

Western Washington Freshwater Wetlands

Volume IV. Northwest Washington:
Jefferson and Clallam Counties



Report to the
Department of Ecology by the
Washington Natural
Heritage Program

Department of Natural Resources

Contract Number C0089039
June 1989



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WESTERN WASHINGTON FRESHWATER WETLANDS

Phase IV: Jefferson and Eastern Clallam Counties

by

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ABSTRACT

This study identifies high quality native wetlands which occur in the lowlands of Jefferson and eastern Clallam Counties, Washington. It focuses on impounded sphagnum and non-sphagnum freshwater wetlands which have rooted vascular plant vegetation. The report includes:

1. A list and descriptions of relatively pristine native wetlands;
2. A list and descriptions of wetlands which have been disturbed but have been or may be restored; and
3. A classification of native vegetated wetlands in the area.



ACKNOWLEDGMENTS

Thanks to the staff of the Olympic National Park, Kalaloch office who provided valuable information on the settlement activity and land use history on the western Olympic Peninsula. They helped me sort out some puzzling vegetation patterns.

I admirably acknowledge those researchers whose work in this region precedes mine. Although beautiful and rewarding to work in, this region requires dedication and perseverance to survey. Particularly I thank Andy Kratz, Tom Kaye and the omnipresent Nelsa and Buck Buckingham.

Also thanks to Mark Sheehan who edited this report.



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INTRODUCTION

Over the last few years, the public has become more aware of the values and functions of wetlands. At the same time, information has become available on the amount and rate of destruction of these systems. The result has been a heightened public concern about the protection and rehabilitation of wetland systems.

The Washington Department of Ecology determined a need for wetland studies which would classify and describe wetland types, identify high quality native systems, and identify wetlands which, though disturbed, have the potential to be restored.

To satisfy part of this need, the Department of Ecology contracted with the Department of Natural Resources, Natural Heritage Program to inventory wetlands located on the Olympic Peninsula. Specifically, this study focuses on native, freshwater, sphagnum and non-sphagnum wetlands which are vegetated by rooted vascular plants.

This report provides the following information.

1. A list and descriptions of "pristine" native wetlands (first tier).
2. A list and descriptions of wetlands which have been disturbed but which have been, or may be able to be, restored (second tier).
3. A classification of native, vegetated wetlands in the study area.

Although a large percentage of the impounded wetlands located in Jefferson and eastern Clallam Counties were reviewed, not all could be surveyed in this study. With further work, it is probable that more sites could be added to this list of high quality wetlands.

STUDY AREA

The study area includes the lands below 2,000 feet in Jefferson and eastern Clallam Counties. It excludes Indian and most National Forest lands but includes some National Park lands (figure 1).

The study area falls within the Coast Range, which is defined as occurring between the Strait of Juan de Fuca to the north, and the Klamath Mountains to the south, the Pacific Ocean to the west, and the Puget-Willamette Lowlands to the east (McKee, 1972). This portion of the Coast Range is primarily differentiated aged marine sedimentary rock, differentiated glacial outwash, undifferentiated glacial till, and alluvium. The western portion of Jefferson County was affected by alpine glaciers, and is composed of a coastal plain, broad river valleys and steep ridges. The eastern portions of Jefferson and Clallam Counties were carved out by continental glaciers and consist of low rolling to moderately steep glacial terraces and narrow river valleys.

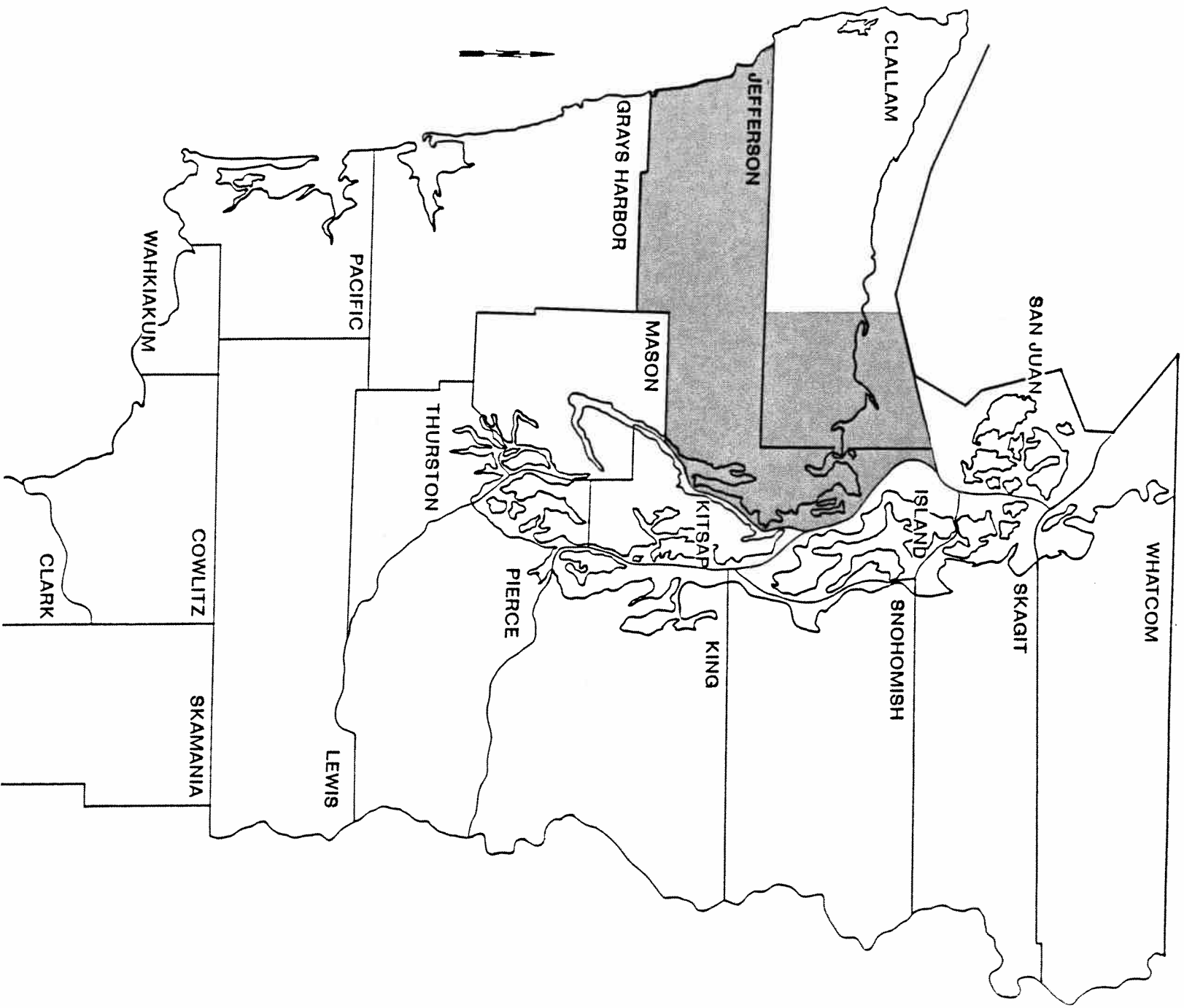


Figure 1: Study Area

Climatically, western Jefferson County is very different from eastern Jefferson and Clallam Counties (U.S.D.A. 1975 and 1987). Both areas have a mild marine climate. But western Jefferson County is part of the wettest area in the continental U.S., with up to 180 inches of rain annually (average 118 inches). Eastern Jefferson and Clallam Counties on the other hand lie within the Olympic rain-shadow and receive between 14 and 55 inches of rain annually.

Winters are overcast and wet in both areas. Annual average daily minimum and maximum temperatures for Forks on the west side of the Olympics are 41° and 58° F respectively (range 33° to 72° F). Annual average daily minimum and maximum temperatures for Sequim and Quilcene on the east side of the Olympic Mountains are 41° and 39° F minimum respectively and 58° and 61° F maximum respectively.

Differences in geologic history and climate between the western and eastern sides of the Olympic Mountains have resulted in very different wetland communities. Sphagnum bogs occur on slopes and nearly flat ground on the west side of the Olympics because of the high rain fall and low evaporation. On the east side of the mountains, bogs only occur in basins which can catch and hold the much more limited rain fall. There are relatively few lakes, ponds and non-sphagnum wetlands on the west side, while these features abound on the east side. The differences in species composition of wetlands on the west and east sides is probably a function of both the migration of species due to glacial events, and differences in climate. Differences are further detailed in the classification (Appendix B).

MEIHODOLOGY

INITIAL SITE SELECTION:

Sites for study were initially selected by: 1) reviewing U.S.G.S. 7.5 and 15 minute quadrangle maps; 2) reviewing the latest available aerial photographs printed at a scale of 1:12,000; 3) retrieval of data already contained within the Natural Heritage Database; and 4) reviewing leads provided by researchers and knowledgeable landowners.

The criteria that were used in this initial site selection were:

1. The degree of human-related physical disturbances. These disturbances included: damming, diking, ditching, filling, draining, logging, other vegetation removal or mining of the substrate. A site continued to be considered for survey if the disturbance appeared to be relatively minor or isolated. Otherwise, the existence of any of these disturbances resulted in the elimination of a site from further consideration.
2. Adjacent land use. Some adjacent land uses are more disruptive of wetlands than are others. Adjacent land uses include: timber production, pasture, agriculture, industry, powerline and gasoline right-of-ways, roads, railroads, recreational development, urban development, and rural development. If an adjacent land use was

highly disruptive, the wetland may have been eliminated from further consideration.

3. The presence and quality of an upland buffer. Assessment of the quality of a buffer was based on 1) the width of the buffer in relationship to adjacent land uses, 2) the composition and age of the buffer, and 3) current uses within the buffer. If a buffer did not exist between a wetland and a disruptive adjacent land use, and the wetland appeared disturbed, then the site was usually eliminated from further consideration for field survey. If, on the other hand, the site appeared undisturbed, it continued to be considered for field surveys, despite the absence of a buffer.

4. The minimum size for sites to be considered was arbitrarily set at two acres.

Sites selected through this process were then ranked according to their apparent quality, and scheduled for field surveys.

FIELD SURVEYS:

Field surveys were conducted during the summer of 1988. Existing data from the Natural Heritage Database were collected in previous years.

Upon visiting a site, a preliminary determination was made to include or eliminate the site from further consideration. Site inclusion was based on the cover and frequency values of non-native plant species, apparent historical use of the wetland (for instance as pasture or for timber harvest), along with the criteria for initial site selection outlined above. Degraded sites were surveyed if they represented relatively better examples of wetland types that have been degraded throughout the region.

For all survey sites, data were collected on physical and biotic features, hydrology, soils, adjacent land use, and historic use. Physical features included topography, elevation, exposure, special climatic conditions, kind or means of impoundment, and wetland configuration. Data on hydrology included water depth, apparent water level fluctuation, drainage patterns within the wetland's basin, and water source.

Soils generally were classified in the field as: sphagnum peat, fibrous peat, heath peat, woody peat, muck, clays, silts, sands, glacial till, or outwash. Soils data were also gathered from the U.S. Soil Conservation Service. Peat soil definitions follow Riggs (1958).

Adjacent land use and historic uses were determined through site observation, talking with owners of a site and adjacent areas, agency personnel, people involved with the timber industry, historical records, and aerial photographs. Of particular use were studies by the National Park Service on the settlement history of Park lands on the Olympic Peninsula.

The biologic evaluation of a site included a detailed description of the vegetation. Assemblages of native plant species were identified during a reconnaissance of each wetland. Lists of species and their percent cover values were recorded for each assemblage. Plant species nomenclature follows Hitchcock and Cronquist (1973). Wildlife species or their sign were noted.

CLASSIFICATION:

An initial classification of relatively undisturbed, native, wetland vegetation was developed (Appendix A). It synthesized the data from the field surveys, the Natural Heritage Database, and the literature.

A matrix of species cover values by stand was developed. The matrix consisted of data collected from the field surveys and the Natural Heritage Database. The stands were the assemblages identified in the reconnaissance surveys.

From this matrix, wetland communities were identified in the following way. Stands (assemblages) were arrayed to reflect similarities in their species composition. If three or more stands had similar species composition and cover values, they were lumped to form a wetland community considered to be recurring in the landscape. A wetland community was identified as not recurring in the landscape if 1) only two stands had similar species composition and cover values, 2) a stand had a species composition dissimilar from any other, or 3) two or more communities had similar dominant species but otherwise very different species composition and cover values. Communities identified in this way were compared with those described in the literature. Recurring and non-recurring communities are described in Appendix B.

FINAL SITE SELECTION CRITERIA:

The following criteria were applied to "first tier" sites, that is, those sites which are the most pristine examples of native, undisturbed, wetland systems:

1. no evidence of human-caused topographic or hydrologic alteration of the wetland;
2. exotic plant species occurred infrequently if at all;
3. relatively little known or apparent human-caused disturbance of the native vegetation;
4. existence of an adequate buffer at sites where adjacent land use was potentially degrading; and
5. no known major water quality problems.

If a site did not meet these criteria, it could still be listed as a "first tier" site if it was the highest quality known example of a community, or

contained particularly important populations of plant or animal species listed as endangered, threatened or sensitive in Washington (Washington Natural Heritage Program, 1987 and Washington Department of Wildlife, Nongame Program, 1988).

The following criteria were applied to "second tier" sites, that is, those sites which were disturbed but have good potential for restoration:

1. no, or isolated, human alteration of the wetland topography;
2. no human caused alteration of the hydrology of the wetland, or else the wetland appeared to have recovered from the alteration;
3. low cover and frequency of exotic plant species;
4. relatively little human-related disturbance of the native vegetation, or excellent recovery from past disturbance;
5. if the wetland system was degraded, it still contained a viable and high quality example of a wetland community; and
6. no known major water quality problems.

CONDITION

The wetlands of western Jefferson County have received a surprising degree of use. Most of the flood plains along the lowlands of the Queets and Hoh Rivers were settled and used to pasture livestock in the past. Many of the sphagnum bogs were also homesteaded and used for pasture. Most of the forested wetlands have been clearcut or selectively logged. As a result, there are not many of these kinds of wetland systems which are in "pristine" condition.

The riparian and oxbow wetlands along the Hoh and Queets are generally in poor condition. Past uses introduced exotic (non-native) weedy plant species which are wide spread and persistent in the environment even where uses were discontinued as much as 30 years ago. Selected surveys of these wetlands indicate that very few still resemble native systems. But more extensive surveys are needed.

Sphagnum bogs were used for pasture and homesteads because they were some of the few natural clearings within a land of once vast forests of giant trees. Most of these homesteads were short lived and abandoned at the latest 30 years ago. Although there were physical disturbances to the bogs (grazing, trampling and attempted draining mostly), few exotic species were introduced. The lack of exotic species and the general failure to substantially alter the hydrology of these wetlands leaves hope that they may recover. Recent logging activities have introduced and spread some tenacious exotic species which pose a threat to the bogs.

There are two general categories of forested wetlands: 1) those with commercial timber values; and 2) those without commercial value. Most of the former

wetland forests have been logged. Many of the latter have been selectively logged. We probably won't know for a century or more whether these systems can recover.

Most wetlands which are still in relatively good condition in eastern Jefferson and Clallam Counties are located within blocks of land used for timber production. In most other areas, the wetlands have been highly disturbed through development and agriculture.

Wetlands within timber blocks have been affected by the introduction of exotic plant species, logging of small or forested wetlands, application of biocides and nutrients and recreational use. Boat access points have been developed by bulldozing wetlands and/or adding fill. Hunters camps, campfires and trails are often located within wetlands.

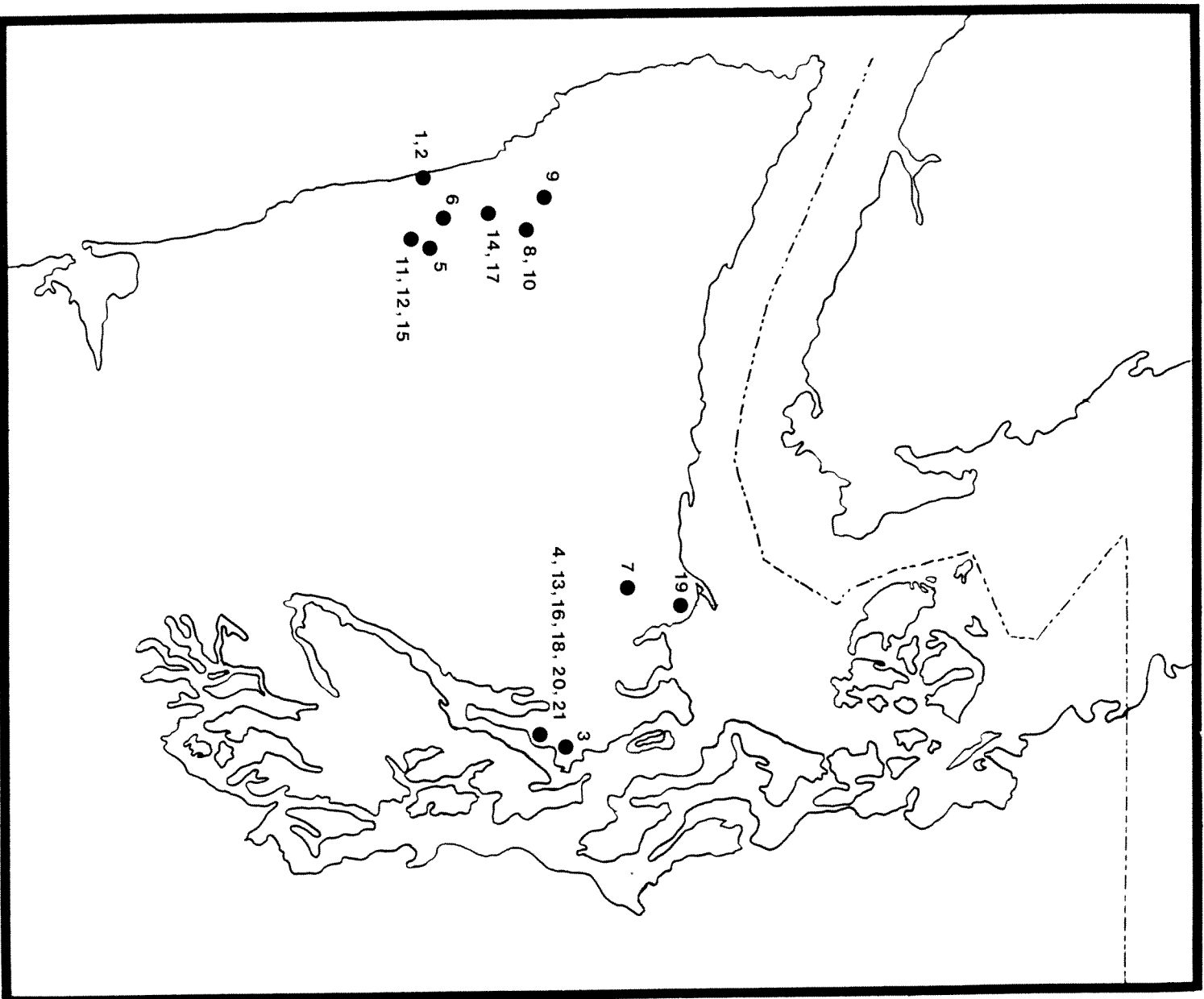


Figure 2: Location of First and Second Tier Sites

SITE LISTS

FIRST TIER SITES:

1. Kalaloch Bog Forest
2. Steamboat Creek Bog Forest
3. Teal Bog
4. Thorndyke Lake
5. Upper Bog

SECOND TIER SITES:

6. Clearwater Ponds
7. Cranberry Lake
8. Crowberry Bog
9. Highway 101 Bog
10. Hoh Bog
11. Lower Bog
12. Mayr Bog
13. Meridian Marsh
14. North Nolan Creek
15. Queets Bog
16. South Mud Lake
17. South Nolan Creek
18. Tule Lake
19. Towne Road Pothole
20. Twin Lakes
21. West Meridian Marsh



Tier One Sites

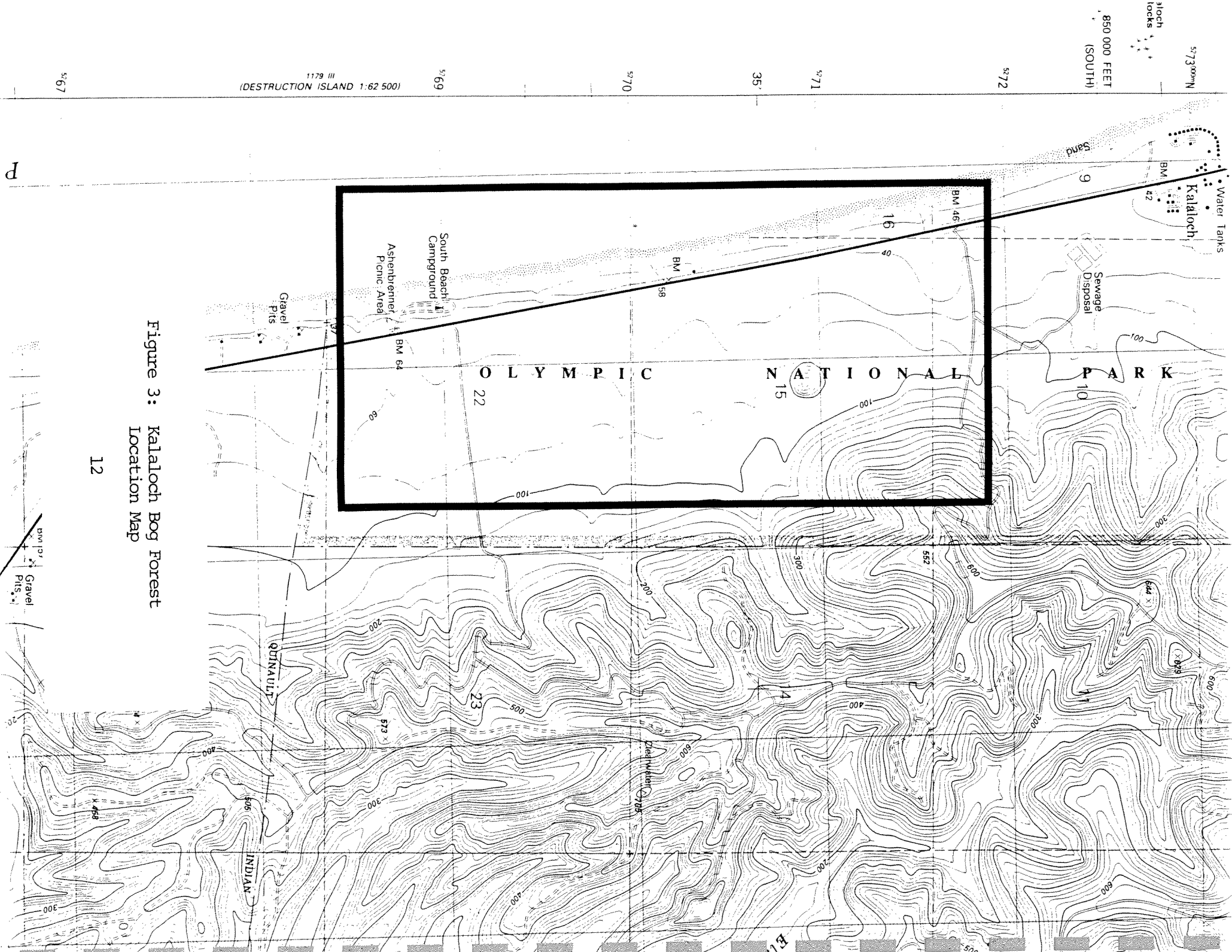
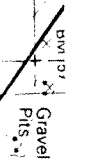


Figure 3: Kalaloch Bog Forest
Location Map



KALALOCH BOG FOREST

LOCATION:

Western Jefferson County; Sections 15 and 22, Township 24 North, Range 13 West, Willamette Meridian. Kalaloch Bog Forest is located within the Olympic National Park.

