WATER

Water is life.

Water is the giver of all life. Water is the blood of Mother Earth and is the interconnection among all living beings. Mother Earth has 71% of her surface covered by water, similar to the human brain and heart. To Anishinaabe people, water is alive and has an energy and sacredness of her own. Water is healing and should be deeply respected. We have a responsibility to protect the health of water for all beings.

Bemidji is the first city on the Mississippi, an identity tied to water and also imbued with a sense of responsibility for downstream communities. Water is critical not only for sustaining life in the community, but is a core piece of the identity of community members, forming the foundation for recreation, tourism, identity, and economy. Indeed, water was often the primary resource discussed in terms of resilience and also love and connection to place, repeatedly across many community conversations.

WATER USE

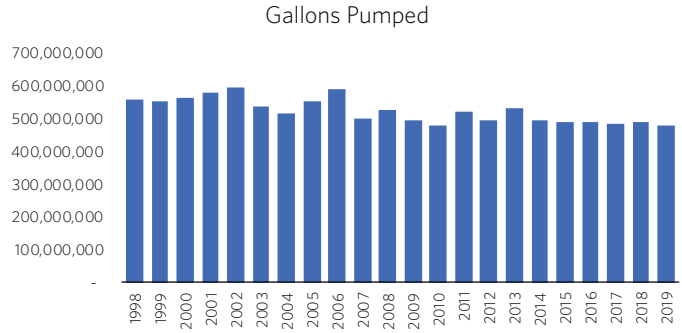
Honoring the life-giving nature of water and ensuring its ability to sustain future populations requires responsibly stewarding its use and consumption. Comprehensively understanding regional water use, however, is a difficult task. Exploring the City of Bemidji's annual groundwater pumping offers a glimpse into collective water use. Over the first two decades of the 21st century, average water volume pumped dropped approximately 80 million gallons and unaccounted water losses dropped from the low-20th percentile to under 10%. Though this fails to capture all variables relevant to groundwater consumption (ie. drilling and permitting of private wells), it still exemplifies the importance of efficiency and conservation measures. Such measures have reduced unaccounted water loss and enabled relatively static consumption despite population growing approximately 20% over the same twenty-year period.

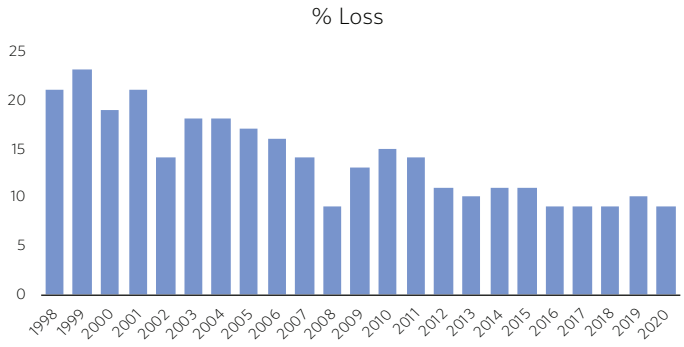
In 2016, the City discovered per- and poly-fluoroalkyl substances (PFAS), or "forever chemicals," in the water pumped for consumption by city residents. After completion of a water treatment facility in 2021, PFAS detection dropped below levels deemed acceptable by the Minnesota Department of Health (70 parts per trillion). Though the immediate issue was resolved, the situation highlights the importance of the precautionary principle in decision-making, particularly when it involves a resource as precious as water.

"Water and access to water is essential for health, economic opportunity."

"With background in water resources fields, I understand the importance of thinking how down stream communities and taking greater responsibility for headwater reaches."

