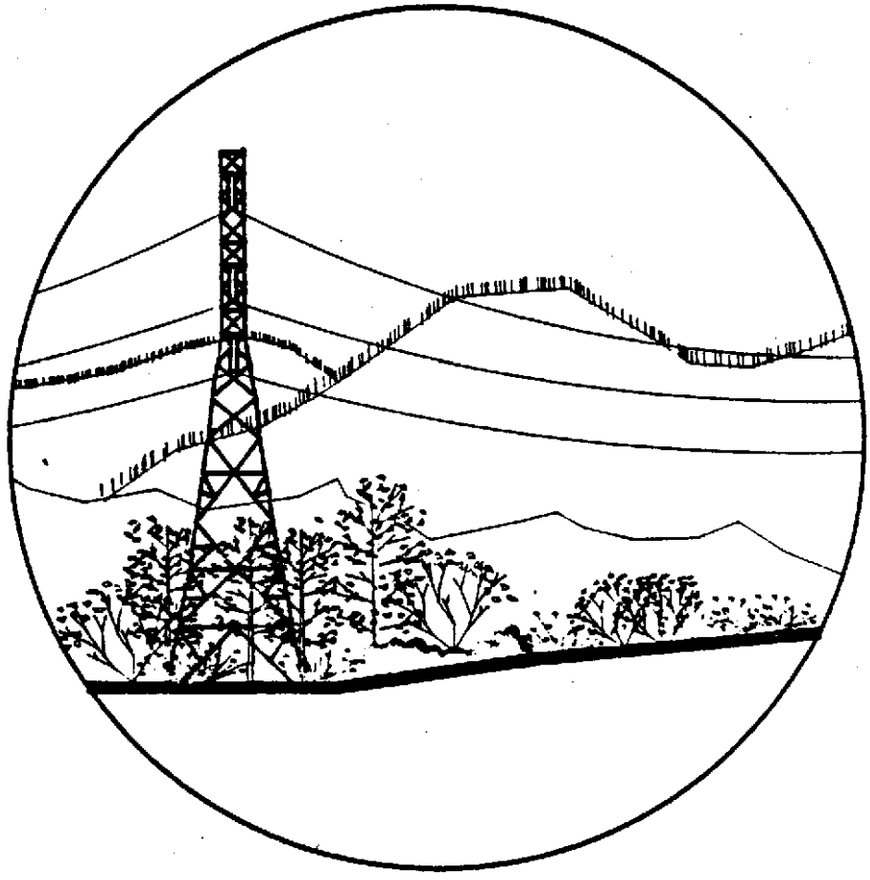
TRANSMISSION RIGHTS OF WAY VEGETATION MANAGEMENT PLAN

AESTHETIC IMPACT EVALUATION

PREPARED FOR

SEATTLE CITY LIGHT



PREPARED BY

COMPLIANCE SERVICES INTERNATIONAL
DAMES & MOORE, INC. AND DON SHIMONO ASSOCIATES

FINAL REPORT

TRANSMISSION RIGHTS-OF-WAY VEGETATION MANAGEMENT PLAN

AESTHETIC IMPACT EVALUATION

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September, 1989

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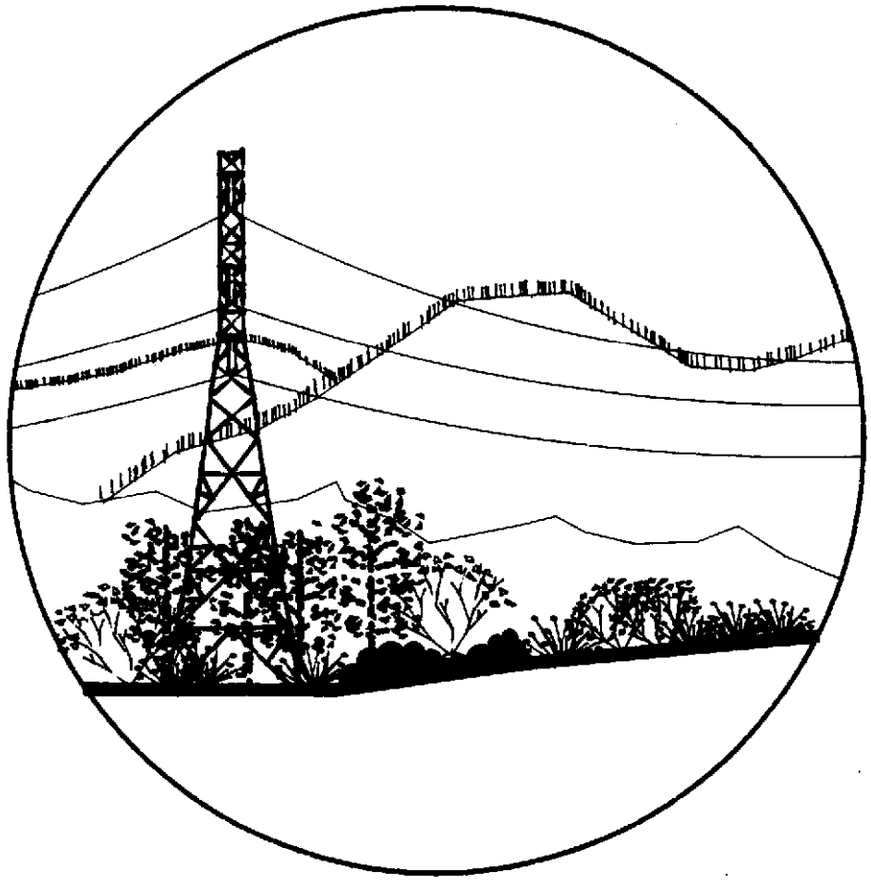
PROJECT MANAGER
MARY BOLDT



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PROJECT MANAGER
DIANA Z. DUKE

OCTOBER 1989

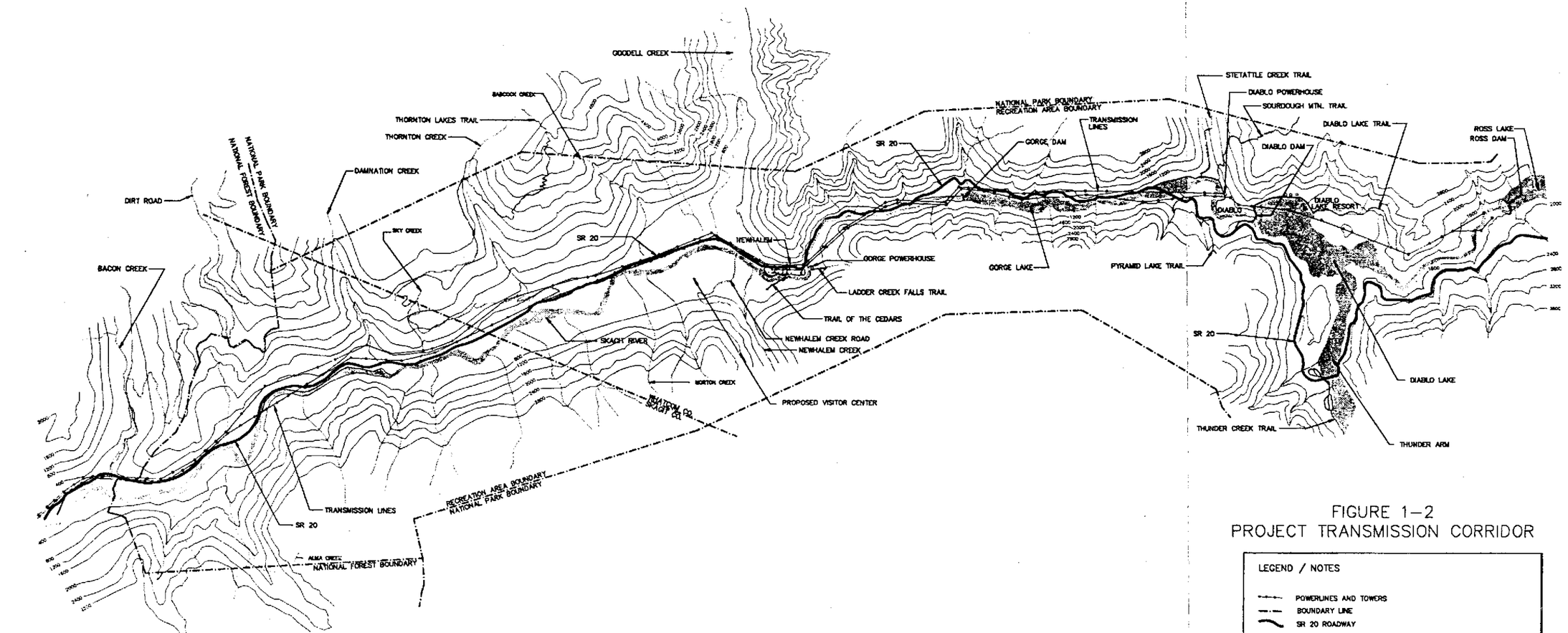


FIGURE 1–2
PROJECT TRANSMISSION CORRIDOR

LEGEND / NOTES

- POWERLINES AND TOWERS
- BOUNDARY LINE
- SR 20 ROADWAY
- SECONDARY ROADWAY
- DIRT ROAD
- CONTOUR LINE
- CREEKS
- TRAILS

INFORMATION SOURCES:
U.S.G.S. 7.5 MINUTE MAP, ROSS DAM QUADRANGLE
U.S.G.S. 7.5 MINUTE MAP, DIABLO DAM QUADRANGLE
U.S.G.S. 15 MINUTE MAP, MARBLEMOUNT QUADRANGLE
GREEN TRAILS 15 MINUTE SERIES MAPS #47 AND #48
SEATTLE CITY LIGHT 1953 PLAN AND PROFILE SECTIONS
AERIAL PHOTOGRAPHS AS FURNISHED BY SEATTLE CITY LIGHT

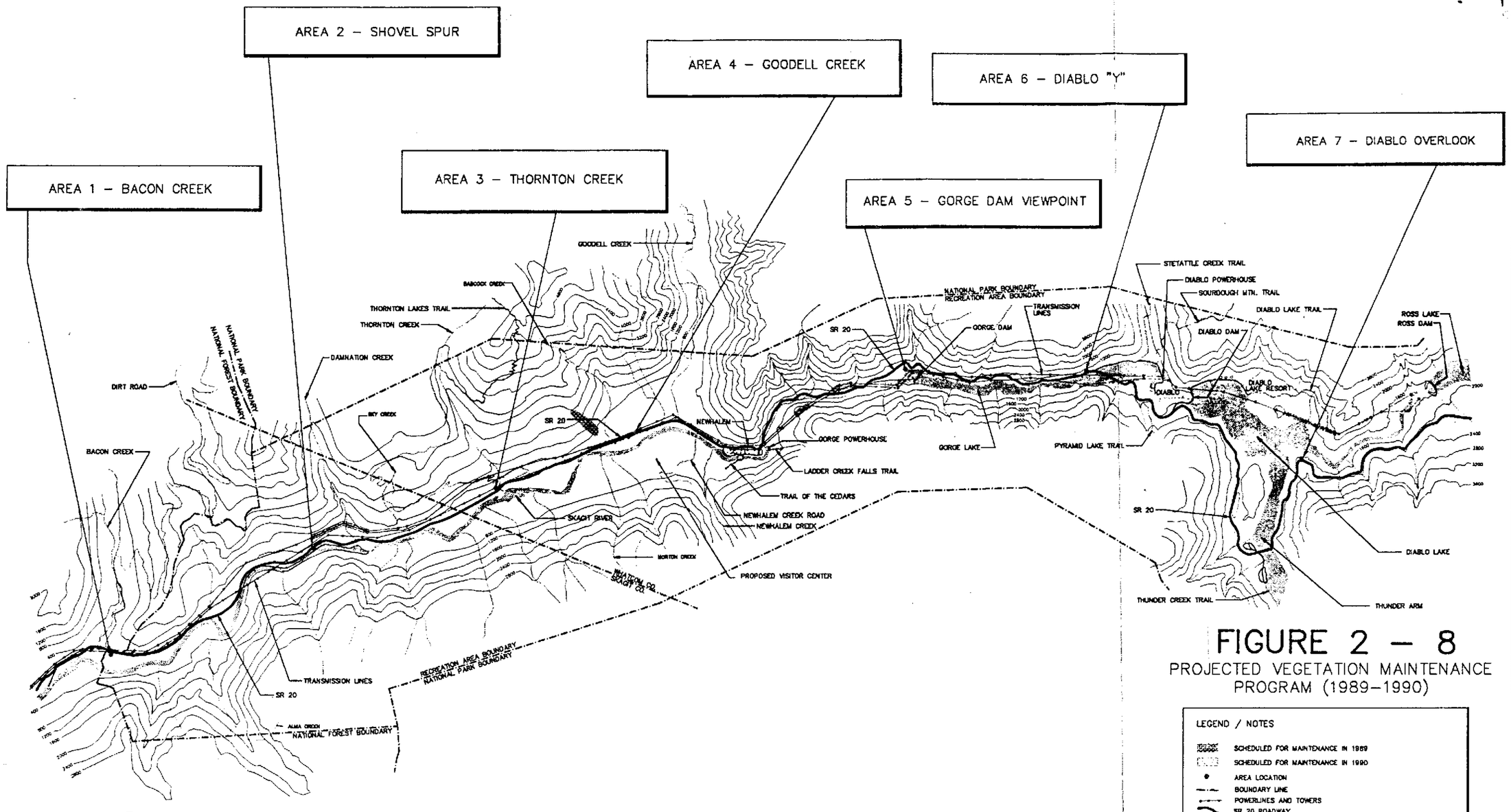
NORTH

0 7000 14000
SCALE

TRANSMISSION CORRIDOR
ROSS LAKE RECREATION AREA
BASE MAP

SEATTLE CITY LIGHT

DON SHIMONO ASSOCIATES
375 118TH AVE. SE SUITE 100
BELLEVUE WA 98005
(206) 454–1500



TRANSMISSION CORRIDOR
ROSS LAKE RECREATION AREA
BASE MAP

SEATTLE CITY LIGHT
DON SHIMONO ASSOCIATES
375 118TH AVE. SE SUITE 100
BELLEVUE WA 98005
(206) 454-1500

FIGURE 2 – 8

PROJECTED VEGETATION MAINTENANCE
PROGRAM (1989–1990)

LEGEND / NOTES

- SCHEDULED FOR MAINTENANCE IN 1989
- SCHEDULED FOR MAINTENANCE IN 1990
- AREA LOCATION
- BOUNDARY LINE
- POWERLINES AND TOWERS
- SR 20 ROADWAY
- SECONDARY ROADWAY
- DIRT ROAD
- CONTOUR LINE
- CREEKS
- TRAILS

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BASE NO. 2-26

FINAL REPORT

TRANSMISSION RIGHTS-OF-WAY VEGETATION MANAGEMENT PLAN

AESTHETIC IMPACT EVALUATION

Prepared For

SEATTLE CITY LIGHT

PROJECT MONITOR
MARY BOLDT

Prepared By

COMPLIANCE SERVICES INTERNATIONAL
DAMES & MOORE, INC. and DON SHIMONO ASSOCIATES

PROJECT MANAGER
DIANA Z. DUKE

September, 1989

EXECUTIVE SUMMARY

In December of 1983, Seattle City Light (SCL) adopted policy and procedures for maintenance of the utility's transmission rights-of-way (ROW). Policy objectives highlight a concern for continual worker safety and uninterrupted transmission of power along the network system. The proper management of vegetation within and bordering the ROW corridors is, therefore, of primary importance. With regard to vegetation management, SCL policy supported the aggressive investigation, evaluation and, where feasible, implementation of an integrated vegetation management approach along ROW corridors.

In response to its own departmental goals and with a sensitivity to the multiple-uses inherent with the administration of the public lands within the Ross Lake National Recreation Area (NRA), SCL contracted a study to evaluate opportunities to enhance their Integrated Vegetation Management Program along the 20-mile segment of the Skagit line that transects the NRA. Vegetation management issues that are correlated with herbicide use, aesthetic impacts, and identification of threatened, endangered and sensitive plant species were targeted for evaluation.

