



THE UNIVERSITY OF ARIZONA

Sustainability & Climate Action Plan

Develop a Green Infrastructure & Landscaping Master Plan

SUSTAINABILITY COMMITMENT(S) THIS INITIATIVE SUPPORTS

- **2 - Water Reduction**

INITIATIVE ALIGNMENT WITH THE CHARGE

- **Eliminate Emissions:** Given the multiple benefits of green infrastructure, the plan will set the stage for reducing emissions via less energy use related to water, more shading of heat-absorbing surfaces and buildings, and encouraging modes of travel that do not create emissions. These performance variables should be tracked to understand changes in energy and water use.
- **Build Community:** Spaces are created, and activities are generated by outdoor areas defined by plants and further enriched by diverse and adapted plantings.
- **Be Actionable:** The plan will provide an actionable and living document to guide investments. This document will be reviewed annually and updated to meet changes in best management practices. A possible pathway would be to adopt the Sustainable SITES Initiative (SITES) rating system to establish benchmarks and guide performance outcomes.
- **Be Data Informed:** The Green Infrastructure Master Plan will be driven by data and analyses and will provide a fact-based framework for decision-making about implementing the plan. For example, a green infrastructure asset inventory will be updated to include location, size, and stormwater mitigation potential as the first step to determine campus stormwater mitigation potential and identify locations for future focus. As an initial step, the plan could take advantage of studies on campus green infrastructure performance and crowd-sourced data-sharing platforms for communication and decision-making.
- **Inspire Adaptive Management:** A planning document as proposed in this initiative will make visible priorities, costs, proposals, and decision-making related to creating inclusive multi-benefit green infrastructure landscapes.
- **Demonstrate Leadership:** Adoption of sustainable stormwater and water reuse management practices on campus will ensure the university is leading a shift away from potable water sources to actively managing stormwater for landscape irrigation and developing a long-term plan to iteratively address water use on campus.

INITIATIVE DETAILS

Initiative Summary

This initiative proposes to develop a comprehensive Green Infrastructure and Landscape Master Plan for the University of Arizona, building on the existing groundwork from the 2009 Surface Water Master Plan. Although the university has significant ongoing research and educational efforts focused on green infrastructure, it currently lacks a unified plan. By integrating these initiatives campus-wide, the university can establish leadership in sustainability. The plan will prioritize stormwater management, define funding mechanisms, and coordinate implementation efforts across departments to enhance the campus landscape's resilience and sustainability. Actionable items include:

- Develop a comprehensive Green Infrastructure and Landscape Master Plan for the University of Arizona, focusing on integrating green infrastructure principles across the campus to manage stormwater effectively.
- Establish a centralized decision-making entity or process to oversee the implementation of the Green Infrastructure Master Plan, defining responsibilities and performance goals for existing and proposed green infrastructure.
- Evaluate and modify existing campus landscapes to incorporate native or regionally adapted vegetation that supports stormwater infiltration and reduces water consumption.
- Implement rooftop water harvesting systems on a district level to collect and utilize rainwater for campus irrigation and operational needs, aiming to reduce reliance on potable and reclaimed water.
- Assess and repurpose existing large underground stormwater tanks to serve as multi-functional reservoirs for storing harvested water and mitigating stormwater runoff, enhancing campus sustainability and resilience.

Proposed Initiative & Background

A comprehensive Green Infrastructure and Landscape Master Plan for campus does not currently exist. While the 2009 Surface Water Master Plan lays much of the technical groundwork for a Green Infrastructure Master Plan, it did not accomplish the full integration needed for it to serve as a tool to transform the campus landscape into one that meaningfully integrates green infrastructure principles at scale. No unit or specific implementation authority exists for such a plan or for managing stormwater flooding impacts related to campus. Risk Management Services is tasked with managing the Stormwater Management Plan mandated by the Arizona Department of Environmental Quality (ADEQ), which focuses on meeting water quality standards.

The university has a substantial portfolio of existing green infrastructure, however, significant needs remain concerning stormwater mitigation and planning, so a plan is needed to take full advantage of the multiple benefits of green infrastructure. Further, courses are focusing on green infrastructure design and implementation and there is a strong cohort of faculty across the campus researching green infrastructure. There are untapped potentials for the University of Arizona to leverage the current knowledge base and momentum to solidify its leadership role nationally in this area, all of which could contribute to a robust Green Infrastructure Master Plan.

The plan should establish priorities, define ongoing funding, and create a decision-making process or entity, which will serve as an ongoing program or initiative for achieving the goals of the plan. Specific departmental responsibilities should be defined, along with performance goals for existing and proposed green infrastructure.

