= Bull Run River (Oregon) =

The Bull Run River is a 21 @.@ 9 @-@ mile (35 @.@ 2 km) tributary of the Sandy River in the U.S. state of Oregon . Beginning at the lower end of Bull Run Lake in the Cascade Range , it flows generally west through the Bull Run Watershed Management Unit (BRWMU) , a restricted area meant to protect the river and its tributaries from contamination . The river , impounded by two artificial storage reservoirs as well as the lake , is the primary source of drinking water for the city of Portland , Oregon .

It is likely that Native Americans living along the Columbia River as early as 10 @,@ 000 years ago visited the Bull Run watershed in search of food . Within the past few thousand years they created trails over the Cascade Range and around Mount Hood , near the upper part of the Bull Run watershed . By the mid @-@ 19th century , pioneers used these trails to cross the mountains from east to west to reach the fertile Willamette Valley . In the 1890s , the City of Portland , searching for sources of clean drinking water , chose the Bull Run River . Dam @-@ building , road construction , and legal action to protect the watershed began shortly thereafter , and Bull Run water began to flow through a large pipe to the city in 1895 .

Erosion @-@ resistant basalt underlies much of the watershed , and streams passing over it are relatively free of sediments . However , turbidity increases when unstable soils sandwiched between layers of basalt and other volcanic rocks are disturbed and wash into the river during rainstorms . Despite legal protections , about 22 percent of the protected zone was logged during the second half of the 20th century , and erosion increased . For a time in 1996 , Portland had to shut down the Bull Run supply because of turbidity and switch to water from wells . A law passed later that year prohibited most logging in or near the watershed , and since then the Portland Water Bureau and the United States Forest Service have closed many of the logging roads and removed culverts and other infrastructure contributing to erosion .

Mature trees , most of them more than 500 years old and more than 21 inches (53 cm) in diameter , cover about half of the watershed , and the rest of the watershed is also heavily forested . Annual precipitation ranges from 80 inches (2 @,@ 000 mm) near the water supply intake to as much as 170 inches (4 @,@ 300 mm) near the headwaters . More than 250 wildlife species , including the protected northern spotted owl , inhabit this forest . Downstream of the BRWMU , the watershed is far less restricted . In the late 19th century , an unincorporated community , Bull Run , became established near the river in conjunction with a hydroelectric project and a related railroad line . About 6 miles (10 km) of the lower river is open to fishing and boating , and the land at the confluence of the Bull Run and Sandy rivers has been a public park since the early 20th century .

= = Course = =

The Bull Run River begins at Bull Run Lake , a natural body of water modified slightly by the Portland Water Bureau , near Hiyo Mountain in the Mount Hood Wilderness . Originating in Clackamas County north of Forest Road 18 (Lolo Pass Road) , its unnamed headwater tributaries enter the lake . Flowing northwest from the lake , the river immediately enters Multnomah County and continues generally northwest for about 5 miles (8 km) . Along this stretch , the river flows by a United States Geological Survey (USGS) stream gauge at river mile (RM) 20 @.@ 9 or river kilometer (RK) 30 @.@ 6 , passes under Forest Road 1025 and Forest Road 10 and receives Blazed Alder Creek from the left and Log Creek and Falls Creek , both from the right . Then the river turns southwest and passes another stream gauge just before entering Bull Run River Reservoir 1 at RM 15 (RK 24) . Also entering the reservoir are Fir Creek from the left , North Fork Bull Run River from the right , then Deer , Cougar , and Bear creeks , all from the right . The Bull Run River exits the reservoir via a spillway 11 miles (18 km) from the river mouth . Forest Road 10 runs roughly parallel to the right bank of the river from near the headwaters to Southwest Bull Run Road , near the mouth .

Entering Bull Run River Reservoir 2 , the river receives Camp Creek from the left , re @-@ enters Clackamas County , and receives South Fork Bull Run River from the left . The river exits the

reservoir via a spillway at about RM 6 (RK 10) . Below Reservoir 2 , Forest Road 10 (Waterworks Road) is on the river 's right bank , and Forest Road 14 is on the left . The river flows by a stream gauge at RM 4 @.@ 7 (RK 7 @.@ 6) and passes under Forest Road 14 before receiving the Little Sandy River from the left at about RM 2 (RK 3) . The river then turns northwest , passes under an unnamed road and then under Southeast Bull Run Road near the unincorporated community of Bull Run , which is on the river 's right , and the defunct powerhouse of the Bull Run Hydroelectric Project , which is on the left . Southeast Camp Namanu Road runs roughly parallel to the river along its right bank from here to the mouth . Along this stretch , the river receives Laughing Water Creek from the right and enters the Sandy River at Dodge Park , about 18 @.@ 5 miles (29 @.@ 8 km) miles from the larger river 's confluence with the Columbia River .

= = = Discharge = = =

The USGS and the water bureau operate a stream gauge at RM 4 @.@ 7 (RK 7 @.@ 6) , which is 1 @.@ 8 miles (2 @.@ 9 km) downstream from Bull Run Reservoir 2 and the water system intake . Measurements are for the river only and do not include water diverted upstream of the gauge to the city water supply or to a former power plant . The maximum flow at this station was 24 @,@ 800 cubic feet per second (700 m3 / s) on December 22 , 1964 , and the minimum flow was 1 @.@ 1 cubic feet per second (0 @.@ 031 m3 / s) on October 4 , 1974 . The drainage area above this gauge is 107 square miles (280 km2) , about 77 percent of the whole watershed . The maximum flow occurred during the floods of December 1964 and January 1965 , rated by the National Weather Service as one of Oregon 's top 10 weather events of the 20th century .

Since 1966 , the USGS has monitored the flow of the Bull Run River at a stream gauge 14 @.@ 8 miles (23 @.@ 8 km) from the mouth . The average flow between then and 2008 was 404 cubic feet per second (11 @.@ 4 m3 / s) . This is from a drainage area of 47 @.@ 90 square miles (124 @.@ 06 km2) , about 34 percent of the entire watershed . The maximum flow recorded during this period was 15 @,@ 800 cubic feet per second (450 m3 / s) on November 5 , 1999 . The minimum was 30 cubic feet per second (0 @.@ 85 m3 / s) on October 28 ? 31 , 1987 .