SIGNIFICANCE:

Kalaloch Bog Forest is a first tier site. It contains what appears to be an uncut bog forest community.

FEATURES:

Sphagnum Bog:

1. Thuja plicata-Tsuga heterophylla/Sphagnum spp. community.

DESCRIPTION:

Physical: Kalaloch Bog Forest consists of several areas of wetland totaling 287 acres. It is located along a two mile section of the outer coast at an elevation of about 100 feet. It occurs on a marine terrace over clay. The soils are a mixture of sphagnum, fibrous and woody peat. The substrate is varied in substance and microtopographic relief. It is a mixture of soil, mounds formed by root wads of uprooted trees, and fallen trees.

There is no channeled flow into or out of these areas. Streams from the ridge to the east flow between the areas of bog forest. The wetland soils are permanently supersaturated and may be flooded seasonally. The mounds and fallen trees are relatively dry.

Biological: The bog forest has an open canopy with less than 50% tree cover. It is co-dominated by scrubby Thuja plicata and Tsuga heterophylla. The understory varies with microtopography. Gaultheria shallon and Vaccinium ovatum are dominant on fallen trees and some root wads. Pyrus fusca, Blechnum spicant and Linnaea borealis occur mostly on root wads. Carex obnupta and Sphagnum spp. are dominant in the areas of wet soils which occur between the fallen trees and root wads.

CONDITION:

Most of Kalaloch Bog Forest appears undisturbed. There is a small area that was logged that is composed of native plant species and appears to be recovering. A road goes through the portion of the bog forest that was cut. National Park staff say that the whole coastal plain was selectively logged prior to their ownership. However, no stumps were found within the surveyed area and the soil type is not suppose to support merchantable timber. The creek drainages between the areas of bog forest were logged in the past.

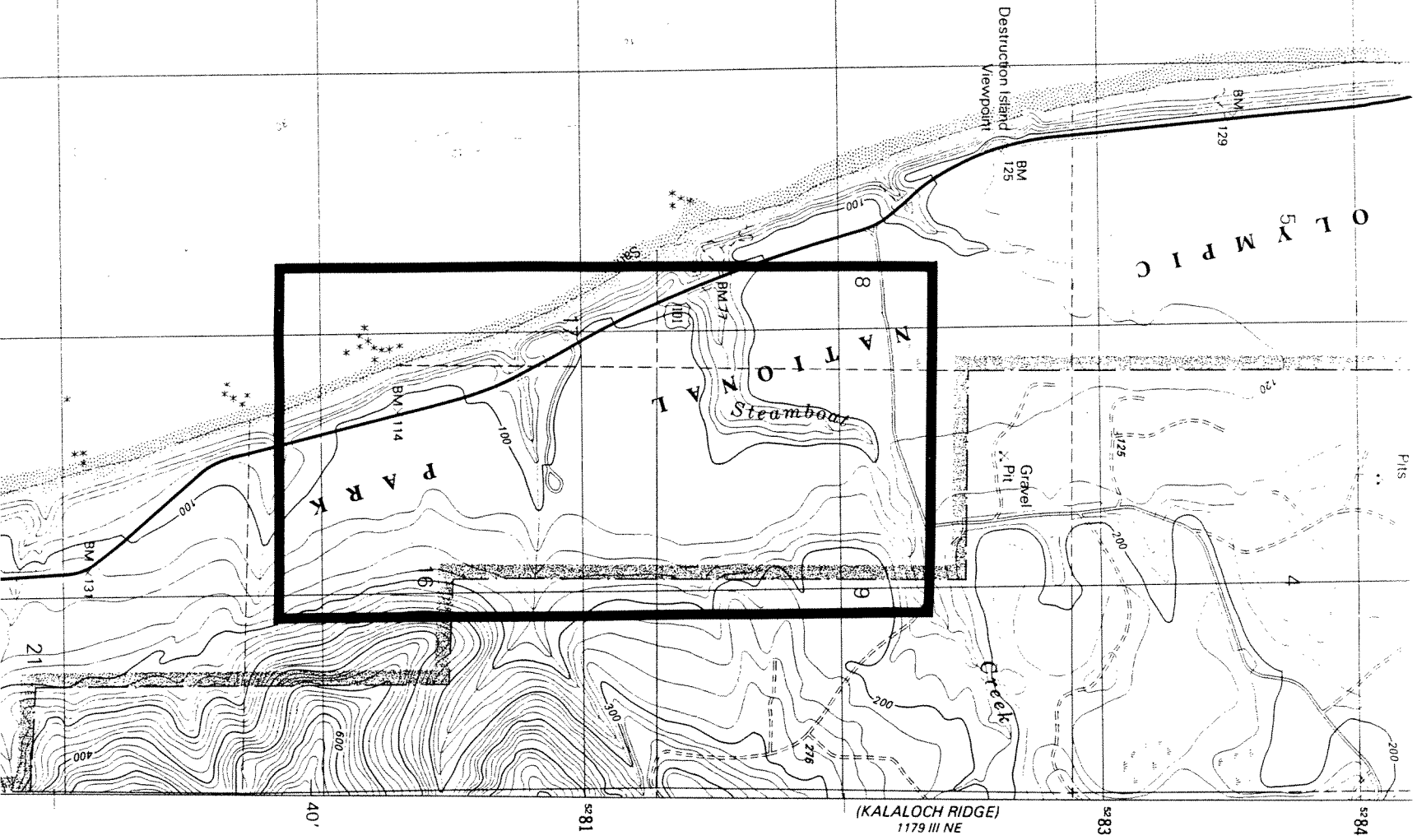


Figure 4: Steamboat Creek Bog Forest
Location Map

STEAMBOAT CREEK BOG FOREST

LOCATION:

Western Jefferson County; Sections 8, 9, 16 and 17, Township 25 North, Range 13 West, Willamette Meridian. Steamboat Creek Bog Forest is located within the Olympic National Park.

SIGNIFICANCE:

Steamboat Creek Bog Forest is a first tier site. It contains what appears to be an uncut bog forest community.

FEATURES:

Sphagnum Bog:

1. Thuja plicata-Tsuga heterophylla/Sphagnum spp. community.

DESCRIPTION:

Physical: Steamboat Creek Bog Forest consists of two areas of wetland totaling 221 acres. It is located along a 1.1 mile stretch of the outer coast at an elevation of about 100 feet. It occurs on a marine terrace over clay. The soils are a mixture of sphagnum, fibrous and woody peat. The substrate is varied in substance and microtopography. It is a mixture of soil, mounds formed by root wads of uprooted trees, and fallen trees.

There is no channeled flow into or out of these two areas. Streams from the ridge to the east flow between and on either side of the areas of bog forest. The wetland soils are permanently supersaturated and may be flooded seasonally. The mounds and fallen trees are relatively dry.

Biological: The bog forest has an open canopy with less than 50% tree cover. It is co-dominated by scrubby Thuja plicata and Tsuga heterophylla. The understory varies with microtopography. Gaultheria shallon and Vaccinium ovatum are dominant on fallen trees and some root wads. Blechnum spicant has high percent cover on relatively dry substrates, mostly root wads. Juncus supiniformis, Rhamnus purshiana and Sphagnum spp. have high percent cover in areas with wet soils between the fallen trees and root wads.

CONDITION:

Most of Steamboat Creek Bog Forest appears undisturbed. Aerial photos show lines that may be old roads or skid trails but these were not found on the ground. National Park staff say that the whole coastal plain was selectively logged prior to their ownership. However, no stumps were found within the surveyed area and the soil type is not suppose to support merchantable timber. The creek drainages that bound the bog forest areas were logged in the past.

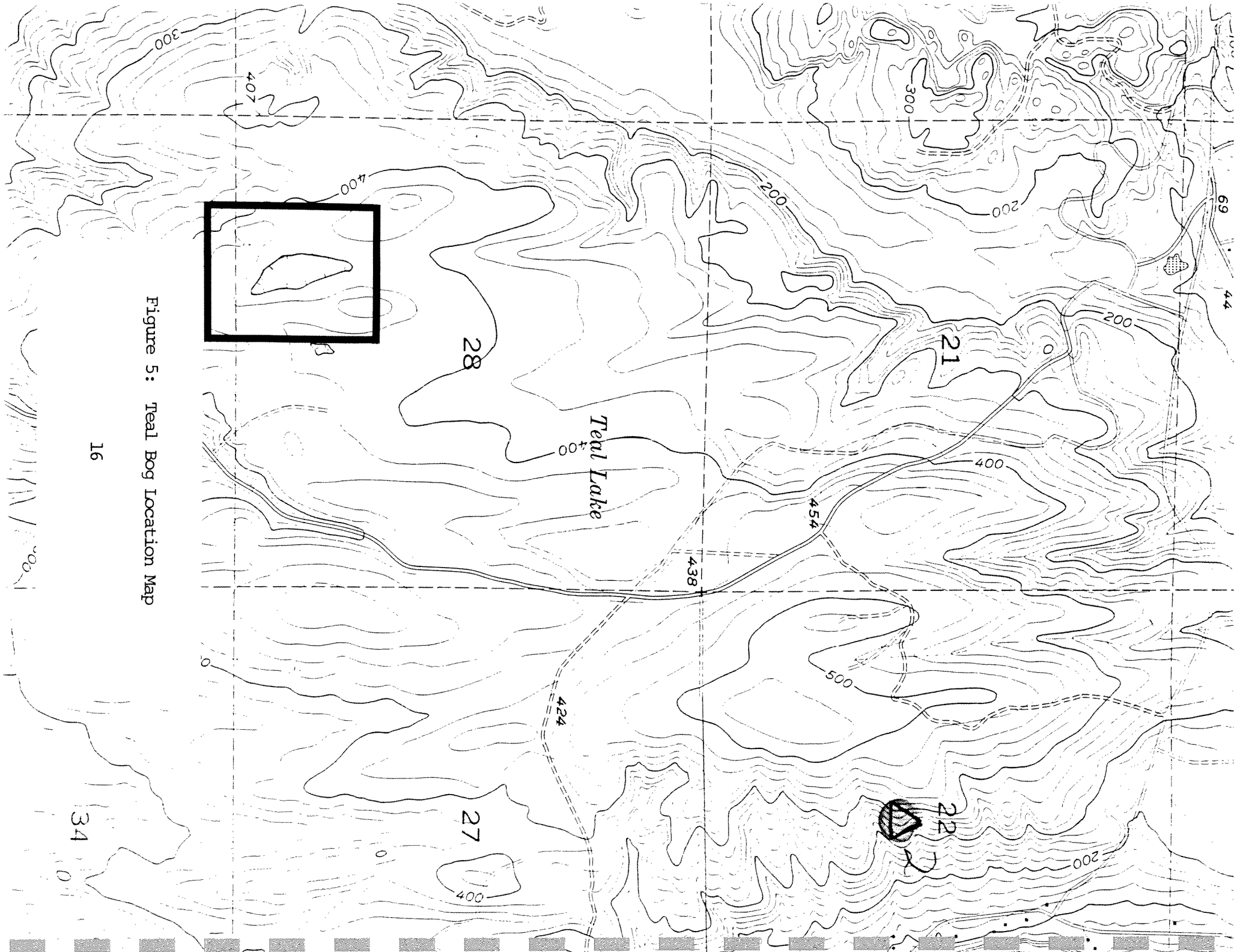


Figure 5: Teal Bog Location Map

TEAL BOG

LOCATION:

Eastern Jefferson County; Section 28, Township 28 North, Range 1 East, Willamette Meridian.

SIGNIFICANCE:

Teal Bog is a first tier site. The site contains one sphagnum bog and one freshwater wetland community.

FEATURES:

Sphagnum Bog:

1. Ledum groenlandicum/Sphagnum spp. community

Freshwater Wetland:

1. Pyrus fusca community

DESCRIPTION:

Physical: Teal Bog is a 7 acre oblong wetland, composed of a 5 acre sphagnum bog island surrounded by a band of freshwater wetland (lagg). It is located on a glacial terrace at 400 feet elevation and occurs in glacial outwash. The lagg soils are anoxic muck and woody material. The bog is composed of hummocky sphagnum and heath peat, with some woody material.

The wetland receives water from precipitation, surface run-off and a short seasonal drainage. It is unclear whether the wetland has an outflow. The lagg is permanently flooded with water up to 3 feet deep. The bog surface is raised slightly above the water level in the lagg and probably receives only rain water.

Biological: The bog is dominated by low growing Ledum groenlandicum and has high percent cover of Kalmia occidentalis and Vaccinium oxycoccos. Six native conifer species are present on the bog, and there are the burned remains of conifers up to 24 inches in diameter.

The lagg is dominated by a Pyrus fusca thicket. Rooted herbaceous species occur along the upland edge in shallow water. In deeper water, P. fusca can be the sole plant species.

CONDITION:

Teal Bog appears undisturbed. It is surrounded by an old second growth forest which is about to be cut. The lagg makes a good barrier to human intrusion and helps buffer perturbations to the system. Snags and stumps in the bog appear to have been burned, but were not cut.

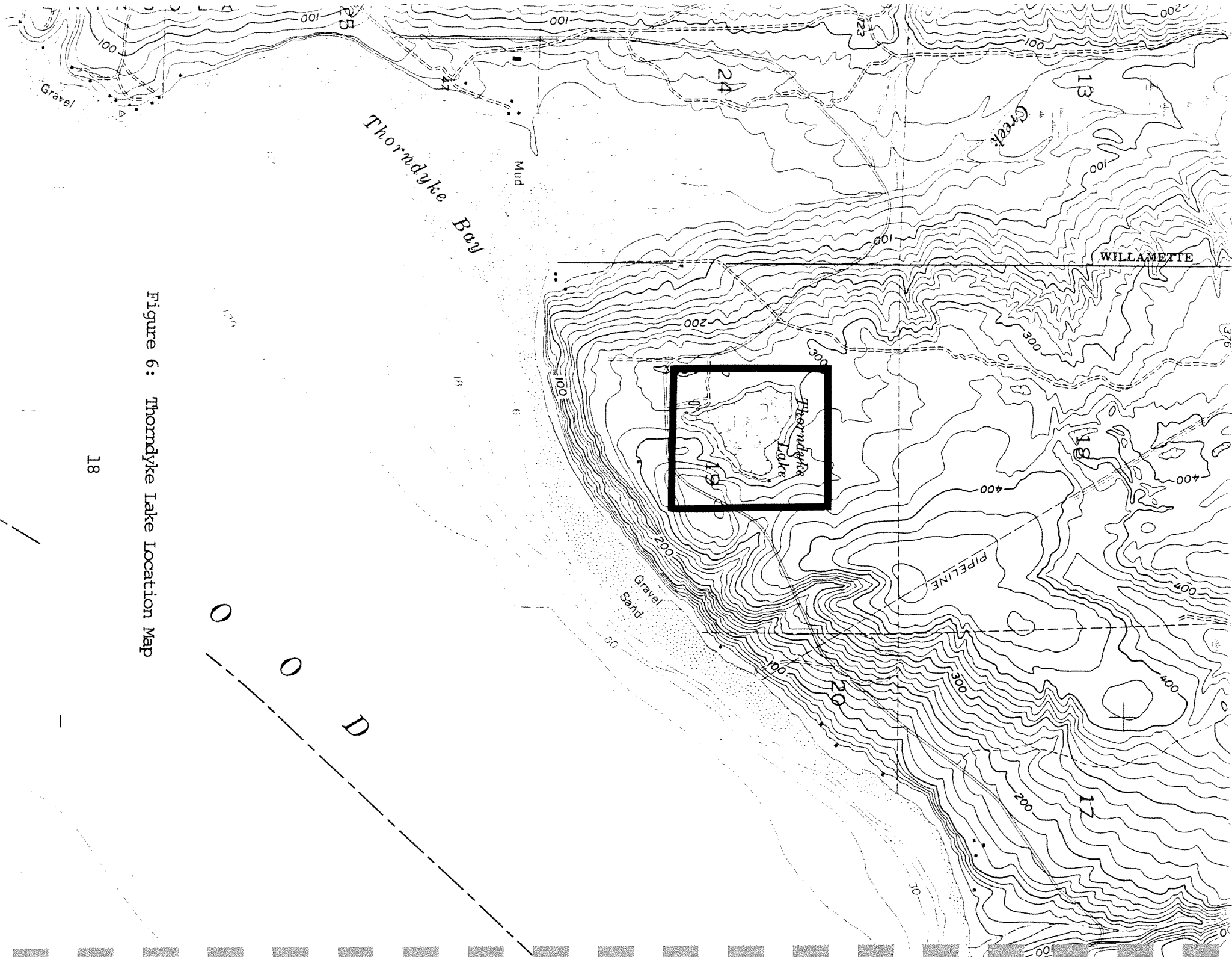


Figure 6: Thorndyke Lake Location Map

THORNDYKE LAKE

LOCATION:

Eastern Jefferson County; Section 19, Township 27 North, Range 1 East, Willamette Meridian.

SIGNIFICANCE:

Thorndyke Lake is a first tier site. It contains high quality examples of five freshwater wetland communities.

FEATURES:

Freshwater Wetland:

1. Nuphar polysepalum community
2. Scirpus acutus community
3. Dulichium arundinaceum community
4. Spiraea douglasii community
5. Pyrus fusca community

DESCRIPTION:

Physical: Thorndyke Lake is located at an elevation of about 269 feet on the northeast end of the Toandos Peninsula. The wetland is fig shaped and covers about 28 acres which includes a one acre permanent pond. Soils are a mixture of fibrous and heath peat with some muck, sphagnum peat and woody material.

The wetland is fed by precipitation and surface run-off. There are two small seasonal streams that feed into the wetland. The outflow appears to be seasonal and controlled by beavers. There is a circular one acre pond in the northwestern portion of the wetland. It is surrounded by progressively more shallow, but permanently flooded wetlands. The shrub dominated wetland margin is seasonally flooded.

Biological: The wetland vegetation forms concentric zones around the pond. Adjacent to the pond is a submerged peat shelf with Nuphar polysepalum and Scirpus acutus. The water over this shelf is 2 to 3 feet deep.

Adjacent to the shelf is a broad band of peat submerged between 10 and 12 inches. This band is covered by a species rich example of the Dulichium arundinaceum community, with relatively high cover values for Juncus balticus, Carex oederi and N. polysepalum. Within this zone are raised areas, with small examples of the Spiraea douglasii community. There are also small patches of sphagnum peat and moss, mostly along the shelf edge.

The Spiraea douglasii community occurs in water 3 to 5 inches deep, around the outer edge of the D. arundinaceum zone. It is most extensive on the northeast side of the wetland. The community is relatively low growing. Dominant species from the D. arundinaceum community occur within the otherwise monospecific stands of S. douglasii.

The outermost wetland zone is covered by an example of the Pyrrus fusca community. Pyrrus fusca forms a nearly closed canopy. There is virtually no understory. In some places there is a narrow moat between this community and the upland.

CONDITION:

Thorndyke Lake appears in nearly pristine condition. There are no signs of human disturbance. There are a few shotgun shells that suggest hunting activities, but there are no signs of extensive human use.

The uplands have all been logged in the past and probably will soon be ready to log again. There once was a building on the east side of the wetland, and a clearing which may have been a pasture. There also was a road which cut across the seasonal outlet for the wetland.



