POPULATION, HOUSING & LAND USE

POPULATION, HOUSING & LAND-USE

POPULATION

The city population was 495 in 1960, 779 in 1970 and 1182 in 1980. The City's population grew by 55% between 1960 and 1970 (this included the annexation of Tolovana Park), and by 52.4% between 1970 and 1980. (The P.S.U. population estimate for 1983 is 1215.)

Between 1970 and 1980, Cannon Beach had the highest growth rate among Clatsop County cities.

During the past decade Cannon Beach's population grew by 52.4% while that of the county grew by 14.1%. Cannon Beach's population as a percentage of the total Clatsop County population has been gradually increasing. In 1960, Cannon Beach's population was 1.8% of the total Clatsop County population; in 1970 it was 2.7% and in 1980 it was 3.7%.

AGE

The major trends affecting various age categories in Oregon between 1970 and 1980 were:

1) A substantial decrease in the percentage of the population under the age of 15 as a result of a decline in fertility rates. However, there were opposing trends within the under 15 age group. While the school-age population (5-14) decreased, the number of preschool children increased. The increase in preschool age children is attributable to women of the "baby boom era" entering the reproductive years;

2) A very large increase in the 15-34 age group as the result of the aging of the baby boom generation;

3) A modest increase in the 45-64 age category due to the entry into this age group of person born during the Great Depression; and

4) A slow but steady increase in the 65 and older age group as the result of increased longevity.

The changes in Cannon Beach's age structure are reflective of some of these general demographic changes, but are divergent in some important ways.

The most important demographic change in Cannon Beach between 1970 and 1980 was the large influx of persons between the ages of 15-24 and 25-44. These age groups grew by 132% and 247%, respectively. The growth in these two age groups represented 96% of the total population growth in the City during the decade. Conversely, the City's population aged 45 or older decreased by 5%.

As a result of these trends, the City's median age decreased and is now only slightly higher than the County median age (33.0 vs 31.5).

The younger character of the City's population is also apparent when comparing Cannon Beach with other Clatsop County cities. In 1970, among Clatsop County cities, Cannon Beach had the smallest percentage of its population in the 25-44 age group and the second smallest percentage in the 15-24 age group. In 1980, it had the highest percentage in the 15-24 age group and second highest percentage in the 25-44 age group. Conversely, in 1970 Cannon Beach had the highest percentage in the 45-64 and 65 and over age groups. In 1980, it had the lowest percentage in the 45-64 age group, but still had the second highest percentage in the over 65 age group.

Cannon Beach's population, by age group, exhibited the following additional trends between 1970 and 1980:

- A 100% increase in the population aged 0-4. Clatsop County's population in this category increased by 25.1%.
- A 5% increase in the population aged 5-14. Clatsop County's population in this age category decreased by 10%.
- A 230% increase in the population aged 18-24. Clatsop County's population in this age category increased by 32%.
- A 10.6% decrease in the population aged 45-59. Clatsop County's population in this age category decreased by 14.2%.
- A 2% decline in the population aged 60 years and older. Clatsop County's population in this age category increased by 14%.

Cannon Beach's median age in 1980 was 33.0 years, with the median age for males being 32.8 and females being 33.3.

TABLE 1

POPULATION BY AGE GROUP, 1970 &1980

	1970					1980				
	0-14	15-24	25-44	45-64	65+	0-14	15-24	25-44	45-64	65+
Cannon Beach	125	101	104	242	207	165	234	361	214	213

TABLE 2

PERCENTAGE OF TOTAL POPULATION BY AGE GROUP, 1970, 1980

	1970					1980				
	0-14	15-24	25-44	45-64	65+	0-14	15-24	25-44	45-64	65+
Cannon Beach	16.0	13.0	13.4	31.1	26.6	13.9	19.7	30.4	18.0	17.9
Clatsop Co.	24.1	17.2	19.7	24.6	14.3	21.1	17.7	26.9	19.7	14.6
OREGON	27.2	17.5	23.0	21.4	10.8	22.4	17.6	29.8	18.7	11.5

TABLE 3

PERCENTAGE CHANGE IN POPULATION BY AGE GROUP, 1970, 1980

	TOTAL	0-14	15-24	25-44	45-64	65+
Cannon Beach	52.4	32.0	131.7	247.1	-11.6	2.9
Clatsop Co.	14.1	-0.2	17.4	56.0	- 9.0	16.4
OREGON	25.9	3.5	26.7	63.4	9.5	33.7

RACE

In 1980, 1.7% of Cannon Beach's population was non-white. Persons of Spanish origin comprised 0.8% of the total population. In comparison, 3.5% of Clatsop County's population was non-white and 1.4% was of Spanish origin. In 1970, 0.2% of Cannon Beach's population was non-white.

HOUSEHOLDS AND HOUSEHOLD SIZE

The average household size increased from 2.15 persons per household in 1970 to 2.23 persons per household in 1980. Cannon Beach was the only city in Clatsop County whose average household size increased during the decade. Between 1970 and 1980, Clatsop County's average household size decreased from 2.7 persons to 2.5 persons. Even though Cannon Beach's average household size increased, it still had the smallest household size among Clatsop County cities.

In 1980, 38.3% of Cannon Beach's households were one person households, 50.8% consisted of two or three persons and 10.9% had four or more persons. Among Clatsop County cities, Cannon Beach had the highest percentage of one person households and the lowest percentage of households containing four or more persons.

In 1970, 32.4% of Cannon Beach's households were one person households, 55.2% consisted of two or three persons, and 12.4% had four or more persons.

Between 1970 and 1980, the percentage of one person households increased, while the percentage of 2 and 3 person households and four or more person households decreased.

HOUSING UNITS

The total number of housing units increased from 881 to 1274 between 1970 and 1980, an increase of 44.6%. The increase in housing units was smaller than the increase in the number of households (44.6% vs. 47.2%). This indicates that some housing units that were second homes became available for use by full time residents during the decade.

The Census classified 691 housing units as being second homes. In 1970, 488 housing units were classified as second homes. The growth in second homes between 1970 and 1980 was 41.6%. During the same period the number of dwelling units for permanent residents increased by 47.3%. As a result, the percentage of the total housing stock in seasonal housing units decreased slightly from 55.4% to 54.4%.

The decade from 1970 to 1980 saw a sharp increase in the number of the City's housing units that consisted of two or more units in 1970, 93% of the City's housing stock was single-family residences and 6% were housing units consisting of two or more units. In 1980, 79% of the City's housing stock was single-family residence and 20% were housing units consisting of two or more units.

The number of mobile homes increased from two to twelve. In comparison with all of Clatsop County, Cannon Beach has a higher percentage of single family residences and lower percentages of 2 or more unit structure and mobile homes.

HOUSING TENURE

The number of owner-occupied housing units increased from 270 in 1970 to 291 in 1980, a 7.7% growth rate. The number of renter occupied housing units increased from 92 to 242, a 163 percent growth rate. As a result of the large increase in the renter occupied housing units, the percentage of the city's housing units that are owner occupied decreased from 74.6% in 1970 to 54.6% in 1980.

For comparison, the percentage of occupied units that are owner occupied in Clatsop County decreased from 66.8% to 64.5% between 1970 and 1980.

HOUSING

The following illustrates the age of housing by the structure's tenure. Renters occupy older housing - 66% of renters live in homes built in 1940 or earlier, whereas the percentage for owner-occupied housing is 45%, and in second homes it is 49%. Conversely, 33% of owner-occupied housing and second homes have been built since 1970, while only 16% of renter occupied units have been built since 1970.

TABLE 4

HOUSING UNITS AS A PERCENTAGE OF TOTAL BY YEAR BUILT

YEAR HOUSING BUILT	TOTAL	OWNER OCCUPIED	RENTAL	SEASONAL
1979 to 1980	6	4	3	7
1975 to 1978	9	18	5	7
1970 to 1974	15	11	8	19
1960 to 1969	7	11	5	8
1950 to 1959	11	10	13	11
1940 to 1949	23	18	31	22
1939 or earlier	29	27	35	27

HOUSING COST

The median value of owner occupied housing in 1980 was $63,800. This was the highest median value among Clatsop County cities and is substantially higher than the County median value of $50,400. The median contract rent was $184. The median contract rent in Clatsop County, in 1980, was $164.

As income increases, the percentage of total income that households spend on rent decreases. Of the households earning less than $5,000, that were compiled, 85% spent 35% or more of their income on housing. For renters earning $5,000 - 9,999, the percentage was 56%. For renters earning between $10,000 - 14,999 the percentage was 6%. No household earning more than $15,000 paid more than 20% of their income for rent.

TABLE 5

RENT AS A PERCENTAGE OF HOUSEHOLD INCOME

INCOME	LESS THAN 20%	20-24%	25-34%	35%+
Less than $5,000	5%	5%	5%	85%
$5,000 - 9,999	6%	9%	29%	56%
$10,000 - 14,999	31%	29%	33%	7%
$15,000 - 19,999	100%			
$20,000	100%			

As with renters, the percentage of total income that homeowners spend on housing costs decreases as income rises.

TABLE 6

OWNER OCCUPIED MONTHLY HOUSING COSTS, AS A

YEAR HOUSING BUILT	TOTAL	OWNER OCCUPIED	RENTAL	SEASONAL
1979 to 1980	6	4	3	7
1975 to 1978	9	18	5	7
1970 to 1974	15	11	8	19
1960 to 1969	7	11	5	8
1950 to 1959	11	10	13	11
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1939 or earlier	29	27	35	27

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Less than $5,000	5%	5%	5%	85%
$5,000 - 9,999	6%	9%	29%	56%
$10,000 - 14,999	31%	29%	33%	7%
$15,000 - 19,999	100%			
$20,000	100%			

As with renters, the percentage of total income that homeowners spend on housing costs decreases as income rises.

TABLE 6

OWNER OCCUPIED MONTHLY HOUSING COSTS, AS A

PERCENTAGE OF INCOME

INCOME	LESS THAN 20%	20-24%	25-34%	35%+
Less than $5,000	9%	11%	43%	37%
$5,000 - 9,999	40%	20%	10%	30%
$10,000 - 14,999	50%	-	28%	22%
$15,000 - 19,999	48%	18%	18%	18%
$20,000	87%	8%	5%	-

INCOME

The median household income in 1979 was $10,927. This was the lowest median household income among Clatsop County cities. The median household income in Clatsop County was $15,262 and in Oregon it was $16,781. Table 7 shows household income in 1979:

TABLE 7

HOUSEHOLD INCOME

INCOME	NUMBER	PERCENTAGE
Less than $10,000	274	46%
$10,000 - 19,999	163	30%
$20,000 - 29,999	72	13%
$30,000 +	58	11%

The median family income in 1979 was $13,500. This was the lowest median family income among Clatsop County cities. The median family income in Clatsop County was $18,820 and in Oregon it was $20,028. Table 8 shows family income in 1979.

TABLE 8

FAMILY INCOME

INCOME	NUMBER	PERCENTAGE
Less than $10,000	98	34%
$10,000 - 19,999	102	35%
$20,000 - 29,999	51	17%
$30,000 +	43	14%

The Oregon Community Development Program identifies households with annual incomes of less than 50% of the county median household income as "low-income," and those households with annual incomes between 50 and 80% of the county median as "moderate income". Applying these criteria to Cannon Beach's permanent households demonstrates that 187 (33%) have annual household incomes of less than $7,631 (50% of the Clatsop County median annual household income of $15,262), and that 136 (24%) have annual household incomes between $7,631 and $12,209 (50 and 80% of the Clatsop County median). Thus, 33% of the permanent households in Cannon

Beach in 1979 could be considered low-income, and 24% moderate-income.

Cannon Beach had the second highest percentage of persons with incomes below the Federal poverty level in 1979 (12.4%). Clatsop County had 11.6% of its population below the poverty level, and Oregon has 10.6%.

ALTERNATIVE POPULATION PROJECTIONS FOR PERMANENT RESIDENTS

I. Method - Increasing percentage of Clatsop County population based on past trends. Assume that the City's share of total county population increases by 0.5% every five years.

1960 $\frac{495}{27380} = 1.8\%$

1970 $\frac{779}{28473} = 2.7\%$

1980 $\frac{1187}{32489} = 3.7\%$

	County Population Projection	Cannon Beach Percentage	Cannon Beach Population
1985	34,000	4.2%	1,428
1990	36,400	4.7%	1,711
1995	38,800	5.2%	2,018
2000	41,500	5.7%	2,366

II. Method - Assume the same growth rate for the period 1980 - 2000 that occurred between 1970 and 1980 (52.4%).

1985	1,498
1990	1,809
1995	2,283
2000	2,757

III. Method - Assume a slightly lower growth rate than during the period 1970 to 1980. A three percent annual rate.

1985	1,377
1990	1,595
1995	1,849
2000	2,143

IV. Method - Project future population growth based on permanent housing units constructed. Based on 1980 Census information, the stock of permanent dwelling units increased at an annual rate of 18.6 units between 1970 and 1980. Applying the same rate to the year 2000 results in the following population projections, assuming a household size of 2.2:

1985	93 du.	205 residents = 1,392
1990	93 du.	205 residents = 1,597
1995	93 du.	205 residents = 1,802
2000	93 du.	205 residents = 2,007

Population Projection Range

	1985	1990	1995	2000
Low	1,377	1,595	1,849	2,007
High	1,498	1,809	2,283	2,757

PLAN POPULATION PROJECTION

Population Projection Method III was selected for planning purposes. Because the long and severe recession of 1981-83 has depressed population growth rates throughout Oregon, it is anticipated that Cannon Beach's 1985 population will be less than the 1,377 persons projected. However, over the planning period, 1980 -2000, it is assumed that the 3% growth rate will prevail because long-range growth factors will overcome growth lags associated with the present economic difficulties of Oregon.

LAND USE SURVEY - 1982

A land-use survey was conducted of the Cannon Beach urban growth boundary in the summer of 1982. The results of the survey are shown on Table 9.

TABLE 9

CANNON BEACH URBAN GROWTH BOUNDARY

1982 LAND-USE SURVEY
(in acres)

LAND USE	NORTHSIDE	DOWNTOWN	MIDTOWN	TOLOVANA	TOTAL
Single-family Residential	13.24	1.71	20.09	22.56	57.6
Single-family Residential - Vacation	10.00	3.56	23.80	32.95	70.28
Duplex & Multi-family (units)	.69 (11)	1.37 (28)	3.44 (56)	3.60 (45)	9.10
Condominium (units)	7.13 (72)	-	-	3.61 (106)	10.74
Retail Commercial	-	8.03	2.19	1.29	11.51
Retail Commercial with Residential (units)	-	.52 (5)	1.63 (4)	.32 (3)	2.08
General Commercial	2.70	-	.77	-	3.47
Motels (units)	.82 (20)	8.97 (168)	6.44 (181)	4.62 (98)	20.85
Public Institution & Open Space	36.30	47.14	25.02	17.41	125.87
Vacant Land	50.78	1.76	116.41	88.52	257.47
TOTAL	121.66	73.16	199.78	174.85	568.97

TABLE 10

CANNON BEACH URBAN GROWTH BOUNDARY

VACANT LAND*
(in acres)

PLAN DESIGNATION AND ZONE	NORTHSIDE (With S/W)	NORTHSIDE (No S/W)	DOWNTOWN (With S/W)	DOWNTOWN (No S/W)	MIDTOWN (With S/W)	MIDTOWN (No S/W)	TOLOVANA (With S/W)	TOLOVANA (No S/W)	TOTAL (With S/W)	TOTAL (No S/W)
RVL	1.93	26.54	-	-	-	18.37	-	27.85	1.93	72.76
RL	1.93	3.93	-	-	11.56	-	15.23	4.49	28.72	8.42
R1	-	-	-	-	-	-	31.50	-	31.50	-
R2	12.32	4.02	.11	-	24.91	-	-	-	37.34	4.02
R3	-	-	-	-	-	-	5.38	-	5.38	-
RM	.11	-	.23	-	2.59	-	.74	-	3.67	-
RAM	-	-	-	-	4.88	7.84	-	-	4.88	7.84
MP	-	-	-	-	-	9.60	-	-	-	9.60
C1	-	-	1.42	-	2.39	-	3.33	-	7.14	-
C2	-	-	-	-	-	1.47	-	-	-	1.47
OSR	-	-	-	-	-	32.80	-	-	-	32.80
TOTAL	16.29	34.49	1.76	-	46.33	70.08	56.18	32.34	120.56	136.91

* Based on 1982 Land-Use Survey.

The urban growth boundary's land use is: 148 acres residential, 38 acres commercial, 126 acres public/open space, and 206.5 acres of vacant land that are zoned for residential use. Of this acreage, 113.4 has ready access to sewer/water facilities and 93.1 does not. There are approximately 12 acres of vacant commercial land.

RESIDENTIAL LAND REQUIREMENTS 1983-2000

Using a population projection of 2,143 permanent residents in the year 2000 results in a need for 111.4 acres of residential land. The following are the calculations for arriving at this figure.

A. Assume

1. That the household characteristics of the permanent population will continue to become like that for Clatsop County as a whole. Therefore, a household size of 2.5 persons per dwelling unit is assumed.

2. The construction of 21.8 permanent dwelling units per year (3% annual growth rate the number of additional permanent du's needed would be (2143 - 1215 ÷ 2.5 = 371).

3. The construction of 20.7 seasonal dwelling units per year (average construction rate 1970-1980).

4. A vacancy factor of 2% for permanent dwelling units and seasonal dwelling units.

5. Two dwelling units demolished per year (one seasonal and one permanent).

6. 75% of the housing units will be single family (including mobile homes) and 25% will be multi-family or duplex. This percentage is assumed to be the same for both permanent and seasonal housing.

7. The density of single family dwellings will be six dwelling units per acre, the density of duplexes will be 10 dwelling units per acre and the density of multi-family dwellings will be fifteen dwelling units per acre.

B. Land Requirements

1. Dwelling units constructed (1983-2000)

a. Permanent dwelling units: 21.8du/yr x 17yrs = 371du.
b. Seasonal dwelling units: 20.7du/yr x 17yrs = 352du.
c. Vacancy factor .02 x 723 = 14 du.
d. Demolished units replaced = 2 x 17 =34 du.
e. Total dwelling units = 771

2. Type of dwelling units

a. Single family residential dwellings: 771 x .75 = 578
b. Multi-family & duplex: 771 x .25 = 193

3. Land requirements

a. Single family residential dwellings: 578 du - 6 du/acre = 96 acres.
b. Multi-family or duplex: 193 du - 12.5 du/acre = 15.4 acres
c. Total residential acreage required 111.4

<u>CAPACITY OF THE URBAN GROWTH BOUNDARY</u>

An inventory of the vacant land available for development within the City of Cannon Beach's Urban Growth Boundary, by sub-area, plan designation/zone, and current availability of sewer/water services is shown on Table 10. The vacant land designated/zoned for residential use (vacant land in the RVL, RL, R1, R2, R3, and RAM designations/zones plus 1/2 of the vacant land in the RM designation/zone, where both residences and motels are outright permitted uses) totals 206.5 acres, of which 113.4 are currently serviced with sewer and water. Furthermore, it is expected that the 93.1 acres which are currently unserviced will be provided with sewer and water services during the planning period. The amount of vacant residential land available within the City's UGB thus compares favorably with the City's projected 1983-2000 residential land need of 111.4 acres.

The vacant land designated/zoned for duplex and multi-family use under the following designations/zones -- R3, 1/2 of RM (assuming only seasonal multi-family dwellings could compete successfully with motels for this land), 1/4 of R2 (assuming that 3/4 of the R2 designated/zoned land will actually develop as single family residences) -- totals 17.57 acres, of which 16.56 acres are currently serviced. This total meets the projected need of 15.4 acres to be developed as duplexes or multi-family dwellings.

PROVISION OF ADEQUATE LAND FOR LOW AND MODERATE INCOME HOUSING TYPES

Low and Moderate Income Permanent Housing Needed

1. Assumptions

    a. Percentage of additional low income permanent households = 33%.

    b. Percentage of additional moderate income permanent households = 25%.

    (See Income section, at page 164, for derivation of percentages.)

2. Dwelling Units Needed (1983-2000)

    a. Low income = .33 x 371 x 1.04 = 127

    b. Moderate income = .24 x 371 x 1.04 = 93

The 127 units of additional low-income permanent housing projected to be needed can be provided for adequately by multi-family dwellings and mobile homes on the vacant R3 and RAM designated land. The 5.38 acres of vacant R3 land are expected to be developed as multi-family dwellings at 15 units/acre, producing 80 dwelling units. In the RAM designation, there are 26 vacant lots in an existing mobile home subdivision; an additional 3.15 acre RAM area northeast of the existing subdivision which could be developed at at least 6 mobile homes/acre (19 units); and a 2.6 acre RAM area southeast of the existing subdivision which, because of slope constraints, is unlikely to develop at more than 4 mobile homes/acre (10 units). These three areas provide for a total of 55 mobile home sites. Thus, a total of 135 lower-income housing opportunities are provided in the R3 and RAM zone. This exceeds the projected need of 127 units.

In addition there is a vacant 7.3 acre area which is currently designated/zoned RVL, but which under Midtown Policy #4 will most likely be given an RAM designation/zone when conversion to urban use occurs. Development on this site at 4 units per acre (due to slope factors) could provide another 29 mobile home sites.

The need for 93 additional units of moderate income housing can be provided for adequately by duplex dwellings on vacant R2 designated land. Assume that 1/4 of the vacant 41.36 acres of R2 designated land is developed for duplexes at an expected density of 10 units/acre, this would provide for 103 moderate income dwelling units. This is greater than the 93 units projected to be needed during the planning period.

ATTACHMENT E

Section 3.100 Mobile Home and RV Park Zone, MP

Purpose: The purpose of this zone is to provide for lower income housing in the form of mobile homes in mobile home parks and on individual lots, recreational vehicle parks and accessory uses, and campgrounds.

1. Uses Permitted Outright

   The following uses and their accessory uses are permitted outright in the MP zone:

   a. Placement of recreational vehicles in an approved recreational vehicle park;

   b. Placement of mobile homes in an approved mobile home park;

   c. Tent camping in an approved campground;

   d. Public park or publicly owned recreation area;

   e. Utility lines necessary for public service;

   f. A trailer or mobile home used temporarily during the construction period of a permitted use for which a building permit has been issued, but not to exceed one year.

2. Conditional Uses Permitted

   In an MP zone, the following uses and their accessory uses are permitted subject to the provisions of Article 6:

   a. Recreation vehicle park;

   b. Campgrounds;

   c. Mobile home parks;

   d. Structural Shoreline Stabilization: Rip-rap, bulkhead or seawall consistent with Section 6.230;

e. Mobile home on an individual lot.

3. Standards.

In an MP zone, the following standards shall apply:

a. Lot Size. A mobile home on an individual lot shall have a minimum lot size of 5,000 square feet. A mobile home placed in a mobile home park shall have a lot size in conformance with Section 6.185. Recreational vehicles placed in a recreational vehicle park shall have a lot size in conformance with Section 4.140.

b. Lot Dimensions.

(1) Mobile homes on an individual lot shall have a minimum lot width of 40 feet and a minimum lot depth of 80 feet. The front yard shall be at least 15 feet. The sideyard shall be at least 5 feet, except on a corner lot, the minimum side yard on the street side shall be 15 feet. The rear yard shall be at least 15 feet, except on a corner lot, it may be a minimum of five feet.

(2) Mobile homes placed in a mobile home park shall meet the lot dimension standards of Section 6.185.

(3) Recreation vehicles placed in a recreation park shall meet the lot dimension standards of Section 4.110.

c. Solar Access. Mobile homes shall be positioned to meet the Solar Access Protection requirements of Section .

d. Building Height. Maximum height of a structure shall be 24 feet, measured as the vertical distance from the average elevation of existing grade to the highest point of a roof surface of a flat roof, to the top of a mansard roof, or to the mean height level between the eaves and the ridge for a pitched roof. The ridge height of a pitched roof shall not exceed 28 feet. Pitched roofs shall be considered those with a 5-12 pitch or greater.

e. Mobile Homes. Mobile homes shall be located in accordance with the requirements of Section 4.500.

f. Signs. As allowed by Section 4.040.

g. Parking. As required by Section 5.010.

h. Design Review. All uses except mobile homes and their accessory structures are subject to Design Review of Section 4.100.

i. Geologic or Soils Engineering Study. As required by Section 4.110.

ATTACHMENT F

AREA 1

Area 1 is proposed to be designated/zoned MP. It is adjoined on the west, north, and southeast corner by areas designated/zoned, or proposed to be designated/zoned, RAM and on the east by the UGB. On the south, Area 1 is adjoined by land designated/zoned C1, C2 and RVL. The designation/zone of the C1 property adjoining the southwest corner of Area 1 was changed to C1 for the purpose of providing an accessory service station and convenience store to serve an RV park to be located in Area 1 (see Ordinance No. 83-17). In addition, the RVL designated/zoned area to the south of Area 1 is ultimately destined, pursuant to Midtown Policy 4, to itself be designated/zoned RAM or MP. With the exception of the 28 unit Elkland Village Mobile Home Subdivision to the west, only two of which sites are developed at present, the areas surrounding Area 1 are currently undeveloped.

Adequacy of Public Facilities and Services

Sewer. There is an eight-inch sewer main running along the south and west boundaries of Area 1. This main is sized adequately to allow for either mobile home or RV park development of Area 1 at the densities allowed under the City's comprehensive plan and zoning ordinance. The Elkland Sewage Lift Station is located near the southeastern corner of Area 1. It receives all of the sewage from the area east of Highway 101 and north of Elk Creek Road by gravity flow and pumps the sewage back to Highway 101.

With its present impellers (pumps) this lift station has an optimum design capacity of 110 dwelling units. Its maximum design capacity, with the present impellers, is between 200 and 300 dwelling units. This means that the current pumping capacity of the lift station is more than adequate to handle development of the

28 lots of the Elkland Village subdivision, the 19 dwelling units which would be likely to be developed in Area 2 at a reasonable density of six per acre, the 10 dwelling units likely to developed in Area 3 at a reasonable density of four dwelling units per acre, the 7 dwelling units which might be developed in the RVL area under its present designation/zone, and the 36 dwelling unit equivalents (three RV or camping units would be the equivalent of one dwelling unit for sewage system purposes; 9.6 x 11 : by 3 = 35.2) which would exist if Area 1 is developed as an RV park or campground at the maximum density allowable in the MP designation/zone of 11 per acre (a total of 100 units). Even if Area 1 were to develop in mobile homes at a reasonable density of six units per acre (57 units), and the designation/zone of the RVL area eventually were changed to RAM, and accompanying mobile home development (considering slope constraint) were at a reasonable four units per acre (total 29 units), the dwelling units in the area served by the sewage lift station would only total 143, well within the maximum design capacity of the lift station.

The recent completion of Cannon Beach's Wetlands Sewage Treatment System insures that there will be adequate sewage treatment capacity to handle the sewage generated from Area 1, regardless of whether the area is eventually developed as mobile homes and/or an RV park.

Water. A six-inch water main is located along the west and south boundaries of Area 1. This main is sized adequately to handle the needs of Area 1 regardless of whether eventual development is mobile homes or an RV park. The City of Cannon Beach's water system has adequate capacity to provided the water needed by Area 1 regardless of ultimate development in mobile homes or an RV park.

Electricity. A Pacific Power & Light substation is located immediately across Elk Creek Road south of Area 1. There are existing transformers at the southwest corner of Area 1 and along Elkland Drive. An Electrical conduit runs up Elkland Drive west of Area 1. Empty electrical conduits available to provide service to Area 1, are located at the northwest and southwest corners of Area 1. Electrical lines are also installed along the southern boundary of Area 1 as far as the Elkland Lift Station. Electrical service could be delivered to Area 1 through these existing lines and conduits or, if the area develops as an RV park, from a single location at the entrance to the RV park, with underground lines within the park.

Telephone and Cable TV. There are terminal junction boxes located on the west side of Elkland Drive, opposite the southwest corner of Area 1. There is an empty conduit already running under Elkland Drive along the west edge of Area 1. Area 1 can be served from these facilities, as either a mobile home development or as an RV park.

Roads. Elkland Drive, which runs along the western boundary of Area 1, was designed to be a collector street and currently provides a paved surface 28 feet in width, in a 75 feet wide right-of-way. Section 9.2.F of the Subdivision Ordinance requires collector streets to be 22 feet in width and have a minimum right-of-way width of 40 feet. The usual average daily traffic (ADT) range for collector streets is 800 to 3,000. Studies reported by the Institute of Traffic Engineers found an average of 8.7 trips per dwelling unit on weekdays and Sundays, and an average of 10 on Saturday. Therefore, Elkland Drive has more than adequate capacity to serve 80 to 300 dwelling units.

The existing Elkland Village Subdivision contains 28 lots. As described above, under the MP designation/zone, Area 1 could be developed with approximately 57 mobile homes (probably not all of which would be accessed from Elkland Drive), and Area 2 (plus the remaining 0.8 acre RAM area outside the existing subdivision) with approximately 19 dwelling units. Therefore, a maximum of 104 dwellings (only 47 dwellings if Area 1 is developed as an RV park with access from Elk Creek Road) would conceivably be accessed from Elkland Drive. This is well within Elkland Drive's capacity.

Elk Creek Road, which runs parallel to the southern boundary of Area 1, but 150 feet to the south (on the other side of the C1 and C2 areas adjoining Area 1), is currently a rocked road with some gravel, 18 feet in width in a 40 foot right-of-way. It extends from the U.S. 101 right-of-way east of the UGB. At present three public facilities structures (Elkland Sewage Lift Station, the P&L Substation and the City Water Reservoir) are the only development accessed from Elk Creek Road.

An RV park in Area 1 could be accessed from Elk Creek Road, through the intervening C1 commercial area, to which the C1 designation/ zone was applied for the specific purpose of providing accessory services to such an RV park. In addition, Area 3 will eventually be accessed from Elk Creek Road, either by a new road running directly north from Elk Creek Road or by an extension of the road which currently runs from Elk Creek Road to the sewage lift station.

Development of Areas 1 and 3, as well as development of the existing commercial areas, would require improvement of the Elk Creek Road. Under the City's Comprehensive Plan, the Planning Commission and Public Works Committee have the authority to set standards for city street projects and streets in private developments. Also, under the City's Subdivision and Zoning Ordinance the City can and no doubt will require any potential developer of Area 1, Area 3 or the commercial areas to improve sections of Elk Creek Road to standards appropriate for the type and density of development allowed by the areas's plan designation/ zone as a condition of approving the proposed development. This will ensure that future development in these areas will proceed concomitantly with necessary improvements, and will not overburden Elk Creek Road.

Fire. There is an existing fire hydrant at the southeast corner of Elkland Drive and Kramer Court, at the northwest corner of Area 1, and also at the intersection of Elkland Drive and Elk Creek Road. Fire protection can be provided to Area 1 by the Cannon Beach Volunteer Fire Department. Adequate access for Fire Department vehicles into Area 1 can be designed and provided for regardless of whether the area develops as mobile homes or as an RV park.

Police. Police protection can be provided to Area 1 by the Cannon Beach Police Department.

Storm drainage. Area 1 does not drain onto any of the adjacent areas, but rather drains into the natural wetland located to the east. Thus, a drainage plan for Area 1 can be developed independently without affecting any of the adjoining properties. Since any development of Area 1 under the proposed new MP zone will require conditional use approval, a specific drainage plan can be required as part of the process.

Impacts on Adjacent Uses and Neighborhoods

Under the MP designation/zone, development of Area 1 with mobile homes as conditional uses could occur either on individual lots or in a mobile home park, whereas the adjacent RAM areas allow mobile homes only on individual lots. Both the MP and RAM designation/ zone have a 5,000 square foot minimum lot size for mobile homes on individual lots. The minimum area requirement for double-wide mobile homes in a park is also 5,000 square feet, and that for single-wide mobile homes is only slightly smaller, 4,000 square feet. Thus, the density of development in a mobile home park in the MP designation/zone would be only slightly greater than that of mobile homes on individual lots in the RAM designation/zone.

The main difference between mobile home parks and mobile homes on individual lots is that mobile home parks generally have private streets with controlled access. This would create no additional impact on adjoining uses. In appearance, and all other respects, a mobile home park in Area 1 would be very similar in use to the existing mobile home subdivision in the adjoining RAM area to the west. Thus, the impacts on adjacent areas would be minimal, and probably negligible.

The major respect in which development of Area 1 may differ from that of the surrounding residential areas is that under the MP designation/zone Area 1 may be developed as an RV park or campground. Therefore, my testimony will center around possible impacts of RV park development (which would also cover any possible impacts of campground development) of Area 1 on adjacent mobile home or other residential uses and neighborhoods, and methods which the city could use under its existing condition use permit authority to minimize and eliminate any adverse affects. Where any exist, possible impacts of RV park development on the adjacent C1 and C2 areas will also be noted and discussed.

Traffic. RV parks must accommodate long vehicles that cannot turn around easily. Problems may occur if these vehicles stray into residential areas which do not have through streets. RV parks frequently have additional traffic not experienced in adjacent residential areas in the form of service vehicles and guests visiting the park occupants. The density of people and vehicles in an RV park will be greater than in most residential neighborhoods, and especially so on weekends. This is the opposite of the standard pattern for a normal residential area, but is typical for residential areas in Cannon Beach. RV park traffic will not adversely affect adjacent commercial areas in that commercial areas are designed for a high volume of traffic.

There are measures available which can virtually eliminate adverse traffic impacts of an RV park. Adequate signing can prevent RV's from inadvertently straying into neighboring residential areas. Keeping the entrance of the RV park as close to a main thoroughfare as possible will reduce the possibility of RV's finding their way into residential neighborhoods. In the case of Area 1, access to an RV park could be from Elk Creek Road through the C1 area created to provide accessory services to the RV park, rather than from the residential Elkland Drive. The C1 area is at the intersection of Elkland Drive and Elk Creek Road, virtually adjacent to the Highway 101 interchange. RV parks generally have only one entrance and exit, which is controlled, reducing the possibility of RV's inadvertently wandering through residential neighborhoods. Furthermore, requiring adequate parking spaces to be provided within the RV park itself for guests of the RV park users, and providing adequate off-street RV parking in the vicinity of the RV park office and check-in area will eliminate possible problems of RV and guests parking in adjacent residential areas or blocking access to adjacent commercial areas and uses.

Another aspect of RV park-related traffic problems is the potential effect upon other parts of the City as the RV's travel to the downtown area for shopping and to recreation areas such as the beach. Potential problems would include increased traffic along these routes and parking congestion at the destinations. Access from Area 1 to downtown Cannon Beach is entirely along arterial streets. No RV traffic will need to traverse residential streets in order to reach the downtown area or the beach. With respect to paring, the City has recently provided a new RV paring area from the downtown and beach areas near the City's sewage treatment facility. Another way to decrease RV traffic in the downtown area would be to provide a mini-convenience store near any RV park in Area 1 in order to provide basic food and personal items.

Noise. In instances where increased noise is observed in the vicinity of an RV park, it usually arises from the increased density of people within the park or from the use of self-contained generators in the RV's. There are several methods which could be used to eliminate these excess noises. If full electricity is provided to the RV park, as would be the case in Area 1, it would not be necessary for park guests to run their generators. A playground or other recreational area could be required to be situated in the central or eastern portion of Area 1 away from adjoining residential areas. Other possible noises from an RV park could be screened out by earthen berms around the perimeter, or could be reduced by vegetative plantings or the use of buffer zones between the RV park and residential areas.

Lighting. While residential areas generally have street lighting (although the residential areas adjoining Area 1 do not at present), and RV park is required to have area lighting. In addition, vehicles may be entering, leaving and driving around an RV park at night to a greater degree than occurs in adjoining residential areas. Adverse impacts of such area lighting and of RV headlights on adjacent residential areas can be minimized through the use of low-level (in both height and intensity) lighting, by screening with vegetation or can be eliminated through use of earthen berms around the perimeter of the RV park and by providing access to the RV park away from residential streets.

Visual appearance. OAR 333-31-020(1) requires the management of an RV park to maintain buildings, grounds, rental units, spaces, and furnishings in good repair and appearance and clean condition. Nevertheless, inhabitants of neighboring residential areas many consider RV's themselves and the offices, restrooms, bathing facilities, laundry facilities, etc. which accompany an RV park visually offensive. This problem can be avoided through good design of the RV park and its accessory structure, and use of buffer zones, vegetative screening, fences and earthen berms so that the RV park is not actually visible from adjacent residential areas, and by designing access to the RV park to keep RV's off of residential streets.

Recreational Character. It is possible that the recreational and tourist character of an RV park could have adverse impacts on adjacent residential neighborhoods, in the form of increased trespass by adults, children, or pets from the RV park. One solution to this problem is to impose strict requirements on restraint of pets in the RV park and to provide both people and pets with adequate recreational opportunities sos that they won't need to go wandering in adjacent residential areas. Such wandering can also be effectively discouraged through use of earthen berms, fences or other barriers.

In the case of Area 1, the nearby beach and ocean can, of course, be used for recreational purposes, but there is also an adjacent natural area to the east in common ownership with Area 1. Nature trails, bike trails, picnic areas, etc. could be provided by the RV park owners in this natural area. The City could also require a certain amount of recreational facilities, such as tennis courts, to be located in an RV park itself.

Impact on Adjacent Lake & Wetlands Use. The adjacent area to the east is under common ownership with area 1, but is outside of the Urban Growth Boundary and, except for the area of the old Highway

Division fill, is currently zoned Lake and Wetlands (LW-Section 3.160, Clatsop County Land and Water Development Use Ordinance). The purpose of this zone is to allow for the conservation of wetlands and shorelands. Permitted uses include low intensity recreation use.

Potential negative impacts on this Lake and Wetlands zone from RV park or mobile home development of Area 1 include disturbance of the wetlands due to construction of improvements on the adjacent property and disturbance of the outdoor recreation nature of the area. In fact, irregardless of the proposed designation/zone, any construction development of the adjacent property could have a negative impact on the wetlands if the construction is not properly done. Erosion of newly worked earth and resulting siltation could adversely impact the wetlands.

There are several construction methods which can be used to control such potential problems. Earth movement should be kept to a minimum and slopes should be kept as flat as possible. Erosion and sediment can be controlled by the installation of temporary silt fences during construction and by the use of slope erosion control fabrics along with slope revegetation on unprotected newly constructed slopes. Implementation of a general landscaping plan will also help to control erosion. The City has authorized, in its standards, the imposition of such measures upon the development of Area 1 and other properties adjacent to these wetlands.

Another potential adverse impact could be the disturbance of the natural outdoor recreation area due to trespass from an adjacent RV or mobile home park in Area 1, such as the use of motorized vehicles within the Lake and Wetlands area. The owners of the wetlands area have proposed in the past to construct and maintain some hiking and biking trails, etc., for access to the Elk Creek area as part of their proposed RV park. The construction of barricades, which allow for foot traffic but not motorized vehicle traffic, will control such trespass on these trails. Typically, such barricades include wooden posts or poles set into the ground at close intervals on a selected pattern. A requirement for installation of such barricades could be made a part of the development standards imposed by the City upon such a development.

AREA 2

This 2.3 acre area is proposed to be designated/zoned RAM. It is bordered on the north and east by UGB, on the west by another RAM area and on the south by Area 1, which is proposed for MP designation/zoning.

Adequacy of Public Facilities and Services

As described for Area 1, an eight-inch sewer line, a six-inch water line and an empty electrical conduit run under elkland Drive and are stubbed out at its intersection with Silverpoint Avenue to within 150 feet of the southwest corner of Area 2, and capacity to provide these services is adequate. Telephone and cable T.V. lines are also readily accessible at this intersection. Road access to Area 2 has already been discussed in the Roads Section under Area 1 above. Fire protection and police protection can be provided by the Cannon Beach Volunteer Fire Department and Cannon Beach Police Department. Drainage from this area is to the north and east into the natural wetland and does not affect any adjoining properties. A storm drainage plan for the property can be prepared at the time development occurs.

Impacts on Adjacent Uses and Neighborhoods

At present, Area 2 is surrounded by undeveloped property. An area with an identical RAM designation/zone is adjacent to Area 2 to the west. Possible impacts of RV park development of the property to the south of Area 2 on Area 2 itself have been dealt with under Area 1. Development of mobile homes or other residential uses in Area 2 would not have adverse impacts on similar mobile home uses or on an RV park located to the south in Area 1. As described under Area 1 above, any such RV park would be buffered by earthen berms, vegetative screening, etc. to protect the adjacent residential areas.

Potential negative impacts on the adjacent LW wetlands area from development allowed by the proposed RAM designation/zone in Area 2 are similar to those previously discussed for Area 1 and may be minimized and controlled in a similar manner.

AREA 3

Area 3 is a 2.6 acre area proposed to be designated/zoned RAM. It is adjoined on the north and the east by the UGB, on the west by Area 1, which is proposed to be designated/zoned MP, and on the south by an RVL area. All of the ares adjoining Area 3 are presently undeveloped.

Adequacy of Public Facilities and Services

An eight-inch sewer line, six-inch water line and full electrical conduit run to the Elkland Sewage Lift Station and are stubbed out about 80 feet from the southwest corner of Area 3. As described under Area 1 above, these sewer, water and electrical facilities have the capacity to serve the development anticipated in Area 3. Telephone and cable T.V. lines are accessible from the existing terminal junction boxes opposite the southwest corner of Area 1. Road access to Area 3 could be provided from Elk Creek Road along the eastern boundary of the C2 area and then along the southern boundary of Area 1 to Area 3 or, what would probably be preferable, from Elk Creek Road through the current RVL area to Area 3. Although Area 3 does have an average slope of 20% (which limits potential residential development of this area to four dwelling units per acre), it has no identified geological hazards which would pose a problem for road building. Road access to Area 3 has already been discussed in the Roads section under Area 1 above. Fire and police protection can be provided to Area 3 by the Cannon Beach Volunteer Fire Department and Cannon Beach Police Department. Drainage from Area 3 is to the north and east into the natural wetlands and does not affect other adjacent properties.

Impacts on Adjacent Uses and Neighborhoods

Under the RAM designation/zone, development of Area 3 will be in the form of mobile homes or other residences. Compatibility between such residential uses and a potential RV park located in Area 1 to the west have been described under Area 1. It is very likely that the RVL area adjoining Area 3 to the south will eventually be given an identical RAM designation, pursuant to Midtown Policy 4. Nevertheless, in the mean time, under its present RVL designation/zone the only likely significant difference between development allowed in the RVL area and in Area 3 (considering the constraints the 20% slope imposes on density in Area 3) is that development of Area 3 may occur in the form of mobile homes, whereas mobile homes are prohibited in the RVL area. However, mobile home development of Area 3 would not have an adverse visual impact on the RVL area because the density of development allowed would not be greater than four units per acre and because modern mobile homes look very much like stick-built housing. Skirting is required to be used by the Department of Commerce, and so the wheels of the mobile home are obscured. Modern mobile homes also use aluminum woodgrain siding and may even come with composition roof shingles, further eliminating the visual difference between them and conventional homes.

Potential negative impacts on the adjacent LW wetlands area from development allowed by the proposed RAM designation/zone in Area 3 are similar to those previously discussed for Area 1 and may be minimized and controlled in a similar manner.

GOAL #17 COASTAL SHORELANDS

The objective of Goal 17, Coastal Shorelands is:

> "To conserve, protect, where appropriate develop, and where appropriate restore the resources and benefits of all coastal shorelands, recognizing their value or protection and maintenance of water quality, fish and wildlife habitat, waster dependent uses, economic resources and recreation and aesthetics. The management of these shoreland areas shall be compatible with the characteristics of the adjacent coastal waters; and
> To reduce the hazard of human life and property, and the adverse effects upon water quality and fish and wildlife habitat, resulting from the use and enjoyment of Oregon's coastal shoreland."

To accomplish this objective, Cannon Beach is required to develop a program for coastal shorelands based on two sets of requirements: the identification of a coastal shoreland boundary and the regulation of uses and activities in certain areas. To provide data for the identification of a coastal shoreland boundary, Goal 17 requires that an inventory of geologic and hydrologic hazards, fish and wildlife habitat, water-dependent uses, economic resources, recreational uses and aesthetic resources be conducted within a "coastal planning area", which is defined as:

> "All lands west of the Oregon Coast Highway as described in ORS 366.235; and
> All lands within an area defined by a line measured horizontally;
> (a) 1000 feet from the shoreline of estuaries; and
> (b) 500 feet from the shoreline of coastal lakes."

This inventory of features within the "coastal shorelands planning area" is used to establish the extent of coastal shorelands. Goal 17 requires that the extent of identified shorelands shall include at least:

(1) Areas subject to ocean flooding and lands within 100 feet of the ocean shore or within 50 feet of an estuary or a coastal lake;

(2) Adjacent areas of geologic instability; where the geologic instability is related to or will impact a coastal water body;

(3) Natural or man-made riparian resources, especially vegetation necessary to stabilize the shoreline and to maintain water quality and temperature necessary for the maintenance of fish habitat and spawning areas;

(4) Areas of significant shoreland and wetland biological habitats; whose habitat quality is primarily derived from or related to the association with coastal water areas;

(5) Areas necessary for water-dependent and water-related uses, including areas of recreational importance which utilize coastal water or riparian resources, areas appropriate for navigation and port facilities, dredge material disposal and mitigation sites, and areas having characteristics suitable for aquaculture;

(6) Areas of exceptional aesthetic or scenic quality, where the quality is primarily derived from or related to the association with coastal water areas; and

(7) Coastal headlands."

Goal 17 also establishes the following specific use priorities for the following areas within coastal shorelands which may be pertinent to Cannon Beach:

(1) Major marshes, significant wildlife habitat, coastal headlands, exceptional aesthetic resources identified in the Comprehensive Plan shall be protected. Uses in these areas shall be consistent with protection of natural values. Such uses may include propagation and selective harvesting of forest products consistent with the Oregon Forest Practices Act, grazing, harvesting wild crops, and low-intensity, water-dependent recreation.

(2) Shorelands in urban and urbanizable areas especially suited for water-dependent uses shall be protected for water-dependent recreational, commercial and industrial uses.

Some factors which contribute to this special suitability are:

(a) deep water close to shore with supporting land transport facilities suitable for ship and barge facilities;
(b) potential for aquaculture;
(c) protected areas subject to scour which would require little dredging for use as marinas; and
(d) potential for recreational utilization of coastal water or riparian resources.

Other uses which may be permitted in these areas are temporary uses which involve minimal capital investment and no permanent structures, or a use in conjunction with and incidental to a water-dependent use.

(3) Local governments shall determine whether there are any existing developed commercial/industrial waterfront areas which are suitable for redevelopment which are not designated as specially suited for water-dependent uses. Plans shall be prepared for these areas which allow for a mix of water-dependent, water-related, and water oriented nondependent uses and shall provide for public access to the shoreline.

In addition to the Comprehensive Plan requirements for coastal shoreland boundary identification and coastal shoreland use and activity regulations, Goal 17 also establishes six implementation requirements regulations, Goal 17 also establishes six implementation requirements dealing with the following areas or features within coastal shorelands:

(1) Forested Lands. Implementation Requirements 1 requires the Oregon Department of Forestry to recognize the unique and special values of coastal shorelands, and to develop (in conjunction with other state and federal agencies) forest management practices and policies which protect and maintain these special shoreland values and forest uses.

(2) Mitigation and Dredged Material Disposal Sites. Implementation Requirements 2 and 3 require that coastal shoreland areas which may be used to fulfill the mitigation requirement of the Estuarine Resources Goal

(Goal 16) or coastal shoreland areas which are identified as dredged material disposal sites be protected from new uses and activities which would prevent their ultimate use for mitigation or dredged material disposal.

(3) Riparian Vegetation. Implementation Requirement 4 requires that riparian vegetation be maintained, and, where appropriate, restored and enhanced where consistent with water-dependent uses.

(4) Structural Shoreline Stabilization. Implementation Requirement 5 establishes a preference for land use management practices and non-structural solutions over structural solutions to problems to erosion and flooding, and requires that structural solutions be designed to minimize adverse impacts on water currents and erosion and accretion patterns.

(5) Implementation Requirement 6 provides that the City, in coordination with the Parks and Recreation Division shall develop and implement a program to provide increased public access. Existing public ownerships, rights-of-way, and similar public easements in coastal shorelands which provide access to or along coastal waters shall be retained or replaced if sold, exchanged or transferred. Rights-of-way may be vacated to permit redevelopment of shoreland areas provided public access across the affected site is retained.

The coastal shoreland boundary for Cannon Beach was established through an inventory of all areas within the "coastal shoreland planning area" defined by Goal 17. The purpose of this inventory was to determine the location of the seven features which are required by Goal 17 to be included within the coastal shorelands. The following is a description of how these seven features where identified.

> "Areas subject to ocean flooding and lands within 100 feet of the ocean shore or within 50 feet of an estuary or coastal lake"... The City of Cannon Beach has identified all areas within the 100 year flood boundary as defined by the HUD Flood Insurance Study for Cannon Beach as coastal shorelands.

The 100-year flood boundary includes all areas which are subject to ocean flooding or are within 100 feet of the ocean shore or within 50 feet of Ecola Estuary.

"A Field Investigation of Geologic Hazards in Cannon Beach, Oregon", by Martin Ross was the basis for determining whether there are adjacent areas of geologic instability. A significant portion of Cannon Beach consists of geologic formations that have the potential for instability or hazard. These areas are identified on the Geologic Hazards and Formations Map as: Toms, Landslide topography; TMA, Astoria formation landslide topography; Sd, older stabilized dune; and Gmt, Marine Terrace deposits exhibiting landslide characteristics south of First Street in Tolovana Park.

A field inspection was used to determine the location of riparian vegetation. Riparian vegetation was identified adjacent to Logan Creek. This is a small stream and thus a 25 foot setback should be adequate to protect the existing vegetation along the stream. No riparian vegetation was identified along Ecola Creek. The southern bank of the creek is separated from upland areas by a dike. The northern bank of the creek, west of U.S. 101 Alternative, is separated from adjacent uplands by Fifth Street. East of U.S. 101 Alternative is a trailer park and horse pasture area. The extreme upstream end of the pasture areas contains the remnants of a forested wetland. No riparian zone was established around this area since the forested wetland itself performs the riparian function. This is also consistent with the approach used in identifying riparian vegetation in Clatsop County (see "Significant Shoreland and Wetland Habitats in the Clatsop Plains").

Areas of significant shoreland and wetland biological habitat were separated into two categories: "major marshes" and "significant wildlife habitat". Wetlands were identified in the study titled "Cannon Beach Wetlands". Based on a functional values assessment of each wetland, this study classified wetlands as having "high", "medium" and "low" values. Wetlands rated as "high" are assumed to be the equivalent of the term "major marshes", as utilized in Goal #17. All wetlands identified by the "Cannon Beach Wetland Study", including those rated as "high", are subject to the city's wetland overlay zone. This zone restricts the uses which are permitted in a wetland. The effect of applying the wetland overlay zone to wetlands rated as "high" is to protect "major marshes" as required by Goal #17.

Significant wildlife habitat was defined to include habitat for rare, threatened, or endangered animal or plant species; band-tail pigeons; unique habitat for sea birds, and Major Big Game Range areas. There are no significant wildlife habitat areas. No areas are identified as being necessary for water-dependent and water-related uses. Chapman Point has been identified as an area of exceptional aesthetic and scenic quality. It could also be considered as coastal headland.

Map shows the final Coastal Shoreland Boundary.

Beachfront Areas where development existed on January 1, 1977. The attached map indicates beachfront ares where development existed on January 1, 1977. Using the definition of development in the LCDC Coastal Goals, "Development means houses, commercial and industrial buildings, and vacant subdivision lots which are physically improved through construction of streets and provision of utilities to the lot and includes areas where an exception to the goal has been approved".

Under this definition, the areas of the City which were undeveloped prior to this date include portions of the Breakers Point area, and portions of the undeveloped dune areas between Breakers Point and Chapman Point (see map for tax lots affected). The rest of the beachfront areas in the City have been platted and developed for many years.

The City determined that there were no existing developed commercial/industrial water front areas suitable for redevelopment.

DELINEATION OF ACTIVE DUNES AND CONDITIONALLY STABILIZED DUNES IN CANNON BEACH

FOR
CITY OF CANNON BEACH
MAY, 1993

PREPARED BY:
DON LEACH

PREPARED BY:
DON LEACH

PROJECT DESCRIPTION

PROJECT: Delineation of the Active Dunes and Conditionally Stabilized Dunes in Cannon Beach.

PURPOSE: Conduct an inventory of beach and dune areas within the Cannon Beach urban growth boundary for the purpose of identifying the location of active dunes and conditionally stabilized dunes.

PROCEDURE: A field study was conducted on April 18, 19, and 28, 1993 following a series of spring rain storms. TheNational Weather Service office in Astoria, Oregon, the closest official weather station, recorded peak wind velocities of 23 mph on April 14, 1993; 31 mph on April 15, 1993; 26 mph on April 16 and 33 mph on April 17, 1993 from a South and Southwest direction. (Footnote Ref. 1) Beaches and dunes at Cannon Beach may have sustained wind velocities of this magnitude, or even higher, coming unobstructedly from the ocean.

MAPPING: The results of the field investigation were recordedon aerial photographs of Cannon Beach. The photographs were flown in April, 1990 and have a scale of 1" = 200'. The delineations are in the form of a line separating active dunes from conditionally stable dunes. (NOTE: The mapping is titled "Delineation of Active Dunes in Cannon Beach, 1993")

DESCRIPTION OF BASIS FOR MAPPING ACTIVE DUNES

The following definitions and descriptions of active dune, conditionally stable dune and uplands were used in the delineation of active dune areas. These definitions and descriptions reflect the terminology used in the following documents: State-wide Planning Goals; Beaches and Dune Handbook for the Oregon Coast, A System of Classifying Oregon's Coastal Beaches and Dunes; and Beaches and Dunes of the Oregon Coast.

ACTIVE DUNES:

Sand dunes are in an active state when they possess insufficient vegetative cover to retard wind erosion. In this condition, the sand dune is experiencing active accretion and/or erosion. Active dunes include mapping units of open dune sand, active dune hummocks and active foredunes. They may be free of vegetation or be covered with vegetation that can survive frequent and extensive sand covering. (Footnote Ref. 2, p 12; Ref. 6, p 24)

CONDITIONALLY STABLE DUNES:

When foredunes exhibit sufficient vegetative cover to retard the erosive effects of the wind, they are defined as conditionally stable. Obviously, the stability of a given foredune is conditional upon the maintenance of the vegetative cover, sand supply and velocity of the wind. Any conditionally stable sand dune is prone to reactivation upon disturbance of the vegetative cover. Conditionally wind stable dunes are still subject to water erosion.

UPLANDS:

The upland soils consist of Walluski silt loam (terrace), Humitropepts-Tropaquepts complex (terrace escarpments), Coquille-Clatsop Complex Silt loams (protected tidal flood plains), and dune lands. (Footnote Ref. 3)

These soils are well vegetated and are wind stable. Vegetation consists of native and ornamental plantings of grass, shrubs, and trees.

CONSIDERATIONS BASED ON FIELD INVESTIGATIONS

Cannon Beach oceanfront lies in a basically north and south direction so that the southwest storm winds essentially blow sand parallel with the beach front. A few exceptions are noted where headlands and building projections create a different wind pattern and larger volumes of sand collect; such areas are located just south of Ecola Court, at Breakers Point, and south of the Center Street beach access. These areas project oceanward from the general shoreline. When the wind encounters one of these projections, it loses velocity causing sand to be deposited.

In some cases the wind is funneled between buildings, a venturi effect is created increasing the wind velocity between the buildings, and the sand is moved farther inland.

On a static or accreting beach, an active dune will commonly evolve toward a conditionally stable state as vegetation is established and the dune raises in elevation. European beach grass is the primary initial stabilizing plant along the Oregon Coast. It will survive with as much as 2-3 ft. of accumulated sand in a single winter season. (Footnote Ref. 5) During the spring and summer, vegetation will grow up through the sand and form a lush growth that can be covered with sand again during the following winter. (Footnote Ref. 6, p. 24)

As the dune height rises due to the sand being collected in the beach grass and the vegetative area of sand collection enlarges beyond the capability of the wind to move the sand, then additional plant species become established. Indicator species for conditionally stable dunes are coast strawberry, pearly everlasting, false dandelion, yarrow, seashore lupine, purple beach pea, bristle hawkbit, salal and Indian paintbrush. These plants either do not occur or occur in only limited amounts on active dunes. (Footnote Ref. 2, p. 44)

Over a period of time, undercutting by waves from storms and ocean currents have caused selected sections of the uplands along Cannon Beach oceanfront to erode. This activity is particularly pronounced in winter months when storms and high tides cause wave erosion at the toe of the uplands and heavy rainfall saturates the soil and renders the uplands unstable when undermined by ocean waves. (Footnote Ref. 4)

To protect these areas, many private and public landowners have resorted to building seawalls of concrete, wooden planking and rock rip rap to reduce the rate of erosion of these uplands. In some cases, windblown sand has collected in the rip rap resulting in vegetation becoming established in the rock crevices and at the toe of the projects. This vegetation includes such plants as beach grass, evergreen and Himalaya blackberries, hooker bush willow, salal, and English ivy. While these plants are not primary stabilizer, other than beach grass, they can take a considerable amount of sand buildup once they are established.

It was noted that the active dune line usually extends from 5-10 ft. into this type of vegetation and may extend up the face of the protected area from 3-5 ft. in elevation. An exception to this general rule is at the public beach access trails. These trails form breaks in the vegetation line and therefore create a venturi effect which increases wind velocity and sand movement further inland at these sites.

GLOSSARY

Accretion:	The build-up of land along a beach or shore by the deposition of waterborne or airborne sand, sediment or other material.
Beach:	Gently sloping areas of loose material that extends landward from the low-water line to a point where there is a definite change in the material type or landform or the line of vegetation.
Dune:	A hill or ridge of sand built up by the wind along sandy coasts.
Dune, Active:	A dune that migrates, grows and diminishes from the effects of wind and supply of sand.
Dune, Conditionally Stable:	A dune which presently has sufficient vegetative cover to retard wind erosion but which is vulnerable to reactivation upon disturbance of this cover.

Terrace: A nearly level to undulating geomorphic surface formed mainly by wave erosion and beach deposition during a period when the land remained static, but which has subsequently been elevated above the beach.

Terrace Escarpment: The steep slope or cliff face of a terrace.

Plant Succession: The gradual and continuous replacement of one kind of plant by another until the community is replaced by another that is more complex.

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(1) NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION NATIONAL WEATHER SERVICE OFFICE, ASTORIA, AIRPORT WARRENTON, OREGON.

(2) BEACHES & DUNES HANDBOOK OF THE OREGON COAST: A SYSTEM OF CLASSIFYING AND IDENTIFYING OREGON'S COASTAL BEACHES AND DUNES, OCZMA, 1979.

(3) SOIL SURVEY OF CLATSOP COUNTY, OREGON, USDA-SCS 1988 MAP 40 & 45.

(4) ENVIRONMENTAL GEOLOGY OF THE COASTAL REGION OF TILLAMOOK AND CLATSOP COUNTIES, OREGON, BULLETIN 74.

(5) CONTROLLING COASTAL SAND DUNES IN THE PACIFIC NORTHWEST USDA CIRCULAR NO. 660.

(6) BEACHES & DUNES OF THE OREGON COAST, USDA/OCCDC, March, 1975.

CANNON BEACH WETLANDS STUDY

INTRODUCTION

Oregon Statewide Planning Goal 5 is *to conserve open space and protect natural and scenic resources*. Wetlands are among the resources protected by Goal 5. Cannon Beach received a wetland planning assistance grant from the Department of Land Conservation and Development and the Oregon Coastal Zone Management Association to complete Goal 5 for wetlands within the City and Urban Growth Boundary. A procedure for meeting the Goal's requirements is outlined in Oregon Administrative Rules (OAR) Chapter 660, Division 16. This procedure involves four steps: a resource inventory; conflicting use analysis; an analysis of the environmental, social, economic and energy consequences of the conflicting use on the resource; and development of a program to achieve the Goal. These steps are outlined in the following paragraphs.

Inventory the Goal 5 Resource: Wetland data from many sources were gathered, analyzed and refined. Wetland significance was determined, and a final inventory was prepared. The inventory is included in Part 1.

Identify Conflicting Uses: Uses and activities that conflict with wetland functions and values are identified for each resource site. Potentially conflicting <u>uses</u> were identified by examining the uses allowed by the City's zoning ordinance. Potentially conflicting <u>activities</u> were identified by considering the range of activities associated with the uses allowed by the zoning ordinance, and activities that are not regulated by the zoning ordinance. Conflicting uses and activities are described in Part 2 of this document.

Determine the Economic, Social, Environmental and Energy Consequences of Allowing Conflicting Uses: For resource sites with identified conflicting uses and activities, the Economic, Social, Environmental and Energy Consequences of allowing and restricting conflicting uses and activities are determined and analyzed. This analysis is included in Part 3 of this document.

Develop a Program to Achieve the Goal: A regulatory program to limit the impacts of conflicting uses and activities on wetland functions and values was developed. This program consists of a Wetland Overlay Zone and Stream Corridor Protection standards incorporated into the city's Zoning Ordinance.

INTRODUCTION

Oregon's land use planning Goal #5 requires that local jurisdictions "conserve open space and protect natural and scenic resources". Cannon Beach received a wetland planning assistance grant from the U.S. Environmental Protection Agency which was administered by the Oregon Department of Land Conservation and Development and the Oregon Division of State Lands (DSL) to complete Goal #5 process for wetlands. Additional funding was provided by the Oregon Coastal Zone Management Association. This process includes: a Local Wetlands Inventory, an evaluation of wetland functional values and site significance, an ESEE analysis, and zoning provisions to protect wetlands.

The Local Wetlands Inventory was conducted according to the standards and guidelines developed by the DSL (OAR 141-86-110 to 240). The objective of this inventory was to document, map, and evaluate wetlands within the Cannon Beach Urban Growth Boundary (UGB). When the inventory was completed, site significance was determined based on wetland functional values. The degree of significance for each site was rated as high, medium, or low. An ESEE analysis was completed for each wetland and zoning ordinance provisions were developed to limit conflicting uses in a manner that protects key wetland values.

2PROJECT TEAM

Christie Galen and Janet Burcham of Fishman Environmental Services conducted the Local Wetlands Inventory. Field inventory of the majority of resource sites was conducted from March through June, 1993. Two additional sites were field checked in August. Mark Barnes, Consulting Planner, conducted the ESEE analysis and prepared draft zoning ordinance amendments.

3METHODOLOGY

The methodology used to inventory wetlands followed the standards and requirements developed by DSL for a Local Wetlands Inventory (1993). Wetlands were determined by the criteria set forth in the Corps of Engineers Wetlands Delineation Manual (1987).

Wetland sites were established based on the following factors: stream corridors, breaks in natural features created by roads or culverts, land ownership, and land use according to initial instructions by DSL. For example, an uninterrupted stream corridor was given one number although it may encompass diverse habitats. If a stream corridor was interrupted by a main road, the continuation of the stream was given a new number.

Each wetland was classified according to Cowardin (1979): Forested wetlands (PFO), shrub-scrub wetlands (PSS), emergent wetlands (EEM, PEM), and streams (R). Streams were assigned an "R" and often a "PFO" if they were forested stream corridors.

Public Involvement

The City of Cannon Beach notified all property owners within the UGB of the study on February 10, 1993. Landowners were invited to attend a public meeting on March 10, 1993 to learn about the purpose and methodology of the inventory. They were also given an opportunity to deny access to their property. Cannon Beach staff reviewed numerous responses and noted tax lots on assessor maps where access was denied. These maps were provided to Fishman Environmental Services for field work. A second public meeting was held on June 25, 1993 to share preliminary results and provide property owners an opportunity to comment on those results.

Literature Review and Field Preparation

A systematic survey began with a field tour conducted by Rainmar Bartl, project manager and City Planner for Cannon Beach. FES staff met with Mr. Bartl to discuss the objectives and methodology for the project and to obtain all available existing information that would help in defining and mapping the wetlands of the study area.

Maps, aerial photos, and other resources utilized for the project included:

· National Wetlands Inventory (NWI) maps for Tillamook Head and Arch Cape (USFWS, 1982)

· Storm Drainage Maps (1993, Scale: 1 in. = 200 ft.) (most useful because open channels which were the dominant wetland resource in the UGB were identified by basin).

· Flood Insurance Rate Maps for Cannon Beach (1976, Scale: 1 in. = 100 ft.) compiled by CH2M Hill from topographic maps by Aerial Mapping Co. of Oregon

· Clatsop County Tax Assessor's map (Scale: 1 in. = 100 ft.)

· Oregon Department Of Transportation aerial photography, blueline reproductions of "Ocean Shores" series sheet nos.21-24. Scale: 1 in. = 200 ft., January 1984.

· USDA-Soil Conservation Service Soil Survey for Clatsop County

· The hydric soils list from the Clatsop County SCS office (SCS 1989)

· Wetland delineations completed previously for a few properties within the UGB that were on file with the City of Cannon Beach

Copies of the NWI map and the soils map for the study area are included in Appendix B.

Ms. Galen met with DSL staff (Janet Morlan, Emily Roth) to review project approach, methods and data sheets. DSL staff approved the methods.

Field

Each site was field surveyed to determine hydrology, soil, vegetation, land features, water resources, condition, adjacent land uses, and to rate the existing wetland functional values. On properties where access was denied, wetlands were viewed from adjacent roadsides or properties. Field notes are found in a document titled "Data Sheets and Wetland Functional Values Assessment Forms."

Wetland Determination

Wetland boundaries were determined according to the criteria and methodologies listed in the Corps of Engineers Wetlands Delineation Manual (1987), using the three parameter approach which specifies an assessment of hydrology, soils, and vegetation. Field work was conducted early enough during the growing season to assess hydrology; this was a critical factor in identifying disturbed wetland sites where relict vegetation and soils were present. At each site where access was permitted, a sample point was established and mapped. Indicators of hydrology (surface ponding, saturation within 12 inches of the surface), hydric soils (gleyed and low chroma matrix, mottles, sulfidic odor, and concretions), hydrophytic vegetation (more than 50% of dominant species are classified as Facultative, Facultative Wet, and Obligate wetland plants by the Federal Hydric Plant List) were recorded on standardized data forms.

Wetland Functional Values

Each site was evaluated for 10 wetland functions based on a field method used by Fishman Environmental Services for similar projects[1]. Wetland functions evaluated included ecological integrity, wildlife habitat, fish habitat, noteworthiness, educational potential, recreation, flood control, sediment trapping, nutrient retention, and urban quality (Table 1). Each function was rated as low, medium, or high. Ratings of values were made for existing conditions at the time of survey and not for the potential values sites might have if conditions were to change.

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1 Fishman Environmental Services developed a field method based on a draft EPA worksheet and elements of the New Hampshire wetland functional values method.

4 MAPPING

Each site was mapped on Clatsop County Tax Assessor's Maps (Scale: 1 in. = 100 ft.) and identified by number. Site boundaries are approximate; they were drawn by superimposing plat maps over contour maps (Flood Insurance Rate Maps) where available, by photo interpretation from 1984 Oregon Department Of Transportation aerial photography blueline reproductions (Scale: 1 in. = 200 ft.), or field measurements by pacing from a point of reference. The topographic maps are based on aerial photographs which are imprecise in forested terrain but were used when they seemed most accurate. In undeveloped areas with few or no cultural features for field orientation, or on properties where access was denied, wetland boundary lines were solely based on photo interpretation and/or contour maps. Consequently, the level of mapping accuracy is variable with each site. A color aerial photo would have allowed more accurate mapping, but it was not available this year due to unseasonal overcast weather.

After public comment and testimony, the location of several of the wetland sites was refined. The final inventory maps are entitled:

"Cannon Beach Local Wetland Inventory, September 20, 1994."

The mapping of the boundaries of the wetland is described by the "Cannon Beach Local Wetland Inventory" maps. The "impact area to be effected" is defined as the drainage sub-basins in which the wetland is located. Drainage sub-basins were determined to provide an appropriate "impact area" because these basins define an area of biological connectivity where various wetland functions are connected together to create a network. The concept of drainage sub-basins defining a biologic and hydrologic impact area is particularly pertinent because in almost all instances wetlands with a sub-basin are linked by a stream. The mapping of the drainage sub-basins within the city's urban growth boundary is contained on maps titled "Storm Drain System, Proposed Capital Improvements". These maps are incorporated into this report by reference. Each site summary sheet contains a reference to the drainage sub-basin in which the wetland site is located. For the reasons listed above, the drainage sub-basins define the wetland resource site and impact area to be affected for the purposes of the EESE analysis.

5 SUMMARY SHEETS

Summary sheets are included in Appendix C for each site. Each summary sheet contains the site number, acres if not limited to a narrow stream channel, location, basin name, tax map number, and tax lots. Site acreages were estimated from the tax assessor maps, or were determined with a planimeter. Summary sheets also contain a brief description of the site, its wetland functional values, impacts/disturbances such as fill or invasive nuisance species, and significance. Table 2 summarizes data for each site. The site summary sheets provide information on the "quantity" of each site in the form of an estimate of the size of the wetland.

6 SIGNIFICANCE CRITERIA

The determination of the quality of a site was based on the wetland functional value assessment. All identified sites were found to be significant. This determination was based on a finding that even where functional values were rated as low, those values still provided important natural values such as wildlife habitat, flood control, sediment trapping and nutrient retention.

The quality of sites was established by assigning each site a degree of significance of low, medium, or high. Each site summary includes a brief description of the basis for the determination of a site's relative significance. Sites that were rated as having low significance consisted of the following: seasonal streams, interrupted into short sections by culverts or development; small, disturbed forested wetlands; and short, perennial, interrupted stream sections consisting of only a channel or a channel with a very narrow fringe. Generally, sites determined to be of low significance were rated low in all the functional values, or had no more than three values that were rated other than low. Many of the sites were rated as having medium wildlife habitat values. Sites of medium significance included small streams with connectivity to other sites, or larger forested wetlands. In order for a site to be rated of medium significance three out of the four of the following criteria had to be rated as medium-low or medium: ecological integrity, wildlife habitat, noteworthiness, and urban quality of life. Sites of high significance consisted of large forested wetlands, moderate size forested wetlands connected to larger natural upland areas, and estuarine emergent wetlands. In order for a site to be rated of high significance two out of four of the following criteria had to be rated as high: ecological integrity, wildlife habitat, noteworthiness, and urban quality of life.

TABLE 1. WETLAND FUNCTIONAL VALUES RATING CRITERIA

1. ECOLOGICAL INTEGRITY
   - High - nearly undisturbed condition, large area, little or no surrounding development, contiguous with other large undisturbed areas, minimum of 5 native plant species
   - Medium - somewhat disturbed condition, somewhat disconnected from other refugia, surrounded by some development
   - Low - very disturbed, distinctly disconnected from other natural areas, monoculture of plant species, surrounded by relatively dense development

2. WILDLIFE HABITAT
   - High - permanent water, diverse cover types and food resources, and connectivity to other wildlife habitat; seasonal water if habitat is critical for amphibians or waterfowl
   - Medium - some disturbance to plant community, some disruption of travel corridors, somewhat less diversity in plant cover and structure
   - Low - no water, limited plant diversity, greatly altered from natural conditions

3. FISH HABITAT (ODFW known populations of native fish)
   - High - spawning, rearing areas present; habitat condition pristine or slightly disturbed
   - Low - very disturbed habitat; polluted, sediment build-up; too small or ephemeral to support fish.

4. NOTEWORTHINESS
   - High - critical habitat for sensitive species, unique features such as forest age, successional stage, or type; large size of natural area in otherwise developed area
   - Medium - not a critical habitat for sensitive species, vegetation community somewhat uncommon, some disturbance evident but recovery relatively advanced
   - Low - no potential habitat for sensitive species, vegetation community common for surrounding area, much disturbance and little or no recovery

5. EDUCATION POTENTIAL
   - High - High ecological diversity, low sensitivity to impacts, safe public access
   - Medium - within bussing distance to schools, moderate to high values for ecological integrity, noteworthiness, and/or wildlife habitat to offer educational potential, some disturbance from natural conditions, small size
   - Low - Low diversity, high sensitivity to impacts, too far to walk from school, no parking available, no public access, very disturbed conditions

(continued next page)

TABLE 1. WETLAND FUNCTIONAL VALUES RATING CRITERIA (continued)

6. RECREATION
   High - variety of natural, undisturbed habitats, wildlife observation, access for boats or pedestrians, good water quality, fishing, boating
   Medium - one or two natural habitats, potential access, cleanup potential, access for water-related activities or public access by trail
   Low - lack of habitat diversity, small size, no access, poor water quality, no boating

7. FLOOD CONTROL
   High - wetland location in drainage and morphology ensures retention of above average flows, large distinct floodplain, located downstream of major sources of input
   Medium - small floodplain, limited retention
   Low - wetlands are small or not appropriately located to retain much runoff

8. SEDIMENT TRAPPING
   High - slopes of watershed above wetland are greater than 8% and have cropland, construction, or logging activities; emergent or herbaceous vegetation is dense or wetland or water impoundment is large enough to allow sediments to collect from the drainage
   Medium - limited floodplain, site not downstream of major source of input
   Low - adjacent slopes less than 3% and undeveloped watershed (forest, abandoned farm), ponding, if present, too small to effectively trap sediments, no floodplain development, site not downstream of major source of input

9. NUTRIENT RETENTION
   High - site downstream of potential sources of excess nutrients (pastureland, urban land); aquatic and/or emergent plants present to absorb nutrients, large floodplain
   Medium - site not downstream of major sources of input, small floodplain and limited vegetation
   Low - site not downstream of potential sources (watershed predominantly forested), no floodplain

10. URBAN QUALITY OF LIFE wetlands as aesthetically valuable and a last refuge for wildlife
   High - natural vegetation, animal choruses, and natural odors predominate, buffer >25 ft, 2 or more cover types, permanent water; potential for educational or passive recreational use; scarcity of wetland type; high visual quality
   Medium - some disturbance; somewhat uncommon vegetation community type but not rare or scarce in area
   Low - unpleasant odors, loud noises, buffers <15 feet and dense surrounding development, 1 cover type and disturbed conditions

7 STUDY AREA SUMMARY

A total of 54 sites was inventoried; many sites contained more than one wetland type. Wetland types within these 54 sites included: 5 emergent wetlands, 3 shrub-scrub wetlands, 27 forested wetlands, and 38 stream sections.

Emergent Wetlands (PEMC, EEM)

Five emergent wetland sites were inventoried including two estuarine wetlands. Typical vegetation growing in freshwater emergent wetlands (PEMC) included soft rush, slough sedge, bulrush, buttercup, velvet grass, and red top. Typical vegetation in estuarine emergent wetlands (EEM) included Pacific silverleaf, Lyngbye's sedge and beachgrass. The freshwater emergent wetlands (Sites 21, 43, and 31) were generally small and disturbed by fill and/or land clearing. Sites 21 and 31 rated Medium due to their association with larger diverse habitat. The estuarine emergent wetlands (Sites 10B and 16) are associated with Ecola Creek. They are highly significant because of their large size and their location. They provide habitat for migrating and wintering waterfowl and resident elk. They also provide water quality functions for flood control, sediment trapping, and nutrient retention.

Scrub-shrub Wetlands (PSSC)

Scrub-shrub wetlands are a small component of larger emergent and forested wetlands.

Forested Wetlands (PFOC)

Twenty-seven forested wetland sites were inventoried. All of these sites are associated with stream corridors or relict drainages. Forested wetland vegetation included a multi-layered canopy dominated by Sitka spruce, red alder, Hooker's willow, salmonberry, skunk cabbage, slough sedge, and lady fern. The diverse layered canopy provides cover, food, nesting and perching sites for a variety of wildlife.

The degree of significance of forested wetlands ranged from Low to High. Low significance reflects the isolation of a site from other natural areas, low vegetative species diversity, and impacts caused by soil, vegetation and/or hydrologic disturbance (Sites 5, 7, 8, 13, 14, 23, 36, 38, 43, 48, and 51). Highly significant sites were large, usually greater than 1 acre, and located adjacent to permanent water source; vegetation on these sites consisted of a variety of food and cover plants for wildlife (Sites 10A, 11, 19, 20, 25, 26, 28, 42B and 50). Sites 19, 20, 42B, and 50 are located near Ecola Creek and provide excellent habitat for small herds of elk which frequent these sites. Each of these sites contains nearly pristine vegetation and some ancient spruce trees. Site 11 is the smallest of these sites but ranks high because it is already established as a park in the center of the city; this increased its urban quality and recreation function values. Sites 25, 26, and 28, which are adjacent sites, are highly significant because the uplands between them have not been developed and together they create a large block of upland and wetland forest. Forested wetlands are one of the most difficult wetland types to replace or restore because of the slow growth rates of trees.

Stream Sections (R)

Thirty-eight stream section sites were inventoried. The Cannon Beach UGB is long and narrow with numerous drainages crossing westward to the ocean. These stream corridors have become interrupted and isolated by major roads such as Highway 101 and Hemlock St, the old Coast Highway, culverts, fill, and development. All of these site disturbances impact the wetland functional values of the site. They impact wildlife habitat, water quality and fish habitat.

The quality and diversity of vegetation along stream corridors influences the diversity of wildlife. Greater plant diversity provides greater food, cover and reproductive resources for wildlife. A site with limited plant diversity has lower wildlife habitat value. Plant diversity may be reduced by disturbance such as channelization of streams and fill for homesites. This can also promote noxious weed growth on the associated disturbed soils, often resulting in dense blackberry thickets that reduce access for large mammals like deer and elk. Himalayan blackberry and English ivy are examples of nuisance plants in Cannon Beach that reduce food, cover and breeding potential for wildlife species because they out-compete native herbaceous plants.

Riparian vegetation also benefits water quality. The riparian canopy shades the stream, helping maintain cooler water temperatures to potentially support aquatic invertebrates, amphibians, and fish. It prevents banks from eroding and contributing silt to the stream. Vegetation on slopes also regulates the rate of runoff into the drainage basin and can physically and biologically remove potential contaminants originating in upland areas. It is important to preserve riparian vegetation to protect water quality.

The majority of streams in the UGB have no habitat for fish because they are short, low flow, and high gradient streams. The exceptions are Ecola Creek and Logan Creek which provide or have the potential to provide fish habitat. Fish species recorded during spawning surveys in Ecola Creek by ODFW (C. Barber, ODFW, pers. comm. 1993) include winter steelhead trout, coho salmon, and sea-run and resident cutthroat trout. Fall chinook salmon may also occur in Ecola Creek. No surveys have been conducted by ODFW in Logan Creek which enters Ecola Creek at the City Park. However, the lower stretch is accessible to juveniles of all the fish species found in Ecola Creek which may move upstream in Logan Creek to feed. The tide gates between the channels in the forested and emergent wetlands flanking the sewage lagoons may block fish passage from Ecola Creek. Consequently it is not likely that juvenile salmonids could move in and out of these freshwater channels from Ecola Creek to feed and rear. No surveys have been conducted by ODFW in these channels to confirm the presence of fish, however.

Thirty-eight stream section sites were inventoried. Some of these streams have more than one site number due to barriers and extreme changes in site conditions caused by urban development. Ratings of stream sections ranged from low to highly significant. Sites rated of low significance were generally seasonal, isolated, culverted streams sandwiched between development (Sites 1-6, 14, 22-24 for example). In extreme cases, the stream was channelized (Sites 9 and 49). Highly significant stream sections contain perennial water, provide travel routes for wildlife, and are located within larger forested wetlands and uplands (Sites 17 and 50, for example).

8 RELATIONSHIP OF INVENTORY TO GOAL #16, ESTUARINE RESOURCES, AND GOAL #17, COASTAL SHORELANDS

Sites identified by the inventory as estuarine (sites 10B and 16) were not included in the subsequent Goal #5 analysis of conflicting uses and the EESE analysis. They are protected by the city's Zoning Ordinance, Estuarine Zone.

Many of the identified sites are located within the city's Coastal Shoreland planning area. All such sites were subjected to the Goal #5 analysis of conflicting uses and the EESE analysis. The Coastal Shoreland Goal, Coastal Shoreland Uses Requirement 1, to protect major marshes, is achieved by limiting conflicting uses in wetlands identified as having a high significance. The objective of Coastal Shorelands, Implementation Requirement 4, to protect riparian vegetation, is achieved by the application of the stream corridor protection standards.

9 RECOMMENDATIONS

The total acreage of the study area exclusive of streets is approximately 570 acres. Of this area, approximately 100 acres are wetlands.

This inventory identified and evaluated 54 wetland and water resources within the Urban Growth Boundary of the City of Cannon Beach. Water, permanent and seasonal, is critical to all wildlife species. It must be of good quality and accessible. All wetlands are regulated by the U.S. Army Corps of Engineers and by the Oregon Division of State Lands. Permits are required from both agencies for placing fill in wetlands, and from DSL for removal from or alteration of wetlands. Wetland boundaries determined for the purpose of this inventory are not delineations as required for state and federal permit applications.

The following recommendations are made for protection of the wetland resources:

1. Forested wetlands are most difficult to replace. Fragmentation of remaining forested wetlands should be avoided to the maximum extent possible.

2. Habitat links between uplands and wetland/water resources should be protected to provide travel corridors for wildlife, particularly elk and deer. Wildlife require access to food, cover and water resources and safe passage for traveling to feeding and rearing sites.

3. Hydrology and soil resources of wetlands need to be protected. Proposed development near wetlands should be carefully reviewed to determine the existing hydrologic patterns that maintain the wetland, and measures should be incorporated to prevent excessive flooding or dewatering of the wetland resource. Development should not be allowed that will disrupt surface or groundwater flows to wetland resources. Soils in wetlands should be protected from compaction and erosion if heavy equipment is used in and around these areas.

4. Fill material, including soil, yard debris, and animal waste should be removed where it has been dumped in wetlands. This will improve wetland and water quality. The City should encourage composting and begin a city wide yard debris collection or composting program to prevent unwanted dumping in natural areas.

5. Invasive plants should be removed to restore native plant communities and enhance wildlife habitat and ecological integrity. English ivy has been used historically to stabilize banks and has gained a foothold along Highway 101. Himalayan blackberry has spread throughout disturbed soil areas. Restoration could be accomplished by pulling out these invasive species; often native species are still present beneath and will thrive once the nuisance plant is removed. Occasionally, native species must be replanted. Native plant alternatives to English ivy should be used to stabilize banks.

6. Water quality and the integrity of stream corridors should be preserved. Development on steep sided slopes that can result in erosion should be discouraged or closely regulated. Planting guidelines for fill and earth disturbing activities can prevent unstable fill slopes and disturbed ground from erosion or invasion of non-native species. Logging operators upstream from the UGB should be encouraged to use forestry best management practices to reduce downstream degradation of streams.

7. Educate the public. Wetlands associated with City parks or near a school have the greatest potential to serve as educational and passive recreation sites. Soft trails or boardwalks may encourage a closer look at some wetland features and foster appreciation of the natural resources. Interpretive signs and brochures can also help the public understand the importance and sensitivity of these natural resources.

8. Structures on pilings proposed over wetland areas should be carefully reviewed at the local level and referred to appropriate state and federal authorities. Development in wetlands is regulated by the state through the Oregon Division of State Lands under ORS 196.800-196.990. The U.S. Army Corps of Engineers has authority to regulate wetlands under Section 404 of the Clean Water Act and has interpreted the use of pilings as a substitute for fill to be subject to that agency's regulation (Regulatory Guidance Letter 90-8). Applications for these types of proposed developments should go through the state and federal wetland permit processes for review.

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APPENDICES

APPENDIX B:	**SOILS AND NATIONAL WETLAND INVENTORY MAPS** **ZONING MAP** **TAX LOT MAP** **KEY TO WETLAND MAPS**
APPENDIX C:	**SUMMARY SHEETS**

APPENDIX B

SOILS AND NATIONAL WETLAND INVENTORY MAPS
ZONING MAP
TAX LOT MAP
KEY TO WETLAND MAPS

APPENDIX C

SUMMARY SHEETS

PART 2 CONFLICTING USES

The City must identify uses and activities that conflict with wetland resources:

> *It is the responsibility of local government to identify conflicts with inventoried Goal 5 resource sites. This is done primarily by examining the uses allowed in broad zoning districts established by the jurisdiction (e.g., forest and agricultural zones).* [OAR 660-16-005]

Potentially conflicting uses, identified in the applicable zone, and their associated activities and accessory uses are briefly described in the following paragraphs. Nearly 70 distinct uses are permitted conditionally or outright in the zones covering the inventoried resource sites.

Residential structures and activities are permitted outright or conditionally at many of the city's wetland resource sites. **Single-residences, manufactured dwellings, multi-family dwellings, temporary manufactured dwellings and recreational vehicles, caretakers' dwellings, and manufactured dwelling parks** are permitted in one or more of the resource sites. In addition to strictly residential use of these structures, the city also allows artists' studios, bed and breakfasts, day care, home occupations and cottage industry in a residence at one or more of the resource sites. A recreation vehicle or manufactured dwelling may be used as a temporary residence during construction of a permanent residence at one or more of the City's wetland resource sites. A caretaker's dwelling is permitted in association with some non-residential uses at some of the wetland resource sites. Residential structures conflict with maintenance of wetland functions and values in several ways. Wetlands are typically filled to accommodate conventionally-built residential structures and manufactured dwellings. Fill eliminates all wetland functions and values beneath the fill, and diminishes some wetland functions in the area near the fill. Post- or pile-supported residences do not require wetland fill, but still conflict with maintenance of some wetland functions and values. A pile- or post-supported residence will eliminate all or nearly all vegetation beneath the building, diminish wetland habitat values around the building, and reduce the wetland's urban quality of life values. **Accessory structures** associated with residential uses, such as garages, driveways, storage buildings and decks, also conflict with maintenance of wetland functions and values primarily because they are built on wetland fill. Activities associated with residential use conflict with some wetland functions and values. Conflicting residential activities include outdoor recreation, exterior lighting, noise and activities associated with domestic pets, vegetation management, construction-related activities, and storm-water runoff from roofs and driveways. **Outdoor recreational activities** that occur around a home disturb many wildlife species, especially larger mammals (such as deer and elk). **Exterior lighting** can conflict with the normal behavior patterns of nocturnal wildlife species (owls, bats, raccoons, etc.). **Domestic pets** that spend all or a part of their time outdoors (especially dogs and cats) can directly harass wildlife by chasing and hunting wetland wildlife species. The scent associated with domestic dogs and cats can disrupt normal wildlife movement and feeding behavior in some species. Food bowls left outside intended for domestic pets can attract wildlife. **Vegetation management** can conflict with maintenance of wetland plant communities. Use of herbicides, insecticides, chemical fertilizers and soil amendments may harm wetland plant or animal communities or degrade wetland water quality. Residential **construction-related activities** conflict with maintenance of wetland values. Noise associated with heavy equipment can disturb wildlife. Improper waste disposal can degrade wetland water quality and impair urban quality of life values at a wetland. This is also true for improper cleaning of tools such as painting equipment and tools used for drywall finishing, roofing, masonry and the like. Improper use and disposal of treated wood can degrade wetland water quality. **Storm-water runoff** from driveways and roofs can degrade wetland water quality and alter wetland hydrology. Both soluble and non-soluble compounds leach out of nearly all modern roofing materials. Some are harmful to aquatic life. Residential **utilities** may be above-ground and below-ground. Above-ground utilities conflict with wetland vegetation, and may conflict with wetland wildlife behavior. Below-ground utilities also conflict with maintenance of wetland plant communities, and may alter wetland hydrology.