The uppermost stream gauge on the main stem is at RM 20 @.@ 9 (RK 30 @.@ 6) , 1 mile (1 @.@ 6 km) downstream from the outlet structure at Bull Run Lake . In operation since 1992 , the gauge recorded an average flow of 26 @.@ 1 cubic feet per second (0 @.@ 74 m3 / s) between then and 2009 . This was from a drainage area of 5 @.@ 08 square miles (13 @.@ 2 km2) , about 4 percent of the total watershed . The maximum flow recorded during this period was 148 cubic feet per second (4 @.@ 2 m3 / s) on February 7 , 1996 . The minimum was 8 @.@ 2 cubic feet per second (0 @.@ 23 m3 / s) on October 28 , 1992 .

In addition to the three main @-@ stem gauges , the USGS operates five other stream gauges in the Bull Run watershed . Each of the following tributaries has one gauge : Fir Creek , Blazed Alder Creek , the North Fork , the South Fork , and the Little Sandy .

Near the outlet structure of Bull Run Lake , a USGS water @-@ stage recorder at RM 21 @.@ 9 (RK 46 @.@ 8) has collected data on lake levels since 1992 . The maximum lake content between then and 2009 was 48 @,@ 340 acre feet (59 @,@ 630 @,@ 000 m3) on February 9 , 1996 , and the minimum was 31 @,@ 080 acre feet (38 @,@ 340 @,@ 000 m3) on October 29 , 1992 . The two Bull Run reservoirs are also equipped with water @-@ stage recorders .

= = Geology = =

Columbia River basalts , 10 to 20 million years old , that underlie much of the Bull Run watershed are exposed near the bottoms of steep canyons along the river and its tributaries . In the western half of the watershed , the Rhododendron formation , rich in sediments , overlies the basalt , and later volcanic flows of basalt and andesite overlie both older formations . Areas of thick talus occur in the eastern part of the watershed at elevations higher than 2 @,@ 500 feet (760 m) above sea level , and north @-@ facing slopes above 2 @,@ 600 feet (790 m) show evidence of glaciation . Over many centuries , streams in the watershed have carved canyons through the Rhododendron

formation to the level of the basalt . Since basalt resists erosion , water traveling over it remains relatively free of sediments . Less than 2 percent of the watershed is at high risk for landslides .

The Bull Run River 's three reservoirs ? Bull Run Lake , Bull Run Reservoir 1 , and Bull Run Reservoir 2 ? are oligotrophic and do not sustain many life forms . Bull Run Lake is in a steep @-@ sided cirque blocked at its lower end by a series of lava flows topped by debris from a glacial moraine . Small streams flow into the lake from ridges above it , and water exits the lake mainly by seeping through porous rock to enter the Bull Run River about 0 @.@ 5 miles (0 @.@ 80 km) downstream . Evidence suggests that over the past several thousand years , although forest fires in the area and volcanic activity on Mount Hood or Mount St. Helens have caused temporary changes in the lake 's limnological condition , it " has always returned to conditions similar to those seen at present . " Turbidity is sometimes a problem in Reservoirs 1 and 2 when unstable soils sandwiched between layers of lava erode into tributaries , especially the North and South forks .

= = History = =

= = = First peoples = = =

Archeological evidence suggests that Native Americans lived along the lower Columbia River as early as 10 @,@ 000 years ago . The area near what later became The Dalles , on the Columbia east of the mouth of the Sandy River , eventually became an important trading center . The Indians established villages on floodplains and traveled seasonally to gather huckleberries and other food on upland meadows , to fish for salmon , and to hunt elk and deer . Although no direct evidence exists that these lower @-@ Columbia Indians traveled up the Sandy , it is likely that they did . Traces of these people include petroglyphs carved into the rocks of the Columbia River Gorge . Within the past few thousand years , Indians created trails across the Cascade Range around Mount Hood . In the 19th century , this trail network linked the Wascopam Mission near The Dalles to settlements in the Willamette Valley . One popular trail crossed over Lolo Pass , near the headwaters of the Bull Run River , and another , which later became the Barlow Road , met the Lolo Pass trail roughly where the Zigzag and Salmon rivers enter the Sandy . Indians from villages along the Columbia , Clackamas , and other rivers also traveled by water to the lower Sandy River area to fish for salmon and to gather berries , nuts and roots . The Klickitat tribe referred to Bull Run Lake as Gohabedikt , meaning " Loon Lake " .

= = = Explorers , settlers , and waterworks = = =

Before the Lewis and Clark Expedition of 1805 , few Europeans or European @-@ Americans had visited the Sandy River basin . One of the first documented visits to the upper Sandy occurred in 1838 , when Daniel Lee drove cattle from the Willamette Valley to Wascopam via the Indian trail over Lolo Pass . By 1840 , pioneers were using the trail to cross the Cascades , and the Barlow Road , following another old trail , opened in 1846 . One of its branches ran along the Devil 's Backbone , a ridge separating the Sandy and Little Sandy basins . A few of these newcomers settled along the Sandy River .

In 1886 , the Portland Water Committee , predecessor of the Portland Water Bureau , began a search for a superior drinking water source . The committee , led by Henry Failing , commissioned Isaac W. Smith , an engineer and surveyor , to inspect any viable water supply in the region . Smith chose the Bull Run River , and a five @-@ month survey trip led him to conclude that a gravity @-@ flow system could deliver clean water from Bull Run to Portland . In 1892 , U.S. President Benjamin Harrison signed a proclamation creating a protected area , the Bull Run Reserve , in the watershed . By 1895 Portland had built a diversion dam on the Bull Run River , and completed its first conduit (Conduit 1) to carry Bull Run water to the city . At about the same time as the Smith survey , a small farming community , at first named Unavilla but renamed Bull Run in 1895 , grew up near the confluence of the Bull Run and Sandy rivers . Meanwhile , improvements to the Barlow Road

encouraged population growth along the lower Sandy and the establishment of cities like Gresham and Sandy . Even so , by 1900 much of the upper Sandy basin was still remote , wild , and accessible mainly by trails .