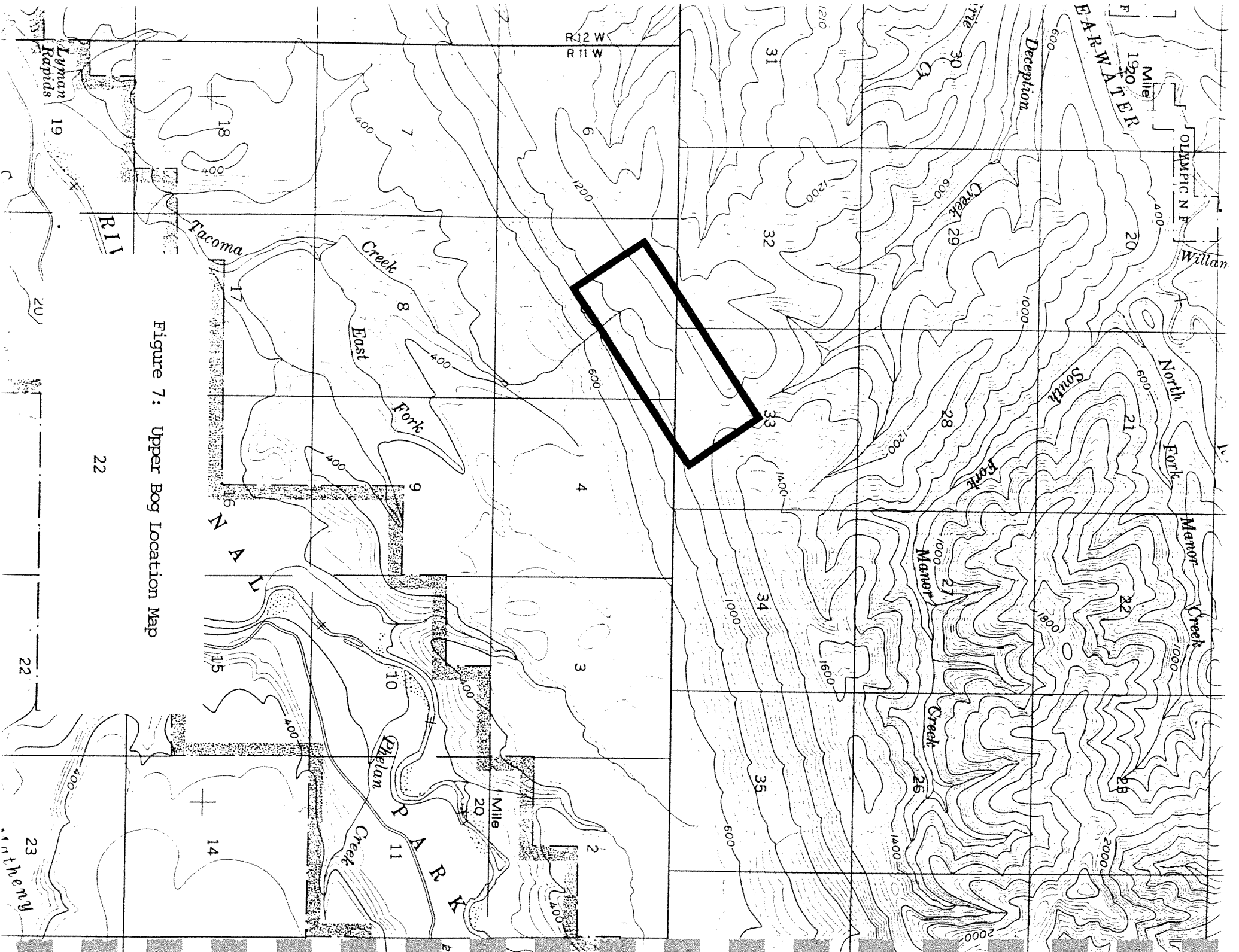


Figure 7: Upper Bog Location Map

UPPER BOG

LOCATION:

Western Jefferson County; Section 5, Township 24 North, Range 11 West and Section 33, Township 25 North, Range 11 West, Willamette Meridian.

SIGNIFICANCE:

Upper Bog is a first tier site. The wetland contains examples of 3 sphagnum bog communities.

FEATURES:

Sphagnum Bog:

1. Carex livida/Sphagnum spp. community
2. Carex rostrata/Sphagnum spp. community
3. Thuja plicata-Tsuga heterophylla/Sphagnum spp. community

DESCRIPTION:

Physical: Upper Bog is located at 1,120 feet elevation on the southeast side of a ridge. It occurs on a sloping bench about 0.75 miles long and 440 feet wide. It consists of 15 acres of herb dominated wetlands and 141 acres of forested bog.

The wetland forms the headwaters of Tacoma Creek. It is fed by precipitation, seeps and surface runoff. The soils are permanently super-saturated except for small seasonal and permanent ponds.

Soils in the open areas are a mixture of sphagnum, fibrous and heath peat. Soils in the forested wetland are mostly fibrous and heath peat with lots of woody material and some sphagnum peat. Fallen trees provide an elevated substrate within the forested wetland.

Biological: The herb dominated wetlands shift from small seasonal or permanent ponds, to a Carex livida/Sphagnum spp. community, to a Carex rostrata/Sphagnum spp. community. Within the C. livida/Sphagnum spp. community, C. livida and C. rostrata have consistently high percent cover values. Rhynchospora alba, Hypericum anagalloides, Gentiana sceptrum, and dwarf Thuja plicata have high percent cover values in places. This is a species rich community.

The Carex rostrata/Sphagnum spp. community has little or no C. livida, and has high percent cover of C. rostrata and Agrostis scabra. In places Boykinia elata and Anemone oregana var. felix have high percent cover.

The Thuja plicata-Tsuga heterophylla/Sphagnum spp. community shifts from an open scrubby forest with an herb bog dominated understory to a closed canopy forest with Gaultheria shallon and Vaccinium alaskaense dominating the mid-story on mounded soil and fallen trees, and herbaceous bog species on low areas between the mounds and fallen trees.

CONDITION:

Upper Bog is in nearly pristine condition. There are a few exotic plant species which have probably been brought in by elk and are localized in the northeast portion of the bog.

A portion of the forested wetland is scheduled to be logged soon.

Second Tier Sites

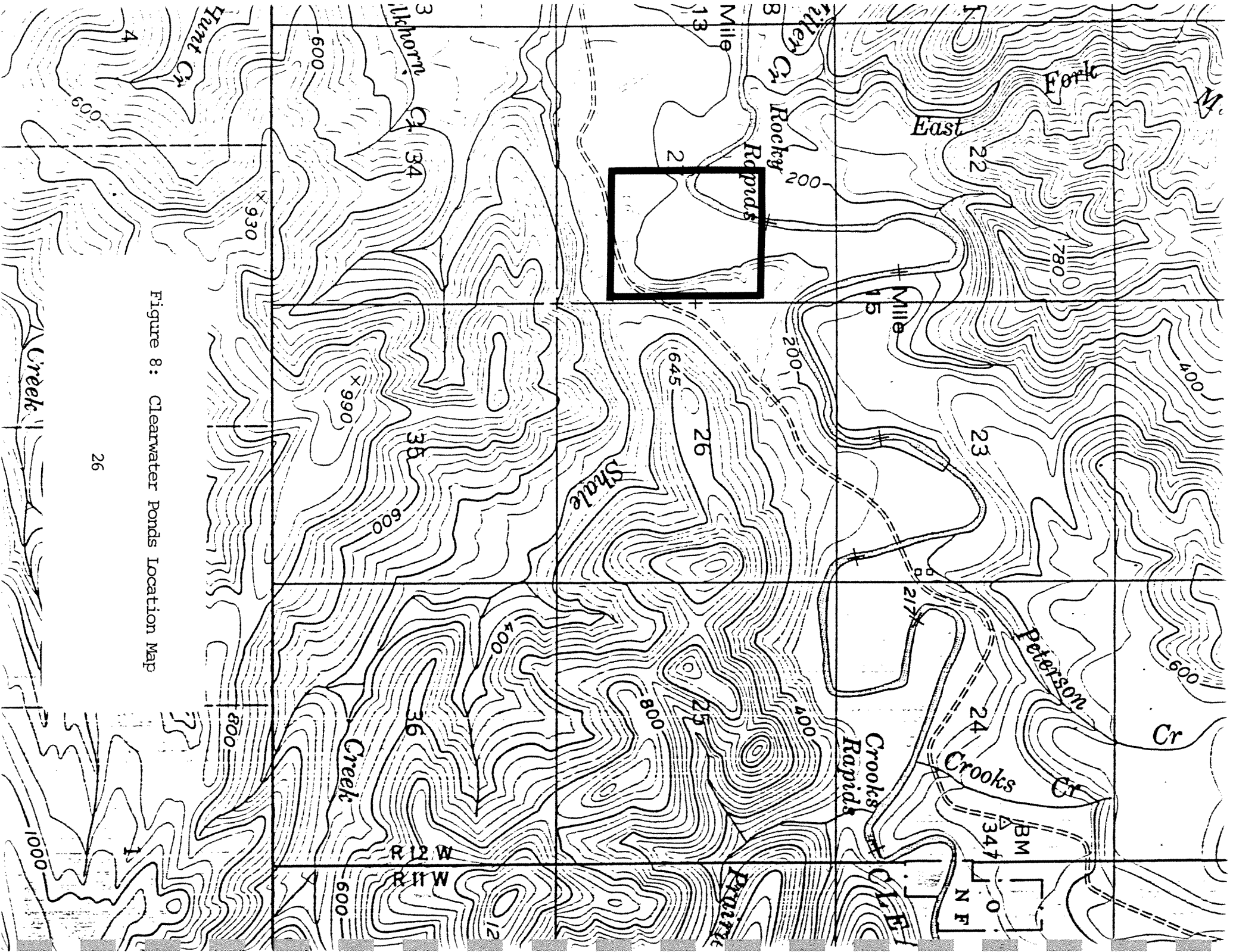


Figure 8: Clearwater Ponds Location Map

CLEARWATER PONDS

LOCATION:

Western Jefferson County; Section 27, Township 25 North, Range 12 West, Willamette Meridian.

SIGNIFICANCE:

Clearwater Ponds is a second tier site. The ponds are of marginal quality, but are included because there are very few flood plain ponds which still resemble native wetlands. Although these ponds have been disturbed in the past, they are dominated by native plants and appear to be recovering.

FEATURES:

Freshwater Wetland:

1. Nuphar polysepalum community

DESCRIPTION:

Physical: Clearwater Ponds is located at 200 feet elevation within the floodplain of the Clearwater River. Each pond is 2.25 acres. The two ponds occur in glacialfluvial material and may be located in old river channels. The ponds have no inflow or outflow. They are permanently flooded and have soft, black, anoxic, organic soils.

Biological: Both ponds are dominated by Nuphar polysepalum. The shallow margins have emergent vegetation characterized by Alnus rubra, Carex obnupta, Rubus spectabilis, Lysichitum americanum and Athyrium filix-femina.

The ponds are used by beaver and there is an old lodge in the western most pond.

CONDITION:

Both ponds have been disturbed in the past. The floodplain was logged, including the wetland margin. A vacated road traverses the steep unstable slope above the western pond. The slope has and continues to slide into the pond, filling the pond and carrying exotic plant species to the pond edge.

The road also bisects the eastern-most pond on fill. The western half of that pond is no longer a pond, but is recovering to a wet forest community. What remains of the eastern pond appears to be in good condition and is similar to the western pond in vegetation. There is a shack on the portion of the road which bisects the eastern pond. It is most likely used as a hunter's shelter, but may be more permanently occupied. The effect of the occupants on the wetland system is unknown.

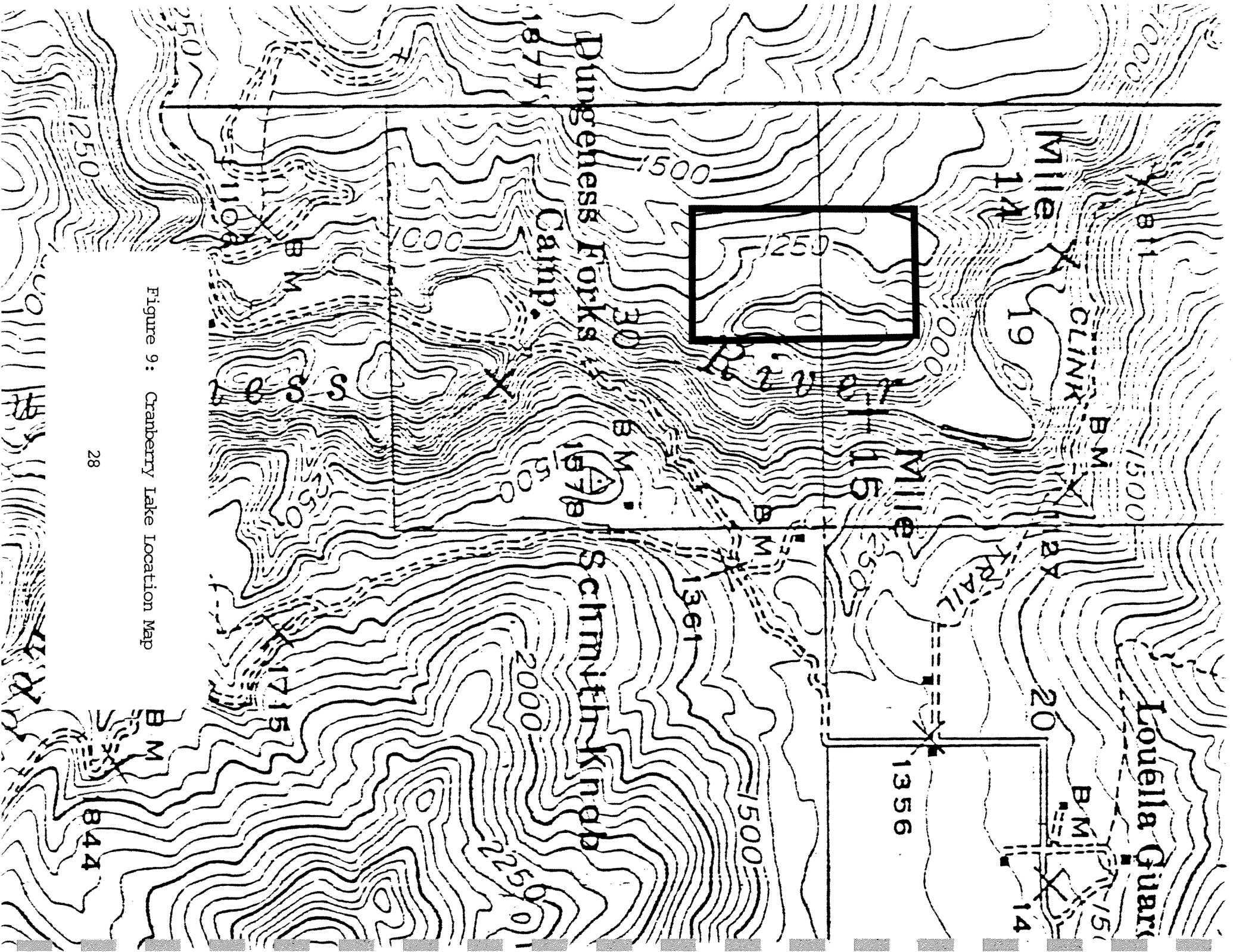


Figure 9 : Cranberry Lake Location Map

CRANBERRY LAKE

LOCATION:

Eastern Clallam County; Section 19, Township 29 North, Range 3 West, Willamette Meridian.

SIGNIFICANCE:

Cranberry Lake is a second tier site. Although portions of the wetland have been degraded, it still contains high quality examples of 2 sphagnum bog and 3 freshwater wetland communities, as well as a population of a plant species listed as sensitive in the state.

FEATURES:

Sphagnum Bog:

1. Vaccinium oxycoccos/Sphagnum spp. community
2. Tsuga heterophylla/Ledum groenlandicum/Sphagnum spp. community

Freshwater Wetland:

1. Nuphar polysepalum community
2. Typha latifolia community
3. Carex rostrata community

DESCRIPTION:

Physical: Cranberry Lake is located in a small steep sided valley at about 1,200 feet elevation. It is long and curved, and generally oriented north-south. There is an approximately 6 acre freshwater wetland which includes a small vegetated pond in the south end. A 1.5 acre floating sphagnum bog is located in the north end of the wetland. The bog is surrounded by a moat or lagg.

The wetland occurs in an area of gravelly loam soils which have developed in basalt and flow breccia. The wetland soils are muck, fibrous peat and sphagnum peat.

The wetland has no apparent inflow or outflow although the topographic map indicates an outflow to the north into the Dungeness River. It is fed by precipitation and surface run-off. All but the margins of the wetland are permanently flooded. The sphagnum mat floats over the water's surface and is supersaturated to wet.

Biological: The sphagnum bog vegetation grades from open water with either Nuphar polysepalum or Menyanthes trifoliata, to very soft supersaturated sphagnum with Eriophorum chamissonis, to slightly firmer but still supersaturated sphagnum with Vaccinium oxycoccos, E. chamissonis, Drosera rotundifolia and low growing Ledum groenlandicum. This grades into a higher, dryer Tsuga heterophylla/L. groenlandicum/Sphagnum spp. community with stunted widely spaced T. heterophylla and low-growing L. groenlandicum.

The south end of the freshwater wetland contains a pond vegetated by Potamogeton sp. and N. polysepalum with some Hippuris sp., Puccinellia pauciflora and Carex rostrata. It is bounded to the north by Typha latifolia and to the south by a disturbed assemblage dominated by Phalaris arundinaceae.

North of the T. latifolia community, the vegetation is dominated by C. rostrata and has high cover of T. latifolia and Potentilla palustris. The substrates in this area are firm peat with as much as 40% sphagnum.

The vegetation in the lagy around the bog is mostly a mixture of T. latifolia, P. palustris, Carex cusickii, C. rostrata and P. pauciflora.

CONDITION:

The south end of the wetland has been disturbed and may have been the site of a homestead. The P. arundinacea in the wetland and weedy species in the adjacent uplands suggest that livestock were kept there.

At the south end of the floating bog, the freshwater wetland appears to be in transition and has unusually firm soils composed at least in part of Sphagnum spp. This suggests that there has been a major change in the wetland, perhaps in its hydrology or nutrients.

The sphagnum bog appears to be undisturbed, although L. groenlandicum is dying in the wetter parts of the mat.



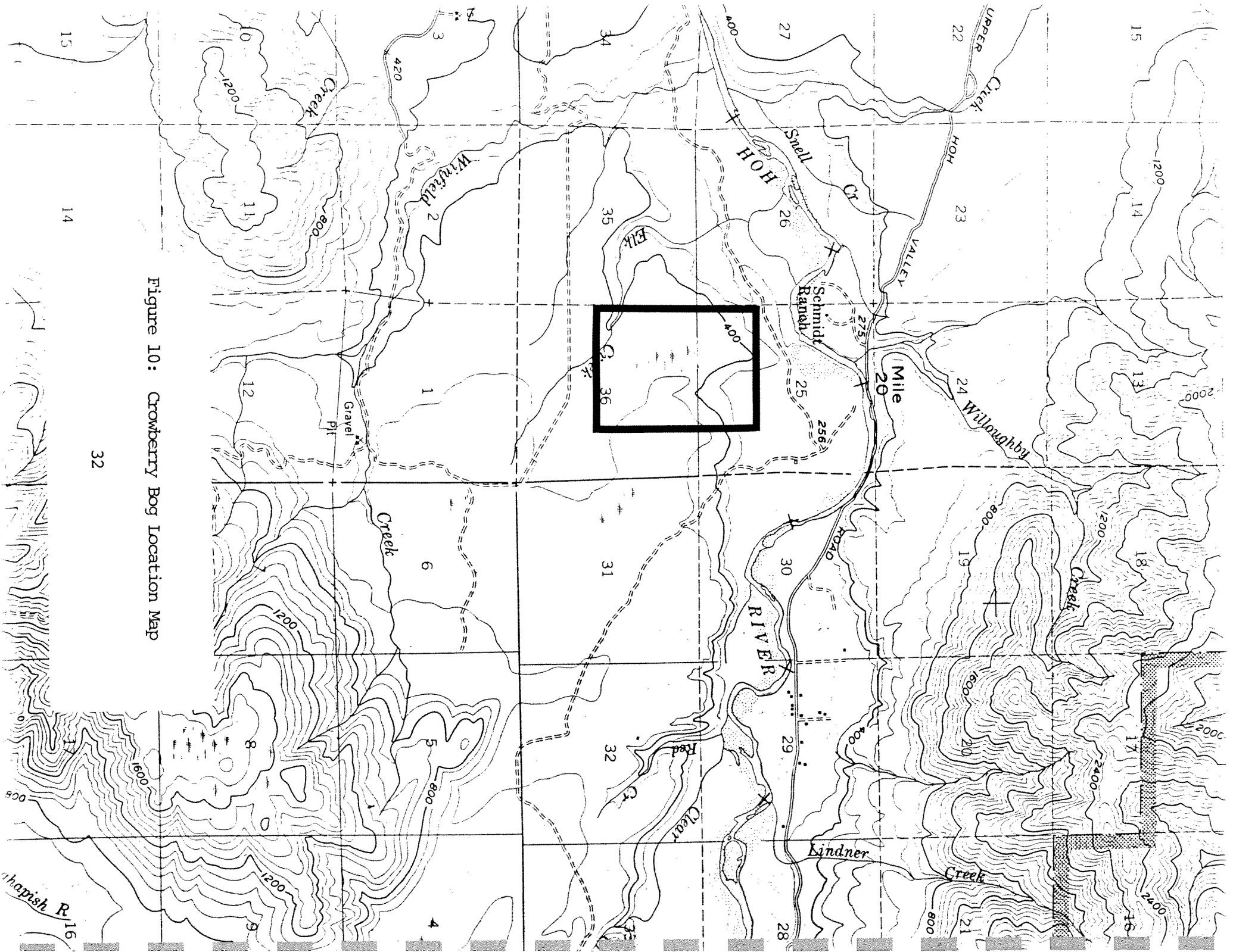


Figure 10: Crowberry Bog Location Map

CROWBERRY BOG

LOCATION:

Western Jefferson County; Section 36, Township 27 North, Range 12 West, Willamette Meridian.

SIGNIFICANCE:

Crowberry Bog is a second tier site. Although disturbed, the site still contains high quality examples of 3 sphagnum bog communities.

FEATURES:

Sphagnum Bog:

1. Kalmia occidentalis-Ledum groenlandicum/Sphagnum spp. community
2. Pinus contorta/Ledum groenlandicum/Sphagnum spp. community
3. Tsuga heterophylla/Ledum groenlandicum/Sphagnum spp. community

DESCRIPTION:

Physical: Crowberry Bog is located at 440 feet elevation on a terrace about 100 feet above the Hoh River. The wetland is over 41 acres, of which 13 acres are high quality, 9.5 acres are recovering and 19 acres are highly disturbed. It occurs in a kidney shaped depression within glacial till and outwash. The soils are a mixture of sphagnum and heath peat with some woody material.

The bog ranges from seasonally dry in the southern portion, to permanently supersaturated in the northern portion. Most of the bog is probably seasonally flooded. There is no apparent channeled inflow, but the wetland drains to the north into the Hoh River. The wetland is mostly fed by precipitation.

