

**Proposal to Apply for
Outstanding Resource Water of the State
Designation for Soap Lake (Grant County, WA)**

Date: April 2, 2021

Applicants: Soap Lake Conservancy, 501(c)(3) organization, EIN: 91-2028084
Confederated Tribes of the Colville Reservation

The Soap Lake Conservancy and the Confederated Tribes of the Colville Reservation (CTCR) are jointly applying for Soap Lake to receive designation as an **Outstanding Resource Water of the State** due to its extremely rare qualities and value to the citizens of the City of Soap Lake (City), the CTCR, the state of Washington, and the world. Soap Lake is a rare meromictic lake, which possesses one of the most diverse and concentrated mineral profiles of all the worlds' lakes. Its waters are renowned, with visitors from around the world coming to Soap Lake in their attempt to heal ailments. Soap Lake was carved out by the massive and numerous erosive Missoula floods thousands of years ago, and it sits at the end of a chain of lakes in the Lower Grand Coulee Corridor roughly 50 miles south of Grand Coulee Dam.

The lake is located in the traditional territory of the škwáxčənəx^w¹, or Moses-Columbia tribe, and is an ecologically unique and culturally significant surface water among the tribes of the Columbia Plateau region. The Moses-Columbia named this lake šmokíəm, which attributes the medicinal value of the alkali water as “healing waters” in the nxaʔamxčín language of the škwáxčənəx^w (Wazaney & Marchand 2007, Brooks 2012).

In addition to the Moses-Columbia, the Chief Joseph Band of Nez Perce, Entiat, Chelan, Okanogan, Palus, and Wenatchi tribes have also valued the lake since time immemorial. Each of these tribes are now included in the confederacy of the CTCR tribal government, and have identified Soap Lake for its natural contributions to the spiritual and physical health of its aquatic minerals and water quality, food and medicine security source, and as an economic trading and community center (Aripa 2010). The traditional ecological knowledge and use of Soap Lake predates Euro-American settlement in the region by thousands of years, and traditional cultural practices of the CTCR associated with the lake continue (Wazaney & Marchand 2007, Aripa 2010).

Soap Lake does not have a natural surface outlet, and there are no natural creeks or streams that supply water to it. Aside from precipitation, water historically entered

¹ Please recognize some computer software does not properly read nxaʔamxčín words, and may display or print them incorrectly in Unicode font. We discovered Word 2011 for Mac, v 14.2.2 changed the wedged c to a box when the document was printed.

Soap Lake from underground, and possibly through unidentified seepages. Since the 1950s, however, the water flow has been altered by the US Bureau of Reclamation and local Irrigation District activities. Exploration activities and completion of the Grand Coulee Dam in 1942, along with irrigation canals and siphons, altered water flow into and out of the lake. Large volumes of fresh water were added to the lake during 1951–1959 and 1962–1963, thereby diminishing mineral concentrations. Commercial and residential extraction of valuable mineral resources from the lake (i.e. salt) during the 1900s also diminished the lake’s unique water quality. Eventually, freshwater incursion was significantly reduced through installation of US Bureau of Reclamation interception wells in 1953 and 1959. Commercial mineral extractions were restricted through a Department of Ecology Water Permit issued to the City in the early 1940’s, although only three permittees still exist as of 2021 including two resorts and one health spa. A fourth permittee owns a 4-plex residential building, but no longer can extract mineral water. The City has recently allowed a local businessman to extract mineral water from the City Tank on two occasions, based on a temporary permit; although, the legality related to the City’s Department of Ecology Water Permit language is not clear. Research evaluating the freshening of the lake through Columbia Basin Irrigation Project water additions determined the interception wells restored the hydrological cycle of the lake to pre-irrigation values, although the meromictic character of the lake continues to change due to continued influx of freshwater causing a reduction in the monimolimnion volume and a lowering of the chemocline layer elevation (Kallis et al 2010). Today, Soap Lake still retains exceptionally high alkalinity, mineral concentrations and diversity even after these historic detrimental activities. CTCR and the Soap Lake Conservancy are making efforts to halt all further dilution of the lake through prohibiting non-precipitation freshwater additions. We are working with the City Council to ensure further degradation and mineral losses do not take place, and we are working towards continued education of local residents and the greater Washington community about the unique and irreplaceable nature of this world-renowned lake. We seek designation for Soap Lake as an Outstanding Resource Water of the State to ensure this lake is recognized for its exceptional qualities and to aid in its preservation. Soap Lake is a rare body of water, and needs recognition as a priceless natural feature within Washington and the United States of America.