Expanding the system 's storage and delivery capacities in stages , the city built Conduit 2 from Bull Run to Portland in 1911 , and in 1917 constructed a small dam at the high water outlet of Bull Run Lake . In 1921 , the city replaced the headworks diversion dam with a new one , about 40 feet (12 m) high , and added Conduit 3 . In 1929 , Portland built Dam 1 (the Ben Morrow Dam) , which is about 200 feet (61 m) high . To keep pace with population growth and increasing water demands , the city created Reservoir 2 behind Dam 2 . The new dam , completed in 1962 at the site of the headworks dam , is a rockfill structure , 110 feet (34 m) high . By that time , the city had already replaced the aging Conduit 1 with Conduit 4 .

= = = Hydroelectric projects = = =

The lower Bull Run River changed dramatically in 1906 , when the Mount Hood Railway and Power Company (MHR & P) began work on the Bull Run Hydroelectric Project . The project included a powerhouse on the Bull Run River at RM 1 @.@ 5 (RK 2 @.@ 4) , and a diversion dam on one of its largest tributaries , the Little Sandy River , 1 @.@ 7 miles (2 @.@ 7 km) from its confluence with the Bull Run River . Water from the Little Sandy Dam diverted much of the Little Sandy 's flow through a wooden flume about 3 @.@ 2 miles (5 @.@ 1 km) long to a 140 @-@ acre (0 @.@ 57 km2) reservoir called Roslyn Lake and from there to the powerhouse .

To begin the project , the MHR & P needed access to the powerhouse site . At the time , it took three hours by stagecoach to reach Bull Run from an electric railway depot in Boring . Roads in the area had to be planked to be usable during heavy rains . Access improved in mid @-@ 1911 , when the company finished construction on a 22 @-@ mile (35 km) railway line between the Montavilla neighborhood in east Portland and Bull Run . In 1912 , the year the powerhouse began generating electricity , the MHR & P merged with the Portland Railway , Light and Power Company , (PRL & P) , which later modified the line for use by electric trolleys .

In 1913 , the PRL & P , the predecessor of the electric utility company known as Portland General Electric (PGE) , expanded the hydroelectric project by building Marmot Dam at RM 30 (RK 48) on the Sandy River , from which it diverted water through canals and tunnels , the longest of which was 4 @,@ 690 feet (1 @,@ 430 m) , to the Little Sandy River upstream of the Little Sandy Dam . This increased the maximum flow along the flume to Roslyn Lake from about 200 cubic feet per second (5 @.@ 7 m3 / s) to about 800 cubic feet per second (23 m3 / s) . Since the combined flow entered the lower Bull Run River after leaving the powerhouse , the system altered the flows of three rivers . In 1999 , close to a century after the start of the project , PGE announced that it would remove the Marmot and Little Sandy dams and related equipment and close the 22 @-@ megawatt powerhouse because of costs associated with maintenance and fish protection . Marmot Dam was demolished in 2007 and the Little Sandy Dam in 2008 , restoring natural flows to the Sandy and Little Sandy .

In 1982 , work on the Portland Hydroelectric Project , unrelated to the Bull Run Hydroelectric Project , began generating electricity at powerhouses below the dams at Reservoirs 1 and 2 on the Bull Run River . Portland sells the electricity from a 24 @-@ megawatt plant at Dam 1 and a 12 @-@ megawatt plant at Dam 2 to PGE , which operates and maintains the equipment . PGE , a corporation with home offices in Portland , has many other sources of electricity , which it sells to customers in a 4 @,@ 000 @-@ square @-@ mile (10 @,@ 000 km2) service area in the northern Willamette Valley .

= = = Logging = = =

Extensive timber cutting in the Sandy River basin began in the mid @-@ 19th century in response to a demand for wood from the Portland metropolitan area . Logging intensified in the lower basin through the 20th century as sawmills became established in Sandy , Boring , Brightwood and other settlements in the region , and railroad spurs extended into the forests . In 1904 , President

Theodore Roosevelt signed into law the Bull Run Trespass Act to forbid activities such as camping and livestock grazing in the Bull Run Reserve . Except for activity related to the waterworks , the protected area changed little until the 1950s , when the United States Forest Service began to advocate logging in the Reserve . After the U.S. Congress passed the Multiple Use ? Sustained Yield Act of 1960 stressing timber production in the national forests , the Forest Service in the 1960s and 1970s built about 170 miles (270 km) of forest roads in the watershed . Before the road @-@ building and heavy logging , " The watershed [had] remained almost inviolable for nearly 60 years , its runoff protected by a largely unbroken expanse of centuries @-@ old trees , " according to a member of the Bull Run Advisory Committee , a scientific panel commissioned by the City of Portland in 1977 to review issues related to Bull Run .

In 1973 , Joseph Miller , Jr . , a retired Portland physician , sued the Forest Service , claiming that its logging violated the Bull Run Trespass Act . In 1976 , U.S. District Judge James M. Burns agreed , and logging was halted . Shortly thereafter , Congress rescinded the Bull Run Trespass Act and replaced it with the Bull Run Watershed Management Act of 1977 , which created the Bull Run Watershed Management Unit (BRWMU) (replacing the Bull Run Reserve) and legalized further Bull Run logging unless it could be shown to reduce water quality . Logging and the debate about logging continued . In 1994 about 75 percent of the BRWMU was made into a reserve for protecting the northern spotted owl and other species dependent on old @-@ growth forests . In February 1996 , runoff from unusually heavy rains in the watershed washed so much eroded soil into the Bull Run storage reservoirs that the City had to shut down the Bull Run supply and switch during the crisis to its emergency supply from a well field along the Columbia River . Later in 1996 , Congress passed the Oregon Resources Conservation Act , which prohibited logging on all Forest Service lands within the Bull Run water supply drainage and another 3 @,@ 500 acres (14 km2) of land that drained to the lower Bull Run River . In 2001 , the Little Sandy Act extended the prohibitions to the entire BRWMU and public lands along the Little Sandy River .

