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The objective of Task 1 was to conduct strategic planning sessions with campus stakeholders in order to assess campus priorities and available resources for future development of a Campus Water Action Plan. We began this work with two visioning meetings and then integrated ongoing strategic planning and stakeholder communication into tasks 2-4. On 1/23/2020, we held a meeting with 15 attendees to discuss campus water knowledge and needs; and on 4/21/2020, we held a follow-up meeting with four attendees to focus on water used in campus landscaping. Key concepts from these meetings are summarized below.

The strategic planning sessions were important for bringing together different perspectives on water conservation. These sessions focused on both outdoor and indoor water use.

In terms of outdoor water use, the discussion revolved around decreasing the amount of irrigation-dependent landscaping at FLC. The first topic discussed was the idea of replacing irrigated turf with xeriscaping. There are already substantial areas of both turf and xeriscaping at FLC, and conversation turned to the relative merits and drawbacks of xeriscaping. Xeriscaping is a popular approach for water conservation at FLC, especially among students. In the last decade, many student research projects have focused on the benefits of xeriscaping for water conservation. In the discussion, identified benefits of xeriscaping were irrigation reduction, plant biodiversity, and incl

used based off the audit resources. The estimates of gallons per flush were grouped by ranges of time to simplify calculations, and to not to overstate the accuracy of these measurements. This is also a conservative approach that takes into account the fact that low flush toilets could be the cause of the extended flush times which does not necessarily mean higher flow rates.

Flow rates for tank-type toilets were recorded based off the fixture mark, and flush times were not recorded because flush times on tank-type toilets do not correlate to gpf in the same way as on flushometer valve type toilets with regular supply pressure. Notes were taken if a significantly long flush time was observed which would indicate a leak or other kind of issue.

Table 1 Estimated gallons per flush based on recorded flush times on flushometer toilets and urinals

Our estimates of annual domestic water consumption for each building are rough estimates. In the case of residence halls, actual occupancy numbers were obtained from Student Housing (not including summer occupancy). In the case of Academic and administrative buildings, rough occupancy estimates were based off building size, function, and floor plans (i.e., counting the number of office and classrooms). Fixture use rates were based off of our audit resources.

Building specific data from sub-metering would increase the accuracy of the building data. Building metering would also provide insights into the water use during COVID restrictions as well as typical use when the buildings are fully utilized again.

One of the most significant observations upon inspection was the variety of fixtures used throughout the FLC campus. In some newer buildings like SFH, Animas, and Bader-

Figure 1 Berndt Hall restroom faucets

Table 3 Academic and Administrative building fixture average flow rates

Table 4 Academic and Administrative building estimated annual water use and cost

	Average Daily Use per	Average Daily	Total Annual Water Use
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Table 5

Table 7 Buildings or areas not assessed

Aquatic Center	Locker rooms were off limits due to COVID; Unable to coordinate with Athletics staff to discuss use patterns
Aspen Hall	Unable to coordinate with Police staff go get access & walk-thru
Centennial Apartments B (2000)	Occupied by students during the summer; Restricted access due to COVID concerns
Chemistry Hall	Lab sinks and other lab water consuming equipment not assessed
Colorado State Forest Service (Office & Shop)	Unable to coordinate with staff go get access & walk-thru
Community Concert Hall at Fort Lewis College	Closed due to COVID; Unable to coordinate with Facilities staff go get access & walk-thru
Cooper Hall	Undergoing renovation
Escalante Hall	Occupied by students during the summer; Restricted access due to COVID concerns
Geology Field Lab	Unable to coordinate with Facilities staff go get access & walk-thru
Physical Plant Services (2 buildings)	Unable to coordinate with Facilities staff go get access & walk-thru
Recreation Complex (Softball Complex)	Closed due to COVID; Unable to coordinate with Facilities staff go get access & walk-thru
Sitter Family Hall	Public restrooms assessed; Lab sinks and other lab water consuming equipment not assessed
Skyhawk Hall	Unable to coordinate with Athletics staff to get access & walk-thru
Stadium (Dennison Memorial Field)	Unable to coordinate with Athletics staff to get access & walk-thru
Student Union (North & South)	Campus Dining water consuming equipment not assessed
Whalen Gymnasium	Public restrooms assessed; Locker rooms were off limits due to COVID; Unable to coordinate with Athletics staff to discuss use patterns
Buddy Stop	No domestic fixtures
Centennial Service Building	No domestic fixtures
Chemical Storage	No domestic fixtures

The following are recommendations from this audit. We recognize that some of these may already match existing facilities protocol and that not all recommendations can immediately be implemented. Recommendations are listed in approximate order of priority.

These are easy and inexpensive fixes that can save substantial amounts of water.

We acquired GIS layers from both the city and the county and the 2019 color aerial imagery (3-

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Figure 3 Map of landscape types on campus. Data Sources: 2019 Aerial Imagery 3-Inch Resolution from La

Table 9 Monthly evapotranspiration, precipitation, and irrigation demand for the growing seasons in 2018-2020. (NOTE: May 2018 irrigation demand is estimated by averaging the demand for May 2019 and 2020 because the Durango CoAgMET station was installed May 20, 2018.)

	ET₀ (in)	Precipitation (in)	ET_L (in)	Irrigation Demand (in)	Irrigation Demand (in)	Irrigation Demand (in)
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**The precipitation value for July 2020 is unusually high, so we contacted the Colorado Climate Center that operates the CoAgMET stations. They agreed that this value is incorrect, but they do not have a more accurate estimate at this point. Several thunderstorms moved through the area in the last week of July 2020, so the monthly rain is probably in the range of 1 to 3 inches. As a result, the 2020 irrigation demand is an underestimate.

Table 10 Irrigation season water demand estimates for FLC turf areas for 2018, 2019 and 2020

Subtask 4.5 focused on one section of campus for an in-depth mapping of the irrigation system. There are 30 clocks which control the timing of irrigation in 30 sections on campus. Within each of those clocked sections, there can be 1 to 10 zones. Each zone has its own irrigation valve buried in the ground with a plastic cover. Those valves are used to manually turn the water on and off in the associated zone (Figure 5). Any given zone can have 10 to 20 sprinkler heads.

If a sprinkler head breaks or a patch of grass doesn't get watered, a member of Physical Plant Services (PPS) must drive out to the site, locate potential irrigation valves (which can be buried under turf if they haven't been touched for years), then manually turn valves on and off until finding one that correlates with the fault in the system. Due to the time required in this guess-and-check process, days can pass before an issue is addressed. Detailed irrigation system mapping could help waste less water by helping PPS staff deal with issues more quickly.

An

could increase water efficiency in two ways:

PPS has slowly been replacing inefficient sprinkler heads on campus with vacuum-sealed sprinkler heads when sprinklers break. With funding (\$20-\$100 per head), PPS could replace all of the less efficient sprinklers, which would result in reduction in irrigation water usage on campus. An outdoor water audit could be used to estimate if replacing all of the heads would be a worthwhile investment. If the sprinklers were all fitted with the correct nozzles, then the Maxicom system could be used again. An alternative, less expensive, option is to replace the improper nozzles with correct ones (instead of replacing the entire sprinkler head). This would not yield the efficien4stem coul