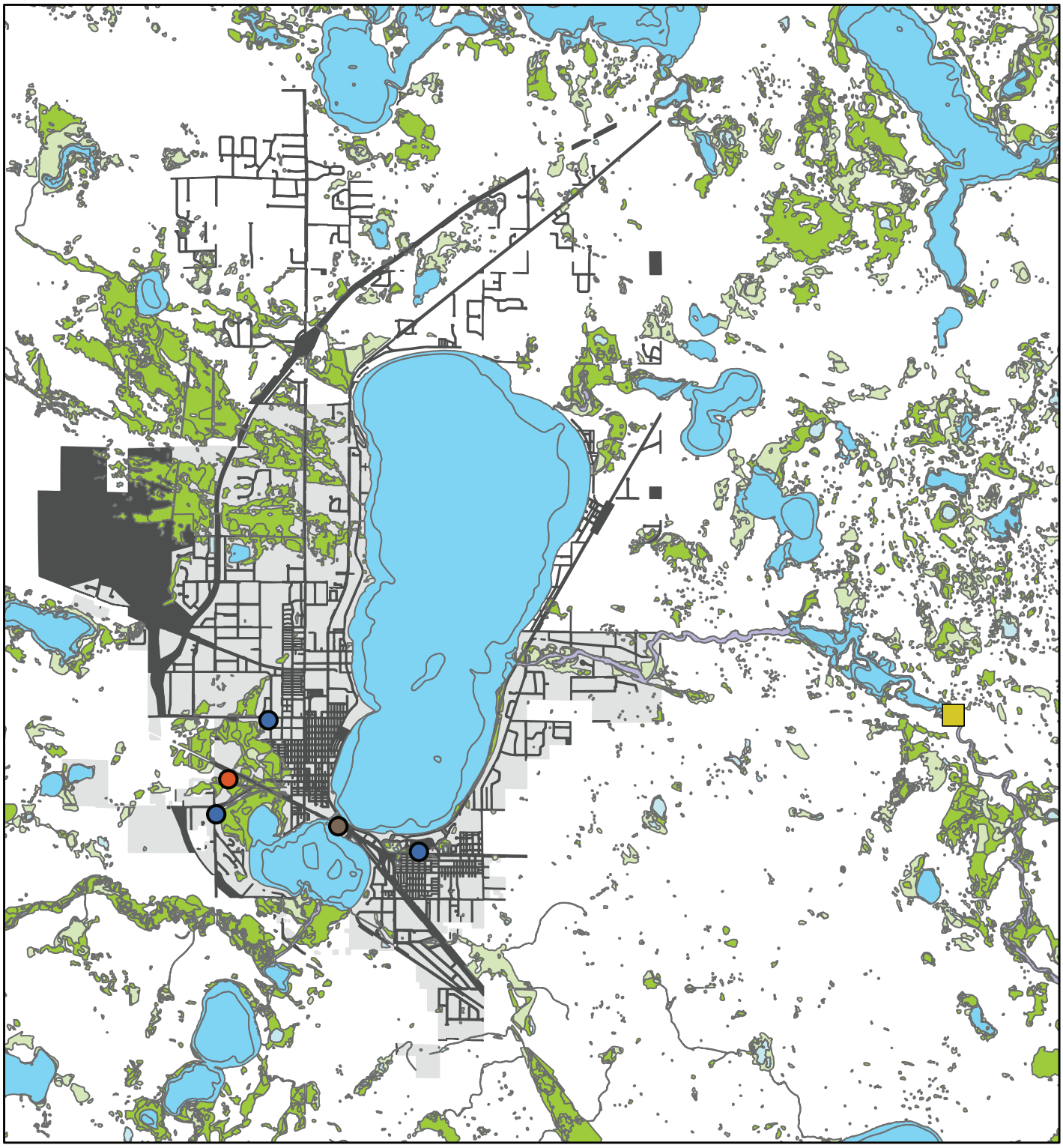
CITY WATER USAGE





Data source: The City of Bemidji

BEMIDJI AREA WETLANDS



Sources: Beltrami County, City of Bemidji, and US Fish and Wildlife Service: National Wetlands Inventory

KEY

- Water Treatment Plant
- Bemidji Public Works (PFAS treatment)
- Water Tower
- Hydroelectric Dam
- Wetland

WATER CONTAMINANTS (LAKE BEMIDJI)

The Minnesota Pollution Control Agency (MPCA) tracks surface water quality of lakes and streams throughout the state. One measure it tracks is the trophic state, or relative nutrient richness. Water high on the Trophic State Index (TSI) are considered eutrophic, often characterized by low-transparency and green tinting. Clear, transparent waters, on the low end of the TSI are oligotrophic. Mesotrophic waters split the difference with moderate clarity. Eutrophic conditions are a symptom of nutrient loading, often introduced through surface water runoff. Based on data collected between 2008 and 2017, Lake Bemidji's waters fall between mesotrophic and eutrophic ranges. Compared to median water clarity throughout the water shed, Lake Bemidji is 2.30 feet lower, suggesting its waters are slightly less transparent than neighboring bodies. Improving both measures of nutrient richness and transparency will require collective effort to reduce storm water runoff and protect the waters our community values so highly.