Between 1958 and 1993 , when the last timber @-@ cutting took place in the BRWMU , about 14 @,@ 500 acres (59 km2) , roughly 22 percent of the water supply drainage , were logged . Since then , to reduce erosion from the outmoded logging infrastructure , the Forest Service and the water bureau have been decommissioning parts of the Bull Run forest road network , which had grown to 346 miles (557 km) . By autumn 2008 , they had closed 78 miles (126 km) of roads , were dismantling another 63 miles (101 km) , and were removing 245 culverts .

= = Watershed = =

The Bull Run watershed drains 139 square miles (360 km2) , most of which is in the Mount Hood National Forest in Multnomah and Clackamas counties in northwest Oregon . The confluence of the Bull Run and Sandy rivers at Dodge Park , about 20 miles (32 km) east of downtown Portland , marks the watershed 's western (downstream) end , while on the east it borders Hood River County , and at Hiyo Mountain it is about 6 miles (9 @.@ 7 km) northwest of Mount Hood in the Cascade Range . It is a sub @-@ watershed of the Lower Columbia ? Sandy Watershed . Elevations within the watershed range from 4 @,@ 750 feet (1 @,@ 450 m) at Buck Peak on the watershed 's northeastern boundary to 243 feet (74 m) at the mouth of the Bull Run River .

As the main source of Portland 's drinking water , the watershed is largely restricted to uses related to water collection , storage , and treatment , and to forest management . The city 's drinking water protection area consists of the 102 square miles (260 km2) of the basin upstream of the water supply intake at RM 6 @.@ 2 (RK 10) . The protection area is part of a larger restricted zone , the BRWMU , which covers 143 square miles (370 km2) . It lies mostly within Multnomah and Clackamas counties but extends in places along its eastern edge into Hood River County . As of 2010 , the Forest Service manages 95 percent of the BRWMU on land owned by the federal government ; the Portland Water Bureau manages the 4 percent that is owned by the City of Portland , and the Bureau of Land Management manages the remaining 1 percent , which is on federal land . Small portions of the watershed that are along the lower main stem or along tributaries are partly outside the BRWMU and fall under other jurisdictions .

Watersheds bordering the Bull Run River drainage basin are those of the West Fork Hood River to the east and northeast , the Sandy River to the south and west , and the Columbia River to the north . Small Columbia River tributaries , each with a subwatershed bordering the Bull Run watershed , flow north from a ridge between the Bull Run and Columbia rivers . These include Eagle , Tanner , Moffett , McCord , Horsetail , Oneonta , Multnomah , and Bridle Veil creeks , which plunge over one or more waterfalls as they enter the Columbia Gorge .

= = = Climate = = =

The climate along the Bull Run River is typical of the western Oregon Cascades foothills . Annual precipitation ranges from 80 inches (2 @,@ 000 mm) near the intake for the Portland water supply to as much as 170 inches (4 @,@ 300 mm) near the headwaters . Summers are dry , and winters , especially November through January , are wet . At low elevations , most of the precipitation arrives in the form of rain , but at higher elevations 25 to 30 percent of the moisture arrives as snow . Fog drip may add significantly to total precipitation in the vicinity of Bull Run Lake . A study published in 1982 suggested that standard rain gauges placed in open areas might be underestimating the contribution of fog drip to heavily forested parts of the watershed by up to 30 percent . Accumulated snow is rare at elevations up to 2 @,@ 000 feet (610 m) above sea level but sometimes reaches 6 to 10 feet (1 @.@ 8 to 3 @.@ 0 m) above 4 @,@ 000 feet (1 @,@ 200 m) . Melting snow adds to streamflow in April and May , and dry soil inhibits streamflow in August . Generally , temperatures are mild . Lows in January range from just below freezing to about 25 ° F (? 4 ° C) , while July highs are usually about 80 ° F (27 ° C) .

The Natural Resources Conservation Service (NRCS) of the United States Department of Agriculture operates snow telemetry (SNOTEL) stations at three places in the Bull Run watershed to help predict how much water will be available from melting snow . Snow depths and density vary with time and location . At the Blazed Alder Creek station , the highest of the three at 3 @,@ 650 feet (1 @,@ 110 m) above sea level , the mean snow @-@ water equivalent (SWE) (the amount of water in the accumulated snow) ranged in 2009 from 0 in July ? October to about 50 inches (1 @,@ 300 mm) in April . A station on the North Fork at an elevation of 3 @,@ 060 feet (930 m) reported a minimum mean SWE of 0 in July ? October 2009 and a maximum of about 37 inches (940 mm) in April . In the same year at the South Fork station , elevation 2 @,@ 690 feet (820 m) , the mean SWE varied from 0 in June ? September to about 10 inches (250 mm) in March .

= = = Infrastructure = = =

Although most of the watershed is generally closed to the public , the protected area includes forest roads , buildings , three dams and reservoirs , two hydroelectric power stations , and other infrastructure used by government employees who manage the forest and the water supply system . The system includes a concrete dam and spillway , added to the natural outlet of Bull Run Lake . The dam , completed in about 1960 , was preceded in 1915 by a timber @-@ and @-@ rockfill structure and later by other measures to increase the lake 's storage capacity and to prevent seepage . These measures raised the lake 's usable storage from about 2 @.@ 8 billion US gallons (11 @,@ 000 @,@ 000 m3) to about 4 @.@ 3 billion US gallons (16 @,@ 000 @,@ 000 m3) , an increase of about 55 percent . Dam 1 , which impounds Reservoir 1 , is a concrete arch @-@ gravity dam about 200 feet (61 m) high , and Dam 2 , a rockfill structure about 110 feet (34 m) high , impounds Reservoir 2 . Although the two reservoirs combined can hold up to about 17 billion US gallons (64 @,@ 000 @,@ 000 m3) , their total usable storage is only about 10 billion US gallons (38 @,@ 000 @,@ 000 m3) .

