the baggage claim level could be converted into a more welcoming environment with the addition of decorative paving, lighting, and furnishings scaled to pedestrians (Exhibit 23). Here are some examples of how that could be accomplished:

- The exterior paving and interior flooring could be integrated through development of a forest floor mosaic pattern combining unit pavers, terrazzo, or carpeting.

- The massive concrete columns that line the platform could be embellished with "butt rests" that allow pedestrians to lean as they wait to be picked up.
- The visual interest of people on foot could be enhanced by the introduction of pedestrian-scaled light fixtures. These might be designed to include whimsical elements reflecting Northwest symbols, such as jumping salmon.

Gateways

The pedestrian bridges from the garage to the terminal could be treated as gateways, both for pedestrians and for people in vehicles passing below them. The bridges could be repainted a lighter color, with plantings added along their upper edges, to create a large-scale arbor effect. Inside the bridges, thematic elements could add interest for those on foot. Because each of the six skybridges marks a route to or from the terminal, each skybridge could have an artistically-interpreted reference to the *Northwest Evergreen Forest*.

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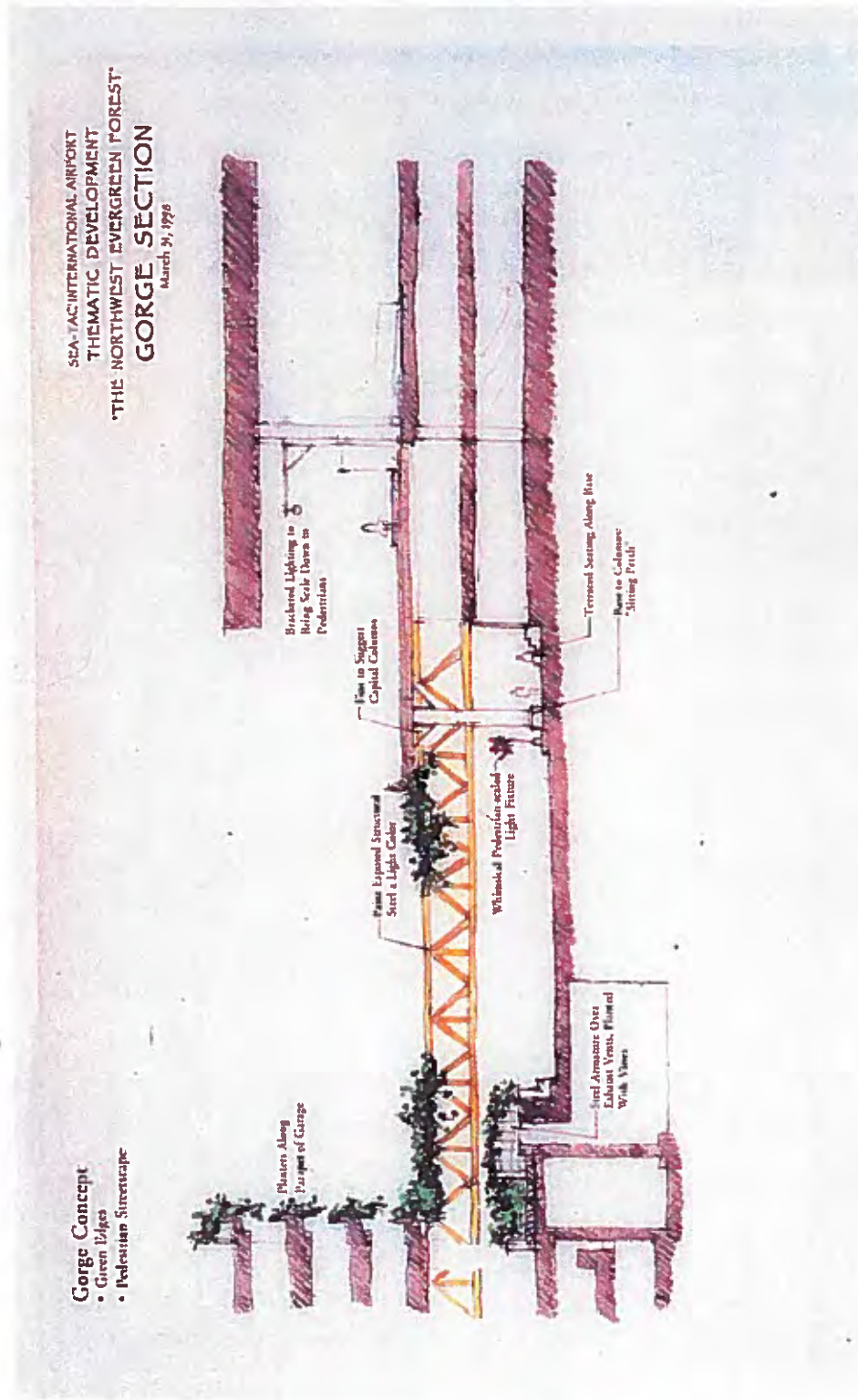


Exhibit 23: The Gorge conceptual cross section

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for
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February 23, 2000

Focal points

The west face of the garage could be planted with ferns, vines, and cascading shrubs at the openings between the curved precast spandrels, and at the top and base, to mask and soften the structure's bulk. Metal armatures—structures taking the form of three-dimensional grids—could be placed at the base of the garage to function as a vine covered trellis, thus concealing the concrete shapes of the ventilation shafts. This way, arriving passengers will encounter a dramatic curtain of green (Exhibit 24).

Both the baggage claim area and the shuttle bus platforms in the garage present opportunities to engage arriving visitors. Dramatic lighting, interpretive displays, artistically designed enclosure railings, and decorative floor treatments would amuse and inform people as they wait.

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for
Seattle - Tacoma International Airport
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Garage planted in dramatic curtain of green cascading shrubs and vines

THE GORGE



SEA-TAC INTERNATIONAL AIRPORT
"THE NORTHWEST EVERGREEN FOREST"

Northwest themes express people, technology, lifestyles, and the arts



Existing view of enplane and deplane drives

exterior platforms become 'welcoming' experience with pedestrian scale furnishings

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Other features

The roof of the garage could be embellished with super-scaled patterns, portraying an impressionistic view of the forest when seen from the air. The effect might be similar to how Boeing camouflaged the roof of its main plant during World War II.

The current ground transportation lot at the north end of the baggage claim level, between the terminal and the proposed hotel, could incorporate perimeter plantings that enclose this canyon-like space in a curtain of green. If an alternate location can be found for the waiting taxis, this space could be turned into a green, pedestrian-scaled courtyard for use by airport visitors and adjacent hotel guests.

6.2 Central Terminal

Overall thematic emphasis

The central terminal will be a place for people to linger and absorb unique forms of architecture, landscape architecture, and art. It is a place to fully immerse visitors in a variety of sensory experiences—integrated into every aspect of the building and its functions.

As the main town square of the airport, the central terminal is a great place to employ thematic treatments. The single most significant design element should be the principal theme of the *Northwest Evergreen Forest*.

Concepts and ideas for integrating the Northwest Evergreen Forest theme into the Central Terminal should be coordinated with the Airport Design Guidelines and Standards, as well, to ensure a consistent and coherent design approach throughout the airport environment.

Unifying elements

Treatments used throughout the central terminal should express the *Northwest Evergreen Forest*. Some examples include stone paving at the entry, with forest-patterned carpet and terrazzo for floors. Patterns of mosses, bark, and foliage used on the walls, with ceilings of dappled colors. Wood columns with stone bases and caps covered with metal foliage sprays would reinforce the forest environment.

Focal points

All of the concourses come together in the central terminal to form a focal point for travelers. This nexus creates the perfect opportunity to create a striking visual focal point that reinforces the *Northwest Evergreen Forest* theme and leaves a vivid impression on the visitor (Exhibit 25).

Two possible focal point treatments are suggested. One might be a huge core sample of the Olympic National Park rain forest, complete with living specimens of Douglas-fir, western red cedar, hanging gardens of moss, dripping water, and mist. The core could be a central courtyard, open to the outside, but separated from the terminal by glass and screened to discourage birds.

Due to climatic requirements, Northwest plants cannot be grown indoors. The core sample's exposure to outside conditions would provide a real element of the Northwest landscape, rather than an artificial replica, inside the terminal. With this approach, non-native tropical plants which grow well indoors can be avoided, since these do not support the principal theme developed for this airport.

A second focal point could be a cascading waterfall that extends the full height of the anticipated three-story space.

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Other features

A good location to incorporate the Cultural Environment supporting theme, using expressions of Northwest faces, and trade and technology, might be at the point where Concourses B and C enter the central terminal. Examples include interpretive exhibits related to local museums such as the Burke Museum, Museum of History and Industry, or Museum of Flight, or a commercially-based exhibit reflecting the region's computer software industry.