<u>Commercial structures and activities</u> are permitted outright or conditionally at several of the city's wetland resource sites. Arts and crafts galleries and studios, building materials sales, business and professional offices, shops associated with the building trades, eating and drinking establishments, financial institutions, garden stores, animal hospital or kennel, gas stations, personal and business service establishments, horticultural nursery, appliance maintenance and repair, retail trade establishments, theaters, parking lots, and warehouses are all allowed

at one or more of the City's wetland resource sites. **Commercial structures** associated with these commercial uses are typically placed on fill in wetlands. Conflicts between fill for commercial structures and wetland functions and values are similar to those for residential structures, and are described above. Post-supported or pile-supported commercial structures are relatively uncommon, but still conflict with many wetland functions and values. The conflicting **accessory structures** associated with these institutional structures include parking lots, storage buildings, walkways, decks, utilities, and the like. Parking lots generate runoff that degrades wetland water quality with hydrocarbons. Parking lots also require wetland fill. Commercial storage buildings are typically built on fill, which conflicts with all wetland functions and values. Walkways over wetlands can be built on fill or on posts. Fill-supported walkways have greater impacts on wetland functions and values than do post-supported walkways. Post-supported decks conflict with maintenance of wetland vegetation, and with wetland functions and values associated with wetland plant communities. Commercial utilities can be above-ground and below ground. Above-ground utilities conflict with wetland vegetation, and may conflict with wetland wildlife behavior. Below-ground utilities also conflict with maintenance of wetland plant communities, and may alter wetland hydrology. **Activities associated with commercial uses** also conflict with wetland resources. Conflicting commercial activities include outdoor human activity, exterior lighting, odors associated with cooking and other activities, noise associated with commercial equipment and vehicles, vegetation management, construction-related activities, storm-water runoff from roofs and parking lots, and waste disposal. Outdoor activity associated with commercial uses in wetlands can disturb wildlife. Commercial exterior lighting can conflict with the normal behavior patterns of nocturnal wildlife species (owls, bats, raccoons, etc.). Odors associated with commercial cooking or other commercial activities can attract some wildlife species and alter wetland animal community structure. Commercial equipment may generate noise that disturbs wetland wildlife species. Vegetation management associated with commercial landscaping can conflict with maintenance of wetland plant communities. Use of herbicides, insecticides, chemical fertilizers and soil amendments may harm wetland plant or animal communities or degrade wetland water quality. Construction-related activities conflict with maintenance of wetland values. Noise associated with heavy equipment can disturb wildlife. Improper waste disposal can degrade wetland water quality and impair urban quality of life values at a wetland. This is also true for improper cleaning of tools such as painting equipment and tools used for drywall finishing, roofing, masonry and the like. Improper use and disposal of treated wood can degrade wetland water quality. Storm-water runoff from driveways, parking lots and the roofs of commercial buildings can degrade wetland water quality and alter wetland hydrolog. Both soluble and non-soluble compounds leach out of nearly all modern roofing materials. Some are harmful to aquatic life. Parking lot run-off can degrade wetland water quality with hydrocarbon pollution. Improper commercial waste disposal can degrade wetland water quality, diminish urban quality of life values at a wetland, and alter the structure of wildlife communities.

Institutional structures and their associated activities are permitted outright or conditionally at one or more of the City's wetland resource sites. Churches, community meeting halls, community buildings, schools, government or municipal structures, museums, and utility substations are all permitted at one or more wetland resource sites. These buildings, the accessory structures associated with them, and the activities they support all conflict with wetland functions and values. In terms of their wetland conflicts, these structures and activities are similar to those related to residential and commercial structures.

Recreation vehicle parks and their associated uses and activities are permitted as outright or conditional uses at one or more of the city's wetland resource sites. Recreation vehicle parks consist of designated spaces for short-term parking and use of a recreation vehicle. The spaces are typically paved with gravel, concrete or asphalt. Utilities such as water, electricity, wastewater disposal, telephone, and cable TV are occasionally, though not always, provided. Central infrastructure, including laundry facilities, picnic areas, indoor recreation facilities and the like are also provided at some recreation vehicle parks. When located in wetland areas, recreation vehicle parks may require fill for the parking spaces, roads, and structures. Conflicting activities associated with recreation vehicle park use include outdoor human activity; exterior lighting; odors associated with combustion; noise associated with equipment and vehicles; vegetation management; construction-related activities; storm-water runoff from roads, parking spaces and buildings; waste disposal, and pet-related activities. These conflicts are described above.

Forest management is permitted at several of the City's wetland resource sites. Forest management practices such as timber harvesting, road building, and reforestation with commercial species conflict with maintenance of wetland functions and values. Removing the mature trees from a forested wetland degrades wetland functions and values associated with this plant community, including wildlife habitat, urban quality of life values, sediment trapping, nutrient retention, educational potential, noteworthiness, and ecological integrity. Reforestation with non-wetland tree species can also alter the plant community and its associated functions and values. Road building associated with forest management may require wetland fill, and can alter wetland hydrology.

Organized camps, parks or public recreation areas, trails, and private campgrounds all conflict with maintenance of wetland functions and values by generating outdoor human activity in wetland areas. These impacts are described above. These types of uses also typically require wetland fill for restrooms, parking areas and other related support facilities. The impacts of fills on wetland functions and values are described above.

A sewage treatment facility is permitted at one of the City's wetland resource sites. Wetlands provide a number of functions that can be used to treat wastewater. There are significant social and ecological benefits associated with using wetlands to treat wastewater. There are also, however, conflicts between wastewater treatment in wetland areas and maintenance of wetland functions and values. Wastewater treatment alters the wetland's natural hydrology. Sewage treatment introduces compounds associated with urban wastewater into wetland plant and animal communities. Roads, pumping facilities, and dikes all require wetland fill. Fences surrounding a treatment facility may be necessary for public safety reasons, but they alter wildlife movements.

OAR 660-16-010 requires that the City develop a program to achieve the purpose of Goal 5. The administrative rule requires that one of three alternative decisions be made for each wetland site:

Protect the resource site;
Allow conflicting uses fully; or

Limit conflicting uses.

The City's decisions with respect to the inventoried sites are summarized in Table 1, and explained in the following paragraphs.

The City will limit conflicting uses on 54 inventoried wetland sites rated as LOW, MEDIUM or HIGH. The limitations are intended to restrict nearly all conflicting uses, while at the same time not result in unconstitutional taking of private property. The restrictions are described in detail in Appendix B, and in general terms in this paragraph. This decision applies to the sites described in Table 1 as "Limit" under the Status column. Fill in these wetlands is permitted only for roads, driveways, small utility or accessory structures. Pile-supported structures are permitted in these wetlands for a single family residence, utility or accessory structures of any size, commercial buildings, and footpaths or bicycle paths. Excavation for utility trenches is allowed in these wetlands. Landscaping and vegetation management is allowed in these wetlands. The City will also adopt and enforce performance standards for these permitted and conditional uses and activities in these wetlands.

None of the inventoried resource sites will be fully protected from all conflicting uses.

Table 1: Status of Wetland Resource Sites with Regard to Conflicting Uses

Site #	Status	Site #	Status
1	Limit	27	Limit
2	Limit	28	Limit
3	Limit	29	Limit
4	Limit	30	Limit
5	Limit	31	Limit
6	Limit	32	Limit
7	Limit	34	Limit
8	Limit	35	Limit
9	Limit	36	Limit
10A	Limit	37	Limit
11	Limit	38	Limit
12	Limit	39	Limit
13	Limit	40	Limit
14	Limit	41	Limit
15	Limit	42A	Limit
17	Limit	42B	Limit
18	Limit	43	Limit
19	Limit	44	Limit
20	Limit	45	Limit
21	Limit	46	Limit
22	Limit	47	Limit
23	Limit	48	Limit
24	Limit	49	Limit
25	Limit	50	Limit
26	Limit	51	Limit
		52	Limit

Limit = Limit Conflicting Uses
Permit = Fully Permit Conflicting Uses
Protect = Prohibit All Conflicting Uses

PART 3:
ECONOMIC, SOCIAL, ENVIRONMENTAL AND ENERGY ANALYSIS

TABLE OF CONTENTS

Atkins Drainage Basin Wetland Resource Site

The Atkins resource site contains a single wetland (site #3) in the Residential Moderate Density (R-1) zone. Potentially conflicting uses allowed in the R-1 zone include:

Single family dwellings
Parks or public recreation areas
Utility lines
Temporary manufactured dwelling or recreation vehicle
Home occupation
Residential home, residential facility
Family, adult day care center
Public or private school or college
Government or municipal structure
Day care center
Church or community meeting hall.

Unregulated conflicting activities also occur or could occur at this resource site. These conflicting uses and activities are described in more detail elsewhere. The Atkins wetland resource site was rated moderate in terms of wildlife habitat values; and low with respect to ecological integrity, fish habitat, noteworthiness, educational potential, recreation, flood control sediment trapping, nutrient retention, and urban quality of life values.

Direct environmental consequences of allowing conflicting uses at this resource site are related to loss of wetland wildlife habitat as well as degradation of other wetland functions and values. Residential structures on fill would result in loss or alteration of wetland vegetation, and alteration of wetland hydrology. Allowing residential structures on piling would damage wetland vegetation and impair wildlife habitat values, but would leave wetland hydrology substantially unaltered. Development of a park or recreation area would conflict with wetland ecological values, including wildlife habitat, at this wetland resource site. Placement of fill material for parking, tennis courts, playgrounds, restrooms and similar facilities commonly provided with park or recreation areas would alter wetland hydrology and eliminate wetland vegetation. Even without wetland fill, a park or recreation area that generates significant levels of human activity would degrade wetland wildlife habitat values. Installation and maintenance of above-ground utility lines may degrade wetland functions and values at this wetland resource site by requiring vegetation removal in the utility corridor. Underground utilities may also require vegetation removal for the corridor, and may interfere with wetland hydrology. A public or private school or college on this wetland resource site would have direct environmental consequences similar to those of any structure requiring fill. Fill for a school building and parking lot would alter wetland hydrology and eliminate wetland vegetation. Fill for a government or municipal structure, church, or community hall would have similar direct environmental impacts on wetland functions and values at this resource site.

Indirect environmental consequences of allowing conflicting uses at the Atkins wetland resource site include wetland habitat disturbance and loss. This indirect consequence is a result of human activity associated with normal residential use of residential structures. Examples of these types of disturbing residential activities include landscape maintenance and development, wildlife harassment by domestic dogs and cats, exterior lighting, and outdoor human recreation. The types of activities allowed in a residence in the Atkins wetland resource site include home occupation, residential home, residential facility, and family or adult day care. These activities generate a higher level of human activity than would typically be found in a single family residence. To the extent that these activities occur outside of the structure, wetland environmental functions and values would be impaired. A park or recreation area at this wetland resource site would generate indirect environmental consequences for wetland functions and values, especially wildlife habitat. Outdoor human activity associated with a park or recreation area would be avoided by many wildlife species. A public or private school or college at this wetland resource site would have harmful indirect environmental consequences similar to those associated with a park or recreation area if a significant level of outdoor human activity were associated with this use. Government and municipal structures that have large parking lots or paved yards may degrade wetland water quality as a result of stormwater runoff.

Direct environmental consequences of restricting conflicting uses and activities at the Atkins wetland resource site include a degree of protection for the wetland functions and values remaining at this resource site, notably wildlife habitat. A pile-supported residence would not impair wetland hydrology, but would alter wetland wildlife habitat. Prohibiting non-residential structures that might otherwise be allowed at this wetland resource site (government structures, churches, community meeting halls) would provide a degree of protection for remaining wetland values. Restricting fills for these structures would maintain wetland wildlife habitat values at their present moderate level. Prohibiting utility lines from crossing this wetland resource site would eliminate their environmental impacts on wetland vegetation and hydrology, and would help maintain wetland wildlife habitat. Restricting normal residential activities (outdoor recreation, landscaping, domestic pets, exterior lighting) would protect wetland wildlife habitat from the adverse impacts caused by these activities. Restricting non-residential activities (such as hiking and vegetation management, which are not necessarily linked to residential development) would help protect wetland wildlife habitat at this resource site.

Indirect environmental consequences of restricting conflicting uses and activities in the Atkins drainage basin could include a degree of protection for the remaining wetland functions and values at this resource site, particularly those associated with wildlife habitat. Restricting residential development to a single unit per lot-of-record would keep residential density and associated human activity to a minimum level. Restricting outdoor humanactivities, such as those associated with a residence, home occupation, or day care center, would provide further protection for wetland resource values. Prohibiting non-residential structures (government structures, churches, community meeting halls) will protect the Atkins wetland resource site from the indirect environmental impacts of these uses: water quality degradation as a result of parking lot runoff, and wildlife disturbance from outdoor human activity and night lighting, for example.

Direct social consequences of allowing conflicting uses at the Atkins wetland resource site include loss of open space in the surrounding residential neighborhood and an incremental social loss related to degradation of wetland wildlife habitat. The Atkins wetland resource site provides open space benefits for neighboring property owners. Allowing development of any structure (residence, government or municipal building, church or community center) at this wetland resource site would reduce or eliminate these benefits. Development of any of the structures permitted at this wetland resource site would diminish wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social loss. The Atkins wetland resource site offers minimal flood protection value, so loss of this function may be of little consequence.

Indirect social consequences of allowing conflicting activities such as outdoor human activity, domestic pets, and exterior lighting at the Atkins wetland resource site may include an incremental erosion of the quality of life enjoyed in Cannon Beach as a result of the degradation and loss of wetland wildlife habitat. To the extent that the presence of wildlife in Cannon Beach is appreciated by residents and visitors, this represents a social loss. Development of any of the structures (residence, government or municipal building, church or community center) or activities (day care or home occupation) allowed in the R-1 zone at this wetland resource site might also increase the level of human activity in the surrounding neighborhood, and lead to increased motor vehicle traffic on adjacent streets. Allowing residential use of the Atkins resource site would yield social benefits if it provided some relief to the housing shortage in the County. Allowing a park or recreation area at this resource site might provide social benefits related to outdoor recreation. Allowing institutional development (government or municipal building, church or community center, school) might yield social benefits related to the services provided in these buildings.

Direct social consequences of restricting conflicting uses at the Atkins wetland resource site may include the preservation of open space in the residential neighborhood surrounding the resource site, and an incremental social benefit from preserving wetland wildlife habitat. The Atkins wetland resource site provides open space for neighboring property owners. Prohibiting any structure (residence, government or municipal building, church or community center) at this wetland resource site would preserve open space andsecure the social benefits of open space. Prohibiting structures at this wetland resource site would protect wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit.

Indirect social consequences of restricting conflicting uses at the Atkins wetland resource site may include incremental improvement of the quality of life in Cannon Beach related to protection of wetland wildlife habitat. Activities that disrupt wildlife use at the Atkins wetland resource site, such as outdoor human activity, diminish the site's wetland wildlife habitat value. Restricting these activities would help preserve existing wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting park or recreation area at this resource site might deny neighboring residents the social benefits related to a nearby outdoor recreation site. Prohibiting institutional development (government or municipal building, church or community center, school) might impair delivery of the social services provided in these buildings. Prohibiting all human activity at this resource site would require extraordinary intervention by the City into areas not normally subject to city regulation. The social costs of this level of intervention would be significant.

Direct economic consequences of allowing conflicting uses at the Atkins wetland resource site include the price difference between the site as buildable land, and as unbuildable land. The size of this avoided loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. The price difference between a buildable and an unbuildable residential lot may be significant. An economic consequence of allowing utility lines to cross this wetland resource site may be cost-efficient location of utility corridors.

Indirect economic consequences of allowing conflicting uses at the Atkins drainage basin wetland resource site include possible loss of property value for adjacent residential land owners. Residential land values in Cannon Beach are relatively high for many reasons, including the increasing scarcity of vacant buildable land, and the proximity of many residential sites to wetland open space areas. Allowing residential development of the Atkins wetland resource site will eliminate the adjacent open space benefits enjoyed by neighboring residential property. This could reduce the value of adjacent residential land. An indirect economic benefit is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are allowed will be relatively higher than if residential uses are restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

Direct economic consequences of restricting conflicting uses at the Atkins wetland resource site include the price difference between the wetland resource site as buildable vacant land, and as unbuildable land. The size of this economic loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. An economic consequence of prohibiting utility corridors from crossing this wetland resource site might be higher utility installation and maintenance costs caused by sub-optimal utility corridor locations.

Indirect economic consequences of restricting conflicting uses at the Atkins wetland resource site may include relatively higher property value for adjacent residential lands. Residential land values in Cannon Beach are high for many reasons, including the increasing scarcity of vacant buildable land in the community, and the proximity of many residential sites to unbuildable wetland open space areas. Restricting development at this resource site will help maintain the adjacent open space benefits enjoyed by neighboring residential property. An additional indirect economic consequence is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are restricted will be relatively lower than if residential uses were un-restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

No direct energy consequences of allowing conflicting uses on the Atkins drainage basin wetland resource site have been identified.

Indirect energy consequences of allowing conflicting uses in the Atkins drainage basin wetland resource site may include the expenditure of the energy related to residential development on the site. Different energy expenditures may be required for construction of a pile-supported house compared to a house on fill compared to a house at a non-wetland site.

No direct energy consequences of restricting conflicting uses on the Atkins drainage basin wetland resource site have been identified.

Indirect energy consequences of restricting conflicting uses in the Atkins drainage basin wetland resource site may include the energy savings related to preventing residential development on the site. Different energy expenditures may be required for construction of a pile-supported house compared to a house on fill compared to a house at a non-wetland site.

Conclusion: Based on the evaluation of this resource site's wetland functions and values, and based on this analysis of environmental, social, economic and energy consequences of allowing and restricting conflicting uses and activities, the City should provide partial protection for this resource site. The overlay zone and associated standards described elsewhere provide an appropriate level of protection given these factors.

Brailler Drainage Basin Wetland Resource Site

The Brailler resource site contains a single wetland (site #6) in the Residential High Density (R-3) zone. Potentially conflicting uses allowed in the R-3 zone include:

Single family dwellings, duplexes and triplexes
Parks or public recreation areas
Utility lines
Temporary manufactured dwelling or recreation vehicle
Home occupation
Residential home, residential facility
Family, adult day care center
Public or private school or college
Government or municipal structure
Day care center
Bed and breakfast
Church or community meeting hall.

Unregulated conflicting activities also occur or could occur at this resource site. These conflicting uses and activities are described in more detail elsewhere. The Brailler wetland resource site was rated moderate in terms of wildlife habitat values; and low with respect to ecological integrity, fish habitat, noteworthiness, educational potential, recreation, flood control sediment trapping, nutrient retention, and urban quality of life values.

Direct environmental consequences of allowing conflicting uses at this resource site are related to loss of wetland wildlife habitat as well as degradation of other wetland functions and values. Residential structures (single family dwellings, duplexes or triplexes) on fill would result in loss or alteration of wetland vegetation, and alteration of wetland hydrology. Allowing residential structures on piling would damage wetland vegetation and impair wildlife habitat values, but would leave wetland hydrology substantially unaltered. Development of a park or recreation area would conflict with wetland ecological values, including wildlife habitat, at this wetland resource site. Placement of fill material for parking, tennis courts, playgrounds, restrooms and similar facilities commonly provided with park or recreation areas would alter wetland hydrology and eliminate wetland vegetation. Even without wetland fill, a park or recreation area that generates significant levels of human activity would degrade wetland wildlife habitat values. Installation and maintenance of above-ground utility lines may degrade wetland functions and values at this wetland resource site by requiring vegetation removal in the utility corridor. Underground utilities may also require vegetation removal for the corridor, and may interfere with wetland hydrology. A public or private school or college on this wetland resource site would have direct environmental consequences similar to those of any structure requiring fill. Fill for a school building and parking lot would alter wetland hydrology and eliminate wetland vegetation. Fill for a government or municipal structure, church, or community hall would have similardirect environmental impacts on wetland functions and values at this resource site. A bed and breakfast would probably have direct environmental consequences at this resource site similar to those of a residence.

Indirect environmental consequences of allowing conflicting uses at the Brailler wetland resource site include wetland habitat disturbance and loss. This indirect consequence is a result of human activity associated with normal residential use of residential structures. Examples of these types of disturbing residential activities include landscape maintenance and development, wildlife harassment by domestic dogs and cats, exterior lighting, and outdoor human recreation. The types of activities allowed in a residence in the Brailler wetland resource site include home occupation, residential home, residential facility, and family or adult day care. These activities generate a higher level of human activity than would typically be found in a single family residence. To the extent that these activities occur outside of the structure, wetland environmental functions and values would be impaired. A park or recreation area at this wetland resource site would generate indirect environmental consequences for wetland functions and values, especially wildlife habitat. Outdoor human activity associated with a park or recreation area would be avoided by many wildlife species. A public or private school or college at this wetland resource site would have harmful indirect environmental consequences similar to those associated with a park or recreation area if a significant level of outdoor human activity were associated with this use. Government and municipal structures that have large parking lots or paved yards may degrade wetland water quality as a result of stormwater runoff. A bed and breakfast would probably generate indirect environmental impacts similar to those of a residence.

Direct environmental consequences of restricting conflicting uses and activities at the Brailler wetland resource site include a degree of protection for the wetland functions and values remaining at this resource site, notably wildlife habitat. A pile-supported residence would not impair wetland hydrology, but would alter wetland wildlife habitat. Prohibiting non-residential structures that might otherwise be allowed at this wetland resource site (government structures, churches, community meeting halls) would provide a degree of protection for remaining wetland values. Restricting fills for these structures would maintain wetland wildlife habitat values at their present moderate level. Prohibiting utility lines from crossing this wetland resource site would eliminate their environmental impacts on wetland vegetation and hydrology, and would help maintain wetland wildlife habitat. Restricting normal residential activities (outdoor recreation, landscaping, domestic pets, exterior lighting) would protect wetland wildlife habitat from the adverse impacts caused by these activities. Restricting non-residential activities (such as hiking and vegetation management, which are not necessarily linked to residential development) would help protect wetland wildlife habitat at this resource site. Prohibiting bed and breakfasts at this wetland resource site would protect wetland resource values, notably wildlife habitat, from the adverse environmental consequences of the bed and breakfast structure.

Indirect environmental consequences of restricting conflicting uses and activities in the Brailler drainage basin could include a degree of protection for the remaining wetland functions and values at this resource site, particularly those associated with wildlife habitat. Restricting residential development to a single unit per lot-of-record would keep residential density and associated human activity to a minimum level. Restricting outdoor human activities, such as those associated with a residence, home occupation, bed and breakfast, or day care center, would provide further protection for wetland resource values. Prohibiting non-residential structures (government structures, churches, community meeting halls) will protect the Brailler wetland resource site from the indirect environmental impacts of these uses: water quality degradation as a result of parking lot runoff, and wildlife disturbance from outdoor human activity and night lighting, for example.

Direct social consequences of allowing conflicting uses at the Brailler wetland resource site include loss of open space in the surrounding residential neighborhood and an incremental social loss related to degradation of wetland wildlife habitat. The Brailler wetland resource site provides open space benefits for neighboring property owners. Allowing development of any structure (residence, government or municipal building, church or community center) at this wetland resource site would reduce or eliminate these benefits. Development of any of the structures permitted at this wetland resource site would diminish wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social loss. The Brailler wetland resource site offers minimal flood protection value, so loss of this function may be of little consequence.

Indirect social consequences of allowing conflicting activities such as outdoor human activity, domestic pets, and exterior lighting at the Brailler wetland resource site may include an incremental erosion of the quality of life enjoyed in Cannon Beach as a result of the degradation and loss of wetland wildlife habitat. To the extent that the presence of wildlife in Cannon Beach is appreciated by residents and visitors, this represents a social loss. Development of any of the structures (residence, government or municipal building, church or community center) or activities (day care, bed and breakfast, or home occupation) allowed in the R-3 zone at this wetland resource site might also increase the level of human activity in the surrounding neighborhood, and lead to increased motor vehicle traffic on adjacent streets. Allowing residential use of the Brailler resource site would yield social benefits if it provided some relief to the housing shortage in the County. Allowing a park or recreation area at this resource site might provide social benefits related to outdoor recreation. Allowing institutional development (government or municipal building, church or community center, school) might yield social benefits related to the services provided in these buildings.

Direct social consequences of restricting conflicting uses at the Brailler wetland resource site may include the preservation of open space in the residential neighborhood surrounding the resource site, and an incremental social benefit from preserving wetland wildlife habitat. The Brailler wetland resource site provides open space for neighboring property owners. Prohibiting any structure (residence, government or municipal building, church or community center) at this wetland resource site would preserve open space and secure the social benefits of open space. Prohibiting structures at this wetland resource site would protect wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit.

Indirect social consequences of restricting conflicting uses at the Brailler wetland resource site may include incremental improvement of the quality of life in Cannon Beach related to protection of wetland wildlife habitat. Activities that disrupt wildlife use at the Brailler wetland resource site, such as outdoor human activity, diminish the site's wetland wildlife habitat value. Restricting these activities would help preserve existing wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting park or recreation area at this resource site might deny neighboring residents the social benefits related to a nearby outdoor recreation site. Prohibiting institutional development (government or municipal building, church or community center, school) might impair delivery of the social services provided in these buildings. Prohibiting all human activity at this resource site would require extraordinary intervention by the City into areas not normally subject to city regulation. The social costs of this level of intervention would be significant.

Direct economic consequences of allowing conflicting uses at the Brailler wetland resource site include the price difference between the site as buildable land, and as unbuildable land. The size of this avoided loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. The price difference between a buildable and an unbuildable residential lot may be significant. An economic consequence of allowing utility lines to cross this wetland resource site may be cost-efficient location of utility corridors.

Indirect economic consequences of allowing conflicting uses at the Brailler wetland resource site include possible loss of property value for adjacent residential land owners. Residential land values in Cannon Beach are relatively high for many reasons, including the increasing scarcity of vacant buildable land, and the proximity of many residential sites to wetland open space areas. Allowing residential development of the Brailler wetland resource site will eliminate the adjacent open space benefits enjoyed by neighboring residentialproperty. This could reduce the value of adjacent residential land. An indirect economic benefit is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are allowed will be relatively higher than if residential uses are restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

Direct economic consequences of restricting conflicting uses at the Brailler wetland resource site include the price difference between the wetland resource site as buildable vacant land, and as unbuildable land. The size of this economic loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. An economic consequence of prohibiting utility corridors from crossing this wetland resource site might be higher utility installation and maintenance costs caused by sub-optimal utility corridor locations.

Indirect economic consequences of restricting conflicting uses at the Brailler wetland resource site may include relatively higher property value for adjacent residential lands. Residential land values in Cannon Beach are high for many reasons, including the increasing scarcity of vacant buildable land in the community, and the proximity of many residential sites to unbuildable wetland open space areas. Restricting development at this resource site will help maintain the adjacent open space benefits enjoyed by neighboring residential property. An additional indirect economic consequence is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are restricted will be relatively lower than if residential uses were un-restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

No direct energy consequences of allowing conflicting uses on the Brailler drainage basin wetland resource site have been identified.

Indirect energy consequences of allowing conflicting uses in the Brailler drainage basin wetland resource site may include the expenditure of the energy related to development of a structure on the site. Different energy expenditures may be required for construction of a pile-supported structure compared to a structure on fill compared to a structure at a nonwetland site.

No direct energy consequences of restricting conflicting uses on the Brailler drainagebasin wetland resource site have been identified.

Indirect energy consequences of restricting conflicting uses in the Brailler drainage basin wetland resource site may include the energy savings related to preventing construction at the site. Different energy expenditures may be required for construction of a pilesupported structure compared to a structure on fill compared to a structure at a non-wetland site.

Conclusion: Based on the evaluation of this resource site's wetland functions and values, and based on this analysis of environmental, social, economic and energy consequences of allowing and restricting conflicting uses and activities, the City should provide partial protection for this resource site. The overlay zone and associated standards described elsewhere provide an appropriate level of protection given these factors.

Breaker's Point Drainage Basin Wetland Resource Site

The Breaker's Point wetland resource site contains four individual wetlands (inventory numbers 17, 18, 19, and 20) in three residential zones. Number 17 is in the Residential Medium Density (R-2) zone. Number 20 is in the Residential Very Low Density (RVL) zone. Numbers 18 and 19 are partially in the R-2 zone, and partially in the Residential Lower Density (RL) zone. Potentially conflicting uses allowed in one or more of the individual wetland areas at the Breaker's Point wetland resource site include:

- Duplex
- Single family dwelling
- Bed and breakfast
- Cottage industry
- Artist's studio
- Day care center
- Family, adult day care center
- Residential home, residential facility
- Home occupation
- Temporary manufactured dwelling or recreational vehicle
- Church or community meeting hall
- Government or municipal structure
- Forest management
- Public or private school or college
- Utility lines
- Parks or public recreation area
- Utility substations.

Unregulated conflicting activities also occur or could occur at this resource site. These conflicting uses and activities are described in more detail elsewhere. The following table shows resource values for wetlands at this resource site.

Functional Values

Inventory Number:	17	18	19	20
Ecological Integrity	M	L	H	M
Wildlife Habitat	H	M	H	M
Fish Habitat	M	L	L	L
Noteworthiness	H	L	M/H	L
Educational Potential	L	L	M	L
Recreation	L	L	L	L
Flood Control	L	L	L	L
Sediment Trapping	L	L	L	L
Nutrient Retention	L	L	L	L
Urban Quality of Life	M	L	H	M

Legend: H = High, M = Medium, L = Low

Direct environmental consequences of allowing conflicting uses at this resource site are related to loss of wetland wildlife habitat as well as degradation of other wetland functions and values. Residential structures (single family dwellings, duplexes, temporary manufactured dwelling, or temporary recreational vehicle) on fill would result in loss or alteration of wetland vegetation, and alteration of wetland hydrology. Allowing residential structures on piling would damage wetland vegetation and impair wildlife habitat values, but would leave wetland hydrology substantially unaltered. Development of a park or recreation area would conflict with wetland ecological values, including wildlife habitat, at this wetland resource site. Placement of fill material for parking, tennis courts, playgrounds, restrooms and similar facilities commonly provided with park or recreation areas would alter wetland hydrology and eliminate wetland vegetation. Even without wetland fill, a park or recreation area that generates significant levels of human activity would degrade wetland wildlife habitat values. Installation and maintenance of above-ground utility lines may degrade wetland functions and values at this wetland resource site by requiring vegetation removal in the utility corridor. Underground utilities may also require vegetation removal for the corridor, and may interfere with wetland hydrology. Allowing utility substations would have similar impacts, and would also require fill. A public or private school or college on this wetland resource site would have direct environmental consequences similar to those of any structure requiring fill. Fill for a school building and parking lot would alter wetland hydrology and eliminate wetland vegetation. Fill for a government or municipal structure, church, orcommunity hall would have similar direct environmental impacts on wetland functions and values at this resource site. A bed and breakfast or an artist's studio would probably have direct environmental consequences at this resource site similar to those of a residence. Forest management is allowed at one of the wetlands (#20) that make up this resource site. Urban quality of life, wildlife habitat, and ecologically integrity are the principal wetland environmental values that would be directly threatened by allowing forest management at this resource site.

Indirect environmental consequences of allowing conflicting uses at the Breaker's Point wetland resource site include wetland habitat disturbance and loss. This indirect consequence is a result of human activity associated with normal residential use of residential structures. Examples of these types of disturbing residential activities include landscape maintenance and development, wildlife harassment by domestic dogs and cats, exterior lighting, and outdoor human recreation. The types of activities allowed in a residence in the Breaker's Point wetland resource site include home occupation, residential home, residential facility, artist's studio, and family or adult day care. These activities generate a higher level of human activity than would typically be found in a single family residence. To the extent that these activities occur outside of the structure, wetland environmental functions and values would be impaired. A park or recreation area at this wetland resource site would generate indirect environmental consequences for wetland functions and values, especially wildlife habitat. Outdoor human activity associated with a park or recreation area would be avoided by many wildlife species. A public or private school or college at this wetland resource site would have harmful indirect environmental consequences similar to those associated with a park or recreation area if a significant level of outdoor human activity were associated with this use. Government and municipal structures that have large parking lots or paved yards may degrade wetland water quality as a result of stormwater runoff. A bed and breakfast would probably generate indirect environmental impacts similar to those of a residence. Forest management is allowed at one of the wetlands (#20) that make up this resource site. Indirect environmental consequences of allowing the vegetation removal associated with forest management may include loss or degradation of some of the resource site's lower-rated wetland environmental values: fish habitat, noteworthiness, educational potential, recreational values, flood control, sediment trapping and nutrient retention.

Direct environmental consequences of restricting conflicting uses and activities at the Breaker's Point wetland resource site include a degree of protection for the wetland functions and values remaining at this resource site, notably wildlife habitat. A pile-supported residence would not impair wetland hydrology, but would alter wetland wildlife habitat. Prohibiting non-residential structures that might otherwise be allowed at this wetland resource site (government structures, churches, community meeting halls) would provide a degree of protection for remaining wetland values. Restricting fills for these structures would maintain wetland wildlife habitat values at their present moderate level. Prohibiting utility lines from crossing this wetland resource site would eliminate their environmental impacts on wetlandvegetation and hydrology, and would help maintain wetland wildlife habitat. Restricting utility substations at this site would prevent their adverse impacts (fill, vegetation removal) from reducing wetland environmental values at this resource site. Restricting normal residential activities (outdoor recreation, landscaping, domestic pets, exterior lighting) would protect wetland wildlife habitat from the adverse impacts caused by these activities. Restricting non-residential activities (such as hiking and vegetation management, which are not necessarily linked to residential development) would help protect wetland wildlife habitat at this resource site. Prohibiting artist's studios and bed and breakfasts at this wetland resource site would protect wetland resource values, notably wildlife habitat, from the adverse environmental consequences of the bed and breakfast structure. Prohibiting forest management activities at this resource site would help preserve the site's higher-rated functions and values, especially wildlife habitat, ecological integrity, educational potential and noteworthiness.

Indirect environmental consequences of restricting conflicting uses and activities in the Breaker's Point drainage basin could include a degree of protection for the remaining wetland functions and values at this resource site, particularly those associated with wildlife habitat. Restricting residential development to a single unit per lot-of-record would keep residential density and associated human activity to a minimum level. Restricting outdoor human activities, such as those associated with a residence, artist's studio, home occupation, bed and breakfast, or day care center, would provide further protection for wetland resource values. Prohibiting non-residential structures (government structures, churches, community meeting halls) will protect the Breaker's Point wetland resource site from the indirect environmental impacts of these uses: water quality degradation as a result of parking lot runoff, and wildlife disturbance from outdoor human activity and night lighting, for example. Prohibiting forest management at this resource site will prevent indirect damage to wetland environmental values.

Direct social consequences of allowing conflicting uses at the Breaker's Point wetland resource site include loss of open space in the surrounding residential neighborhood and an incremental social loss related to degradation of wetland wildlife habitat. The Breaker's Point wetland resource site provides open space benefits for neighboring property owners. Allowing development of any structure (residence, day care facility, bed and breakfast, artist's studio, government or municipal building, church or community center) at this wetland resource site would reduce or eliminate these benefits. Development of any of the structures permitted at this wetland resource site would diminish wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social loss. The Breaker's Point wetland resource site offers minimal flood protection value, so loss of this function may be of little consequence.

Indirect social consequences of allowing conflicting activities such as outdoor human activity, domestic pets, and exterior lighting at the Breaker's Point wetland resource site may include an incremental erosion of the quality of life enjoyed in Cannon Beach as a result of the degradation and loss of wetland wildlife habitat. To the extent that the presence of wildlife in Cannon Beach is appreciated by residents and visitors, this represents a social loss. Development of any of the structures (residence, government or municipal building, church or community center) or activities (day care, bed and breakfast, artist's studio, or home occupation) allowed in the R-3 zone at this wetland resource site might also increase the level of human activity in the surrounding neighborhood, and lead to increased motor vehicle traffic on adjacent streets. Allowing residential use of the Breaker's Point resource site would yield social benefits if it provided some relief to the housing shortage in the County. Allowing a park or recreation area at this resource site might provide social benefits related to outdoor recreation. Allowing institutional development (government or municipal building, church or community center, school) might yield social benefits related to the services provided in these buildings. Allowing forest management activities would result in the loss of trees in the forested portions of this wetland resource site. Trees contribute to the community's scenic beauty, and their loss would diminish this wetland resource site's *urban quality of life* value.

Direct social consequences of restricting conflicting uses at the Breaker's Point wetland resource site may include the preservation of open space in the residential neighborhood surrounding the resource site, and an incremental social benefit from preserving wetland wildlife habitat. The Breaker's Point wetland resource site provides open space for neighboring property owners. Prohibiting any structure (residence, government or municipal building, utility substation, church or community center) at this wetland resource site would preserve open space and secure the social benefits of open space. Prohibiting structures at this wetland resource site would protect wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting artist's studios at this wetland resource site might conflict with the city's desire to support the arts. Prohibiting forest management would help preserve trees at this resource site. Trees contribute to the quality of life in Cannon Beach, and the social benefits of preserving trees are widely recognized in this community.

Indirect social consequences of restricting conflicting uses at the Breaker's Point wetland resource site may include incremental improvement of the quality of life in Cannon Beach related to protection of wetland wildlife habitat. Activities that disrupt wildlife use at the Breaker's Point wetland resource site, such as outdoor human activity, diminish the site's wetland wildlife habitat value. Restricting these activities would help preserve existing wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting park or recreation area at this resource site might deny neighboring residents the social benefits related to a nearby outdoor recreation site. Prohibiting institutional development(government or municipal building, utility substation, church or community center, school) might impair delivery of the services provided in these buildings. Prohibiting all human activity at this resource site would require extraordinary intervention by the City into areas not normally subject to city regulation. The social costs of this level of intervention would be significant.

Direct economic consequences of allowing conflicting uses at the Breaker's Point wetland resource site include the price difference between the site as buildable land, and as unbuildable land. The size of this avoided loss would vary depending on which of the several conflicting uses allowed at this resource site are considered. The price difference between a buildable and an unbuildable residential lot may be significant. If the price of land at this wetland site includes the potential market price for timber to be harvested from the site, allowing forest management will secure this economic benefit of site ownership.

Indirect economic consequences of allowing conflicting uses at the Breaker's Point wetland resource site include possible loss of property value for adjacent residential land owners. Residential land values in Cannon Beach are relatively high for many reasons, including the increasing scarcity of vacant buildable land, and the proximity of some residential sites to wetland open space areas or forested wetlands. Allowing development or forest management at the Breaker's Point wetland resource site will eliminate the adjacent open space benefits enjoyed by neighboring residential property. This could reduce the value of adjacent residential land. An indirect economic benefit is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are allowed will be relatively higher than if residential uses are restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts. An economic consequence of allowing utility lines to cross this wetland resource site may be cost-efficient location of utility corridors. An economic consequence of allowing institutional development (government or municipal building, utility substation, church or community center, school) at this wetland resource site may be cost-efficient location of these structures.

Direct economic consequences of restricting conflicting uses at the Breaker's Point wetland resource site include the price difference between the wetland resource site as buildable vacant land, and as unbuildable land. The size of this economic loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. An economic consequence of prohibiting utility corridors from crossing this wetland resource site might be higher utility installation and maintenance costs caused by sub-optimal utility corridor locations. Prohibiting forest management might reduce the potential market value of a forested wetland site.

Indirect economic consequences of restricting conflicting uses at the Breaker's Point wetland resource site may include relatively higher property value for adjacent residential lands. Residential land values in Cannon Beach are high for many reasons, including the increasing scarcity of vacant buildable land in the community, and the proximity of some residential sites to unbuildable wetland open space areas or forested wetlands. Restricting development or timber removal at this resource site will help maintain these benefits enjoyed by neighboring residential property. An additional indirect economic consequence is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are restricted will be relatively lower than if residential uses were unrestricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

No direct energy consequences of allowing conflicting uses on the Breaker's Point drainage basin wetland resource site have been identified.

Indirect energy consequences of allowing conflicting uses in the Breaker's Point drainage basin wetland resource site may include the expenditure of the energy related to development of a structure on the site. Different energy expenditures may be required for construction of a pile-supported structure compared to a structure on fill compared to a structure at a non-wetland site.

No direct energy consequences of restricting conflicting uses on the Breaker's Point drainage basin wetland resource site have been identified.

Indirect energy consequences of restricting conflicting uses in the Breaker's Point drainage basin wetland resource site may include the energy savings related to preventing construction at the site. Different energy expenditures may be required for construction of a pile-supported structure compared to a structure on fill compared to a structure at a nonwetland site.

Conclusion: Based on the evaluation of this resource site's wetland functions and values, and based on this analysis of environmental, social, economic and energy consequences of allowing and restricting conflicting uses and activities, the City should provide partial protection for this resource site. The overlay zone and associated standards described elsewhere provide an appropriate level of protection given these factors.

Chena Drainage Basin Wetland Resource Site

The Chena wetland resource site contains a single wetland (inventory number 53) in the Residential Lower Density (RL) zone. Potentially conflicting uses allowed at the Chena wetland resource site include:

Single family dwelling
Day care center
Family, adult day care center
Residential home, residential facility
Home occupation
Temporary manufactured dwelling or recreational vehicle
Church or community meeting hall
Government or municipal structure
Structural shoreline stabilization
Public or private school or college
Utility lines
Parks or public recreation area

Unregulated conflicting activities also occur or could occur at this resource site. These conflicting uses and activities are described in more detail elsewhere. The Chena wetland resource site was rated moderate in terms of wildlife habitat, and low in terms of all other wetland functions and values.

Direct environmental consequences of allowing conflicting uses at this resource site are related to loss of wetland ecological functions and values, especially wildlife habitat. Residential structures (single family dwellings, temporary manufactured dwelling, or temporary recreational vehicle) on fill would result in loss or alteration of wetland vegetation, and alteration of wetland hydrology. Allowing residential structures on piling would damage wetland vegetation and impair wildlife habitat values, but would leave wetland hydrology substantially unaltered. Development of a park or recreation area would conflict with wetland ecological values at this wetland resource site. Placement of fill material for parking, tennis courts, playgrounds, restrooms and similar facilities commonly provided with park or recreation areas would alter wetland hydrology and eliminate wetland vegetation. Even without wetland fill, a park or recreation area that generates significant levels of human activity would degrade wetland ecological values. Installation and maintenance of aboveground utility lines may degrade wetland functions and values at this wetland resource site by requiring vegetation removal in the utility corridor. Underground utilities may also require vegetation removal for the corridor, and may interfere with wetland hydrology. A public or private school or college on this wetland resource site would have direct environmental consequences similar to those of any structure requiring fill. Fill for a school building andparking lot would alter wetland hydrology and eliminate wetland vegetation. Fill for a government or municipal structure, church, or

community hall would have similar direct environmental impacts on wetland functions and values at this resource site.

Indirect environmental consequences of allowing conflicting uses at the Chena wetland resource site include wetland habitat disturbance and loss. This indirect consequence is a result of human activity associated with normal residential use of residential structures. Examples of these types of disturbing residential activities include landscape maintenance and development, wildlife harassment by domestic dogs and cats, exterior lighting, and outdoor human recreation. The types of activities allowed in a residence in the Chena wetland resource site include home occupation, residential home, residential facility, and family or adult day care. These activities generate a higher level of human activity than would typically be found in a single family residence. To the extent that these activities occur outside of the structure, wetland environmental functions and values would be impaired. A park or recreation area at this wetland resource site would generate indirect environmental consequences for wetland functions and values, especially wildlife habitat. Outdoor human activity associated with a park or recreation area would be avoided by many wildlife species. A public or private school or college at this wetland resource site would have harmful indirect environmental consequences similar to those associated with a park or recreation area if a significant level of outdoor human activity were associated with this use. Government and municipal structures that have large parking lots or paved yards may degrade wetland water quality as a result of stormwater runoff.

Direct environmental consequences of restricting conflicting uses and activities at the Chena wetland resource site include a degree of protection for the wetland functions and values remaining at this resource site, notably wildlife habitat. A pile-supported residence would not impair wetland hydrology, but would alter wetland wildlife habitat. Prohibiting non-residential structures that might otherwise be allowed at this wetland resource site (government structures, churches, community meeting halls) would provide a degree of protection for remaining wetland values. Restricting fills for these structures would maintain wetland wildlife habitat values at their present moderate level. Prohibiting utility lines from crossing this wetland resource site would eliminate their environmental impacts on wetland vegetation and hydrology, and would help maintain wetland wildlife habitat. Restricting normal residential activities (outdoor recreation, landscaping, domestic pets, exterior lighting) would protect wetland wildlife habitat from the adverse impacts caused by these activities. Restricting non-residential activities (such as hiking and vegetation management, which are not necessarily linked to residential development) would help protect wetland wildlife habitat at this resource site.

Indirect environmental consequences of restricting conflicting uses and activities in the Chena drainage basin could include a degree of protection for the remaining wetlandfunctions and values at this resource site, particularly those associated with wildlife habitat. Restricting residential development to a single unit per lot-of-record would keep residential density and associated human activity to a minimum level. Restricting outdoor human activities, such as those associated with a residence, home occupation, or day care center, would provide further protection for wetland resource values. Prohibiting non-residential structures (government structures, churches, community meeting halls) will protect the Chena wetland resource site from the indirect environmental impacts of these uses: water quality degradation as a result of parking lot runoff, and wildlife disturbance from outdoor human activity and night lighting, for example.

Direct social consequences of allowing conflicting uses at the Chena wetland resource site include loss of open space in the surrounding residential neighborhood and an incremental social loss related to degradation of wetland wildlife habitat. The Chena wetland resource site provides open space benefits for neighboring property owners. Allowing development of any structure (residence, day care facility, government or municipal building, church or community center) at this wetland resource site would reduce or eliminate these benefits. Development of any of the structures permitted at this wetland resource site would diminish wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social loss. The Chena wetland resource site offers minimal flood protection value, so loss of this function may be of little consequence.

Indirect social consequences of allowing conflicting activities such as outdoor human activity, domestic pets, and exterior lighting at the Chena wetland resource site may include an incremental erosion of the quality of life enjoyed in Cannon Beach as a result of the degradation and loss of wetland wildlife habitat. To the extent that the presence of wildlife in Cannon Beach is appreciated by residents and visitors, this represents a social loss. Development of any of the structures (residence, government or municipal building, church or community center) or activities (day care, or home occupation) allowed at this wetland resource site might also increase the level of human activity in the surrounding neighborhood, and lead to increased motor vehicle traffic on adjacent streets. Allowing residential use of the Chena resource site would yield social benefits if it provided some relief to the housing shortage in the County. Allowing a park or recreation area at this resource site might provide social benefits related to outdoor recreation. Allowing institutional development (government or municipal building, church or community center, school) might yield social benefits related to the services provided in these buildings.

Direct social consequences of restricting conflicting uses at the Chena wetland resource site may include the preservation of open space in the residential neighborhood surrounding the resource site, and an incremental social benefit from preserving wetlandwildlife habitat. The Chena wetland resource site provides open space for neighboring property owners. Prohibiting any structure (residence, government or municipal building, church or community center) at this wetland resource site would preserve open space and secure the social benefits of open space. Prohibiting structures at this wetland resource site would protect wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit.

Indirect social consequences of restricting conflicting uses at the Chena wetland resource site may include incremental improvement of the quality of life in Cannon Beach related to protection of wetland wildlife habitat. Activities that disrupt wildlife use at the Chena wetland resource site, such as outdoor human activity, diminish the site's wetland wildlife habitat value. Restricting these activities would help preserve existing wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting park or recreation area at this resource site might deny neighboring residents the social benefits related to a nearby outdoor recreation site. Prohibiting institutional development (government or municipal building, church or community center, school) might impair delivery of the services provided in these buildings. Prohibiting all human activity at this resource site would require extraordinary intervention by the City into areas not normally subject to city regulation. The social costs of this level of intervention would be significant.

Direct economic consequences of allowing conflicting uses at the Chena wetland resource site include the price difference between the site as buildable land, and as unbuildable land. The size of this avoided loss would vary depending on which of the several conflicting uses allowed at this resource site are considered. The price difference between a buildable and an unbuildable residential lot may be significant.

Indirect economic consequences of allowing conflicting uses at the Chena wetland resource site include possible loss of property value for adjacent residential land owners. Residential land values in Cannon Beach are relatively high for many reasons, including the increasing scarcity of vacant buildable land, and the proximity of some residential sites to wetland open space areas. An indirect economic benefit is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are allowed will be relatively higher than if residential uses are restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts. An economic consequence of allowing utility lines to cross this wetland resource site may be cost-efficient location of utility corridors. An economic consequence of allowing institutional development (government or municipal building, church or community center, school) at this wetland resource site may be cost-efficient location of these structures.

Direct economic consequences of restricting conflicting uses at the Chena wetland resource site include the price difference between the wetland resource site as buildable vacant land, and as unbuildable land. The size of this economic loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. An economic consequence of prohibiting utility corridors from crossing this wetland resource site might be higher utility installation and maintenance costs caused by sub-optimal utility corridor locations.

Indirect economic consequences of restricting conflicting uses at the Chena wetland resource site may include relatively higher property value for adjacent residential lands. Residential land values in Cannon Beach are high for many reasons, including the increasing scarcity of vacant buildable land in the community, and the proximity of some residential sites to unbuildable wetland open space areas. Restricting conflicting development at this resource site will help maintain these benefits enjoyed by neighboring residential property. An additional indirect economic consequence is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are restricted will be relatively lower than if residential uses were un-restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

No direct energy consequences of allowing conflicting uses on the Chena drainage basin wetland resource site have been identified.

Indirect energy consequences of allowing conflicting uses in the Chena drainage basin wetland resource site may include the expenditure of the energy related to development of a structure on the site. Different energy expenditures may be required for construction of a pile-supported structure compared to a structure on fill compared to a structure at a nonwetland site.

No direct energy consequences of restricting conflicting uses on the Chena drainage basin wetland resource site have been identified.

Indirect energy consequences of restricting conflicting uses in the Chena drainage basin wetland resource site may include the energy savings related to preventing constructionat the site. Different energy expenditures may be required for construction of a pilesupported structure compared to a structure on fill compared to a structure at a non-wetland site.

Conclusion: Based on the evaluation of this resource site's wetland functions and values, and based on this analysis of environmental, social, economic and energy consequences of allowing and restricting conflicting uses and activities, the City should provide partial protection for this resource site. The overlay zone and associated standards described elsewhere provide an appropriate level of protection given these factors.

Commercial 3 Drainage Basin Wetland Resource Site

The Commercial 3 resource site contains a single wetland (site 11) in the Limited Commercial (C-1) zone. Potentially conflicting uses allowed in the C-1 zone include:

Duplex
Single family dwelling
Family, adult day care center
Residential home, residential facility
Temporary manufactured or recreational vehicle
Multi-family dwelling
Gas station
Church or community meeting hall
Government or municipal structure
Repair & maintenance service
Retail trade establishment
Structural shoreline stabilization
Business or professional offices
Garden store
Utility lines
Park or public recreation area
Arts & crafts gallery or studio
Plant nursery
Cabinet shop or similar trade or craft shop
Parking lot
Building materials sales
Financial institution
Theater
Personal or business service
Eating & drinking establishment.

Unregulated conflicting activities also occur or could occur at this resource site. These conflicting uses and activities are described in more detail elsewhere. The Commercial 3 wetland resource site was rated *high* in terms of urban quality of life and recreation values. Environmental integrity, wildlife habitat, noteworthiness, and educational potential were rated *medium* at this wetland resource site. Fish habitat, flood control, sediment trapping, and nutrient retention were *low*-rated values at the Commercial 3 wetland resource site.

Direct environmental consequences of allowing conflicting uses at this resource site are related to loss of the higher-rated wetland ecological values: wetland wildlife habitat,environmental integrity, and noteworthiness. Commercial structures and uses (gas station, repair or maintenance facility, retail trade establishment, business or professional offices, garden store, arts & crafts gallery or studio, plant nursery, cabinet shop, building material sales, bank, theater, personal or business service establishment, restaurant or bar) on fill would result in the loss or alteration of wetland vegetation and hydrology. This would damage or eliminate the higher-rated wetland functions and values mentioned above. Residential structures (single family residence, duplex, multi-family structure, temporary RV) on fill would result in loss or alteration of wetland vegetation and wetland hydrology. Allowing residential structures on piling would damage wetland vegetation, but would leave wetland hydrology substantially unaltered. Development of a park or recreation area would conflict with wetland ecological values, including wildlife habitat and ecological integrity, at this wetland resource site. Placement of fill material for parking, tennis courts, playgrounds, restrooms and similar facilities commonly provided with park or recreation areas would alter wetland hydrology and eliminate wetland vegetation. Even without wetland fill, a park or recreation area that generates significant levels of human activity would degrade wetland wildlife habitat values. Installation and maintenance of above-ground utility lines may degrade wetland functions and values at this wetland resource site by requiring vegetation removal in the utility corridor. Underground utilities may also require vegetation removal for the corridor, and may interfere with wetland hydrology. A public or private school or college on this wetland resource site would have direct environmental consequences similar to those of any structure requiring fill. Fill for a school building and parking lot would alter wetland hydrology and eliminate wetland vegetation. Fill for a government or municipal structure, church, or community hall would have similar direct environmental impacts on wetland functions and values at this resource site. Development of a parking lot, allowed in the C-1 zone, would require wetland fill. It would diminish or eliminate all of the higherrated wetland values at this resource site. Wetland water quality and aquatic habitat could be degraded if contaminated parking lot runoff entered the wetland.

<u>Indirect environmental consequences of allowing</u> conflicting uses at the Commercial 3 wetland resource site include wetland habitat disturbance and loss. This indirect consequence is a result of human activity associated with normal commercial activities, and with residential use of residential structures. Disruptive commercial activities include human activity, outdoor storage, parking, exterior lighting. Examples of these types of disturbing residential activities include landscape maintenance and development, wildlife harassment by domestic dogs and cats, exterior lighting, and outdoor human recreation. The types of activities allowed in a residence in the Commercial 3 wetland resource site include home occupation, residential home, residential facility, and family or adult day care. These activities generate a higher level of human activity than would typically be found in a single family residence. To the extent that these activities occur outside of the structure, wetland environmental functions and values would be impaired. A park or recreation area at this wetland resource site would generate indirect environmental consequences for wetland functions and values, especially wildlife habitat. Outdoor human activity associated with apark or recreation area would be avoided by many wildlife species. A public or private school or college at this wetland resource site would have harmful indirect environmental consequences similar to those associated with a park or recreation area if a significant level of outdoor human activity were associated with this use. Government and municipal structures that have large parking lots or paved yards may degrade wetland water quality as a result of stormwater runoff.

Direct environmental consequences of restricting conflicting uses and activities at the Commercial 3 wetland resource site include a degree of protection for the wetland functions and values remaining at this resource site, especially urban quality of life, recreation values, environmental integrity, wildlife habitat, noteworthiness, and educational potential. A pilesupported residence would not impair wetland hydrology, but would alter wetland wildlife habitat and environmental integrity. Prohibiting non-residential structures that might otherwise be allowed at this wetland resource site (commercial or institutional structures) would provide a degree of protection for remaining wetland values. Restricting fills for these structures would maintain wetland wildlife habitat and ecological integrity. Prohibiting utility lines from crossing this wetland resource site would eliminate their environmental impacts on wetland vegetation and hydrology, and would help maintain wetland wildlife habitat. Restricting normal residential activities (outdoor recreation, landscaping, domestic pets, exterior lighting) would protect wetland wildlife habitat from the adverse impacts caused by these activities. Restricting non-residential activities (such as hiking and vegetation management, which are not necessarily linked to residential development) would help protect wetland wildlife habitat and environmental integrity at this resource site. Prohibiting parking lot development at this site would protect wetland values prone to damage from fill: urban quality of life, environmental integrity, wildlife habitat, noteworthiness, educational potential, fish habitat, flood control, sediment trapping, and nutrient retention

Indirect environmental consequences of restricting conflicting uses and activities at the Commercial 3 resource site could include a degree of protection for the remaining wetland functions and values at this resource site, particularly those associated with wildlife habitat and ecological integrity. Restricting residential development to a single unit per lot-of-record would keep residential density and associated human activity to a minimum level. Restricting outdoor human activities would provide further protection for wetland resource values. Prohibiting commercial and residential structures will protect the Commercial 3 wetland resource site from the indirect environmental impacts of these uses: water quality degradation as a result of parking lot runoff, and wildlife disturbance from outdoor human activity and night lighting, for example.

Direct social consequences of allowing conflicting uses at the Commercial 3 wetland resource site include loss of open space in the surrounding neighborhood and an incrementalsocial loss related to degradation of wetland wildlife habitat and ecological integrity. The Commercial 3 wetland resource site provides open space benefits for neighboring property owners. Allowing development of any structure (residential, commercial or institutional) at this wetland resource site would reduce or eliminate these benefits. Development of any of the structures permitted at this wetland resource site would diminish wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social loss. The Commercial 3 wetland resource site offers minimal flood protection value, so loss of this function may be of little consequence. Educational potential would be degraded or lost if conflicting uses requiring fill or vegetation removal were allowed.

Indirect social consequences of allowing conflicting activities such as outdoor human activity, domestic pets, and exterior lighting at the Commercial 3 wetland resource site may include an incremental erosion of the quality of life enjoyed in Cannon Beach as a result of the degradation and loss of urban quality of life values and wetland wildlife habitat values. To the extent that the presence of wildlife in Cannon Beach is appreciated by residents and visitors, this represents a social loss. Development of any of the structures (residence, commercial building, institutional structure) or activities allowed in the C-1 zone at this wetland resource site might also increase the level of human activity in the surrounding neighborhood, and lead to increased motor vehicle traffic on adjacent streets. Allowing residential use of the Commercial 3 resource site would yield social benefits if it provided some relief to the housing shortage in the County. Allowing a park or recreation area at this resource site might provide social benefits related to outdoor recreation. Allowing institutional development (government or municipal building, church or community center, school) might yield social benefits related to the services provided in these buildings.

Direct social consequences of restricting conflicting uses at the Commercial 3 wetland resource site may include the preservation of open space in the neighborhood surrounding the resource site, and an incremental social benefit from preserving urban quality of life values and wetland wildlife habitat. The Commercial 3 wetland resource site provides open space for neighboring property owners. Prohibiting any structure (residence, commercial structure, institutional facility) at this wetland resource site would preserve open space and secure the social benefits of open space. Prohibiting structures at this wetland resource site would protect wetland values: urban quality of life, recreation values, environmental integrity, wildlife habitat, noteworthiness, and educational potential. To the extent that residents and visitors appreciate these wetland functions and values in Cannon Beach, this represents a social benefit. This resource site's educational potential would be preserved if conflicting uses that required fill or vegetation removal were prohibited.

Indirect social consequences of restricting conflicting uses at the Commercial 3 wetland resource site may include incremental improvement of the quality of life in Cannon Beach related to protection of urban quality of life, wetland wildlife habitat, and other wetland functions and values associated with this resource site. Activities that disrupt wildlife use at the Commercial 3 wetland resource site, such as outdoor human activity, diminish the site's wetland wildlife habitat value. Restricting these activities would help preserve existing wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting park or recreation area at this resource site might deny neighboring residents the social benefits related to a nearby outdoor recreation site. Prohibiting institutional development (government or municipal building, church or community center, school) might impair delivery of the social services provided in these buildings. Prohibiting all human activity at this resource site would require extraordinary intervention by the City into areas not normally subject to city regulation. The social costs of this level of intervention would be significant.

Direct economic consequences of allowing conflicting uses at the Commercial 3 wetland resource site include the price difference between the site as buildable land, and as unbuildable land. The size of this avoided loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. The price difference between a buildable and an unbuildable commercial lot may be significant. An economic consequence of allowing utility lines to cross this wetland resource site may be cost-efficient location of utility corridors.

Indirect economic consequences of allowing conflicting uses at the Commercial 3 wetland resource site include possible loss of property value for adjacent land owners. Land values in Cannon Beach are relatively high for many reasons, including the increasing scarcity of vacant buildable land, and the proximity of some developable sites to wetland open space areas. Allowing commercial, residential or institutional development at the Commercial 3 wetland resource site will eliminate the adjacent open space benefits enjoyed by neighboring property. This could reduce the value of adjacent land. An indirect economic benefit is realized by taxing districts that assess property taxes on this site. The assessed value of the site if development is allowed will be relatively higher than if development is restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

Direct economic consequences of restricting conflicting uses at the Commercial 3 wetland resource site include the price difference between the wetland resource site as buildable vacant land, and as unbuildable land. The size of this economic loss would vary depending on which of the various conflicting uses allowed at this resource site areconsidered. An economic consequence of prohibiting utility corridors from crossing this wetland resource site might be higher utility installation and maintenance costs caused by sub-optimal utility corridor locations.

Indirect economic consequences of restricting conflicting uses at the Commercial 3 wetland resource site may include relatively higher property value for adjacent lands. Real estate values in Cannon Beach are high for many reasons, including the increasing scarcity of vacant buildable land in the community, and the proximity of many developable sites to unbuildable wetland open space areas. Restricting development at this resource site will help maintain the adjacent open space benefits enjoyed by neighboring property. An additional indirect economic consequence is realized by taxing districts that assess property taxes on this site. The assessed value of the site if development is restricted will be relatively lower than if commercial, residential or institutional development were un-restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

No direct energy consequences of allowing conflicting uses on the Commercial 3 wetland resource site have been identified.

Indirect energy consequences of allowing conflicting uses in the Commercial 3 wetland resource site may include the expenditure of the energy related to construction at the site. Different energy expenditures may be required for construction of a pile-supported building compared to a structure on fill compared to construction at a non-wetland site.

No direct energy consequences of restricting conflicting uses on the Commercial 3 wetland resource site have been identified.

Indirect energy consequences of restricting conflicting uses in the Commercial 3 wetland resource site may include the energy savings related to preventing development on the site. Different energy expenditures may be required for construction of a pile-supported building compared to one on fill compared to a structure at a non-wetland site.

Conclusion: Based on the evaluation of this resource site's wetland functions and values, and based on this analysis of environmental, social, economic and energy consequences of allowing and restricting conflicting uses and activities, the City should provide partial protection for this resource site. The overlay zone and associated standards described elsewhere provide an appropriate level of protection given these factors.

Coolidge 1 and 2 Drainage Basin Wetland Resource Site

The Coolidge 1 and 2 wetland resource site contains four individual wetlands (inventory numbers 22, 23, 24 and 27) in three residential zones. Wetlands #22 and #24 are in the Residential Medium Density (R2) zone. Wetland #27 is in the Residential Lower Density (RL) zone. Wetland #23 is in the R2 zone and the Residential Moderate Density (R1) zone. Potentially conflicting uses allowed in one or more of the individual wetland areas at the Coolidge 1 and 2 wetland resource site include:

- Duplex
- Single family dwelling
- Bed and breakfast
- Artist's studio
- Day care center
- Family, adult day care center
- Residential home, residential facility
- Home occupation
- Temporary manufactured dwelling or recreational vehicle
- Church or community meeting hall
- Government or municipal structure
- Structural shoreline stabilization
- Public or private school or college
- Utility lines
- Parks or public recreation area.

Unregulated conflicting activities also occur or could occur at this resource site. These conflicting uses and activities are described in more detail elsewhere. The following table shows resource values for wetlands at this resource site.

Functional Values

Inventory Number:	22	23	24	27
Ecological Integrity	L	L	L	L
Wildlife Habitat	M	M	L	L
Fish Habitat	L	L	L	L
Noteworthiness	L	L	L/M	L
Educational Potential	L	L	L	L
Recreation	L	L	L	L
Flood Control	L	L	L	L
Sediment Trapping	L	L	L	L
Nutrient Retention	L	L	L	L
Urban Quality of Life	M	L	L/M	L

Legend: H = High, M = Medium, L = Low

Direct environmental consequences of allowing conflicting uses at this resource site are related to loss of wetland wildlife habitat as well as degradation of the site's other wetland functions and values. Residential structures (single family dwellings, duplexes, temporary manufactured dwelling, or temporary recreational vehicle) on fill would result in loss or alteration of wetland vegetation, and alteration of wetland hydrology. Allowing residential structures on piling would damage wetland vegetation and impair wildlife habitat values, but would leave wetland hydrology substantially unaltered. Development of a park or recreation area would conflict with wetland ecological values, including wildlife habitat, at this wetland resource site. Placement of fill material for parking, tennis courts, playgrounds, restrooms and similar facilities commonly provided with park or recreation areas would alter wetland hydrology and eliminate wetland vegetation. Even without wetland fill, a park or recreation area that generates significant levels of human activity would degrade wetland wildlife habitat values. Installation and maintenance of above-ground utility lines may degrade wetland functions and values at this wetland resource site by requiring vegetation removal in the utility corridor. Underground utilities may also require vegetation removal for the corridor, and may interfere with wetland hydrology. A public or private school or college on this wetland resource site would have direct environmental consequences similar to those of any structure requiring fill. Fill for a school building and parking lot would alter wetland hydrology and eliminate wetland vegetation. Fill for a government or municipalstructure, church, or community hall would have similar direct environmental impacts on wetland functions and values at this resource site. A bed and breakfast or an artist's studio would probably have direct environmental consequences at this resource site similar to those of a residence.

Indirect environmental consequences of allowing conflicting uses at the Coolidge 1 and 2 wetland resource site include wetland habitat disturbance and loss. This indirect consequence is a result of human activity associated with normal residential use of residential structures. Examples of these types of disturbing residential activities include landscape maintenance and development, wildlife harassment by domestic dogs and cats, exterior lighting, and outdoor human recreation. The types of activities allowed in a residence in the Coolidge 1 and 2 wetland resource site include home occupation, residential home, residential facility, artist's studio, and family or adult day care. These activities generate a higher level of human activity than would typically be found in a single family residence. To the extent that these activities occur outside of the structure, wetland environmental functions and values would be impaired. A park or recreation area at this wetland resource site would generate indirect environmental consequences for wetland functions and values, especially wildlife habitat. Outdoor human activity associated with a park or recreation area would be avoided by many wildlife species. A public or private school or college at this wetland resource site would have harmful indirect environmental consequences similar to those associated with a park or recreation area if a significant level of outdoor human activity were associated with this use. Government and municipal structures that have large parking lots or paved yards may degrade wetland water quality as a result of stormwater runoff. A bed and breakfast would probably generate indirect environmental impacts similar to those of a residence.

Direct environmental consequences of restricting conflicting uses and activities at the Coolidge 1 and 2 wetland resource site include a degree of protection for the wetland functions and values remaining at this resource site, notably wildlife habitat. A pilesupported residence would not impair wetland hydrology, but would alter wetland wildlife habitat. Prohibiting non-residential structures that might otherwise be allowed at this wetland resource site (government structures, churches, community meeting halls) would provide a degree of protection for remaining wetland values. Restricting fills for these structures would maintain wetland wildlife habitat values at their present moderate level. Prohibiting utility lines from crossing this wetland resource site would eliminate their environmental impacts on wetland vegetation and hydrology, and would help maintain wetland wildlife habitat. Restricting utility substations at this site would prevent their adverse impacts (fill, vegetation removal) from reducing wetland environmental values at this resource site. Restricting normal residential activities (outdoor recreation, landscaping, domestic pets, exterior lighting) would protect wetland wildlife habitat from the adverse impacts caused by these activities. Restricting non-residential activities (such as hiking and vegetation management, which are not necessarily linked to residential development) would help protect wetland wildlife habitat at this resource site. Prohibiting artist's studios and bed andbreakfasts at this wetland resource site would protect wetland resource values, notably wildlife habitat, from the adverse environmental consequences of the bed and breakfast structure.

Indirect environmental consequences of restricting conflicting uses and activities in the Coolidge 1 and 2 drainage basin could include a degree of protection for the remaining wetland functions and values at this resource site, particularly those associated with wildlife habitat. Restricting residential development to a single unit per lot-of-record would keep residential density and associated human activity to a minimum level. Restricting outdoor human activities, such as those associated with a residence, artist's studio, home occupation, bed and breakfast, or day care center, would provide further protection for wetland resource values. Prohibiting non-residential structures (government structures, churches, community meeting halls) will protect the Coolidge 1 and 2 wetland resource site from the indirect environmental impacts of these uses: water quality degradation as a result of parking lot runoff, and wildlife disturbance from outdoor human activity and night lighting, for example.

Direct social consequences of allowing conflicting uses at the Coolidge 1 and 2 wetland resource site include loss of open space in the surrounding residential neighborhood and an incremental social loss related to degradation of wetland wildlife habitat. The Coolidge 1 and 2 wetland resource site provides open space benefits for neighboring property owners. Allowing development of any structure (residence, day care facility, bed and breakfast, artist's studio, government or municipal building, church or community center) at this wetland resource site would reduce or eliminate these benefits. Development of any of the structures permitted at this wetland resource site would diminish wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social loss. The Coolidge 1 and 2 wetland resource site offers minimal flood protection value, so loss of this function may be of little consequence.

Indirect social consequences of allowing conflicting activities such as outdoor human activity, domestic pets, and exterior lighting at the Coolidge 1 and 2 wetland resource site may include an incremental erosion of the quality of life enjoyed in Cannon Beach as a result of the degradation and loss of wetland wildlife habitat. To the extent that the presence of wildlife in Cannon Beach is appreciated by residents and visitors, this represents a social loss. Development of any of the structures (residence, government or municipal building, church or community center) or activities (day care, bed and breakfast, artist's studio, or home occupation) allowed in the R-3 zone at this wetland resource site might also increase the level of human activity in the surrounding neighborhood, and lead to increased motorvehicle traffic on adjacent streets. Allowing residential use of the Coolidge 1 and 2 resource site would yield social benefits if it provided some relief to the housing shortage in the County. Allowing a park or recreation area at this resource site might provide social benefits related to outdoor recreation. Allowing institutional development (government or municipal building, church or community center, school) might yield social benefits related to the services provided in these buildings.

Direct social consequences of restricting conflicting uses at the Coolidge 1 and 2 wetland resource site may include the preservation of open space in the residential neighborhood surrounding the resource site, and an incremental social benefit from preserving wetland wildlife habitat. The Coolidge 1 and 2 wetland resource site provides open space for neighboring property owners. Prohibiting any structure (residence, government or municipal building, church or community center) at this wetland resource site would preserve open space and secure the social benefits of open space. Prohibiting structures at this wetland resource site would protect wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting artist's studios at this wetland resource site might conflict with the city's desire to support the arts.

Indirect social consequences of restricting conflicting uses at the Coolidge 1 and 2 wetland resource site may include incremental improvement of the quality of life in Cannon Beach related to protection of wetland wildlife habitat. Activities that disrupt wildlife use at the Coolidge 1 and 2 wetland resource site, such as outdoor human activity, diminish the site's wetland wildlife habitat value. Restricting these activities would help preserve existing wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting park or recreation area at this resource site might deny neighboring residents the social benefits related to a nearby outdoor recreation site. Prohibiting institutional development (government or municipal building, church or community center, school) might impair delivery of the services provided in these buildings. Prohibiting all human activity at this resource site would require extraordinary intervention by the City into areas not normally subject to city regulation. The social costs of this level of intervention would be significant.

Direct economic consequences of allowing conflicting uses at the Coolidge 1 and 2 wetland resource site include the price difference between the site as buildable land, and as unbuildable land. The size of this avoided loss would vary depending on which of the several conflicting uses allowed at this resource site are considered. The price difference between a buildable and an unbuildable residential lot may be significant.

Indirect economic consequences of allowing conflicting uses at the Coolidge 1 and 2 wetland resource site include possible loss of property value for adjacent residential land owners. Residential land values in Cannon Beach are relatively high for many reasons, including the increasing scarcity of vacant buildable land, and the proximity of some residential sites to wetland open space areas or forested wetlands. Allowing development or forest management at the Coolidge 1 and 2 wetland resource site will eliminate the adjacent open space benefits enjoyed by neighboring residential property. This could reduce the value of adjacent residential land. An indirect economic benefit is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are allowed will be relatively higher than if residential uses are restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts. An economic consequence of allowing utility lines to cross this wetland resource site may be cost-efficient location of utility corridors. An economic consequence of allowing institutional development (government or municipal building, church or community center, school) at this wetland resource site may be cost-efficient location of these structures.

Direct economic consequences of restricting conflicting uses at the Coolidge 1 and 2 wetland resource site include the price difference between the wetland resource site as buildable vacant land, and as unbuildable land. The size of this economic loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. An economic consequence of prohibiting utility corridors from crossing this wetland resource site might be higher utility installation and maintenance costs caused by sub-optimal utility corridor locations.

Indirect economic consequences of restricting conflicting uses at the Coolidge 1 and 2 wetland resource site may include relatively higher property value for adjacent residential lands. Residential land values in Cannon Beach are high for many reasons, including the increasing scarcity of vacant buildable land in the community, and the proximity of some residential sites to unbuildable wetland open space areas or forested wetlands. Restricting development or timber removal at this resource site will help maintain these benefits enjoyed by neighboring residential property. An additional indirect economic consequence is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are restricted will be relatively lower than if residential uses were unrestricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

No direct energy consequences of allowing conflicting uses on the Coolidge 1 and 2 drainage basin wetland resource site have been identified.
Indirect energy consequences of allowing conflicting uses in the Coolidge 1 and 2 drainage basin wetland resource site may include the expenditure of the energy related to development of a structure on the site. Different energy expenditures may be required for construction of a pile-supported structure compared to a structure on fill compared to a structure at a non-wetland site.

No direct energy consequences of restricting conflicting uses on the Coolidge 1 and 2 drainage basin wetland resource site have been identified.

Indirect energy consequences of restricting conflicting uses in the Coolidge 1 and 2 drainage basin wetland resource site may include the energy savings related to preventing construction at the site. Different energy expenditures may be required for construction of a pile-supported structure compared to a structure on fill compared to a structure at a nonwetland site.

Conclusion: Based on the evaluation of this resource site's wetland functions and values, and based on this analysis of environmental, social, economic and energy consequences of allowing and restricting conflicting uses and activities, the City should provide partial protection for this resource site. The overlay zone and associated standards described elsewhere provide an appropriate level of protection given these factors.

Coolidge 3 Drainage Basin Wetland Resource Site

The Coolidge 3 resource site contains a single wetland (site 43) in the Limited Commercial (C-1) zone and the Residential Medium Density (R2) zone. Potentially conflicting uses allowed in these zones include:

Duplex
Single family dwelling
Bed and breakfast
Artist's studio
Day care center
Family, adult day care center
Residential home, residential facility
Home occupation
Temporary manufactured dwelling or recreational vehicle
Multi-family dwelling
Gas station
Church or community meeting hall
Government or municipal structure
Repair & maintenance service
Retail trade establishment
Structural shoreline stabilization
Business or professional office
Garden store
Public or private school or college
Utility lines
Parks or public recreation area
Arts & crafts gallery or studio
Plant nursery
Cabinet shop, etc
Parking lot
Building materials sales
Financial institution
Theater
Personal or business service
Eating & drinking establishment.

Unregulated conflicting activities also occur or could occur at this resource site. These conflicting uses and activities are described in more detail elsewhere. The Coolidge 3 wetland resource site was rated *low* in terms of all rated wetland functions and values.

Direct environmental consequences of allowing conflicting uses at this resource site are related to loss of wetland ecological values: wetland wildlife habitat, ecological integrity,nutrient retention, and sediment trapping. Commercial structures and uses (gas station, repair or maintenance facility, retail trade establishment, business or professional offices, garden store, arts & crafts gallery or studio, plant nursery, cabinet shop, building material sales, bank, theater, personal or business service establishment, restaurant or bar) on fill would result in the loss or alteration of wetland vegetation and hydrology. This would damage or eliminate the higher-rated wetland functions and values mentioned above. Residential structures (single family residence, duplex, multi-family structure, temporary RV) on fill would result in loss or alteration of wetland vegetation and wetland hydrology. Allowing residential structures on piling would damage wetland vegetation, but would leave wetland hydrology substantially unaltered. Development of a park or recreation area would conflict with wetland ecological values at this wetland resource site. Placement of fill material for parking, tennis courts, playgrounds, restrooms and similar facilities commonly provided with park or recreation areas would alter wetland hydrology and eliminate wetland vegetation. Even without wetland fill, a park or recreation area that generates significant levels of human activity would degrade wetland wildlife habitat values. Installation and maintenance of above-ground utility lines may degrade wetland functions and values at this wetland resource site by requiring vegetation removal in the utility corridor. Underground utilities may also require vegetation removal for the corridor, and may interfere with wetland hydrology. A public or private school or college on this wetland resource site would have direct environmental consequences similar to those of any structure requiring fill. Fill for a school building and parking lot would alter wetland hydrology and eliminate wetland vegetation. Fill for a government or municipal structure, church, or community hall would have similar direct environmental impacts on wetland functions and values at this resource site. Development of a parking lot, allowed in the C-1 zone, would require wetland fill. It would diminish or eliminate all of the higher-rated wetland values at this resource site. Wetland water quality and aquatic habitat could be degraded if contaminated parking lot runoff entered the wetland.

Indirect environmental consequences of allowing conflicting uses at the Coolidge 3 wetland resource site include wetland habitat disturbance and loss. This indirect consequence is a result of human activity associated with normal commercial activities, and with residential use of residential structures. Disruptive commercial activities include human activity, outdoor storage, parking, exterior lighting. Examples of these types of disturbing residential activities include landscape maintenance and development, wildlife harassment by domestic dogs and cats, exterior lighting, and outdoor human recreation. The types of activities allowed in a residence in the Coolidge 3 wetland resource site include home occupation, residential home, residential facility, and family or adult day care. These activities generate a higher level of human activity than would typically be found in a single family residence. To the extent that these activities occur outside of the structure, wetland environmental functions and values would be impaired. A park or recreation area at this wetland resource site would generate indirect environmental consequences for wetland functions and values. Outdoor human activity associated with a park or recreation area would be avoided by many wildlife species. A public or private school or college at thiswetland resource site would have harmful indirect environmental consequences similar to those associated with a park or recreation area if a significant level of outdoor human activity were associated with this use. Government and municipal structures that have large parking lots or paved yards may degrade wetland water quality as a result of stormwater runoff.

Direct environmental consequences of restricting conflicting uses and activities at the Coolidge 3 wetland resource site include a degree of protection for the wetland functions and values remaining at this resource site, especially urban quality of life, recreation values, environmental integrity, wildlife habitat, noteworthiness, and educational potential. A pilesupported residence would not impair wetland hydrology, but would alter wetland wildlife habitat and environmental integrity. Prohibiting non-residential structures that might otherwise be allowed at this wetland resource site (commercial or institutional structures) would provide a degree of protection for remaining wetland values. Restricting fills for these structures would maintain wetland wildlife habitat and ecological integrity. Prohibiting utility lines from crossing this wetland resource site would eliminate their environmental impacts on wetland vegetation and hydrology, and would help maintain wetland wildlife habitat. Restricting normal residential activities (outdoor recreation, landscaping, domestic pets, exterior lighting) would protect wetland wildlife habitat from the adverse impacts caused by these activities. Restricting non-residential activities (such as hiking and vegetation management, which are not necessarily linked to residential development) would help protect wetland wildlife habitat and environmental integrity at this resource site. Prohibiting parking lot development at this site would protect wetland values prone to damage from fill: urban quality of life, environmental integrity, wildlife habitat, noteworthiness, educational potential, fish habitat, flood control, sediment trapping, and nutrient retention

Indirect environmental consequences of restricting conflicting uses and activities at the Coolidge 3 resource site could include a degree of protection for the remaining wetland functions and values at this resource site, particularly those associated with wildlife habitat and ecological integrity. Restricting residential development to a single unit per lot-of-record would keep residential density and associated human activity to a minimum level. Restricting outdoor human activities would provide further protection for wetland resource values. Prohibiting commercial and residential structures will protect the Coolidge 3 wetland resource site from the indirect environmental impacts of these uses: water quality degradation as a result of parking lot runoff, and wildlife disturbance from outdoor human activity and night lighting, for example.

Direct social consequences of allowing conflicting uses at the Coolidge 3 wetland resource site include loss of open space in the surrounding neighborhood and an incremental social loss related to degradation of wetland wildlife habitat and ecological integrity. TheCoolidge 3 wetland resource site provides open space benefits for neighboring property owners. Allowing development of any structure (residential, commercial or institutional) at this wetland resource site would reduce or eliminate these benefits. Development of any of the structures permitted at this wetland resource site would diminish wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social loss. The Coolidge 3 wetland resource site offers minimal flood protection value, so loss of this function may be of little consequence.

Indirect social consequences of allowing conflicting activities such as outdoor human activity, domestic pets, and exterior lighting at the Coolidge 3 wetland resource site may include an incremental erosion of the quality of life enjoyed in Cannon Beach as a result of the degradation and loss of urban quality of life values and wetland wildlife habitat values. To the extent that the presence of wildlife in Cannon Beach is appreciated by residents and visitors, this represents a social loss. Development of any of the structures (residence, commercial building, institutional structure) or activities allowed in the C-1 zone at this wetland resource site might also increase the level of human activity in the surrounding neighborhood, and lead to increased motor vehicle traffic on adjacent streets. Allowing residential use of the Coolidge 3 resource site would yield social benefits if it provided some relief to the housing shortage in the County. Allowing a park or recreation area at this resource site might provide social benefits related to outdoor recreation. Allowing institutional development (government or municipal building, church or community center, school) might yield social benefits related to the services provided in these buildings.

Direct social consequences of restricting conflicting uses at the Coolidge 3 wetland resource site may include the preservation of open space in the neighborhood surrounding the resource site, and an incremental social benefit from preserving urban quality of life values and wetland wildlife habitat. The Coolidge 3 wetland resource site provides open space for neighboring property owners. Prohibiting any structure (residence, commercial structure, institutional facility) at this wetland resource site would preserve open space and secure the social benefits of open space. Prohibiting structures at this wetland resource site would protect wetland values: urban quality of life, recreation values, environmental integrity, wildlife habitat, noteworthiness, and educational potential. To the extent that residents and visitors appreciate these wetland functions and values in Cannon Beach, this represents a social benefit. This resource site's educational potential would be preserved if conflicting uses that required fill or vegetation removal were prohibited.

Indirect social consequences of restricting conflicting uses at the Coolidge 3 wetland resource site may include incremental improvement of the quality of life in Cannon Beach related to protection of urban quality of life, wetland wildlife habitat, and other wetland functions and values associated with this resource site. Activities that disrupt wildlife use atthe Coolidge 3 wetland resource site, such as outdoor human activity, diminish the site's wetland wildlife habitat value. Restricting these activities would help preserve existing wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting park or recreation area at this resource site might deny neighboring residents the social benefits related to a nearby outdoor recreation site. Prohibiting institutional development (government or municipal building, church or community center, school) might impair delivery of the social services provided in these buildings. Prohibiting all human activity at this resource site would require extraordinary intervention by the City into areas not normally subject to city regulation. The social costs of this level of intervention would be significant.

Direct economic consequences of allowing conflicting uses at the Coolidge 3 wetland resource site include the price difference between the site as buildable land, and as unbuildable land. The size of this avoided loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. The price difference between a buildable and an unbuildable commercial lot may be significant. An economic consequence of allowing utility lines to cross this wetland resource site may be cost-efficient location of utility corridors.

Indirect economic consequences of allowing conflicting uses at the Coolidge 3 wetland resource site include possible loss of property value for adjacent land owners. Land values in Cannon Beach are relatively high for many reasons, including the increasing scarcity of vacant buildable land, and the proximity of some developable sites to wetland open space areas. Allowing commercial, residential or institutional development at the Coolidge 3 wetland resource site will eliminate the adjacent open space benefits enjoyed by neighboring property. This could reduce the value of adjacent land. An indirect economic benefit is realized by taxing districts that assess property taxes on this site. The assessed value of the site if development is allowed will be relatively higher than if development is restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

Direct economic consequences of restricting conflicting uses at the Coolidge 3 wetland resource site include the price difference between the wetland resource site as buildable vacant land, and as unbuildable land. The size of this economic loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. An economic consequence of prohibiting utility corridors from crossing this wetland resource site might be higher utility installation and maintenance costs caused by sub-optimal utility corridor locations.
Indirect economic consequences of restricting conflicting uses at the Coolidge 3 wetland resource site may include relatively higher property value for adjacent lands. Real estate values in Cannon Beach are high for many reasons, including the increasing scarcity of vacant buildable land in the community, and the proximity of many developable sites to unbuildable wetland open space areas. Restricting development at this resource site will help maintain the adjacent open space benefits enjoyed by neighboring property. An additional indirect economic consequence is realized by taxing districts that assess property taxes on this site. The assessed value of the site if development is restricted will be relatively lower than if commercial, residential or institutional development were un-restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

No direct energy consequences of allowing conflicting uses on the Coolidge 3 wetland resource site have been identified.

Indirect energy consequences of allowing conflicting uses in the Coolidge 3 wetland resource site may include the expenditure of the energy related to construction at the site. Different energy expenditures may be required for construction of a pile-supported building compared to a structure on fill compared to construction at a non-wetland site.

No direct energy consequences of restricting conflicting uses on the Coolidge 3 wetland resource site have been identified.

Indirect energy consequences of restricting conflicting uses in the Coolidge 3 wetland resource site may include the energy savings related to preventing development on the site. Different energy expenditures may be required for construction of a pile-supported building compared to one on fill compared to a structure at a non-wetland site.

Conclusion: Based on the evaluation of this resource site's wetland functions and values, and based on this analysis of environmental, social, economic and energy consequences of allowing and restricting conflicting uses and activities, the City should provide partial protection for this resource site. The overlay zone and associated standards described elsewhere provide an appropriate level of protection given these factors.

Coolidge 12 and 13 Drainage Basin Wetland Resource Site

The Coolidge 12 and 13 wetland resource site contains five individual wetlands (inventory numbers 12, 13, 14, 15, and 37) in three residential zones. Wetlands 12, 13, 14, and 15 are in the Residential Medium Density (R2) zone. Wetland #37 is in the Residential Lower Density (RL) zone. Potentially conflicting uses allowed in one or more of the individual wetland areas at the Coolidge 12 and 13 wetland resource site include:

- Duplex
- Single family dwelling
- Bed and breakfast
- Artist's studio
- Day care center
- Family, adult day care center
- Residential home, residential facility
- Home occupation
- Temporary manufactured dwelling or recreational vehicle
- Church or community meeting
- Government or municipal structure
- Structural shoreline stabilization
- Public or private school or college
- Utility lines
- Parks or public recreation area.

Unregulated conflicting activities also occur or could occur at this resource site. These conflicting uses and activities are described in more detail elsewhere. The following table shows resource values for wetlands at this resource site.

	Functional Values				
Inventory Number:	12	13	14	15	37
Ecological Integrity	L/M	L/M	L	L	M
Wildlife Habitat	L/M	L/M	M	M	M
Fish Habitat	L	L	L	L	L
Noteworthiness	L/M	L	L	M	L
Educational Potential	L	L	L	L	L
Recreation	L	L	L	L	L
Flood Control	L	L	L	L	L
Sediment Trapping	L	L	L	L	L
Nutrient Retention	L	L	L	L	L
Urban Quality of Life	M	L/M	M	M	M

Legend: H = High, M = Medium, L = Low

Direct environmental consequences of allowing conflicting uses at this resource site are related to loss of ecological integrity and wetland wildlife habitat as well as degradation of the site's other wetland functions and values. Residential structures (single family dwellings, duplexes, temporary manufactured dwelling, or temporary recreational vehicle) on fill would result in loss or alteration of wetland vegetation, and alteration of wetland hydrology. Allowing residential structures on piling would damage wetland vegetation and impair wildlife habitat values, but would leave wetland hydrology substantially unaltered. Development of a park or recreation area would conflict with wetland ecological values, including wildlife habitat and ecological integrity, at this wetland resource site. Placement of fill material for parking, tennis courts, playgrounds, restrooms and similar facilities commonly provided with park or recreation areas would alter wetland hydrology and eliminate wetland vegetation. Even without wetland fill, a park or recreation area that generates significant levels of human activity would degrade wetland wildlife habitat values and ecological integrity. Installation and maintenance of above-ground utility lines may degrade wetland functions and values at this wetland resource site by requiring vegetation removal in the utility corridor. Underground utilities may also require vegetation removal for the corridor, and may interfere with wetland hydrology. A public or private school or college on this wetland resource site would have direct environmental consequences similar to those of any structure requiring fill. Fill for a school building and parking lot would alterwetland hydrology and eliminate wetland vegetation. Fill for a government or municipal structure, church, or community hall would have similar direct environmental impacts on wetland functions and values at this resource site. A bed and breakfast or an artist's studio would probably have direct environmental consequences at this resource site similar to those of a residence.

Indirect environmental consequences of allowing conflicting uses at the Coolidge 12 and 13 wetland resource site include wetland habitat disturbance and loss, and reduction of the site's ecological integrity. These indirect consequences are a result of human activity associated with normal residential use of residential structures. Examples of these types of disturbing residential activities include landscape maintenance and development, wildlife harassment by domestic dogs and cats, exterior lighting, and outdoor human recreation. The types of activities allowed in a residence in the Coolidge 12 and 13 wetland resource site include home occupation, residential home, residential facility, artist's studio, and family or adult day care. These activities generate a higher level of human activity than would typically be found in a single family residence. To the extent that these activities occur outside of the structure, wetland environmental functions and values would be impaired. A park or recreation area at this wetland resource site would generate indirect environmental consequences for wetland functions and values, especially wildlife habitat. Outdoor human activity associated with a park or recreation area would be avoided by many wildlife species. A public or private school or college at this wetland resource site would have harmful indirect environmental consequences similar to those associated with a park or recreation area if a significant level of outdoor human activity were associated with this use. Government and municipal structures that have large parking lots or paved yards may degrade wetland water quality as a result of stormwater runoff. A bed and breakfast would probably generate indirect environmental impacts similar to those of a residence.