The North Cascades Highway (SR20) is the primary transportation corridor that provides access to the numerous locations suitable for scenic viewing and recreation offered by the NRA. The Skagit Hydroelectric Power Project's 240 kV transmission system alignment runs parallel to much of this highway within the NRA. An inventory was conducted of the Skagit transmission towers, lines and ROW corridor visibility from the North Cascades Highway. Site reconnaissance and consultation with SCL personnel resulted in the identification of seven areas (Aesthetic Target Areas) in the project area that were recommended for visual impact reduction. The Aesthetic Target Areas are located along SR20 and within the Ross Lake National Recreation Area between Bacon Creek and Ross Dam. A range of vegetative management scenarios to mitigate the visual impacts of the seven Aesthetic Target Areas are proposed in the form of Vegetation Mitigation Management Prescriptions.

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PROJECT INTRODUCTION

PROJECT INTRODUCTION

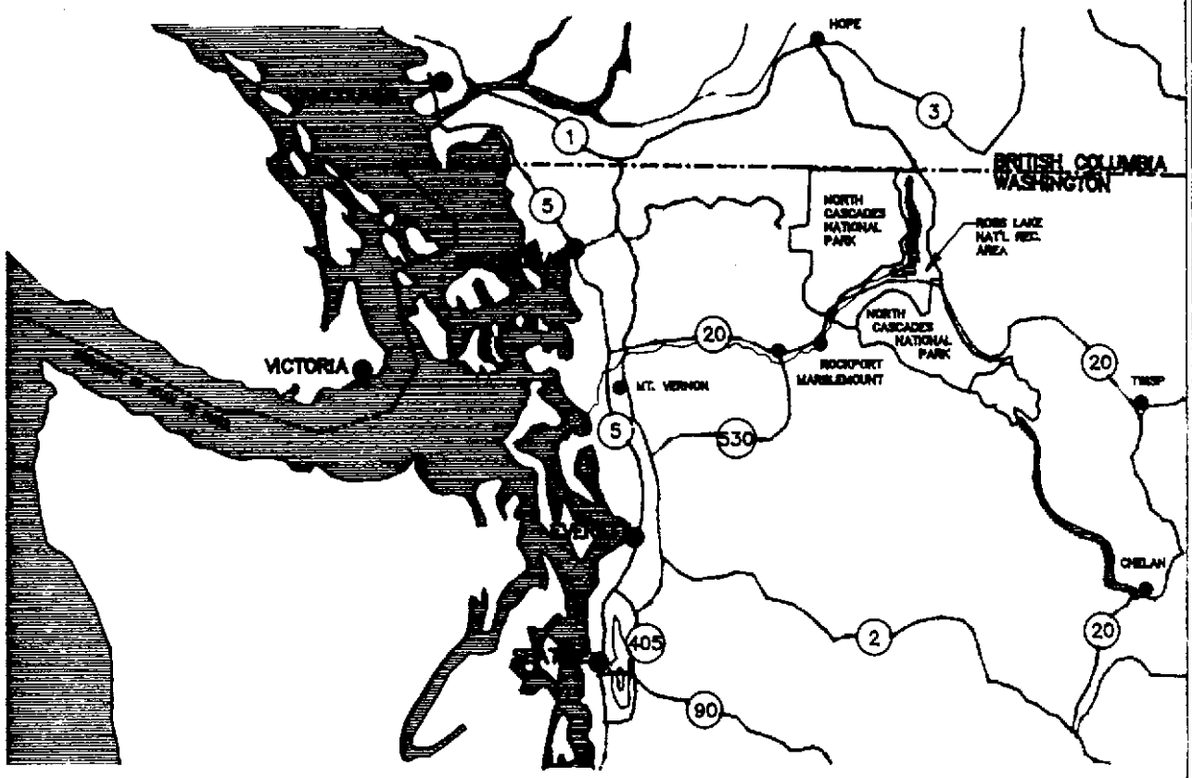
PROJECT STUDY AREA

The Ross Lake National Recreation Area (NRA) is one of three major and contiguous national park units that comprise the North Cascades National Park Service Complex, an area which is noted for its natural scenic beauty and multitude of recreational attractions. The NRA divides the neighboring North Cascades National Park into its north and south units. Lake Chelan National Recreation Area is the third national park of the complex. It is located at the southern boundary of the North Cascades National Park - South Unit. The configuration of the NRA follows the Skagit River drainage from the north at the Canadian/United States border southward and then continues in a general southwest direction. Lands within the Ross Lake National Recreation Area are administered by the National Park Service (NPS).

The project study area (Figure 1-1, Project Vicinity Map) is defined as the Seattle City Light (SCL) Skagit transmission line rights-of-way (ROW) corridors located in the NRA. The eastern boundary of the project study area is located at Ross Dam (approximately 1,200 ft above mean sea level). The western boundary of the NRA is located at the confluence of the Bacon Creek tributary to the Skagit River (approximately 800 ft above mean sea level). The north and south boundaries of the project study area correspond with the ROW boundaries.

Of the 190 miles of ROW developed and maintained by SCL in northwestern Washington, approximately 20 linear miles of the utility's Skagit line transects the NRA. Figure 1-2, Project Transmission Line, overlays the 240 kV Skagit transmission line alignment on a project area base map. As depicted by this figure, the transmission corridor generally parallels both the North Cascades Highway and the Skagit River corridor. The Skagit transmission system consists of two lines. The line designated as the B line is situated to the north of and runs a parallel course to the southern D line. As shown in Figure 1-2, on a number of occasions, segments of the parallel lines split and temporarily run separate courses. The ROW width varies from 75 ft for wood-pole lines to 150 ft for each of the two steel lattice tower lines B and D.

The North Cascades Highway (SR20) was built to provide access to the three Seattle City Light hydroelectric power generation facilities located on the Skagit River. It presently provides one of the more popular scenic transportation routes across the Cascade Mountains.



SEATTLE CITY LIGHT
TRANSMISSION RIGHT-OF-WAY VEGETATION MANAGEMENT PLAN

FIGURE 1-1
PROJECT VICINITY MAP

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AESTHETIC IMPACT EVALUATION

AESTHETIC IMPACT EVALUATION

INTRODUCTION

SCL Departmental Policy and Procedure (DPP) goals for the maintenance of the utility's transmission rights-of-way were adopted in 1983 (DPP 500 P I-506). The policy goals included the development of an integrated vegetation management approach that would be reviewed annually and used as a guide by SCL to maintain the integrity of the utility's transmission network system and associated ROW. This policy further states objectives to maintain the ROW in cooperation with governmental agencies having jurisdiction over neighboring lands and to encourage multiple uses of the ROW for public benefit, as long as those uses do not compromise the maintenance or repair of the line.

More recent attention to multiple-use issues which affect portions of SCL's transmission and ROW network occurred with the passage of the Washington Park Wilderness Act of 1988 (Public Law 100-668) and with SCL's submittal of a relicensing application to the Federal Energy Regulatory Commission (FERC) for the Skagit Hydroelectric Power Generation Project (Project No. 553-005-Washington).

The Washington Park Wilderness Act designated wilderness area within the North Cascades National Park Complex as well as within two other national parks in the state of Washington. A 20-mile segment of the SCL Skagit transmission line and ROW corridor traverses public lands within the NRA. These public lands are administered by the NPS. The manner in which the ROW vegetation is maintained along this segment of the corridor is of interest to the NPS, as they are responsible for the management of NRA lands in accordance with the objectives of the aforementioned wilderness act. With specific reference to the NRA, the Washington Park Wilderness Act allows the removal and disposal of trees within power line rights-of-way as is necessary to protect transmission lines, towers and equipment, provided that, to the extent possible, such activity is required to be conducted in a manner to protect scenic viewsheds.

Following review of Seattle City Light's relicensing application, FERC requested additional information concerning aesthetic impacts of the Skagit Project. In a letter to SCL concerning a review of the relicensing application (October 31, 1988), FERC noted both the high scenic quality and recreational use of the NRA/Skagit Project lands and the public's heightened awareness of the altered natural landscapes, as well as their increasing concern for visual quality. As a result, FERC is requesting a more detailed analysis of the aesthetic impact issue.

In response to these developments, SCL has conducted an aesthetic impact evaluation of the 20-mile 240 kV Skagit transmission line and ROW located in the Ross Lake National Recreation Area. This evaluation has been conducted in tandem with and supplements the comprehensive aesthetic impact evaluation of all of the Skagit Hydroelectric Power Project transmission structures that has been prepared under a separate contract.

The scope of this task is to:

- conduct an evaluation of the visibility of the transmission structure and ROW from the North Cascades Highway (SR20) within the NRA and identify areas that should be targeted for visual impact reduction (Aesthetic Target Areas);
- document the extent of visibility, character and magnitude of visual impact for the Aesthetic Target Area ROW segments; and
- evaluate and recommend viable vegetative management techniques (mitigation prescriptions) for minimizing the visual impacts of the transmission structures and corridor.

The results of this evaluation will be reviewed by SCL, after which, SCL will decide which of the recommended mitigation prescriptions will be incorporated in the utility's Integrated Vegetation Management Program for the Skagit transmission line and ROW corridor that is located between the Sauk River crossing and the line's northern terminus at Ross Dam.

EVALUATION APPROACH

Data Collection and Review

Initial activities focused on a review of the available data concerning the project segment of the Skagit transmission corridor. Data sources include:

- Seattle City Light Departmental Policy and Procedure for transmission ROW maintenance (DPP 500- P I-506),
- supplemental information requests from FERC (FERC 1988) and the Washington Park Wilderness Act of 1988 (Public Law 100-668),
- prior data inventories (Envirosphere 1985) conducted as part of City Light's Vegetation Management Program,
- maps, aerial photographs, aerial video documentation, and plan and profile engineering design and detail drawings for the project transmission ROW (refer to References).

Seattle City Light and Interagency Consultation

Operational and Safety Constraints -

SCL staff responsible for vegetation maintenance along the project ROW were consulted to obtain a familiarity with the vegetation management techniques that are currently being implemented to guard visual resources of the neighboring lands. Additional information was obtained concerning SCL's operational and safety constraints that are integral to the successful and uninterrupted distribution of power via the Skagit line.

One of the key objectives is to manage the vegetation in the ROW corridor to prevent vegetation from contacting the power lines, thus preventing transmission failure, fire hazards and potential safety hazards to SCL maintenance personnel. Additionally, unimpaired access is important for quick response to repair transmission failure or control the spread of fires. Other aspects that affect worker safety and the transmission system's integrity include line sag and sway, tree size and age, and soil type, slope and stability. Costs associated with an inability to quickly respond to such adverse scenarios are substantial (Newby 1989). Consequently, it is necessary for SCL maintenance crews to

routinely manage vegetation to control height and clear vegetation within and along the ROW margins. The proximity of vegetation to overhead power lines is dictated, in part, by the Washington General Safety and Health Standards, WAC 296-24-960 and Safety Standards for Electrical Construction Code (WAC 296-44-21230) presented in the Appendix.

Interagency Consultation -

Early in the project's development an agency consultation meeting was held with the NPS, SCL and the consulting contractor project staff. The meeting provided an opportunity to review NPS issues of concern regarding the management of the public lands adjacent to the transmission ROW. The objectives and approach to determining the key aesthetic impacts of the transmission line corridor to viewers enroute along SR20 and the development of mitigation recommendations was presented. No issues, in addition to those targeted by the objectives of this contract subtask, were presented by the NPS.

Additional presentation of this contract workscope was made to members of the Forest Service (FS), the North Cascades Conservation Council (NCCC), and the consulting team contracted to prepare supplemental documentation to support FERC's relicense of the Skagit Hydroelectric Power Project.

Visual Impact Determination

In addition to a review of the database of materials made available from SCL, a site reconnaissance of the project area was conducted. The entire length of SR20 in the project study area was traveled to identify areas where the transmission line towers and ROW had a high level of visibility to travelers along the highway. A number of areas which had a history of concern were pointed out by SCL staff. Additional areas of concern were included as a result of the survey of the project study area.

AESTHETIC TARGET AREAS (ATA)

Reconnaissance of the project study area and consultation with key SCL personnel resulted in the identification of seven areas (Aesthetic Target Areas) that are recommended for visual impact reduction.

The selection of ATAs was based upon the visibility of the transmission line features and its likely adverse impact to viewers traveling SR20. Elements of consideration include:

1) Viewer Exposure - the visibility of the transmission corridor to travelers enroute or located at key viewpoint locations along SR20. The significance of the viewer's exposure is affected by:

   - the viewing distance zones (i.e. views of the project features experienced from foreground, middleground and background distances [USDA 1974]),
   - the duration of the viewing activity (affected by whether views are experienced while moving or stationary),
   - the portion of the transmission line features and ROW exposed to viewers at key viewpoint locations (i.e. lines, towers, ROW cleared vegetation), and
   - the visual magnitude or the extent of the visibility of the transmission features and ROW corridor.

2) Viewer Sensitivity - based upon the numbers of viewers, the visual characteristics of the natural environment, and the viewer's probable expectations.

3) Visual Compatibility - the varying level of contrast of the visual characteristics (i.e. form, line, color, texture) of the transmission features and corridor with those of the surrounding natural landscape elements.

Figure 2-1 locates the seven areas on the project base map. Following an upstream progression from the western project boundary near Bacon Creek, the Aesthetic Target Areas named in the figure are:

1) Bacon Creek
2) Shovel Spur
3) Thornton Creek
4) Goodell Creek
5) Gorge Dam Viewpoint
6) Diablo "Y"
7) Diablo Overlook

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The ATAs are somewhat evenly distributed along the highway between the Bacon Creek tributary and the eastern end of the project study area at Ross Dam. At each of the areas a location was selected for stationary viewing. Stationary viewing activities increase the significance of the visual impact experience due to the extended period of time over which the viewer is exposed. Consequently, the associated evaluation of impact represents a worst-case scenario. As much as possible, the viewing site was selected based upon a location which was reasonably safe and likely to attract a recreationist to pull off the highway to rest or to participate in some level of recreational activity (i.e. hiking, fishing, temporary rest/picnicking, scenic viewing). Boundaries of the ATAs correspond to the farthest steel lattice transmission towers that are visible in either direction along the transmission ROW corridor from the stationary viewpoint . Views of the transmission corridor, when traveling east and westbound along SR20 through each of the ATAs, were recorded.

The degree to which viewers are impacted by the visibility of the transmission towers, lines and cleared ROW is highly variable among the seven ATAs. Table 2-1, Aesthetic Target Area Visual Impact Determination presents the aesthetic impact parameters (i.e. viewer exposure, viewer sensitivity) which were evaluated to determine the significance of the visual impacts of the transmission corridor from each of the ATA sites. Aesthetic impact evaluation tasks undertaken to support the FERC supplemental information request discuss, in detail, numbers of recreationists/viewers that experience the visual resources of the project study area.

Based on the relative impact significance rating scores in Table 2-1, the ATAs were prioritized as follows:

1. Goodell Creek
2. Bacon Creek
3. Diablo Overlook
4. Thornton Creek
5. Gorge Dam Viewpoint

The Diablo "Y" and Shovel Spur sites both received the same significance rating of 25.

