January 9, 2002

FINAL SANDY RIVER NAVIGABILITY REPORT

Recommendation

Based on the evidence of the historical use and condition of the Sandy River presented in this report, the Division of State Lands (Division) recommends to the State Land Board (Land Board) that it:

- Adopt the findings and conclusions contained in this report pursuant to OAR 141-121-0040 and, in so doing,
- Assert a state claim to the bed and banks of the Sandy River below the line of ordinary high water from River Mile (RM) 0.0 to 37.5.

Findings and Conclusions

- A favorable comparison exists between the present and estimated past flow rates of the Sandy River.
- The flow of the Sandy River in 1859, when Oregon became a state, was most likely about average.
- A strong likelihood exists that current and recent uses of the Sandy River could have been accomplished on the waterway at the time of statehood.
- The Sandy River at the time of statehood was susceptible to use for log and railroad tie drives and Native American Chinook-type canoes.
- Current recreational uses have similar draft requirements as did Chinook-type canoes.

The following findings lead the Division to reach these conclusions:

<u>Condition of the Sandy River</u>

- The Sandy River is today, and was at the time of statehood, a fast moving, often turbid river. In places near its mouth it is often shallow; a condition noted in the reports of early explorers.
- It was capable of being used for travel in 1806 to at least a distance of six miles by a canoe, and in 1872 to a distance of three miles by a sailing ship.
- A government surveyor in 1855 meandered the river on his maps to what is now RM 4.5, thereby indicating that the waterway was “navigable” to this point.
- With the exception of the segment near its confluence with the Columbia River, and in the vicinity of Brightwood, the Sandy River has remained generally within the channel it currently occupies.
- The flow of the Sandy River has been monitored at one site for 89 years, and at another site for 57 years. Therefore, its flow characteristics are well known.
- The flow of the Sandy River varies markedly on a daily, monthly, yearly, and seasonal basis due to both natural causes and consumptive uses. However, its

pattern of high and low water periods is generally predictable with its highest levels between November and May, and the lowest from July through September.
- The total amount of precipitation which fell in 1859 in the vicinity of the Sandy River appears to have been about average when compared to that recorded for an average year at other nearby locations.
- No significant alterations to the Sandy River are known to have been made by logging companies to facilitate the floating of logs down the waterway.

Historical Use of the Sandy River

- Logging companies used nearly the entire length of the Sandy River under study to float their logs and railroad ties downriver to Troutdale from a number of upriver locations.
- The number of logs and railroad ties floated in a single drive was often very large, consisting of tens of thousands of individual pieces.
- The companies typically floated their logs and railroad ties during the spring.
- The period in which most of this activity occurred was between the late 1800s and early 1900s.
- The entire length of the Sandy River under study is used, often intensively, for recreational purposes (for example, boating, rafting, canoeing, kayaking, and drift boating).
- The intensity of recreational use depends on the flow characteristics of the particular segment, accessibility, the type of recreational watercraft, and time of year.

Background

This report was prepared by the Division pursuant to the requirements of Oregon Revised Statutes (ORS) 274.400 to 274.412 and Oregon Administrative Rules (OAR) 141-121-0000 through 141-121-0040. It is the third and final report to be issued under these rules on the title navigability of the Sandy River from RM 0.0 to 37.5, and is a revision of the report issued by the Division on September 6, 2001. The purpose of this report is to present:

- A record of the historical use and physical condition of the Sandy River since 1859, when Oregon became a state, from RM 0.0 (the point of confluence of the Sandy River with the Columbia River) to approximately RM 37.5 (the point of confluence of the Salmon River with the Sandy River), and
- A recommendation to the State Land Board as to whether this evidence is sufficient to meet the requirements of the federal test for navigability for public (title) ownership purposes.

Sources of Information Used in the Preparation of this Report

The Division relied on a wide variety of resources to prepare this report such as periodicals, personal diaries, legislative committee files, hydroelectric licensing reports, survey notes, water resource model results, geologic studies, court documents, previous navigability studies, personal communications with historians and

anthropologists, and the testimony submitted during, and after the Land Board's October 17, 2001 public hearing.

Among the periodicals providing the most insight into the historical condition and use of the Sandy River during the early 1900s were the Gresham Outlook and Beaver State Herald newspapers, and the Columbia River and Oregon Timberman trade journal. Often specific events concerning, for example, activities at various sawmills on the Sandy River were written about in two or more of these publications, and sometimes confirmed by testimony and other documents.

An additional source of information used in developing this report was the research conducted in the late 1970s, and contained in a 1980 report by James E. Farnell, Ph.D., for the Division on the historical condition and use of the Sandy River (Farnell, 1980). Division staff acquired and read many of the newspapers, trade journals, and court documents cited by Dr. Farnell to not only validate the information sources, but also to gain insights into the historical condition and use of the river.

To help collect and review these and other documents, as well as provide additional relevant historical information, the Division retained Stephen Beckham, Ph.D., Professor of History, Lewis & Clark College.

Division staff also examined via helicopter the current physical characteristics of, and real estate development patterns adjacent to, the Sandy River from its confluence with the Columbia River to approximately RM 50.

What Is "Navigability" About and Why Is This Study Being Done?

Prior to the American Revolutionary War, the King of England owned the bed and banks of all navigable waterways, including those within the original thirteen colonies (Shively v. Bowlby, 1894). When the colonies asserted their independence from the British, they became the owner of the land underlying what are termed "navigable" waters, as well as the land underlying tidal waters. On July 13, 1787, in An Ordinance for the Government of the Territory of the United States, North-West of the River Ohio (more commonly known as the Northwest Ordinance), the concept of the Equal Footing Doctrine was introduced. Under this doctrine, all new states entering the Confederacy of the United States would do so on an equal footing with the original thirteen states. Since that time, the federal courts have affirmed this right. Therefore, when Oregon was admitted to the Union in 1859, it was guaranteed all the rights and privileges granted in the Northwest Ordinance and became the owner of all land underlying the navigable waterways within its borders as a part of its sovereignty. It also became the owner of all land subject to the ebb and flow of the tide under English Common Law, a right later affirmed in Shively v. Bowlby (1894), and Phillips Petroleum v. Mississippi (1988).

Since the time of statehood, the bed and banks of only ten of Oregon's over 12,000 named streams have been determined to be publicly owned. Because neither the Land Board nor any other government entity has made a decision on the title navigability of

the vast majority of the state's waterways, uncertainty exists whether the federal government intended their beds and banks to be publicly or privately held.

In numerous decisions, beginning with the Daniel Ball decision in 1870, the United States Supreme Court and other federal courts have developed the following test to determine whether a waterway is "navigable" for "title," that is, public ownership purposes:

(1) It must be capable of, or susceptible to being used as a highway for the transportation of people or goods;
(2) Using customary modes of trade and travel on water;
(3) In its natural and ordinary condition;
(4) At the time of statehood (which in the case of Oregon is February 14, 1859).

This study is being done to determine if sufficient historical and other evidence exists that the Sandy River from RM 0.0 to 37.5 meets these four requirements of the federal test for title navigability.

Who Requested This Study and Why?

In late 1997, the Sandy River Chapter of the Association of Northwest Steelheaders submitted to the Division a written navigability study request for the Sandy River from RM 0.0 to 37.5, pursuant to the requirements of ORS 274.400 to 274.412, and OAR 141-121-0000 through 141-121-0040. In their request, the Steelheaders cited conflicts between river property owners and river users as the principal reason for needing such a study.

After reviewing this request and determining that it met the requirements stipulated in the administrative rules, the Division advised the public through newspaper notices, and landowners adjacent to the subject segment of the Sandy River by mail, of receipt of the navigability study request. These notices also sought public input on the merits of the study and alternatives to conducting it. At the June 10, 1997 Land Board meeting, an informational item was presented by the Division summarizing the comments received.