Direct environmental consequences of restricting conflicting uses and activities at the Coolidge 12 and 13 wetland resource site include a degree of protection for the wetland functions and values remaining at this resource site, notably wildlife habitat. A pilesupported residence would not impair wetland hydrology, but would alter wetland wildlife habitat. Prohibiting non-residential structures that might otherwise be allowed at this wetland resource site (government structures, churches, community meeting halls) would provide a degree of protection for remaining wetland values. Restricting fills for these structures would maintain wetland wildlife habitat values at their present moderate level. Prohibiting utility lines from crossing this wetland resource site would eliminate their environmental impacts on wetland vegetation and hydrology, and would help maintain wetland wildlife habitat. Restricting utility substations at this site would prevent their adverse impacts (fill, vegetation removal) from reducing wetland environmental values at this resource site. Restricting normal residential activities (outdoor recreation, landscaping, domestic pets, exterior lighting) would protect wetland wildlife habitat from the adverse impacts caused by these activities. Restricting non-residential activities (such as hiking and vegetation management, which are not necessarily linked to residential development) would help protectwetland wildlife habitat at this resource site. Prohibiting artist's studios and bed and breakfasts at this wetland resource site would protect wetland resource values, notably wildlife habitat and ecological integrity, from the adverse environmental consequences of the bed and breakfast structure.

Indirect environmental consequences of restricting conflicting uses and activities in the Coolidge 12 and 13 drainage basin could include a degree of protection for the remaining wetland functions and values at this resource site, particularly those associated with wildlife habitat and ecological integrity. Restricting residential development to a single unit per lotof-record would keep residential density and associated human activity to a minimum level. Restricting outdoor human activities, such as those associated with a residence, artist's studio, home occupation, bed and breakfast, or day care center, would provide further protection for wetland resource values. Prohibiting non-residential structures (government structures, churches, community meeting halls) will protect the Coolidge 12 and 13 wetland resource site from the indirect environmental impacts of these uses: water quality degradation as a result of parking lot runoff, and wildlife disturbance from outdoor human activity and night lighting, for example.

Direct social consequences of allowing conflicting uses at the Coolidge 12 and 13 wetland resource site include loss of open space in the surrounding residential neighborhood, degradation of the site's *noteworthiness* values, and an incremental social loss related to degradation of wetland wildlife habitat. The Coolidge 12 and 13 wetland resource site provides open space benefits for neighboring property owners. Allowing development of any structure (residence, day care facility, bed and breakfast, artist's studio, government or municipal building, church or community center) at this wetland resource site would reduce or eliminate these benefits. Development of any of the structures permitted at this wetland resource site would diminish wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social loss. The Coolidge 12 and 13 wetland resource site offers minimal flood protection value, so loss of this function may be of little consequence.

Indirect social consequences of allowing conflicting activities such as outdoor human activity, domestic pets, and exterior lighting at the Coolidge 12 and 13 wetland resource site may include an incremental erosion of the quality of life enjoyed in Cannon Beach as a result of the degradation and loss of wetland wildlife habitat. To the extent that the presence of wildlife in Cannon Beach is appreciated by residents and visitors, this represents a social loss. Development of any of the structures (residence, government or municipal building, church or community center) or activities (day care, bed and breakfast, artist's studio, orhome occupation) allowed in the R-3 zone at this wetland resource site might also increase the level of human activity in the surrounding neighborhood, and lead to increased motor vehicle traffic on adjacent streets. Allowing residential use of the Coolidge 12 and 13 resource site would yield social benefits if it provided some relief to the housing shortage in the County. Allowing a park or recreation area at this resource site might provide social benefits related to outdoor recreation. Allowing institutional development (government or municipal building, church or community center, school) might yield social benefits related to the services provided in these buildings.

Direct social consequences of restricting conflicting uses at the Coolidge 12 and 13 wetland resource site may include the preservation of open space in the residential neighborhood surrounding the resource site, preservation of the site's *noteworthiness* values, and an incremental social benefit from preserving wetland wildlife habitat. The Coolidge 12 and 13 wetland resource site provides open space for neighboring property owners. Prohibiting any structure (residence, government or municipal building, church or community center) at this wetland resource site would preserve open space and secure the social benefits of open space. Prohibiting structures at this wetland resource site would protect wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting artist's studios at this wetland resource site might conflict with the city's desire to support the arts.

Indirect social consequences of restricting conflicting uses at the Coolidge 12 and 13 wetland resource site may include incremental improvement of the quality of life in Cannon Beach related to protection of wetland wildlife habitat. Activities that disrupt wildlife use at the Coolidge 12 and 13 wetland resource site, such as outdoor human activity, diminish the site's wetland wildlife habitat value. Restricting these activities would help preserve existing wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting park or recreation area at this resource site might deny neighboring residents the social benefits related to a nearby outdoor recreation site. Prohibiting institutional development (government or municipal building, church or community center, school) might impair delivery of the services provided in these buildings. Prohibiting all human activity at this resource site would require extraordinary intervention by the City into areas not normally subject to city regulation. The social costs of this level of intervention would be significant.

Direct economic consequences of allowing conflicting uses at the Coolidge 12 and 13 wetland resource site include the price difference between the site as buildable land, and as unbuildable land. The size of this avoided loss would vary depending on which of the several conflicting uses allowed at this resource site are considered. The price differencebetween a buildable and an unbuildable residential lot may be significant.

Indirect economic consequences of allowing conflicting uses at the Coolidge 12 and 13 wetland resource site include possible loss of property value for adjacent residential land owners. Residential land values in Cannon Beach are relatively high for many reasons, including the increasing scarcity of vacant buildable land, and the proximity of some residential sites to wetland open space areas. Allowing development or forest management at the Coolidge 12 and 13 wetland resource site will eliminate the adjacent open space benefits enjoyed by neighboring residential property. This could reduce the value of adjacent residential land. An indirect economic benefit is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are allowed will be relatively higher than if residential uses are restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts. An economic consequence of allowing utility lines to cross this wetland resource site may be cost-efficient location of utility corridors. An economic consequence of allowing institutional development (government or municipal building, church or community center, school) at this wetland resource site may be cost-efficient location of these structures.

Direct economic consequences of restricting conflicting uses at the Coolidge 12 and 13 wetland resource site include the price difference between the wetland resource site as buildable vacant land, and as unbuildable land. The size of this economic loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. An economic consequence of prohibiting utility corridors from crossing this wetland resource site might be higher utility installation and maintenance costs caused by sub-optimal utility corridor locations.

Indirect economic consequences of restricting conflicting uses at the Coolidge 12 and 13 wetland resource site may include relatively higher property value for adjacent residential lands.

Residential land values in Cannon Beach are high for many reasons, including the increasing scarcity of vacant buildable land in the community, and the proximity of some residential sites to unbuildable wetland open space areas. Restricting development at this resource site will help maintain these benefits enjoyed by neighboring residential property. An additional indirect economic consequence is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are restricted will be relatively lower than if residential uses were un-restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

No direct energy consequences of allowing conflicting uses on the Coolidge 12 and 13 drainage basin wetland resource site have been identified.

Indirect energy consequences of allowing conflicting uses in the Coolidge 12 and 13 drainage basin wetland resource site may include the expenditure of the energy related to development of a structure on the site. Different energy expenditures may be required for construction of a pile-supported structure compared to a structure on fill compared to a structure at a non-wetland site.

No direct energy consequences of restricting conflicting uses on the Coolidge 12 and 13 drainage basin wetland resource site have been identified.

Indirect energy consequences of restricting conflicting uses in the Coolidge 12 and 13 drainage basin wetland resource site may include the energy savings related to preventing construction at the site. Different energy expenditures may be required for construction of a pile-supported structure compared to a structure on fill compared to a structure at a nonwetland site.

Conclusion: Based on the evaluation of this resource site's wetland functions and values, and based on this analysis of environmental, social, economic and energy consequences of allowing and restricting conflicting uses and activities, the City should provide partial protection for this resource site. The overlay zone and associated standards described elsewhere provide an appropriate level of protection given these factors.

Coos Drainage Basin Wetland Resource Site

The Coos resource site contains a single wetland (site # 48) in the Residential High Density (R-3) zone. Potentially conflicting uses allowed in the R-3 zone include:

Single family dwellings, duplexes and triplexes
Parks or public recreation areas
Utility lines
Temporary manufactured dwelling or recreation vehicle
Home occupation
Residential home, residential facility
Family, adult day care center
Public or private school or college
Government or municipal structure
Day care center
Bed and breakfast
Church or community meeting hall.

Unregulated conflicting activities also occur or could occur at this resource site. These conflicting uses and activities are described in more detail elsewhere. The Coos wetland resource site was rated *low* for all wetland functions and values.

Direct environmental consequences of allowing conflicting uses at this resource site are related to loss of wetland environmental functions and values (wildlife habitat, fish habitat, ecological integrity, nutrient retention, and sediment trapping). Residential structures (single family dwellings, duplexes or triplexes) on fill would result in loss or alteration of wetland vegetation, and alteration of wetland hydrology. Allowing residential structures on piling would damage wetland vegetation and impair wildlife habitat values, but would leave wetland hydrology substantially unaltered. Development of a park or recreation area would conflict with wetland ecological values at this wetland resource site. Placement of fill material for parking, tennis courts, playgrounds, restrooms and similar facilities commonly provided with park or recreation areas would alter wetland hydrology and eliminate wetland vegetation. Even without wetland fill, a park or recreation area that generates significant levels of human activity would degrade wetland fish and wildlife habitat values. Installation and maintenance of above-ground utility lines may degrade wetland functions and values at this wetland resource site by requiring vegetation removal in the utility corridor. Underground utilities may also require vegetation removal for the corridor, and may interfere with wetland hydrology. A public or private school or college on this wetland resource site would have direct environmental consequences similar to those of any structure requiring fill. Fill for a school building and parking lot would alter wetland hydrology and eliminate wetland vegetation. Fill for a government or municipal structure, church, or community hall would have similar direct environmental impacts on wetland functions and values at this resource site. A bed and breakfast would probably have direct environmental consequences at this resource site similar to those of a residence.

Indirect environmental consequences of allowing conflicting uses at the Coos wetland resource site include wetland habitat disturbance and loss. This indirect consequence is a result of human activity associated with normal residential use of residential structures. Examples of these types of disturbing residential activities include landscape maintenance and development, wildlife harassment by domestic dogs and cats, exterior lighting, and outdoor human recreation. The types of activities allowed in a residence in the Coos wetland resource site include home occupation, residential home, residential facility, and family or adult day care. These activities generate a higher level of human activity than would typically be found in a single family residence. To the extent that these activities occur outside of the structure, wetland environmental functions and values would be impaired. A park or recreation area at this wetland resource site would generate indirect environmental consequences for wetland functions and values, especially wildlife habitat. Outdoor human activity associated with a park or recreation area would be avoided by many wildlife species. A public or private school or college at this wetland resource site would have harmful indirect environmental consequences similar to those associated with a park or recreation area if a significant level of outdoor human activity were associated with this use. Government and municipal structures that have large parking lots or paved yards may degrade wetland water quality as a result of stormwater runoff. A bed and breakfast would probably generate indirect environmental impacts similar to those of a residence.

Direct environmental consequences of restricting conflicting uses and activities at the Coos wetland resource site include a degree of protection for the wetland functions and values remaining at this resource site. A pile-supported residence would not impair wetland hydrology, but would alter wetland wildlife habitat. Prohibiting non-residential structures that might otherwise be allowed at this wetland resource site (government structures, churches, community meeting halls) would provide a degree of protection for remaining wetland values. Restricting fills for these structures would maintain wetland wildlife habitat values at their present moderate level. Prohibiting utility lines from crossing this wetland resource site would eliminate their environmental impacts on wetland vegetation and hydrology, and would help maintain wetland wildlife habitat. Restricting normal residential activities (outdoor recreation, landscaping, domestic pets, exterior lighting) would protect wetland wildlife habitat from the adverse impacts caused by these activities. Restricting nonresidential activities (such as hiking and vegetation management, which are not necessarily linked to residential development) would help protect wetland wildlife habitat at this resource site. Prohibiting bed and breakfasts at this wetland resource site would protect wetland resource values from the adverse environmental consequences of the bed and breakfast structure.

Indirect environmental consequences of restricting conflicting uses and activities in the Coos drainage basin could include a degree of protection for the remaining wetland functions and values at this resource site. Restricting residential development to a single unit per lotof-record would keep residential density and associated human activity to a minimum level. Restricting outdoor human activities, such as those associated with a residence, home occupation, bed and breakfast, or day care center, would provide further protection for wetland resource values.

Prohibiting non-residential structures (government structures, churches, community meeting halls) will protect the Coos wetland resource site from the indirect environmental impacts of these uses: water quality degradation as a result of parking lot runoff, and wildlife disturbance from outdoor human activity and night lighting, for example.

Direct social consequences of allowing conflicting uses at the Coos wetland resource site include loss of open space in the surrounding residential neighborhood and an incremental social loss related to degradation of wetland wildlife habitat. The Coos wetland resource site provides open space benefits for neighboring property owners. Allowing development of any structure (residence, government or municipal building, church or community center) at this wetland resource site would reduce or eliminate these benefits. Development of any of the structures permitted at this wetland resource site would diminish wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social loss. The Coos wetland resource site offers minimal flood protection value, so loss of this function may be of little consequence.

Indirect social consequences of allowing conflicting activities such as outdoor human activity, domestic pets, and exterior lighting at the Coos wetland resource site may include an incremental erosion of the quality of life enjoyed in Cannon Beach as a result of the degradation and loss of wetland wildlife habitat. To the extent that the presence of wildlife in Cannon Beach is appreciated by residents and visitors, this represents a social loss. Development of any of the structures (residence, government or municipal building, church or community center) or activities (day care, bed and breakfast, or home occupation) allowed in the R-3 zone at this wetland resource site might also increase the level of human activity in the surrounding neighborhood, and lead to increased motor vehicle traffic on adjacent streets. Allowing residential use of the Coos resource site would yield social benefits if it provided some relief to the housing shortage in the County. Allowing a park or recreation area at this resource site might provide social benefits related to outdoor recreation. Allowing institutional development (government or municipal building, church or community center, school) might yield social benefits related to the services provided in these buildings.

Direct social consequences of restricting conflicting uses at the Coos wetland resourcesite may include the preservation of open space in the residential neighborhood surrounding the resource site, and an incremental social benefit from preserving wetland wildlife habitat. The Coos wetland resource site provides open space for neighboring property owners. Prohibiting any structure (residence, government or municipal building, church or community center) at this wetland resource site would preserve open space and secure the social benefits of open space. Prohibiting structures at this wetland resource site would protect wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit.

Indirect social consequences of restricting conflicting uses at the Coos wetland resource site may include incremental improvement of the quality of life in Cannon Beach related to protection of wetland wildlife habitat. Activities that disrupt wildlife use at the Coos wetland resource site, such as outdoor human activity, diminish the site's wetland wildlife habitat value. Restricting these activities would help preserve existing wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting park or recreation area at this resource site might deny neighboring residents the social benefits related to a nearby outdoor recreation site. Prohibiting institutional development (government or municipal building, church or community center, school) might impair delivery of the social services provided in these buildings. Prohibiting all human activity at this resource site would require extraordinary intervention by the City into areas not normally subject to city regulation. The social costs of this level of intervention would be significant.

Direct economic consequences of allowing conflicting uses at the Coos wetland resource site include the price difference between the site as buildable land, and as unbuildable land. The size of this avoided loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. The price difference between a buildable and an unbuildable residential lot may be significant. An economic consequence of allowing utility lines to cross this wetland resource site may be cost-efficient location of utility corridors.

Indirect economic consequences of allowing conflicting uses at the Coos wetland resource site include possible loss of property value for adjacent residential land owners. Residential land values in Cannon Beach are relatively high for many reasons, including the increasing scarcity of vacant buildable land, and the proximity of many residential sites to wetland open space areas. Allowing residential development of the Coos wetland resource site will eliminate the adjacent open space benefits enjoyed by neighboring residential property. This could reduce the value of adjacent residential land. An indirect economicbenefit is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are allowed will be relatively higher than if residential uses are restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

Direct economic consequences of restricting conflicting uses at the Coos wetland resource site include the price difference between the wetland resource site as buildable vacant land, and as unbuildable land. The size of this economic loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. An economic consequence of prohibiting utility corridors from crossing this wetland resource site might be higher utility installation and maintenance costs caused by sub-optimal utility corridor locations.

Indirect economic consequences of restricting conflicting uses at the Coos wetland resource site may include relatively higher property value for adjacent residential lands. Residential land values in Cannon Beach are high for many reasons, including the increasing scarcity of vacant buildable land in the community, and the proximity of many residential sites to unbuildable wetland open space areas. Restricting development at this resource site will help maintain the adjacent open space benefits enjoyed by neighboring residential property. An additional indirect economic consequence is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are restricted will be relatively lower than if residential uses were un-restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

No direct energy consequences of allowing conflicting uses on the Coos drainage basin wetland resource site have been identified.

Indirect energy consequences of allowing conflicting uses in the Coos drainage basin wetland resource site may include the expenditure of the energy related to development of a structure on the site. Different energy expenditures may be required for construction of a pile-supported structure compared to a structure on fill compared to a structure at a nonwetland site.

No direct energy consequences of restricting conflicting uses on the Coos drainage basin wetland resource site have been identified.
Indirect energy consequences of restricting conflicting uses in the Coos drainage basin wetland resource site may include the energy savings related to preventing construction at the site. Different energy expenditures may be required for construction of a pile-supported structure compared to a structure on fill compared to a structure at a non-wetland site.

Conclusion: Based on the evaluation of this resource site's wetland functions and values, and based on this analysis of environmental, social, economic and energy consequences of allowing and restricting conflicting uses and activities, the City should provide partial protection for this resource site. The overlay zone and associated standards described elsewhere provide an appropriate level of protection given these factors.

Ecola Creek Drainage Basin Wetland Resource Site

The Ecola Creek wetland resource site contains eight individual wetlands (inventory numbers 10, 16, 39, 40, 41, 42, 44, and 50) in several different zones. The following table summarizes the complex zoning situation at this wetland resource site:

Ecola Creek Wetland Resource Site Zone

	inventory number:								
zone:	10A	16	39	40	41	42A	42B	44	50
Residential Very Low Density zone					X				
Open Space zone						X			
Open Space Recreation zone		X	X	X			X		
Institutional zone	X						X		
Park Management zone		X							
Commercial, General zone								X	
Manufactured Dwelling Park & Recreational Vehicle Park zone									X
Residential, Lower Density zone									X

Potentially conflicting uses allowed in one or more of the individual wetland areas at the Ecola Creek wetland resource site include:

Manufactured dwelling park
Single family dwelling
Day care center
Residential home, residential facility
Temporary manufactured dwelling, recreational vehicle
Sewage treatment facility
Community buildings
Enclosed recreational uses
Educational institutions
Government or municipal structure
Forest management
Utility lines
RV parks
Cabinet shop or other trade or craft shop
Warehouses and storage
Private campgrounds
Utility substations
Caretaker's or watchman's dwelling
Cottage industry
Family, adult day care center
Home occupation
Museums
Organized camps
Animal hospital or kennel
Church or community meeting hall
Structural shoreline stabilization
Public or private school or college
Parks or public recreation area
Plant nursery
Trails
Parking lot
Building materials sales

Unregulated conflicting activities also occur or could occur at this resource site. These conflicting uses and activities are described in more detail elsewhere. The following table shows resource values for wetlands at this resource site.

Ecola Creek Resource Site Functional Values

Inventory Number:	10A	16	39	40	41	42A	42B	44	50
Ecological Integrity	H	L	H	H	H	H	H	L	H
Wildlife Habitat	H	M/H	L/M	M	L/M	H	H	M	H
Fish Habitat	L	L	L	L	L	L	L	L	L
Noteworthiness	H	L	M	M	M	H	H	L	M
Educational Potential	H	L	L	L	L	M	L	L	M
Recreation	H	H	L	L	L	L/M	L	L	M
Flood Control	M	L	L	L	L	H	M	L	L
Sediment Trapping	L	L	L	L	L	H	H	L	L
Nutrient Retention	L	L	L	L	L	H	H	L	L
Urban Quality of Life	H	H	L	L	L	H	L	L	M

Legend: H = High, M = Medium, L = Low

Only fish habitat is rated low at all of this resource site's wetlands.

Direct environmental consequences of allowing conflicting uses at this resource site are related to loss or degradation of highly-rated ecological functions and values: ecological integrity, wildlife habitat, sediment trapping and nutrient quality. **Residential structures** (single family dwellings, manufactured dwelling, recreational vehicle) on fill would result in loss or alteration of wetland vegetation and wetland hydrology. Allowing residential structures on piling would damage wetland vegetation and impair wetland ecological functions and values, but would leave wetland hydrology substantially unaltered. Development of a **park or recreation area** would conflict with maintenance of wetland ecological functions and values at this wetland resource site. Placement of fill material for parking, tennis courts, playgrounds, restrooms and similar facilities commonly provided withpark or recreation areas would alter wetland hydrology and eliminate wetland vegetation. Even without wetland fill, a park or recreation area that generates significant levels of human activity would degrade wetland wildlife habitat values. Installation and maintenance of above-ground **utility lines** may degrade wetland functions and values at this wetland resource site by requiring vegetation removal in the utility corridor. Underground utilities may also require vegetation removal for the corridor, and may interfere with wetland hydrology. Allowing utility substations would have similar impacts, and would also require fill. Fill for an **institutional structure** (school building, government or municipal structure, church or community hall, museum, community building) would have direct environmental impacts on wetland functions and values at this resource site. The impacts would be similar to those caused by a fill for a residence. A **bed and breakfast or an artist's studio** would probably have direct environmental consequences at this resource site similar to those of a residence. **Forest**

management is allowed at one of the wetlands (# 44) that make up this resource site. Wetland ecological functions values would be directly threatened by allowing forest management at this resource site. A **sewage treatment** facility that includes fill structures and dikes for ponds will have adverse environmental consequences for this wetland resource site. An **animal hospital or kennel** that includes fill for structures will alter wetland hydrology and vegetation, and have adverse consequences for wetland ecological functions and values. Commercial horticultural activities associated with a **plant nursery** have adverse consequences for wetland ecological functions and values. Pesticide drift into adjacent wetland areas could alter wetland plant and animal communities. Fill **commercial structures** (plant nursery, craft or trade shop, warehouses or storage buildings, building material sales) would have adverse consequences on wetland ecological functions and values similar to those of residential or institutional structures. A private **campground or an RV park** would degrade wetland ecological functions and values by requiring fill for structures and possibly for camping spaces; and by generating outdoor human activity that disturbs wildlife. **Parking lots**, whether separate from or in conjunction with one of the commercial or institutional uses in allowed at this resource site, require fill and can generate contaminated runoff. The adverse consequences of parking lots on this resource site's highly-rated ecological values could be significant. **Trails** are permitted at this resource site. Trail development and use may conflict with wetland ecological functions and values at this resource site by requiring fill; and by bringing human activity into wetland areas that are somewhat sheltered from human activity.

<u>Indirect environmental consequences of allowing</u> conflicting uses at the Ecola Creek wetland resource site include wetland habitat disturbance and loss. This indirect consequence is a result of human activity associated with normal residential use of residential structures. Examples of these types of disturbing residential activities include landscape maintenance and development, wildlife harassment by domestic dogs and cats, exterior lighting, and outdoor human recreation. The types of activities allowed in a residence in the Ecola Creek wetland resource site include home occupation, residential home, residential facility, artist's studio, and family or adult day care. These activities generate a higher level of human activity than would typically be found in a single family residence. To the extent that these activities occur outside of the structure, wetland environmental functions and values would beimpaired. A park or recreation area at this wetland resource site would generate indirect environmental consequences for wetland functions and values, especially wildlife habitat. Outdoor human activity associated with a park or recreation area would be avoided by many wildlife species. A public or private school or college at this wetland resource site would have harmful indirect environmental consequences similar to those associated with a park or recreation area if a significant level of outdoor human activity were associated with this use. Government and municipal structures that have large parking lots or paved yards may degrade wetland water quality as a result of stormwater runoff. A bed and breakfast would probably generate indirect environmental impacts similar to those of a residence. Forest management is allowed at one of the wetlands (#20) that make up this resource site. Indirect environmental consequences of allowing the vegetation removal associated with forest management may include loss or degradation of some of the resource site's lower-rated wetland environmental values: fish habitat, noteworthiness, educational potential, recreational values, flood control, sediment trapping and nutrient retention.

Direct environmental consequences of restricting conflicting uses and activities at the Ecola Creek wetland resource site include a degree of protection for the wetland functions and values remaining at this resource site, notably wildlife habitat. A pile-supported residence would not impair wetland hydrology, but would alter wetland wildlife habitat. Prohibiting non-residential structures that might otherwise be allowed at this wetland resource site (government structures, churches, community meeting halls) would provide a degree of protection for remaining wetland values. Restricting fills for these structures would maintain wetland wildlife habitat values at their present moderate level. Prohibiting utility lines from crossing this wetland resource site would eliminate their environmental impacts on wetland vegetation and hydrology, and would help maintain wetland wildlife habitat. Restricting utility substations at this site would prevent their adverse impacts (fill, vegetation removal) from reducing wetland environmental values at this resource site. Restricting normal residential activities (outdoor recreation, landscaping, domestic pets, exterior lighting) would protect wetland wildlife habitat from the adverse impacts caused by these activities. Restricting non-residential activities (such as hiking and vegetation management, which are not necessarily linked to residential development) would help protect wetland wildlife habitat at this resource site. Prohibiting artist's studios and bed and breakfasts at this wetland resource site would protect wetland resource values, notably wildlife habitat, from the adverse environmental consequences of the bed and breakfast structure. Prohibiting forest management activities at this resource site would help preserve the site's higher-rated functions and values, especially wildlife habitat, ecological integrity, educational potential and noteworthiness.

Indirect environmental consequences of restricting conflicting uses and activities in the Ecola Creek drainage basin could include a degree of protection for the remaining wetlandfunctions and values at this resource site, particularly those associated with wildlife habitat. Restricting residential development to a single unit per lot-of-record would keep residential density and associated human activity to a minimum level. Restricting outdoor human activities, such as those associated with a residence, artist's studio, home occupation, bed and breakfast, or day care center, would provide further protection for wetland resource values. Prohibiting non-residential structures (government structures, churches, community meeting halls) will protect the Ecola Creek wetland resource site from the indirect environmental impacts of these uses: water quality degradation as a result of parking lot runoff, and wildlife disturbance from outdoor human activity and night lighting, for example. Prohibiting forest management at this resource site will prevent indirect damage to wetland environmental values.

Direct social consequences of allowing conflicting uses at the Ecola Creek wetland resource site include loss of open space in the surrounding residential neighborhood and an incremental social loss related to degradation of wetland wildlife habitat. The Ecola Creek wetland resource site provides open space benefits for neighboring property owners. Allowing development of any structure (residence, day care facility, bed and breakfast, artist's studio, government or municipal building, church or community center) at this wetland resource site would reduce or eliminate these benefits. Development of any of the structures permitted at this wetland resource site would diminish wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social loss. The Ecola Creek wetland resource site offers minimal flood protection value, so loss of this function may be of little consequence.

Indirect social consequences of allowing conflicting activities such as outdoor human activity, domestic pets, and exterior lighting at the Ecola Creek wetland resource site may include an incremental erosion of the quality of life enjoyed in Cannon Beach as a result of the degradation and loss of wetland wildlife habitat. To the extent that the presence of wildlife in Cannon Beach is appreciated by residents and visitors, this represents a social loss. Development of any of the structures (residence, government or municipal building, church or community center) or activities (day care, bed and breakfast, artist's studio, or home occupation) allowed in the R-3 zone at this wetland resource site might also increase the level of human activity in the surrounding neighborhood, and lead to increased motor vehicle traffic on adjacent streets. Allowing residential use of the Ecola Creek resource site would yield social benefits if it provided some relief to the housing shortage in the County. Allowing a park or recreation area at this resource site might provide social benefits related to outdoor recreation. Allowing institutional development (government or municipal building, church or community center, school) might yield social benefits related to the services provided in these buildings. Allowing forest management activities would result in the loss of trees in the forested portions of this wetland resource site. Trees contribute to thecommunity's scenic beauty, and their loss would diminish this wetland resource site's *urban quality of life* value.

Direct social consequences of restricting conflicting uses at the Ecola Creek wetland resource site may include the preservation of open space in the residential neighborhood surrounding the resource site, and an incremental social benefit from preserving wetland wildlife habitat. The Ecola Creek wetland resource site provides open space for neighboring property owners. Prohibiting any structure (residence, government or municipal building, utility substation, church or community center) at this wetland resource site would preserve open space and secure the social benefits of open space. Prohibiting structures at this wetland resource site would protect wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting artist's studios at this wetland resource site might conflict with the city's desire to support the arts. Prohibiting forest management would help preserve trees at this resource site. Trees contribute to the quality of life in Cannon Beach, and the social benefits of preserving trees are widely recognized in this community.

Indirect social consequences of restricting conflicting uses at the Ecola Creek wetland resource site may include incremental improvement of the quality of life in Cannon Beach related to protection of wetland wildlife habitat. Activities that disrupt wildlife use at the Ecola Creek wetland resource site, such as outdoor human activity, diminish the site's wetland wildlife habitat value. Restricting these activities would help preserve existing wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting park or recreation area at this resource site might deny neighboring residents the social benefits related to a nearby outdoor recreation site. Prohibiting institutional development (government or municipal building, utility substation, church or community center, school) might impair delivery of the services provided in these buildings. Prohibiting all human activity at this resource site would require extraordinary intervention by the City into areas not normally subject to city regulation. The social costs of this level of intervention would be significant.

Direct economic consequences of allowing conflicting uses at the Ecola Creek wetland resource site include the price difference between the site as buildable land, and as unbuildable land. The size of this avoided loss would vary depending on which of the several conflicting uses allowed at this resource site are considered. The price difference between a buildable and an unbuildable residential lot may be significant. If the price of land at this wetland site includes the potential market price for timber to be harvested from the site, allowing forest management will secure this economic benefit of site ownership.
Indirect economic consequences of allowing conflicting uses at the Ecola Creek wetland resource site include possible loss of property value for adjacent residential land owners. Residential land values in Cannon Beach are relatively high for many reasons, including the increasing scarcity of vacant buildable land, and the proximity of some residential sites to wetland open space areas or forested wetlands. Allowing development or forest management at the Ecola Creek wetland resource site will eliminate the adjacent open space benefits enjoyed by neighboring residential property. This could reduce the value of adjacent residential land. An indirect economic benefit is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are allowed will be relatively higher than if residential uses are restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts. An economic consequence of allowing utility lines to cross this wetland resource site may be cost-efficient location of utility corridors. An economic consequence of allowing institutional development (government or municipal building, utility substation, church or community center, school) at this wetland resource site may be cost-efficient location of these structures.

Direct economic consequences of restricting conflicting uses at the Ecola Creek wetland resource site include the price difference between the wetland resource site as buildable vacant land, and as unbuildable land. The size of this economic loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. An economic consequence of prohibiting utility corridors from crossing this wetland resource site might be higher utility installation and maintenance costs caused by sub-optimal utility corridor locations. Prohibiting forest management might reduce the potential market value of a forested wetland site.

Indirect economic consequences of restricting conflicting uses at the Ecola Creek wetland resource site may include relatively higher property value for adjacent residential lands. Residential land values in Cannon Beach are high for many reasons, including the increasing scarcity of vacant buildable land in the community, and the proximity of some residential sites to unbuildable wetland open space areas or forested wetlands. Restricting development or timber removal at this resource site will help maintain these benefits enjoyed by neighboring residential property. An additional indirect economic consequence is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are restricted will be relatively lower than if residential uses were unrestricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

No direct energy consequences of allowing conflicting uses on the Ecola Creekdrainage basin wetland resource site have been identified.

Indirect energy consequences of allowing conflicting uses in the Ecola Creek drainage basin wetland resource site may include the expenditure of the energy related to development of a structure on the site. Different energy expenditures may be required for construction of a pile-supported structure compared to a structure on fill compared to a structure at a nonwetland site.

No direct energy consequences of restricting conflicting uses on the Ecola Creek drainage basin wetland resource site have been identified.

Indirect energy consequences of restricting conflicting uses in the Ecola Creek drainage basin wetland resource site may include the energy savings related to preventing construction at the site. Different energy expenditures may be required for construction of a pile-supported structure compared to a structure on fill compared to a structure at a nonwetland site.

Conclusion: Based on the evaluation of this resource site's wetland functions and values, and based on this analysis of environmental, social, economic and energy consequences of allowing and restricting conflicting uses and activities, the City should provide partial protection for this resource site. The overlay zone and associated standards described elsewhere provide an appropriate level of protection given these factors.

Elkland Drainage Basin Wetland Resource Site

The Elkland resource site contains a single wetland (site #38) in the Residential Alternative/Manufactured Dwelling (RAM) zone. Potentially conflicting uses allowed in the RAM zone include:

- Manufactured dwelling park
- Duplex
- Single family dwelling
- Manufactured dwelling
- Day care center
- Family, adult day care center
- Residential home, residential facility
- Home occupation
- Temporary manufactured dwelling or recreational vehicle
- Multi-family dwelling
- Church or community meeting hall
- Government or municipal structure
- Public or private school or college
- Utility lines
- Parks or public recreation area
- Utility substations.

Unregulated conflicting activities also occur or could occur at this resource site. These conflicting uses and activities are identified and described in more detail elsewhere. The Elkland wetland resource site was rated low for all wetland resource functions and values.

Direct environmental consequences of allowing conflicting uses at this resource site are related to loss or degradation of wetland ecological functions and values (fish and wildlife habitat, nutrient retention, sediment trapping, and ecological integrity). Residential structures (manufactured dwelling, single family structure, duplex, temporary recreation vehicle) on fill would result in loss or alteration of wetland vegetation, and alteration of wetland hydrology. Allowing residential structures on piling would damage wetland vegetation, but would leave wetland hydrology substantially unaltered. Development of a park or recreation area would conflict with wetland ecological values at this resource site. Placement of fill material for parking, tennis courts, playgrounds, restrooms and similar facilities commonly provided with park or recreation areas would alter wetland hydrology and eliminate wetland vegetation. Even without wetland fill, a park or recreation area that generates significant levels of human activity would degrade wetland wildlife habitat values. Installation and maintenance of above-ground utility lines may degrade wetland functions and values at this wetland resource site by requiring vegetation removal in the utility corridor. Underground utilities may also require vegetation removal for the corridor, and may interfere with wetland hydrology. A public or private school or college on this wetland resource site would have directenvironmental consequences similar to those of any structure requiring fill. Fill for a school building and parking lot would alter wetland hydrology and eliminate wetland vegetation. Fill for a government or municipal structure, church, or community hall would have similar direct environmental impacts on wetland functions and values at this resource site.

Indirect environmental consequences of allowing conflicting uses at the Elkland wetland resource site include wetland habitat disturbance and loss. This indirect consequence is a result of human activity associated with normal residential use of residential structures. Examples of these types of disturbing residential activities include landscape maintenance and development, wildlife harassment by domestic dogs and cats, exterior lighting, and outdoor human recreation. The types of activities allowed in a residence in the Elkland wetland resource site include home occupation, residential home, residential facility, and family or adult day care. These activities generate a higher level of human activity than would typically be found in a single family residence. To the extent that these activities occur outside of the structure, wetland environmental functions and values would be impaired. A park or recreation area at this wetland resource site would generate indirect environmental consequences for wetland functions and values, especially wildlife habitat. Outdoor human activity associated with a park or recreation area would be avoided by many wildlife species. A public or private school or college at this wetland resource site would have harmful indirect environmental consequences similar to those associated with a park or recreation area if a significant level of outdoor human activity were associated with this use. Government and municipal structures that have large parking lots or paved yards may degrade wetland water quality as a result of stormwater runoff.

Direct environmental consequences of restricting conflicting uses and activities at the Elkland wetland resource site include a degree of protection for the wetland ecological functions and values remaining at this resource site. A pile-supported residence would not impair wetland hydrology, but would alter wetland vegetation. Prohibiting non-residential structures that might otherwise be allowed at this wetland resource site (government structures, churches, community meeting halls) would provide a degree of protection for remaining wetland values. Restricting fills for these structures would maintain wetland wildlife habitat values at their present low level. Prohibiting utility lines from crossing this wetland resource site would eliminate their environmental impacts on wetland vegetation and hydrology. Restricting normal residential activities (outdoor recreation, landscaping, domestic pets, exterior lighting) would protect wetland wildlife habitat from the adverse impacts caused by these activities. Restricting non-residential activities (such as hiking and vegetation management, which are not necessarily linked to residential development) would help protect wetland wildlife habitat at this resource site.

Indirect environmental consequences of restricting conflicting uses and activities in theElkland drainage basin could include a degree of protection for the remaining wetland ecological functions and values at this resource site. Restricting residential development to a single unit per lot-of-record would keep residential density and associated human activity to a minimum level. Restricting outdoor human activities, such as those associated with a residence, home occupation, or day care center, would provide further protection for wetland resource values.

Prohibiting non-residential structures (government structures, churches, community meeting halls) will protect the Elkland wetland resource site from the indirect environmental impacts of these uses: water quality degradation as a result of parking lot runoff, and wildlife disturbance from outdoor human activity and night lighting, for example.

Direct social consequences of allowing conflicting uses at the Elkland wetland resource site include loss of open space in the surrounding residential neighborhood and an incremental social loss related to degradation of wetland wildlife habitat. The Elkland wetland resource site provides open space benefits for neighboring property owners. Allowing development of any structure (residence, government or municipal building, church or community center) at this wetland resource site would reduce or eliminate these benefits. Development of any of the structures permitted at this wetland resource site would diminish wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social loss. The Elkland wetland resource site offers minimal flood protection value, so loss of this function may be of little consequence.

Indirect social consequences of allowing conflicting activities such as outdoor human activity, domestic pets, and exterior lighting at the Elkland wetland resource site may include an incremental erosion of the quality of life enjoyed in Cannon Beach as a result of the degradation and loss of wetland wildlife habitat. To the extent that the presence of wildlife in Cannon Beach is appreciated by residents and visitors, this represents a social loss. Development of any of the structures (residence, government or municipal building, church or community center) or activities (day care or home occupation) allowed in the R-1 zone at this wetland resource site might also increase the level of human activity in the surrounding neighborhood, and lead to increased motor vehicle traffic on adjacent streets. Allowing residential use of the Elkland resource site would yield social benefits if it provided some relief to the housing shortage in the County. Allowing a park or recreation area at this resource site might provide social benefits related to outdoor recreation. Allowing institutional development (government or municipal building, church or community center, school) might yield social benefits related to the services provided in these buildings.

Direct social consequences of restricting conflicting uses at the Elkland wetland resource site may include the preservation of open space in the residential neighborhood surrounding the resource site, and an incremental social benefit from preserving wetlandwildlife habitat. The Elkland wetland resource site provides open space for neighboring property owners. Prohibiting any structure (residence, government or municipal building, church or community center) at this wetland resource site would preserve open space and secure the social benefits of open space. Prohibiting structures at this wetland resource site would protect wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit.

Indirect social consequences of restricting conflicting uses at the Elkland wetland resource site may include incremental improvement of the quality of life in Cannon Beach related to protection of wetland wildlife habitat. Activities that disrupt wildlife use at the Elkland wetland resource site, such as outdoor human activity, diminish the site's wetland wildlife habitat value. Restricting these activities would help preserve existing wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting park or recreation area at this resource site might deny neighboring residents the social benefits related to a nearby outdoor recreation site. Prohibiting institutional development (government or municipal building, church or community center, school) might impair delivery of the social services provided in these buildings. Prohibiting all human activity at this resource site would require extraordinary intervention by the City into areas not normally subject to city regulation. The social costs of this level of intervention would be significant.

Direct economic consequences of allowing conflicting uses at the Elkland wetland resource site include the price difference between the site as buildable land, and as unbuildable land. The size of this avoided loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. The price difference between a buildable and an unbuildable residential lot may be significant. An economic consequence of allowing utility lines to cross this wetland resource site may be cost-efficient location of utility corridors.

Indirect economic consequences of allowing conflicting uses at the Elkland drainage basin wetland resource site include possible loss of property value for adjacent residential land owners. Residential land values in Cannon Beach are relatively high for many reasons, including the increasing scarcity of vacant buildable land, and the proximity of many residential sites to wetland open space areas. Allowing residential development of the Elkland wetland resource site will eliminate the adjacent open space benefits enjoyed by neighboring residential property. This could reduce the value of adjacent residential land. An indirect economic benefit is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are allowed will be relatively higherthan if residential uses are restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

Direct economic consequences of restricting conflicting uses at the Elkland wetland resource site include the price difference between the wetland resource site as buildable vacant land, and as unbuildable land. The size of this economic loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. An economic consequence of prohibiting utility corridors from crossing this wetland resource site might be higher utility installation and maintenance costs caused by sub-optimal utility corridor locations.

Indirect economic consequences of restricting conflicting uses at the Elkland wetland resource site may include relatively higher property value for adjacent residential lands. Residential land values in Cannon Beach are high for many reasons, including the increasing scarcity of vacant buildable land in the community, and the proximity of many residential sites to unbuildable wetland open space areas. Restricting development at this resource site will help maintain the adjacent open space benefits enjoyed by neighboring residential property. An additional indirect economic consequence is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are restricted will be relatively lower than if residential uses were un-restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

No direct energy consequences of allowing conflicting uses on the Elkland drainage basin wetland resource site have been identified.

Indirect energy consequences of allowing conflicting uses in the Elkland drainage basin wetland resource site may include the expenditure of the energy related to residential development on the site. Different energy expenditures may be required for construction of a pile-supported house compared to a house on fill compared to a house at a non-wetland site.

No direct energy consequences of restricting conflicting uses on the Elkland drainage basin wetland resource site have been identified.

Indirect energy consequences of restricting conflicting uses in the Elkland drainage basin wetland resource site may include the energy savings related to preventing residential development on the site. Different energy expenditures may be required for construction of a pile-supported house compared to a house on fill compared to a house at a non-wetland site.

Conclusion: Based on the evaluation of this resource site's wetland functions and values, and based on this analysis of environmental, social, economic and energy consequences of allowing and restricting conflicting uses and activities, the City should provide partial protection for this resource site. The overlay zone and associated standards described elsewhere provide an appropriate level of protection given these factors.

Elm Drainage Basin Wetland Resource Site

The Elm resource site contains a single wetland (site #21) in the Residential Medium Density (R-2) zone. Potentially conflicting uses allowed in the R-2 zone include:

- Duplex
- Bed and breakfast
- Artist's studio
- Structural shoreline stabilization
- Single family dwellings
- Parks or public recreation areas
- Utility lines
- Temporary manufactured dwelling or recreation vehicle
- Home occupation
- Residential home, residential facility
- Family, adult day care center
- Public or private school or college
- Government or municipal structure
- Day care center
- Church or community meeting hall.

Unregulated conflicting activities also occur or could occur at this resource site. These conflicting uses and activities are identified and described in more detail elsewhere. The Elm wetland resource site was rated moderate in terms of wildlife habitat, ecological integrity, and urban quality of life values. Other wetland functions and values were rated low at the Elm resource site: fish habitat, noteworthiness, educational potential, recreation, flood control, sediment trapping, and nutrient retention.

Direct environmental consequences of allowing conflicting uses at this resource site are related to loss of wetland ecological functions and values, especially those rated moderate: wildlife habitat and ecological integrity. Residential structures on fill would result in loss or alteration of wetland vegetation, and alteration of wetland hydrology. Allowing residential structures on piling would damage wetland vegetation and impair wetland ecological values, but would leave wetland hydrology substantially unaltered. Development of a park or recreation area would conflict with wetland ecological values, including wildlife habitat and ecological integrity, at this wetland resource site. Placement of fill material for parking, tennis courts, playgrounds, restrooms and similar facilities commonly provided with park or recreation areas would alter wetland hydrology and eliminate wetland vegetation. Even without wetland fill, a park or recreation area that generates significant levels of human activity would degrade wetland wildlife habitat values. Installation and maintenance of above-ground utility lines may degrade wetland functions and values at this wetland resource site by requiring vegetation removal in the utility corridor. Underground utilities may also require vegetation removal for the corridor, and may interfere with wetland hydrology. Apublic or private school or college on this wetland resource site would have direct environmental consequences similar to those of any structure requiring fill. Fill for a school building and parking lot would alter wetland hydrology and eliminate wetland vegetation. Fill for a government or municipal structure, church, or community hall would have similar direct environmental impacts on wetland functions and values at this resource site.

Indirect environmental consequences of allowing conflicting uses at the Elm wetland resource site include wetland habitat disturbance and loss. This indirect consequence is a result of human activity associated with normal residential use of residential structures. Examples of these types of disturbing residential activities include landscape maintenance and development, wildlife harassment by domestic dogs and cats, exterior lighting, and outdoor human recreation. The types of activities allowed in a residence in the Elm wetland resource site include home occupation, residential home, residential facility, and family or adult day care. These activities generate a higher level of human activity than would typically be found in a single family residence. To the extent that these activities occur outside of the structure, wetland environmental functions and values would be impaired. A park or recreation area at this wetland resource site would generate indirect environmental consequences for wetland functions and values, especially wildlife habitat. Outdoor human activity associated with a park or recreation area would be avoided by many wildlife species. A public or private school or college at this wetland resource site would have harmful indirect environmental consequences similar to those associated with a park or recreation area if a significant level of outdoor human activity were associated with this use. Government and municipal structures that have large parking lots or paved yards may degrade wetland water quality as a result of stormwater runoff.

Direct environmental consequences of restricting conflicting uses and activities at the Elm wetland resource site include a degree of protection for the wetland functions and values remaining at this resource site, notably wildlife habitat. A pile-supported residence would not impair wetland hydrology, but would alter wetland wildlife habitat. Prohibiting nonresidential structures that might otherwise be allowed at this wetland resource site (government structures, churches, community meeting halls) would provide a degree of protection for remaining wetland values. Restricting fills for these structures would maintain wetland wildlife habitat values at their present moderate level. Prohibiting utility lines from crossing this wetland resource site would eliminate their environmental impacts on wetland vegetation and hydrology, and would help maintain wetland ecological values (notably wildlife habitat and ecological integrity). Restricting normal residential activities (outdoor recreation, landscaping, domestic pets, exterior lighting) would protect wetland wildlife habitat from the adverse impacts caused by these activities. Restricting non-residential activities (such as hiking and vegetation management, which are not necessarily linked to residential development) would facilitate maintenance of wetland ecological functions and values at this resource site.

Indirect environmental consequences of restricting conflicting uses and activities in the Elm drainage basin could include a degree of protection for the remaining wetland ecological functions and values at this resource site. Restricting residential development to a single unit per lot-of-record would keep residential density and associated human activity to a minimum level. Restricting outdoor human activities, such as those associated with a residence, home occupation, or day care center, would provide further protection for wetland resource values. Prohibiting non-residential structures (government structures, churches, community meeting halls) will protect the Elm wetland resource site from the indirect environmental impacts of these uses: water quality degradation as a result of parking lot runoff, and wildlife disturbance from outdoor human activity and night lighting, for example.

Direct social consequences of allowing conflicting uses at the Elm wetland resource site include loss of open space in the surrounding residential neighborhood and an incremental social loss related to degradation of wetland wildlife habitat. The Elm wetland resource site provides open space benefits for neighboring property owners. Allowing development of any structure (residence, government or municipal building, church or community center) at this wetland resource site would reduce or eliminate these benefits. Development of any of the structures permitted at this wetland resource site would diminish wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social loss. The Elm wetland resource site offers minimal flood protection value, so loss of this function may be of little consequence.

Indirect social consequences of allowing conflicting activities such as outdoor human activity, domestic pets, and exterior lighting at the Elm wetland resource site may include an incremental erosion of the quality of life enjoyed in Cannon Beach as a result of the degradation and loss of wetland wildlife habitat. To the extent that the presence of wildlife in Cannon Beach is appreciated by residents and visitors, this represents a social loss. Development of any of the structures (residence, government or municipal building, church or community center) or activities (day care or home occupation) allowed in the R-1 zone at this wetland resource site might also increase the level of human activity in the surrounding neighborhood, and lead to increased motor vehicle traffic on adjacent streets. Allowing residential use of the Elm resource site would yield social benefits if it provided some relief to the housing shortage in the County. Allowing a park or recreation area at this resource site might provide social benefits related to outdoor recreation. Allowing institutional development (government or municipal building, church or community center, school) might yield social benefits related to the services provided in these buildings.

Direct social consequences of restricting conflicting uses at the Elm wetland resource site may include the preservation of open space in the residential neighborhood surroundingthe resource site, and an incremental social benefit from preserving wetland wildlife habitat. The Elm wetland resource site provides open space for neighboring property owners. Prohibiting any structure (residence, government or municipal building, church or community center) at this wetland resource site would preserve open space and secure the social benefits of open space. Prohibiting structures at this wetland resource site would protect wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit.

Indirect social consequences of restricting conflicting uses at the Elm wetland resource site may include incremental improvement of the quality of life in Cannon Beach related to protection of wetland wildlife habitat. Activities that disrupt wildlife use at the Elm wetland resource site, such as outdoor human activity, diminish the site's wetland wildlife habitat value. Restricting these activities would help preserve existing wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting park or recreation area at this resource site might deny neighboring residents the social benefits related to a nearby outdoor recreation site. Prohibiting institutional development (government or municipal building, church or community center, school) might impair delivery of the social services provided in these buildings. Prohibiting all human activity at this resource site would require extraordinary intervention by the City into areas not normally subject to city regulation. The social costs of this level of intervention would be significant.

Direct economic consequences of allowing conflicting uses at the Elm wetland resource site include the price difference between the site as buildable land, and as unbuildable land. The size of this avoided loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. The price difference between a buildable and an unbuildable residential lot may be significant. An economic consequence of allowing utility lines to cross this wetland resource site may be cost-efficient location of utility corridors.

Indirect economic consequences of allowing conflicting uses at the Elm drainage basin wetland resource site include possible loss of property value for adjacent residential land owners. Residential land values in Cannon Beach are relatively high for many reasons, including the increasing scarcity of vacant buildable land, and the proximity of many residential sites to wetland open space areas. Allowing residential development of the Elm wetland resource site will eliminate the adjacent open space benefits enjoyed by neighboring residential property. This could reduce the value of adjacent residential land. An indirect economic benefit is realized by taxing districts that assess property taxes on this site. Theassessed value of the site if residential uses are allowed will be relatively higher than if residential uses are restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

Direct economic consequences of restricting conflicting uses at the Elm wetland resource site include the price difference between the wetland resource site as buildable vacant land, and as unbuildable land. The size of this economic loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. An economic consequence of prohibiting utility corridors from crossing this wetland resource site might be higher utility installation and maintenance costs caused by sub-optimal utility corridor locations.

Indirect economic consequences of restricting conflicting uses at the Elm wetland resource site may include relatively higher property value for adjacent residential lands. Residential land values in Cannon Beach are high for many reasons, including the increasing scarcity of vacant buildable land in the community, and the proximity of many residential sites to unbuildable wetland open space areas. Restricting development at this resource site will help maintain the adjacent open space benefits enjoyed by neighboring residential property. An additional indirect economic consequence is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are restricted will be relatively lower than if residential uses were un-restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

No direct energy consequences of allowing conflicting uses on the Elm drainage basin wetland resource site have been identified.

Indirect energy consequences of allowing conflicting uses in the Elm drainage basin wetland resource site may include the expenditure of the energy related to residential development on the site. Different energy expenditures may be required for construction of a pile-supported house compared to a house on fill compared to a house at a non-wetland site.

No direct energy consequences of restricting conflicting uses on the Elm drainage basin wetland resource site have been identified.
Indirect energy consequences of restricting conflicting uses in the Elm drainage basin wetland resource site may include the energy savings related to preventing residential development on the site. Different energy expenditures may be required for construction of a pile-supported house compared to a house on fill compared to a house at a non-wetland site.

Conclusion: Based on the evaluation of this resource site's wetland functions and values, and based on this analysis of environmental, social, economic and energy consequences of allowing and restricting conflicting uses and activities, the City should provide partial protection for this resource site. The overlay zone and associated standards described elsewhere provide an appropriate level of protection given these factors.

Gulcana Drainage Basin Wetland Resource Site

The Gulcana wetland resource site contains three individual wetlands (inventory numbers 29, 35, and 45) in the Residential Very Low Density (RVL) zone and the Residential Lower Density (RL) zone. Potentially conflicting uses allowed in one or more of the individual wetland areas at the Gulcana wetland resource site include:

Single family dwelling
Cottage industry
Day care center
Family, adult day care center
Residential home, residential facility
Home occupation
Temporary manufactured dwelling or recreation vehicle
Church or community meeting hall
Government or municipal structure
Structural shoreline stabilization
Forest management
Public or private school or college
Utility lines
Parks or public recreation area

Unregulated conflicting activities also occur or could occur at this resource site. These conflicting uses and activities are described in more detail elsewhere. The following table shows resource values for wetlands at this resource site.

Gulcana Resource Site Functional Values

Inventory Number:	29	35	45
Ecological Integrity	L	M	L
Wildlife Habitat	L	M	L
Fish Habitat	L	L	L
Noteworthiness	L	L/M	L
Educational Potential	L	L	L
Recreation	L	L	L
Flood Control	L	L	L
Sediment Trapping	L	L	L
Nutrient Retention	L	L	L
Urban Quality of Life	M	L	L

Legend: H = High, M = Medium, L = Low

Direct environmental consequences of allowing conflicting uses at this resource site are related to loss of wetland ecological functions and values, especially wildlife habitat and ecological integrity. Residential structures (single family dwellings, temporary manufactured dwelling, or temporary recreational vehicle) on fill would result in loss or alteration of wetland vegetation, and alteration of wetland hydrology. Allowing residential structures on piling would damage wetland vegetation and impair wildlife habitat values, but would leave wetland hydrology substantially unaltered. Development of a park or recreation area would conflict with wetland ecological values at this wetland resource site. Placement of fill material for parking, tennis courts, playgrounds, restrooms and similar facilities commonly provided with park or recreation areas would alter wetland hydrology and eliminate wetland vegetation. Even without wetland fill, a park or recreation area that generates significant levels of human activity would degrade wetland ecological values. Installation and maintenance of above-ground utility lines may degrade wetland functions and values at this wetland resource site by requiring vegetation removal in the utility corridor. Underground utilities may also require vegetation removal for the corridor, and may interfere with wetland hydrology. A public or private school or college on this wetland resource site would have direct environmental consequences similar to those of any structure requiring fill. Fill for a school building and parking lot would alter wetland hydrology and eliminate wetland vegetation. Fill for a government or municipal structure, church, or community hall would have similar direct environmental impacts on wetland functions and values at this resource site. Forest management is allowed at one of the wetlands (# 35) that make up this resource site. Wildlife habitat and ecologically integrity are the principal wetland environmental values that would be directly threatened by allowing forest management at this resource site.

Indirect environmental consequences of allowing conflicting uses at the Gulcana wetland resource site include wetland habitat disturbance and loss. This indirect consequence is a result of human activity associated with normal residential use of residential structures. Examples of these types of disturbing residential activities include landscape maintenance and development, wildlife harassment by domestic dogs and cats, exterior lighting, and outdoor human recreation. The types of activities allowed in a residence in the Gulcana wetland resource site include home occupation, residential home, residential facility, and family or adult day care. These activities generate a higher level of human activity than would typically be found in a single family residence. To the extent that these activities occur outside of the structure, wetland environmental functions and values would be impaired. A park or recreation area at this wetland resource site would generate indirect environmental consequences for wetland functions and values, especially wildlife habitat. Outdoor human activity associated with a park or recreation area would be avoided by many wildlife species. A public or private school or college at this wetland resource site would have harmful indirect environmental consequences similar to those associated with a park or recreation area if a significant level of outdoor human activity were associated with this use. Government and municipal structures that have large parking lots or paved yards may degrade wetland water quality as a result of stormwater runoff. Forest management is allowed at one of the wetlands (# 35) that make up this resource site. Indirect environmental consequences of allowing the vegetation removal associated with forest management may include loss ordegradation of some of the resource site's lower-rated wetland environmental values: fish habitat, noteworthiness, educational potential, recreational values, flood control, sediment trapping and nutrient retention.

Direct environmental consequences of restricting conflicting uses and activities at the Gulcana wetland resource site include a degree of protection for the wetland functions and values remaining at this resource site, notably wildlife habitat. A pile-supported residence would not impair wetland hydrology, but would alter wetland wildlife habitat. Prohibiting non-residential structures that might otherwise be allowed at this wetland resource site (government structures, churches, community meeting halls) would provide a degree of protection for remaining wetland values. Restricting fills for these structures would maintain wetland wildlife habitat values at their present moderate level. Prohibiting utility lines from crossing this wetland resource site would eliminate their environmental impacts on wetland vegetation and hydrology, and would help maintain wetland wildlife habitat. Restricting normal residential activities (outdoor recreation, landscaping, domestic pets, exterior lighting) would protect wetland wildlife habitat from the adverse impacts caused by these activities. Restricting non-residential activities (such as hiking and vegetation management, which are not necessarily linked to residential development) would help protect wetland wildlife habitat at this resource site. Prohibiting forest management activities at this resource site would help maintain the site's ecological functions and values, especially wildlife habitat and ecological integrity.

Indirect environmental consequences of restricting conflicting uses and activities in the Gulcana drainage basin could include a degree of protection for the remaining wetland functions and values at this resource site, particularly those associated with wildlife habitat. Restricting residential development to a single unit per lot-of-record would keep residential density and associated human activity to a minimum level. Restricting outdoor human activities, such as those associated with a residence, home occupation, or day care center, would provide further protection for wetland resource values. Prohibiting non-residential structures (government structures, churches, community meeting halls) will protect the Gulcana wetland resource site from the indirect environmental impacts of these uses: water quality degradation as a result of parking lot runoff, and wildlife disturbance from outdoor human activity and night lighting, for example. Prohibiting forest management at this resource site will prevent indirect damage to wetland ecological values.

Direct social consequences of allowing conflicting uses at the Gulcana wetland resource site include loss of open space in the surrounding residential neighborhood and an incremental social loss related to degradation of wetland wildlife habitat. The Gulcana wetland resource site provides open space benefits for neighboring property owners. Allowing development of any structure (residence, day care facility, government or municipal building, church or community center) at this wetland resource site would reduce or eliminate these benefits. Development of any of the structures permitted at this wetland resource site would diminish wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social loss. The Gulcana wetland resource site offers minimal flood protection value, so loss of this function may be of little consequence.

Indirect social consequences of allowing conflicting activities such as outdoor human activity, domestic pets, and exterior lighting at the Gulcana wetland resource site may include an incremental erosion of the quality of life enjoyed in Cannon Beach as a result of the degradation and loss of wetland wildlife habitat. To the extent that the presence of wildlife in Cannon Beach is appreciated by residents and visitors, this represents a social loss. Development of any of the structures (residence, government or municipal building, church or community center) or activities (day care, or home occupation) allowed at this wetland resource site might also increase the level of human activity in the surrounding neighborhood, and lead to increased motor vehicle traffic on adjacent streets. Allowing residential use of the Gulcana resource site would yield social benefits if it provided some relief to the housing shortage in the County. Allowing a park or recreation area at this resource site might provide social benefits related to outdoor recreation. Allowing institutional development (government or municipal building, church or community center, school) might yield social benefits related to the services provided in these buildings. Allowing forest management activities would result in the loss of trees in the forested portions of this wetland resource site. Trees contribute to the community's scenic beauty, and their loss would diminish this wetland resource site's *urban quality of life* value.

Direct social consequences of restricting conflicting uses at the Gulcana wetland resource site may include the preservation of open space in the residential neighborhood surrounding the resource site, and an incremental social benefit from preserving wetland wildlife habitat. The Gulcana wetland resource site provides open space for neighboring property owners. Prohibiting any structure (residence, government or municipal building, church or community center) at this wetland resource site would preserve open space and secure the social benefits of open space. Prohibiting structures at this wetland resource site would protect wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting forest management would help preserve trees at this resource site. Trees contribute to the quality of life in Cannon Beach, and the social benefits of preserving trees are widely recognized in this community.

Indirect social consequences of restricting conflicting uses at the Gulcana wetland resource site may include incremental improvement of the quality of life in Cannon Beach related to protection of wetland wildlife habitat. Activities that disrupt wildlife use at the Gulcana wetland resource site, such as outdoor human activity, diminish the site's wetland wildlife habitat value. Restricting these activities would help preserve existing wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting park or recreation area at this resource site might deny neighboring residents the social benefits related to a nearby outdoor recreation site. Prohibiting institutional development (government or municipal building, church or community center, school) might impair delivery of the services provided in these buildings. Prohibiting all human activity at this resource site would require extraordinary intervention by the City into areas not normally subject to city regulation. The social costs of this level of intervention would be significant.

Direct economic consequences of allowing conflicting uses at the Gulcana wetland resource site include the price difference between the site as buildable land, and as unbuildable land. The size of this avoided loss would vary depending on which of the several conflicting uses allowed at this resource site are considered. The price difference between a buildable and an unbuildable residential lot may be significant. If the price of land at this wetland site includes the potential market price for timber to be harvested from the site, allowing forest management will secure this economic benefit of site ownership.

Indirect economic consequences of allowing conflicting uses at the Gulcana wetland resource site include possible loss of property value for adjacent residential land owners. Residential land values in Cannon Beach are relatively high for many reasons, including the increasing scarcity of vacant buildable land, and the proximity of some residential sites to wetland open space areas or forested wetlands. Allowing development or forest management at the Gulcana wetland resource site will eliminate the adjacent open space benefits enjoyed by neighboring residential property. This could reduce the value of adjacent residential land. An indirect economic benefit is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are allowed will be relatively higher than if residential uses are restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts. An economic consequence of allowing utility lines to cross this wetland resource site may be cost-efficient location of utility corridors. An economic consequence of allowing institutional development (government or municipal building, church or community center, school) at this wetland resource site may be cost-efficient location of these structures.

Direct economic consequences of restricting conflicting uses at the Gulcana wetland resource site include the price difference between the wetland resource site as buildable vacant land, and as unbuildable land. The size of this economic loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. An economic consequence of prohibiting utility corridors from crossing this wetland resource site might be higher utility installation and maintenance costs caused by sub-optimal utility corridor locations. Prohibiting forest management might reduce the potential market value of a forested wetland site.

Indirect economic consequences of restricting conflicting uses at the Gulcana wetland resource site may include relatively higher property value for adjacent residential lands. Residential land values in Cannon Beach are high for many reasons, including the increasing scarcity of vacant buildable land in the community, and the proximity of some residential sites to unbuildable wetland open space areas or forested wetlands. Restricting development or timber removal at this resource site will help maintain these benefits enjoyed by neighboring residential property. An additional indirect economic consequence is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are restricted will be relatively lower than if residential uses were unrestricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

No direct energy consequences of allowing conflicting uses on the Gulcana drainage basin wetland resource site have been identified.

Indirect energy consequences of allowing conflicting uses in the Gulcana drainage basin wetland resource site may include the expenditure of the energy related to development of a structure on the site. Different energy expenditures may be required for construction of a pile-supported structure compared to a structure on fill compared to a structure at a nonwetland site.

No direct energy consequences of restricting conflicting uses on the Gulcana drainage basin wetland resource site have been identified.

Indirect energy consequences of restricting conflicting uses in the Gulcana drainage basin wetland resource site may include the energy savings related to preventing construction at the site. Different energy expenditures may be required for construction of a pilesupported structure compared to a structure on fill compared to a structure at a non-wetlandsite.

Conclusion: Based on the evaluation of this resource site's wetland functions and values, and based on this analysis of environmental, social, economic and energy consequences of allowing and restricting conflicting uses and activities, the City should provide partial protection for this resource site. The overlay zone and associated standards described elsewhere provide an appropriate level of protection given these factors.

Hemlock Drainage Basin Wetland Resource Site

The Hemlock wetland resource site contains four individual wetlands (inventory numbers 25, 26, 28, and 32) in two residential zones. Number 32 is in the Residential Very Low Density (RVL) zone. Numbers 25, 26, and 28 are in the Residential Lower Density (RL) zone. Potentially conflicting uses allowed in one or more of the individual wetland areas at the Hemlock wetland resource site include:

- Single family dwelling
- Cottage industry
- Day care center
- Family, adult day care center
- Residential home, residential facility
- Home occupation
- Temporary manufactured dwelling or recreational vehicle
- Church or community meeting hall
- Government or municipal structure
- Structural shoreline stabilization
- Forest management
- Public or private school or college
- Utility lines
- Parks or public recreation areas.

Unregulated conflicting activities also occur or could occur at this resource site. These conflicting uses and activities are described in more detail elsewhere. The following table shows functional values for wetlands at this resource site.

	Hemlock Resource Site Functional Values			
Inventory Number:	25	26	28	32
Ecological Integrity	H	M/H	M	M
Wildlife Habitat	M	M	M	M
Fish Habitat	L	L	L	L
Noteworthiness	H	M/H	M	L/M
Educational Potential	L	L	L	L
Recreation	L	L	L	L
Flood Control	L	L	L	L
Sediment Trapping	L	L	L	L
Nutrient Retention	L	L	L	L
Urban Quality of Life	H	H	M	L

Legend: H = High, M = Medium, L = Low

Direct environmental consequences of allowing conflicting uses at this resource site are related to loss of wetland ecological functions and values, especially wildlife habitat and ecological integrity. Residential structures (single family dwellings, temporary manufactured dwelling, or temporary recreational vehicle) on fill would result in loss or alteration of wetland vegetation, and alteration of wetland hydrology. Allowing residential structures on piling would damage wetland vegetation, but would leave wetland hydrology substantially unaltered. Development of a park or recreation area would conflict with wetland ecological values, including wildlife habitat and ecological integrity, at this wetland resource site. Placement of fill material for parking, tennis courts, playgrounds, restrooms and similar facilities commonly provided with park or recreation areas would alter wetland hydrology and eliminate wetland vegetation. Even without wetland fill, a park or recreation area that generates significant levels of human activity would degrade wetland ecological values. Installation and maintenance of above-ground utility lines may degrade wetland functions and values at this wetland resource site by requiring vegetation removal in the utility corridor. Underground utilities may also require vegetation removal for the corridor, and may interfere with wetland hydrology. A public or private school or college on this wetland resource site would have direct environmental consequences similar to those of any structure requiring fill. Fill for a school building and parking lot would alter wetland hydrology and eliminate wetland vegetation. Fill for a government or municipal structure, church, or community hall would have similar direct environmental impacts on wetland ecological functions and values at this resource site. Forest management is allowed at one of the wetlands (# 32) that make up this resource site. Wildlife habitat and ecologically integrity are the principal wetlandecological values that would be directly threatened by allowing forest management at this resource site.

Indirect environmental consequences of allowing conflicting uses at the Hemlock wetland resource site include degradation of some wetland ecological values. This indirect consequence is a result of human activity associated with normal residential use of residential structures. Examples of these types of disturbing residential activities include landscape maintenance and development, wildlife harassment by domestic dogs and cats, exterior lighting, and outdoor human recreation. The types of activities allowed in a residence in the Hemlock wetland resource site include home occupation, residential home, residential facility, and family or adult day care. These activities generate a higher level of human activity than would typically be found in a single family residence. To the extent that these activities occur outside of the structure, wetland environmental functions and values would be impaired. A park or recreation area at this wetland resource site would generate indirect environmental consequences for wetland functions and values, especially wildlife habitat. Outdoor human activity associated with a park or recreation area would be avoided by many wildlife species. A public or private school or college at this wetland resource site would have harmful indirect environmental consequences similar to those associated with a park or recreation area if a significant level of outdoor human activity were associated with this use. Government and municipal structures that have large parking lots or paved yards may degrade wetland water quality as a result of stormwater runoff. Forest management is allowed at one of the wetlands (# 32) that make up this resource site. Indirect environmental consequences of allowing the vegetation removal associated with forest management may include loss or degradation of some of the resource site's lower-rated wetland environmental values: fish habitat, sediment trapping and nutrient retention.

Direct environmental consequences of restricting conflicting uses and activities at the Hemlock wetland resource site include a degree of protection for the wetland functions and values remaining at this resource site, notably wildlife habitat. A pile-supported residence would not impair wetland hydrology, but would alter wetland wildlife habitat. Prohibiting non-residential structures that might otherwise be allowed at this wetland resource site (government structures, churches, community meeting halls) would provide a degree of protection for remaining wetland values. Restricting fills for these structures would maintain wetland wildlife habitat values at their present moderate level. Prohibiting utility lines from crossing this wetland resource site would eliminate their environmental impacts on wetland vegetation and hydrology, and would help maintain wetland wildlife habitat. Restricting normal residential activities (outdoor recreation, landscaping, domestic pets, exterior lighting) would protect wetland wildlife habitat from the adverse impacts caused by these activities. Restricting non-residential activities (such as hiking and vegetation management, which are not necessarily linked to residential development) would help protect wetland wildlife habitat at this resource site. Prohibiting forest management activities at this resource site would help preserve the site's higher-rated ecological functions and values, especially wildlife habitat andecological integrity.

Indirect environmental consequences of restricting conflicting uses and activities in the Hemlock drainage basin could include a degree of protection for the remaining wetland functions and values at this resource site, particularly those associated with wildlife habitat and ecological integrity. Restricting residential development to a single unit per lot-of-record would keep residential density and associated human activity to a minimum level. Restricting outdoor human activities, such as those associated with a residence, home occupation, or day care center, would provide further protection for wetland resource values. Prohibiting nonresidential structures (government structures, churches, community meeting halls) will protect the Hemlock wetland resource site from the indirect environmental impacts of these uses: water quality degradation as a result of parking lot runoff, and wildlife disturbance from outdoor human activity and night lighting, for example. Prohibiting forest management at this resource site will prevent indirect damage to wetland environmental values.

Direct social consequences of allowing conflicting uses at the Hemlock wetland resource site include loss of open space in the surrounding residential neighborhood and an incremental social loss related to degradation of wetland wildlife habitat. The Hemlock wetland resource site provides open space benefits for neighboring property owners. Allowing development of any structure (residence, day care facility, government or municipal building, church or community center) at this wetland resource site would reduce or eliminate these benefits. Development of any of the structures permitted at this wetland resource site would diminish wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social loss. The Hemlock wetland resource site offers minimal flood protection value, so loss of this function may be of little consequence.

Indirect social consequences of allowing conflicting activities such as outdoor human activity, domestic pets, and exterior lighting at the Hemlock wetland resource site may include an incremental erosion of the quality of life enjoyed in Cannon Beach as a result of the degradation and loss of wetland wildlife habitat. To the extent that the presence of wildlife in Cannon Beach is appreciated by residents and visitors, this represents a social loss. Development of any of the structures (residence, government or municipal building, church or community center) or activities (day care or home occupation) allowed at this wetland resource site might also increase the level of human activity in the surrounding neighborhood, and lead to increased motor vehicle traffic on adjacent streets. Allowing residential use of the Hemlock resource site would yield social benefits if it provided some relief to the housing shortage in the County. Allowing a park or recreation area at thisresource site might provide social benefits related to outdoor recreation. Allowing institutional development (government or municipal building, church or community center, school) might yield social benefits related to the services provided in these buildings. Allowing forest management activities would result in the loss of trees in the forested portions of this wetland resource site. Trees contribute to the community's scenic beauty, and their loss would diminish this wetland resource site's *urban quality of life* value.

Direct social consequences of restricting conflicting uses at the Hemlock wetland resource site may include the preservation of open space in the residential neighborhood surrounding the resource site, and an incremental social benefit from preserving wetland wildlife habitat. The Hemlock wetland resource site provides open space for neighboring property owners. Prohibiting any structure (residence, government or municipal building, church or community center) at this wetland resource site would preserve open space and secure the social benefits of open space. Prohibiting structures at this wetland resource site would protect wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting forest management would help preserve trees at this resource site. Trees contribute to the quality of life in Cannon Beach, and the social benefits of preserving trees are widely recognized in this community.

Indirect social consequences of restricting conflicting uses at the Hemlock wetland resource site may include incremental improvement of the quality of life in Cannon Beach related to protection of wetland wildlife habitat. Activities that disrupt wildlife use at the Hemlock wetland resource site, such as outdoor human activity, diminish the site's wetland wildlife habitat value. Restricting these activities would help preserve existing wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting park or recreation area at this resource site might deny neighboring residents the social benefits related to a nearby outdoor recreation site. Prohibiting institutional development (government or municipal building, church or community center, school) might impair delivery of the services provided in these buildings. Prohibiting all human activity at this resource site would require extraordinary intervention by the City into areas not normally subject to city regulation. The social costs of this level of intervention would be significant.

Direct economic consequences of allowing conflicting uses at the Hemlock wetland resource site include the price difference between the site as buildable land, and as unbuildable land. The size of this avoided loss would vary depending on which of the several conflicting uses allowed at this resource site are considered. The price difference between a buildable and an unbuildable residential lot may be significant. If the price of land at this wetland site includes the potential market price for timber to be harvested from thesite, allowing forest management will secure this economic benefit of site ownership.

Indirect economic consequences of allowing conflicting uses at the Hemlock wetland resource site include possible loss of property value for adjacent residential land owners. Residential land values in Cannon Beach are relatively high for many reasons, including the increasing scarcity of vacant buildable land, and the proximity of some residential sites to wetland open space areas or forested wetlands. Allowing development or forest management at the Hemlock wetland resource site will eliminate the adjacent open space benefits enjoyed by neighboring residential property. This could reduce the value of adjacent residential land. An indirect economic benefit is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are allowed will be relatively higher than if residential uses are restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts. An economic consequence of allowing utility lines to cross this wetland resource site may be cost-efficient location of utility corridors. An economic consequence of allowing institutional development (government or municipal building, church or community center, school) at this wetland resource site may be cost-efficient location of these structures.

Direct economic consequences of restricting conflicting uses at the Hemlock wetland resource site include the price difference between the wetland resource site as buildable vacant land, and as unbuildable land. The size of this economic loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. An economic consequence of prohibiting utility corridors from crossing this wetland resource site might be higher utility installation and maintenance costs caused by sub-optimal utility corridor locations. Prohibiting forest management might reduce the potential market value of a forested wetland site.

Indirect economic consequences of restricting conflicting uses at the Hemlock wetland resource site may include relatively higher property value for adjacent residential lands. Residential land values in Cannon Beach are high for many reasons, including the increasing scarcity of vacant buildable land in the community, and the proximity of some residential sites to unbuildable wetland open space areas or forested wetlands. Restricting development or timber removal at this resource site will help maintain these benefits enjoyed by neighboring residential property.

An additional indirect economic consequence is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are restricted will be relatively lower than if residential uses were unrestricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.
No direct energy consequences of allowing conflicting uses on the Hemlock drainage basin wetland resource site have been identified.

Indirect energy consequences of allowing conflicting uses in the Hemlock drainage basin wetland resource site may include the expenditure of the energy related to development of a structure on the site. Different energy expenditures may be required for construction of a pile-supported structure compared to a structure on fill compared to a structure at a nonwetland site.

No direct energy consequences of restricting conflicting uses on the Hemlock drainage basin wetland resource site have been identified.

Indirect energy consequences of restricting conflicting uses in the Hemlock drainage basin wetland resource site may include the energy savings related to preventing construction at the site. Different energy expenditures may be required for construction of a pilesupported structure compared to a structure on fill compared to a structure at a non-wetland site.

Conclusion: Based on the evaluation of this resource site's wetland functions and values, and based on this analysis of environmental, social, economic and energy consequences of allowing and restricting conflicting uses and activities, the City should provide partial protection for this resource site. The overlay zone and associated standards described elsewhere provide an appropriate level of protection given these factors.

Kenai Drainage Basin Wetland Resource Site

The Kenai resource site contains two wetlands (inventory numbers 4 and 5) in the Residential High Density (R-3) zone and the Residential Moderate Density (R-1) zone. Potentially conflicting uses allowed in these zones include:

Single family dwellings, multi-family dwellings
Parks or public recreation areas
Utility lines
Temporary manufactured dwelling or recreation vehicle
Home occupation
Residential home, residential facility
Family, adult day care center
Public or private school or college
Government or municipal structure
Day care center
Bed and breakfast
Church or community meeting hall.

Unregulated conflicting activities also occur or could occur at this resource site. These conflicting uses and activities are described in more detail elsewhere. Both wetlands at the Kenai wetland resource site were rated moderate in terms of wildlife habitat values and low with respect to ecological integrity, fish habitat, educational potential, recreation, flood control sediment trapping, nutrient retention, and urban quality of life values. Kenai wetland 5 was rated moderate, and wetland 4 was rated low, in terms of noteworthiness.

<u>Direct environmental consequences of allowing</u> conflicting uses at this resource site are related to loss of wetland wildlife habitat as well as degradation of other wetland functions and values. Residential structures (single family dwellings, multi-family dwellings) on fill would result in loss or alteration of wetland vegetation, and alteration of wetland hydrology. Allowing residential structures on piling would damage wetland vegetation and impair wildlife habitat values, but would leave wetland hydrology substantially unaltered. Development of a park or recreation area would conflict with wetland ecological values, including wildlife habitat, at this wetland resource site. Placement of fill material for parking, tennis courts, playgrounds, restrooms and similar facilities commonly provided with park or recreation areas would alter wetland hydrology and eliminate wetland vegetation. Even without wetland fill, a park or recreation area that generates significant levels of human activity would degrade wetland wildlife habitat values. Installation and maintenance of above-ground utility lines may degrade wetland functions and values at this wetland resource site by requiring vegetation removal in the utility corridor. Underground utilities may also require vegetation removal for the corridor, and may interfere with wetland hydrology. A public or private school or college on this wetland resource site would have directenvironmental consequences similar to those of any structure requiring fill. Fill for a school building and parking lot would alter wetland hydrology and eliminate wetland

vegetation. Fill for a government or municipal structure, church, or community hall would have similar direct environmental impacts on wetland functions and values at this resource site. A bed and breakfast would probably have direct environmental consequences at this resource site similar to those of a residence.

Indirect environmental consequences of allowing conflicting uses at the Kenai wetland resource site include wetland habitat disturbance and loss. This indirect consequence is a result of human activity associated with normal residential use of residential structures. Examples of these types of disturbing residential activities include landscape maintenance and development, wildlife harassment by domestic dogs and cats, exterior lighting, and outdoor human recreation. The types of activities allowed in a residence in the Kenai wetland resource site include home occupation, residential home, residential facility, and family or adult day care. These activities generate a higher level of human activity than would typically be found in a single family residence. To the extent that these activities occur outside of the structure, wetland environmental functions and values would be impaired. A park or recreation area at this wetland resource site would generate indirect environmental consequences for wetland functions and values, especially wildlife habitat. Outdoor human activity associated with a park or recreation area would be avoided by many wildlife species. A public or private school or college at this wetland resource site would have harmful indirect environmental consequences similar to those associated with a park or recreation area if a significant level of outdoor human activity were associated with this use. Government and municipal structures that have large parking lots or paved yards may degrade wetland water quality as a result of stormwater runoff. A bed and breakfast would probably generate indirect environmental impacts similar to those of a residence.

Direct environmental consequences of restricting conflicting uses and activities at the Kenai wetland resource site include a degree of protection for the wetland functions and values remaining at this resource site, notably wildlife habitat. A pile-supported residence would not impair wetland hydrology, but would alter wetland wildlife habitat. Prohibiting non-residential structures that might otherwise be allowed at this wetland resource site (government structures, churches, community meeting halls) would provide a degree of protection for remaining wetland values. Restricting fills for these structures would maintain wetland wildlife habitat values at their present moderate level. Prohibiting utility lines from crossing this wetland resource site would eliminate their environmental impacts on wetland vegetation and hydrology, and would help maintain wetland wildlife habitat. Restricting normal residential activities (outdoor recreation, landscaping, domestic pets, exterior lighting) would protect wetland wildlife habitat from the adverse impacts caused by these activities. Restricting non-residential activities (such as hiking and vegetation management, which are not necessarily linked to residential development) would help protect wetland wildlife habitat at this resource site. Prohibiting bed and breakfasts at this wetland resource site wouldprotect wetland resource values, notably wildlife habitat, from the adverse environmental consequences of the bed and breakfast structure.

Indirect environmental consequences of restricting conflicting uses and activities in the Kenai drainage basin could include a degree of protection for the remaining wetland functions and values at this resource site, particularly those associated with wildlife habitat. Restricting residential development to a single unit per lot-of-record would keep residential density and associated human activity to a minimum level. Restricting outdoor human activities, such as those associated with a residence, home occupation, bed and breakfast, or day care center, would provide further protection for wetland resource values. Prohibiting non-residential structures (government structures, churches, community meeting halls) will protect the Kenai wetland resource site from the indirect environmental impacts of these uses: water quality degradation as a result of parking lot runoff, and wildlife disturbance from outdoor human activity and night lighting, for example.

Direct social consequences of allowing conflicting uses at the Kenai wetland resource site include loss of open space in the surrounding residential neighborhood and an incremental social loss related to degradation of wetland wildlife habitat. The Kenai wetland resource site provides open space benefits for neighboring property owners. Allowing development of any structure (residence, government or municipal building, church or community center) at this wetland resource site would reduce or eliminate these benefits. Development of any of the structures permitted at this wetland resource site would diminish wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social loss. The Kenai wetland resource site offers minimal flood protection value, so loss of this function may be of little consequence.

Indirect social consequences of allowing conflicting activities such as outdoor human activity, domestic pets, and exterior lighting at the Kenai wetland resource site may include an incremental erosion of the quality of life enjoyed in Cannon Beach as a result of the degradation and loss of wetland wildlife habitat. To the extent that the presence of wildlife in Cannon Beach is appreciated by residents and visitors, this represents a social loss. Development of any of the structures (residence, government or municipal building, church or community center) or activities (day care, bed and breakfast, or home occupation) allowed in the R-3 zone at this wetland resource site might also increase the level of human activity in the surrounding neighborhood, and lead to increased motor vehicle traffic on adjacent streets. Allowing residential use of the Kenai resource site would yield social benefits if it provided some relief to the housing shortage in the County. Allowing a park or recreationarea at this resource site might provide social benefits related to outdoor recreation. Allowing institutional development (government or municipal building, church or community center, school) might yield social benefits related to the services provided in these buildings.

Direct social consequences of restricting conflicting uses at the Kenai wetland resource site may include the preservation of open space in the residential neighborhood surrounding the resource site, and an incremental social benefit from preserving wetland wildlife habitat. The Kenai wetland resource site provides open space for neighboring property owners. Prohibiting any structure (residence, government or municipal building, church or community center) at this wetland resource site would preserve open space and secure the social benefits of open space. Prohibiting structures at this wetland resource site would protect wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit.

Indirect social consequences of restricting conflicting uses at the Kenai wetland resource site may include incremental improvement of the quality of life in Cannon Beach related to protection of wetland wildlife habitat. Activities that disrupt wildlife use at the Kenai wetland resource site, such as outdoor human activity, diminish the site's wetland wildlife habitat value. Restricting these activities would help preserve existing wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting park or recreation area at this resource site might deny neighboring residents the social benefits related to a nearby outdoor recreation site. Prohibiting institutional development (government or municipal building, church or community center, school) might impair delivery of the social services provided in these buildings. Prohibiting all human activity at this resource site would require extraordinary intervention by the City into areas not normally subject to city regulation. The social costs of this level of intervention would be significant.

Direct economic consequences of allowing conflicting uses at the Kenai wetland resource site include the price difference between the site as buildable land, and as unbuildable land. The size of this avoided loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. The price difference between a buildable and an unbuildable residential lot may be significant. An economic consequence of allowing utility lines to cross this wetland resource site may be cost-efficient location of utility corridors.

Indirect economic consequences of allowing conflicting uses at the Kenai wetland resource site include possible loss of property value for adjacent residential land owners. Residential land values in Cannon Beach are relatively high for many reasons, including the increasing scarcity of vacant buildable land, and the proximity of many residential sites to wetland open space areas. Allowing residential development of the Kenai wetland resource site will eliminate the adjacent open space benefits enjoyed by neighboring residential property. This could reduce the value of adjacent residential land. An indirect economic benefit is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are allowed will be relatively higher than if residential uses are restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

Direct economic consequences of restricting conflicting uses at the Kenai wetland resource site include the price difference between the wetland resource site as buildable vacant land, and as unbuildable land. The size of this economic loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. An economic consequence of prohibiting utility corridors from crossing this wetland resource site might be higher utility installation and maintenance costs caused by sub-optimal utility corridor locations.

Indirect economic consequences of restricting conflicting uses at the Kenai wetland resource site may include relatively higher property value for adjacent residential lands. Residential land values in Cannon Beach are high for many reasons, including the increasing scarcity of vacant buildable land in the community, and the proximity of many residential sites to unbuildable wetland open space areas. Restricting development at this resource site will help maintain the adjacent open space benefits enjoyed by neighboring residential property. An additional indirect economic consequence is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are restricted will be relatively lower than if residential uses were un-restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

No direct energy consequences of allowing conflicting uses on the Kenai drainage basin wetland resource site have been identified.

Indirect energy consequences of allowing conflicting uses in the Kenai drainage basin wetland resource site may include the expenditure of the energy related to development of a structure on the site. Different energy expenditures may be required for construction of a pile-supported structure compared to a structure on fill compared to a structure at a nonwetland site.

No direct energy consequences of restricting conflicting uses on the Kenai drainage basin wetland resource site have been identified.

Indirect energy consequences of restricting conflicting uses in the Kenai drainage basin wetland resource site may include the energy savings related to preventing construction at the site. Different energy expenditures may be required for construction of a pilesupported structure compared to a structure on fill compared to a structure at a non-wetland site.

Conclusion: Based on the evaluation of this resource site's wetland functions and values, and based on this analysis of environmental, social, economic and energy consequences of allowing and restricting conflicting uses and activities, the City should provide partial protection for this resource site. The overlay zone and associated standards described elsewhere provide an appropriate level of protection given these factors.

Logan Drainage Basin Wetland Resource Site

The Logan wetland resource site contains a single wetland (inventory number 1) in the Residential Lower Density (RL) zone. Potentially conflicting uses allowed at the Logan wetland resource site include:

Single family dwelling
Day care center
Family, adult day care center
Residential home, residential facility
Home occupation
Temporary manufactured dwelling or recreational vehicle
Church or community meeting hall
Government or municipal structure
Structural shoreline stabilization
Public or private school or college
Utility lines
Parks or public recreation area

Unregulated conflicting activities also occur or could occur at this resource site. These conflicting uses and activities are described in more detail elsewhere. The Logan wetland resource site was rated moderate in terms of wildlife habitat, and low in terms of all other wetland functions and values.

Direct environmental consequences of allowing conflicting uses at this resource site are related to loss of wetland ecological functions and values, especially wildlife habitat. Residential structures (single family dwellings, temporary manufactured dwelling, or temporary recreational vehicle) on fill would result in loss or alteration of wetland vegetation, and alteration of wetland hydrology. Allowing residential structures on piling would damage wetland vegetation and impair wildlife habitat values, but would leave wetland hydrology substantially unaltered. Development of a park or recreation area would conflict with wetland ecological values at this wetland resource site. Placement of fill material for parking, tennis courts, playgrounds, restrooms and similar facilities commonly provided with park or recreation areas would alter wetland hydrology and eliminate wetland vegetation. Even without wetland fill, a park or recreation area that generates significant levels of human activity would degrade wetland ecological values. Installation and maintenance of aboveground utility lines may degrade wetland functions and values at this wetland resource site by requiring vegetation removal in the utility corridor. Underground utilities may also require vegetation removal for the corridor, and may interfere with wetland hydrology. A public or private school or college on this wetland resource site would have direct environmental consequences similar to those of any structure requiring fill. Fill for a school building andparking lot would alter wetland hydrology and eliminate wetland vegetation. Fill for a government or municipal structure, church, or

community hall would have similar direct environmental impacts on wetland functions and values at this resource site.

Indirect environmental consequences of allowing conflicting uses at the Logan wetland resource site include wetland habitat disturbance and loss. This indirect consequence is a result of human activity associated with normal residential use of residential structures. Examples of these types of disturbing residential activities include landscape maintenance and development, wildlife harassment by domestic dogs and cats, exterior lighting, and outdoor human recreation. The types of activities allowed in a residence in the Logan wetland resource site include home occupation, residential home, residential facility, and family or adult day care. These activities generate a higher level of human activity than would typically be found in a single family residence. To the extent that these activities occur outside of the structure, wetland environmental functions and values would be impaired. A park or recreation area at this wetland resource site would generate indirect environmental consequences for wetland functions and values, especially wildlife habitat. Outdoor human activity associated with a park or recreation area would be avoided by many wildlife species. A public or private school or college at this wetland resource site would have harmful indirect environmental consequences similar to those associated with a park or recreation area if a significant level of outdoor human activity were associated with this use. Government and municipal structures that have large parking lots or paved yards may degrade wetland water quality as a result of stormwater runoff.

Direct environmental consequences of restricting conflicting uses and activities at the Logan wetland resource site include a degree of protection for the wetland functions and values remaining at this resource site, notably wildlife habitat. A pile-supported residence would not impair wetland hydrology, but would alter wetland wildlife habitat. Prohibiting non-residential structures that might otherwise be allowed at this wetland resource site (government structures, churches, community meeting halls) would provide a degree of protection for remaining wetland values. Restricting fills for these structures would maintain wetland wildlife habitat values at their present moderate level. Prohibiting utility lines from crossing this wetland resource site would eliminate their environmental impacts on wetland vegetation and hydrology, and would help maintain wetland wildlife habitat. Restricting normal residential activities (outdoor recreation, landscaping, domestic pets, exterior lighting) would protect wetland wildlife habitat from the adverse impacts caused by these activities. Restricting non-residential activities (such as hiking and vegetation management, which are not necessarily linked to residential development) would help protect wetland wildlife habitat at this resource site.

