APPENDIX E

CAMPUS GROUNDWATER CONSERVATION PLANNING PROTOCOL

PREPARED BY THE METROPOLITAN CONSERVATION DISTRICTS

FUNDING PROVIDED IN PART BY THE CLEAN WATER FUND FROM THE CLEAN WATER, LAND, AND LEGACY AMENDMENT

The Campus Groundwater Conservation Planning (CGCP) protocol was adapted from the South Florida Water Management District Water Supply Development Section's *Water Efficiency and Self Conducted Water Audits at Commercial and Institutional Facilities: A Guide for Facility Managers, Second Edition* (2013) and the EPA's *WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities* (2012).

Prepared by:

- Mitch Haustein, Anoka Conservation District, Stormwater and Shoreland Specialist
- Daniel Cibulka, Sherburne Soil and Water Conservation District, Water Resource Specialist
- Tiffany Determan, Isanti Soil and Water Conservation District, District Manager
- Troy Kuphal, Scott Soil and Water Conservation District, District Manager
- Andrea Prichard, Ramsey Conservation District, Environmental GIS Technician
- Jay Riggs, Washington Conservation District, District Manager

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- Doug Bonar, Anoka-Hennepin School District, Sites and Grounds Supervisor
- Brian Davis, Metropolitan Council, Senior Engineer, Water Supply Planning
- Mick Jost, Minnesota Technical Assistance Program, Team Leader and Senior Scientist
- Tim McGovern, Scott County, Facilities Manager
- Carmelita Nelson, Minnesota Department of Natural Resources, Water Conservation Consultant
- Kristin Seaman, City of Woodbury, Environmental Resources Specialist
- Stephanie Grayzeck Souter, Washington County Department of Public Health and Environment, Associate Planner
- Jim Westerman, City of Woodbury, Utilities Supervisor/Environmental Resource Coordinator

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INTRODUCTION

The Campus Groundwater Conservation Planning (CGCP) protocol provides a standardized methodology for identifying and ranking potential water conservation best management practices on campuses. While protocols currently exist for completing such efforts, widespread application of the protocols and implementation of the identified water conservation practices or behaviors is limited.

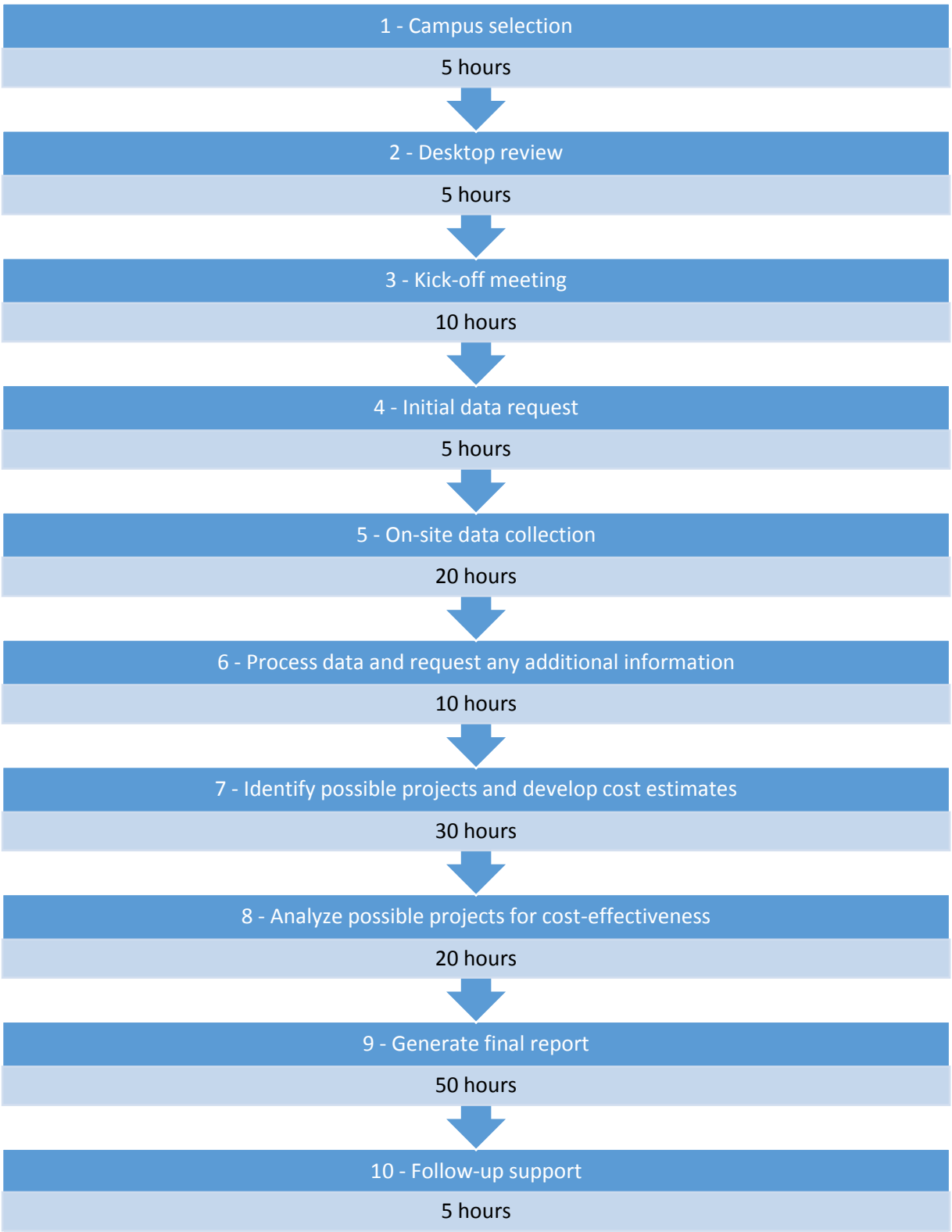
The Metropolitan Conservation Districts (MCD), through funding provided by a Clean Water Fund Accelerated Implementation Grant, created this CGCP protocol by adapting multiple existing protocols with the ultimate goal of water conservation project implementation. The CGCP protocol can be implemented by Soil and Water Conservation District (SWCD) staff throughout the State and produces a list of prioritized water conservation project opportunities. Project opportunities are ranked by cost-effectiveness and achieve water conservation through both reduced use as well as increased groundwater recharge. The straightforward work products produced by the CGCP protocol empower campus decision makers to confidently implement cost-effective water conservation projects.

