Miami River Watershed Assessment
and
Analysis of ODF Lands

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1.0 INTRODUCTION

1.1 Purpose and Context

The Miami River Watershed Assessment and Analysis was developed in response to the Northwest Oregon State Forests Management Plan (ODF 2001, [FMP]). The project area, including the Miami River watershed and an adjoining frontal hydrologic unit was selected by ODF as one of a number of priority watersheds in western Oregon where analysis is to be conducted in support of objectives set forth in the FMP, and in support of Oregon Plan for Salmon and Watersheds (OPSW).

The FMP directs and guides management on State Forest lands administered by the Oregon Department of Forestry (ODF) in northwestern Oregon. One of the many objectives of the FMP is the conservation of aquatic and riparian resources, and the upland areas that directly influence them, as a means of assuring the long-term persistence of properly functioning habitat for riparian dependent species, particularly anadromous salmonids. Watershed analysis is a component strategy of that objective, and its overall goal is to determine if properly functioning conditions exist along streams that flow through lands administered by ODF (ODF 2004).

This study was prepared specifically for the ODF and is intended primarily for their use. Its purpose is to support ODF staff in their development of management strategies and implementation plans that promotes the attainment of a properly functioning aquatic and riparian network on Tillamook State Forest lands within the project area.

The processes, functions, and mechanisms integral to the aquatic and riparian systems that exist on ODF lands in the project area are the primary focus of this analysis. Conditions on ODF lands are emphasized because: 1) ODF is mandated by the FMP to analyze conditions on State Forest lands, 2), the FMP only applies to ODF managed lands, and 3) prior studies of the area did not address in sufficient detail information specifically useful for resource management and planning on ODF lands in the project area. However, watershed concerns often transcend ownership boundaries. Although the management of non-state lands is outside the scope of ODF's administrative authority, information about conditions on other ownerships is evaluated to discern if it is relevant to the conditions and management on ODF lands.

1.2 Methodology

This analysis follows the process outlined in subsection 7, Section 2 of the ODF's State Forest Program Watershed Analysis Manual (ODF 2004). In the manual, two distinct phases are identified, an assessment phase and an analysis phase. The former addresses historic and current conditions, inherent physical processes, and land use trends, while the latter addresses the relationships between existing conditions, select ecosystem functions, management goals, and desired conditions. The manual stipulates that the methodologies to be used should be compatible with those outlined in the Oregon Watershed Assessment Manual (OWEB 1999).

The ODF manual lists three sets of questions that are to be answered in each of the phases. Determining the answers to these questions provide the foundation and

framework of the ODF analysis process. For the assessment phase, “OWEB Critical Questions” are to be answered. For both phases “ODF Supplemental Questions” are to be answered. For the analysis phase “Key Analysis Questions are to be answered. These questions along with their individual answers are listed in Section 5.0 of this document.

1.3 Prior Studies Relevant to this Project Area

In 1992 Tillamook Bay was officially nominated to EPA’s National Estuary Program. Since then a number of studies and analyses similar or parallel to this effort have been conducted. Several have been broad-scale studies that address conditions across the entire Tillamook Bay watershed, which the Miami project area is tributary to. These are comprehensive studies that address a wide variety of resources, and provide an excellent and informative interpretation of intrinsic processes, existing conditions, and land use trends across the landscape. These studies include: An Environmental History of Tillamook Bay Estuary and Watershed (TBNEP 1996), Landscape Change in the Tillamook Bay Watershed (TBNEP 1997), and the Tillamook Bay Environmental Characterization (TBNEP 1998).

Similar but smaller scale assessments have also been conducted for some of the individual watersheds that are tributary to the Tillamook Bay Watershed, such as the Kilchis, Trask, and Wilson River watersheds which neighbor the Miami. One report in particular addressed conditions specific to the Miami River Watershed, and is titled the “Miami River Watershed Assessment” (E&S 2001). It was prepared for the Tillamook Bay Performance Partnership, which is a non-profit group dedicated to enhancing the estuaries and watersheds of Tillamook County. Using the methodologies outlined in the OWEB manual, the Miami River Watershed Assessment (E&S 2001) analyzed conditions relevant to aquatic and riparian resources, and concluded with a set of suggested restoration strategies. The assessment and analysis that follows however, is intended to be separate, even though it is similar and uses much of the information presented in the E&S study.

The assessment presented here differs from previous studies in several ways. First, the title of this document, “The Miami Watershed Assessment and Analysis,” reflects the two-phase process directed by ODF’s State Forest Program Watershed Analysis Manual. Secondly, the project area that study addresses includes not only the Miami River watershed, but also an adjoining hydrologic unit which contains the drainages of several small streams which flow directly into Tillamook Bay, but which are separate from any of the other primary tributary watersheds that have been studied previously.

Another notable difference between this effort and the previous work is the availability of several updated base data layers and newer aerial photo imagery. The streams layer database used for this effort is a smaller, finer scale than that used prior; thereby resulting in a stream network with significantly more stream miles, especially headwater tributaries. The division of hydrologic units is also different. This project recognizes fewer distinct hydrologic units compared to the E&S study (2001), resulting in a more uniform subwatershed size. Aerial imagery used for this iteration is also more recent, and included 2002 and 2003 high-resolution photos, which enabled a more refined mapping of vegetative cover that is more closely representative of locally recognizable patch characteristics.

Numerous other studies have also been conducted over the last twenty years in the Tillamook Bay area. They have addressed in detail a variety of select resources integral to Tillamook Bay, such as fisheries, shell fish, salt marshes, wetlands, and tide gates, to name a few. Many of these documents are housed in the Tillamook Estuary Partnership library.

In an attempt to minimize redundancy with previous studies of like kind, this project will incorporate and build upon the results of earlier efforts. New findings will be explicitly oriented to select conditions on specified lands.

2.0 PROJECT AREA OVERVIEW

Much of the general information in this chapter has been described previously in numerous other studies, and has been analyzed in detail before. The intended audience of this document, ODF staff, has a close familiarity with and prior knowledge of the project area. They are relatively well read about the basic physical and intrinsic characteristics of the Tillamook Bay and Northern Oregon Coast Region. Thus, for the sake of brevity and to limit redundancy, this section primarily addresses details considered essential to a general overview of the project area.

