MERCED COUNTY UNIVERSITY COMMUNITY PLAN
POLICY DISCUSSION PAPER

WATER-RELATED INFRASTRUCTURE SYSTEMS

For CPAC Discussion: April 26, 2001Meeting

I. INTRODUCTION AND SETTING

This Report provides a preliminary set of goals, objectives, and policies for inclusion in the Water-Related Infrastructure element of the Merced County University Community Plan (UCP). The Water-Related Infrastructure Element describes the set of water-related goals and policies that will guide infrastructure design in the University Community and its relationship to the University of California Campus (Campus) and the region as a whole. Because water-related infrastructure systems are closely interrelated, many of the policies described will be similar for the water, wastewater, and storm drainage components.

MAJOR POLICY ISSUES

Before developing specific infrastructure policies, several overarching issues warrant discussion. Common themes and consistent policies addressing adequacy, affordability, and sustainability goals are briefly addressed as follows:

Adequacy. Adequate potable water, wastewater, and stormwater infrastructure facilities must be provided to meet the needs of the University Community. Systems must be designed to exceed minimum design requirements under a variety of operating conditions and emergency situations. Drought, fire, or significant storm events are examples of long or short-term conditions that must be considered in facility planning and infrastructure delivery. Potential interruption of service must be a last consideration in overall system design.

Adequacy can be achieved in two ways: 1) in a totally independent setting or 2) in collaboration with the Campus. Considering economic and institutional factors, infrastructure planning for the University Community should not take place without consideration of the potential opportunities for shared facilities with the Campus. In many instances, integrating community and campus systems allows for cost-effective phasing of water-related infrastructure and achievement of common sustainability goals. Costs can be more equitably spread over a larger user base and redundant facilities can be minimized when infrastructure systems are closely linked. As such, collaboration on infrastructure systems is recommended when this represents a logical, feasible alternative.

Recommendation: Consider options for joint infrastructure systems with UC Merced.

Affordability. Infrastructure systems must be affordable within a generally acceptable range of values. Costs can be viewed from two perspectives.

One approach is to minimize an initial investment in facilities by selecting the alternative with the least first cost. With this strategy, no consideration is given to long-term maintenance or replacement costs in the decision-making process. While advantageous in reducing initial infrastructure capital costs, the "cheapest, short-term" approach to infrastructure development has created serious repercussions for long-term system viability.

In contrast, a more balanced approach to infrastructure system design is recommended. Rather than simply minimizing first costs to ensure that a system is affordable, multiple factors are assessed. Affordability should take into account both first costs along with recurring costs in a present worth analysis. In addition, in any economic assessment of alternative rates or financing mechanisms, it is crucial that not only all costs are included and that all benefits be recognized and quantified. This is particularly important for integrated systems where costs associated with one component may offset costs or create benefits in another area. Only by considering these *total infrastructure costs (and benefits)* can an equitable strategy for financing infrastructure be developed.

Recommendation: Consider total infrastructure costs and benefits.

Sustainability. Traditional infrastructure planning has focused upon distinct, individual systems with little or no inter-relationships. Separation and centralization have been stressed at the expense of integration and multiple-use. Unfortunately, infrastructure costs have increased dramatically as available water resources have diminished. The evolving solution is a re-assessment and re-emphasis upon integrated infrastructure systems to achieve sustainable development. This recommended strategy is an emerging mechanism for considering the impacts of population growth, economic and technical development, and resource depletion. Although manifest in different ways, both the public and private sectors are beginning to see how unsustainable practices may produce undesirable effects on their organizations, customers, communities, and the future at large. In an effort to create a sustainable community, the following overarching objectives can be applied to the water-related infrastructure discussed herein:

- Maximize the integration of water-related infrastructure.
- Emphasize the most efficient use of water.

- Use gravity for wastewater conveyance as much as possible and limit the use of energy-intensive pumps.
- Use natural systems for treatment of wastewater and stormwater when practical, as opposed to mechanical systems.
- Use a system's output or waste for beneficial use (i.e., recycle treated wastewater for irrigation, etc.).
- Provide flexibility to allow a change in technology, funding, and/or management to be implemented easily at a future date.

<u>Recommendation: Integrate sustainability objectives in infrastructure planning.</u>

II. ISSUES, GOALS, OBJECTIVES, AND POLICIES

This section outlines the overall issues, goals, objectives, and associated policies for potable water, wastewater, and stormwater infrastructure for the University Community. Each section provides a summary of existing infrastructure conditions and background information for each issue presented. Under each issue, a more specific goal and objective have been identified and under each objective several policies have been recommended. As would be expected, there are issues and associated policies that apply to all water-related infrastructure systems. As such, some policies may apply to more than one infrastructure component, and therefore may be repeated in several locations.

POTABLE WATER INFRASTRUCTURE

Existing Conditions

There are currently no existing public potable water supply, storage, or distribution infrastructure systems within the University Community Planning (UCP) area. However, there are multiple private domestic and agricultural wells within the UCP area. It is anticipated that potable water supply for the UCP area will be provided via groundwater wells, either drilled within or near UCP area boundaries. These wells could be operated as part of the existing City of Merced water supply system or as a separate utility serving only the UC Merced community.