After various attempts to resolve the issues of concern leading to the study request, Division staff decided that no further progress could be made toward bringing together the proponents of, and opponents to, a navigability study. Therefore, on June 6, 2000, the Division requested and received Land Board approval to undertake a navigability study of the subject 37.5-mile segment of the Sandy River.

Geographic Markers

When discussing the 37.5 mile segment of the Sandy River that is the subject of this report, it is useful to correlate specific physical features with approximate river mile points and vice versa. The mile points indicated in Table 1 are based on the current

configuration of the Sandy River and are used as reference points throughout this report.

The reader is cautioned, however, that when applying these distances in a historical context, some difference may exist in the location of physical features indicated by a specific mile point today and one referred to in the past. This is because RM 0.0, or the starting point of all distances measured along the Sandy River, is located where the waterway currently joins the Columbia River. Because the location of this point has changed many times in the past as the result of the accretion and erosion of the Sandy River Delta, so also has the specific location of features over time in terms of their river mile location. Although this difference is not likely great, the location of RM 4.5 today, for example, may possibly not be the same as it was at the time of statehood.

Table 1

Mileage Location Points on the Sandy River

Approximate River Mile (RM)	Adjacent Physical Feature
0.0	Confluence of Sandy River with Columbia River
2.5	Interstate 84 Bridge
2.5-3.5	Lewis & Clark State Park
3.0	Troutdale-Crown Point Highway Bridge
6.0	Stark Street Bridge
6.0-18.5	Sandy River State Scenic Waterway Segment and Federal Wild and Scenic River Segment
6.0-7.0	Dabney State Park
10.0-14.0	Oxbow County Park
15.0	Indian John Island
18.5	Confluence of Bull Run River with Sandy River at Dodge Park
18.8	Lusted Road Bridge
24.0	Revenue Bridge
30.0	Marmot Dam
33.5	Confluence of Alder Creek with Sandy River
36.5	Sleepy Hollow-Marmot Bridge
37.5	Confluence of Salmon River with Sandy River
38.0	Brightwood

The Condition and Use of the Sandy River at Statehood

As discussed earlier in this report, any waterway must meet certain criteria established by the federal courts to be considered navigable for title purposes. To determine whether the Sandy River meets any or all of these requirements, it is first necessary to establish what the Sandy River's "natural and ordinary condition" likely was at the time of statehood (February 14, 1859).

Considerable evidence about the historic use, and likely physical condition of the Sandy River at the time of statehood, can be found in, or inferred from:

- The diaries and reports of early explorers and surveyors,
- Geologic and engineering reports,
- Hydrologic data and water resource models,
- Newspaper articles, trade journals, and local history books, and
- Reports and observations of current use by recreationists.

The information contained in each of these sources of data will be discussed in the following section.

Diaries and Reports of Early Explorers and Surveyors

From the diaries and reports of early explorers and surveyors, insights can be obtained regarding the physical condition of the Sandy River prior to statehood. This information can be used to help determine the river's "natural and ordinary condition" as well as whether it was actually used as, or "capable of being used as a highway for the transportation of people or goods."

The first European to discover the Sandy River was Lieutenant W.R. Broughton of the Vancouver Expedition. Unable to get his flagship *Discovery* over the bar at the mouth of the Columbia River, Captain George Vancouver ordered Lt. Broughton to attempt to enter the Columbia in the smaller ship *Chatham*. In October 1792, Lt. Broughton succeeded and took his ship as far as what is now called the Sandy River. Upon sighting this waterway, Lt. Broughton named it Barings River, most likely to honor an English banking family. In his notes, Capt. Vancouver described the Sandy River as *"…near half a mile wide, and in crossing it the depth was from 6 to 3 fathoms"* (or 36 to 18 feet deep) (Elliott, 1917).

In November 1805, thirteen years after Lt. Broughton reported sighting the Sandy River, the Lewis and Clark Expedition passed the waterway on their way down the Columbia River. During their return trip up the Columbia River in April 1806, Lewis and Clark sent three members of their expedition to explore what they called the Quicksand River (or what is now called the Sandy River). In his diary entry of April 1, 1806, Lewis gives the first detailed description of the lower part of the Sandy River:

> *"This morning early we dispatched Sergt. Pryor with two men in a small canoe up quicksand river with orders to proceed as far as he could and return this evening. we also sent a party of three hunters over the river to hunt a large bottom of woodland and prarie above the entrance of the Quicksand river; the ballance of the hunters we sent out in different directions on this side of the Columbia. the Indians who encamped near us last evening continued with us untill about midday. they informed us that the quicksand river which we have heretofore deemed so considerable, only extendes through the Western mountains as far as the S. Western side of mount hood where it takes it's source"* (Thwaites, 1959).

Lewis further reports of the Sandy River in his diary:

> *"they* [the Indians] *informed us that the quicksand river is navigable a short distance only in consequence of falls and rapids; and that no nation inhabits it. Sergt. Pryor returned in the evening and reported that he has ascended the river six miles; that above that point at which it divides itself into two channels it is about 300 yds. wide tho' the channel is no more than 50 yds and only 6 ft deep. this is a large volume of water to collect in so short a distance; I therefore think it probable that there are some large creeks falling into it from the S.W. the bed of this stream is formed entirely of quicksand; it's banks are low and at present overflown. the water is turbid and current rapid*" (Thwaites, 1959).

In his journal entry of the same day, Clark gives a similar description of the exploration of the Sandy River. However, he adds in his report that:

> *"…the other part of the river* [contains] *from 2 to 4 inches water…"* (Thwaites, 1959).

The type of "small canoe" used by Lewis and Clark's party to explore the Sandy River was most likely of the Chinook-type acquired from tribes in the vicinity of Fort Clatsop. However, it is possible they may have used one of the dugout canoes that the members of the expedition used to descend the Clearwater, Snake and Columbia Rivers in late 1805. Regardless of which watercraft was used, they were typically of a shallow draft and capable of floating on water from six to twelve inches deep (Beckham, 2000; Wright, 2001; Holm, 2001).

As discussed earlier in this document, the river mileages cited by explorers to various points along the Sandy River may not coincide with those used today to identify the location of those points. Therefore, the six-mile distance reportedly traveled by Lewis and Clark's party up the Sandy River may have not been as far upstream as the six-mile point at the Stark Street Bridge is today.

In 1872, Captain John Harlow, a sea captain from Maine, reportedly sailed what is described as "an old brigantine" up the Sandy River during a spring freshet and beached it near the mouth of Beaver Creek (approximately RM 3). He did this to convince railroad builders that the Sandy River was navigable and, therefore, a possible way for him to transport his produce to market on ships. Because Capt. Harlow proved the lowermost part of the Sandy River could be used for commerce, the railroad was forced to either build a drawbridge over the waterway to ensure that other boats would not be impeded, or establish a depot at his farm, which they ultimately did in 1882 (Nesbit, 1996).

In the mid-1800s, Lafayette Cartee secured a contract from the United States Government to survey the land adjacent to the lower Sandy River. In the instructions given to Cartee by the federal government, he was told to meander, that is, establish the boundary of *"both banks of navigable rivers . . . by taking the courses and distances of their sinuosities*." This was to be done to determine the limits of land available for sale by the government (General Land Office, 1851).

Although no specific direction was given to surveyors at that time concerning what constituted a "navigable stream," Cartee meandered the first 4.5 miles of the Sandy

River, stopping at the boundary between Township 1 North, Range 4 East and Township 1 South, Range 4 East. In his notes for Township 1 North, Range 3 East, Cartee stated:

> *"The Sandy River is not navigable for any kind of boats or scarcely for canoes, it being very rapid and having sand bars which are constantly changing their positions"* (Cartee, 1855a).