Beyond nutrient-loading, our community must be aware of impacts our daily actions have upon local bodies of water. Driving vehicles on frozen bodies of water is an obvious example for the importance of maintaining automobiles to prevent oil and gas leaks and reduce general litter. Perhaps more important, however, is the importance of maintaining roadways and parking lots adjacent to lakes and rivers. Achieving greater efficiency in winter road maintenance (ie. pre-salting roads and chemically optimizing brine solutions) is necessary to reduce chloride intrusion. Because maintenance of roadways falls within varying jurisdictions - from private residents to the City, County, and State (MnDOT) - such practices should be encouraged at all levels. Additionally, implementing sedimentation basins and reducing the overall square footage of impermeable surfaces near Lake Bemidji can further reduce water contamination by reducing or altogether preventing direct runoff.

"Always the ability to invest more in drinking water – or, how could we change our habits so that we can continue to use clean water."

"Think more about activities in our sensitive aquafers and recharge areas. Small scale hydroelectric incorporated into floodwater mitigation projects (FDR) – flood damage reduction. Wastewater treatment and discharge: improvement and infrastructure investments"

"Protect ground water and surface water. Find funding for making water available."

PROJECTED PRECIPITATION SCENARIOS FOR MINNESOTA

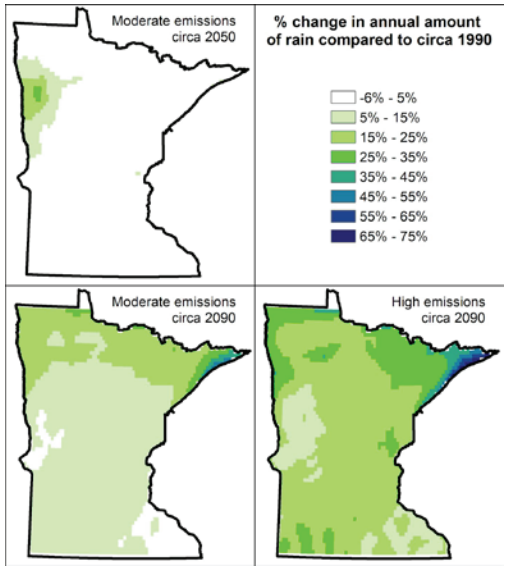


Figure 1. Percent change in annual amount of precipitation relative to circa 1990. Circa 1990 corresponds to the average of 1980-1999 of our modeled climate data. Future scenarios also represent 20-year averages, circa 2050 corresponds to 2040-2059 and circa 2090 corresponds to 2080-2099.

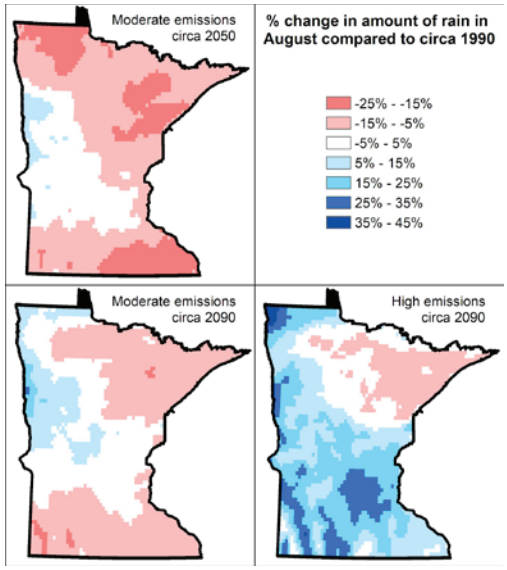


Figure 3. Percent change in amount of precipitation in August.