Regionally, the City of Merced water supply system consists of wells on a mile grid, 16-inch mains on a mile grid, and 12-inch mains on a ½-mile grid. The City utilizes four aboveground storage tanks to meet fire flow requirements. The nearest potential connection to the City's existing water supply system is a 16-inch main located at the intersection of Yosemite Avenue and McKee Road, approximately 2/3 of a mile from the southwesterly corner of the UCP area property boundary. However, the City's existing water supply system does not have adequate reserve capacity to serve the UCP area without constructing additional wells. Each City well can produce up to 3,500 gallons per minute (gpm) and includes wellhead disinfection and fluoridation systems (1).

Based on information obtained from local hydrogeologists and well drillers, well yields decrease rapidly in foothill areas. Based on USGS reports documenting PG&E test wells in the area, yields from 1,000 to 2,000 gpm per groundwater well can be expected within the UCP area (2). However, actual production capacities must be determined for the UCP area by further hydrogeological investigations including the drilling of test wells.

WATER SUPPLY GOALS AND OBJECTIVES

Issue W1: Safe Drinking Water Supply

Potable water for the UCP area must meet the minimum drinking water standards established by the United States Environmental Protection Agency (USEPA) under the Safe Drinking Water Act (SDWA) and Primary Maximum Contaminant Levels (MCLs) established by the California Department of Health Services (DHS). Congress originally passed the SDWA in 1974 to protect public health by regulating the nation's public drinking water supply. The law was amended in 1986 and 1996 and requires many actions to protect drinking water and its sources including rivers, lakes, reservoirs, springs, and groundwater wells. SDWA authorizes the USEPA to establish national health-based standards for drinking water to protect against both naturally-occurring and man-made contaminants that may be found in drinking water. USEPA, states, and water suppliers then work together to ensure these standards are met (3).

Goal:

- Ensure safe water quality that meets regulatory standards is available for the community.

Objective:

- Design potable water system to meet Federal and State drinking water regulatory standards.

Policies:

- Require new water sources to meet or exceed the DHS Title 22 regulation regarding water quality.
- Implement monitoring programs to ensure water sources consistently comply with drinking water regulations.

Issue W2: Adequate Water Supply

To ensure adequate water is available for future generations, MID and the City of Merced jointly commissioned a long-range water supply study in 1992 through a Memorandum of Understanding. The resultant document, the *Merced Water Supply Plan*, was completed in 1995 and identified groundwater as the sole source of drinking water for Merced and its surrounding communities. The *Merced Water Supply Plan* is currently being updated, but continues to recommend the use of groundwater for drinking water supply in the Merced region.

Goal:

- Identify adequate water supply that is consistent with overall regional water supply plan.

Objective:

- Design well field that provides adequate water supply while consistent with regional plan.

Policies:

- Site groundwater wells consistent with City of Merced operational strategy.
- Size wells and storage to provide water supply to meet community needs.
- Require that an adequate water supply be demonstrated before approving new development.

Issue W3: Reliable Water Supply

A typical community water supply, distribution, and storage system contains redundant facilities to ensure adequate and reliable water service is available during emergencies (i.e., fires) and times of large water demands (i.e., summer irrigation). If a community is served via groundwater wells, backup wells are installed and may be used during maintenance of primary wells or when emergency conditions arise. Distribution systems are designed with a minimum of two water supply points for neighborhoods and business centers to ensure continuous water supply. Storage tanks provide water storage to meet fire flow requirements, fluctuating daily demands, and emergency needs.

Goal:

- Provide a reliable water supply and distribution system.

Objectives:

- Include system features that allow operation under multiple demand scenarios and emergency conditions.

Policies:

- Provide redundant water supply sources to mitigate drought conditions.
- Maintain a five-year lead time in the planning of needed water system improvements and include identified improvements with the County's Capital Improvement Plan (CIP).
- Provide water supply, storage, and adequately-sized pipelines to provide fire flows at any point within the Community to meet recommendations of the Insurance Services Office (ISO) and/or the County Engineer, while maintaining minimum pressures in accordance with requirements outlined in the California DHS/Waterworks Standards.
- Provide adequate water storage to supply the needs of the community that meets the following parameters:
  - Diurnal Operational Needs (for meeting peak flows) – 25 percent of peak daily demand.
  - Fire Reserve – provide fire reserve as required by the ISO or California DHS/Waterworks Standards.
  - Emergency Storage – 25% of average daily demand.

Issue W4: Groundwater Supply Protection

Water is a precious commodity in California. The state's population continues to increase while water supplies remain relatively fixed. To ensure water is available for future generations, residents of California can implement programs to minimize water use and promote the use of recycled water for various commercial, industrial, and irrigation needs. Water conservation and recycled water programs can significantly reduce community water needs and therefore reduce the draw on local groundwater sources.

Recycled water use in California is regulated under the California Code of Regulations (CCR) Title 22. Title 22 provides a list of treatment levels and corresponding uses. For example, undisinfected secondary recycled water can be used to irrigate vineyards, fodder crops, and non food-bearing trees (i.e., Christmas trees). However, to spray irrigate parks, schools, golf courses, and residential landscaping, recycled water must be disinfected and undergo tertiary treatment. The use of recycled water is most cost-effective when the level of treatment is selected to meet a specific end use.