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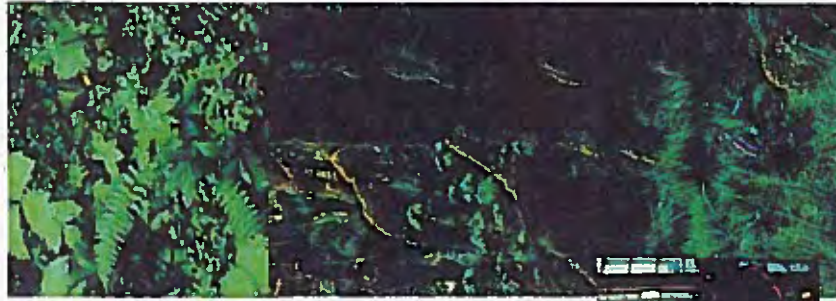


CENTRAL
TERMINAL



Existing Food
Court

terrazzo floors provide
creative opportunities
for unifying treatments



A Northwest 'zen' garden forms the
centerpiece in the Northwest Commons

SEA-TAC INTERNATIONAL AIRPORT
"THE NORTHWEST EVERGREEN FOREST"



pacific northwest
commerce and trade



intersections
and
passageways
are excellent
locations for
focal points

Exhibit 25: The Central Terminal images

6.3 Concourses, Satellites and Satellite Transit System (STS)

Overall thematic emphasis:

Each concourse and satellite could express the principal theme of the *Northwest Evergreen Forest*, and be assigned one of the components of the mountains to sound transect. This conceptual plan suggests the following associations:

- The forests and clearings theme could be applied to Concourses A and D, because of their visual relationship to the forest-covered foothills of the Cascade Mountains.
- The mountains and foothills theme could be applied to Concourses B and C, reflecting their orientation to the territorial views of the Olympic Mountains.
- The sound and ocean theme could be applied to the North and South Satellites and the STS.

Unifying elements

Flooring, lighting, and directional signs throughout the concourses could help orient travelers through these spaces. Applying the mountains and foothills theme to Concourses B and C, for example, might include references to glacial streams and plains in the floor patterns (Exhibit 26).

Gateways

Each jetway presents an opportunity to create a sense of gateway, where passengers pass through into the gates and holding areas. The outside of the jetways could be painted with thematic representations, or bold colors that may suggest the deep blues and greens found in the mountains to sound transect.

The new construction at Concourse A could express a powerful sense of gateway. This could be accomplished by incorporating spaces with high ceilings, generous natural light, and grandly proportioned architectural forms.

Focal points

Changes in the direction of concourses, or intersections of passageways, could provide places for focal points using art, interpretive displays, lighting, or a combination of elements.

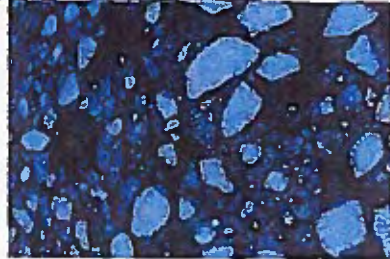
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CONCOURSE C



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"THE NORTHWEST EVERGREEN FOREST"



floor patterns and colors
might include references
to glacial streams



Large scale artworks
provide meeting places
and aid in wayfinding



Existing Terminus
Concourse C



Utilize references to
Puget Sound and
Pacific Ocean

6.4 Future North End Air Terminal

Overall Thematic Emphasis

Given that this will be a new terminal building complex including overpasses, parking structure, and access roads, there is an opportunity to fully engage the principal theme and supportive themes in all of the ways described in the preceding sections. Thematic expressions can be incorporated into the initial programming phase of design, and be refined through design development and contract documents. The project will afford numerous opportunities to integrate art with architecture and landscape architecture, as well as the use of signs, lighting, materials, and colors that embody the themes.

Unifying elements

Because of the strong visual connection to Mount Rainier and the Olympic Mountains, the overall design might reflect the mountains and foothills sub-theme. Interior treatments could echo the feel of a high alpine meadow. Examples include floor patterns reminiscent of glacial ice flow, surrounded by mountain meadows. Mountain murals could enhance the walls, with deep blue ceilings. Wood columns with stone bases help set the subalpine forest environment. Interior treatments should also reflect the Airport Design Guidelines and Standards.

Gateways

With Mount Rainier so dominant from the north, airport entry to this terminal could be enhanced by developing a major linear open space oriented to the southwest toward the mountain and the city of SeaTac. An alpine garden in front of the new terminal, with low flowering shrubs and groundcovers, would reinforce the mountains and foothills sub-theme.

A spine of greenery could connect the alpine garden at the north end with the outdoor view terrace at the south end. A central courtyard within the terminal could provide a focal point that expresses the character of the *Northwest Evergreen Forest*.

Focal point

This conceptual plan recommends that the terminal be designed with an orientation toward views of Mount Rainier and the Olympic Mountains (Exhibit 27), and the aircraft at the jetways. The new terminal design could incorporate interior courtyards, open to the sky, with exterior garden spaces related to these mountain views. The interior courtyards may also need to be screened to detract birds and other wildlife.

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for
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MT. RAINIER VISTA

...designed with an orientation to the
view of Mt. Rainier, the Olympic
Mountains and the aircraft at the jetways



SEA-TAC INTERNATIONAL AIRPORT
"THE NORTHWEST EVERGREEN FOREST"



...incorporate interior
courtyards and exterior
garden spaces

Exhibit 27: Mount Rainier vista images

7.0 APPLYING THEMES TO THE AIRFIELD

Overall thematic emphasis

The airfield is governed by a number of very restrictive design limitations, making the range of thematic applications more limited. However, because it is a vast open space, the airfield could reflect aspects of the forests and clearings sub-theme (Exhibit 28). Requirements for airfield control, safety and security will have to be considered, as well.

Unifying element

The groundcovers between the runways and taxiways could consist of plant material that do not support or attract birds, but still project broad patterns of color. Alternating bands of long, differently colored grasses could provide visual drama not usually associated with these expansive, flat surfaces. When selecting species of grasses, consider size and profusion of seeds, ability to withstand wind and erosion, and their attraction to wildlife.

Where travelers walk outside on the tarmac—from commuter planes to concourse stairways—the ground surface could be detailed with decorative paving to announce arrival, provide directions, and instill the *Northwest Evergreen Forest* theme. The paving pattern design could reflect the mountains and foothills sub-theme suggested for Concourses B and C, and incorporate references to glacial streams and the adjacent forest floor.

Gateways

Covered walkway structures connecting commuter plane travelers and concourses might be treated in the same manner as jetways, designed as gateways to the region. The metal support structures could be painted in deep forest greens to suggest the evergreen forest, or glacial blues to suggest the alpine glaciers of the Olympic Mountains.

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for
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Exhibit 28: Airfield conceptual site plan

LANDSCAPE DESIGN GUIDELINES **Vision, Themes, and Images**

for
• Seattle-Tacoma International Airport •

Appendices

Prepared for:
PORT OF SEATTLE
Aviation Division

Seattle, Washington

February 23, 2000

APPENDIX A:

GENERAL PLANTING DESIGN POLICIES AND GUIDELINES

General Design Policies

The *Northwest Evergreen Forest*, as the principal guiding theme of the conceptual plan for Seattle-Tacoma International Airport, is envisioned as the overall structure to the landscape surrounding the airport. In places, it will be the dominant landscape feature, composed almost entirely of native plant material. At the pedestrian scale or as an area of special emphasis, the forest will serve as a backdrop and frame for non-native plants that are selected for their ornamental value (i.e., color, foliage, form, and massing). The plan recommends that as planting designs are developed for each area, they should be reflective of the multi-layered structure of the forest. At the forest floor level, this begins with groundcovers and herbaceous plants; at eye level, it includes shrubs and small trees, and at the canopy level the towering trunks of evergreen trees are found.

General planting guidelines for specific development types included in this conceptual plan are as follows:

Parking lots

Whenever and wherever parking lots are proposed within the airport complex, the following design criteria should be

considered to integrate them within the *Northwest Evergreen Forest* theme:

- Provide perimeter and interior planting for screening and shade.
- Consider providing planting between rows of stalls to break up the expanse of paving where possible, particularly where visible from adjacent land uses or transportation corridors.
- Consider providing bio-filtration swales between rows of cars for removal of pollutants from storm water runoff, but do not allow standing water to form.
- Consider porous paving solutions (geogrid and other successors to grasscrete) as alternatives to asphaltic concrete and concrete paving.
- Select plants suitable for harsh environments, and draw on the expertise of community resource agencies, such as the University of Washington's Center for Urban Horticulture, in defining emerging species and varieties.
- Refer to the Landscape Design Standards for more detailed requirements regarding landscape development at Sea-Tac International Airport.