Green infrastructure filters and absorbs stormwater where it falls. In 2019, Congress enacted the Water Infrastructure Improvement Act, which defines green infrastructure as "the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest, and reuse, or landscaping to store, infiltrate, or evapotransporate stormwater and reduce flows to sewer systems or to surface waters."

The university landscape has been a site for horticultural and landscape experimentation since its founding. This evolution of the campus landscape continues and has been moving toward a more regionally rooted approach for its planting. These changes are supportive of and consistent with the goals of the Sustainability & Climate Action Plan. However, there is a need for better overall clarity and direction in this evolution to facilitate a more rapid transition toward the most resilient and high-performing future condition. The services associated with vegetation can be expanded while adopting practices that are less resource-intensive and therefore more sustainable.

Use the campus landscape to mitigate stormwater flows on and leave campus by infiltrating the majority of rain events within landscapes designed as green infrastructure. Among the practices, policies, and plans that will play a part in implementing this initiative are:

- Establish a formal goal of a certain size of storm event (such as a 50-year storm) to mitigate on-campus stormwater flows through landscape infiltration and align campus landscape and development practices such that this goal can be achieved within a set timeframe.
- Co-locate significant, large-event mitigation within major campus open spaces, while designing to infiltrate smaller events within the same physical spaces.
- Take every opportunity to infiltrate water from smaller events within all smaller landscape areas, planting beds and planter strips, etc.
- Transform current hardscapes into permeable surfaces to infiltrate rain and stormwater to offset landscape water use that in turn will reduce reclaimed water use and potentially help eliminate pumped well water use for landscaping. This will help lead to a circular water economy on campus.
- Modify and create stormwater runoff patterns to increase water filtration through permeable surfaces, curb cuts, infiltration basins, and other techniques that help maximize water capture so that pollutants may be filtered on-site using natural processes.

The University of Arizona has a history of managing stormwater within its landscapes, and this approach is growing as a tool regionally and nationally for utilizing site-generated water to create multiple benefits that support sustainability. Few municipal stormwater sewers are serving the campus, so to address flooding issues the primary option available is on-site landscape infiltration.

Vegetation choices should be predominantly native or regionally adapted and capable of thriving primarily on harvested rainwater while also providing shade and other benefits appropriate to an urban desert campus. Campus policies and practices should be aligned to realize this goal, which relates to not only plant selection but to management practices as well.

Included actions to implement this goal include:

- Increase current planting of and awareness of native edible plants on campus. When compared with non-native fruit trees, this will help reduce water consumption while increasing campus interest in green infrastructure through the unique edibility aspect. Additionally, more frequent/advertised edible landscape tours through the Campus Arboretum as well as improved signage to help engage students/faculty/staff.
- Use the campus landscape as an applied test setting for developing new techniques that hybridize conventional landscape irrigation methods with methods using passive water harvesting.
- Develop infrastructure to adapt building roofs to direct stormwater into cisterns or to other productive uses in buildings or landscapes.
- Assess campus landscape plant cover to identify areas where non-essential turf and other high-water use landscape surface plantings can be replaced with attractive xeric plantings. Integrate new passive water harvesting grading for converted landscapes.
- Incorporate provisions to implement these goals within updated DSS sections.
- Enhanced support should be provided for creating and managing decision support tools based on GIS technology. This would extend the current maintenance of data about trees on campus through the current GIS database of campus trees. This could enable measuring and tracking data about landscape cover, amount of turf, and changes over time as well as maintain mapping of irrigation systems so that they can be more easily maintained, performance can be tracked, etc. Assess the shading impacts of the canopy and track changes over time. This could be a much longer list.

A future Green Infrastructure Master Plan should also incorporate rainwater harvesting into the campus structure. Many of the existing stand-alone cisterns on campus are currently not functional. Like other combined utility systems (e.g., chilled water, steam), there is efficiency in the provision of services and maintenance by having centralized systems for harvested water. A resource that largely runs off campus currently can be harnessed to reduce costs, reduce risk, and enhance sustainability. Rainwater from roofs can be harvested as well as site ground-level storm runoff and be stored in large cisterns or underground reservoirs which serve a dual storage/reuse and storm runoff mitigation purpose. Such reservoirs can also serve to store excess condensate for reuse as well as potentially store reclaimed water that is added during off-peak times. This will help create a system of redundancy and resilience and is in keeping with local trends.

Related precedents to draw on exist in other municipalities and universities.

Develop rooftop water harvesting on a district level for collecting water from multiple buildings and site ground-level surfaces to store, filter, and use it in the campus irrigation system and to offset water used in utility and building operations. Collecting and utilizing rooftop water from multiple buildings is more cost-effective and efficient than single-building systems (i.e. CAPLA, ENR2). Identify new developments and existing districts where this would be feasible. The university should also begin to utilize stormwater and rainwater in landscaping and other applications to reduce the use of potable water and reclaimed water.