Goal:

- Minimize water use throughout the community.

Objectives:

- Promote water conservation and use of recycled water.
- Match appropriate water quality to water use.

Policies:

- Implement an active water conservation program to reduce future water demand to the extent allowed by law by establishing building requirements for new construction, providing educational information through local media sources, and establishing effective rate changes to encourage conservation.
- Require the use of best available technologies (BAT) for water conservation, including, but not limited to water-conserving toilets, showerheads, faucets, and water-conserving irrigation systems.
- Require meters for all water connections.
- Develop incentives to encourage the use of recycled water by industrial, commercial, recreational, and agricultural users.
- Provide a distribution system for recycled water use that is easily accessible.
- Provide recycled water at the level required for a specific reuse opportunity.

Issue W5: Mitigation of Groundwater Impacts

Groundwater is identified in the *Merced Water Supply Plan* as the sole source of drinking water for the Merced region. To further ensure adequate water supplies for future development, the *Merced Water Supply Plan* recommends providing direct recharge facilities throughout the region to help stabilize groundwater levels. Groundwater recharge facilities can be used to percolate and/or inject treated stormwater or recycled water into local aquifers. Besides water conservation and the use of recycled water, groundwater recharge is another method of minimizing withdrawal impacts on groundwater supplies.

Goal:

- Minimize impacts to groundwater and identify recharge opportunities.

Objectives:

- Limit localized drawdown due to groundwater extraction.
- Participate in groundwater recharge program, either locally or regionally.

Policies:

- Distribute wells to minimize localized drawdown.
- Provide on-site groundwater recharge or provide recycled water for regional groundwater recharge program.

- Evaluate groundwater recharge capabilities every five years and ensure adequate long-term protection of groundwater resources.

WASTEWATER INFRASTRUCTURE

Existing Conditions

There is currently no existing wastewater collection, reuse, or disposal infrastructure within the UCP area. Rural residences located west of the UCP area are not served by the City of Merced but instead utilize individual septic systems for wastewater disposal. Septic systems are permitted through the Merced County Department of Public Health, Division of Environmental Health.

The nearest potential connection to the City of Merced's wastewater collection system is a 27-inch sewer at the intersection of G Street and Cormorant (about 3 ½ miles from the northwesterly corner of the UCP area). According to City staff this trunk sewer would have capacity for the UC Merced campus and surrounding community for a period of 10 to 20 years. Beyond 20 years, additional facilities would be required within the City system to convey UCM and UCP area flows. There is also an 18-inch wastewater main located at the corner of E. Yosemite Avenue and N. Parsons Avenue (about 1 mile from the southwesterly corner of the UCP area) (1).

The City of Merced owns and operates a wastewater treatment facility (WWTF) that provides sewerage services to commercial and industrial customers and 62,000 City residents. The WWTF also serves certain unincorporated areas outside of the City limits. The WWTF, located southwest of Merced, has a design capacity of 10 million gallons per day (mgd) and currently treats an average dry weather flow of 7.4 mgd (4).

The WWTF operates under a National Pollution Discharge Elimination System (NPDES) permit issued by the California Regional Water Quality Control Board (Regional Board). Table 1 presents a summary of Regional Board effluent limitations for the WWTF (4).

TABLE 1
Merced WWTF NPDES Effluent Limitations (4)

Constituents	Units	Monthly Average	Weekly Average	7-Day Maximum	Daily Maximum
BOD_5	mg/L	30[2]	45[2]	--	90[2]
	lbs/day	2,501[3]	3,752[3]	--	7,503[3]
Total Suspended Solids	mg/L	30[2]	45[2]	--	90[2]
	lbs/day	2,501[3]	3,752[3]	--	7,503[3]
Oil and Grease	mg/L	10	--	--	15
	lbs/day	834	--	--	1,251
Settleable Solids	mg/L	0.2	--	--	1.0
Chlorine Residual	mg/L	0.1	--	--	0.5
Total Coliform	MPN[4]/100 mL	--	--	23	240

1 Five-day, biochemical oxygen demand at 20°C
2 To be ascertained by a flow proportional 24-hour composite sample
3 Value based upon a design capacity of 10 mgd (*x* mg/L * 8.34 * 10 mgd = *z* lbs/day), where *x* is the maximum concentration allowable
4 Most probable number

Effluent shall also not exceed the following limits at any time of the year:

TABLE 2
Merced WWTF Effluent Ammonia Limitations (4)

Constituents	Units	Monthly Average	4-Day Average	Daily Maximum
Ammonia (as Nitrogen)	mg/L	2.3	5.0	20.0
	lbs/day[1]	190	420	1,670

1 Value based on a design capacity of 10 mgd (*x* mg/L * 8.34 * 10 mgd = *z* lbs/day), where *x* is the maximum concentration allowable.

Facilities at the WWTF include a headworks, septage receiving, primary and secondary clarification, activated sludge aeration basins, chlorination and dechlorination, anaerobic sludge digesters, and sludge drying beds. Dried sludge is disposed of on 600 acres of City-owned farmland as a soil amendment (4).