It is uncertain why Cartee did not continue to meander that portion of the Sandy River south of Township 1 South, Range 4 East. However, Cartee's field notes for Township 1 South, Range 4 East (which is immediately south of the point where he stopped meandering the Sandy River) state:

> *"The land on this boundary is gently rolling at the west end & increases in unevenness to hilly on the East end. It has all been burnt over & a larger part of the timber is dead & dying and and about half fallen & strewed over the surface & that is filled in with under growth of vine maple Haszle Elder Maple Blackberry briaris & Black raspberry weeds &c. making the surface as bad to get over as can be imagined"* (Cartee, 1855b).

> *"The timber on this township is dense & very large. There is considerable of it however that has been burnt. The N.E. Quarter of this township has not been Surveyed on account of its not being suitable for cultivation, it is extremely rough with many perpendicular bluffs along the creeks & small streams which run through deep. There are but few claims taken in this township yet. The Sandy run from the S.E. to the N.W. corner of this township which has perpendicular bluffs from 200 feet & 500 feet high"* (Cartee, 1855b).

Section Summary - Pre-Statehood/Exploration Period: The foregoing descriptions of the Sandy River by explorers and early settlers indicate that the Sandy River 100 or more years ago was:

- Fast moving, turbid, and in places at and near its mouth, shallow.
- Capable of being used for travel to at least a distance of 3 miles by a sailing ship and 6 miles by canoe.
- Considered "navigable" for at least 4.5 miles by the surveyor retained by the United States Government.

<u>Geologic and Engineering Reports</u> (Physical Condition)

From geologic and engineering reports, information can be obtained regarding the course and physical condition of the Sandy River prior to, and since statehood. This information is primarily useful in establishing the "natural and ordinary condition" of the Sandy River.

The Sandy River is 55 miles long and drains an area of about 508 square miles. It is often divided into four distinct topographic segments, three of which occur within the scope of this navigability study:

(1) From its source on the west side of Mount Hood (RM 55) to the confluence of the Zigzag River (RM 42), the Sandy River falls 1,600 feet in elevation, its channel characterized by narrow chutes and boulders.
(2) From the Zigzag River to Marmot Dam (RM 30), the river flows with a moderate gradient through a wider valley, much of which is known as Messinger Bottom.
(3) Below Marmot Dam, the river descends down a steep-walled narrow canyon at a moderate to steep gradient of over 40 feet per mile to the mouth of the Bull Run River near Dodge Park (RM 18.5).
(4) From Dodge Park, the Sandy River descends gradually through an 800-foot deep, narrow gorge. For the last several miles, this gorge widens, eventually becoming flat pastureland in the vicinity of the Columbia River (Taylor, 1998; Lewis, 1993).

Along its route to the Columbia River, the Sandy River cuts through a series of formations consisting primarily of basalt and andesite flows, pyroclastics, landslide and/or mudflow material, and glacial deposits. Because much of this material after deposition is relatively stable yet somewhat easy to erode, the Sandy River has cut deep narrow canyons along many of its segments (United States Geological Survey (USGS), 1989). Within these canyons, the Sandy River has been relatively confined and has exhibited little lateral movement (USGS, 1914). However, in those areas having a more moderate topography or gentle gradient such as near its mouth (RM 0.0 to 2.5) and in the vicinity of Messinger Bottom (approximately RM 32 to 35.5), the Sandy River has been known to change its course, often rapidly.

Given its name, it is not surprising that a notable characteristic of the Sandy River is the amount of sediment that this waterway transports as bed load which ultimately is deposited as a delta at its mouth. Because the Sandy River originates from meltwater from the Reid and Sandy Glaciers on the slopes of Mount Hood, it carries large amounts of very fine-grained material called “rock flour.” This sediment is generated from the slow scraping and grinding of the Reid and Sandy Glaciers over bedrock. In addition to this glacially derived silt, the Sandy River also carries a considerable amount of sediment resulting from the gradual downcutting of the river through various types of volcanic layers. A third source of the sediment carried by the Sandy River is the material deposited into it because of volcanic activity on Mount Hood. Over the past several thousand years, eruptive activity on Mount Hood (the most recent of which occurred in 1865) has periodically deposited large quantities of mud and ash into the four river systems (Sandy, Salmon, Hood and White) surrounding the mountain. About 1,500 years ago, a lahar (a water-saturated mixture of mud and rock fragments, some as large as truck-sized boulders) is known to have swept down the southwest flank of Mount Hood, completely burying the valley floor of the Sandy River and accumulating to a depth of approximately 40 feet near the mouth of this waterway (USGS, 1989; 2001a, b).

Not surprisingly, as is typical of many rivers that form deltas, the course of the Sandy River from approximately River Mile 2.5 to its confluence with the Columbia has changed many times throughout the years. On many occasions, particularly during a flood event, the river near its mouth has either split into two or many channels, or

occupied an entirely different single channel. Because these changes often interfered with the ability of fish to migrate up the Sandy River, numerous efforts have been undertaken to force the river back to one course or another, including construction of a dike, dredging, and the use of explosives (The Oregonian, 1924a, b, c, 1926a, b, 1930, 1932, 1937, 1938; Brockman, 1928, 1946).

In 1964, another major flood on the Sandy resulted in the river changing its course and causing extensive damage to homes, particularly along the segment extending from Alder Creek to one mile above Clear Creek (RM 33.5 to 44.5). Following this flood, the U.S. Army Corps of Engineers channelized the river along this segment (USACE, 1965; Gamble, 2000).

Section Summary – Geologic and Engineering Records Describing Physical Condition: It is reasonable to conclude that the Sandy River has, with the exception of the segment near its confluence with the Columbia River and in the vicinity of Brightwood, remained generally within the channel it currently occupies.

Hydrologic Data and Water Resource Models (Streamflow)

Hydrologic data and water resource models can be used to establish current and past flows of the Sandy River. With this information, it is possible to determine what was likely the Sandy River's "ordinary and natural condition" at the time of statehood.

The Sandy River is similar in many ways to other mountain streams. Its flow varies greatly on a daily and seasonal basis depending on the amount of rain falling in its watershed, rate of snowpack and glacier melt, and withdrawals for human and agricultural consumption. Although the river typically runs at its highest levels between November and May as the result of heavy winter rains and spring snowpack melt, peak flows can occur during almost every season as the result of major storm events. The lowest flows of the river most often occur in August and September.

Whether the flows observed today on the Sandy River are similar to those which existed at the time of Oregon's statehood depends on which segment of the waterway is being considered. For example, above Marmot Dam (RM 30), the Sandy River's current flow pattern is similar to that in 1859. However, below Marmot Dam, the flow pattern currently observed is most likely not the same as that which occurred at the time of statehood. This is due to three factors:

- Construction of the Marmot Dam in 1913 (where water is diverted through a series of canals, flumes and tunnels to Roslyn Lake and the Bull Run powerhouse to generate electricity);
- Withdrawal of water from a tributary of Cedar Creek to supply the City of Sandy's municipal requirements; and
- Storage and diversion of water from the Bull Run River since 1895 to supply Portland's municipal requirements.