2.1 Setting and Physiography

The 28,037-acre project area is located approximately 60 air miles west of Portland on the northern portion of Oregon's coast (Figure 1). It is situated along the northeastern shore of Tillamook Bay between the towns of Tillamook and Garibaldi on U.S. Highway 101; within it is contained the town of Bay City and the small unincorporated community known as Idaville. Its shape is roughly 12 miles long and 4 miles wide (Figure 2).

Situated within the Coast Range Physiographic Province described by Franklin and Dyrness (1973), the landscape in the project area exhibits both mountainous and nearly level terrain. Three distinct "ecoregions," as described by OWEB (1999) are represented, volcanic uplands, coastal uplands, and coastal lowlands. The two upland ecoregions comprise most (93%) of the project area. They primarily consist of densely forested, heavily dissected, steep and rugged mountains that are separated by narrow confined valleys. The elevation rises from sea level on the western margin to a maximum of 2,778 feet on the ridge that defines the far eastern boundary. The lowlands that comprise the remaining 7 percent of the project area, are located in the far southwestern corner, and are typified as a fertile, broad, low elevation (<100 feet), gently sloping alluvial coastal plain.

The Miami River watershed is the smallest and northern most of the five primary watersheds that flow into Tillamook Bay. To the south are the Kilchis, Wilson, Trask, and Tillamook rivers. The Miami River valley is a major feature that bisects the project area. Its southwest to northeast trending axis between Garibaldi and the far eastern divide is about 11 miles long. The main valley is about 0.3 miles wide at its mouth, narrowing to several hundred feet far upstream. The portion of the coastal plain in the southwest corner of the project area is roughly three square miles in size, but extends outside the boundary to the south and east. Along the Bay, locally recognized landmarks include, from south to north: Kilchis Point, Goose Point, Sandstone Point,

and Hobsonville Point. Most of the ridges and mountaintops in the project area are unnamed, but common labels on topographic maps include Doty Hill on the southeastern divide, and Crag Mountain and Foley Peak along a portion of the northern divide.

2.2 Basic Geology and Soils

The coastal lowlands consist primarily of fluvial and estuarine deposits. Soils that formed on these alluvial sediments are generally deep, and may be well drained or poorly drained. Textures vary from sand to silty clay loam, and surface horizons are relatively thick, dark, and rich. Near the bay, there are notable areas of organic peat soils associated with tidal marshes. The floor of the Miami River valley also consists of alluvium (OWEB 1999).

To the north and east, the low coastal plain transitions into the coastal uplands that occupy most of the western portion of the project area. These are underlain primarily by bedded sedimentary rock formations of relatively weak and highly weathered sandstone siltstone, and mudstone. Soils mantling the coastal uplands are generally moderately deep colluvium, and are well drained. Textures range from fine sandy loams and silt loams to silty clay loams. The volcanic uplands comprise the greatest proportion (64%) of the project area. They are underlain by thick basaltic igneous rock formations that locally are associated with the Tillamook Volcanics formations described by Wells et al (1994) and others. Soils that have developed are generally moderately deep to shallow, well-drained colluvium. Textures range from gravely to very rocky silt loams and loams. Rock outcrops are abundant (OWEB 1999).

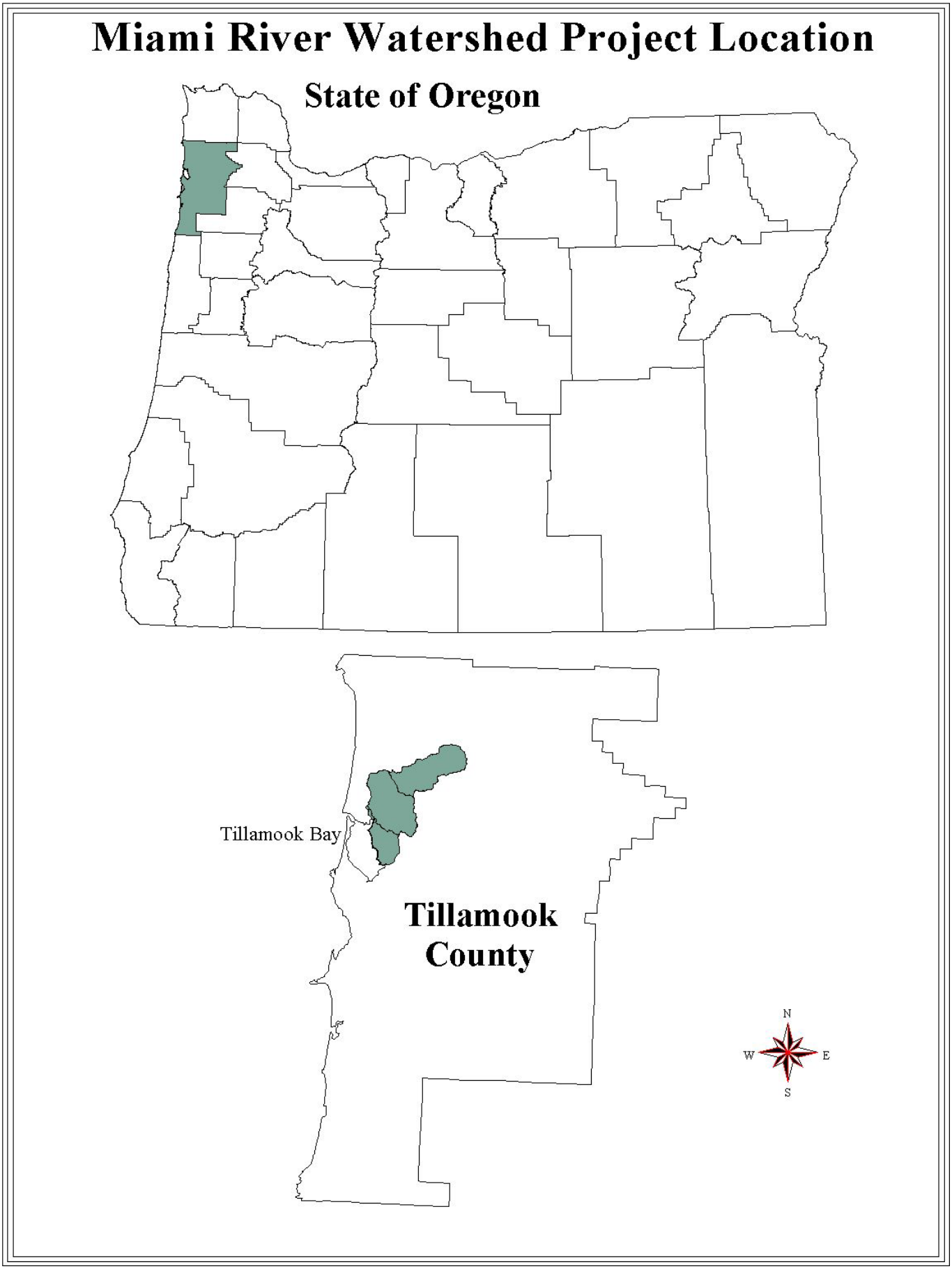

Figure 1. Miami River Watershed Location Map.