Effluent from the WWTF is either discharged to Hartley Slough, the Merced Wildlife Management Area, or the industrial wastewater disposal site. Approximately 75 to 80 percent of the WWTF effluent flow is discharged to Hartley Slough, which enters Owens Creek, and subsequently a network of natural and artificial channels tributary to the San Joaquin River, a water of the United States. Another 20 to 25 percent of the WWTF effluent is discharged to the 385-acre Merced Wildlife Management Area, a mitigation area created to offset habitat losses incurred through the development of an industrial wastewater disposal site.

A small portion of the WWTF effluent is discharged to a City owned and operated 580-acre industrial wastewater disposal site south of the WWTF to irrigate fodder crops grown during periods of low industrial flows (4).

WASTEWATER GOALS AND OBJECTIVES

Issue WW1: Protection of Surface Water and Groundwater

Wastewater will be generated in the UCP area. This wastewater will contain organic and inorganic constituents that if not removed or their concentrations reduced could degrade receiving groundwater or surface water bodies. Degradation of groundwater and surface water bodies could pose threats to public health and the environment.

Goal:

- Protect groundwater and surface water from contamination by wastewater.

Objective:

- Design and construct a wastewater collection and treatment system(s) that protects groundwater and surface water.

Policies:

- Design a treatment plant that will produce an effluent that meets regulatory standards.
- Treatment levels will be selected to meet standards for intended reuse or discharge point.
- Provide reliable and redundant treatment processes.

Issue WW2: Adequate Wastewater Systems

Wastewater generated in the UCP area will need to be conveyed from points of generation to a point(s) of treatment. These conveyance facilities need to be sized and constructed in such a manner to accommodate all planned development for the life of the project. Inadequate conveyance facilities can result in excessive infiltration and inflow, surcharging of pipelines, sinkholes, odors, and other nuisances.

Goal:

- Ensure provision of adequate wastewater conveyance capacity to accommodate planned development.

Objective:

- Design and construct wastewater conveyance to accommodate planned development

Policies:

- Conform to City of Merced design standards.
- Prohibit cross-connection of sanitary sewer and storm drain system.
- Minimize wastewater flows through water conservation efforts.

Issue WW3: Energy Efficient Wastewater Systems

Wastewater conveyance and treatment can be energy intensive endeavors. The largest energy demands associated with wastewater conveyance and treatment typically are from pumping and aeration. Energy demands can be minimized by designing the wastewater conveyance and treatment systems to avoid pumping and aeration where necessary, and to utilize the most energy efficient equipment where appropriate.

Goal:

- Minimize the energy use associated with the wastewater conveyance and treatment system(s).

Objective:

- Design the most energy efficient wastewater collection and treatment system.

Policies:

- Use gravity flow in lieu of pumping wherever appropriate (i.e., align wastewater collection system to follow natural contours on site).

- Require the use of equipment that meets minimum mandated efficiencies.
- Design wastewater facility layout for energy efficiency.
- Develop incentives to encourage the use of renewable energy (e.g., solar, wind, hydro, biomass).
- Use natural systems (i.e., wetlands, ponds, overland flow) instead of mechanical systems, where possible.
- Promote reuse at the point of generation (i.e., locate recycled water facilities as close as possible to reuse sites to minimize pumping distances).
- Encourage recovery of energy from treatment processes (i.e., digester gas cogeneration).

Issue WW4: Sustainable Wastewater Systems

Reuse of treated wastewater is becoming more prevalent in California due to increasing populations and reduced water supplies. Higher sustainability can be achieved through integrated water resources. Every drop of recycled water used for irrigation, for example, is a drop of water that is not pumped from groundwater supplies. There are many ways to create a sustainable wastewater system by recycling as much treated wastewater as possible within the community. Potential recycled water opportunities include:

- Identifying agricultural use opportunities for recycled water, including irrigation of fodder crops, orchards, vineyards, and other crops.
- Using recycled water for irrigation of landscape medians, parks, schools, and residential landscaping.
- Utilizing recycled water for institutional facility toilet flushing.
- Enhancing the environment for both wildlife and community residents through the construction of water features and wetlands.

Goal:

- Maximize opportunities for wastewater reuse on-site.

Objective:

- Design a sustainable wastewater conveyance, treatment, and reuse system by maximizing the use of recycled water.
- Promote opportunities for habitat and community enhancement through the beneficial reuse of wastewater.

Policies:

- Develop incentives for using recycled water (i.e., differential pricing, uninterrupted supply).
- Discourage direct discharge of treated wastewater to surface waters.
- Integrate reuse within building systems and landscape irrigation systems.
- Make recycled water accessible to agricultural users.
- Use recycled water for wildlife habitat and for community enhancement through the creation of water features, including constructed wetlands, ponds, and fountains in the community.

STORM DRAINAGE INFRASTRUCTURE

Existing Conditions

Topography

The topography of the UCP area can generally be classified as mild to flat sloped terrain. The high point within the project area is approximately 245 feet above mean sea level (msl) in the northeast section at the Le Grand Canal and the lowest elevation of 186 feet msl at the southwest corner near the intersection of Lake Road and Yosemite Avenue (5). Slopes in the northern half of the project site are generally steeper than the southern half. The northern half of the project area is currently grassland pasture for grazing cattle while the lower areas contain irrigated row crops.