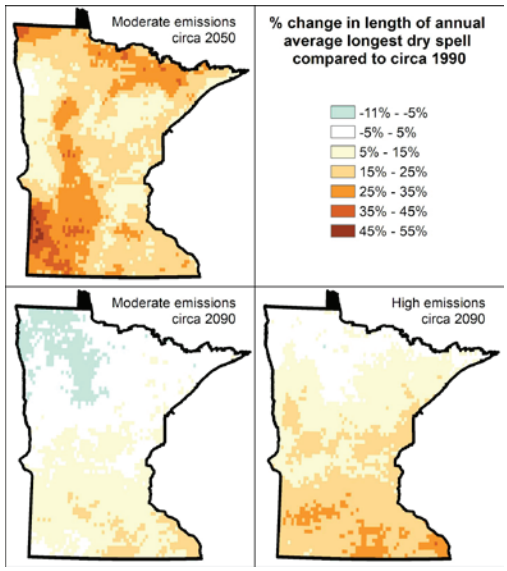


Figure 5. Percent change in length of annual average longest dry spell.

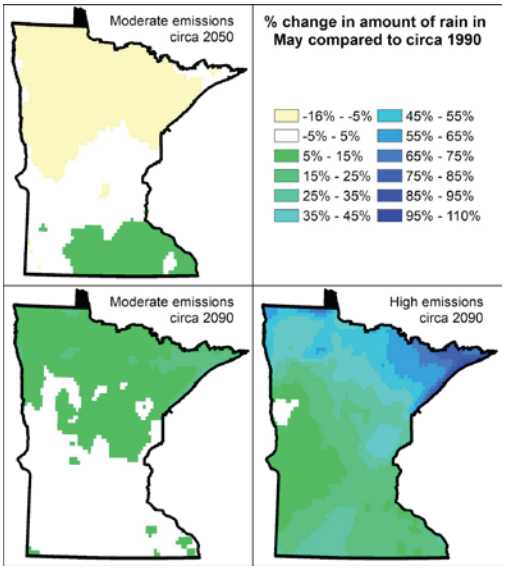


Figure 2. Percent change in amount of precipitation in May.

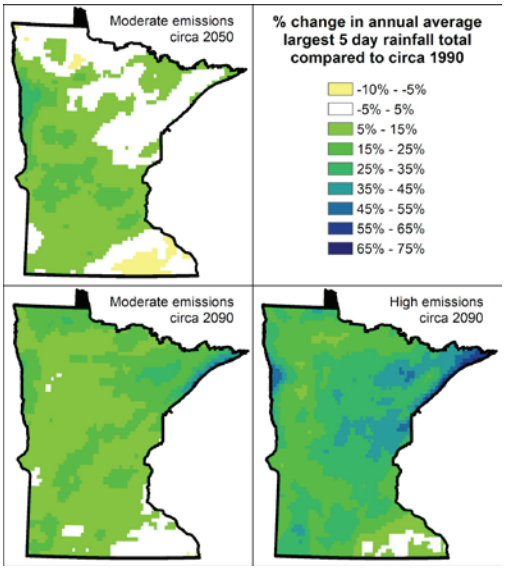


Figure 4. Percent change in annual average largest 5-day rainfall total.

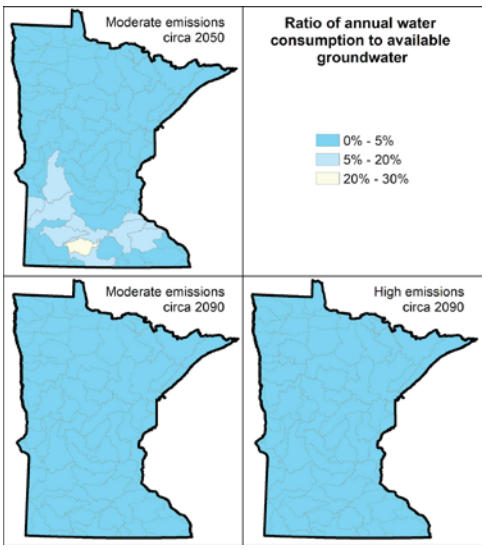


Figure 9. Groundwater depletion under climate change.
Although withdrawals and consumption of water are projected to increase, this is offset by projected increases in precipitation. The increases in precipitation were smallest in the mid-century scenario so depletion is more apparent. Although we found little evidence for depletion annually, monthly or seasonal depletion may still exist. Due to processing resource constraints, the ensemble for this analysis consisted of four models; bcc-csm1-1 CCSM4, CNRM-CM5, and GFDL-ESM2M.