The raw water intake (headworks) at Bull Run is just below Dam 2 . This is where water is diverted from the river for chlorination and then routed into three distribution conduits for delivery to Portland . About 23 percent of the watershed 's annual runoff is diverted to the city 's water supply .

The main roads within the BRWMU include Forest Road 10 , which runs for much of its length along the north side of the river . It links the community of Bull Run near the mouth of the river and Forest

Road 18 (Lolo Pass Road) east of Bull Run Lake . Branching off Forest Road 10 downstream of Reservoir 2 , Forest Roads 12 and 14 form a loop south of the river . The loop extends as far east as Goodfellow Lakes , near the source of the Little Sandy River . Below the BRWMU , Bull Run Road , open to the public , crosses the river between the community of Bull Run and Dodge Park .

The Bull Run River Bridge , a 240 @-@ foot (73 m) Pennsylvania @-@ petit truss span that carries Bull Run Road , was originally the west truss of the Burnside Bridge over the Willamette River in downtown Portland . It includes parts made of wrought iron as well as steel , and its truss portals incorporate nautical design elements meant for Portland , an inland seaport . Built in 1894 , the bridge was moved to Bull Run in 1926 , when a new Burnside Bridge replaced the old one . The Sandy River Bridge over the Sandy River at Dodge Park , just upriver from the mouth of the Bull Run River , was the 300 @-@ foot (91 m) east truss of the Burnside Bridge .

= = = Flora and fauna = = =

Thick forests cover about 95 percent of the watershed . Douglas @-@ fir is the dominant tree species in the basin below 3 @,@ 400 feet (1 @,@ 000 m) above sea level , where western redcedar thrives in moist areas and western hemlock also grows . Douglas @-@ fir and noble fir are the dominant species at higher elevations , and Pacific silver fir is the climax species . Mature trees , which cover about 54 percent of the watershed , are mostly more than 500 years old and have diameters exceeding 21 inches (53 cm) . Trees between 9 inches (23 cm) and 21 inches (53 cm) in diameter cover about 34 percent of the basin , while younger , smaller trees dominate the remaining 12 percent . The forest floors support many smaller plants such as salal and sword fern . About 5 percent of the watershed consists of unvegetated water bodies or bare rock and a tiny fraction of meadow .

More than 250 wildlife species , including peregrine falcon , bald eagle and northern spotted owl are thought to frequent the watershed . Migratory birds such as loons use the basin for feeding and nesting as they travel along the Pacific Flyway . Native fish species include chinook and coho salmon , steelhead , coastal cutthroat trout , Pacific lamprey , and rainbow trout , but since 1922 the headworks dam or its successor , Dam 2 , have blocked anadromous fish passage to the upper river and its tributaries . Many amphibian and reptile species thrive near streams and ponds . Roosevelt elk , American black bear , coyote , cougar , black @-@ tailed deer , North American river otter , American mink , and North American beaver are among the mammals found in the watershed .

= = Recreation = =

Adjacent to the confluence of the Bull Run and Sandy rivers , 14 @-@ acre (5 @.@ 7 ha) Dodge Park offers tree @-@ shaded picnic areas , a swimming hole , a sandy beach , and a boat ramp for launching rafts , kayaks , and drift boats on the Sandy River . The Portland Water Bureau owns and maintains the park , established in the early 20th century . Originally called Bull Run Park , it was renamed for Frank Dodge , superintendent of the water bureau from 1897 to 1914 . Until supplanted by automobile highways , the electric trolley to Bull Run carried passengers to and from the park until 1930 . The water bureau estimates that at least 30 @,@ 000 people visited the park in 1926 . As of 2015 , the bureau has plans to restore and improve the park as time and money allow .

Although most of the Bull Run River watershed is closed to the public , whitewater enthusiasts sometimes run the lower 2 @.@ 5 @-@ mile (4 @.@ 0 km) stretch from the Bull Run Road bridge to the Sandy River . The put @-@ in place for the run is just below the powerhouse , and the take @-@ out is at Dodge Park . The run features a permanent slalom course near the put @-@ in , six class 3 rapids in the first 2 miles (3 km) , and a short stretch of class 2 water at the end of the run .

Fishing is limited to the lower reaches of the river . Hatchery Chinook salmon and summer and winter steelhead are sometimes caught near the confluence with the Sandy River , and catch and release fishing for wild trout is allowed from the mouth of the river to the edge of the Bull Run watershed reserve .

Access to the Bull Run Watershed Management Unit is generally limited to government employees

and guests on official business , and security guards keep watch on its three gated entrances . However , the water bureau offers public tours in the summer and fall , and hikers may use the Pacific Crest Trail , which runs along the eastern edge of the watershed near Mount Hood . The bureau has been averaging about 85 group tours a year .

= .hack (video game series) =

.hack / d?t hæk / is a series of single @-@ player hack and slash developed for the PlayStation 2 console by CyberConnect2 and published by Bandai . The series of four games , titled .hack / / Infection , .hack / / Mutation , .hack / / Outbreak , and .hack / / Quarantine , features a " game within a game " ; a fictional massively multiplayer online role @-@ playing game (MMORPG) called The World which does not require the player to connect to the Internet . Players may transfer their characters and data between games in the series . Each game comes with an extra DVD containing an episode of .hack / / Liminality , the accompanying original video animation series which details fictional events that occur concurrently with the games .

The games are part of a multimedia franchise called Project .hack which explores the mysterious origins of The World . Set after the events of the anime series .hack / / Sign , the games focus on a player named Kite and his quest to discover why some users have become comatose as a result of playing The World . The search evolves into a deeper investigation of The World and its effects on the stability of the Internet .

Critics gave the series mixed reviews . It was praised for its unique setting and its commitment to preserve suspension of disbelief , as well as the character designs . However , it was criticized for uneven pacing and a lack of improvement between games . The commercial success of the franchise led to the production of .hack / / frägment ? a remake of the series with online capabilities ? and .hack / / G.U. , another video game trilogy .