Soils

There are at least 37 different soil types within the UCP area. Soils vary from gravely soils with very high permeability rates to tight clay and hardpan with very low rates of permeability (6). The soils on the southern portion of the site are associated with old alluvial fans and terrace remnants. These soils are medium textured and are characterized by a strongly cemented or indurated hardpan.

The northern portion of the UCP site contains soils associated with high terraces, which contain gravelly loams formed from old gravelly alluvium. The soils in this area have a clay pan and a cemented iron-silica hardpan.

Over one-half of the UCP area is covered by just three soils: 1) Redding Gravelly Loam - 26% coverage, 2) Wyman Clay Loam - 16.8 % coverage, and 3) Yokohl Clay Loam - 14.8% coverage.

Rainfall

The storms that produce flooding in the Merced area generally occur during the winter months, October through April. The average annual precipitation for the Merced area is approximately 12 inches (7). The maximum precipitation of a 100-year frequency, 24-hour duration event at Merced Gage Station No.2 is 2.81 inches of rainfall (8).

The two types of storms that produce heavy rainfall in the Merced area are General Storms and Local Storms. General Storms are wide spread rainfall events that generally last from one to four days with one or more storm waves within the overall event. Each wave within the overall event lasts for 2 to 4 hours and contains periods of heavy rainfall. Local Storms, during the winter, often occur within a wide spread General Storm. The Local Storms produce high intensity rainfall events over a smaller land area occurring within the General Storm event. Local Storms in small watersheds will produce high peak flow events in creeks and drainage ways.

Existing Watersheds

Cottonwood Creek traverses the project site from northeast to southwest and drains a majority of the northern portion of the site. The flow of Cottonwood Creek is interrupted as it travels southwest at the Le Grand Canal and again further downstream at the Fairfield Canal. Runoff is impounded behind the levees of the canals creating ponds. These ponds are currently being used as water features for the Merced Hills Golf Course. Theoretically, excess runoff can enter the canals by seepage or if the stage of the impoundment is great enough it can spill into the canals by overtopping the levees.

Shed area tributary to Cottonwood Creek below Fairfield Canal captures runoff and flows within a natural creek that meanders until it intersects Lake Road near Cardella Road. Runoff contribution to Cottonwood Creek from west of Lake Road is minor with new development detaining project runoff upstream of Lake Road before discharging to minor creeks tributary to Cottonwood Creek. As Cottonwood Creek approaches the Lake Road crossing, slopes flatten creating wide-shallow flow conditions. The types of vegetative growth and heights of the plants within this area is evidence of the wide-shallow flow condition. The Lake Road crossing of Cottonwood Creek consists of two 36-inch non-reinforced concrete pipes with wooden headwalls. Currently, the inlet and outlet are constricted by overgrowth of vegetation and excess sediment deposition.

A constructed irrigation canal drains irrigated lands and captures natural drainage north of the Fairfield 'A' Canal and south of the Fairfield Canal to Cottonwood Creek. The confluence of the drain canal and Cottonwood Creek occurs upstream of the Lake Road crossing.

Irrigated row crops between the Le Grand and Fairfield Canals are assumed to drain back to the Fairfield Canal via gated structures.

Four sheds south of the Fairfield 'A' Canal drain to Rascal Creek. Three separate concrete drainpipes convey agricultural drainage as well as storm runoff from three of the four sheds south from Yosemite Avenue to Rascal Creek (9). The fourth shed, the eastern most shed, discharges directly to Fairfield Canal.

Flood Hazard Determination

Currently, no flood studies are available through FEMA or at a local level that delineate flood hazards within the UCP area. There is evidence of wide, shallow flooding along the lower reaches of Cottonwood Creek and the pond areas upstream of the Fairfield Canal. Additionally, observations of extensive shallow flooding during large infrequent storm events made by a landowner indicate that the existing infrastructure is inadequate to convey large storm events.

MID Infrastructure

The existing storm drainage infrastructure currently serving the area that will become the UCP area is limited to the Merced Irrigation District (MID) canal system. MID operates three canal systems, Le Grand, Fairfield, and Fairfield 'A', within the project area. The primary function of the canals is to deliver irrigation water from Lake Yosemite to downstream agricultural users. However, in some circumstances, the canals also collect surface stormwater runoff as they traverse the project site. Cottonwood Creek is the only drainage course within the UCP area not under MID jurisdiction (10).

The operational regime of the MID system is to open the irrigation gates at Yosemite Lake on March 31st and close them on October 31st (10). The water enters Fairfield canal delivering irrigation water to downstream agricultural users in the Merced area during this time period. During the winter months, Lake Yosemite acts as flood control detention releasing excess flows to Le Grand Canal. Water levels in Lake Yosemite can be increased to serve demand by importing water from the Merced River via an upstream canal.