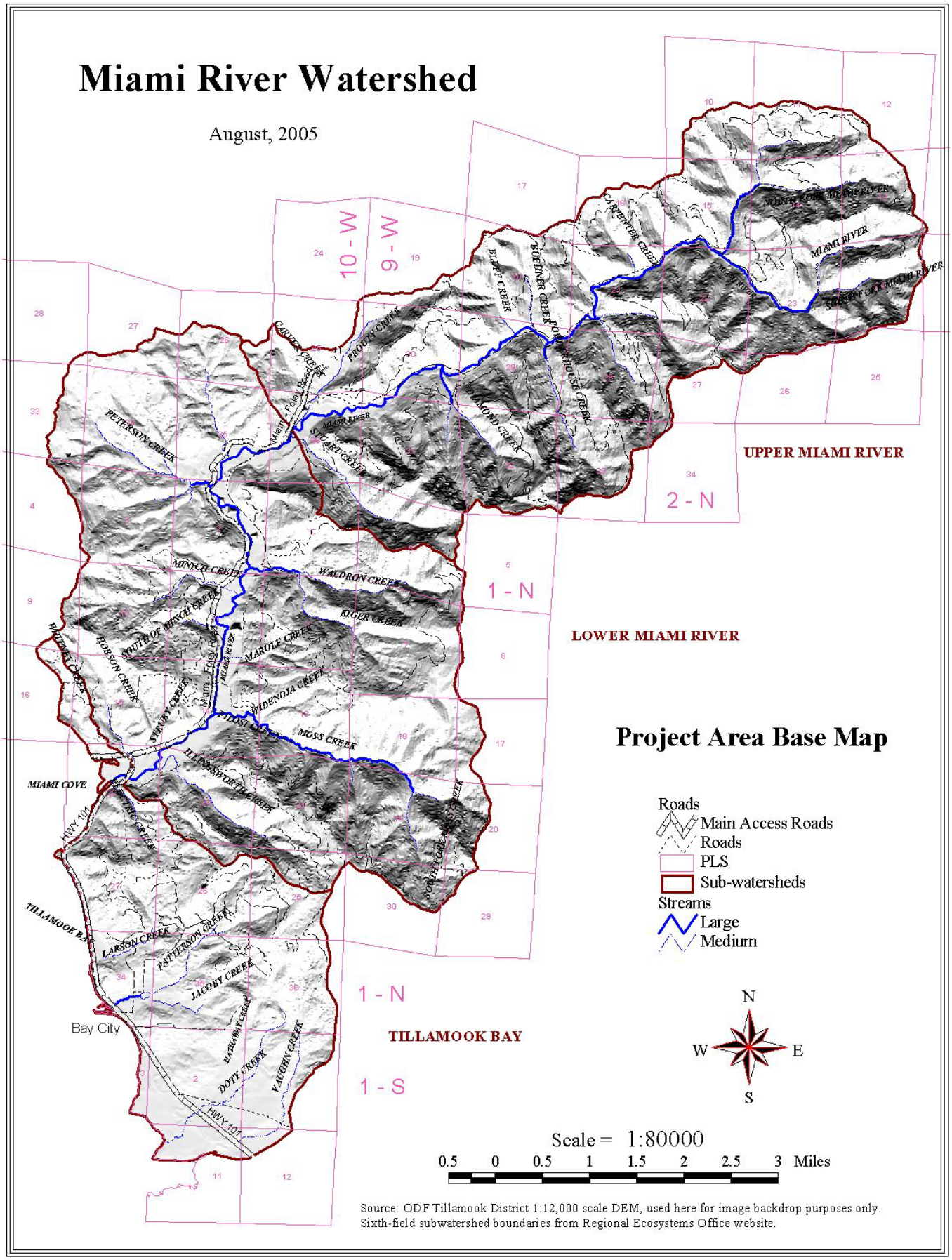

Figure 2. Miami River Watershed Project Area base map.

2.3 General Climate

The project area is typified as having a moderate climate. Marine effects from the Pacific Ocean greatly influence and tempers seasonal weather patterns that dominate the region. Winter is usually cool and wet; snow and freezing temperatures are only common at the highest elevations. Summer is fairly cool and moist. Relative humidity is nearly always high. The warmest, clearest days along the coast are generally in autumn. Every few years, abnormal temperatures occur, and even at the lower elevations there are several consecutive days with freezing temperatures in winter; while in summer a week or longer may become hotter than normal. Daily mean temperatures are cooler at the higher elevations (OCS 2005).

Average precipitation ranges between about 90 and 120 inches annually, increasing toward the eastern divide of the Miami Watershed to more than 140 inches (TBNEP 1998a). Most of the precipitation falls in winter, about 57 percent from November through February. Less than 10 percent falls in the summer months, although fog and drizzle are not infrequent (OCS 2005).

Since the majority (96%) of the project area lies below an elevation of 2,000 feet, average seasonal snowfall across most of the project area is usually only a trace or less. On average, less than one day per year has at least 1 inch of snow on the ground at elevations below 1,000 feet. Snow is more abundant at elevations of about 2,000 feet and above, where several inches accumulate occasionally (ODF/BLM 2003).

During the winter months, the storm track moves south from the Gulf of Alaska, usually bringing repeated strong, low-pressure weather systems to the Pacific Northwest. These storms, as well as those characterized as a “pineapple express”, often deliver periodic heavy rains to the region. During many years there are one or two storms that bring exceptionally heavy rains and damaging winds during the wet season. Resultant flooding often inundates low-lying areas. Thunderstorms are uncommon in the basin, although they are more frequent inland and primarily occur in the summer time (ODF/BLM 2003).