Collected and filtered water could be stored in tanks/reservoirs for later use or pumped into existing irrigation mainlines to supplant the use of potable and reclaimed water for campus landscape irrigation, and in the case of larger reservoirs, the water could be used for operational/utility purposes. Existing tank facilities and large stormwater tanks such as those under the east end of the Mall or those under Bear Down Field should be evaluated for modification to function as part of a district's water storage. Existing large underground stormwater tanks can be modified to provide multiple benefits, including storm mitigation while providing a water reservoir at the same time.

Data Analyses to Support Initiative

Prior drainage analyses exist to support this initiative, along with supporting analyses that would come with the creation of a Green Infrastructure Master Plan.

Data from the existing Campus Arboretum collection database can be used as a starting point for a broader analysis of the benefits and steps needed to implement this initiative. It is difficult to manage assets if it is unknown what or where they are. Important questions, for example, are things such as how much shade is generated. Where are areas that need more shade? What is the mix of species, how much water do they use, and how much can be saved by changing plants?

Conduct overall system analysis and review of issues with existing cisterns as input into the actual project/plan implementation.

Assessment of benefits of harvested water for landscape and utility purposes, including applications such as toilet flushing (as compared to reclaimed water with different water quality).

This initiative intends to capture and store as much water as possible for reuse, while expecting that an increment of storm flows, particularly in large flood-inducing events, will exceed the capacity of storage and will therefore need to be managed using landscape infiltration.

Resource Requirements & Return on Investment

Resource Requirements

- This would not be a discrete project with a specific budget. Rather, this initiative would result in realigning practices and policies over many years, with some of the efforts noted requiring specific funding allocations to be defined.
- A portion of the project implementations that are related to this initiative could be implemented as part of major capital project site development budgets.
- Initial assessment costs (internal and/or consultants) along with efforts to align policies and practices.
- On-the-ground implementation will be a long-term effort to transition vegetation where applicable along with enhancing open areas with appropriate new vegetation. These costs will be spread over many years and could come from operational budgets, or if made a higher priority, funding could be assigned for a more focused planting effort (e.g. a university version of the COT million-trees initiative).

- Specialized technology for measuring and managing vegetation could be employed, costs TBD.
- GIS support resources, TBD.
- Significant costs for systems planning, design, construction, and ongoing maintenance.
- Implementation of some tank systems could be through major capital project site development budgets.

Return on Investment

- There are potential cost savings through utility and water savings.
- These efforts will increase the efficiency of buildings and landscapes which will provide major savings for the university in the long-term while protecting valuable resources such as water.

Potential Funding Sources

- University Facility Services general funds
- Central Administration funding

Accountable Division(s) & Department(s)

- University Facility Services
- Parking & Transportation Services
- Campus Arboretum
- Grounds Management
- Consultants

Partners & Collaborators

- Office of Sustainability
- Students for Sustainability
- Hydrology & Atmospheric Sciences
- Ecological Restoration Club
- Landscape Architecture
- Cooperative Extension professionals
- Risk Management Services

Implementation

Length of Time to Implement

- Less than one year
- One to five years
- More than five years

Difficulty of Implementation

- Low
- Medium
- High
- Extremely High

Relative Timing

- Begin within two years
- Begin in three to five years
- Begin in six years or later

Metrics for Success

- Percentage of campus with harvested storm and rainwater (total area of rain/stormwater capture divided by total area of campus).
- Water capture capacity of all infiltration features and performance in different-size storm events.
- Changes in greenspace growth, water capture, decrease in heat island.
- Reduction in 2, 10, 25, 50, and 100-year event volumes and peak flows at primary points of concentration.
- Percentage increase in water infiltration capacity of the campus landscape.
- Percentage of overall campus landscape evapotranspiration provided by infiltrated water.
- Effective alignment of policies and practices among all entities involved in implementation and management
- Number of native edible plants planted and number of edible landscape tours with attendance records
- Completion of landscape surface assessment
- Adoption of custom maintenance practices for sustainable vegetation
- Change in overall canopy coverage
- Change in plant species composition
- Building roof areas and site ground-level areas and related and modeling water yield in different storm events.
- Irrigation and utility water offsets, related cost savings.
- Plan completion and adoption within two years.
- Quantitative measures based on modeling the impact of implementing the Green Infrastructure Master Plan, such as reduced storm flows, increased evapotranspiration, canopy cover, species diversity, maintenance costs, water savings, etc.
- Potential survey data from students/faculty. A current PIF project on campus GSI performance can be drawn on, with additional survey data that can contribute to the project.