MID has requested that stormwater runoff from the UCP area be discharged to the Fairfield Canal system (10). Capacity does not exist in the Le Grand Canal for project runoff. MID has also indicated that pumped discharge to the canal is preferred because of the ability to discontinue discharging project runoff during periods of high stages within the Fairfield Canal. Therefore, proposed stormwater detention basins are required to be sized to store an entire storm event volume because the peak stage in the Fairfield Canal can occur at any time and is independent of project peak flows (10).

Future infrastructure constructed by MID might include an open channel connection from the Fairfield 'A' canal as it crosses Yosemite Avenue, south to Rascal Creek. The intended purpose of this MID project is continued delivery of agricultural irrigation water to irrigators in areas south of the UCP area. The proposed facility could also possibly serve to transmit storm runoff from the southern portion of the UCP area to Rascal Creek.

STORM DRAINAGE GOALS AND OBJECTIVES

Issue S1: Adequate Storm Drainage Systems

As the UCP area develops into a community, hard surfaces impervious to runoff will be added within the watersheds due to the construction of buildings, parking lots, roadways, and driveways. The increase of impervious surfaces correlates to an increase of the peak flow in the creeks and channels within the project boundary. The increase in flow places structures adjacent to the creeks at increased risk of damage due to flooding. To reduce the peak flow runoff impact, a cost effective and comprehensive collection, conveyance, and stormwater detention system must be developed.

Goal:

- Design storm drains to accommodate planned development.

Objective:

- Design stormwater collection system per Merced County Standards (11).

Policies:

- Create a Storm Drainage Master Plan (SDMP) for the UCP area. Project proponents shall prepare a design-level Storm Drainage System Master Plan (SDMP) for the UCP area project in accordance with the Public Works Department Improvement Standards and Specifications and Storm Drainage Design Manual, for County approval prior to the first Final Planned Unit Development approval. The County, project proponents, and successors-in-interest shall implement such Master Plan as needed to accommodate the location and rate of flow of increased project runoff. The preparation of such Master Plan shall be by a civil engineer and shall evaluate the appropriate design (size) and location of adequate drainage facilities to reduce post-project peak flows in accordance with County policy and standards. Final drainage facility designs recommended by this SDMP shall be implemented as part of the design of individual villages.

- Create a Capital Improvement Plan (CIP) to construct the SDMP elements. The County shall levy impact fees as needed on new development to finance necessary improvements in drainage facilities and services for those new areas.
- Drainage Right-of-Way and Easements. As a condition of project approvals, the County shall require reservation of right-of-way and easements for designated drainage facilities.
- Create an MID master plan for areas within the UCP area. Project proponents shall prepare a design-level MID facilities master plan. The plan shall demonstrate the ability of the MID system to continue to deliver irrigation to downstream users despite modification to the existing system.

Issue S2: Capability of Storm Drainage System

Because stormwater will runoff at a higher peak flow after development, facilities must be developed that mitigate the increase in flow to minimize potential problems downstream of the project. Stormwater detention basins are the most widely accepted and cost efficient method of reducing the peak flow to a pre-project flow.

Goal:

- No net increase in stormwater peak flows off-site.

Objective:

- Design and construct facilities to detain stormwater runoff such that no adverse impacts are created downstream of project.

Policies:

- New development shall provide stormwater detention sufficient to limit outflow to a level consistent with downstream limitations, which is more stringent than pre-developed condition limitations, for sheds contributing to Cottonwood Creek. For discharges to the MID facilities the peak must be limited to the capacity available at time of discharge.
- Merced County standards require design of stormwater systems to the 10-year, 24-hour storm, therefore provisions shall be made to convey or store runoff up to the 100-year, 24-hour storm event without causing flooding damage to adjacent structures.
- Collection systems, pipelines and open channels, shall be designed to current Merced County Standards (11).

Issue S3: Relationship to UC Merced Campus

The proposed UC Merced campus is located upstream of the UCP area; therefore some stormwater runoff will flow into the UCP site. A means of directing the UC Merced campus runoff into the UCP area system is crucial to avoid flood damage to properties within the UCP area.

Goal:

- Develop a consistent stormwater management approach between the University Community and Campus.

Objective:

- Design facilities within project that are sized to accept offsite runoff from UC Campus where required.

Policies:

- Development of the Storm Drainage Master Plan for the UCP area shall be accomplished in close coordination with the design of the UC Merced drainage system. Close engineering coordination between the two projects is crucial for both parties.

Issue S4: Sustainability of Storm Drainage Systems

Opportunities exist to make use of the stormwater runoff and achieve higher sustainability through integrated water resources. Current practices encourage the immediate conveyance of runoff from lands to regional creeks or canals where the water is lost. Incorporation of stormwater runoff harvesting practices (i.e., ponds, wetlands, underground tanks) on small or a regional scale can be incorporated into the UCP area. The captured stormwater can then be used for irrigation or groundwater recharge.

Goal:

- Create opportunities to use stormwater runoff and decrease dependency on groundwater resources.

Objective:

- Provide captured stormwater runoff for irrigation of public facilities and/or recharge to aquifer on-site to offset use of potable water.

Policies:

- Residential development shall incorporate water-harvesting techniques for storage of runoff from the roofs and/or yards. The runoff can be stored and applied on-site as irrigation.
- Create recharge basins for stormwater recharge to the aquifer system. The water can be extracted by well at a later date to meet irrigation water demands.