As much as 600 cubic feet per second (cfs) of water can be diverted from the Sandy River at Marmot Dam to Roslyn Lake. Although nearly all of this water is ultimately returned to the Sandy River via the Bull Run River, this diversion results in diminished flows in the Sandy River between RM 30 and the return site at RM 18.5. The duration and magnitude of these flow reductions are dependent on how much water is required to maintain the level of Roslyn Lake, and how much of that water is subsequently released into the Bull Run River during power generation. An additional factor impacting the flow of the Sandy River from RM 30.0 to 18.5 is that Portland General Electric, owner/operator of the Marmot Dam, is required as a condition of its license to maintain a minimum flow below Marmot Dam of:

- 200 cfs from June 16 through October 15;
- 400 cfs from October 16 through October 31; and
- 460 cfs from November 1 through June 15.

Municipal needs for water and agricultural water rights from the Sandy River are a significant source of withdrawal. The City of Sandy obtains its water from Alder Creek and Brownell Spring, a tributary of Cedar Creek, both of which flow into the Sandy River. Because the city's peak demand of approximately 2.8 cfs is relatively minimal, it does not have an appreciable impact on the Sandy River's flow (Walker, 2001). However, the withdrawal of water for Portland's municipal needs is substantial and significantly affects the flow of the Bull Run River which, in turn, impacts the flow of the Sandy River. Agricultural withdrawal rights for the Sandy Basin, the majority of which are downstream of the confluence of Cedar Creek, are granted for 84.27 cubic feet per second. However, to what extent these rights are actually used is uncertain.

The flow of the Sandy River is measured at two gages installed and monitored by the United States Geological Survey (USGS): 14137000 is 0.3 miles above Marmot Dam, and 14142500 is 0.1 miles downstream from the confluence of the Bull Run River with the Sandy River. Because these two gages have been in place for many years, the flow pattern over time of the Sandy River at each of these locations is known. Tables 2 and 3 present data from these gages.

Table 2

Average Monthly Flow in CFS for the Sandy River below the Confluence of Bull Run: 1910-1999

January	3,499	**July**	816
February	3,391	**August**	499
March	3,023	**September**	533
April	3,318	**October**	1,178
May	2,823	**November**	3,127
June	1,802	**December**	3,770

Source: USGS, 2001c

Table 3

Average Monthly Flow in CFS for the Sandy River Just above Marmot Dam: 1911-1999

January	2,036	**July**	648
February	1,898	**August**	430
March	1,664	**September**	409
April	1,873	**October**	660
May	1,807	**November**	1,597
June	1,228	**December**	2,095

Source: USGS, 2001d

From the data obtained from these same gages, the USGS has determined the likelihood that the Sandy River will equal or exceed a given flow at each of the two above gage locations (Tables 2 and 3). Tables 4 and 5 indicate the likelihood that the flow of the Sandy River below the confluence of the Bull Run River and just above Marmot Dam will equal or exceed the following rates in cfs during the months indicated.

Table 4

Likelihood That the Flow of the Sandy River Will Equal or Exceed the Following Rates in CFS below the Confluence of the Bull Run River

	50%	75%		50%	75%
January	2,340	1,490	**July**	744	591
February	2,350	1,580	**August**	498	412
March	2,600	1,740	**September**	467	349
April	3,150	2,380	**October**	623	401
May	2,880	2,040	**November**	1,910	1,010
June	1,560	1,090	**December**	2,660	1,700

Note: These flow projections are based on the actual flow of the Sandy River for the period 1921-1961, and reflect withdrawals made for municipal and agricultural purposes.

Source: USGS, 1990a

Table 5

Likelihood That the Flow of The Sandy River Will Equal or Exceed the Following Rates in CFS above Marmot Dam

	50%	75%		50%	75%
January	1,390	913	**July**	592	496
February	1,360	952	**August**	411	362
March	1,370	1,040	**September**	368	318
April	1,740	1,320	**October**	422	326
May	1,730	1,260	**November**	1,030	585
June	1,040	792	**December**	1,410	941

Note: These flow projections are based on the actual flow of the Sandy River for the period 1921-1961 and reflect withdrawals made for municipal and agricultural purposes.

Source: USGS, 1990b

According to the USGS, the actual flow of the Sandy River based on 57 years of records immediately downstream of the confluence of the Bull Run River for 1911-1914, 1930-1966, and 1985-2000 is (USGS, 2001e):

Minimum instantaneous flow:	45 cfs in September 1962
Maximum instantaneous flow:	84,400 cfs in December 1964
Average flow:	2,192 cfs

Based on 89 years of records for water years 1911-1987, the USGS has determined the actual flow immediately above Marmot Dam to be (USGS, 2001f):

Minimum instantaneous flow:	190 cfs in September 1994
Maximum instantaneous flow:	61,400 cfs in December 1964
Average flow:	1,361 cfs

Because Oregon became a state approximately 50 years prior to the installation of any gages along the Sandy River, it is not possible to know precisely what the flow of this waterway was in 1859. However, the flow patterns observed on the Sandy River from these gages are most likely the same as those that occurred at the time of statehood.

Another way to obtain some idea of the condition of the Sandy River at the time of statehood is to use a model developed by the Oregon Water Resources Department (OWRD). From this model the flow of the Sandy and other rivers in Oregon can be determined, assuming no consumptive uses or flow regulation. According to this model, the average monthly flow (at a 50% and 80% exceedence level) of the Sandy River under normal rainfall conditions at the time of statehood at four locations in 1859 would be as indicated in Table 6.

Table 6

Likelihood of Flows at Various Points along the Sandy River at Statehood

	Below confluence of Salmon River (+/-RM 37.5)		Above confluence of Bull Run River (+/-RM 19.0)		Below confluence of Bull Run River (+/-RM 18.0)		At confluence of Columbia (+/-RM 1.0)	
	All flows indicated are in cfs							
	50%	80%	50%	80%	50%	80%	50%	80%
January	1,412	823	1,720	989	2,780	1,536	3,190	1,810
February	1,411	959	1,680	1,120	2,720	1,745	3,130	2,040
March	1,293	968	1,500	1,110	2,450	1,750	2,760	2,000
April	1,561	1,097	1,770	1,240	2,880	1,961	3,120	2,190
May	1,507	1,129	1,680	1,230	2,649	1,900	2,740	1,940
June	955	716	1,030	772	1,519	1,075	1,620	1,190
July	567	447	608	490	830	650	950	726
August	416	344	424	364	562	487	633	539
September	394	311	406	331	594	458	682	503
October	413	328	449	339	766	510	843	561
November	940	536	1,190	609	2,126	1,062	2,210	1,160
December	1,466	880	1,740	1,010	2,830	1,625	3,230	1,880

Note: **Below confluence of Salmon River** determined by adding the natural flow of the Salmon River at its mouth (OWRD watershed ID#71557) with the natural flow of the Sandy River above the Salmon River (OWRD watershed ID#71559).
Above confluence of Bull Run River (OWRD watershed ID#30300104).
Below confluence of Bull Run River determined by adding the natural flow of the Bull Run River at its mouth (OWRD watershed ID#30300101) with the natural flow of the Sandy River above the Bull Run River (OWRD watershed ID#30300104).
At confluence of Columbia (OWRD watershed ID#71480).

Source: Oregon Water Resources Department, 2001

Meteorological records kept by officers stationed at various United States Army forts in Oregon provide information concerning the amount of rainfall that occurred at the time of statehood. Table 7 presents the amount of precipitation according to observations taken in 1859 by medical officers at Fort Yamhill (near Grand Ronde/Willamina), Fort Vancouver, and Fort Cascades (near Beacon Rock/Bonneville Dam), as well as the average precipitation for stations in Willamina, Bonneville Dam, and Portland International Airport during the period 1948-2000.