TABLE 2-1

SEATTLE CITY LIGHT T-LINE VEGETATION MANAGEMENT

AESTHETIC TARGET AREA VISUAL IMPACT DETERMINATION

AREA 1: BACON CREEK

VIEWSHED DESCRIPTION	VIEWER EXPOSURE			IMPACT SIGNIFICANCE	
	VISIBILITY	ANALYSIS RATING 1 - 3 (min - max)		SUBTOTAL	TOTAL
VIEWPOINT LOCATION	Visibility of T-line Features				
SR20;(M.P. 111)	* transmission towers	3			
Skagit River: R.M. 83.00	* T-lines	3			
	* ROW clearing	3			
			SUBTOTAL	9	
	Observer Position / Viewing Angle				
	* inferior (1)	1	Westward		
	* normal (2)	2	at Site looking		
	* superior (3)		eastward		
	* perpendicular (1)				
	* linear (2)	2			
			SUBTOTAL	5	
VIEWSHED CHARACTERISTICS	Viewing Distance Zone				
	* background (1)				
	* middleground (2)				
Transmission lines B & D cross SR20 west of Bacon Creek target area and again east of Bacon Creek Campground access road.	* foreground (3)	3			
			SUBTOTAL	3	17
Transmission lines, towers and cleared vegetation within ROW dominate views of and through the target area.	VIEWER SENSITIVITY				
	VIEWING POTENTIAL / DURATION	ANALYSIS RATING			
	Opportunity Type				
	* Primary travel route	3			
	* Informal turnout	2			
	* Formal campground site				
	Bacon Creek Campground (West of project boundary)	3			
			SUBTOTAL	8	
	Viewer Category				
	* Pleasure driver	1			
	* Recreationist				
	- picknicking/ temporary rest	3			
	- fishing	3			
	- informal hiking (no establ. trails)	2			
			SUBTOTAL	9	
	View Duration				
	* traveling (1)	1			
	* still viewing (2)	2			
	* extended viewing (3)				
			SUBTOTAL	9	26
			TOTAL		43

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TABLE 2-1
SEATTLE CITY LIGHT T-LINE VEGETATION MANAGEMENT
AESTHETIC TARGET AREA VISUAL IMPACT DETERMINATION

AREA 2: SHOVEL SPUR

VIEWSHED DESCRIPTION	VIEWER EXPOSURE VISIBILITY	ANALYSIS RATING 1 - 3 (min - max)	IMPACT SIGNIFICANCE SUBTOTAL	TOTAL
VIEWPOINT LOCATION	Visibility of T-line Features	D-line		
SR20;(M.P. 114.4) Skagit River: R.M. 87.75	* transmission towers	2		
	* T-lines	2		
	* ROW clearing	1		
		SUBTOTAL	5	
	Observer Position / Viewing Angle			
	* inferior (1)	1		
VIEWSHED CHARACTERISTICS	* normal (2)			
	* superior (3)			
	* perpendicular (1)	1		
	* linear (2)		2	
The transmission ROW parallels SR20 to the north. Line D is adjacent to the highway and line B is situated up slope and above the highway along a steep embankment.	Viewing Distance Zone			
	* background (1)	1		
	* middleground (2)			
	* foreground (3)			
		SUBTOTAL	1	8
	VIEWER SENSITIVITY			
	VIEWING POTENTIAL / DURATION	ANALYSIS RATING		
	Opportunity Type			
	* Primary travel route	3		
	* Informal turnout	2		
		SUBTOTAL	5	
	Viewer Category			
	* Pleasure driver	1		
	* Recreationist			
	- picknicking/ temporary rest	3		
	- fishing	3		
	- informal hiking (no establ. trails)	2		
		SUBTOTAL	9	
	View Duration			
	* traveling (1)	1		
	* still viewing (2)	2		
	* extended viewing (3)			
		SUBTOTAL	3	17
		TOTAL		25

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TABLE 2-1
SEATTLE CITY LIGHT T-LINE VEGETATION MANAGEMENT
AESTHETIC TARGET AREA VISUAL IMPACT DETERMINATION

AREA 3: THORNTON CREEK

VIEWSHED DESCRIPTION	VIEWER EXPOSURE: VISIBILITY — ANALYSIS RATING 1 - 3 (min - max)		IMPACT SIGNIFICANCE: SUBTOTAL	TOTAL
VIEWPOINT LOCATION	Visibility of T-line Features			
SR20;(M.P. 117) Skagit River: R.M. 90	* transmission towers	3		
	* T-lines	3		
	* ROW clearing	3		
		SUBTOTAL	9	
	Observer Position / Viewing Angle			
VIEWSHED CHARACTERISTICS	* inferior (1)			
	* normal (2)	2		
	* superior (3)			
Line D closely parallels SR20 to the north and Line B is situated above the highway along a steep bank north of Line D.	* perpendicular (1)			
	* linear (2)	2		
		SUBTOTAL	4	
	Viewing Distance Zone			
Line D, its towers and cleared ROW dominate views to the north side of the highway. Line B can be from a stationary and only slightly visible while traveling along the highway.	* background (1)			
	* middleground (2)			
	* foreground (3)	3		
		SUBTOTAL	3	16

VIEWER SENSITIVITY: VIEWING POTENTIAL / DURATION	ANALYSIS RATING			
Opportunity Type				
* Primary travel route	3			
* Informal turnout	2			
* Formal trail head access nearby		SUBTOTAL	5	
Viewer Category				
* Pleasure driver	1			
* Recreationist				
- picknicking/ temporary rest	3			
- fishing	3			
		SUBTOTAL	7	
View Duration				
* traveling (1)	1			
* still viewing (2)	2			
* extended viewing (3)	3			
		SUBTOTAL	6	18
		TOTAL		34

- sclmtrx4

TABLE 2-1
SEATTLE CITY LIGHT T-LINE VEGETATION MANAGEMENT
AESTHETIC TARGET AREA VISUAL IMPACT DETERMINATION

AREA 4: GOODELL CREEK

VIEWSHED DESCRIPTION	VIEWER EXPOSURE VISIBILITY	ANALYSIS RATING 1 - 3 (min - max)	IMPACT SIGNIFICANCE SUBTOTAL	TOTAL
VIEWPOINT LOCATION SR20;(M.P.120.2 Skagit River: R.M. 92.25	Visibility of T-line Features			
	* transmission towers	3		
	* T-lines	3		
	* ROW clearing	3		
		SUBTOTAL	9	
	Observer Position / Viewing Angle			
VIEWSHED CHARACTERISTICS	* inferior (1)			
	* normal (2)	2 eastward		
	* superior (3)			
The transmission lines are aligned along both sides of SR20, Line B to the north and Line D to the south of the highway.	* perpendicular (1)			
	* linear (2)	2		
		SUBTOTAL	4	
The transmission lines, towers and cleared ROW dominate views from the highway. For the entire length of the Goodell Creek Target area.	Viewing Distance Zone			
	* background (1)			
	* middleground (2)			
	* foreground (3)	3		
		SUBTOTAL	3	16
	VIEWER SENSITIVITY			
	VIEWING POTENTIAL / DURATION	ANALYSIS RATING		
Only tops of two or three towers of the T-Line are slightly visible at a distance from the proposed visitor's center site west of the Goodell campground.	Opportunity Type			
	* Primary travel route	3		
	* Informal turnout	2		
	* Formal campground site nearby Goodell Campground	3		
A microwave distribution line, along Trapper's peak ridge north of the highway would not be visible from the highway or visitor's center.	* Proposed NPS Visitor's center loc. on south side of river.	1		
		SUBTOTAL	8	
	Viewer Category			
	* Pleasure driver	1		
	* Recreationist			
	- picknicking/ temporary rest	3		
	- fishing	3		
	- informal hiking (no establ. trails)	2		
	* Formal scenic viewing activity	3		
		SUBTOTAL	12	

TABLE 2-1
SEATTLE CITY LIGHT T-LINE VEGETATION MANAGEMENT
AESTHETIC TARGET AREA VISUAL IMPACT DETERMINATION

AREA 4: GOODELL CREEK (Continued)

VIEWSHED DESCRIPTION	VIEWER EXPOSURE		IMPACT SIGNIFICANCE	
	VISIBILITY	ANALYSIS RATING 1 - 3 (min - max)	SUBTOTAL	TOTAL
	View Duration			
	* traveling extended viewing while traveling due to parallel alignment of T-lines and SR20.	2		
	* still viewing (2)	2		
	* extended viewing-still (3) from NPS Visitor's Center	3		
		SUBTOTAL	7	
		TOTAL		43

- sclmtrx 5

TABLE 2-1
SEATTLE CITY LIGHT T-LINE VEGETATION MANAGEMENT
AESTHETIC TARGET AREA VISUAL IMPACT DETERMINATION

AREA 5: GORGE DAM VIEWPOINT

VIEWSHED DESCRIPTION

VIEWPOINT LOCATION

SR20;(M.P. 123.
Skagit River: R.M. 96.5

VIEWSHED CHARACTERISTICS

The site is situated south of SR20 and overlooks Gorge Dam and its reservoir to the southeast. The surrounding area is dominated by rugged terrain and covered by dense evergreen forest vegetation.

The transmission lines are located between the viewpoint site and SR20 on the top of a ridge which separates the two. The T-Line crosses over the Skagit River west of the dam and is clearly visible from the viewpoint, as are the T-line towers along the north side of Gorge Lake.

VIEWER EXPOSURE		IMPACT SIGNIFICANCE	
VISIBILITY	ANALYSIS RATING 1 - 3 (min - max)	SUBTOTAL	TOTAL
Visibility of T-Line Feature			
* transmission towers	3		
* T-Lines	3		
* ROW clearing	3		
	SUBTOTAL	9	
Observer Position / Viewing Angle			
* inferior (1)	1		
* normal (2)			
* superior (3)			
* perpendicular (1)			
* linear (2)	2		
	SUBTOTAL	3	
Viewing Distance Zone			
* background (1)			
* middleground (2)	2		
* foreground (3)			
	SUBTOTAL	2	14

VIEWER SENSITIVITY			
VIEWING POTENTIAL / DURATION	ANALYSIS RATING		
Opportunity Type			
* Primary travel route	3		
* Formal turnout	3		
* Proposed formal scenic viewpoint	3		
	SUBTOTAL	9	
Viewer Category			
* Pleasure driver	1		
* Recreationist			
- picknicking/ temporary rest	3		
- boating			
- fishing			
	SUBTOTAL	4	
View Duration			
* traveling (1)			
* still viewing (2)	2		
* extending viewing (3)	3		
- future	SUBTOTAL	5	18
	TOTAL		32

sclmtrx6

TABLE 2-1

SEATTLE CITY LIGHT T-LINE VEGETATION MANAGEMENT

AESTHETIC TARGET AREA VISUAL IMPACT DETERMINATION

AREA 6: DIABLO "Y"

VIEWSHED DESCRIPTION

VIEWPOINT LOCATION

SR20;(M.P. ___)
Skagit River: R.M. 99.0

VIEWSHED CHARACTERISTICS

Line B crosses diagonally over the east end of Diablo Lake and continues up a ridge east of the lake. Line D crosses over Diablo Lake further west of Line B and parallels the lake along a steep rocky embankment. It later rejoins Line B at the east end of the lake.

The views of transmission lines of Line B are clearly visible from SR20. Views of Line D's lines and towers are minimized by the light colored backdrop of the rocky embankment. Where the two lines converge at the east end of Lake Diablo, distant views of the transmission lines, towers and cleared vegetation is exposed by the west-facing ridge.

VIEWER EXPOSURE			IMPACT SIGNIFICANCE	
VISIBILITY	ANALYSIS RATING 1 - 3 (min - max)		SUBTOTAL	TOTAL
Visibility of T-line Features	B-Line	D-Line	B / D	B / D
* transmission towers	3	2		
* T-lines	3	2		
* ROW clearing	3	1		
		SUBTOTAL	9 / 5	
Observer Position / Viewing Angle				
* inferior (1)	1		D-Line	
* normal (2)	2		B-Line at lake elevation	
* superior (3)				
* perpendicular (1)				
* linear (2)		SUBTOTAL	2 / 1	
Viewing Distance Zone	B-Line	D-Line		
* background (1)				
* middleground (2)		2		
* foreground (3)	3			
		SUBTOTAL	3 / 2	14 / 8

VIEWER SENSITIVITY			
	ANALYSIS RATING		
VIEWOpportunity Type			
* Primary travel route	3		
* Informal turnout	2		
	SUBTOTAL	5	
Viewer Category			
* Pleasure driver	1		
* Recreationist			
- picknicking/ temporary rest			
- boating			
- fishing	3		
- informal hiking (no establ. trails)			
	SUBTOTAL	4	
View Duration			
* traveling (1)			
* still viewing (2)	2		
* extended viewing (3)			
	SUBTOTAL	2	11
	TOTAL (B / D)		25 / 19

- sclmtrx7

TABLE 2-1

SEATTLE CITY LIGHT T-LINE VEGETATION MANAGEMENT

AESTHETIC TARGET AREA VISUAL IMPACT DETERMINATION

AREA 7: DIABLO OVERLOOK

VIEWSHED DESCRIPTION

VIEWPOINT LOCATION

SR20;(M.P. ___)
Skagit River: R.M. 102.75

VIEWSHED CHARACTERISTICS

A single transmission line crosses over the northern most tip of Lake Diablo traversing over steep heavily forested terrain.

Distant views of the T-Line towers are clearly visible where it crosses over Diablo Lake from the viewpoint situated above the lake and at the south side. A portion of cleared land is visible west of the lake where the terrain is exposed to the viewer. The heavy vegetation screens the remainder of the cleared areas, exposing only the tips of the towers and transmission lines which tend to be highlighted by the dark background provided by the evergreens.

VIEWER EXPOSURE			IMPACT SIGNIFICANCE	
VISIBILITY	ANALYSIS RATING 1 - 3 (min - max)		SUBTOTAL	TOTAL
Visibility of T-Line Features				
* transmission towers	3			
* T-lines	3			
* ROW clearing	2			
		SUBTOTAL	8	
Observer Position / Viewing Angle				
* inferior (1)				
* normal (2)				
* superior (3)	3			
* perpendicular (1)				
* linear (2)				
		SUBTOTAL	3	
Viewing Distance Zone				
* background (1)				
* middleground (2)	2			
* foreground (3)				
		SUBTOTAL	2	13
VIEWER SENSITIVITY				
VIEWING POTENTIAL / DURATION	ANALYSIS RATING			
Opportunity Type				
* Primary travel route	3			
* Formal scenic viewpoint Diablo Overlook	3			
		SUBTOTAL	6	
Viewer Category				
* Pleasure driver	1			
* Recreationist				
- picknicking/ temporary rest	3			
- boating/resort	3			
- fishing	3			
- hiking (Diablo Lake Trail)	3			
		SUBTOTAL	13	
View Duration				
* traveling (1)	1			
* still viewing (2)	2			
* extended viewing/ boating (3)	3			
		SUBTOTAL	6	19
		TOTAL		38

- sclmtrx8

DEVELOPMENT OF VISUAL IMPACT MITIGATION RECOMMENDATIONS

The objective of this task is to formulate from the visual impact analysis results management recommendations that can be integrated with other key issues of SCL's Vegetation Management Program. Accordingly, a range of Vegetation Mitigation Management Prescriptions have been developed that can be used to reduce the visual impact characteristics of each of the ATAs. Computer Aided Design (CAD) drawings (Figures 2-2 through 2-7) present a variety of mitigation management prescriptions and their anticipated results. These figures graphically show how visual impacts can be minimized as a result of each of the vegetation management prescriptions. Table 2-2 provides an interpretive key to the figure's plant symbols. The table shows a plant symbol and its correlated plant size and the vegetative species that typically have growth characteristics which correspond to the desired plant height shown.

The graphic figures illustrate a range of viable vegetation management techniques which can be standardized as vegetation mitigation prescriptions for visual impact reduction. The mitigation prescriptions are intended to be developed to an appropriate level of detail which will allow their application along the project ROW or along any of the other SCL rights-of-way as similar impact scenarios occur. The mitigation prescriptions can be applied individually or combined as necessary to address the varying impact circumstances as they arise.

For ease of review, Table 2-2 and Figures 2-2 through 2-7 are presented at the end of the following discussion of the goals and objectives of the mitigation prescriptions.

VEGETATION MITIGATION PRESCRIPTION GOALS AND OBJECTIVES

The mitigation prescriptions illustrated in Figures 2-2 through 2-7 demonstrate ways in which supplemental planting techniques and/or natural infill techniques within the transmission line ROW can effectively screen views of transmission lines, towers and cleared corridors from SR20 and designated viewpoints. Plantings outside the ROW are also utilized where views of transmission line corridors cannot be effectively and/or economically screened by managing vegetation within the ROW. Establishing vegetative screening close to the viewers allows a larger section of the transmission line corridor to be screened using the minimum amount of vegetation. In such cases, the further the transmission line is from the viewer, the greater the portion of the corridor is screened from the viewer.