= = Gameplay = =

.hack simulates an MMORPG ; players assume the role of a participant in a fictional game called The World . The player controls the on @-@ screen player character Kite from a third @-@ person perspective but first @-@ person mode is available . The player manually controls the viewing perspective using the game controller . Within the fictional game , players explore monster @-@ infested fields and dungeons , and " Root Towns " that are free of combat . They can also log off from The World and return to a computer desktop interface which includes in @-@ game e @-@ mail , news , message boards , and desktop and background music customization options . The player may save the game to a memory card both from the desktop and within The World at a Save Shop . A Data Flag appears on the save file after the player completes the game , allowing the transfer of all aspects of the player character and party members to the next game in the series .

The series is typical of action role @-@ playing games , in which players attack enemies in real time . The game 's action pauses whenever the menu is opened to select magic to cast , items to use , or skills to perform . The player directly controls Kite and the other characters are controlled by artificial intelligence . The player may either provide the computer @-@ controlled characters with guidelines (" attack " , " first aid " , " magic " , etc .) or issue direct commands . Most hostile creatures are contained within magic portals and combat will not begin until the player character approaches the portal and releases the monsters inside . Kite possesses a unique ability called " Data Drain " which allows him to transform these enemies into rare items . Many boss monsters are known as " Data Bugs " ? enemies with corrupted data which gives them infinite health . Data Drain is used to repair the damaged monsters ' data and render them vulnerable but its use increases Kite 's level of infection , randomly causing harmful side effects . The infection can be cured by defeating enemies without Data Drain .

Root Towns are non @-@ combat areas of The World where the player may restock items , buy equipment , or chat and trade with other players of The World . In many towns , the player may also

raise a sentient , pig @-@ like creature called a Grunty , which can be ridden in fields and in later games raced for prizes . A blue portal called the Chaos Gate is used to travel between towns (called " servers ") and to access the fields and dungeons where battles occur . A three @-@ word password system controls the characteristics of each area ; attributes such as the prevalence of monsters or items change depending on the properties of each word in the password phrase . Certain plot @-@ related areas have restricted access , but the player character has an ability called " Gate Hacking " which allows him to access these areas using " Virus Cores " obtained through Data Drain .

= = Plot = =

= = = Setting = = =

The .hack games are set in an alternate timeline of Earth , in the year 2010 . After a computer virus called " Pluto 's Kiss " crashes nearly every computer in the world , access to the Internet is closed to the general public to address security concerns . After two years without the Internet and online games , a MMORPG called The World is released . It becomes the most popular online game of all time with over 20 million unique players . Shortly before the events portrayed in the .hack games , a number of users become comatose as a result of playing The World . However , the developers blame their condition on cyberterrorism .

The World was developed by a German programmer named Harald Hoerwick ; its backstory is based on the Epitaph of Twilight , an epic poem by Emma Wielant . Her death inspired Hoerwick to create the game . Elements of the poem are coded into the game 's programming . The hidden purpose of Hoerwick 's game is to develop the ultimate artificial intelligence (AI) , which is capable of making decisions for itself . To this end , Hoerwick inserted functions into the system which monitor and extract behavioral data from millions of the game 's players to aid in the AI 's learning process . After Hoerwick 's death , these pieces of code became black boxes to the current developers , who cannot fathom their purpose , yet are critical to the proper functioning of the game .

= = = Characters = = =

The main protagonist of .hack is Kite , a new player of The World whose friend Orca becomes comatose under mysterious circumstances . Kite is joined by nearly twenty other players in his quest to solve the mystery of the coma victims . The players who have the greatest impact on the success of Kite 's mission are BlackRose , a fellow newbie to The World whose brother is also in a coma ; Balmung , a legendary player who seeks to eliminate sources of corruption in the game he loves ; and Wiseman , an information broker who becomes a key strategist for Kite 's team . Helba , a professional hacker , and Lios , a reluctant system administrator , also aid in Kite 's efforts to rescue the coma victims .

= = = Story = = =

In .hack / / Infection , Kite 's friend Orca invites him to play The World . In the first dungeon they visit , they encounter a girl in white , Aura , being chased by a humanoid monster . Aura tries to entrust Orca with an item called " the Book of Twilight " , but the monster attacks him , crashing The World 's servers . Kite 's player discovers that Yasuhiko , Orca 's player , has fallen comatose after the attack , and resolves to discover the cause . Kite meets BlackRose , who takes him to a cathedral where they are attacked by a headless swordsman . The legendary player Balmung appears and defeats it , but the monster revives itself as a Data Bug . The Book of Twilight then activates , altering Kite 's character data and giving him the Twilight Bracelet . He uses its Data Drain to correct the swordsman 's code , allowing Balmung to kill it . Balmung accuses Kite of causing the viral

infection spreading through the game , and leaves . Kite and BlackRose decide to cooperate to help the coma victims . After investigating a number of leads , Kite and BlackRose track down Skeith , the creature that put Orca into a coma . They defeat Skeith , but it transforms into a larger enemy called Cubia , from which they escape .

In .hack / / Mutation , Kite and BlackRose encounter system administrator Lios , who declares Kite 's bracelet to be an illegal hack . He tries to delete Kite 's character data , but fails due to Kite 's data being encrypted by the Book of Twilight . Helba intervenes , and convinces Lios to observe Kite for the time being . Lios directs them to an area where they find Innis , a monster with powers similar to Skeith 's . Upon defeating Innis , Kite receives an e @-@ mail from Aura , who reveals that she is an AI . They travel to an area to meet her ; but Cubia attacks them , and they repel the monster with difficulty . Short on leads , they contact Wiseman , who is intrigued by Kite 's bracelet . He suggests that Skeith and Innis are based on the " Cursed Wave " , an antagonistic force featured in the poem Epitaph of Twilight , upon which The World is based . Wiseman helps grant them access to Net Slum , a place known as a paradise for hackers and wandering AIs . Upon arrival , another Cursed Wave monster called Magus attacks them . They defeat it and return to the Root Town , where they discover that the computer virus has spread to The World 's main servers and into the real world .