The CGCP protocol provides a detailed analysis of all water using systems on a campus, both indoor and outdoor. Generally, commercial and institutional water use can be divided into four categories: water use meters and leak detection, domestic indoor, non-domestic indoor, and outdoor. The protocol ensures water using equipment in each category is analyzed for water conservation potential.

Prior to beginning the CGCP protocol on a particular campus, it is helpful to understand the average water use of other campuses of a similar type. Knowing the broad categories of use and how each contributes to a facility's total water use may identify areas with the greatest reduction potential. For example, on average nearly 50% of water use in schools is in restrooms. Therefore, a detailed analysis of the restroom sanitary fixtures (i.e. faucets, toilets, and urinals) is imperative. This does not mean highly cost-effective water conservation practices will not be identified in other areas of the campus. Rather, it helps provide a basic understanding of the facility's likely water use patterns based on other campuses of a similar type. Appendix A provides a quick reference guide for understanding general water use patterns based on campus type (e.g. office buildings and schools).

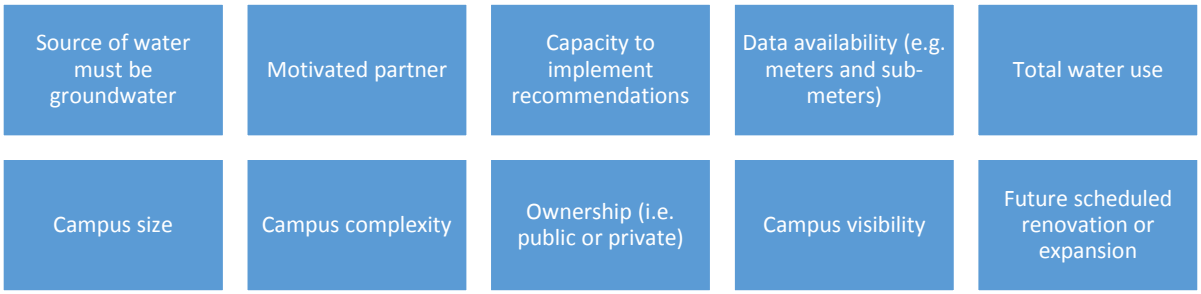
Prior to implementing this protocol, the user must receive CGCP introductory training from a previously trained SWCD staff member. This document provides the complete CGCP protocol, which consists of 10 steps that are listed below. Time investment for SWCD staff will vary by level of experience with the CGCP protocol as well as the size and complexity of the campus being analyzed. That being said, the steps below also include rough time estimates for each step of the process.

The rough time estimates total 160 hours. The steps with hours estimates that are most likely to be campus-dependent are 5 – 9 based on campus size and complexity.



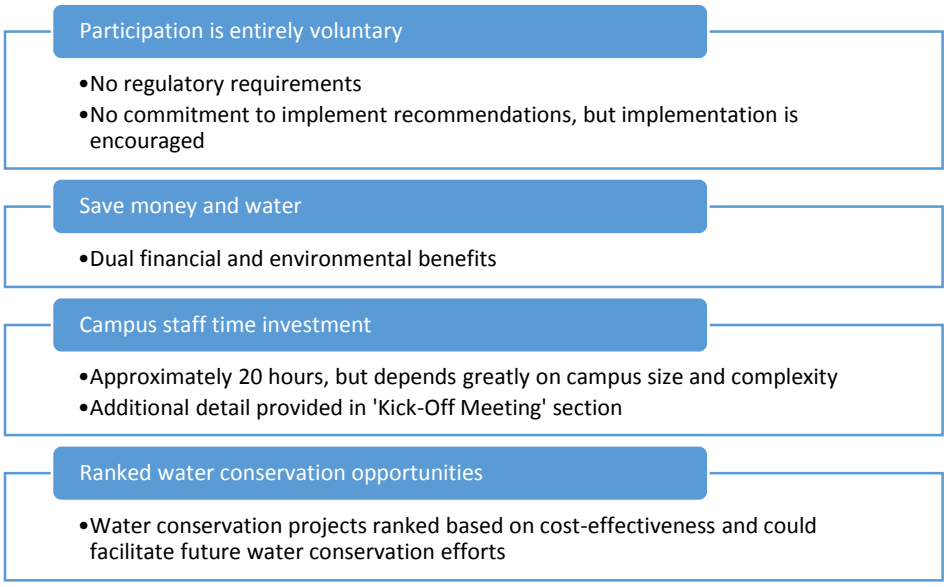
1 - CAMPUS SELECTION

The first step in the CGCP protocol is to select a campus for study. The following elements should be considered when selecting an eligible campus.