Climate change projections for improved management of infrastructure, industry, and water resources in Minnesota

PALMER DROUGHT SEVERITY INDEX

Minnesota's Department of Natural Resources publishes historical and projected climate trends through its Climate Explorer web page. Among the metrics tracked are temperatures (minimum, maximum, and average), precipitation, and relative dryness. The latter is depicted through a standardized index known as the Palmer Drought Severity Index (PDSI). According to the PDSI, the Mississippi River Headwaters region experienced relatively wet conditions from 2015 through the spring of 2021. June 2021, however, ushered in one of the driest seasons of the preceding three decades. As of November 2021, the dry conditions persisted. Local impacts are felt by the recreation and tourism industries in response to low surface water levels in lakes and streams. Non-human species feel similar burden as they are forced to adapt to the dearth of moisture. Increased strain is placed on groundwater supply resulting from continued extraction for uses with varying degrees of necessity. Monitoring trends in drought conditions and exploring ways to build community resilience to prepare for future dry spells will be critical.

"Move to a community norm of more native plants in yards – to be adapted to greater dry spells and tolerate extreme heat"

"Recognition of the implications of climate change... needs to be part of the conversation for planning and community development."

"Engage developers in water protection practices."

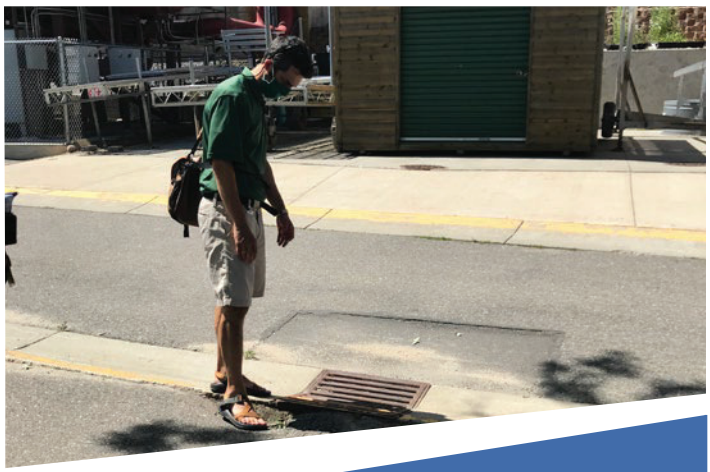
"Future development could be impacted by accessibility to clean water sources in a changing climate"

"Joint Planning Board grappling with parking standards and parking improvements. People parking on grass instead of paving it over to meet zoning requirements."

WATER AT BSU

STORMWATER & LANDSCAPING

Its location on the western shore of Lake Bemidji is a defining characteristic of Bemidji State University. Highlighting the lake as a distinguishing theme of place suggests the need, as within the broader community, to recognize and monitor instances and impacts of stormwater runoff directly attributable to university operations. One example is campus' southernmost parking lot around Bangsberg Hall. In its present state, stormwater runoff drains from this parking lot directly into Lake Bemidji, effectively concentrating vehicular effluent. The absence of sedimentation basins to collect runoff from this and other parking lots across campus, particularly those located nearest the lake, places the University's lake-based identify at risk. Reducing chemical compounds at the source, such as chloride salts used as a deicer during the winter or fertilizers applied to green spaces, may further reduce the impact of stormwater runoff. As an alternative to turf grasses, implementing deep-rooted, native plants into the landscape can hinder sediment flow, support groundwater recharge, and reduce the need for water-intensive irrigation. Rainwater collection from facility rooftops can simultaneously reduce runoff whilst productively routing or storing water for irrigation. Exploring and implementing these and other strategies will support both water quality and BSU's stewardship of Lake Bemidji.