The direction of the prevailing wind is highly dependent upon season and location. In general, winds affecting the planning area are usually prevailing from the north during the summer and from the south and southwest in the wintertime, particularly during periods of stormy weather. Average annual wind speed is the greatest during winter along the coast. The strongest winds are nearly always from the south or southwest as a result of strong, cyclonic frontal systems that move across the coast from the Pacific. In most winters, one or two large-scale storms bring strong and sometimes damaging winds. Wind gusts of 70 to 80 mph are nearly an annual occurrence at exposed locations along the coast and ridgetops. Winds during the summer along the coast can become brisk and generate rough ocean conditions, but seldom attains speeds great enough to be damaging (USDA 1997).

2.4 Watersheds and Streams

A hierarchy of hydrologic units delineated by the USGS is recognized in the project area, which is comprised of two distinct and separate 5th-field hydrologic units (Figure 3). The largest is the Miami River watershed (USGS hydrologic unit code 1710020307), which accounts for about 82 percent of the entire project area, and drains approximately

23,034 acres. It is divided further into two similar sized 6th-field subdivisions identified as the Lower and Upper Miami subwatersheds (hydrologic unit codes 171002030702 and 171002030703 respectively). These divisions are different than those recognized in the existing Miami River Watershed Assessment prepared by E&S (2001).

The Miami River hydrologic unit exhibits a classic dendritic branching pattern. Numerous tributary streams flow into the mainstem river along its entire length. Each being fed by many smaller headwater, first- and second-order streams that originate above from the steep mountains. Names of some of the major streams include (listed in clockwise order from the mouth): Hobson, Struby, Minich, Peterson, Prouty, North Fork, South Fork, Powderhouse, Diamond, Stuart, Waldron, Moss, and Illingsworth. Based upon a stream map that was prepared for ODF at a scale of 1:12,000, about 83 percent of the total stream miles in the project area occur in the Miami River watershed (Table 1). Of these about 63 percent and 32 percent respectively flow through ODF and private industrial owned lands. The remaining 6 percent flow across lands designated as private non-industrial owners.

Table 1. Estimated Stream Miles by Owner Class in the Project Area.

Owner Class	Lower Miami	Upper Miami	Tillamook Bay	Total
Private Industrial	134	13	3	150
Private Non Industrial	23	4	56	83
State	62	232	36	330
Total	219	249	95	563

Source: ODF 2004

The other 5th-field hydrologic unit, which makes up the remaining 18 percent (5,003 ac.) of the project area, is distinctly separate from any of these primary rivers. It is situated between the mouths of the Miami and Kilchis watersheds. All of the streams within it flow directly to Tillamook Bay; none are tributary to any other stream. These streams originate from the low, steep mountains of the coastal highland and, in general flow parallel to each other individually to the bay. In this report, this “frontal” hydrologic unit is named the Tillamook Bay frontal subwatershed (USGS hydrologic unit code 171002030603), names of the major streams within its bounds include (listed north to south): Whitney, Electric Larson, Patterson, Doty, and Vaughn. About 17 percent of the total stream miles in the project area are located in the frontal hydrologic unit. Of these about 59 percent and 38 percent respectively flow through private non-industrial and ODF designated lands, only about 3 percent flow across lands identified as private industrial owners.