Indirect environmental consequences of restricting conflicting uses and activities in the Logan drainage basin could include a degree of protection for the remaining wetlandfunctions and values at this resource site, particularly those associated with wildlife habitat. Restricting residential development to a single unit per lot-of-record would keep residential density and associated human activity to a minimum level. Restricting outdoor human activities, such as those associated with a residence, home occupation, or day care center, would provide further protection for wetland resource values. Prohibiting non-residential structures (government structures, churches, community meeting halls) will protect the Logan wetland resource site from the indirect environmental impacts of these uses: water quality degradation as a result of parking lot runoff, and wildlife disturbance from outdoor human activity and night lighting, for example.

Direct social consequences of allowing conflicting uses at the Logan wetland resource site include loss of open space in the surrounding residential neighborhood and an incremental social loss related to degradation of wetland wildlife habitat. The Logan wetland resource site provides open space benefits for neighboring property owners. Allowing development of any structure (residence, day care facility, government or municipal building, church or community center) at this wetland resource site would reduce or eliminate these benefits. Development of any of the structures permitted at this wetland resource site would diminish wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social loss. The Logan wetland resource site offers minimal flood protection value, so loss of this function may be of little consequence.

Indirect social consequences of allowing conflicting activities such as outdoor human activity, domestic pets, and exterior lighting at the Logan wetland resource site may include an incremental erosion of the quality of life enjoyed in Cannon Beach as a result of the degradation and loss of wetland wildlife habitat. To the extent that the presence of wildlife in Cannon Beach is appreciated by residents and visitors, this represents a social loss. Development of any of the structures (residence, government or municipal building, church or community center) or activities (day care, or home occupation) allowed at this wetland resource site might also increase the level of human activity in the surrounding neighborhood, and lead to increased motor vehicle traffic on adjacent streets. Allowing residential use of the Logan resource site would yield social benefits if it provided some relief to the housing shortage in the County. Allowing a park or recreation area at this resource site might provide social benefits related to outdoor recreation. Allowing institutional development (government or municipal building, church or community center, school) might yield social benefits related to the services provided in these buildings.

Direct social consequences of restricting conflicting uses at the Logan wetland resource site may include the preservation of open space in the residential neighborhood surrounding the resource site, and an incremental social benefit from preserving wetlandwildlife habitat. The Logan wetland resource site provides open space for neighboring property owners. Prohibiting any structure (residence, government or municipal building, church or community center) at this wetland resource site would preserve open space and secure the social benefits of open space. Prohibiting structures at this wetland resource site would protect wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit.

Indirect social consequences of restricting conflicting uses at the Logan wetland resource site may include incremental improvement of the quality of life in Cannon Beach related to protection of wetland wildlife habitat. Activities that disrupt wildlife use at the Logan wetland resource site, such as outdoor human activity, diminish the site's wetland wildlife habitat value. Restricting these activities would help preserve existing wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting park or recreation area at this resource site might deny neighboring residents the social benefits related to a nearby outdoor recreation site. Prohibiting institutional development (government or municipal building, church or community center, school) might impair delivery of the services provided in these buildings. Prohibiting all human activity at this resource site would require extraordinary intervention by the City into areas not normally subject to city regulation. The social costs of this level of intervention would be significant.

Direct economic consequences of allowing conflicting uses at the Logan wetland resource site include the price difference between the site as buildable land, and as unbuildable land. The size of this avoided loss would vary depending on which of the several conflicting uses allowed at this resource site are considered. The price difference between a buildable and an unbuildable residential lot may be significant.

Indirect economic consequences of allowing conflicting uses at the Logan wetland resource site include possible loss of property value for adjacent residential land owners. Residential land values in Cannon Beach are relatively high for many reasons, including the increasing scarcity of vacant buildable land, and the proximity of some residential sites to wetland open space areas. An indirect economic benefit is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are allowed will be relatively higher than if residential uses are restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts. An economic consequence of allowing utility lines to cross this wetland resource site may be cost-efficient location of utility corridors. An economic consequence of allowing institutional development (government or municipal building, church or community center, school) at thiswetland resource site may be cost-efficient location of these structures.

Direct economic consequences of restricting conflicting uses at the Logan wetland resource site include the price difference between the wetland resource site as buildable vacant land, and as unbuildable land. The size of this economic loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. An economic consequence of prohibiting utility corridors from crossing this wetland resource site might be higher utility installation and maintenance costs caused by sub-optimal utility corridor locations.

Indirect economic consequences of restricting conflicting uses at the Logan wetland resource site may include relatively higher property value for adjacent residential lands. Residential land values in Cannon Beach are high for many reasons, including the increasing scarcity of vacant buildable land in the community, and the proximity of some residential sites to unbuildable wetland open space areas. Restricting conflicting development at this resource site will help maintain these benefits enjoyed by neighboring residential property. An additional indirect economic consequence is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are restricted will be relatively lower than if residential uses were un-restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

No direct energy consequences of allowing conflicting uses on the Logan drainage basin wetland resource site have been identified.

Indirect energy consequences of allowing conflicting uses in the Logan drainage basin wetland resource site may include the expenditure of the energy related to development of a structure on the site. Different energy expenditures may be required for construction of a pile-supported structure compared to a structure on fill compared to a structure at a nonwetland site.

No direct energy consequences of restricting conflicting uses on the Logan drainage basin wetland resource site have been identified.

Indirect energy consequences of restricting conflicting uses in the Logan drainage basin wetland resource site may include the energy savings related to preventing constructionat the site. Different energy expenditures may be required for construction of a pilesupported structure compared to a structure on fill compared to a structure at a non-wetland site.

Conclusion: Based on the evaluation of this resource site's wetland functions and values, and based on this analysis of environmental, social, economic and energy consequences of allowing and restricting conflicting uses and activities, the City should provide partial protection for this resource site. The overlay zone and associated standards described elsewhere provide an appropriate level of protection given these factors.

Maher Drainage Basin Wetland Resource Site

The Maher wetland resource site contains a single wetland (inventory number 2) in the Residential Lower Density (RL) zone. Potentially conflicting uses allowed at the Maher wetland resource site include:

- Single family dwelling
- Day care center
- Family, adult day care center
- Residential home, residential facility
- Home occupation
- Temporary manufactured dwelling or recreational vehicle
- Church or community meeting hall
- Government or municipal structure
- Structural shoreline stabilization
- Public or private school or college
- Utility lines
- Parks or public recreation area

Unregulated conflicting activities also occur or could occur at this resource site. These conflicting uses and activities are described in more detail elsewhere. The Maher wetland resource site was rated moderate in terms of wildlife habitat, and low in terms of all other wetland functions and values.

Direct environmental consequences of allowing conflicting uses at this resource site are related to loss of wetland ecological functions and values, especially wildlife habitat. Residential structures (single family dwellings, temporary manufactured dwelling, or temporary recreational vehicle) on fill would result in loss or alteration of wetland vegetation, and alteration of wetland hydrology. Allowing residential structures on piling would damage wetland vegetation and impair wildlife habitat values, but would leave wetland hydrology substantially unaltered. Development of a park or recreation area would conflict with wetland ecological values at this wetland resource site. Placement of fill material for parking, tennis courts, playgrounds, restrooms and similar facilities commonly provided with park or recreation areas would alter wetland hydrology and eliminate wetland vegetation. Even without wetland fill, a park or recreation area that generates significant levels of human activity would degrade wetland ecological values. Installation and maintenance of aboveground utility lines may degrade wetland functions and values at this wetland resource site by requiring vegetation removal in the utility corridor. Underground utilities may also require vegetation removal for the corridor, and may interfere with wetland hydrology. A public or private school or college on this wetland resource site would have direct environmental consequences similar to those of any structure requiring fill. Fill for a school building andparking lot would alter wetland hydrology and eliminate wetland vegetation. Fill for a government or municipal structure, church, or

community hall would have similar direct environmental impacts on wetland functions and values at this resource site.

Indirect environmental consequences of allowing conflicting uses at the Maher wetland resource site include wetland habitat disturbance and loss. This indirect consequence is a result of human activity associated with normal residential use of residential structures. Examples of these types of disturbing residential activities include landscape maintenance and development, wildlife harassment by domestic dogs and cats, exterior lighting, and outdoor human recreation. The types of activities allowed in a residence in the Maher wetland resource site include home occupation, residential home, residential facility, and family or adult day care. These activities generate a higher level of human activity than would typically be found in a single family residence. To the extent that these activities occur outside of the structure, wetland environmental functions and values would be impaired. A park or recreation area at this wetland resource site would generate indirect environmental consequences for wetland functions and values, especially wildlife habitat. Outdoor human activity associated with a park or recreation area would be avoided by many wildlife species. A public or private school or college at this wetland resource site would have harmful indirect environmental consequences similar to those associated with a park or recreation area if a significant level of outdoor human activity were associated with this use. Government and municipal structures that have large parking lots or paved yards may degrade wetland water quality as a result of stormwater runoff.

Direct environmental consequences of restricting conflicting uses and activities at the Maher wetland resource site include a degree of protection for the wetland functions and values remaining at this resource site, notably wildlife habitat. A pile-supported residence would not impair wetland hydrology, but would alter wetland wildlife habitat. Prohibiting non-residential structures that might otherwise be allowed at this wetland resource site (government structures, churches, community meeting halls) would provide a degree of protection for remaining wetland values. Restricting fills for these structures would maintain wetland wildlife habitat values at their present moderate level. Prohibiting utility lines from crossing this wetland resource site would eliminate their environmental impacts on wetland vegetation and hydrology, and would help maintain wetland wildlife habitat. Restricting normal residential activities (outdoor recreation, landscaping, domestic pets, exterior lighting) would protect wetland wildlife habitat from the adverse impacts caused by these activities. Restricting non-residential activities (such as hiking and vegetation management, which are not necessarily linked to residential development) would help protect wetland wildlife habitat at this resource site.

Indirect environmental consequences of restricting conflicting uses and activities in the Maher drainage basin could include a degree of protection for the remaining wetlandfunctions and values at this resource site, particularly those associated with wildlife habitat. Restricting residential development to a single unit per lot-of-record would keep residential density and associated human activity to a minimum level. Restricting outdoor human activities, such as those associated with a residence, home occupation, or day care center, would provide further protection for wetland resource values. Prohibiting non-residential structures (government structures, churches, community meeting halls) will protect the Maher wetland resource site from the indirect environmental impacts of these uses: water quality degradation as a result of parking lot runoff, and wildlife disturbance from outdoor human activity and night lighting, for example.

Direct social consequences of allowing conflicting uses at the Maher wetland resource site include loss of open space in the surrounding residential neighborhood and an incremental social loss related to degradation of wetland wildlife habitat. The Maher wetland resource site provides open space benefits for neighboring property owners. Allowing development of any structure (residence, day care facility, government or municipal building, church or community center) at this wetland resource site would reduce or eliminate these benefits. Development of any of the structures permitted at this wetland resource site would diminish wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social loss. The Maher wetland resource site offers minimal flood protection value, so loss of this function may be of little consequence.

Indirect social consequences of allowing conflicting activities such as outdoor human activity, domestic pets, and exterior lighting at the Maher wetland resource site may include an incremental erosion of the quality of life enjoyed in Cannon Beach as a result of the degradation and loss of wetland wildlife habitat. To the extent that the presence of wildlife in Cannon Beach is appreciated by residents and visitors, this represents a social loss. Development of any of the structures (residence, government or municipal building, church or community center) or activities (day care, or home occupation) allowed at this wetland resource site might also increase the level of human activity in the surrounding neighborhood, and lead to increased motor vehicle traffic on adjacent streets. Allowing residential use of the Maher resource site would yield social benefits if it provided some relief to the housing shortage in the County. Allowing a park or recreation area at this resource site might provide social benefits related to outdoor recreation. Allowing institutional development (government or municipal building, church or community center, school) might yield social benefits related to the services provided in these buildings.

Direct social consequences of restricting conflicting uses at the Maher wetland resource site may include the preservation of open space in the residential neighborhood surrounding the resource site, and an incremental social benefit from preserving wetlandwildlife habitat. The Maher wetland resource site provides open space for neighboring property owners. Prohibiting any structure (residence, government or municipal building, church or community center) at this wetland resource site would preserve open space and secure the social benefits of open space. Prohibiting structures at this wetland resource site would protect wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit.

Indirect social consequences of restricting conflicting uses at the Maher wetland resource site may include incremental improvement of the quality of life in Cannon Beach related to protection of wetland wildlife habitat. Activities that disrupt wildlife use at the Maher wetland resource site, such as outdoor human activity, diminish the site's wetland wildlife habitat value. Restricting these activities would help preserve existing wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting park or recreation area at this resource site might deny neighboring residents the social benefits related to a nearby outdoor recreation site. Prohibiting institutional development (government or municipal building, church or community center, school) might impair delivery of the services provided in these buildings. Prohibiting all human activity at this resource site would require extraordinary intervention by the City into areas not normally subject to city regulation. The social costs of this level of intervention would be significant.

Direct economic consequences of allowing conflicting uses at the Maher wetland resource site include the price difference between the site as buildable land, and as unbuildable land. The size of this avoided loss would vary depending on which of the several conflicting uses allowed at this resource site are considered. The price difference between a buildable and an unbuildable residential lot may be significant.

Indirect economic consequences of allowing conflicting uses at the Maher wetland resource site include possible loss of property value for adjacent residential land owners. Residential land values in Cannon Beach are relatively high for many reasons, including the increasing scarcity of vacant buildable land, and the proximity of some residential sites to wetland open space areas. An indirect economic benefit is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are allowed will be relatively higher than if residential uses are restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts. An economic consequence of allowing utility lines to cross this wetland resource site may be cost-efficient location of utility corridors. An economic consequence of allowing institutional development (government or municipal building, church or community center, school) at thiswetland resource site may be cost-efficient location of these structures.

Direct economic consequences of restricting conflicting uses at the Maher wetland resource site include the price difference between the wetland resource site as buildable vacant land, and as unbuildable land. The size of this economic loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. An economic consequence of prohibiting utility corridors from crossing this wetland resource site might be higher utility installation and maintenance costs caused by sub-optimal utility corridor locations.

Indirect economic consequences of restricting conflicting uses at the Maher wetland resource site may include relatively higher property value for adjacent residential lands. Residential land values in Cannon Beach are high for many reasons, including the increasing scarcity of vacant buildable land in the community, and the proximity of some residential sites to unbuildable wetland open space areas. Restricting conflicting development at this resource site will help maintain these benefits enjoyed by neighboring residential property. An additional indirect economic consequence is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are restricted will be relatively lower than if residential uses were un-restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

No direct energy consequences of allowing conflicting uses on the Maher drainage basin wetland resource site have been identified.

Indirect energy consequences of allowing conflicting uses in the Maher drainage basin wetland resource site may include the expenditure of the energy related to development of a structure on the site. Different energy expenditures may be required for construction of a pile-supported structure compared to a structure on fill compared to a structure at a nonwetland site.

No direct energy consequences of restricting conflicting uses on the Maher drainage basin wetland resource site have been identified.

Indirect energy consequences of restricting conflicting uses in the Maher drainage basin wetland resource site may include the energy savings related to preventing constructionat the site. Different energy expenditures may be required for construction of a pilesupported structure compared to a structure on fill compared to a structure at a non-wetland site.

Conclusion: Based on the evaluation of this resource site's wetland functions and values, and based on this analysis of environmental, social, economic and energy consequences of allowing and restricting conflicting uses and activities, the City should provide partial protection for this resource site. The overlay zone and associated standards described elsewhere provide an appropriate level of protection given these factors.

Ocean Drainage Basin Wetland Resource Site

The Ocean resource site contains three wetlands (inventory numbers 7, 8, and 9) in the Residential High Density (R-3) zone and the Residential Moderate Density (R-1) zone. Potentially conflicting uses allowed in these zones include:

- Single family dwellings, multi-family dwellings
- Parks or public recreation areas
- Utility lines
- Temporary manufactured dwelling or recreation vehicle
- Home occupation
- Residential home, residential facility
- Family, adult day care center
- Public or private school or college
- Government or municipal structure
- Day care center
- Bed and breakfast
- Church or community meeting hall.

Unregulated conflicting activities also occur or could occur at this resource site. These conflicting uses and activities are described in more detail elsewhere. All three wetlands in the Ocean resource site were rated low for all functions and values except for number 7, which was rated medium for urban quality of life.

Direct environmental consequences of allowing conflicting uses at this resource site are related to loss or degradation of wetland ecological values (ecological integrity, fish and wildlife habitat, sediment trapping, and nutrient retention). Residential structures (single family dwellings, multi-family dwellings) on fill would result in loss or alteration of wetland vegetation, and alteration of wetland hydrology. Allowing residential structures on piling would damage wetland vegetation and impair wildlife habitat values, but would leave wetland hydrology substantially unaltered. Development of a park or recreation area would conflict with wetland ecological values, at this wetland resource site. Placement of fill material for parking, tennis courts, playgrounds, restrooms and similar facilities commonly provided with park or recreation areas would alter wetland hydrology and eliminate wetland vegetation. Even without wetland fill, a park or recreation area that generates significant levels of human activity would degrade wetland wildlife habitat values. Installation and maintenance of above-ground utility lines may degrade wetland functions and values at this wetland resource site by requiring vegetation removal in the utility corridor. Underground utilities may also require vegetation removal for the corridor, and may interfere with wetland hydrology. A public or private school or college on this wetland resource site would have direct environmental consequences similar to those of any structure requiring fill. Fill for a school building and parking lot would alter wetland hydrology and eliminate wetland vegetation. Fill for a government or municipal structure, church, or community hall would have similar direct environmental impacts on wetland functions and values at this resource site. A bed and breakfast would probably have direct environmental consequences at this resource site similar to those of a residence.

Indirect environmental consequences of allowing conflicting uses at the Ocean wetland resource site include wetland habitat disturbance and loss. This indirect consequence is a result of human activity associated with normal residential use of residential structures. Examples of these types of disturbing residential activities include landscape maintenance and development, wildlife harassment by domestic dogs and cats, exterior lighting, and outdoor human recreation. The types of activities allowed in a residence in the Ocean wetland resource site include home occupation, residential home, residential facility, and family or adult day care. These activities generate a higher level of human activity than would typically be found in a single family residence. To the extent that these activities occur outside of the structure, wetland environmental functions and values would be impaired. A park or recreation area at this wetland resource site would generate indirect environmental consequences for wetland ecological functions and values. Outdoor human activity associated with a park or recreation area would be avoided by many wildlife species. A public or private school or college at this wetland resource site would have harmful indirect environmental consequences similar to those associated with a park or recreation area if a significant level of outdoor human activity were associated with this use. Government and municipal structures that have large parking lots or paved yards may degrade wetland water quality as a result of stormwater runoff. A bed and breakfast would probably generate indirect environmental impacts similar to those of a residence.

Direct environmental consequences of restricting conflicting uses and activities at the Ocean wetland resource site include a degree of protection for the wetland functions and values remaining at this resource site. A pile-supported residence would not impair wetland hydrology, but would alter wetland wildlife habitat. Prohibiting non-residential structures that might otherwise be allowed at this wetland resource site (government structures, churches, community meeting halls) would provide a degree of protection for remaining wetland values. Restricting fills for these structures would maintain wetland wildlife habitat values at their present moderate level. Prohibiting utility lines from crossing this wetland resource site would eliminate their environmental impacts on wetland vegetation and hydrology, and would help maintain wetland wildlife habitat. Restricting normal residential activities (outdoor recreation, landscaping, domestic pets, exterior lighting) would protect wetland wildlife habitat from the adverse impacts caused by these activities. Restricting nonresidential activities (such as hiking and vegetation management, which are not necessarily linked to residential development) would help protect wetland wildlife habitat at this resource site. Prohibiting bed and breakfasts at this wetland resource site would protect wetland resource values from the adverse environmental consequences of the bed and breakfast structure.

Indirect environmental consequences of restricting conflicting uses and activities in the Ocean drainage basin could include a degree of protection for the remaining wetland ecological functions and values at this resource site. Restricting residential development to a single unit per lot-of-record would keep residential density and associated human activity to a minimum level. Restricting outdoor human activities, such as those associated with a residence, home occupation, bed and breakfast, or day care center, would provide further protection for wetland resource values. Prohibiting non-residential structures (government structures, churches, community meeting halls) will protect the Ocean wetland resource site from the indirect environmental impacts of these uses: water quality degradation as a result of parking lot runoff, and wildlife disturbance from outdoor human activity and night lighting, for example.

Direct social consequences of allowing conflicting uses at the Ocean wetland resource site include loss of open space in the surrounding residential neighborhood and an incremental social loss related to degradation of wetland wildlife habitat. The Ocean wetland resource site provides open space benefits for neighboring property owners. Allowing development of any structure (residence, government or municipal building, church or community center) at this wetland resource site would reduce or eliminate these benefits. Development of any of the structures permitted at this wetland resource site would diminish wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social loss. The Ocean wetland resource site offers minimal flood protection value, so loss of this function may be of little consequence.

Indirect social consequences of allowing conflicting activities such as outdoor human activity, domestic pets, and exterior lighting at the Ocean wetland resource site may include an incremental erosion of the quality of life enjoyed in Cannon Beach as a result of the degradation and loss of wetland wildlife habitat. To the extent that the presence of wildlife in Cannon Beach is appreciated by residents and visitors, this represents a social loss. Development of any of the structures (residence, government or municipal building, church or community center) or activities (day care, bed and breakfast, or home occupation) allowed in the R-3 zone at this wetland resource site might also increase the level of human activity in the surrounding neighborhood, and lead to increased motor vehicle traffic on adjacent streets. Allowing residential use of the Ocean resource site would yield social benefits if it provided some relief to the housing shortage in the County. Allowing a park or recreation area at this resource site might provide social benefits related to outdoor recreation. Allowing institutional development (government or municipal building, church or community center, school) might yield social benefits related to the services provided in these buildings.

Direct social consequences of restricting conflicting uses at the Ocean wetlandresource site may include the preservation of open space in the residential neighborhood surrounding the resource site, and an incremental social benefit from preserving wetland wildlife habitat. The Ocean wetland resource site provides open space for neighboring property owners. Prohibiting any structure (residence, government or municipal building, church or community center) at this wetland resource site would preserve open space and secure the social benefits of open space. Prohibiting structures at this wetland resource site would protect wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit.

Indirect social consequences of restricting conflicting uses at the Ocean wetland resource site may include incremental improvement of the quality of life in Cannon Beach related to protection of wetland wildlife habitat. Activities that disrupt wildlife use at the Ocean wetland resource site, such as outdoor human activity, diminish the site's wetland wildlife habitat value. Restricting these activities would help preserve existing wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting park or recreation area at this resource site might deny neighboring residents the social benefits related to a nearby outdoor recreation site. Prohibiting institutional development (government or municipal building, church or community center, school) might impair delivery of the social services provided in these buildings. Prohibiting all human activity at this resource site would require extraordinary intervention by the City into areas not normally subject to city regulation. The social costs of this level of intervention would be significant.

Direct economic consequences of allowing conflicting uses at the Ocean wetland resource site include the price difference between the site as buildable land, and as unbuildable land. The size of this avoided loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. The price difference between a buildable and an unbuildable residential lot may be significant. An economic consequence of allowing utility lines to cross this wetland resource site may be cost-efficient location of utility corridors.

Indirect economic consequences of allowing conflicting uses at the Ocean wetland resource site include possible loss of property value for adjacent residential land owners. Residential land values in Cannon Beach are relatively high for many reasons, including the increasing scarcity of vacant buildable land, and the proximity of many residential sites to wetland open space areas. Allowing residential development of the Ocean wetland resource site will eliminate the adjacent open space benefits enjoyed by neighboring residential property. This could reduce the value of adjacent residential land. An indirect economicbenefit is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are allowed will be relatively higher than if residential uses are restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

Direct economic consequences of restricting conflicting uses at the Ocean wetland resource site include the price difference between the wetland resource site as buildable vacant land, and as unbuildable land. The size of this economic loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. An economic consequence of prohibiting utility corridors from crossing this wetland resource site might be higher utility installation and maintenance costs caused by sub-optimal utility corridor locations.
Indirect economic consequences of restricting conflicting uses at the Ocean wetland resource site may include relatively higher property value for adjacent residential lands. Residential land values in Cannon Beach are high for many reasons, including the increasing scarcity of vacant buildable land in the community, and the proximity of many residential sites to unbuildable wetland open space areas. Restricting development at this resource site will help maintain the adjacent open space benefits enjoyed by neighboring residential property. An additional indirect economic consequence is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are restricted will be relatively lower than if

residential uses were un-restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

No direct energy consequences of allowing conflicting uses on the Ocean drainage basin wetland resource site have been identified.

Indirect energy consequences of allowing conflicting uses in the Ocean drainage basin wetland resource site may include the expenditure of the energy related to development of a structure on the site. Different energy expenditures may be required for construction of a pile-supported structure compared to a structure on fill compared to a structure at a nonwetland site.

No direct energy consequences of restricting conflicting uses on the Ocean drainage basin wetland resource site have been identified.

Indirect energy consequences of restricting conflicting uses in the Ocean drainage basin wetland resource site may include the energy savings related to preventing construction at the site. Different energy expenditures may be required for construction of a pilesupported structure compared to a structure on fill compared to a structure at a non-wetland site.

Conclusion: Based on the evaluation of this resource site's wetland functions and values, and based on this analysis of environmental, social, economic and energy consequences of allowing and restricting conflicting uses and activities, the City should provide partial protection for this resource site. The overlay zone and associated standards described elsewhere provide an appropriate level of protection given these factors.

Tolovana Drainage Basin Wetland Resource Site

The Tolovana resource site contains three individual wetlands (index numbers 30, 31, and 46) in the Limited Commercial (C-1) zone, the Residential Moderate Density (R2) zone, and the Residential Very Low Density (RVL) zone. Potentially conflicting uses allowed in these zones include:

Duplex
Single family dwelling
Cottage industry
Day care center
Family, adult day care center
Residential home, residential facility
Home occupation
Temporary manufactured dwelling or recreational vehicle
Multi-family dwelling
Gas station
Church or community meeting hall
Government or municipal structure
Repair & maintenance service
Retail trade establishment
Structural shoreline stabilization
Business or professional offices
Forest management
Garden store
Public or private school or college
Utility lines
Parks or public recreation area
Arts & crafts gallery or studio
Plant nursery
Cabinet shop, trade or craft shop
Parking lot
Building materials sales
Financial institution
Theater
Personal or business service
Eating & drinking establishment.

Unregulated conflicting activities also occur or could occur at this resource site. These conflicting uses and activities are described in more detail elsewhere. The Tolovana wetland resource site was rated *low* in terms of all rated wetland functions and values.

Direct environmental consequences of allowing conflicting uses at this resource siteare related to loss of wetland ecological values: wetland wildlife habitat, ecological integrity, nutrient retention, and sediment trapping. Commercial structures and uses (gas station, repair or maintenance facility, retail trade establishment, business or professional offices, garden store, arts & crafts gallery or studio, plant nursery, cabinet shop, building material sales, bank, theater, personal or business service establishment, restaurant or bar) on fill would result in the loss or alteration of wetland vegetation and hydrology. This would damage or eliminate the higher-rated wetland functions and values mentioned above. Residential structures (single family residence, duplex, multi-family structure, temporary RV) on fill would result in loss or alteration of wetland vegetation and wetland hydrology. Allowing residential structures on piling would damage wetland vegetation, but would leave wetland hydrology substantially unaltered. Development of a park or recreation area would conflict with wetland ecological values at this wetland resource site. Placement of fill material for parking, tennis courts, playgrounds, restrooms and similar facilities commonly provided with park or recreation areas would alter wetland hydrology and eliminate wetland vegetation. Even without wetland fill, a park or recreation area that generates significant levels of human activity would degrade wetland wildlife habitat values. Installation and maintenance of above-ground utility lines may degrade wetland functions and values at this wetland resource site by requiring vegetation removal in the utility corridor. Underground utilities may also require vegetation removal for the corridor, and may interfere with wetland hydrology. A public or private school or college on this wetland resource site would have direct environmental consequences similar to those of any structure requiring fill. Fill for a school building and parking lot would alter wetland hydrology and eliminate wetland vegetation. Fill for a government or municipal structure, church, or community hall would have similar direct environmental impacts on wetland functions and values at this resource site. Development of a parking lot, allowed in the C-1 zone, would require wetland fill. It would diminish or eliminate all of the higher-rated wetland values at this resource site. Wetland water quality and aquatic habitat could be degraded if contaminated parking lot runoff entered the wetland. Forest management would diminish wetland ecological values by removing vegetation and disturbing soils.

Indirect environmental consequences of allowing conflicting uses at the Tolovana wetland resource site include wetland habitat disturbance and loss. This indirect consequence is a result of human activity associated with normal commercial activities, and with residential use of residential structures. Disruptive commercial activities include human activity, outdoor storage, parking, exterior lighting. Examples of these types of disturbing residential activities include landscape maintenance and development, wildlife harassment by domestic dogs and cats, exterior lighting, and outdoor human recreation. The types of activities allowed in a residence in the Tolovana wetland resource site include home occupation, cottage industry, residential home, residential facility, and family or adult day care. These activities generate a higher level of human activity than would typically be found in a single family residence. To the extent that these activities occur outside of the structure, wetland environmental functions and values would be impaired. A park or recreation area at this wetland resource site would generate indirect environmental consequences for wetland functions and values. Outdoor human activity associated with apark or recreation area would be avoided by many wildlife species. A public or private school or college at this wetland resource site would have harmful indirect environmental consequences similar to those associated with a park or recreation area if a significant level of outdoor human activity were associated with this use. Government and municipal structures that have large parking lots or paved yards may degrade wetland water quality as a result of stormwater runoff.

Direct environmental consequences of restricting conflicting uses and activities at the Tolovana wetland resource site include a degree of protection for the wetland functions and values remaining at this resource site, especially urban quality of life, recreation values, environmental integrity, wildlife habitat, noteworthiness, and educational potential. A pilesupported residence would not impair wetland hydrology, but would alter wetland wildlife habitat and environmental integrity. Prohibiting non-residential structures that might otherwise be allowed at this wetland resource site (commercial or institutional structures) would provide a degree of protection for remaining wetland values. Restricting fills for these structures would maintain wetland wildlife habitat and ecological integrity. Prohibiting utility lines from crossing this wetland resource site would eliminate their environmental impacts on wetland vegetation and hydrology, and would help maintain wetland wildlife habitat. Restricting normal residential activities (outdoor recreation, landscaping, domestic pets, exterior lighting) would protect wetland wildlife habitat from the adverse impacts caused by these activities. Restricting non-residential activities (such as hiking and vegetation management, which are not necessarily linked to residential development) would help protect wetland wildlife habitat and environmental integrity at this resource site. Prohibiting parking lot development at this site would protect wetland values prone to damage from fill: urban quality of life, environmental integrity, wildlife habitat, noteworthiness, educational potential, fish habitat, flood control, sediment trapping, and nutrient retention. Restricting forest management activities at this resource site would facilitate maintenance of wetland ecological values and functions.

Indirect environmental consequences of restricting conflicting uses and activities at the Tolovana resource site could include a degree of protection for the remaining wetland functions and values at this resource site, particularly those associated with wildlife habitat and ecological integrity. Restricting residential development to a single unit per lot-of-record would keep residential density and associated human activity to a minimum level. Restricting outdoor human activities would provide further protection for wetland resource values. Prohibiting commercial and residential structures will protect the Tolovana wetland resource site from the indirect environmental impacts of these uses: water quality degradation as a result of parking lot runoff, and wildlife disturbance from outdoor human activity and night lighting, for example.

Direct social consequences of allowing conflicting uses at the Tolovana wetland resource site include loss of open space in the surrounding neighborhood and an incremental social loss related to degradation of wetland wildlife habitat and ecological integrity. The Tolovana wetland resource site provides open space benefits for neighboring property owners. Allowing development of any structure (residential, commercial or institutional) at this wetland resource site would reduce or eliminate these benefits. Development of any of the structures permitted at this wetland resource site would diminish wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social loss. The Tolovana wetland resource site offers minimal flood protection value, so loss of this function may be of little consequence. Forest management activities would remove trees from this wetland resource site and diminish wetland social values, including urban quality of life values.

Indirect social consequences of allowing conflicting activities such as outdoor human activity, domestic pets, and exterior lighting at the Tolovana wetland resource site may include an incremental erosion of the quality of life enjoyed in Cannon Beach as a result of the degradation and loss of urban quality of life values and wetland wildlife habitat values. To the extent that the presence of wildlife in Cannon Beach is appreciated by residents and visitors, this represents a social loss. Development of any of the structures (residence, commercial building, institutional structure) or activities allowed in the C-1 zone at this wetland resource site might also increase the level of human activity in the surrounding neighborhood, and lead to increased motor vehicle traffic on adjacent streets. Allowing residential use of the Tolovana resource site would yield social benefits if it provided some relief to the housing shortage in the County. Allowing a park or recreation area at this resource site might provide social benefits related to outdoor recreation. Allowing institutional development (government or municipal building, church or community center, school) might yield social benefits related to the services provided in these buildings.

Direct social consequences of restricting conflicting uses at the Tolovana wetland resource site may include the preservation of open space in the neighborhood surrounding the resource site, and an incremental social benefit from preserving urban quality of life values and wetland wildlife habitat. The Tolovana wetland resource site provides open space for neighboring property owners. Prohibiting any structure (residence, commercial structure, institutional facility) at this wetland resource site would preserve open space and secure the social benefits of open space. Prohibiting structures at this wetland resource site would protect wetland values: urban quality of life, recreation values, environmental integrity, wildlife habitat, noteworthiness, and educational potential. To the extent that residents and visitors appreciate these wetland functions and values in Cannon Beach, this represents a social benefit. This resource site's educational potential would be preserved if conflicting uses that required fill or vegetation removal were prohibited. Restricting forest management would help maintain trees on the site, and would preserve wetland social values and functions, like urban quality of life values, related to these trees.

Indirect social consequences of restricting conflicting uses at the Tolovana wetland resource site may include incremental improvement of the quality of life in Cannon Beach related to protection of urban quality of life, wetland wildlife habitat, and other wetland functions and values associated with this resource site. Activities that disrupt wildlife use at the Tolovana wetland resource site, such as outdoor human activity, diminish the site's wetland wildlife habitat value. Restricting these activities would help preserve existing wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting park or recreation area at this resource site might deny neighboring residents the social benefits related to a nearby outdoor recreation site. Prohibiting institutional development (government or municipal building, church or community center, school) might impair delivery of the social services provided in these buildings. Prohibiting all human activity at this resource site would require extraordinary intervention by the City into areas not normally subject to city regulation. The social costs of this level of intervention would be significant.

Direct economic consequences of allowing conflicting uses at the Tolovana wetland resource site include the price difference between the site as buildable land, and as unbuildable land. The size of this avoided loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. The price difference between a buildable and an unbuildable commercial lot may be significant. An economic consequence of allowing utility lines to cross this wetland resource site may be cost-efficient location of utility corridors. Allowing forest management activities maintains the element of this site's value associated with merchantable timber.

Indirect economic consequences of allowing conflicting uses at the Tolovana wetland resource site include possible loss of property value for adjacent land owners. Land values in Cannon Beach are relatively high for many reasons, including the increasing scarcity of vacant buildable land, and the proximity of some developable sites to wetland open space or forested wetland areas. Allowing commercial, residential or institutional development at the Tolovana wetland resource site will eliminate the adjacent open space benefits enjoyed by neighboring property. This could reduce the value of adjacent land. An indirect economic benefit is realized by taxing districts that assess property taxes on this site. The assessed value of the site if development is allowed will be relatively higher than if development is restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

Direct economic consequences of restricting conflicting uses at the Tolovana wetland resource site include the price difference between the wetland resource site as buildable vacant land, and as unbuildable land. The size of this economic loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. An economic consequence of prohibiting utility corridors from crossing this wetland resource sitemight be higher utility installation and maintenance costs caused by sub-optimal utility corridor locations. Prohibiting forest management would remove the component of the site's value associated with merchantable timber on the site.

Indirect economic consequences of restricting conflicting uses at the Tolovana wetland resource site may include relatively higher property value for adjacent lands. Real estate values in Cannon Beach are high for many reasons, including the increasing scarcity of vacant buildable land in the community, and the proximity of many developable sites to unbuildable wetland open space areas. Restricting development at this resource site will help maintain the adjacent open space benefits enjoyed by neighboring property. An additional indirect economic consequence is realized by taxing districts that assess property taxes on this site. The assessed value of the site if development is restricted will be relatively lower than if commercial, residential or institutional development were un-restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

No direct energy consequences of allowing conflicting uses on the Tolovana wetland resource site have been identified.

Indirect energy consequences of allowing conflicting uses in the Tolovana wetland resource site may include the expenditure of the energy related to construction at the site. Different energy expenditures may be required for construction of a pile-supported building compared to a structure on fill compared to construction at a non-wetland site.

No direct energy consequences of restricting conflicting uses on the Tolovana wetland resource site have been identified.

Indirect energy consequences of restricting conflicting uses in the Tolovana wetland resource site may include the energy savings related to preventing development on the site. Different energy expenditures may be required for construction of a pile-supported building compared to one on fill compared to a structure at a non-wetland site.

Conclusion: Based on the evaluation of this resource site's wetland functions and values, and based on this analysis of environmental, social, economic and energy consequences of allowing and restricting conflicting uses and activities, the City should provide partial protection for this resource site. The overlay zone and associated standards described elsewhere provide an appropriate level of protection given these factors.

Umpqua Drainage Basin Wetland Resource Site

The Umpqua resource site contains two wetlands (inventory numbers 36 and 47) in the Residential High Density (R-3) zone and the Residential Moderate Density (R-1) zone. Potentially conflicting uses allowed in these zones include:

Single family dwellings, multi-family dwellings
Parks or public recreation areas
Utility lines
Temporary manufactured dwelling or recreation vehicle
Home occupation
Residential home, residential facility
Family, adult day care center
Public or private school or college
Government or municipal structure
Day care center
Bed and breakfast
Church or community meeting hall.

Unregulated conflicting activities also occur or could occur at this resource site. These conflicting uses and activities are described in more detail elsewhere. The Umpqua resource site rated low on all wetland functions and values.

Direct environmental consequences of allowing conflicting uses at this resource site are related to loss or degradation of wetland ecological values (ecological integrity, fish and wildlife habitat, sediment trapping, and nutrient retention). Residential structures (single family dwellings, multi-family dwellings) on fill would result in loss or alteration of wetland vegetation, and alteration of wetland hydrology. Allowing residential structures on piling would damage wetland vegetation and impair wildlife habitat values, but would leave wetland hydrology substantially unaltered. Development of a park or recreation area would conflict with wetland ecological values, at this wetland resource site. Placement of fill material for parking, tennis courts, playgrounds, restrooms and similar facilities commonly provided with park or recreation areas would alter wetland hydrology and eliminate wetland vegetation. Even without wetland fill, a park or recreation area that generates significant levels of human activity would degrade wetland wildlife habitat values. Installation and maintenance of above-ground utility lines may degrade wetland functions and values at this wetland resource site by requiring vegetation removal in the utility corridor. Underground utilities may also require vegetation removal for the corridor, and may interfere with wetland hydrology. A public or private school or college on this wetland resource site would have direct environmental consequences similar to those of any structure requiring fill. Fill for a school building and parking lot would alter wetland hydrology and eliminate wetland vegetation. Fill for a government or municipal structure, church, or community hall would have similar direct environmental impacts on wetland functions and values at this resource site. A bed and breakfast would probably have direct environmental consequences at this resource sitesimilar to those of a residence.

Indirect environmental consequences of allowing conflicting uses at the Umpqua wetland resource site include wetland habitat disturbance and loss. This indirect consequence is a result of human activity associated with normal residential use of residential structures. Examples of these types of disturbing residential activities include landscape maintenance and development, wildlife harassment by domestic dogs and cats, exterior lighting, and outdoor human recreation. The types of activities allowed in a residence in the Umpqua wetland resource site include home occupation, residential home, residential facility, and family or adult day care. These activities generate a higher level of human activity than would typically be found in a single family residence. To the extent that these activities occur outside of the structure, wetland environmental functions and values would be impaired. A park or recreation area at this wetland resource site would generate indirect environmental consequences for wetland ecological functions and values. Outdoor human activity associated with a park or recreation area would be avoided by many wildlife species. A public or private school or college at this wetland resource site would have harmful indirect environmental consequences similar to those associated with a park or recreation area if a significant level of outdoor human activity were associated with this use. Government and municipal structures that have large parking lots or paved yards may degrade wetland water quality as a result of stormwater runoff. A bed and breakfast would probably generate indirect environmental impacts similar to those of a residence.

Direct environmental consequences of restricting conflicting uses and activities at the Umpqua wetland resource site include a degree of protection for the wetland functions and values remaining at this resource site. A pile-supported residence would not impair wetland hydrology, but would alter wetland wildlife habitat. Prohibiting non-residential structures that might otherwise be allowed at this wetland resource site (government structures, churches, community meeting halls) would provide a degree of protection for remaining wetland values. Restricting fills for these structures would maintain wetland wildlife habitat values at their present moderate level. Prohibiting utility lines from crossing this wetland resource site would eliminate their environmental impacts on wetland vegetation and hydrology, and would help maintain wetland wildlife habitat. Restricting normal residential activities (outdoor recreation, landscaping, domestic pets, exterior lighting) would protect wetland wildlife habitat from the adverse impacts caused by these activities. Restricting nonresidential activities (such as hiking and vegetation management, which are not necessarily linked to residential development) would help protect wetland wildlife habitat at this resource site. Prohibiting bed and breakfasts at this wetland resource site would protect wetland resource values from the adverse environmental consequences of the bed and breakfast structure.

Indirect environmental consequences of restricting conflicting uses and activities in the Umpqua drainage basin could include a degree of protection for the remaining wetland ecological functions and values at this resource site. Restricting residential development to a single unit per lot-of-record would keep residential density and associated human activity to a minimum level. Restricting outdoor human activities, such as those associated with a residence, home occupation, bed and breakfast, or day care center, would provide further protection for wetland resource values. Prohibiting non-residential structures (government structures, churches, community meeting halls) will protect the Umpqua wetland resource site from the indirect environmental impacts of these uses: water quality degradation as a result of parking lot runoff, and wildlife disturbance from outdoor human activity and night lighting, for example.

Direct social consequences of allowing conflicting uses at the Umpqua wetland resource site include loss of open space in the surrounding residential neighborhood and an incremental social loss related to degradation of wetland wildlife habitat. The Umpqua wetland resource site provides open space benefits for neighboring property owners. Allowing development of any structure (residence, government or municipal building, church or community center) at this wetland resource site would reduce or eliminate these benefits. Development of any of the structures permitted at this wetland resource site would diminish wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social loss. The Umpqua wetland resource site offers minimal flood protection value, so loss of this function may be of little consequence.

Indirect social consequences of allowing conflicting activities such as outdoor human activity, domestic pets, and exterior lighting at the Umpqua wetland resource site may include an incremental erosion of the quality of life enjoyed in Cannon Beach as a result of the degradation and loss of wetland wildlife habitat. To the extent that the presence of wildlife in Cannon Beach is appreciated by residents and visitors, this represents a social loss. Development of any of the structures (residence, government or municipal building, church or community center) or activities (day care, bed and breakfast, or home occupation) allowed in the R-3 zone at this wetland resource site might also increase the level of human activity in the surrounding neighborhood, and lead to increased motor vehicle traffic on adjacent streets. Allowing residential use of the Umpqua resource site would yield social benefits if it provided some relief to the housing shortage in the County. Allowing a park or recreation area at this resource site might provide social benefits related to outdoor recreation. Allowing institutional development (government or municipal building, church or community center, school) might yield social benefits related to the services provided in these buildings.

Direct social consequences of restricting conflicting uses at the Umpqua wetland resource site may include the preservation of open space in the residential neighborhood surrounding the resource site, and an incremental social benefit from preserving wetland wildlife habitat. The Umpqua wetland resource site provides open space for neighboring property owners. Prohibiting any structure (residence, government or municipal building, church or community center) at this wetland resource site would preserve open space and secure the social benefits of open space. Prohibiting structures at this wetland resource site would protect wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit.

Indirect social consequences of restricting conflicting uses at the Umpqua wetland resource site may include incremental improvement of the quality of life in Cannon Beach related to protection of wetland wildlife habitat. Activities that disrupt wildlife use at the Umpqua wetland resource site, such as outdoor human activity, diminish the site's wetland wildlife habitat value. Restricting these activities would help preserve existing wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting park or recreation area at this resource site might deny neighboring residents the social benefits related to a nearby outdoor recreation site. Prohibiting institutional development (government or municipal building, church or community center, school) might impair delivery of the social services provided in these buildings. Prohibiting all human activity at this resource site would require extraordinary intervention by the City into areas not normally subject to city regulation. The social costs of this level of intervention would be significant.

Direct economic consequences of allowing conflicting uses at the Umpqua wetland resource site include the price difference between the site as buildable land, and as unbuildable land. The size of this avoided loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. The price difference between a buildable and an unbuildable residential lot may be significant. An economic consequence of allowing utility lines to cross this wetland resource site may be cost-efficient location of utility corridors.

Indirect economic consequences of allowing conflicting uses at the Umpqua wetland resource site include possible loss of property value for adjacent residential land owners. Residential land values in Cannon Beach are relatively high for many reasons, including the increasing scarcity of vacant buildable land, and the proximity of many residential sites to wetland open space areas. Allowing residential development of the Umpqua wetland resource site will eliminate the adjacent open space benefits enjoyed by neighboringresidential property. This could reduce the value of adjacent residential land. An indirect economic benefit is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are allowed will be relatively higher than if residential uses are restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

Direct economic consequences of restricting conflicting uses at the Umpqua wetland resource site include the price difference between the wetland resource site as buildable vacant land, and as unbuildable land. The size of this economic loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. An economic consequence of prohibiting utility corridors from crossing this wetland resource site might be higher utility installation and maintenance costs caused by sub-optimal utility corridor locations.

Indirect economic consequences of restricting conflicting uses at the Umpqua wetland resource site may include relatively higher property value for adjacent residential lands. Residential land values in Cannon Beach are high for many reasons, including the increasing scarcity of vacant buildable land in the community, and the proximity of many residential sites to unbuildable wetland open space areas. Restricting development at this resource site will help maintain the adjacent open space benefits enjoyed by neighboring residential property. An additional indirect economic consequence is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are restricted will be relatively lower than if residential uses were un-restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

No direct energy consequences of allowing conflicting uses on the Umpqua drainage basin wetland resource site have been identified.

Indirect energy consequences of allowing conflicting uses in the Umpqua drainage basin wetland resource site may include the expenditure of the energy related to development of a structure on the site. Different energy expenditures may be required for construction of a pile-supported structure compared to a structure on fill compared to a structure at a nonwetland site.

No direct energy consequences of restricting conflicting uses on the Umpqua drainagebasin wetland resource site have been identified.

Indirect energy consequences of restricting conflicting uses in the Umpqua drainage basin wetland resource site may include the energy savings related to preventing construction at the site. Different energy expenditures may be required for construction of a pilesupported structure compared to a structure on fill compared to a structure at a non-wetland site.

Conclusion: Based on the evaluation of this resource site's wetland functions and values, and based on this analysis of environmental, social, economic and energy consequences of allowing and restricting conflicting uses and activities, the City should provide partial protection for this resource site. The overlay zone and associated standards described elsewhere provide an appropriate level of protection given these factors.

Unnamed Drainage Basin Wetland Resource Site

The Unnamed wetland resource site contains a single wetland (inventory number 49) in the Residential Lower Density (RL) zone. Potentially conflicting uses allowed at the Unnamed wetland resource site include:

Single family dwelling
Day care center
Family, adult day care center
Residential home, residential facility
Home occupation
Temporary manufactured dwelling or recreational vehicle
Church or community meeting hall
Government or municipal structure
Structural shoreline stabilization
Public or private school or college
Utility lines
Parks or public recreation area

Unregulated conflicting activities also occur or could occur at this resource site. These conflicting uses and activities are described in more detail elsewhere. The Unnamed wetland resource site was rated low in terms of all wetland functions and values.

Direct environmental consequences of allowing conflicting uses at this resource site are related to loss of wetland ecological functions and values. Residential structures (single family dwellings, temporary manufactured dwelling, or temporary recreational vehicle) on fill would result in loss or alteration of wetland vegetation, and alteration of wetland hydrology. Allowing residential structures on piling would damage wetland vegetation and impair wildlife habitat values, but would leave wetland hydrology substantially unaltered. Development of a park or recreation area would conflict with wetland ecological values at this wetland resource site. Placement of fill material for parking, tennis courts, playgrounds, restrooms and similar facilities commonly provided with park or recreation areas would alter wetland hydrology and eliminate wetland vegetation. Even without wetland fill, a park or recreation area that generates significant levels of human activity would degrade wetland ecological values. Installation and maintenance of above-ground utility lines may degrade wetland functions and values at this wetland resource site by requiring vegetation removal in the utility corridor. Underground utilities may also require vegetation removal for the corridor, and may interfere with wetland hydrology. A public or private school or college on this wetland resource site would have direct environmental consequences similar to those of any structure requiring fill. Fill for a school building and parking lot would alter wetland hydrology and eliminate wetland vegetation. Fill for a government or municipal structure,church, or community hall would have similar direct environmental impacts on wetland functions and values at this resource site.

Indirect environmental consequences of allowing conflicting uses at the Unnamed wetland resource site include wetland habitat disturbance and loss. This indirect consequence is a result of human activity associated with normal residential use of residential structures. Examples of these types of disturbing residential activities include landscape maintenance and development, wildlife harassment by domestic dogs and cats, exterior lighting, and outdoor human recreation. The types of activities allowed in a residence in the Unnamed wetland resource site include home occupation, residential home, residential facility, and family or adult day care. These activities generate a higher level of human activity than would typically be found in a single family residence. To the extent that these activities occur outside of the structure, wetland environmental functions and values would be impaired. A park or recreation area at this wetland resource site would generate indirect environmental consequences for wetland functions and values, especially wildlife habitat. Outdoor human activity associated with a park or recreation area would be avoided by many wildlife species. A public or private school or college at this wetland resource site would have harmful indirect environmental consequences similar to those associated with a park or recreation area if a significant level of outdoor human activity were associated with this use. Government and municipal structures that have large parking lots or paved yards may degrade wetland water quality as a result of stormwater runoff.

Direct environmental consequences of restricting conflicting uses and activities at the Unnamed wetland resource site include a degree of protection for the wetland functions and values remaining at this resource site, notably wildlife habitat. A pile-supported residence would not impair wetland hydrology, but would alter wetland wildlife habitat. Prohibiting non-residential structures that might otherwise be allowed at this wetland resource site (government structures, churches, community meeting halls) would provide a degree of protection for remaining wetland values. Restricting fills for these structures would maintain wetland wildlife habitat values at their present moderate level. Prohibiting utility lines from crossing this wetland resource site would eliminate their environmental impacts on wetland vegetation and hydrology, and would help maintain wetland wildlife habitat. Restricting normal residential activities (outdoor recreation, landscaping, domestic pets, exterior lighting) would protect wetland wildlife habitat from the adverse impacts caused by these activities. Restricting non-residential activities (such as hiking and vegetation management, which are not necessarily linked to residential development) would help protect wetland wildlife habitat at this resource site.

Indirect environmental consequences of restricting conflicting uses and activities in the Unnamed drainage basin could include a degree of protection for the remaining wetland functions and values at this resource site, particularly those associated with wildlife habitat. Restricting residential development to a single unit per lot-of-record would keep residential density and associated human activity to a minimum level. Restricting outdoor human activities, such as those associated with a residence, home occupation, or day care center, would provide further protection for wetland resource values. Prohibiting non-residential structures (government structures, churches, community meeting halls) will protect the Unnamed wetland resource site from the indirect environmental impacts of these uses: water quality degradation as a result of parking lot runoff, and wildlife disturbance from outdoor human activity and night lighting, for example.

Direct social consequences of allowing conflicting uses at the Unnamed wetland resource site include loss of open space in the surrounding residential neighborhood and an incremental social loss related to degradation of wetland wildlife habitat. The Unnamed wetland resource site provides open space benefits for neighboring property owners. Allowing development of any structure (residence, day care facility, government or municipal building, church or community center) at this wetland resource site would reduce or eliminate these benefits. Development of any of the structures permitted at this wetland resource site would diminish wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social loss. The Unnamed wetland resource site offers minimal flood protection value, so loss of this function may be of little consequence.

Indirect social consequences of allowing conflicting activities such as outdoor human activity, domestic pets, and exterior lighting at the Unnamed wetland resource site may include an incremental erosion of the quality of life enjoyed in Cannon Beach as a result of the degradation and loss of wetland wildlife habitat. To the extent that the presence of wildlife in Cannon Beach is appreciated by residents and visitors, this represents a social loss. Development of any of the structures (residence, government or municipal building, church or community center) or activities (day care, or home occupation) allowed at this wetland resource site might also increase the level of human activity in the surrounding neighborhood, and lead to increased motor vehicle traffic on adjacent streets. Allowing residential use of the Unnamed resource site would yield social benefits if it provided some relief to the housing shortage in the County. Allowing a park or recreation area at this resource site might provide social benefits related to outdoor recreation. Allowing institutional development (government or municipal building, church or community center, school) might yield social benefits related to the services provided in these buildings.

Direct social consequences of restricting conflicting uses at the Unnamed wetland resource site may include the preservation of open space in the residential neighborhood surrounding the resource site, and an incremental social benefit from preserving wetland wildlife habitat. The Unnamed wetland resource site provides open space for neighboringproperty owners. Prohibiting any structure (residence, government or municipal building, church or community center) at this wetland resource site would preserve open space and secure the social benefits of open space. Prohibiting structures at this wetland resource site would protect wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit.

Indirect social consequences of restricting conflicting uses at the Unnamed wetland resource site may include incremental improvement of the quality of life in Cannon Beach related to protection of wetland wildlife habitat. Activities that disrupt wildlife use at the Unnamed wetland resource site, such as outdoor human activity, diminish the site's wetland wildlife habitat value. Restricting these activities would help preserve existing wetland wildlife habitat values. To the extent that residents and visitors appreciate the presence of wildlife in Cannon Beach, this represents a social benefit. Prohibiting park or recreation area at this resource site might deny neighboring residents the social benefits related to a nearby outdoor recreation site. Prohibiting institutional development (government or municipal building, church or community center, school) might impair delivery of the services provided in these buildings. Prohibiting all human activity at this resource site would require extraordinary intervention by the City into areas not normally subject to city regulation. The social costs of this level of intervention would be significant.

Direct economic consequences of allowing conflicting uses at the Unnamed wetland resource site include the price difference between the site as buildable land, and as unbuildable land. The size of this avoided loss would vary depending on which of the several conflicting uses allowed at this resource site are considered. The price difference between a buildable and an unbuildable residential lot may be significant.

Indirect economic consequences of allowing conflicting uses at the Unnamed wetland resource site include possible loss of property value for adjacent residential land owners. Residential land values in Cannon Beach are relatively high for many reasons, including the increasing scarcity of vacant buildable land, and the proximity of some residential sites to wetland open space areas. An indirect economic benefit is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are allowed will be relatively higher than if residential uses are restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts. An economic consequence of allowing utility lines to cross this wetland resource site may be cost-efficient location of utility corridors. An economic consequence of allowing institutional development (government or municipal building, church or community center, school) at this wetland resource site may be cost-efficient location of these structures.

Direct economic consequences of restricting conflicting uses at the Unnamed wetland resource site include the price difference between the wetland resource site as buildable vacant land, and as unbuildable land. The size of this economic loss would vary depending on which of the various conflicting uses allowed at this resource site are considered. An economic consequence of prohibiting utility corridors from crossing this wetland resource site might be higher utility installation and maintenance costs caused by sub-optimal utility corridor locations.

Indirect economic consequences of restricting conflicting uses at the Unnamed wetland resource site may include relatively higher property value for adjacent residential lands. Residential land values in Cannon Beach are high for many reasons, including the increasing scarcity of vacant buildable land in the community, and the proximity of some residential sites to unbuildable wetland open space areas. Restricting conflicting development at this resource site will help maintain these benefits enjoyed by neighboring residential property. An additional indirect economic consequence is realized by taxing districts that assess property taxes on this site. The assessed value of the site if residential uses are restricted will be relatively lower than if residential uses were un-restricted. This increment affects the amount of property tax paid by the owner of this site to the various taxing districts.

No direct energy consequences of allowing conflicting uses on the Unnamed drainage basin wetland resource site have been identified.

Indirect energy consequences of allowing conflicting uses in the Unnamed drainage basin wetland resource site may include the expenditure of the energy related to development of a structure on the site. Different energy expenditures may be required for construction of a pile-supported structure compared to a structure on fill compared to a structure at a nonwetland site.

No direct energy consequences of restricting conflicting uses on the Unnamed drainage basin wetland resource site have been identified.

Indirect energy consequences of restricting conflicting uses in the Unnamed drainage basin wetland resource site may include the energy savings related to preventing construction at the site. Different energy expenditures may be required for construction of a pilesupported structure compared to a structure on fill compared to a structure at a non-wetland site.

Conclusion: Based on the evaluation of this resource site's wetland functions and values, and based on this analysis of environmental, social, economic and energy consequences of allowing and restricting conflicting uses and activities, the City should provide partial protection for this resource site. The overlay zone and associated standards described elsewhere provide an appropriate level of protection given these factors.

SITE SUMMARY

SITE NO.: 1 **ACRES:** NA **NWI CLASSIFICATION:** R, seasonal
LOCATION: Between Hwy 101 and Logan St., southern end of City **BASIN NAME:** Logan
TAX MAP NO.: 4106CB **TAX LOTS:** 3405, 3406, 3407 **DATE OF INVENTORY:** 4/20/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

Based on best professional judgment and field assessment methods

GENERAL DESCRIPTION This site is a small, narrow seasonal stream channel averaging 5 ft. wide and 5 in. deep, located between Hwy 101 and Logan Lane. It is culverted under a homesite and Logan Road. Above the culvert, two channels combine into one and the wetland at the confluence is approximately 30 ft. wide. Vegetation is dominated by a dense salmonberry thicket with red alder canopy. Other species include twinberry, red elderberry, lady fern, bulrush, rush, buttercup and water parsley. Coarse woody debris is abundant and provides cover for small wildlife species. Adjacent hillslopes are steep, and the wetland boundary occurs at the toe of the slope where sword fern occurs.

WETLAND FUNCTIONAL VALUES All of the functional values rated low due to the small size of the drainage and the level of existing disturbance from residential development, construction of Highway 101, and upstream logging.

IMPACTS/DISTURBANCES Filling and culverting of channel.

SIGNIFICANCE Low. This stream and riparian community has wildlife value but it is small and isolated from other natural areas by Highway 101. Consequently, it is primarily important for drainage runoff and is rated low relative to other Cannon Beach Wetlands.

SITE SUMMARY

SITE NO.: 2 **ACRES:** NA **NWI CLASSIFICATION:** R, seasonal
LOCATION: Between Hwy 101 and Logan Lane, south end of City. **BASIN:** Maher
TAX MAP NO.: 4106CB **TAX LOTS:** 3408, 3411 **DATE OF INVENTORY:** 4/20/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Two small tributaries join to form one channel averaging 5 ft. wide and 5 in. deep east of Logan Lane. Hillslopes are very steep and stream is high gradient. Second growth spruce and alder dominate the canopy with western red cedar present. The understory is dominated by salal, sword fern, false lily-of-the-valley and lady fern. The wetland is limited to the channel except west of Logan Lane where a pocket of slough sedge approximately 20 ft. wide occurs. In this area the stream is ditched along a beach access path below Logan Lane until it reaches the beach. This site is bounded by residential development.

WETLAND FUNCTIONAL VALUES All of the functional values rated low because of the high level of disturbance (ditching , culverting, etc.) along this drainage.

IMPACTS/DISTURBANCES Most of the channel has been ditched or culverted. English ivy is spreading into the riparian zone; it should be removed before it degrades native flora.

SIGNIFICANCE Low. Because of its small size and disturbance factors, this site is primarily important for drainage runoff.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 3 **ACRES:** NA **NWI CLASSIFICATION:** R, seasonal
LOCATION: Between Maher St. and West Way **BASIN:** Atkins
TAX MAP NO.: 4106CB **TAX LOTS:** 906, 1700, 1800, 1803, 1805, 1806, 1900 **DATE OF INVENTORY:** 4/20/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Small stream with steep banks and narrow incised channel that is approximately 5 ft. wide. Water depth ranged from 1-5 inches. Hillslopes are moderate to steep. Vegetation is dense, brushy salmonberry with a second growth Sitka spruce canopy. The understory is dominated by sword fern and false lily-of-the-valley. The wetland is limited to the channel which is very short between Hemlock St. and Logan Lane.

WETLAND FUNCTIONAL VALUES All of the functional values rated low because of the short length of open channel remaining and the existing level of disturbance.

IMPACTS/DISTURBANCES Fill and lawn development have occurred on hillslopes within the riparian area. If filling is allowed in riparian habitat, erosion control measures must be taken to protect water quality and prevent stream degradation. Adjacent residents have dumped yard debris into the corridor. Disposal of yard debris should not be permitted in stream corridors.

SIGNIFICANCE Low. This site is primarily important for drainage runoff.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 4 **ACRES:** ≤0.5
LOCATION: Between Pacific St. (Beach Loop) and Kenai St.
TAX MAP NO.: 4106BC **TAX LOTS:** 9801, 9802

NWI CLASSIFICATIONS: R/PSS
BASIN: First Street
DATE OF INVENTORY: 4/20/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L?	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION This stream is an open channel for only a short stretch in the City between Hemlock St. and Pacific St. Wetlands are generally confined to the channel except in disturbed area of fill where zone of saturation is approximately 20 ft. wide. The canopy is dominated by 15 ft. red alder saplings. The understory contains brushy salmonberry, slough sedge, skunk cabbage, and two species of rushes. Streets and dwellings surround this site. The wetland boundary occurs where vegetation changes from sedges to Himalayan blackberry and Sitka spruce and ground surface is elevated by fill.

SOIL Silty Clay (9-17 10 YR 4/1-2 w/5YR 4/6 mottles); mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES All of the functional values rated low due to the short length of open channel and the level of disturbance due to filling that has occurred.

IMPACTS/DISTURBANCES Much of channel has been ditched or culverted. Widest area of wetlands has been partially filled, but this has not effectively altered site hydrology.

SIGNIFICANCE Low. (depends on presence of permanent water)

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 5 **ACRES:** <0.5 **NWI CLASSIFICATIONS:** R/PFO
LOCATION: Upstream continuation of Site 4, east of Pacific St. (Beach Loop) **BASIN:** First St.
TAX MAP NO.: 4106BC **TAX LOTS:** 9400, 9500, 9600 **DATE OF INVENTORY:** 4/20/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	M	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Site 5 is upstream of Site 4 between Hwy 101 and Hemlock St. Hillslopes are moderate. The stream channel averages approximately 1 ft. wide and is braided. Vegetation is older second growth spruce and western hemlock than downstream in Site 4 and a few larger Sitka spruce are present. The understory is dominated by skunk cabbage. The upper end of the wetland is approximately 30 ft. wide and the lower end is approximately 55 ft. wide. Wetlands are defined by the toe of the slope where vegetation changes from skunk cabbage to sword fern, salal, and false lily-of-the-valley.

SOIL Silty Clay Loam; mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES All functional values rated low due to the short length of open channel except as noteworthiness which rated medium due to some very large Sitka spruce located along the banks.

IMPACTS/DISTURBANCES Grading or filling has occurred on the channel near Hemlock St. English ivy is encroaching from Highway 101 fill slopes. Himalayan blackberry dominates residential fill. Invasive species such as ivy and blackberry should be controlled.

SIGNIFICANCE Low. Because of its small size and high level of disturbance, this site rates low. Restoration and enhancement of native flora--preservation of old growth Sitka spruce and permanent water would increase the value of this site.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 6 **NWI CLASSIFICATION:** R
LOCATION: Between Hemlock St. and Hwy 101, north of Kenai St. **BASIN:** Brailler
TAX MAP NO.: 4106BC **TAX LOT:** 10600 **DATE OF INVENTORY:** 4/21/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L?	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Very small stream culverted for all of its length below site from Hemlock St. to the beach. Channel is confined between high ground to the south and fill placed for lawn development to the north. The channel and wetland fringe includes approximately 10 ft. The channel averages 3 ft. wide and 6 in. deep. The hillslope above the south bank is undeveloped mixed coniferous/deciduous forest. The canopy is dominated by red alder and western hemlock. The understory is dominated by salmonberry, false lily-of-the-valley, water parsley, lady fern, and English ivy. Wetlands are defined by the toe of the slope and dominance of sword fern.

WETLAND FUNCTIONAL VALUES All functional values rated low due to the short length of open channel and the impacts of fill on this small stream.

IMPACTS/DISTURBANCES Filling for building on one side and culverting of much of stream length.

SIGNIFICANCE Low. This site is small and isolated from other natural areas by roads and residences.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 7 **ACRES:** <1
LOCATION: Between Hwy 101 and Hemlock St.
TAX MAP NO.: 4106BC **TAX LOTS:** 4300, 4400 4500, 4501

NWI CLASSIFICATIONS: R/PFO
BASIN: Ocean
DATE OF INVENTORY: 4/21/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L?	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	M

GENERAL DESCRIPTION Mosaic of wetlands and uplands with three braided channels. The stream channel divides, flows subterranean, resurfaces, and forms pools. Stream channels average 3 ft. wide and 5 in. deep. Vegetation is dominated by Sitka spruce, salmonberry, and skunk cabbage and includes lady fern, slough sedge, and false lily-of-the-valley. The stream is culverted below the site from Hemlock Street to the beach. Wetlands are defined by the change in vegetation from skunk cabbage to sword fern.

SOIL Silty Clay Loam (10YR 4/1, 10 YR 4/3 2/7.5YR 5/8 mottles); mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES Urban quality of life rated medium due to the visual aesthetics of the site and limited disturbance.

IMPACTS/DISTURBANCES English ivy is common in the margins of the wetlands and is encroaching the site. It should be removed.

SIGNIFICANCE Low - Medium. This site is somewhat significant for the size of open space and maturity of forest stand it contains.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 8 **ACRES:** <0.5 **NWI CLASSIFICATIONS:** PFO
LOCATION: East of Pacific St. at intersection with Midway St. **BASIN:** Ocean
TAX MAP NO.: 4106BC **TAX LOT:** 2900 **DATE OF INVENTORY:** 4/21/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION This undeveloped lot slopes down from Hemlock St. to Pacific St. and is vegetated with second growth Sitka spruce with an understory of slough sedge. The property may have been wet over a larger area at some earlier time, but the small stream (Site 9) that may have supplied some of the water is now ditched along the property line. The lowest area of the property adjacent to Pacific St. still has wetland hydrology. The extent of saturation within 12 in. of the surface defines the wetland boundary which is approximately 30 ft. by 30 ft.

SOIL Silty Loam (10YR 2/1); mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES All functional values rated low due to the limited size of the site and the altered hydrology and vegetation community. The second growth forest type and size on this site is widespread in the UGB.

IMPACTS/DISTURBANCES Fill was placed in the lowest portion of the property over the last several weeks just prior to the field survey but not spread flat.

SIGNIFICANCE Low due to its small size, fill, and hydrologic alterations. The extent of jurisdictional wetlands needs to be examined more carefully than this inventory allows because of filling and hydrologic alterations.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 9 **ACRES:** NA **NWI CLASSIFICATIONS:** R?
LOCATION: East of Pacific St. at intersection with Midway St. **BASIN:** Ocean
TAX MAP NO.: 4106BC **TAX LOTS:** 2900, Govt. Lot 4 **DATE OF INVENTORY:** 4/21/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Small stream issuing from a culvert under Hemlock St. flows a short distance in the natural channel, then is ditched along the property lines in or adjacent to Midway St. right-of-way before being culverted the remaining length to the beach. The stream is approximately 3 ft. wide and 6 in. deep. Driveway and lawn development have removed riparian vegetation for most of the length of the natural channel. Remaining vegetation includes Sitka spruce, red elderberry, false lily-of-the-valley, and lady fern. Wetlands are confined to the channel.

WETLAND FUNCTIONAL VALUES All functional values rated low because the channel has been so altered for residential and road development.

IMPACTS/DISTURBANCES Ditching and culverting have altered natural features. Vegetation in the lower area is dominated by weedy species including reed canarygrass and Himalayan blackberry.

SIGNIFICANCE Low due to its small size and high level of disturbance.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 10a **ACRES:** ≈ 30 **NWI CLASSIFICATION:** PFOC
LOCATION: North, E., & S. of the sewage treatment ponds **BASIN:** Ecola Creek
TAX MAP NO.: 51020CC; **TAX LOT:** 200; 201; **DATE OF INVENTORY:** 4/21/93
51029
200
51020CB
3700, 5301;
51020CA
300

Wetland Functional Values Assessment [1]			
Ecological Integrity	H	Recreation	H
Wildlife Habitat	H	Flood Control	M
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	H	Nutrient Retention	L
Education Potential	H	Urban Quality of Life	H

GENERAL DESCRIPTION This site includes the forested wetlands north, east, and south of the sewage treatment ponds. Ecola Cr. divides the north end. Before construction of Highway 101, site 10A was contiguous with site 42. Seeps and flowing water occur throughout the area with some pools greater than 1 ft. deep. The red alder canopy is of more than one age. The shrub layer is dominated by twinberry and includes salmonberry, Hooker's willow, and red elderberry. The herbaceous layer is dominated by skunk cabbage in the wettest areas and includes slough sedge, water parsley, and lady fern. A well traveled path meanders through the south end. It is used by pedestrians, fishers, and bicyclists. It contains a limited amount of garbage. The wetland boundaries are defined by the toe of the slope adjacent to Hwy. 101 and to the upland forest to the north and south.

SOIL Silty Clay with fine gravel (10YR 2/1, 5YR 5/8); mapped as Coquille-Clatsop Complex SiL by SCS.

WETLAND FUNCTIONAL VALUES Many functional values rated high due to the large size of this site remaining undisturbed after construction of the sewage treatment ponds, the structural and species diversity of the forest/shrub/emergent community, public access, its location contiguous with extensive wetlands and forest lands of Ecola Creek Basin, and the valuable open space refugia for wildlife.

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[1] *Based on best professional judgment and field assessment methods*

IMPACTS/DISTURBANCES Construction of the sewage treatment ponds eliminated the center of this large wetland area and redirected natural water flow, but the site still remains wetlands. Biking should not be allowed on trails through the site because it degrades them and causes erosion of soil and degradation of water quality.

SIGNIFICANCE High. The multi-layered canopy with well developed understory benefits wildlife and people. Diverse habitat with permanent water, abundant snags, coarse woody debris, large size, trails, etc. This site should be preserved and maintained as a natural area for passive recreation, education, and refuge for wildlife.

SITE SUMMARY

SITE NO.: 10b **ACRES:** ≈ 6
LOCATION: West of the sewage treatment ponds
TAX MAP NO.: 51020CC **TAX LOT:** 201

NWI CLASSIFICATION: EEM/ESS/PEM
BASIN: Ecola Creek
DATE OF INVENTORY: 4/21/93

Wetland Functional Values Assessment [1]

Ecological Integrity	H	Recreation	H
Wildlife Habitat	H	Flood Control	M
Fish Habitat	L	Sediment Trapping	M
Noteworthiness	H	Nutrient Retention	M
Education Potential	H	Urban Quality of Life	H

GENERAL DESCRIPTION This site includes the estuarine/palustrine emergent wet meadow with fringing willow stands west of the sewage treatment ponds. Vegetation is dominated by Lyngbye's sedge and Pacific silverleaf. Hooker's willow is encroaching into the emergent habitat degrading the estuary. Elk graze the meadow seasonally. The wetland boundary is defined by fill for roadways and parking lots.

SOIL Silty Clay (10YR 3/1-2 with sulfidic odor); mapped as Coquille-Clatsop Complex by SCS.

WETLAND FUNCTIONAL VALUES Many functional values rated high due to the large size and near-natural condition of the site. The site provides valuable open space for wildlife; it is contiguous with extensive wetlands and forest lands of Ecola Creek drainage.

IMPACTS/DISTURBANCES Construction of the sewage treatment ponds eliminated the center of this large wetland area and redirected natural water flow, but it is still a productive wetland.

SIGNIFICANCE High. This large site of diverse habitat is a valuable refuge for wildlife and provides scenic and aesthetic benefits for people.

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[1] *Based on best professional judgment and field assessment methods*

SITE SUMMARY

SITE NO.: 11 **ACRES:** <0.5
LOCATION: Elk Run City Park at Spruce St. south of 1st St.
TAX MAP NO.: 51030AA **TAX LOT:** 3700, 3701, 3702, 3800, 4401, 4402

NWI CLASSIFICATION: PFOC
BASIN: Commercial 3
DATE OF INVENTORY: 4/21/93

Wetland Functional Values Assessment [1]

Ecological Integrity	M	Recreation	H
Wildlife Habitat	M	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	M	Nutrient Retention	L
Education Potential	M	Urban Quality of Life	H

GENERAL DESCRIPTION This undeveloped lot maintained as a natural wayside by the City is a remnant of old growth Sitka spruce forest with depressions of pooled water, skunk cabbage, and a meandering stream channel. The wetland is small and isolated, surrounded by Spruce and Hemlock Streets and Ecola Square. The wetland boundary is defined by fill material and a topographic break as well as the change in vegetation from skunk cabbage to sword fern and salal.

SOIL Silty Clay (10YR 2/2, 4/4 with 7.5YR 4/6 mottles) mapped as Coquille-Clatsop Complex by SCS.

WETLAND FUNCTIONAL VALUES This site rated medium for noteworthiness because it is an old growth forest remnant with a natural stream channel. Education potential rated medium due to its small size, central location, and public access. Urban Quality of Life rated high for its visual aesthetics. Ecological Integrity and Wildlife Habitat rated medium due to its small size and isolation.

IMPACTS/DISTURBANCES Fill for the development of building pad and parking lot for Ecola Square has been pushed into the wetlands along the north side.

SIGNIFICANCE High. The dominance of native vegetation, pools of water, and proximity to the city increase the significance of this site. This is a great site to provide the public with environmental interpretation of forest/skunk cabbage community, importance of wetlands, etc. It should continue to be protected as a park for public use.

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[1] *Based on best professional judgment and field assessment methods*

SITE SUMMARY

SITE NO.: 12 **ACRES:** <1
LOCATION: East end of Gower St.
TAX MAP NO.: 51029BC **TAX LOTS:** 7100, 7101, 7200, 7400, 7500, 7600, 7900, 8000

NWI CLASSIFICATIONS: PFO/R
BASIN: Coolidge 12 & 13
DATE OF INVENTORY: 4/21/93

Wetland Functional Values Assessment [1]

Ecological Integrity	M	Recreation	L
Wildlife Habitat	L-M	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L-M	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	M

GENERAL DESCRIPTION This site was observed from neighboring properties and the road because access was denied. The property appears to be a mosaic of uplands and wetlands with older second growth alder and spruce canopy and diverse shrub and groundcover vegetation. A small stream enters and exits the site with pockets of skunk cabbage.

SOIL No sample (access denied); mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES The functional values of ecological integrity, wildlife habitat, noteworthiness, and urban quality of life rated moderate mainly due to the large size of this undeveloped lot. The wetlands alone may be of less significance, but combined with the surrounding older second-growth forest they offer a diversity of wildlife habitat. The wetlands provide seasonal water for wildlife that inhabit the forest.

IMPACTS/DISTURBANCES Difficult to assess without access.

SIGNIFICANCE Medium. This site is moderately significant due to its large size and the diversity of the understory which is uncommon in second growth forest stands within the UGB.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 13 **ACRES:** <0.5
LOCATION: On Cypress Ct. off Dawes Ave.
TAX MAP NO.: 51029CB **TAX LOTS:** 1801, 1805, 1806, 1808

NWI CLASSIFICATION: PFOC
BASIN: Coolidge 13
DATE OF INVENTORY: 4/21/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L-M	Recreation	L
Wildlife Habitat	L-M	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L-M

GENERAL DESCRIPTION Access was denied on part of this site; observations were made from adjoining properties. This site is continuous with Site 12. The canopy is dominated by red alder. The shrub understory contains scattered salmonberry and salal. The herbaceous understory is dominated by slough sedge. Surface water does not appear to be present on site.

SOIL Silt Loam (10YR 2/1); mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES The functional values of ecological integrity, wildlife habitat, and urban quality of life rated moderate at most mainly because this undeveloped site is in close proximity to Site 12 which increases its size and habitat value. Access was denied, so presence of water could not be verified. No streams entered or left the site.

IMPACTS/DISTURBANCES Difficult to assess without access.

SIGNIFICANCE Low. This wetland is of low significance due to its small size.

[1] *Based on best professional judgment and field assessment methods*

SITE SUMMARY

SITE NO.: 14 **ACRES:** <1
LOCATION: East of intersection of Dawes and Spruce St.
TAX MAP NO.: 51029CB **TAX LOTS:** 1600, 1601, 1604

NWI CLASSIFICATIONS: PFOC/R
BASIN: Coolidge 13
DATE OF INVENTORY: 4/21/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	M	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	M

GENERAL DESCRIPTION This forested wetland was delineated by CH2M Hill (9/11/90). The CH2M Hill wetland delineation identified wetlands over most of TL 1604. We feel these wetlands are not as extensive as previously described but include a mosaic of uplands and wetlands and a perennial stream. The canopy is dominated by red alder. Salmonberry and slough sedge dominate the understory. Sword fern and English holly are scattered throughout the site which indicates wetlands hydrology is not consistently present.

SOIL CH_2M Hill (9-21-90); mapped as Humitropepts-Tropaquepts Complex by SCS.

WETLAND FUNCTIONAL VALUES This site received a medium rating for wildlife habitat and urban quality of life because it is a relatively large undeveloped site with a permanent stream. Coarse woody debris, a significant habitat feature for small wildlife species, is common on the forest floor.

IMPACTS/DISTURBANCES English holly is scattered throughout the site and should be removed to prevent its spread.

SIGNIFICANCE Low. This site is of low significance due to its size and isolation.

[1] *Based on best professional judgment and field assessment methods*

SITE SUMMARY

SITE NO.: 15 **ACRES:** <.5 **NWI CLASSIFICATIONS:** PFO/R
LOCATION: East of Evergreen St. between Dawes and Coolidge Sts. **BASIN: Coolidge 13**
TAX MAP NO.: 51030AD **TAX LOTS:** 12302, 12303, 12304, 12305, 12306, 12307, 12308, 12309 **DATE OF INVENTORY:** 4/21/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L-M	Recreation	L
Wildlife Habitat	L-M	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	M	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	M

GENERAL DESCRIPTION This stream is larger than many of the streams in the UGB It is approximately 3-5 ft. wide and 12 in. deep. Its floodplain is a wetland which becomes 50 feet wide in places. Short stretches of it remain forested with a red alder and Sitka spruce dominated canopy. The understory is dominated by skunk cabbage and water parsley with lady fern, red elderberry and salmonberry. Other parts of the channel have been ditched, filled for building pads and parking lots, and culverted. Wetlands are confined to the channel where it is ditched or the edge of fill where it is filled or the break in slope at the boundary between skunk cabbage and sword fern.

SOIL Silty Clay Loam (10YR 3/2 with 5YR 4/6 mottles) and Silty Clay (10YR 4/1 with 7.5 YR 4/6 mottles); mapped as Walluski SiL and Humitropepts-Tropaquepts Complex by SCS.

WETLAND FUNCTIONAL VALUES The functional values of ecological integrity, wildlife habitat, noteworthiness, and urban quality of life rated moderate based on the remnants of older spruce forest that occur along sections of the channel. Much development in and adjacent to the channel has disrupted the stream corridor for wildlife movement.

IMPACTS/DISTURBANCES The most serious impacts have been filling of the channel for building and parking lot pads. This has caused siltation in the stream and channelization in places.

SIGNIFICANCE Medium. This stream corridor is moderately significant and the remainder of the open channel should be protected by native tree/shrub buffers if adjacent development is permitted.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 16 **ACRES:** ≈ 8
LOCATION: North of Ecola Creek
TAX MAP NO.: 51020CB **TAX LOTS:** 2800, 3000, 3100 3200, 3700, 5300

NWI CLASSIFICATIONS: PEM/EEM
BASIN: Ecola Creek
DATE OF INVENTORY: 4/22/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	H
Wildlife Habitat	M-H	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	H

GENERAL DESCRIPTION Site 16 is an palustrine/estuarine emergent wetland. The wetland has been disturbed by construction of a rocky dike near the city park west of the old highway and by grazing horses on the east side of the highway. Vegetation is dominated by slough sedge, beach grass, and soft rush to the west. Other small isolated wetlands are scattered in remnant pockets in the park north of the dike. Hooker's willow is a common constituent of these pockets. East of the old Oregon Coast highway no access was permitted; vegetation is cropped short and difficult to identify from a distance but appears to be a pasture mix with clumps of soft rush. The estuary attracts a variety of resident and migrant wildlife species. Elk also graze the meadow seasonally.

SOIL Sandy; mapped as Coquille-Clatsop Complex by SCS.

WETLAND FUNCTIONAL VALUES The functional values of recreation and urban quality of life rated high for this site because it has been developed specifically as a park with visual aesthetics and public facilities. Wildlife Habitat rated medium to high; high due to the relationship of Ecola Creek to the site; medium due to the impact of grazing east of the old highway.

IMPACTS/DISTURBANCES Fill material is common throughout the site. Himalayan blackberry should be controlled and replaced with native vegetation.

SIGNIFICANCE High. The western half of this site has high recreation value and should be maintained for public use. The estuary has high value for migratory and resident wildlife.

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[1] *Based on best professional judgment and field assessment methods*

SITE SUMMARY

SITE NO.: 17 **ACRES:** NA **NWI CLASSIFICATION:** R
LOCATION: Between Hemlock St. and Ecola Park Road **BASIN: Breaker's Point**
TAX MAP NO.: 51019AD **TAX LOTS:** 10890, 11200, 11302, 11[illegible] **DATE OF INVENTORY:** 4/22/93
11001, 11003, 10800, 10900, 10901
TAX MAP NO.: 51020CB **TAX LOTS:** 2800, 3300

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	H	Flood Control	L
Fish Habitat	L?	Sediment Trapping	L
Noteworthiness	H	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Logan Creek which flows through Site 16 and Site 20 is surrounded by residential development and roads as well as large tracts of forested wetland. The channel contains permanent water and is downcut approximately 3.5 ft. in some areas. Riparian vegetation is dominated by a red alder canopy with a few very large, old growth Sitka spruce (4+ Ft. in diameter) located adjacent to the channel. The understory is dominated by very brushy Himalayan blackberry due to past filling and land clearing in the residential areas between Hemlock St. and Ecola Park Highway. In the forested wetland, the understory is composed of the native species described in Site 20. Other species includes red elderberry and giant horsetail.

WETLAND FUNCTIONAL VALUES Noteworthiness rated high due to the presence of a few very large, old-growth Sitka spruce. Wildlife habitat rated high due to the presence of permanent water and surrounding forested wetland.

IMPACTS/DISTURBANCES Himalayan blackberry (see above). Remove Himalayan blackberry and replace with native species.

SIGNIFICANCE High. The site is highly significant due to the presence of a permanent water tributary to Ecola Creek, noteworthy old-growth spruce trees, and multi-layered lush native wetland forest which accompanies most of the stream.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 18 **ACRES:** NA **NWI CLASSIFICATION:** R
LOCATION: From Ecola Park upstream to origin near vicinity of 8th & Laurel Sts
BASIN: Breakers Point
TAX MAP NO.: 51019AD & 51019AA **TAX LOTS:** (see below) **DATE OF INVENTORY:** 4/22/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION This is a small tributary that originates near 8th St. and Ecola Park Hwy. and is one of the small feeder streams to Logan Creek. Much of the stream is ditched and culverted for building pads and road crossings. The natural channel is downcut as much as 4 ft. Wetlands are mainly confined to the channel.

WETLAND FUNCTIONAL VALUES All of the functional values rated low for this stream because most of its length has been ditched, culverted, and filled.

IMPACTS/DISTURBANCES Much of the channel has been straightened and culverted.

SIGNIFICANCE This stream is of low significance; however, any future development along the open channel should be required to leave an adequate buffer.

TAX MAP NO: 51019AD
TAX MAP NO: 51019AA
TAX LOTS:
TAX LOTS:

1000	2000	2600
1800	2100	2700
1900	2200	2800
1901	2500	2900
1902		3000

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[1] Based on best professional judgment and field assessment methods

3100	6200
3300	5603
11200	5602
	5700
	5701
	5801
	5800
	5900

SITE SUMMARY

SITE NO.: 19 **ACRES:** ≈6 **NWI CLASSIFICATION:** PFO
LOCATION: Between Ecola Park Hwy., Laurel St. and 6th St. **BASIN: Breakers Point**
TAX MAP NO.: 51019AD & 51019AA **TAX LOTS:** (see next page)
DATE OF INVENTORY: 4/22/93

Wetland Functional Values Assessment [1]

Ecological Integrity	H	Recreation	L
Wildlife Habitat	H	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	M-H	Nutrient Retention	L
Education Potential	M	Urban Quality of Life	H

GENERAL DESCRIPTION This forested wetland is large and diverse and contiguous with larger forest lands of Ecola Park to the north. Vegetation is dominated by a red alder canopy with a couple of noteworthy old growth Sitka spruce. The herbaceous understory is dominated by slough sedge, skunk cabbage, water parsley and creeping buttercup. Seasonal pooled water occurs throughout the site. The structural diversity of vegetation and diverse species composition offer high wildlife forage and cover values. Elk sign was common on an elk trail that meanders through the site. Most of the site is wetland with small hummocks of upland interspersed. Wetlands are defined by the change in vegetation from skunk cabbage and/or rushes to sword fern and/or salal.

SOIL Sandy Silty Loam (10YR 2/2) and Silty Clay (10YR 4/1 with 5YR 4/6/ 5/8 mottles); mapped as Walluski SiL and Templeton-Ecola SiL by SCS.

WETLAND FUNCTIONAL VALUES The functional values of ecological integrity, wildlife habitat, noteworthiness, and urban quality of life rated high because of the large size of the site, its location contiguous to larger forest lands, the natural and diverse structure and species richness of the forest community.

IMPACTS/DISTURBANCES Fill from backyards on the eastern margin of the site has encroached on the wetlands. Himalayan blackberry is present in this disturbed part of the site and should be removed and replaced with native species.

SIGNIFICANCE High. This site is highly significant for providing a low elevation forage area for elk, a groundwater discharge area for seeps that feed Logan Creek, and for the size of near-natural open space it represents.

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[1] *Based on best professional judgment and field assessment methods*

SITE SUMMARY

SITE NO.: 19 (continued) **ACRES:** ≈6 **NWI CLASSIFICATION:** PFO
LOCATION: Between Ecola Park Hwy., Laurel St. and 6th St. **BASIN: Breakers Point**

TAX MAP NO. 51019AD				**TAX MAP NO. 51019AA**	
TAX LOTS: 3100, 3300				TAX LOTS:	
1500	3300	303	600	6502	6500
1600	3400	304	700	6600	6501
1601	3500	305	701	6700	6503
1700	200	306	800	7500	6400
2900	300	307	900	7501	6801
3000	301	400			
3100	302	500			

SITE SUMMARY

SITE NO.: 20 **ACRES:** ≈10+
LOCATION: East of Ecola Park Hwy. and north of 6th St.
TAX MAP NO.: 51020CB **TAX LOT:** 200
TAX MAP NO.: 51020BC **TAX LOTS:** 400, 500, 501, 502, 100

NWI CLASSIFICATION: PFO
BASIN: Breakers Point
DATE OF INVENTORY: 4/22/93

Wetland Functional Values Assessment [1]

Ecological Integrity	H	Recreation	L
Wildlife Habitat	H	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	H	Nutrient Retention	L
Education Potential	H	Urban Quality of Life	H

GENERAL DESCRIPTION This is a large undeveloped area that is the best example of native coastal Sitka spruce forest within the UGB. Large old growth Sitka spruce and red alder dominate the multi-layered forest canopy. The shrub understory is dominated by red elderberry and salmonberry. The herbaceous understory is dominated by skunk cabbage, slough sedge, and water parsley with scattered clumps of lady fern. Depressions filled with seasonal water are scattered throughout the forest. Logan Creek meanders through this site. The area is used by elk and is contiguous with higher elevation forests outside the UGB. Elk move freely between the forested hillsides to the north and the swampy site lowlands.