While the only requirement for participation is that the source of water for the campus is groundwater, final campus selection should strive to provide the greatest potential reduction in water use based on the quantitative and qualitative considerations above. Commonly considered campus types include: schools/colleges, community centers, libraries, and government offices.

The promotional handout in Appendix B should be used as the initial outreach piece to introduce the program. It provides a summary of the program, benefits, process, common water conservation opportunities analyzed, and campus staff roles. The talking points below can be used in conjunction with the handout to assist with initial discussions.



Once a campus has been identified and campus staff are eager to participate in the CGCP program, clear expectations should be communicated to the campus staff regarding the process, their time investment, and facility access necessary to complete the protocol. These elements are best communicated during a kick-off meeting (step 3) between SWCD staff conducting the protocol and campus staff. Ideally, campus staff will include one lead administrative staff member responsible for campus-wide decision making as well as the facilities manager.

Appendix C provides additional guidance for campus selection in the event that multiple campuses have expressed a desire to participate in the CGCP program but available funding limits the number of campuses that can be analyzed. This scenario may become commonplace when the CGCP program is established.

2 - DESKTOP REVIEW

In preparation for the kick-off meeting, a detailed desktop review of the campus should be completed so that a general understanding of the campus is established. The desktop review should be completed in GIS using commonly available data. The points below include the elements to review, relevance of each element to the CGCP protocol, and commonly available GIS datasets to use for the review.

General campus layout and acreage

- Familiarization with the campus in advance of the kick-off meeting will ensure a productive meeting
- GIS data - recent aerial photographs and parcel data

Building footprint areas

- Understand count of buildings and footprints for future data entry
- GIS data - footprints manually digitized using recent aerial photographs or georeferenced building blueprints

Land uses

- Aid in the identification of potentially irrigated areas
- GIS data - recent aerial photographs, Metropolitan Council land use data or locally available land use data

Soils

- Identification of groundwater recharge opportunities is an element of the protocol, and understanding the potential for infiltration practices is a first step
- GIS data - county soil survey

Stormwater infrastructure

- Understanding where stormwater runoff is routed is important for identifying potential water reuse and groundwater recharge opportunities
- GIS data - storm sewer data

Topography

- Understanding where water drains on the campus is important for identifying potential water reuse and groundwater recharge opportunities
- GIS data - LiDAR

Upon completion of the desktop review, it is recommended that an overview map of the campus be prepared for the kick-off meeting in order to facilitate detailed notetaking on specific campus areas. The desktop review process will also likely generate questions that should be carefully noted for clarification either during the kick-off meeting or as part of the initial data request.

3 - KICK-OFF MEETING

Once campus staff have expressed a general desire to participate in the CGCP process, a kick-off meeting should be held to further outline the process, identify specific campus goals, and conduct an introductory tour of the campus. The meeting should minimally include one lead administrative staff member responsible for campus-wide decision making as well as the facilities manager.

Collaborating with campus staff throughout the process is an important step toward developing an effective water conservation program because commitment and support must come from all levels within the organization (e.g. management, facility managers, facility personnel, and guests). Generating interest and buy-in for the CGCP program at a high level within the organization can increase the likelihood of campus-wide buy-in and implementation of water conservation opportunities identified.

It is critical to maintain positivity during the kick-off meeting. Conversations should focus on the benefits of potential water conservation projects rather than attacking a campus for excessive water use. Focusing on potential financial benefits via conservation of water is likely the most effective method for promoting the CGCP process. That being said, the environmental benefits of groundwater conservation should also be highlighted.

The general steps below provide an outline for the kick-off meeting. Please note the kick-off meeting should be customized for each campus to ensure the most productive meeting possible.

Emphasize potential for energy, water, and cost savings

- CGCP goal is to reduce groundwater use but that has associated financial benefits
- For example, switching to high efficiency restroom fixtures can save 2,000 gallons per full-time employee annually. Under that scenario, typical return on investment is 1-4 years and is often less than 2.5 years.

Emphasize participation is voluntary

- Searching for a water conservation partner
- The report is not filed with a particular agency and SWCDs are non-regulatory

Clearly explain the importance of groundwater

- Personalize the aquifer by introducing the source of water for the campus

Review general CGCP process

- Kick-off meeting, data request, on-site data collection, identify possible projects and develop cost estimates, analyze projects for cost-effectiveness, and generate final report

Identify campus-specific water conservation goals

- Water-using systems of interest or concern
- Previous water conservation initiatives (e.g. equipment/fixture upgrades and/or energy/water audits)

Identify existing water conservation efforts and educational programs

- For example, water conservation curriculum, educational signage across campus, and company sustainability initiatives

Complete the DOE FEMP worksheet

- Requires readily available information that is used to highlight high-level opportunities
- Introduces general water-using systems that are commonly analyzed

Campus staff time investment estimates

- Kick-off meeting, initial campus tour - 2 hours
- Data gathering for initial request (e.g. utility billing data, list of water using equipment and readily available data, meter and sub-meter data) - 4 hours
- Coordination of access for on-site data collection - 8 hours (may vary based on campus size and complexity)
- Data gathering for follow-up request - 2 hours
- Meeting to review final report - 2 hours
- Total - 18 hours

Introductory campus tour

- Gain familiarity of campus layout and buildings prior to on-site data collection

4 - INITIAL DATA REQUEST

The initial data request will gather all readily available information related to water-using systems on the campus. Below is a list of the items that should be requested. The amount of information available will vary by campus. However, regardless of campus type, some water using systems are universal and should always be considered. These include leak detection, use of sub-meters for high consumption points (e.g. irrigation systems, cooling towers, and commercial-grade kitchens), and close analysis of cooling towers because they often represent the single largest use for a facility.