Commercial development

Where commercial development is proposed, it should be integrated within the *Northwest Evergreen Forest* theme. Recommendations include the following:

- Integrate regional open space with development.
- Provide usable exterior spaces adjacent to the buildings for use by airport staff.
- Provide planting along public streets and exterior property lines to integrate the development with adjacent land uses and the surrounding communities.
- Refer to the Landscape Design Standards for more detailed requirements for landscape development at Sea-Tac International Airport.

Operational (non-public) buildings

Where operational buildings, such as cargo hangers and maintenance facilities are proposed, their perimeters and edges should be integrated within the *Northwest Evergreen Forest* theme. This applies primarily along public streets and exterior property lines where planting can help integrate the facilities with adjacent land uses and the surrounding communities.

Wildlife Issues

Background and concerns

Wildlife collisions with aircraft

An important safety hazard created by native birds and other wildlife involves collision with aircraft. These occurrences are relatively rare, but their risk and frequency of occurrence has increased with the sharp increase in air traffic. Aircraft collisions with wildlife can be deadly, and are always costly. Research into this problem began in earnest in 1960 when a small plane collided with a flock of starlings and killed 62 people (Pearson 1967). Since then, a variety of methods to reduce wildlife and aircraft collisions have been proposed (Friederici 1997), and the Federal Aviation Administration (FAA) has issued an Advisory Circular (FAA 1997) for airport planning to reduce collision risks.

In accordance with FAA requirements and airport certification standards, the Port of Seattle has a *Wildlife Hazard Management Plan*, which consists of both long-term and short-term programs for controlling wildlife populations in the immediate vicinity of the airport. The primary goals of these programs are:

- Identifying potential wildlife attractants onsite.
- Altering or eliminating these features to reduce the risk of a wildlife and aircraft collision.

FAA policies discourage incompatible uses, including planting types, that could attract and exacerbate wildlife hazards in Runway Protection Zones (RPZs)—areas extending 1,000 feet beyond the runways. The policies also prohibit obstacles of any kind, including plantings, that extend upward into the Object Free Areas (OFAs), which extend 200 feet beyond the runway ends.

All species of wildlife can potentially pose a threat to aircraft safety. However, some species are more commonly involved in aircraft strikes than others are. According to the FAA Advisory Circular (FAA 1997) titled *Hazardous Wildlife Attractants On or Near Airports*, gulls, waterfowl, raptors, and deer have accounted for 67 percent of all damaging aircraft strikes nationwide from 1993 through 1995. The remaining 33 percent of damaging aircraft strikes involved (in descending order of frequency) doves, vultures, blackbirds and starlings, crows, wading birds, and canids (coyotes and domestic dogs).

At Seattle-Tacoma International Airport, approximately 20 bird strike incidents occur each year (Port of Seattle FSEIS 1997; Bulman Pers. Comm.), including strikes with starlings, gulls, waterfowl (geese, ducks, and shorebirds), and pigeons. Although not as common as the most common hazard species, raptors are also a concern.

Wildlife habitat at Seattle-Tacoma International Airport

The land surrounding the airport has been highly altered over the past 150 years by human activity. Most of the animal species that once lived in this area are greatly reduced in numbers, as their favored types of habitat have been converted to other land uses. Many wildlife species are also opportunistic; finding ways to survive in this highly urbanized landscape. Several species of native wildlife and some introduced species have adapted to and, indeed, have flourished in the habitats still found in the area.

The Seattle-Tacoma International Airport Master Plan Update EIS inventoried a total of 2,352 acres of terrestrial wildlife habitat, seven streams, and several water bodies in the 4-square-mile area encompassing the airport. Terrestrial habitat types include managed and unmanaged grassland (mowed and managed lawns, pastures, row crops, and unmowed fields), shrub and forest areas (deciduous and evergreen), and wetlands, along with several stormwater and wastewater detention ponds. Des Moines Creek, Miller Creek and Walker Creek are the largest streams near the airport. Each has large associated wetland areas.

If all of the facilities and improvements identified in the Airport Master Plan Update were implemented, approximately 700 acres of terrestrial habitat would be eliminated. The largest losses would be of open grassland and relatively uniform stands of deciduous forest. These landscape elements provide the most desirable habitats for the wildlife species of greatest concern at the airport. A

reduction of the extent of these habitat types would help reduce the potential for damaging aircraft strikes.

Controlling hazard wildlife by species

The wildlife species that present the greatest concern at Seattle-Tacoma International Airport include waterfowl, starlings, crows, gulls, and raptors.

Canada geese

Problem:

Large numbers of Canada geese have modified their migratory habits to reside year round in many areas of western Washington. Geese are especially attracted, as are gulls, to the mowed lawns and wetlands at the south end of the airport, which experience relatively little day to day human disturbance.

Solutions:

Extensions of the runway safety areas and construction of the South Aviation Support Area (SASA) project will reduce the amount of desirable habitat for this species, as will decreasing the open grassland in favor of more forested environment (see below). Currently, the Port of Seattle has an active program to relocate populations of Canada geese from the Tyee Valley Golf Course (Bulman, personal communication). Adults and young are transported to other habitats to discourage the numbers of resident birds.

Starlings and crows

Problem:

Starlings and crows are gregarious flocking birds attracted to dense, uniform, even-aged stands of trees. Large flocks of these birds can be observed swarming to desirable overnight roosting sites, literally covering the crowns of tall trees at dusk. Frequently used habitats in the vicinity of the airport include the deciduous forests in the North SeaTac Park area and in the Miller Creek wetlands south of South 154th Street; the deciduous forests west of the present airport in the third runway expansion area; and deciduous groves in and around the large wetland system adjacent to the Tyee Valley Golf Course and in the Des Moines Creek corridor.

Solutions:

Ongoing management of these wildlife populations at the airport includes selective thinning of dense tree stands to eliminate overlapping branches and uniform height canopy, and using sound deterrents. Crows in particular will disperse at the sound of frightening noise created by crackers (shotgun shells loaded with firecrackers instead of shot) (Bulman, personal communication).

In general, hazards from these animals can be reduced by minimizing the amount of uniform, even-aged forest and instead encouraging forest stands with trees and shrubs of diverse heights and ages. Such complex forests are less desirable to hazardous wildlife such as crows (Kozloff, 1995; Marzluff, personal communication). Complex forests are created by planting the sites over many years and by

incorporating diverse woody species of varying heights and crown structures.

With the reduction of grassland habitat and open wetlands that attract geese, gulls, and waterfowl, the wildlife species of greatest hazard concern are crows and starlings. Reducing perching, nesting, and foraging opportunities can actively reduce the problem. Roosting habits of crows should be continually monitored. If large communal roosts and their associated flight paths are found near the airport, they should be eliminated by means such as setting off explosives in the presence of large flocks of crows; this has been found effective in moving crow roosting locations elsewhere (Marzluff, personal communication). Active thinning of trees in roosting sites also deters crows, but may not be as cost-effective as using explosives as needed.

Raptors

Problem:

Several raptor species are reported to occur in the vicinity of the airport. Red-tailed hawk is the most commonly occurring raptor. A raptor survey conducted for the Final Supplemental EIS (SEIS) reported that no raptor nests have been identified in the third runway expansion area. Other surrounding areas have not been surveyed to the level of detail provided for the Final SEIS; however, the most likely area for raptor nests is south of the Tyee Valley Golf Course in the deciduous forest surrounding Des Moines Creek.

Solutions:

According to the SEIS, raptor use of the airport area is primarily limited to foraging for food—typically small mammals. Raptors will use any elevated landing site (e.g., branches and tops of tall trees, lighting supports, and tall fence posts) that provides an unobstructed vantage point to perch and watch for prey in adjacent grasslands. They hunt open, grassy areas containing natural vegetation because rodents such as mice and moles will be abundant and visible.

Providing taller (approximately 12" high) unmowed grasses, augmented by significant shrub cover for potential prey in grasslands—particularly around edges that are closest to potential raptor perch sites—best reduces habitat suitability for raptors. They will move to other foraging sites where prey is more easily caught (Marzluff, personal communication).

Controlling hazard wildlife with raptors

While wild raptors are a component of the wildlife hazard at the airport, their trained counterparts could be part of the solution. In addition to the general methods discussed above, creative means of controlling hazard wildlife include the use of falconers.

A highly unusual method of eliminating aircraft collisions with flocking birds was employed at a British Navy airfield. A team of falconers, flying two falcons per year, sharply reduced airfield bird populations and, as a consequence, lowered air-strike damage from \$600,000 per year to zero (Welty 1975, Kuhring 1969).

A similar program is underway at Kennedy International Airport. In 1996, the first year falconry was used at Kennedy, there was a 61 percent decline in the number of birds striking airplanes while falcon flights were underway, compared with the same period in 1995 (Revkin, A. C. 1997). The program was re-authorized for 1997 at a cost to the Port Authority of New York and New Jersey of \$228,000. The head falconer for the Kennedy International Airport falconry program stated that the only deterrent birds never lose their fear for is the sight of a raptor.