Biological: Crowberry Bog is dominated by low-growing shrubs: Kalmia occidentalis, Empetrum nigrum and Vaccinium oxycoccos. In places there is high percent cover of Eriophorum chamissonis and Ledum groenlandicum. The south end of the bog is drier than the north and was burned in the past. The burned area is dominated by L. groenlandicum, Pteridium aquilinum and Xerophyllum tenax, and has numerous snags.

Within the shrub bog are areas of stunted Pinus contorta or Tsuga heterophylla. Where the trees are stunted, the understory is similar to that in the areas dominated by low-growing shrubs. Around the margins of the shrub bog are areas of relatively tall, densely growing P. contorta and T. heterophylla. In these areas, Gaultheria shallon and X. tenax generally dominate the understory. In places, L. groenlandicum and P. aquilinum also co-dominate.

CONDITION:

The interior shrub and stunted tree dominated portion of Crowberry Bog is in good condition, although the southern area of shrub bog was burned, apparently during a slash burn on the adjacent upland. The dense P.

contorta and T. heterophylla bog forests, which surround the high quality interior, appear to be second growth, either cut or burned in the past.

Surrounding the second growth forest, is a band of clearcut Thuja plicata-Tsuga heterophylla/Sphagnum spp. bog forest. This area may never recover and now contains a large population of an aggressive weedy plant species, Juncus effusus, which has the potential to spread into the undisturbed shrub bog.



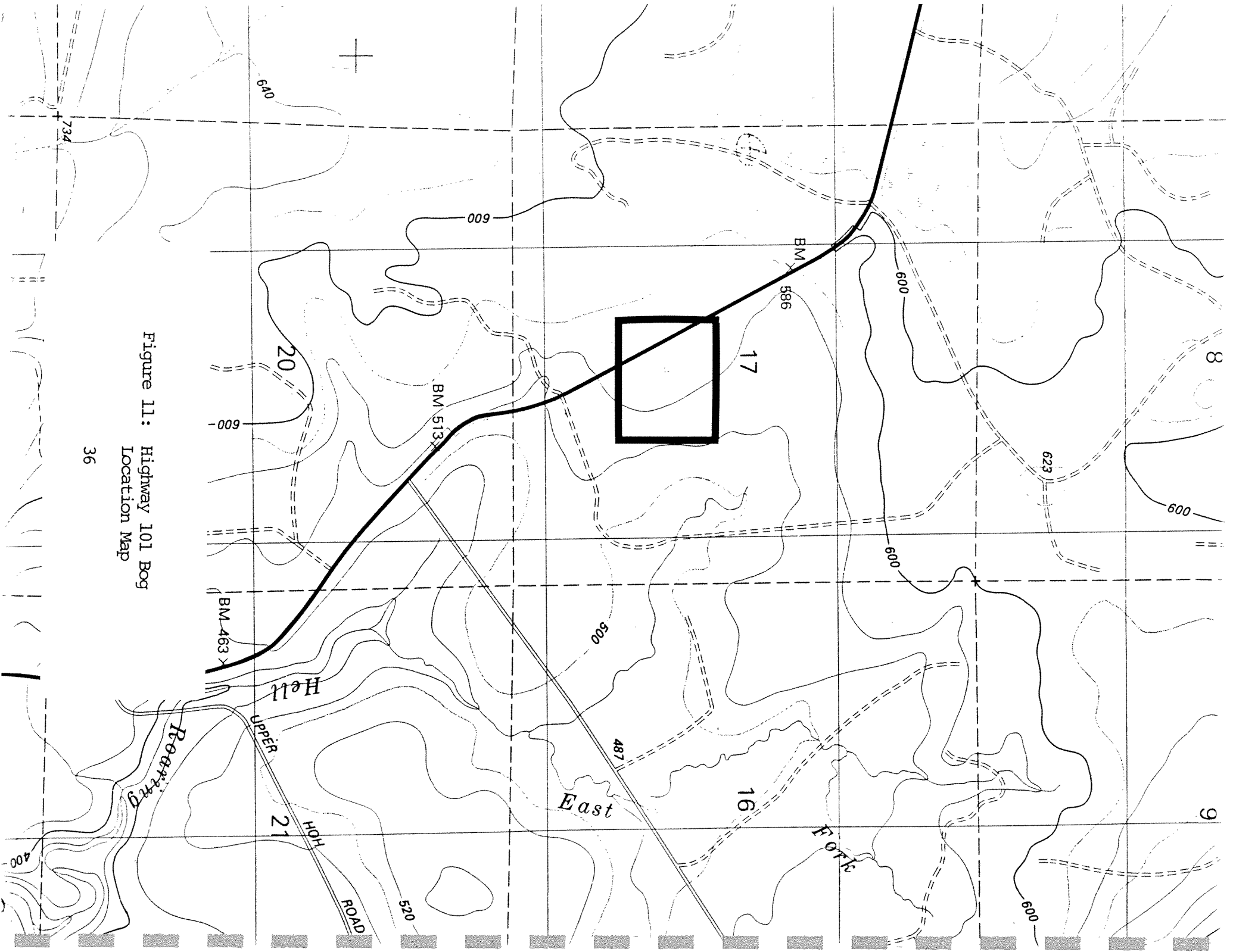


Figure 11: Highway 101 Bog
Location Map

HIGHWAY 101 BOG

LOCATION:

Western Jefferson County; Section 17, Township 27 North, Range 12 West, Willamette Meridian.

SIGNIFICANCE:

Highway 101 Bog is a second tier site. Although disturbed, the site contains examples of three sphagnum bog communities, seems to be recovering and is dominated by native plant species.

FEATURES:

Sphagnum Bog:

1. Sanguisorba officinalis/Sphagnum spp. community
2. Kalmia occidentalis-Ledum groenlandicum/Sphagnum spp. community
3. Thuja plicata-Tsuga heterophylla/Sphagnum spp. community

DESCRIPTION:

Physical: Highway 101 Bog is a 6.6 acre wetland located at 560 feet elevation on a glacial terrace. It occurs within a depression in a mixture of gravelly silt loam and silt clay loam soils, but the wetland soils are a mixture of sphagnum, fibrous, heath and woody peat.

The wetland appears to have no channeled inflow or outflow. It is probably seasonally flooded and then saturated to supersaturated.

Biological: The bog meadow area appears uniform except for the disturbed area next to the highway. The area is dominated by Sanguisorba officinalis and Sphagnum spp. Carex rostrata is subdominant.

The shrub zone is dominated by Kalmia occidentalis, Ledum groenlandicum and Spiraea douglasii. Pyrus fusca and Rhamnus purshiana have high percent cover.

The tree dominated area is composed of a scrubby Thuja plicata bog forest.

CONDITION:

Highway 101 Bog is disturbed, but is still dominated by native plant species and has potential for recovery. Highway 101 passes through the west side of the bog on fill. The bog once extended across the highway and included a small area south west of the roadway. The meadow has been graded adjacent to the highway but is dominated by native plant species, S. officinalis and C. rostrata. The highway also goes through portions of the shrub and forested bog communities. The hydrology of the bog has been altered by the roadway, but it is difficult to say to what degree. The bog forest appears to have been selectively logged in the past.

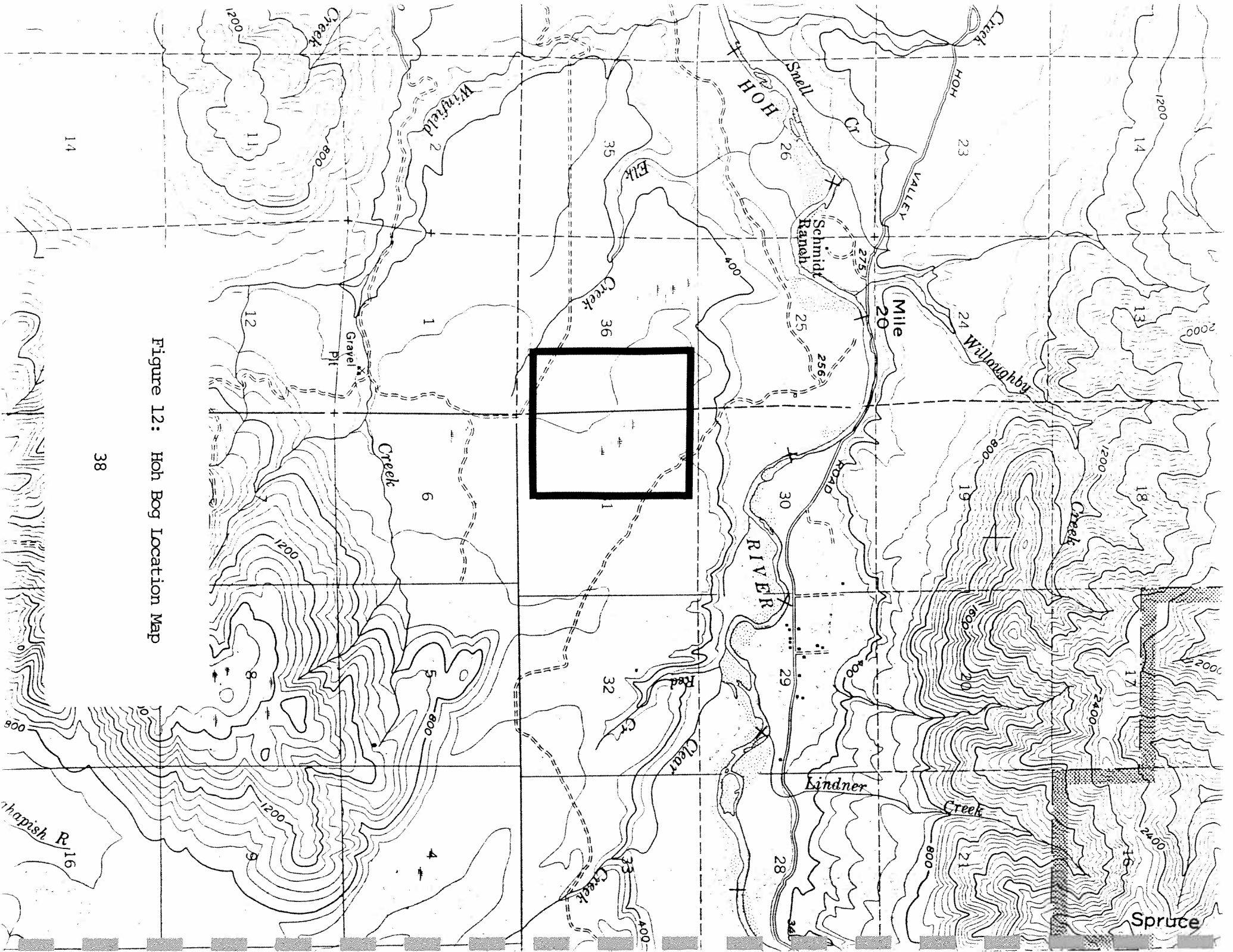


Figure 12: Hoh Bog Location Map

HOH BOG

LOCATION:

Western Jefferson County; Section 31, Township 27 North, Range 11 West, Willamette Meridian.

SIGNIFICANCE:

Hoh Bog is a second tier site. Although disturbed in the past, it still contains high quality variations of 1 sphagnum bog community.

FEATURES:

Sphagnum Bog:

1. Kalmia occidentalis-Ledum groenlandicum/Sphagnum spp. community

DESCRIPTION:

Physical: Hoh Bog is located at 480 feet elevation on a terrace above the Hoh River. It occurs in a shallow, kidney shaped basin within glacial till and outwash. The high quality interior portion of the bog is 15 acres with an additional 12.5 acres of logged bog forest.

The bog is relatively dry. It contains scattered small ponds or holes and is probably seasonally flooded. There is no channeled inflow but the wetland drains to the north into the Hoh River. The soils are a mixture of sphagnum, sedge and heath peat with some woody material.

Biological: The interior portion of Hoh Bog is dominated by low growing shrubs, Kalmia occidentalis, Ledum groenlandicum and Empetrum nigrum. Along portions of the wetland margins Carex rostrata is co-dominant. In the center of the shrub zone are dwarf Tsuga heterophylla.

CONDITION:

The interior shrub dominated portion of the bog appears to be in good condition. The Thuja plicata-Tsuga heterophylla/Sphagnum spp. bog forest community has been clearcut. It is unclear whether the forested bog will recover.

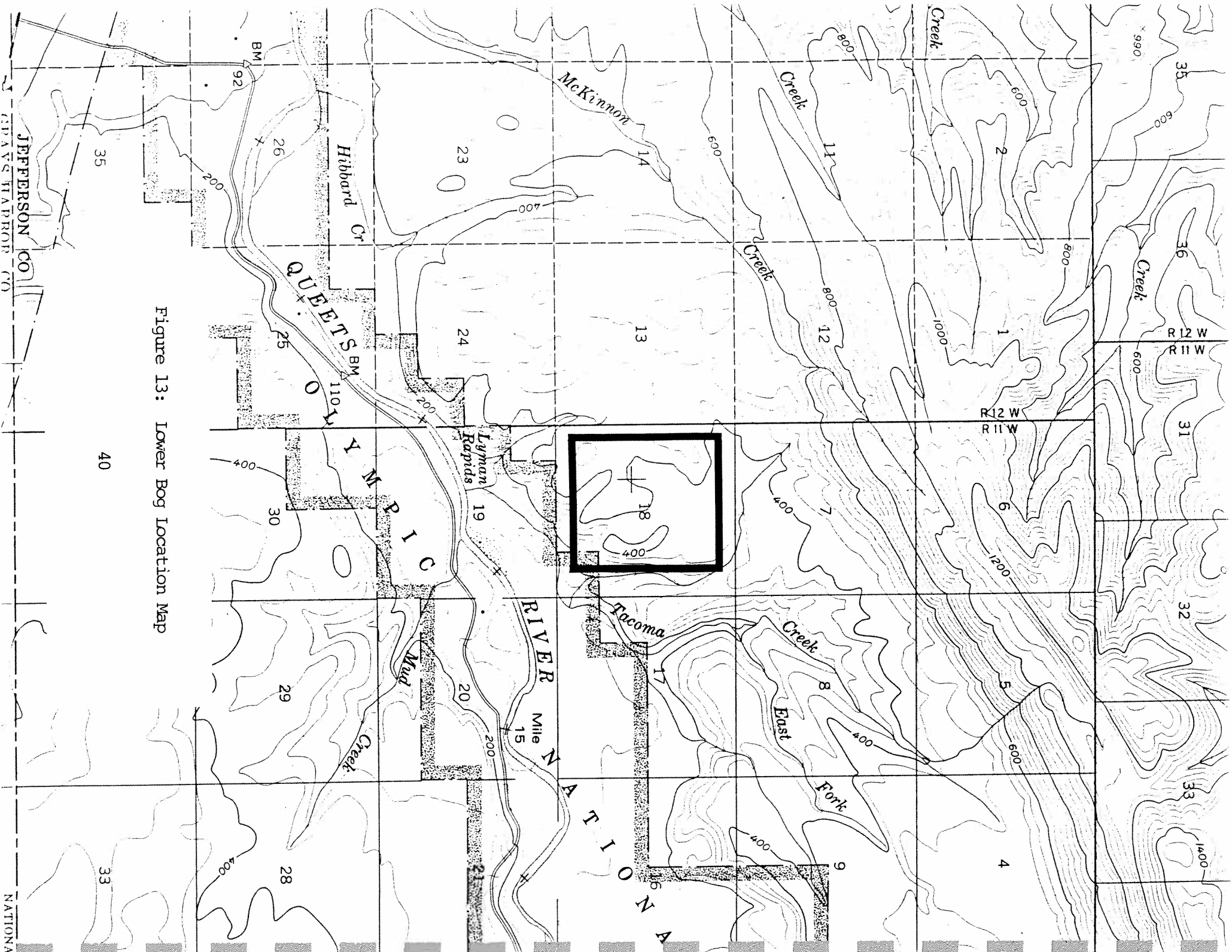


Figure 13: Lower Bog Location Map

35

40

33

JEFFERSON CO
JEFFERSON CO

NATONA

R 12 W
R 11 W

R 12 W
R 11 W

McKinnon

Hibbard Cr

QUEETS CREEK

LYNN RIVER

TACOMA NATIONAL RIVER

Tacoma

Creek

East Fork

Lynn Rapids

Mead

BM 92

BM 110

990

35

36

31

32

33

1400

2

1

6

5

4

13

18

17

16

23

24

19

20

21

26

25

30

29

28

800

Creek

800

Creek

400

400

400

400

800

600

1000

1200

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600

800

400

400

200

400

200

400

400

600

600

1400

LOWER BOG

LOCATION:

Western Jefferson County; Section 18, Township 24 North, Range 11 West, Willamette Meridian.

SIGNIFICANCE:

Lower Bog is a second tier site. The bog has recovered well from past disturbance and contains examples of 4 sphagnum bog communities.

FEATURES:

Sphagnum Bog:

1. Carex livida/Sphagnum spp. community
2. Sanguisorba officinalis/Sphagnum spp. community
3. Kalmia occidentalis-Ledum groenlandicum/Sphagnum spp. community
4. Thuja plicata-Tsuga heterophylla/Sphagnum spp. community

DESCRIPTION:

Physical: Lower Bog is a 30 acre sloping wetland on a glacial terrace at 400 feet elevation. It occurs in an area of gravelly glacial till with a cemented layer. The wetland soils are a mixture of sphagnum, fibrous and heath peat in the meadow area and fibrous, heath and woody peat with some sphagnum peat in the forested area.

The wetland covers the bottom and surrounding slopes of a small basin. There are a few small seasonal ponds located along a seasonal drainage which runs along the bottom of the basin. Some of the vegetated areas are seasonally flooded although most are just supersaturated.

Biological: An example of the Carex livida/Sphagnum spp. community is located along the drainage where the ground is wettest. Within it are pockets dominated by Rhynchospora alba. Most of the area is codominated by C. livida, Agrostis scabra, Hypericum anagalloides and Nephrrophyllidium crista-galli. In slightly drier areas, the vegetation is dominated by Sanguisorba officinalis with high percent cover of A. scabra and patchy distribution of C. livida, Gentiana scepstrum and Deschampsia caespitosa.

Slightly drier areas than those dominated by herbs are dominated by low-growing shrubs, Kalmia occidentalis and Ledum groenlandicum, and the herbaceous species Sanguisorba officinalis. In places, either Vaccinium caespitosum or V. oxycoccos are co-dominant, and Carex rostrata is co-dominant throughout.

An area of Thuja plicata-Tsuga heterophylla/Sphagnum spp. community is located in the southwest portion of the wetland. Gaultheria shallon, Menziesia ferruginea and Vaccinium alaskaense grow on fallen trees and dominate the mid-story. Lysichitum americanum and Blechnum spicant dominate the understory on wet soils.

CONDITION:

If there are no further perturbations and the exotic species can be controlled, most of the bog is expected to recover from past disturbances.

Lower Bog was probably used to pasture livestock in the late 1800's and early 1900's. The drainage appears to have been hand dug, either enhancing an existing drainage or creating a new one. There are some exotic plant species within the bog, concentrated in the southern part of the herb dominated area. It is possible that Y. caespitosum is not native to the bog but was introduced.

A four acre area of forested wetland was cut in the northern part of the wetland.



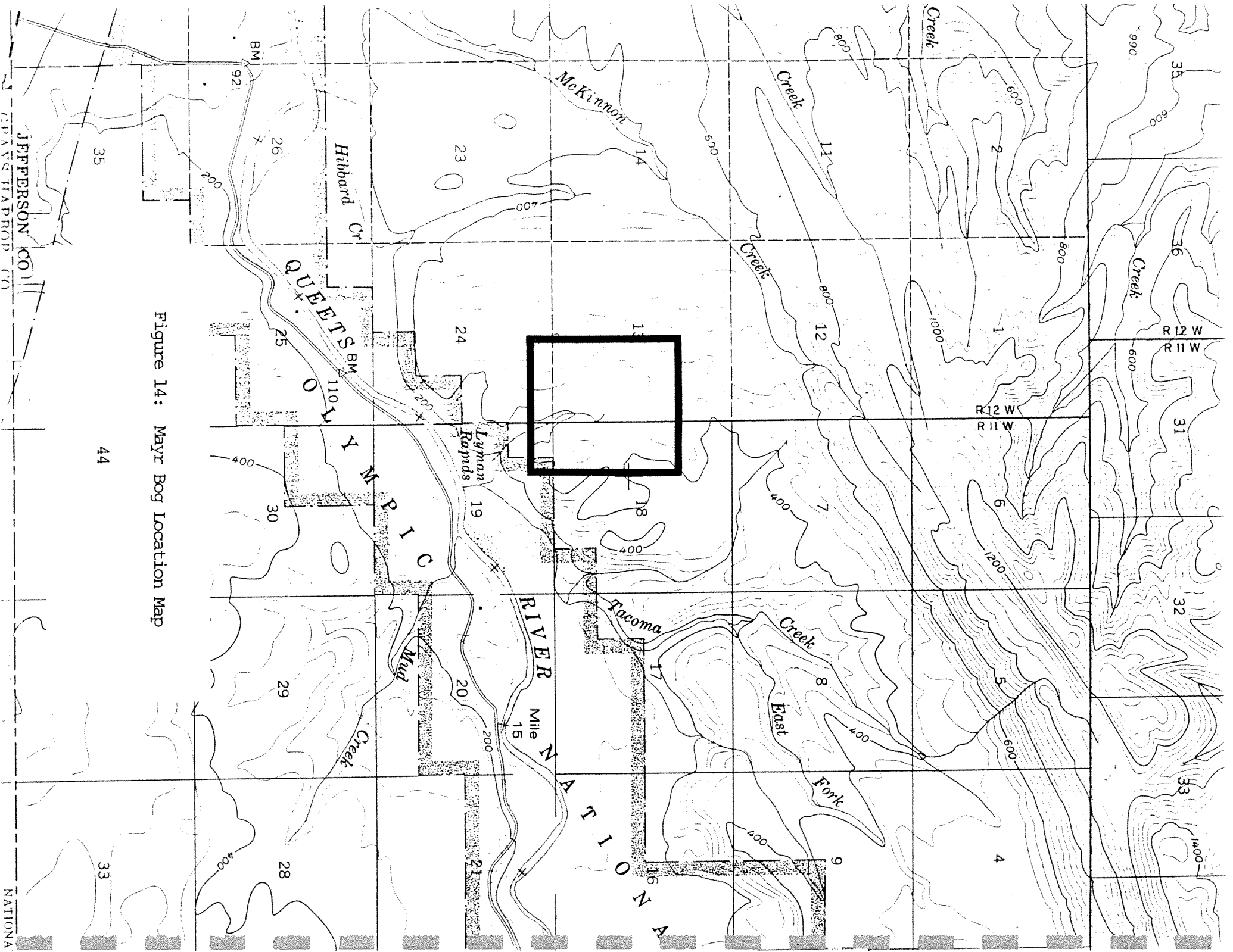


Figure 14: Mayr Bog Location Map

MAYR BOG

LOCATION:

Western Jefferson County; Section 13, Township 24 North, Range 12 West, Willamette Meridian.