We respectfully request review of our application below for designation of Soap Lake as an Outstanding Resource Water of the State (**Tier III-b**). Our responses to required criteria are indicated below, and are listed in *italic font*.

Washington Department of Ecology

Application for “Outstanding Resource Water of the State”, Tier III

[Tier III](#) is used when a high-quality water is designated as an **outstanding resource water**. The water quality and uses of these waters must be maintained and protected against all sources of pollution.

Public nominations must include sufficient information to show how the water body meets the appropriate conditions of an outstanding resource water.

If the information proposed demonstrates that the water body meets the eligibility requirements, we will schedule a review of the nominated water for designation. The review will include a public process and consultation with recognized tribes in the geographic vicinity of the water.

Outstanding resource waters can be designated for either Tier III(A) or Tier III(B) protection.

1. Tier III(A) is the highest level of protection and allows no further degradation after the waters have been formally designated.
2. **Tier III(B)** is the second highest level of protection and conditionally allows minor degradation to occur due to highly controlled actions. The requirements for Tier III(B) are:
 1. Sources of pollution — considered individually and cumulatively — are not to cause measurable degradation of the water body.
 2. Sources of pollution must use:
 1. Applicable advance waste treatment and control techniques.
 2. Prevent runoff pollution from nonpoint sources.
 3. Reasonably represent state-of-the art-technology.
 4. Minimize the degradation of water quality to non-measurable levels (where total elimination is not feasible).

Tier III anti-degradation eligibility

To be eligible for designation as outstanding resource water in Washington, the water must have **one or more** of the following characteristics:

1. The water is in a relatively pristine condition or possesses exceptional water quality, **and** also occurs in federal and state parks, monuments, preserves, wildlife refuges, wilderness areas, marine sanctuaries, estuarine research reserves, or wild and scenic rivers.

(Soap Lake does not qualify for this characteristic)

2. The water body must be **largely free from human sources of degradation.**

Soap Lake's salt and mineral concentrations, and volume, were altered by the water impacts caused by the Grand Coulee Dam and irrigation canals. These impacts increased freshwater inflow; however, interception wells and pumps were installed in the late 1950s to substantially reduce freshwater inflow by piping the water at incursion points to

nearby canals. The City of Soap Lake (City Council) has taken measures to reduce the potential for pollution, and restricts water and salt/mineral extraction to ensure the lake retains its world-renowned mineral diversity and concentrations. The City Council has adopted a City of Soap Lake Shoreline Master Program (2014) which adheres to the rules and regulations of the Washington State Shoreline Management Act (1971), as well as has passed City of Soap Lake Resolution 849 (2016), each having made formal commitments to ensure preservation and restoration of the lake takes place into the future.

The City of Soap Lake Shoreline Master Program exists to provide and include:

- *“...protection against adverse effects to the public health, the land and its vegetation and wildlife, and the waters of the state and their aquatic life...”*
- *“The shoreline includes floodways; land within 200 feet of the ordinary high water mark (OHWM) of the waterways; floodplains up to 200 feet from the floodway edge; and associated wetlands.”*

The Soap Lake Comprehensive Plan (2019) states:

- *The City of Soap Lake is a community that respects and preserves its natural, historical and cultural resources.*
- *The City of Soap Lake is a community that recognizes the unique characteristics of Soap Lake and we seek to provide excellent stewardship of the outstanding scenic and natural features which surround us.*
- *The City of Soap Lake recognizes its historical reputation as a community devoted to healing waters and overall healthy environment.*
- *We the residents will revitalize our Soap Lake community into a place recognized and appreciated for its healing attributes for the mind, body and spirit.*
- *We will create improved year-round opportunities to enjoy the healing waters and mud of Soap Lake.*

The Soap Lake Conservancy is a non-governmental organization whose mission is the restoration and preservation of Soap Lake, including its shorelines, buffers, biotic community, salt/mineral profile and concentrations, and its adjacent ecosystem. The City Council has established a Soap Lake Conservancy and City of Soap Lake Joint Lake Liaison Committee (hereafter, Lake Liaison Committee) to monitor the lake, evaluate concerns, and provide recommendations.