In .hack / / Outbreak , Balmung realizes that he cannot end the situation on his own , and joins Kite 's quest . BlackRose tells Kite that her brother became comatose under similar circumstances as Orca , which renews both characters ' determination . Wiseman formulates a plan to combat the Cursed Wave , enlisting Helba 's assistance . Their teamwork destroys the Wave monster Fidchell , but the aftermath causes networks in the real world to malfunction . Aura contacts Kite again , but their meeting is cut short by Cubia 's reappearance . Lios , observing Cubia 's power , agrees to join Kite , Helba , and the others to combat the Cursed Wave . In the resulting operation , the team pools their resources to defeat another Wave monster called Gorre , with no repercussions in the real world .

.hack / / Quarantine sees the current server becoming increasingly unstable . To fix the problem , Helba replaces it with a copy of the Net Slum . At the bottom of a dungeon , Kite encounters Mia , a member of his party . He discovers that Mia is actually another Cursed Wave monster named Macha , whom he reluctantly defeats . Meanwhile , Cubia grows stronger , and Kite 's team barely fends off its latest attack . In contrast , Operation Orca is a success as they destroy Tarvos , the next Wave monster . Kite seeks the advice of Harald Hoerwick , the creator of the game who survives beyond death through his AI incarnations . Aura appears and hints that Cubia is the " shadow " of Kite 's Twilight Bracelet . Cubia ambushes them and destroys the AI Harald . In their final battle , Kite recalls Aura 's hint and has BlackRose destroy the bracelet , causing Cubia to fade away . Without the bracelet , the final Wave member , Corbenik , ambushes the party in Net Slum Root Town . With the aid of the spirits of the coma victims , Kite penetrates Corbenik 's barrier . Aura sacrifices herself to end the battle , restoring the network to normal and reviving all the coma victims .

= = Development = =

Development for .hack began in early 2000 with the aim of shocking and surprising the player and creating a distinctive product . CyberConnect2 's president Hiroshi Matsuyama played a key role in developing the concept for the series . A number of core ideas , including " slaying dragons or being a thief in London " were explored , but these were rejected in favor of an " offline / online game " . Matsuyama said that this would give young gamers an opportunity to experience online play without paying monthly fees or needing powerful Internet connections . The developers looked at a number of MMORPGs such as Phantasy Star Online , Ultima Online , and Final Fantasy XI for inspiration , and drew influences from the prior works of character designer Yoshiyuki Sadamoto (Neon Genesis Evangelion) and scenario writer Kazunori It? (Ghost in the Shell) . It? noted that casting the player into the role of a subscriber of The World creates a unique story @-@ telling situation which draws the player deeper into the plot .

From the start of its development , .hack was envisioned as a four @-@ part series intended to

mirror the four @-@ volume story arcs found in manga . Matsuyama theorized that the act of transferring saved data across the four volumes would help to create a sense of the human drama embodied by the games ' story and invest the player into the narrative . The games were developed simultaneously alongside other elements of Project .hack such as .hack / / Sign to emphasize the multimedia aspect of the franchise . The three @-@ month gap between each game 's release allowed the developers to make minor changes in response to criticisms . The games were packaged with bonus DVDs featuring episodes of .hack / / Liminality , an original video animation (OVA) series that depicts events that occur concurrently with the games . The developers intended the OVA series to depict fictional events happening in the real world outside the game . Players in Japan who purchased all four games were rewarded with .hack / / Gift , an OVA parodying the .hack series . After the completion of the series , the development team produced .hack / / frägment , a game using the same engine as the .hack series with an online multiplayer component . The aims of .hack / / frägment were to allow the developers to watch player interactions in an online environment and to gauge interest in an .

= = Reception = =

By March 2004 , sales of the .hack games exceeded 1 @.@ 73 million , with 780 @,@ 000 copies sold in Japan . Critics gave the series mixed reviews . .hack / / Infection received the most positive reviews of the series ; critics were intrigued by the games ' unique premise . Jeremy Dunham of IGN was impressed by the game 's commitment to preserve the illusion of online and praised the character designs and the inclusion of the Japanese voice track , but criticized the camera manipulation and the game 's shortness and lack of difficulty . A Game Informer reviewer praised the way it captures the sense of community that a real MMORPG offers .

Many reviewers cited the game 's unusual setting as the counterbalance to the mediocre gameplay , repetitive environments and poor camera control . Overall , the first game was moderately well received , with reviewers overlooking gameplay flaws because of a compelling story . Christian Nutt of Gamespy awarded if four stars out of five and commended Bandai for breaking new ground and Cyber Connect 2 for providing an engrossing RPG experience . Gary Steinman of Official U.S. PlayStation Magazine wrote , " [a] t its core , .hack is not a good game " , calling the battle systems " wildly unbalanced " and the graphics " spectacularly underwhelming " , but said the " mind @-@ bending " story allowed him to look past its obvious flaws and anticipate future games in the series . Greg Kasavin of GameSpot was less forgiving , deriding .hack / / Infection as a sub @-@ par version of Kingdom Hearts .

.hack / / Mutation also received mixed reviews , and many critics complained that little was done to address the problems of its predecessor . Fennec Fox of Gamepro said that game , " is simply an extension of Infection " , with " muddy graphics , questionable control , and a story concept that ? s just interesting enough to keep you going . " Greg Kasavin of GameSpot gave it a rating of 6 @.@ 7 out of 10 and wrote , " not only does it bring you exactly the same sort of repetitive hack @-@ and @-@ slash gameplay , but it 's also similarly short and simple and once again offers little in the way of plot or character development . " Nutt found the second game to be more addictive than the first , despite its numerous shortcomings such as obvious padding towards the end of the story . He praised the " mixture of cool story and viscerally engaging RPG gameplay " , the accelerating story , gameplay progression and memorable boss battles . Other reviewers were encouraged by the MMORPG @-@ oriented details that contribute to the game 's presentation and built excitement for the future of the series . IGN also named .hack / / Mutation as PlayStation 2 Game of the Month for May 2003 .