Inventory of all water using fixtures and equipment

- Minimally a count of water using fixtures and equipment in order to properly plan the on-site data collection, which may include: sanitary fixtures (e.g. faucets, showerheads, toilets, and urinals), irrigation systems, cooling towers, residential and commercial grade appliances, and industrial processes

24 months of utility billing (i.e. water, gas, and electricity)

- Gas and electricity are used to estimate additional financial benefits associated with reducing hot water use
- Used to review trends in recent use

24 months of meter and sub-meter data

- Used for leak detection and analysis of independently metered water-using equipment
- Where meters do not exist, it may be beneficial to recommend either using temporary or permanent meters for a period prior to implementation of the CGCP protocol.

Personnel characteristics

- For example, number of employees and visitors, hours per day buildings are occupied, and months per year buildings are occupied

Irrigation system layout

- Ideally a full layout of the system should be requested, minimally a count of controllers and zones is needed

Mechanical blueprints or as-built plan sets for large water using systems

- Large water using systems could include cooling towers and boilers
- This information aids with preparation for on-site data collection

Following receipt of the data, the CGCP worksheets should be populated to the extent possible. Significant data gaps will exist, but entering the data available at this point in the process will identify information gaps as well as highlight information that must be gathered during the on-site data collection step. Information collected during the kick-off meeting and introductory campus tour should also be included.

The CGCP worksheets to be populated with data from the initial data request and on-site data collection are available in the Microsoft Excel file titled ‘CGCP_Audit_Worksheets’. Worksheet tabs are categorized and color-coded as either 'WS' (Worksheet) or 'BMPs' (Best Management Practices). 'WS' tabs are designed to facilitate field data collection of campus water use. Information on the tabs is formatted to fit on 8.5"x11" paper so they can be printed for use in the field. Alternatively, data could be entered directly into the 'WS' tabs if a tablet is available during the data collection phase. 'BMPs' tabs provide best management practices and other water conservation considerations for each category. These tabs include tips for water conservation specific to their corresponding category (e.g. faucets, toilets, and mechanical systems). Bolded lines within the 'BMPs' tabs represent low and no-cost actions to conserve water.

Tab order from left to right in the file represents one possible sequence of the protocol. However, because each campus is unique, the order and content of the worksheets may need to be customized to best fit the site-specific conditions. The list below provides an overview of each CGCP ‘WS’ as well as a brief description about its general use.

Contact Information

- Header sheet containing contact information for facility staff and SWCD staff implementing protocol

Building Information

- Details about each building on the campus (e.g. year built, foundation SF, number of floors, number of months in operation annually)
- Attach an overview map of the campus for reference

Building Occupancy

- One sheet per building that provides monthly details about employee and visitor populations

Water Consumption History

- Summarizes monthly water consumption data available from water utility bills and meter data

Water Use Summary

- Assists with initial understanding of water-using systems on campus; serves as a broad overview of how water is used

Meter and Sub-Meter Data

- Detailed information on meters and sub-meters

Leak Detection

- Formatted to document meter readings before and after periods with known use to facilitate leak detection

Utility Bills and Daily Use

- Provides guidance on determining indoor and outdoor water use volumes depending on how water is metered

Faucets

- Complete inventory of faucets and associated flow rates
- Data collected from flow bag measurements on each fixture

Showerheads

- Complete inventory of showerheads and associated flow rates
- Data collected from flow bag measurements on each fixture

Toilets

- Complete inventory of toilets and associated flow rates
- Data collected from timed flushes on each fixture

Urinals

- Complete inventory of urinals and associated flow rates
- Data collected from timed flushes on each fixture

List continued on next page

Residential-Grade Appliances

- Collect as much information as possible about equipment such as dishwashers, ice machines, and clothes washers
- Information from both the equipment specifications and the typical operator use habits are important

Commercial-Grade Appliances

- Collect as much information as possible about equipment such as dishwashers, ice machines, steam cookers, combi ovens, and clothes washers
- Information from both the equipment specifications and the typical operator use habits are important

Commercial-Grade Fixtures

- Collect as much information as possible about equipment such as hand faucets and pre-rinse spray valves
- Data collected from flow bag measurements on each fixture
- Information from both the equipment specifications and the typical operator use habits are important

Cooling Tower

- Collect as much information as possible; may need to contact subcontracted vendor if not managed by campus staff

Boiler

- Collect as much information as possible; may need to contact subcontracted vendor if not managed by campus staff

Pool

- Collect as much information as possible; may need to contact subcontracted vendor if not managed by campus staff

Irrigation System

- Collect detailed information for each zone including types of heads, and run times
- Attach a map that shows irrigated areas by zone

Landscaping and Irrigation

- Complete in conjunction with irrigation system worksheet
- Compile notes on vegetation and overall functionality and efficiency of each zone

Onsite Alternative Water Use Opportunities

- Document any opportunities for alternative water use or reuse

Groundwater Recharge Opportunities

- Document any opportunities for infiltration of stormwater

Facility Water Balance

- Summary table of all water use on campus

As previously noted, it will not be possible to complete most of the worksheets at this point in the process. However, a general understanding of the campus should have been gained from the kick-off meeting, introductory campus tour, and initial data gathering. Knowledge of the campus and its water-using systems should next be used to conduct the on-site data collection step. The worksheets should either be printed with the information available at this point already entered to be used during the on-site data collection step or they should be available on a tablet for direct data entry during the on-site data collection step.