Issue S5: Relationship to Merced Irrigation Systems

Because some of the proposed storm drainage facilities will discharge to MID facilities (Fairfield, Fairfield 'A' Canals and Rascal Creek) preparations will have to be made to minimize discharge impacts to the current MID systems. During large storm events discharging stormwaters may have to be reduced while the MID Canals are at peak stage (full).

The proposed phasing of the UCP area will be to construct the villages closest to the campus then progressively move southward to Yosemite Avenue. Agricultural is anticipated to continue within the UCP area, therefore the MID facilities that deliver irrigation water to these areas will need to remain in place and functioning. Likewise, agricultural areas southwest of the UCP area will also need to continue to receive irrigation water until a time in the future when downstream irrigation needs cease.

The existing MID canal system meanders through the project area delivering irrigation water users downstream of Yosemite Lake. The canals are unfenced, have steep side slopes, incorporate perimeter roadways and are lined with hardpan soils. MID staff has expressed concern over the risk and liability issues associated with retaining open and accessible canals through an urban development.

Goal:

- Protect / preserve MID irrigation system and delivery to agricultural users.

Objective:

- Proposed facilities to be compatible with existing capacity restrictions of MID facilities.
- Design and construct facilities that will continue irrigation water delivery to downstream users. Proposed drainage facilities to integrate the delivery of irrigation water from March to October to downstream users.

Policies:

- Discharge to MID facilities shall be via pump and be able to cease discharge when MID facilities do not have capacity available. Detention basins discharging to MID facilities shall be sized to capture the entire 10-

year, 24-hour storm volume. A sensor device will be located in the receiving body of water to determine when the canal or creek is at capacity and will shut off pump discharge.

- The Fairfield 'A' Canal and associated laterals shall remain in place and functioning to supply continued users downstream until such time as alternate facilities are provided.

Issue S6: Preservation of Natural Drainage Patterns

Existing creeks and drainages, such as Cottonwood Creek, provide natural meandering drainage paths that create lower stream velocities, areas that can serve to enhance water quality and provide aesthetic and open space value to the community.

Generally, constructed channels are designed to minimize the cost of construction by delivering water from the source to the destination via the shortest route. By taking the shortest route it effectively increases the channel slope when compared to a creek that meanders. An increase in slope increases the velocity of the water in the creek or channel causing a much greater potential for erosion of the channel walls and bottom. Erosion of the channel creates greater operation and maintenance expenses because repairs have to be made and sediment downstream has to be removed to maintain the flow capacity. It then becomes necessary to line the constructed channel with rock, grass or matting to prevent the erosion from occurring.

Urban development creates impervious surfaces, such as roadways, that collect oils, greases and sediments that end up in the storm drainage collection system that outlets into the creek systems. The primary treatment will occur in the detention basins but wide shallow flow through grassed floodplain areas can aid in effectively reducing contaminant levels in stormwater runoff.

By creating a land plan and roadway alignments that integrate with the existing stream systems it will produce infrastructure cost savings while preserving open space. Minimizing the number of roadway crossings over a creek reduces infrastructure costs and reduces the impacts on the flow of water.

Goal:

- Preserve natural floodplains and reduce infrastructure construction costs and potential flood hazards to structures.

Objective:

- Design drainage corridors to mirror the natural topography and creek system.

Policies:

- Retain or re-construct portions of natural drainage paths to maintain stream velocities at or near pre-developed conditions.
- Retain existing or enhanced floodplain width to establish wildlife corridors and maintain natural vegetation.
- Prohibit development, placement of fill or structural improvements (except for flood control purposes and minimal roadway crossings) within the 100-year floodplain. Recreational activities that do not conflict with habitat may be permitted within the floodplain.
- Include a pedestrian, bicycle and equestrian path through the floodplain corridors to enhance circulation and recreational opportunities.
- Public paths shall be incorporated into the land plan to allow linkages from the urban areas to the natural areas. The paths shall be landscaped with native species of vegetation.
- Stormwater detention basins (Basins) shall be located near existing or re-created stream corridors.

Issue S7: Mitigation of Stormwater Quality

The National Pollutant Discharge Elimination System (NPDES) permit system was established in the Clean Water Act (CWA) to regulate municipal and industrial discharges to surface waters of the U.S. Each NPDES permit contains limits on allowable concentrations and mass emissions of pollutants contained in the discharge.

Nonpoint sources diffuse and originate over a wide area rather than from a definable point. Nonpoint pollution often enters receiving water in the form of surface runoff and is not conveyed by way of pipelines or discrete conveyances. As defined in the federal regulations, such nonpoint sources are generally exempt from federal NPDES permit program requirements. However, two types of nonpoint source discharges are controlled by the NPDES program; nonpoint source discharges caused by general construction activities and the general quality of stormwater in municipal stormwater systems (either as part of a combined system or as a separate system in which runoff is carried through a developed conveyance system to specific discharge locations). The 1987 amendments to the CWA directed the USEPA to implement the stormwater program in two phases. Phase 1 addressed discharges from large (population 250,000 or above) and medium (population 100,000 to 250,000) municipalities and certain industrial activities. Phase 2 addresses all other discharges defined by the USEPA that are not included in Phase 1. The Phase 2 regulations became effective February 2000. The State Water Resources Control Board (SWRCB) is required to issue general permits for Phase 2 regulated jurisdictions by December 2002. Fully implemented Phase 2 programs must be in place by the end of the first permanent term, typically five years.