There are 15 residences, 2 private RV Resorts, 1 city RV park, 3 private resorts, and 1 Tribe property with land that meets the lakes' shoreline buffer. These property owners are required to abide by state, county and/or city laws found within the City of Soap Lake Shoreline Master Program and Washington State Shoreline Management Act. These documents state no one can alter the natural shorelines or riparian buffers, and cannot allow chemicals, sewage or garbage to contaminate the shoreline, buffers or lake. Any exemption would require extensive permitting.

3. The water has **unique aquatic habitat types** — such as peat bogs — that by conventional water quality parameters — like dissolved oxygen, temperature, or sediment — are not considered high quality, but are unique and regionally rare examples of their kind.

Soap Lake is an exceptional lake of its kind in Washington, and possibly the United States and world. It is an alkaline meromictic lake, with very high salinity and an exceptional mineral profile. Bennet (1962) summarized various study results for Soap Lake and found 22 constituents of salts, minerals, free elements, and an unusual oil (ichthyol). As a result of the unusual water chemistry, specialized bacteria evolved in Soap Lake and have created a unique environment worth conserving (Paul and Mormile 2017). The chemocline between the upper and lower layer contains a bacterium unique to Soap Lake, named Thioalkalimicrobium microaerophilum sp. nov. (Sorokin 2007,); and a unique bacterium of a newly described genus was isolated from drift wood in Soap Lake and named Nitrincola lacisaponensis gen. nov., sp. nov (Dimitriu 2005). Soap Lake was studied by scientists at Central Washington University through National Science Foundation grants due to potential similarities with possible lakes on subsurface Mars; the lake was given a rare designation as a National Science Foundation Microbial Lab in 2002 (https://www.nsf.gov/awardsearch/showAward?AWD_ID=0132158). Over 100 scientific research studies have referenced Soap Lake microbial life, algae, minerals or its element profile; many of these references pertain to direct research conducted on the lake (https://scholar.google.com/scholar?as_vis=0&q=%22soap+lake%22&hl=en&as_sdt=1,48). Soap Lake is a world-renowned scientific marvel.

4. The water has **both high water quality and regionally unique recreational value.**

Soap Lake water was tested by scientists as early as 1893, due to mining and geology agencies interest in the salts. Doctor W. Thomas Edmondson, a University of Washington zoology professor who specialized in aquatic environments, took an interest in Soap Lake water quality and mineral content. He collected dozens of water specimens from the lake almost every year between 1952 and the mid-1990's, ensuring they were collected, labeled and stored in a scientific manner. These specimens had numerous tests run for their salt/mineral concentrations and additional parameters. Edmondson wrote numerous scientific papers discussing Soap Lake's characteristics, and documented the changes he observed in Soap Lake (Edmondson 1992). After Edmondson passed away in 2000, his

colleagues Leo Bodensteiner and Anthony Gabriel were able to run additional tests on some of the water specimens using modern techniques (see Bodensteiner's lecture about Soap Lake at: https://www.youtube.com/watch?v=qe_n90LdM_g). The Soap Lake Conservancy has continued collecting, storing, and testing water every few years, as funding allows. The most recent tests were performed in 2020, and included pollution tests. The Conservancy and University of Washington are in possession of most of Edmondson's historic samples.