5 - ON-SITE DATA COLLECTION

A site visit is necessary to gather much of the detailed information about water using systems on the campus. At this point in the process, a general understanding of water use on the campus and an understanding of the data that must be collected during the on-site data collection step should have been established.

The CGCP worksheets, either in hardcopy or digital format, should be used to guide the on-site data collection process. The worksheets outlined in step 4 should each be reviewed and populated for all applicable water using systems on the campus. All data available on water using systems should be collected, which may include makes and models of equipment, measured flow rates on fixtures, and frequency of use information from equipment operators and facilities managers.

Please note flow rates of water using lavatory fixtures (e.g. faucets, showerheads, toilets, and urinals) change over time, so each fixture should be measured (flow bag or timed flush) and documented. Additional information is available in the corresponding CGCP worksheet tabs. One leaky or underperforming fixture can represent a significant waste of water.

General assumptions regarding lavatory use are listed at the bottom of the faucets, toilets, and urinals worksheet tabs. Be sure to note modifications to these assumptions based on information gathered during the on-site data collection process. Modifications to the assumptions will be used to edit inputs to the water use calculators and potential benefit calculators used in later steps.

General assumptions regarding use do not exist for larger water using equipment (e.g. commercial kitchen equipment, cooling towers, and irrigation systems). It is important to gather usage information from operators of the equipment.

6 - PROCESS DATA

Following the on-site data collection process, all data should be entered into the CGCP worksheets. At this point, gaps in the data may remain, and one final request for information could be submitted to the facilities manager.

Guidance for data entry and processing is available in the worksheets and corresponding references.

7 - IDENTIFY POTENTIAL PROJECTS AND DEVELOP COST ESTIMATES

Based on the water-using systems identified on the campus, develop a list of possible water conservation projects and water conservation best management practices. Water conservation projects may include replacement of fixtures and equipment. For example, WaterSense labeled products use at least 20% less water without sacrificing performance and are independently certified. Similarly, ENERGY STAR qualified kitchen equipment is at least 10% more water efficient than standard models. For larger, expensive equipment, leasing water efficient models may be an option. Water conservation best management practices may include low- or no-cost behavior or operational modifications to conserve water.

Cost estimates should be developed for the possible water conservation projects and best management practices identified in order to facilitate the cost-effectiveness analysis. Standardized cost information

for fixture and equipment replacement is available in the corresponding water use reduction calculators. Please modify with site-specific information to the extent practicable.

Appendix D provides additional guidance for identification of on-site groundwater recharge opportunities (i.e. potential infiltration sites).

8 - ANALYZE RECOMMENDATIONS FOR COST-EFFECTIVENESS

The spreadsheet calculators can be used to estimate potential reductions in water use accomplished by the projects identified in step 7. The list below provides an overview of each calculator as well as a brief description about its general use.

Meter leaks and daily water use

- Assists with identifying potential leaks and estimating the amounts of water used for irrigation if the irrigation line is not sub-metered

Domestic plumbing fixtures

- Data from worksheets can be entered directly into this calculator and the summary tab provides an overview of potential water savings

Energy Star residential appliances

- Use for dishwashers and clothes washers

Energy Star Certified commercial kitchen equipment

- Data collected on worksheets are used to populate this calculator that includes a summary and detailed results tabs
- Use for dishwashers, ice machines, steam cookers, and pre-rinse spray valves

Commercial-grade kitchen water use

- Use for handwashing faucets, pre-rinse spray valves, and combi ovens

Cooling towers

- Data collected on worksheets can be entered directly into this calculator

Irrigation water use

- Provides estimated run times for each zone based on information collected during a catch can test for distribution uniformity
- Estimating water use savings for irrigation system modifications will likely need to be manually calculated due to system variability and complexity

Water use analysis

- Use to generate summaries of campus water use
- Output is a pie chart of all use categories - <10% unaccounted for water is acceptable, >10% indicates a significant leak or unaccounted for consumption point

For each project, the estimated water use reduction and the estimated cost can be used to calculate the simple payback period of the project using the equation below.