The goal of the NPDES non-point source regulations is to improve the quality of stormwater discharged to receiving waters to the "maximum extent practicable" through the use of Best Management Practices (BMPs). BMPs can include the development and implementation of various practices including educational measures (workshops informing public of what impacts results when household chemicals are dumped into storm drains), regulatory measures (local authority of drainage facility design), public policy measures (label storm drain inlets as to impacts of dumping on receiving waters) and structural measures (filter strips, grass swales and detention ponds).

Goal:

- No net degradation in stormwater quality.

Objective:

- Comply with NPDES Phase 2 program and monitoring.

Policies:

- Apply best management practices (BMPs) for stormwater quality.
- Require stormwater quality control devices and measures as part of the collection system to prevent sediment, petroleum, and heavy metals from entering the stream systems.
- Detention basins shall incorporate a permanently wet portion of basin to sustain vegetation beneficial to water quality. The vegetation shall be appropriate for biotic uptake of contaminants found in urban runoff and be beneficial for the types of animal species that might occur in this region.
- Implement a stormwater quality monitoring program. The program will monitor the contaminant loading from the project to insure the facilities are functioning and meet the discharge standards set by SWRCB.
- An element of the Storm Drain Master Plan (SDMP) shall address the facilities and devices that will function to improve stormwater quality. The section shall function as a stormwater quality master plan within the SDMP.
- Internal collector and business roadways shall incorporate a median with sufficient width to allow for a grass swale. The grass swale shall be part of a dual storm drainage system where the “first flush” runoff will travel through the grass swales before entering the regional collection system.
- Encourage sensitivity to water pollution through educational and outreach programs aimed at the residential landowner. The programs could speak to the impacts to stormwater of the use of petrochemicals, herbicides and pesticides.
- Install stormwater treatment devices to treat runoff from large parking areas.

Issue S8: Multiple-use Stormwater Detention Basins

Traditionally stormwater detention basins have been constructed with only one purpose, to store runoff. The large land areas consumed by detain basins can be used for multiple uses. Great potential exists for incorporation of recreational uses in detention basins.

During the dry season the basin would be open to all recreational opportunities. During the winter months, the water levels will rise and fall over time providing the detention storage required to attenuate the peak flows.

Goal:

- Maximize multiple land uses of stormwater detention basins.

Objective:

- Provide areas that meet requirements of detention, water quality, recreation, habitat, and conservation.

Policies:

- Create recreational opportunities where feasible within detention basins. Play fields, play structures, wildlife habitat areas and wildlife observation are all excellent recreational opportunities that can be realized within a given detention basin.
- Create a wetland habitat as part of the water quality component of the detention basin to support specific species.
- The play fields shall not be inundated by more than one foot of water during the 10-year storm event consistent with Merced County Standards.
- Basins shall be designed to ensure public safety by minimizing hazards when a basin serves multiple uses such as recreation.

Issue S9: Environmental Sensitivity

Currently the lands within the UCP area sustain a number of species of plants and animals. Proper design and maintenance of drainage facilities can sustain and even promote species associated with ponding water.

The creation of corridors that encompass existing or created drainage paths can enhance the number of opportunities to create ponding water locations.

Goal:

- Preserve or create wetlands habitat.

Objective:

- Provide open space and opportunities for species preservation and enhancement.

Policies:

- Preserve areas of native species habitat.
- Maximize the opportunities for intermittent shallow water impoundment during the wet season.
- Promote the growth of native vegetation.

References:

(1) Personal communication with Steve Stroud, City Engineer, City of Merced.

(2) PG&E well yield test data – forthcoming from Dan Pope.

(3) Understanding the Safe Drinking Water Act, prepared by the United States Environmental Protection Agency, December 1999, http://www.epa.ca.gov/safewater.

(4) *Order No. 5-00-246, NPDES No. CA0079219 Waste Discharge Requirements for City of Merced Wastewater Treatment Facility, Merced County*, prepared by the California Regional Water Quality Control Board, Central Valley Region, October 2000.

(5) United States Geological Survey (USGS), *Merced Quadrangle, 7.5 minute series topographic mapping*, revised 1976.

(6) United States Department of Agriculture (USDA), *Soil Conservation Service, Soil Survey, Merced Area, California*, reissued March 1991.

(7) National Weather Service (NWS), San Francisco Bay Area, Climatological data, located at the following internet address: http://www.nws.mbay.net/climate.html.

(8) State of California, Department of Water Resources, *Rainfall Depth-Duration-Frequency for California*, November 1982.

(9) Personal communication with Jim Hunt, property owner within the UCP area.

(10) Personal communication with Hicham M. Eltal, Manager of Engineering, Water Resources, Merced Irrigation District (MID).

(11) Merced County, Storm Drainage Design Manual, date unknown