SOIL Fine Sandy Silty Clay (10YR 3/1, 7.5YR 5/8 mottles); mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES This site is the largest remnant of the original old growth spruce forest remaining in the UGB. For that reason, the functional values of ecological integrity, wildlife habitat, noteworthiness, education potential, and urban quality of life all rated highly. This site contains critical breeding habitat features such as snags, downed woody debris, and seasonal pondings.

IMPACTS/DISTURBANCES Little or no disturbance has occurred except encroaching residential development, road construction and possibly some selective logging at the edges of this site.

SIGNIFICANCE High. Site 20 is one of the most significant wetlands in Cannon Beach. This site rates high for providing a low elevation forage area for elk, a groundwater discharge area for seeps that feed Logan Creek, and for the large size of its natural wetland forest. To maintain its high rating the forest should remain in one piece. Fragmentation should be avoided.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 21 **ACRES:** <1 **NWI CLASSIFICATIONS:** R/PFO/PEM
LOCATION: Between Old Coast Hwy. and 6th St. and Beech St. **BASIN: Elm**
TAX MAP NO.: 51020CB **TAX LOTS:** 2400, 2402, 2403, 2405, 2600, 2700 **DATE OF INVENTORY:** 4/22/93

Wetland Functional Values Assessment [1]

Ecological Integrity	M	Recreation	L
Wildlife Habitat	M	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	M

GENERAL DESCRIPTION This site is a small headwater stream with 2 branches that join to flow down a steep ravine of second growth spruce. As the topography flattens out, the canopy changes to red alder with a skunk cabbage and salmonberry understory. At the lowest reach before the stream is culverted under Beech St., gravel fill has been placed in a slough sedge dominated emergent wetland and graded flat. The natural channel and vegetation is altered significantly by recent fill near Beech Street, but wetlands still occur over much of the filled area. The wetland boundary is defined by the toe of hillslopes in the upper end of the channel. It is less distinct in the lower end because of recent fill activities. In this area the wetland boundary probably extended to Beech Street.

SOIL Refusal due to gravel. Mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES Ecological Integrity, Wildlife Habitat, and Urban Quality of Life rated medium for this site based on the diversity of forest and wetland vegetation communities.

IMPACTS/DISTURBANCES The lower half of the channel has been ditched and filled. The emergent wetland has been filled with gravel and yard debris. Gravel and yard debris should be removed and replaced with native wetland vegetation.

SIGNIFICANCE Medium. This site is moderately significance because of its size and diversity. Hillslopes are very steep and future development should be required to leave an adequate buffer to protect water quality from slope erosion.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 22 **ACRES:** <1
LOCATION: Between Hills and Ross Lanes west of Spruce St.
TAX MAP NO.: 51030DA **TAX LOTS:** 6900, 7300, 7400, 7500, 7601, 8500, 8400, 8300, 9800, 9900, 10000, 10100

NWI CLASSIFICATION: PFO
BASIN: Coolidge 1
DATE OF INVENTORY: 4/23/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L-M

GENERAL DESCRIPTION Water for this site probably originates from the hill to the south but appears on the surface from no visible culvert between Hills and Ross Lanes. A broad area up to approximately 40 ft. wide at the widest point, of slow flowing or pooled water is dominated by skunk cabbage and lady fern. The channel then becomes more distinct and flows northwest between culverts and ends in another broad swale. Wetlands are defined by the channel or the change in vegetation from wetland skunk cabbage to upland sword fern or salal.

SOIL Silty Clay (10YR 2/1 with 10 YR 4/6 mottles); mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES All of the functional values rated low because extensive alteration of the natural channel due to roads, residential development, and culverts.

IMPACTS/DISTURBANCES Most of the stream length has been ditched or culverted.

SIGNIFICANCE Low. This site is of low significance due to small size, isolation, and proximity to residential development.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 23 **ACRES:** ≤0.5
LOCATION: South of Arbor Lane to Spruce St. near Elliott Way
TAX MAP NO.: 51030DA **TAX LOTS:** 10700, 10800, 10900, 9600, 8700, 8800, ??, 7200, 6900

NWI CLASSIFICATIONS: R, PFO
BASINS: Coolidge 1 & 2
DATE OF INVENTORY: 4/23/93

TAX MAP NO.: 51030DD **TAX LOTS:** 905, 6600, 6700, 6100, 6000

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L-M

GENERAL DESCRIPTION This seasonal stream originates on the hillside south of Arbor Lane and is a narrow, steep-gradient channel until it crosses Arbor Lane where the channel begins to meander and braid through hummocks of upland. The broadest area of saturation, approximately 15 ft. wide, occurs just south of Hills Lane before the channel is culverted. North of Hills Lane, the channel has been filled, but depressions in the old channel still hold rainfall and support skunk cabbage. Wetland vegetation is dominated by a Sitka spruce canopy. The understory is dominated by salmonberry, slough sedge, and skunk cabbage. Wetlands are generally confined to the channel but occasionally broaden into a forested wetland. The forested wetland boundary is defined by the change in vegetation from skunk cabbage to upland vegetation such as sword fern.

SOIL Clay (10YR 2/6 with 10YR 4/6 mottles), gley (5Y 6/1); mapped as Walluski SiL and Templeton-Ecola SiL by SCS.

WETLAND FUNCTIONAL VALUES All of the functional values rated low because the stream channel is altered by road and residential development. The uppermost length south of Arbor Lane is less developed to date due to the steepness of the surrounding slopes.

IMPACTS/DISTURBANCES Some of the stream channel has been filled and culverted.

Based on best professional judgment and field assessment methods

SIGNIFICANCE Low. This site is of low significance due to its size, isolation and proximity to residential development.

SITE SUMMARY

SITE NO.: 24 **ACRES:** <1 **NWI CLASSIFICATION:** PSS
LOCATION: Intersection of Forest Lawn Rd. and Hemlock St. **BASIN: Coolidge 2**
TAX MAP NO.: 51030DA **TAX LOT:** 4100 **DATE OF INVENTORY:** 4/23/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L-M	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L-M

GENERAL DESCRIPTION This site was viewed from the road since access was denied. The ground slopes down from south to north, and almost one-half of the lower portion of the property is willow/scrub wetlands. Vegetation is dominated by Hookers willow, twinberry, and slough sedge. Standing water is widespread under the willows and water flows out of this area into a culvert under Hemlock St. The southern portion of the property is upland with larger conifers and upland shrubs. There is a transition area between uplands and wetlands which is a mosaic that contains salal covered upland hummocks surrounded by wetland depressions. Wetlands are defined by a slight break in the slope and the change in vegetation from willows to spruce trees.

SOIL No sample (access denied); mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES The functional values of noteworthiness and urban quality of life rated moderate at most based on the size of this undeveloped lot and the juxtaposition of willow-dominated wetlands with conifer-dominated uplands.

IMPACTS/DISTURBANCES Site has been cut off from other wetlands by surrounding roads and drainage from the wetland has been culverted. The site is located adjacent to a main thoroughfare (Hemlock Street).

SIGNIFICANCE Low - medium. This site is of low to moderate significance. Future development on the upland portion of the property should be required to leave a buffer for the wetlands.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 25 **ACRES:** <1 **NWI CLASSIFICATIONS:** PFO, R
LOCATION: East of the intersection of Nelchena & Hemlock St. **BASIN: Hemlock**
TAX MAP NO.: 51032BC **TAX LOTS:** 500, 1500, 1501 1502, 1503, 1600, 1700 **DATE OF INVENTORY:** 4/23/93

Wetland Functional Values Assessment [1]

Ecological Integrity	H	Recreation	L
Wildlife Habitat	M	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	H	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	H

GENERAL DESCRIPTION This stream is located west of Highway 101. Its a braided channel that flows alternately between the surface and subsurface. The stream channel is approximately 3 ft. wide and the forested wetland surrounding the channel is up to 150 ft. The forested wetland is a multi-layered diverse mixed coniferous/deciduous forest. The canopy is dominated by red alder and Sitka spruce. Understory vegetation is dominated by salmonberry, red elderberry, slough sedge, skunk cabbage, and lady fern. Wetlands are defined by a break in slope and the change in vegetation from a Sitka spruce/skunk cabbage community to a Sitka spruce/sword fern community.

SOIL Silty Clay (10YR 3/1 with 7.5YR 5/8 mottles); mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES The functional values of ecological integrity, noteworthiness, and urban quality of life rated high due to the near pristine condition of the stream channel and surrounding forest. The undeveloped lot is large and the forest is little disturbed by logging or residential development.

IMPACTS/DISTURBANCES Some residential development has occurred on the south side of the property, but a vegetated buffer of varying width remains. The main drainage feature is nearly pristine.

SIGNIFICANCE High. This site is highly significant due to its large size, its location adjacent to sites 26 and 28 and its limited disturbance.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 26 **ACRES:** <1.5 **NWI CLASSIFICATIONS:** PFOC, R
LOCATION: Between Matanuska & Tanana Sts., Hemlock St. & Hwy 101 **BASIN: Hemlock**
TAX MAP NO.: 51032BC **TAX MAP NO.:** 51032BB **DATE OF INVENTORY:** 4/23/93
TAX LOTS: 500, 601, 1200, 1300, 1400, 1401 **TAX LOT:** 306

Wetland Functional Values Assessment [1]

Ecological Integrity	M-H	Recreation	L
Wildlife Habitat	M	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	M-H	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	H

GENERAL DESCRIPTION This stream corridor is contiguous with Site 28 and in close proximity to Site 25. The mixed forest canopy is dominated by Sitka spruce and red alder. Sitka spruce is present in slightly drier soils while the red alder is found closer to the channel. Numerous fallen trees are scattered throughout the swale and are nurse logs for upland seedlings and shrub species, such as salal and red huckleberry. The wetland herbaceous vegetation is dominated by skunk cabbage and includes water parsley, slough sedge, and lady fern. The wetland is broadest (100 ft.) at the lower end and narrows to 50 ft. behind midway and becomes a wetland/upland mosaic. Wetland are reduced to the channel in the upper reach. The stream channel averages 5 ft. wide and 2 in. deep. The channel substrate is clogged with sediment.

SOIL Silty Clay (10YR 3/1 and 5YR 4/1 with 7.5YR 5/8 mottles); mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES Urban Quality of Life rated high because the forest adjacent to and surrounding the stream is older second growth that provides a scenic open space and buffer for the neighborhood. Ecological Integrity, Wildlife habitat, and Noteworthiness rated medium or medium-high due to the size and vegetative diversity of the forested swales.

IMPACTS/DISTURBANCES The stream channel is natural except for recent fill adjacent to Hemlock Street.

SIGNIFICANCE High. The size of the site and its connectivity to Sites 25 and 28 increase its significance.

[1] *Based on best professional judgment and field assessment methods*

SITE SUMMARY

SITE NO.: 27 **ACRES:** NA
LOCATION: South of and crossing Arbor Lane
TAX MAP NO.: 51030DD **TAX LOT:** 5400, 5500, 4701, 7200, 7300

NWI CLASSIFICATION: R
BASIN: Coolidge 1
DATE OF INVENTORY: 4/23/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION This is a very small seasonal stream (less than 1 ft. wide) originating on the hill south of Arbor Lane that is filled and culverted at Arbor Lane and appears to percolate below the surface in tax lot 5400. Gravel fill is also placed on this lot that may have caused the natural flow to move subsurface. The headwater of the stream is a steep, narrow ravine surrounded by uplands and spruce forest. Wetlands are confined to the channel.

WETLAND FUNCTIONAL VALUES All of the functional values of this site are rated low due to ditching, culverting, and filling of the lower length of the channel, and the small size of the upper stretch.

IMPACTS/DISTURBANCES Channel has been ditched, filled and culverted for much of its length. Future development adjacent to the upper length should be required to leave an adequate buffer to protect the steep slopes from eroding into the stream.

SIGNIFICANCE Low. Its primary significance is for drainage runoff.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 28 **ACRES:** <0.5
LOCATION: East of Matanuska/Hemlock
TAX MAP NO.: 51032BC **TAX LOT:** 500

NWI CLASSIFICATIONS: PFO, R
BASIN: Hemlock
DATE OF INVENTORY: 5/18/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION This intermittent stream corridor contains pockets of pooled surface water. The forest canopy is dominated by a dense stand of Sitka spruce. The understory is dominated by skunk cabbage with 50% bare ground. The stream channel is approximately 3 ft. wide and water, where present, is 1-2 in. deep. The wetland boundary is defined by the break in slope and where vegetation changes from skunk cabbage to sword fern.

SOIL Silty Clay (10YR 7/1 with 7.5YR 5/8 mottles); mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES All wetland functional values rated low due to the lack of diversity of vegetation and the seasonal nature of the stream.

IMPACTS/DISTURBANCES None

SIGNIFICANCE Medium. The significance of this site is medium due to its connectivity with sites 25 and 26 and the forest upland ridges which exist between them.

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[1] *Based on best professional judgment and field assessment methods*

SITE SUMMARY

SITE NO.: 29 **ACRES:** <1 **NWI CLASSIFICATIONS:** PFO, R
LOCATION: North of Hemlock/Amber Lane **BASIN:** Gulcana
TAX MAP NO.: 51032BB **TAX LOTS:** 117, 199, 301, 316 **DATE OF INVENTORY:** 5/18/93

Wetland Functional Values Assessment [1]

Ecological Integrity L	Recreation	L
Wildlife Habitat L-M	Flood Control	L
Fish Habitat L	Sediment Trapping	L
Noteworthiness L	Nutrient Retention	L
Education Potential L	Urban Quality of Life	M

GENERAL DESCRIPTION Site 29 is a common greenspace area for the surrounding residential properties. The mostly closed Sitka spruce canopy limits understory shrub vegetation, but salmonberry and red elderberry are present. Understory wetland vegetation is dominated by skunk cabbage, water parsley, slough sedge, and lady fern. Soils were saturated to the surface throughout the swale during the survey. A seasonal/permanent (?) stream flows through the site and is approximately 5 ft. wide. The wetland boundary is defined by the toe of the hillslopes where the wetland vegetation described above is no longer is present.

SOIL Gray with bright orange mottles (10YR 2/1 with 10YR 5/8 mottles); mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES Most values rated low due to the lack of vegetation diversity. If permanent water is present in this drainage, wildlife habitat values increases to medium. Urban quality of life also rates medium because it is a protected greenspace common area with limited disturbance.

IMPACTS/DISTURBANCES English ivy is encroaching the site and should be removed. Steep side slopes should be protected from eroding into the stream.

SIGNIFICANCE Medium.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 30 **ACRES:** NA
LOCATION: N & E of N Chinook Street
TAX MAP NO.: 1032CA **TAX LOTS:** 3300, 3400, 3401, 3500, 3501, 3600, 3700, 3900

NWI CLASSIFICATION: R
BASIN: Tolovana
DATE OF INVENTORY: 5/19/93

Wetland Functional Values Assessment [1]

Ecological Integrity	M	Recreation	L
Wildlife Habitat	M	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L-M	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Site 30 is a narrow high gradient seasonal stream corridor located on the edge of residential development. The intermittent channel is approximately 5 ft. wide. It is culverted under Highway 101 and eventually connects to Site 46. The riparian corridor is dominated by Sitka spruce, red elderberry and sword fern. Other species include western hemlock, red alder, Hooker's willow, and Himalayan blackberry. There are occasional pockets of skunk cabbage within the drainage swale. Wetlands are generally confined to the channel, until it reaches the Tolovana Highway Loop where it broadens out into a dense willow thicket.

WETLAND FUNCTIONAL VALUES Ecological Integrity and Wildlife Habitat rated medium due to the location of the stream corridor adjacent to a larger undeveloped forest. The stream is also important for drainage runoff.

IMPACTS/DISTURBANCES Himalayan blackberry is present on slopes adjacent to residences. It should be removed and replaced with native species of shrubs/herbs to prevent further encroachment into the forest. The steep sideslope should be protected from eroding into the stream.

SIGNIFICANCE Medium. The stream corridor is used as a wildlife travel corridor providing wildlife a route to and from the coastal forests.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 31 **ACRES:** <0.5
LOCATION: East of Hwy 101, N of Tolovana exit
TAX MAP NO.: 51032BC **TAX LOTS:** 100, 101, 400

NWI CLASSIFICATIONS: R, PEM
BASIN: Tolovana
DATE OF INVENTORY: 6/26/93

Wetland Functional Values Assessment [1]

Ecological Integrity	M	Recreation	L
Wildlife Habitat	M	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Site 31 is a seasonal (?) stream. The channel is approximately 3 ft. wide. The wetland broadens to 15 ft. at approximately 150 ft. east of Highway 101. It becomes even wider, between 50 ft. and 60 ft., 100 ft. east of the highway. The channel meanders through a dense Sitka spruce forest with limited understory. When it reaches the wetland, the canopy has been cleared. Vegetation in the forest opening is dominated by skunk cabbage and small fruited bulrush and includes lady fern, hedgenettle, and salmonberry. Part of the wetland is a mosaic. The wetland boundary is defined by the lack of bulrush and sedge and the increase in Sitka spruce.

SOIL Aquic moisture regime; mapped as Templeton-Ecola SiL by SCS.

WETLAND FUNCTIONAL VALUES Ecological Integrity and Wildlife Habitat rated medium due to the connectivity of the stream corridor with larger forest lands to the east. The stream is also important for drainage runoff.

IMPACTS/DISTURBANCES Canopy vegetation has been cleared recently.

SIGNIFICANCE Medium. The stream corridor is used as a wildlife travel corridor for wildlife providing wildlife a route to and from the Coast Range.

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[1] *Based on best professional judgment and field assessment methods*

SITE SUMMARY

SITE NO.: 32 **ACRES:** NA **NWI CLASSIFICATION:** R
LOCATION: East of Hwy 101, N of Tolovana exit & N of site 31 **BASIN: Hemlock**
TAX MAP NO.: 51032BC **TAX LOTS:** 100, 300 **DATE OF INVENTORY:** 6/26/93

Wetland Functional Values Assessment [1]

Ecological Integrity	M	Recreation	L
Wildlife Habitat	M	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Site 32 is a stream corridor. Wetlands are limited to the channel and adjacent floodplain. Wetland width is approximately 10 ft. The stream is located in a steeply sloped steep gradient channel that is culverted under Highway 101. The dense canopy is dominated by Sitka spruce and red alder. Wetland vegetation along stream margins is dominated by skunk cabbage and lady fern. The wetland boundary is defined by a topographic break and a change in herbaceous vegetation from skunk cabbage and lady fern to oxalis, sword fern, and/or deer fern.

WETLAND FUNCTIONAL VALUES Ecological Integrity and Wildlife Habitat rated medium due to the connectivity of the stream corridor with larger forest lands to the east. The stream corridor is also important for drainage runoff.

IMPACTS/DISTURBANCES Yard debris has been dumped frequently on the southern hillslopes above the drainage.

SIGNIFICANCE Medium. This stream corridor is used as a wildlife travel corridor for elk, deer, birds, etc., providing wildlife a route to and from the Coast Range.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 33 **ACRES:** NA **NWI CLASSIFICATION:** R, seasonal
LOCATION: East of Hwy 101, N of Tolovana exit, N of site 32, & S of private road
BASIN: Hemlock
TAX MAP NO.: 51032BC **TAX LOT:** 102 **DATE OF INVENTORY:** 6/26/93

Wetland Functional Values Assessment [1]

Ecological Integrity	M	Recreation	L
Wildlife Habitat	M	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	M	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Site 33 is a seasonal stream corridor. Wetlands are limited to the channel and adjacent floodplain. Wetland width is approximately 10 ft. The stream is located in a steeply sloped steep gradient channel that is culverted under Highway 101. The dense canopy is dominated by Sitka spruce. Wetland vegetation along the stream margin is dominated by skunk cabbage and lady fern. The wetland boundary is defined by the toe of the hillslopes and a change in herbaceous vegetation to oxalis, sword fern, and deer fern.

WETLAND FUNCTIONAL VALUES Ecological Integrity, Wildlife Habitat, and noteworthiness rated medium due to the connectivity of the stream corridor with larger forest lands to the east. The stream corridor is also important for runoff.

IMPACTS/DISTURBANCES Garbage, such as an old road sign, has been dumped on slopes above the drainage.

SIGNIFICANCE Medium. This stream corridor is used as a wildlife travel corridor providing wildlife a route to and from the Coast Range.

[1] *Based on best professional judgment and field assessment methods*

SITE SUMMARY

SITE NO.: 34 **ACRES:** NA **NWI CLASSIFICATION:** R
LOCATION: E of Hwy 101, N of site 33, just S of public road **BASIN: Hemlock**
TAX MAP NO.: 51032BB **TAX LOT:** 118 **DATE OF INVENTORY:** 6/26/93

Wetland Functional Values Assessment [1]

Ecological Integrity	M	Recreation	L
Wildlife Habitat	M	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	M	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Site 34 is a perennial stream. Wetlands are confined to the channel which is approximately 5 ft. wide. Water is approximately 2 in. deep. Lady fern is present along the channel margins. The wetland boundary is distinct and defined by a topographic break. Riparian vegetation includes a Sitka spruce canopy with a sparse shrub understory of salal and salmonberry. Herbaceous cover is dominated by sword fern and deer fern.

SOIL not sampled in stream bed.

WETLAND FUNCTIONAL VALUES Ecological Integrity, Wildlife Habitat, and noteworthiness rated medium due to the connectivity of the stream corridor with larger forest lands to the east. The stream corridor is also important for drainage runoff.

IMPACTS/DISTURBANCES None.

SIGNIFICANCE Medium. The stream corridor is used as a wildlife travel corridor providing wildlife a route to and from the Coast Range.

[1] *Based on best professional judgment and field assessment methods*

SITE SUMMARY

SITE NO.: 35 **ACRES:** NA **NWI CLASSIFICATION:** R
LOCATION: E of Hwy 101, N of site 34, approximately 325 ft. N of public road
BASIN: Gulcana?
TAX MAP NO.: 51032BB **TAX LOTS:** 101, 121 **DATE OF INVENTORY:** 6/26/93

Wetland Functional Values Assessment [1]

Ecological Integrity	M	Recreation	L
Wildlife Habitat	M	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Site 35 is a narrow stream channel. The wetlands are confined to the channel and are approximately 3 ft. wide. Extremely steep hillslopes surround the drainage. Riparian vegetation is dominated by a dense Sitka spruce canopy. The understory is mostly bare ground with scattered sword fern. The wetland boundary is defined by the channel and a distinct topographic break.

WETLAND FUNCTIONAL VALUES Ecological Integrity and Wildlife Habitat rated medium due to the connectivity of the stream corridor with larger forest lands to the east. The stream corridor is also important for drainage runoff.

IMPACTS/DISTURBANCES None.

SIGNIFICANCE Medium. This stream corridor is used as a wildlife travel corridor providing wildlife a route to and from the Coast Range.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 36 **ACRES:** <0.5 **NWI CLASSIFICATION:** PFOC
LOCATION: N of the E end of Tyee Street. **BASIN: Umpqua**
TAX MAP NO.: 51032CC **TAX LOT:** 900, 901 **DATE OF INVENTORY:** 6/26/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Site 36 is a forested depression area surrounded by fill and residential development. The dense canopy is dominated by Sitka spruce. The herbaceous understory is dominated by skunk cabbage and lady fern and includes slough sedge. Bare ground is prevalent. Salal is also common on large fallen trees. Coarse woody debris is abundant. Soils contained low chromas and were saturated to the surface. Limited surface ponding was also present.

SOIL Silty Clay Loam (10YR 2/1) saturated to surface; mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES Wetland values rated low due to its small size and isolation.

IMPACTS/DISTURBANCES Construction debris has been dumped in margins of the wetlands. Historic logging also left abundant tree fall and woody debris. Present owners are attempting to clear out construction debris and re-plant with native vegetation.

SIGNIFICANCE Low. Past disturbance and isolation reduce the significance of this site relative to other Cannon Beach forested wetlands.

[1] Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 37 **ACRES:** ≤1 **NWI CLASSIFICATIONS:** RP, PFOC
LOCATION: Poplar Street **BASIN: Coolidge 13**
TAX MAP NO.: 51029CB **TAX LOTS:** 1000, 1302, 1314 **DATE OF INVENTORY:** 5/18/93 & 6/26/93

Wetland Functional Values Assessment [1]

Ecological Integrity	M	Recreation	L
Wildlife Habitat	M	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	M

GENERAL DESCRIPTION Site 37 is a stream channel with a broad forested wetland swale. The mixed forest canopy is dominated by Sitka spruce and red alder. The understory consists of skunk cabbage, water parsley, and lady fern with sparsely scattered red huckleberry and red elderberry. Surface water occurs in the channel and scattered in shallow pondings throughout the PFO. The wetland is approximately 50 ft. wide on the northern end and becomes smaller to the south. It is reduced to approximately 5 ft. wide west of Poplar. The wetland boundary is well defined by a topographic break.

SOIL Silty Clay Loam (10YR 2/1-2 with bright orange mottles 10YR 5/8). Mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES Ecological Integrity rated medium reflecting its somewhat disturbed condition. Wildlife Habitat rated medium due to the presence of permanent water coupled with its connectivity to larger open space areas. Urban Quality of Life rated medium due to the visual aesthetics of the site.

IMPACTS/DISTURBANCES Land clearing and road building have allowed invasive species like English ivy and Himalayan blackberry a foothold on the periphery of the site. These invasive species should be removed and replaced with native plant species before they further degrade the native vegetation.

SIGNIFICANCE Medium.

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[1] Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 38 **ACRES:** <.5
LOCATION: NE of Hwy 101/trailer park entrance (Elkland Rd.)
TAX MAP NO.: 51029BC **TAX LOTS:** 10900, 11000

NWI CLASSIFICATION: PFOC
BASIN: Elkland
DATE OF INVENTORY: 5/18/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION This forested wetland contains seasonal water. Vegetation is dominated by a red alder canopy with Sitka spruce. The understory is dominated by Hooker's willow and slough sedge. The wetland has been influenced by historic filling for Highway 101 and Elkland Road. The wetland boundary is defined by the lower edge of fill to the south and west, and the change in vegetation from slough sedge and red alder to upland grasses and forbs to the north and east.

SOIL Silty Clay Loam (5Y 4/1 with 10 YR 3/4 mottles). Mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES All functional values rated low due to isolation of the site from other natural areas.

IMPACTS/DISTURBANCES Site is surrounded by fill and fragmented by roadways.

SIGNIFICANCE Low in relationship to other Cannon Beach forested wetlands.

[1] *Based on best professional judgment and field assessment methods*

SITE SUMMARY

SITE NO.: 39 **ACRES:** NA
LOCATION: E of Elk Creek Road, SE of Site 40
TAX MAP NO.: 51029CA **TAX LOT:** 400

NWI CLASSIFICATION: R, seasonal
BASIN: Ecola Creek
DATE OF INVENTORY: 6/26/93

Wetland Functional Values Assessment [1]

Ecological Integrity	H	Recreation	L
Wildlife Habitat	M	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	M	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION This seasonal steep gradient stream is approximately 3 ft. wide and 2 in. deep. Stream substrate contains gravels. Site 39 is a tributary to Ecola Creek. The wetland boundary extends into the floodplain on either side of the channel and is approximately 10 ft. wide. Vegetation is dominated by Sitka spruce, red alder, oxalis, skunk cabbage, and water parsley. The wetland boundary is generally defined by topography and specifically defined by the change in vegetation from skunk cabbage to sword fern. Elk tracks were observed.

WETLAND FUNCTIONAL VALUES The high rating for ecological integrity reflects the natural condition of the stream corridor with no surrounding development. The stream corridor provides a wildlife travel corridor between Ecola Creek and the Coast Range. Since water is only seasonal, wildlife habitat rated medium. Noteworthiness also rated medium due to the significance of connectivity of the site.

IMPACTS/DISTURBANCES None

SIGNIFICANCE Medium. This site is moderately significant because it provides a wildlife corridor between Ecola Creek and the Coast Range.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 40 **ACRES:** NA **NWI CLASSIFICATION:** R, seasonal
LOCATION: E of Elk Creek Road, NW of Site 39 & SE of Site 41 **BASIN: Ecola Creek**
TAX MAP NO.: 51029CA **TAX LOT:** 400 **DATE OF INVENTORY:** 6/26/93

Wetland Functional Values Assessment [1]

Ecological Integrity H	Recreation L
Wildlife Habitat M	Flood Control L
Fish Habitat L	Sediment Trapping L
Noteworthiness M	Nutrient Retention L
Education Potential L	Urban Quality of Life L

GENERAL DESCRIPTION This seasonal steep gradient stream is approximately 3 ft. wide and 2 in. deep. Stream substrate contains gravels. Site 40 is a tributary to Ecola Creek. The wetland boundary extends into the floodplain on either side of the channel and is approximately 10 ft. wide. Vegetation is dominated by Sitka spruce, red alder, oxalis, skunk cabbage, and water parsley. The wetland boundary is generally defined by topography and specifically defined by the change in vegetation from skunk cabbage to sword fern. Elk tracks were observed.

WETLAND FUNCTIONAL VALUES The high rating for ecological integrity reflects the natural condition of the stream corridor with no surrounding development. The stream corridor provides a wildlife travel corridor between Ecola Creek and the Coast Range. Since water is only seasonal, wildlife habitat rated medium. Noteworthiness also rated medium due to the significance of connectivity of the site.

IMPACTS/DISTURBANCES None

SIGNIFICANCE Medium. This site is moderately significant because it provides a wildlife corridor between Ecola Creek and the Coast Range.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 41 **ACRES:** NA
LOCATION: E of Elk Creek Road, NW of Site 40
TAX MAP NO.: 51029CA **TAX LOT:** 300

NWI CLASSIFICATION: R, seasonal
BASIN: Ecola Creek
DATE OF INVENTORY: 6/26/93

Wetland Functional Values Assessment [1]

Ecological Integrity	H	Recreation	L
Wildlife Habitat	M	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	M	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION This seasonal steep gradient stream is approximately 3 ft. wide and 2 in. deep. Stream substrate contains gravels. Site 40 is a tributary to Ecola Creek. The wetland boundary extends into the floodplain on either side of the channel and is approximately 10 ft. wide. Vegetation is dominated by Sitka spruce, red alder, oxalis, skunk cabbage, and water parsley. The wetland boundary is generally defined by topography and specifically defined by the change in vegetation from skunk cabbage to sword fern. Elk tracks were observed.

WETLAND FUNCTIONAL VALUES The high rating for ecological integrity reflects the natural condition of the stream corridor with no surrounding development. The stream corridor provides a wildlife travel corridor between Ecola Creek and the Coast Range. Since water is only seasonal, wildlife habitat rated medium. Noteworthiness also rated medium due to the significance of connectivity of the site.

IMPACTS/DISTURBANCES None

SIGNIFICANCE Medium. This site is moderately significant because it provides a wildlife corridor between Ecola Creek and the Coast Range.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 42a **ACRES:** ~ 11
LOCATION: E of Hwy 101; located N & E of Haskell Lane
TAX MAP NO.: 51029CA **TAX LOT:** 101
TAX MAP NO.: 51029BD **TAX LOT:** 100, 200, 400
TAX MAP NO.: 51029 **TAX LOT:** 101
TAX MAP NO.: 51029BC **TAX LOT:** 8100, 100

NWI CLASSIFICATION: PFOC
BASIN: Ecola Creek
DATE OF INVENTORY: 6/26/93

Wetland Functional Values Assessment [1]

Ecological Integrity	H	Recreation	L-M
Wildlife Habitat	H	Flood Control	H
Fish Habitat	L	Sediment Trapping	H
Noteworthiness	H	Nutrient Retention	H
Education Potential	M	Urban Quality of Life	H

GENERAL DESCRIPTION This forested wetland contains a multi-layered canopy with diverse vegetation. The canopy is dominated by red alder and includes Sitka spruce trees and large snags. The shrub understory contains willow and twinberry. The herbaceous understory is dominated by slough sedge and skunk cabbage and includes lady fern. Additional habitat features include seasonal pondings for breeding amphibians such as tree frogs and snags for cavity nesters such as pileated woodpeckers. Site 42 is large and connected to Ecola Creek and the Coast Range.

SOIL SiL (
2.5Y 2/0 or 5Y 3/1 with 5YR 4/6 mottles) gley. Mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES High ratings due to large size and its position in the Ecola Creek watershed. Contains significant habitat for cavity nesters and amphibians. Potential to preserve water quality by trapping sediments and retaining nutrients from upstream logging activities.

IMPACTS/DISTURBANCES A portion of the site has been filled with construction debris and a roadway. Himalayan blackberry is growing on the fill.

SIGNIFICANCE High. Wildlife travel corridors should be maintained between Ecola Creek and forest lands.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 43 **ACRES:** NA
LOCATION: E of Hwy 101 treatment wetlands
TAX MAP NO.: ? missing map **TAX LOT:** ? missing map

NWI CLASSIFICATION: PFO
BASIN: Ecola Creek
DATE OF INVENTORY: 6/26/93

Wetland Functional Values Assessment [1]

Ecological Integrity	H	Recreation	L
Wildlife Habitat	H	Flood Control	M
Fish Habitat	L	Sediment Trapping	H
Noteworthiness	H	Nutrient Retention	H
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION The tertiary treatment wetland is a forested wetland with a fairly open deciduous canopy and permanent pondings. Secondary effluent is pumped through numerous channels throughout the site where it is polished. Red alder dominates the canopy with a few scattered old-growth Sitka spruce trees and stumps. The understory is dominated by twinberry, skunk cabbage, and slough sedge and includes red elderberry and salmonberry. Elk tracks are abundant throughout the site. Wood duck and mallard are also common. This site is adjacent to Ecola Creek and provides excellent habitat for wildlife attracted to the stream.

SOIL Silty Clay (5Y 4/1). Mapped as Coquille-Clatsop Complex by SCS.

WETLAND FUNCTIONAL VALUES The high rated functions were due to the large size of the site, permanent water, large size of Sitka spruce trees, and tertiary treatment of secondary sewage effluent. The low rated functions were due to lack of access to the site.

IMPACTS/DISTURBANCES The tertiary treatment system has altered natural hydrologic fluctuations, but many wetland functional values remain high.

SIGNIFICANCE High. Site 43 provides highly significant water quality functions and wildlife habitat.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 42b **ACRES:** ~29
LOCATION: Between Elliot and Sunset
TAX MAP NO.: 51030DA **TAX LOTS:** 6000, 5200

NWI CLASSIFICATION: PFOC, PEM
BASIN: Coolidge 3
DATE OF INVENTORY: 8/10/93

Wetland Functional Values Assessment

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Site 43 is an isolated forested/emergent wetland depression area surrounded by fill and residential and commercial development. The dense canopy is dominated by Hooker's willow and contains Sitka Spruce. The understory contains water parsley where present and Himalayan blackberry and salal in the drier areas bordering the woodland. The emergent wetland is dominated by buttercup, velvet grass, bentgrass and birdsfoot trefoil. It is too late in the season to assess the extent of hydrology and the boundary is uncertain.

SOIL Silty Clay (10Y 3/2 with 7.5YR 5/8 MT), moist; mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES The wetland values rated low due to its small size, disturbance and isolation.

IMPACTS/DISTURBANCES The site has been impacted by fill for surrounding development

SIGNIFICANCE Low. Past disturbance and isolation reduce the significance of this site.

SITE NO.: 44 **ACRES:** NA

NWI CLASSIFICATION: R

SITE SUMMARY

SITE NO.: 42b **ACRES:** ~29
LOCATION: Between Elliot and Sunset
TAX MAP NO.: 51030DA **TAX LOTS:** 6000, 5200

NWI CLASSIFICATION: PFOC, PEM
BASIN: Coolidge 3
DATE OF INVENTORY: 8/10/93

Wetland Functional Values Assessment

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Site 43 is an isolated forested/emergent wetland depression area surrounded by fill and residential and commercial development. The dense canopy is dominated by Hooker's willow and contains Sitka Spruce. The understory contains water parsley where present and Himalayan blackberry and salal in the drier areas bordering the woodland. The emergent wetland is dominated by buttercup, velvet grass, bentgrass and birdsfoot trefoil. It is too late in the season to assess the extent of hydrology and the boundary is uncertain.

SOIL Silty Clay (10Y 3/2 with 7.5YR 5/8 MT), moist; mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES The wetland values rated low due to its small size, disturbance and isolation.

IMPACTS/DISTURBANCES The site has been impacted by fill for surrounding development

SIGNIFICANCE Low. Past disturbance and isolation reduce the significance of this site.

LOCATION: E of powerline on edge of forest
TAX MAP NO.: 51029CA **TAX LOTS:** 200, 300, 301

BASIN: Elk Creek Road
DATE OF INVENTORY: 6/26/93

SITE SUMMARY

SITE NO.: 42b **ACRES:** ~29
LOCATION: Between Elliot and Sunset
TAX MAP NO.: 51030DA **TAX LOTS:** 6000, 5200

NWI CLASSIFICATION: PFOC, PEM
BASIN: Coolidge 3
DATE OF INVENTORY: 8/10/93

Wetland Functional Values Assessment

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Site 43 is an isolated forested/emergent wetland depression area surrounded by fill and residential and commercial development. The dense canopy is dominated by Hooker's willow and contains Sitka Spruce. The understory contains water parsley where present and Himalayan blackberry and salal in the drier areas bordering the woodland. The emergent wetland is dominated by buttercup, velvet grass, bentgrass and birdsfoot trefoil. It is too late in the season to assess the extent of hydrology and the boundary is uncertain.

SOIL Silty Clay (10Y 3/2 with 7.5YR 5/8 MT), moist; mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES The wetland values rated low due to its small size, disturbance and isolation.

IMPACTS/DISTURBANCES The site has been impacted by fill for surrounding development

SIGNIFICANCE Low. Past disturbance and isolation reduce the significance of this site.

Wetland Functional Values Assessment [1]

SITE SUMMARY

SITE NO.: 42b **ACRES:** ~29
LOCATION: Between Elliot and Sunset
TAX MAP NO.: 51030DA **TAX LOTS:** 6000, 5200

NWI CLASSIFICATION: PFOC, PEM
BASIN: Coolidge 3
DATE OF INVENTORY: 8/10/93

Wetland Functional Values Assessment

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Site 43 is an isolated forested/emergent wetland depression area surrounded by fill and residential and commercial development. The dense canopy is dominated by Hooker's willow and contains Sitka Spruce. The understory contains water parsley where present and Himalayan blackberry and salal in the drier areas bordering the woodland. The emergent wetland is dominated by buttercup, velvet grass, bentgrass and birdsfoot trefoil. It is too late in the season to assess the extent of hydrology and the boundary is uncertain.

SOIL Silty Clay (10Y 3/2 with 7.5YR 5/8 MT), moist; mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES The wetland values rated low due to its small size, disturbance and isolation.

IMPACTS/DISTURBANCES The site has been impacted by fill for surrounding development

SIGNIFICANCE Low. Past disturbance and isolation reduce the significance of this site.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 42b **ACRES:** ~29
LOCATION: Between Elliot and Sunset
TAX MAP NO.: 51030DA **TAX LOTS:** 6000, 5200

NWI CLASSIFICATION: PFOC, PEM
BASIN: Coolidge 3
DATE OF INVENTORY: 8/10/93

Wetland Functional Values Assessment

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Site 43 is an isolated forested/emergent wetland depression area surrounded by fill and residential and commercial development. The dense canopy is dominated by Hooker's willow and contains Sitka Spruce. The understory contains water parsley where present and Himalayan blackberry and salal in the drier areas bordering the woodland. The emergent wetland is dominated by buttercup, velvet grass, bentgrass and birdsfoot trefoil. It is too late in the season to assess the extent of hydrology and the boundary is uncertain.

SOIL Silty Clay (10Y 3/2 with 7.5YR 5/8 MT), moist; mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES The wetland values rated low due to its small size, disturbance and isolation.

IMPACTS/DISTURBANCES The site has been impacted by fill for surrounding development

SIGNIFICANCE Low. Past disturbance and isolation reduce the significance of this site.

GENERAL DESCRIPTION This seasonal steep gradient stream is approximately 5 ft. wide. The wetland fringe averages 15 ft. across. Vegetation is dominated by a Sitka spruce canopy. The understory is dominated by skunk cabbage (95%) and includes slough sedge and salmonberry. The wetland

SITE SUMMARY

SITE NO.: 42b **ACRES:** ~29 **NWI CLASSIFICATION:** PFOC, PEM
LOCATION: Between Elliot and Sunset **BASIN: Coolidge 3**
TAX MAP NO.: 51030DA **TAX LOTS:** 6000, 5200 **DATE OF INVENTORY:** 8/10/93

Wetland Functional Values Assessment

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Site 43 is an isolated forested/emergent wetland depression area surrounded by fill and residential and commercial development. The dense canopy is dominated by Hooker's willow and contains Sitka Spruce. The understory contains water parsley where present and Himalayan blackberry and salal in the drier areas bordering the woodland. The emergent wetland is dominated by buttercup, velvet grass, bentgrass and birdsfoot trefoil. It is too late in the season to assess the extent of hydrology and the boundary is uncertain.

SOIL Silty Clay (10Y 3/2 with 7.5YR 5/8 MT), moist; mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES The wetland values rated low due to its small size, disturbance and isolation.

IMPACTS/DISTURBANCES The site has been impacted by fill for surrounding development

SIGNIFICANCE Low. Past disturbance and isolation reduce the significance of this site.

boundary is defined by a break in slope and where dominant vegetation changes from skunk cabbage to sword fern. Water source is from a culvert.

SITE SUMMARY

SITE NO.: 42b **ACRES:** ~29
LOCATION: Between Elliot and Sunset
TAX MAP NO.: 51030DA **TAX LOTS:** 6000, 5200

NWI CLASSIFICATION: PFOC, PEM
BASIN: Coolidge 3
DATE OF INVENTORY: 8/10/93

Wetland Functional Values Assessment

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Site 43 is an isolated forested/emergent wetland depression area surrounded by fill and residential and commercial development. The dense canopy is dominated by Hooker's willow and contains Sitka Spruce. The understory contains water parsley where present and Himalayan blackberry and salal in the drier areas bordering the woodland. The emergent wetland is dominated by buttercup, velvet grass, bentgrass and birdsfoot trefoil. It is too late in the season to assess the extent of hydrology and the boundary is uncertain.

SOIL Silty Clay (10Y 3/2 with 7.5YR 5/8 MT), moist; mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES The wetland values rated low due to its small size, disturbance and isolation.

IMPACTS/DISTURBANCES The site has been impacted by fill for surrounding development

SIGNIFICANCE Low. Past disturbance and isolation reduce the significance of this site.

WETLAND FUNCTIONAL VALUES All of the functional values rated low with the exception of Wildlife Habitat due to the small size of the drainage and the level of existing disturbance due to

SITE SUMMARY

SITE NO.: 42b **ACRES:** ~29
LOCATION: Between Elliot and Sunset
TAX MAP NO.: 51030DA **TAX LOTS:** 6000, 5200

NWI CLASSIFICATION: PFOC, PEM
BASIN: Coolidge 3
DATE OF INVENTORY: 8/10/93

Wetland Functional Values Assessment

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Site 43 is an isolated forested/emergent wetland depression area surrounded by fill and residential and commercial development. The dense canopy is dominated by Hooker's willow and contains Sitka Spruce. The understory contains water parsley where present and Himalayan blackberry and salal in the drier areas bordering the woodland. The emergent wetland is dominated by buttercup, velvet grass, bentgrass and birdsfoot trefoil. It is too late in the season to assess the extent of hydrology and the boundary is uncertain.

SOIL Silty Clay (10Y 3/2 with 7.5YR 5/8 MT), moist; mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES The wetland values rated low due to its small size, disturbance and isolation.

IMPACTS/DISTURBANCES The site has been impacted by fill for surrounding development

SIGNIFICANCE Low. Past disturbance and isolation reduce the significance of this site.

culverts, fill, and adjacent clearcutting. Wildlife Habitat rated medium due to the presence of permanent water.

SITE SUMMARY

SITE NO.: 42b **ACRES:** ~29
LOCATION: Between Elliot and Sunset
TAX MAP NO.: 51030DA **TAX LOTS:** 6000, 5200

NWI CLASSIFICATION: PFOC, PEM
BASIN: Coolidge 3
DATE OF INVENTORY: 8/10/93

Wetland Functional Values Assessment

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Site 43 is an isolated forested/emergent wetland depression area surrounded by fill and residential and commercial development. The dense canopy is dominated by Hooker's willow and contains Sitka Spruce. The understory contains water parsley where present and Himalayan blackberry and salal in the drier areas bordering the woodland. The emergent wetland is dominated by buttercup, velvet grass, bentgrass and birdsfoot trefoil. It is too late in the season to assess the extent of hydrology and the boundary is uncertain.

SOIL Silty Clay (10Y 3/2 with 7.5YR 5/8 MT), moist; mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES The wetland values rated low due to its small size, disturbance and isolation.

IMPACTS/DISTURBANCES The site has been impacted by fill for surrounding development

SIGNIFICANCE Low. Past disturbance and isolation reduce the significance of this site.

IMPACTS/DISTURBANCES Disturbed by fill sand and culverts.

SIGNIFICANCE Low due to large amount of disturbance.

SITE SUMMARY

SITE NO.: 45 **ACRES:** NA
LOCATION: NW of Gulcana/Hemlock
TAX MAP NO.: 51031AA **TAX LOTS:** 5401, 5402

NWI CLASSIFICATION: R, seasonal
BASIN: Gulcana
DATE OF INVENTORY: 6/26/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Site 45 is a stream corridor which is a continuation of Site 29 that is culverted under Hemlock Street. The stream has been channelized and is approximately 3 ft. wide. It bisects a mowed lawn. Vegetation on channel banks is dominated by lady fern. Other vegetation present within the channel includes water parsley, speedwell, buttercup, bulrush, and scattered Hooker's willow. Wetlands are confined to the channel and a narrow (approximately 5 ft.) wetland fringe.

WETLAND FUNCTIONAL VALUES All functional values rated low due to the high degree of disturbance.

IMPACTS/DISTURBANCES Surrounded by a weedy mowed lawn.

SIGNIFICANCE Low. This site is primarily significant for drainage runoff.

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[1]Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 46 **ACRES:** NA **NWI CLASSIFICATION:** R ?
LOCATION: NE of Hemlock/N of Haystack Resort (Near Hwy interchange) **BASIN: Tolovana**
TAX MAP NO.: 51032CB **TAX LOTS:** 900, 1003 **DATE OF INVENTORY:** 6/26/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION This perennial stream corridor is channelized and is a continuation of Site 30. The channel and wetland fringe averages 5 ft. wide. Riparian vegetation is dominated by red alder, Hooker's willow and Himalayan blackberry. Sitka spruce, buttercup, and water parsley are also present. The south bank is adjacent to a large parking lot and the north bank is adjacent to a mowed lawn. Wetland are confined to the channel and steep channel banks.

WETLAND FUNCTIONAL VALUES All functional values rated low due to the high degree of site disturbance.

IMPACTS/DISTURBANCES Stream is channelized and culverted and surrounded by a mowed lawn on one side and a parking lot on the other.

SIGNIFICANCE Low. This site is primarily significant for drainage runoff.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 47 **ACRES:** NA
LOCATION: NW of Hemlock/Umpqua
TAX MAP NO.: 51031DD **TAX LOTS:** 501, 600, 800, 900, 1001, 1002

NWI CLASSIFICATION: R ?
BASIN: Umpqua
DATE OF INVENTORY: 6/26/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION This seasonal stream has been channelized, culverted and filled. Access is extremely difficult due to dense Himalayan blackberry and Hooker's willow thickets. Much of the thicket is probably a relict wetland that has been dewatered by hydrologic alterations. The channel averages 3 ft. wide. Soil was sampled in an adjacent depression area.

SOIL SiC saturated to surface 10YR 3/1 with 7.5YR 3/4 MT

WETLAND FUNCTIONAL VALUES This site is only significant for drainage runoff.

IMPACTS/DISTURBANCES Extreme disturbance due to channelization and fill.

SIGNIFICANCE Low due to a large amount of disturbance.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 48 **ACRES:** < 0.5 **NWI CLASSIFICATION:** R, PFOC
LOCATION: NE of Tolvana/Hemlock **BASIN: Coos**
TAX MAP NO.: 51032CC **TAX LOT:** 500 **DATE OF INVENTORY:** 5/18/93 & 6/26/93
TAX MAP NO.: 51032CC, supp. #2 **TAX LOTS:** 8000, 8001, 8002, 8003

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION This forested swale contains a canopy of Sitka spruce with snags. The understory is dominated by skunk cabbage, water parsley, and slough sedge. In drier areas or on fallen trees salal dominates the understory. The south half of the wetland is a mosaic with salal dominating the understory upland pockets. The wetland is approximately 50 ft. wide north of the condominiums and is reduced to braided channelized streams approximately 2.5 ft. wide as the channels meander under house pilings and between houses on the east end of the site. Upon return on 6/26 to sample soils, the forest had been cleared and pushed into the wetlands.

SOIL Too disturbed to assess. Mapped as Walluski SiL by SCS.

WETLAND FUNCTIONAL VALUES Before extensive clearing was accomplished, the site was rated medium for wildlife due to unique site functions such as seasonal pondings and snags. Recent disturbance has reduced the value of this site.

IMPACTS/DISTURBANCES This site has been impacted by stream channelization and land clearing.

SIGNIFICANCE Low.

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[1] *Based on best professional judgment and field assessment methods*

SITE SUMMARY

SITE NO.: 49 **ACRES:** NA **NWI CLASSIFICATION:** R, spring
LOCATION: W of Hemlock adjacent to Oswald West Home **BASIN: no name**
TAX MAP NO.: 51031AA **TAX LOT:** 500 **DATE OF INVENTORY:** 6/26/93

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	H	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Site 49 is a spring and drainage ditch. The spring is enclosed in a potentially historic landmark as part of the Oswald West Estate. The spring feeds a narrow incised drainage ditch that is approximately 2 ft. wide and surrounded by a mowed lawn. Vegetation on the bank of the ditch includes buttercup and grass.

WETLAND FUNCTIONAL VALUES Noteworthiness rated high due to the historic nature of the spring "box".

IMPACTS/DISTURBANCES The channel is an incised ditch surrounded by a mowed lawn.

SIGNIFICANCE Low for the ditch. High for the spring.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 51 **ACRES:** <0.5 **NWI CLASSIFICATION:** PFOC, R
LOCATION: Kenai/Pacific **BASIN: Brailler**

SITE SUMMARY

SITE NO.: 50 **ACRES:** ≈ 7+ **NWI CLASSIFICATION:** PFO, R
LOCATION: N of Ecola Creek and W of Highway 101 **BASIN: Ecola Creek**
TAX MAP NO.: 51020CB **TAX LOTS:** 3400, 3700, 5301 **DATE OF INVENTORY:** 5/18/93
TAX MAP NO.: 51020CA **TAX LOT:** 300

Wetland Functional Values Assessment [1]

Ecological Integrity	H	Recreation	M
Wildlife Habitat	H	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	M	Nutrient Retention	L
Education Potential	M	Urban Quality of Life	M

GENERAL DESCRIPTION The large forested wetland contains a stream channel that enters the site from a culvert under Highway 101. The channel averages 5 ft. across. The deciduous forest canopy is dominated by red alder. The understory is dominated by skunk cabbage (80%) and also includes water parsley, slough sedge, lady fern, oxalis and stinking currant. Adjacent uplands are dominated by Sitka spruce and red elderberry. Elk sign is abundant.

SOIL Silty Clay (gray with bright orange mottles); mapped as Walluski SiL and Templeton-Ecola Sil by SCS.

WETLAND FUNCTIONAL VALUES Many values rated high and medium due to the large size of the forested wetland and the relative naturalness of the site. The site is adjacent to Ecola Creek estuary and extensive forests on the other side of Highway 101. This site contains critical breeding habitat features such as snags, downed woody debris, and seasonal pondings.

IMPACTS/DISTURBANCES The margins of the wetlands have been impacted by overnight camping park; also fragmented by Highway 101.

SIGNIFICANCE High. This site is highly significant for its large size providing elk habitat, groundwater discharge area, and for connectivity with Ecola Creek estuary.

Based on best professional judgment and field assessment methods

SITE SUMMARY

SITE NO.: 52 **ACRES:** NA **NWI CLASSIFICATION:** R, seasonal
LOCATION: NW of Nazina/Hemlock **BASIN: Chena**
TAX MAP NO.: 51031AA **TAX LOTS:** 901, 902, 1600 **DATE OF INVENTORY:** 3/15/94

Wetland Functional Values Assessment [1]

Ecological Integrity	L	Recreation	L
Wildlife Habitat	L	Flood Control	L
Fish Habitat	L	Sediment Trapping	L
Noteworthiness	L	Nutrient Retention	L
Education Potential	L	Urban Quality of Life	L

GENERAL DESCRIPTION Site 52 is a stream corridor which begins at a culvert under Hemlock Street and continues approximately 200 feet to a covered drainage at Nazina Avenue. The channel and wetland fringe averages 5 feet in width. There are several areas where ponding water has created broader wetland areas. Riparian vegetation is dominated by Sitka spruce, Hooker's willow, and water parsley.

WETLAND FUNCTIONAL VALUES All functional values rated low due to the high degree of disturbance.

IMPACTS/DISTURBANCES Surrounded by roadways.

SIGNIFICANCE Low. This site is primarily significant for drainage runoff.

NOTE: This site was assessed by Rainmar Bartl, City of Cannon Beach, after the field work was completed by FES

[1] *Based on best professional judgment and field assessment methods*

CANNON BEACH:
An Integrated Approach to Sand Management

Including
A Proposal to the City of Cannon Beach
for Sand Management Activity by the
Breakers' Point Homeowners Association
by
Charles L. Rosenfeld
Registered Professional Geologist

September 10, 1997

AMENDED AND ADOPTED

Executive Summary

Cannon Beach:
An Integrated Approach to San Management

This document summarizes the status of mobile sediment processes within the Cannon Beach littoral cell, reviews historical changes, known causes, and measured volumes of sand. The beaches within the Cannon Beach cell are classified and divided into littoral sub-cells on the basis of their dynamics and behavior. Littoral areas within the City of Canon Beach planning area have been classified into management units, based upon their landuse and historical management approaches. Descriptions of sand management problems within each of the proposed management units are addressed, and a framework for an overall sand management policy for the City of Canon Beach is proposed.

A complete color infrared (CIR) air photo inventory of the City of Cannon Beach planning area was analyzed to locate and define the sand management units, their specific problems, and the status of stilling vegetation within each of them. This enabled a more specific discussion of problem areas and areas of environmental sensitivity with the oceanfront management zone.

The Breakers' Point Homeowner's Association has included a more detailed 'site specific' analysis of the problems at the south end of Chapman Beach, and proposes a sand management plan to remedy some of the more critical problems at the condominium site. The proposed sand management actions are initially limited to a short area of beach fronting the southwest portion of the property. The management actions consist of a three step process to enhance vegetation vigor, grade advancing dune crests into a series of low sand ridges, and re-vegetate the affected area. The timing of these actions has been adjusted to reduce the possibility of storm modification, and the area has been restricted in size and orientation to reduce any potential affects on adjacent properties and views.

The proposed actions will produce a more even dune topography, with 'natural' appearing dune ridges, and vegetation gaps will be eliminated, reducing the need for recurring remedial action. The total volume of sand to be graded is less than 4,000 cubic yards. The project site will be monitored throughout the life of the plan, and subsequent management activity will be based on the success of the initial actions. The plan is expected to be effective for seven to ten years.

Charles L. Rosenfeld
Registered Professional Geologist

Cannon Beach:
An Integrated Approach to Sand Management

INTRODUCTION

This document has been written in conformance with the requirements established in "Dune Management Planning: A guide to preparing a Dune Management Plan as provided for in Statewide Planning Goal 18 (Beaches & Dunes)," by the Oregon Department of Land Conservation and Development, July 1989, and its subsequent addendum dated December 12, 1991. The current document is based upon prior submissions, revised according to suggestions made by Shorelands Solutions (1994) and subsequent discussions with staff members of DLCD, DOGAMI, and members of the DLCD Coastal Zone Technical Advisory Group. Additional suggestions were made by Rainmar Bartl, Cannon Beach City Planner. The author is grateful for the constructive cooperation of everyone involved.

Part I:
CANNON BEACH LITTORAL CELL:
EVALUATION OF SHORELINE PROCESSES
AND MANAGEMENT IMPLICATIONS

Littoral cells are contiguous stretches of shoreline where sand is seasonally moved by wave and wind processes. Along the Oregon coast, littoral cells are bounded by rocky headlands which obstruct the marine currents from carrying sand from one `cell' to the next. Thus the sand volume, its sources and mineralogy, and the processes which are constantly shaping and reforming its beaches have characteristics unique to that cell. This section describes the factors which influence the behavior of beach and sand dynamics in the Cannon Beach littoral cell.

The Cannon Beach littoral cell extends from Cape Falcon north for a distance of sixteen kilometers to Chapman Point. The volume, consistency, mineralogy and dynamics of the mobile bodies of sand within this cell were selected for intensive study during the summer of 1990[1]. The data acquisition included (1) beach surveys to determine the profile from the vegetation line to below mean sealevel (MSL), (2) seismic refraction surveys to determine the thickness of sand beneath the surveyed profiles, and hence determine the total sand volumes, and (3) analysis of aerial photos to determine beach width at mean sealevel to locate the sources of sand and the direction of net transport within the cell.

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[1]Rosenfeld, C.L., C.D. Peterson, D.J. Pettit, P.L. Jackson, and A.J. Kimerling, `Integrated Photogrammetric and Geophysical Monitoring of Shoreline Instability in the Littoral Cells of the Pacific Northwest, USA', Coastal Sediments '91, Seattle, p. 1503-1517.

The Cannon Beach cell contains approximately 4 million cubic meters of sand, of which nearly 30% presently resides in the northernmost 2 kilometers at Chapman Beach[2]. Like much of the sand along the Oregon coast, most of it originated millions of years ago as sediment washed from the Klamath mountains far to the south which formed sandstones and mudstones in a shallow sea that were later uplifted into the Coast Range of today. The tectonic forces that shaped these coastal mountains also uplifted older shorelines which have been preserved as marine terraces. Over the past two million years, climatic fluctuations associated with the Pleistocene `ice ages' have lowered sealevel as much as 300 feet, causing the shoreline migrate west of its present position. During these periods of lowered sealevel, the headlands which block the transport of sand along the coast today were often several miles inland from the beach. This permitted sand to be readily shifted along the coast. Huge volumes of glacially eroded sediment were carried into the sea by the Columbia River, but as the glaciers melted and sealevel rose to its present height, Cape Falcon blocked sand transport to the south and Chapman Point blocked the northern end. The Cannon Beach littoral cell, having no major river systems which supply it with sediment, has a remnant of the sand carried here prior to the last sealevel rise mixed with sand eroded from the old marine terraces as the waves of Pacific storms have lashed this shoreline over the past 10,000 years. Each year sand is swept from the beaches by ocean currents that will deposit it into deep water, or by winds that will carry sand into inland dunes. Sand lost from the beaches is only replaced by sediment eroded from the terraces, which are sometimes protected by seawalls or `revetments', thus management of the sand resources is critical to the survival of our beaches.

From Ecola Creek to Tolovana Beach the total volume of sand decreases from 338 to 162 cubic meters of sediment per linear meter of shoreline. Sand volume decreases toward the south boundary of the cell, from a high of 729 cubic meters per meter of shoreline to a low of only 85 cubic meters per meter at Cove Beach. Aerial photography from 1978, 1985,1989, and 1993 was compared for all beaches within the cell. The Cannon Beach cell showed marked changes following the 1983 `El Nino' event, with a marked widening of the northern beaches and severe depletion of the beaches south of Hug Point. The beaches north of Silver Point have adjusted to near their 1978 width, while those south of Hug Point have shown little recovery. This evidence suggests that Hug Point may act as a `one-way' valve to sediment transport in the Cannon Beach cell.[3]

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[2]Pettit, D.J., 1990, Distribution of Sand Within Selected Littoral Cells in the Pacific Northwest', Unpublished Master's Thesis, Portland State University, 249pp.

[3]The `near shore' bathymetry at Hug Point may allow northward transport of sediment by the longshore current during winter months when winds from the southwest and near-shore sand bars exist, but may not permit such transport once the prevailing summer winds from the northwest, characterized by gentle swells,

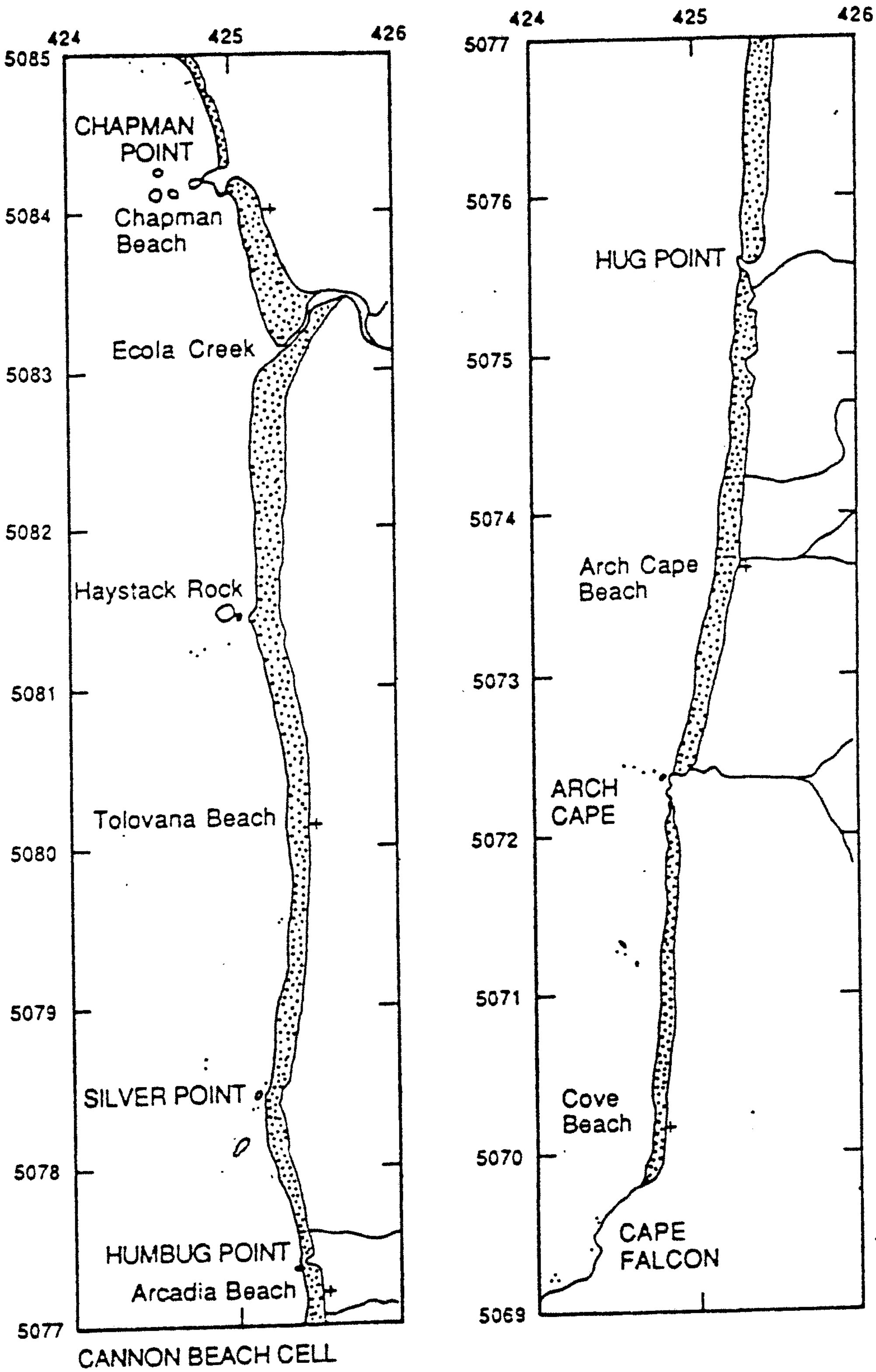

Figure 1: Mobile sand in the Cannon Beach littoral cell (1000 meter UTM Grid squares shown)

Table 2 Beach Profile Locations.

Transect Locations	Profile	Grain Size	Size Std. Dev.	Beach Prof. W.	Mid-Slope	Ave. Slope	Foredune Ht.
CHAPMAN B.	5083750	0.166	0.026	250	1.1	1.6	8.5
TOLOVANA SP	5079700	0.166	0.037	164	1.6	2.1	
ARCADIA B.	5077150	0.187	0.034	164	1.4	2.4	
ARCH CAPE	5073650	0.187	0.033	180	1.4	2.1	
COVE B.	5070000	0.152	0.045	34	1.6	5.1	

Table 2 Beach Profile Locations

Backshore Ht.	Platform Depth	Cs MHHW	Cs MLLW	Cs TOTAL Area	Ap. Width	Ap. Ave. Width	Ap. Std. Dev.
5.5	-1.5	530	730	730	171	172	7
5.5	-1	20	220	230	137	135	16
5.5	-2	30	290	380	109	96	26
5.5	-1.5	50	170	170	92	86	23
1.5	-2.5	30	110	270	44	33	12

Table 2 Beach Profile Locations

Ap. S.D/Mean	Ap. Cor. Fac.	Adj. Cs MHHW	Adj. Cs MLLW	Adj. Cs TOTAL	Segm. Length	Vol. MHHW	Vol. MLLW
0.04	1	530	730	730	2075	1100000	1513000
0.12	0.99	20	210	220	3630	54000	774000
0.27	0.89	30	250	340	2835	78000	718000
0.26	0.93	50	160	160	3110	139000	503000
0.38	0.76	20	90	200	2195	50000	186000

Table 2 Beach Profile Locations

Vol. TOTAL
1513000
810000
958000
503000
443000

Table 2 is part of a spreadsheet being developed for coastal zone management.
Colums of primary interest to this plan include:
Profile: the UTM (northing) location of detailled crossections
Beach Profile Width: width of mobile sand (in meters)
Average slope: beach slope (in degrees), steeper= more erosion
Foredune Height: average height of adjacent foredunes, in meters.
Cs MHHW: cubic meters of sand above Mean High Water, per linear meter
Cs MLLW: cubic meters of sand above Mean Low Water, per linear meter
Ap. Ave. Width: width of active beach, average for segment
Segm. Length: length of shoreline, in meters, characterized by profile
Vol MHHW/MLLW/Total: volume of sand above, for entire segment

TABLE 2:
TRANSECTS AND BEACH VOLUMES, JULY 1993

FACTORS AFFECTING THE STABILITY OF THE SHORELINE

Interannual climatic forcing of the sand transport processes[4] has clearly portrayed the differences between segments of the Cannon Beach cell in terms of erosion, deposition, and the rates of beach recovery. Mineralogy has identified the lateral boundaries of the cell[5], and sand size[6] has indicated the long term nature of the northward sand transport. From these studies the Cannon Beach littoral cell may be sub-divided into segments based wholly upon the process characteristics exhibited. Figure 1 is a map of the mobile sand areas within the Cannon Beach cell. This map is registered to the Universal Transverse Mercator (UTM) grid system, with locations in meters[7]. Between Hug Point and Silver Point interannual fluctuations in sand volume is intense, but recovery is rapid. North of Silver Point the effects of storms can be severe, but higher sand volumes and localized shoreline protection features have restrained erosion and encouraged rapid recovery. Chapman Beach, north of Ecola Creek contains the greatest concentration of accumulated sand, and has shown constant growth during the period from 1978 to present. Beach sand volumes for the Cannon Beach cell are summarized in Table 2, and the UTM locations for the beach profiles are listed as Transect Locations.

Longshore variations within the Cannon Beach Littoral Cell form narrow, low volume, lower stability, 'eroded' beaches at the south end of the cell to wide, high volume, higher stability, 'accreted' beaches at the north end of the cell are clearly documented by these transects. Similar longshore variations in beach width and sand volume have been

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push the near-shore sand back onto the beach. This would greatly exaggerate the net northward flow of sediment within the Cannon Beach cell.

[4]Peterson, C.D., P.L. Jackson, D.J. O'Niel, C.L. Rosenfeld and A.J. Kimerling, 1990, `Littoral Cell response to interannual climatic forcing 1983-1987 on the central Oregon coast, USA', Journal of Coastal Research, 6:87-110.

[5]Peterson, C.D., M.E. Darienzo, D.J. Pettit, P.L. Jackson and C.L. Rosenfeld, 1991, `Littoral Cell development in the Cascadia Margin of the Pacific Northwest, USA', From Shoreline to Abyss, SEPM Special Publication No. 46, p. 17-34.

[6]Ibid., p.26.

[7]The UTM system is used here as this is the grid system employed in the `Beach-Shoreline Data Base, Pacific Northwest Region, USA' to be published shortly by the Oregon Department of Geology and Mineral Industries, Portland.

reported elsewhere along the Oregon coast, with this interannual pattern becoming recognized as a common, if not characteristic, feature of littoral cells along the north Oregon coast.[8] The observations noted above, together with the succession of shoreline promontories that occur at remarkably equal increments (approximately every 3000 meters) along the shoreline, support a first order zonation in terms of coastal processes and morphologic characteristics between northern, central, and southern segments of the Cannon Beach Littoral Cell (i.e. Chapman Point (UTM 5084000 to Silver Point (UTM 5078500), Silver Point to Hug Point (UTM 5075500), Hug Point to Cape Falcon (UTM 5069500) respectively).

The geological history of the beach within the City of Cannon Beach is historically linked to the same pattern of northward sand movement and accumulation as is in evidence today. Like the City of Seaside, the central commercial district of Cannon Beach is built upon a sand spit which developed from the south. In the case of Cannon Beach the spit developed northward from the vicinity of Haystack Rock (UTM 5081.500) to the present position of Ecola Creek (UTM 5083.200), a length of about 1700 meters, with a maximum width of nearly 300 meters. This barrier spit gradually isolated a backwater lagoon that has `filled-in' by bog succession for at least the past 3000 years[9], as is evidenced by a succession of peat horizons and buried logs. Radiocarbon dates for the buried organic horizons indicate dates of 3040+/-80, 2640+/-70, 1060+/-50 and 380+/-60 Radiocarbon Years Before Present (RCYBP). These peat horizons, covered by tidal flat mud or sand layers, are interpreted by some marine geologists to represent the backwater lagoon vegetation which was then covered by tidal flat sediment during a major tsunami event triggered by an earthquake (approaching Magnitude 9.0) along the Cascadia Subduction Zone (CSZ) of the continental margin. Analysis of the burial depths of the youngest prehistoric CSZ tsunami (360+/-60 RCYBP) suggests that the tsunami overtopped the Cannon Beach spit south of Second Street, and also followed the course of Ecola Creek. The depositional transition between foredunes and backshore dunes occurs at about 5 meters (16 feet) elevation along the Cannon Beach spit (similar to other barrier spits along

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[8] Komar, P.D. 1992. Ocean Processes and Hazards along the Oregon Coast. In Coastal Natural Hazards: Science, Engineering, and Public Policy, J.W. Good and S.S. Ridlington, ed.: 38-73. ORESU-B-92-001, Corvallis: Oregon Sea Grant, Oregon State University. Marra, J. J., 1993. Sand Management Planning in Oregon. In Proceedings CZ93, 8th Symposium on Coastal and Ocean Management, New Orleans.

[9]Gallaway, J.P., A.M. Watkins, C.D. Peterson, S.C. Craig and B.L. McLeod, 1992, `Study of tsunami inundation of Ecola Creek wetlands and spit, Cannon Beach, Oregon: Final Report to the Clatsop County Sherriffs Office, Clatsop County, Oregon, 21pp.

the Oregon coast[10]), this infers tsunami runups of at least 6 meters (20 feet) at Cannon Beach for a major CSZ event. The tsunami associated with the 1964 Gulf of Alaska earthquake, by contrast, was limited to the lower channel area of Ecola Creek[11] where the highway bridge near the mouth of the creek was destroyed. The wave action of the 1964 tsunami mimicked previous events as it entered the mouth of the Ecola channel, then spread out laterally east of Larch Street. Figure 4 is a map of the City of Cannon Beach showing the tsunami run-up areas derived from Gallaway, et. al., 1992, Priest, et. al. 1996 (draft) and local topography.

Part II:
LITTORAL SUB-CELLS AND MANAGEMENT UNITS WITHIN THE CITY OF CANNON BEACH

City of Cannon Beach planning area includes two disticntive littoral sub-cells: Tolovana Beach (UTM 5078000 to 5081450), and Cannon Beach (UTM 5081450 to 5084100). Tolovana beach extends from Silver Point to Haystack Rock, while Cannon Beach occupies the segment of shoreline between Haystack Rock and Chapman Point. Although Cannon Beach shoreline segments may not be distinct from the standpoint of coastal processes and morphologic characteristics, a subdivision of the area between Haystack Rock and Chapman Point is warranted for management purposes on the basis of varied development characteristics, construction setbacks, and shoreline management strategies. Given similarities in terms of coastal processes and morphologic characteristics, management unit designations may be based on a consideration of factors such as the type and/or level of existing land uses or prescribed management measures. In this regard, it is worth note that similar sorts of subdivisions of shoreline segments, primarily for management purposes, have become common in Oregon[12].

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[10]Ibid.,Pettit, 1991.

[11]Peterson, C.D., M.E. Darienzo, S.F. Burns, and W.K. Burris, 1993, `Fieldtrip guide to Cascadia paleoseismic evidence along the northern Oregon coast: Evidence of subduction zone seismicity in the central Cascadia margin',<u>Oregon Geology</u>, v.55 (5), p. 99-114.

[12] Ternyik, Wilbur and Cortright, R., 1986. Rockaway/Nedonna Beach Dune Management Study: Nedonna Beach Foredune Grading Plan. Oregon Department of Land Conservation and Development. 55p.

Shoreland Solutions, 1993. City of Seaside Foredune Management Plan: Management Strategy.

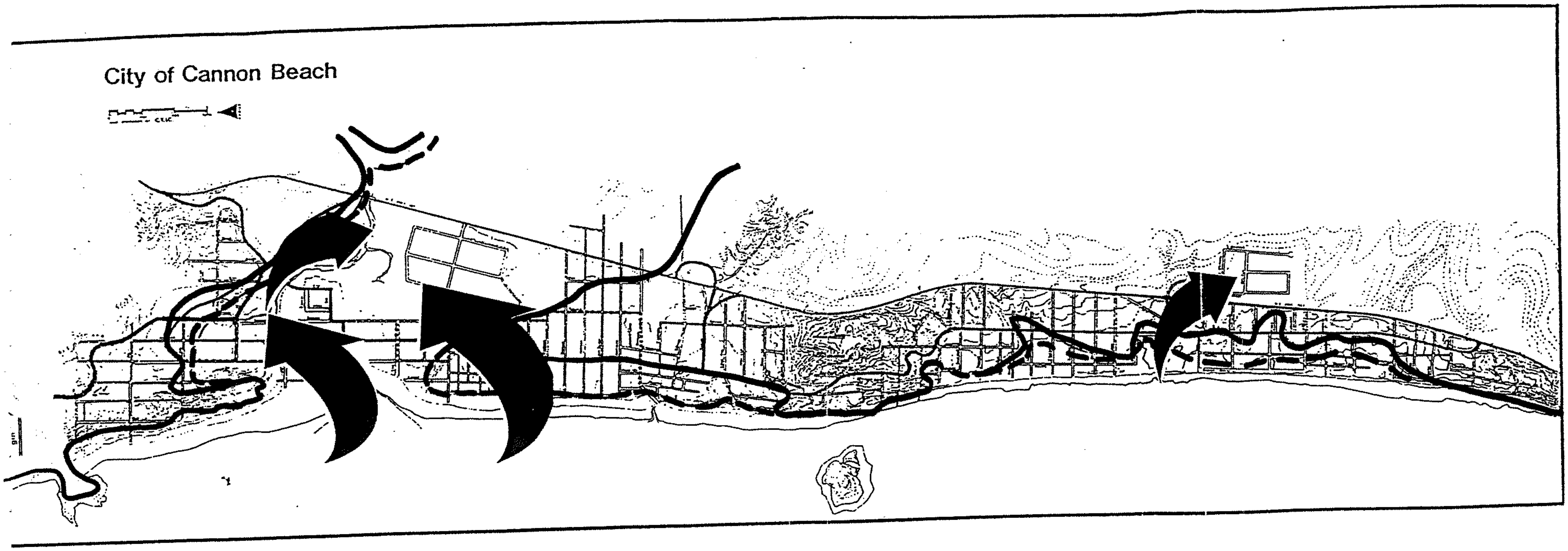
DOGAMI, 1993. Chronic Hazards Mapping Pilot Project. Final Report to the Oregon Department of And Conservation and Development. September, 1993.

The characteristics of the management units within the Cannon Beach sub-cell are defined based on geology and shoreline management practices, and are located on Figure 3B. These management units are separated at Haystack Rock, Harrison Street, Kramer Point and Ecola Creek, resulting in four resource units of critical importance. Management activity within any management unit should consider the character of adjacent units, thus assuring planning integrity within the entire Cannon Beach planning area. Figure 3B illustrates these proposed management units using aerial photos which illustrate the extent of active sand areas within the City of Cannon Beach planning area.

Starting at Haystack Rock north to the storm water discharge and ramp at the foot of Harrison Street is the Haystack Management Unit. This area is characterized by the bedrock exposures of the headland adjacent to the rock and the sand accumulation associated with the wave refraction around that monolith. Historically, shoreline erosion has been weak, and recession has been slow. The sand accumulated shoreward of Haystack Rock is technically known as a 'tombolo' and provides localized protection from wave energy.

From the Harrison Street ramp to Kramer Point the shoreline is underlain by Tertiary marine terrace deposits, with a low erosion bluff fronting the beach. This area is defined as the Presidential Management Unit. This area has experienced substantial sand accumulations since the mid-1980's. From Harrison Street north to Washington Street the accumulated sand has been stabilized by natural willows and beach grass, with willow predominating in the south end and beach grass at the north end. North of Jackson Street, the dune's height has increased to the extent that properties east of Ocean Avenue hav had their views impacted. Properties along Ocean Avenue have also experienced sand inundation of building foundations, lawns and lanscaped areas. This effect is particularly pronounced between Adams Street and Jefferson Street, where Ocean Avenue has not been improved. From Washington Street north to First Street, the dunes that have developed have a limited vegetation cover. As a result, their height is less than that of the dunes further south. However, because of the limited vegetation cover on these dunes, the level of sand inundation of abutting properties is generally greater than that of areas further south in this management unit.

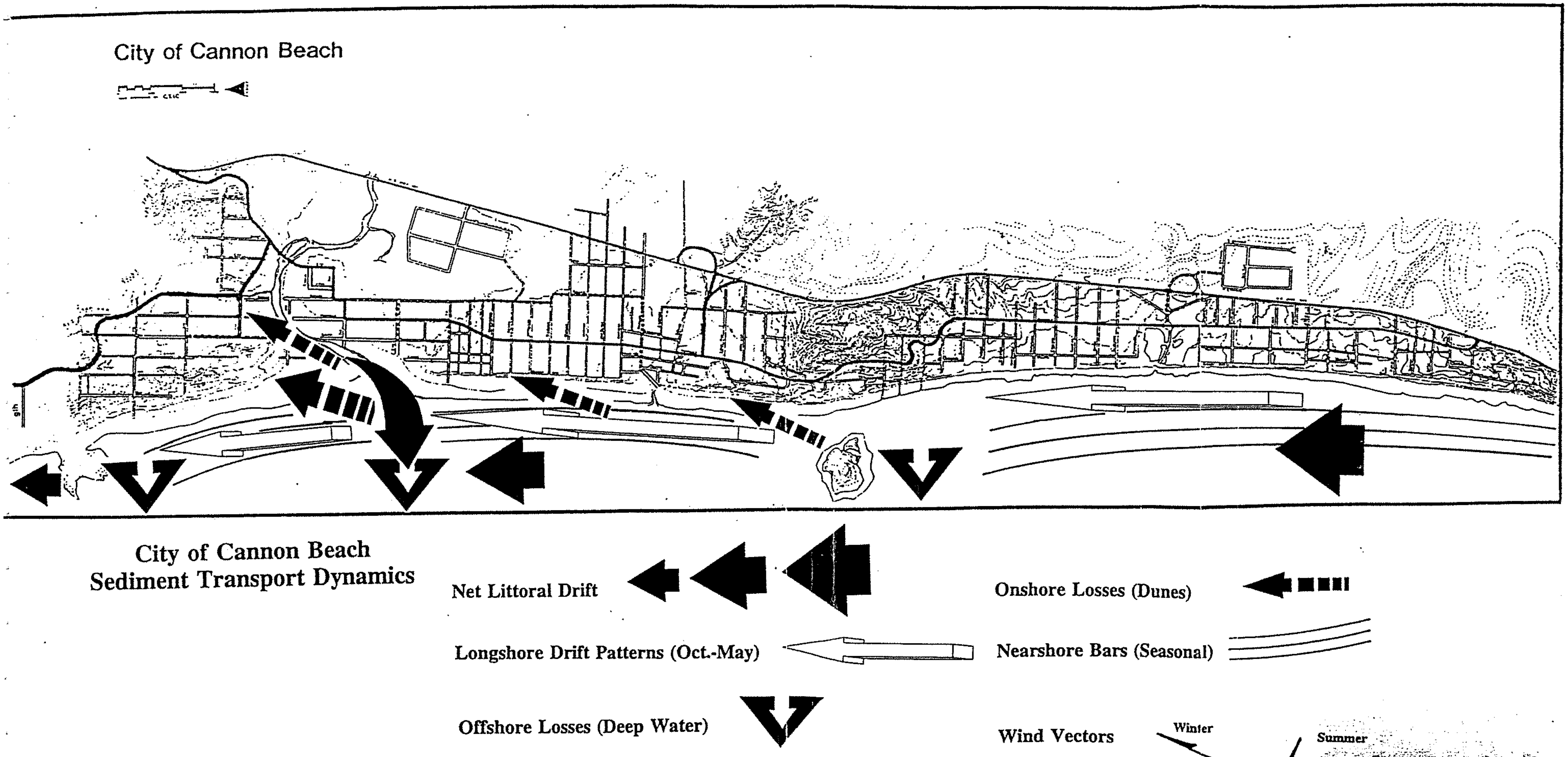
North of Kramer Point to the Ecola Creek channel is the Downtown Management Unit, which is the oldest attempt at structural control of the shoreline within the Cannon Beach cell. The downtown area is an old sand spit, consisting of loose sand, separated from the mainland by a back marsh bay. Primarily stabilized by seawalls and rock revetments, some dating back to the early 1930's, the extent of reliance on shoreline protection devices in this management unit is unique within the Cannon Beach littoral cell. Problems associated with the Downtown Management Unit include longshore transport of sand and



Tsunami Run-up Areas

Arrows showing primary areas of run-up after Gallaway et. al. 1992
Solid line is maximum predicted run-up from a Continental Margin earthquake, dashed line is evidence from 1964 Alaska earthquake, after Priest et. al. 1996.

Figure 4:



City of Cannon Beach
Sediment Transport Dynamics

Figure 5

rip-cell effects caused by wave energy reflection from the seawall, which must be monitored to retain the recreational quality of the beach.

The remaining shoreline north of the Ecola Creek channel is the Chapman Management Unit. By contrast, shoreline management has been based entirely on sand stabilization by vegetation. Some of the beachgrass plantings in the Chapman Management Unit date back to the early 1950's. Effectively, the Chapman Management Unit consists of residential construction at higher elevations in the Chapman Beach sub-division and the adjacent Visher property, and those to the south which were constructed at lower elevations. Developers of the Chapman Beach sub-division have agreed not to engage in dune grading activities, and the Vishers have publicly stated a similar intent. The owner's of the lower elevation structures to the south must rely on a combination of vegetation management with occasional sand grading.

Part III
HISTORY OF SAND DUNE VEGETATION AND STABILIZATION

European beachgrass (ammophila arenaria) was introduced to the coast of Oregon around Coos Bay in the late 1880's. The historical use of European beachgrass within the Cannon Beach littoral cell probably dates back to the initial use of this grass cover on the Warrenton dunes area of the Clatsop plains to the north, however, no specific historical evidence exists to its extensive or planned use until the 1950's. Historical photography of the Chapman Beach area[13] show no plantings of beachgrass at that time. A soil and water conservation project was under taken in cooperation with the Soil Conservation Service along the northern portion of Chapman Beach north of UTM 5083.500 during the 1960's. This project successfully introduced European beachgrass and greatly increased the retention of accumulated sand in the area. As a result, conditionally stable dunes now front the marine terrace along most of Chapman Beach, ranging in width from about 75 feet at the south end to a maximum of 200 feet further north. In the late 1960's a property owner attempted to mechanically terrace and surface the south end of Chapman Beach from Ecola Creek to Fifth Street. This effort was largely unsuccessful, as it was not accompanied by stabilizing vegetation, and the terraces wee soon covered by advancing foredunes. By the mid-1970's this area was at least partially stabilized by the spread of European beachgrass from the project area to the north.

[13]Photos of Chapman Beach taken in the 1930's were provided by Mr. John Yeon of Portland, and are included in Rosenfeld, C., 1976, Terrain sensitivity of the proposed Breakers' point condominium site, Cannon Beach, Oregon, Final Report prepared for the City of Cannon Beach, 24 pp.