Water as wildlife attractant

With regard to water features such as streams, ponds, and waterfalls, the key to reducing their attractiveness to hazard wildlife, such as waterfowl, is to have them covered—most easily and naturally by a closed-canopy vegetative cover. Waterfalls themselves do not attract hazard wildlife, so are not at issue (Marzluff, personal communication). Small bodies of flowing water such as Miller Creek can be covered by canopy to minimize their source of hazard. But larger, less linear bodies of water, such as stormwater detention facilities, are more difficult to cover with vegetation and are therefore hazard-wildlife attractants which should be discouraged in the airport area (Marzluff, personal communication). Smaller detention ponds can be heavily planted with aggressive, water-loving plants such as hardhack (*Spirea douglasii*) to cover the water surface.

Mitigation habitats

Many expansion and redevelopment projects are being planned or are currently underway at the airport, and some of these will impact natural wildlife habitats. Permit agreements between the FAA and environmental permitting agencies could include a clause that if mitigation habitats become a wildlife attractant for hazardous species, the Port of Seattle may alter the habitat to discourage wildlife use. This philosophy would likely influence projects undertaken as part of this conceptual plan.

Horticultural Requirements and Survivability

Site analysis

To select plants that will thrive with a minimum of maintenance requirements, the most important first step is a careful analysis of the intended sites. It should be noted that site conditions around the airport are extremely diverse, in terms of microclimate, exposure, and soil characteristics. Therefore, designers and implementers of each landscape project should sample growing conditions on their site thoroughly. Newly created planting sites with fresh fill dirt are especially prone to exhibit differences in conditions over a small geographic area.

Microclimate

Above-ground site characteristics that should be evaluated include the following:

- Timing and intensity of sunlight, both throughout the day and the year.
- Presence of artificial sources of heat, usually human-generated.
- Presence of topographic hollows and low points, where cold air will drain and create a local frost pocket.
- Local wind conditions, including any tunneling or eddying effects.
- Local sources of airborne pollution that could affect plant health and survival. In areas where plants already exist, those plants should be examined even

if they will be removed—for clues to stressful conditions that may affect new plantings.

Soil conditions

Soil conditions, often more critical to plant success than microclimate, deserve critical assessment. Specific soil conditions include the following:

- pH (or soil reactivity)
- Pollutants (including metals from previous sites of transported fill)
- Micro-nutrient presence and availability to plants
- Texture
- Structure
- Bulk density
- Drainage (tested directly, as opposed to educated guesses based on texture and bulk density)
- Presence and depth of surface organic layer
- Differentiation of soil horizons below the surface
- Sources of below-ground temperature anomaly (e.g., in soil over an underground building or parking garage). Landscape Architects should refer to Craul (1995) for comprehensive information about urban soils.

A careful consideration of the soil conditions will help landscape professionals select plants with stress tolerances and physiological ranges which are appropriate for the site. Other site conditions require modification before planting. For instance, sites that have well drained soils lacking in organic matter can be supplemented with compost mixes

applied as a top dressing and incorporated into the top foot or so. Organic matter leaches to underlying soil fairly readily, so overly deep (and expensive) incorporation is usually not necessary.

Sites with poorly drained soils, which usually also lack sufficient organic matter, should be amended with a mix of sandy soil and compost. As discussed above, amendments should be incorporated into the ambient soil to a 12" depth in order to reduce any drastic discontinuity of soil texture, which can alter water drainage, and ultimately root growth.

If slope stability is an issue, which can be the case with slopes over 30 degrees from horizontal, landscape architects and installation contractors should consult soils and geotechnical engineers about the advisability of incorporating one or more geosynthetic materials to stabilize the slope until new vegetative cover can do so.

Plant information resources

Information on the physiological ranges of Northwest native plants is found in many sources, most notably Kruckeberg (1996) and Sunset (1995). More comprehensive assessments of native tree and shrub species are compiled in Hamilton and Kruckeberg (1994), including review of stress tolerances in both natural and urban environments. Natural community associations of plant species in the Northwest are presented in Franklin and Dyrness (1988). Appropriate plant selection and landscape practices for potentially unstable slopes are reviewed in Mensahe (1993).

The above bibliographic resources are very useful, but landscape architects and designers need to be aware that empirical information on the performance of many native species under urban conditions still has room for improvement.

To achieve a successful native landscape, it is best to incorporate a diverse plant palette that will simulate natural plant communities, discourage hazardous wildlife, and thrive even if some species do not perform up to expectations.

Non-native plantings

Our maritime climate presents the opportunity for open-air cultivation of a much wider range of woody plants than is possible in many other temperate climate regions of the world. Because of this unique climate, many varieties of non-native plants are available to enhance and augment the Pacific Northwest natives described in Table A (found in Appendix B). Representative example species—with very similar form, color, and texture to native species—that could be appropriate for the conceptual plant palette include:

Trees

ash (*Fraxinus*), fir (*Abies*), maple (*Acer*), etc.

Shrubs

azaleas (*Rhododendron*), daphne (*Daphne*), mountain laurel (*Kalmia*), rhododendron (*Rhododendron*), Fragrant sarcococca (*Sarcococca*), viburnum (*Viburnum*), etc.

Groundcovers and vines

Boston ivy (*Parthenocissus*), periwinkle (*Vinca*), sweet woodruff (*Galium*) etc.

Refer to the Landscape Standards Committee for a more complete list of approved native and non-native plants at Sea-Tac International Airport.

Invasive species

Competition from unwanted, aggressive plants such as Himalayan blackberry, Scots broom, and English ivy can often ruin a new planting. Therefore, removing unwanted invaders is paramount in the first stages of site preparation.

Manual removal of the Himalayan blackberry should be followed by a plant specific application of herbicide. Follow up mowing should be part of maintenance program.

Scots broom should be completely removed with systemic eradication herbicide when the plant is in bloom. After foliage has died back, remove and dispose plants and roots. If re-growth occurs, a second application of herbicide may be required.

English ivy should be manually removed.

A mixture of overstory trees could be planted to achieve a multi-level canopy that will prevent adequate sunlight for the growth of blackberry and broom.

Containerized plant soils

In the special case of soil planters around the edge of the garage and within the terminal, the most stressful above-ground condition is likely to be caused by reflected light and heat. Containerized soils experience much more extreme diurnal fluctuations in temperature than normal soils.

As a result, soil mixes should be light and appropriately drained (fast enough so roots do not drown, but slow enough to reduce over-frequent watering. Rapid establishment of plants also requires a thorough drip irrigation system. Planted areas inside the terminal will experience the same stresses, but the severity will be inversely proportional to the size of the area and depth of soil.

Indoor plantings

Growing Northwest woody plants indoors, without direct exposure to the atmosphere, is very challenging because the overly warm, dry conditions present indoors are very unlike their native environments. Successful indoor plantings of large native woody species are very labor-intensive, requiring that containerized plants be rotated in and out of the sites as frequently as monthly, and restored to health in open outdoor environments.

As an alternative, the open courtyard approach is recommended, with some supplemental watering (e.g., rooftop drainage, if not polluted) to compensate for reduced rainfall interception. Window materials and glazing should be chosen to reflect as little light and heat as possible into the courtyard. In such conditions, species such as noble fir and Douglas-fir, and possibly mountain hemlock, are most likely to succeed.

For specific horticultural requirements and survivability recommendations related to implementing the conceptual plan in specific locations of the airport, see Appendix B.

Sustainability

One of the goals of the conceptual plan is to utilize and reuse runoff to help support the planted areas within the airport complex. As landscape projects are designed for each zone of the airport, existing drainage patterns and systems will provide the basis for designing new collection, detention, and treatment facilities that can blend with and sustain those landscapes. The basic findings of the stormwater drainage plan for Seattle-Tacoma Airport that relates to this conceptual plan are summarized below.

Overview of the storm drainage system plan

In February 1997, the Port of Seattle published the Seattle-Tacoma International Airport Storm Drainage System Comprehensive Plan (SDSCP). The report, which was prepared by HDR Engineering, Inc., describes the existing Storm Drainage System (SDS) and presents recommendations for modifications to system capacity and the detention of stormwater flows. The report was based on the existing conditions at the airport, and did not include future development plans such as the third runway, South Access Road extension, or the South Aviation Support Area (SASA). Aspects of the SDS relating to water quality were not included in the plan.

For the study of the existing SDS, the various drainage basins in and around the airport were identified and analyzed. Impervious areas within the basins include runways, taxiways, roads, parking lots, airport buildings, sidewalks, etc. Pervious areas include both designed planting areas and undeveloped regions. The report found that stormwater from the basins enters the existing SDS and passes through one of four detention facilities, ultimately discharging into either Des Moines or Miller Creeks.