Table 7

Weather Observations for Stations in the Vicinity of the Sandy River Basin: 1859 and 1948-2000

Army Observations *Total Precipitation in 1859*		**Western Regional Climate Center Observations** *Average Total Precipitation 7/1948-12/2000*	
All precipitation indicated is in inches			
Fort Yamhill	55.63	Willamina	52.58
Fort Cascades	60.97	Bonneville Dam	77.54
Fort Vancouver	38.86	Portland International	37.16

Source: Coolidge, 1860; Glisan, 1874; Western Regional Climate Center, 2001

As is evident from the data on Table 7, the total rainfall recorded in 1859 at the army forts indicated was approximately the same as that which falls on the average at weather stations near to the sites of these forts.

Section Summary - Streamflow: Based on the information available concerning the historic streamflow of the Sandy River, hydrology of the Sandy River Basin, and climatic data, the following conclusions can be made:

- Because the Sandy River has been monitored at one site for 89 years (immediately downstream of the confluence of the Bull Run River), and another for 57 years (immediately upstream from Marmot Dam), its flow characteristics are well known.
- The flow of the Sandy River varies markedly on a daily, monthly, yearly and seasonal basis due to both natural causes and consumptive uses. However, the Sandy River's pattern of high and low water periods is generally predictable, with its highest levels between November and May and its lowest levels from July through September.
- Withdrawal of water from the Bull Run River by Portland for municipal use has the greatest overall impact on the flow of the Sandy River from RM 18.5 to its mouth. The diversion of water from the Sandy River for generating electricity also has a major impact on the river's flow, particularly from RM 30.0 to 18.5.
- The total amount of precipitation which fell in 1859 in the vicinity of the Sandy River appears to have been about the same as that which has been recorded in an average year at other nearby locations.

Newspaper Articles, Trade Journals, and Local History Books

Considerable information concerning the use of the Sandy River by logging companies can be found in newspaper articles and trade journals. With these data, it is possible to determine if the Sandy River was *"used as a highway for the transportation of people or goods."* Because the floating of logs down a waterway has been determined by the court to be a use that meets the provisions of the federal test for navigability, how the Sandy River has been used in this way is of importance (State of Oregon v. Riverfront Protection Association, 1982).

In the late 1800s and early 1900s, many log and railroad tie drives are reported to have occurred on the Sandy River. According to testimony given in court by Frank Bacon, who lived 2.5 miles north of Sandy, logs and railroad ties were floated down the Sandy River to Troutdale from one or more mills in the vicinity of Brightwood during the period 1895 to 1909. He further testified that during the period October 1905 until 1907, he and his father cut 35,000 ties that they dumped into the Sandy at Revenue Bridge (RM 24):

> *"Cold-decked them during the winter and then had a flume extended from the mill to the river and cold-decked them along the flume, then in June when backwater from the Columbia River was present we had a boom at Troutdale and run our ties to Troutdale and elevated them with a steam hoist and shipped them aboard the O.S.L."* (Scheuffle v. Newman, 1949).

Bacon also stated during his testimony that:

> *"Well, the last ties floated down the Sandy River to my knowledge was in 1921, but they didn't come clear through to Troutdale, they came down from Brightwood to the Big Sandy Dam and were diverted through the tunnels by way of Portland General Electric canal and put aboard at Bull Run*" (Scheuffle v. Newman, 1949).

Confirmation that railroad ties were floated from the vicinity of Brightwood to Troutdale is contained in the notes of the State Fish Warden. On June 11, 1901, the following entry appears in his diary:

> "*While at The Dalles, Or. I received word from Supt. Brown of the Salmon River Hatchery notifying me that Mr. C. Minsinger, owner of a saw mill on the Sandy River below the mouth of the Salmon River, and also other parties names not mentioned, were floating Rail Road Ties down the Sandy River from his mill to Troutdale, and that in breaking jams that they made in said river, the men employed in running these ties were using powder or other explosives which would kill or injure salmon that may be near thereof and as it was contrary to the law requested that I attend at once to having the matter stopped."*
>
> *"On meeting Mr. Mensinger he informed me that he had secured permission from Clackamas County, County Commissioners to run the ties down said stream and also to use explosives in said stream for the purpose of clearing it of large boulders"* (Fish Warden's Diary, 1901-1908).

Additional substantiation of Bacon's testimony that logs, cordwood and railroad ties were floated down the Sandy River from various points in the early 1900s is contained in the following articles appearing in the documents cited:

- In April, 1900, <u>The Columbia River and Oregon Timberman</u> reported that:

> *"Messinger's saw mill, 12 miles up the Sandy River, is sawing an average of 350 ties daily. The ties are floated down the river to Troutdale, a distance of 30 miles"* (<u>The Columbia River and Oregon Timberman</u>, 1900b).

If the ties traveled a distance of 30 miles to Troutdale, then Messinger's sawmill at that time must have been located in the vicinity of RM 33, or near the confluence of Alder Creek with the Sandy River.

- In June 1900, The Columbia River and Oregon Timberman reported that:

  "R. Wood, the well known saw mill man, has taken hold of C. Messinger's mill at Sandy. This mill has a capacity of 800 ties daily, and is admirably arranged for handling ties cheaply. The ties drop from the cut-off saw right into the flume which carries them to the Sandy River, where they are floated to Troutdale, a distance of thirty miles, where they are elevated to the cars from the river" (The Columbia River and Oregon Timberman, 1900c).

  Again, if the ties traveled a distance of 30 miles to Troutdale, then Messinger's sawmill at that time must have been located in the vicinity of RM 33, or near the confluence of Alder Creek with the Sandy River.

  In this same issue of The Columbia River and Oregon Timberman, a news item appeared stating:

  "About 65,000 ties have been dumped in the Sandy River by Bramhall's and Menisinger's saw mill and will at once begin to drive to Troutdale, where they will be taken out by an endless chain elevator" (The Columbia River and Oregon Timberman, 1900c).

  This item assumably refers to Messinger's sawmill. The reference to Bramhall's sawmill is most likely his facility near Aims.

- In August 1901, The Columbia and Oregon Timberman contained the following news item:

  "The Sandy River at Troutdale is full of ties, which have been driven down the river. Loading will not commence until about the first of September. Cummins & Cole have 30,000 at Troutdale, Bromhall has 60,000 to come down. Messinger & Co.'s 60,000 ties are mostly disposed of" (The Columbia River and Oregon Timberman, 1901).

- The January 25, 1907 edition of the Beaver State Herald contained a news item stating that:

  "The four saw-mills at Cougar mountains [near Hurlburt] *started up last Monday…and are all engaged in cutting railroad ties which will be run down the Sandy to Troutdale in the spring"* (Beaver State Herald, 1907a).

- In July 1907, The Beaver State Herald reported that the following saw mills in the vicinity of Aims floated ties down the Sandy River:

> *"O.I. Hickman is busy having just reached Troutdale with about 80,000 ties which he drove down Sandy River. About 11,000 were from Bacon's mill and the balance from C.L. Fox's and Wm. Masterton's mills. He will start again soon with two crews. One will take Johnson's ties and the other will take a drive of 45,000 from C.T. Fox's and Wm. Masterson's mills. It is rumored that Mr. Hickman cleared $500 above expenses on his first drive. He is an old experienced driver, having made 22 trips down the Sandy River"* (The Beaver State Herald, 1907b).

In the November 1914 issue of The Columbia River and Oregon Timberman, additional mention is made of a sawmill in the vicinity of Aims:

> *"Wihlon & Co. have moved their tie mill to a new site near Aims into a good body of timber. They have started up their mill and will float the ties down the Sandy"* (The Columbia River and Oregon Timberman, 1903).

Articles appearing at various times in newspapers refer to the inability of sawmills along the Sandy River to operate until logs deposited at upstream sites arrive. When the water in the Sandy River would rise, a routine occurrence every year, usually in late spring, news items such as the following would be placed in trade journals:

> *"The high water in the Sandy has brought down the Bramhall and other ties, which are now held at the Troutdale boom"* (The Columbia River and Oregon Timberman, 1904).