SIGNIFICANCE:

Mayr Bog is a second tier site. It was disturbed in the past and has recovering examples of 2 sphagnum bog communities.

FEATURES:

Sphagnum Bog:

1. Sanguisorba officinalis/Sphagnum spp. community
2. Kalmia occidentalis-Ledum groenlandicum/Sphagnum spp. community

DESCRIPTION:

Physical: Mayr Bog is a 23 acre wetland located on a glacial terrace at 400 feet elevation. It occurs in a shallow depression within gravely glacial till which has a cemented layer. Soils within the wetland are a mixture of sphagnum, fibrous and heath peat.

Portions of the bog may be seasonally flooded, but for the most part substrates are wet to supersaturated. There is a seasonal stream which drains the wetland but there is no apparent channeled inflow.

Biological: The meadow portions of the wetland are mostly an example of a Sanguisorba officinalis/Sphagnum spp. community. Deschampsia caespitosa and Agrostis scabra have high percent cover as well as S. officinalis. Within this area are patches dominated by either Carex livida or Rhynchospora alba.

The shrub dominated areas are covered by a dense low-growing example of the Kalmia occidentalis-Ledum groenlandicum/Sphagnum spp. community in which S. officinalis is co-dominant.

CONDITION:

Mayr Bog is recovering from past disturbance. It was the site of a short-lived homestead which was abandoned in 1921 after the "21 Blow". The wetland was used to pasture livestock and some drainage channels were dug. Vaccinium caespitosum, which occurs in the bog, may have been introduced.

The forests around the bog have all been cut recently, in most cases leaving no buffer. Areas of wet forest were also cut.

Although the vegetation in the wetland is disturbed, the herbaceous portion is still composed of native species, suggesting that it may eventually recover.

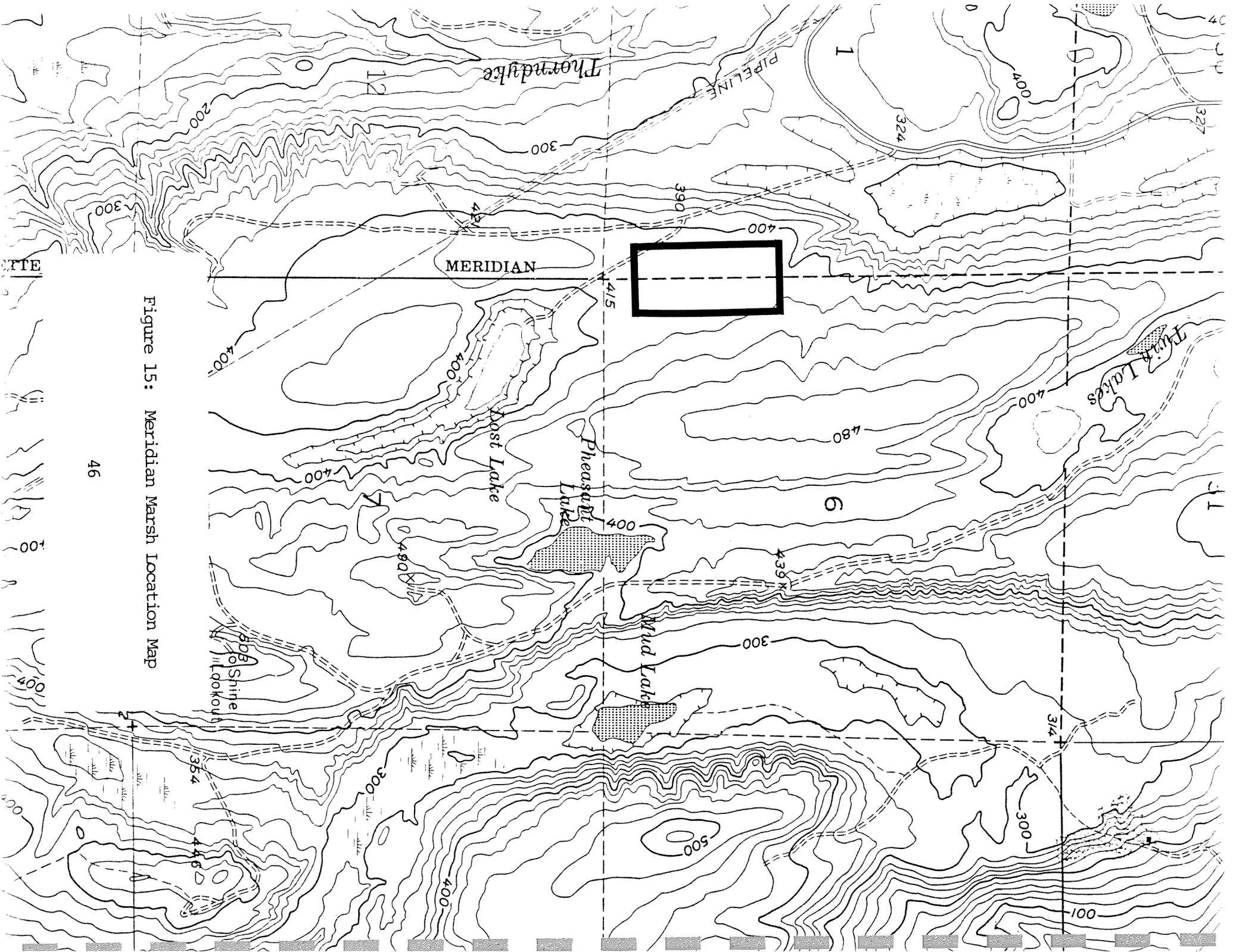


Figure 15: Meridian Marsh Location Map

MERIDIAN MARSH

LOCATION:

Eastern Jefferson County; Section 6, Township 27 North, Range 1 East and Section 1, Township 27 North, Range 1 West, Willamette Meridian.

SIGNIFICANCE:

Meridian Marsh is a second tier site. It is high quality with no apparent disturbance, but is small. It is composed primarily of one freshwater wetland community and has a small example of a second.

FEATURES:

Freshwater Wetland:

1. Carex vesicaria community
2. Spiraea douglasii community

DESCRIPTION:

Physical: Meridian Marsh is a series of four wetlands totalling 4 acres. It is located on a glacial terrace at about 400 feet elevation. It occurs in a north-south oriented glacial scour on gravelly glacial till with a semi-permeable cemented layer. Soils are a mixture of fibrous and heath peat with a little sphagnum peat.

The wetlands appear to be seasonally flooded with pockets which are permanently, but shallowly flooded. The series of wetlands appear to have two outflows, one to the north and the second to the south. Both are probably seasonal streams. There is no apparent channelled inflow.

Biological: The wetlands are dominated by densely growing Spiraea douglasii which reaches a height of 8 feet. There is some Sphagnum spp. in the understory and 5-10% cover of Pyrus fusca.

Small openings in the S. douglasii community are permanently flooded and co-dominated by Carex vesicaria, Puccinellia pauciflora and Nuphar polysepalum.

CONDITION:

The wetlands appear undisturbed. The adjacent uplands were clearcut about 40 years ago.

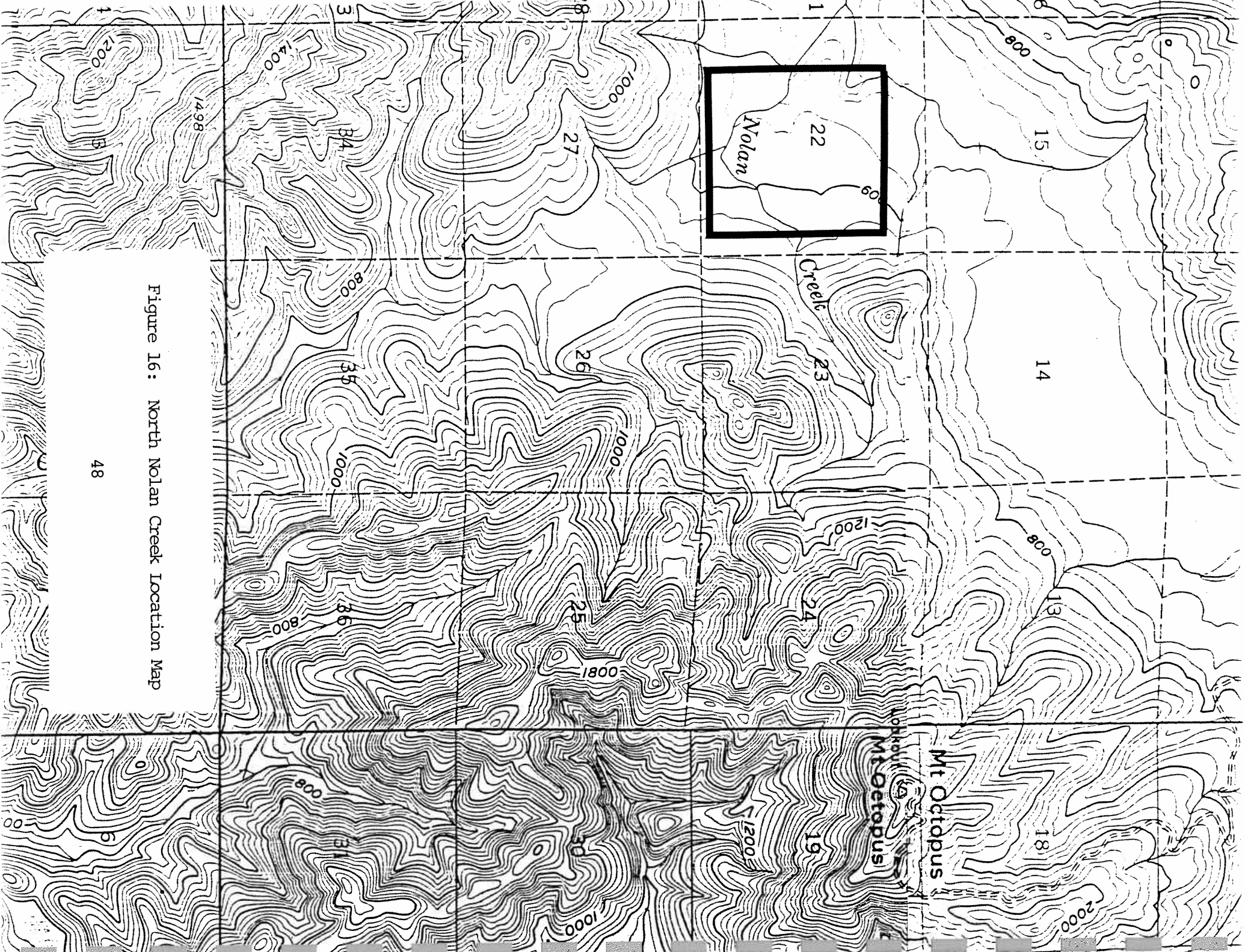


Figure 16: North Nolan Creek Location Map

NORTH NOLAN CREEK

LOCATION:

Western Jefferson County; Section 22, Township 26 North, Range 12 West, Willamette Meridian.

SIGNIFICANCE:

North Nolan Creek is a second tier site. It has been affected by logging, but still contains high quality examples of 3 sphagnum bog communities.

FEATURES:

Sphagnum Bog:

1. Carex rostrata/Sphagnum spp. community
2. Rhynchospora alba-Carex livida/Sphagnum spp. community
3. Thuja plicata-Tsuga heterophylla/Sphagnum spp. community

DESCRIPTION:

Physical: North Nolan Creek is located at 580 feet elevation in shallow depressions within a mixture of glacial till and alluvium. It occurs as two areas covering a total of 20 acres. One area is roughly hemi-spherical in shape and contains examples of all of the bog communities. The second is long and narrow and is composed of forested bog.

The soils are a mixture of sphagnum, fibrous, heath and woody peat. The soils range from being seasonally flooded to permanently supersaturated. There are shallow seasonal ponds. There is no channeled inflow or outflow, but the wetlands are part of the Nolan Creek drainage.

Biological: There are only 2 acres of herb dominated wetlands at this site. The vegetation progresses from shallow ponds with patchy Juncus supiniformis and Carex livida to nearly pure Rhynchospora alba around the margins of the ponds, to a species rich area dominated by C. livida, R. alba, Sanguisorba officinalis and Gentiana sceptrum. The latter area has patches of dwarfed Thuja plicata. The western portion of the bog meadow has low vegetative cover and is codominated by Carex rostrata and G. sceptrum.

The herb dominated area grades into a scrubby and then a commercial quality Thuja plicata-Tsuga heterophylla/Sphagnum spp. community. The second, long narrow area of wetland which composes this site is a commercial T. plicata-T. heterophylla/Sphagnum spp. community.

CONDITION:

North Nolan Creek wetland is in relatively good condition. The long narrow area is in excellent condition and is surrounded by old growth forest. The hemispherical area has been logged along the eastern half, and an area of bog forest was harvested. No buffer was left. There is an old logging spur which provides access to the bog and has a weedy plant species, Juncus effusus growing along it.

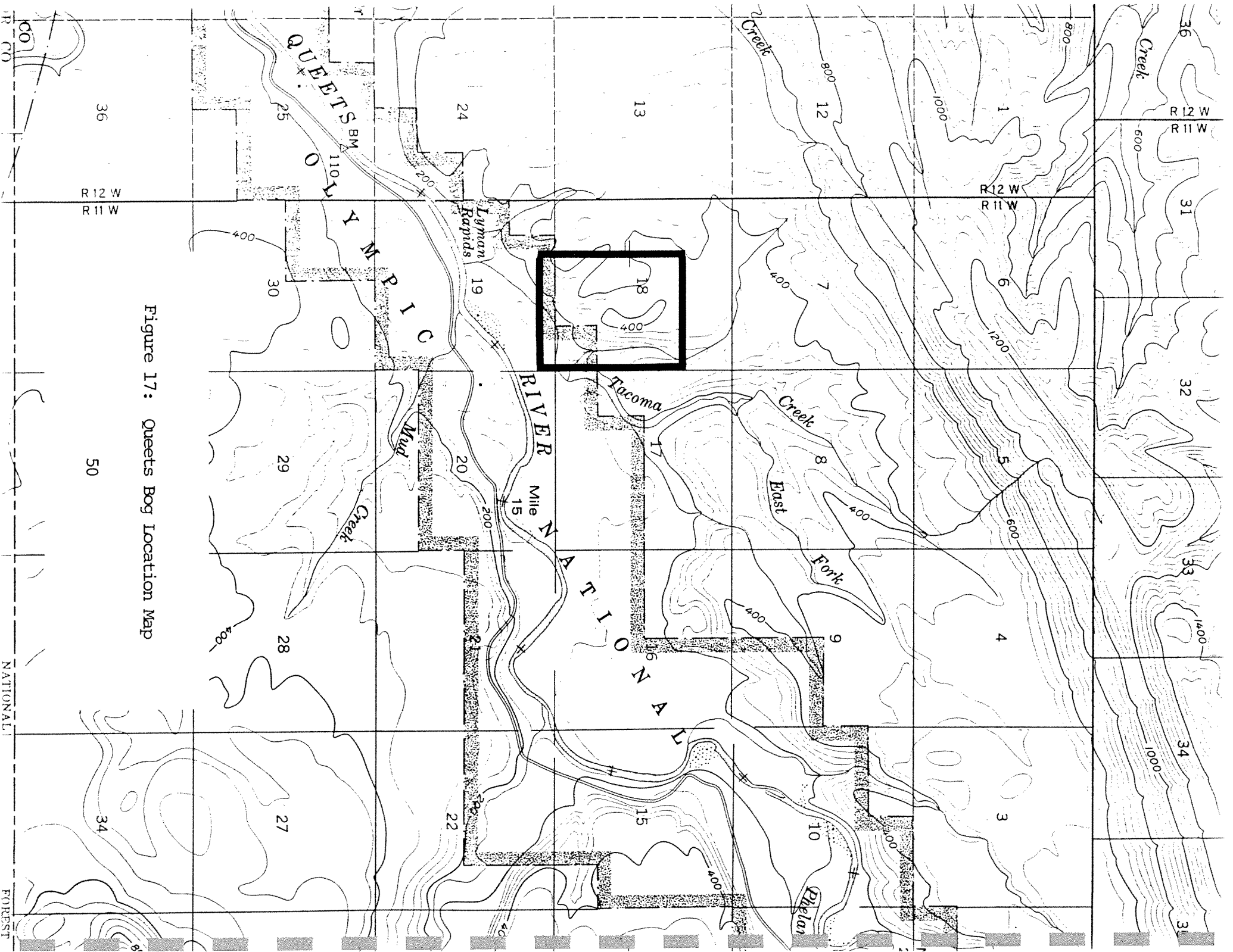


Figure 17: Queets Bog Location Map

R 12 W
R 11 W

50

R 12 W
R 11 W

NATIONAL

FOREST

QUEETS BOG

LOCATION:

Western Jefferson County; Section 18, Township 24 North, Range 11 West, Willamette Meridian.

SIGNIFICANCE:

Queets Bog is a second tier site. It contains high quality examples of 4 sphagnum bog communities.

FEATURES:

Sphagnum Bog:

1. Carex rostrata/Sphagnum spp. community
2. Kalmia occidentalis-Ledum groenlandicum/Sphagnum spp. community
3. Pinus contorta/Ledum groenlandicum/Sphagnum spp. community
4. Thuja plicata-Tsuga heterophylla/Sphagnum spp. community

DESCRIPTION:

Physical: Queets Bog is a 12 acre wetland on a glacial terrace at 400 feet elevation. It occurs in a depression within an area of gravelly glacial till with a cemented layer. Wetland soils are a mixture of sphagnum, fibrous, heath and woody peat. The wetland may be seasonally flooded, but is reduced to saturated soils during the summer.

Biological: The bog is quite diverse for its size. The northern end of the bog contains an example of a Pinus contorta/Ledum groenlandicum/Sphagnum spp. community. The P. contorta are up to 10 inches in diameter and over 120 years old. The understory is open. It is species rich and has high percent cover of Kalmia occidentalis, L. groenlandicum, Carex rostrata, Sanguisorba officinalis and Pteridium aquilinum. Both P. contorta and Thuja plicata are reproducing.

The Thuja plicata-Tsuga heterophylla/Sphagnum spp. bog forest community is located on the west slope of the wetland. It is typical of this kind of bog forest, with high percent cover of Gaultheria shallon and Vaccinium alaskaense on fallen logs and Lysichitum americanum and Cornus canadensis on the soil.

The open area of the bog is a mixture of the Carex rostrata/Sphagnum spp. and Kalmia occidentalis-Ledum groenlandicum/Sphagnum spp. communities. The former has high percent cover of C. rostrata and S. officinalis. The latter is a low-growing, open example of the community with the former community intermixed.

CONDITION:

For the most part, the Queets Bog is in good condition. However, a one acre portion of the P. contorta bog has been clearcut. There is an oddly straight line, visible in aerial photos but not on the ground, in the south end of the bog. There are no exotic species.

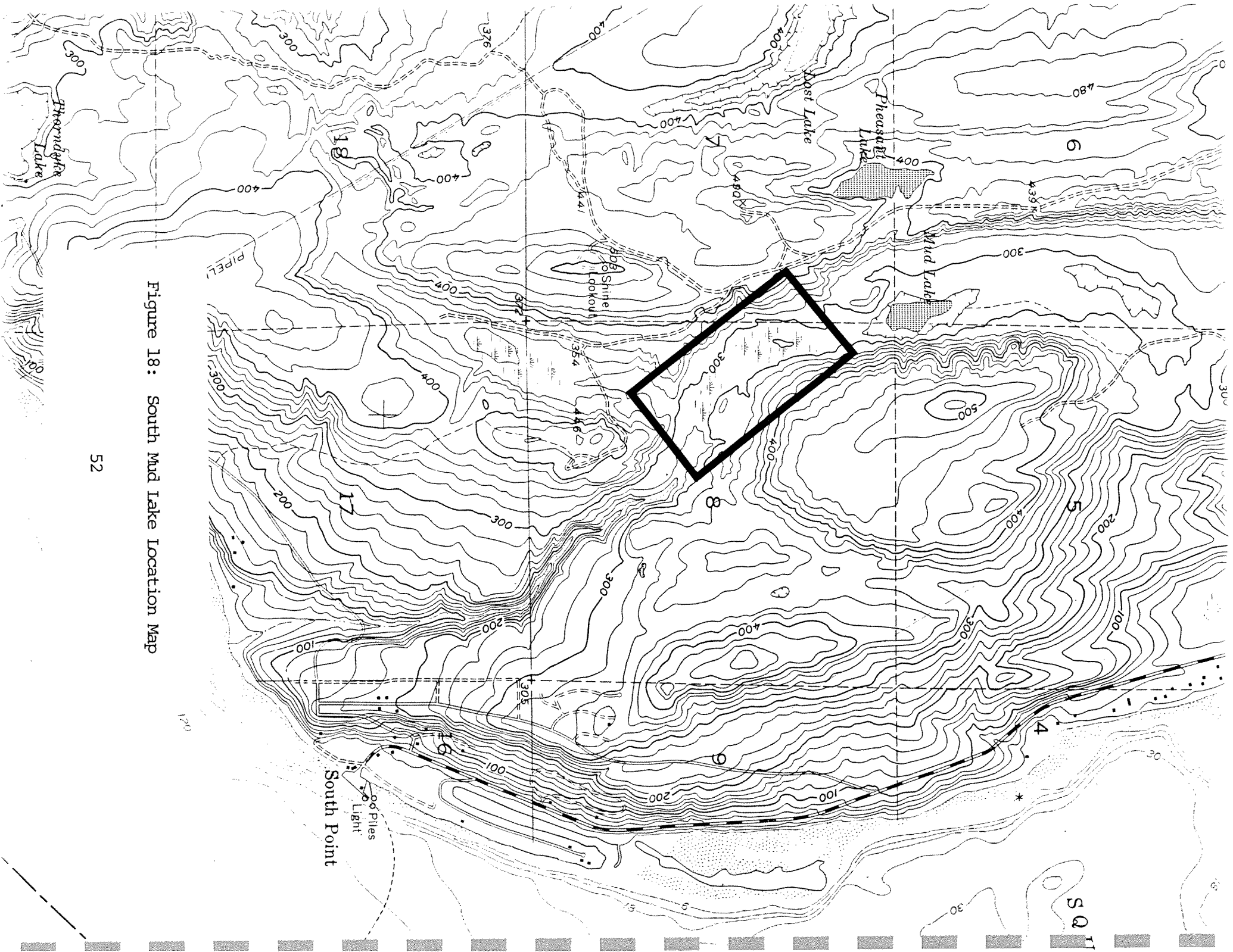


Figure 18: South Mud Lake Location Map

SOUTH MUD LAKE

LOCATION:

Eastern Jefferson County; Section 8, Township 27 North, Range 1 East, Willamette Meridian.