Size and location of vegetation that is either planted or encouraged to grow within the transmission corridor is governed by the line sag and sway clearance requirements, from transmission lines (primary) and towers (secondary) of vegetation at mature size. The SCL standard for minimum clearance of the lines is 16 ft.

The feathering treatment of vegetation along the ROW margins will minimize the generally abrupt visual contrast in the color, line and texture of the ROW, which typically contains a minimal amount of vegetation, with that of the adjacent and more dense forest vegetation. Use of variable trees and shrub heights will give the appearance of a natural infill of vegetation within the ROW. Application of this mitigation technique, at key locations in the project study area, will minimize the visual impact of the transmission structures and corridor on the natural and scenic visual character of the NRA. This objective can also be accomplished by utilizing a mix of vegetation with variable fast and slow growth characteristics.

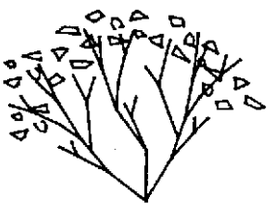
The use of vegetation under the transmission lines which encourages wildlife foraging by providing suitable food and protective cover is suggested where maintaining the maximum amount of line clearance is most critical. Foraging activities will help keep much of the vegetation growth in these areas to a minimum. As a result, the frequency of vegetative maintenance required to control tree heights that could interfere with the lines would be reduced. The need for such maintenance activities could potentially be reduced from an annual cycle to a 3-year maintenance cycle.

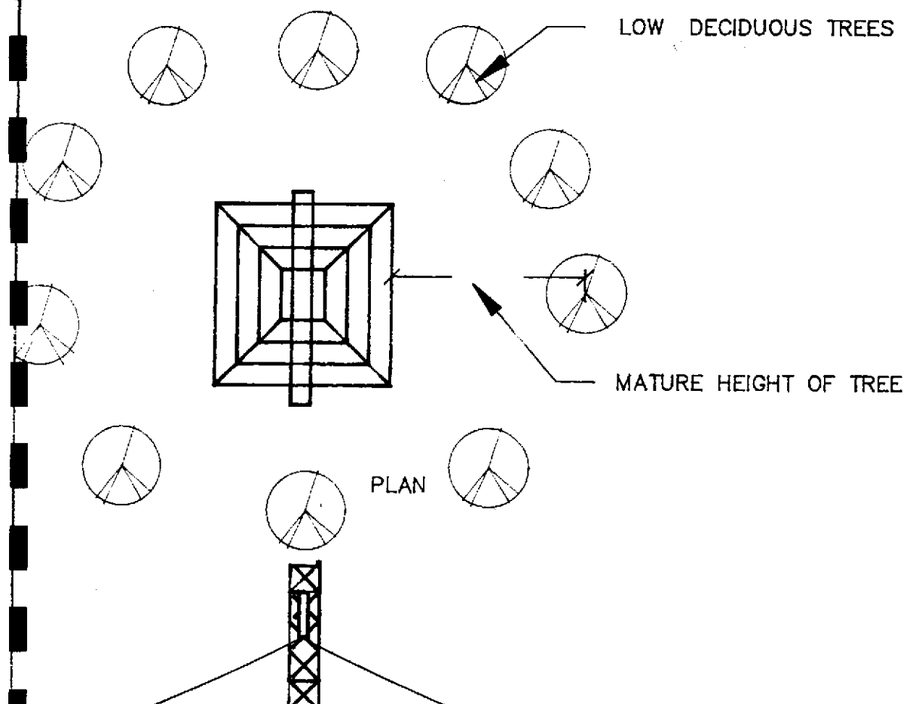
Effective pruning procedures to keep vegetation heights from endangering transmission lines will need to continue within the transmission ROW, utilizing the criteria established by the mitigation prescriptions as a general guide for pruning techniques. Pruning tolerances of the mitigation prescriptions allow for approximately a three-year growth period beyond the fall line clearance height for trees which could potentially damage transmission lines and towers. This allowance will minimize the frequency of maintenance required to control tree height.

The incorporation of the various vegetation management prescription techniques in SCL's Integrated Vegetation Management Program will potentially reduce the need for herbicide uses. Where vegetation establishment needs to be kept to a minimum, such as maintenance access routes and around the tower bases, herbicide uses can be evaluated.

TABLE 2 – 2

PLANTING KEY

SYMBOL	TYPE\SIZE	EXAMPLE
	**EVERGREEN TREES** TALL (OVER 60') MEDIUM (40'–60')	 DOUGLAS FIR LODGEPOLE PINE
	**DECIDUOUS TREES** TALL (OVER 60') MEDIUM (40'–60') LOW (25'–40')	 RED MAPLE BLACK COTTONWOOD VINE MAPLE
 	**WILDLIFE FORAGING SHRUBS** TALL (8'–15') MEDIUM (3'–8') LOW (1'–3')	 RED OSIER DOGWOOD RED ELDERBERRY SALAL



MITIGATION: PROVIDE A HEIRARCHY OF VEGETATION HEIGHTS UNDER THE TRANSMISSION LINES WHERE THEY ARE VISIBLE FROM SR 20. PLANT AND/OR ALLOW TO GROW TALLER VEGETATION AROUND THE TOWERS WHERE TRANSMISSION LINES HAVE THE GREATEST GROUND CLEARANCE. PLANT AND/OR ALLOW TO GROW VEGETATION THAT DECREASES PROGRESSIVELY IN HEIGHT TOWARDS THE CENTER WHERE TRANSMISSION LINE GROUND CLEARANCE IS AT ITS LOWEST POINT. UTILIZE WILDLIFE FORAGING VEGETATION WHERE TRANSMISSION LINE GROUND CLEARANCE IS MINIMAL.

RESULTS: VEGETATION PROVIDES PARTIAL SCREENING OF EXPOSED CORRIDOR, SOFTENS BOLD LINEAR FEATURES OF TOWER STRUCTURE, REDUCES VISUAL MAGNITUDE OF TRANSMISSION LINE FEATURES AND REDUCES CONTRAST OF CLEARED AREA WITH VEGETATION ALONG THE MARGINS OF THE CORRIDOR RIGHT OF WAY.

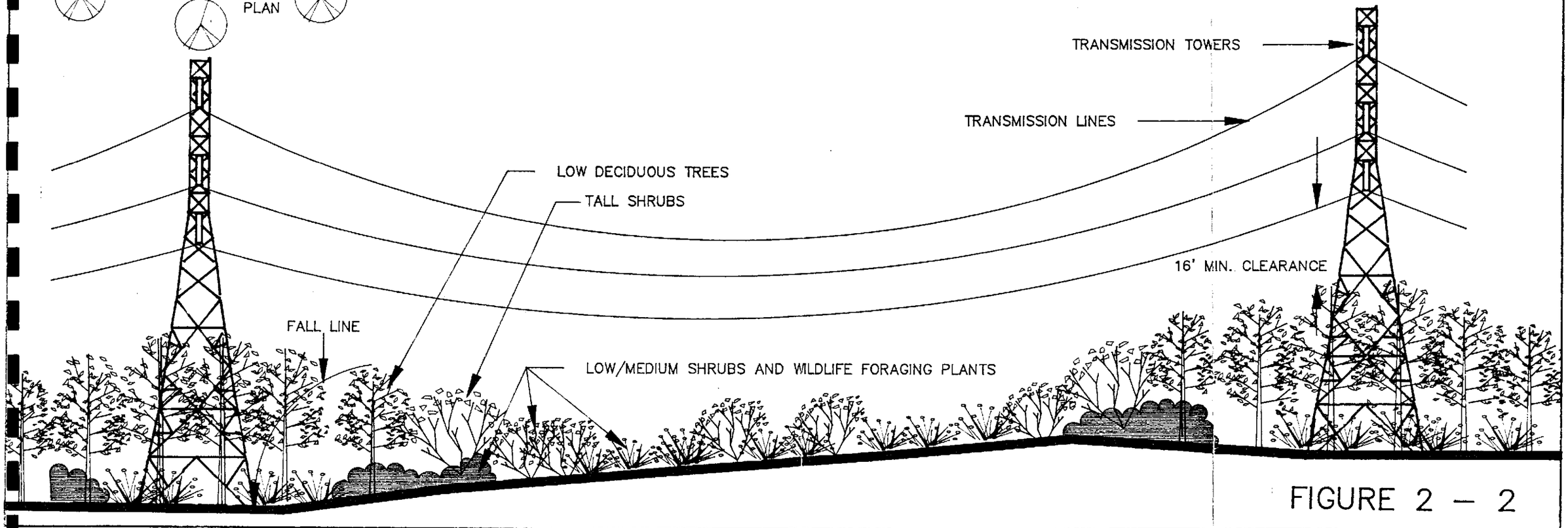
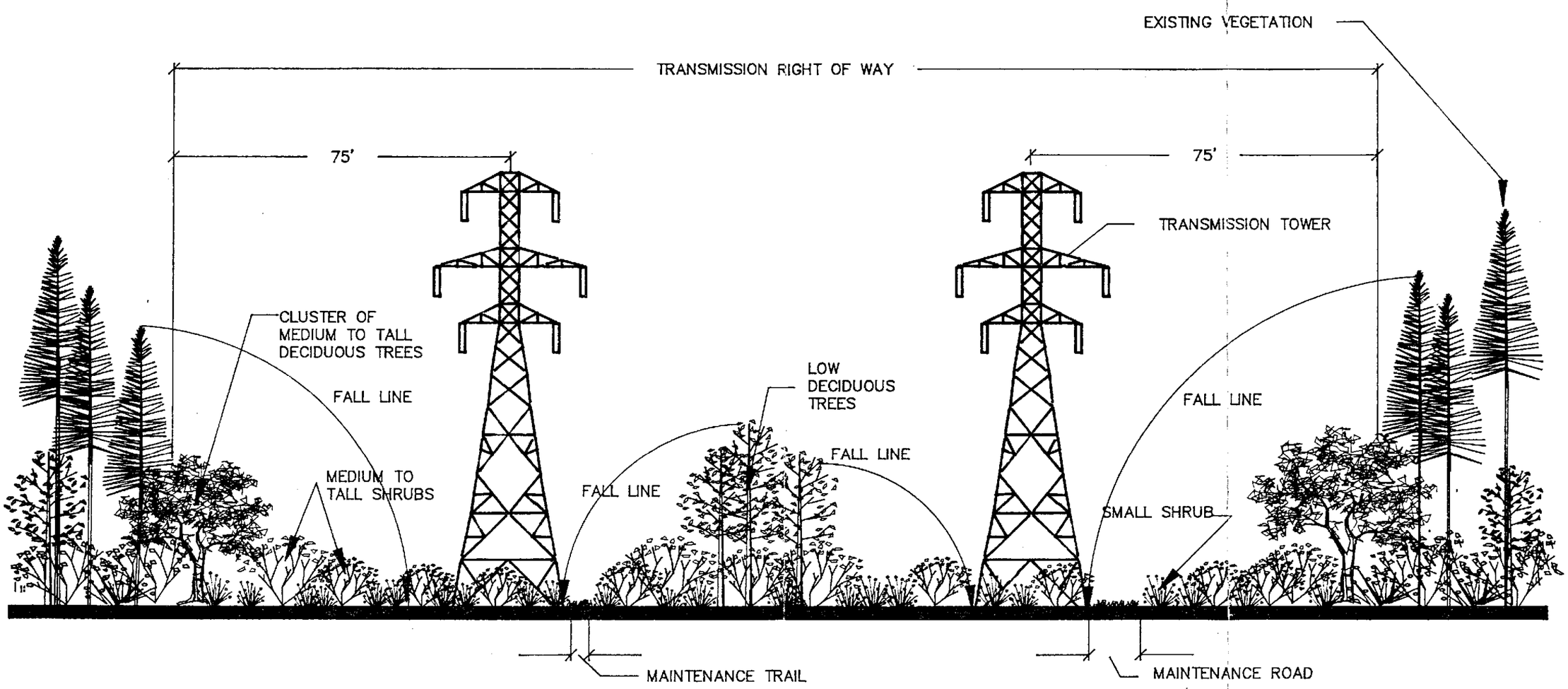


FIGURE 2 – 2

TRANSMISSION RIGHT OF WAY
VEGETATION MITIGATION PRESCRIPTION

TYPE–A
T–LINE CORRIDOR
PROFILE PLANTING



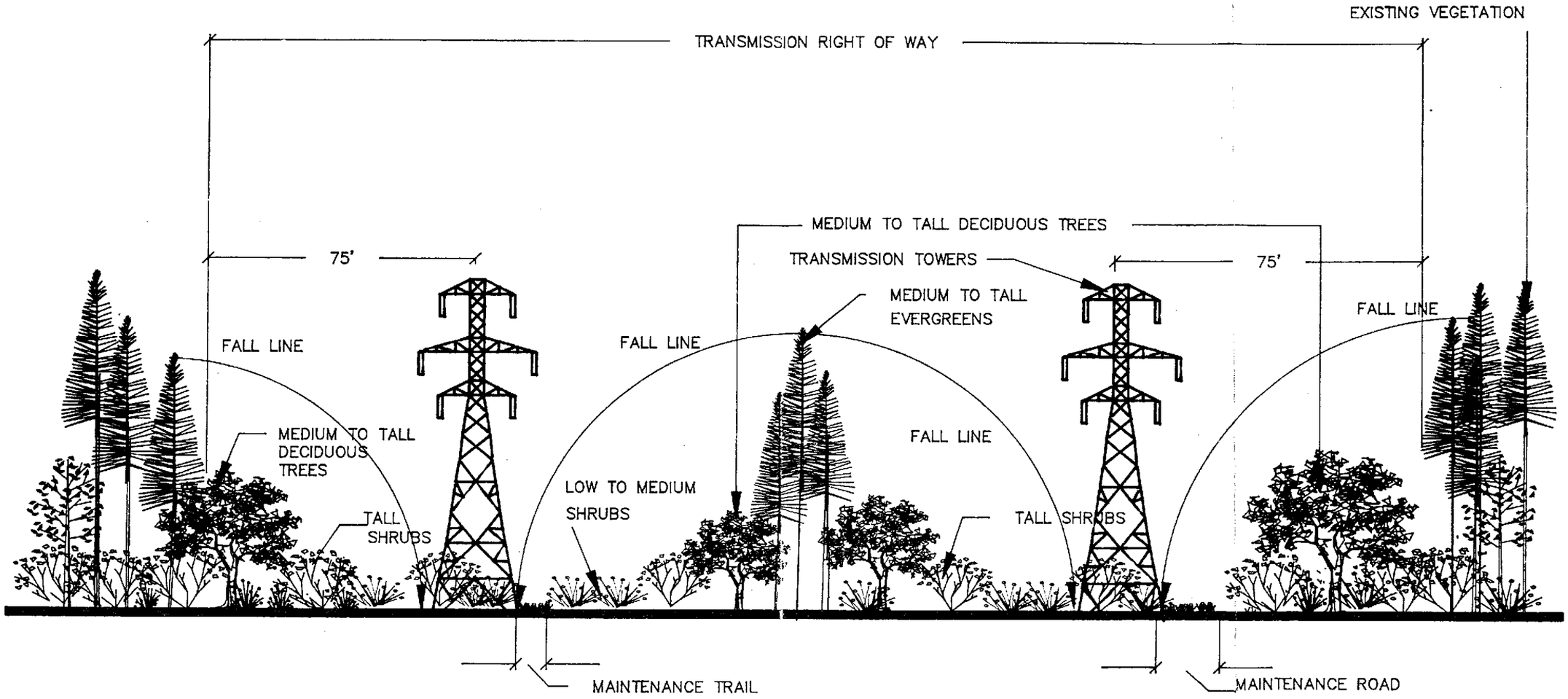
MITIGATION PLANT AND/OR ALLOW TO GROW VEGETATION ALONG THE MARGINS OF THE CORRIDOR RIGHT OF WAY WITH TALLER VEGETATION ALONG THE OUTER MOST EDGE, DECREASING PROGRESSIVELY IN HEIGHT UNDER THE TRANSMISSION LINES. CLUSTER PLANTINGS TO PROVIDE A MEANDERING EDGE TREATMENT ALONG THE SIDES OF THE CORRIDOR. UTILIZE WILDLIFE FORAGING VEGETATION UNDER THE TRANSMISSION LINES.