> *"Cone Brothers' mill at Troutdale has been closed down temporarily owing to the scarcity of logs. The first rise in the Sandy will give them a supply"* (The Columbia River and Oregon Timberman, January 1900a).

> *"The river has arisen sufficiently high to float down the railroad ties from the upper mills and this work will begin very soon"* (Gresham Outlook, 1912).

> *"The Johnson Lumber Company's new saw mill* [in Sandy] *closed Monday. They will make some repairs and changes on the mill and will also make a tie drive as soon as there is back water in the Sandy at Troutdale"* (Beaver State Herald, 1908).

> *"The* [Sandy] *river has reached a stage sufficiently high to float down the railroad ties from the upper mill, and the work will begin soon"* (Beaver State Herald, 1917).

This use of the Sandy River to float logs and railroad ties during its spring stage is also substantiated in an oral history by Fay Davis, a sawmill worker, about a log drive from Trout Creek (RM 13.5) to Troutdale:

> *"they didn't drive them* [the ties] *often. Mostly in the spring after the water went down"* (Woodward, 1975).

In 1915, Mr. J. Scales filed a lien in Clackamas County against First State Bank for non-

payment of wages for his *" . . . labor, assistance and material in driving . . . cord wood in said Sandy River . . . ."* In the lien Mr. Scales claimed ownership to 3,000 cords of various types of wood floated that year down the Sandy River. Although the wood was put into the Sandy River at Revenue Bridge (RM 24), much of it never made it all the way to Troutdale and ended up on the banks of the waterway (Clackamas County, 1915). This was reportedly not an uncommon occurrence for cordwood.

In November 1923, an eight-mile long flume was completed, connecting the Sandy Lumber Company's sawmill near the present location of Brightwood with the Portland Railway, Light & Power Company's flume at the Marmot Dam. With this structure (called the Bechill Flume) in place, the Sandy River Lumber Company could flume its railroad ties directly from its Brightwood sawmill to *the "docks at Bull Run station,"* a distance of 20 miles. To gain access to this transportation system, the Dixon & Howatt mill at Cherryville constructed a six-mile long flume which joined the Bechill Flume. However, even after the construction of this flume, logs cut for the Sandy Lumber Company in the Brightwood Flats area continued to be floated down the Sandy River to the mill (The Timberman, 1923; Hartman and Schwartz, 1973).

In the early 1900s, one logging company is known to have used explosives to remove an obstacle from the Sandy River to facilitate log drives (Beaver State Herald, 1907c). However, based on the research conducted, this practice is not believed to have been common. Additionally, no evidence was found of the construction of splash dams on the Sandy River by logging companies to assist in moving logs downstream.

Section Summary – Post-Statehood Historical Use: Based on the record of historical use of the Sandy River by logging companies, the following conclusions can be made:

- Logging companies used nearly the entire length of the Sandy River under study (RM 3.0 to 37.5) to float their logs and railroad ties downriver to Troutdale from a number of upstream locations.
- The number of logs and railroad ties floated in a single drive was often very large, consisting of tens of thousands of individual pieces.
- The companies typically floated their logs and railroad ties during the spring.
- The period in which most of this activity occurred was between the late-1800s and early 1900s.
- On a geographic basis, the greatest number of log and railroad tie drives occurred on that section of the Sandy River between the confluence of the Bull Run River and Troutdale.
- No significant alterations to the Sandy River are known to have been made by logging companies to facilitate the floating of logs down the waterway.

Reports and Observations of Current Use

If a waterway has not markedly changed its flow characteristics or channel over time, how it has been recently used is an important consideration in determining how it could have been used in the past. Therefore, reports and observations of the recent and current use of the Sandy River are important.

A major use of the Sandy River (other than for the transport of logs and railroad ties) is recreation, which includes boating, angling, kayaking, rafting, and canoeing. The entire length of the Sandy River under study has been identified in river guidebooks as usable for kayakers, canoeists and rafters, with the minimum recommended flows in cfs required. Table 8 presents these minimum recommended flows.

Table 8

Minimum Recommended Flows By Segment For Recreational Uses

River Segment	Minimum Flow in CFS
• Sleepy Hollow-Marmot Bridge to Marmot Dam (RM 36.5 to 30.0)	700
• Marmot Dam to Revenue Bridge (RM 30.0 to 24.0)	1,200
• Revenue Bridge to Dodge Park (RM 24.0 to 18.5)	1,200
• Dodge Park to Oxbow Park (RM 18.5 to 10.0-14.0)	1,200
• Oxbow Park to Dabney State Park (RM 10.0-14.0 to 6.0-7.0)	700+
• Dabney State Park to Lewis and Clark State Park (RM 6.0-7.0 to 2.5-3.5)	500

Source: Willamette Kayak & River Club, 1994; Garren, 1996

Most Sandy River anglers and recreationists put in their drift boats, kayaks and rafts at Dodge Park (18.5) or Oxbow Park (RM 10 to 14) and float downstream to any one of a number of takeout points, such as Dabney Park (RM 6 to 7) or Chinook Landing (on the Columbia River, approximately two miles downstream from the mouth of the Sandy River). This trip can be taken throughout much of the year, contingent on water availability. In addition, many of the upriver segments listed above are run, often in succession, by more experienced kayakers when sufficient water is available. In June 1999, a number of kayakers floated most of the entire length of the Sandy River, putting in above Brightwood and taking their boats out at Chinook Landing. In April 2001, a number of kayakers also floated the same length, with groups alternately putting in and taking out at various points along the waterway (Garren, 2001).

Some Sandy River anglers and recreationists also use powerboats which they typically put in at Dabney Park (RM 6-7) and take out at Chinook Landing.

Several commercial guides and outfitters provide float trips on the Sandy River to anglers seeking summer and winter steelhead, spring Chinook, and coho salmon. These guides most often use drift boats, which they put in at either Dodge Park (RM 18.5) or Oxbow Park (RM 10-14), contingent on flow conditions, and take out at Dabney Park (RM 6-7). Typically, the season in which these trips are offered extends from November to early June.

Section Summary – Current Use: From the foregoing, it is evident that:

- The entire length of the Sandy River under study (RM 0.0 to 37.5) is used, often intensively, for recreational purposes (for example, rafting, canoeing, kayaking, and drift boating).
- The intensity of recreational use depends on the flow characteristics of the particular segment, accessibility, the type of recreational watercraft, and time of year.

Evaluation of the Evidence

As stated in the beginning of this report, the federal test for navigability is used to determine if the bed and banks of a waterway were intended to be granted to the public at the time of statehood. Whether the Sandy River meets the requirements of a navigable waterway for title purposes depends entirely on how well the historical use and flow data meet the federal test requirements. In this section, a question and answer format will be used to determine whether the requirements of the federal test are met by the evidence presented in this report.

The federal test requires that a waterway:

(1) Must be capable of, or susceptible to being used as a highway for the transportation of people or goods;
(2) Using customary modes of trade and travel on water;
(3) In its natural and ordinary condition;
(4) At the time of statehood (which in the case of Oregon is February 14, 1859).

Was the Sandy River Actually Used As a Highway of Commerce?

From the foregoing discussion, considerable evidence exists that the Sandy River has been, and continues to be, used as a "highway for the transportation of people or goods." This use started as early as 1806 when Lewis and Clark reported that members of their expedition traveled six miles upstream. Then, in 1872, Captain John Harlow sailed and beached a vessel approximately three miles upstream. This was followed over an approximately twenty-five year period commencing in the late 1800s and ending in the mid-1920s by the driving of cordwood, logs and railroad ties down various segments of the Sandy River, one of which was from just below the present location of Brightwood to Troutdale. During more recent times, rafters, anglers in drift boats, and canoeists, have used the entire length of the Sandy River under study for recreational purposes.