These tests have demonstrated Soap Lake water is relatively pollution-free; however, the salt/mineral concentrations have declined substantially due to historic extractions, and dilution caused by the Grand Coulee Dam irrigation canals. The US Bureau of Reclamation has taken steps to halt the inflow of freshwater which has helped to reduce the freshening of the lake, while the City Council has restricted mineral water extraction to halt further loss. To this day, few other lakes on Earth possess the mineral diversity and high concentrations found in Soap Lake.

Soap Lake offers exceptional peaceful recreation and reported healing value. As previously discussed, the lake was used by numerous CTCR tribes for thousands of years as a lake to heal their maladies and replenish their mental and physical health. Barbara Aripa, a CTCR citizen, stated the lake and land was an important site for the tribes, with the people coming there frequently to swim in the water for cleansing and healing after the long winter, to feel the medicine in their hearts and minds and bodies, to sing songs that would cleanse, to camp, for powwows, to play stick game, and to reunite with each other (Wazaney & Marchand 2007, Aripa 2010). The cultural significance to this lake spans thousands of years and has been integrated into Euro-American culture. Upon learning of the value of the lake by CTCR tribes, white settlers appropriated and advertised the healing qualities of this lake in the early 1900s as a remedy for Buerger's Disease (Thompson 1943). Subsequently, war veterans with amputations and Buerger's disease, and people with psoriasis, eczema, arthritis and a host of other medical conditions began flocking to Soap Lake to benefit from soaking in its mineral waters. The benefits were enough to encourage state and federal governments to establish a formal facility called the McKay Memorial Research Hospital in Soap Lake, where war veterans would take priority for treatment with the lake's mineral water (Washington Session Laws 1947). To this day, CTCR citizens, descendants, and people from around the world continue to visit Soap Lake, soak in its mineral waters, and acquire mental health benefits from the peaceful, quiet, serene, and beautiful landscape encompassing the lake.

Soap Lake is also surrounded by wetland habitat, salt and mineral crusted shorelines, varied upland shrub-steppe habitat, and towering cliff walls and rocky outcroppings. The lake, along with these additional habitat types, offer unique wildlife habitat and provide wonderful wildlife viewing opportunities. It is possible wildlife derive health benefits from the mineral profile of this lake as well, although this has not been studied.

5. The water is of **exceptional statewide ecological significance.**

Many soda lakes and a few meromictic lakes exist world-wide (e.g. Mono Lake, which is certified as an Outstanding Resource Water of the State in California), but Soap Lake is a unique lake with few others on Earth comparable to its exceptional qualities. The lake's diverse and concentrated mineral and salt profile have created a very unique ecosystem. The lake possesses specialized bacteria found nowhere else on Earth (Dimitriu 2005, Sorokin 2007) and an exceptionally high sulfide concentration in the lowest layer (monimolimnion) which possibly allowed for the evolution of these rare bacteria. The bacteria and plankton in this lake have only received limited research thus far, and a great deal is still to be learned.

Soap Lake's unique ecology is dependent upon its unique mineral profile. Aside from specialized bacteria and plankton, many wildlife species use the lake and may gain health benefits found nowhere else. This remains to be studied, but could include reductions in parasite loads by soaking in and drinking the water, and foraging upon the specialized biotic community. The lake's high salinity allows for buoyancy and lower freezing temperatures which may benefit waterfowl and their young offspring. The lake is an important part of the ecosystem for humans who find remedy for their mental and physical health afflictions that require peaceful environments, arid climate, and water with this diverse profile.

Indigenous traditional ecological knowledge (TEK) data transmitted intergenerationally over thousands of years has informed the CTCR that Soap Lake is a unique and significant body of water. Recently, the Western scientific community has also recognized it as a special place worthy of protection. Scientist Pedro Dimitriu who discovered a new genus of bacteria in Soap Lake stated: "This lake is basically in the middle of the desert. Finding these new bacteria shows that rain forests aren't the only sources of biodiversity that need to be protected. Soap Lake needs to be protected, and this will help prove it needs to be in the future." (University Of Missouri-Rolla 2004).