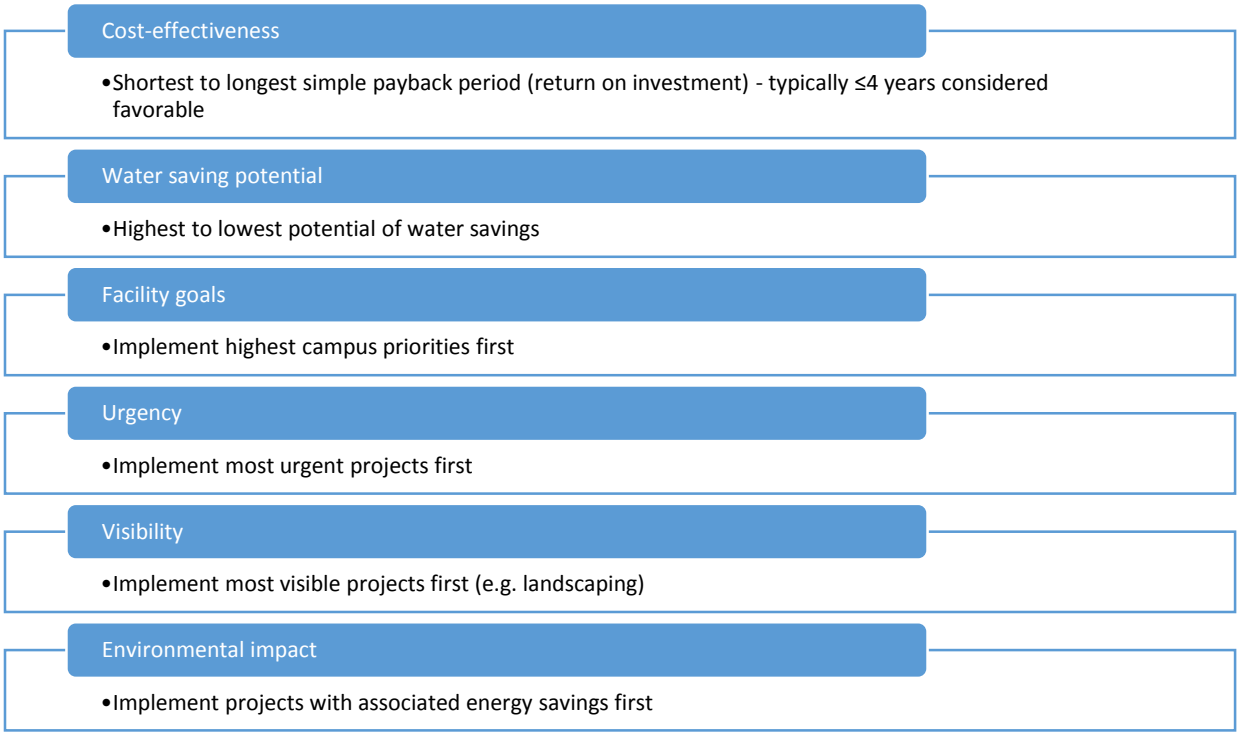
Simple Payback Period = Project Cost ÷ (Water Savings · Cost of Water and Wastewater)

Where:

- Simple Payback Period (years)
- Project Cost (dollars)
- Water Savings (gallons per year)
- Cost of Water and Wastewater (dollars per gallon)
    - The true cost of water factors in costs associated with chemicals, electricity, and gas.
    - It is important to note that investments in water saving are paid back at the highest water utility block rate, thereby providing the greatest reduction in payback period, until total water use drops to the next tier.

Zero-cost recommendations (e.g. behavioral and operational modifications) should be highlighted in a separate table with corresponding reductions in water use.

Projects may then be ranked by a variety of factors. The list below includes some possibilities for ranking the projects. Discussions with campus staff will help identify which rankings may be most useful for a given campus.



The resulting project ranking table(s) will become one of the primary deliverables to the campus. The table(s) will guide future decision making on water conservation projects. Therefore, it's imperative to include a suite of useful ranking tables based on priorities determined by campus staff.

9 - GENERATE FINAL REPORT

At this point in the protocol process, all elements necessary to complete the final report should have been generated. The final report should follow the provided example report in Appendix E and strive to concisely and clearly convey the water conservation opportunities identified on the campus. The list below highlights the primary sections of the final report.

Summary of current water use

- Provides a complete understanding of campus water use
- Water performance indices (gal/ft^2/yr) for buildings and grounds
- Water cost indices ($/ft^2/yr) for buildings and grounds
- Water profiles by month for years available to show seasonal peaks and annual variation

Water conservation practices identified

- Brief descriptions of water conservation practices and how they work

Cost-effectiveness analysis

- Detailed cost estimates for proposed projects
- Ranking table(s)

Summary implementation plan

- Straightforward action sheet that provides a recommended implementation plan to immediately begin reducing water use
- Differentiates projects that can be implemented for little or no money and those that will require more time and money investment