Figure 3A: Littoral Zone Sub-Divisions,
City of Cannon Beach

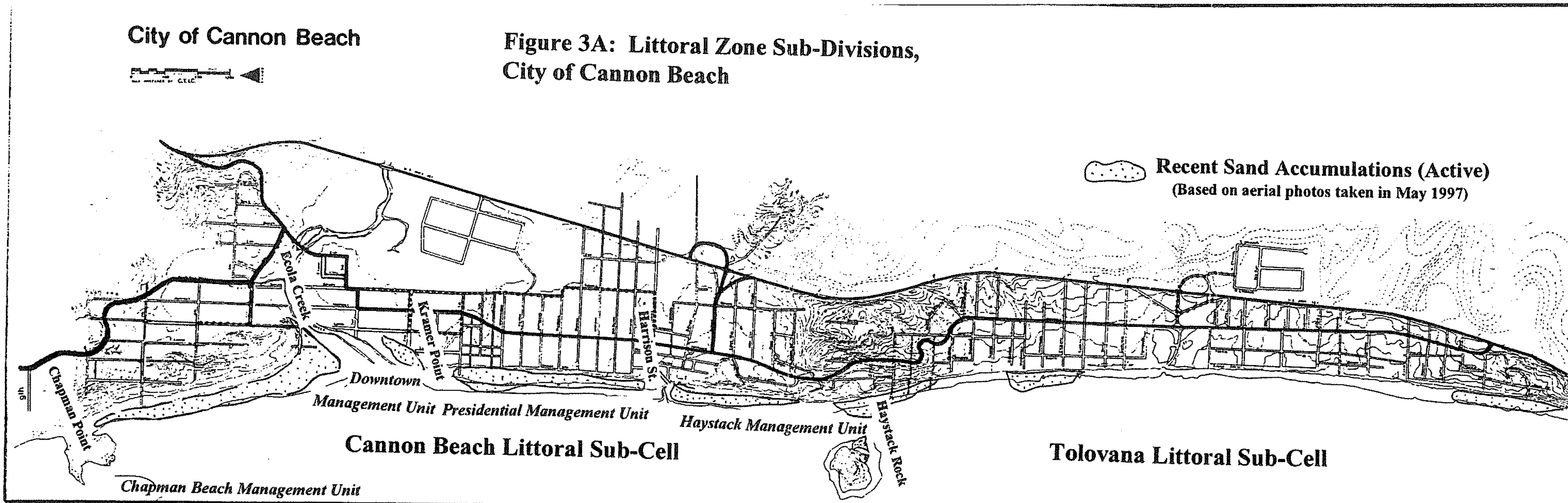


Figure 3B: San Management Units,
Cannon Beach Littoral Sub-Cell

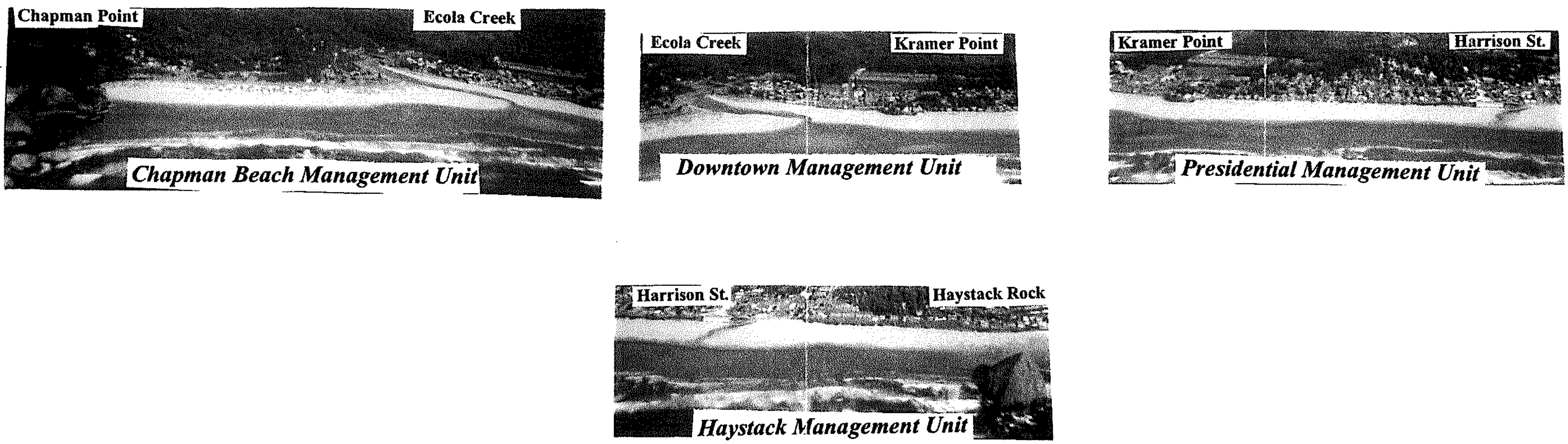
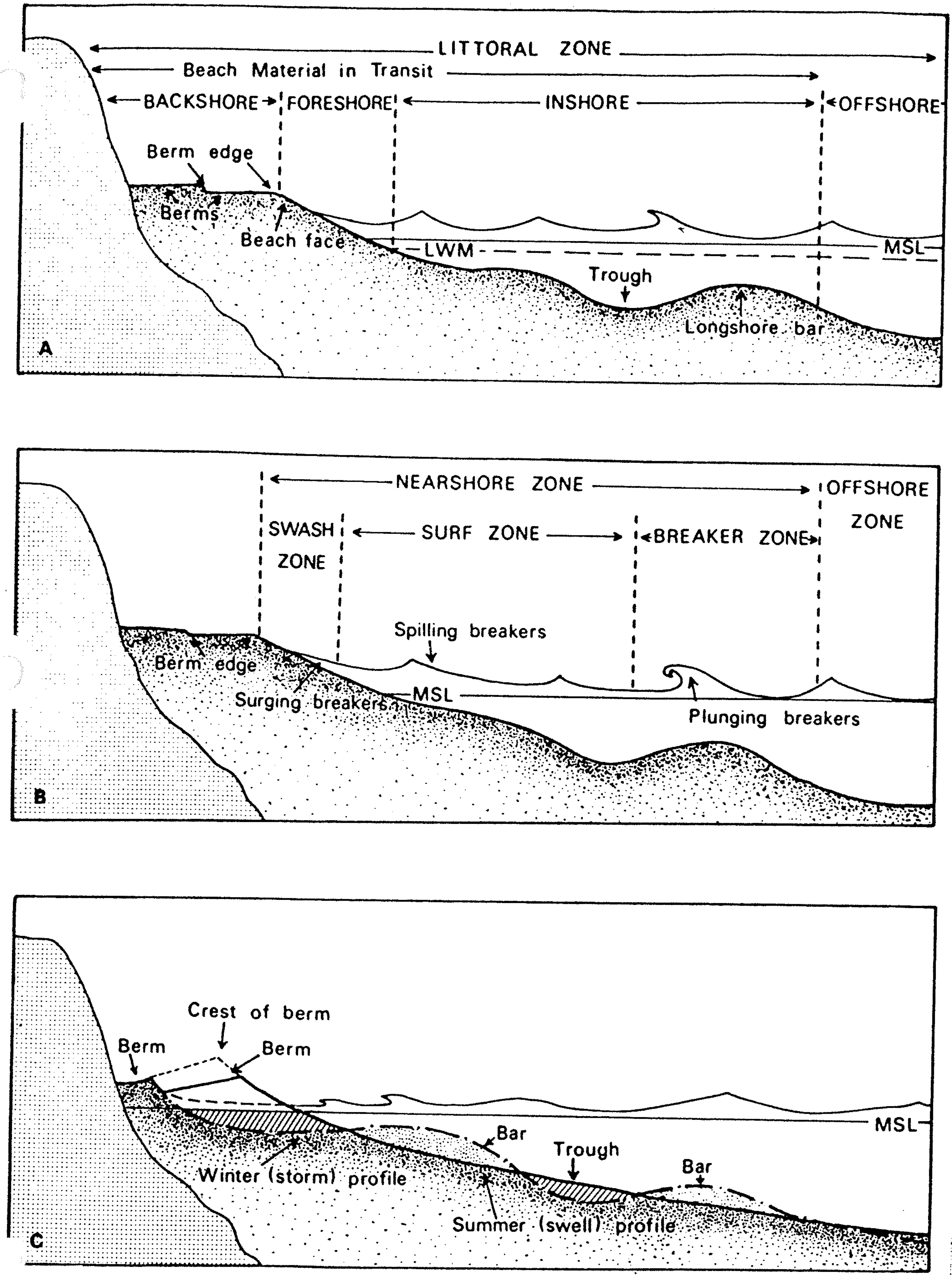


Figure 6: Illustration of technical terms used



SCHEMATIC DIAGRAMS SHOWING ZONES USED TO DESCRIBE (A) BEACH PROFILES, (B) WAVE AND CURRENT ACTION, (C) PROFILE CHANGES DUE TO STORM AND SWELL WAVES

Since 1979, sand management activities along the south portion of Chapman Beach have been carried out by the Breakers' Point Homeowners Association, and their immediate neighbors. Immediately following construction the developer planted beachgrass using the Clatsop plains planting specifications. The initial activity centered about the formation of an adequate marine erosion barrier, and the stabilization of blowing sand disturbed by the construction activities. In 1981, a severe winter storm deposited large volumes of sand over the entire condominium site, including the roofs of the two-story residences. The homeowners took remedial action, including toppling of the crest of the vegetated dune toward the beach. Subsequent repair activity included raking of buried beachgrass chutes to the surface and replanting of badly damaged areas. Since that time, annual inspections of the beach/dune system by a registered geologist, and a survey of sand stabilization conditions has precluded major inundation of structures. Foundations, decks and mudsills have been periodically cleared of sand accumulations by remedial grading, with the bulk of sand disposal occurring at the foot of Larch Street.

At present, most open sand areas above the storm berm have been planted with beach grass along the south section of Chapman Beach. Temporary sand fences, that Breakers' Point had seasonally employed to defeat `blowouts' and protect new plantings, have been eliminated. Although this area is relatively immune to normal `short-term' sand inundation, emergency provisions of sand fencing are kept on hand in the event of unusual storm-related activity.

The rapid accumulation of sand at the north end of the littoral cell, resulting from the 1982-83 '*El Nino*', has caused considerable increases in sand volume along Chapman Beach. An extraordinary accumulation occurred at the south end of this beach unit, creating both a sand management problem and gradual encroachment of the dune crest on the development. Aggressive sand management activities were required at Breakers' Point from 1983 until 1990 to reduce the rate of sand encroachment. These intensive measures included continuous sand fencing during the winter months, raking to expose buried beachgrass plantings, and the application of fertilizer to stimulate plant growth. Under present conditions, a similar strategy would be required only during periods of heavy '*El Nino*' sand accumulations.

To the south, in the Presidential Management Unit, sand accumulation has resulted in all the property owners between First Street and Washington Street obtaining remedial grading permits to allow the annual removal of sand which has inundated dwellings and associated improvements. South of Washington Street, management activities have been limited to the trimming of dune grass and willows in order to limit their impact on ocean views. Property owners in this area have attempted to develop a dune management plan, but to date have not been successful.

The extensive use of seawalls and rip-rap for shoreline protection within the Downtown Management Unit has produced several undesirable effects. As a recent storm has shown[14], high tides and storm set-up can generate wave activity which extends to the seawall. Reflected waves cause cavitation at the base of the shoreline structure, lowering the beach surface and mobilizing the sand. At present the Ecola Creek channel flows almost due south following the axis of this lowered beach profile. Figure 8. This limits the beach available to recreational users, and insures that sand carried by the littoral current continues to the north. Owing to the inherently complex nature of inlet dynamics, it is difficult to identify a single causative factor that would account for the current trend of southerly inlet migration. Increasing sand volumes on Chapman Beach, specifically the southward growth of the foredune, may be a factor affecting channel migration. Stream discharge is insufficient to overcome the obstruction presented by large sand volumes. Reflection off the seawall and refraction of waves up the channel also play a role.

Finally, human alterations, in the form of rip-rap placed along upper reaches of the channel for the purposes of bank stabilization, are probably also a major factor affecting channel configuration. Ecola Creek inlet dynamics is clearly an important consideration. A more extensive, more detailed aerial photographic and hydrographic analysis involving an attempt to correlate inlet configurations with forcing events is warranted. The need to generate additional background information on inlet dynamics, however, does not preclude consideration of the proposed management efforts, as long as proposed sand management action do not include a transfer of sand volume across the estuary mouth or involve channel modification. Marra[15] suggests that additional work in this area could be carried out in the context of ongoing project monitoring and evaluation efforts.

The lack of severe sand erosion and inundation effects in the Tolovana littoral sub-cell is actually quite remarkable, considering the amount of intermittent erosion protection which occupies this unit. Much of the sand which accumulated in this area following the 1982-83 'El Nino' event has been redistributed by the longshore current, and has either been moved progressively north around Haystack Rock, or has been lost to deep water sedimentation.

Figure 5 illustrates the primary features of sediment transport dynamics within the City of Cannon Beach planning area. While this map diagrams the net aggregate aspects of the sediment budget, readers are reminded that seasonal wind shifts, storm patterns and interannual variations in wave climate affect the rate of these processes at any given time.

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[14]A moderate early winter storm, December 10-13, 1993, produced wave reflections strong enough to carry drift logs northwestward across Ecola Creek, and erode several meters of foredune hummocks.

[15] Marra, J. (1994), 'Technical Review of Chapman Beach Sand Management Plan', Shoreland Solutions, 9 pages.

The division between vegetation hummocks and more cohesive dunes occurs at an elevation of roughly 16 feet above M.S.L. as determined by surveys conducted in 1993 at the south end of Chapman Beach. An independent estimate of a relatively infrequently occurring runup elevation was made, by Marra (1994) using a relationship given in Komar (1993) for the total elevation achieved by the swash of the ocean waves above the mean water level. Using a hindcasted significant wave height of ~24 feet and wave period of 14 seconds obtained from CERC (1989) for the section of shoreline fronting Cannon Beach and an average beach slope for Chapman Beach of 1.6 degrees obtained from Table 2 in this relationship, and assuming a high high water level of 12 feet above M.S.L., resulted in a projected runup elevation of roughly 16 feet above M.S.L. This agreement between Marra's calculations and the authors' observation based on morphologic evidence supports the suggestion that runup above 16 feet above M.S.L. is expected to occur relatively infrequently. Together these observations support the use of the 16 foot elevation as a reasonable foreshore berm elevation, Figure 6. Likewise, the 'Leach line' defines the shoreward limits of active dunes within the Cannon Beach's Ocean Management zone.

Part IV: SAND MANAGEMENT STRATEGIES FOR THE CANNON BEACH AREA

Sand management within the Cannon Beach planning area must be coordinated throughout a management area, while specific actions must be `tailored' to suit the particular problems, sand dynamics, and historic management practices of that unit. As the permitting agency, the City should coordinate efforts between management units to ensure efficient, non-conflicting, implementation of management procedures.

Sand management activities within the proposed management units should be based upon a specific sand management proposal. Such a proposed action may be initiated by the City, an association formed for the purpose of implementing management activities, or potentially a formally recognized management district with an established tax base. Once approved, sand management actions should be reviewed and revised every five years, or more often if necessity dictates.

Implementation of a management activity should include, at a minimum, monitoring of at least 500 linear feet of shoreline, with overview by the City for a period of at least two years following each action. The City should require, at its option, annual inspection and report by management personnel or an 'independent' reviewer selected by the City. Annual reports should comment on the effectiveness of the procedure, the adequacy of the management actions, and suggestions for modification to the action which provide the flexibility to meet constantly changing shoreline situations.

Shoreline structures should not be used as a management procedure in units where such structures do not already exist. Priority should be on non-structural management approaches, especially vegetation planting and maintenance procedures. The terminology used to describe the physiography of a shoreline and the dynamics of the processes which shape it are often confused. Figure 6 shows a representative crossection of the shoreline features which are found within this planning area, and labels the features with the terms used in this report.

Dune shaping and re-grading permitted within the management unit must follow a specific site plan constructed in order to correct one or more of the following problems:

A. To insure the flood protection values of the dune system, it is beneficial to prescribe `in-filling' of depressions and swales to add bulk or width to dunes bringing them up to the 100-year flood elevation plus four feet. The standard shall be the Federal Flood Hazard Elevation-Frequency Study. It should be noted that active dunes are inherently unstable and that grading and vegetation management should improve flood resistance, however, dunes <u>cannot</u> preclude the possibility of ocean flooding.

B. The reduction of sand inundation to property and structures. Inundation shall be defined as the rapid or progressive burial of structures to above the `mud-sill', preventing proper ventilation of the crawl space, and possible `dry-rot' damage to structural materials. Property inundation includes substantial damage to landscaped areas, including progressive burial of lawns, beach access structures and irrigation systems.

C. The restoration of views lost due to progressive dune growth above the `100-year plus four foot' elevation. Grading plans designed to include this objective should include measures to reduce the future growth of dune crests, and thus reduce the frequency of re-grading for view enhancement. Properties receiving the benefit of view restoration may be subject to revised tax assessments.

To insure conformance with the City's Comprehensive Plan, any alteration of dunes in the Ocean Management (OM) zone must retain the sand within the zone. Transfer of material within the zone can be directed to meet certain prescribed needs, and must conform to DLCD Goal 18 criteria. Re-distribution priority for sand from management activities are:

1. `in-fill' depression and `blowout' hollows within the project area.
2. provide sand to build-up dunes within the same management unit.
3. replace sand lost to marine or stream erosion.
4. enhance public access to beaches.
5. provide sand to other management units within the cell, in conformance with their approved sand management plan.
6. provide sand to management agencies, such as the Corps of Engineers for beach nourishment or other works within the Cannon Beach cell.

Under no circumstances should off-shore disposal or transport out of the littoral cell be considered, as the Cannon Beach cell has very few active sand sources.

Sand management involves the interaction of the marine processes, coastal geomorphology, atmosphere and wave climate, and vegetation. As such, sand management plans should be constructed or approved by a state registered geologist with coastal process experience, and should include consultations with a vegetation specialist or professional engineer, as appropriate. Semi-annual reports should document results of sand management activities for three years following each procedure, with an annual review of the management area for the life of the planned activity.

These strategies provide a basis within which specific sand management actions may be designed within each of the proposed management units defined within the City of Cannon Beach planning area. The text of this document is intentionally brief for review and implementation purposes, however, additional detail may be found in the included appendices.

Part V:
AREAS OF ENVIRONMENTAL SENSITIVITY

The Chapman Beach management unit is bounded by Chapman Point to the north, an exposed bedrock headland with considerable erosional resistance. The headland is flanked by a narrow tidal pool area etched into a wave-cut bench at the base of the basalt monoliths. These tide pools range in elevation from about -2 to +6 feet, and have been occasionally covered by nearshore sand bars at their lower extremities. At present, the tide pools lie almost 400 feet west of the foredune complex at the north end of Chapman Beach.

The mussel beds that cling to the rocks are probably the most obvious resource of the area, although numerous other marine invertebrates occupy this ecological niche. It is extremely unlikely that any of the permitted management activities within the Chapman Beach unit would seriously affect this resource. Even if the longshore current would continue to carry the mobile sediment northward within the littoral cell, the deflection of this current by the Chapman Point headland, and the concentration of wave energy around the rocks will assure continued function of the tide pools.

Haystack Rock and the offshore rocks and islands west of Chapman Point provide valuable nesting and rearing grounds for a variety of seabirds. The intertidal community at the base of Haystack Rock is the focus of environmental education activities, and although interannual variation in sediment supply affects the nearshore tide pools, this is part of the constantly changing dynamics of this environmental setting. Sand management activities within one kilometer of the Rock should specifically address the potential for altering the delivery of sand to the tide pools. At present the sand accumulation fronting the

Presidential Management Unit or the Haystack Management Unit which flanks the adjacent headland appear too small to have any significant impact upon the Haystack Rock habitat.

Both Haystack Rock and the offshore rocks and islands are sufficiently distant from Chapman Management Unit that no impacts of sand management in this unit are anticipated.

Although there has been a considerable increase in the area of exposed sand along Chapman Management Unit, its continued recreational use and easy access to domestic pets discourage its potential for the endangered Snowy Plover. Any effort to potentially increase this area's value as a plover habitat would require almost complete discontinuance of its present recreational uses.

Likewise, the habitat of the Silver-spotted butterfly is oriented to the leeward side of coastal foredunes, when considerable vegetation diversity has been preserved. Such sites at Chapman Beach are occupied by residential structures except for Les Shirley Park along Ecola Creek. Experience in managing habitat for the Oregon silver spotter butterfly at Camp Rilea (14 kilometers north of Chapman Beach) has shown that mowing of non-native grasses promotes the growth of the common violet upon which the caterpillar depends. No impacts of management activity are envisioned that would affect this habitat.

The recently published Oregon Wildlife Atlas[16] lists no recent sightings of endangered species within the Cannon Beach sub-cell.

The esturine resources of Ecola Creek include marshes that are used for sewage treatment, and anadromous fish runs characterized by considerable return variability[17]. The banks of Ecola Creek are unprotected west of Larch Street, and channel stability is extremely poor. Major changes in channel configuration have been routine over the past twenty years, with channel orientation and channel capacity varying with stream discharge, longshore transport of sand, and storm events. Experience has illustrated that neither bank stabilization structures, such as rip-rap, nor the bank fill dumping of `pit run' rock and gravel by the City at the foot of Larch Street has had any long term effect on either the hydrology or ecology of the estuary. The 50 cubic yard annual fill limit imposed on all estuaries by the Corps of Engineers appears to be an adequate safeguard for Ecola Creek.

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[16] Kimerling, et.al., Oregon Wildlife Atlas, Oregon State University Press, 1997.

[17] Personal communication with Tom Nicholson, Oregon Department of Fish and Wildlife.

Major seasonal changes affect the surf zone and nearshore along the beach. Figure 6 shows a typical crossection of a beach illustrating the coastal morphology, and marine dynamics as defined by the U.S Army Corps of Engineers. In Oregon, the beach morphology changes seasonally with nearshore sand bars developing in response to winter storms, then the sand from the bars is gradually pushed back onto the beach by the constant swells of the summer winds. Figure 7 shows the morphology of these seasonal change areas as they occur along Chapman Beach[18]. The volume of sand involved in the seasonal beach changes varies between 20 and 70 cubic meters per linear meter of shoreline along Chapman Beach. This far exceeds the volume of any dune modification procedures envisioned.[19] Sand volumes and interannual variations in sand transport are considerably less on both Cannon and Tolavana beaches, with estimates ranging from 1 to 10 cubic meters per linear meter of shoreline.

PART VI:
AREAS REQUIRING MANAGEMENT, 1997-2000

Several areas of sand accumulation are problematic within the City of Cannon Beach. The area subject to the City's Oceanfront Management Overlay zone, incoroprated in the City's Comprehensive Plan, contains areas of significant variability in sand supply and dynamics. As discussed in Part I, interannual variation in wave climate, storm activity and shoreline erosion produce frequently changing patterns of sand accumulation and erosion within the city. Examples of small accumulation areas include the flanks of Haystack Rock, and the beach access west of the 'Wayfarer'. These small areas usually contain less than 10,000 cubic yards of sand above the storm beach, and could be managed by an annual grading permit system. Intermediate scale sand problem areas would include sand accumulation along the 'Presidential Streets', or the loss of beach sand fronting the seawall between First and Third Streets. Management of these areas require a more comprehensive approach, which should include consideration of the effects of grading upon adjacent property, long term sediment transport and the environment. Using the criteria proposed in Part IV, a sand management plan, including monitoring should be evaluated as a conditional use by the city.

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[18]The terminology used is adopted from Komar, P.D., 1979,`Physical Processes and Geologic Hazards on the Oregon Coast', Beaches and Dunes Handbook for the Oregon Coast, Oregon Coastal Zone Management Association.

[19] Calculation of managed sand volumes (based on 1997 surveys) shows a volume of less than 2000 cu. meters to be placed over a 300 meter length of shoreline, i.e. 6.6 cu. meters per linear meter of shoreline.

The only large scale area of concern for sand management is Chapman Beach north of Ecola Creek. The climatic variability previously discussed has deposited a great amount of sand along the Chapman Beach area since 1982. The principal result of this accumulation is the line of coppice dunes[20] and active foredunes which flank the seaward edge of the previous shoreline bluff which had been developed by erosion in the previous three decades. The location of these recent sand features is shown in figure 7 as the zone of coppice dunes lying between the flotsam line and the conditionally stable dunes. The older conditionally stable dunes have over 80% vegetation cover at an elevation of nearly 12 meters (40 feet) with a width averaging nearly 50 meters (160 feet). These dunes contain about 650 cubic meters of sand for each linear meter of shoreline, and are flanked on their seaward sides by the active coppice and developing foredunes which contain an average 150 cubic meters of sand per linear meter of shoreline. Thus an incredible 800 cubic meters of sand is in storage for each linear meter of shoreline within the Chapman Management Unit[21]. Thus the conditionally stable dunes along Chapman Beach[22] contain nearly as much sand as is currently mobile along all the remaining beaches of the Cannon Beach littoral cell.

The sand management activity conducted by the Breaker's Point Homeowner's Association has greatly increased the protective nature of the narrow foredunes which flanked the development in 1979. Repeated measurements along several transects in the Breakers' Point area show that the volume of sand above above 16 feet MSL has increased from an average of 120 cubic meters to 339 cubic meters per linear meter of shoreline. While the volume and width of the dunes have increased the erosion protection from these dunes, the area is composed of a sequence of advancing foredune ridges with closed depressions and an irregular crest. Vegetative controls have only been partially successful at stabilizing these dunes as they face directly into the prevailing winter storm direction. A comprehensive management effort, involving dune grading and vegetation management is required to correct some of the persistent sand accumulation problems, and to strengthen

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[20] F.A. Melton (1940) defines a **coppice dune** as any sandune type held together or formed about a cap of wind resistant vegetation. This term is in common use in the geological literature. [Melton, F.A. (1940), `A tentative classification of sand dunes and its application to the dune history of the southern High Plains', Journal of Geology, vol. 48, 113-174}

[21] This figure is based upon measurements of the total sand contained west of the marine terrace deposits. Petit (1992) totaled only the active sand seaward of the vegetation line.

[22] These conditionally stable dunes are mapped by Leach 1993, the delineation of which is almost identical to the boundary mapped by Rosenfeld at Breakers' Point in 1979.

Figure 7:

Chapman Beach Sand Management Unit

0 50 100 feet

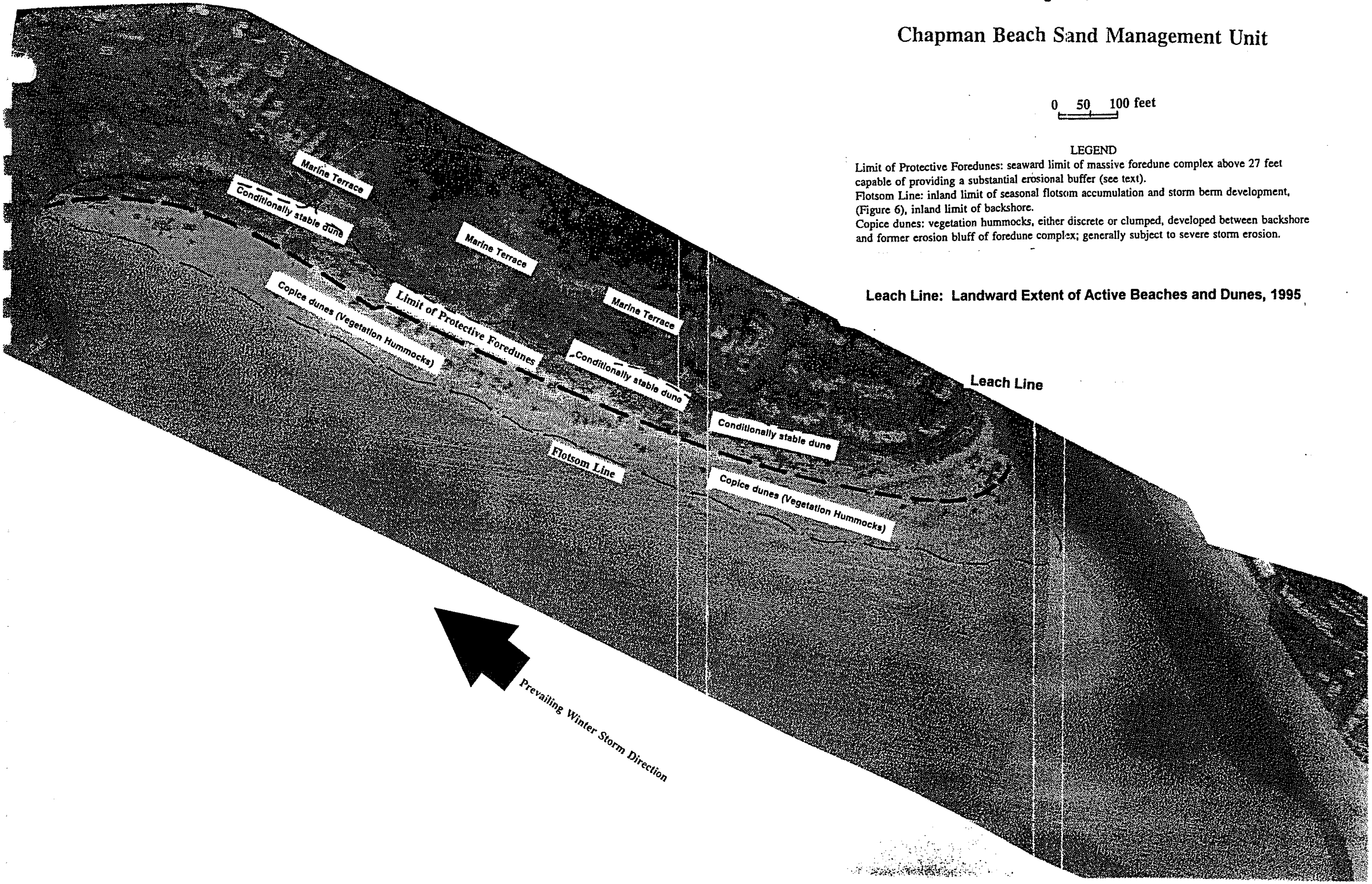
LEGEND

Limit of Protective Foredunes: seaward limit of massive foredune complex above 27 feet capable of providing a substantial erosional buffer (see text).

Flotsom Line: inland limit of seasonal flotsom accumulation and storm berm development, (Figure 6), inland limit of backshore.

Copice dunes: vegetation hummocks, either discrete or clumped, developed between backshore and former erosion bluff of foredune complex; generally subject to severe storm erosion.

Leach Line: Landward Extent of Active Beaches and Dunes, 1995



the protective qualities of the foredune system, especially along the exposed windward southwest flank.

Ecola Creek has varied considerably in its channel morphology since 1978 when observations related to the Breakers' Point management activities have tracked its course. In 1979 the City of Cannon Beach improved an existing vehicle beach access by dumping `pit run' gravel and rock at the foot of Larch Street. At that time the right bank of the creek channel was 26 meters (86 feet) from the edge of the asphalt paving on Larch Street, and the slope created by the fill materials allowed emergency vehicles to descend 5 meters (16 feet) to the sandy bank of the stream. By the spring of 1983 significant accumulations of sand had covered the vehicle access and the creek channel had migrated to a point some 37 meters (120 feet) south of the Larch Street pavement. Ecola Creek deepened its channel in the following years, and in 1989 the sandy bank at the foot of Larch was being eroded into a near vertical bank. At low tide stumps and roots of an ancient buried forest were visible at the bottom of the creek channel- no wood samples were taken at that time, however these may be related to a coseismic subsidence event[23]. In 1991 the bank eroded through the `pit run' fill and presently (1997) exposes utility pipes within 9 meters (30 feet) of the edge of the asphalt paving. Presently, the former vehicle access ramp serves to conduct direct storm runoff from Larch Street into the channel of Ecola Creek. Severe gully erosion has developed at this point, and sand disposal should be used to infill the breach.

The mouth of Ecola Creek has undergone a similar radical transformation. 1976 aerial photos show the mouth of the creek aligned roughly southwest and entering the ocean at UTM 5083.100. Following the large sand accumulations of 1983, the channel became a conduit for reflected wave energy which has progressively moved sand northward across the channel, building up the right (north) bank, causing a deflection of the channel course progressively south. As the channel alignment began to closely coincide with the winter storm direction large swells and breakers traveled up the channel during high tide or storm surge, greatly accelerating the erosion at the foot of Larch Street. Figure 8 shows an aerial view of these conditions in November of 1996; note the erosion cusp that has developed near the tip of the accumulated sand. This cusp is aligned with the reflected wave energy from the opposing seawall and is <u>not</u> aligned with either the pattern of stream erosion nor with the storm direction indicated by the orientation of the sand ripples, this erosion cusp from the reflected wave energy still exists today. As reflected energy continues to move sand northward across the channel Ecola Creek will continue to edge progressively south.

Elsewhere along Chapman Beach the seasonal growth of the winter storm berm has not been interrupted by an exceptional storm sequence in nearly a decade. As a result, early colonization of the residual sand by European beachgrass and Beach Silver-top has formed

[23]See Gallaway et.al., op cit.

Figure 8: Aerial Photo of the Chapman Beach area. Arrow shows direction of erosion cusp developed by wave refraction and alignment of Ecola Creek. (November 12, 1993)

coppice dunes which remain throughout the year. Given the shoreline history of the area, these features will most likely be removed by severe winter storms. In the mean time they offer some limited protection to the erosion scarp previously cut into the older conditionally stabilized dunes, primarily due to the `capture' of driftwood[24] which may help to absorb the energy of storm waves. Permitting driftwood to collect along the beach may assure sufficient driftwood in backshore areas.

Overall the dynamics and stability of Chapman Beach is good. Stream erosion by Ecola Creek at the south end of this unit may cause potential problems, which should be addressed, however, the influence of seawall and revetments to the south of the creek are factors. Future '*El Nino*' events may alter the sand dynamics, and once again produce significant accretion along Chapman Beach.

Part VII:
BREAKERS' POINT DUNE PROBLEM AREAS

The area of concern is located at the extreme south end of the Chapman Management Unit, from the mouth of Ecola Creek north to Sixth Street (UTM 5083.100 to 5083.550) extending from the flotsam line to the Leach line.[25] For the purposes of this management proposal, all areas seaward of Leach line to the flotsam line will be referred to as the Eolian Zone, figures 6 and 7.

Figure 7 delineates the area which is proposed for the proposed management actions. The inland line is the boundary of eolian (wind) activity proposed by Leach, the dashed line represents the seaward limits of cohesive dunes of sufficient height, volume and stability to represent some measure of erosion protection, and is refereed to as the limit of protective dunes. Toward the swash zone is the transitional area consisting of coppice dunes (vegetation hummocks) bounded by the winter storm berm, which is marked by flotsam from recent storms. This aerial image was acquired on October 18, 1995 and serves as a base map for illustrating the factors which require attention in this management action.

Figure 9 shows property ownership of the active dune areas, consisting of privately owned residential parcels to the north and east of the marked property line, and City of Cannon

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[24]J.E. Stembridge, `Shoreline Changes and Physiographic Hazards along the Oregon coast' (1975, Ph.D. dissertation, U. Oregon) documents instances where recent depletion of driftwood has accelerated erosion at several sites along the coast.

[25]Leach, D.S. (1993), `Delineation of active dunes and conditionally stabilized dunes in Cannon Beach', Final Report to the City of Cannon Beach, May 1993, 7pp.

South Chapman Beach Project Area

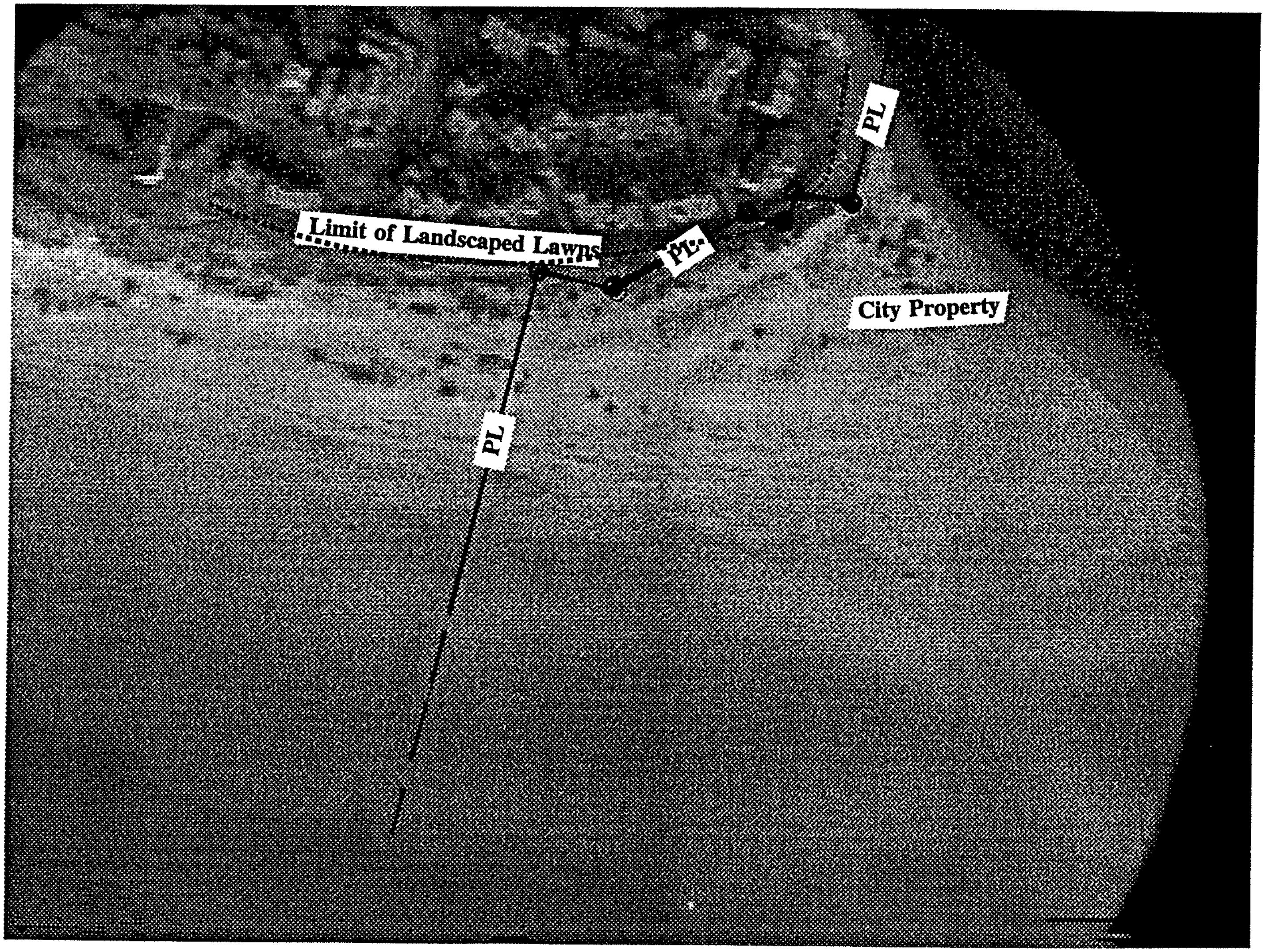

Figure 9: Property ownership along the south end of Chapman Beach.

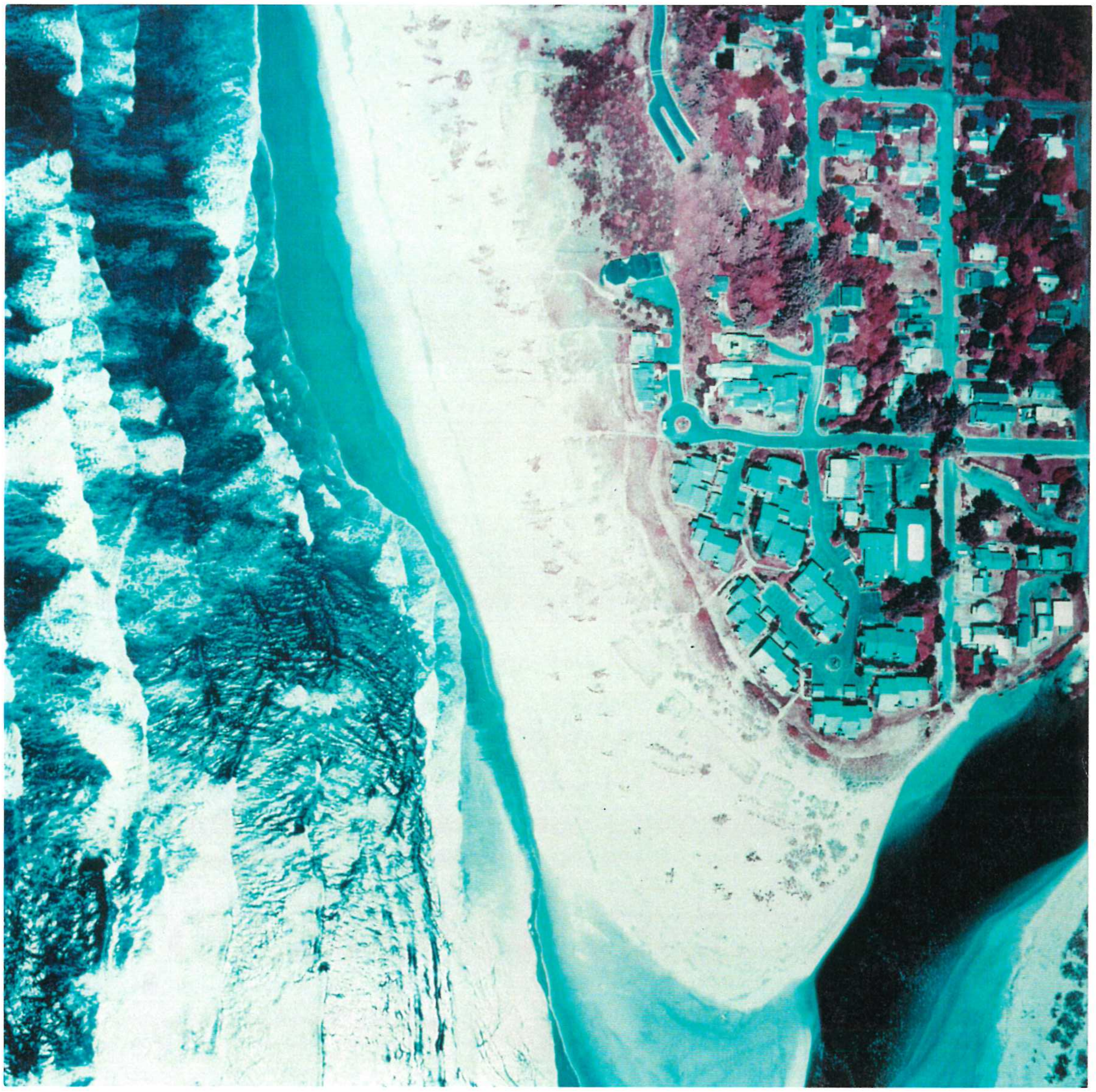

Figure 10: Color infrared aerial photo of vegetation along the south end of Chapman Beach. Darker red tones indicate dense healthy vegetation. Lighter tones of beachgrass plantings shows where less effective sparse vegetation occurs.

Beach property to the west and south. Sand management of the area encompasses both public and private land and should be mutually beneficial to all parties concerned.

Although considerable backshore elevation and foreshore width has been added since the FEMA Flood Hazard Elevation Study was completed in 1978, the conservative 27 foot elevation predicted for the 100-year return interval flood was used as a base, and increased by four feet as specified by the City of Cannon Beach Comprehensive Plan and zoning ordinance.

Figure 10 is a color infrared (CIR) aerial photo taken in May 1997 that illustrates the rectangular areas planted with beachgrass vegetation within the zone of protective dunes. The present vegetation cover has been mapped at less than 30% using the `quadrat' measurement system, which is a 30% reduction in plant vigor when compared to a similar CIR photo taken in October 1989. These areas are all oriented in the direction of the winter storm direction and are potentially subject to re-activation. An example of this is documented in Figure 11 where the extent of sand inundation following three days of southwesterly storm activity on December 9-11, 1993 is shown. Accumulations varied between 0.15 foot on the landscaped lawn to over 1.05 feet in a trough previously covered by Sea-Lyme grass (E. mollis). This view shows that the inundation area has the potential to grow and intensify, with a corresponding increase in areas of sparse vegetation (<30%).

Another significant concern is the loss of protective foredune area to both stream and wave erosion. Ecola Creek continues to hug its right bank, cutting into the foot of Larch Street and into the foredune at the south end of this management unit. Additionally, wave reflection from the seawall and revetment south of the creek, observed during the recent December storms, eroded a deep cusp in the backshore beach at UTM 5083.150 and have caused erosion of the coppice dunes adjacent to the south tip of the beach. The breaking crest of a waves reflected from the seawall on the opposite shore of Ecola Creek have been photographed advancing toward the south tip of Chapman Beach. Nearly 100 feet of erosion has been documented during the storms of 1993-94.

Advancing dune crests at elevations above the specified 31 foot height that have been increasingly restricting views from adjacent residential structures for more than ten years. In several cases these crests contain active `slip faces' which are the main source of dune encroachment on the adjacent structures. The extent of accumulation which routinely occurs as a result of sand inundation from advancing slip faces during winter storms covers 'mudsills' and decks. These slip faces are too close to the structures to utilize 'remedial grading' to remove sand within 35 feet of foundations without creating dangerously 'unstable' slopes, Figure 11. In 1993 the dune face advancing on building J-8 had a slope of 15 degrees, in 1997 the angle has increased to 22 degrees. This approaches the 'angle of repose for sand' of 28 degrees, which is constantly unstable.

Figure 11: Photo illustrating the proximity of the advancing dune crest to Breakers' Point buildings L-7 and J-8. Active crests have grown to the height of the second floor roofline.

Recent studies of coastal real estate values contend that ocean views account for 35 to 60% of property value. Thus both the investment security of owners and the eventual impact on the tax-base must be addressed by proper dune management that preserves both.

The long-term effects of sand inundation have caused thousands of dollars of property damage in the Chapman Management Unit. Even when sand accumulation is thin enough that lawn and shrubs recover, the sand added to the soil gradually builds up and fills beneath decks and boardwalks, and eventually buries foundations above the 'mudsill' causing dry rot damage.

The extent of the problems addressed in this section require an integrated approach at sand management involving an interdisciplinary team approach to effectively accomplish the management objectives in conformance with the limitations of the environment, available resources and public law. The following section presents the physical specifications for this management project, and establishes standards for public participation in the management activities.

Part VIII:
BREAKERS' POINT PROJECT PROPOSAL

Large areas of sparse vegetation exist throughout the project area, figure 12. Backshore areas should be stabilized with a healthy vegetation cover and maintained at elevations above the specified elevation of 31 feet. At present several large areas of dune troughs and closed depressions exist below the specified elevation and wind erosion continues to remove volume from the protective foredune. The management activities proposed in this section are designed to address two main problems: that of sand inundation of the residential area and view obstruction from residential structures both within the project area and those immediately south of Ecola Creek are addressed. The continual erosion problem on the south end of Chapman Beach requires a far more extensive program that is more appropriate for a governmental agency. Additionally, improvement of the foredune configuration to reduce sand transport during winter storms, and improved safety and and reduced sand incursions at beach access points are addressed.

The overall purposes of this management project is to strengthen the protective foredune, reduce sand inundation of landscaped areas and irrigation systems, reduce encroachment of dune crests toward residential structures, improve ocean views and provide an environment consistent with the values of a residential community. This will be done by:

1) creating a dune crest at no lower than 31 feet, with a minimum of 700 square feet of dune crossection above the 100-year flood elevation. This action will involve building up low spots and grading of irregular crest areas.

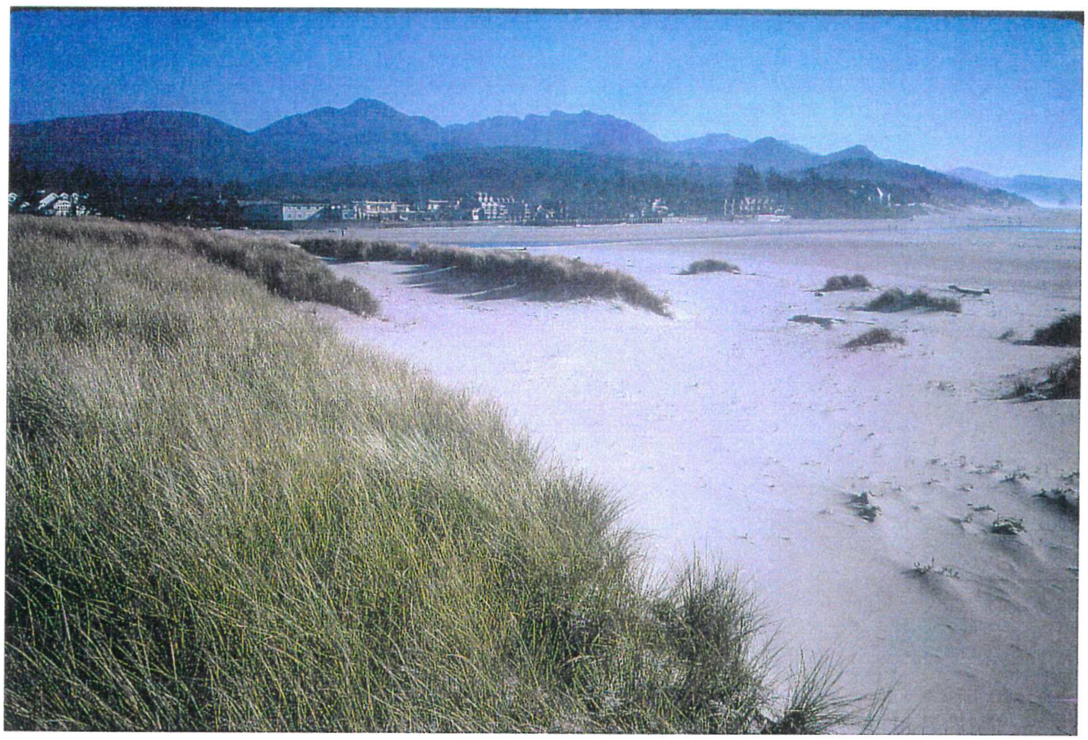

Figure 12: Areas of open sand provide sources of sand which accumulate along the interior dune crests, adjacent to structures.

2) increasing the volume and wind resistance of the foredune by sand placement from graded crest areas to lower areas of the eolian zone. The `protective dune' zone has been defined to consist of the area of the dune complex that provides significant potential erosion protection to the properties within the Chapman Beach management unit. The width of this zone varies with the dune volume and storm direction, and has taken into account possible view obstruction to properties south of Ecola Creek. Sand transfer to this area will 'infill' gaps and blowouts within the dune complex. Three lines of dune ridges, with irregular crests will be used to provide a more natural, rather than 'graded' appearance to the project site.

3) along limited areas within the project the dune crest will be lowered to restore partial views and significantly reduce the encroachment of dune crests from the near proximity of structures. These actions will conform to the protection goals of the plan and will only be applied to only the most affected structures.

4) using the present distribution of coppice dunes, a system of low protective dunes will be established within the vicinity of the storm beach. These features will provide initial reduction of wind velocities and reduce the requirement for sand fences to protect new plantings of stabilizing vegetation. It is anticipated that some of these features will be sacrificed to winter storm action.

The timing of each management action is important because of the life cycle of dune vegetation and the potential for wind erosion of exposed sand. Generally, most management actions occur between October and March, when beach grasses are dormant and exposed sands are wetted by frequent precipitation[26]. However, this period also coincides with peak storm intensities and wind velocities which tends to increase the risk of sand transport to adjacent areas. This proposal would delay dune grading and revegetation until the March/April period, which is after 90% of historical storm damage dates have passed. Sufficient precipitation persists through mid-June, and the risk of a major wind transport event is considerably reduced.[27]

Appendix B documents the total area of cut and fill within the project area, along with the total volume for each area in cubic yards. The cut and fill measurements are from topography measured on June 1, 1997, and have been computer analyzed using SURFER software. Since dune configurations are subject to rapid change, all transects will be re-

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[26] Observations of sand transport activity, by James Hanna, at an experimental site in the Oregon Dunes National Recreation Area show that sand transport is dramatically reduced by even the slightest surface wetting.

[27] Daly, C. (1996), "Precipitation Patterns for Oregon", NRCS Water and Climate Center.

surveyed and a new cut and fill analysis will be performed immediately prior to grading activity. All sites will be appropriately staked for grading accuracy.

Any crest to be graded that contains a viable beach grass cover will be `harvested' and the root matrix will be stockpiled prior to grading. Once lowered, the conserved `stockpiled mulch' will be used to cover the exposed sand areas, and will be immediately fertilized. Similarly, vegetated depressions or placement sites will also have their vegetation conserved. The `stockpiled' vegetation matrix will recover quickly, provided that the grading actions are completed with ten days. This matrix of grasses preserves the variety of beach plants which have established themselves in the project area, and provide a superior surface mulch to retard wind erosion. Careful supervision of the vegetation recovery by an experienced beachgrass contractor and a vegetation ecology expert, as outlined in Step One of Appendix C (Vegetation Management) will determine if irrigation is required during the early summer period. Adequate fertilizer is required for all new plantings, and a supplement should be applied to established or damaged plants.

A complete series of crossections is included in Appendix B (Dune Alteration) which show measured dune sections, finished grades based on cut and fill estimates, and the volume of sand above 27 feet elevation. FEMA regulations require a minimum of 540 square feet of dune section above the 100-year flood elevation in stillwater areas. FEMA draws the limit of velocity flooding at the elevation where it predicts that waves are breaking one foot above the crest of the foredune. In these shallow flooding areas there is still wave damage and erosion, although wave energy is much reduced[28]. Figure 13 shows the FEMA Flood map constructed in 1977. Since that date natural sand accumulations have increased dune elevations from and average of 24 feet to over 37 feet (in one location from 14 feet to over 42 feet), with an average volume of 650 cubic meters per linear meter of shoreline. The proposed actions displace less than 1% of the total volume within the project area. The sand grading activity will provide additional erosional resistance during storms, and poses no adverse effect on flood elevations.

Foreslope sand placement has been specified as a secondary priority location (following troughs and depressions below the specified elevation) in order to maximize the placement of sand volume above the 27 foot elevation. Each crossection containing a cut or fill segment is labeled to show the volume of cut and/or fill and also the total crossectional area above 27 feet. The smallest volume of protective foredune is 669 square feet fronting unit

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[28]These considerations were discussed by the staff of the Oregon Department of Land Conservation and Development, the FEMA Regional Staff, CH2M-Hill (the contractor for the Cannon Beach Flood Study)and the Department of Geology and Mineral Industries. The 100-year plus four foot elevation was derived by consensus, and influenced by the fact that levee structures are typically built two to four feet above predicted flood elevations.

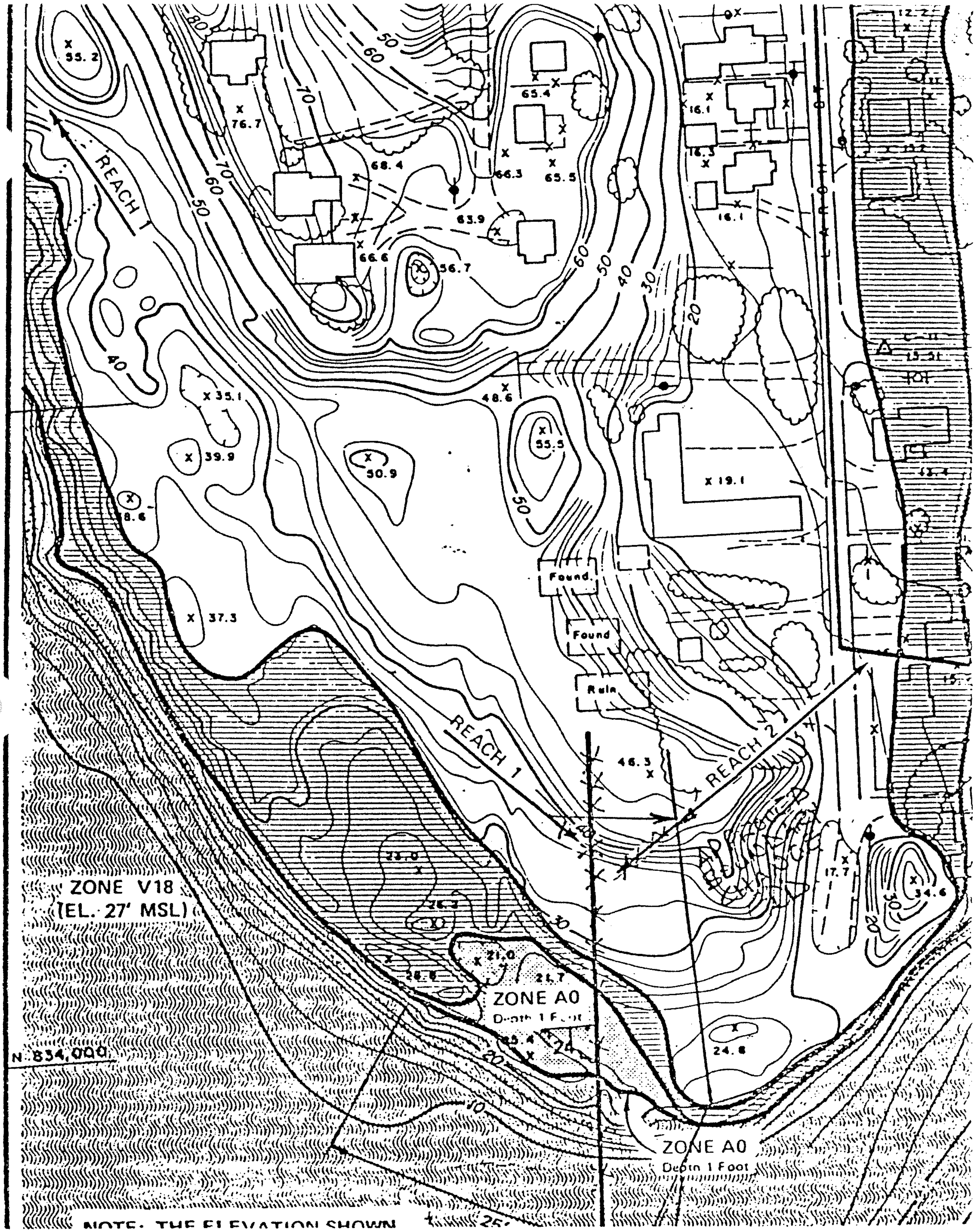

Figure 13: 1977 FEMA Flood map showing elevations of the 100 year flood.

Figure 14: Photographs taken from (A) Whale Park and (B) the bank of Ecola Creek, at Hemlock Street west of the school. Visible cut areas are illustrated in red, fill areas are shown in blue. All graded areas will be replanted. Photo C shows project site with cut (red) and fill (blue) areas indicated. Note that all activity is separated from the Ecola Creek channel.

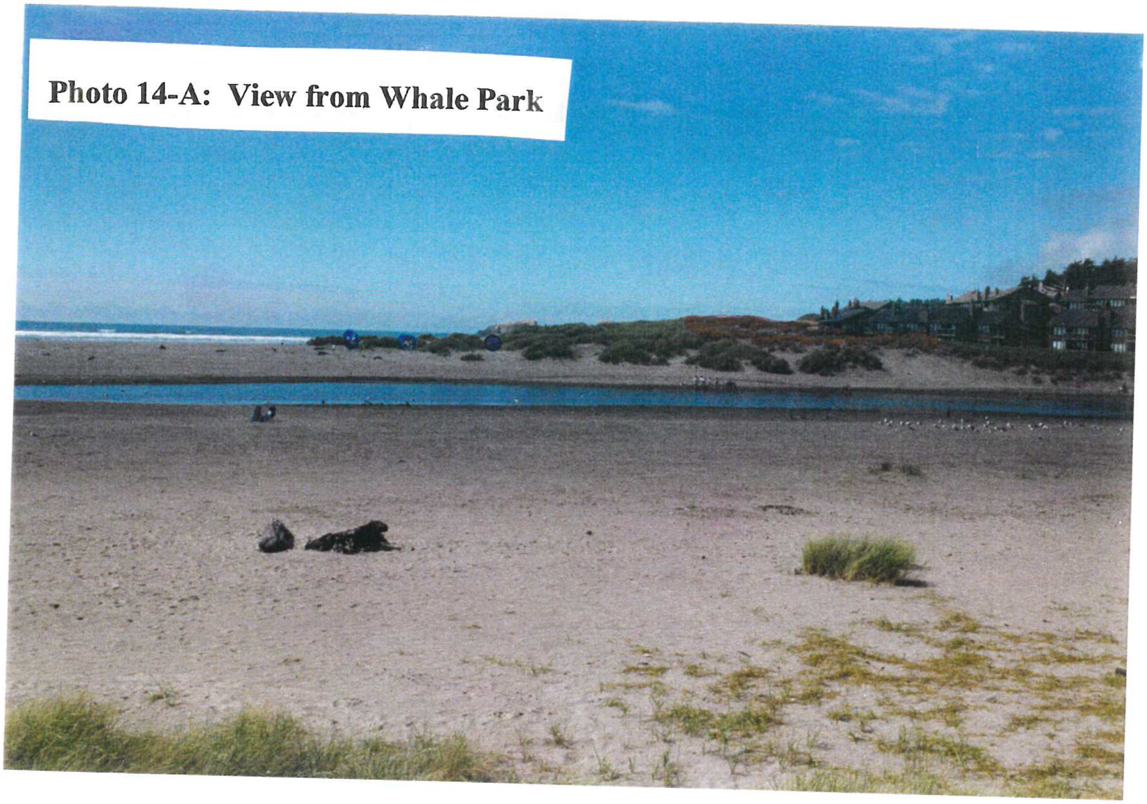

Photo 14-A: View from Whale Park

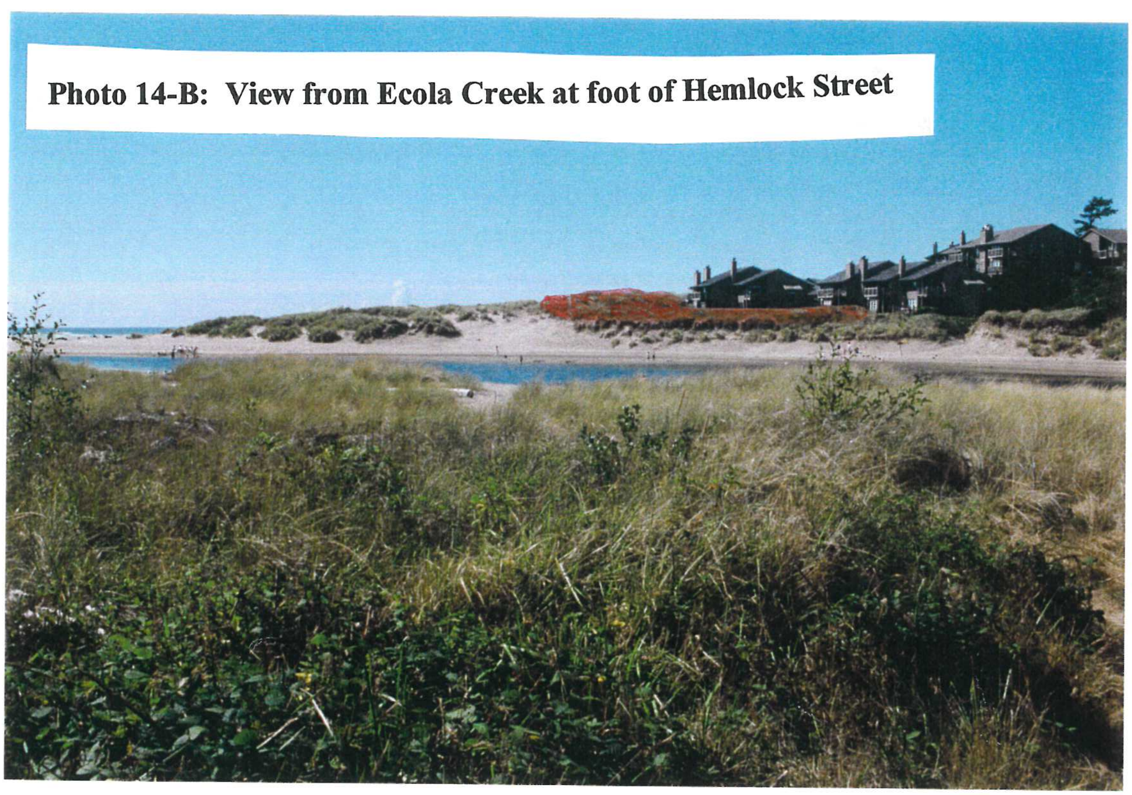

Photo 14-B: View from Ecola Creek at foot of Hemlock Street

Photo 14-C: Aerial View of 'Cut and Fill' Areas

L7, which is 125% of the volume required by FEMA. Crossectional volumes above 27 feet increase in a northward direction to a volume of over 6500 square feet, more than 1400% of the requirement.

Since the FEMA Flood Study was completed in 1978 (Figure 13), construction activity and sand accumulation has raised the average level of the V-Zone at the south end of the project area from about 23 feet to over 29 feet. The proposed dune alterations follow the suggestion of Marra (1994):

> "The following possible minor modifications to the proposed management measures are offered for consideration:
> Rather than taking the form of a single foredune crest with a broad, gently-sloping backslope, a reconfigured foredune area might take the form of two or more parallel ridges of varying elevation. Such an alternative configuration would give the foredune area an arguably more 'natural' look while continuing to maintain existing sand volumes within the foredune area. A drawback to this alternative is that as the complexity of foredune morphology is increased so to is the complexity of grading and stabilization efforts."

Appendix A details the design of the proposed dune modifications, including the locations of cut and fill areas, and the final dune reconfiguration. The multiple dune crests created will be modified naturally by wind and waves, with the expectation that the seaward dunes may be sacrificed in the event of severe storm activity.

In subsequent years, planting of sand stilling grasses will be carried out in the lower foreslope portions of the foredune, including planting of Elymus mollis in hummock patterns mimicking the hummocky nature of the natural foreslope. Plantings for density enhancement will be done in the October to March period, as no grading will accompany these actions. Coppice dune plantings will be planned to elevations below 16 feet M.S.L. Such plantings would have the potential benefit of trapping sand at lower in the foreshore and as a result minimizing growth in the crestal portions of the foredune. Further, such plantings would have the potential benefit of reducing the amount of sand bypassing the management area and as a result minimize adverse impacts on adjacent down-wind properties. The accumulation of sand in lower portions of the foreshore would also have potential benefits in terms of increased ocean erosion/flood protection. However, such planting and trapping efforts would be assumed to be generally sacrificial in nature, in that vegetation and sand accumulations at such low elevations could be expected to be removed during winter storm events.

No grading activity is planned in the vicinity of the Ecola Creek channel, and a 100 foot streambank buffer will be observed. This accomplishes two objectives: (1) it eliminates any possibility of sediment or fertilizer contamination of the estuary, and (2) sand placement will not affect the views from residents south of Ecola Creek.

A major design objective of this plan is to retain the natural aesthetics of the project site, and preserve the existing views from adjacent properties. Figure 14 illustrates the 'view shed' from areas adjacent to this project, and indicates the proposed cut and fill locations- with cut areas illustrated in red and fill locations shown in blue. All graded surfaces will be hand raked to restore a natural surface, and beachgrass plantings will be accompanied by the re-introduction of the preserved rhizome and root matrix to insure biodiversity.

As indicated in Appendix C, a comprehensive monitoring system is proposed. The projected life of this management action is five to ten years. Since these dunes have not been completely graded in over a decade, we feel that the more comprehensive approach offered by this plan will assure its long-term value. The data accumulated during the monitoring efforts should be of considerable value in addressing future sand management strategies in the area. Agency and local government officials, as well as citizen task-force members are always welcome to add their constructive ideas to the on-site inspections.

SUMMARY

The plan outlined in the above text meets the stated objectives and current state and federal regulations. In the event that any portion of this project area is included in the Federal Fish & Wildlife Coastal Barrier plan, no conflicts with that legislation is expected. The residents of the south Chapman Management Unit project area who have sponsored this effort have done so with the intention of improving the stability and protection of their living environment, and improving the overall consistency of their sand management program. They encourage other members of the community to utilize the information provided by this effort to address other sand problems within the Cannon Beach planning area.

This document is submitted in a spirit of cooperation, and the management actions and monitoring program outlined are intended to incorporate both public and individual involvement in the betterment of our community.

Horning Geosciences

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Email: horning@pacifier.com

October 18, 2004

Breakers Point Home Owners Association
Bruce Francis, Manager
P.O. Box 246
Cannon Beach, Oregon 97110

RE: Phase 3 Sand Grading, Foredune Area of Breakers Point Condominiums, Cannon Beach, Clatsop County, Oregon

Dear Bruce:

This report addresses proposed sand management activities for the Phase 3 sand grading program at Breakers Point, including property extending about 150 ft north of 5th Street, where the road meets the foredune. Preceding the volume analyses is a summary of past findings and activities in the Phase 1A, 1B, and 2 grading program, plus revegetation findings.

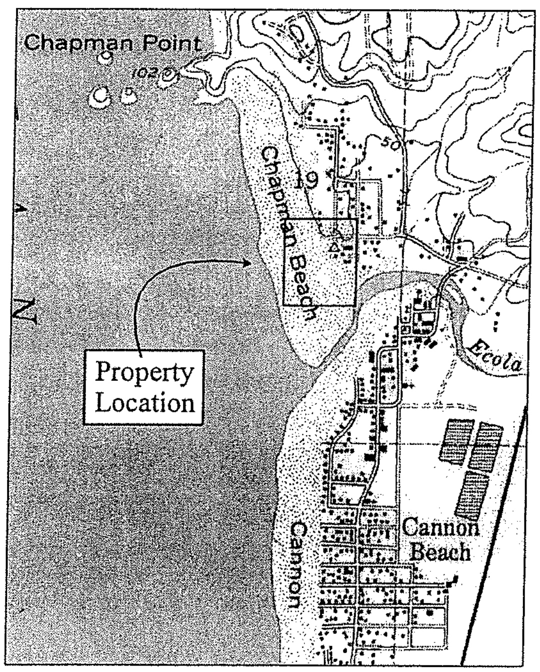


Figure 1: Property location map; extracted from the Tillamook Head 7.5' USGS Quadrangle Map.

Phase 1A

- Excavated Year 2000;
- Located at south end of the foredune complex;
- 8500 cubic yards excavated from east side of dune and deposited along western dune toe and blowout depressions;
- Area of 1.0 acre excavated, measuring about 340 ft long and 100 ft wide;
- Central dune area was left in a natural state;
- Replanted with mixed European and Great Lakes American beachgrass on 18-inch spacings, three culms per bunch;
- Fertilized with ammonium nitrate fertilized at 300 lb per acre, and fenced to keep out foot traffic;
- Beachgrass establishment highly successful, >90% survival in cut area, accessory volunteer plants appeared, including sharp sedge, verbenas, and Nootka rose; fill area grass plantings suffered near the upper west edge of fill, due to resting gulls and human activities.

Phase 1B

- Excavated in Year 2002;
- Cut area consisted of central dune ridge that was left in a natural state in Phase 1A;
- About 7000 cubic yards excavated and deposited along the western dune toe;
- About 0.8 acre excavated, measuring 385 ft long by 80 ft wide;
- Fill area for 1A/1B was about 1.25 acres;
- Replanted primarily with European beach grass following Phase 1A procedure, plus experimental

clump planting was carried out;
- Fertilized as per 1A and protected by signage;
- Results similar to those for Phase 1A, except that the 1B survival and robustness of clump plants were equal to and much better than 1A, respectively.

Phase 2
- Excavated in Year 2003;
- Cut area consisted of the crest and eastern part of the foredune complex;
- About 5800 cubic yards was excavated;
- Cut area was about 210 ft long and 160 ft wide;
- About 1.0 acre was cut;
- Fill area was about 310 ft long and 120 ft wide, following same criteria as Phase 1a/1B;
- Replanted with combined European beach grass in 1 to 1.5 inch clumps (up to 15 culms), plus Great Lakes American beach grass, on 18 inch centers and fertilized as per earlier phases;
- Clump survival was greater than 90 percent; Great Lakes beach grass spread rapidly.

Beach Grass Summary
- Phase 1A grasses benefited by protection from wind and salt by the unexcavated 1B sand ridge;
- Survival of plantings is lower near the beach from desiccation, salt, bird damage, and human activity;
- Planting clumps results in better size and survival and smaller 3-culm bunches;
- Great Lakes beach grass thrives along the Oregon Coast, survives burial well, and spreads more than European beach grass, which forms clumps;
- American beach grass does not perform as well as the other two varieties in dune stabilization, as it dies out during the winter;
- Survival rates of all plantings has been greater than 90 percent;
- Numerous stolons start from roots after cutting and filling, but mortality appears to be high during summer drought, apparently due to limited root structure and water storage capacity;
- As determined by number of culms in European beach grass clumps, rate of growth appears to increase by 80 to 400 percent annually during the first 2 years after planting; this is a geometric increase that must eventually taper off as in-filling of open areas occurs;
- Burial by up to 3 ft of sand results in even more robust growth; less burial results in less robust growth; this may be due to water availability in the subsurface;
- Some beach grass suffered mortality from heavy winds of October 2003, resulting in patches of open sand; these may evolve into blowouts unless replanted.

Phase 3 Findings
- To be excavated in Spring of 2005;
- Cut area is about 360 ft long, averaging 150 ft wide and including the crest and east side of the fore-dune;
- Cut area is about 1.5 acres;
- Fill area is about 1.5 acres, with similar dimensions to those of the cut area;
- Two "islands" of undisturbed ground will be left between the cut and fill areas,
- Two "sand baffle" ridges, about 10 ft wide and about 200 ft long will run along Profiles 5-5' and 5-5'; these will trap wind-blown sand and prevent excessive migration onto properties north and east of the excavated area; about 25 ft of worst-case scenario sand inundation may occur in the foredune of the lot north of Phase 3;
- About 9500 cubic yards of sand will be cut;
- Filling will build out to the coppice dune line, filling in depressions, but leaving several grassy hummocks; the cut/fill surface will undulate, but slope at about 5 percent to the west, overall;

- Excavation will take place prior to May 1, 2005;
- European, American, and Great Lakes beach grass will be planted by the clump method on 24-inch centers over the cut and fill area;
- The sand baffle ridges will be excavated and replanted within 2 years to complete the excavation of Phase 3;
- This project will reduce sand inundation of landscaped areas, strengthen the protective foredune by filling in blowout depressions, improve views for properties east of the project; reduce potential sand encroachment on nearby properties, and provide an environment consistent with a residential community.

Phase 3 Volume Calculations

Breakers Point 2004 Sand Volume Calculations- Phase 3

Cut Calculations

Profile	Profile Area sq ft	Panel	cut Panel Area sq ft	cut Panel Width ft	cut Panel Volume cu ft	cut Panel Volume cu yd
1-1'	589	1	589	25	14725	545
2-2'	431	12	510	56	28560	1058
3-3'	702	23	567	69	39089	1448
4-4'	640	34	671	56	37576	1392
5-5'	998	45	819	103	84357	3124
6'6'	895	56	947	55	52058	1928
Total Fill (cubic yards)						9495

Fill Calculations

Profile	Profile Area sq ft	Panel	fill Panel Area sq ft	fill Panel Width ft	fill Panel Volume cu ft	fill Panel Volume cu yd
1-1'	587	1	587	25	14675	544
2-2'	607	12	597	54	32238	1194
3-3'	721	23	664	66	43824	1623
4-4'	713	34	717	56	40152	1487
5-5'	857	45	785	107	83995	3111
6'6'	944	56	901	55	49528	1834
Total Fill (cubic yards)						9793

See accompanying diagrams for profile locations Calculations show that sand storage volume is greater than sand to be excavated. Fieldwork was carried out on July 28, 2004, with the assistance of Mr. Bruce Francis, Manager, Breakers Point Condominiums.

Please call if you have questions.

CERTIFIED
OREGON
Thomas S. Horning
No. E1131
ENGINEERING GEOLOGIST

Thomas S. Horning

Thomas S. Horning, MS, RG, CEG
Chief Geologist, Horning Geosciences

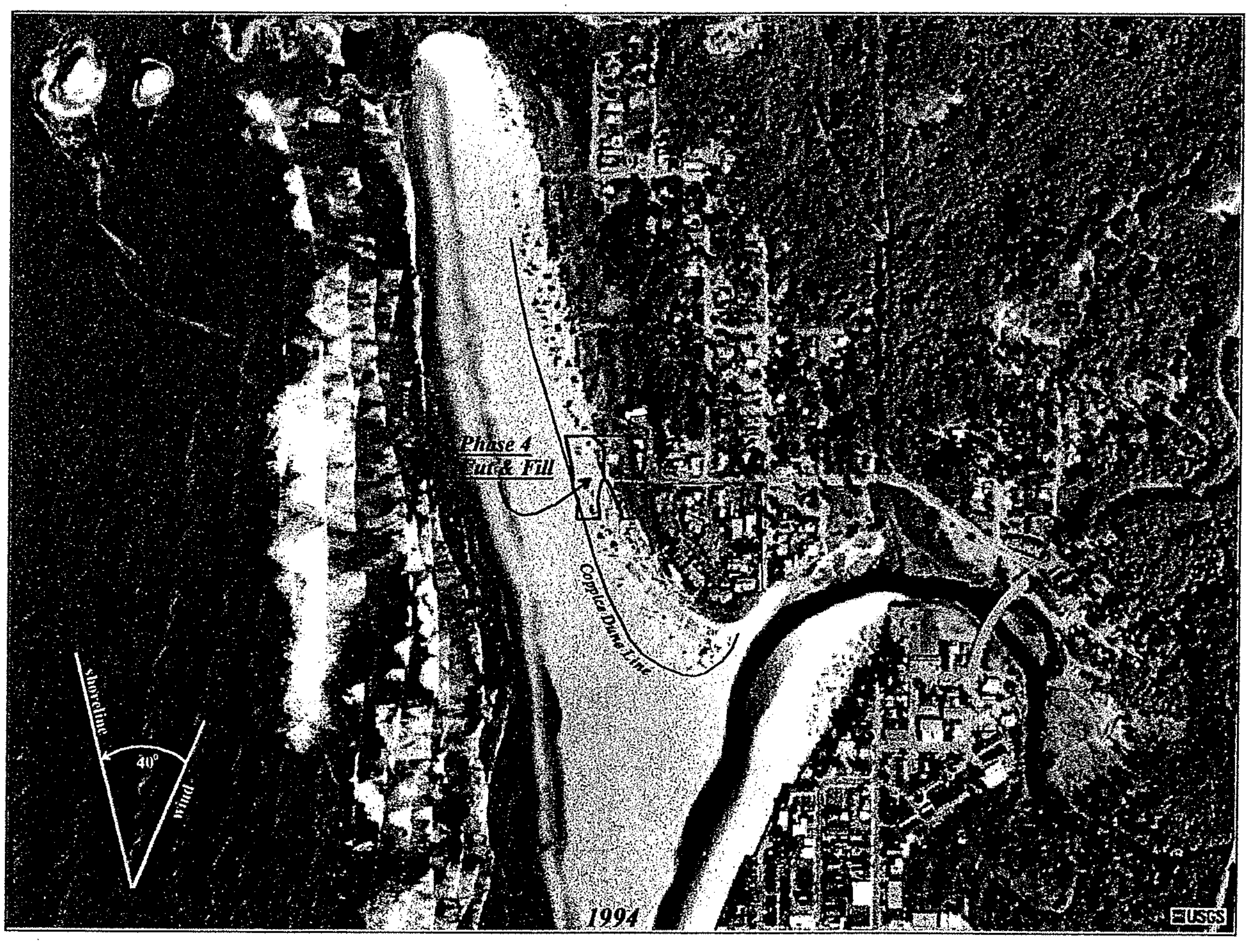


Figure 2: Aerial photo of the Breakers Point Condos in northern Cannon Beach; the Phase 3 project area is outlined, and the coppice dune line is shown. Photo taken in 1994 by the US Geological Survey. Wind vector directions are shown for average winter storm winds.

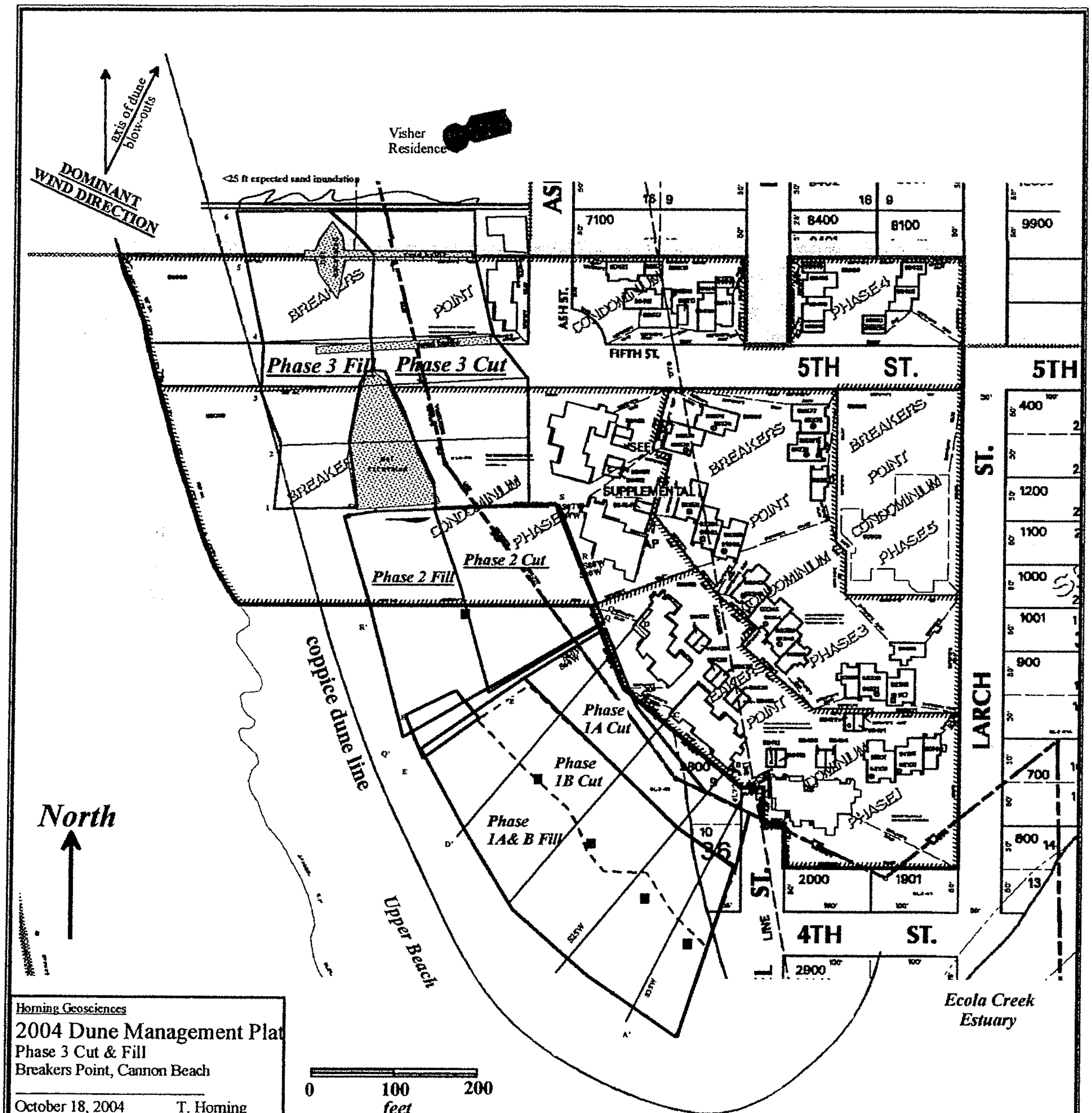


Figure 3: Map of the Breakers Point area, showing the proposed Phase 3 sand excavation project, plus areas for Phases 1A/1B and Phase 2. The coppice dune line is from Figure 2.

Figure 4: Aerial photos of the Phase 3 area, with profile lines shown. Lower photos are an oblique stereoscopic aerial photo pair, taken in early October 2004.

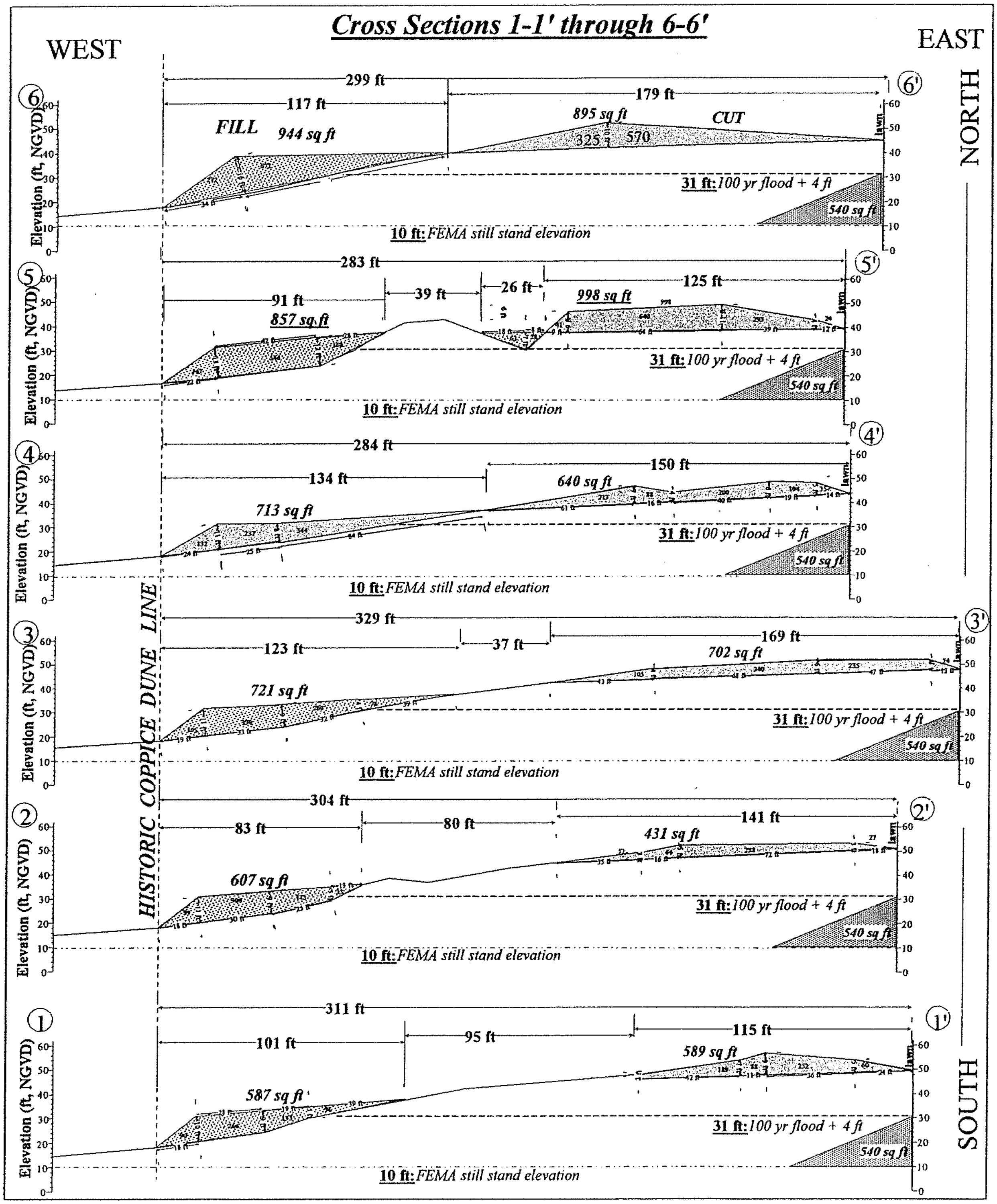


Figure 5: Profiles 1-1' through 6-6' in the Phase 3 project area.

Appendix A:

Design Objectives and Timeline

This section defines a dune grading and sand management project within the Chapman Beach area of the City of Cannon Beach. The project site is located along the southwestern edge of the Breakers' Point Condominiums, covering a frontage of 440 linear feet of oceanfront dunes with vegetation enhancement encompassing 900 linear feet of shoreline. The problems associated with the project site are documented in a series of reports starting in 1975, including initial success in vegetation management of wind erosion, increased wave erosion resistance, and controlled beach access. A significant change in sediment dynamics within the Cannon Beach littoral cell, triggered by the 1982-83 'el Nino' event, has also been documented by several additional studies. The resulting concentration of sand at the northern end of the cell has yielded problems at the project site since then. These observations are documented in a comprehensive file at the Planning Department of the City of Cannon Beach.

Objectives:

1. This project is designed to preclude the continued encroachment of active dune crests which have increasingly affected the structures within the project site for over 15 years. While the dunes within the project area will remain active, a short term reduction in the rate of dune encroachment (5- 10 years) is envisioned.

2. In an effort to reduce the landward encroachment of the active dunes, vegetation controls have been used. While effective, this has created over-steepened slopes and higher dune crests, which as effectively blocked former beach access points and established dune crests as high as second story rooflines. Reducing these crests, and re-opening controlled access points is desirable.

3. Continued dune growth has made landscaping and building maintenance both difficult and costly, creating the need for nearly constant remedial actions. This project will re-establish effective landscaping areas, reduce sand encroachment on structures, and partially re-establish views from residential units nearly buried by dune growth.

Design:

This project is strictly limited in area, and focused on only the most critical sites. Additionally, the project is designed to reduce environmental risk to adjacent land by orienting the actions to limit lateral wind drift, enhance vegetation along the flanks of the project area, and phase all future actions based upon reaching and documenting 'milestones' of success before proceeding further.

The timing of the proposed actions is designed to reduce storm risk, while ensuring vegetation survival. Unlike traditional 'Ammophila-only' beach grass plantings, the planted area will include Sea-lyme grass, coast Lupine, sedge and common rose, which have been established in the project area.

The basic design reduces dune crests to 31 feet (100 year flood elevation plus 4 feet) at the south boardwalk, which tapers laterally to the existing dune crest elevations at the middle boardwalk and at the south end of the condominium complex. Vegetation removed from grading areas will be conserved for plant stock and mulch. Plant vigor will be enhanced in adjacent areas to increase sand control. Sand fill will be deposited in a series of irregular dune crests upwind of the project site between 16 and 27 feet in elevation, conforming to the natural appearance of existing coppice dunes. The ultimate goal is to achieve a more 'natural appearing' dune landscape with fewer gaps and 'blowouts' which contribute to sand encroachment on the structures.

This management plan is designed for a 10 year lifetime. Phase I consists of the most critical site, with the most extreme storm exposure. Subsequent phases consist of incremental extensions of the edges of the initial project site, integrated with vegetation and sand management activity to assure continuity of the management strategy. Each subsequent phase will be submitted for City review and conditional use permit as part of the on-going monitoring actions.

Methodology:

The Phase I project site is limited to an 900 foot long strip with a SSW orientation at the south end of Chapman Beach as shown in photo B-1.

1. Plant vigor within the project area will be enhanced by fertilizer applications in November, prior to any physical actions. Subsequent fertilizer applications will be continued as needed until January.

2. B-2 illustrates the crossections of the dune grading and fill placement at the project site. All sections retain sand volumes well above required minimums, and are tapered to reduce blowout potential. Total sand volume of the grading project is approximately 2000 cubic yards.

3. Grading and re-planting operations will be conducted in three steps, as illustrated in Figure A-1 through A-3:

A-1: Beach vegetation from the project area west of units L-7 and J-8 is harvested, cut for re-planting, and stored. Resdual organic mulch is stockpiled in a staging area adjacent to the South Boardwalk. A beach access road is used to haul graded sand from the dune crest to form two irregular dune crests connecting existing coppice dunes.

A-2: Disturbed areas are mulched with stored organic materials, graded dune area is re-planted, as are adjacent blowouts. Plants and mulch south of the Boardwalk are stored, while graded materials are used to form a third dune crest at the end of the access road.

A-3: Remaining disturbed areas are mulched with stored organic materials, graded dune area is re-planted, along with adjacent blowouts. Access road is removed and sand hummocks are created.

Each of the three steps will take 7- 10 days, depending on weather. Each step insures minimal storm exposure and vegetation storage periods.