SIGNIFICANCE:

South Mud Lake is a second tier site. The wetland is composed of 2 freshwater wetland and one sphagnum bog communities.

FEATURES:

Sphagnum Bog:

1. Ledum groenlandicum/Sphagnum spp. community

Freshwater Wetland:

1. Salix spp.-Spiraea douglasii community
2. Spiraea douglasii community

DESCRIPTION:

Physical: The South Mud Lake wetland system is approximately 16 acres. It is located on a glacial terrace at an elevation of 300 feet. The wetland has developed on glacial till. Soils are a mixture of fibrous, heath and sphagnum peat.

The wetland has a perched water table and water levels are partially controlled by beavers. Most of the wetland is permanently flooded, except for the approximately 4 acre sphagnum bog, which is supersaturated. The wetland has no channeled inflow but drains to the south into Hood Canal.

Biological: The southern half of the wetland is a species rich, beaver controlled system. It is slightly larger than 4 acres and is permanently flooded. At one time it was dry enough for conifers to grow. It is dominated by Salix spp., Spiraea douglasii, Nuphar polysepalum, Typha latifolia and Sparganium emersum.

The northern part of the wetland is composed of a 4 acre sphagnum bog encircled by a 7.5 acre permanently flooded S. douglasii community. Salix spp. and Carex rostrata have high cover values within the S. douglasii community. The sphagnum bog community is dominated by 4-5 foot tall Ledum groenlandicum. There are snags and smaller living conifers in the bog.

CONDITION:

South Mud Lake is recovering from past human disturbance. There are cut stumps in the southern part of the wetland. Stumps in the northern part are rotted so it's difficult to tell if the trees were cut. The raised water levels appear to be due to the activities of beavers.

Although the wetlands are disturbed, no exotic species were observed and the vegetation appears to be recovering well.

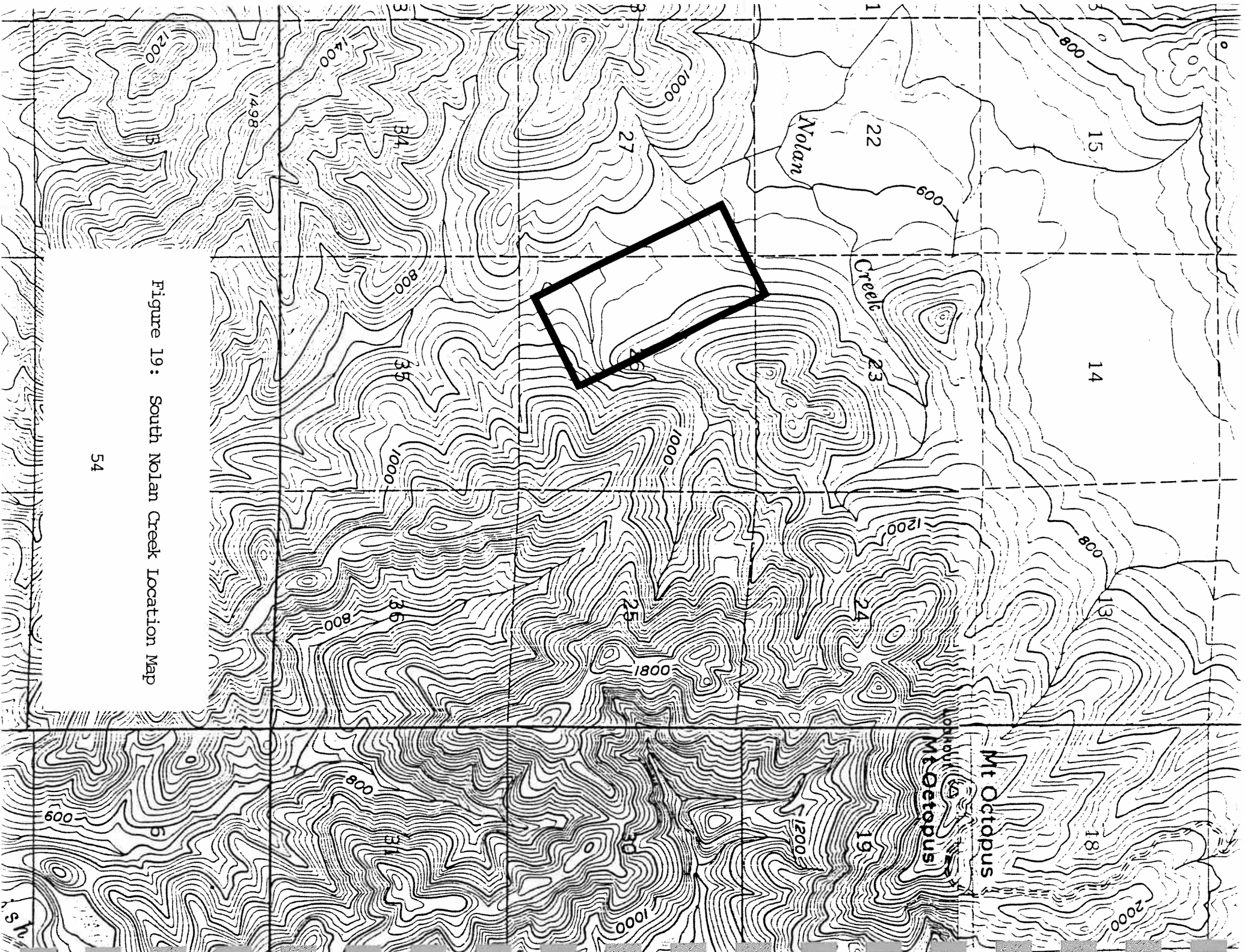


Figure 19: South Nolan Creek Location Map

SOUTH NOLAN CREEK

LOCATION:

Western Jefferson County; Sections 26 and 27, Township 26 North, Range 12 West, Willamette Meridian.

SIGNIFICANCE:

South Nolan Creek is a second tier site. It has been selectively logged, but still contains high quality examples of 4 sphagnum bog communities.

FEATURES:

Sphagnum Bog:

1. Carex rostrata/Sphagnum spp. community
2. Juncus supiniformis/Sphagnum spp. community
3. Rhynchospora alba-Carex livida/Sphagnum spp. community
4. Thuja plicata-Tsuga heterophylla/Sphagnum spp. community

DESCRIPTION:

Physical: South Nolan Creek is located at 960 feet elevation and seems to overlap two drainages, Nolan Creek and Christmas Creek. It is a long narrow wetland which covers 25 acres.

The wetland occurs on a mixture of glacial till and alluvium. The soils are a mixture of sphagnum, fibrous, heath and woody peat. There is no apparent channeled inflow or outflow. The wetland may be seasonally flooded, but soils are only wet during the summer. There are shallow seasonal ponds.

Biological: There are nearly 6.4 acres of herb dominated wetlands at this site. The vegetation progresses from shallow ponds with patchy Juncus supiniformis, to a species rich area dominated by Rhynchospora alba around the margins of the ponds, to a species rich area codominated by Carex livida, Carex rostrata and Sanguisorba officinalis.

The herb dominated area grades into a scrubby Thuja plicata-Tsuga heterophylla/Sphagnum spp. community with up to 25% cover of T. plicata. This area grades into a denser example of the community that has been selectively cut.

CONDITION:

South Nolan Creek wetland is in relatively good condition. The herb dominated area appears untouched. The denser bog forest was selectively logged in the past. The scrubby bog forest is largely untouched, except where recent clearcuts have gone to the wetland edge and no buffers were left.

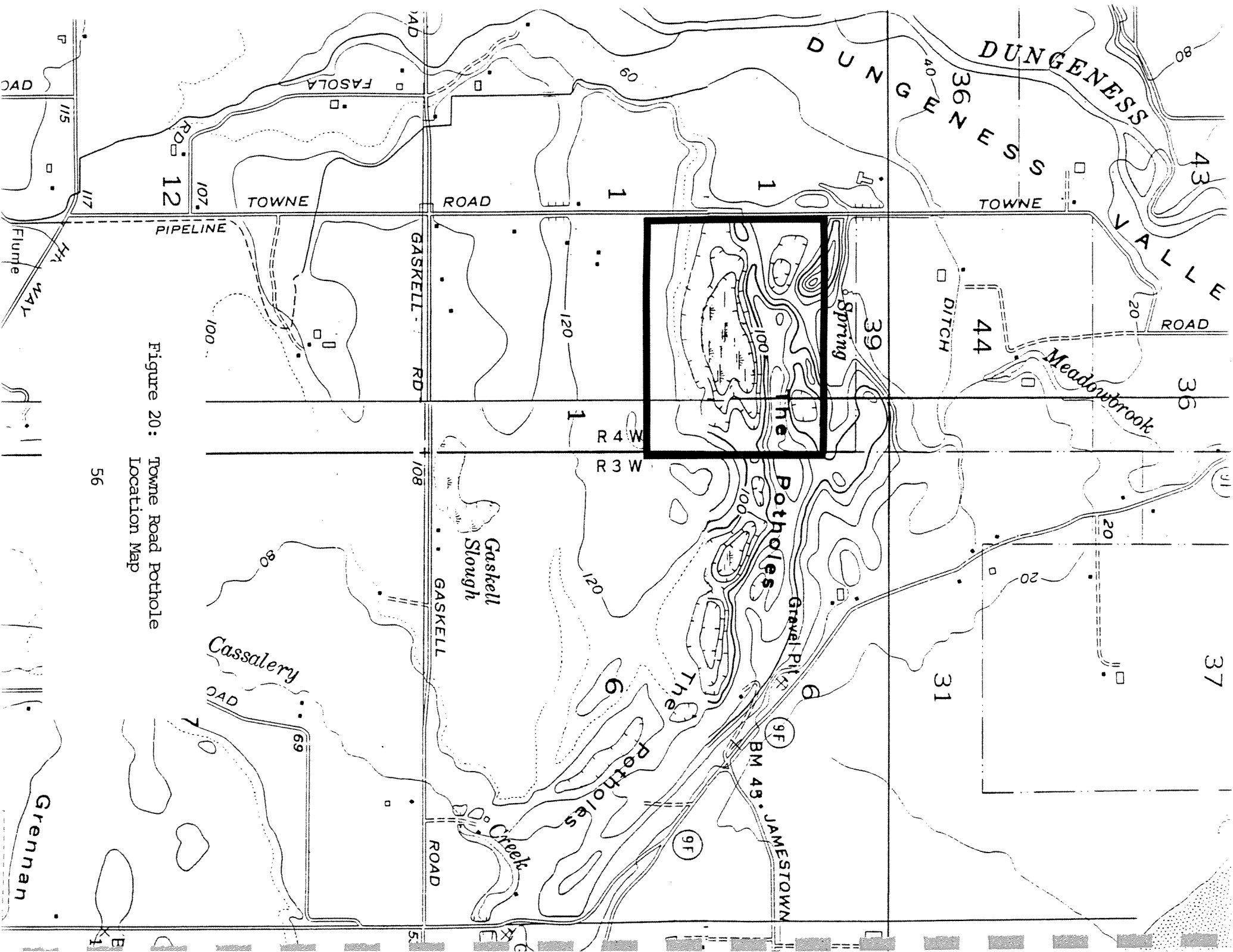


Figure 20: Towne Road Pothole Location Map

TOWNE ROAD POTHOLE

LOCATION:

Eastern Clallam County; Section 1, Township 30 North, Range 4 West, Willamette Meridian.

SIGNIFICANCE:

Towne Road Pothole is a second tier site. The wetland is being encroached upon by suburban development, but still has a relatively high quality example of a freshwater wetland.

FEATURES:

Freshwater Wetland:

1. Nuphar polysepalum community
2. Carex cusickii community

DESCRIPTION:

Physical: Towne Road Pothole is located at 40 feet elevation in a depression within a lateral moraine. It occurs on glacial outwash. Wetland soils are organic muck and fibrous peat with woody material. The wetland has no inflow or outflow, but receives water from precipitation and sheet flow. It is permanently flooded.

Biological: The wetland vegetation is chaotic, probably due to large water level fluctuations. The deepest areas are covered with Nuphar polysepalum. Other areas have quaking mats of Carex cusickii over which several shrub and herb species grow. The remainder of the wetland is a species rich mixture of emergent shrubs and herbs such as Salix spp., Cornus stolonifera, Spiraea douglasii, Typha latifolia, C. cusickii and Oenanthe sarmentosa. Large Thuja plicata snags are scattered through this portion of the wetland.

CONDITION:

The wetland is being encroached on by development and fill. Recently, fill was pushed into the western end of the wetland. Houses are being built on the ridge to the north of the wetland. If the filling and development continue, the wetland is expected to be badly damaged.

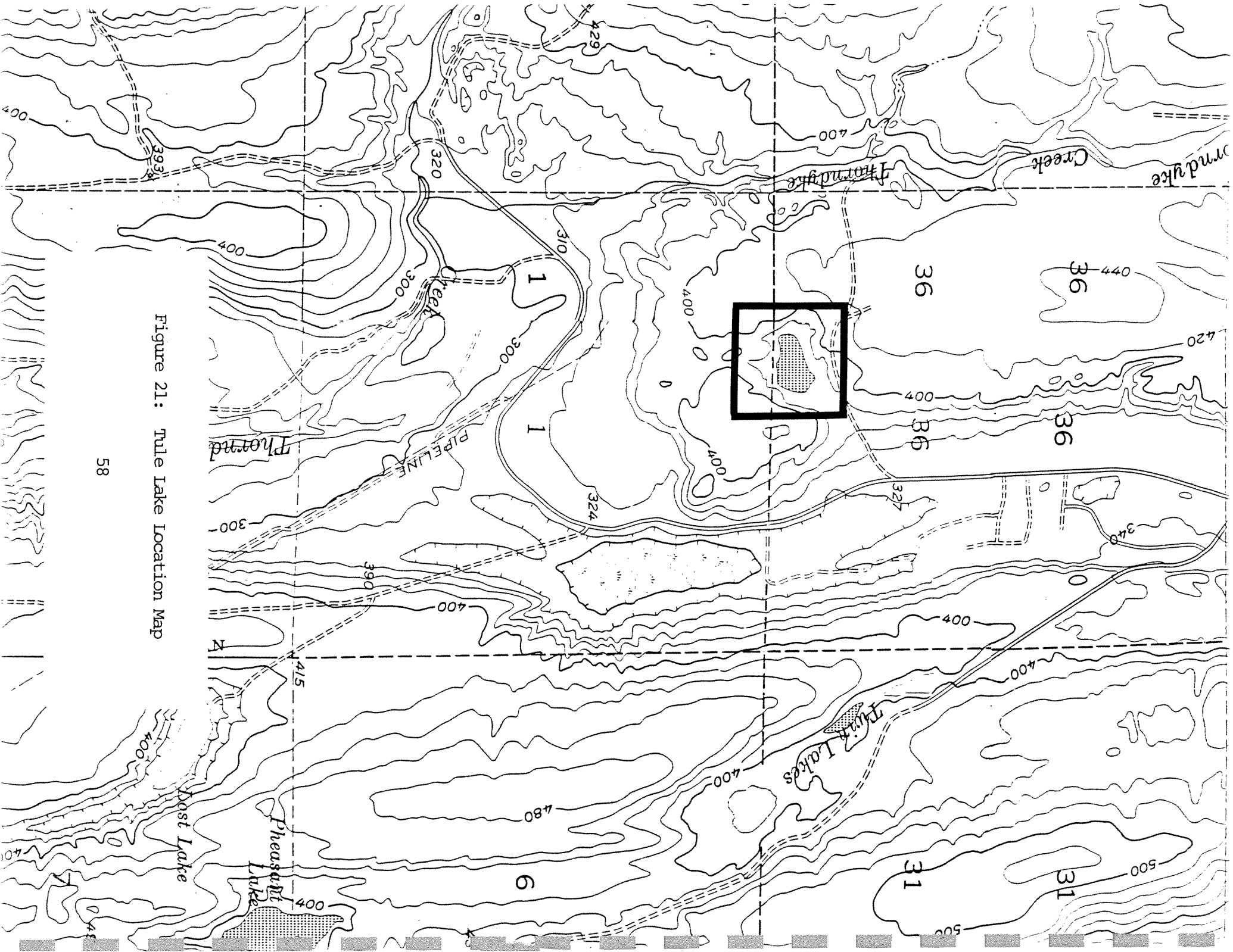


Figure 21: Tule Lake Location Map

TULE LAKE

LOCATION:

Eastern Jefferson County; Section 36, Township 28 North, Range 1 West, Willamette Meridian.

SIGNIFICANCE:

Tule Lake is a second tier site. The site contains examples of four freshwater wetland communities and a 1 acre pond.

FEATURES:

Freshwater Wetland:

1. Nuphar polysepalum community
2. Scirpus acutus community
3. Dulichium arundinaceum community
4. Spiraea douglasii community

DESCRIPTION:

Physical: Tule Lake consists of a 6 acre wetland and one acre pond. It is located at an elevation of 380 feet on a glacial terrace. The wetland occurs on glacial till, over a cemented layer. The wetland soils are muck with some fibrous and heath peat.

Most of the wetland is permanently flooded. It has no apparent channeled inflow or outflow.

Biological: The wetland vegetation forms concentric zones around the pond. The unvegetated pond is surrounded by Scirpus acutus with Nuphar polysepalum intermixed. The next landward zone is composed nearly exclusively of Dulichium arundinaceum. Within this zone are what appear to be channels which are vegetated with N. polysepalum. Along the upland margin of the wetland is a narrow, seasonally flooded zone dominated by Spiraea douglasii. S. douglasii forms a dense, nearly monotypic stand with an occasional Pyrus fusca.

CONDITION:

The wetland appears relatively undisturbed. A make-shift boat launch area has been bulldozed into the north side of the lake. Soil and vegetation was pushed into the wetland and to either side of the boat launch. The uplands are all second growth, and were recently thinned.

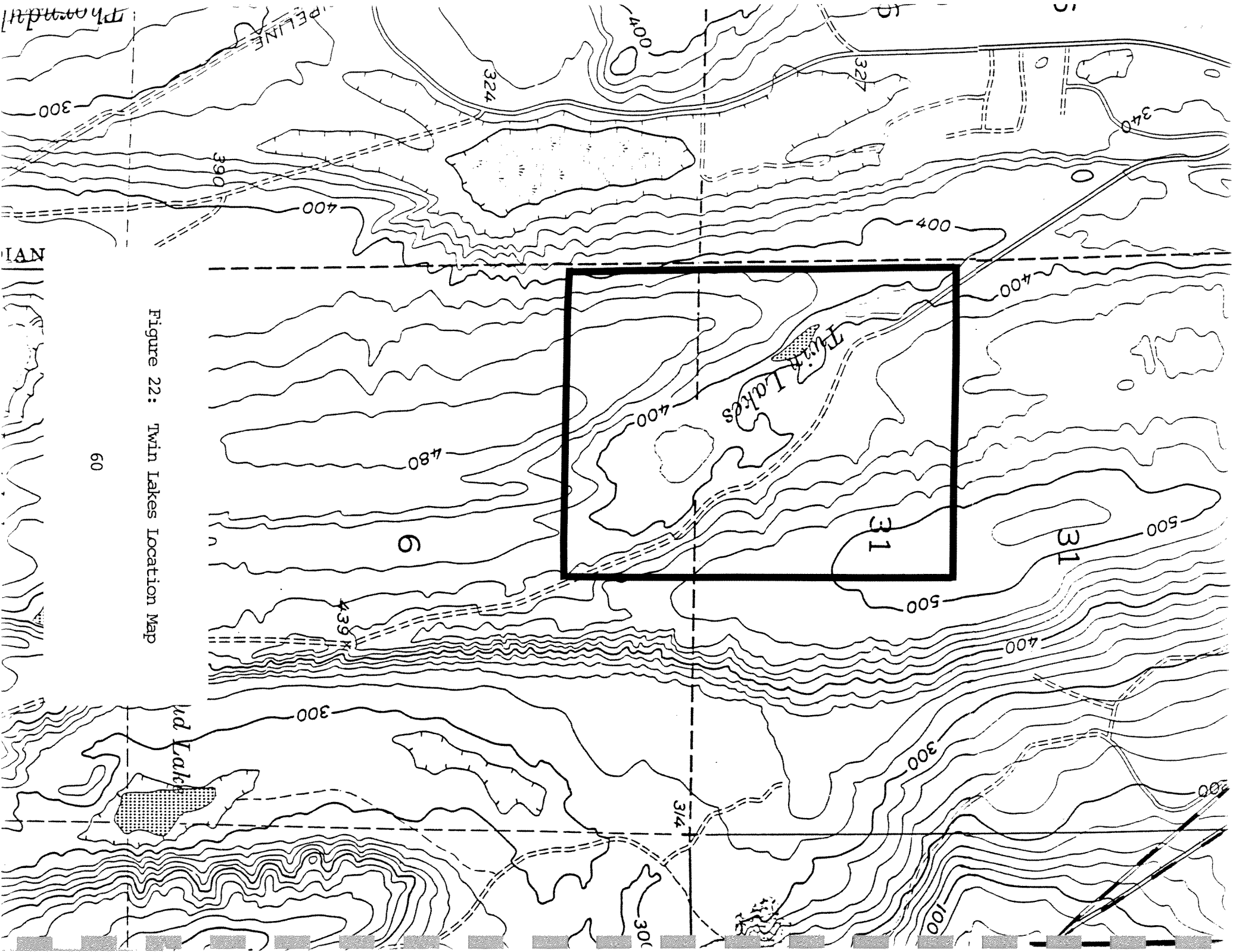


Figure 22: Twin Lakes Location Map

TWIN LAKES

LOCATION:

Eastern Jefferson County; Section 6, Township 27 North, Range 1 East, Willamette Meridian.