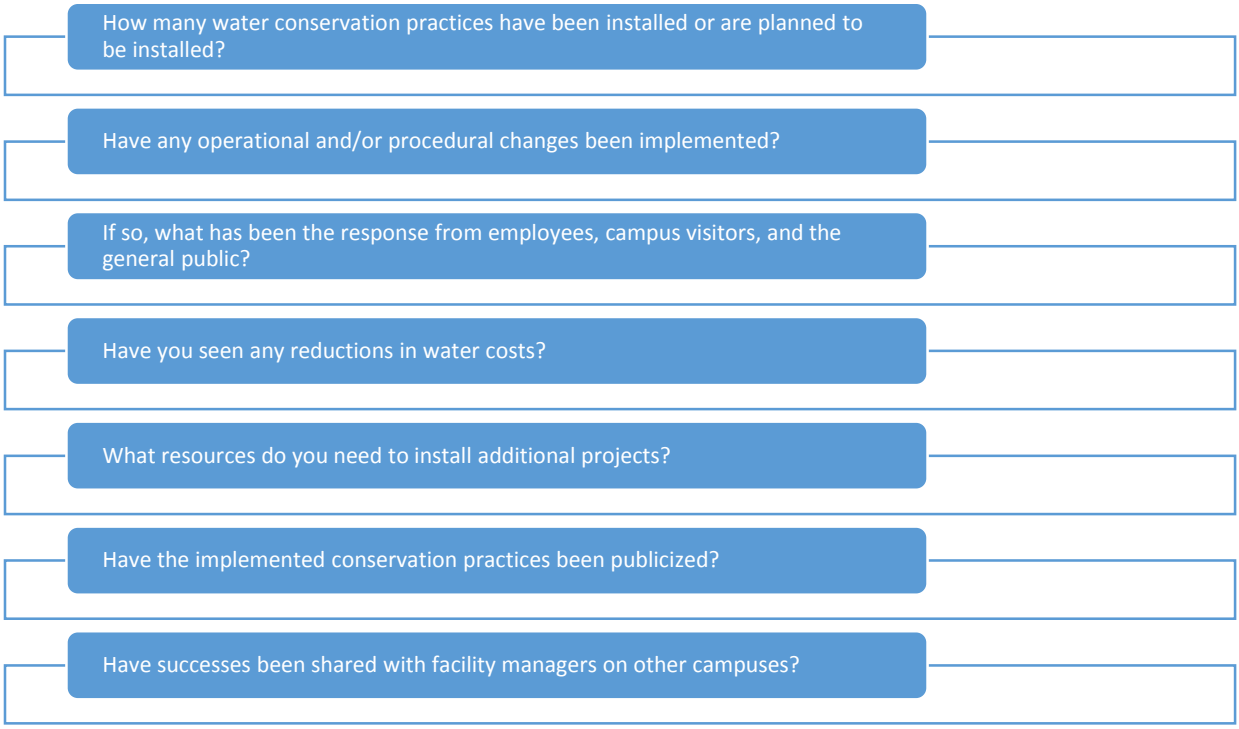
Potential funding opportunities

- Funding sources that could potentially help offset the cost of water conservation projects
- Will vary by campus location, but county, city, watershed management organization, and water utility provider are good starting points
- http://www.dsireusa.org/ provides a searchable database by state for energy incentives. Unfortunately, it does not appear to have much for water conservation.

The completed report should be presented to campus staff at a formal meeting. Similar to the kick-off meeting, presentation of the final report should be to administrative staff responsible for campus decision making as well as the facilities manager responsible for managing campus water use.

10 - FOLLOW-UP SUPPORT

Presentation of the final report should not be the final communication with campus staff. Continued follow-up to gauge implementation of recommendations and assist with troubleshooting potential challenges to implementation should occur 6 – 12 months following delivery of the final report. The questions below can be used to guide the check-in process.



Follow-up support can also focus on facilitating outreach and advertisement of the water conservation projects implemented following completion of the CGCP protocol. Benefits, both environmental and financial, can be used to promote participation from other campuses.

Finally, encouraging long-term tracking of water use on the campus will provide a means to evaluate progress achieved by projects as well as identify new water conservation goals and opportunities.

REFERENCES

EPA. 2012. *WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities*. U.S. Environmental Protection Agency, Washington, DC.

South Florida Water Management District Water Supply Development Section. 2013. *Water Efficiency and Self Conducted Water Audits at Commercial and Institutional Facilities: A Guide for Facility Managers, Second Edition*. West Palm Beach, FL.

APPENDIX A

TYPICAL CAMPUS WATER USE

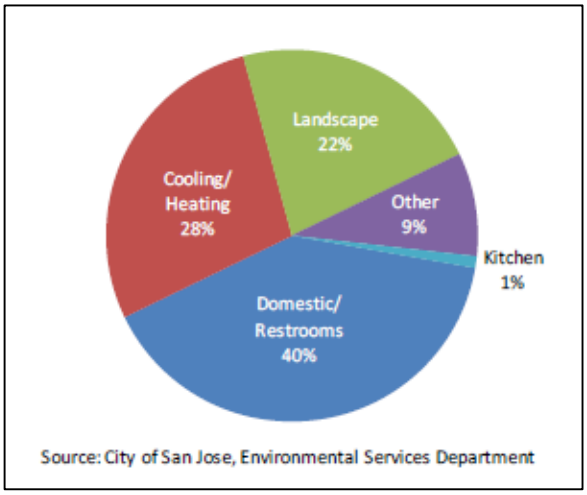
Information in Appendix A is directly from the SFWMD Guide. Typical water use in office buildings and schools is presented here because they represent the most likely campus types on which the CGCP protocol will be implemented. The SFWMD Guide includes other campus types on pages 15-17.

As the CGCP protocol is implemented on campuses and local data become available, updated typical campus water use charts should be generated. This will allow water use to be compared amongst other campuses of a similar type with data specific to Minnesota.

OFFICE BUILDINGS

Water use in a typical office building is primarily comprised of domestic/restrooms, cooling/heating, and landscape uses. These three categories account for approximately 90% of the total water use. Therefore, commonly effective conservation projects often include:

- Restroom fixture replacement
- Public education promoting conservation among building tenants
- Cooling tower efficiency retrofits such as improved system controls
- Irrigation efficiency measures such as weather- or moisture-based irrigation controllers
- Landscaping changes using native or climate adaptive plants