RESULTS: EDGES OF TRANSMISSION LINE CORRIDORS WILL FEATHER INTO THE CORRIDOR, ELIMINATING THE HARD EDGES AND THEREBY BECOMING LESS OBVIOUS TO VIEWERS.

FIGURE 2 – 3

TRANSMISSION RIGHT OF WAY VEGETATION MITIGATION PRESCRIPTION

TYPE–B CORRIDOR EDGE PLANTING



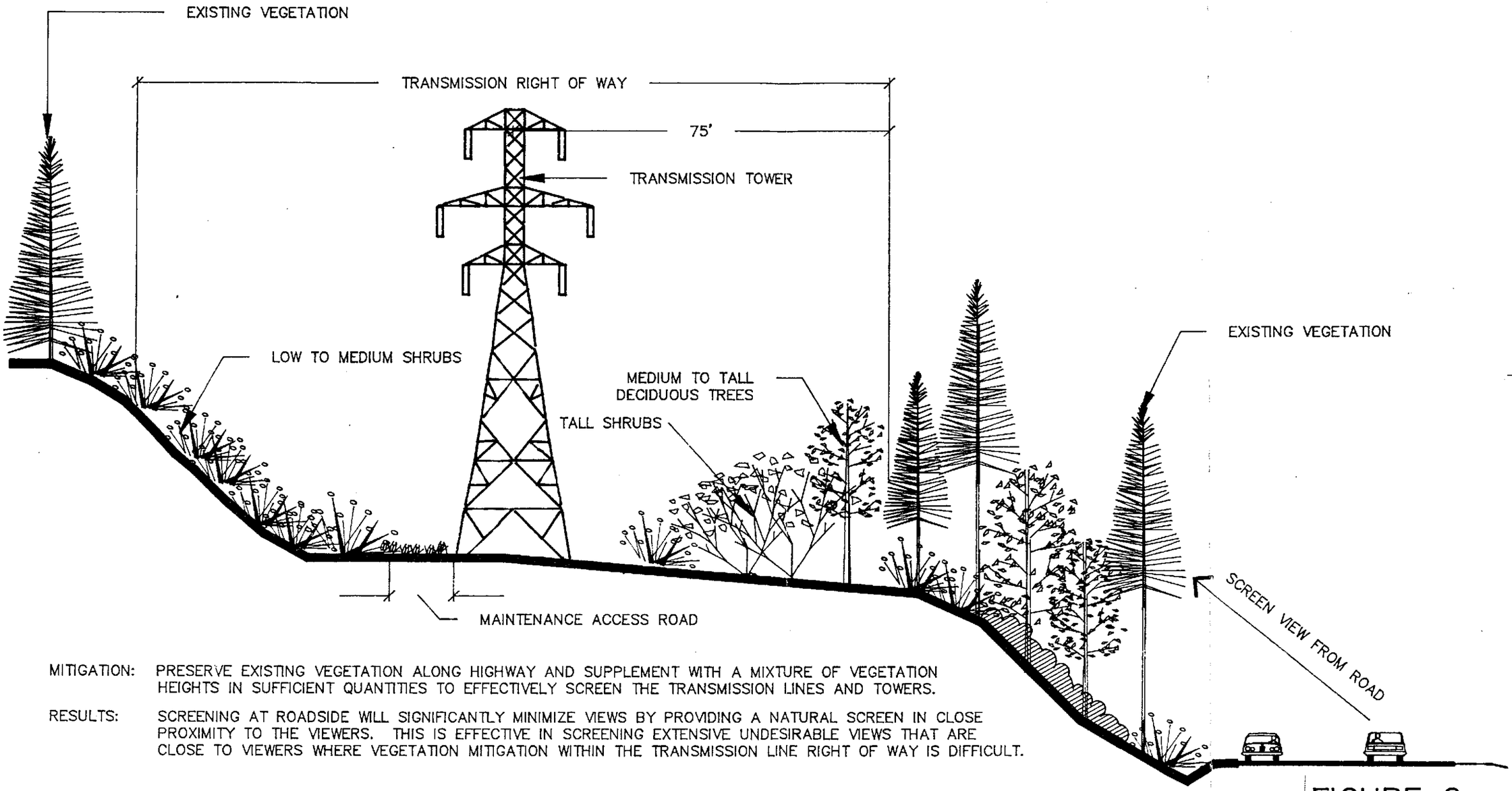
MITIGATION: EDGE TREATMENT IS THE SAME AS TYPE–B ALONG BOTH SIDES OF CORRIDOR. PLANT AND/OR ALLOW TO GROW AREAS BETWEEN TOWERS WITH THE TALL VEGETATION AT CENTER THAT DECREASES PROGRESSIVELY SMALLER TOWARDS THE TOWERS.

RESULTS: EXPOSURE OF THE WIDE CLEARED CORRIDOR WILL BE SIGNIFICANTLY REDUCED AS WELL AS MINIMIZING VIEWS OF THE TOWERS AND TRANSMISSION LINES.

FIGURE 2 – 4

TRANSMISSION RIGHT OF WAY VEGETATION MITIGATION PRESCRIPTION

TYPE–C WIDE CORRIDOR PLANTING



MITIGATION: PRESERVE EXISTING VEGETATION ALONG HIGHWAY AND SUPPLEMENT WITH A MIXTURE OF VEGETATION HEIGHTS IN SUFFICIENT QUANTITIES TO EFFECTIVELY SCREEN THE TRANSMISSION LINES AND TOWERS.

RESULTS: SCREENING AT ROADSIDE WILL SIGNIFICANTLY MINIMIZE VIEWS BY PROVIDING A NATURAL SCREEN IN CLOSE PROXIMITY TO THE VIEWERS. THIS IS EFFECTIVE IN SCREENING EXTENSIVE UNDESIRABLE VIEWS THAT ARE CLOSE TO VIEWERS WHERE VEGETATION MITIGATION WITHIN THE TRANSMISSION LINE RIGHT OF WAY IS DIFFICULT.

FIGURE 2 – 5

TRANSMISSION RIGHT OF WAY VEGETATION MITIGATION PRESCRIPTIONS

TYPE–D ROADSIDE PLANTING

MITIGATION: PLANT AND/OR ALLOW TO GROW DENSE PLANTINGS OF TALL SHRUBS PARALLEL TO SR 20 WHERE TRANSMISSION LINE RIGHT OF WAY CROSSES THE HIGHWAY. CONTINUE SHRUB PLANTING TO EXISTING VEGETATION ON EITHER SIDE OF THE TRANSMISSION LINE RIGHT OF WAY.

RESULTS: VIEWS OF THE TRANSMISSION LINE CORRIDOR AND TOWERS CAN BE EFFECTIVELY SCREENED FOR THOSE WHO ARE TRAVELING THROUGH THE RIGHT OF WAY ON SR 20 BY PLANTING DENSE VEGETATION ADJACENT TO SR 20.

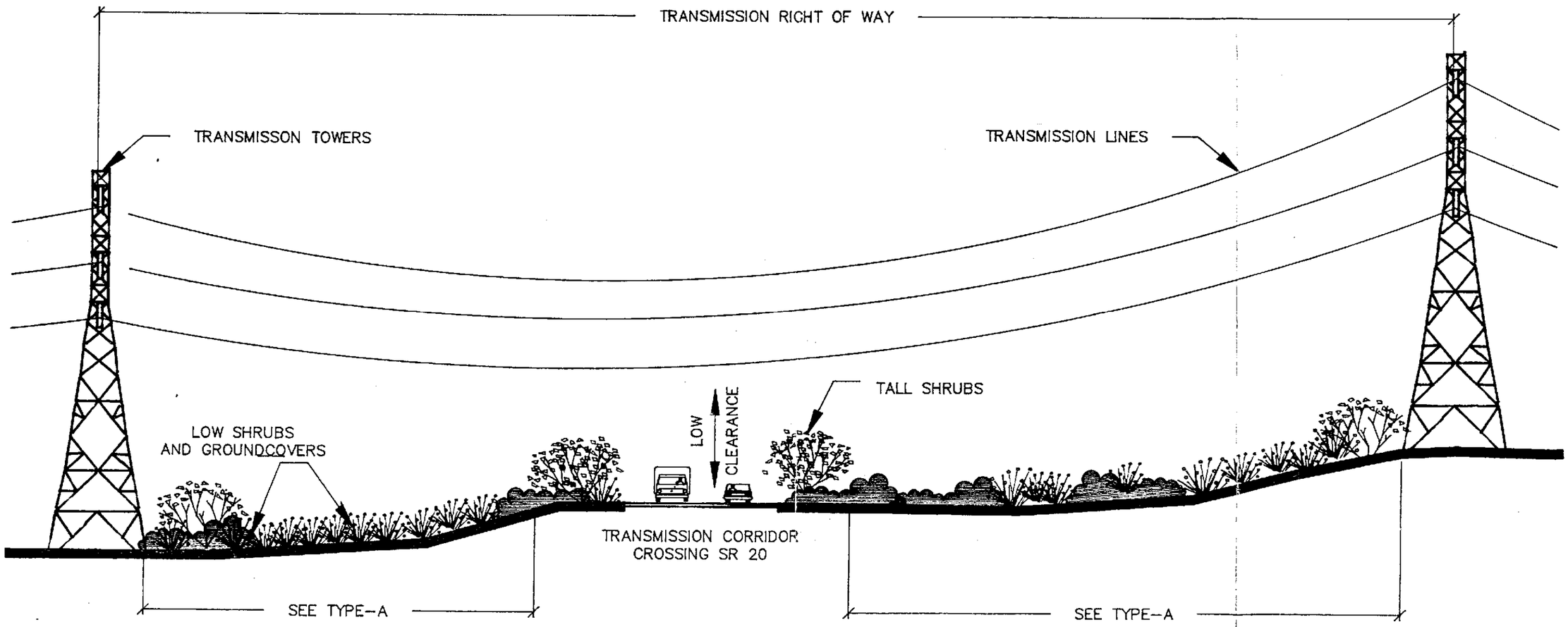
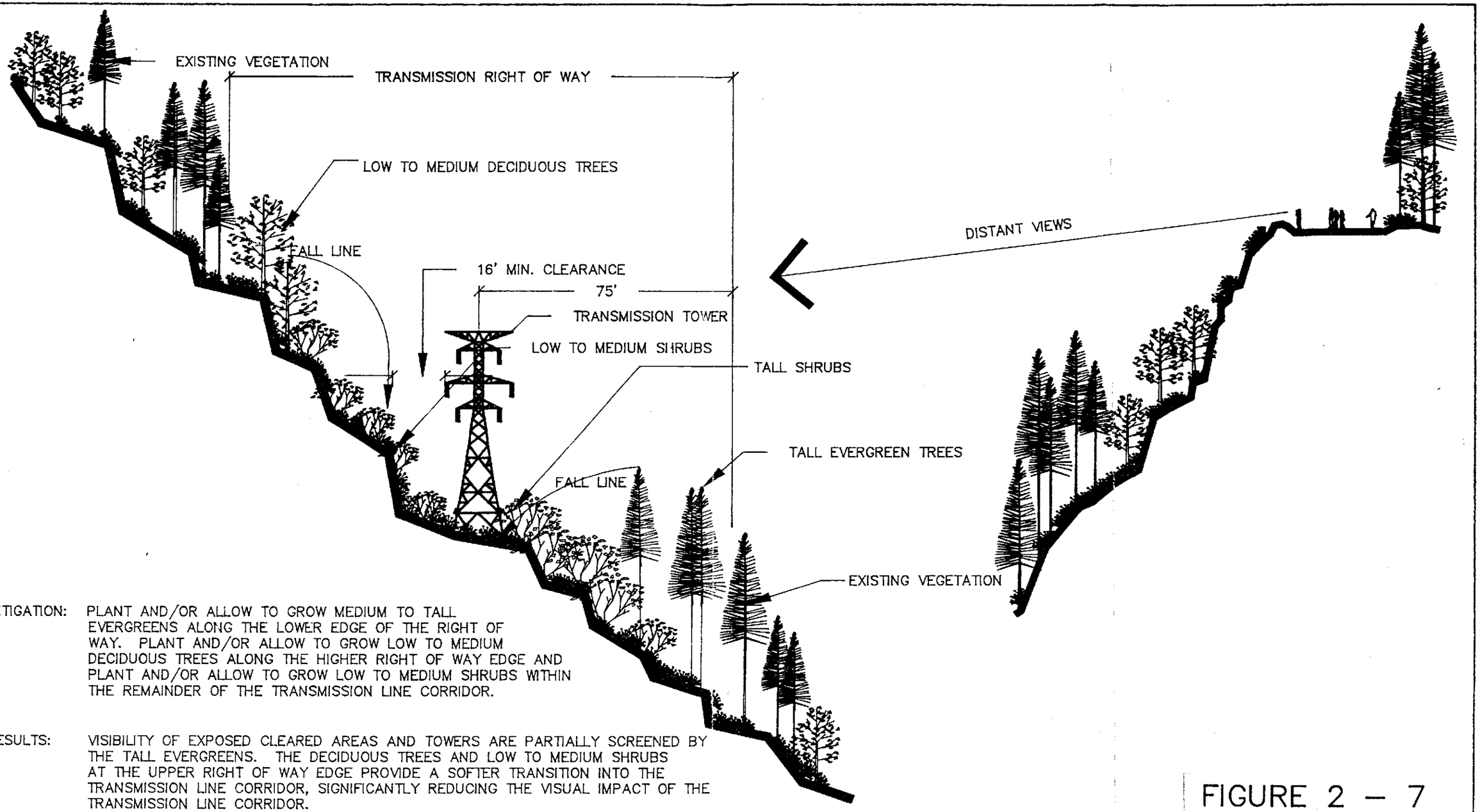


FIGURE 2 – 6

TRANSMISSION RIGHT OF WAY VEGETATION MITIGATION PRESCRIPTION

TYPE–E
T–LINE CROSSING
PLANTING



MITIGATION: PLANT AND/OR ALLOW TO GROW MEDIUM TO TALL EVERGREENS ALONG THE LOWER EDGE OF THE RIGHT OF WAY. PLANT AND/OR ALLOW TO GROW LOW TO MEDIUM DECIDUOUS TREES ALONG THE HIGHER RIGHT OF WAY EDGE AND PLANT AND/OR ALLOW TO GROW LOW TO MEDIUM SHRUBS WITHIN THE REMAINDER OF THE TRANSMISSION LINE CORRIDOR.

RESULTS: VISIBILITY OF EXPOSED CLEARED AREAS AND TOWERS ARE PARTIALLY SCREENED BY THE TALL EVERGREENS. THE DECIDUOUS TREES AND LOW TO MEDIUM SHRUBS AT THE UPPER RIGHT OF WAY EDGE PROVIDE A SOFTER TRANSITION INTO THE TRANSMISSION LINE CORRIDOR, SIGNIFICANTLY REDUCING THE VISUAL IMPACT OF THE TRANSMISSION LINE CORRIDOR.

FIGURE 2 – 7

TRANSMISSION RIGHT OF WAY VEGETATION MITIGATION PRESCRIPTIONS

TYPE – F PERPENDICULAR EXPOSED CORRIDOR PLANTING

PROGRAM IMPLEMENTATION BY SCL

The viability of implementing any or all of the recommended prescriptions will depend on additional consideration of issues concerning SCL's specific concerns, as discussed under Operational Safety Constraints, and the ability to establish native vegetative communities in the ROW. Consideration of the latter requires a more detailed and site-specific analysis of slope stability, soil type and other factors that influence the establishment of native vegetation species. Information concerning species of native vegetation associated with the project ROW was compiled in 1987. The plant species list, presented for ease of reference in the Appendix, lists plants inventoried along the Skagit ROW in the project study area as well as along all the SCL transmission network north of Seattle.