In general, the comprehensive plan concluded that the existing storm drainage system, including catch basins, inlets, pipe networks, detention facilities, etc., provides adequate conveyance and capacity, and meets current drainage standards. The existing detention facilities—Tyee Pond, Northwest Ponds, Lake Reba, and Lake Reba Regional Detention Facility—either meet or exceed detention requirements during large storm events (e.g., 25-year and 24-hour storm events). However, the report found that approximately 4.5 percent of the existing pipe system exceeded capacity during large storm events. The report recommended retrofitting manholes with sealed lids in order to permit surcharging of the current system, so that capacities of these segments would meet current drainage capacity requirements.

For specific sustainability recommendations related to implementing the conceptual plan in specific locations of the airport, see Appendix B.

Concepts for collection and treatment of stormwater

The existing facilities at the airport are adequate to handle conveyance, treatment, and peak flow control of storm water. These systems appear to meet at least the minimum requirements for protection of ground and surface water, and the habitats associated with downstream basins.

As development occurs in the zones identified in this document, there is an opportunity to enhance the existing facilities for conveyance and treatment, while supporting the goals of the conceptual plan and addressing concerns about wildlife attractants. An important component needed to achieve the goals of this plan is that stormwater systems appear natural, (i.e., no hard-edged ponds or conveyance swales).

These opportunities include:

- Developing natural-looking stream channels with subsurface drain rock that can convey the flows without visible open water. This type of facility would be fine for stormwater conveyance, but would not provide water quality treatment for water from areas subject to vehicular use.
- Biofiltration swales are a widely accepted method of stormwater treatment in the Northwest. Bioswales with a dense planting of broad leaf emergent species that obscure intermittent surface water flow would be an ideal way to treat roadway runoff.

- Strip filtration is another popular method of treatment. Stormwater can be dispersed over a large area and cleaned as it flows downhill. This may have applications on the west slope of the third runway fill.

- Water reuse for irrigation is more problematic. These systems would require extensive facilities to separate clean and dirty water, treat dirty water, and store and recirculate water. It may be more practical to retrieve water from the various regional detention facilities for use in irrigation.

In areas where stormwater detention will be needed, efforts should be made to avoid a heavily engineered look. Ponds that manage peak flows should fit into the topography of the surrounding environment.

General Landscape Maintenance

Maintenance effectiveness and long-term maintenance costs of developed landscapes, particularly naturalized, are dependent on following factors:

- Maintenance and appearance objectives
- Access for personnel and equipment
- Proper soil preparation and condition
- Establishment of effective drainage
- Following the forest progression
- Irrigation and water delivery systems
- Site topography
- Adequate traffic and pathway planning
- Ground surfacing and groundcover selection
- Use of pesticides and herbicides

Each of these factors will be covered in this report. It is generally recommended that an experienced Certified Landscape Professional (CLP) with a background in maintenance operations be included in landscape design teams for conceptual discussion, as well as to plan review and maintenance specifications. To best facilitate future development and improvement projects at the airport, it is recommended that a full-time supervisor be hired to oversee landscape maintenance and design.

For specific maintenance requirements related to implementing the conceptual plan in specific locations of the airport, see Appendix B.

Maintenance and appearance objectives

The objective for the majority of airport property will be the maintenance and appearance of a native Northwest landscape. As each area of the conceptual plan is developed, design teams should consider one of the following two planting options related to initial size of plant materials at installation and consider the associated budget implications:

- **Natural forest progression**
Landscape development plans that anticipate future maturity at a slower pace should be planted and maintained with densities anticipating natural plant form development and spacing.
- **Mature, natural landscapes at installation**
Creation of initial environments which attempt to duplicate or suggest mature, natural landscapes will require denser and more mature plantings (i.e., higher initial and ongoing maintenance cost) than those in which natural forest progression is encouraged as an alternative. Initial, high density, mature plantings may also require more attention to pruning, thinning, or transplanting operations. But because of their shade-providing characteristics, they may offer an advantage over the natural forest progression option because shade loving groundcover and lower story canopy materials can be established earlier in the landscape development process.

A number of plants recommended in the conceptual plan plant palette have optional maintenance characteristics depending on the extent to which natural versus developed or maintained appearance is desired. Woodland perennials may develop many characteristics which could be regarded as desirable or undesirable, depending on appearance objectives.

For instance, rhododendron species in the natural environment are left with seed pods, which can affect growth habit and plant compactness. In the maintained environment, seed pods must be removed each year—a higher cost procedure. Natural leaf fall and mosses are retained in the natural environment, but removed in the maintained environment.

In perimeter areas, and those which are observed rather than interactive elements, natural development and maintenance practice should be used. However, provision should be made for maintenance operations to prevent or eliminate noxious and invasive species, even in natural areas.

Access for maintenance personnel and equipment

The accessibility of landscape design features can have a large impact on the feasibility and long range cost of maintenance operations. Designers should consider how each feature would be accessed by personnel, vehicles, and equipment.

For example, it is important to consider access along perimeter roadways to ensure that personnel and vehicles

can safely enter and leave these areas. Safe access to planters and elevated interior or exterior plantings along garage parking ramps is recommended, as is access to interior or exterior atrium spaces—which may be glassed or otherwise separated from direct public access—and access for pruning and trimming hanging or cascading vine features.

Proper soil conditioning and preparation

Typically, soils from large-scale construction are highly compacted, poorly draining, and usually deficient in organic material and nutrients needed for adequate plant establishment.

Particular attention should be devoted to soil structure in plantings where native materials are to be established. Incorporation of composted organic materials to depths of 8 to 12 inches and up to 35 percent by volume is recommended, similar to current procedures used by Washington State Department of Transportation (WSDOT).

It should be remembered that typical root zones exist in the top few inches of soil where plants retrieve most of their water, air, and nutrients. Adequate soil drainage in planting areas, with the exception of bog and wetland plantings, is essential. During installation procedures, care should be taken to avoid excessive layering and compaction of subsurface soils to assure adequate drainage and air pore space for root systems. There is little chance of compensating for poor soil drainage and aeration through maintenance practices.

Effective drainage

Adequate surface, as well as subsurface, drainage is critical to the successful establishment of plant communities. Because of their potential to act as wildlife hazard attractants, it is critical that landscape drainage patterns for planting areas consider collection patterns and destinations for surface water—to prevent the creation of lagoons, wetlands, and open water courses at the airport. Natural drainage should be encouraged where possible and where not, drainage collection should be planned to avoid pooling water. Flotation and flooding of either artificial or naturalized mulches should be avoided.

Following the forest progression

The plant palette recommended for the *Northwest Evergreen Forest* theme incorporates many different natives requiring conditions ranging from wet to dry, shade to sun, and short to tall. When selecting plants, designers should consider natural forest progression.

Here are some examples:

- Shade-loving groundcovers should not be used where the progression of landscape maturity will not establish shade conditions for some years.
- When selecting plants for parking garage fascia, where trailing or hanging plantings are recommended, avoid moist shade-lovers (e.g., ferns and mosses) on south and west exposures, where

they will not survive regardless of the level of maintenance.

- Vine maple (*Acer circinatum*) thrives best in well lighted, but shady environments. When planted in open sun, it will typically survive but not establish the attractive deep forest character normally intended.

If a mature forest, open clearing, or wetland character is intended, large size plant specimens need to be specified in the initial design. To the maximum extent possible, the presence and preservation of existing, naturalized plants—particularly on the north and west sides of the airport facilities—is encouraged and must be considered early on in the grading and development planning process.

Irrigation and water delivery systems

During their initial years of establishment, plant communities are sensitive to the presence of adequate moisture. To the extent that irrigation design can place water at or near the point of use, it is a wise investment to do so during the original design and installation phase. Plants accustomed to moist woodland environments near water, or deeply shaded environments, may need additional water in a developed environment. In such situations, overhead spray irrigation may be necessary beyond initial establishment periods, particularly where only intermittent or seasonal natural flows will be present.

In situations where natural development and adaptation of species will be encouraged, attention should be given to the

fact that rainfall is highly variable throughout the Northwest, and annual rainfall at Seattle-Tacoma International Airport does not approach western Olympic and Cascade Mountains slopes, where many of these plants are native. Supplemental irrigation will be a necessity throughout most areas of the conceptual plan. Because irrigation systems are typically turned off during winter months, plantings located beneath overhead projections will not receive normal winter exposure to rainwater and thus be vulnerable to stress and in some cases death. In such situations self-draining irrigation zones should be planned as year round systems, with adequate protection from freeze damage planned into the system. This will be particularly true of recessed planting containers located in the Gorge and parking garage areas.

It is strongly encouraged that centralized irrigation monitoring and control systems be implemented as part of the overall plan. Furthermore, specific zoning and timing should be included to accommodate the many microclimates around the airport. The long range savings in maintenance labor time, and potential for optimization of water use efficiency, will more than adequately return the higher initial investment on centralized computer controlled irrigation systems. Such planning should be incorporated into the initial infrastructure development planning of the airport.