.hack / / Outbreak represented a shift in the critical reception of the series as reviewers grew tired of the incremental or nonexistent improvements between titles . Kasavin rated it 6 @.@ 4 out of 10 , and wrote that it " just doesn 't make for a satisfying experience " . Dunham gave it an overall rating of 8 @.@ 4 out of 10 , praised the battle system and wrote that there had been a great improvement in the artificial intelligence of ally characters and enemies , although he was disappointed by the lack of any other changes . Nutt awarded .hack / / Outbreak three stars out of five , writing that the game

's " extremely challenging enemies and lots of solo missions give the game an edge that keeps it from becoming boring " . However , he criticized the four @-@ part game structure , observing , " we are paying Bandai $ 200 for one game " and that " the extreme lack of improvements from volume to volume is ... downright exploitative of the fans " .

Some critics called the final game , .hack / / Quarantine , a satisfying conclusion to a mediocre series , while others said it is a confusing mess of poor pacing and plot holes . Dunham awarded the game 8 @.@ 3 out of 10 and called the plot twists " shocking and clever " . Kasavin rated it 6 @.@ 1 out of 10 and wrote that , " [o] n its own merits , Quarantine isn 't a bad game , and [loyal players] should find it to have a satisfying conclusion that , sure enough , leaves the possibility for further adventures in The World " . He also called Bandai 's decision to add 60 to 80 hours of padding to the game , split it into four full @-@ priced products , and release these as a series disappointing . Nutt was similarly disappointed with the final game , awarding it two stars out of five . He wrote that the story was well @-@ presented and excellent , but that it was only present in the game 's first and last quarters . He was satisfied by the game 's ending and loved its story , style , and characters , but grew tired of the game 's " endless chains of chambers , these easily @-@ defeated enemies , this total lack of strategy " . The Game Informer reviewer hoped to see a more effective implementation of .hack 's concept in the future . Japanese magazine Famitsu Weekly gave the .hack games scores in the 29 to 30 out of 40 range , indicating average reviews . However , the Japanese Computer Entertainment Supplier 's Association (CESA) honored the series for its combination of different fictional media including games , anime , radio , and manga into a compelling whole at the 2002 @-@ 2003 CESA Awards .

= = Related media and legacy = =

The .hack video games are part of a multimedia franchise that includes novels , manga , and anime series . Set before the events of the video games , .hack / / Sign is an anime television series that establishes The World as a setting . .hack / / Another Birth is a series of novels that retells the story of the games from BlackRose 's perspective . .hack / / XXXX is a manga adaptation of the games ' story with changes to some elements , such as Cubia acting as a player character . The first official sequel to the games is the manga and anime series .hack / / Legend of the Twilight , which began serializing on July 30 , 2002 . It tells the story of Shugo and Rena ? regular players who win avatars of Kite and BlackRose in a contest ? and their exploration of The World and its secrets . .hack / / G.U. is a series of video games also released in multiple parts that forms the centerpiece of .hack Conglomerate , a new project set seven years after the events of Project .hack with a new version of The World .

= = = Music = = =

The games ' soundtrack , titled .hack / / Game Music Perfect Collection , was released as a double album in Japan on April 23 , 2003 . It features 68 compositions by Chikayo Fukuda , Seizo Nakata , and Norikatsu Fukuda . A special edition of this soundtrack includes a third disc featuring sound effects and clips used in the games . The album was released with fewer tracks in North America as .hack / / Game Music Best Collection . Patrick Gann of RPGFan wrote that the second disc , which contains music for cutscenes and special events , was stronger than the first disc 's generic town and battle themes . He called the soundtrack " techno meets opera " , singled out the volume intro tracks for particular praise . Gann noted that the North American release functions as a " Best of " album , but felt that " a lot of solid music [is] missing " in this release . Other reviewers were less enthusiastic ; Paul Koehler of RPGamer called the music " particularly bland " and IGN 's Dunham lamented that the second installment did not introduce many new pieces . However , he concluded that " the melodious piano and oboe themes were still brawny enough to convince us that we needed to buy the soundtrack sometime in the near future " .

.hack / / Game Music Perfect Collection

.hack / / Game Music Best Collection

= = = .hack / / frägment = = =

.hack / / frägment is a multiplayer online game based on the fictional MMORPG , The World . It was released only in Japan on November 23 , 2005 and online service ended on January 18 , 2007 , after being extended two months because of its popularity . Famitsu Weekly gave .hack / / frägment a cumulative score of 29 out of 40 over four reviews , much like its reviews of the main series . Designer Hiroshi Matsuyama described the game as a way to see how players would react to online play . The game uses the same game engine as the .hack video game series and thus , its gameplay is identical , with the exception of online mode . Players explore areas and fight monsters in real time . A major difference is that during online play , the action does not pause when the menu is opened . Players may still use the skill " Data Drain " to weaken monsters and collect rare items . The user interface and control scheme are otherwise unchanged .

Players may create their characters based on a number of preset body shapes and color schemes and may choose a class (such as Wavemaster or Twin Blade) and character name . In online mode , players may enter a lobby and search for a maximum of two other players to join them on an adventure . The game includes an expanded communication interface that allows players to chat , send e @-@ mail , post to an in @-@ game Bulletin Board System , and receive server news updates . It is possible to establish ad @-@ hoc chat rooms separate from the public @-@ access ones . Guilds are permanent , exclusive chat rooms for members . In offline mode , players may level up , obtain items , and learn new skills as one of their online mode characters without the need for an Internet connection . Players may invite characters from the .hack games , .hack / / Sign , and .hack / / Legend of the Twilight into their party . The " story mode " of .hack / / frägment is identical to that of the .hack games , with the player 's created character replacing Kite . While offline , players may use a PC utility called " HackServer " to create areas and dungeons and release them online . The creators of the most popular areas are given the ability to add strong monsters for players to defeat .