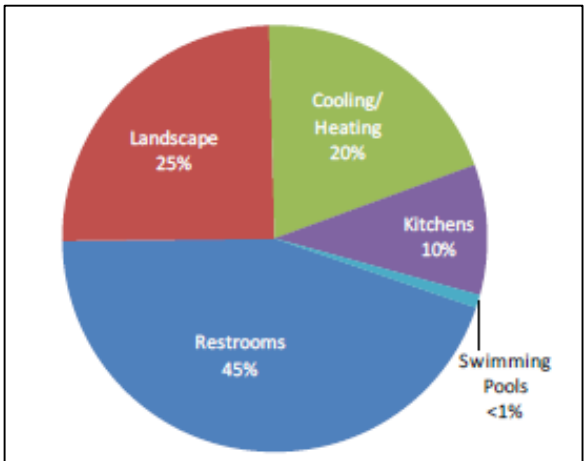


Source: City of San Jose, Environmental Services Department

SCHOOLS

Water use in a typical school building is primarily comprised of restrooms, landscape, cooling/heating, and kitchen uses. Use in restrooms accounts for nearly half of the total water use. Therefore, commonly effective conservation projects often include:

- Restroom fixture replacement
- Cooling tower efficiency retrofits
- Irrigation efficiency measures such as weather- or moisture-based irrigation controllers



Source: City of San Jose, Environmental Services Department

APPENDIX B

CGCP PROMOTIONAL HANDOUT

The CGCP promotional handout is to be used as a marketing tool during initial correspondence with campus staff. The handout summarizes the program, outlines the benefits and process, provides an overview of common water conservation opportunities analyzed, and introduces requirements of campus staff.

CAMPUS GROUNDWATER CONSERVATION PLANNING

SUMMARY

The 11-county Metropolitan Conservation Districts have developed a groundwater conservation planning protocol for large-acreage campuses. The systematic approach reviews water-using systems campus-wide and identifies potential water-saving opportunities. Participation in the program is entirely voluntary. As a deliverable, the campus receives a prioritized list of potential water conservation opportunities in order of cost-effectiveness, which could facilitate future water conservation efforts. The effort is funded by a Clean Water Fund Accelerated Implementation Grant from the Clean Water, Land and Legacy Amendment.

BENEFITS

ANALYZE COST-BENEFIT

Identify and rank water conservation opportunities and provide low– or no-cost solutions

SAVE MONEY

Prioritize water use reduction projects in a cost-effective manner to maximize return on investment

CONSERVE GROUNDWATER

Practice sustainable use of groundwater to meet current and future needs; groundwater is an undervalued, limited resource in Minnesota

PROCESS

KICK-OFF MEETING

Discuss process, goals, and potential water conservation opportunities

ON-SITE DATA COLLECTION

Inventory and assess water-using equipment across the campus

REPORT GENERATION

Summarize water-using equipment and prioritize water conservation opportunities

COMMON WATER CONSERVATION OPPORTUNITIES ANALYZED

- Facility leak detection
- Facility water balance
- Water reuse opportunities
- Groundwater recharge opportunities
- Faucets
- Showerheads
- Toilets
- Urinals
- Irrigation systems
- Cooling towers
- Water-using appliances
- Industrial processes

CAMPUS STAFF ROLES

- Identify campus goals
- Provide utility billing and meter data
- Coordinate access for on-site data collection
- Advocate campus-wide water conservation

Anoka Conservation District
Mitch Haustein
Mitch.Haustein@AnokaSWCD.org
763.434.2030 x15

Metro Conservation Districts

Clean Water Land & Legacy Amendment

APPENDIX C

CAMPUS PRIORITIZATION AND SELECTION

In the event that interest in the CGCP program exceeds available funding, prioritization and final selection of the campuses will be necessary. The options below could be useful for prioritizing and final selection. If quantitative thresholds are employed, they should be refined on a county-specific basis to reflect the characteristics of interested campuses and allow for effective screening.

Use DOE FEMP worksheet to generate a qualitative summary of potential water conservation opporutnities.

Conduct a high-level analysis with information that can be easily gathered with minimal time investment from campus staff.

- Desktop review of campus including building footprints, campus area, and irrigated areas.
- 24 months of utility billing data
- Age of infrastructure
- Employee and visitor data

Thresholds for advancing to full protocol implementation could be required.

- Minimum campus size
- Minimum annual water use per day or per year

Subjective parameters could also be considered

- Visibility of campus
- Desire to implement change
- Capacity to implement changes (e.g. funding availability or planned construction or expansion)

APPENDIX D

GROUNDWATER RECHARGE OPPORTUNITIES

The CGCP protocol targets water conservation through both reduced use and groundwater recharge. The primary considerations listed below should be used as a first step for identifying campus groundwater recharge opportunities (i.e. stormwater runoff infiltration opportunities).

Determine feasibility of infiltration

- Soil types and water table elevation
- Proximity to sensitive areas such as Drinking Water Supply Management Areas (DWSMA)
  - Shapefiles and maps showing DWSMAs, DWSMA vulnerability, Emergency Response Areas, and Wellhead Protection Areas can be found on the Minnesota Department of Health website or on Minnesota Geospatial Commons.

Consider common infiltration practices for implementation

- Bioinfiltration, pervious pavement, tree trench, swale with check dam, underground storage

If additional guidance is needed for identifying groundwater recharge opportunities, the Center for Watershed Protection's Urban Stormwater Retrofit Practices Manual 3 (complete reference below) could serve as a useful resource.

Schueler, T., D. Hirschman, M. Novotney, and J. Zielinski. 2007. *Urban Stormwater Retrofit Practices. Manual 3, Urban Subwatershed Restoration Manual Series. Center for Watershed Protection*. Ellicott City, MD.

APPENDIX E

EXAMPLE CGCP REPORT

This appendix includes an example CGCP report.