Site topography

Slope areas, whether elevated or depressed, should be designed with naturalizing plantings requiring minimum access and maintenance. This will have a beneficial impact

on maintenance effectiveness and cost. Slopes exceeding 3:1 horizontal to vertical should consider terracing and retainage, and should not be planted with grasses or groundcovers that will require mechanical mowing and trimming.

Traffic and pathway planning

Traffic patterns for human movement and activity that may affect the nature of plantings, groundcovers and walkways should be anticipated. Areas not intended for pedestrian access should be screened or guarded. Low-hanging tree branches, hanging vines, and plant sizing should consider pedestrian, as well as vehicular sight and visibility requirements, to avoid excessive pruning and trimming. Planting designs should encourage development of natural plant forms to the maximum extent possible.

An additional consideration, important in pedestrian environments is site security. Dense plantings should be avoided near parking lots or poorly lit locations where pedestrian access is required. The use of potentially flammable mulches should be avoided near all traffic paths where smoking materials may be tossed or disposed. This is particularly a concern in smoke-free airports, where entries and exits may be light-up or toss-out areas for smoking travelers.

Ground surfacing and groundcover selection

Selection of groundcovers will affect the degree of maintenance required. Typically, bark mulch has been utilized as the most natural initial mulch product in the Northwest. It is encouraged on this project as an alternative

to compost mulches, which tend to dry out, blow away, and encourage early weed and invasive species development. Compost mulches should only be used as an incorporated soil amendment.

In the forest environment of the conceptual plan, many native groundcovers have been recommended for the plant palette. Non-invasive species are to be encouraged, and shade versus sun tolerance levels must be considered. Again, where a deep shade or moisture-loving plant is specified, consideration must be given to forest progression and whether such a groundcover can be established initially, or deferred to a subsequent phase planting.

Subsequent maintenance intensity and cost will be determined largely by the extent to which a naturalized versus a developed appearance is desired, particularly in outlying areas of the conceptual plan. In general, naturalized conditions requiring lower maintenance intensity will be preferred. Leaf and needle drop should be retained, so that a natural duff or forest floor can develop. In developed areas, such as high use pedestrian zones, public entrances to the terminal, along International Boulevard, and portions of South 188th Street, a more maintained and developed appearance is preferred. In these areas the requirements for access, irrigation, nutrition, chemical, periodic mulch replenishment and pruning requirements will likely be higher.

Pesticides and herbicides

Management and maintenance practices should be incorporated into airport operations to reduce pollutant loading to downstream surface waters. These include choosing (or modifying) landscape maintenance practices to reduce the amounts of nutrients and other pollutants that could enter stormwater runoff. An integrated vegetation management plan should be prepared, detailing management practices that reduce the use of chemicals such as fertilizers, herbicides, and pesticides, as well as irrigation practices that minimize surface runoff. Chemicals should be chosen that have little or no soluble phosphorus content, to avoid loading Miller and Des Moines Creeks. In addition, other methods of pest control should be considered including natural predators, plant selection, and maintenance practices.

APPENDIX B: PLANTING GUIDELINES FOR IMPLEMENTING THE THEME

The *Northwest Evergreen Forest* is the principal guiding theme of the Seattle-Tacoma International Airport. Before reading this appendix, please refer to Sections 2.0 through 7.0 in the main body of this document.

The conceptual plan envisions that multi-level evergreen forests will provide the overall structure to the landscape surrounding the airport. In places, it will be the dominant landscape feature, composed almost entirely of native plant material. At the pedestrian scale, or as an area of emphasis, the evergreen forest will serve as a backdrop and frame for non-native plants that are selected for their ornamental value (color, foliage, form, and massing). These areas include the Gorge between the airport terminal and garage structure, entrances to public buildings, and along International Boulevard and South 188th Street in the City of SeaTac.

The planting guidelines in this report follow the same order of locations within the airport complex, as does the conceptual plan.

Representative conceptual plant palettes of dominant tree, shrub, and understory species are identified throughout this

report to help define the desired character of each zone. Additional minor species components of each plant palette are shown in Table A, entitled *Suggested Northwest Native Woody Plant Species for Airport Landscapes*, which is included at the end of this section.

The plant palettes and other planting guidelines identified here will provide a workable basis and the catalyst for developing complete designs for future projects.

Designers should also refer to the Landscape Design Standards for a list of approved plants at Sea-Tac International Airport.

North Side

The north side of the airport and its edges are envisioned to represent the temperate coniferous forests that cloak the western slopes of the Cascade Mountains. The SR 518 corridor, from Burien to Interstate 5, would provide the evergreen backdrop for landscapes along South 154th Street and at the recently completed North Employee Parking Lot.

The North Access Road will carry airport visitors into the heart of the terminal, passing by the Cascade Portal at the South 160th Street overpass.

Plant selection

The conceptual plant palette for the SR 518 Corridor and the North Access Road are very similar.

Several opportunities exist to lessen the visual impact of the pair of 40-foot high retaining walls alongside the relocated South 154th/156th Street. Consider these recommendations:

- Adjust road cross-section to allow an 8-foot minimum planting zone against proposed wall on the uphill side, between runway and service drive portion. Plant species should be selected both to create screening and set the tone for the *Northwest Evergreen Forest* as a simple, bold, and recognizable design visible from passing cars on SR 518. A north facing exposure, little direct sunlight,

and variation in soil from native till to free-draining backfill and wetland soils may limit plant selection.

- Plant a hedge of *Calocedrus decurrens*/incense cedar interspersed with *Acer circinatum*/vine maple, and *Parthenocissus quinquefolia*/Virginia creeper planted at the base to cover the wall with green. Other options for dominant evergreen trees within the height limits imposed by the location at the runway ends includes *Pinus contorta*/lodgepole pine or *Myrica californica*/Pacific wax myrtle. *Cupressocyparis leylandii*/Leyland cypress is also an option, but would require occasional shearing. Other plants to intersperse might include: *Cornus mutabilis*/pacific dogwood, *Spirea douglasii*/Douglas spirea.
- Consider *Larix occidentalis*/western larch as dominate confer outside of object free zones.
- Plant *Thuja plicata* excelsior/excelsior western red cedar, as dominate planting below the wall at edge of wetland. Intersperse with *Cornus stolonifera* redtwig dogwood, *Salix sp.*/native willows or *Alnus rubra*/red alder.

Additional species lists for the SR 518 Corridor and the North Access Road are combined in the following table, with moisture-loving plants noted with an asterisk (*).

<u>Major Trees</u>	<u>Major Shrubs</u>	<u>Major Understory Plants</u>
Douglas-Fir	Pacific Rhododendron	False lily-of-the-valley *
Western Red Cedar	Vine maple	Sword fern
Western Hemlock		Vanilla leaf *
Swamp birch *		
Red birch *		

* Indicates species intended only for planting near water. All species without an asterisk are intended for use in both areas. For minor components, see list in Table A.

Horticultural requirements and survivability

- Upland plants in this association are adapted to the glacial till-derived soils of our region. Soils should be deep, slightly acidic, generally well-drained, and of fairly coarse texture.
- Streamside soils should have a higher silt and organic content to help retain moisture.
- Analyze onsite soils to determine horticultural suitability and the need for topsoil importation, use of compost, or other soil nutrient amendments. It is anticipated that soil amendments 8 to 12 inches deep may be desirable.

- Use a vegetation shredding machine to process landscape maintenance debris for use as onsite mulch. If time allows during the design and development of large-scale plantings along the SR 518 corridor, use shredded plant debris to heavily mulch future planting areas at least two years prior to planting, allowing the mulch to rot in place as a soil supplement and weed control.
- A compacted soil layer or artificial liner may be needed to retain stream flows in the channel.
- Plant moisture-dependent materials along stream edge to assure access to adequate moisture.
- Provide temporary irrigation during at least the first two years of plant establishment

Maintenance

- Protect from invasion by undesirable invasives, (e.g., Himalayan blackberry) by performing semi-annual or annual hand eradication and selective chemical eradication during the early years of establishment.
- For maintenance and appearance during the dry season, use a rock-lined stream bed designed to mimic the boulder-strewn streams of the Cascade Mountains.

Sustainability

The north access zone includes both roadway and landscape areas paralleling SR 518 and the North Access Road. The route borders the airport on the north and winds itself around and travels south on the east side of the airport property. Several drainage basins intersect this zone and stormwater from this zone discharges either to the north or south. Most of the runoff in the north access road zone discharges via the Storm Drainage System (SDS) to Lake Reba, Lake Reba Regional Detention Facility and Miller Creek. Areas of the north access road located south of the Federal Express Air Cargo facility discharge to the south and into Tyee Pond via the SDS facilities. From Tyee Pond, the stormwater enters the east tributary of Des Moines Creek. The Storm Drainage System Comprehensive Plan (SDSCP) recommended that only a couple SDS segments within this zone needed improvements (adding sealed manhole lids) in order to meet capacity. The improvements could be done concurrently with future airfield projects such as:

- Channel stormwater runoff from the roadway to the boulder-filler mountain stream.