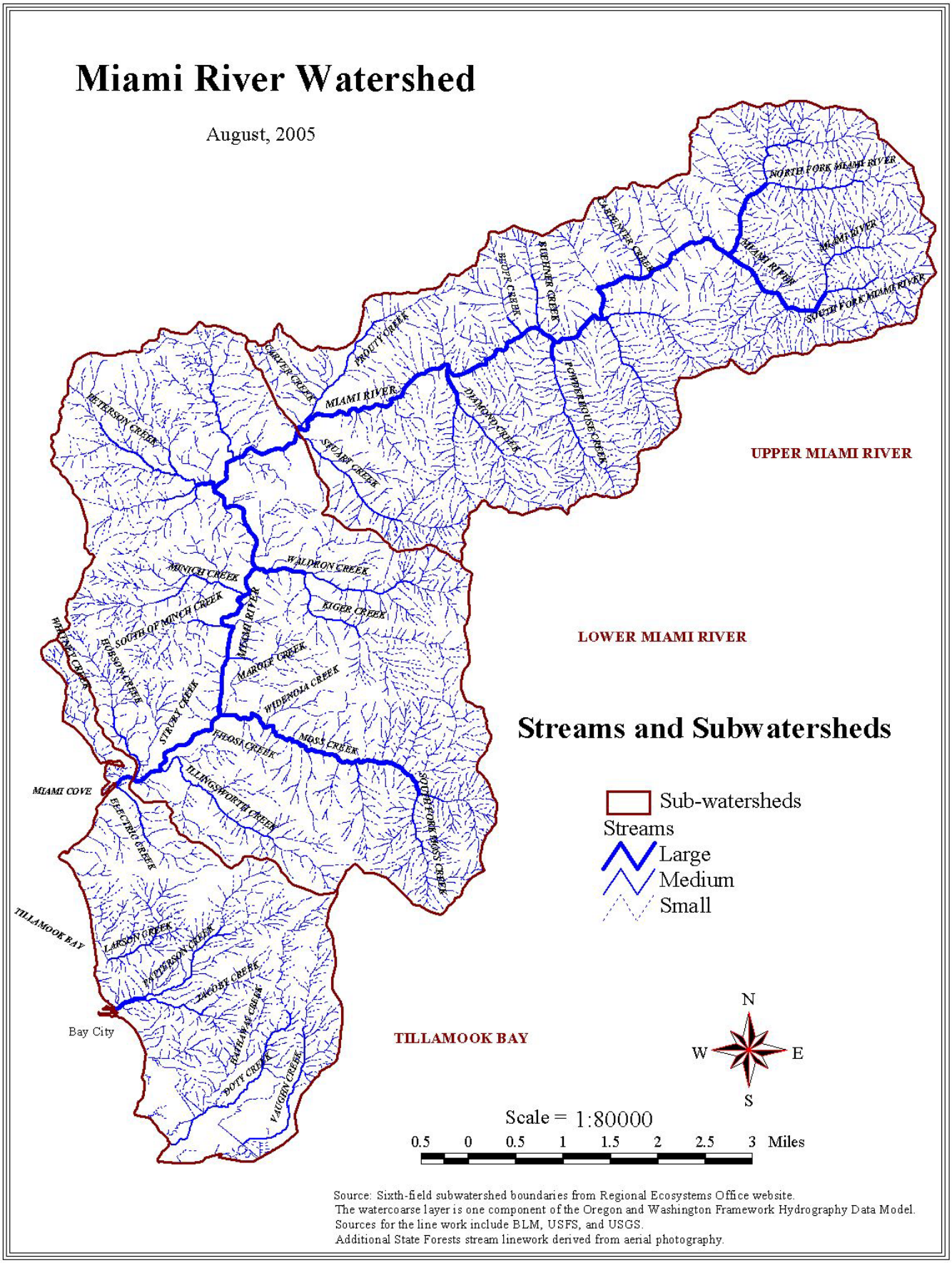

Figure 3. Streams and subwatershed boundaries for the Miami River Watershed Project Area.

2.5 General Ownership and Land Cover

Three owner classes recognized in the project area by this report include private industrial timberlands (PI), private non-industrial lands (PNI), and State lands. State lands comprise the largest (57%) owner class in the project area. All but 28 acres of these lands are within the officially designated Tillamook State Forest, the remainder is county land administered by the ODF. The majority (88%) of State lands in the project area are located within the Miami hydrologic unit, particularly within the Upper Miami where they comprise 92 percent of the subwatershed (Table 2). In comparison, private industrial timberlands amount to about 58 percent of the lower Miami subwatershed, while state lands account for about 32 percent. Within the Tillamook Bay frontal subwatershed, where urban, rural residential, and agricultural land uses are dominant; private non-industrial owners account for the greatest percentage of area (57%). State lands amount to nearly 40 percent of the Tillamook Bay frontal subwatershed.

Table 2. Acres by Ownership Category and Subwatershed

Owner Category	Lower Miami	Upper Miami	Tillamook Bay	Total
Private Industrial	6,979	616	165	7,760
Private Non Industrial	1,288	233	2,862	4,382
State Admin. Lands	3,788	10,181	1,976	15,894
Total	12,004	11,030	5,003	28,037

Source ODF 2004a.

Natural resource management and timber production are the dominant land uses across the majority of the project area (92%). Agricultural, rural residential, and urban land use account for slightly less than 8 percent of the entire project area, and represent most of the non forest areas. Most non-forest areas are privately owned, and are located in the southwest half of the Tillamook Bay frontal subwatershed and the floor of the Miami River Valley. It is estimated that roughly one percent of State lands are non-forest (i.e., rock outcrops, brush in right-of-way corridors).

The majority (91%) of the project area consists of a forested cover; the remaining nine percent is non-forest. Two major potential vegetation zones, as described by Franklin and Dyrness (1973) comprise the forested portion: the Sitka spruce zone and the western hemlock zone. The portion of the project area that is within the coastal lowland ecoregion is dominated by the Sitka Spruce zone, while both zones are represented in the coastal uplands ecoregion. The volcanic uplands ecoregion that occurs in the project area is dominated by the western hemlock zone.

The Sitka spruce zone occupies the lowlands, drainage bottoms, and lower hillslopes in the project area below about 450 feet (about 20% of the total area). More than half of the zone is in private ownership, and includes significant areas converted to a non forest status where agricultural, rural residential, and urban land uses prevail, particularly across the low coastal plain in the southwestern corner of the project area

and in the main Miami River valley. Within the low coastal plain, there are also notable patches of naturally occurring non-forest, such as grass meadows, wetlands, and tidal marshes along the margin of the bay.

The Sitka spruce zone transitions into the western hemlock zone, which locally occupies higher ground and accounts for roughly 80 percent of the project area, mostly in the Miami subwatersheds. About 95 percent of this zone is on ODF administered lands or privately owned industrial timberlands where natural resource and timber management are the predominant land uses.

3.0 HISTORICAL CONDITIONS

Much has been documented and reiterated portraying the environment in its pre-settlement context in the Tillamook Basin and its tributaries (E&S 2001, E&S 2001a, ODF/BLM 2003, TBNEP 1998, TBNEP 1998a, TBNEP 1997, TBNEP 1996). Indigenous local populations and cultures have been comprehensively addressed in these previous studies, as have patterns of Euro-American settlement and land use, and the historical condition of natural resources. However, much of this information is more regional in context, so there is little that pertains specifically to ODF lands in the project area. To minimize redundancy, this section incorporates by reference the previous cited studies and omits reiterating too much of that which is not specific to local aspects of the project area. It is intended to be a brief section, so narrative is minimal and the salient points are presented as simple bullet statements for quick review.

3.1 Historical Vegetative Cover

- The dominant stand-age class for the Miami watershed in 1850 is estimated to have been older than two hundred years. Early landscape maps of 1856/1857 indicate that the uplands in the project area were heavily timbered. (TBNEP 1996). Early surveyor notes make repeated references to the abundance of hemlock and spruce in the understory, potentially indicating late-seral conditions (ODF 2004c). It is inferred that these conditions prevailed across most of the present day ODF lands.

- The 1856/1857 landscape maps indicate that the Miami valley bottom was comprised of “first rate” stands of timber with dominant conifers being spruce, hemlock, cedar, and yellow fir (i.e., Douglas-fir). A similar patch of forest cover was mapped in an area proximally located between Doty and Hathaway Creeks in the frontal subwatershed (TBNEP 1996).

- On the coastal lowland in the proximity of Bay City and in the Larsen Creek drainage, as well as the area between Doty and Vaughn Creeks, the 1856/1857 map depicts broad meadows, prairies, and wetlands. Along the margin of the bay between Bay City and the mouth of Vaughn Creek, patches of dense scrub and shrub were mapped that were interspersed with wet meadows, tidelands, and sloughs (TBNEP 1996). It is documented that the local culture in the area commonly used fire as a “land management tool” to create and maintain meadows on the coastal lowlands in the area.