Project Monitoring

Plant vigor and dune configuration will be mapped semi-annually during the first three years. Aerial photography taken each spring will document project conditions, and effects on adjacent areas. An annual report will contain the observations and data. Additional dune grading/planting will be contingent upon the successful stabilization of the initial project (Phase I). Successive phases will implement dune grading and vegetation stabilization, in smaller increments, northward to Fifth Street to stabilize the public access boardwalk area. Each incremental phase will be proposed following the spring photography and mapping, and will be submitted to the City by July 15 of the year preceding the action. Thus, subsequent actions will be proposed in conjunction with on-going beachgrass and sand management activity.

Due to the interest in this project, the City of Cannon Beach may conduct its own monitoring program. Breakers' Point will have a local geologist available to determine management actions in the event of storm damage.

PHASE I ACTIONS:

STEP 1

CUT

FILL

STEP 2

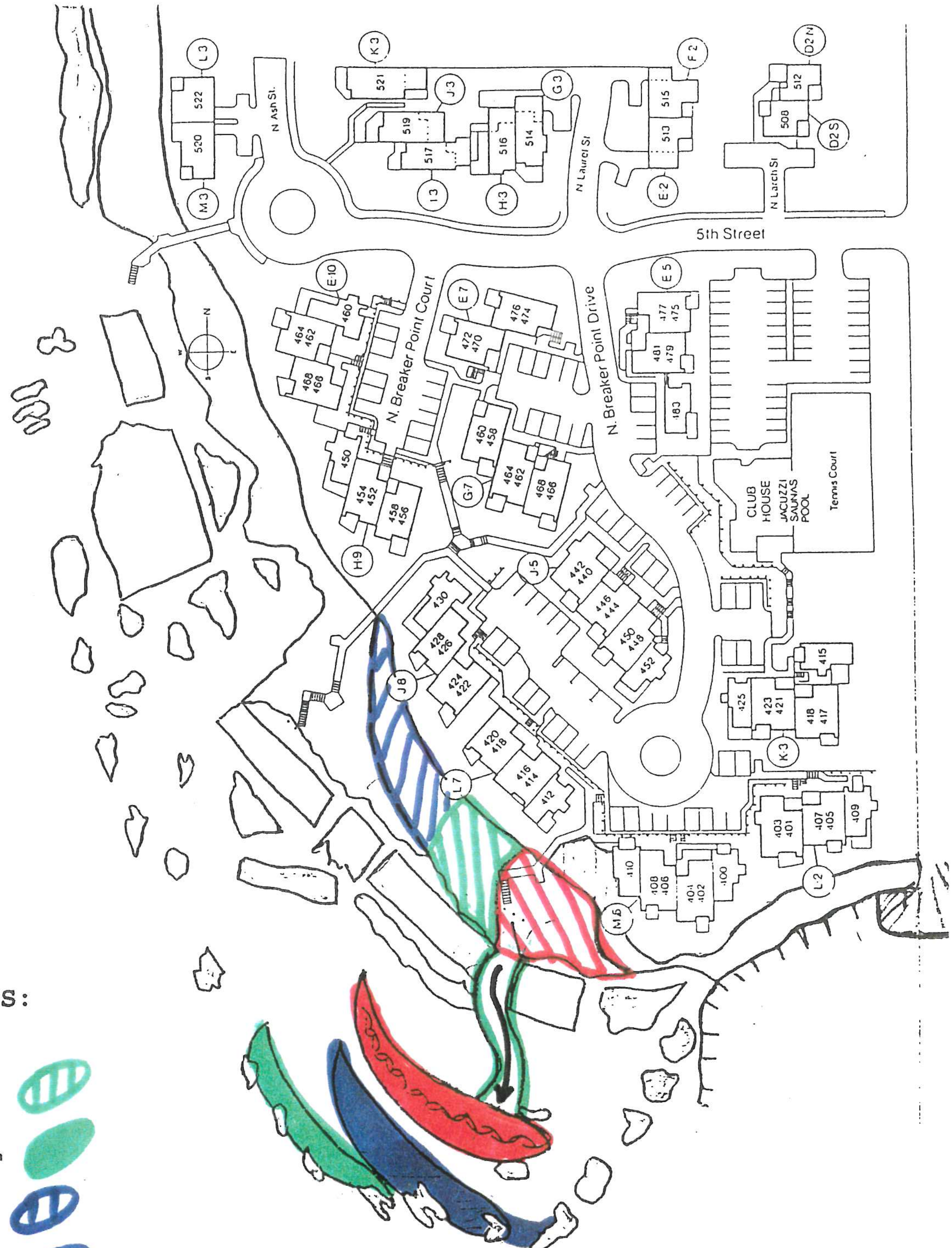
CUT

FILL

VEGETATION STORAGE

Figure A-1:

Removal of vegetation fronting L-7 and J-8, grading of dune and construction of parallel dune ridges.



PHASE I ACTIONS:

STEP 1
CUT
FILL

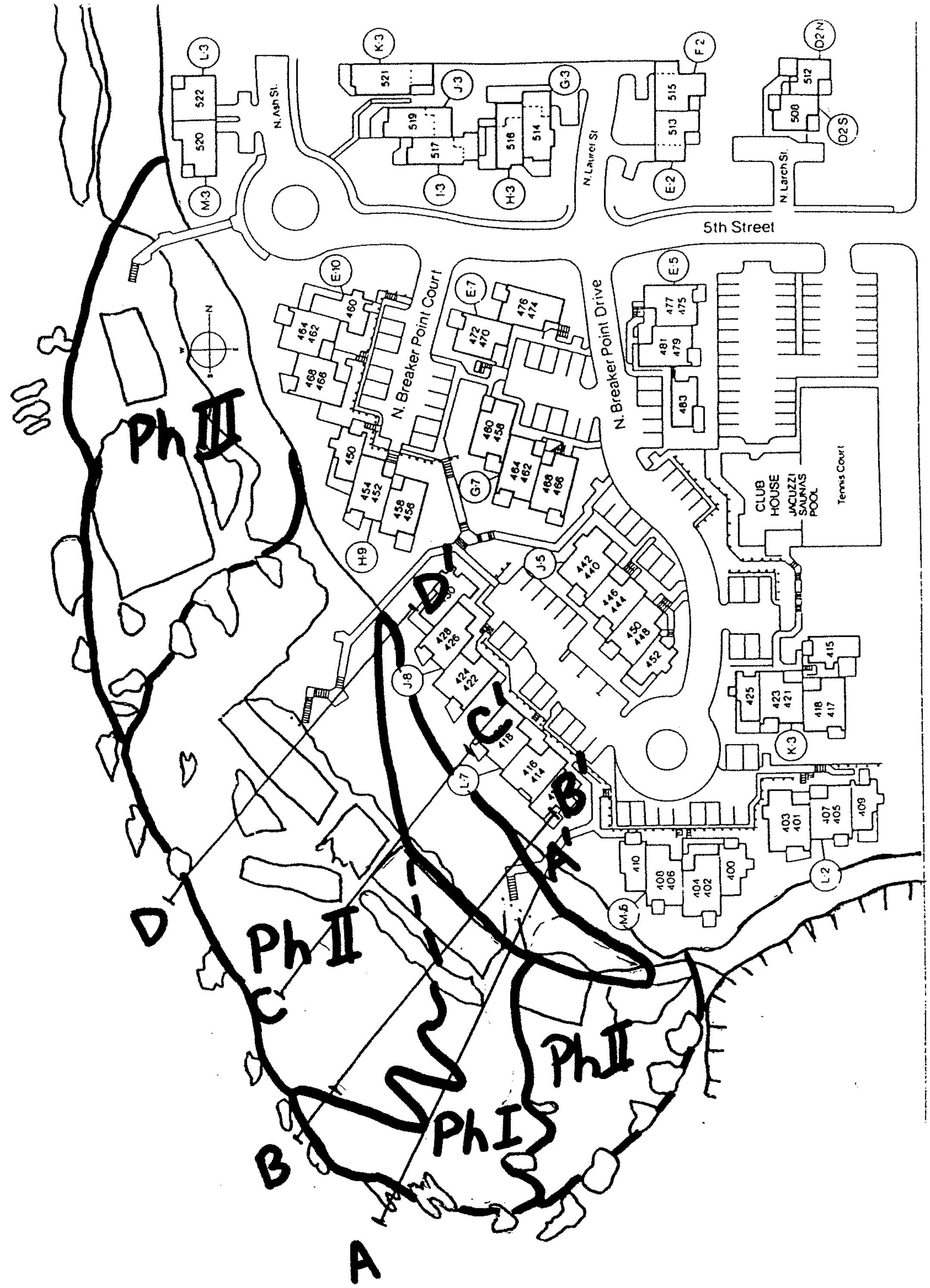
STEP 2
CUT
FILL

STEP 3
CUT
FILL

Figure A-2:
Re-planting of graded dune areas. Removal of vegetation at south boardwalk, construction of third dune ridge.

Figure A-3:
Re-planting of remaining graded dunes, removal of access road.

Deletey



5th Street
N. Ash St.
N. Laurel St
N. Larch St.
N. Breaker Point Court
N. Breaker Point Drive
CLUB HOUSE
JACUZZI
SAUNAS
POOL
Tennis Court
Ph III
Ph II
Ph II
Ph I
A
B
C
D
A'
B'
C'
D'

Appendix B:

Project Specifications

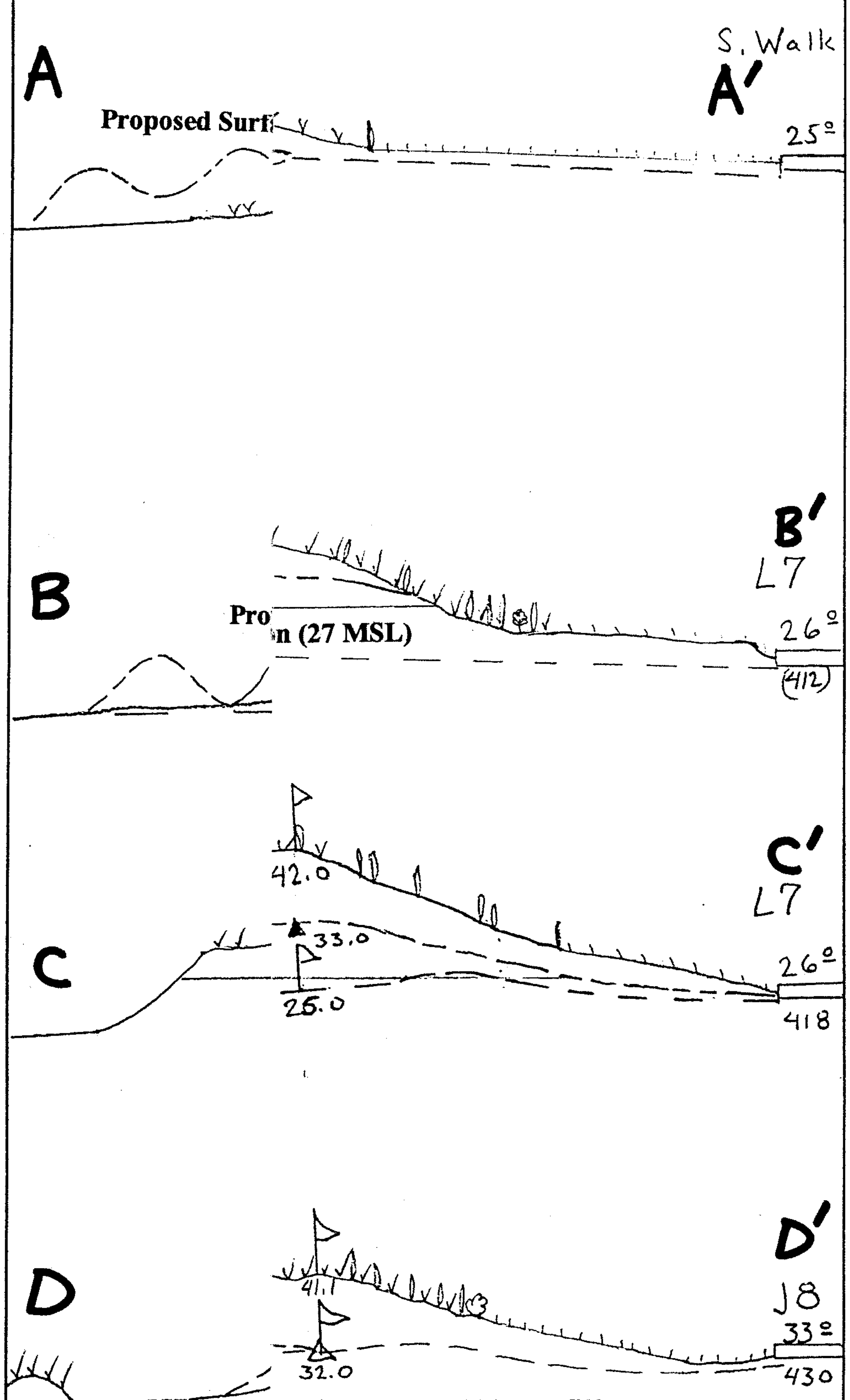
B-1: Project Location on Aerial Photo

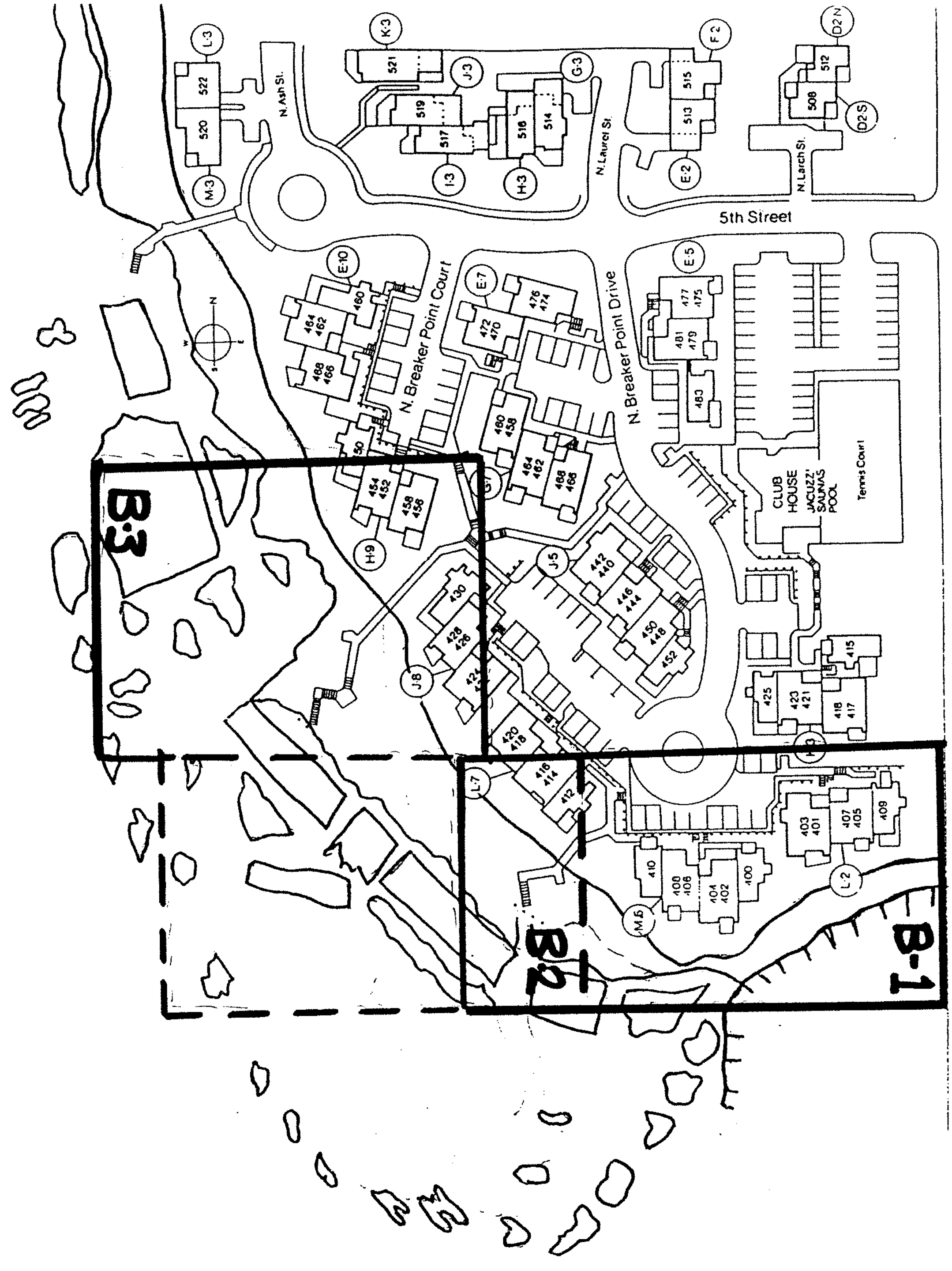
B-2: Project Crossections (Cut volume and area above 100 year flood elevations)

B-3: Topographic map of project area

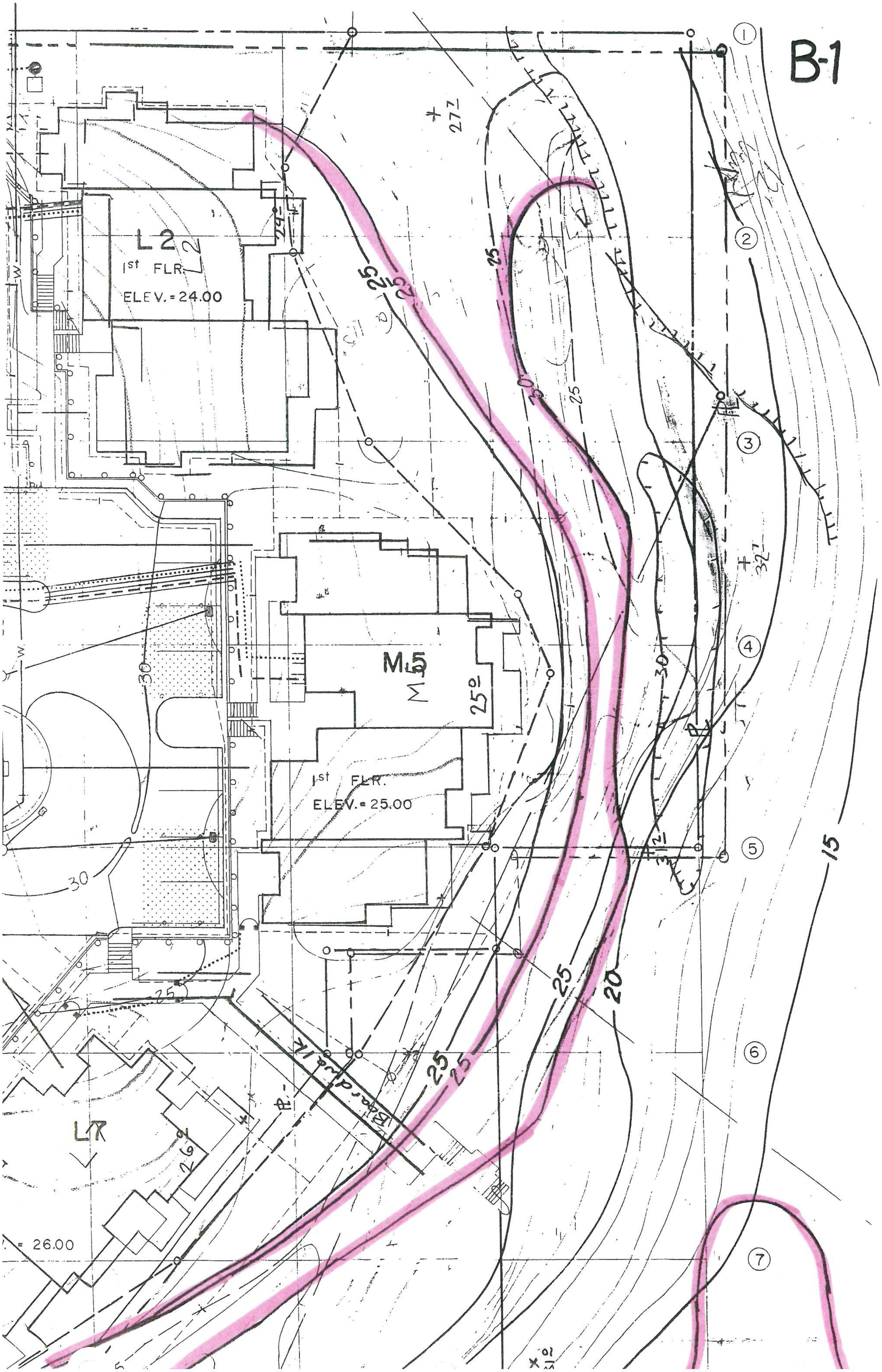
B-1: Project Location on Aerial Photo

SUBJECT: DUNE CROSS (___) are	DATE:
	DATE:

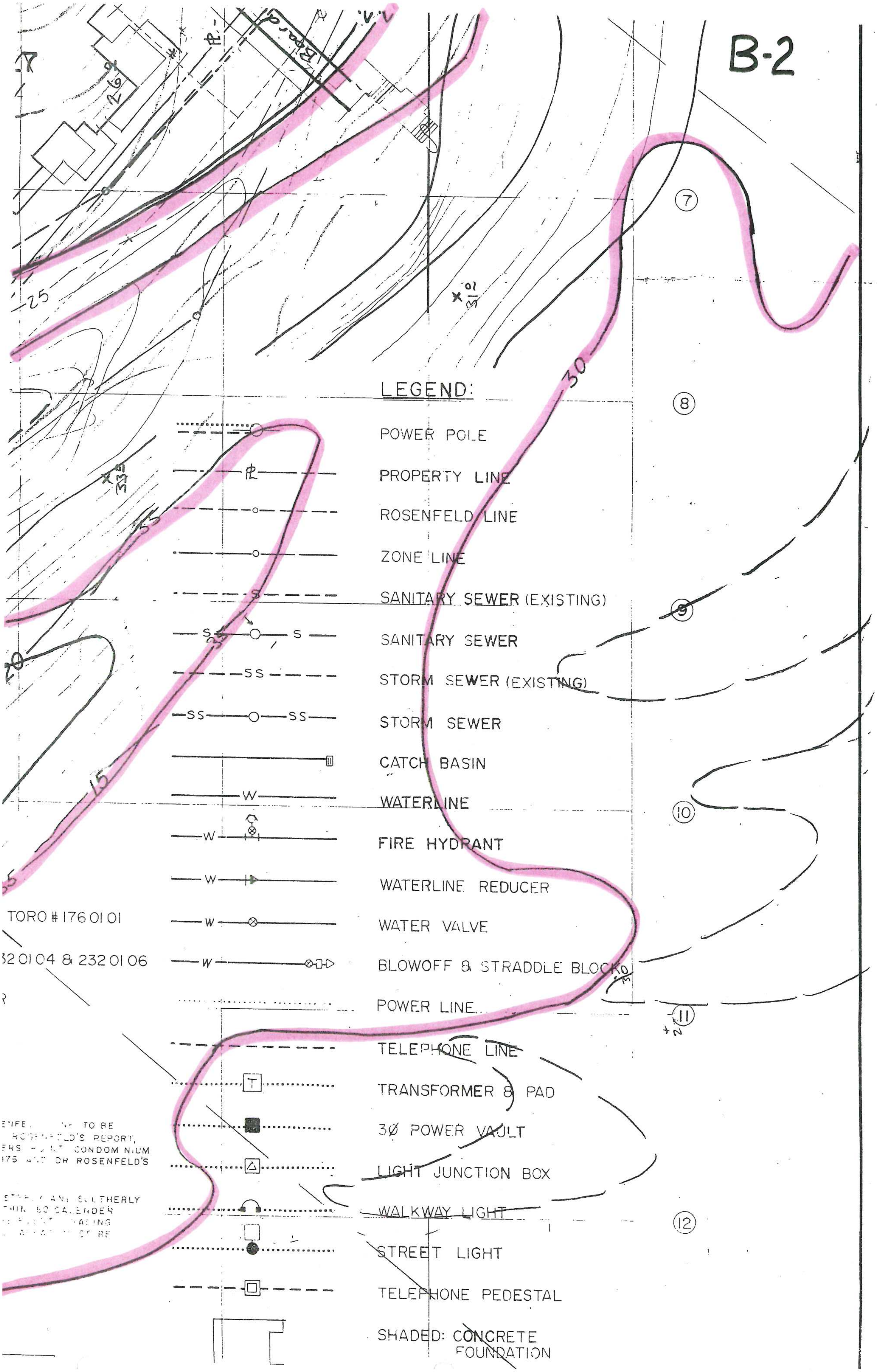




5th Street
N. Ash St.
N. Laurel St.
N. Larch St.
N. Breaker Point Court
N. Breaker Point Drive
CLUB HOUSE
JACUZZI
SAUNAS
POOL
Tennis Court
B-1
B-2
B-3



B-1
L2
1st FLR.
ELEV. = 24.00
M5
25°
1st FLR.
ELEV. = 25.00
L7
26°
= 26.00
Boardwalk
1
2
3
4
5
6
7
15
20
25
30
27±
32±



B-2
LEGEND:
POWER POLE
PROPERTY LINE
ROSENFELD LINE
ZONE LINE
SANITARY SEWER (EXISTING)
SANITARY SEWER
STORM SEWER (EXISTING)
STORM SEWER
CATCH BASIN
WATERLINE
FIRE HYDRANT
WATERLINE REDUCER
WATER VALVE
BLOWOFF & STRADDLE BLOCK
POWER LINE
TELEPHONE LINE
TRANSFORMER & PAD
3Ø POWER VAULT
LIGHT JUNCTION BOX
WALKWAY LIGHT
STREET LIGHT
TELEPHONE PEDESTAL
SHADED: CONCRETE FOUNDATION
TORO # 176 01 01
32 01 04 & 232 01 06
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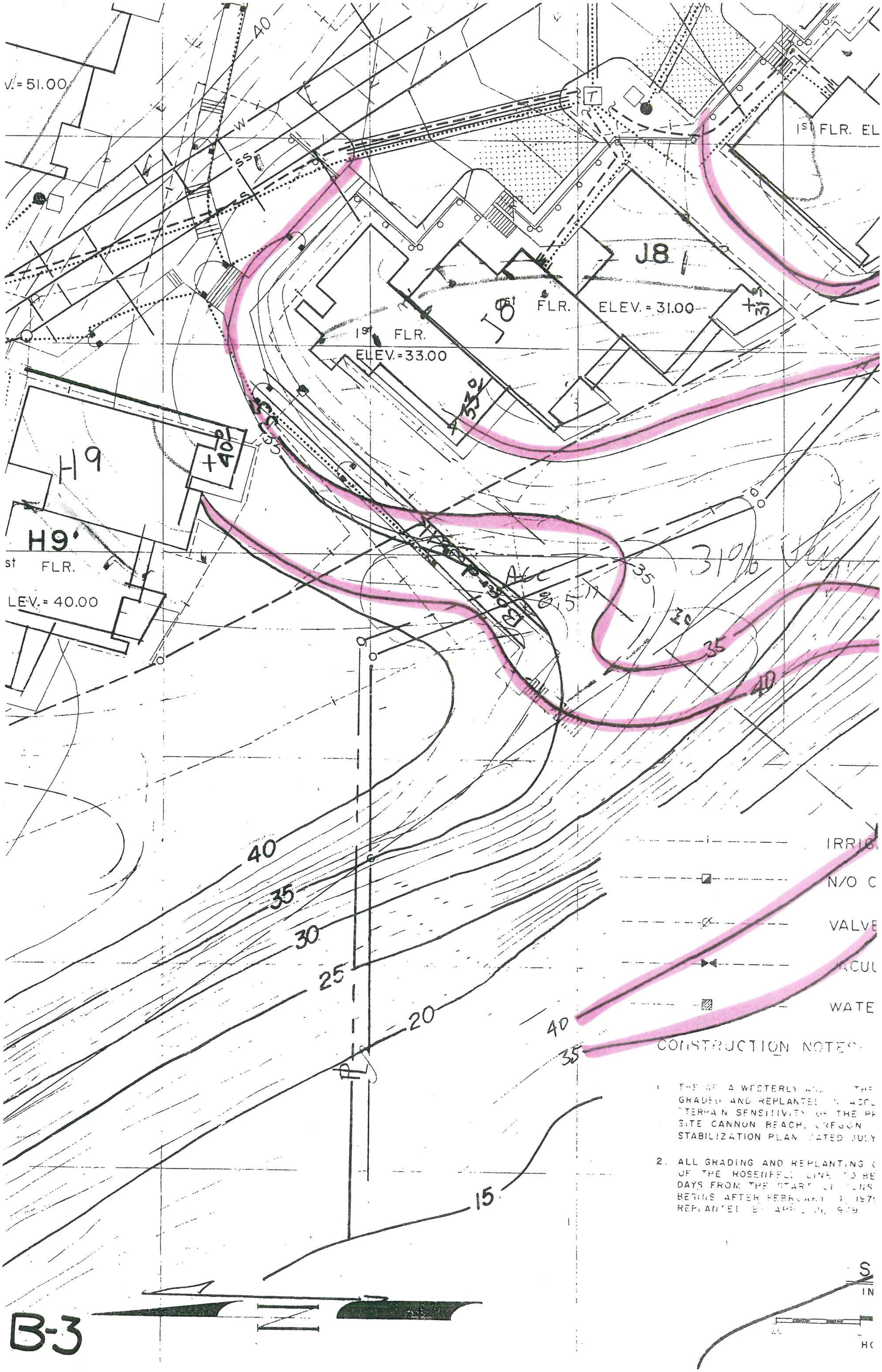

V. = 51.00
1st FLR. EL
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1st FLR. ELEV. = 31.00
J8
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40
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CONSTRUCTION NOTES
1. THE ... A WESTERLY ... THE GRADED AND REPLANTED ... TERRAIN SENSITIVITY OF THE ... SITE CANNON BEACH, OREGON ... STABILIZATION PLAN DATED JULY
2. ALL GRADING AND REPLANTING ... OF THE ROSENFELD LINE TO BE ... DAYS FROM THE START OF CONS... BEGINS AFTER FEBRUARY 1, 1979 ... REPLANTED BY APRIL ..., 1979
B-3
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Appendix D: Presidential Streets Management Unit

(Kramer Point to Harrison Street)

INTRODUCTION

This appendix consists of two parts. Part I: Factors Affecting the Stability of the Shoreline updates elements of the original overall foredune management plan document "Cannon Beach: An Integrated Approach to Sand Management". Storms experienced along the Oregon coast during the last two winters were truly exceptional (Komar et al., in review). On one occasion during the El Niño winter of 1997-98 the deep-water significant wave height reached over 30 feet. This is on the order of the then projected elevation of the 100-year storm event based on the previous 15 years data. During the La Niña winter of 1998-99 the deep-water significant wave height reached this elevation on four occasions. A deep-water significant wave height of approximately 45 feet was reached during one of these storms. Such extreme conditions resulted in erosion all along the Oregon coast and significant erosion at several 'hot spots'. Thus, the focus of Part I is a review of wave and water level projections that incorporate the data from the last two winters. It also assesses the implications of this information to sand management in the Cannon Beach littoral cell.

Part II: Presidential Streets Sand Management Strategy outlines proposed sand management measures for the area between Kramer Point and Harrison Street. Proposed management measures include: foredune grading; vegetative stabilization; drainage and access management; and monitoring and maintenance for three designated areas within the Presidential Street Management Unit. Although needs vary somewhat between the three areas within the management unit, overall the proposed management measures are intended to maintain or enhance ocean flood/erosion protective functions of the natural foredune area; minimize inundation brought about by excessive accumulation of wind-blown sand and correspondingly maintain or enhance ocean views; maintain or enhance access to recreational uses associated with the open sand beach; and maintain or enhance existing stormwater drainage.

Part I: Factors Affecting the Stability of the Shoreline

Factors affecting shoreline stability operate across a broad range of spatial and temporal scales. Exactly which factors need to be considered varies from setting to setting. Along dune-backed shorelines of the Oregon coast extreme wave and water levels associated with storm events is the primary factor affecting shoreline stability (Figure 1).

Tides, storm surges, barometric pressure effects, temperature effects, and baroclinic currents all affect mean water level (Figure 2). Superimposed upon these longer term elevations in mean water level are short-term variations associated with the passage of waves and expressed at the shoreline as runup. Extreme water surface elevations achieved during storms result from the simultaneous occurrence of individual maxima within this range of forcing events. In terms of flooding, or wave overtopping , it is the magnitude of the storm water level that is of particular interest. In terms of erosion, or wave undercutting , storm duration and direction as well as magnitude need to be considered. Long term trends attributable to factors such as relative sea level rise may also need to be accounted for. These various factors are considered further below.

Long Term Trends. The geologic setting of the Oregon coast is that of a convergent margin, where the oceanic Juan de Fuca Plate plunges below the continental North American Plate at the Cascadia Subduction Zone. Tectonic activity along the convergent margin is cyclic. One part of the tectonic cycle is characterized by a major earthquake event which occurs as the strain that has accumulated within the subduction zone is suddenly and dramatically released. Recently, a great deal of attention has been given to these Cascadia Subduction Zone earthquake events. Summarizing the work of a number of investigators, DOGAMI (1995) suggest that the Oregon coast could experience a Magnitude 8-9 earthquake in the near future. Specifically, they report that there is a 10-20% chance that such a great earthquake event could occur in the next 50 years. This estimate is based on analyses which suggest that the average return interval for such an event is on the order of every 400 ± 200 years. Based on an analysis of over 400 years of detailed records of damage-causing tsunamis that have been kept by the Japanese, Satake et al. (1996) have concluded that the last Cascadia Subduction Zone earthquake was a Magnitude 9 event that occurred at about 9:00 P.M. on January 26, 1700. This is consistent with Native American legends which say the earthquake occurred on a winter night (Komar, 1997).

Damage from such an event would include not only that resulting from ground shaking, but also that resulting from earthquake-induced liquefaction, landsliding, subsidence, and tsunami. Madin (1992) has outlined a generalized scenario for such an event. At the onset, severe ground shaking occurs for several minutes. During this time, amplification and liquefaction effects occur in areas of unconsolidated, saturated sediment. Massive ancient landslides are reactivated. Rapid, coast-wide subsidence on the order of 2 to 6 feet also occurs in association with the release of accumulated strain during the earthquake. Although flooding associated with subsidence would occur immediately in some low-lying areas, the effects of subsidence are more likely to be manifest over the long term as increased flooding and coastal erosion during storms. This scenario is further complicated by the likely occurrence of locally generated tsunami expected to arrive within 5 to 40 minutes after the initial earthquake and to continue to arrive at intervals over a period of several hours. Shorelines of bays, estuaries, and low lying sand barriers would experience immediate flooding and erosion.

DOGAMI (1995) has conducted numerical simulations of tsunami waves generated in response to Cascadia Subduction Zone earthquake events. For the Cannon Beach area they project locally generated tsunami elevations that range from about 12 to 16 feet NGVD29 under the low end scenario and 18 to 36 feet NGVD29 under the high end scenario. Elevations of 14 to 22 feet NGVD29 are given as mid-range estimates. Elevations are expected to show considerable variation locally. It is possible that tsunami waves may be as high as 50 feet NGVD29. Additional information on tsunami effects in the Cannon Beach area is considered in the accompanying work.

During the other part of the tectonic cycle noted above, an extended period of gradual aseismic uplift of the coastal margin occurs in response to the accumulation of strain within the subduction zone. Gradual variations in mean water level accompany this part of the tectonic cycle. Superimposed upon these tectonically-induced variations in shoreline position are variations in global eustatic sea level due to the alternating growth and melting of glaciers. What is particularly relevant in this regard is the net change in mean water level, or relative sea level rise .

Komar (1992) has plotted elevation changes and their relationship to sea level rise as a basis for estimating rates of relative sea level rise along the length of the Oregon coast. From Komar's work it can be inferred that the mean water level along the Cannon Beach shoreline is increasing at a rate that is currently on order of 4 to 8 inches per century. If rates of relative sea level rise increase as envisioned under scenarios of global warming in response to the greenhouse effect (SCOR, 1991; Komar, 1998a), then a rate of 20 to 30 inches per century is not an unreasonable estimate for the projected rate of increase in the mean water level along the Cannon Beach shoreline.

The concepts of *sand supply* and the *sediment budget* should be noted in the context of long term trends. These concepts involve viewing a given segment of shoreline, or littoral cell in terms of the positive or negative transfers of sediment that occur within it (Komar, 1996). The resultant balance of the sediment budget is determined by comparing the volume of sediment gained from *sources* (positive transfers) to the volume lost to *sinks* (negative transfers). A negative balance means that more sand is leaving than is arriving and, that as a result, that segment of shoreline is eroding. Conversely, a positive balance means that more sand is arriving than is leaving so that the segment of shoreline is accreting. Additional information on sand supply in the Cannon Beach littoral cell is considered in the accompanying work.

Short Term Events. As noted earlier, along dune-backed shorelines of the Oregon coast storm events are the primary factor affecting extreme wave and water levels, and in turn flooding and erosion. The response of the foredune system to storm wave attack is its rapid retreat landward: Sand is transferred from onshore to offshore. This transfer of sand from subaerial to subaqueous storage during storms is illustrated in Figure 3. Rip currents are often an important element of nearshore circulation during these storms. By focusing wave attack, they accentuate erosion locally. When wave and water levels drop following the storm the foredune system gradually advances seaward: Sand is transferred from offshore to onshore, thus completing what is typically referred to as the storm/post-storm recovery cycle.

In terms of storminess the Oregon coast exhibits a marked seasonality. In summer, regional atmospheric circulation is dominated by the North Pacific High. This brings fair weather, north-north westerly winds, and low waves. In winter, regional atmospheric circulation is dominated by the Aleutian Low, a series of low pressure centers that pass over the North Pacific at intervals of several days to a week or two. These winter storms bring heavy rains, strong south to southwesterly winds, and high waves. Because winds and waves tend to arrive from the southwest during the winter and from the northwest during the summer, Oregon coast littoral cells generally exhibit a seasonal reversal in the direction of longshore as well as cross-shore transport. Specifically, net transport tends to be offshore and to the north in winter: onshore and to the south during the summer.

Recently, considerable attention has been given to interannual variations in storminess or so-called ENSO events (Komar, 1986; Peterson, et al, 1990; Komar,1998b). Analyses have been completed of the ENSO processes that affect flooding and erosion along the coast, including a detailed documentation of the wave conditions and mean water levels (Komar et al., in preparation). At one end of the ENSO spectrum are El Niños. In an El Niño the most important effect is elevated mean water levels along the Oregon coast produced by sea level 'waves' originating at the equator plus the more local effects of warmer offshore water and strong northward-flowing currents. When the 1997-98 El Niño reached its maximum development, the monthly-mean water level was raised by 70 cm. Comparable increases in mean water level were also observed during the 1982-83 El Niño (Komar, 1986). Wave energy is relatively low during an El Niño. This is because there is a southerly shift in storm systems. During both the 1982-83 and 1997-98 El Niño winters erosion tended to be centered in "hot-spot" areas north of headlands and along the north shores of tidal inlets (Komar, 1986; Komar, 1998b).

At the other end of the ENSO spectrum are La Niñas. During the La Niña winter of 1998-99 the monthly-mean water level was for the most part close to normal, and thus its effects not as important as during an El Niño. Wave energy, however, is relatively high during a La Niña. This is because the storm systems pass directly over the Oregon coast. Hence, the greater than 45 feet deep-water significant wave height observed during the March 2-4, 1999 storm referred to in the introduction. During the La Niña winter of 1998-99 erosion was more coast-wide (Komar et al., 1999a).

Cannon Beach exhibited patterns of erosion that conform to those elsewhere (Ranimar Bartl, personal communication). Specifically Ecola Creek migrated northward and erosion was focused on Chapman Point during the 1997-98 El Niño. During the La Niña winter of 1998-99 erosion occurred all along the Cannon Beach shoreline.

Komar et al., (1999b) summarize extreme wave and water level statistics. Water levels are based on an analysis of a 24 year data set obtained from the Yaquina Bay tide gauge (Table 1). They range from 7.2 to 8.5 feet NGVD29 for 5 to 100 year return intervals respectively. Significant wave heights are based on an analysis of a data set from the CDIP Bandon buoy spanning the years 1981--96. They range from 24.0 to 30.5 feet for 5 to 100 year return intervals respectively. A more recent analysis of wave height statistics has been conducted (J. Allan, personal communication). This analysis is based on data collected from the NDBC Newport buoy between 1975 and 1999. Unlike the earlier CDIP data set, this data set includes the 1997-98 El Niño and 1998-99 La Niña events. The results of this analysis give significantly higher projected extreme wave heights. Specifically, they range from 39.0 to 51.8 feet for 5 to 100 year return intervals respectively, or are about about 60 to 70% greater than the earlier estimates!

Most recently it has been recognized that interdecadal variations in storminess occur in the Pacific Northwest (JISAO/SMA, 1999). Whereas ENSO events are characterized by a shift between El Niño and La Niña conditions over a period of 2 to 7 years, so called PDO events are characterized by a shift between warm-dry and cool-wet phases over a period of 20 to 30 years. These PDO events are not well understood at this time. However, it appears that the warm-dry phase favors the occurrence of El Niño conditions. Conversely, the cool-wet phase favors the occurrence of La Niña conditions. What is particularly important is the suggestion that a phase change from warm--dry to cool-wet conditions may have occurred in the mid-1990's. Because the cool-wet phase favors the occurrence of La Niña conditions and La Niña conditions are associated with an increase in the frequency and intensity of storms in the Pacific Northwest, the Oregon coast may be expected to experience an increase in flooding and erosion. Further, a recently completed analysis of spatial and temporal variations in the wave climate of the North Pacific suggests that the heights of storm waves have progressively increased during the last three decades (Allan and Komar, 2000; Allan and Komar, in review). Along the Oregon coast the annual average increase in winter significant wave height is about 3cm.

DUNE HAZARD ASSESSMENT

The information presented above provides the basis for assessing the potential for wave overtopping and undercutting along the Cannon Beach shoreline. Four event scenarios are identified in Table 2. Each scenario represents a different combination of water level and wave height: Scenario #1 a '5 year/5 year' combination which, assuming independent event probabilities, corresponds to a 25 year event; Scenario #2 a '5 year/25 year' combination which corresponds to a 125 year El Niño event; Scenario #3 a '25 year/5 year' combination which corresponds to a 125 year La Niña event; and Scenario #4 a '50 year/50 year ' combination which represents a truly extreme 2500 year event.

Using a relationship given in Ruggiero et al., (1996) to calculate wave runup, the total storm water level achieved under Scenario #1 is 17.2 feet NGVD29; under Scenario #2 is 17.9 feet NGVD29; under Scenario #3 is 19.4 feet NGVD29; and under Scenario #4 is 21.6 feet NGVD29 (Table 2: Figure 4A). These projected elevations are about 20% greater than earlier estimates, which did not include the recent El Niño and La Niña events. These projected elevations compare favorably with observed elevations - total storm water levels during the El Niño winter of 1997-98 and the La Niña winter of 1998-99 reached approximately 16 and 19 feet NGVD29 respectively (Komar et al, in review). These projected elevations compare with projected 100 year 'V-zone' elevations of 17 to 29 feet NGVD29 for the Cannon Beach shoreline (FIRM, 1978).

The potential landward extent of wave undercutting (DHZ) under the above mentioned event scenarios is calculated from a form of the relationship given by Komar et al., (1999b) where,

$$DHZ = (S_{dune} + D) + (L_R \times T_p) + (L_r \times T_p)$$

(Formula 1)

where

S_{dune} = the total horizontal extent of foredune retreat projected to occur during a design storm event or cluster of storm events (feet);

D = the dune topographic stability factor (feet);

L_R = the average annual rate that the shoreline is projected to migrate landward due to sediment budget considerations (feet/year);

L_r = the average annual rate that the shoreline is projected to migrate landward due to relative sea level rise (feet/year); and

T_p = the planning period (years).

There are several methods that can be used to calculate S_{dune}, the extent to which foredunes are undercut by wave runup during extreme storm events. Here, a simple geometric model described by Komar et al. (1999b) is used. This model translates the existing beach/dune form landward in response to elevated storm water levels according to the following relationship:

$$E_{max} = \frac{(WL - Hj) + \Delta BL}{\tan\beta}$$

(Formula 2)

where E_{max}, the maximum extent of foredune retreat, is equivalent to S_{dune}; WL is the storm water level; Hj is the elevation of the beach/dune junction; ΔBL is vertical shift in the beach profile that can result from the presence of a rip current - in effect a safety factor; and tanß the beach slope.

Values for the total water level are those associated with the four event scenarios. Values for the elevation of the beach/dune junction and the beach slope are 11.8 feet and 0.030 (tanß) respectively. These values were obtained from elevation surveys along the area between Harrison Street and Kramer Point in Cannon Beach conducted on October 11, 1999.

Given the above, the projected landward extent of foredune retreat is 177 feet under Scenario #1; 198 feet under Scenario #2; 250 feet under Scenario #3: and 320 feet under Scenario #4 (Table 2). If the potential presence of a rip embayment is taken into account by lowering the beach/dune junction elevation to 10.5 feet, the lowest observed elevation, then in all scenarios the projected extent of foredune retreat is increased by 45 feet.

It is important to note that the simple geometric model is not time dependent: The model assumes that the extreme storm event is of unlimited duration. Numerical simulations using the U.S. Army Corps of Engineers SBEACH model suggest that much if not most of the profile change induced by storms occurs rapidly. However, time periods as long as one month may be needed to develop the fully eroded profile predicted by the geometric model (W. McDougal, personal communication). This suggests that estimates of the extent of foredune retreat obtained from the simple geometric model are best viewed as possible maxima. Another important consideration in this regard is the existence of the relatively resistant marine terrace deposits that underlie portions of the foredune along Cannon Beach. The exact location of the terrace deposits is unclear, however it is highly likely they will act to considerably limit the potential landward extent of foredune retreat.

The term D is intended to account for the fact that storms cut a near-vertical slope in the foredune and that this slope tends to fail. Assuming that the extent of this failure is approximated by the stable angle of repose in loose sand, then

$$D = \underline{H_{dune}} \approx 1.5H_{dune}$$

$\tan 33°$ (Formula 3)

where H_{dune} is the difference between the elevation of the beach/dune junction and the elevation of the primary dune crest. For the Cannon Beach shoreline this would extend the projected extent of foredune retreat landward a distance of about 45 feet. Considering that relatively resistant marine terrace deposits underlie much of the foredune area the inclusion of this additional term may not be warranted.

The sediment budget is assumed to be roughly balanced over the long term. L_R is therefore set equal to zero and thus excluded from the analysis. Estimates of relative sea level rise (L_r) were noted earlier. Incorporating a moderate rate of accelerated sea level rise along the Cannon Beach shoreline over a 50 year time period results in a distance on the order of 20 feet to be added to Sdune.

Thus, formula (1) yields a total distance (measured landward from the accreted foredune toe) that ranges from about 180 feet at the low end to 385 feet at the high end. A distance of 250 feet represents an approximate mid-range value. This is illustrated in Figure 4B.

The Design Foredune. Based on the preceding discussion an idealized 'design foredune' is identified for the Presidential Management Unit of the Cannon Beach subcell (Figure 5). At an elevation of 30 feet NGVD29, the **primary foredune crest** is located a distance approximately 50 feet seaward of the western edge of Ocean Avenue. This elevation meets or exceeds projected 100 year 'V-zone + 4 foot' elevations along this segment of shoreline. An irregular **secondary foredune crest** is located approximately 100 feet seaward of the western edge of Ocean Avenue. It ranges from 20 to 25 feet NGVD29 in elevation. The minimum in this elevation range exceeds all but the most extreme total water elevations predicted as part of this study. The 100 foot width of this relatively steeply-dipping **upper foreslope** is well vegetated (60 to 90% cover). **Vegetated hummocks**, extend seaward of the secondary foredune crest down to about 12 feet NGVD29 in elevation. The 150 foot width of this relatively gently-dipping **lower foreslope**, which is defined as the area between the seaward edge of the vegetated hummocks and the **foredune toe**, is moderately vegetated (30 to 60% cover). The combined 250 foot ideal width of the design foredune meets or exceeds the extent of foredune retreat projected under all but the extreme event scenario. Seaward of the foredune toe lies the open sand beach.

The width and height of the design foredune constitutes a substantial buffer to storm wave attack. It maintains flood and erosion protection potential. Further, this idealized configuration encourages outward as opposed to upward growth of the foredune. In this way it minimizes the potential for sand inundation. Should excess sand accumulate along the lower foreslope, it can be regraded on an as needed basis without jeopardizing the stability of the bulk of the foredune. Hence the design foredune establishes a basis for proposed modifications described in the subsequent section.

CONCLUSIONS

This document briefly reviews factors affecting the stability of the Cannon Beach littoral cell. Its focus is on wave and water level projections that incorporate the data from the last two winters - the El Niño winter of 1997-98 and the La Niña winter of 1998-99 - and an assessment of the implications of this information to the potential for wave overtopping and undercutting.

- Ranging from 39.0 to 51.8 feet for 5 to 100 year return intervals respectively, analysis of data that includes the recent El Niño and La Niña events yield significant wave heights that are about or about 60 to 70% greater than earlier estimates
- Projections of the total storm water level, which range from 17 to 22 feet NGVD29 for 25 to 2500 year return intervals respectively, are about 20% greater than earlier estimates that did not include the recent El Niño and La Niña events. These projected elevations compare with total storm water levels of about 16 and 19 feet NGVD29 observed during the El Niño winter of 1997-98 and the La Niña winter of 1998-99 respectively, and with projected 100 year 'V-zone' elevations that range from 17 to 29 feet NGVD29.
- Projections of potential foredune retreat based on a simple geometric model that translates the existing beach/dune form landward in response to elevated storm water levels yield total retreat

distances ranging from about 180 to 385 feet.

This information provides the basis for identification of a 'design foredune' configuration that maintains flood/erosion protection potential and minimizes the potential for sand inundation.

Part II: Presidential Streets Sand Management Strategy

OVERVIEW

The Presidential Streets Management Unit extends from Kramer Point to Harrison Street. Problems associated with the management unit are documented in "Cannon Beach: An Integrated Approach to Sand Management", the City of Cannon Beach's foredune management plan. Problems associated with sand transport and deposition are not new to this area. Prior to the 1970's the general configuration of the shoreline was a broad open sand beach, backed by a shoreline bluff consisting of the erosional face of an exposed marine terrace. Residential development of the upper surface of the marine terrace continued from the 1920's through the 1960's. Ocean Avenue, which occupies a major portion of this management unit, was constructed along a 40 foot-wide 'right of way' with permanent beach access stairs located at the end of Harrison Street. Salt tolerant vegetation such as Salal, Hooker willow, and Sea-lyme grass occupied occasional clusters along the face of the bluff, however, no substantial vegetation barrier was required as open wind-blown sand volumes were minimal. In the 1960's a sand stabilization project using European beachgrass was conducted along the northern half of Chapman Beach. The grass quickly spread throughout much of the Cannon Beach area, and by the early 1980's covered much of the upper beach areas along the shoreline north of Haystack Rock. The 1982-83 El Niño Event triggered a change in sediment transport dynamics within the Cannon Beach littoral cell, such that an unprecedented volume of sand accumulated along the northern 3000 meters of the littoral cell. The significant dune growth and crest migration documented along Chapman Beach (Appendix A), was paralleled by a substantial accumulation along the base of the former marine terrace face and the growth of a vegetated foredune. This foredune area was studied by Charles Rosenfeld and Wilbur Ternyik in 1983, in response to growing concerns about sand inundation and property damage in the vicinity of Laurel Street. Ternyik pointed out that dense clumps of vegetation were acting as natural groins, capturing increasing amounts of wind-blown sand. Rosenfeld added that continued sand accumulation would build a dune crest along the terrace face. This has been the case. This increase in beach and dune sand volume through the late 1990's has enhanced ocean flood/erosion protection potential. However, it has also presented problems by clogging storm drains, covering roads, damaging landscaping, filling rain gutters, and limiting pedestrian access to the beach.

Following from the above, the overall objectives of the proposed foredune management strategy are to:

- Maintain or enhance ocean flood/erosion protective functions of the natural foredune area;
- Minimize inundation brought about by excessive accumulation of wind-blown sand and correspondingly maintain or enhance ocean views;
- Maintain or enhance access to recreational uses associated with the open sand beach; and
- Maintain or enhance existing stormwater drainage.

The recognition of individual areas within the overall management unit constitutes the framework of the proposed management strategy. Area I extends from Jackson Street to Harrison Street; Area II from Jackson Street to the north line of Tax Lot 700 & 15135, Map 51030AA, 100 feet north of Washington Street; and Area III from the north line of Tax Lot 700 & 15135, Map 51030AA to Kramer Point. Each area is distinguished by a combination of physical and social settings. For each area the relative priority of the management objectives identified above varies somewhat. The result is that different types of management practices are prescribed for the different areas (Table 3). Proposed management measures include: foredune grading; vegetative stabilization; drainage and access management; and monitoring and maintenance. Other than maintenance and enhancement of existing vegetation cover, little modification is envisioned for Area I. In Area II prescribed management practices will focus on foredune grading and vegetation stabilization. Special attention is given to drainage and access management needs within this area. Foredune grading and vegetative stabilization is also prescribed for

Area III. Monitoring and maintenance of the entire area is to be conducted for at least the first two years following initial implementation. A detailed description of the setting, objectives, and prescribed management practices associated with each of the management areas is given below.

AREA I: Harrison Street to about 50 feet south of Jackson Street

Description. At Harrison Street this area consists of a high bank shoreline with a steep bluff facing the beach. The upper level consists of marine terrace deposits with a thin sand covering. At street level the surface slopes gently eastward and is covered by Orchard grass. The crest and bluff are vegetated by brush and woody non-native plants, including Coast salix and Evergreen blackberry. Minor amounts of European beachgrass occupy the upper beach to a distance of 70 feet west of the street. Crest elevation is ~35 feet NGVD29 and crest width is ~20 feet.

At Jackson Street this area is fronted by a nearly level marine terrace surface with a shallow sand cover. This section contains an old and thick cover of Salal which has been cut to permit a walking path. The Salal has been allowed to become dense, and in some places, subject to salt burn. Crest elevation is ~32 feet NGVD29 and crest width is ~60 feet.

Management Objectives (with relative priority in bold)

- **Maintain or enhance ocean flood/erosion protective functions of the natural foredune area;**
- Minimize inundation brought about by excessive accumulation of wind-blown sand and correspondingly maintain or enhance ocean views;
- **Maintain or enhance access to recreational uses associated with the open sand beach**; and
- Maintain or enhance existing stormwater drainage.

Recommendations (see also Table 3 and Figures 6 and 7)

- **Sand Removal** - The removal of sand from the foredune area is prohibited.

- **Foredune Grading** - Grading of this foredune area is not proposed at this time.
- **Vegetative Stabilization** - Planting of sand-stilling grasses is not proposed at this time.
- **Monitoring and Maintenance** - Prune and thin the woody herbaceous cover to achieve the maximum plant vigor and sustained health. Eliminate the blackberry. Fertilize the existing beach grass seasonally. (See also the section on Monitoring and Maintenance below.)

AREA II: about 50 feet south of Jackson Street to the north line of Tax Lot 700 & 15135, Map 51030AA, 100 feet north of Washington Street

Description. At Monroe Street this area consists of a high, broad sand dune that extends west of Ocean Avenue. The dune has grown vertically as a result of non-native European beach grass, and has attempted to migrate inland, blocking drainage and causing sand inundation problems for oceanfront residents. This is a principal problem area, requiring both foredune grading and vegetative stabilization. Crest elevation is ~42 fee NGVD29 and crest width is ~80 feet.

At Jefferson Street this area consists of a high, broad sand dune that extends west of Ocean Avenue. The dune has grown vertically as a result of non-native European beach grass, and has attempted to migrate inland, blocking drainage and causing sand inundation problems for oceanfront residents. The Jefferson Street area contains the most serious street runoff problem in the project area, and has the highest reported rate of sand inundation problems, as well. Landward migration of the sand dunes has reduced Ocean Avenue to a pedestrian walkway, and presents an annual problem to the residential structures. The need for the City of Cannon Beach to perform remedial cuts through the dunes to drain ponded water from the street, opens both a notch for wind gusts and exposes sand to direct wind transport. This section requires the creation of a vegetated drainage swale, as well as crest height reduction and vegetative stabilization. Crest elevation is ~40 feet NGVD29 and crest width is ~60 feet.

At Adams Street this area consists of a high, broad sand dune that extends west of Ocean Avenue. The dune has grown vertically as a result of non-native European beach grass, and has attempted to migrate inland, blocking drainage and causing sand inundation problems for oceanfront residents. The Adams

Street area also periodically has its storm runoff ponded by advancing sand, requiring the City to breach the dune to improve drainage, but also causing wind transport to the north which affects the residents of both Ocean Avenue and Laurel Street. This section requires the creation of vegetated drainage swale, as well as crest height reduction and vegetative stabilization. Crest elevation is ~44 feet NGVD29 and crest width is ~110 feet.

Management Objectives (with relative priority in bold)

- Maintain or enhance ocean flood/erosion protective functions of the natural foredune area;
- **Minimize inundation brought about by excessive accumulation of wind-blown sand and correspondingly maintain or enhance ocean views;**
- Maintain or enhance access to recreational uses associated with the open sand beach; and
- **Maintain or enhance existing stormwater drainage.**

Recommendations (see also Table 3 and Figures 8, 9a, and 9b)

- **Sand Removal** - The removal of sand from the foredune area is prohibited.
- **Foredune Grading** - Although grading down to the 'V-zone 100 year plus 4 foot' elevation of 28 feet NGVD29 is permitted, it is envisioned that a primary foredune crest will be established at an average elevation of ~30 feet NGVD29. Where fully developed, the primary crest will be located at a distance ~60 feet seaward from the western edge of Ocean Avenue. Where modified to accommodate stormwater drainage, the primary crest will be located at a distance ~20 feet seaward from the western edge of Ocean Avenue. The primary crest will be contoured so as to achieve a smooth transition between these two end-member profile configurations. At an elevation of ~25 feet NGVD29, an irregular secondary foredune crest will be located at a distance ~125 feet seaward from the western edge of Ocean Avenue. The lower foreslope will extend about 125 feet out seaward from the secondary foredune crest and down to an elevation of about 12 feet NGVD29.

Grading should occur in this area during the spring (March or April). Graded sand is to be transferred seaward from high areas of the foredune crest to low areas elsewhere along the crest and foreslope. After low areas have been filled consideration may be given to the transfer of excess sand northward or southward into adjacent areas, or further seaward so as to allow a combination of wave and wind-driven sediment transport to redistribute it. To facilitate grading and sand transfer, access for heavy equipment will be needed on a temporary basis. Upon completion of grading and transfer activities, access paths will need to be repaired (typically, through the planting of sand stilling grasses).

Preliminary estimates indicate a total graded area of ~75,000 square feet, with a total cut of ~24,000 cubic yards and total fill of ~20,000 cubic yards. As noted above, the ~4,000 cubic yards of 'excess' sand will be transferred to adjacent areas and/or further seaward so as to allow a combination of wave and wind-driven sediment transport to redistribute it. Grading will leave ~1000 square feet or more of 'frontal dune reservoir' about the 100 year 'V-zone' elevation of 24 feet NGVD29 along the entire length of this area - except in the immediate vicinity of Monroe where a 25 foot extension of the drainage culvert is needed to provide for a frontal dune reservoir in excess of 540 square feet (Attachment A). Albeit temporary, the increase in width along the foredune toe that will occur as a result of grading ranges from none to as much as ~50 feet.

- **Vegetative Stabilization** - Planting of sand-stilling grasses in this area consists of the dune area that is presently vegetated. Planting should occur immediately following grading. Planting should be carried out so as to mimic natural vegetation patterns as much as possible. Specific planting recommendations are as follows:

    Along the primary crest and backslope plant primary grasses (e.g. 80% European Beachgrass and 20% American Dunegrass) at moderate densities (e.g. hill spacing of 18" with 3 culms per hill) to achieve 60% to 90% cover.

Planting should be carried out during rainy periods before and/or after winter storms, when temperatures are between 32 and 60 degrees F and the sand is wet at a 3 inch depth. Preferably immediately after planting, fertilize with ammonium sulfate fertilizer (N-P-K:21-0-0) at a rate of

~200 -400 pounds per acre, with follow up fertilization again in the subsequent late fall or early spring rainy period (after SCS, 1991).

- **Monitoring and Maintenance** - Foreslope shaping, remedial grading, repair planting, and other maintenance activities should be conducted on an as needed basis. Regular visual inspections will provide the basis for assessing needs in this regard. Primary grasses should be fertilized in the spring and fall. Mowing may be conducted annually on an as needed basis. (See also the section on Monitoring and Maintenance below.)

Area III: North line of Tax Lot 700 & 15135, Map 51030AA, 100 feet north of Washington Street to Kramer Point

Description. This is the most open sand area in the City of Cannon Beach, and has the inundation history to match. This area has suffered massive sand accumulations into yards, pedestrian access points, and side streets. Vegetation is sporadic and not effective at sand transport control. The narrow beach, steep sand bank and proximity to the houses requires extensive foredune grading and vegetative stabilization. Crest elevation is ~39 feet NGVD29 and crest width is ~20 feet.

Management Objectives (with relative priority in bold)

- Maintain or enhance ocean flood/erosion protective functions of the natural foredune area;
- **Minimize inundation brought about by excessive accumulation of wind-blown sand and correspondingly maintain or enhance ocean views;**
- **Maintain or enhance access to recreational uses associated with the open sand beach**; and
- Maintain or enhance existing stormwater drainage.

Recommendations (See also Table 3 and Figures 10 and 11.)

- **Sand Removal** - The removal of sand from the foredune area is prohibited.
- **Foredune Grading** - Although grading down to the 'V-zone 100 year plus 4 foot' elevation of 28 feet NGVD29 is permitted, it is envisioned that a primary foredune crest will be established at an average elevation of ~30 feet NGVD29.. The primary crest will be located at a distance ~75 feet seaward of the existing 'fence line'. At an elevation of ~25 feet NGVD29, an irregular secondary foredune crest will be located at a distance ~75 feet seaward from the western edge of the primary foredune crest. The lower foreslope will extend about 100 feet out seaward from the secondary foredune crest and down to an elevation of about 12 feet NGVD29.

Grading should occur in this area during the spring (March or April). Graded sand is to be transferred seaward from high areas of the foredune crest to low areas elsewhere along the crest and foreslope. After low areas have been filled consideration may be given to the transfer of excess sand northward or southward into adjacent areas, or further seaward so as to allow a combination of wave and wind-driven sediment transport to redistribute it. To facilitate grading and sand transfer, access for heavy equipment will be needed on a temporary basis. Upon completion of grading and transfer activities, access paths will need to be repaired (typically, through the planting of sand stilling grasses).

Preliminary estimates indicate a total graded area of ~65,000 square feet, with a total cut of ~30,000 cubic yards and total fill of ~25,000 cubic yards. As noted above, the ~5,000 cubic yards of 'excess' sand will be transfered to adjacent areas and/or further seaward so as to allow a combination of wave and wind-driven sediment transport to redistribute it. Grading will leave ~1500 square feet of 'frontal dune reservoir' above the 100 year 'V-zone' elevation of 24 feet NGVD29 along the entire length of this area (Attachment A). Albeit temporary, the increase in width along the foredune toe that will occur as a result of grading is ~50 feet.

It is important to note that planting is designed to encourage outward as opposed to upward growth of the foredune. However, sand accumulation in the area is particularly high. As a result, it is anticipated that regrading may be warranted in this area on a regular basis.

● **Vegetative Stabilization** - With the exception of a 35 foot wide unvegetated buffer strip located directly west of the 'fence line' to facilitate maintenance, planting of sand-stilling grasses should be carried out across the entire graded foredune area. Planting should occur immediately following grading. Planting should be carried out so as to mimic natural vegetation patterns as much as possible. Specific planting recommendations are as follows:

Along the primary crest and backslope plant primary grasses (e.g. 80% European Beachgrass and 20% American Dunegrass) at moderate densities (e.g. hill spacing of 18" with 3 culms per hill) to achieve 60% to 90% cover;

Along the upper foreslope and secondary crest plant primary grasses (e.g. 80% European Beachgrass and 20% American Dunegrass) at high densities (e.g. hill spacing of 12" with 5 culms per hill) to achieve greater than 60% cover; and

Along the lower foreslope plant primary grasses (e.g. 80% European Beachgrass and 20% American Dunegrass) at high densities (e.g. hill spacing of 12" with 5 culms per hill) to achieve as much as

60% cover over the area from about 25 feet to 18 feet NGVD29 in elevation and plant primary grasses (e.g. 80% European Beachgrass and 20% American Dunegrass) at moderate densities (e.g. hill spacing of 18" with 3 culms per hill) to achieve as much as 30% cover over the area from about 18 feet to 14 feet NGVD29 in elevation. Vegetation planted below an elevation of about 16 feet NGVD29 is best viewed as sacrificial, in that it may well be lost during winter storms and as a result need to be replanted on a regular basis.

Planting should be carried out during rainy periods before and/or after winter storms, when temperatures are between 32 and 60 degrees F and the sand is wet at a 3 inch depth. Preferably immediately after planting, fertilize with ammonium sulfate fertilizer (N-P-K :21-0-0) at a rate of ~200 -400 pounds per acre, with follow up fertilization again in the subsequent late fall or early spring rainy period (after SCS, 1991).

Planting in front of every tax lot in this area may not be essential. Without planting such areas will continue to have problems with sand accumulation. Over time these problems may extend to adjacent areas where planting has occurred and, as a result, more frequent regarding and planting be warranted. In this regard it is recommended that at least 85% of the tax lots follow the planting recommendations outlined above.

- **Monitoring and Maintenance** - Foreslope shaping, remedial grading, repair planting, and other maintenance activities should be conducted on an as needed basis. Regular visual inspections will provide the basis for assessing needs in this regard. Primary grasses should be fertilized in the spring and fall. Mowing may be conducted annually on an as needed basis. (See also the section on Monitoring and Maintenance below.)

DRAINAGE AND ACCESS MANAGEMENT

Special attention will be given to foredune grading and sand transfer activities in the immediate vicinity of stormwater drains and drainage culvert outlets located at street ends. Efforts will be made to keep existing drains and culvert outlets exposed. As noted above, the foredune area will be configured (both graded and planted) in an effort to provide for stormwater drainage and storage needs (Figure 12). These areas will be monitored following initial implementation (see below).

Special attention also needs to be given to managing vehicular access along the western edge of Ocean Avenue. No modifications to the existing road width are planned. However, it is recommended that a swale lined with Salal be be located just seaward of the western edge of Ocean Avenue. This will be used to discourage vehicles from parking west of Ocean Avenue and to protect primary plantings along the foredune crest from pedestrian traffic.

Management of pedestrian access will focus on encouraging voluntary cooperation through education. Initially access management measures will be limited to the posting of informational signs at identified access points (i.e. street ends) and around recently planted areas. The purpose of these signs is to identify sensitive foredune areas and direct recreational users away from them. Posters or other informational materials may also be prepared and distributed to residents and visitors. Consideration may need to be given to implementation of more formal access management measures, such as post and rope fencing of identified access trails, wooden walkover structures, and temporary access restriction using fencing in particularly sensitive foredune areas.

POTENTIAL ADVERSE IMPACTS TO ADJACENT PROPERTY

The project area is located between the Haystack Management Unit, with its offshore rocks and nearshore tide pools, and the Downtown Cannon Beach Management Unit, with its seawalls, revetments, and constantly changing Ecola Creek inlet. The scope and timing of the sand management measures outlined above are intended to minimize adverse impacts to these adjacent areas. Considering that the total amount of sand being moved is on the order of 2% of the sand that exists along that segment of shoreline, impacts to adjacent properties is expected to be minimal. Monitoring and maintenance will help to insure that this is the case. Thus, with respect to adverse impacts, their potential will be greatest following initial grading and planting, will be generally limited to the active management area, and will decrease over time. This said, potential problems are considered briefly below.

- Grading within Areas II and III during the Spring will leave open sand exposed to the northerly winds of summer. Sand movement downwind and inland may result in an increased accumulation directly in front of properties in Area III, along Ocean Avenue in Area II, and along the lower foreslope and crest of the dune in Area I. Sand accumulation in Areas II and III can be readily addressed in the context of maintenance. Some additional sand may accumulate in Area I beyond that which would occur normally. This would actually be beneficial from the prospective of flood and erosion protection and is unlikely to present any problems in terms of potential sand inundation. Further, accumulation in this 'buffer' area ensures that the Haystack Management Unit will not be affected by the proposed sand management plan

- It is during the subsequent winter, before plantings have taken hold, that the greatest potential for adverse impacts exists. Sand that accumulated in Area I may simply be blown back towards Areas II and III by the strong southerly winds of winter. Therefore little potential exists for adverse impacts to this area and the adjacent area to the south. Potential problems associated with limited planting in Area II were noted earlier - i.e. increased maintenance along Ocean Avenue. Although they may extend to Area III, these problems are likely to be primarily limited to Area II: Area III has been an open sand area and therefore should not experience any more problems with sand accumulation than it has in the past. Correspondingly, there will be little to no impact on the extent to which the proposed management area is a source of sand to the Downtown Cannon Beach Management Unit. Over time the amount supplied to this adjacent area may decrease somewhat. However, the ability of sand accumulation in Area III to occur to the extent that it will starve downwind locations will be severely limited by the effects of wave attack during storms.

MONITORING AND MAINTENANCE

A pre-grading and post-grading inspection needs to be conducted by a qualified professional. Further, it is recommended that such an individual be present at various stages during the initial implementation of recommended management measures (i.e. grading and planting). Additional monitoring and maintenance activities need to be conducted over a two year period following initial implementation of management measures described above.

Monitoring will involve the visual inspection of the active management area and adjacent foredune areas by a qualified professional on a biannual basis and after severe winter storms. Visual inspections will be used to identify areas where repair planting or other types of maintenance measures are needed. Elevation surveys, in the form of beach profiling along established profile lines, will be carried out on an annual basis. Reports summarizing observations made during visual inspections and the results of elevation surveys will be prepared on a biannual basis over the two year period following initial implementation.

Maintenance activities will be carried out on an as needed basis. The City of Cannon Beach needs to be consulted prior to commencing such activities. Maintenance may involve foreslope shaping and remedial grading. Foreslope shaping is appropriate when:

The crest and foreslope are so dissected and irregular that they significantly impede proper growth of the foredune and/or maintenance of drainage basins. In this instance, shaping will typically involve minor sand transfer so as to reestablish desired design specification.

The foreslope is scarped in response to wave undercutting. In this instance, shaping will involve grading a portion of the crest just large enough to fill in the foreslope to an angle between 25 and 33 degrees.

The foreslope is being nourished with sand from outside the management unit. In this instance, shaping will involve filling in the foreslope to an angle between 25 and 33 degrees.

Another maintenance measure, remedial grading, is needed to clear sand which has piled up against exterior walls, doors, or windows, thereby blocking access to dwelling and potentially causing damage to these structures. The City of Cannon Beach needs to be consulted prior to commencing such activities.

Because of damage by erosion or trampling, as well as simply a lack of complete survival of initial plantings, some repair planting will generally be needed to maintain plant cover. The foreslope and crest of foredunes, and other more exposed areas with less than 60% vegetative cover should be replanted with beachgrass at high densities (e.g. 12" hill spacing and 5 culms per hill). The backslope of foredunes, and other less exposed areas with less than 30% vegetative cover should be replanted with beachgrass at lower densities (e.g. 18" hill spacing and 3 culms per hill). In all areas where efforts are being made to establish new plantings fertilizer should be applied during the spring and fall to maintain continued plant vigor.

Secondary plantings may be established in backslope areas. This should be done when initial stabilizing vegetation is well established (generally after two years). Plants appropriate for secondary stabilization include salal, evergreen huckleberry, shore pine, purple beach pea, seashore lupine, and tree lupine. Planting of secondary species should occur directly in the existing stand of beachgrass. Care should be taken to minimize removal or destruction of beach grass so that it can continue to stabilize the area while secondary species become established. Succession should occur naturally since beachgrass tends to thin out and die where it is cut off from sand accretion.

Mowing may be conducted annually during the late spring through early summer (i.e. May 15 to July 15) on an as needed basis. At least six to eight inches of grass should be left above ground. Recently mowed areas should be closely monitored for signs of blowout development.

Sand fencing is not envisioned, but is not precluded as an option.

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Tables

Table 1. Summary of Extreme Events.

Table 2. Cannon Beach Dune Hazard Assessment: Summary of Event Scenarios

Table 3. Summary of Presidential Street Sand Management Measures.

Figure Captions

Figure 1. Factors affecting shoreline stability along dune-backed shorelines of the Oregon coast. The focus on this work is on short-term events.

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Figure 4A. Illustration showing projected total water levels from this study, 100 year 'V-zone' elevation, and 100 year 'V-zone' + 4 foot elevation along the Presidential Streets Management Unit (the horizontal lines). The October 11, 1999 profiles at Jackson, Monroe, Jefferson, and Adams are provided for reference. Note that elevation is in feet NGVD29 and distance is in feet. Note that West and the Pacific Ocean are on the right. Note that the arrows attached to the three horizontal lines indicate the range in values, and thus the lines are mid-points in the range.

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Figure 5. The 'design foredune'. Note foredune width and height. Note that the pattern of vegetation cover is intended to mimic that which occurs naturally. Note the presence of the secondary crest, which is intended to encourage outward as opposed to upward growth of the foredune. Should growth in this area become excessive then regrading would occur.

Figure 6. Plan view of Area I: Jackson Street to Harrison Street. Note that no grading or planting is envisioned at this time. Also note the locations of existing drainage culverts.

Figure 7. Beach Profiles at Area I: Jackson Street to Harrison Street.

Figure 8. Plan view of Area II: Washington Street to Jackson Street. Note the area where grading is proposed, including the location of the primary and secondary crests. In this regard note how the variation in the location of the primary crest so as to accommodate stromwater runoff is shown schematically. Note that sand transfer is seaward and possible alongshore in this area. Note that planting is limited to only the area within the Ocean Avenue 'right of way'. Also note the locations of existing drainage culverts.

Figure 9a. Beach Profiles at Area II: Washington Street to Jackson Street showing fully-developed design profile. Note the difference between the graded profile in this and the accompanying figure, here the primary crest is located further seaward. Note the elevation of the primary crest relative to the '100 year + 4 foot' maximum elevation of 28 feet NGVD29. Sand transfer will consist of removal from the crest and fill towards the toe. Note that as shown planting is limited to only the area within the Ocean Avenue 'right of way'. Also note the small planted swale located directly seaward of the existing Ocean Avenue so as to preclude vehicular access.

Figure 9b. Beach Profiles at Area II: Washington Street to Jackson Street showing drainage-modified design profile. Note the difference between the graded profile in this and the accompanying figure, here the primary crest is located further landward. Note the elevation of the primary crest relative to the '100 year + 4 foot' maximum elevation of 28 feet NGVD29. Sand transfer will consist of removal from the crest and fill towards the toe. Note that as shown planting is limited to only the area within the Ocean Avenue 'right of way'. Also note the small planted swale located directly seaward of the existing Ocean Avenue so as to preclude vehicular access.

Figure 10. Plan view of Area III: Kramer Point to Washington Street. Note the area where grading is proposed, including the location of the primary and secondary crests. Note that planting will occur across the entire graded area - with the exception of a 35 foot wide unvegetated buffer strip located directly west of the 'fence line' to facilitate maintenance. It will mimic natural vegetation patterns as much as possible.

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Figure 12. Results of an analysis of stormwater drainage basin needs at culvert outlets in the management area.

Table 1

Summary of Extreme Event Statistics

Return Interval	Wave Height (meters) feet	Wave Height (meters) feet
5 year	(7.3) 24.0'	(11.9) 39.0'
25 year	(8.4) 27.5'	(14.3) 46.9'
50 year	(8.9) 29.2'	(15.1) 49.5'
100 year	(9.3) 30.5'	(15.8) 51.8'
	CDIP Bandon	NDBC Newport

Return Interval	Water Level (meters) feet
5 year	(2.2) 7.2'
25 year	(2.4) 7.9'
50 year	(2.5) 8.2'
100 year	(2.6) 8.5'
	Yaquina Bay

Table 2

Cannon Beach Dune Hazards Assessment: Summary of Event Scenarios

Scenario#1 (5/5)

Water Level meters (feet) NGVD 29	Wave Height meters (feet)	Storm Total meters (feet) NGVD 29	Retreat Distance
2.2 (7')	12.0 (39')	5.2 (17.2')	54.7 meters 177 feet

Scenario#2 (25/5 El Niño)

Water Level meters (feet)NGVD 29	Wave Height meters (feet)	Storm Total meters (feet) NGVD 29	Retreat Distance
2.4 (8')	12.0 (39')	5.4 (17.9')	61.3 meters 198 feet

Scenario#3 (5/25 La Niña)

Water Level meters (feet)NGVD 29	Wave Height meters (feet)	Storm Total meters (feet) NGVD 29	Retreat Distance
2.2 (7')	14.0 (47')	5.9 (19.4')	77.3 meters 250 feet

Scenario#4 (50/50)

Water Level meters (feet)NGVD 29	Wave Height meters (feet)	Storm Total meters (feet) NGVD 29	Retreat Distance
2.5 (8')	15.0 (50')	6.6 (21.6')	99.0 meters 320 feet

with D	+ 45 feet
with Rip Bay	+ 45 feet
with accelerated sea level rise	+ 20 feet

Table 3
Summary of Presidential Street Sand Management Measures

Area I: Harrison Street to about 50 feet south of Jackson Street

- No Sand Removal
- No Foredune Grading
- No Vegetative Stabilization
- Monitoring and Maintenance

Area II: about 50 feet south of Jackson Street to the north line of Tax Lot 700 & 15135, Map 51030AA, 100 feet north of Washington Street

- No Sand Removal
- Foredune Grading

primary crest	elevation ~30 feet @ ~60 feet west of Ocean Avenue for fully-developed profile
	elevation ~30 feet @ ~20 feet west of Ocean Avenue for drainage-modified profile
secondary crest	elevation ~25 feet @ ~125 feet west of Ocean Avenue

- Vegetative Stabilization

  limited to within the Ocean Avenue right of way - 60 to 90% cover

- Monitoring and Maintenance

Area III: North line of Tax Lot 700 & 15135, Map 51030AA, 100 feet north of Washington Street to Kramer Point

- No Sand Removal
- Foredune Grading

primary crest	elevation ~30 feet @ ~75 feet west across Laurel Street
secondary crest	elevation ~25 feet @ ~150 feet west across Laurel Street

- Vegetative Stabilization

  extending from the primary crest to the toe of the secondary crest - 30 to 90% cover

- Monitoring and Maintenance

N.B. all elevations are relative to NGVD29

Figure 1. Factors affecting shoreline stability along dune-backed shorelines of the Oregon coast.

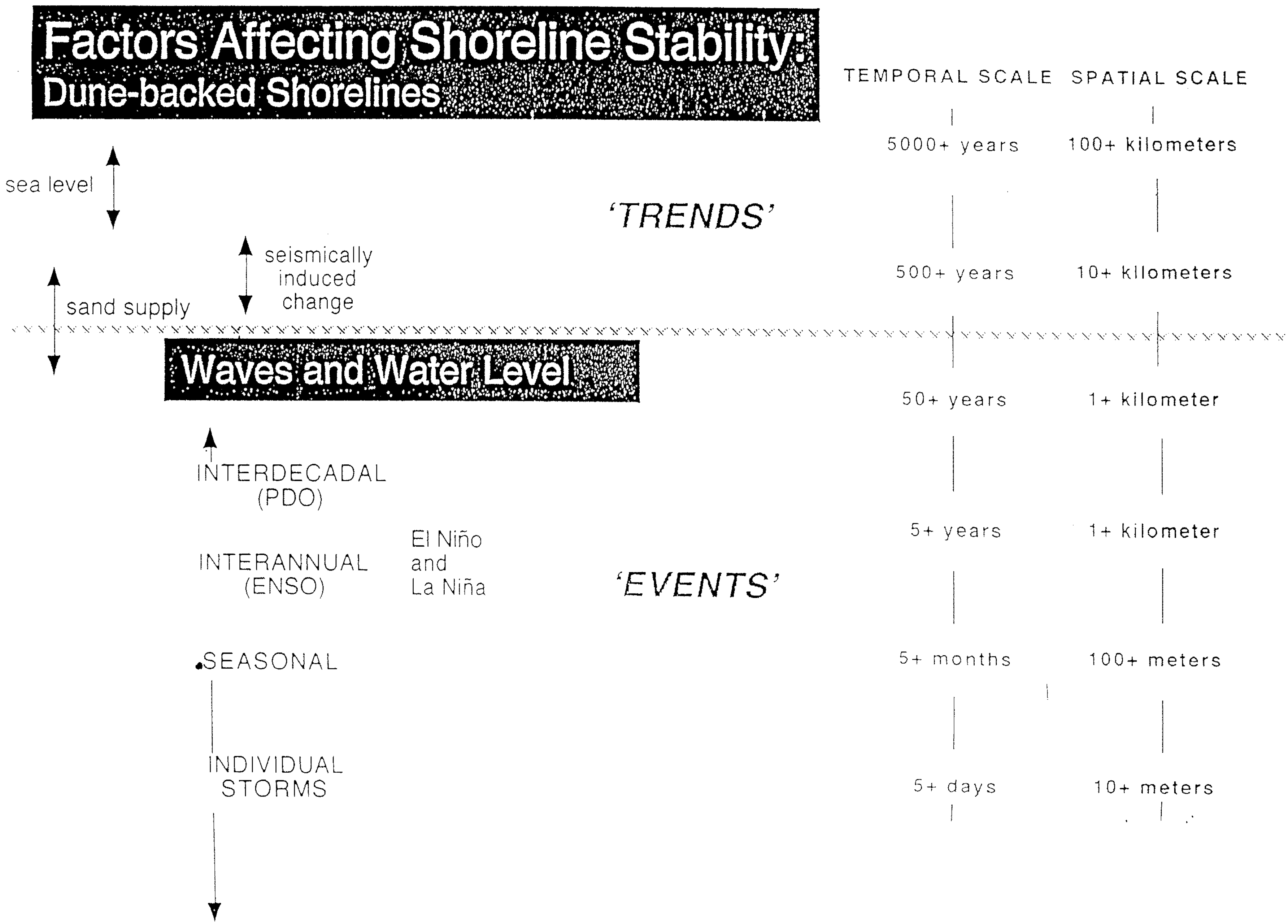
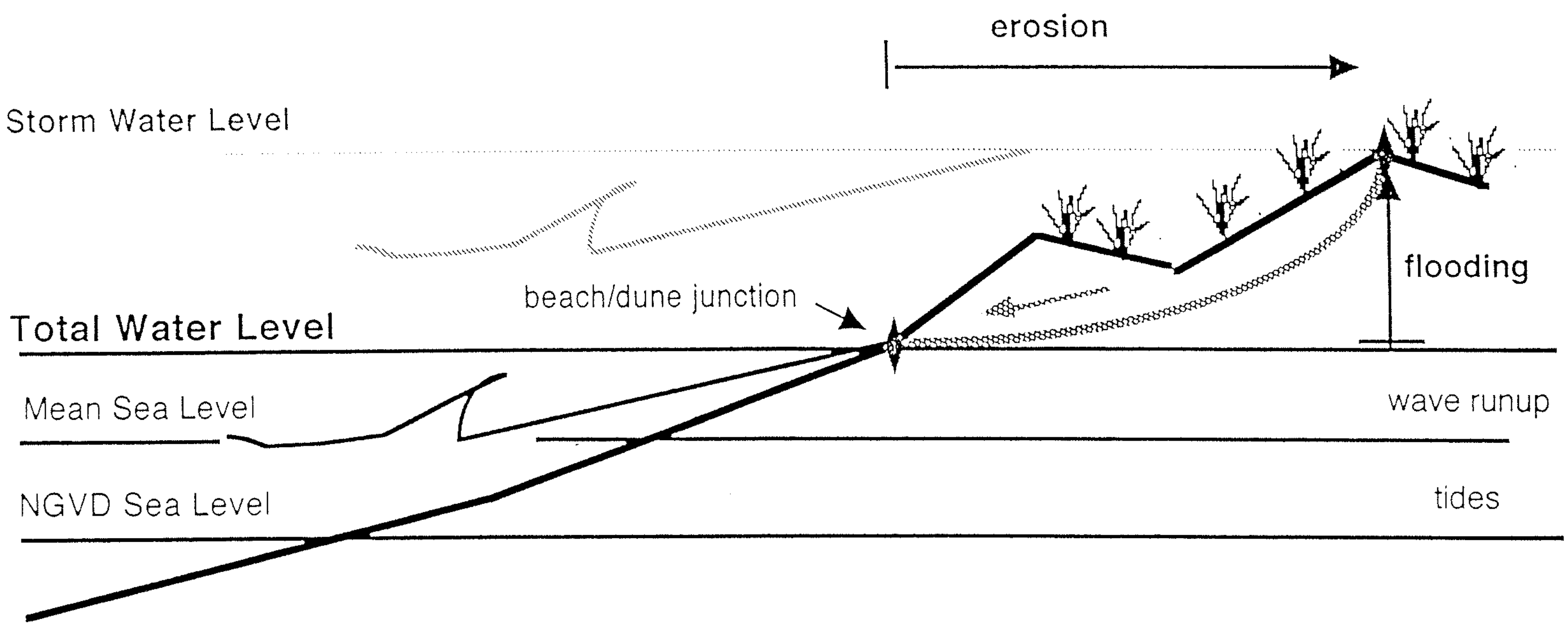


Figure 2. Illustration of factors affecting total water level and hence the potential for wave overtopping and undercutting along dune-backed shorelines.

Overtopping and Undercutting



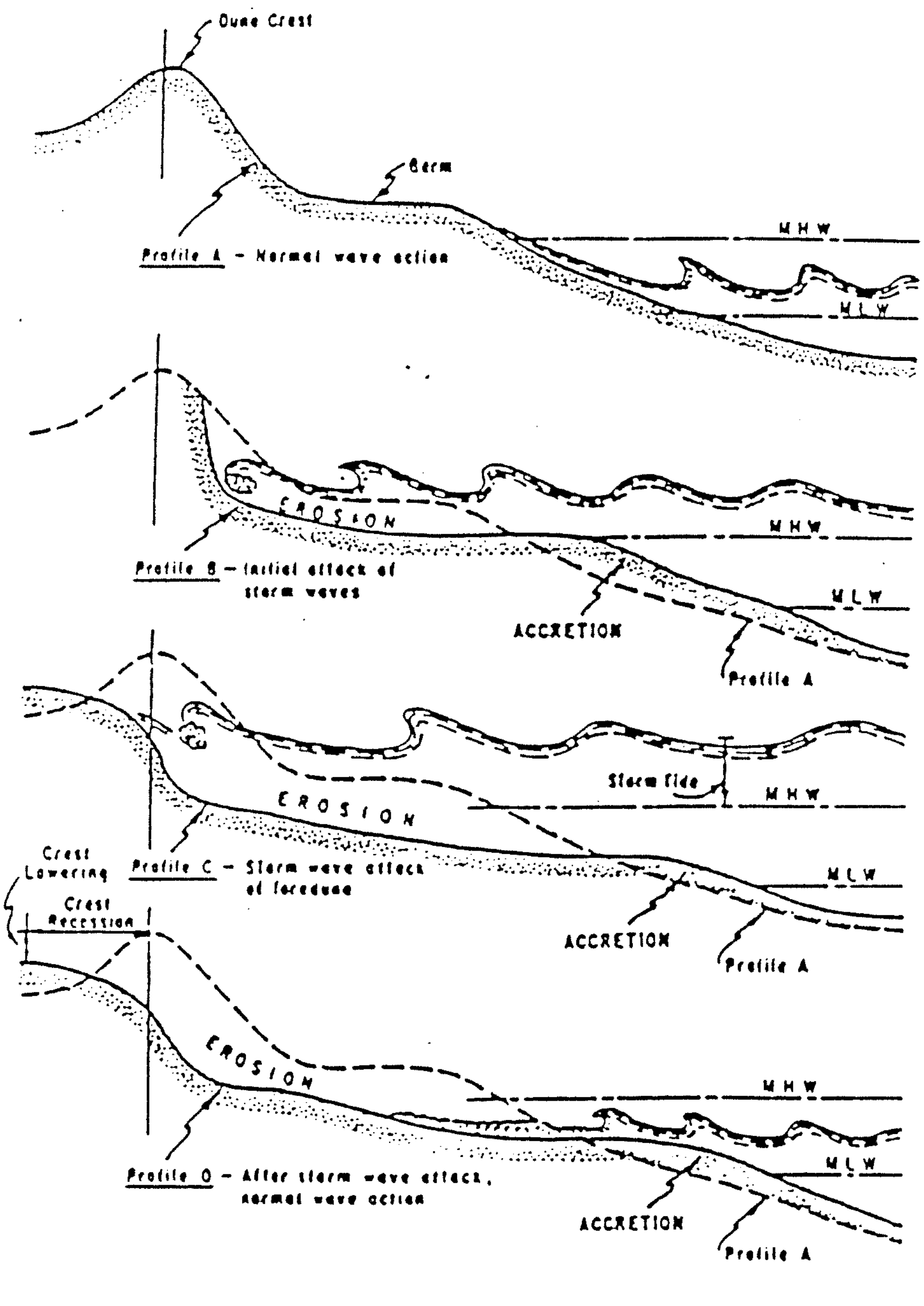


Figure 3. Illustration of shoreline response to wave attack (from CERC, 1984).