Wildlife issues

- Areas underneath the flight path along SR 518 will incur the highest level of restriction for selection of plant material.
- Space tree plantings widely to reduce the attraction to crows.
- Design the gradient of the boulder-filler stream to keep the water below boulder level, and not visible from the air, so as not to attract waterfowl.
- Use large boulders and overhanging plantings in streambed.
- Provide a canopy cover for the stream to reduce overhead visibility and gull and waterfowl use.

South Side

The proposed themes for the south side of the airport are the wet coastal forest of the central Puget Sound lowlands and the pine/oak woodland of the south Puget Sound. Proposed gateways include the Pacific Mists Portal at the new south entry, and the Portal to the City of SeaTac and Portal to Puget Sound at the west and east ends of the South 188th Street tunnel under the runway.

A multi-level Olympic Grove of western red cedar trees is proposed as a gateway from the intersection of South 188th Street and 28th Avenue South, up to the south edge of the parking garage. A Rhododendron Valley is suggested along South 188th Way, west of the South 188th Street tunnel, that would transition into a pine/oak woodland in the undeveloped expanse to the south. Coastal forest plantings are envisioned to augment naturally-vegetated, moist soil areas to the south of the airport, either as a replacement for the short grass habitat of the Tyee Valley Golf Course or further south in the Des Moines Creek corridor.

In addition to wildlife hazard concerns for all areas surrounding the airport, this zone poses special challenges for plant selection because of safety criteria related to land use and planting in the Runway Protection Zone (RPZ). Plants selected for areas in close proximity to the runway ends and the Object Free Areas (OFAs) should be limited to low-growing trees and shrubs suggested in the conceptual plant palette.

Plant selection

Inclusion of the coastal forest theme is important to convey the overall site concept of the *Northwest Evergreen Forest*. The implementation of this particular theme is challenging, because in its true and native form, it would require a consistent and relatively large contribution of water to support plant species unique to that environment. With the exception of the coastal forest palette proposed for moist soil areas near Des Moines Creek, the concepts presented here are intended to suggest some elements of the coastal forest environment that can be adapted to the drier site conditions that prevail along the south perimeter of the airport along South 188th Street.

The Rhododendron Valley would extend from the west perimeter of the airport toward the west end of the South 188th Street tunnel and the Portal to the City of SeaTac. The concept incorporates the native rhododendron understory element of the Pacific Coast forest that is found throughout the Olympic Peninsula region, complemented by rhododendron cultivars that help suggest the look of this coastal community. Large tree species are limited in this zone because of aircraft safety requirements. Suggested dominant species include:

<u>Major Trees</u>	<u>Major Shrubs</u>	<u>Major Understory Plants</u>
Vine maple	Pacific rhododendron	Sword fern
Low-growing cypress cultivars	Rhododendron cultivars	
	Manzanita	

The coastal forest palette proposed for the extreme southern region of the Runway Protection Zone and further south includes tall-growing native evergreen tree species that may be considered undesirable depending on their placement and massing. Alternative selections could include cultivars with more compact growth habits. It will be important to ensure that treed areas do not develop dense, uniform height canopies that are attractive to starlings and crows. A complex-canopy forest with a well-developed understory can provide essentially self-contained habitat for wildlife. If located well to the south of the airport, this type of land cover could decrease the likelihood of Canada geese, the most problematic wildlife hazard species at the airport.

Suggested plants for the coastal forest palette include:

Major Trees Major Understory Plants

Red alder	Foals huckleberry
Sitka spruce	Sword fern
Western red cedar	
Western hemlock	
Low-growing hemlock & cedar cultivars	

The south Puget Sound woodland would encompass the undeveloped and drier area south of South 188th Street and west of the tunnel. Widely spaced cultivars and grafted specimens of tree species that reach relatively low mature heights could be placed in scattered clusters to evoke the feel of a pine and oak woodland, while minimizing potential aircraft hazards in this zone. Suggested native and non-native species include:

Major Trees Major Understory Plants

Shore pine	Idaho fescue and related native grasses
Western white pine	
Garry oak	
Madrone	

Horticultural requirements and survivability

- Analyze onsite soils to determine horticultural suitability for oak woodland plantings, and determine the need for topsoil importation, use of compost, or other soil nutrient amendments. It is anticipated that soil amendments 8 to 12 inches deep may be desirable in this area.
- Analyze soil pH for rhododendron plantings, and amend soil to achieve appropriate acidity and organic content. Prepare soils to a depth of at least 12 inches.

- Analyze irrigation needs for plant establishment and survivability, and provide temporary and/or supplemental irrigation as required.
- Encourage accelerated development of plant community structure using methods outlined in the general maintenance section of Appendix A.
- Provide adequate access for maintenance.
- Protect from colonization by invasive species, especially Scots broom in the oak woodland area.

Sustainability

The south side zone includes buildings, parking lots, roadways, and planted and undeveloped pervious areas to the south and southeast of the airport. Runoff from this zone discharges to Tyee Pond for detention and then into Des Moines Creek. The Storm Drainage System Comprehensive Plan (SDSCP) concluded that the existing Storm Drainage System (SDS) had adequate capacity for future development and, other than regular maintenance, no additional stormwater detention improvements were recommended. Additional water quality treatment and dispersion recommendations include:

- Channel runoff through biofiltration swales and release across planting areas with shallow, below-ground dispersion trenching.

- Achieve required water quality with strip filtration and other effective natural systems. Systems should replicate natural drainage patterns.

Wildlife issues

- Reduce standing water and shrubs or cattails in marshy areas to decrease attraction of blackbirds.
- Replace short grass areas, such as the golf course, with plantings chosen from the coastal forest plant palette. Develop the landscape over time to provide a varied age and height canopy with a well-developed understory that confines adapted species to the forest area and reduces attraction for geese and other waterfowl.
- Avoid garbage storage or disposal in this area to reduce attractions for crows and gulls.
- Consider periodic selective thinning of trees to reduce cover and create a canopy of varied height.
- Trees should be widely spaced to prevent development of a closed and uniform canopy that would be attractive to starlings.

West Side

The proposed overall thematic emphasis of the west side embodies aspects of the riparian forest along the Miller Creek corridor, and the Puget Sound upland evergreen forest on the west-facing fill slope that will be created by construction of the third runway. Future commercial development areas in the west sector would be set in clearings to express the character of the overall forest setting.

Plant selection

Riparian area: Miller Creek

Portions of the Miller Creek channel will be relocated to accommodate construction of the third runway. Currently, a mitigation plan is being prepared to support permit applications for that project. The following plant palette is recommended for use in areas that are not subject to the current plan, but may be impacted by future development or if additional enhancement of the corridor is desired.

<u>Major Trees</u>	<u>Major Shrubs</u>	<u>Major Understory Plants</u>
Red alder	Red osier dogwood	Sword fern
Black cottonwood	Hardhack spirea	
Western red cedar		
Western hemlock		

West slope of the new runway

The height of plant materials proposed for the west slope of the new runway will need to comply with FAA requirements for the Runway Protection Zone. Lower growing components of the plant palette should be used on the upper slopes with taller species located on the lower slopes.

<u>Major Trees</u>	<u>Major Shrubs</u>	<u>Major Understory Plants</u>
Douglas Fir	Pacific rhododendron	Sword fern
Western hemlock	Vine maple	
Western red cedar		

Horticultural requirements and survivability

- Upland plants in this association are adapted to glacial till-derived soils of our region. Soils should be deep, slightly acidic, generally well-drained, and of fairly coarse texture.
- Analyze onsite soils to determine horticultural suitability and determine the need for topsoil importation, use of compost, or other soil nutrient amendments. It is anticipated that soil amendments 8 to 12 inches deep may be desirable. This is especially important if the third runway embankment structural fill is to support plant growth and development.
- Provide temporary irrigation during at least the first two years of plant establishment.
- Protect from invasive species, especially Himalayan blackberry and English ivy, during early landscape development.

Sustainability

During the examination of the Storm Drainage System (SDS) for the Storm Drainage System Comprehensive Plan (SDSCP), construction of the third runway had not begun; therefore, the runoff from the slope of the third runway zone was not analyzed.

- Consider detention and water quality facilities that are not heavily engineered, geometric systems, but

rather follow the contours and emulate the natural system as much as possible.

- Strip filtration should be considered for stormwater treatment. Stormwater can be dispersed over a large area and cleaned as it flows downhill.

Wildlife issues

- Selectively thin forest on lower slope to reduce cover for starlings and crows.

Parking garage

The west face of the garage could be planted with ferns, vines, and cascading shrubs. The effect should confront the arriving passenger with a dramatic curtain of green.