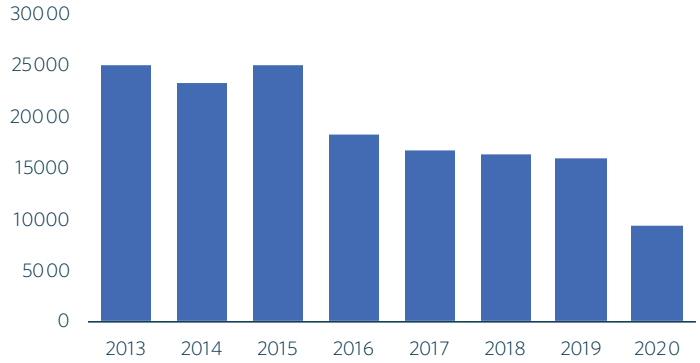
WATER USE

Minnesotans cherish their home, the Land of 10,000 Lakes, for the numerous opportunities it affords to interact with water. A shining example for harmonious appreciation and stewardship of Lake Bemidji's water resource may be observed in the lake-based programming offered through BSU. Recreational programming offered by the Outdoor Program Center (OPC) provides students and community members with an opportunity to interact on and in the water in ways safe for human and non-human populations alike. Many vessels operated by the OPC (canoes, kayaks, stand up paddle boards, sailboats) depend on human-power.

Through human-powered means and beyond, lakes Bemidji and Irving, and water bodies to which they are connected through the Mississippi, are used by thousands of outdoor enthusiasts. Motor sports open the lake to enjoyment by anglers, skiers, boarders, swimmers, and more. The water resources surrounding campus are undoubtedly a factor in many students' decision to earn their degree at Bemidji State. Those same resources provide benefit beyond recreational enjoyment. The lake and its shoreline offer numerous teaching and learning opportunities. The study of freshwater species living in the water, trees and plants growing along the shore, and avian species sustained by both are all within reach of professors and their pupils.

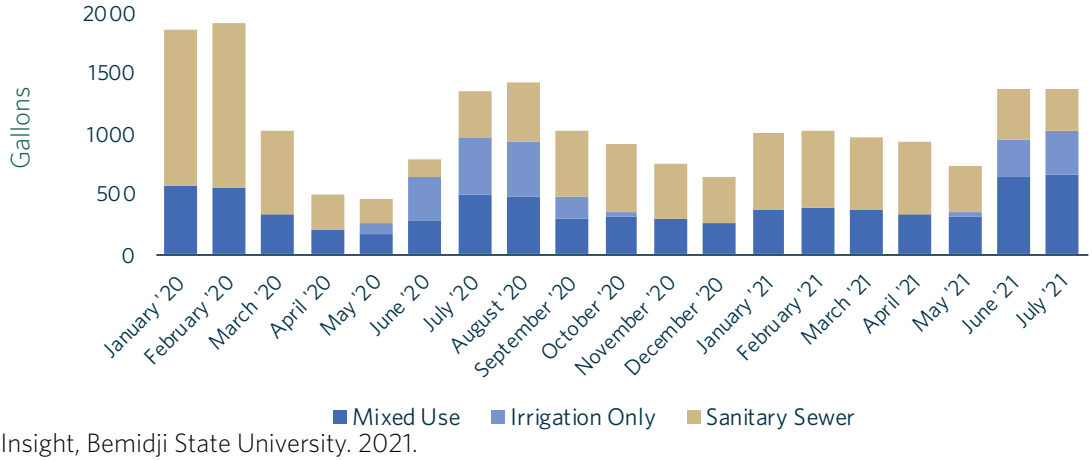
Beyond recreation and learning opportunities afforded by surface bodies of water, we must acknowledge the importance of water for consumption. We consume water for a variety of purposes from hydration to hygiene to irrigation of curated landscapes. The University has striven to make fresh drinking water accessible at no cost to everyone who visits campus, in part through installation of dual-purpose water fountains with bottle-filling stations. As of 2021, bottle-filling stations are accessible in almost every building across campus. Providing unfettered access to fresh drinking water is not synonymous with unrestricted consumption, however. Reducing consumption of water for personal hygiene (ex. low-flow shower fixtures, sink faucets, and toilets), laundry and dishware-related uses (ex. efficient appliances), and irrigation (ex. conversion of turf grasses to deep-rooted native plants, engineering our built environment to capture rainwater for natural irrigation) should remain a priority.

BSU TOTAL WATER USE 2013-2020 (GALLONS)



Data Source: B3 Insight, Bemidji State University. 2021.

BSU WATER USE BREAKDOWN



Data Source: B3 Insight, Bemidji State University. 2021.