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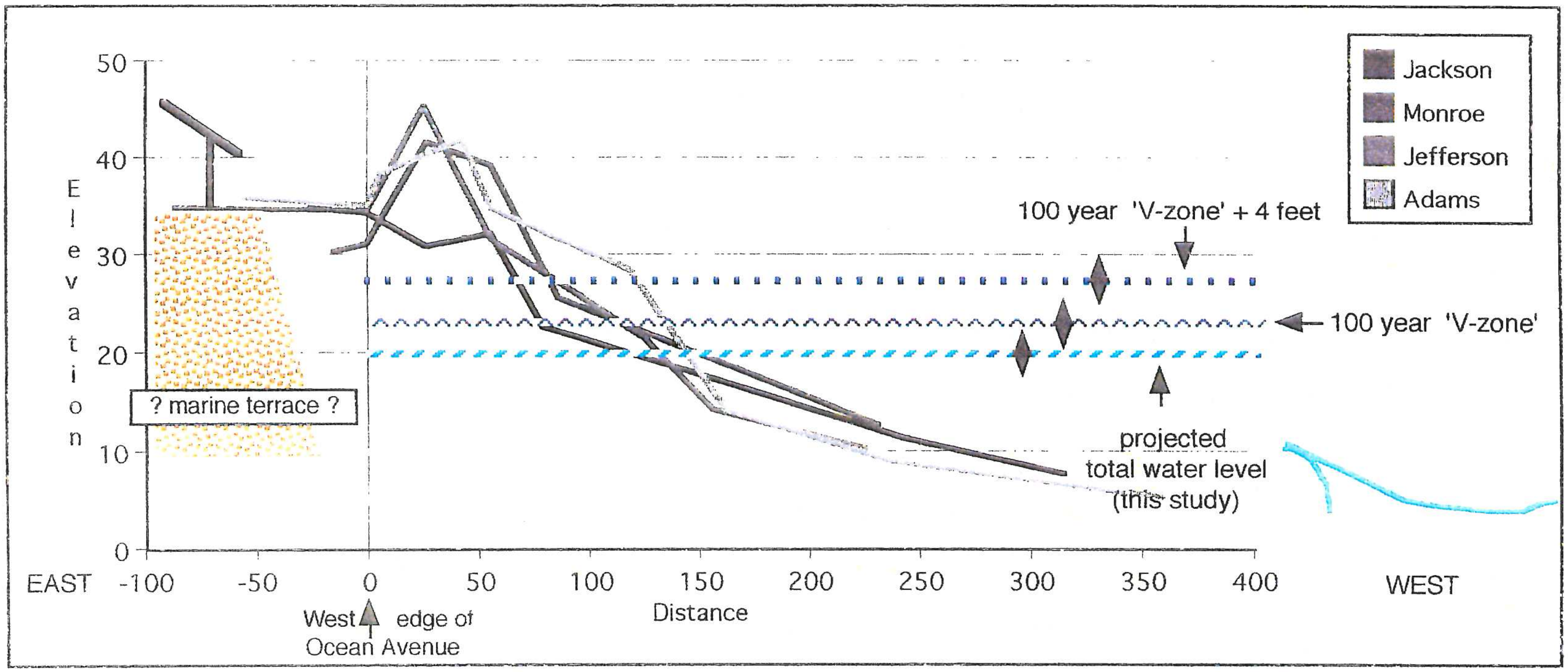

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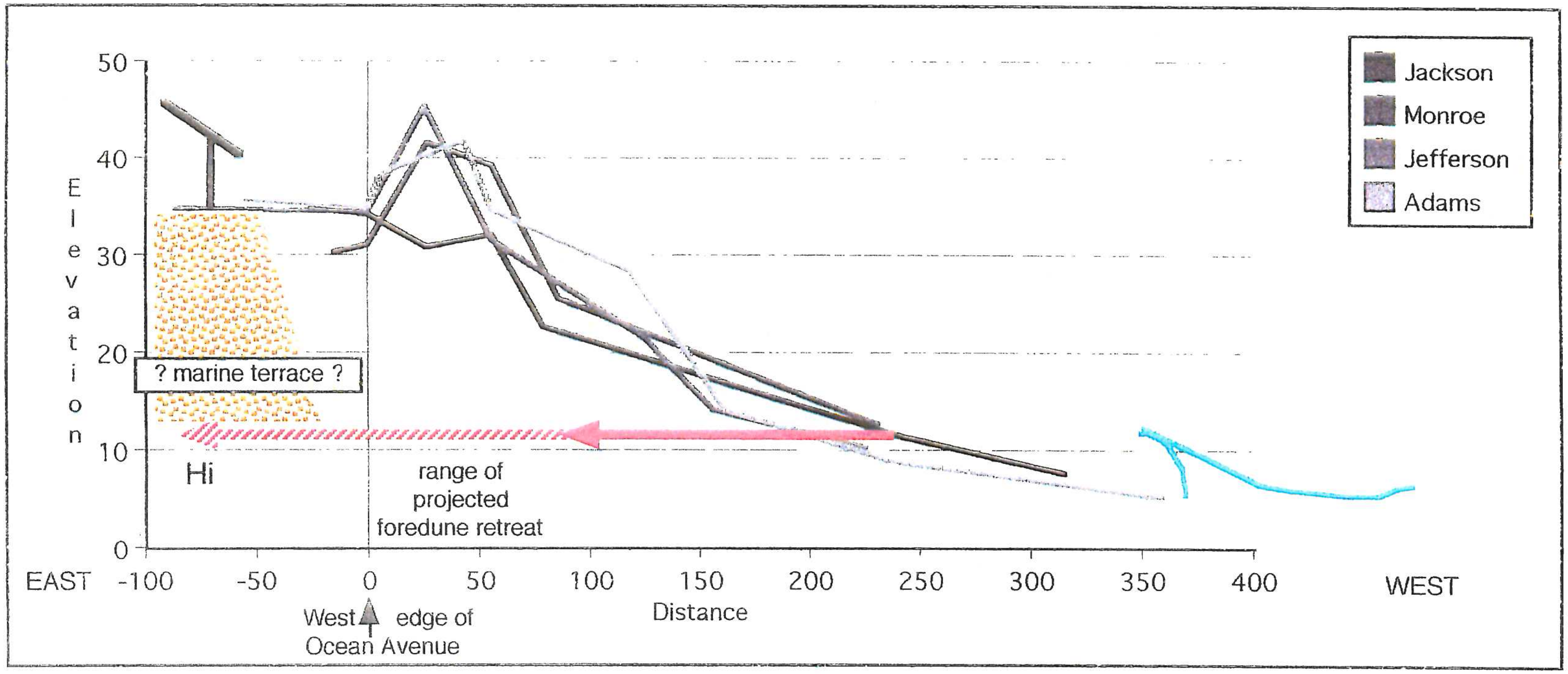

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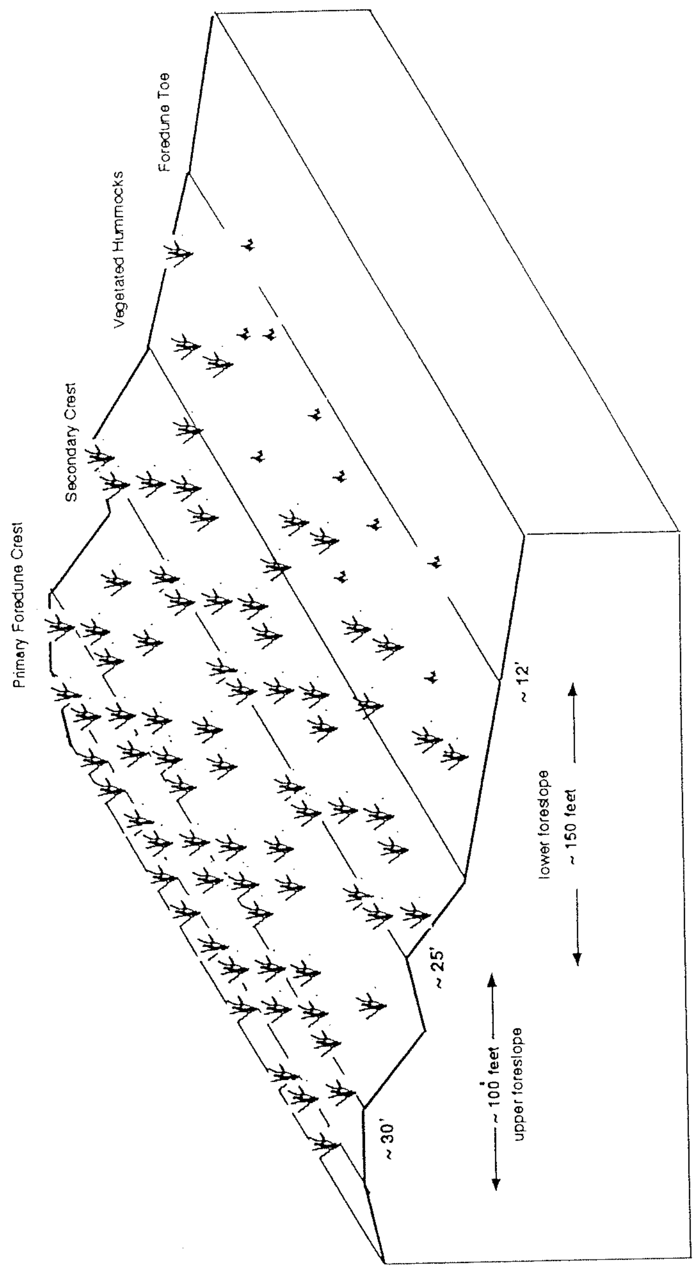

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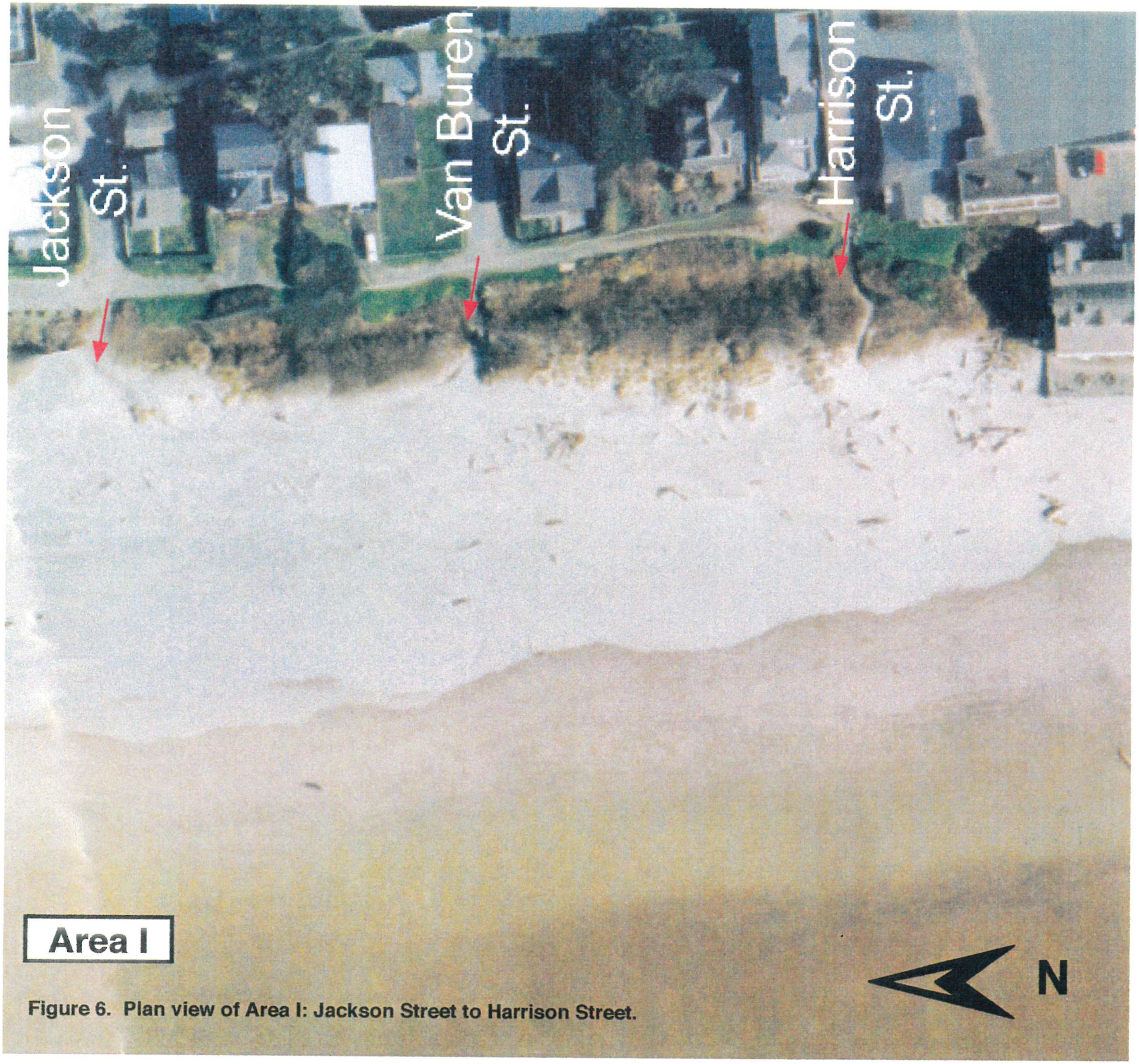

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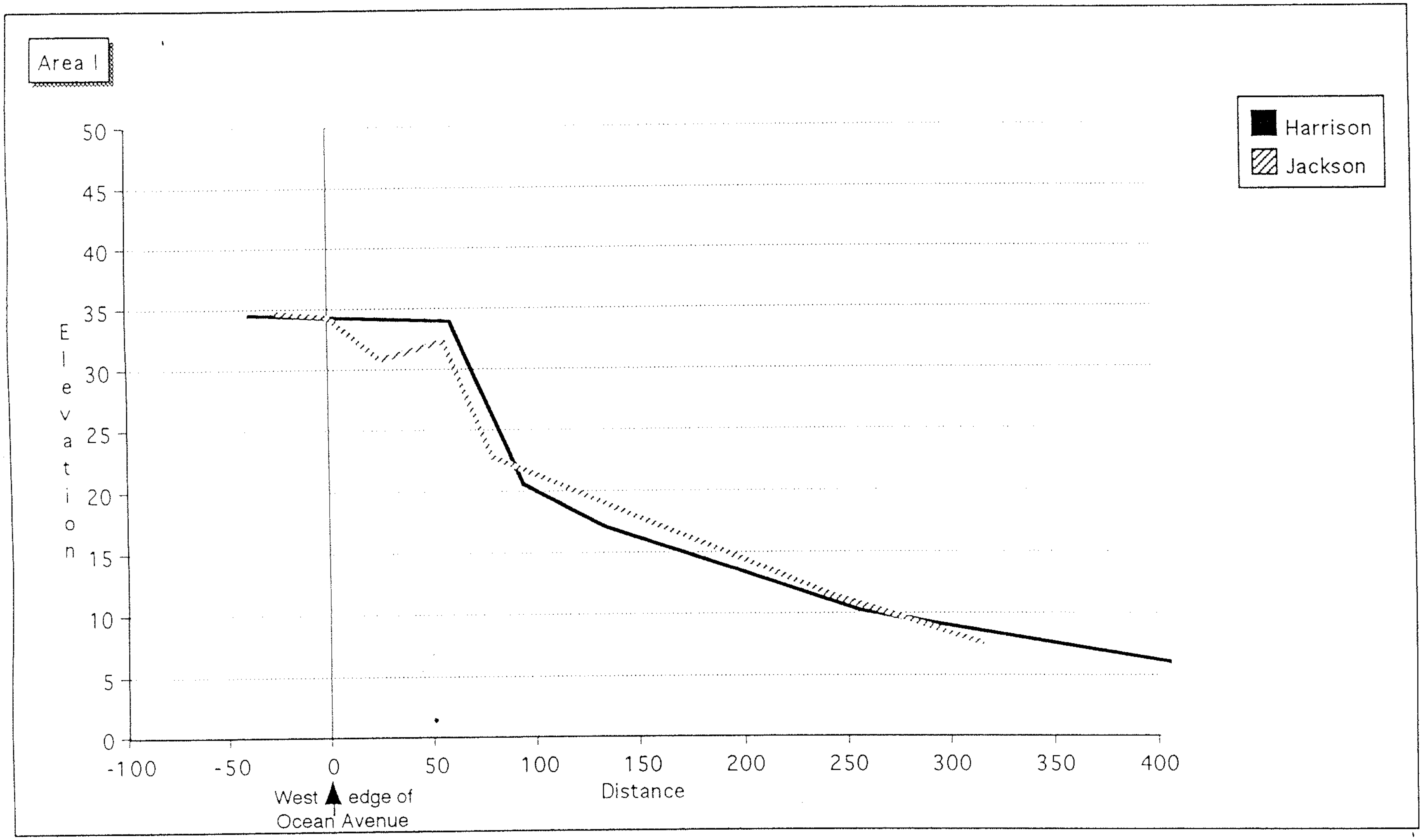

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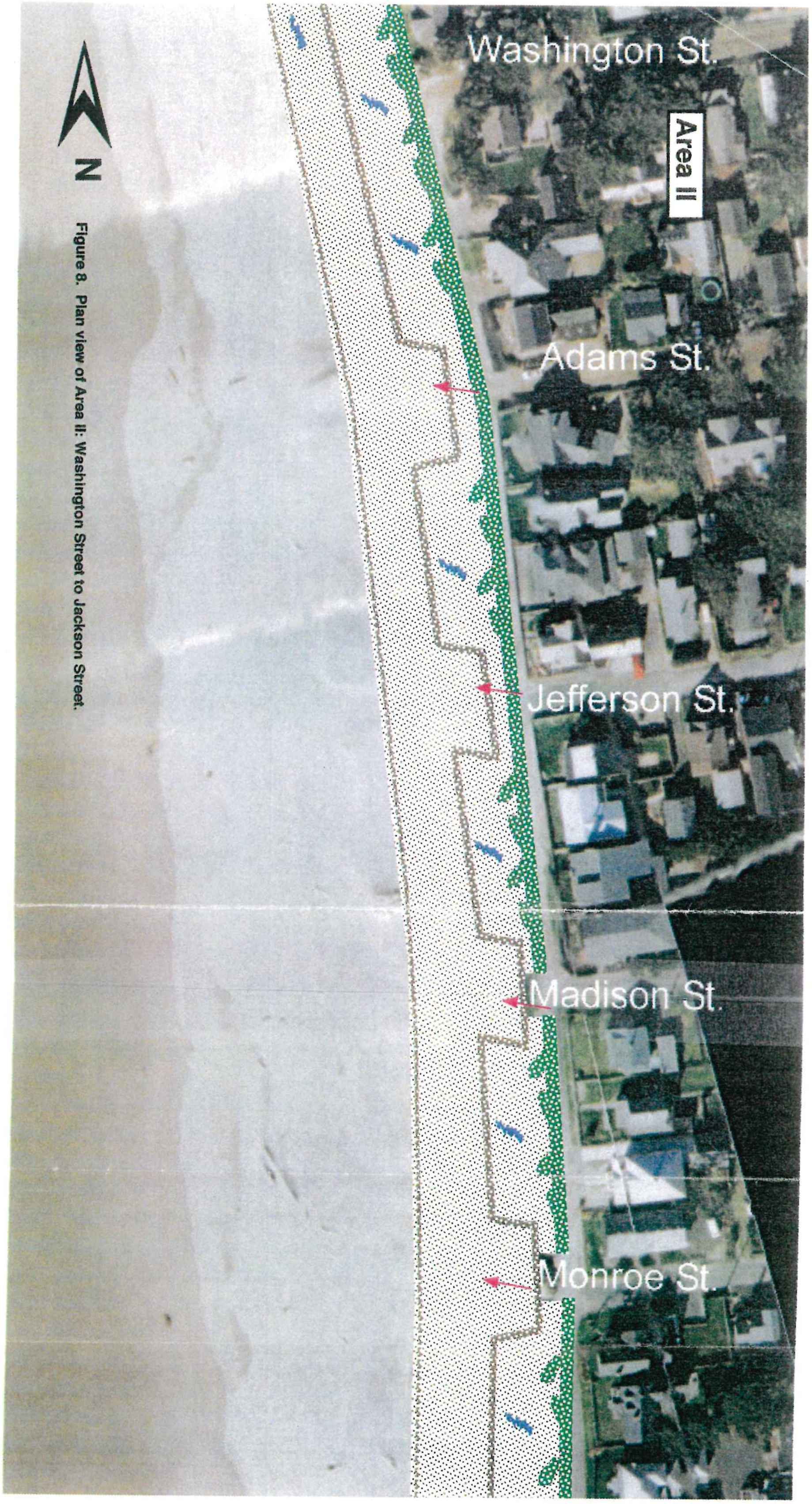
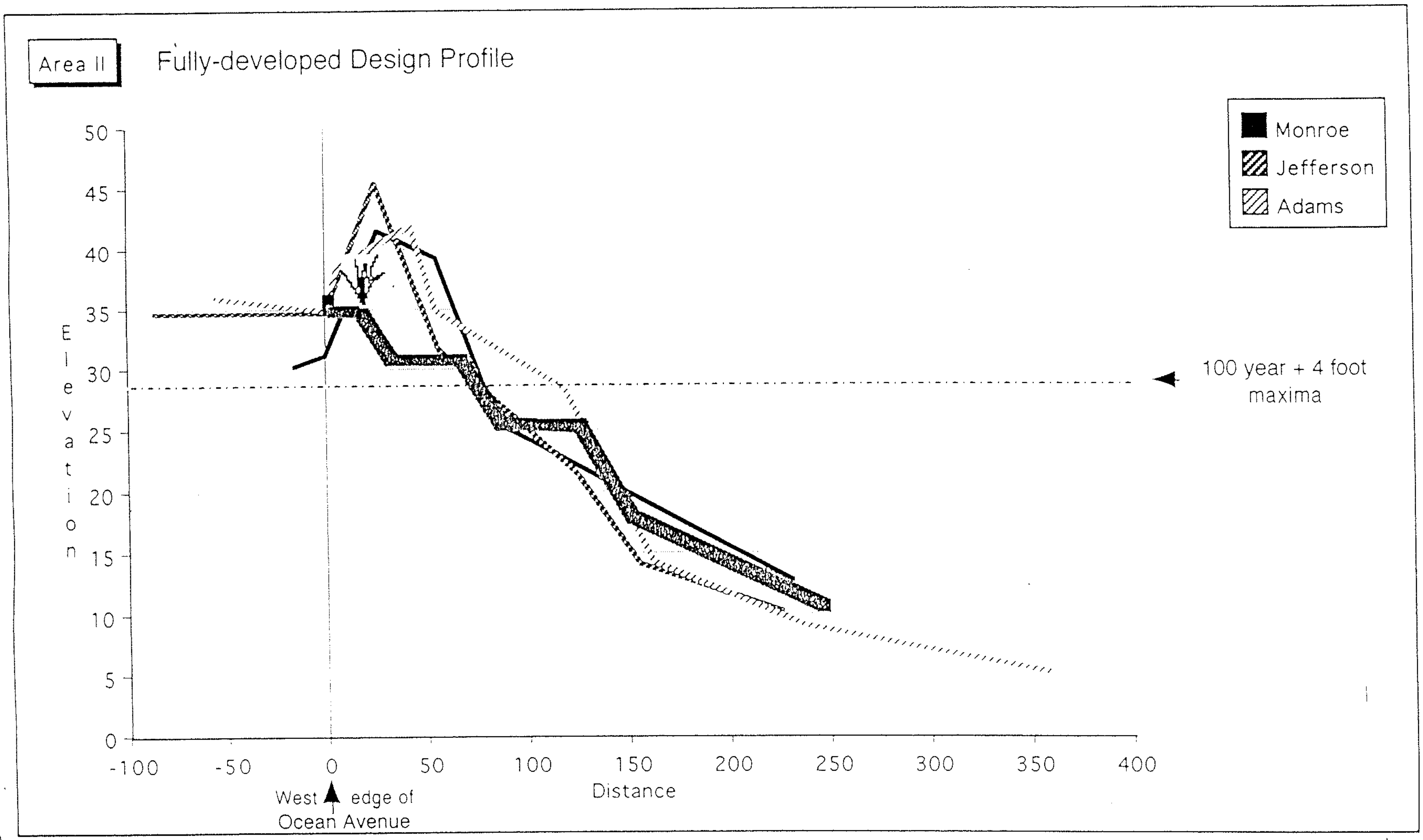


Figure 8. Plan view of Area II: Washington Street to Jackson Street.



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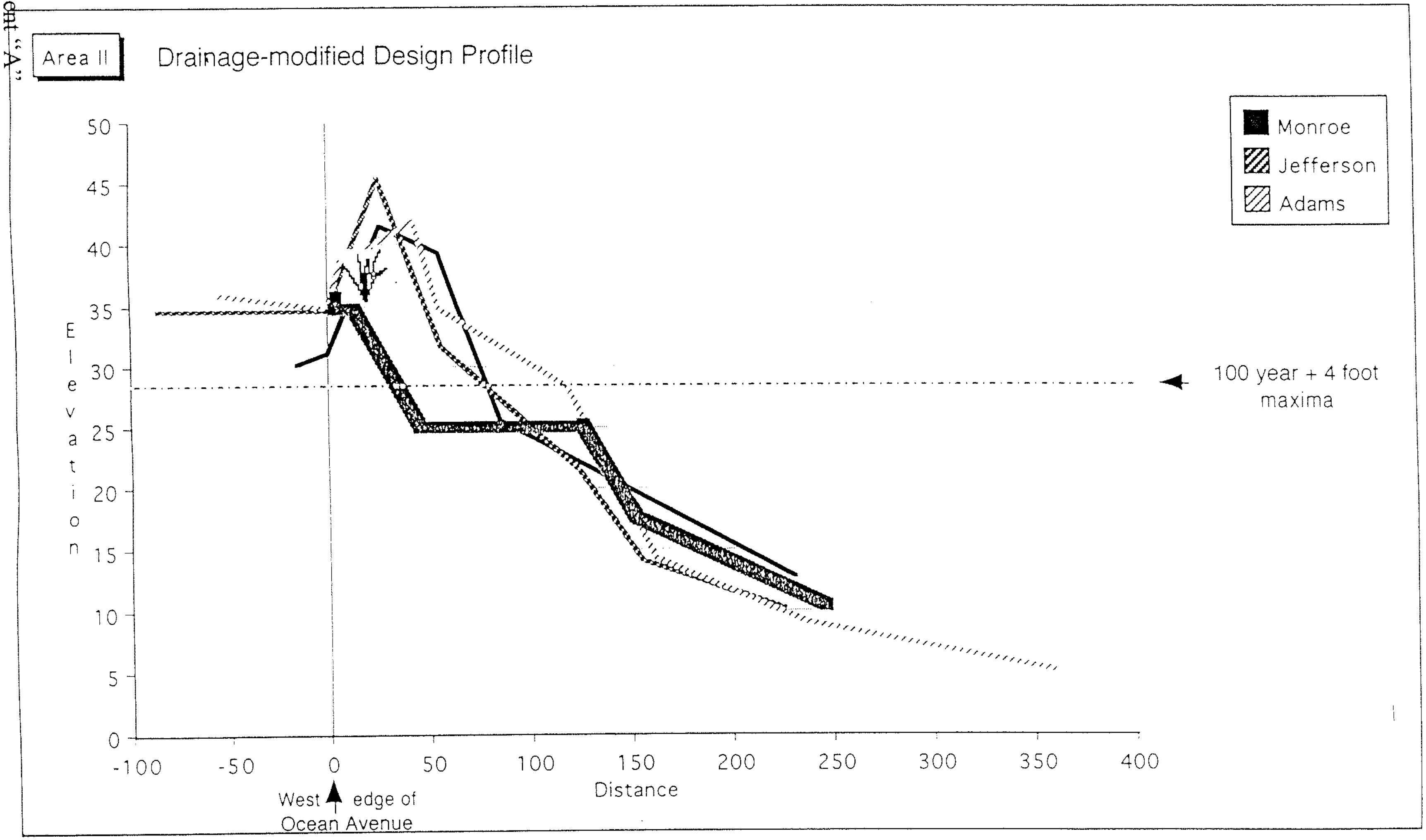
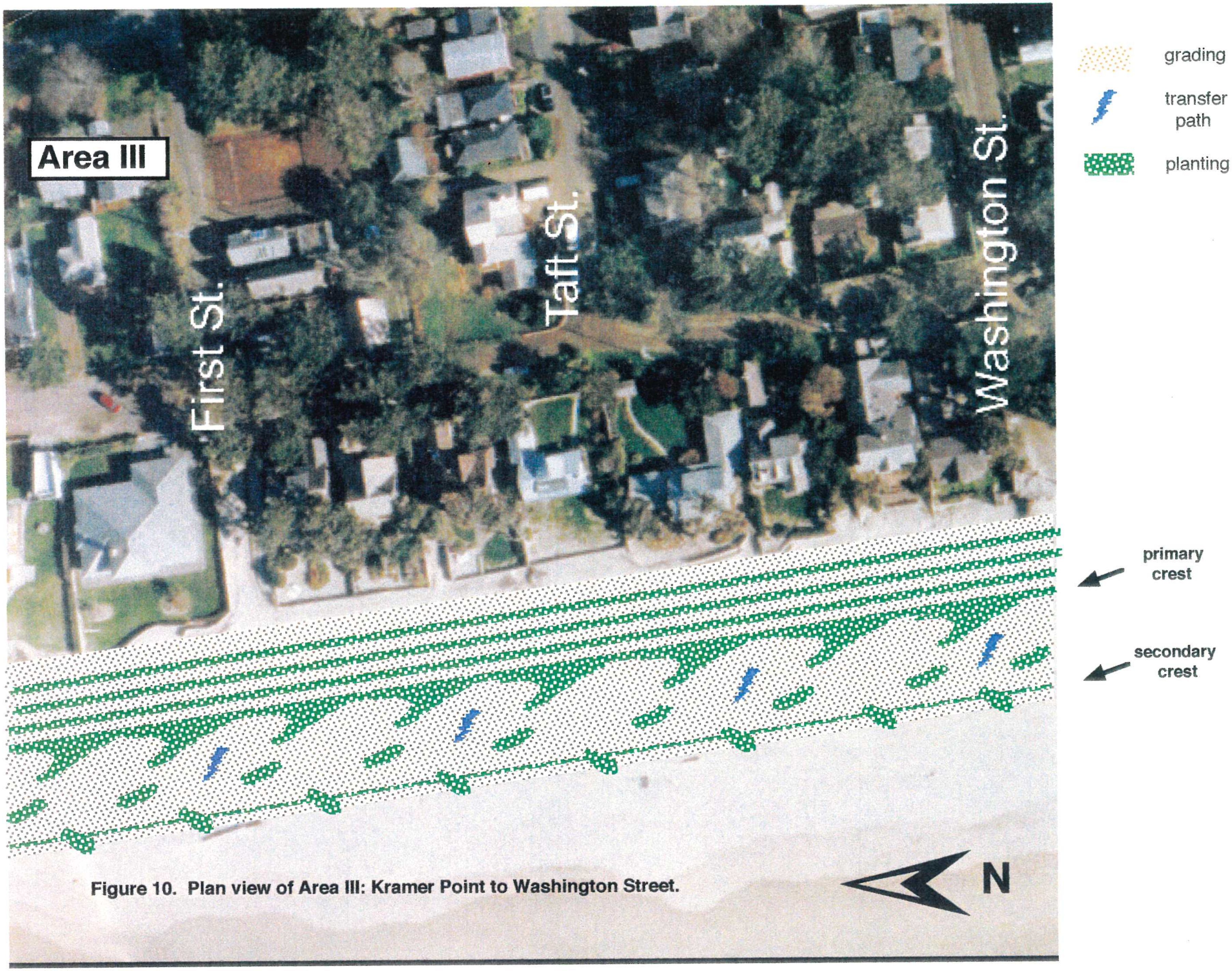


Figure 9b. Beach Profiles at Area II: Washington Street to Jackson Street showing drainage-modified design profile.

planted area graded profile



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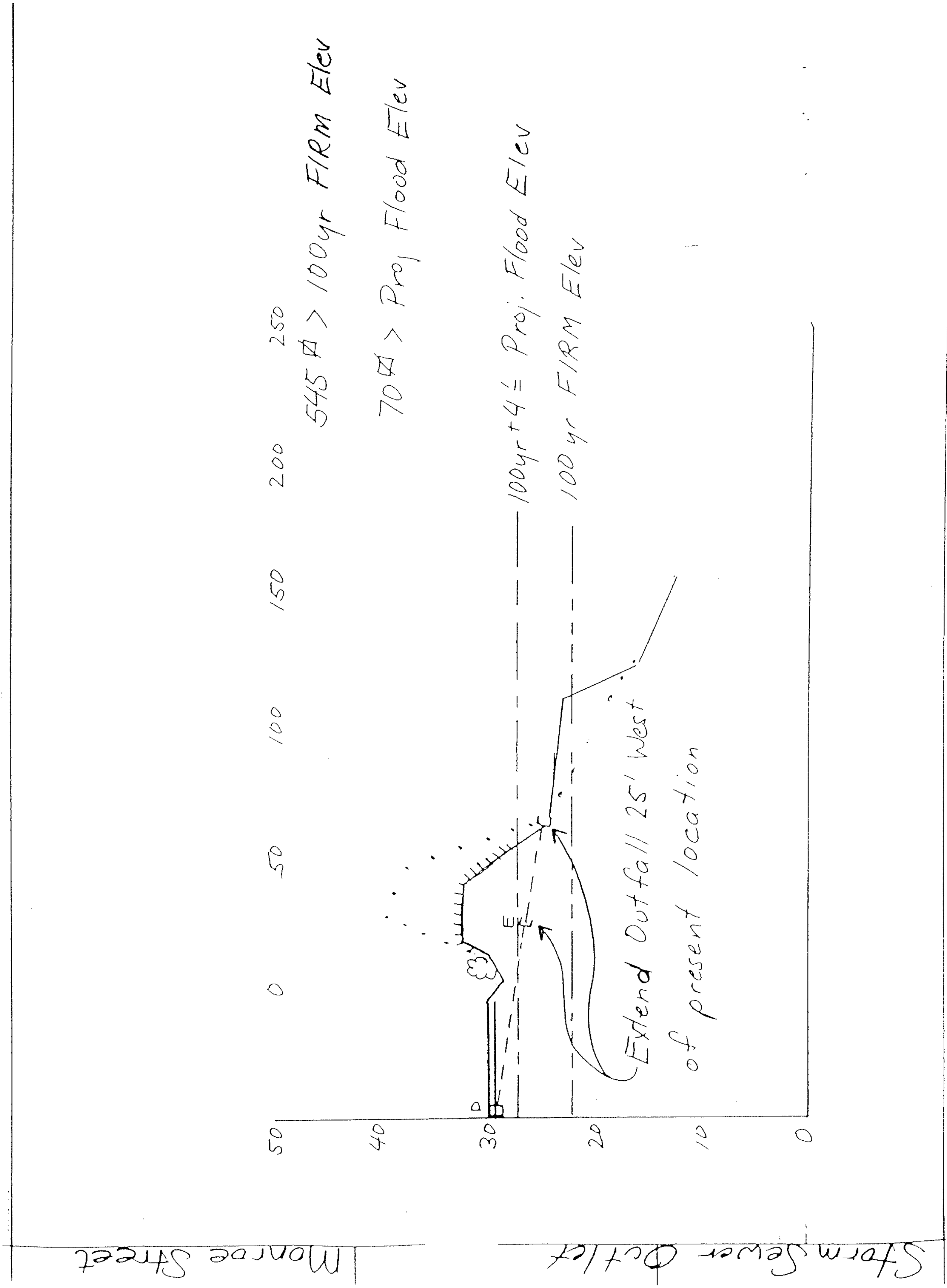
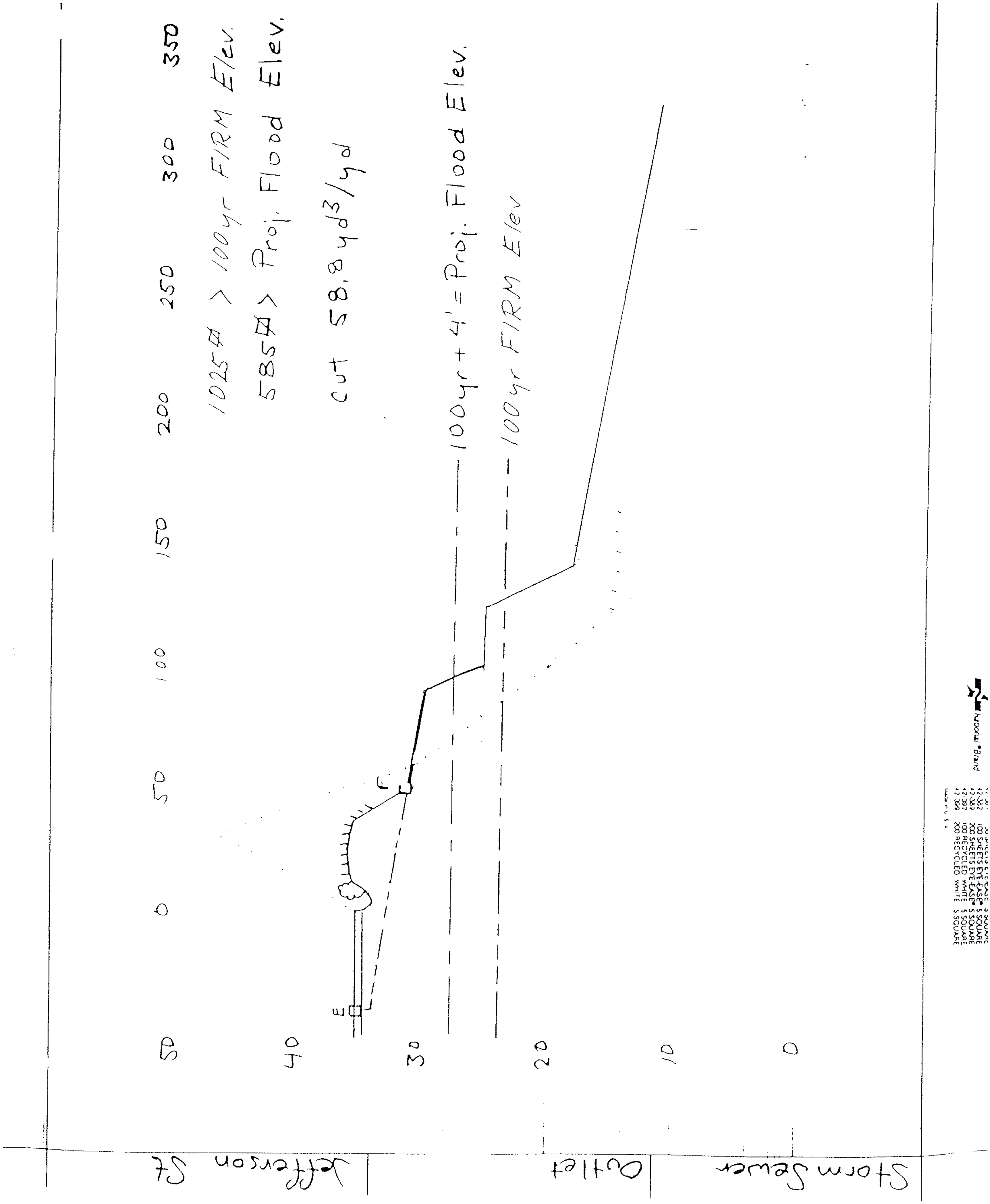
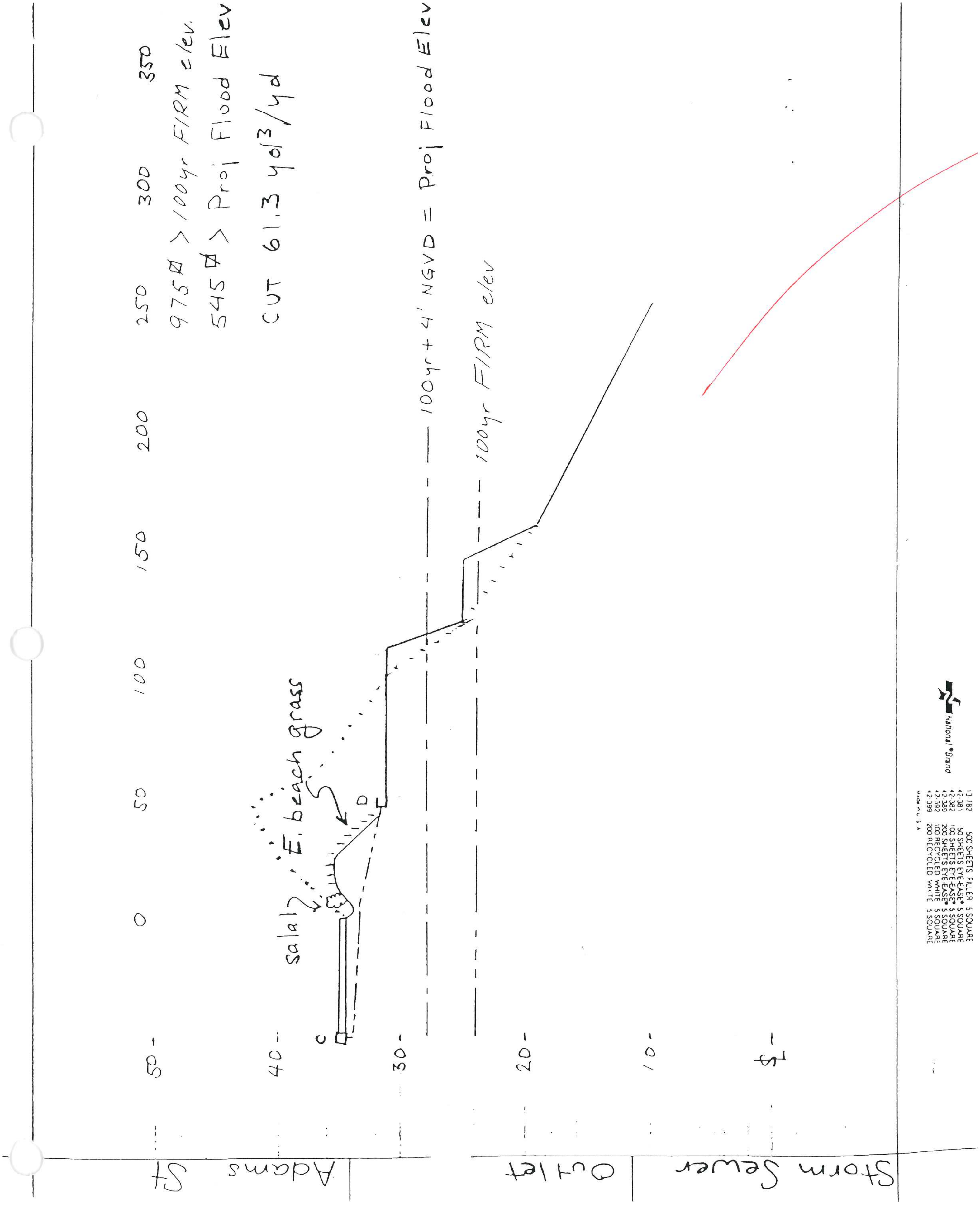


545 Ø > 100yr FIRM Elev
70 Ø > Proj Flood Elev
100yr + 4' = Proj. Flood Elev
100 yr FIRM Elev
Extend Outfall 25' West of present location
0
50
100
150
200
250
10
20
30
40
50
D
E
Monroe Street
Storm Sewer Outlet



Jefferson St
Outlet
Storm Sewer
1025Ø > 100yr FIRM Elev.
585Ø > Proj. Flood Elev.
Cut 58.8 yd³/yd
100yr + 4' = Proj. Flood Elev.
100yr FIRM Elev
E
F
0
50
100
150
200
250
300
350
50
40
30
20
10
0



350
300
250
200
150
100
50
0
975 ⊠ > 100yr FIRM elev.
545 ⊠ > Proj Flood Elev
CUT 61.3 yd³/yd
100yr + 4' NGVD = Proj Flood Elev
100yr FIRM elev
E. beach grass
salal
C
D
50
40
30
20
10
5
Adams St
Outlet
Storm Sewer

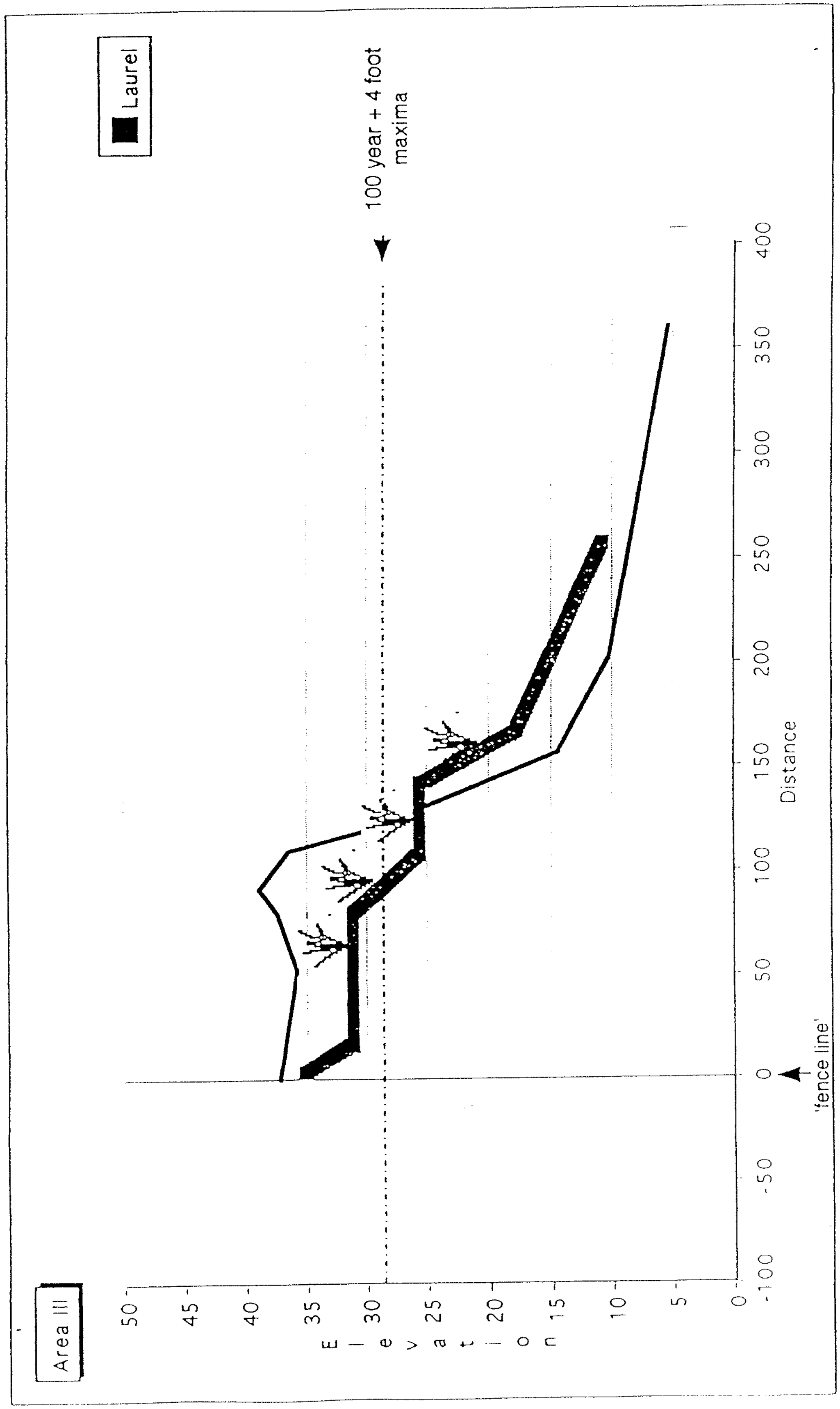
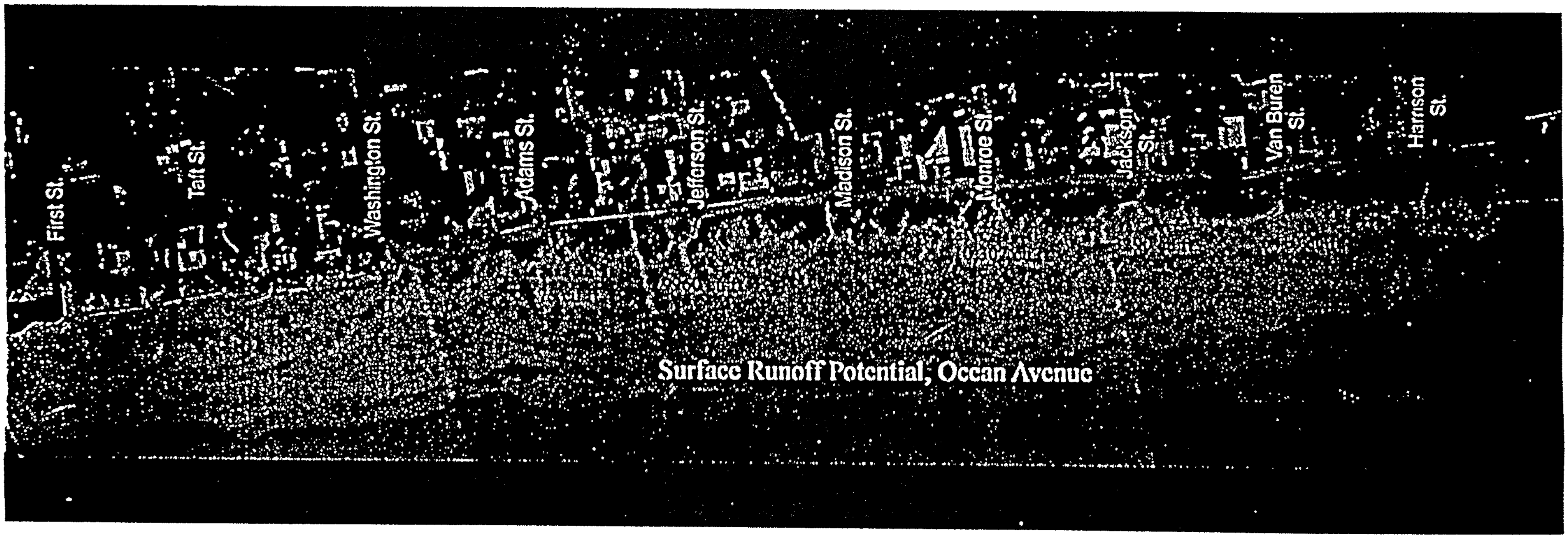


Figure 11. Beach Profiles at Area III: Kramer Point to Washington Street showing design profile.

planted area

graded profile



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BEFORE THE COMMON COUNCIL OF THE CITY OF CANNON BEACH

FOR THE PURPOSE OF AMENDING THE COMPREHENSIVE PLAN BACKGROUND REPORT – SAND MANAGEMENT PLAN-CHAPMAN POINT MANAGEMENT UNIT	))))	ORDINANCE NO. 05-02

THE COMMON COUNCIL OF THE CITY OF CANNON BEACH ORDAINS AS FOLLOWS:

Section 1. Amend the Comprehensive Plan Background Report, Cannon Beach: An Integrated Approach to Sand Management, by incorporating the Horning Geosciences Report dated October 18, 2004, attached hereto as Attachment "A," into the existing document at the conclusion of Part VIII, Breakers' Point Project Proposal.

Section 2. Amend the Comprehensive Plan Background Report, Cannon Beach: An Integrated Approach to Sand Management, by amending Appendix A: Design Objectives and Timeline by deleting an exhibit attached hereto as Attachment "B."

ADOPTED by the Common Council of the City of Cannon Beach this 1st day of February, 2005, by the following roll call vote:

YEAS:
NAYS:
EXCUSED:

David S. Rouse, Mayor

Attest:

Approved as to Form:

Peggy Coats, City Manager

William Canessa, Attorney

Attachment "A"

Horning Geosciences

808 26th Avenue, Seaside, OR 97138

Ph./FAX: (503)738-3738

Email: horning@pacifier.com

October 18, 2004

Breakers Point Home Owners Association
Bruce Francis, Manager
P.O. Box 246
Cannon Beach, Oregon 97110

RE: Phase 3 Sand Grading, Foredune Area of Breakers Point Condominiums, Cannon Beach, Clatsop County, Oregon

Dear Bruce:

This report addresses proposed sand management activities for the Phase 3 sand grading program at Breakers Point, including property extending about 150 ft north of 5th Street, where the road meets the foredune. Preceding the volume analyses is a summary of past findings and activities in the Phase 1A, 1B, and 2 grading program, plus revegetation findings.

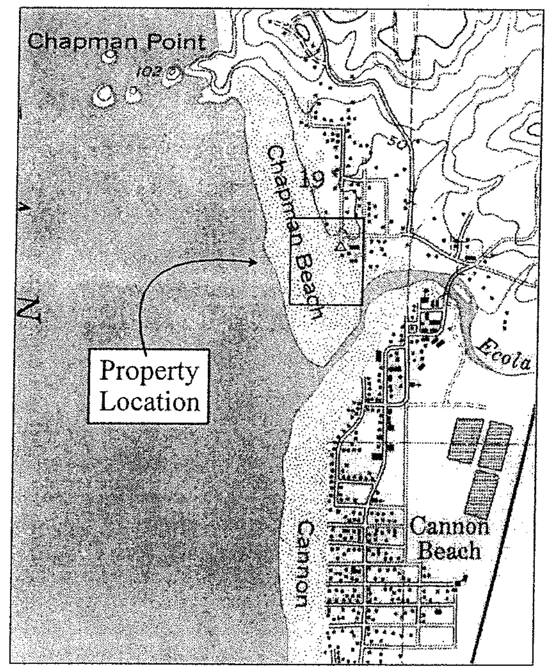


Figure 1: Property location map; extracted from the Tillamook Head 7.5' USGS Quadrangle Map.

<u>Phase 1A</u>

- Excavated Year 2000;
- Located at south end of the foredune complex;
- 8500 cubic yards excavated from east side of dune and deposited along western dune toe and blowout depressions;
- Area of 1.0 acre excavated, measuring about 340 ft long and 100 ft wide;
- Central dune area was left in a natural state;
- Replanted with mixed European and Great Lakes American beachgrass on 18-inch spacings, three culms per bunch;
- Fertilized with ammonium nitrate fertilized at 300 lb per acre, and fenced to keep out foot traffic;
- Beachgrass establishment highly successful, >90% survival in cut area, accessory volunteer plants appeared, including sharp sedge, verbenas, and Nootka rose; fill area grass plantings suffered near the upper west edge of fill, due to resting gulls and human activities.

<u>Phase 1B</u>

- Excavated in Year 2002;
- Cut area consisted of central dune ridge that was left in a natural state in Phase 1A;
- About 7000 cubic yards excavated and deposited along the western dune toe;
- About 0.8 acre excavated, measuring 385 ft long by 80 ft wide;
- Fill area for 1A/1B was about 1.25 acres;
- Replanted primarily with European beach grass following Phase 1A procedure, plus experimental

clump planting was carried out;
- Fertilized as per 1A and protected by signage;
- Results similar to those for Phase 1A, except that the 1B survival and robustness of clump plants were equal to and much better than 1A, respectively.

Phase 2
- Excavated in Year 2003;
- Cut area consisted of the crest and eastern part of the foredune complex;
- About 5800 cubic yards was excavated;
- Cut area was about 210 ft long and 160 ft wide;
- About 1.0 acre was cut;
- Fill area was about 310 ft long and 120 ft wide, following same criteria as Phase 1a/1B;
- Replanted with combined European beach grass in 1 to 1.5 inch clumps (up to 15 culms), plus Great Lakes American beach grass, on 18 inch centers and fertilized as per earlier phases;
- Clump survival was greater than 90 percent; Great Lakes beach grass spread rapidly.

Beach Grass Summary
- Phase 1A grasses benefited by protection from wind and salt by the unexcavated 1B sand ridge;
- Survival of plantings is lower near the beach from desiccation, salt, bird damage, and human activity;
- Planting clumps results in better size and survival and smaller 3-culm bunches;
- Great Lakes beach grass thrives along the Oregon Coast, survives burial well, and spreads more than European beach grass, which forms clumps;
- American beach grass does not perform as well as the other two varieties in dune stabilization, as it dies out during the winter;
- Survival rates of all plantings has been greater than 90 percent;
- Numerous stolons start from roots after cutting and filling, but mortality appears to be high during summer drought, apparently due to limited root structure and water storage capacity;
- As determined by number of culms in European beach grass clumps, rate of growth appears to increase by 80 to 400 percent annually during the first 2 years after planting; this is a geometric increase that must eventually taper off as in-filling of open areas occurs;
- Burial by up to 3 ft of sand results in even more robust growth; less burial results in less robust growth; this may be due to water availability in the subsurface;
- Some beach grass suffered mortality from heavy winds of October 2003, resulting in patches of open sand; these may evolve into blowouts unless replanted.

Phase 3 Findings
- To be excavated in Spring of 2005;
- Cut area is about 360 ft long, averaging 150 ft wide and including the crest and east side of the fore-dune;
- Cut area is about 1.5 acres;
- Fill area is about 1.5 acres, with similar dimensions to those of the cut area;
- Two "islands" of undisturbed ground will be left between the cut and fill areas,
- Two "sand baffle" ridges, about 10 ft wide and about 200 ft long will run along Profiles 5-5' and 5-5'; these will trap wind-blown sand and prevent excessive migration onto properties north and east of the excavated area; about 25 ft of worst-case scenario sand inundation may occur in the foredune of the lot north of Phase 3;
- About 9500 cubic yards of sand will be cut;
- Filling will build out to the coppice dune line, filling in depressions, but leaving several grassy hum-mocks; the cut/fill surface will undulate, but slope at about 5 percent to the west, overall;

- Excavation will take place prior to May 1, 2005;
- European, American, and Great Lakes beach grass will be planted by the clump method on 24-inch centers over the cut and fill area;
- The sand baffle ridges will be excavated and replanted within 2 years to complete the excavation of Phase 3;
- This project will reduce sand inundation of landscaped areas, strengthen the protective foredune by filling in blowout depressions, improve views for properties east of the project; reduce potential sand encroachment on nearby properties, and provide an environment consistent with a residential community.

Phase 3 Volume Calculations

Breakers Point 2004 Sand Volume Calculations- Phase 3

Cut Calculations

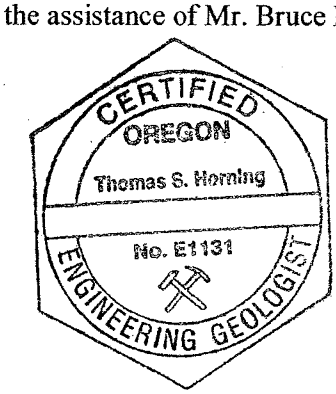
Profile	Profile Area sq ft	Panel	cut Panel Area sq ft	cut Panel Width ft	cut Panel Volume cu ft	cut Panel Volume cu yd
1-1'	589	1	589	25	14725	545
2-2'	431	12	510	56	28560	1058
3-3'	702	23	567	69	39089	1448
4-4'	640	34	671	56	37576	1392
5-5'	998	45	819	103	84357	3124
6'6'	895	56	947	55	52058	1928
Total Fill (cubic yards)						9495

Fill Calculations

Profile	Profile Area sq ft	Panel	fill Panel Area sq ft	fill Panel Width ft	fill Panel Volume cu ft	fill Panel Volume cu yd
1-1'	587	1	587	25	14675	544
2-2'	607	12	597	54	32238	1194
3-3'	721	23	664	66	43824	1623
4-4'	713	34	717	56	40152	1487
5-5'	857	45	785	107	83995	3111
6'6'	944	56	901	55	49528	1834
Total Fill (cubic yards)						9793

See accompanying diagrams for profile locations Calculations show that sand storage volume is greater than sand to be excavated. Fieldwork was carried out on July 28, 2004, with the assistance of Mr. Bruce Francis, Manager, Breakers Point Condominiums.

Please call if you have questions.



Thomas S. Horning, MS, RG, CEG
Chief Geologist, Horning Geosciences

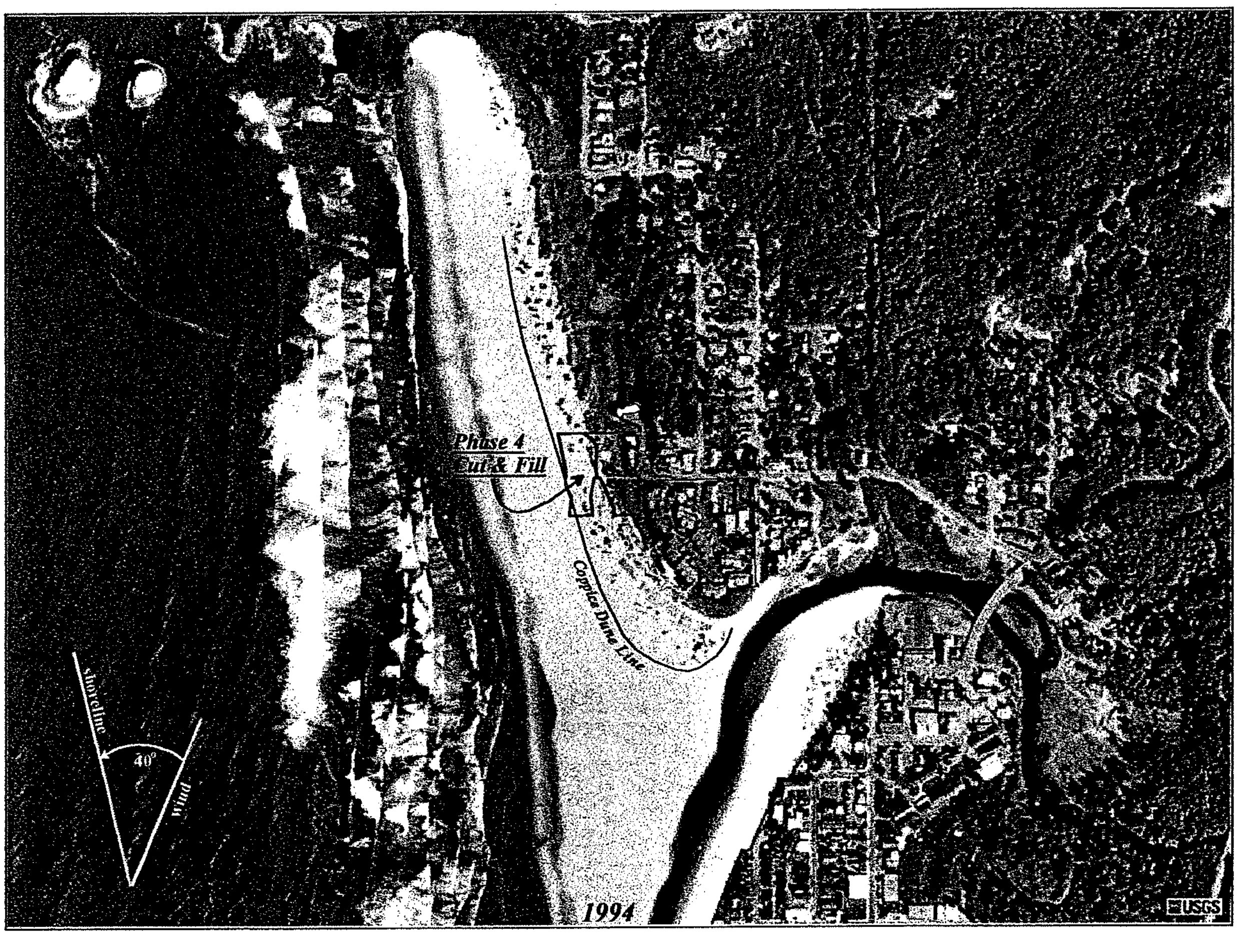


Figure 2: Aerial photo of the Breakers Point Condos in northern Cannon Beach; the Phase 3 project area is outlined, and the coppice dune line is shown. Photo taken in 1994 by the US Geological Survey. Wind vector directions are shown for average winter storm winds.

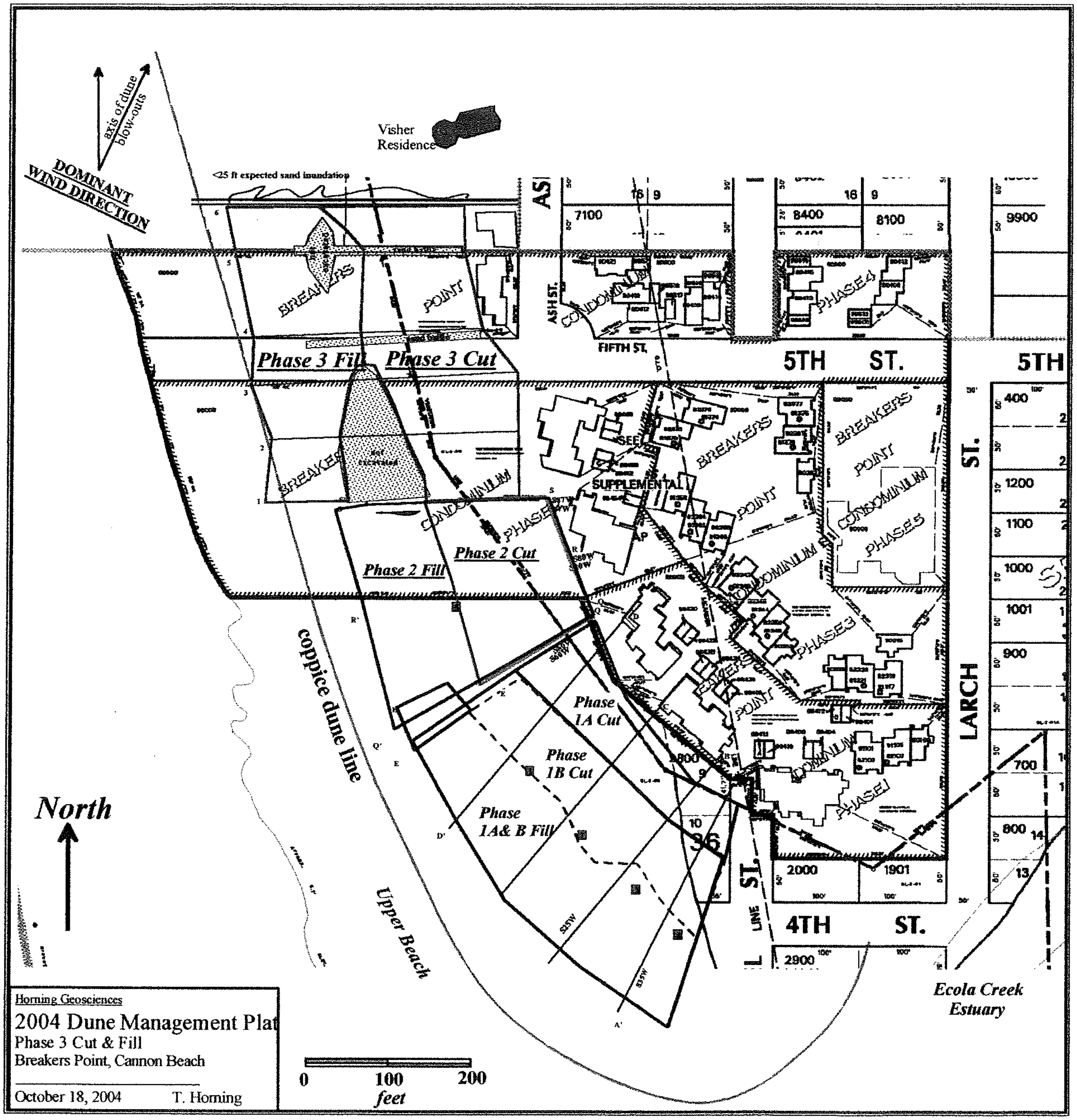


Figure 3: Map of the Breakers Point area, showing the proposed Phase 3 sand excavation project, plus areas for Phases 1A/1B and Phase 2. The coppice dune line is from Figure 2.

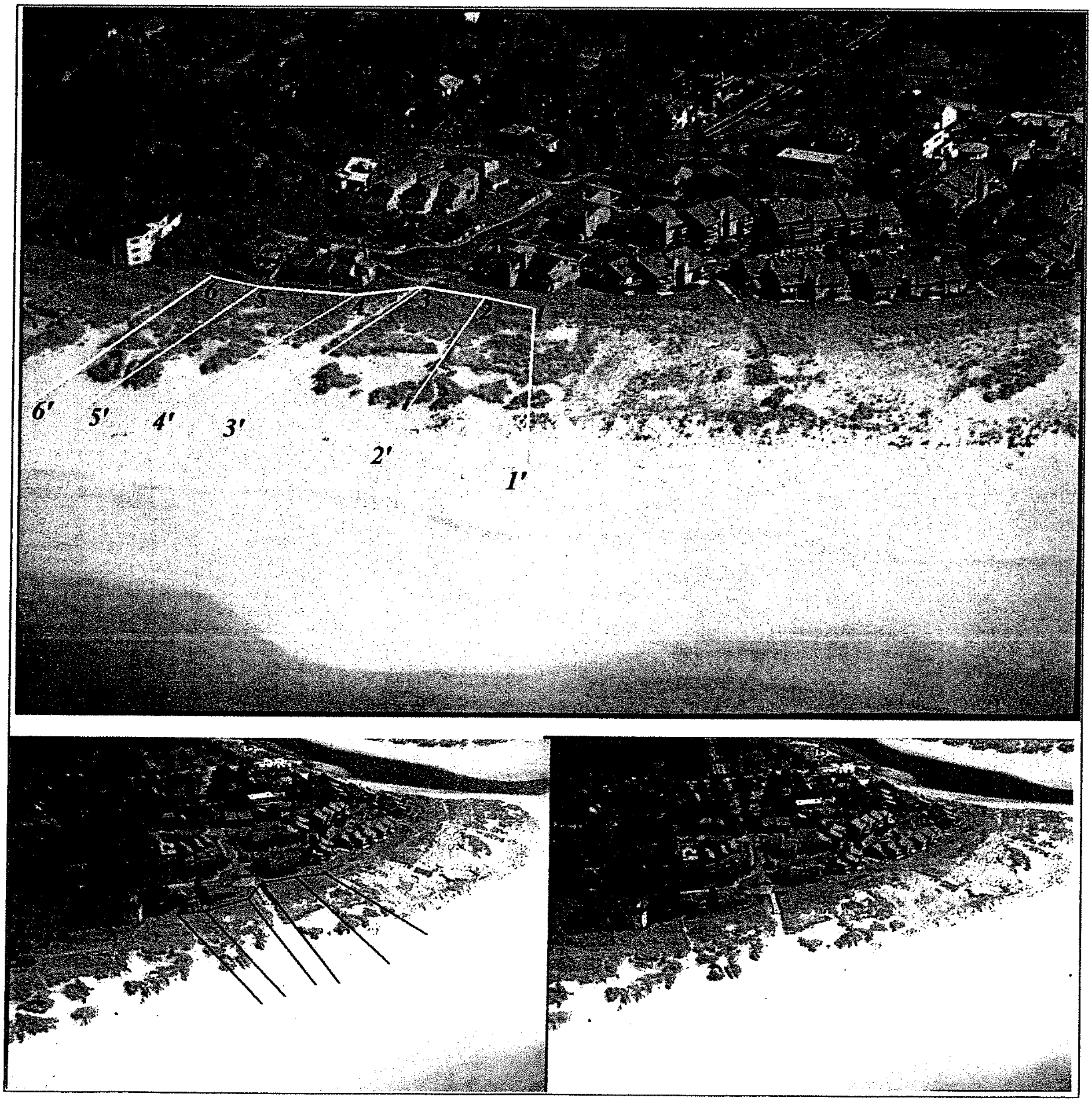


Figure 4: Aerial photos of the Phase 3 area, with profile lines shown. Lower photos are an oblique stereoscopic aerial photo pair, taken in early October 2004.

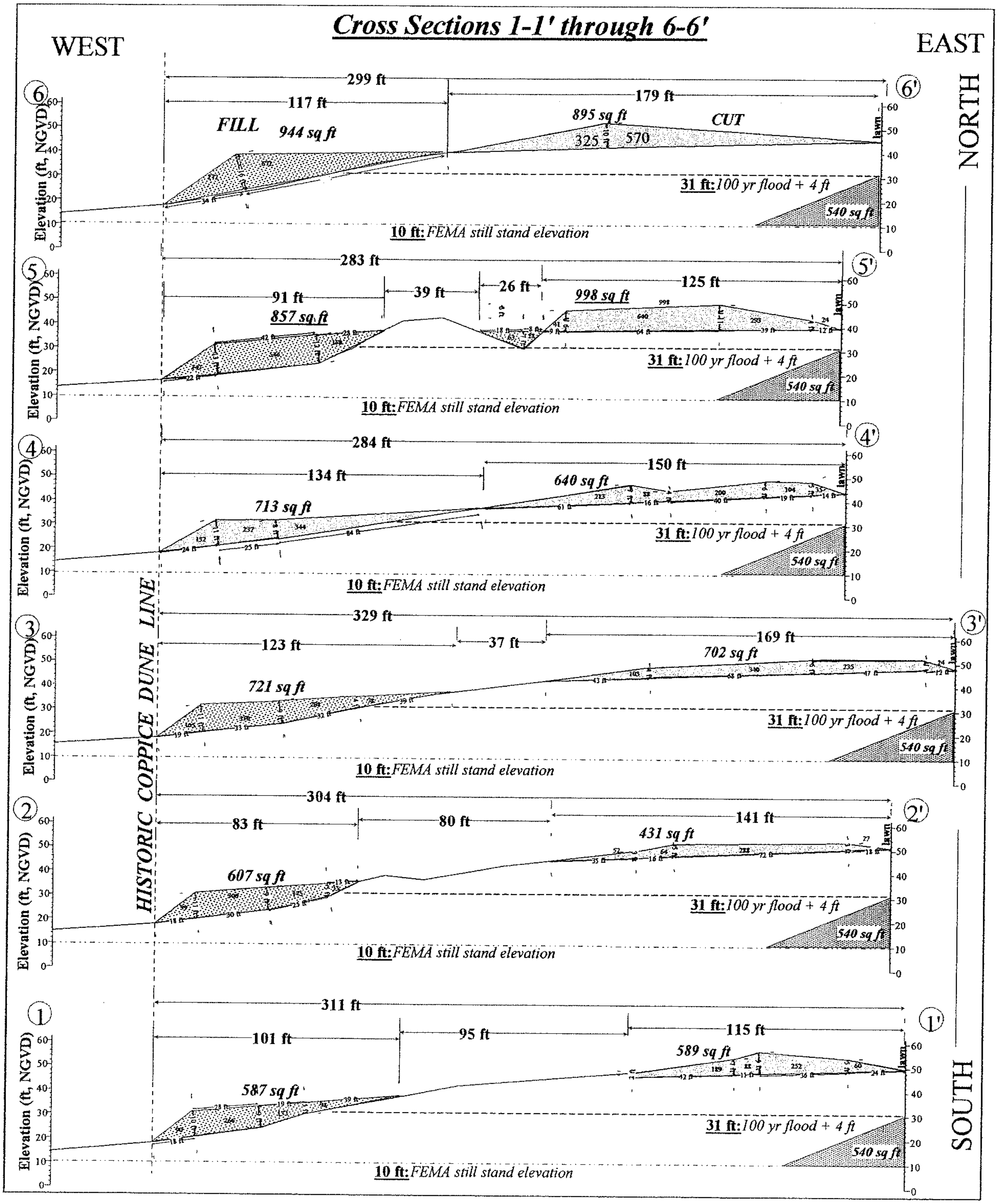


Figure 5: Profiles 1-1' through 6-6' in the Phase 3 project area.

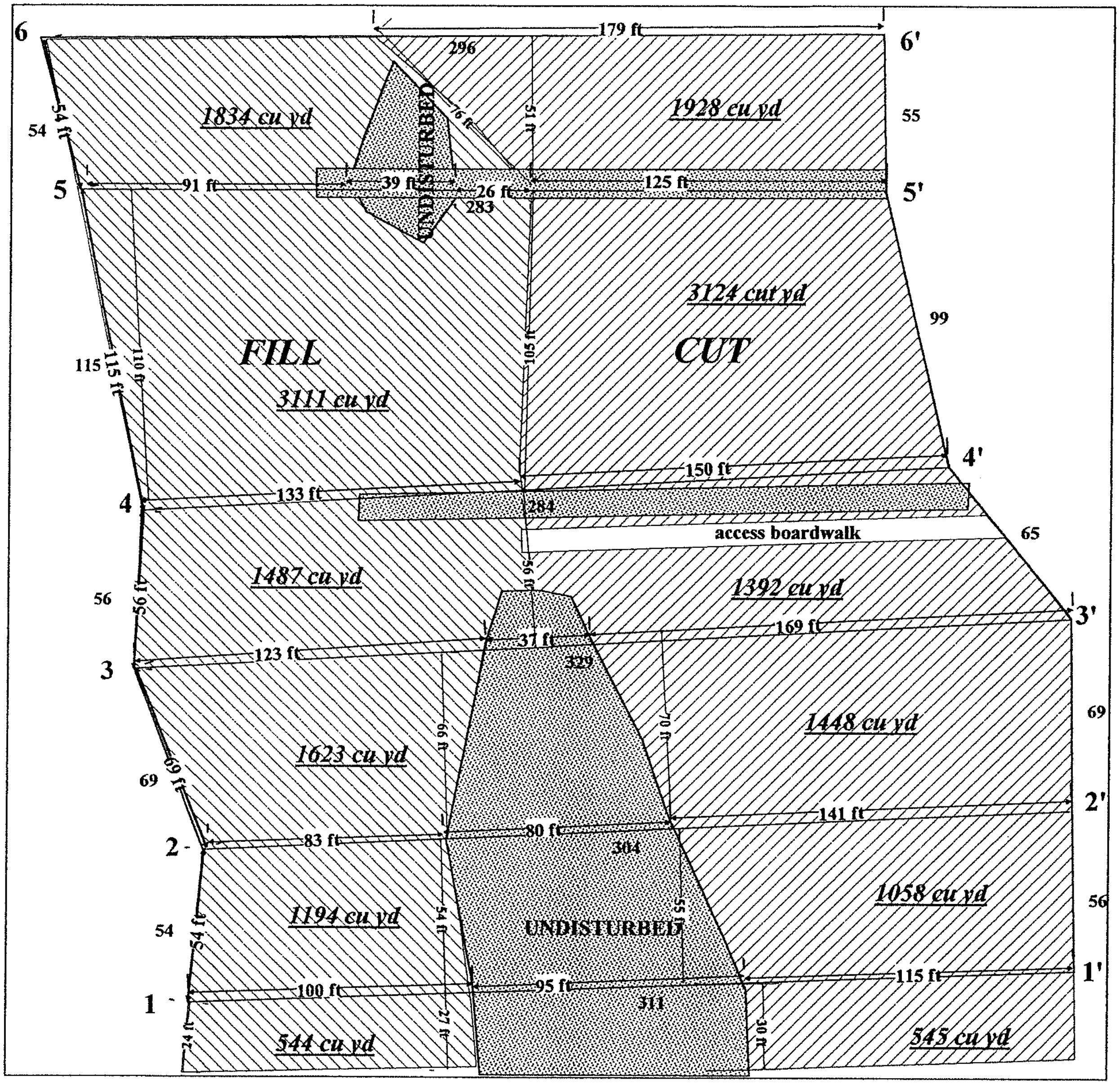
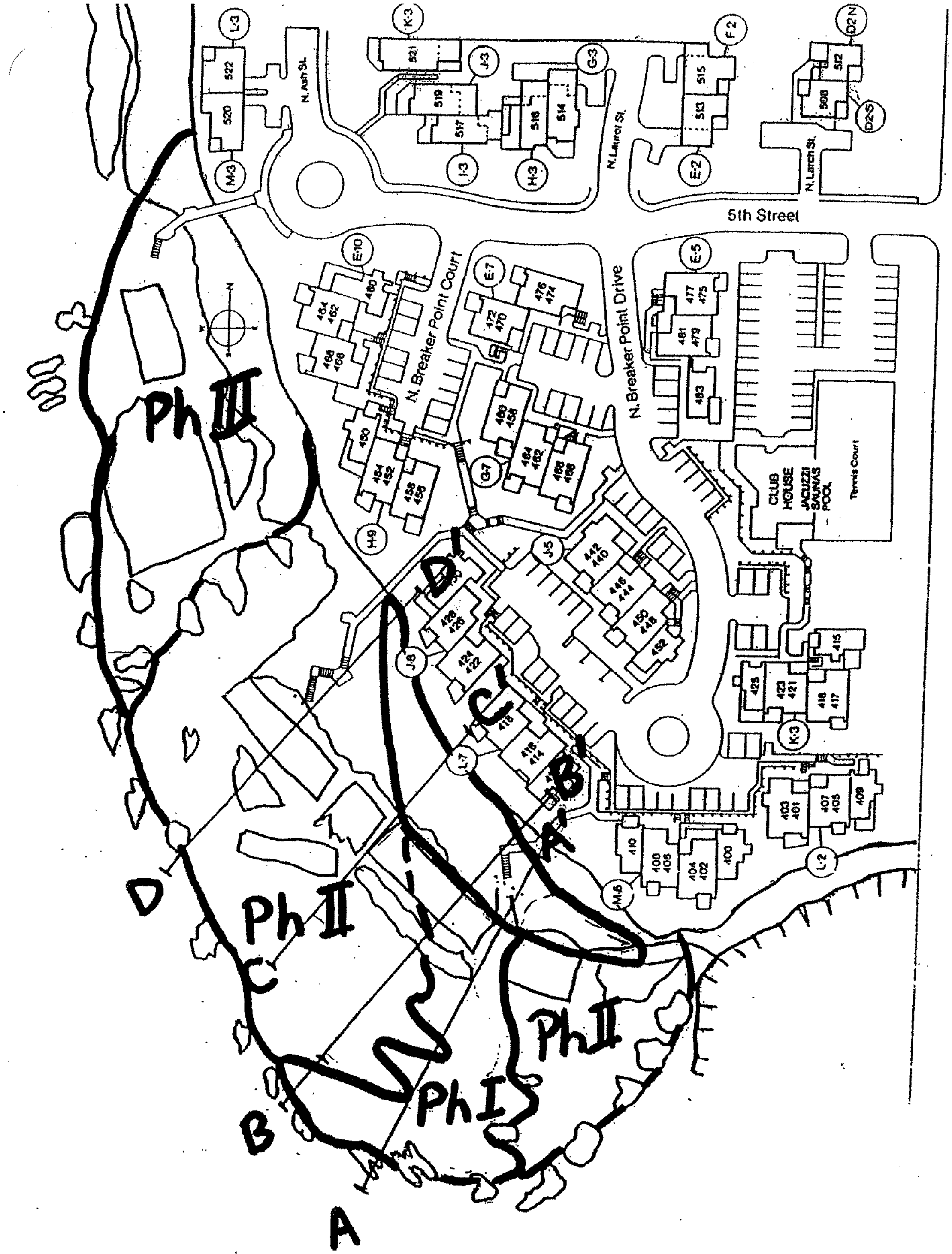


Figure 6: Cut and fill details for the Phase 3 sand-grading project, Breakers Point, Cannon Beach, Oregon.

Attachment "B"



Attachment "C"

Minutes – January 4, 2005, Council Meeting

DRAFT

(4) Appreciation of Outgoing Councilors

Rouse thanked Ayres and Vetter for their service to the City of Cannon Beach. He acknowledged their efforts and presented them with flower arrangements in their coffee cups and their name plaques.

Dooley stated that he had appreciated both of the outgoing Councilors' contributions while serving on the Council and said that he appreciated how much help and support Ayres had provided him at the beginning of his term.

Ayres said that she appreciated her opportunity to serve the City and thanked City staff members for their help during her term.

Vetter thanked Kramer for stepping down and allowing him to fill the position. He noted that serving on the Council is a lot of work and takes a lot of time and he has mixed emotions about leaving. He said that he gained a lot of insight into what it takes to be a Councilor and he realized the importance of having Council members that work together well and communicate with each other in a positive and professional manner. He thanked Rouse for the way he has run the Council meetings and thanked all of the sitting Councilors for their willingness to listen and maintain a cooperative effort. Vetter said that he realizes that no matter what decision the Council makes on a matter, some of the constituency will not agree. He encourages the public to be lenient and accepting of the decisions and realize that the Council is working hard to make what they believe to be the best decision for the community.

(5) Swearing in of Incoming Councilors

Raskin and Williams were sworn in by Judge pro tem Dale Shafer, as Councilors to the positions for which they have been elected. They were seated and Rouse welcomed them to the Council.

(6) Selection of a Council President

Motion: Williams moved to elect Swigart to serve as Council President; Raskin seconded the motion.

Vote: Dooley, Williams, Raskin and Rouse voted AYE; the vote was 4/0 in favor and the motion passed unanimously.

(7) Public Hearing and Consideration of CP 04-04, Breakers Point Homeowners Association Comprehensive Plan Background Report Amendment – Sand Management Plan – Chapman Beach Management Unit.

Rouse asked if there were any conflicts of interest and noted that there were none. Bartl summarized his staff report. He also noted that there was correspondence from Carlich property but that the property is not adjacent to the area proposed for grading proposal. Raskin asked why this section wasn't included in the original plan and Bartl responded that he was not sure how the original boundaries were established. Rouse explained the procedure for the public hearing and opened the public hearing with a request for testimony from proponents.

Mike Morgan, 3607 E. Chinook, Cannon Beach, OR, 97110, said that he was representing the Breakers Point Homeowners Association as the planner responsible for administering the dune grading process. He said that the homeowners didn't originally anticipate that the Sand Management Plan would be necessary for this area so it wasn't included in the initial plan. Morgan said that while preparing this application, they had contacted surrounding property owners to make sure that it would not have a negative impact and made amendments to resolve any concerns that were identified.

No one else wished to testify regarding the proposed Comprehensive Plan Amendment and the public hearing was closed.

Motion: Dooley moved to tentatively approve the plan amendment and to direct staff to prepare final findings and an ordinance; Raskin seconded the motion.

Vote: Dooley, Williams, Raskin and Rouse voted AYE; the vote was 4/0 in favor and the motion passed unanimously.

(8) Consideration of Resolution 05-01 Authorizing the Issuance, Sale, Execution and Delivery of not to Exceed $4,680,000 General Obligation Bonds, in One or More Series; Authorizing a Special Ad Valorem Tax Levy; Designating an Authorized Representative; Delegating the Approval and the Authorization of Distribution of the Preliminary and Final Official Statements; and Related Matters.

Motion: Dooley moved to adopt Resolution 05-01; Raskin seconded the motion.

Vote: Dooley, Williams, Raskin and Rouse voted AYE; the vote was 4/0 in favor and the motion passed unanimously.

(9) Consideration of Revision of Attachment "A" of Resolution 04-25

Gannon summarized her staff report. Dooley asked why the rates were different and Gannon explained that there was a typographic error in the attachment to Resolution 04-25 so it did not reflect the approved rates and this attachment corrects the errors.

Motion: Raskin moved to adopt Resolution 04-25; Williams seconded the motion.

Vote: Dooley, Williams, Raskin and Rouse voted AYE; the vote was 4/0 in favor and the motion passed unanimously.

(10) Consideration of a Recommendation of an Appointment of a Council Member to the Weyerhaeuser – City of Cannon Beach Liaison Committee.

Motion: Williams moved to appoint Raskin to the Weyerhaeuser – City of Cannon Beach Liaison Committee; Dooley seconded the motion.

Vote: Dooley, Williams, Raskin and Rouse voted AYE; the vote was 4/0 in favor and the motion passed unanimously.

(11) Consideration of Approval of Parks and Community Services Committee Recommendations for FY 2004-05 Community Grants.

Gannon summarized her staff report detailing the activities of the Parks and Community Services Committee. Raskin asked about the changes in funding and Coats explained that they consolidated all of the grants for the fiscal year to prevent the largest prior grantees from having to wait an additional six months for approval of the final budget. Raskin asked why some of the organizations that had previously received grants did not receive recommendations for approval this time. Coats said that there were a number of reasons but it could be because they applicant did not complete the evaluation properly or provide all required documentation. She also explained that some of the organizations that had received funds in the past don't need funds until next summer so their