Of equal importance is the consideration of the SCL projected workload and maintenance forecasts which dictate the annual vegetation maintenance activity for the project study area ROW corridors. Figure 2-8 overlays the planned vegetation maintenance programs for the 1989 and 1990 season. Much of the work targeted for the 1989 season was complete by mid-summer (Stanchfield 1989).

Knowledge of planned future activity will enable SCL to evaluate the visual resource considerations of the area targeted for vegetation maintenance activity and assign a vegetation mitigation prescription to that area. The prescription would then serve as a goal for the transmission system's maintenance crew to meet. Decisions can then be reached in advance of any activity concerning the appropriateness of the mitigation prescription as well as a determination of any cost-benefit issues of concern.

Page no 2-26

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REFERENCES

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_____. 1953. 15-minute map series: Marblemount Quadrangle.

APPENDIX A

SEATTLE CITY LIGHT TRANSMISSION ROW PLANT SPECIES INVENTORY

Source: Envirosphere Company. 1985. Report to Seattle City Light Distribution Division for Inventory of Transmission Right-of-Way Vegetation

SEATTLE CITY LIGHT
TRANSMISSION ROW PLANT SPECIES LIST

Trees

Abies amabilis (Silver Fir)
Acer rubrum (Red Maple)
Acer glabrum (Rocky Mountain Maple)
Aesculus hippocastanum (Chestnut)
Acer macrophyllum (Big Leaf Maple)
Abies procera (Noble Fir)
Alnus rubra (Red Alder)
Arbutus menziesii (Madrona)
Betula papyrifera (Paper Birch)
Betula spp.
Fagus sylvatica (European Beech)
Fraxinus latifolia (Oregon Ash)
Gleditsia triacanthos (Honey Locust)
Liriodendron tulipifera (Yellow Poplar, Tulip Tree)
Populus alba (Silver [White] Poplar)
Prunus serotina (Black Cherry)
Prunus emarginata (Bitter Cherry)
Pinus contorta (Lodgepole Pine)
Pseudotsuga menziesii (Douglas Fir)
Populus nigra (Lombardi Poplar)
Prunus pennsilvanica (Wild Cherry)
Populus tremuloides (Quaking Aspen)
Pinus spp. (Pine)
Picea sitchensis (Sitka Spruce)
Populus trichocarpa (Black Cottonwood)
Pinus monticola (Western White Pine)
Picea spp. (Spruce)
Platanus spp. (Sycamore)
Quercus rubra (Red Oak)
Robinia pseudoacacia (Black Locust)
Sorbus aucuparia (European Mountain Ash)
Thuja plicata (Western Red Cedar)
Tsuga heterophylla (Western Hemlock)

Landscape conifer - short
Landscape conifer - tall
Landscape deciduous - tall
Landscape deciduous - short

Trees/Shrubs (depending on size)

Acer circinatum (Vine Maple)
Crataegus douglasii (Hawthorn)
Cornus nuttallii (Pacific Dogwood)
Ilex aquifolium (English Holly)
Sorbus aucuparia (European Mountain Ash)
Sambucus racemosa (Red Elderberry)
Salix spp. (Willow)

Shrubs

Amelanchier alnifolia (Service Berry)
Acer circinatum (Vine Maple)
Arctostaphylos uva-ursi (Kinnikinnik)
Berberis aquifolium (Oregon Grape)
Betula glandulosa (Bog Birch)
Berberis nervosa (long-leaved Oregon Grape)
Cytisus scoparius (Scotch Broom)
Corylus cornuta (Hazelnut)
Crataegus douglasii (Hawthorn)
Cornus stolonifera (Red-osier Dogwood)
Gaultheria shallon (Salal)
Holodiscus discolor (Oceanspray)
Hedera helix (English Ivy)
Kalmia occidentalis (Bog Laurel)
Ledum columbianum (Trapper's Tea)
Lonicera involucrata (Twinberry)
Ledum groenlandicum (Labrador Tea)
Pyrus fusca (Wild Crabapple)
Menziesia ferruginea (False Azalea)
Oemleria cerasiformis (Indian Plum)
Oplopanax horridum (Devil's Club)
Physocarpus capitatus (Ninebark)
Penstemon davidsonii var. menziesii
Pachistima myrsinites (Mountain Box)
Prunus spp. (Cherry)
Ribes sanguineum (Red Flowering Currant)
Rubus discolor (Himilayan Blackberry)
Rhus spp. (Sumac)
Rubus laciniatus (Evergreen Blackberry)
Rhamnus purshiana (Cascara)
Ribes spp. (Gooseberry)
Rubus spectabilis (Salmonberry)
Rubus parviflorus (Thimbleberry)
Rubus ursinus (Trailing Blackberry)
Rosa spp. (Rose)
Rhododendron spp. (Rhododendron)
Sorbus sitchensis (Mountain Ash)
Spiraea douglasii (Hardhack)
Spiraea densiflora (Spirea)
Sambucus racemosa (Red Elderberry)
Symphoricarpus albus (Snowberry)
Salix spp. (Willow)
Vaccinium membranaceum
Vaccinium oxycoccus (Cranberry)
Vaccinium parvifolium (Red Huckleberry)
Vaccinium uliginosum (Bog Blueberry)
Vaccinium spp. (Unidentified Huckleberry)

Sedges/Rushes/Grass/Ferns

Athyrium felix-femina (Lady Fern)
Alopecurus spp. (Foxtail Grass)
Azolla spp. (Water Fern)
Blechnum spicant (Deer Fern)
Pteridium aquilinum (Bracken Fern)
Carex aquatilis (Water Sedge)
Carex obnupta (Slough Sedge)
Carex spp. (Sedge)
Dulichium arundinaceum
Eriophorum chamissonis (Cottongrass)
Equisetum spp. (Horsetail)
Eleocharis spp. (Spikerush)
Glyceria spp. (Manna Grass)
Unknown grass species
Juncus acuminatus (Tapered Rush)
Juncus bufonius (Toad Rush)
Juncus effusus (Common Rush)
Juncus ensifolius (Dagger-leaf Rush)
Juncus oxymeris (Pointed Rush)
Juncus supiniformis (Spreading Rush)
Juncus tenuis (Slender Rush)
Juncus spp. (Rush)
Lemna minor (Duckweed)
Luzula spp. (Wood Rush)
Lycopodium clavatum (Clubmoss)
Marchantia spp. (Liverwort)
Unknown moss species
Phalaris arundinacea (Reed Canary Grass)
Polystichum munitum (Sword Fern)
Sphagnum spp. (Peat moss)
Isoetes spp. (Quillwort)
Ricciocarpus natans (Aquatic Liverwort)
Sparganium emersum (Simplestem Bur-reed)
Scirpus fluviatilis (River Bulrush)
Sparganium eurycarpum (Broadfruited Bur-reed)
Sparganium minimum (Small Bur-reed)
Scirpus maritimus (Seacoast Bulrush)
Scirpus microcarpus (Small-fruited Bulrush)
Scirpus validus (Great Bulrush)
Scirpus spp. (Bulrush)

Herbs

Alisma gramineum (Narrow leaved Water Plantain)
Alisma plantago-aquatica (Water Plantain)
Aruncus sylvester (Goatsbeard)
Brasenia schreberi (Water Shield)
Caltha biflora (Marsh Marigold)
Cornus canadensis (Bunch berry)
Cicuta douglasii (Water Hemlock)
Corallorhiza maculata (Spotted Coral Root)

Herbs

Cuscuta salina (Saltmarsh Dodder)
Chrysanthemum leucanthermum (Oxeye Daisy)
Conium maculatum (Poison Hemlock)
Cirsium arvense (Canada Thistle)
Coptis trifolia (Gold thread)
Clintonia uniflora (Bluebead Lily)
Digitalis purpurea (Foxglove)
Drosera rotundifolia (Sundew)
Distichlis spicata (Salt Grass)
Epilobium angustifolium (Fireweed)
Epilobium spp. (Willow herb)
Elodea nuttallii (Waterweed)
Erythronium spp. (Avalanche Lily)
Fragaria spp. (Wild Strawberry)
Galium spp. (Bedstraw)
Geum macrophyllum (Large-leaved Yellow Geum)
Goodyera oblongifolia (Rattlesnake Plantain)
Hackelia floribunda (Many-flowered Stickseed)
Heracleum lanatum (Cow-parsnip)
Hypericum perforatum (Klamath Weed)
Hypochaeris radicata (Cats Ear)
Iris pseudacris (Yellow Iris)
Lysichitum americanum (Skunk Cabbage)
Linnaea borealis (Twin Flower)
Lobelia dortmanna (Water Lobelia)
Lactuca muralis (Wall Lettuce)
Ludwigia palustris (Water Purslane)
Lythrum salicaria (Purple Loosestrife)
Lupinus spp. (Lupine)
Mentha arvensis (Mint)
Maianthemum dilatatum (Wild Lily of the Valley)
Mimulus guttatus (Monkey Flower)
Marah oreganus (Manroot)
Montropa uniflora (Indian Pipe)
Menyanthes trifoliata (Bog Bean)
Myriophyllum spp. (Water Milfoil)
Nymphaea odorata (White Pond Lily)
Nuphar polysepalum (Yellow Pond Lily)
Oenanthe sarmentosa (Water Parsley)
Pyrola elliptica (White Wintergreen)
Polygonum hydropiper (Marsh Pepper)
Plantago lanceolata (Plantain)
Potomogeton natans (Pond weed)
Potentilla pacifica (Pacific Silverweed)
Potentilla palustris (Potentilla)
Prunella vulgaris (Self-heal)
Parentucellia viscosa (Yellow Schrophularia)
Ranunculus aquatilis (Water Crowfoot)
Rumex spp. (Dock)
Ranunculus repens (Creeping Buttercup)

Herbs (Continued)

Solidago canadensis (Goldenrod)
Solanum dulcamara (Bittersweet Nightshade)
Spiranthes romanzoffiana (Ladies-tresses)
Salicornia virginica (Pickleweed)
Sagittaria latifolia (Wapato)
Sium suave (Water Parsnip)
Streptopus spp. (Twisted Stalk)
Stachys cooleyae (Hedge Nettle)
Trientalis arctica (Bog Starflower)
Thermopsis montana (Buck-bean)
Typha latifolia (Cattail)
Tolmiea menziesii (Youth-on-Age)
Tanacetum officinale (Tanzy)
Triglochin maritimum (Arrow Grass)
Tiarella trifoliata (Foamflower)
Urtica dioic (Stinging Nettle)
Utricularia minor (Bladderwort)
Veronica americana (American Brooklime)
Veratrum californicum (False Hellebore)
Veronica scutellata (Marsh Speedwell)
Viola palustris (Marsh Violet)
Vallisneria americana (Wild Celery)
Zostera marina (Eel Grass)
Zannichellia palustris (Horned Pondweed)

APPENDIX B

PROXIMITY TO OVERHEAD POWER LINES

WAC 296-24-960 Proximity to overhead power lines. (1) General requirements – high voltage lines.

(a) Minimum clearance.

(i) No work shall be performed, no material shall be piled, stored or otherwise handled, no scaffolding, commercial signs, or structures shall be erected or dismantled, nor any tools, machinery or equipment operated within the specified minimum distances from any energized high voltage electrical conductor capable of energizing the material or equipment; except where the electrical distribution and transmission lines have been deenergized and visibly grounded at point of work, or where insulating barriers not a part of or an attachment to the equipment have been erected, to prevent physical contact with the lines, equipment shall be operated proximate to, under, over, by, or near powerlines only in accordance with the following:

(ii) For lines rated 50 kv. or below, minimum clearance between the lines and any part of the equipment or load shall be 10 feet.

(iii) For lines rated over 50 kv. minimum, clearance between the lines and any part of the equipment or load shall be 10 feet plus 0.4 inch for each 1 kv. over 50 kv., or twice the length of the line insulator but never less than 10 feet.

(b) Overhead electric lines. Where overhead electric conductors are encountered in proximity to a work area, the employer shall be responsible for:

(i) Ascertaining the voltage and minimum clearance distance required, and

(ii) Maintaining the minimum clearance distance, and

(iii) Ensuring that the requirements of subsection (1) of this section are complied with.

(c) Not covered: Employees working under chapters 296-32 and 296-45 WAC.

(2) Low voltage lines. When work is being carried out in proximity to energized electrical service conductors operating at 750 volts or less, such work shall be performed in a manner to prevent contact by any worker with the energized conductors.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-13-045 (Order 82-22), § 296-24-960, filed 6/11/82; 82-02-003 (Order 81-32), § 296-24-960, filed 12/24/81.]

APPENDIX C

SAFETY STANDARDS FOR

ELECTRICAL CONSTRUCTION CODE

(WAC 296-44-21230)

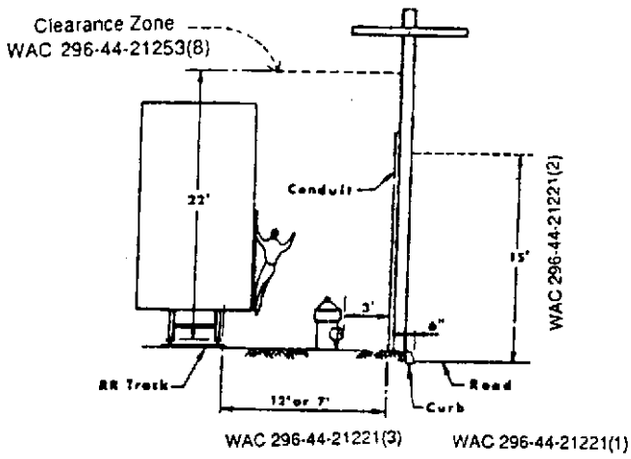

Fig. 212-1

Clearances to Other Objects

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-16-007 (Order 86-26), § 296-44-21221, filed 7/25/86.]

WAC 296-44-21230 Vertical clearance of wires, conductors, cables, and live parts of equipment above ground, rails, or water. The vertical clearance of all wires, conductors, cables, and live parts of equipment above ground in generally accessible places, or above the top of the rails or water, shall not be less than the following:

(1) Basic clearances for wires, conductors, and cables. The clearances in Table 212-1 apply under the following conditions:

(a) Conductor temperature of 60°F, no wind, with final unloaded sag in the wire, conductors, or cables, or with initial unloaded sag in cases where these facilities are maintained approximately at initial unloaded sags.

(b) Span lengths not greater than the following:

Loading District	Span Lengths (feet)
Heavy	[1]175
Medium	[1]250
Light	350

[1] One hundred fifty feet in heavy-loading district and two hundred twenty-five feet in medium-loading district for three-stand conductors, each wire of which is 0.09 inches or less in diameter.

Table 212-1 Minimum Vertical Clearance of Wires, Conductors, and Cables Above Ground, Rails, or Water
(Voltages are phase to ground for effectively grounded circuits and those other circuits where all ground faults are cleared by promptly deenergizing the faulted section, both initially and following subsequent breaker operations. See the definition section for voltages of other systems.)