- By 1890, large patches on both the lowlands and uplands in the frontal subwatershed had been logged. Much of the lowlands had been converted to pasture for rural and agricultural land use. Lower reaches of the Miami valley had also been logged. By 1920, cleared forestland patches had expanded somewhat, extending across most of the frontal subwatershed and up the lower half of the Miami valley to Prouty Creek. However, much of the upper half and interior portions (present-day ODF land) of the Miami watershed were not extensively cut over, and the eastern two-thirds of the project area was still generally intact (TBNEP 1996).

- The eastern half of the Miami watershed burns in the 1933 fire, and again in the 1939 fire (Fick and Martin 1992). By 1940, the majority of the project area, including present-day ODF land, had been burned or cutover, and the predominant forest stand age-class was less than 50 years old (TBNEP 1996). There are very few large, contiguous, remnant patches of old forest structure on ODF lands in the project area. Most remnant trees in the project area are located on ODF land, and occur as small isolated stands within larger patch types along the valley bottom margins of the upper Miami River and its tributaries. It's estimated that about 2% of ODF lands are comprised of patches greater than 130 years old in the project area. All are located in the portions of the upper Miami that didn't burn.

3.2 Inherent Disturbance

- It is well documented that large storms and intense precipitation events are a frequent occurrence in the Coast Range. They are the primary disturbance mechanism that causes flooding and heavy runoff, which often leads to landslide and stream channel (fluvial) erosion. Landslide and fluvial erosion are considered to be the dominant inherent erosion processes in Coast Range basins such as the Miami project area (TBNEP 1998).

- The preponderance of steep slopes, shallow soils, highly weathered rock formations, along with the seasonally wet climate combine to make unstable slopes a common naturally occurring condition in the project area. Shallow, rapidly moving landslides are the dominant hillslope erosion process. Their occurrence is nearly always associated with winter storms when soil moisture is greatest (Harr and Yee 1975). The steep and very steep slopes that are prominent in the drainages of the upper Miami subwatershed, and those in the Moss, Illingsworth, Stewart, and Kiger drainages are notably susceptible.

- Inherent rates of erosion and sedimentation in the Coast Range are well documented to be relatively high naturally, and the background rate of sedimentation is highly variable. Post-fire increases in the rate of inherent surface and landslide erosion in western Oregon can be significant after large, intense fires. In the portion of the upper Miami subwatershed that was burned over by the Tillamook fire of 1933, and again in 1939, it is inferred that for a time sediment inputs increased substantially above background rates. Logging practices and road construction customary for that time period were not expressly intent on minimizing sedimentation compared to current day standards, so subsequent salvage of fire killed timber likely exacerbated accelerated erosion further, particularly in the South Fork.

- For the 22-year period of record between 1973 and 1995 on the Miami River, the five largest peak events occurred in 1977, 1983, 1986, 1990, and1994. For

Patterson Creek in the frontal subwatershed, the five highest peaks for the 17-year period of record between 1952 and 1968 occurred in 1953, 1955, 1961, 1964, and 1965. The flood of 1996 was another event of significance that affected the Miami watershed. It spawned heavy runoff and a number of landslides that caused considerable damage, particularly to roads (per. comm. K. Mills 2005).

- High winds are another frequent, natural disturbance agent in the Coast Range. Wind gusts approaching 100 miles per hour occur in most years, usually during winter. Extreme damaging winds have been recorded in nearly every decade since 1900 (TBNEP 1998). While specific records of localized wind damage on ODF lands in the project area are not known to have been assembled, the most recent and damaging wind storms that are likely to have affected the project area occurred in 1962, 1963, 1967, 1971, 1981,1995, and 2002 (NOAA 2005).

- There is evidence of large fires in the northern Coast Range as long ago as the 1600s. Some of the earliest documented landscape-scale fires that occurred in 1845 and 1868 originated in the Willamette Valley and Clatsop County respectively. The 1868 fire is believed to have burned into the northwestern portion of the watershed in the headwater areas of Minich and Peterson Creeks. While the cause of those fires is uncertain, it is believed that historic fires in the northwest Coast Range may be as equally associated with starts from lightning or humans (TBNEP 1996 and 1998). Much of the frontal subwatershed and the majority of the eastern half of the Miami watershed have been affected by human caused wildfire.

- There are a variety of forest pathogens that are disturbance agents in the Coast Range. In particular, a high incidence of Swiss Needle Cast became prevalent in the early 1980’s in the Tillamook Burn. The infection continues to spread. As a result, the majority of Douglas-fir dominated stands on ODF lands in the upper Miami subwatershed have become infected to various degrees (ODF 2001 and 2003).