Was the Sandy River the Same at Statehood As It Is Today?

To determine the "susceptiblity" of the Sandy River to use at the time of Oregon's statehood, it is necessary to determine if the waterway could have been used in 1859 as "a highway for the transportation of people or goods" using the customary modes of travel and trade on water at the time. One key to this determination is whether the flow and location of the Sandy River have changed significantly since the time of statehood.

Based on the information presented in this report, with the exception of the documented movement in the location of its confluence with the Columbia River and changes in its course in the vicinity of Brightwood, there is no evidence that the general configuration of the river today is substantially different than it was at the time of statehood. As for the Sandy's flow, it is likely that the waterway carried at least as much, if not more water at the time of statehood than it does today. This is because at the time of statehood, there were no withdrawals of water from the Sandy River for municipal or agricultural use. And secondly, there is evidence that the amount of precipitation in 1859 was about the same as the average yearly amount received in the vicinity over the past five decades.

<u>What Types of Transportation of People or Goods Could Have Occurred at the Time of Statehood</u>?

As the evidence presented in this report indicates:

- The general condition of the Sandy River has remained essentially unchanged for most of its length, and
- The Sandy River most likely flowed at a rate equal to or greater than what we see today.

Therefore, if these assumptions are correct, many of the same uses observed during the past century on the Sandy River, for example, log and railroad tie driving, could have occurred at the time of statehood.

Further support for this conclusion can be developed by analyzing the following data:

- The actual stream flow data for the Sandy River collected by the United States Geological Survey (Tables 2 and 3);
- The flow data for the Sandy River derived from the Water Availability Reporting System model developed by the Oregon Water Resources Department (Table 6);
- The recommended flows required along various stretches of the Sandy River for various recreational uses (Table 8);
- The draft and cfs flow requirements for various watercraft currently used on the Sandy River (Table 9 below); and
- The draft requirements of current and past watercraft that have, or could have used the Sandy River.

As indicated on Table 8, a flow of 1,200 cfs would allow recreationists to use the entire length of the Sandy River under study for kayaking, canoeing and rafting. Table 9 presents the flow requirements for various recreational watercraft.

Table 9

Sandy River Flow Requirements for Various Recreational Watercraft

Watercraft	Flow Required in CFS
• Drift boating	700 to 3,000
• Whitewater canoeing, rafting and kayaking	1,200 to 3,000
• Open canoeing and kayaking	700+
• Flatwater rafting	550 to 700
• Boating	700 to 3,000

Source: Oregon Water Resources Department, 1992

Tables 2 and 3 give the average monthly flows in cfs of the Sandy River over the period 1910/1911-1999 as determined by the USGS. From these tables it is evident that an average monthly flow of 1,200 cfs typically occurs both below the confluence of the Bull Run River and just above Marmot Dam from November through June of each year.

Based on the same actual flow data, the USGS has determined that there is a 75% chance that during any given month, the flow of the Sandy River (after withdrawals for municipal and agricultural uses) below the confluence of the Bull Run River will exceed 1,200 cfs from December through May. Similarly, there is a 75% chance that the river flow (after withdrawals for municipal and agricultural uses) just above Marmot Dam will exceed 1,200 cfs in April and May (Tables 4 and 5).

Table 10 (next page) indicates how many months of the year there is a 75% chance that the flow of the Sandy River after withdrawals and diversions for municipal and agricultural uses will meet or exceed the minimum required flow for recreational uses for the stretches indicated. From this table, it is apparent that recreational uses and, therefore, the ferrying of passengers and goods could typically use various segments of the Sandy River from six to nine months each year.

Table 10

Likelihood of Sandy River Flows Meeting Recreational Requirements Based on United States Geological Survey Exceedence Projections

River Segment	Recommended Minimum Flow in CFS	Period in Which There Is a 75% Chance That the Minimum Flow Will Occur during an Entire Month
Brightwood to Marmot Dam (RM 36.5 to 30.0)	700	Above Marmot Dam December through June
Marmot Dam to Dodge Park (RM 30.0 to 18.5)	1,200	Not Available
Dodge Park to Oxbow Park (RM 18.5 to 10.0)	1,200	Below confluence of Bull Run December through May
Oxbow Park to Dabney State Park (RM 10.0 to 6.0-7.0)	700+	Below confluence of Bull Run November through June
Dabney State Park to Lewis & Clark SP (RM 6.0-7.0 to 2.5-3.5)	500	Below confluence of Bull Run November through July

Table 11 (next page) gives the Oregon Water Resources Department's estimate of the projected flow of the Sandy River, assuming no consumptive uses or flow regulation at a 50% and 80% exceedence – conditions which could have existed at the time of statehood. As indicated from this table, recreational users and, therefore, boats ferrying passengers and goods could use various segments of the Sandy River for kayaking, canoeing and rafting from six to twelve months of the year under a 50% exceedence; and from two to twelve months of the year under an 80% exceedence.

Table 11

Likelihood of Sandy River Flows Meeting Recreational Requirements Based on Oregon Department of Water Resources Model Indicating Likely Flows at the Time of Statehood

River Segment	Recommended Minimum Flow	Period in Which There Is a 50% and 80% Chance That the Recommended Minimum Flow Would Have Occurred at Statehood during an Entire Month
Brightwood to Marmot Dam (RM 36.5 to 30.0)	700	50%: November through June 80%: December through June
Marmot Dam to Dodge Park (RM 30.0 to 18.5)	1,200	50%: December through May 80%: April through May
Dodge Park to Oxbow Park (RM 18.5 to 10.0)	1,200	50%: November through June 80%: December through May
Oxbow Park to Dabney State Park (RM 10.0 to 6.0-7.0)	700+	50%: October through July 80%: November through June
Dabney State Park to Lewis & Clark SP (RM 6.0-7.0 to 2.5-3.5)	500	50%: All year 80%: All year

How Do Current Watercraft Compare to Past Modes of Transportation?

According to recreationists, a typical “loaded” drift boat accommodating 2 to 3 persons has a draft of 4-6 inches; a fully loaded inflatable raft accommodating 4-8 people, 6-12 inches; and a fully loaded kayak, 3-5 inches.

No evidence is available to suggest that Native Americans used the Sandy River as a highway of commerce. However, Lewis and Clark report in their journals that three members of their group ascended the river for six miles in a small, what is believed to be a Chinook-type canoe. Depending on the size of the canoe used and number of people carried by it, such canoes (based on descriptions in Lewis and Clark’s journals) are believed to have been able to skim through water 6 to 8 inches deep.

Given the similarity in the draft requirements between a Chinook-type canoe and several of the watercraft currently in use today, it is reasonable to assume that a Chinook-type canoe could have used the Sandy River in the same way as current recreationists.

References

Beaver State Herald, 1907a, Hurlburt, January 25, 1907.

_____ 1907b, Aims, July 12, 1907, p. 3.

_____ 1907c, Troutdale, May 10, 1907, p 5.

_____ 1908, Sandy, March 27, 1908, p. 6.

_____ 1917, Troutdale, May 23, 1917.

Beckham, S. D., 2000, Professor of History, Lewis & Clark College, Portland, personal communication, December 21 and 26, 2000.

Brockmann, E. F., 1928, An Analysis of the Report of Ralph P. Cowgill, Special Engineer, on the Sandy River Situation: Western Out-of-Doors, November 28, 1928, p. 10, 11, and 13.