Nature of Surface underneath wires, conductors, or cables	Communication conductors and cables, guys, messengers, surge protection wires, neutral conductors meeting WAC 296-44-21209 (5)(a), supply cables meeting WAC 296-44-21209 (3)(a) and supply cables of 0 to 750 V meeting WAC 296-44-21209 (3)(b) or 296-44-21209 (3)(c)[11] (ft)	Open supply line conductors of 0 to 750 V and supply cables over 750 V meeting WAC 296-44-21209 (3)(b) or 296-44-21209 (3)(c) (ft)	Open supply line conductors		Trolley and electrified railroad contact conductors and associated span or messenger wires[1]	
			750 V to 22 kV (ft)	22 to 50 kV (ft)	0 to 750 V to ground (ft)	750 V to 50 kV to ground (ft)
Where wires, conductors, or cables cross over or overhang						
1. Track rails of railroads (except electrified railroads using over-head trolley conductors)[2 16 20]	[3 15]27	[3]27	[3]28	29	[4]22	[4]22
2. Roads, streets, alleys; nonresidential driveways, parking lots, and other areas subject to truck traffic[21 22]	[6 13 23]18	18	20	21	[5]18	[5]20
3. Residential driveways; commercial areas not subject to truck traffic[21 22]	[24]12	[Ka]15	20	21	[5]18	[5]20

4. Other land traversed by vehicles such as cultivated, grazing, forest, orchard, etc.	18	18	20	21	—	—
5. Spaces or ways accessible to pedestrians only [9]	[8] [7]15	[8a] [14]15	15	16	16	18
6. Water areas not suitable for sailboating or where sailboating is prohibited [19]	15	15	17	17	—	—
7. Water areas suitable for sailboating including lakes, ponds, reservoirs, tidal waters, rivers, streams, and canals with an unobstructed surface area of: [17] [18] [19]						
(a) Less than 20 acres	18	18	20	21	—	—
(b) 20 to 200 acres	26	26	28	29	—	—
(c) 200 to 2000 acres	32	32	34	35	—	—
(d) Over 2000 acres	38	38	40	41	—	—
8. Public or private land and water areas posted for rigging or launching sailboats	Clearance above ground shall be 5 ft greater than in 7 above, for the type of water areas served by the launching site					
Where wires, conductors, or cables run along and within the limits of highways or other road rights-of-way but do not overhang the roadway						
9. Roads, streets, or alleys	[13] [23] [25]18	18	20	21	[5]18	[5]20
10. Roads in rural districts where it is unlikely that vehicles will be crossing under the line	[10] [12]14	[10]15	18	19	[5]18	[5]20

[1] Where subways, tunnels, or bridges require it, less clearances above ground or rails than required by Table 232-1 may be used locally. The trolley and electrified railroad contact conductor should be graded very gradually from the regular construction down to the reduced elevation.

[2] For wire, conductors, or cables crossing over mine, logging, and similar railways which handle only cars lower than standard freight cars, the clearance may be reduced by an amount equal to the difference in height between the highest loaded car handled and twenty feet, but the clearances shall not be reduced below that required for street crossings.

[3] These clearances may be reduced to twenty-five feet where paralleled by trolley-contact conductor on the same street or highway.

[4] In communities where twenty-one feet has been established, this clearance may be continued if carefully maintained. The elevation of the contact conductor should be the same in the crossing and next adjacent spans. (See WAC 296-44-31792 (4)(b) for conditions which must be met where uniform height above rail is impractical.)

[5] In communities where sixteen feet has been established for trolley and electrified railroad contact conductors 0 to 750 V to ground, or eighteen feet for trolley and electrified railroad contact conductors exceeding 750 V, or where local conditions make it impractical to obtain the clearance given in the table, these reduced clearances may be used if carefully maintained.

[6] If a communication service drop or a guy which is effectively grounded or is insulated against the highest voltage to which it is exposed, up to 8.7 kV, crosses residential streets and roads, the clearance may be reduced to sixteen feet at the side of the traveled way provided the clearance at the center of the traveled way is at least eighteen feet. This reduction in clearance does not apply to arterial streets and highways which are primarily for through traffic, usually on a continuous route.

[7] This clearance may be reduced to the following values:

	feet
(a) For insulated communication conductors and communication cables	8
(b) For conductors of other communication circuits	10
(c) For guys	8
(d) For supply cables meeting WAC 296-44-21209 (3)(a).	10

[8] This clearance may be reduced to the following values:

(a) Twelve feet for supply conductors limited to 300 V to ground

(b) Ten feet for drip loops of service drop conductors limited to 150 V to ground and meeting WAC 296-44-21209 (3)(b) or (c) and the portion of the associated service drop span located within fifteen feet of the service entrance to buildings.

[9] Spaces and ways accessible to pedestrians only are areas where vehicular traffic is not normally encountered or not reasonably anticipated.

[10] Where a supply or communication line along a road is located relative to fences, ditches, embankments, etc., so that the ground under the line would not be expected to be traveled except by pedestrians, this clearance may be reduced to the following values:

	feet
(a) Insulated communication conductor and communication cables	8
(b) Conductors of other communication circuits	10
(c) Supply cables of any voltage meeting WAC 296-44-21209 (3)(a) and supply cables limited to 150 V to ground meeting WAC 296-44-21209 (3)(b) or (c)	10

(d) Supply conductors limited to 300 V to ground	12
(e) Guys.	8

11 No clearance from ground is required for anchor guys not crossing track rails, streets, driveways, roads, or pathways.

12 This clearance may be reduced to thirteen feet for communication conductors.

13 Where this construction crosses over or runs along alleys, driveways, or parking lots, this clearance may be reduced to fifteen feet for spans limited to one hundred fifty feet.

14 Where supply circuits of 600 V or less, with transmitted power of 5000 W or less, are run along fenced (or otherwise guarded) private rights-of-way in accordance with the provisions specified in WAC 296-44-19409 (2)(b) this clearance may be reduced to ten feet.

15 The value may be reduced to twenty-five feet for guys, for cables carried on messengers, and for supply cables meeting WAC 296-44-21209 (3)(a). This value may be reduced to twenty-five feet for conductors effectively grounded throughout their length and associated with supply circuits of 0 to 22 kV, only if such conductors are stranded, are of corrosion-resistant material, and conform to the strength and tension requirements for messengers given in WAC 296-44-27821(9).

16 Adjacent to tunnels and overhead bridges which restrict the height of loaded rail cars to less than twenty feet, these clearances may be reduced by the difference between the highest loaded rail car handled and twenty feet, if mutually agreed to by the parties at interest.

17 For controlled impoundments, the surface area and corresponding clearances shall be based upon the design high water level. For other waters, the surface area shall be that enclosed by its annual high water mark, and clearances shall be based on the normal flood level. The clearance over rivers, streams, and canals shall be based upon the largest surface area of any one mile long segment which includes the crossing. The clearance over a canal, river, or stream normally used to provide access for sailboats to a larger body of water shall be the same as that required for the larger body of water.

18 Where an overwater obstruction restricts vessel height to less than the following:

For a surface area in acres of	A reference vessel height in feet of
less than 20	16
20 to 200	24
200 to 2000	30
over 2000	36

the required clearance may be reduced by the difference between the reference vessel height given above and the overwater obstruction height, except that the reduced clearance shall not be less than that required for the surface area on the line crossing side of the obstruction.

19 Where the United States Army Corps of Engineers, or the state, or a surrogate thereof has issued a crossing permit, clearances of that permit shall govern.

20 See WAC 296-44-21253(8) for the required horizontal and diagonal clearances to rail cars.

21 These clearances do not allow for the future road resurfacing.

22 For the purpose of this rule, trucks are defined as any vehicle exceeding eight feet in height. Areas not subject to truck traffic are areas where truck traffic is not normally encountered or not reasonably anticipated.

23 For communications cables supported on a messenger, and with span lengths not exceeding one hundred fifty feet, the clearance may be reduced to seventeen feet above or along local streets or roads. This reduction does not apply for arterial streets or highways which are primarily for through traffic, usually on a continuous route.

24 This clearance may be reduced to ten feet for communication conductors and cables, guys, messengers and supply cables meeting WAC 296-44-21209 (3)(a).

25 Communication cables supported on a steel messenger may have a 60°F clearance of fifteen feet where span lengths do not exceed one hundred fifty feet and poles are back of curbs or other deterrents to vehicular traffic.

(2) Additional clearances for wires, conductors and cables. Greater clearances than specified in Table 212-1, (subsection (1) of this section) shall be provided where required by (a) and (b) of this subsection. Increases are cumulative where more than one apply.

Note 1: Additional clearances are not required for guys.

Note 2: Additional clearances are not required for communication cables supported on messengers and communication wires which do not overhang the traveled way, but run along and within the limits of public highways or other public rights-of-way for traffic.

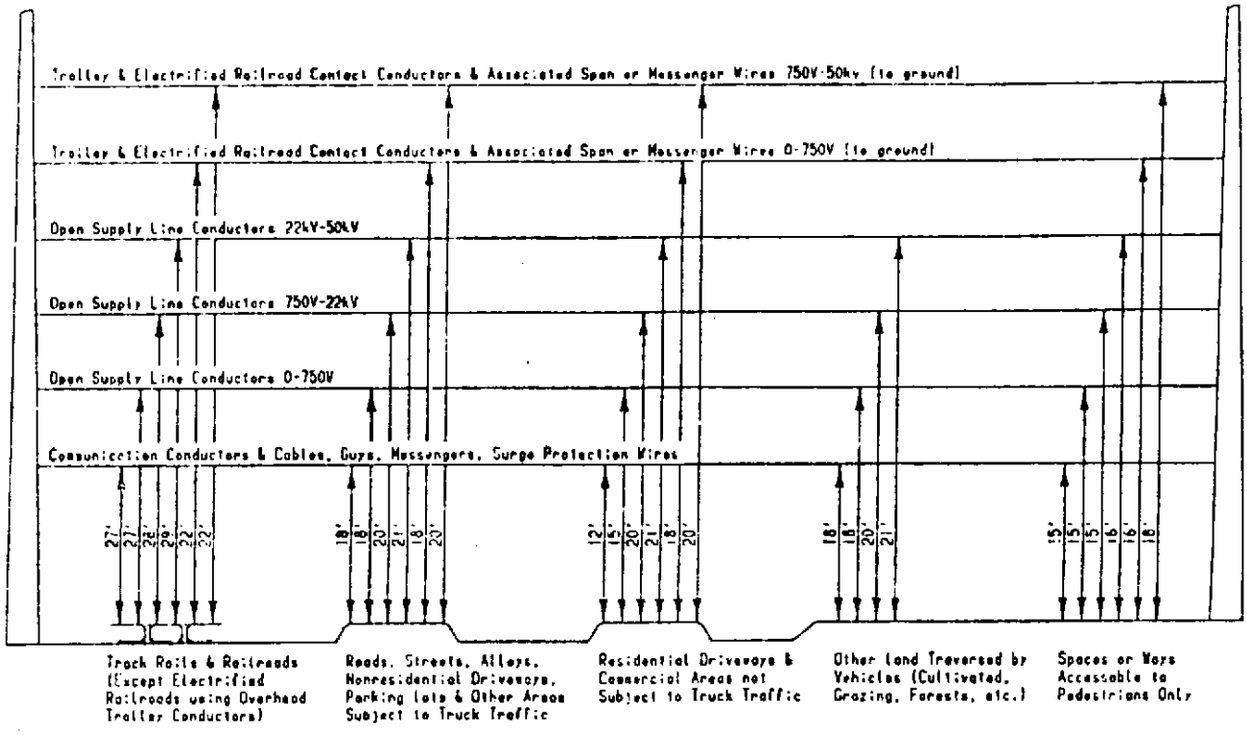

Fig 212-2a
Minimum Vertical Clearance Above Ground or Rails
(Re: Table 212-1)

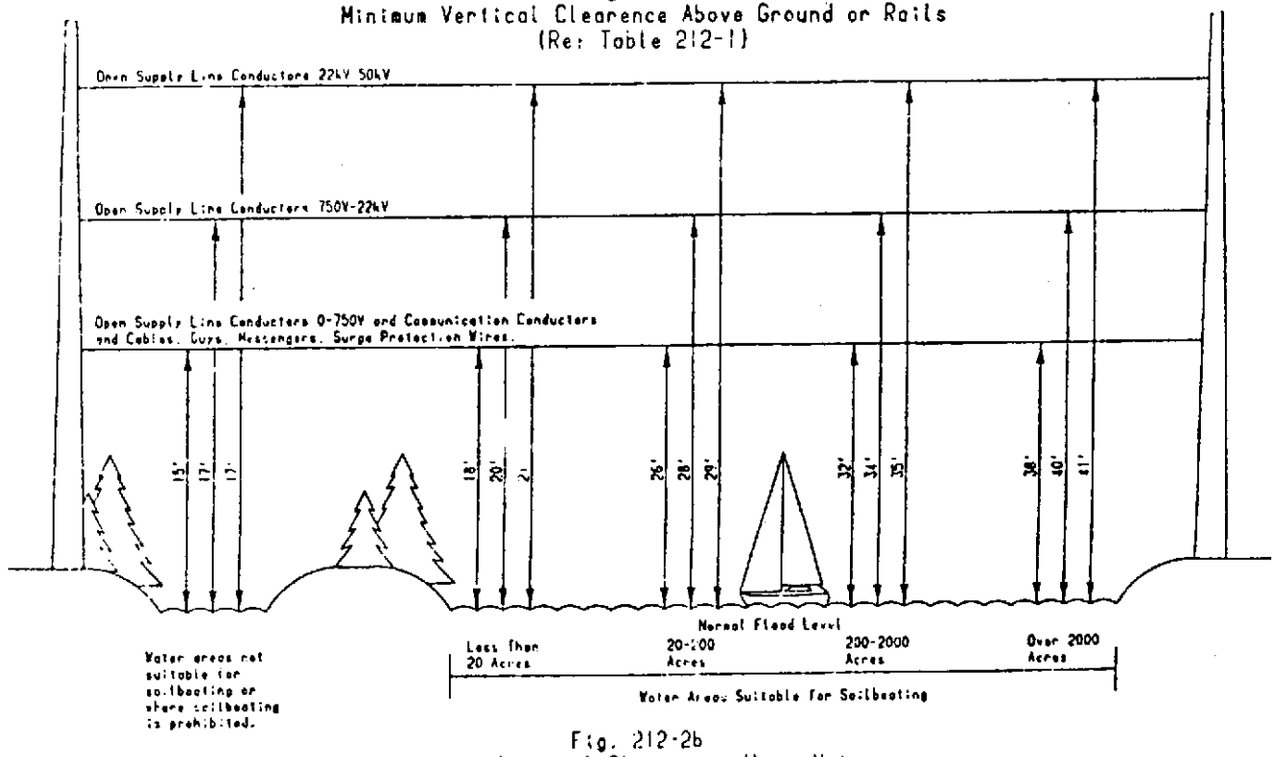

Fig. 212-2b
Minimum Vertical Clearances Above Water
(Re: Table 212-1)

(a) Voltages exceeding 50 kilovolts.

(i) For voltages between 50 and 470 kilovolts, the clearance specified in Table 212–1, (subsection (1) of this section) shall be increased at the rate of 0.4 in per kilovolt in excess of 50 kilovolts. For voltages exceeding 470 kV, the clearance shall be determined by the alternate method given by subsection (4) of this section. All clearances for lines over 50 kV shall be based on the maximum operating voltage.

Note: For voltages exceeding 98 kV alternating current to ground or 139 kV direct current to ground, clearances less than those required above are permitted for systems with known maximum switching surge factors (see subsection (4) of this section).

(ii) The additional clearance for voltages exceeding 50 kV specified in (a)(i) of this subsection shall be increased three percent for each one thousand feet in excess of thirty-three hundred feet (1000 m) above mean sea level.

(iii) For voltages exceeding 98 kV alternating current to ground, or 139 kV direct current to ground, either the clearances shall be increased or the electric field, or the effects thereof, shall be reduced by other means, as required, to limit the current due to electrostatic effects to 5.0 milliamperes, rms, if the largest anticipated truck, vehicle, or equipment under the line were shortcircuited to ground. For this determination, the conductors shall be at a final unloaded sag at 120°F.

(b) Sag increase.

(i) No additional clearance is required for trolley and electrified railroad contact conductors.

(ii) No additional clearance is required where span lengths are less than those listed in subsection (1)(b) of this section, and the maximum conductor temperature for which the supply line is designed to operate is 120°F or less.

(iii) Where supply lines are designed to operate at or below a conductor temperature of 120°F and spans are longer than specified in subsection (1)(b) of this section, the minimum clearance at midspan shall be increased by the following amounts.

(A) General.

For spans exceeding the limits specified in WAC 296-44-21230 (1)(b), the clearance specified in Table 212-1 shall be increased by 0.1 foot for each ten feet of the excess of span length over such limits. See (b)(iii)(C) of this subsection.

(B) Railroad crossings.

For spans exceeding the limits specified in subsection (1)(b) of this section, the clearance specified in Table 212-1 shall be increased by the following amounts for each ten feet by which the crossing span length exceeds such limits. See (b)(iii)(C) of this subsection.