Plant selection

- Native plants are largely untested in such an environment. Highest reliability would be achieved by selecting non-native varieties that perform the desired aesthetic function of creating a wall of green.
- Native rock clematis (*Clematis columbiana*) should be considered.
- Some native ferns may tolerate site conditions. Their use could be tested by incorporating limited numbers of species into the garage wall plantings.

Horticultural requirements and survivability

- This will be a high-maintenance landscape, especially during the establishment period.
- Irrigation and soil mixes are key factors for ensuring plant health. Soil for container plantings should be lightweight and nutrient balanced where planters are suspended beyond garage walls.
- Daily conditions of sunlight and shade, air and concrete temperature, and air quality should be recorded over an extended period of time to guide plant selection.

Sustainability

Stormwater collected from the roof downspouts and drainage facilities for the parking garage and terminal discharges into Tyee Pond on the south side of the airport, and then outfalls into the east tributary of Des Moines Creek. The Storm Drainage System Comprehensive Plan (SDSCP) stated that the existing Storm Drainage System (SDS) facilities had adequate capacity and recommended no changes. The drainage can be divided into two categories:

- Water that needs treatment.
- Clean water from roof areas. Drainage from roof areas could potentially be recycled for other uses, but costs for developing storage and distribution systems may outweigh benefits.
- Provide drip irrigation with tempered water to prevent freezing.

Wildlife issues

- East of the garage, space large trees so that branches will not touch, and some space will remain between the trees at maturity. This will reduce their attractiveness to starlings and crows. Cover all trash containers to reduce gulls and crows.
- Design garage roof perimeters, lamp posts, and planters with slanted edges and slick surfaces to minimize their use as perch sites by pigeons, crows, and gulls.

Terminal

The proposed overall thematic emphasis for the terminal areas is an expression of all types of the *Northwest Evergreen Forest*. The central terminal should also incorporate interpretations of the supporting themes of Pacific Northwest natural and cultural environments. The central terminal is the proposed focal point of the airport, and will be a place for people to linger and absorb unique forms of architecture, landscape architecture, and art. This is the place to fully immerse the visitors in a variety of sensory experiences.

Plant selection

Many potential garden styles and themes for the terminal area are suggested by the wealth of Northwest environmental heritage. A truly native forest landscape poses especially difficult challenges because of the horticultural requirements of these species in interior spaces. Therefore, the proposal for an Olympic core sample, open to the sky but enclosed with glass, provides a viable alternative to indoor plants. It should allow the survivability of a range in types and sizes of plants from the *Northwest Evergreen Forest*.

The horticulture section of Appendix A addresses Northwest native species viability in interior gardens. Suggested framework plants for interior areas include ferns, Norfolk Island pine, azaleas, podocarpus, and spathiphyllum. Interpretive displays of famous Northwest gardens (e.g., Washington Park Arboretum, Bellevue Botanical Garden, Rhododendron Species Botanical Garden, and Bloedel Reserve) could be incorporated into the design of interior plant displays.

Horticultural requirements and survivability

- Survivability depends on good maintenance, as well as horticultural and plant selection issues discussed in the horticulture section of Appendix A.

Sustainability

- Recommended watering methods include hand watering or a drip irrigation system using domestic water.

Wildlife issues

- None for indoor plantings.

Runway Islands

The planting concept for the areas between the runways is to use low-maintenance grasses to create visual interest from above and discourage wildlife use. Of particular importance is ensuring that sight lines from aircraft to runway directional signs are kept completely unobstructed.

Plant selection

Grasses that grow approximately 12" tall should be used for this area. Species could be planted in large patterns to provide visual interest. However, these patterns may become less distinct over time because of plant dispersal and intermixing. Recommended species include Idaho fescue (*Festuca idahoensis*), chewings fescue (*Festuca rubra commutata*), annual rye (*Lolium multiflorum*), and red top (*Agrostis alba*). All plants selected for this area would require the approval of the Airfield Line of Business.

Horticultural requirements and survivability

Consideration must be given to the drought and chemical tolerance of plantings in this area. The recommended species are known to be drought-tolerant and should perform well in this location. However, chemical tolerance is unknown. Further research should be conducted on this topic, including surveys of other airports nationwide that use native grasses in the runway medians.

Sustainability

Stormwater from the runway islands discharge either north or south, depending upon their location relative to an east-west oriented ridgeline. The majority of the runoff from the runway islands discharges to the south and flows via the Storm Drainage System (SDS) into the west tributary of the Des Moines Creek. The stormwater from the runway islands on the north side of the airport discharge to the north and flow via the SDS to Lake Reba and the Lake Reba Regional Detention Facility. From Lake Reba Regional Detention Facility, the stormwater discharges into Miller Creek.

In the Storm Drainage System Comprehensive Plan (SDSCP), it was concluded that capacity of the SDS for the runway islands needed improvement. The plan indicated that larger pipe sizes could be installed for the system to have adequate capacity during large storm events.

However, the report also recommended that installing sealed manhole lids would enable the existing system to surcharge—thus, allowing the system to meet the demands during large storm events. Since the improvements were limited to small segments within the SDS, the SDSCP concluded the improvements could be done concurrently with future airfield projects such as pavement replacement, maintenance, etc. Treatment for this drainage includes IWS and strip filtration in the runway islands.

Specific stormwater treatments for the runway area could include:

- Draining a percentage of the runway runoff to the grassy medians.
- Using biofiltration grasses along the runway edges that are kept short to ensure visibility of runway signs, and filter runoff before it moves to more exotic species.

Wildlife issues

- Allow grasses to grow with only ambient moisture (i.e., no irrigation) to reduce the amount of lush green top growth that could be attractive to gulls, waterfowl, and deer.
- Allow grass to reach mature height to reduce foraging opportunities for gulls and raptors.
- Remove potential perch trees adjacent to grassland to discourage raptors.
- Include low shrubs in areas adjacent to the perimeter fences to provide cover for small mammals, thereby reducing grassland use by raptors and coyotes.

TABLE A. SUGGESTED NORTHWEST NATIVE WOODY PLANT
SPECIES FOR
AIRPORT LANDSCAPES

Species	PS	Mt	Co	PO	Rip	Species	PS	Mt	Co	PO	Rip
LARGE TREES						SHRUBS & SMALL TREES					
<i>Abies amabilis</i> (Pacific silver fir)	m		m			<i>Acer circinatum</i> (Vine maple)	M		m		m
<i>Abies grandis</i> (Grand fir)	m		m			<i>Arctostaphylos columbiana</i> (Manzanita)			M		
<i>Acer macrophyllum</i> (Bigleaf maple)	m		m			<i>Cornus sericea</i> (Red-osier dogwood)					M
<i>Alnus rubra</i> (Red alder)	m		M		M	<i>Rhododendron macrophyllum</i> (Pacific rhod.)	M		M		
<i>Arbutus menziesii</i> (Madrone)	m		m			<i>Spiraea douglasii</i> (Hardhack spirea)					M
<i>Betula glandulosa</i> (Swamp birch)		M				<i>Vaccinium ovalifolium</i>	m		m		
<i>Betula occidentalis</i> (Red birch)		M									
<i>Betula papyrifera</i> (Paper birch)	m					GROUNDCOVERS					
<i>Calocedrus decurrens</i> (Incense cedar)	m					<i>Ceanothus prostratus</i> (Mahala mat)					m
<i>Chamaecyparis lawsoniana</i> (Lawson cypress)			m			<i>Oxalis oregana</i> (Oregon Oxalis)	m		m		m
						<i>Phlox</i> (native phlox)	m				m
<i>Cornus nuttallii</i> (Pacific dogwood)	m		M		m	<i>Phyllodoce spp</i> (Mtn. Heather)	m				
<i>Picea sitchensis</i> (Sitka spruce)	m		m			<i>Yanconveria planipetalap</i> (Small inside-out flower)			m		
<i>Pinus contorta</i> (Shore pine)	m		m		M						
<i>Pinus monitcola</i> (Western white pine)	m		M		M						
<i>Pinus ponderosa</i> (Ponderosa pine)	m		m		M						
<i>Populus trichocarpa</i> (Black cottonwood)	M		m								
<i>Pseudotsuga menziesii</i> (Douglas-fir)	m		m		M						
<i>Quercus garryana</i> (Garry oak)	m		M								
<i>Thuja plicata</i> (Western redcedar)	M		M		M						
<i>Tsuga heterophylla</i> (Western hemlock)	M		M		M						
<i>Umbellularia californica</i> (California laurel)			m								

Notes: M = major component of a given landscape area, m = minor component; PS = Puget Sound upland forest in North Entry and Western perimeter; Mt = mountain stream in North Entry; Co = Coastal forest in South perimeter, including Rhododendron Valley; PO = Southern Puget Sound pine/oak woodland; Rip = riparian area along Miller Creek in Western perimeter area

All plants must be approved by the Port of Seattle, per the Landscape Design Standards, prior to use at the airport.

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