SIGNIFICANCE:

Twin Lakes is a second tier site. It contains 2 ponds, and examples of 6 freshwater wetland and 2 sphagnum bog communities.

FEATURES:

Sphagnum Bog:

1. Carex cusickii/Sphagnum spp. community
2. Kalmia occidentalis-Ledum groenlandicum/Sphagnum spp. community

Freshwater Wetland:

1. Nuphar polysepalum community
2. Carex vesicaria community
3. Dulichium arundinaceum community
4. Juncus balticus community
5. Pyrus fusca community
6. Spiraea douglasii community

DESCRIPTION:

Physical: Twin Lakes is a 28 acre wetland system composed of 10 acres of open water in two ponds, 17 acres of vegetated freshwater wetlands and 1 acre of sphagnum bog vegetation. It is located at an elevation of 400 feet on a glacial terrace. It has developed on glacial till, probably over a cemented layer.

The southern half of Twin Lakes is somewhat oval in shape. There is a central pond surrounded by peat mats, over which most of the different freshwater wetland communities and all of the site's sphagnum bog communities occur. The freshwater wetlands may be seasonally flooded. Soils are mostly fibrous, heath and sphagnum peat. Organic muck occurs within the pond.

The northern half of the wetland is long and narrow with steep sides. The margins of the northern wetland are vegetated but peat mats have not developed here as in the southern half of the wetland. The interior of this long narrow area is permanently, but shallowly flooded. The vegetated margin grades from permanently to seasonally flooded. Soils are muck, and fibrous and heath peat.

A small channel connects the two ponds, and the wetland is continuous.

Biological: Around the southern pond is a discontinuous band of Nuphar polysepalum about 10-15 feet wide. Scirpus subterminalis and Dulichium arundinaceum extend out into this band. Landward of this zone is the seasonally flooded peat mats. The vegetation on the mats is a mosaic of

D. arundinaceum and Juncus balticus dominated communities with patchy high cover of Carex oederi, Rhynchospora alba, Juncus supiniformis and N. polysepalum.

The northern wetland is characterized by dense Carex vesicaria meadows which are permanently to seasonally flooded. There are patches in the shallow open water which are dominated by Puccinellia pauciflora or Fleocharis acicularis.

Landward of the herb dominated wetland communities is a broad zone dominated by Spiraea douglasii. This zone appears to be seasonally flooded. In the southern half of the wetland, this zone has peat soils. In the northern half, the zone has a mixture of peat and mineral soils. In general, S. douglasii is low-growing at this site and has several associated species. Carex obnupta is co-dominant in areas that have some Sphagnum spp. cover. In other areas either Carex vesicaria or Pyrus fusca are co-dominant.

There is one relatively large area of sphagnum bog along the northwest margin of the southern pond. Along the pond margin is a narrow band of Carex cusickii/Sphagnum spp. community. The rest of the bog is an example of a low-growing Ledum groenlandicum/Sphagnum spp. community, with high cover of Kalmia occidentalis and Vaccinium oxycoccos.

CONDITION:

Twin Lakes is in relatively good condition. Both the northern and southern ponds have roughly developed access points. The northern access is a rough road that ends in a boat launch. It is located in an area that has very little wetland so the boat launch has caused relatively little damage. The southern access is a foot path which crosses a broad area of freshwater wetland. Unfortunately, motorcycles have gone down the foot path and been driven through the southeast portion of the marsh, forming "donuts" in the marsh vegetation and peat. A foot path extends north, through the marsh, from the southern access.

The remains of a small shelter are located on the southeast portion of the peat mat, adjacent to the pond edge.

There are indications that the water level in the wetland has changed over time, but that may be a natural occurrence. Old maps show the northern pond to be smaller than it currently is. The water level in the southern wetland also appears higher than in the past: stumps indicate that a few trees once grew near the pond margin and there are areas of submerged sphagnum peat that may have been above the water level at one time.



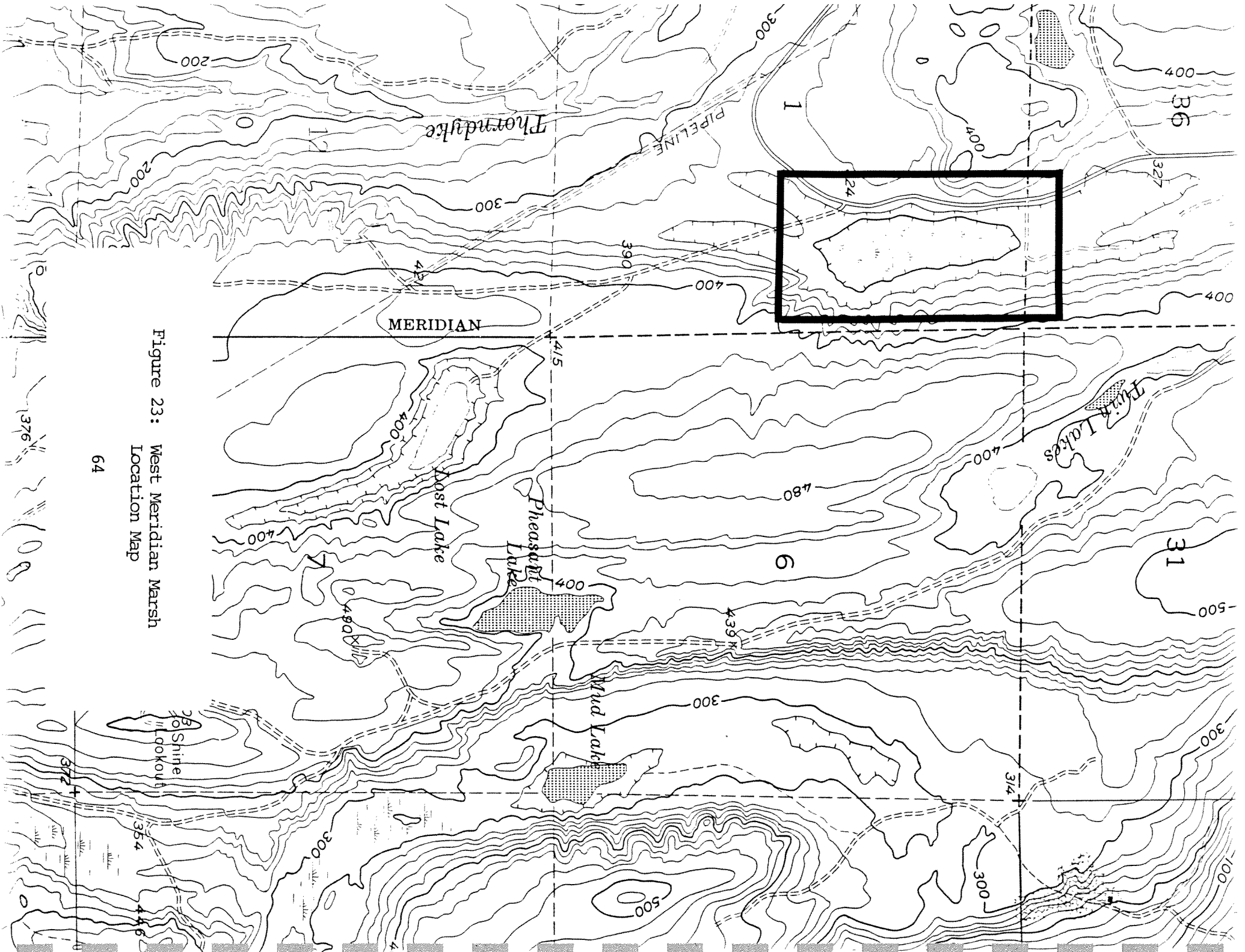


Figure 23: West Meridian Marsh
Location Map

WEST MERIDIAN MARSH

LOCATION:

Eastern Jefferson County; Section 1, Township 27 North, Range 1 West, Willamette Meridian.

SIGNIFICANCE:

West Meridian Marsh is a second tier site. It contains examples of four freshwater wetland communities.

FEATURES:

Freshwater Wetland:

1. Nuphar polysepalum community
2. Dulichium arundinaceum community
3. Juncus balticus community
4. Spiraea douglasii community

DESCRIPTION:

Physical: West Meridian Marsh is an 18 acre oblong-shaped wetland located at 300 feet elevation on a glacial terrace. It occurs in a shallow basin that has neither an inflow nor an outflow. Most of the wetland is permanently, but shallowly flooded. Soils are a combination of fibrous and heath peat, and a little sphagnum peat.

Biological: The wetland is completely vegetated. There is a band of Spiraea douglasii community around the upland edge of the wetland. It occurs on a slope and is seasonally flooded and dried. This community is nearly pure S. douglasii, except for some Sphagnum spp.

The main body of the wetland is a mosaic of Nuphar polysepalum, Juncus balticus and Dulichium arundinaceum communities. The N. polysepalum community occurs in the deepest portions of the wetland where soils are permanently flooded, organic muck. It is co-dominated by N. polysepalum and Scirpus subterminalis. The nearly monotypic D. arundinaceum community occurs in water up to 15 inches deep, over soft fibrous peat. The Juncus balticus community occurs in water up to 12 inches deep over firmer fibrous peat, and is nearly a monotypic stand of J. balticus.

CONDITION:

West Meridian Marsh appears to be in good condition. The wetland vegetation appears to have undergone a change in the recent past, as indicated by S. douglasii stumps which occur throughout. The change is most likely due to a change in the water level, of unknown cause. For the most part, the wetland is composed of native plant species. There is one small population of Phalaris arundinacea in the south-central portion of the wetland.

An old road lies along the northern margin of the wetland, but appears to have caused minor damage. The uplands have all been logged in the past. Those around the south end of the wetland have recently been logged, leaving a very narrow partial buffer.



GLOSSARY

Dominant - a plant species which covers at least 20 percent of an area.

Exotic - a non-native species.

Fibrous Peat - peat composed of the remains of herbaceous plants, mostly sedges. It contains little if any Sphagnum spp.

Freshwater - water with less than 0.5 parts per thousand marine derived salt.

Heath Peat - peat composed of the remains of shrubby plants.

Hummock - a small mound. Hummocky microtopography consists of small mounds, usually composed of sphagnum moss.

Impounded - backed-up or accumulated behind an obstruction. An impounded wetland is one in which water has backed-up or accumulated behind an obstruction such as a beaver dam.

Lagg - the mineral-rich drainage area surrounding a sphagnum bog.

Minerotrophic Water - water that has been in contact with mineral soil.

Minor Occurrence - a plant species which covers less than 5 percent of a given area.

Muck - peat decomposed to such a degree that plant parts can not be distinguished.

Native - indigenous to, or originating naturally in, Washington; remaining or growing in an unaltered natural condition.

Peat - the remains of plants which have accumulated in water or in wet places.

Pristine - having never been disturbed or altered from the native condition.

Sphagnum Bog - a wetland with a well developed Sphagnum moss or peat layer and resultant distinctive flora.

Sphagnum Peat - peat composed primarily of Sphagnum spp.

Subdominant - a plant species which covers between 5 and 20 percent of an area.

Woody Peat - peat composed of particles of partially decomposed wood.



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APPENDIX A

PRELIMINARY CLASSIFICATION OF OLYMPIC PENINSULA FRESHWATER WETLANDS

This is an initial classification of native vegetation in impounded freshwater wetlands located in the lowlands of the Olympic Peninsula, Washington: Clallam and Jefferson Counties.

The classification is intended to assist in the characterization and comparison of native wetlands on the Olympic Peninsula, but also uses comparative data from the lowlands of the Puget Trough region and southwestern Washington. It was developed following a review of the literature and one year of reconnaissance level field surveys of relatively undisturbed wetlands. It should be treated as a preliminary classification, ready for quantitative field testing.

During field surveys, each site was characterized by describing its apparent physical characteristics and plant communities. The communities were identified by: 1) dominant species, 2) presence or absence of key indicator species, and 3) observable differences in environmental conditions, such as soil characteristics or hydrology. A range of percent cover was recorded for all observed species in relatively undisturbed and accessible wetlands.

Wetland plant communities are difficult to define. Discrete communities are not typical. Instead, continua and mosaics of species appear to be the norm. Some of the recognized communities recur throughout the inventory area. Others are variable, but tend towards recurring communities. Yet others do not recur or are not consistent in their associated species or environmental characteristics.

The classification below has been divided into two parts. The first includes recurring communities, that is, those for which at least three examples were found. The second includes communities observed to occur two or fewer times, or which occurred more frequently but were highly variable in their associated species composition.

The classification is similar to that used for the May, 1986 Northwest Wetlands Technical Conference convened by the Washington Department of Ecology in Port Townsend, Washington. The classification differs from that used at the conference in that it does not include information on soils. It also provides one finer level of resolution than did the conference classification; the plant community level. The classification is compatible with Cowardin et al., 1979.

CLASSIFICATION OF REQUIRING COMMUNITIES:

I. Low Elevation Sphagnum Bog

- A. Non-macrophyte
 - 1. bog pond
- B. Herb Dominated
 - 1. Carex cusickii/Sphagnum spp. community
 - 2. Carex livida/Sphagnum spp. community
 - 3. Carex rostrata/Sphagnum spp. community
 - 4. Juncus supiniformis/Sphagnum spp. community
 - 5. Rhynchospora alba-Carex livida/Sphagnum spp. community
 - 6. Sanguisorba officinalis/Sphagnum spp. community
- C. Shrub Dominated
 - 1. Kalmia occidentalis-Ledum groenlandicum/Sphagnum spp. community
 - 2. Ledum groenlandicum/Sphagnum spp. community
- D. Tree Dominated
 - 1. Pinus contorta/Ledum groenlandicum/Sphagnum spp. community
 - 2. Thuja plicata-Tsuga heterophylla/Sphagnum spp. community
 - 3. Tsuga heterophylla/Ledum groenlandicum/Sphagnum spp. community

II. Low Elevation Freshwater Wetland

- A. Permanently Flooded
 - 1. Non-macrophyte
 - a. pond/lake
 - 2. Macrophyte
 - a. Nuphar polypetalum community
 - b. Scirpus acutus community
 - c. Scirpus subterminalis community
 - d. Typha latifolia community
- B. Saturated soils or Seasonally Flooded
 - 1. Herb Dominated
 - a. Carex vesicaria community
 - b. Dulichium arundinaceum community
 - c. Juncus balticus community
 - 2. Shrub Dominated
 - a. Pyrus fusca community
 - b. Salix spp.-Spiraea douglasii community
 - c. Spiraea douglasii community
 - 3. Tree Dominated
 - none

CLASSIFICATION OF NON-RECURRING COMMUNITIES:

I. Low Elevation Sphagnum Bog

- A. Non-macrophyte
none
- B. Herb Dominated
none
- C. Shrub Dominated
 - 1. Vaccinium oxycoccos/Sphagnum spp. community
- D. Tree Dominated
none

II. Low Elevation Freshwater Wetland

- A. Permanently Flooded
 - 1. Non-macrophyte
none
 - 2. Macrophyte
 - a. Puccinellia pauciflora community
- B. Saturated Soils or Seasonally Flooded
 - 1. Herb Dominated
 - a. Carex cusickii community
 - b. Carex rostrata community
 - 2. Shrub Dominated
none
 - 3. Tree Dominated
none

APPENDIX B

OLYMPIC PENINSULA FRESHWATER WETLAND COMMUNITY DESCRIPTIONS

Described below are those wetland communities which are known to occur within the study area. The descriptions provide information on physical and floristic characteristics of each community. Included are species lists which distinguish between the dominant or characteristic species ("Typical Species"), and those which are minor or uncharacteristic ("Other Species"). Average percent cover is given for the "typical species".

The community descriptions are presented in two major groups, the first includes those communities which were observed to recur in the landscape, while the second includes those which were not observed to recur. Within each of these major categories are two subheadings: sphagnum bog and freshwater (non-sphagnum) wetland communities.

Although this study encompasses a small geographic region, there are major differences in climatic conditions and geologic history between the west and east sides of the Olympic Peninsula resulting in very different wetland floras. Although there are wetland plant species found both on the west and east sides of the Peninsula, their communities are very different from each other. The first line of each community description tells where in the study area and elsewhere in western Washington the community occurs.

RECURRING COMMUNITIES

LOW ELEVATION SPHAGNUM BOG COMMUNITIES

A sphagnum bog is characterized by the presence of sphagnum moss species (*Sphagnum* spp.) and sphagnum peat. Bogs have low pH and low nutrient availability. They typically are fed by precipitation, which is low nutrient water. This set of conditions gives rise to an unusual flora, many species of which are unique to sphagnum bogs.

Throughout most of the western Washington lowlands, sphagnum bogs occur in depressions or basins. Their surfaces are flat to convex and they receive water only from precipitation. However, on the west side of the Olympic Mountains bogs can occur on slopes as well as in basins. The ability to develop sloping bogs is due to the high precipitation/evaporation ratio found on the west side of the Olympic Peninsula. These sloping bogs are probably in contact with some minerotrophic water (water that has been in contact with mineral soil) and have higher nutrient levels than bogs fed exclusively by rain water (Darman, 1986).

Differences in nutrient levels and glacial history are primarily responsible for the observed differences between the bog floras of western and eastern Olympic Peninsula. There are species common to bogs in both areas, but there are many which are only located on one side or the other of the Peninsula.

These floristic differences are great enough so that the same bog communities do not occur in both areas.

Bog Pond: Typically these are small ponds or lakes bounded on at least one side by sphagnum peat. The pH of the water is 5.5 or less. The water is usually brown to red brown in color. Often these ponds are surrounded by mats of sphagnum which slowly extend out over the water's surface and finally fill the basin. These ponds frequently overlay fibrous, heath, woody, and sphagnum peat.

Bog ponds are most common east of the Olympic Mountains within the study area. They occur in glacial scours or kettles and can be a few acres in size.

Small seasonal to permanent ponds occur within sloping bogs on the west side of the Olympic Peninsula. These ponds typically lie perpendicular to the slope and catch water flowing over the bog surface and seeping downhill through the peat. They are typically oblong and only a few square feet. The seasonal ponds often support populations of Juncus supiniformis.

Carex cusickii/Sphagnum spp. community: This community occurs in eastern Jefferson and Clallam Counties, and throughout the Puget Trough lowlands. It occurs along the water's edge of floating or quaking sphagnum mats. Some of the species extend out into the open water in advance of the sphagnum mat, possibly forming a support structure around which Sphagnum spp. grow. Substrates are mostly sphagnum and fibrous peat, with some heath peat.

Typical Species:

Agrostis scabra
Carex cusickii 25-50%
Menyanthes trifoliata
Potentilla palustris 2-20%
Sphagnum spp. 100%

Other Species:

Cicuta douglasii
Drosera rotundifolia
Kalmia occidentalis
Lycopus uniflorus
Spiraea douglasii
Vaccinium oxycoccos
Veronica scutellata

Carex livida/Sphagnum spp. community: This community is typical of sloping bogs in western Jefferson County and also occurs along the coast in southwestern Washington. It is only known to occur at one site in the Puget Trough region. It occurs on supersaturated sphagnum and fibrous peat soils, in areas which are probably seasonally flooded. It can be in contact with minerotrophic water, and living Sphagnum spp. usually do not exceed 50% cover.

Typical Species:

Carex livida 15-25%
Carex rostrata 1-10%
Sphagnum spp. 0-50%

Other Species:

Agrostis sp.	Juncus cf ensifolius
Agrostis scabra	Juncus supiniformis
Anemone oregana var. felix	Kalmia occidentalis
Boykinia elata	Nephrophyllidium crista-galli
Calamagrostis canadensis	Rhynchospora alba
Camassia sp.	Sanguisorba officinalis
Carex interior complex	Spiranthes romanzoffiana
Deschampsia caespitosa	Trientalis arctica
Gentiana sceptrum	Vaccinium oxycoccos
Hypericum anagalloides	Viola sp.

Carex rostrata/Sphagnum spp. community: This community occurs in western Jefferson County and intergrades with the Carex livida/Sphagnum spp. and Sanguisorba officinalis/Sphagnum spp. communities. It occurs on mixed sphagnum and fibrous peat soils which are permanently flooded with a few inches of water, or are supersaturated. Typically it occurs in a shaded portion of a site. Although it is a species rich community, most species have low cover values (< 5%). The Thuja plicata are always stunted, and usually are only a few feet tall.

Typical Species:

Carex rostrata 10-25%
Sphagnum spp. 60-95%

Other Species:

Agrostis sp.	Linnaea borealis
Agrostis scabra	Nephrophyllidium crista-galli
Anemone oregana var. felix	Pinus contorta
Blechnum spicant	Pinus monticola
Boykinia cf elata	Pteridium aquilinum
Camassia sp.	Rhamnus purshiana
Carex interior complex	Rhynchospora alba
Carex livida	Sanguisorba officinalis
Deschampsia caespitosa	Thuja plicata
Drosera rotundifolia	Trientalis arctica
Gentiana sceptrum	Vaccinium oxycoccos
Hypericum anagalloides	Viola sp.
Kalmia occidentalis	Xerophyllum tenax
Ledum groenlandicum	

Juncus supiniformis/Sphagnum spp. community: This community occurs in western Jefferson County in small seasonally flooded depressions or ponds. The substrate is probably a mixture of decomposed fibrous and sphagnum peat. The surface layer of peat dries during the summer in most cases, but the underlying peat is saturated. The underlying peat is usually soft and more decomposed than that adjacent to the depression. Although the depressions/ponds occur within sphagnum peat, there is seldom any living Sphagnum spp. A similar community occurs in the Puget Trough, on artificially flooded peat mats, where most of the original vegetation has died.