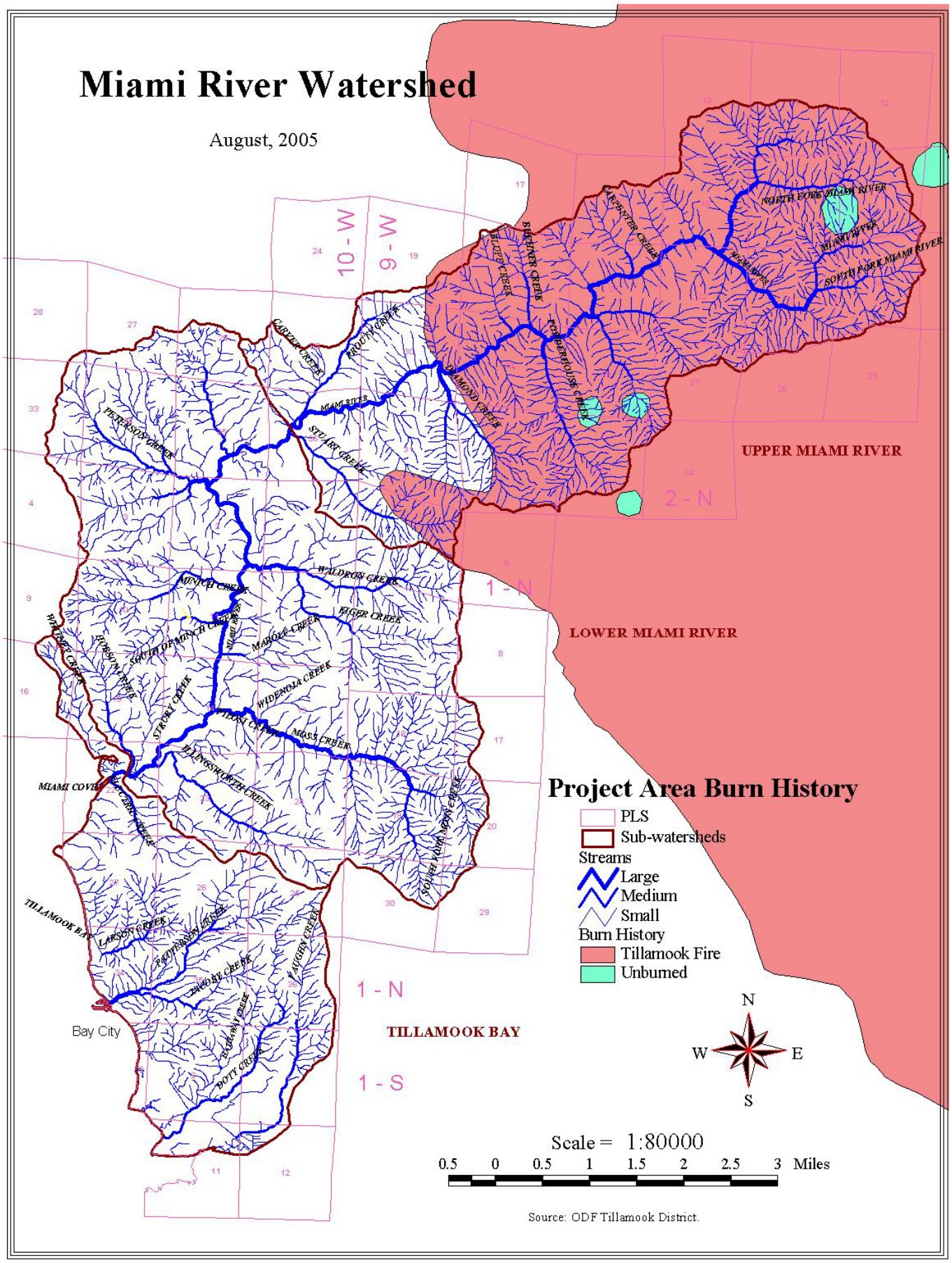

Figure 4. Burn history of the Miami River Watershed Project Area.

3.3 Historical Land Use and Human Disturbance

- Early landscape maps and anecdotal accounts make reference to semi permanent villages near the mouth of Patterson and Vaughn Creeks, and along the Miami estuary, suggesting that local indigenous peoples inhabited the coastal lowlands of the project area year-round prior to Euro-American settlement (TBNEP 1996). Meander survey notes from 1856 stated that the Miami valley was uninhabited.

- Early explorers made documented visits to Tillamook Bay in the 1780's. By the early 1850's Euro-Americans began settling on the coastal lowlands. By 1900, donation land claim settlements resulted in nearly all the shore adjacent lands on the coastal lowlands to become privately owned (TBNEP 1996).

- Surveyor notes from 1873 and 1884 noted fire-killed trees in the vicinity of the middle reaches of Patterson and Jacoby Creeks and near the project area boundary south along the middle reaches of Vaughn Creek. Small-scale human-caused fires in the frontal subwatershed where population centers were concentrated were likely somewhat frequent in both pre- and post-settlement times (ODF 2004c).

- Commercial logging to supply local mills started in the early 1860s, when sawmills began to operate at the mouths of the major rivers and in the primary valleys in the basin. A mill was located at Hobsonville Point near the mouth of the Miami, and operated from about 1883 to 1907 under various ownerships. Another mill operated in Bay City between 1879 and 1900 (pers. comm. D. Clough 2005, TBNEP 1996).

- Log transport down rivers via log drives and splash dams is documented in neighboring watersheds during the early days of logging, however, none is known to have occurred on the Miami River (TBNEP 1996).

- Farming and logging are the primary industries by 1900, and the conversion of land for urban, rural, and agricultural uses becomes widespread. The first water districts become established and wetlands are drained. In the early 1900s, roads are constructed up the major river valleys (such as the Miami), which are the easiest routes into the interior reaches (TBNEP 1997).

- The development of dikes, levees, and tide gates become common practice in the early 1900's. Affected streams in the project area include the lower reaches of Doty, Hathaway, Patterson and Vaughn Creeks, as well as the Miami River estuary. The construction of tide gates continued into the 1960s, and dike construction continued into the 1980's (TBNEP 1996).

- In 1911 the railroad between Tillamook and Portland was completed. It is located along the shore of the frontal subwatershed and crosses every major tributary in the project area including the mouth of the Miami River. In a related anecdote, railroad logging is known to have occurred in the Larsen Creek drainage (pers. comm. D. Clough 2005).

- Between 1900 and 1933, it is estimated that roughly 9% of those lands currently administered by the ODF had been harvested in the project area (ODF 2005). While there are no known records of harvest on non-ODF lands during this time period,

private industrial owners had moved into the watershed. By the end of this period, the main Miami River road extended to about Diamond Creek. During WW I, harvest of Sitka spruce for military aircraft was a primary focus.

- Acquisition by the State and County of private timberlands in the project area occurs between 1925 and 1949. In 1973 these lands are included in the newly established Tillamook State Forest. Early management emphasis was focused toward fire control, salvage logging, and reforestation objectives (Fick and Martin 1992, ODF 2001).

- An estimated 75% of the Miami watershed burned in the 1933 Tillamook Burn (ODF 2004a). Portions burned again in the 1939 fires (Fick and Martin 1992, TBNEP 1996). The upper half of the Miami from the eastern divide to Diamond Creek was affected (Figure 4).

- Post Tillamook burn salvage logging in the Miami watershed started in 1937 and continued at a high-level until 1941. Nearly all of the post-fire salvage was completed by 1959 (Fick and Martin 1992, TBNEP 1996).

- Most roads on ODF lands in the upper Miami subwatershed were constructed during the period between 1937 and 1960. The main Miami River road extending up into the North Fork and the South Fork road were constructed in the 1940's to access fire-killed timber; and the Foley Peak and Fire Break 3 roads were constructed in the 1940's and 1950's for timber salvage and fire control. Most of the road system on ODF lands in the project area is in place by 1950. Seeding and reforestation programs were ongoing between 1949 and1970 and included the eastern portion of the Miami watershed (Fick and Martin 1992, TBNEP 1996).