_____ 1946, Smelt and the Sandy River, A.E. Herrington Commercial Printers, 5 p.

Cartee, Lafayette, 1855a, Plat of Survey, T1N, R3E, W.M., U.S. Bureau of Land Management Archives, Portland.

_____ 1855b, Plat of Survey, T1N, R4E, W.W., U.S. Bureau of Land Management Archives, Portland.

Clackamas County, 1915, Mechanic's Lien Record Book 5, p. 102 and 104.

Coolidge, R. H., 1860, Statistical Report of the Sickness and Mortality in the Army of the United States, The Records of the Surgeon General's Office from January 1855 to January 1860, 36th Congress, 1st Session, Senate, Ex. Doc. No. 52, p. 405-491 and Notes and Errata.

Elliott, T. C., 1917, Where is Point Vancouver?, in Oregon Historical Quarterly, no. 18, p. 73-82.

Farnell, J. E., 1980, Sandy and Hood River Navigability Studies, for the Oregon Division of State Lands, 39 p.

Fish Warden's Diary, 1901-1908, p. 15-17, held by the Oregon State Archives, Salem.

Gamble, D., 2000, U.S. Army Corps of Engineers, Portland District, personal communication, October 31, 2000.

Garren, John, 1996, Oregon River Tours: Portland, Oregon, Garren Publishing, p. 226-231.

_____ 2001, personal communication, April 29, 2001.

General Land Office, 1851, Instructions to the Surveyor-General of Oregon; Being a Manual for Field Operations, Washington, D.C., Gideon and Company, p. 23-28.

Glisan, R., 1874, Journal of Army Life: San Francisco, A. L. Bancroft and Company, 512 p.

Gresham Outlook, 1912, Troutdale, May 24, 1912.

Hartman, E. and Schwartz, M., 1973, Sandy Pioneers, Early Settlers and Barlow Road Days: Gresham, Oregon, The Outlook Publishing Company, p. 213.

Holm, B., 2001, Curator Emeritus, Burke Museum, University of Washington, Seattle, March 14, 2001.

Lewis, D., 1993, Sandy Wild and Scenic River and State Scenic Waterway Management Plan, for the U.S. Bureau Of Land Management and Oregon State Parks and Recreation Dept., p. 17-18.

Nesbit, S., 1996, A History of Troutdale: internet website http://www.multnomah.lib.or.us/ritnet/ed/ths/hist01.html.
Oregon Water Resources Department, 2001, Water Availability Reporting System, internet website: http://www.wrd.state.or.us
_____ 1992, Scenic Waterway River Flow Assessments.
Phillips Petroleum v. Mississippi, 1988, 484 U.S. 469.
Scheufele v. Newman, 1949, 187 Or. 263, Direct examination of Frank Bacon, p. 307-319.
Shively v. Bowlby, 1894, 152 U.S. 1.
State of Oregon v. Riverfront Protection Association, 1982, 672 F.2d 792 (9th Cir. 1982).
Taylor, B., 1998, Salmon and Steelhead Runs and Related Events of the Sandy River Basin – A historical perspective, for Portland General Electric, p. 5-7.
The Columbia River and Oregon Timberman, 1900a, Oregon Mills, January 1900, v. 1, no. 3, p. 11.
_____ 1900b, The Tie Mills, April 1900, v. 1, no. 6, p. 11.
_____ 1900c, Oregon Mills, June 1900, v. 1, no. 8, p. 7.
_____ 1901, Oregon Mills, August 1901, v. 11, no. 10, p. 7.
_____ 1903, Oregon Mills, November 1903, v. 5, no. 1, p. 20.
_____ 1904, Oregon Mills, June 1904, v. 5, no. 8, p. 43.
The Oregonian, 1924a, Sandy To Be Deepened, April 9, 1924.
_____ 1924b, River Will Be Cleared, May 13, 1924.
_____ 1924c, Fish Channel Opened, September 6, 1924.
_____ 1926a, Dike in Sandy Planned, November 14, 1926.
_____ 1926b, Game Fish Plan Blocked: Rancher Objects To Dam To Divert Big Sandy, December 12, 1926.
_____ 1930, Birthright Of The Sandy River, May 30, 1930.
_____ 1932, Sandy Dam Work Starts, August 7, 1932.
_____ 1937, Engineers To Con Opening Of Sandy, November 21, 1937.
_____ 1938, Sandy Directed Into New Route, April 9, 1938.
The Timberman, 1923, Sandy, November 1923, v. 24, no. 11, p. 159-160.
Thwaites, R.G., 1959, Original Journals of the Lewis and Clark Expedition, 1804-1806, v. 4, p. 227-228 and 230.
U.S. Army Corps of Engineers (USACE), 1965, Internal memorandum, p. 86-88 and 107.
U.S. Geological Survey (USGS), 1914, Profile Surveys in Hood and Sandy River Basins, Oregon, Water Supply Paper 348, 7 p. and plates.
_____ 1989, Volcano Hazards in the Mount Hood Region, Oregon, internet website: http://vulcan.wr.usgs.gov/Volcanoes/Hood/Hazards/OFR97-89/OFR97-89.html
_____ 1990a, Statistical Summaries of Streamflow Data in Oregon, Open-File Report 90-118, v. 1, Monthly and Annual Streamflow, and Flow Duration Values, 14142400 Sandy River Below Bull Run River, near Bull Run, Oregon, p. 171.
_____ 1990b, Statistical Summaries of Streamflow Data in Oregon, Open-File Report 90-118, v. 1, Monthly and Annual Streamflow, and Flow-Duration values, 14137000 Sandy River near Marmot, Oregon, p. 162.

_____ 2001a, Mount Hood, Oregon, internet website: http://vulcan.wr.usgs.gov/Volcanoes/PacificNW/AGU-T106/hood.html.

_____ 2001b, Key geologic events in the Mount Hood region during the past 30,000 years: internet website: http://vulcan.wr.usgs.gov/Volcanoes/Hood/Hazards/OFR97-89/key_geologic_events_30000yrs.html

_____ 2001c, Monthly Streamflow Statistics for Oregon, USGS 14142500 Sandy River Below Bull Run River, near Bull Run, Oregon, internet website: http;//water.usgs.gov/or/nwis/monthly/?site_no=14142500&agency_cd=USGS

_____ 2001d, Monthly Streamflow Statistics for Oregon, USGS 14137000 Sandy River near Marmot, Oregon, internet website: http://water.usgs.gov/or/nwis/monthly/?site_no14137000&agency_cd=USGS

_____ 2001e, Hydrograph and Station Description for 14142500: Provisional Data Subject to Revision, 14142500 – Sandy River Below Bull Run River Near Bull Run, internet website: http://oregon.usgs.gov/rt-cgi/gen_stn_pg?station=14142500

_____ 2001f, Hydrograph and Station Description for 14137000: Provisional Data Subject to Revision, 14137000 – Sandy River Near Marmot, internet website: http://oregon.usgs.gov/rt-cgi/gen_stn_pg?station=14137000

Walker, M, 2001, Public Works Director, City of Sandy, personal communication, August 3, 2001.

Western Regional Climate Center, 2001, Period of Record Monthly Climate Summary for Bonneville Dam, Oregon; Willamina, Oregon; and Portland WSFO, Oregon, internet websites: http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?orwill, orbonn, and orport

Willamette Kayak & River Club, 1994, Soggy Sneakers: Seattle, The Mountaineers, p. 186-195.

Woodward, J. A., 1975, After the Spring Freshets Went Down, as told by Fay Davis to William Wahlke and Peggy Estes, in Oxen, Axes and China Teacups: Gresham: Mount Hood Community College, p. 60-63.

Wright, R.K., 2001, Curator of Native American Art, Burke Museum, University of Washington, Seattle, March 14, 2001.