The National Science Foundation recognized Soap Lake as an official Microbial Observatory in 2002, granting three-years of funding valued at \$850,000 to study the unique community of life forms found throughout the stratified lake's water column. Drs. Mormile and Pinkart of Central Washington University, and Dr. Peyton of Washington State University were co-principal investigators. Scientific articles written about these research projects can be found on GoogleScholar.

6. The water **has cold water thermal refuges critical to the long-term protection of aquatic species. For this type of outstanding resource water, the non-degradation protection would apply only to temperature and dissolved oxygen.**

Soap Lake is an 864-acre meromictic lake which possesses two large-volume layers separated by a thin chemocline layer. The upper layer (mixolimnion) spans from the

surface to approximately 20 meters below the surface and contains a diluted chemical solution of water, minerals and salts. The surface water is approximately 23° C (73° F) in late May, with dissolved oxygen levels of 9.2mg/L at 10m below surface. Below the upper layer is the thin chemocline layer with a dissolved oxygen level of 0.1mg/L at 20m depth. Directly below the chemocline layer is the lower layer (monimolimnion) which spans between roughly 20m and 24m depth, is anoxic (dissolved oxygen is 0mg/L), and has a temperature of approximately 6° C (42° F) (Sorokin 2007, Soap Lake Conservancy 2020). All three layers of the lake possess specialized bacteria, with some being found nowhere else on Earth. One newly described species was collected at the thin chemocline at very cold temperatures and nearly anoxic conditions (Sorokin 2007; proposed species name *Thioalkalimicrobium microaerophilum* sp. nov.). The lake is too saline and alkaline to allow for fish, crayfish, or other typical aquatic higher life-forms, although contains abundant copepod zooplankton, phytoplankton, algae and bacteria.

Supplemental Information:

The City of Soap Lake sits along the southern shore of its namesake lake, and occupies approximately 1.25 square miles of land. The city was officially incorporated in 1919 and currently has approximately 1600 residents. There are numerous inns, hotels, and resorts focused on promoting the healing qualities of the lake and its serene and beautiful surroundings. The majority of properties adjacent to the shoreline are in private ownership, although the City of Soap Lake owns a few parcels retained as public beaches and parks. The Soap Lake Shoreline Master Program (2014) outlines many laws pertaining to preservation of the lake, shorelines and buffers upland of the Ordinary High Water Mark (OHWM established at 1078' for Soap Lake). Soap Lake Municipal Code directs the citizenry to refer to the Shoreline Master Program for the official laws, although any county or state law that is more stringent takes precedence. Soap Lake City Council has also established a Lake Liaison Committee, which monitors the lake, evaluates concerns, and makes recommendations to the Council; it is a subcommittee of the Soap Lake Conservancy.

Aside from the very unique bacteria, zooplankton and phytoplankton that evolved in this unusual lake, the lake is an exceptional site for waterfowl, songbird, and raptor use. It is possible some species of mammals, reptiles and amphibians use the lake on occasion for drinking water, to cool off during summer, or for other reasons. Waterfowl species are consistently found on Soap Lake, including Canada geese, ducks (mallards, northern shovellers, American wigeon, ringnecks, ruddy, scaup), and others. Additional water-associated birds routinely seen on the lake and shores include eared and pie-billed grebes, black-necked stilts and Wilson's phalarope. Occasional sightings of common loons and swans have been documented. Raptors include prairie falcons, bald eagles, and numerous hawks and owls. This lake is possibly an important lake for migrating waterfowl, which may benefit from the mineral and saline waters. The high alkalinity and salt content allows for buoyancy and possibly assists with killing parasites. Saline waters require slightly lower temperatures to freeze compared to freshwater lakes, which means Soap Lake remains ice-free longer than freshwater lakes. This offers valuable winter habitat for

waterfowl. Waterfowl, killdeer, red-wing blackbirds and other birds nest on and near the lakeshore, where newly hatched duck broods can be found in the waters during early summer. Wetland-associated songbirds (red-wing blackbirds, yellow-headed black birds), upland songbirds (sparrows, hummingbirds, warblers, American goldfinch, other), shorebirds (killdeer, other), and many others are seen on the lake or on the shores, with some of them nesting on the shores.

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