Typical Species:

Juncus supiniformis 70%

Other Species:

Carex livida
Hypericum anagaloides
Rhynchospora alba

Rhynchospora alba-Carex livida/Sphagnum spp. community: This community occurs in western Jefferson County, and extends south into Grays Harbor County. It occupies the area around ponded or flowing water where the peat is super-saturated and probably seasonally flooded. Often it occupies areas which look like krumholtz; small hummocks or islands with stunted Thuja plicata and drier site species surrounded by saturated peat and wetter site species. This community intergrades with the Carex livida/Sphagnum spp. community.

Typical Species:

Carex livida 1-10%
Kalmia occidentalis 1-10%
Rhynchospora alba 20-65%
Sphagnum spp. 0-90%

Other Species:

Agrostis sp.	Juncus supiniformis
Agrostis aequalvis	Kalmia occidentalis
Agrostis scabra	Lectum groenlandicum
Blechnum spicant	Linnaea borealis
Boykinia cf elata	Nephrrophyllidium crista-galli
Camassia sp.	Pteridium aquilinum
Carex interior complex	Pyrus fusca
Carex rostrata	Sanguisorba officinalis
Deschampsia caespitosa	Thuja plicata
Drosera rotundifolia	Tofieldia glutinosa
Empetrum nigrum	Trientalis arctica
Gaultheria shallon	Vaccinium oxycoccos
Gentiana sceptrum	Viola sp.
Hypericum anagaloides	Xerophyllum tenax
Juncus ensifolius	

Sanguisorba officinalis/Sphagnum spp. community: This community occurs in western Jefferson County, and along the coast of southwest Washington. It is drier and more species rich than the Carex livida/Sphagnum spp. community. Substrates are composed mostly of fibrous and sphagnum peat. The occurrence of this community in sites which have been disturbed in the past suggests that it, or at least Sanguisorba officinalis, is resilient in the face of some past disturbances.

Typical Species:

Carex livida 1-15%
Sanguisorba officinalis 20-60%
Sphagnum spp. 35-100%

Other Species:

Agrostis sp.	Hypericum anagalloides
Agrostis aequivalvis	Kalmia occidentalis
Agrostis scabra	Ledum groenlandicum
Blechnum spicant	Nephrophyllidium crista-galli
Boykinia sp.	Pinus contorta
Calamagrostis canadensis	Pinus monticola
Camassia sp.	Rhynchospora alba
Carex interior complex	Spiranthes romanzoffiana
Carex obnupta	Thuja plicata
Carex rostrata	Trientalis arctica
Carex sitchensis	Tsuga heterophylla
Deschampsia caespitosa	Vaccinium caespitosum
Drosera rotundifolia	Vaccinium oxycoccos
Gentiana sceptrum	Veratrum sp.

Kalmia occidentalis-Ledum groenlandicum/Sphagnum spp. community: This community occurs in western Jefferson County, and extends south into Grays Harbor County. It is a low-growing shrub dominated community which includes a large number of herbaceous species. The tall dense stands of Ledum groenlandicum, which are common over most of the western Washington lowlands, seldom occur here. Substrates are a mixture of heath, sedge and sphagnum peat.

Typical Species:

Kalmia occidentalis 10-50%
Ledum groenlandicum 5-50%
Sphagnum spp. 15-100%
Vaccinium oxycoccos 1-15%

Other Species:

Agrostis sp.	Nephrophyllidium crista-galli
Agrostis scabra	Picea sitchensis
Anemone oregana var. felix	Pinus contorta
Blechnum spicant	Pinus monticola
Boykinia cf elata	Pseudotsuga menziesii
Calamagrostis canadensis	Pteridium aquilinum
Carex interior complex	Pyrus fusca
Carex livida	Rhamnus purshiana
Carex rostrata	Rhynchospora alba
Carex sitchensis	Sanguisorba officinalis
Cornus canadensis	Spiraea douglasii
Deschampsia caespitosa	Thuja plicata
Drosera rotundifolia	Tofieldia glutinosa
Empetrum nigrum	Trientalis arctica
Eriophorum chamissonis	Tsuga heterophylla
Gaultheria shallon	Vaccinium caespitosum
Gentiana sceptrum	Veratrum sp.
Lysichitum americanum	Xerophyllum tenax
Maianthemum dilatatum	

Ledum groenlandicum/Sphagnum spp. community: This community occurs in eastern Jefferson and Clallam Counties, and throughout the Puget Trough lowlands. The substrate is mostly a mixture of sphagnum and heath peat, and is relatively dry. The community ranges from tall dense stands of Ledum groenlandicum with few other associated species, to low-growing shrub dominated communities with many associated species. The latter community typically occurs in areas of hummocky microtopography caused by Sphagnum and other moss species.

Typical species:

Kalmia occidentalis 0-40%
Ledum groenlandicum 10-95%
Sphagnum spp. 0-100%

Other species:

<u>Agrostis scabra</u>	<u>Potentilla palustris</u>
<u>Carex rostrata</u>	<u>Pseudotsuga menziesii</u>
<u>Cladina rangiferina</u>	<u>Pteridium aquilinum</u>
<u>Drosera rotundifolia</u>	<u>Rhamnus purshiana</u>
<u>Eriophorum chamissonis</u>	<u>Rhynchospora alba</u>
<u>Gaultheria shallon</u>	<u>Spiraea douglasii</u>
<u>Juncus cf supiniformis</u>	<u>Thuja plicata</u>
<u>Nuphar polysepalum</u>	<u>Tsuga heterophylla</u>
<u>Picea sitchensis</u>	<u>Vaccinium oxycoccos</u>
<u>Pinus contorta</u>	<u>Vaccinium parvifolium</u>
<u>Pinus monticola</u>	

Pinus contorta/Ledum groenlandicum/Sphagnum spp. community: This community occurs in western Jefferson County and extends south into Grays Harbor County. It varies from open shrublands with low-growing Kalmia occidentalis and Ledum groenlandicum, and scattered stunted Pinus contorta, to stands of pole sized P. contorta with L. groenlandicum and Gaultheria shallon. It occurs on dry firm sphagnum peat, and in some cases there are signs of past fire. Where there are signs of fire, there is little or no living Sphagnum spp. and there is high cover of Pteridium aquilinum.

Typical species:

Gaultheria shallon <1-25%
Kalmia occidentalis 0-35%
Ledum groenlandicum 5-35%
Pinus contorta 20-50%
Pteridium aquilinum 1-35%
Sphagnum spp. 0-100%

Other species:

<u>Agrostis scabra</u>	<u>Hypericum anagalloides</u>
<u>Anemone oregana var. felix</u>	<u>Linnaea borealis</u>
<u>Blechnum spicant</u>	<u>Lysichitum americanum</u>
<u>Boykinia cf elata</u>	<u>Maianthemum dilatatum</u>
cf <u>Calamagrostis</u> sp.	<u>Neprophyllidium crista-galli</u>
<u>Camassia</u> sp.	<u>Sanguisorba officinalis</u>
<u>Carex interior</u> complex	<u>Thuja plicata</u>

Carex rostrata
Cornus canadensis
Drosera rotundifolia
Empetrum nigrum
Eriophorum chamissonis
Gentiana sceptrum

Tofieldia glutinosa
Tsuga heterophylla
Trientalis arctica
Vaccinium oxycoccos
Veratrum sp.
Xerophyllum tenax

Thuja plicata-Tsuga heterophylla/Sphagnum spp. community: This community occurs in western Jefferson County, and extends south into Grays Harbor County. It has an open canopy and at least some living Sphagnum spp. The ground ranges from being covered with shallow standing water to saturated peat. The peat is a combination of sphagnum, fibrous, heath and woody material. Large woody debris and fallen trees are typical, and provide an above ground level substrate that supports upland species. The mid- and understories are a mosaic of wetland and upland species, and of herb and shrub dominated assemblages.

Typical Species:

Blechnum spicant 2-40%
Gaultheria shallon 2-60%
Lysichitum americanum <1-10%
Sphagnum spp. 1-90%
Thuja plicata 15-50%
Tsuga heterophylla 2-45%

Other Species:

Abies amabilis
Agrostis sp.
Agrostis oregonensis
Alnus rubra
Anemone oregana var. felix
Boykinia elata
Camassia sp.
Carex interior complex
Carex livida
Carex obnupta
Carex rostrata
Cornus canadensis
Deschampsia caespitosa
Drosera rotundifolia
Gentiana sceptrum
Hypericum anagalloides
Juncus ensifolius
Juncus supiniformis
Kalmia occidentalis
Ledum groenlandicum
Linnaea borealis
Luzula sp.
Maianthemum dilatatum
Menziesia ferruginea
Picea sitchensis

Pinus monticola
Polystichum munitum
Pseudotsuga menziesii
Pteridium aquilinum
Pyrus fusca
Rhamnus purshiana
Rhynchospora alba
Rubus pedatus
Rubus spectabilis
Rubus ursinus
Sanguisorba officinalis
Scirpus microcarpus
Spiranthes romanzoffiana
Tiarella trifoliata
Tofieldia glutinosa
Trientalis arctica
Trisetum canescens
Vaccinium cf alaskaense
Vaccinium ovatum
Vaccinium oxycoccos
Vaccinium parvifolium
Veratrum sp.
Viola sp.
Xerophyllum tenax

Tsuga heterophylla/Ledum groenlandicum/Sphagnum spp. community: This community occurs infrequently in eastern Jefferson and Clallam Counties, but is common throughout the Puget Trough lowlands, so is listed here as a recurring community. It occurs on slightly raised or drier portions of sphagnum bogs. The substrate is composed of sphagnum, other mosses, heath and woody peat. The trees are small but not highly stunted. The canopy is open. The shrub layer is relatively short, about three feet tall.

Typical Species:

Ledum groenlandicum 40%
Sphagnum spp. 25%
Tsuga heterophylla 35-40%

Other Species:

Eriophorum chamissonis Pinus monticola

LOW ELEVATION FRESHWATER WETLAND COMMUNITIES

Freshwater wetlands are those which have no marine derived salts, and very little sphagnum, either living or in the soil. The pH is greater than 5.5, either circumneutral or basic. They may be high or low nutrient systems.

Nuphar polysepalum community: This community occurs in eastern Jefferson and Clallam Counties and throughout the Puget Trough and southwest Washington lowlands. It is found in shallow permanently flooded areas. This community occurs waterward of emergent vegetation and landward of open water. It occurs as monospecific mats.

Typical species:

Nuphar polysepalum 20-80%

Other species:

none

Scirpus acutus community: This community occurs in eastern Jefferson County and throughout the Puget Trough region. It can occur as a monospecific Scirpus acutus stand or in mixture with Nuphar polysepalum. It is typically found in water 2-3 feet deep, and in this area, forms a ring around deeper open water.

Typical Species:

Nuphar polysepalum 10-20%
Scirpus acutus 30-50%

Other Species:

none

Scirpus subterminalis community: This community occurs in eastern Jefferson County, and the southern Puget Trough lowlands. It occurs in shallow, permanently flooded areas on fibrous peat and muck soils. It is most common in Mason County in ponds within Spiraea douglasii/Sphagnum spp. communities.

Typical Species:

Nuphar polypetalum 20%

Scirpus subterminalis 20%

Other Species:

Dulichium arundinaceum

Juncus cf supiniformis

Puccinellia pauciflora

Typha latifolia community: This community occurs in eastern Jefferson and Clallam Counties and throughout the Puget Trough region. It can occur as a monospecific community or in mixture with the Carex cusickii community. It occurs in standing water as much as 3 feet deep, or on floating sedge mats. Soils are a mixture of muck and fibrous peat.

Typical Species:

Typha latifolia 20-70%

Other Species:

(see Carex cusickii community)

Carex vesicaria community: This community occurs in eastern Jefferson County and is common in kettle wetlands throughout the Puget Trough lowlands. In the study area, this community occurs on fibrous peat soils that are either seasonally or permanently, but shallowly flooded.

Typical Species:

Carex vesicaria 30-95%

Nuphar polypetalum 2-20%

Other Species:

Puccinellia pauciflora

Spiraea douglasii

Dulichium arundinaceum community: This community occurs in eastern Jefferson County and throughout the Puget Trough and portions of southwestern Washington. It occurs on fibrous peat soils that are either seasonally or permanently, but shallowly flooded. Within the study area, it is a relatively species rich community. Incorporated into this community are a few small patches in which Carex oederi and/or Rhynchospora alba are the dominant plant species.

Typical Species:

Dulichium arundinaceum 10-70%

Other Species:

Carex livida	Menyanthes trifoliata
Carex oederi	Nuphar polysepalum
Carex vesicaria	Potentilla palustris
Eleocharis acicularis	Rhynchospora alba
Juncus balticus	Scirpus subterminalis
Juncus cf. supiniformis	Spiraea douglasii
Lycopus uniflorus	Utricularia vulgaris
Mentha sp.	

Juncus balticus community: This community occurs in eastern Jefferson County, and occasionally throughout the Puget Trough lowlands. It occurs in areas that have fibrous peat soils and which are permanently, but shallowly flooded.

Typical Species:

Juncus balticus 15-40%
Nuphar polysepalum <1-15%

Other Species:

Carex oederi	Mentha arvensis
Dulichium arundinaceum	Menyanthes trifoliata
Hypericum anagalloides	Potentilla palustris
Juncus cf. supiniformis	Rhynchospora alba

Pyrus fusca community: This community occurs in eastern Jefferson County and throughout the Puget Trough and southwest Washington lowlands. It typically occurs along the upland edge of wetlands and is seasonally flooded. It occurs mostly on supersaturated muck and woody debris in the study area, but on shallow muck over glacial till or sand in other areas. It has a closed canopy and virtually no understory component.

Typical Species:

Pyrus fusca 95%
Spiraea douglasii 5%

Other Species:

Salix spp.

Salix spp. - Spiraea douglasii community: This community occurs in eastern Jefferson and Clallam Counties, and throughout the Puget Trough and southwest Washington lowlands. It is shallowly but permanently flooded. The canopy is open and has a species rich understory. Soils are anoxic muck with woody debris and some fibrous peat. The woody debris provides a second substrate for rooted vascular plants.

Typical Species:

Salix spp. 10-30%
Spiraea douglasii 25-50%

Other Species:

Alnus rubra
Carex cusickii
Carex obnupta
Carex rostrata
Ledum groenlandicum
Nuphar polysepalum
Oenanthe sarmentosa

Pinus monticola
Potentilla palustris
Puccinellia pauciflora
Sparanium emersum
Typha latifolia
Vaccinium parvifolium

Spiraea douglasii community: This community occurs in eastern Jefferson and Clallam Counties within the study area, and throughout the Puget Trough and southwest Washington lowlands. It can be either seasonally or permanently flooded. Spiraea douglasii typically forms dense nearly monospecific stands, and is 6-10 feet tall. Soils are a mixture of muck, fibrous and heath peat, and occasional a little sphagnum peat.

Typical species:

Spiraea douglasii 70-100%

Other species:

Alnus rubra
Carex obnupta
Carex oederi
Carex rostrata
Carex vesicaria
Dulichium arundinaceum
Hypericum anagalloides
Juncus balticus
Ledum groenlandicum

Lycopus uniflorus
Menyanthes trifoliata
Nuphar polysepalum
Pinus monticola
Pyrus fusca
Salix spp.
Sphagnum spp.
Thuja plicata
Tsuga heterophylla

NON-RECURRING COMMUNITIES

LOW ELEVATION SPHAGNUM BOG COMMUNITIES

Vaccinium oxycoccos/Sphagnum spp. community: This community occurs at one site in eastern Clallam County. It occurs on a thin quaking sphagnum mat which submerges when stepped on. Ledum groenlandicum occurs throughout the community, but is dying. The hydrology of the area appears to have been altered and the vegetation is still responding to the alteration. This community is an odd mixture of very wet and relatively dry site sphagnum bog species.

Typical Species:

Drosera rotundifolia 10-15%
Eriophorum chamissonis 10-20%
Ledum groenlandicum 5-25%
Sphagnum spp. 100%
Vaccinium oxycoccos 20-30%

Other Species:

Carex pauciflora *Menyanthes trifoliata*
Carex rostrata *Tsuga heterophylla*

LOW ELEVATION FRESHWATER WETLAND COMMUNITIES

Puccinellia pauciflora community: This community occurs at one site in eastern Jefferson County. It occurs in permanently flooded areas on fibrous peat soils.

Typical Species:

Puccinellia pauciflora 10-20%

Other Species:

Eleocharis acicularis *Sparganium emersum*
Eleocharis palustris *Utricularia* sp.

Carex cusickii community: This community occurs in eastern Clallam County within the study area, but also occasionally throughout the Puget Trough. The examples of this community are highly variable, the common characteristic is the floating mats composed of Carex cusickii. Within the study area, it is the predominant plant community in a kettle wetland which has fluctuating water levels and chaotic vegetation. The quaking sedge mats have some large woody debris and snags.

Typical Species:

Carex cusickii 50-60%

Other Species:

Agrostis sp.	Nuphar polysepalum
Alnus rubra	Potentilla palustris
Athyrium filix-femina	Spiraea douglasii
Epilobium sp.	Thuja plicata
Galium sp.	Typha latifolia
Lonicera involucrata	Viola sp.

Carex rostrata community: This is an odd community found at one site in eastern Clallam County. It occurs on sphagnum and fibrous peat that is seasonally to permanently flooded. It looks as if the hydrology of the area has been altered recently and that the vegetation is still responding to that change.

Typical Species:

Carex rostrata	35-75%
Potentilla palustris	1-25%

Other Species:

Bidens cernua	Oenante sarmentosa
Carex cusickii	Sparanium sp.
Epilobium sp	Sphagnum spp.
Lemna sp.	Typha latifolia
Lycopus uniflorus	Viola sp.

APPENDIX C

PLANT SPECIES SCIENTIFIC AND COMMON NAMES

<u>Scientific Name</u>	<u>Common Name</u>
Abies amabilis	Pacific silver fir
Agrostis sp.	bentgrass
Agrostis aequalvalvis	Alaska bentgrass
Agrostis oregonensis	Oregon bentgrass
Agrostis scabra	winter bentgrass
Alnus rubra	red alder
Anemone oregana var. felix	Oregon anemone
Athyrium filix-femina	lady-fern
Bidens cernua	nodding beggars-tick
Blechnum spicant	deer-fern
Boykinia elata	slender boykinia
Calamagrostis sp.	reedgrass
Calamagrostis canadensis	bluejoint reedgrass
Camassia sp.	camas
Carex cusickii	Cusick's sedge
Carex interior complex	inland sedge
Carex livida	pale sedge
Carex obnupta	slough sedge
Carex oederi	green sedge
Carex rostrata	beaked sedge
Carex sitchensis	Sitka sedge
Carex vesicaria	inflated sedge
Cicuta douglasii	Douglas' water-hemlock
Cladina rangiferina	reindeer lichen
Cornus canadensis	bunchberry
Cornus stolonifera	red-osier dogwood
Deschampsia caespitosa	tufted hairgrass
Drosera rotundifolia	sundew
Dulichium arundinaceum	dulichium
Eleocharis acicularis	needle spike-rush
Eleocharis palustris	creeping spike-rush
Empetrum nigrum	crowberry
Epilobium sp.	willow-herb
Eriophorum chamissonis	Chamisso's cotton-grass
Galium sp.	bedstraw
Gaultheria shallon	salal
Gentiana sceptrum	king's gentian
Hypericum anagalloides	bog St. John's-wort
Juncus balticus	Baltic rush
Juncus ensifolius	dagger-leaf rush
Juncus supiniformis	spreading rush
Kalmia occidentalis	western bog laurel
Ledum groenlandicum	Labrador-tea

Lemna sp.
Linnaea borealis
Lonicera involucreta
Luzula sp.
Lycopus uniflorus
Lysichitum americanum
Malanthemum dilatatum
Mentha sp.
Mentha arvensis
Menyanthes trifoliata
Menziesia ferruginea
Nephrrophyllidium crista-galli
Nuphar polypetalum
Oenanthe sarmentosa
Picea sitchensis
Pinus contorta
Pinus monticola
Polystichum munitum
Potentilla palustris
Pseudotsuga menziesii
Pteridium aquilinum
Puccinellia pauciflora
Pyrus fusca
Rhamnus purshiana
Rhynchospora alba
Rubus pedatus
Rubus spectabilis
Rubus ursinus
Salix sp.
Sanguisorba officinalis
Scirpus acutus
Scirpus microcarpus
Scirpus subterminalis
Sparganium sp.
Sparganium emersum
Sphagnum spp.
Spiraea douglasii
Spiranthes romanzoffiana
Thuja plicata
Tiarella trifoliata
Tofieldia glutinosa
Trientalis arctica
Trisetum canescens
Tsuga heterophylla
Typha latifolia
Utricularia sp.
Utricularia vulgaris
Vaccinium alaskaense
Vaccinium caespitosum
Vaccinium ovatum
Vaccinium oxycoccos
Vaccinium parvifolium
Vaccinium sp.

duckweed
western twinflower
black twin-berry
woodrush
northern bugleweed
skunk cabbage
beadruby
mint
corn mint
buckbean
fool's huckleberry
deer-cabbage
Indian pond lily
Pacific water-parsley
Sitka spruce
lodgepole pine
western white pine
sword-fern
purple cinquefoil
Douglas fir
bracken
weak alkaligrass
western crabapple
cascara
white beakrush
five-leaved bramble
salmonberry
Pacific blackberry
willow
garden burnet
hardstem bulrush
small-fruit bulrush
water clubrush
bur-reed
simplestem bur-reed
sphagnum
spirea
ladies-tresses
western red cedar
foamflower
sticky tofieldia
northern starflower
tall trisetum
western hemlock
cat-tail
bladderwort
common bladderwort
Alaskan blueberry
dwarf bilberry
evergreen huckleberry
wild cranberry
red bilberry
blueberry

Veratrum sp.
Veronica scutellata
Viola sp.
Xerophyllum tenax

false hellebore
marsh speedwell
violet
Indian basket-grass
(beargrass)