Loading district	Amount of increase per 10 feet: Large conductors (ft)	Amount of increase per 10 feet: [1]Small conductors (ft)
Heavy and medium	0.15	0.30
Light	0.10	0.15

[1] A small conductor is a conductor having an overall diameter of metallic material equal to or less than the following values:

Material	Outside diameter of conductor: Solid (inches)	Outside diameter of conductor: Stranded (inches)
All copper	0.160	0.250
Other than all copper	0.250	0.275

(C) Limits.

The maximum additional clearance need not exceed the arithmetic difference between final unloaded sag at a conductor temperature of 60°F (15°C), no wind, and final sag at the following conductor temperature and condition, whichever difference is greater, computed for the crossing span.

(I) 32°F no wind, with radial thickness of ice, if any, specified in WAC 296-44-26309(2) for the loading district concerned.

(II) 120°F (50°C), no wind.

(iv) Where supply lines are designed to operate at conductor temperature above 120°F regardless of span length, the minimum clearance at midspan specified in subsections (1) and (2)(a) of this section shall be increased by the difference between final unloaded sag at a conductor temperature of 60°F no wind, and final sag at the following conductor temperature and condition, whichever difference is greater, computed for the crossing span.

(A) 32°F no wind, with radial thickness of ice, if any, specified in WAC 296-44-26309(2) for the loading district concerned.

(B) The maximum conductor temperature for which the supply line is designed to operate, with no horizontal displacement.

Note: The phase and neutral conductors of a supply line should be considered separately when determining the sag increases of each due to temperature rise.

(v) Where minimum clearance is not at midspan, the additional clearances specified in (b)(iii) and (iv) of this subsection may be reduced by multiplying by the following factors:

Distance from nearer support of crossing span to point of crossing in percentage of crossing span length	Factors[1]
5	0.19
10	0.36
15	0.51
20	0.64
25	0.75
30	0.84
35	0.91
40	0.96
45	0.99
50	1.00

[1] Interpolate for intermediate values.

In applying this rule, the "point of crossing" is the location under the conductors of any topographical feature which is the determinant of the clearance.

(3) Clearance to live parts of equipment mounted on structures.

(a) Basic clearances. The vertical clearance above ground for unguarded live parts such as potheads, transformer bushings, surge arresters, and short lengths of supply conductors connected thereto, which are not subject to variation in sag, shall be as shown in Table 212-2.

Table 212-2. Minimum Vertical Clearance of Rigid Live Parts Above Ground

(Voltages are phase to ground for effectively grounded circuits and those other circuits where all ground faults are cleared by promptly de-energizing the faulted section, both initially and following subsequent breaker operations. See the definition section for voltages of other systems.)

Nature of surface below live parts	0 to 750 V	750 V to 22 kV	22 to 50 kV
1. Where live parts overhang:			
a. Roads, streets, alleys; nonresidential driveways; parking lots and other areas subject to truck traffic [4,5]	16	18	19
b. Residential driveways; commercial areas not subject to truck traffic [4,5]	[1]13	18	19
c. Other land traversed by vehicles such as cultivated land, grazing land, forest, orchard, etc.	16	18	19
d. Spaces and ways accessible to pedestrians only. [3,4,6]	[1,3,4]13	13	14
2. Where live parts are along and within the limits of highways or other road rights-of-way but do not overhang the roadway:			
a. Roads, streets, and alleys	[2]16	18	19
b. Roads in rural districts where it is unlikely that vehicles will be crossing under the line.	[2]13	16	17

[1] This clearance may be reduced to the following values:

	feet
(a) Live parts limited to 300 V to ground	12
(b) Live parts limited to 150 V to ground and drip loops of service drop conductors limited to 150 V to ground and meeting WAC 296-44-21209 (3)(b) or (c).	10

[2] Where a supply line along a road is limited to 300 V to ground and is located relative to fences, ditches, embankments, etc., so that the ground under the line would not be expected to be traveled except by pedestrians, this clearance may be reduced to twelve feet.

[3] Where supply circuits of 600 V or less, with transmitted power of 5000 W or less, are run along fenced (or otherwise guarded) private rights-of-way in accordance with the provisions specified in WAC 296-44-19409 (2)(b), this clearance may be reduced to ten feet.

[4] For the purpose of this rule, trucks are defined as any vehicle exceeding eight feet in height.

[5] These clearances do not allow for future road resurfacing.

[6] Spaces and ways accessible to pedestrians only are areas where vehicular traffic is not normally encountered or not reasonably anticipated.

(b) Additional clearances for voltages exceeding 50 kilovolts.

(i) For voltages between 50 and 470 kilovolts, the clearance specified in Table 212-2 ((a) of this subsection) shall be increased at the rate of 0.4 in per kilovolt in excess of 50 kV. For voltages exceeding 470 kV, the clearances shall be determined by the alternate method given by subsection (4) of this section. All clearances for lines over 50 kV shall be based on the maximum operating voltage.

Note: For voltages exceeding 98 kV alternating current to ground or 139 kV direct current to ground, clearances less than those required above are permitted for systems with known maximum switching surge factors. (See subsection (4) of this section.)

(ii) The additional clearance for voltages exceeding 50 kV specified in (b)(i) of this subsection shall be increased three percent for each one thousand feet in excess of thirty-three hundred feet above mean sea level.

(iii) For voltages exceeding 98 kV alternating current to ground, or 139 kV direct current to ground either the clearances shall be increased or the electric field, or the effects thereof, shall be reduced by other means, as required, to limit the current due to electrostatic effects to 5.0 milliamperes, rms, if the largest anticipated truck, vehicle, or equipment under the line were short-circuited to ground.

(4) Alternate clearances for voltages exceeding 98 kilovolts alternating current to ground or 139 kilovolts direct current to ground. The clearances specified in subsections (1), (2) and (3) of this section may be reduced for circuits with known switching surge factors but shall not be less than the values computed by adding the reference height to the electrical component of clearance.

(a) Sag conditions of line conductors. Minimum vertical clearances shall be maintained under the following conductor temperatures and conditions:

(i) 32°F no wind, with radial thickness of ice specified in WAC 296-44-26309(2) for the loading district concerned.

(ii) 120°F, no wind.

(iii) Maximum conductor temperature, for which the line is designed to operate, if greater than 120°F, with no horizontal displacement.

(b) Reference heights are shown in Table 212-3.

(c) Electrical component of clearance.

(i) The clearance computed by the following equation and listed in Table 212-4 shall be added to the reference heights specified in Table 212-3.

$$D = 3.28\left[\frac{V \cdot (PU) \cdot a}{500\,K}\right]^{1.667} bc \quad \text{(ft)}$$

where

V maximum alternating current crest operating voltage to ground or maximum direct current operating voltage to ground in kilovolts;

PU maximum switching surge factor expressed in per-unit peak voltage to ground and defined as a switching surge level for circuit breakers corresponding to ninety-eight percent probability that the maximum switching surge generated per breaker operation

does not exceed this surge level, or the maximum anticipated switching surge level generated by other means, whichever is greater;

a = 1.15, the allowance for three standard deviations;

b = 1.03, the allowance for nonstandard atmospheric conditions;

c = 1.2, the margin of safety;

K = 1.15, the configuration factor for conductor-to-plane gap.

(ii) The value of D shall be increased three percent for each one thousand feet in excess of fifteen hundred feet above mean sea level.

(iii) Either the clearances shall be increased or the electric field, or the effects thereof, shall be reduced by other means, as required, to limit the current due to electrostatic effects to 5.0 milliamperes, rms, if the largest anticipated truck, vehicle, or equipment under the line were shortcircuited to ground. For this determination, the conductors shall be at a final unloaded sag at 120°F.

(d) Limit. The clearances derived from (b) and (c) of this subsection shall be not less than the clearances given in Tables 212-1 or 212-2 computed for 98 kilovolts alternating current to ground in accordance with subsection (2)(a) or (3)(b) of this section, respectively.

Table 212-3 Reference Heights

	Nature of surface underneath lines	Ft
a	Track rails of railroads (except electrified railroads using overhead trolley conductors) [1]	22
b	Streets, alleys, roads, driveways, and parking lots	14
c	Spaces and ways accessible to pedestrians only [2]	9
d	Other land, such as cultivated, grazing, forest or orchard, which is traversed by vehicles	14
e	Water areas not suitable for sailboating or where sailboating is prohibited	14
f	Water areas suitable for sailboating including lakes, ponds, reservoirs, tidal waters, rivers, streams, and canals with unobstructed surface area [3,4]	
	(1) less than 20 acres	18
	(2) 20 to 200 acres	26
	(3) 200 to 2000 acres	32
	(4) over 2000 acres	38
g	In public or private land and water areas posted for rigging or launching sailboats, the reference height shall be five feet greater than in f. above, for the type of water areas serviced by the launching site.	

1 See WAC 296-44-21253(8) for the required horizontal and diagonal clearances to rail cars.

2 Spaces and ways accessible to pedestrians only are areas where vehicular traffic is not normally encountered or not reasonably anticipated.

3 For controlled impoundments, the surface area and corresponding clearances shall be based upon the design high water level. For other waters, the surface area shall be that enclosed by its annual high water mark, and clearances shall be based on the normal flood level. The clearance over rivers, streams, and canals shall be based upon the largest surface area of any one mile-long segment which includes the crossing. The clearance over a canal or similar waterway providing access for sailboats to a larger body of water shall be the same as that required for the larger body of water.

4 Where an overwater obstruction restricts vessel height to less than the following:

For a surface of	A reference vessel height of ft
(1) less than 20 acres	16
(2) 20 to 200 acres	24
(3) 200 to 2000 acres	30
(4) over 2000 acres (800 ha)	36

The required clearance may be reduced by the difference between the reference vessel height given above and the overwater obstruction height, except that the reduced clearance shall not be less than that required for the surface area on the line crossing side of the obstruction.

Table 212-4 Electrical Component of Clearance Above Ground or Rail in (c)(i) of this subsection (Add three percent for each one thousand feet in excess of fifteen hundred feet above mean sea level. Increase clearance to limit electrostatic effects in accordance with (c)(iii) of this subsection.)

Maximum operating voltage phase-to-phase (kV)	Switching surge factor (per unit)	Switching surge (kV)	Electrical component of clearance (ft)
242	4.5 or less	839 or less	[1]8.6
362	2.8 or less	839 or less	[1]8.6
550	1.9 or less	839 or less	[1]8.6
	2.0	898	10.8
	2.2	988	12.7
	2.4	1079	14.6
	2.6	1168	16.7
800	1.6	1045	13.9
	1.8	1176	16.9
	2.0	1306	20.1
	2.1 or more	1372 or more	[2]21.8

1 Limited by (d) of this subsection.

2 Limited by subsections (1) and (2) of this section.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-16-007 (Order 86-26), § 296-44-21230, filed 7/25/86.]

WAC 296-44-21241 Clearances between wires, conductors, and cables carried on different supporting structures. (1) General.

Crossings should be made on a common supporting structure, where practical. In other cases, the clearance between any two crossing or adjacent wires, conductors, or cables carried on different supporting structures shall not be any less at any location in the spans than that required by WAC 296-44-21241. The minimum clearance shall be as illustrated by a clearance envelope developed under WAC 296-44-21241 (1)(b) applied at the positions on or within conductor movement envelopes developed under WAC 296-44-21241 (1)(a) at which the two wires, conductors, or cables would be closest together. For purposes of this determination, the relevant positions of the wires, conductors, or cables on or within their respective conductor movement envelopes are those which can occur when (a) both are simultaneously subjected to the same ambient air temperature and wind

APPENDIX D

TITLE II - NORTH CASCADES NATIONAL PARK SERVICE COMPLEX WILDERNESS (PUBLIC LAW 100-668)

TITLE II—NORTH CASCADES NATIONAL PARK SERVICE COMPLEX WILDERNESS

SEC. 201. DESIGNATION.

(a) WILDERNESS.—In furtherance of the purposes of the Wilderness Act (16 U.S.C. 1131 et seq.; 78 Stat. 890), certain lands in the North Cascades National Park, Ross Lake National Recreation Area, and Lake Chelan National Recreation Area, Washington, which—

(1) comprise approximately six hundred and thirty-four thousand six hundred and fourteen acres of wilderness, and approximately five thousand two hundred and twenty-six acres of potential wilderness additions, and

(2) are depicted on a map entitled "Wilderness Boundary, North Cascades National Park Service Complex, Washington", numbered 168–60–186 and dated August 1988,

are hereby designated as wilderness and therefore as components of the National Wilderness Preservation System. Such lands shall be known as the Stephen Mather Wilderness.

SEC. 202. HYDROELECTRIC PROJECTS.

Section 505 of the Act of October 2, 1968 (82 Stat. 930; 16 U.S.C. 90d–4) is amended as follows: strike "in the recreation areas", and insert in lieu thereof "in the lands and waters within the Skagit River Hydroelectric Project, Federal Energy and Regulatory Commission Project 553, including the proposed Copper Creek, High Ross, and Thunder Creek elements of the Project; and the Newhalem Project, Federal Energy and Regulatory Commission Project 2705, within the Ross Lake National Recreation Area; the lands and waters within the Lake Chelan Project, Federal Energy and Regulatory Commission Project 637; the Company Creek small hydroelectric project at Stehekin within the Lake Chelan National Recreation Area; and existing hydrologic monitoring stations necessary for the proper operation of the hydroelectric projects listed herein".

SEC. 203. LAND ACQUISITION FOR ADMINISTRATIVE FACILITIES.

Section 301(a) of the Act of October 2, 1968 (82 Stat. 927; 16 U.S.C. 90b) is hereby amended to add a new subsection as follows:

"(b) The Secretary is hereby authorized to acquire, with the consent of the owner, lands outside of the authorized boundaries of North Cascades National Park Service Complex for the purpose of

construction and operation of a backcountry information center not to exceed five acres. The Secretary of the Interior is further authorized to acquire with the consent of the owner, lands for the construction of a headquarters and administrative site or sites, for the North Cascades National Park, Ross Lake National Recreation Area, and Lake Chelan National Recreation Area not to exceed ten acres. The lands so acquired shall be managed as part of the park.".

SEC. 204. AUTHORIZATION OF APPROPRIATIONS.

There are hereby authorized to be appropriated to the Secretary of the Interior such sums as may be necessary to complete the land acquisitions authorized pursuant to section 203 of this Act.

SEC. 205. RENEWABLE NATURAL RESOURCE USE IN RECREATION AREAS.

Section 402(a) of the Act of October 2, 1968 (82 Stat. 928; 16 U.S.C. 90c-1) is hereby amended to read as follows:

"The Secretary shall administer the recreation areas in a manner which in his judgment will best provide for (1) public outdoor recreation benefits and (2) conservation of scenic, scientific, historic, and other values contributing to public enjoyment. Within that portion of the Lake Chelan National Recreation Area which is not designated as wilderness, such management, utilization, and disposal of renewable natural resources and the continuation of existing uses and developments as will promote, or are compatible with, or do not significantly impair public recreation and conservation of the scenic, scientific, historic, or other values contributing to public enjoyment, are authorized. In administering the recreation areas, the Secretary may utilize such statutory authorities pertaining to the administration of the national park system, and such statutory authorities otherwise available to him for the conservation and management of natural resources as he deems appropriate for recreation and preservation purposes and for resource development compatible therewith. Within the Ross Lake National Recreation Area the removal and disposal of trees within power line rights-of-way are authorized as necessary to protect transmission lines, towers, and equipment;": *Provided*, That to the extent practicable, such removal and disposal of trees shall be conducted in such a manner as to protect scenic viewsheds.".

SEC. 206. MINERAL RESOURCE USE IN RECREATION AREAS.

Section 402(b) of the Act of October 2, 1968 (82 Stat. 928; 16 U.S.C. 90c-1b) is hereby amended to read as follows:

"The lands within the recreation areas, subject to valid existing rights, are hereby withdrawn from all forms of appropriation or disposal under the public land laws, including location, entry, and patent under the United States mining laws, and disposition under the United States mineral leasing laws: *Provided, however*, That within that portion of the Lake Chelan National Recreation Area which is not designated as wilderness, sand, rock and gravel may be made available for sale to the residents of Stehekin for local use so long as such sale and disposal does not have significant adverse effects on the administration of the Lake Chelan National Recreation Area.".