- Between 1933 and 1960, it is estimated that roughly 50% of those lands currently administered by the ODF had experienced some form of timber harvest (including post-burn salvage). Most occurred in the upper Miami subwatershed (ODF 2005).

- Dams for municipal water use for the town of Garibaldi were constructed up Electric Creek in 1953 and Struby Creek in 1955. Both reaches were considered to be too steep for salmon spawning (ODF 2004b).

- To protect the main Miami River haul route, dikes were constructed to close off several side channels of the river near the confluence with Powderhouse Creek in 1958. Channelization of the mainstem river between Diamond and Powderhouse Creeks is also carried out as a measure to protect the road from high water (ODF 2004b).

- A cat road was routed up a lower reach of Stuart Creek. In places it was directly in the channel, or immediately next to it. A considerable degree of channel disturbance was noted (ODF 2004b). Bridge construction work on the Miami River that occurred in the early 1950's between Prouty Creek and the confluence of the North and South Forks, resulted in heavy equipment operating directly in the main channel of the Miami River (pers. comm. D. Clough).

- Stream cleanout was a common practice to protect fish until 1976. Anecdotal evidence from biologist notes in the early 1950's suggests that logging debris as well

as any other remnant LWD such as log jams was removed from reaches of No Name Creek, Peterson Creek, the upper Miami mainstem, the South Fork, and the North Fork (ODF 2004b).

- A comparatively minor degree of gravel mining occurred periodically during the 1960's and 1970's, primarily along the mainstem of the Miami River near the mouths of Peterson and Stuart Creeks (pers. comm. D. Clough 2005, ODF 2004b).

- Between 1960 and 1980, roughly 43% of those lands currently administered by the ODF underwent some form of timber harvest. Most occurred in the upper Miami, but harvest in the lower Miami was also prevalent (ODF 2005).

- Since 1980, it is estimated that about 9% of ODF lands in the project area have undergone some form of harvest. Most has occurred in the lower Miami subwatershed. The first commercial thinning harvests in the Miami began in the mid 1980's (ODF 2001 and 2005).

3.4 Historical Fish Populations and Distribution

There is little known data specific to the project area that characterizes the abundance and distribution of fish. However, a summary of basin-wide study findings for Tillamook Bay conclude some general historical trends that are inferred to have affected populations in the project area:

- Commercial gillnetting to support commercial canneries began in the late 1800's in the bay (TBNEP 1998).
- The first fish hatcheries in the basin appeared in the early 1900's (TBNEP 1998).
- Hatchery releases peaked between the mid 1920's and late 1940's (TBNEP 1998).
- General declines in the salmon catch were noticed in the1930's (TBNEP 1996).
- Significant declines in the salmon catch were first observed in the1940's, and poor returns were recorded throughout the1950's (TBNEP 1998).
- Tillamook Bay was closed to commercial fishing in 1961 (TBNEP 1998).
- With the exception of fall Chinook salmon, populations of all other anadromous salmonids in the Tillamook basin have declined significantly over the last 100 years (TBNEP 1998).

Current fish distribution in the project area is estimated to be similar to historic distribution (ODFW 2005). Historical habitat conditions are not well documented. However, there are anecdotal notes from stream survey reports that were conducted in the Miami watershed in the early 1950's that provide a snapshot glimpse of relative conditions at that time (ODF 2004b). Some of the more salient items specific to reaches in the project area are listed below.

- Sightings of coho fry, fingerlings, and trout were observed in the lower reaches of Diamond, Illingsworth, Minich, South Minich, Moss, No Name, Prouty, Stuart, and Stewart Creeks; as well as the mainstem Miami between Stuart Creek and the confluence of the North and South Forks. Steelhead and Coho had been observed spawning by a local resident in Stuart Creek. Local workers observed adult "dog" (chum salmon) and Coho migrating up Prouty Creek. Stocking of hatchery fish was

conducted in the upper Miami subwatershed in 1952. A culvert barrier on Illingsworth Creek was observed just upstream from its mouth.

- Descriptions and locations of in-stream woody debris in survey notes:
  - A large log jam packed with gravel is observed in the middle reach of Diamond Creek.
  - Several small woody debris jams are observed in Stuart Creek.
  - A small jam was located in the middle reach of Stewart Creek.
  - One of the main tributaries to Peterson Creek has a large jam in its lower reach.
  - There were seven very large, dense jams packed with gravel in the middle and upper-middle reaches of Moss Creek.
  - A number of beaver dams were observed in Moss and Peterson Creeks.
  - A small jam was noted in the middle reach of Minich Creek.
  - Two large jams in No Name creek were removed during stream cleanout activities.

- Select substrate descriptions by reach in the survey include:
  - Of the surveyed tributaries to the Miami, fines were observed in lower Stuart Creek, the lowest reaches of Illingsworth and Peterson Creeks, and in lower South Minich Creek.
  - Quality spawning substrate was observed in Prouty Creek, in the lower-middle reach of Illingsworth Creek, the lower-middle reach of Moss Creek, and the main tributaries to Peterson Creek.

- Survey notes pertaining to the mainstem Miami between Prouty Creek and the confluence of the North and South Forks:
  - Lower reach between Prouty and Powderhouse Creeks comprised of excellent spawning gravels.
  - There are two very large jams in the lower reach, one of which has a spillway cut into the middle for fish passage.
  - The upper reach from Powderhouse to the main forks has an estimated 20% of fines in the substrate. The fines are attributed to active logging operations near the confluence of the main forks.
  - There are two very large jams in the upper reach. One is a large deposit of logging-related debris, which is noted as muddying the water; the other is noted as being an “old” jam.

- Survey notes and observations of the South Fork:
  - The surrounding hillslopes have been burned-over and logged. The only trees noted are a few widely spaced, small alders.
  - Fine sediment is estimated to comprise 10% of the substrate in all reaches.
  - There are several large deposits of logging-related debris, loose dirt, and rock in the main channel of the South Fork and its main contributing forks. The water is turbid immediately below these deposits
  - No fish were observed while surveying the South Fork.

- Survey notes and observations of the North Fork:
  - Hill sides are not as heavily burned or logged as the S. Fork, alder, maple, and fir abundant.
  - Substrate is comprised of an estimated 5-10% fine sediment in all reaches. Good spawning gravel is noted in the lower reaches, but the middle and upper reaches are dominated by large, coarse substrate.